THE ROLE AND FUTURE OF THE UK REFINING SECTOR IN THE SUPPLY OF PETROLEUM PRODUCTS AND ITS VALUE TO THE UK ECONOMY

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IHS has acquired Purvin & Gertz

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GLOSSARY AND ABBREVIATIONS

API	American Petroleum Institute
ARA	Amsterdam-Rotterdam-Antwerp
B/D	Barrels per day
Barrel	42 US Gallons, 35 Imperial gallons, 159 litres
Biodiesel	Diesel fuel produced from agricultural products rather than mineral oil
Biogasoline	Gasoline containinig ethanol or ETBE derived from agricultural products
CAFE	Corporate Average Fuel Efficiency: a standard measure of fuel economy in the U.S.
CDU	Crude Distillation Unit
CIF	Cost, insurance and freight
CIF Price	Price of product delivered to named location. Includes product cost, insurance cost and freight cost to that location.
CIS	Commonwealth of Independent States, consisting of eleven former Soviet Republics: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Ukraine, and Uzbekistan
CNG	Compressed Natural Gas
CRF/ICRF	Capital recovery factor / Incremental capital recovery factor
CTL	Coal to liquids
ECA	Emissions Control Area
EFTA	European Free Trade Association
EPA	Environment Protection Agency: a U.S. Government body
ETBE	Ethyl tertiary butyl ether, a gasoline blend component
EU	European Union
FCC	Fluid Catalytic Cracker
FCC Equivalent	Residue conversion processing capacity expressed as an equivalent to an FCC unit
FOB	Free on board
FOB Price	Price of a product at named load port delivered free on board to ship. Insurance and freight costs to another location are separate and have to be paid by the buyer.
Gross Refinery Margin	Value of all products sold on refinery minus the cost of all crude oil and other feedstocks
GTL	Gas to liquids
HCU	Hydrocracker Unit
HDS	Hydrodesulphurisation. Catalytic process to remove sulphur from oil products
HSD	High speed diesel
IEA	International Energy Agency
IOC	International Oil Company
LLS	Louisiana Light Sweet (Crude Oil)
LPG	Liquified petroleum gas
LSD	Low-sulphur diesel
MTA	Million Tonnes per Annum
MTBE	Methyl tertiary butyl ether, a gasoline blend component
Net Cash Refinery Margin	The Gross Refinery Margin minus fixed and variable operating costs
NGL	Natural gas liquids
NOC	National Oil Company
NWE	North West Europe
°API	Degree API. Measure of density, usually for crude oils and condensates
OECD	Organisation for Economic Co-operation and Development
OPEC	Organisation of Petroleum Exporting Countries
pa	Per annum
PGI	Purvin & Gertz Inc. (Note Purvin & Gertz was acquired by IHS in November 2011)
RBOB	Reformulated Blendstock for Oxygenate Blending. An unfinished gasoline prepared for ethanol blending
RFCC	Residue Fluid Catalytic Cracker
RFG	Reformulated gasoline - clean gasoline required in some U.S. regions
RME	Rapeseed Methyl Ester - a biodiesel component
SECA	Sulphur Emission Control Area
SUV	Sports Ultility Vehicle
TAN	Total Acid Number. A measure of the acidity of crude oil, expressed as milligrams of potassium hydroxide per gram of crude (mgKOH/g).
Tonne	1 metric tonne. 1,000 kilograms
tpy	tonnes per year
ULSD	Ultra Low Sulphur Diesel usually 10 or 15 parts per million wt. Sulphur
Urals	Russian export blend crude oil
USGC	U.S. Gulf Coast
VLCC	Very Large Crude Carrier
VGO	Vacuum gasoil
WTI	West Texas Intermediate (Crude Oil)

REFINERY PROCESS UNIT DESCRIPTION AND PRODUCTS

Unit	Main Function
Crude Distillation	Provides feed to all downstream units
Vacuum Distillation	Provides feed to cracking/coking units and produces fuel oil or bitumen
Thermal Cracking	Cracks heavy feedstocks to lighter products using high temperature
Visbreaking	Mild cracking of vacuum residues to reduce viscosity for fuel oil blending
Solvent Deasphalting	Extracts higher quality cracker feedstock from heavy residues and also produces very viscous fuel oil or bitumen product
Residue HDS	De-sulphurises heavy residues to improve their quality as feedstock to cracking units
Residue Hydrocracking	Cracks heavy residue at high temperature and pressure in presence of catalyst and hydrogen to produce mainly low sulphur middle distillate
Fluid Coker	Heats heavy straight run and cracked residues to produce light products and fuel gas
Delayed Coker	Heats heavy straight run and cracked residues to produce light products and solid coke
VGO HDS	De-sulphurises vacuum gasoils to improve their quality as feedstock to cracking units
Fluid Catalytic Cracking	Cracks vacuum gasoil feed at high temperature in presence of a fluidised bed of catalyst to produce primarily gasoline and some lower quality diesel product
Resid Catalytic Cracking	Cracks residue feeds at high temperature in presence of a fluidised bed of catalyst to produce primarily gasoline and some lower quality diesel product
Alkylation	Produces high quality gasoline component from LPG
Polymerisation	Produces high octane gasoline component from LPG
MTBE Unit	Produces Methyl Tertiary Butyl Ether high octane gasoline component
TAME Unit	Produces Tertiary Amyl Methyl Ether high octane gasoline blend component
Isomerisation	Isomerises normal alkanes to their isomers, e.g. hexane to methylpentane. Used to boost octane of naphtha for gasoline blending
Hydrocracker	Cracks vacuum gasoil feed at high temperature in presence of catalyst and hydrogen to produce primarily low sulphur middle distillates
Reformer - Semi-Regenerative	Produces high octane gasoline component called reformate from naphtha using fixed bed reactor
Reformer - Continuous	Produces high octane gasoline component called reformate from naphtha using moving bed reactors. Produces higher octane product than sem-regenerative reformer
BTX Extraction	Extracts pure Benzene/Toluene/Xylene from mixed hydrocarbon feed (usually heavy reformate)
Naphtha Hydrotreating	Desulphurises naphtha to feed to reformer, or for gasoline blending
Gasoline Desulfurisation	Desulphurises mainly cracked gasolines typically produced by catalytic cracking to allow blending of low and ultra-low sulphur gasoline
Distillate Hydrotreating	Desulphurises diesel/gasoil/kerosene fractions to allow production of low and ultra-low sulphur diesel and heating gasoil
Asphalt	Produces asphalt/bitumen
Sulphur Plant	Extracts elemental sulphur from refinery gases produced by the various desulphurisation processes
Hydrogen Plant	Produces hydrogen as feedstock for hydrocrackers and hydrotreaters

I. INTRODUCTION

The downstream oil market in the UK is going through a process of change characterised by weak overall petroleum demand, growth in the aviation sector, increasing numbers of diesel vehicles and a reduction in the use of oil for power generation. The profile of companies and investors in the market is also changing, with a more diverse ownership profile in the refining sector, a steadily increasing supermarket presence in the retail sector, continuing pressure on margins and sustained levels of competition; these trends are likely to continue in the future.

The UK Government Department for Energy and Climate Change (DECC) has conducted a number of assessments of the downstream oil industry in the UK over the past few years. These have included joint work with industry under the Downstream Oil Industry Forum (DOIF) on the resilience of the sector which includes work on supply infrastructure by Wood Mackenzie, an assessment of the downstream oil sector by Deloitte LLP examining its resilience to a number of hypothetical 'stress test' scenarios, and an assessment of the UK's refined product supply market, the competitiveness of the UK's refining sector and its changing ownership profile by Purvin and Gertz (PGI).

Based upon the above, at the July 2011 meeting of the Downstream Oil Industry Forum (DOIF) it was agreed that DECC officials and the UK Petroleum Industry Association (UKPIA) would work together to prepare the scope of work for a project needed to form the basis for a strategic policy framework for the UK refining sector.

The project objectives are as follows:

To define and quantify the role played by UK refining in terms of security of product supply and wider socio-economic benefits.

To define ways to quantify/measure the security of supply benefits of retaining a refining base, building upon existing/analogous approaches.

To estimate, by each UK region, the role that each of the UK's seven operational refineries plays in product supply and the benefits they bring to their local communities.

To review the role of refined products as enablers: their key role in the transport system (road/aviation/marine), as energy products (LPG/kerosene) and specialities (lubricants, bitumen, special fluids & solvents) and as a feedstock for the chemical industry.

To consider how the refining industry may evolve in future (to 2030), under each of four scenarios (described below), identifying areas of current EU and UK policy of relevance to the industry, analysing their impact on the industry and the UK market from a security of supply/wider economic point of view.

This report seeks to provide information and analysis to meet the above objectives.

Any third party in possession of the report should not place any reliance on the report. PGI conducted this analysis and prepared this report utilising reasonable care and skill in applying methods of analysis consistent with normal industry practice. All

results are based on information available at the time of review. Changes in factors upon which the review is based could affect the results. Forecasts are inherently uncertain because of events or combinations of events that cannot reasonably be foreseen including the actions of government, individuals, third parties and competitors. NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY.

Some of the information on which this report is based has been obtained from others including DECC, UKPIA and its members. PGI has utilized such information without verification unless specifically noted otherwise. PGI accepts no liability for errors or inaccuracies in information provided by others.

II. EXECUTIVE SUMMARY

KEY POINTS

- The UK refining industry makes a substantial contribution to the UK economy, supporting an estimated 26,400 jobs. The annual contribution to the economy is some £2.3 billion. If the activities of the UK crude oil production sector are included, an additional £9 billion can be added to the contribution to the UK economy. Whilst UK refineries are not necessarily needed to refine UK crude oil, refineries somewhere are required to process UK production, so the two sectors cannot be entirely segregated.

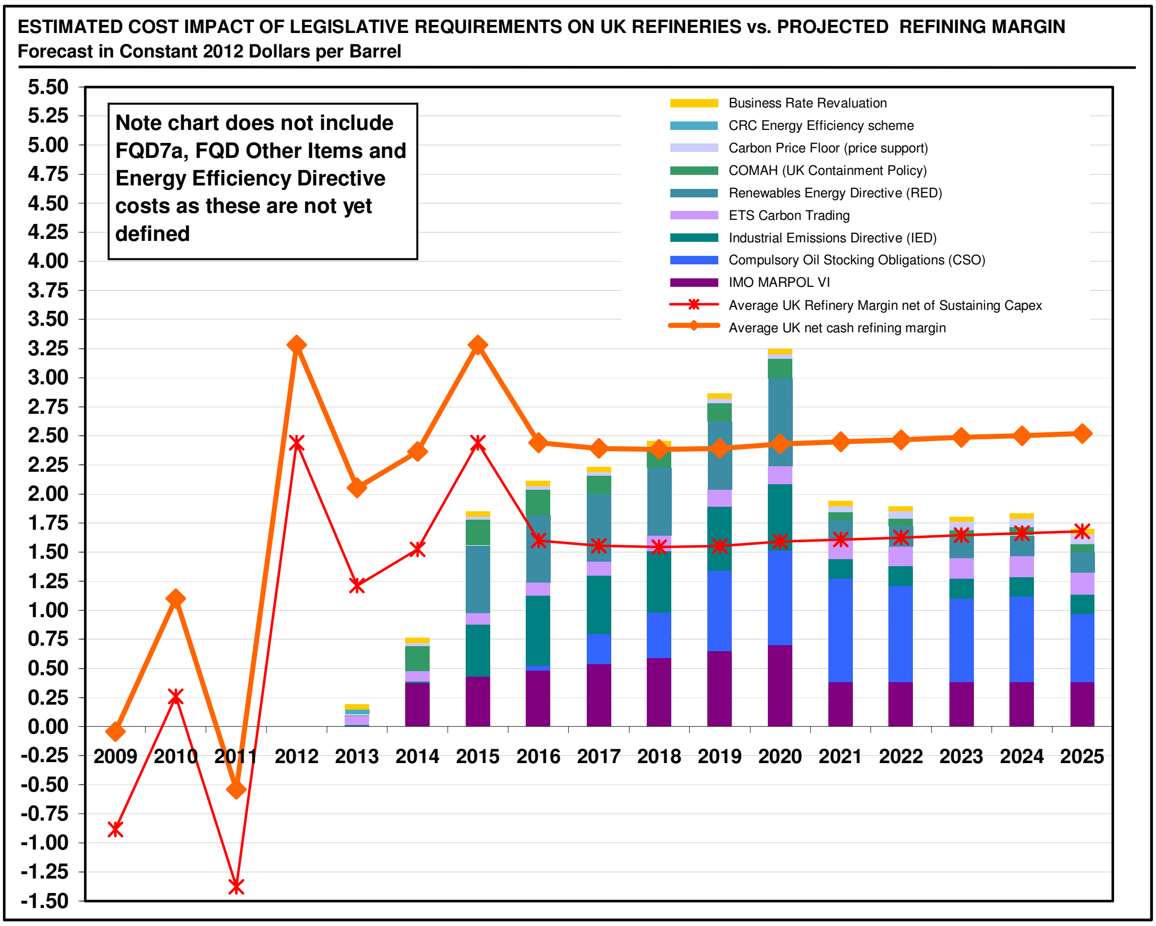
- The refining industry plays a vital role in maintaining the country's fuel supplies. Based on the IEA's approach used in its Model for Short Term Energy Security (MOSES), which considers imports compared to demand, the UK is already at the high risk level for supply of diesel and jet fuel and close to high risk for burning kerosene (domestic heating oil). Projected future demand trends and any further closure of UK refineries would substantially increase this risk.

- There are substantial differences in supply robustness across the UK. The south of the country is particularly at risk with low levels of own supply cover for all fuels, and no spare capacity in import logistics to meet any further shortfall if existing production should be interrupted.

- Assuming a level playing field with other refiners across the EU and world in respect of compliance investment, the UK refineries would be considered to be competitive. Long term projections for the average net cash margins for the UK refiners are around $2.6 per barrel, at a level to be expected for large efficient cat-cracking refineries. With annualised turnaround costs and depreciation of around $0.86 per barrel this gives an operating result of around $1.64 per barrel. Refineries of this type form part of what PGI define as core refining capacity – capacity that is needed globally for the global refined product supply and demand to balance. However, in the long term investment in additional diesel production capability is required. To simply keep pace with current demand trends, the UK refineries would need to invest some £1.5 to £2.3 billion over the next 20 years. The projected margins allow some level of re-investment if there are no other cost burdens on the industry.

- There is the prospect of significant increases in capital expenditure and operating costs for UK refiners as a result of proposed UK, EU and in some cases Global legislation. From 2015 to 2020 the total cost of such legislative items adds up to around $2.5 per barrel, of which only an estimated $1.3 per barrel might be passed on to the consumer (as global competition from non-EU refiners would limit this). Required capital expenditure over this period is estimated at £5.5 billion, most of which would not generate any return on investment. It is important to recognise that the legislative cost impact is likely to increase further once the impact from currently not fully defined and hence uncosted legislation, such as the Fuels Quality Directive (FQD) and Energy Efficiency Directive (EED), are factored in. Note that the cost impact of Article 7a of the FQD has been estimated by others to be in the range of $1.5 to $7.0 per barrel based on the original version of the proposed legislation.

- As shown in the figure below, the capital expenditure and costs related to legislation would largely eliminate the projected refining margin in UK refineries in the period to 2025. The figure compares the projected costs of legislation against the projected average UK refinery net cash margin and the projected average UK refinery net cash margin minus current sustaining capital requirements ($0.84 per barrel).



- We believe that no industry would bear such an investment burden for no return. It would be highly likely that when faced with such a large mandatory capital expenditure requirement that provides no return on investment, UK refiners could be forced to close more UK refineries. Firstly some may not have access to adequate finance to undertake such expenditure. Secondly, those refiners fortunate to have access to adequate finance would still be likely to conclude that operating in the UK (or EU) would not provide adequate return on investment compared to other regions and would voluntarily decide to close UK and European operations.

- PGI have undertaken a broad-brush projection of Return on Average Capital Employed (ROACE) for the UK refining industry. From 2013 to 2030 the UK industry as a whole could expect an average simple return on investment of around 4.1% (not including any cost for FQD7a and EED). Applying a simple discount rate of 3.5% this ROACE falls to 3.2%. A 10% discount rate drops the ROACE to 2.2%. On an estimated average capital employed of some £6.8 billion, such a low return is also very likely to make refiners conclude that operating in the UK (or Europe) would not provide adequate return on investment compared to other regions or businesses, and therefore voluntarily decide to close UK and European refining operations.

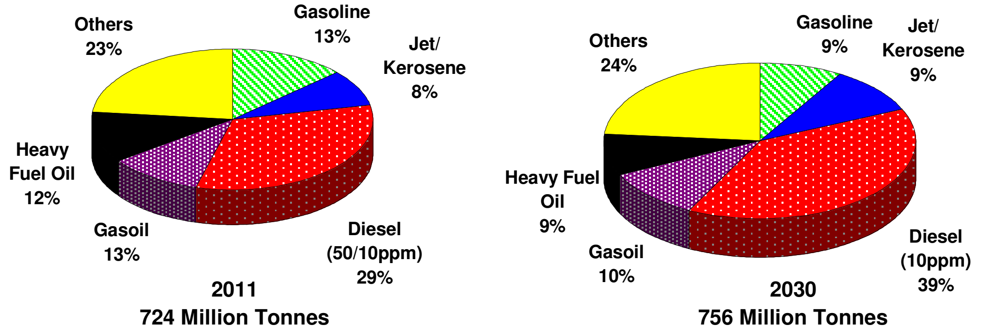
- Further closure of UK refining capacity would leave the UK even more exposed to the international refined product market for those products already at high risk based on IEA methodology.

EUROPEAN REFINED PRODUCT MARKET

The refined product market in Europe and in the UK has changed considerably over the last decade. The major changes have been a significant reduction in demand of gasoline and heavy fuel oil, and significant increase in demand of diesel and jet fuel. The increase in diesel demand has been driven by two main factors, long term economic growth that increases commercial diesel consumption, and dieselisation of the private car fleet, driven by a combination of fiscal policy (in most European countries diesel is significantly less expensive at the pump compared to gasoline due to lower taxation levels), and the availability of good quality diesel powered cars that provide greater economy than their gasoline fuelled counterparts. The efficiency of diesel cars also results in lower overall CO_2 emissions per km driven, helping auto-manufactures meet ever more stringent efficiency targets. Fuel oil use has declined steadily for many years, with the largest falls in electricity generation and the industrial sectors as environmental regulations result in industry and generators switching to cleaner alternative fuels.

These demand trends are expected to continue. In 2011, refined product demand in Europe, including 36 million tonnes of refinery fuels and 56 million tonnes of bunker demand, is estimated to have been 724 million tonnes. This is expected to grow slightly to 756 million tonnes by 2030, driven by growth of diesel and jet transport fuels. Gasoline demand is expected to continue to decline.

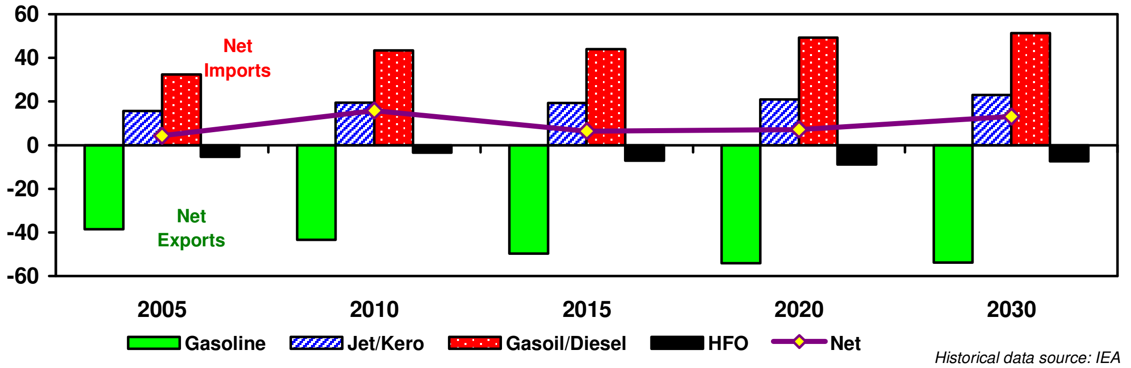
FIGURE II-1
TOTAL EUROPEAN PRODUCT DEMAND AND PRODUCT SHARES: 2011 AND 2030



Note: Includes Bunker Demand and Refinery Fuels. "Others" includes Naphtha, LPG, Petcoke, Lubes, Bitumen, Waxes *Historical data source: IEA*

These changes in product demand are taking place more rapidly than the European refining industry can respond. Refineries that were constructed in the 1960s and 1970s and expanded in the 1980s were designed for a market place with significantly higher fuel oil and gasoline demand and significantly lower middle distillate (diesel/gasoil/jet) demand. The result is an increasing imbalance between supply capability and demand requirements that has to be balanced by international trade. Europe therefore has an excess supply of gasoline and a deficit of middle distillates, and these imbalances are expected to continue to grow.

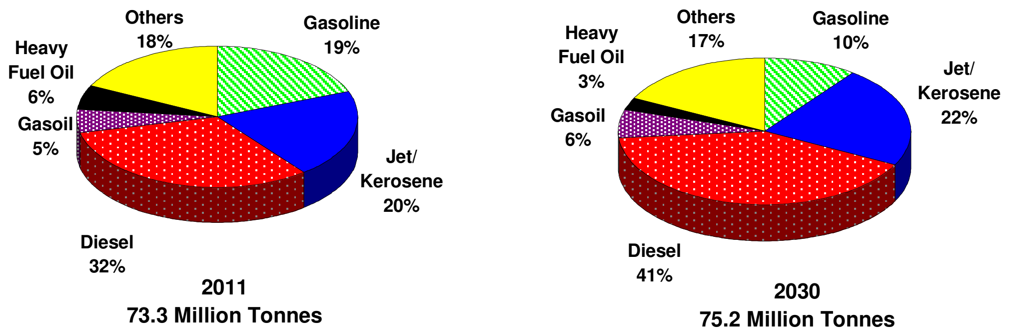
FIGURE II-2
EUROPEAN PRODUCT TRADE BALANCE, 2005 - 2030
(Million Tonnes)



Historical data source: IEA

The UK refined product market has followed a similar trend to that in the rest of Europe, despite the fact that in the UK diesel is taxed at the same rate as gasoline at the pump. These trends are also forecast to continue, with increasing middle distillate demand reduced gasoline demand and increased imbalances in refined product trade.

FIGURE II-3
UK PRODUCT DEMAND AND PRODUCT SHARES: 2011 AND 2030



Note: Includes Bunker Demand and Refinery Fuels. "Others" includes Naphtha, LPG, Petcoke, Lubes, Bitumen, Waxes

Historical data source: IEA

UK REFINING CAPACITY FUTURE SCENARIOS

This report investigates the impact of a number of pre-defined refining industry scenarios on the UK refined product trade balances. These scenarios are:-

1 **Steady State**: The number of operating refineries and their primary distillation and secondary conversion capabilities remains at 2012 levels.

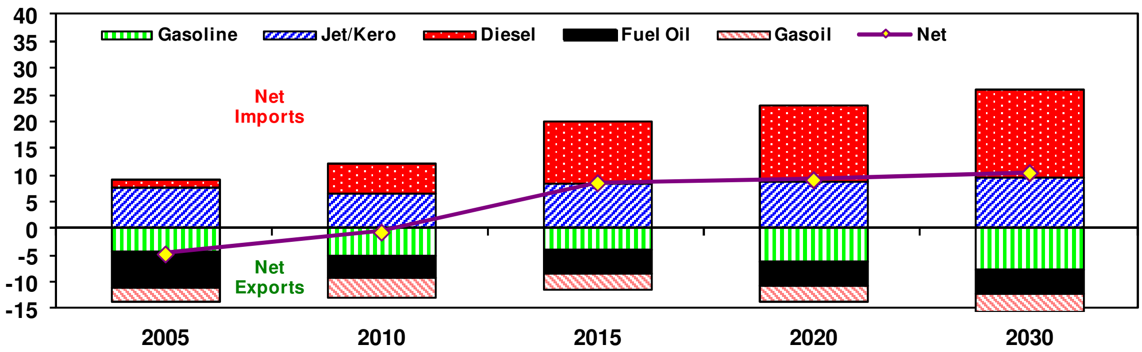
2 **Enhanced Complexity**: The number of operating refineries and primary distillation capacity remains the same but a secondary conversion upgrade occurs across the sector consistent with that assumed in the 2011 PGI report scenario

3 **Significantly Enhanced Complexity**: The number of operating refineries and primary distillation capacity remains the same but secondary conversion capacity is upgraded across the sector beyond that assumed in the 2011 PGI report scenario (i.e. improving the gasoline/middle distillate balance and improving the product trade balances vs. those set out in the 2011 report).

4 **Reduced Capacity**: Three further UK refineries close with loss of the associated primary distillation/secondary conversion capacity.

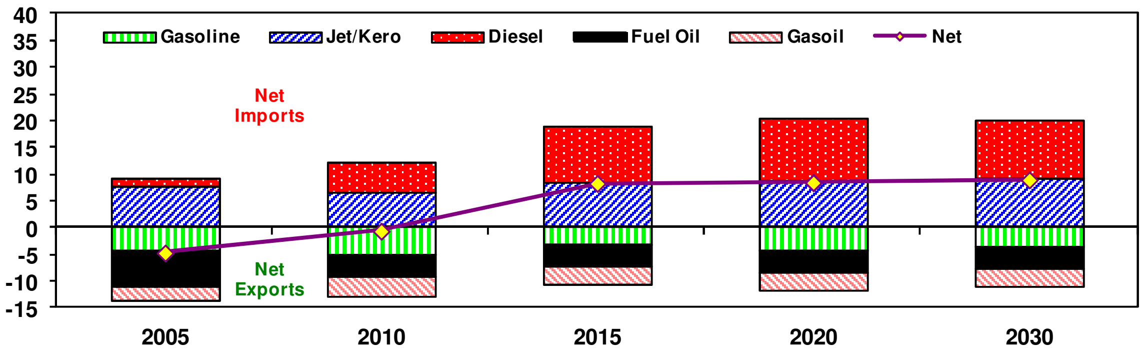
In all four scenarios, the refined product demand for main fuels is projected as shown in Figure II-3 and described in detail in Section V of this report. Figures II-4 through to II-7 below show the impact of the defined scenarios on the UK refined product trade balances.

FIGURE II-4
SCENARIO 1: UK PRODUCT TRADE BALANCE, 2005 - 2030, NO INVESTMENT
(Million Tonnes per Year)



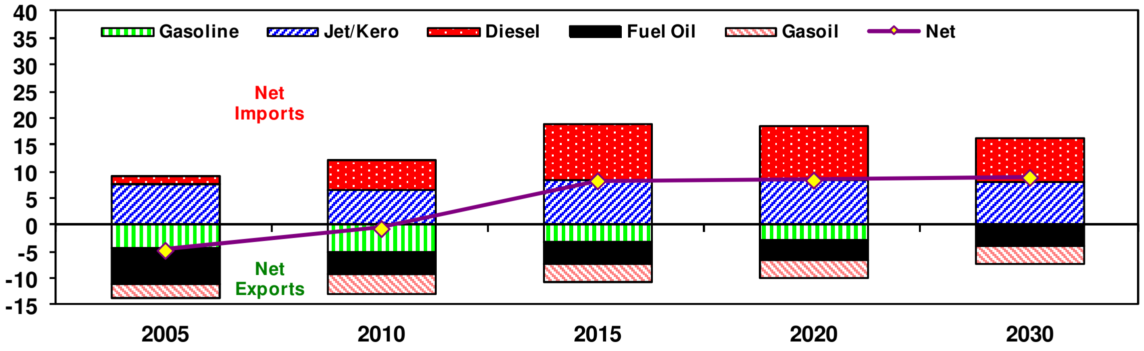
Historical data source: IEA

FIGURE II-5
SCENARIO 2: UK PRODUCT TRADE BALANCE, 2005 - 2030, ENHANCED COMPLEXITY
(Million Tonnes per Year)



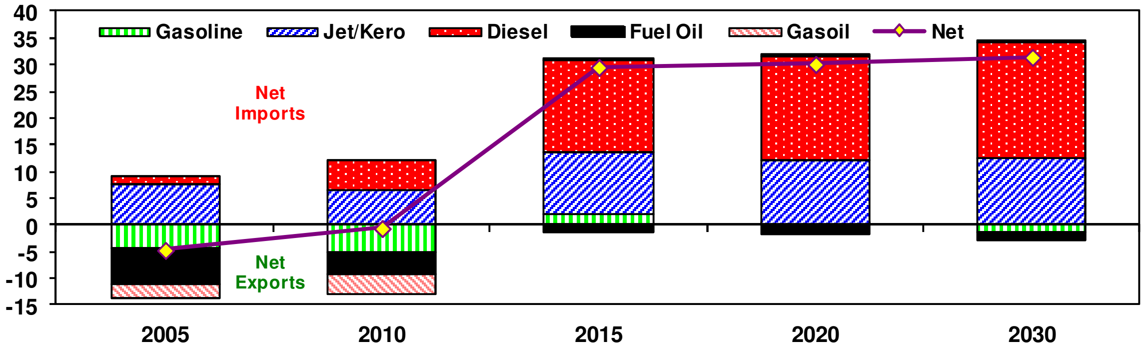
Historical data source: IEA

FIGURE II-6
SCENARIO 3: UK PRODUCT TRADE BALANCE, 2005-2030, SIGNIFICANTLY ENHANCED COMPLEXITY
(Million Tonnes per Year)



Historical data source: IEA

FIGURE II-7
SCENARIO 4: UK PRODUCT TRADE BALANCE, 2005-2030, REDUCED REFINERY CAPACITY
(Million Tonnes per Year)



Historical data source: IEA

UK REFINING COVER UNDER EACH SCENARIO

Refining cover is defined as the total production of a refined product divided by its consumption, within the same country or region.

$$\textbf{Refining Cover} = \frac{\textbf{Production of Product}}{\textbf{Demand for Product}} * 100\ \%$$

The refined product cover under each scenario is summarised in the table below.

UNITED KINGDOM REFINING COVER (percent of demand supplied by UK refineries)

		2000	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030
Scenario 1: Steady State												
	Gasoline	108	120	131	137	123	116	123	131	159	177	187
	Jet	60	41	49	55	48	44	44	43	41	40	39
	Diesel	no split	98	70	71	57	52	50	49	44	42	41
	Gasoil	no split	122	157	225	218	206	208	164	164	169	174
	Kerosene	80	86	69	74	62	56	55	55	56	57	57
Scenario 2: Modest Investment												
	Gasoline	108	120	131	137	121	113	117	123	138	141	136
	Jet	60	41	49	55	48	45	44	44	43	43	42
	Diesel	no split	98	70	71	57	53	53	53	53	55	58
	Gasoil	no split	122	157	225	218	211	214	169	169	174	179
	Kerosene	80	86	69	74	62	56	55	55	55	56	57
Scenario 3: Enhanced Investment												
	Gasoline	108	120	131	137	121	113	117	123	121	103	96
	Jet	60	41	49	55	48	45	44	44	47	51	50
	Diesel	no split	98	70	71	57	53	53	53	57	64	66
	Gasoil	no split	122	157	225	218	211	214	169	169	174	179
	Kerosene	80	86	69	74	62	56	55	55	55	56	57
Scenario 4: Three Refineries Close												
	Gasoline	108	120	131	137	123	116	123	75	91	101	107
	Jet	60	41	49	55	48	44	44	25	23	23	22
	Diesel	no split	98	70	71	57	52	50	28	25	24	23
	Gasoil	no split	122	157	225	218	206	208	94	94	97	99
	Kerosene	80	86	69	74	62	56	55	31	32	32	33

Under both the steady state scenario and the modest investment scenario, the current imbalances in the UK supply demand balance become worse. Under both these scenarios the UK would be in a worse supply position than in 2011 before the closure of Coryton refinery. There remains exposure to the international refined product markets, with significant imports of diesel and jet required to balance demand.

Under the enhanced investment scenario, the imbalances in the UK supply demand balances improve compared to the present day (2013) and are kept at similar levels to 2011 Under this scenario the UK would be in an improved supply position compared to the present with exposure to limited gasoline export markets eliminated and exposure to the jet and diesel import markets limited to what should be normally manageable levels.

Under the refinery closure scenario (three refineries close in 2015), the imbalances in the UK supply demand would put the UK in a precarious supply position. The UK gasoline shortage over 2015 to 2025 would likely be manageable with imports from a regional and international market that has surplus gasoline. The exposure to the jet and diesel international import markets would be extremely high and at this level regular disruption to UK supply from an import market that is itself relatively tight could be expected. In our opinion the level of refined product supply cover in this scenario should be considered unacceptable.

UK SUPPLY CHAIN ROBUSTNESS AND RESILIENCE

The International Energy Agency has developed a model (Model of Short Term Energy Security, MOSES) to enable member countries to evaluate and compare their energy security. Amongst other factors, the MOSES model puts most emphasis on net product import dependence. The level of imports a country has is the single biggest factor that affects a country's oil product energy security. The 'deficit' benchmark of high risk is quite clearly set by MOSES at 45% (i.e. refining cover of 100 - 45 = 55%).

In 2013 the UK is projected to have a total combined refined product cover of 83%, i.e. a net deficit of 17% over all products, which would put the UK in the low risk category.

However a surplus of one product does not help with a deficit of another. If the refined products are looked at individually a very different (and more accurate and useful) picture emerges. In 2013 the UK is expected to have a jet fuel deficit of 55%, a diesel deficit of 47% and a kerosene deficit of 44%, putting diesel and jet fuel in the high risk category and burning kerosene almost in the high risk category. (See table below)

UNITED KINGDOM REFINED PRODUCT IMPORT DEPENDENCY (percent of demand imported)

		2000	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030
Scenario 1: Steady State												
	Gasoline	-8	-20	-31	-37	-23	-16	-23	-31	-59	-77	-87
	Jet	40	59	51	45	52	56	56	57	59	60	61
	Diesel	no split	2	30	29	43	48	50	51	56	58	59
	Gasoil	no split	-22	-57	-125	-118	-106	-108	-64	-64	-69	-74
	Kerosene	20	14	31	26	38	44	45	45	44	43	43
Scenario 2: Modest Investment												
	Gasoline	-8	-20	-31	-37	-21	-13	-17	-23	-38	-41	-36
	Jet	40	59	51	45	52	55	56	56	57	57	58
	Diesel	no split	2	30	29	43	47	47	47	47	45	42
	Gasoil	no split	-22	-57	-125	-118	-111	-114	-69	-69	-74	-79
	Kerosene	20	14	31	26	38	44	45	45	45	44	43
Scenario 3: Enhanced Investment												
	Gasoline	-8	-20	-31	-37	-21	-13	-17	-23	-21	-3	4
	Jet	40	59	51	45	52	55	56	56	53	49	50
	Diesel	no split	2	30	29	43	47	47	47	43	36	34
	Gasoil	no split	-22	-57	-125	-118	-111	-114	-69	-69	-74	-79
	Kerosene	20	14	31	26	38	44	45	45	45	44	43
Scenario 4: Three Refineries Close												
	Gasoline	-8	-20	-31	-37	-23	-16	-23	25	9	-1	-7
	Jet	40	59	51	45	52	56	56	75	77	77	78
	Diesel	no split	2	30	29	43	48	50	72	75	76	77
	Gasoil	no split	-22	-57	-125	-118	-106	-108	6	6	3	1
	Kerosene	20	14	31	26	38	44	45	69	68	68	67

Note: A negative % indicates product surplus, i.e. no import dependency

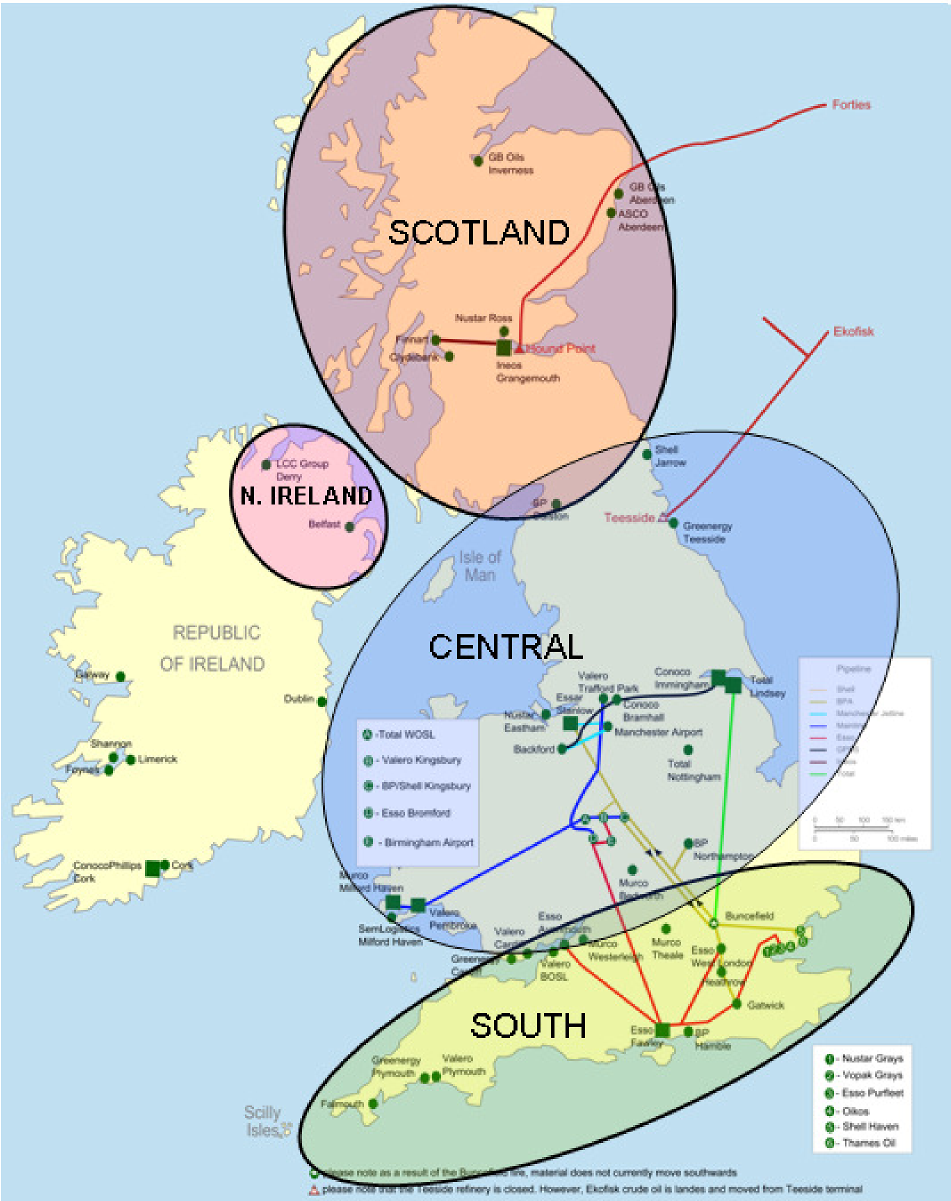
Overall the UK has a robust and resilient supply of gasoline and gasoil as these products are in surplus, with many suppliers across the country. However the supply of diesel and in particular jet fuel and kerosene is not robust.

Under Scenario 2, the Modest Investment Scenario, the UK's import dependency remains relatively unchanged, with refinery improvements more or less keeping pace with changes in middle distillate demand. Only in Scenario 3, the Enhanced Investment Scenario does the import dependency for middle distillates decline, such that the UK would move into the medium risk category for diesel and burning kerosene. Clearly in Scenario 4, the refinery closures case, import dependency for diesel jet and kerosene would be very high at 67 to 78%, well above the high risk benchmark of 45%.

There are major differences in UK regional supply chain robustness and resilience. We have referred to robustness as the availability of supply in the region compared to demand and resilience as the diversity of sources of supply to the region. To analyse this PGI has placed the official government regions in one of four "Supply Envelopes" These envelopes have been defined based on the existing main fuels supply infrastructure and represent logical connected regions of refined product supply from the different UK refineries. These are shown in figure II-8 below.

FIGURE II-8

UK MAIN FUELS DISTRIBUTION INFRASTRUCTURE AND DEFINED SUPPLY ENVELOPES



Northern Ireland and Scotland are defined as individual supply envelopes. This is because they are isolated from the rest of the UK by geography with limited connectivity with other envelopes. The Central supply envelope has been defined as consisting of North East England, North West England, Yorkshire and Humber, East Midlands, West Midlands and Wales. These regions are all interconnected by the existing main fuels distribution infrastructure. The South supply envelope is defined as consisting of Greater London, East England, South East England, and South England. There are limited connections into this envelope from other envelopes.

Demand data for each envelope has been estimated for diesel, gasoline, kerosene and jet fuel based on UK Government regional data for 2005 to 2010 for diesel, gasoline and kerosene and a 2010 estimate for UK airports' demand. Refinery supply has been estimated based on UK average national production split by refinery capacity in each envelope. The refining cover for each fuel in the envelopes is shown below. Note that these projections correspond to Scenario 2, the modest investment scenario.

UNITED KINGDOM REGIONAL REFINED PRODUCT COVER (percent of demand produced)

		2000	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030
Gasoline	Central estimate	144	163	175	185	171	176	184	193	216	220	213
	South estimate	68	73	81	84	64	40	41	43	49	50	48
	Scotland estimate	172	186	205	213	197	203	211	222	249	254	245
	Northern Ireland	0	0	0	0	0	0	0	0	0	0	0
Jet	Central estimate	237	167	197	222	204	208	206	204	199	198	197
	South estimate	21	14	17	19	14	9	9	8	8	8	8
	Scotland estimate	220	148	181	199	184	187	185	183	179	178	177
	Northern Ireland	0	0	0	0	0	0	0	0	0	0	0
Kerosene	Central estimate	229	249	199	213	187	186	184	184	186	189	190
	South estimate	75	78	64	67	49	29	29	29	29	29	30
	Scotland estimate	110	115	95	99	87	87	86	86	87	88	89
	Northern Ireland	0	0	0	0	0	0	0	0	0	0	0
Diesel	Central estimate	-	127	90	92	77	80	79	79	79	82	86
	South estimate	-	65	47	47	33	20	20	20	20	21	22
	Scotland estimate	-	134	98	98	82	85	84	84	84	87	92
	Northern Ireland	-	0	0	0	0	0	0	0	0	0	0

Northern Ireland has very poor robustness, with 100% import dependency on the rest of the UK. However the fact that Northern Ireland has many potential suppliers means that supply is resilient – disruption to one supply source can be replaced by another.

Scotland has good robustness, with surplus supply of gasoline, jet, and gasoil, and a modest deficit of diesel. However Scotland has poor resilience, with very high dependency on Grangemouth refinery.

The Central supply envelope (comprising North West and North East England, Wales, Yorkshire and Humberside, West Midlands and East Midlands) is the most robust and resilient region in the UK. The region has a surplus of gasoline, jet and kerosene and a modest deficit of diesel. In addition the region has multiple suppliers and would therefore be resilient to a short term disruption to a single supplier.

The South envelope, comprising of London, South East England and South West England is neither robust nor resilient with the recent closure of the Coryton refinery worsening the situation. The region is short of all products, with even gasoline having an import dependency of 60% and jet fuel an import dependency of 91%. Although there are multiple importers supplying product into the region, the import infrastructure is running at capacity, and could not cope with additional demand if there were a disruption to supply from Fawley refinery. Jet fuel would be more resilient than other fuels simply because such a large volume is already imported that loss of refinery supply would be less significant. The future opening of the Thames Oil Port at the former Coryton refinery site will improve resilience, but not robustness.

CONTRIBUTION OF UK REFINERIES TO THE UK ECONOMY

In 2011 the UK refining industry directly employed 4162 people with a further 4380 people working on the refinery sites as contractors. These personnel were paid a total of £416 million, generating £95 million income tax and £35 million national insurance contributions. In addition the refining industry and contractor employers paid an additional £49 million in employer national insurance contributions.

Owing to the poor margin environment, 2011 was a very difficult year for UK refiners. The industry earned a gross margin of around 3.27 $/bbl but operating costs were 4.21 $/bbl giving a net cash margin of minus 0.94 $/bbl. Despite this the industry spent $214 million (£134 million) on maintenance turnarounds and had capital expenditure of £355 million, 82% of which was sustaining capital (i.e. licence to operate) rather than on profit improvement. Our estimate of the total contribution of the main fuels refining industry in terms of money provided into the UK economy in 2011 is £1,702 million.

Purvin & Gertz has taken the 2011 UK industry performance, and projected this forward based on our long term crude oil and refined product price sets, to provide a similar set of data for a normal margin year. In this future normal year the industry would be expected to earn a gross margin of around 6.6 $/bbl, with operating costs of 4.0 $/bbl, giving a net cash margin of 2.6 $/bbl. With other contributions being held at the same level as in 2011, our estimate of the total contribution of the main fuels refining industry in terms of money provided into the UK economy in a future normal year would be £2,057 million. These contributions are summarised in the table below.

SUMMARY OF AGGREGATED UK REFINERY DATA

		2011	Future Normal Year (2025)
No. of Direct Employees		4162	4162
No. of Contractors Employed		4380	4380
Total Salaries Paid	£M	416	416
Total Income Tax Paid	£M	95	95
Total National Insurance Paid	£M	35	35
Total Employer National Insurance Contribution	£M	49	49
Total Refinery Throughput	kbbl	521,939	561,205
Gross Refinery Margin	$M	1705	3727
Total Operating Costs	$M	2195	2254
Net Cash Margin	$M	-490	1473
Gross Refinery Margin	$/bbl	3.27	6.64
Total Operating Costs	$/bbl	4.21	4.02
Net Cash Margin	$/bbl	-0.94	2.62
Annualised Turnaround Costs	$M	214	214
Depreciation	$M	236	236
Calculated Operating Result	$M	-939	1024
Estimated Corporation Tax Paid	$M	-244	266
Estimated Corporation Tax Paid	£M	-152	166
Capital Expenditure	£M	355	355
Total Input to UK Economy	£M	**1702**	**2057**

A macro-economic model was constructed based on ONS data to calculate the impact that this direct contribution of the refining industry has on the UK economy. The model was calibrated using 2010 ONS data, before applying the model to the 2011 and future year input data.

The model estimated that the UK refining industry currently supports close to 88,100 jobs, and in 2011 contributed approximately £10.1 billion to the UK economy. Around 61,500 of the jobs and £9 billion of the GDP contribution are tied to the production of crude oil and, therefore, are not necessarily at risk if UK refineries were to close providing that this level of refining activity continues to take place somewhere else in the world. (However ultimately production of crude oil and oil refining are linked and therefore some crude oil production somewhere in the world is dependent on UK refined product demand and hence the UK refineries). Some 26,400 jobs and £1.1 billion of GDP contribution was directly supported by the UK refining industry in 2011.

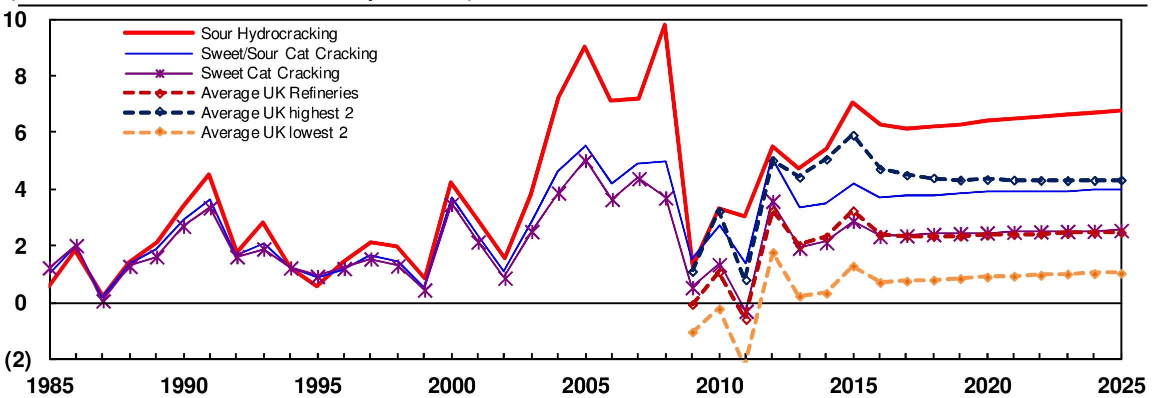
In a more normal margin year the same number of jobs would be supported by the refining industry. However, the UK refining industry would contribute approximately £12 billion to the UK economy, £9.7 billion of the GDP contribution resultant on the production of crude oil and £2.3 billion directly attributable to the UK refining industry

In conclusion, in 2011 the total contribution to the UK GDP attributable to the existence of the UK refineries was £1.1 billion and in a normal margin year this would be just over £2.3 billion.

UK REFINERIES COMPETITIVE POSITION

The UK refineries are predominantly of cat-cracking configuration. Based on the data submitted by UK refineries, Purvin & Gertz has modelled the UK refineries and compared the projected net cash margins with those that would be expected from our benchmark refineries.

FIGURE II-9
CIF NWE NET CASH REFINING MARGINS
(Forecast in Constant 2011 Dollars per Barrel)



It can be seen that the average net cash margin performance of the UK refineries follows almost exactly our Sweet Cat Cracking refinery benchmark, with a long term net cash margin of around 2.6 $/barrel. Given that the UK refineries are predominantly cat-cracking based and process predominantly sweet (low sulphur) crude this is unsurprising. The average margins of the “highest 2” and “lowest 2” UK refineries show the potential expected range of performance. It should be noted that over the range of real-price data (2009 to 2012) the “highest 2” and “lowest 2” refineries were not the same refineries each year.

Note also the difference in net margin between a sweet cat-cracking refinery and a sour hydrocracking refinery. The projected net margin for the sour hydrocracking refinery is some 4 $/barrel higher than that for a sweet cat-cracking refinery. The sour hydrocracking refinery produces a higher proportion of diesel and jet/kerosene and lower proportion of gasoline compared with a cat cracking refinery, while processing lower value crude oil. It is this difference in margin that would form the driver for investment in hydrocracking facilities.

Note that the margin projections above assume the continuation of the current cost structure of the UK refiners, and do not include the potential additional operating costs associated with future legislation discussed below.

The analysis shows that the UK refineries margin performance is at least comparable with a well operated, 200,000 barrel per day cost competitive cat-cracking benchmark refinery that sells its product inland at CIF prices. While such a refinery does not have the highest margins, it would form part of what we call our core refining capacity – refining capacity that we would expect to survive, and that is actually needed in order to keep the European market adequately supplied.

In conclusion, the UK refineries are expected to continue to be competitive going forward against other EU refineries providing the UK does not continue to introduce legislation that makes them uncompetitive. Providing the UK refineries are not subjected to additional costs that refineries in other countries do not have to bear, then there are many refineries in Europe that owing to their smaller size and less complex configuration would be expected to close before the existing UK refineries would be expected to come under pressure to close. However, the closure of any given refinery is very much dependent on the individual circumstances facing the operator at any given time.

For costs incurred by refineries as a result of EU legislation, unless there is a mechanism for pass through of these costs to the consumer, there is a strong risk that EU refineries could become uncompetitive versus refineries located outside the EU which are not subject to the same legislation.

ANALYSIS OF THE COST OR IMPACT OF FUTURE LEGISLATIVE REQUIREMENTS

The UK's international obligations and legislative requirements arising from EU Directives and UK Government policies have the potential to significantly impact costs in the UK refining sector. These are listed below.

International	• MARPOL Annex VI / IMO (low sulphur shipping fuel)
	• Compulsory oil stocking obligations (CSO)
EU	• EU Emission Trading System (ETS) Directive – Phase III
	• Fuel Quality Directive – Article 7a
	• Industrial Emissions (IPPC) Directive
	• Fuel Quality Directive – product quality/vapour pressure specifications
	• Renewable Energy Directive
	• Energy Efficiency Directive
UK	• Environment Agency Containment Policy
	• Carbon Floor Pricing
	• CRC Energy Efficiency Scheme
	• Rating revaluation

Purvin & Gertz has reviewed the potential cost impact of these items in significant detail in Section X of this report. It should be noted that cost items that are EU specific reduce the ability of EU refineries to compete with refineries outside the EU not subject to such stringent regulation. It should also be noted that cost items that are UK specific reduce the competitiveness of UK refineries compared to EU refineries and compared to refineries outside the EU.

From 2013 to 2030 we estimate UK refineries will need to invest close to £5.5 billion in new emission abatement equipment, new processing capacity, crude and product storage and containment improvements. These sizable investments would be in addition to the investments needed in new processing capacity to address the gasoline/middle distillate imbalance seen in the UK.

In the same time period, additional operational costs are projected to amount to £5.9 billion. This is partly attributed to the cost of operating new equipment described above, but over £1.4 billion (approximately 24%) of the additional costs would be related to payments for additional European Union Allowances (EUAs) and supporting the UK's target carbon floor price. These aggregated costs are summarised in the table below.

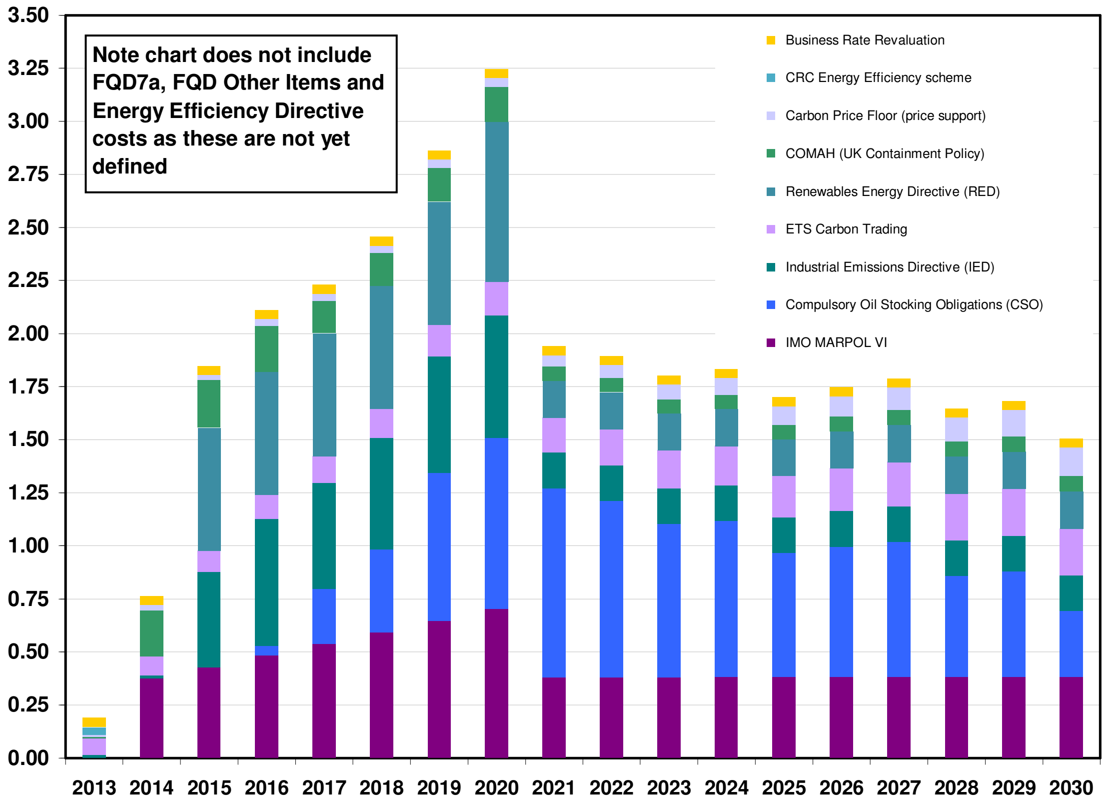
ESTIMATED COST IMPACT OF LEGISLATIVE REQUIREMENTS ON UK REFINERIES (2013 - 2030)
(Constant 2012 thousand of £ unless noted, undiscounted and excludes financing costs)

			Estimated Cost to UK Refineries (2013 - 2030)			
Policy Initiative		**Cost Pass Through**	**Capital Cost**	**Operational Cost**	**Total Cost**	**Average * ($/B)**
International	IMO MARPOL VI	Yes	905,920	1,710,470	**2,616,390**	**0.42**
	Compulsory Oil Stocking Obligations (CSO)	Yes	2,084,016	850,457	**2,934,473**	**0.47**
EU Regulatory Policy	Industrial Emissions Directive (IED)	No	900,553	747,888	**1,648,442**	**0.27**
	EU ETS Carbon Trading	No	-	1,008,982	**1,008,982**	**0.16**
	Renewables Energy Directive (RED)	Yes	1,200,000	660,000	**1,860,000**	**0.30**
	FQD7a: Crude & GHG reduction	No	Legislation not yet defined and so cost impact not determined			
	FQD Other: Product Quality	Yes				
	Energy Efficiency Directive	No				
	COMAH (UK Containment Policy) - Primary	Partial	9,333	7,700	**17,033**	**0.00**
	COMAH (UK Containment Policy) - Secondary	Partial	426,673	244,150	**670,823**	**0.11**
	COMAH (UK Containment Policy) - Tertiary	Partial	Cost impacts not yet determined			
UK Regulatory Policy	Carbon Price Floor (price support)	No	-	398,563	**398,563**	**0.06**
	CRC Energy Efficiency scheme	No	-	12,192	**12,192**	**0.00**
UK Fiscal	Business Rate Revaluation	No	-	266,448	**266,448**	**0.04**
		Total	**5,526,495**	**5,906,850**	**11,433,345**	**1.85**

Note:
* Based on UK refinery throughput (2013 - 2030) of 1,301 million tonnes = 9,884 million barrels (using 7.6 barrels per tonne). £1.00 = $1.59

The additional £11.4 billion of capital and operating costs are very significant. The average annual cost increase is 1.85 $/B from 2013 to 2030, 2.0 $/B from 2015 to 2030 and is expected to be highest over 2016 to 2020 averaging 2.6 $/B, and peaking at 3.25 $/B in 2020 as illustrated in Figure II-10 below. It is important to recognise that the legislative cost impact is likely to increase further once the impact from currently not fully defined and hence uncosted legislation, such as FQD and EED, are factored in. Note that Wood Mackenzie has estimated the cost impact of Article 7a of the FQD to be in the range of $1.5 to $7.0 per barrel based on the original version of the proposed legislation which would be additional to the cost impacts shown below.

FIGURE II-10
ESTIMATED COST IMPACT OF LEGISLATIVE REQUIREMENTS ON UK REFINERIES (2013 - 2030)
(Forecast in Constant 2012 Dollars per Barrel)



With the average net refining margin of the UK industry projected at around 2.5 $/B before any such legislative costs, this additional cost increase represents a huge additional burden on an industry already under significant pressure.

However more significant than this average net margin impact is the fact that the UK refiners would have to find some £5.5 billion in capital expenditure over this time period, £4.6 billion of which some part may be recoverable via costs passed through to the consumer and £900 million of which would likely be unrecoverable with no potential cost pass through to consumer.

In a number of cases when faced with such a large mandatory capital expenditure requirement that provides no return on investment, a number of UK refiners could be forced to close UK refineries as they may not have access to adequate finance. Those refiners fortunate to have access to adequate finance would still be likely to conclude that operating in the UK would not provide adequate return on investment compared to other regions and voluntarily decide to close UK and European operations.

PGI have undertaken a broad-brush projection of Return on Average Capital Employed (ROACE) for the UK refining industry based on the projected margins, combined with the projected capital and operating costs of the projected legislation. Over 2013 to 2030 the UK industry as a whole could expect an average simple return on investment of around 4.1% (not including any cost for FQD7a and Energy Efficiency Directive). At a simple discount rate of 3.5% this ROACE falls to 3.2%. A 10% discount rate drops the ROACE to 2.2%. This is on an estimated average capital employed of some £6.8 billion.

Such a low return on a very large capital investment is also very likely to make refiners conclude that operating in the UK (or Europe) would not provide adequate return on investment compared to other regions or businesses, and therefore voluntarily decide to close UK and European refining operations.

ESTIMATE OF SCENARIO PROBABILITY

PGI has been asked to provide an estimate of the most likely scenario, or combination of scenarios. Such an estimate is difficult to make as much of the information it can be based on is by nature uncertain – forecasts of supply and demand and economic activity over many years. The likelihood of each scenario occurring would also be influenced by whether the legislative items described in Section X are implemented or not.

SCENARIO PROBABILITY UNDER CURRENT LEGISLATIVE ENVIRONMENT

We believe that Scenario 1, the Steady State scenario is the least likely. This is because the existing refineries can and do respond to market pressures and are constantly looking for improvements in performance and profitability or they will close if profitability remains low. Some of the improvements can be achieved with low or modest investment/cost and so some modest improvements may take place. Hence this scenario, while interesting as a comparator benchmark, has a very low possibility of actually occurring.

Of the four defined scenarios, we believe Scenario 2 is the most likely. Scenario 2 is consistent with our 2012 regional and global forecasts for refined product supply demand and trade as published in our Global Petroleum Market Outlook multi-client study. This scenario envisages continuous improvement in refinery capability over a number of years, (2013 through to 2030) combined with some major capital investment. Nevertheless this scenario still requires significant investment of the order 2.4 to 3.6 billion US$ over the next 20 years. Note that this excludes the cost impact of legislative requirements discussed above.

Scenario 3 we believe has a low probability of occurring, as under this scenario, the competitiveness and profitability of the UK refining industry would improve, while the UK would still have an import price related market for middle distillate grades. However as well as the on-going continuous improvement in refinery capability this scenario would require very significant investment in the UK refining industry over the next 20 years, with capital costs of the order of 4.8 to 6.0 billion US$. The sheer scale of investment required makes this scenario less likely. Note that this excludes the cost impact of legislative requirements discussed above.

Scenario 4 – a further three UK refineries close, we believe to be highly unlikely under today's legislative environment. Closure of this many refineries would move the UK to a wholly import market for all products over the 2015 to 2025 period. This would have the impact of boosting local refining margins, as the refinery gate value for gasoline would move from export related to import related price, with the middle distillates also remaining at import related prices and fuel oil moving away from export related pricing. Logistical issues in some areas could also result in localised price increases also boosting the margins of the nearest refineries able to supply into these areas.

Based on our projected refinery margin outlook the most likely combination of scenarios would be some kind of combination of Scenarios 2 and 4. Since the act of closure of refineries would improve local margins, a more likely outcome would be the closure of one or possibly two refineries that would bring the gasoline refining cover close to 100% over 2015 to 2025. Closure of two refineries would move the entire UK market pricing for gasoline to import parity (diesel, jet and kerosene are already at import parity). On a country basis, gasoil and fuel oil would remain at export parity pricing (although there could be regional exceptions). Approximately this would give an increase in UK gasoline price of 10 $/tonne. Based on the average gasoline yield of UK refineries of 22.2% wt. in 2012 this would result in an increase in UK refinery margins of approximately 2.3 $/tonne or 0.3 $/B of crude processed. While this would be a welcome margin boost for the surviving refineries it is not a large enough change to guarantee their long term survival, particularly if significant additional costs are added to the bottom line by legislation.

SCENARIO PROBABILITY UNDER POTENTIAL FUTURE LEGISLATIVE ENVIRONMENT

In Section X, the additional cost of legislation on UK refiners over 2013 to 2030 is calculated to be an average of 1.85 $/B, with the average from 2015 to 2030 being 2.0 $/B, and with a five year period from 2016 to 2020 where additional costs average 2.6 $/B.

Furthermore the legislative items would require immense capital expenditure, £3.9 billion between 2015 and 2020 and £5.5 billion overall between 2013 and 2030, for no return on investment.

PGI believe that no industry would bear such an investment burden for no or little return. If faced with such a large mandatory capital expenditure requirement that provides no return on investment, a number of UK refiners would be forced to close UK refineries. Firstly many refiners may not have access to adequate finance, and secondly those refiners fortunate to have access to adequate finance would still be likely to conclude that operating in the UK (and Europe) would not provide adequate return on investment compared to other regions and voluntarily decide to close UK and European operations.

In this situation, Scenario 4 (with potentially even more refinery closures) would become the most likely scenario.

Since most of the legislative items are European legislation, and would also severely impact EU refineries significant closures of EU refineries could also be expected. This would leave the UK (and EU) very exposed to the international refined product markets, and dependent on refineries located outside the region for refined product supply.

It is likely that these refineries outside of the region would be emitting similar levels of CO_2 and other industrial emissions as if the refining capacity had remained within the UK and EU and potentially significantly higher levels of emissions depending on how stringent local regulations would be and how well operated the refineries were. Europe would simply have “exported” the environmental and climate change issues associated with supplying Europe’s refined product demand to other countries.

Given the importance of a secure supply of refined products to a modern economy and the impact significant disruption to supply could have on economic output, quality of life, and even national security, we believe that such a situation would be unacceptable to the UK and EU governments and should most certainly be avoided.

III. AN INTRODUCTION TO CRUDE OIL REFINING AND A BRIEF HISTORY OF OIL REFINING IN THE UK

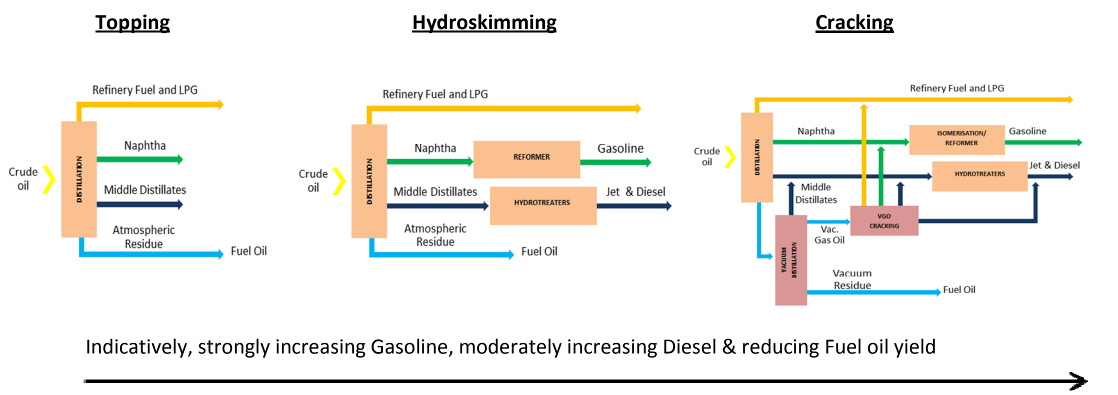
CRUDE OIL REFINING

Crude oil contains a mixture of substances containing carbon and hydrogen (mostly hydrocarbons) and varies enormously in quality and sulphur content depending on the origin of the oil. It is not, therefore, suitable for use directly in transport, heating and other applications and has to be refined to manufacture products which are both useful and of consistent quality.

Simplistically a refinery first separates the petroleum fractions that occur naturally in the crude oil **(distillation).** It then uses reactors to change molecular structure by, for example reforming and cracking, to manufacture more of the most valuable products (**conversion**), before removing any unwanted sulphur from the product (**desulphurisation**).

Refineries are not the same and range considerably in size and complexity. The figure below shows a typical range of configurations:

FIGURE III-1 TYPICAL REFINERY CONFIGURATIONS



Topping refineries are the least complex refineries, hydroskimming refineries are slightly more complex, and cracking refineries significantly more complex. Complexity may be further increased by adding more or different process units. In general the more complex a refinery is the higher proportion of light high value products it will produce (e.g. gasoline, diesel, jet fuel) and the lower proportion of low value products it will produce (fuel oil).

A refinery does not only consist of processing units; crude oil jetty and receipt tankage are required as well as storage for intermediate production, blending and finished sales tankage. Water treatment, laboratories, maintenance and administration facilities are also needed and the whole refinery site requires a very large area, typically more than 200 hectares[1] for a mid-sized refinery. Given land and planning permission, it would cost around £4-5bn to construct one today, therefore these vital assets are unlikely to be replaced under the current and projected economic environment.

[1] A little under a square mile. For reference a football pitch is about 1 hectare

In summary, all crude oils are different and they are processed in refineries which are also all different.

FIGURE III-2 FAWLEY REFINERY–SHOWING PROCESS UNITS, TANK FARMS AND JETTY

Courtesy of ExxonMobil

A BRIEF HISTORY OF CRUDE OIL REFINING IN THE UK[2]:

Oil has been produced and refined in the UK for more than 150 years. In the mid 19th century small volumes of light oil products were produced from oil shale.

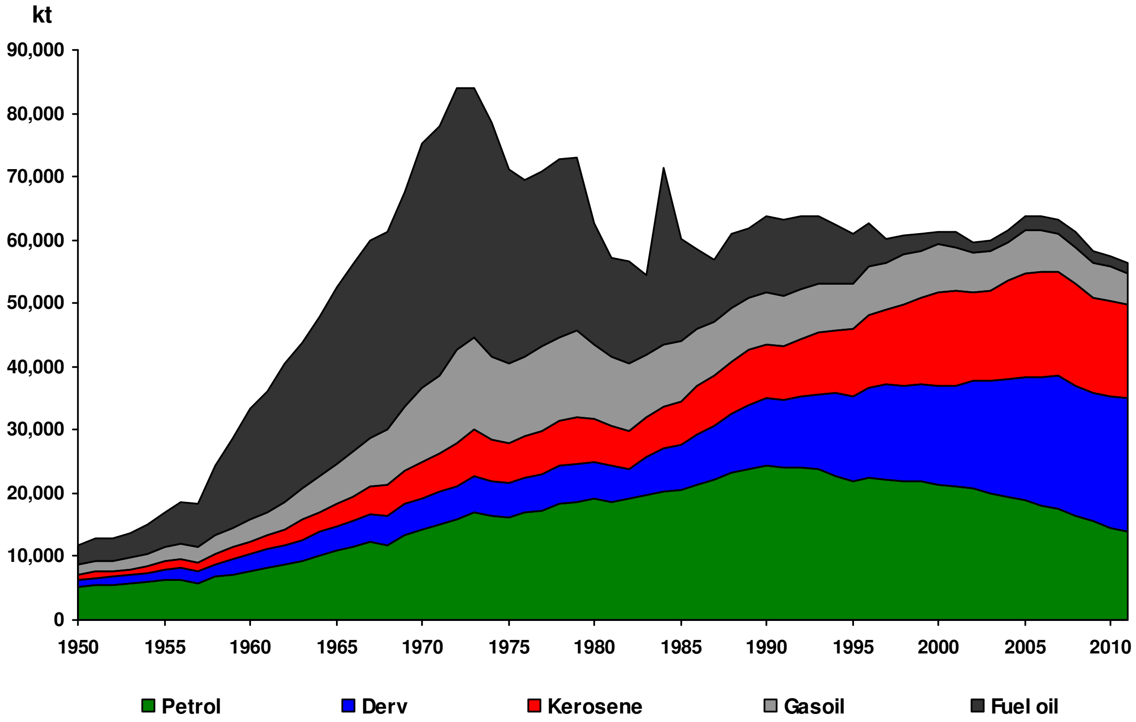
It was not until the 1920s before the UK saw small crude oil refineries at Shell Haven, Fawley, Llandarcy and Grangemouth. The largest growth, however, came between 1950 to 1970 when the crude oil refining capacity increased from around 11 million tonnes (mte) per annum to over 100mte to meet the demands of the rapidly increasing UK market.

As Figure III-3 shows, the largest markets at the time were for fuel oil and gasoline, and since many crude oils naturally contain around 50%[3] residue (which is used to produce fuel oil), many refineries were built as simple 'hydroskimming' plants with few conversion units.

[2] Sources of data: Volumes- DECC statistics; Refining history – 'Oil refineries and bulk storage of crude oil and petroleum products' – Department of the Environment 1995

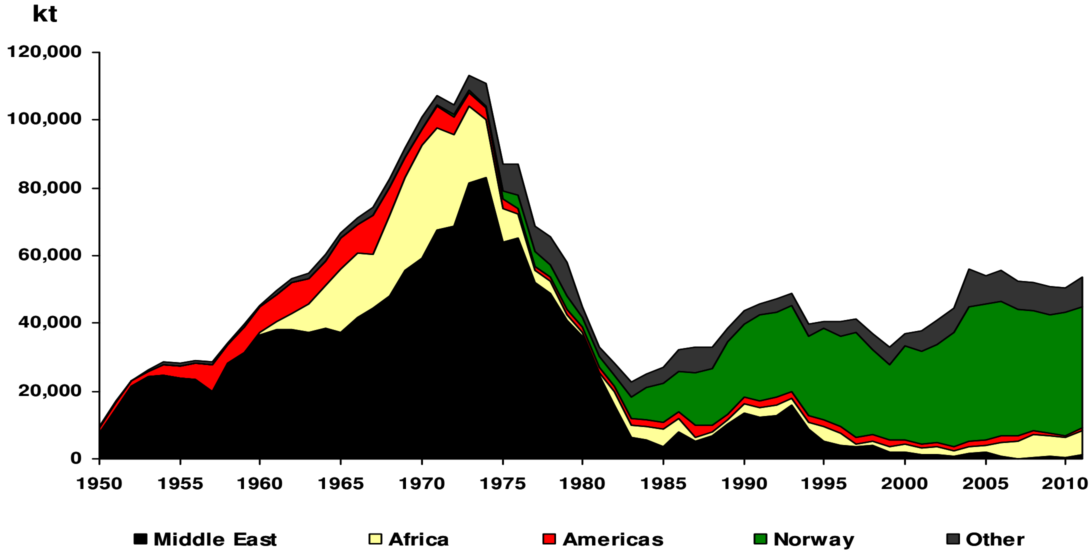
[3] Typical level for Middle East crudes, but actual levels vary considerably by crude type and origin

FIGURE III-3 UK OIL CONSUMPTION 1950 TO 2011 (major products only)*



* Note: Excludes LPG, Naphtha, Lubricants, Bitumen, Solvents, Aviation Gasoline, Specialty Kerosenes

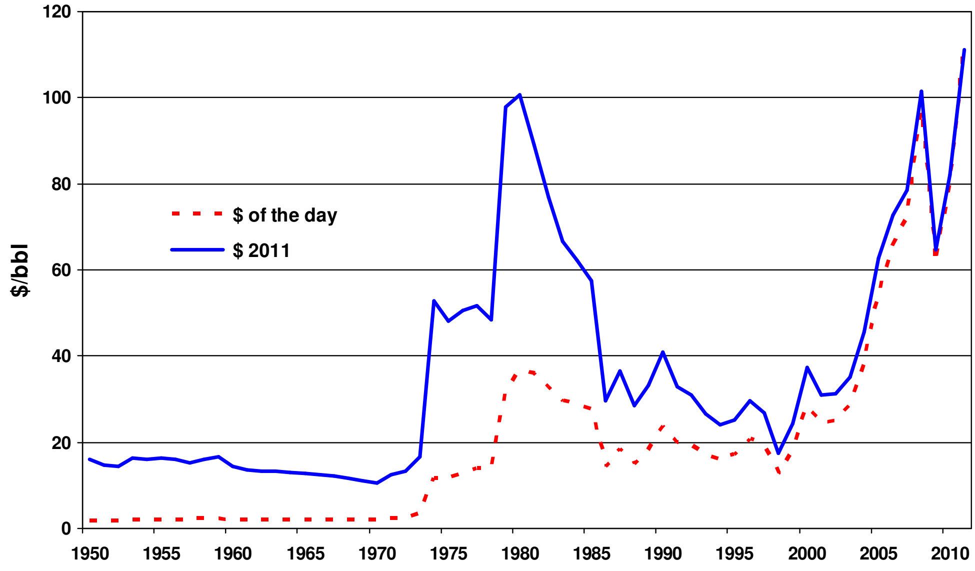
FIGURE III-4 CRUDE OIL IMPORTS TO THE UK 1950 TO 2011



Source – DECC statistics

Most crude oil supplies came from Middle East countries along with some from Africa (Figure III-4), and with the cost of crude oil (Figure III-5) remaining less than $2/barrel[4] until the late 1960s, freight became a key part of the economics of refining hence larger ships (including VLCCs[5]) were used and refineries were located near deep water ports for access and as close to the market as practicably possible to minimise delivery costs. The last new 'grass roots' refinery in the UK was constructed at Milford Haven in 1973 with the design driven by the market conditions at the time[6].

FIGURE III-5 CRUDE OIL PRICE 1950 TO 2011*



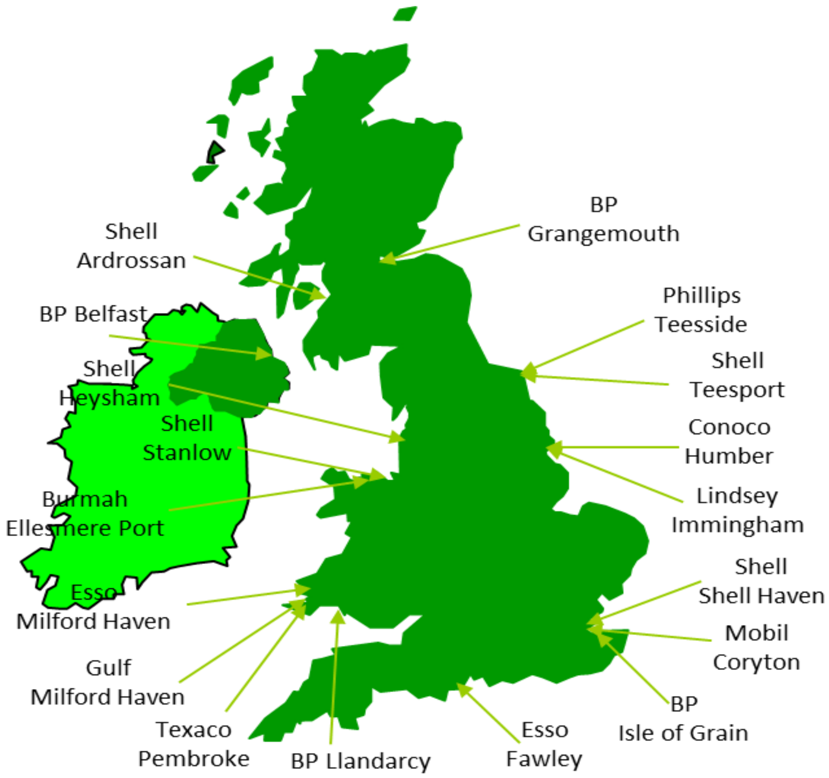
* Source BP

Pipelines and distribution terminals were constructed to deliver oil products to all parts of the UK in the most efficient and cost effective way.

By 1970 there were 23 operating refineries in the UK, located as follows (Figure III-6):

4 Measurement of volume of crude oil, equals 35 UK gallons or 159 litres .
5 Very Large Crude Carrier – typically 1.6 million barrels
6 Low crude oil price, access to a deep water port and high market for fuel oil

FIGURE III-6 UK REFINERY LOCATIONS - 1970*



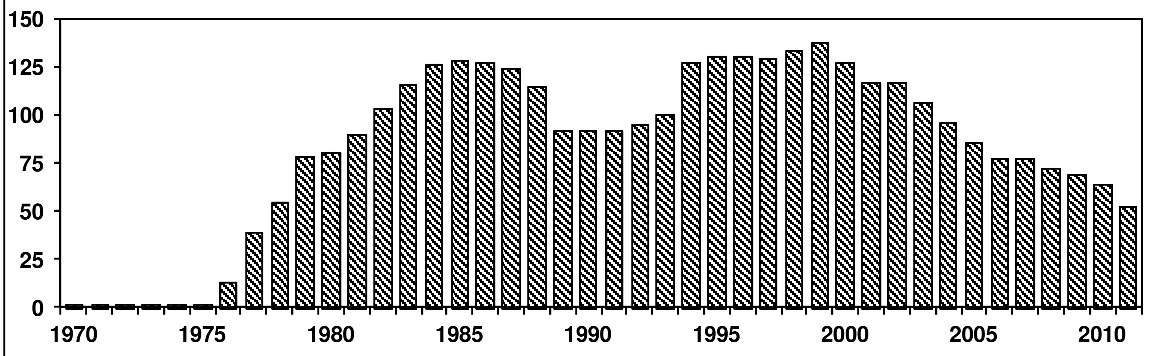
*Excludes Bitumen locations

During the 1970s the refined product fuels market changed; the volume of fuel oil consumed primarily in the power generation sector, started to fall (being replaced by gas) and the gasoline market continued to grow. Diesel demand however remained comparatively low and it wasn't until the late 1980s that the diesel demand increased above gasoil [7].

The UK was now producing its own crude oil from its North Sea installations (Figure 7) and this was either piped or shipped to existing coastal refineries. The cost of crude oil was also increasing and therefore increasing the working capital requirements of transporting crude oil, making VLCC movements over shorter distances less economic.

[7] Gasoil is used for off road machinery, stationary engines, industrial heating and marine.

FIGURE III-7
UK CRUDE OIL PRODUCTION 1970 to 2011
(Million Tonnes per Year)



Historical data source: DECC DUKES

Further, product quality also changed to improve air quality primarily with phasing out of lead in gasoline and reduction of sulphur in other products as well as other changes[8].

To respond to the changing market, less residue and more gasoline was needed as well as improvements to the quality of the products manufactured. Therefore less crude oil was processed and more residue was upgraded to increase the yield of gasoline produced from each barrel. This was achieved by increasing refinery complexity which typically included the installation of more vacuum distillation, catalytic cracking[9] and associated process units[10] with desulphurisation plants. These were huge investments, many in excess of £0.5bn in today's money at each upgraded refinery, but given the increasing market demand for light products particularly gasoline at the time could be justified economically.

By the mid 1990s the UK gasoline market peaked at 24mte (and still more than double the diesel market) and the demand for kerosene (jet fuel and domestic heating oil) product topped 10mte.

Changing company global strategies, demand stagnation and overall economics resulted in further refinery closures and by 2000 only nine refineries (excluding two bitumen plants) remained operational. All had been upgraded with catalytic cracking and other conversion units except for Teesside refinery which remained a 'topping' plant with jet/kerosene production and gasoil desulphurisation to produce diesel fuel.

Post 2000 saw increasing environmental and climate change legislation as well as continuing changes to product quality with more sulphur reductions on transport and heating fuels as well as the introduction of biofuels.

The EU Emissions Trading Scheme commenced in 2005 and the Renewable Transport Fuels Obligation, which requires suppliers to add biofuels to transport fuels, started in 2008. New refinery and terminal safety facilities were also required following the Buncefield incident in 2005. More environmental legislation followed[11].

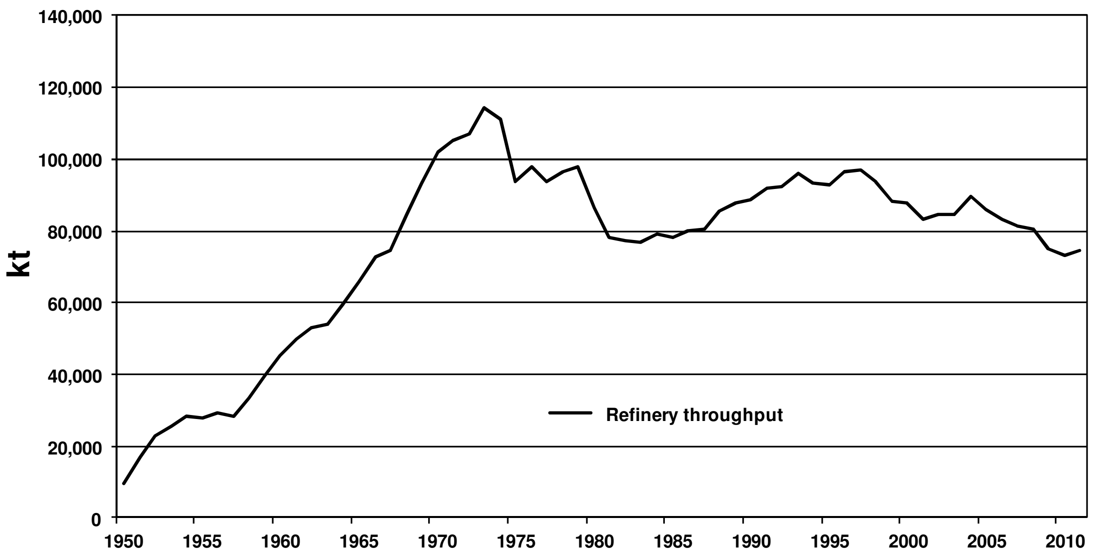
Driven by taxation, legislation and fuel economy, the demand for diesel fuel continued to increase and by 2005, diesel demand, at more than 19mte, exceeded that of gasoline for

[8] Includes Vapour pressure, benzene, cold flow properties & aromatics etc.
[9] A refinery process to convert high boiling point hydrocarbons to mostly gasoline components
[10] Includes Reforming, Alkylation and Isomerisation.
[11] Measures yet to be implemented, includes Industrial Emission Directive, Fuels Quality Directive, IMO Marpol, Carbon Floor pricing

the first time. Both gasoline and diesel became 'sulphur free' (less than 10 parts per million) by 2009, facilitating high investment for advanced processes in refineries. Fuel for Non Road Mobile Machinery[12] also became sulphur free by 2012.

Driven by economics refinery throughputs progressively fell (Figure III-8).

FIGURE III-8 REFINERY THROUGHPUT 1950 TO 2011*



At the time of publication, the UK demand for gasoline is less than 14mte and road diesel more than 21mte. Overall jet plus kerosene demand has grown to nearly 15mte, driven by the dramatic increase in air travel.

Manufacturers have continued to adapt their refineries in response to this changing environment. This has involved substantial investments in environmental measures as well as installing and upgrading desulphurisation and other process units to produce more aviation kerosene and diesel. However such is the growth in these fuels, it would take major reconfiguration for many refineries at huge incremental cost to fully match the UK product demand. Typically this would require the installation of hydrocracking[13] facilities, with a reduction of catalytic cracking capacity, costing in excess of £0.7bn at each location.

As such, the supply and demand balance in 2011 saw the UK net exporting gasoline (6mte) while importing diesel (5 mte, around a quarter of UK consumption) and jet kerosene (6mte, around a half of UK consumption). A similar supply and demand imbalance also exists across the EU.

In a period of change, recession and poor refining margins, Teesside refinery closed in 2009, Coryton closed in 2012 and the crude processing capacity was also reduced at Fawley later in 2012. These closures will further impact the UK's supply and demand balances by

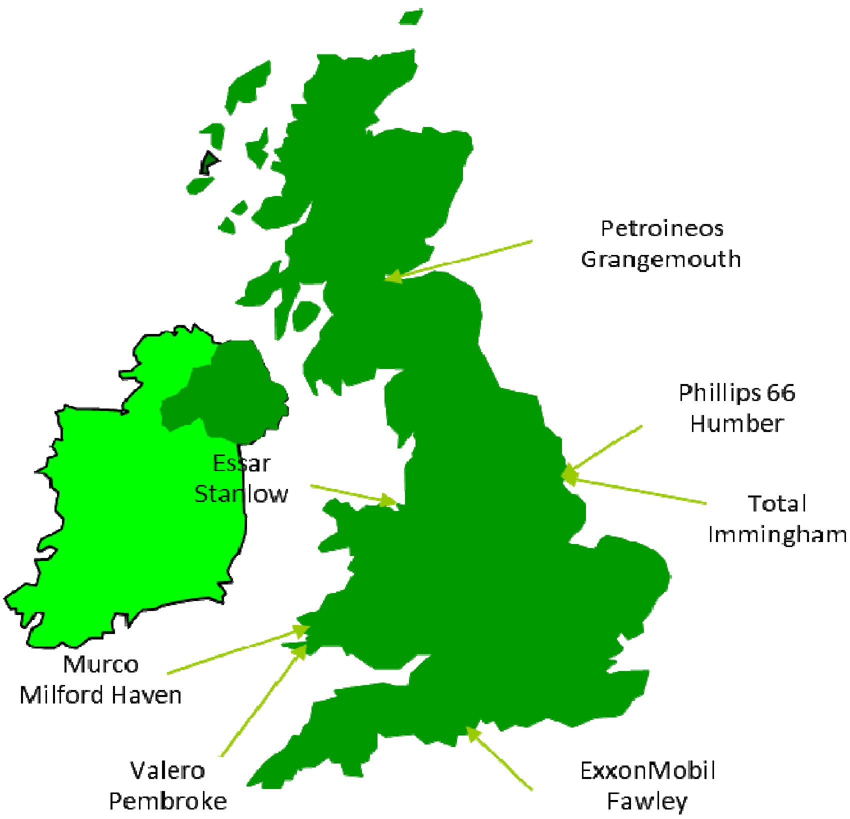
[12] Off road uses, Rail, Agriculture, Forestry, Inland Navigation etc.

[13] A refinery process which consumes large volumes of hydrogen & converts high boiling point hydrocarbons essentially to distillate components.

reducing the net volume of gasoline exported while increasing the volumes of imported diesel and aviation kerosene.

Today in the UK there are seven operational refineries[14] which are located as follows (Figure III-9):

FIGURE III-9 CRUDE OIL REFINING IN THE UK - 2013



The overall capacity is around 1.5 million barrels per day (a little over 73mte per annum) which makes the UK the 3rd largest refiner in the EU after Italy and Germany.

[14] Excludes two bitumen plants.

Summary of UK Refining Capacity 2012

Refinery	Owner	Primary Distillation Capacity (MT/A)	Primary Distillation Capacity (KB/D)	Nelson Complexity Factor
Fawley	ExxonMobil	12.0	246	11.6
Stanlow	Essar	11.2	230	10.0
South Killingholme (Humber)	Phillips 66	10.8	221	11.5
Lindsey	Total	10.8	221	6.4
Grangemouth	PetroChina / Ineos	10.2	210	7.8
Pembroke	Valero	10.2	210	9.2
Milford Haven	Murphy	6.3	130	7.0
Eastham *	Nynas / Shell	1.4	27	3.5
Dundee *	Nynas	0.6	12	3.5
Total		**73.5**	**1507**	

* Note Bitumen refinery, no main fuels production

IV. AN OVERVIEW OF THE EUROPEAN REFINING MARKET

SIMPLIFIED GLOBAL CRUDE AND PRODUCT MARKETS OVERVIEW

GLOBAL CRUDE OIL MARKET

Crude oils of widely varying qualities are produced from the thousands of oil fields in the world. As discussed in Section III, every crude oil is different from every other crude oil, although they can often be grouped into similar categories of crude oil based on certain properties, such as crude density, sulphur content and acid content.

The properties of any individual crude oil allow it to be valued, based on how it would be processed through different refinery types. Unfortunately every refinery is also different from every other refinery (even refineries of identical design will exhibit slight differences in their operation – not least because they may be operated by different personnel). Therefore the value of any particular crude to one refinery is different to the value of that crude to another refinery. Note that the value of any particular crude to a refiner is different to its price.

Aside from short term disruptions to supply (which can cause significant price spikes), crude oil prices across the globe vary based on the demand for that type of crude, the amount of supply of that type of crude, the ease (or difficulty) in processing the crude, and the freight cost of moving the crude from supply source to consuming region.

Thus a crude oil that more easily produces proportionally higher quantities of desired high value light products such as gasoline and diesel, will usually command a higher price than a crude oil that produces more low value heavy products such as fuel oil.

Apart from price differences due to crude oil quality, international crude oil prices differ from region to region based on the freight rates to deliver crude from one region to another. While any crude oil can in theory be delivered to any global location, usually crude oils produced in regions that are short of crude oil stay within that region, while crude oils produced in regions that have a surplus of crude oil are exported to other regions with a shortage. For example the Middle East region has a significant crude oil surplus and delivers crude (a whole range of different crudes) to North America, Europe, India, and Asia. North African crudes are delivered into Mediterranean Europe, West African crudes to North Europe and North America.

As a result of this global trade in crude oils, crude oil prices across the globe are linked to each other with price variations for the same crude in different regions set by the freight differentials. Provided adequate logistics exist to get the crude to markets, the market is self-adjusting – if a surplus of crude in one region starts to push the price down, the lower price makes the crude more attractive in another region and it will be transported (usually shipped) to other regions, tightening the supply in the source region and bringing the price up. Over time a degree of equilibrium pricing develops between regions for different crudes.

As there are so many different crude oils, marker or benchmark crudes have developed to enable easier pricing of different crudes for both sellers and buyers. Well known marker crudes are Dated Brent (North Sea), West Texas Intermediate (USA), and Dubai

(Middle East). These benchmark crudes developed because they were (at least originally) highly liquid crudes (i.e. with high production rates) that were freely available to multiple buyers and therefore difficult for any buyer to “corner the market”.

The Dated Brent benchmark now comprises a basket of four crudes, Brent System, Forties, Oseberg and Ekofisk, and is quoted as the most competitive (i.e. lowest) price of any of these individual crudes on any day. Prior to 2007 Brent crude usually set the Dated Brent benchmark. Since the start-up of the Buzzard field in January 2007, which feeds into the Forties pipeline system, the quality of Forties has reduced and now Forties normally sets the Dated Brent quoted price, as it is of marginally lower quality than the other crudes. However if Forties price were to be artificially raised by a reduction in production, or one trader buying up all available cargos, then one of the other crudes would become the lowest price crude of the day and prevent the Dated Brent quote from being artificially manipulated. Other crudes in the European crude market often price off of the Dated Brent quote with an adjustment for quality differences. According to the Intercontinental Exchange (ICE) around two-thirds of the world’s crude now uses Dated Brent and some of its derivatives as a price benchmark.

GLOBAL REFINED PRODUCTS MARKET

Similarly to the global crude market, long term global prices for refined products of the same quality do not vary by more than the freight differential between regions. If the price of a particular product rises in one region (which will be due to a supply constraint such as unscheduled refinery shutdown), then it very quickly becomes worthwhile shipping product from other regions to the higher priced region. This has the ultimate impact of increasing the price in the supplying region, and reducing the price in the receiving region, until the equilibrium is re-established again. In addition prices of refined products of similar quality will also not vary substantially more than the freight differential between regions, as refiners and blenders in the regions are very capable of purchasing product in one region and blending it into a similar product in another region. Table IV-1 shows historical prices for different refined products in different regions.

There are a number of structural flows of refined products across the globe, e.g. gasoline flows from Europe to North America. Therefore structurally the price for bulk gasoline in North America (US East Coast) is higher than the gasoline price in Europe (Amsterdam Rotterdam Antwerp, ARA). Diesel flows from the CIS, North America and India to Europe. Therefore European diesel prices are higher than in all other supplying regions. Jet fuel flows from the Middle East and Asia to Europe and so European jet prices are also among the highest across the globe. Fuel oil flows from Russia and Europe to the Far East. Therefore European fuel oil prices are among the lowest in the world.

When there is a (short term) disruption to normal product supply in a region, prices for product can spike upwards as local demand temporarily exceeds supply. The price spike encourages producers in other regions to increase production (subject to their own maximum capacity constraints) and export product to the region with the shortage. This in turn results in an increase in price of the in-demand product(s) in all regions. However, owing to the time taken to produce the additional product, schedule the export cargos and then deliver over long distance, the local restriction in supply can remain in a region for a number of weeks before equilibrium is re-established.

The differences in refined product demand in different regions impacts the price of crude and refined products in different regions, which in turn impacts refinery gross margins in the different regions. This is discussed in more detail for the European market below.

EUROPEAN REFINED PRODUCT SUPPLY DEMAND AND TRADE BALANCE

This section looks at the general European refined product demand outlook and the implications for the regional supply-demand balance and product trade flows out to 2030. It also addresses the specific outlook for products trade into the northern European market, and the implications for the United Kingdom, by discussing and analysing likely future product imports and exports by source/destination.

Since 2000, the European refining industry has become increasingly out of balance with changing domestic demand trends, making the region ever more reliant on trade flows to balance demand with supply. The most notable changes have been a growing surplus of gasoline and an increasing shortfall of diesel, a result of the increasing popularity of diesel-powered private vehicles and growth in commercial diesel. The rapid growth in aviation, which carried on from the trend seen in the late 1990s, has also seen an increase in net jet/kerosene imports as demand has outstripped regional supply.

Although Europe's principal trading patterns have not broadly changed in this timeframe, Asia has recently emerged as a trading partner. Strong economic growth and the expansion of its refining industry has seen Asia emerge as a source of imports of middle distillates and a destination for exports of heavy fuel oil. It is not, however, likely to be a destination for exports of gasoline, as future Asian demand is expected to be met primarily by regional supply. European gasoline exports, therefore, are expected to remain primarily within the Atlantic Basin.

A summary of European product supply, demand and trade balances is shown in Table IV-2.

ECONOMIC BACKGROUND AND PRINCIPAL DEMAND TRENDS

Following the general world economic slowdown in 2001 and 2002 and before the financial crisis of 2008, European economic growth had been consistent and quite strong. The average rate for the region was in the order of 2.3% per year, with the strongest growth being seen in countries such as Ireland, the Baltic States and other former Eastern European countries such as the Czech Republic, Hungary, Poland and Slovakia.

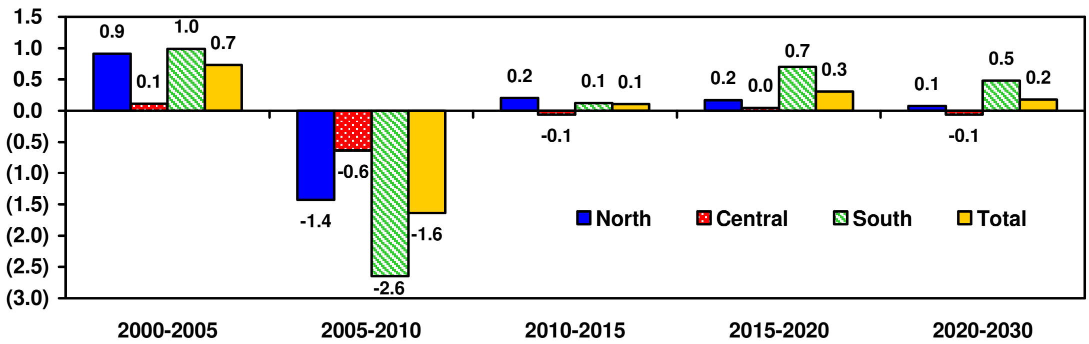
However, the recession of 2008-2009 had a considerable impact on European economies, with average GDP falling by 4.2%. The greatest decline was in Finland, by 8.2%, with the economies of Ireland (7.0%), Iceland (6.7%) and Hungary (6.5%) also contracted significantly, the former two countries suffering from banking collapses. The four largest economies also fell considerably, from 2.6% for France, to 4.9% for Germany and the United Kingdom, and to 5.2% for Italy. Albania and Poland were the only countries to avoid an economic decline in 2009, with GDP rising by 3.4% and 1.6% respectively. The recovery from the recession remains tentative, with several countries still exposed by high levels of debt, the most visible examples being Greece, Spain, Portugal and Ireland.

European GDP recovered somewhat in 2010, by 2.0%, helped by several government incentives and programmes although it was the one-off nature of these programmes in 2010 that led to GDP growth slowing again in 2011, to an estimated 1.8% on average. Continued issues of high debt have contributed to a further slowdown in GDP growth for 2012, which is now likely to be broadly unchanged from that in 2011, such that it is unlikely to be before 2014 that overall average GDP growth may exceed 2.0% again. In the longer term, we expect central and eastern European countries to grow the strongest, with those that acceded to the European Union (EU) in 2004 and Croatia – which is due to accede to the EU on 1st July 2013 – benefitting most from inwards investment.

The forecast for oil demand is developed on a basis consistent with the overall energy requirements. In the transport sector, where oil faces only minimal competition from other energy forms, the forecasts were made using transportation fuel models. These models incorporate assumed changes to the vehicle parc in terms of both numbers and type of vehicle, miles driven and the changes to vehicle technology which are expected to be introduced and which will significantly impact future demand. For other sectors, such as residential/commercial, industry and power generation, oil demand projections take into account competition from alternative energy sources such as natural gas, solid fuels, nuclear energy and renewables.

Regional demand growth projections are presented for the three major regions of Europe. Figure IV-1 shows the regional demand projections for North, Central and South Europe for total refined products demand from 2000 to 2030.

FIGURE IV-1
EUROPEAN PRODUCT DEMAND GROWTH (2000 - 2030)
(Percent per Year)



Historical data source: IEA

As can be seen in the chart above, the most significant changes have been over the 2005-2010 time period, with total European demand estimated to have fallen by 1.6% per year, compared with an average of 0.7% per year growth over the 2000-2005 timeframe. Oil demand fell each year from 2007 to 2010, as a result of two main causes:

- **The recession and economic downturn from 2008 to 2010.** From late in the third quarter of 2008 oil demand began to decline sharply, with the largest fall being the 5.2% drop in demand in 2009. This accounted for a fall of 38 million tonnes from 2008 levels, with a further decline of 10 million tonnes, or 1.5%, in 2010. In percentage terms, the largest falls were for heavy fuel oil (11.0%, primarily because of a 10% drop in bunker demand), jet fuel (6.8%) and gasoil and diesel combined (3.7%).

- **Rising oil prices and the mild winter of 2007.** Before the onset of recession European demand had already declined, as consumers ran down stocks of heating oil and delayed purchases as a result of the sharp increases in oil prices. In most of continental Europe, domestic heating oil is a gasoil quality material (with detailed specifications changing from country to country, primarily different cold flow properties and sulphur content). This is different to the UK and Ireland where domestic heating oil is primarily a lighter kerosene grade. As a result, European non-automotive gasoil demand fell by 13% year-on-year, including a 22% drop in the residential / commercial sector. With heavy fuel oil demand also falling for power generation use, which in many countries is as a swing or peak fuel (i.e. only used when other generation such as gas or hydroelectricity is at full capacity), total oil demand in 2007 fell by 10 million tonnes, or 1.4%, from 2006 levels.

As a result of the weak economic conditions continuing, 2011 total petroleum demand fell further, by 5.3 million tonnes, or 0.8%. Changes in demand are likely to be relatively modest over the next few years, but over the long term, growth rates are expected to pick up slightly, with the highest rates expected to be in Southern Europe as this region has the greatest number of growing economies and, potentially, the highest economic growth rate of the three regions. Northern Europe, on the other hand, is generally a mature economic region such that the only major areas of growth are expected to be in road diesel and jet fuel. Oil demand in the Central region is dominated by the German market and, therefore, that country's projected trends of declining gasoline and heating oil (gasoil) demand in the residential/commercial sector, the latter a result of substitution by renewables and increasing energy efficiency.

AUTOMOTIVE FUEL DEMAND

The main, continuing, trend in light product demand in Europe is that of a decline for gasoline and an increase in that for diesel fuel. The main drivers of this structural shift are the change in private car ownership patterns that have been seen across Europe for the past twenty years, which are expected to continue, combined with steady growth in commercial diesel demand for road transportation (with the exception of the recession in 2009).

Across most of Europe, lower taxation of diesel fuel compared to gasoline at the pump results in diesel being significantly cheaper per litre for the consumer – this despite the fact that bulk diesel prices before tax have been higher than gasoline since 2000, and significantly higher since 2005. Table IV-3 shows pre-tax prices, taxes, and pump prices for 95-octane gasoline and road diesel across some of the major consuming countries in Europe from 2001 to 2011.

With significant improvement in the quality and product range of diesel powered cars together with the better economy of diesel vehicles versus gasoline vehicles, this has been a major driver in the dieselisation of the European car parc over the last decade. For many consumers across the continent, particularly those that have a high annual mileage, running a diesel car is more cost effective than running a gasoline car. Table IV-4 shows the price differential in Euro/litre between gasoline and diesel, together with car population data for some of the major consuming countries in Europe from 2001 to 2011. It can be seen that in all countries the % of diesel cars in the car parc has been increasing.

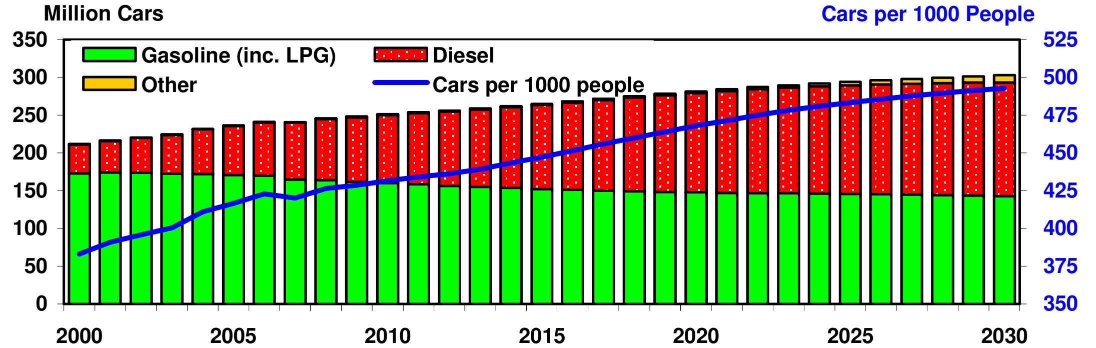
In terms of taxation of fuel at the pump, the UK is an exception to the European norm as since the year 2000 diesel and gasoline have been taxed at the same rate as each other. Nevertheless dieselisation of the car parc in the UK is also accelerating, as the efficiency advantages of diesel cars outweigh the higher cost per litre of diesel fuel for medium and high mileage drivers.

The transport sector (including aviation and local marine, but excluding international bunkers) currently accounts for 55% of European oil demand (Table IV-2). The main uses in the transport sector are in private cars and commercial vehicles, including buses, and over the forecast period this proportion is projected to rise slightly, to 58% by 2030 and 59% by 2040. The development of regulations and technology affecting private cars in particular have had and will continue to have a significant influence on future demand for, and the qualities of, transport fuels.

The steady growth in new car registrations throughout the last decade came to an abrupt halt in 2008, with new car sales for the EU-27 plus the EFTA[15] countries of Iceland, Norway and Switzerland[16] being 7.9% lower than in 2007. New registrations in 2009 fell by a further 1.7%, although this would have been even lower were it not for the schemes introduced by the German and UK governments to offer a cash rebate to consumers to trade in older vehicles for current models. This resulted in an increase in registrations in Germany of over 23% in 2009 compared with 2008, and in the United Kingdom, registrations for September to December 2009 rose by nearly 27% over the same period in 2008. For 2010, new-car registrations for the same area fell by a further 5.0% over 2009, with one of the largest declines being in Germany, which fell by 23.4% after the one-off increase in 2009. Other markets with large declines were Hungary (27.8%) and Greece (35.6%), although countries such as Denmark, Ireland, Netherlands, Portugal and Sweden recorded large increases, from 25% up to as much as 54%.

For 2011, available data show that new registrations for passenger cars were still on a downwards path, falling by 1.1% over the same period in 2010. Total vehicle ownership in Europe is currently about 434 per 1,000 people, and is projected to increase to around 500 per 1,000 people by 2030 (Figure IV-2). Within this total, diesel vehicles in Europe are forecast to increase from around 94 million to 151 million by 2030, with most of the increase reflecting changes already in progress.

FIGURE IV-2
EUROPE PASSENGER VEHICLE OUTLOOK



Historical data source: ACEA

[15] European Free Trade Association
[16] Excluding Cyprus and Malta, for which data is unavailable

Regarding projections of long-term automotive fuel demand, we have assumed that average emissions of new car registrations will continue to move towards the current 2020 target of 95g CO_2/km, although our view is that this target will not be met on an average basis across the whole of Europe. Analysing gasoline and diesel demand and current registration trends across the region, it can be seen that different countries are at different stages towards this target, such that by 2020 it is expected that average emissions, based on current fuel consumption trends, will be closer to about 110g CO_2/km.

Allowing for additional savings made possible through more efficient air-conditioning systems, improvements in low rolling-resistance tyres, etc., claimed emissions are likely to be near the 100g CO_2/km level, and for the majority of manufacturers, diesel cars are expected to continue to be encouraged as one of the strategies to help meet these lower CO_2 emission targets.

The production and uptake of common rail diesel systems for passenger car and light commercial diesel engines has occurred rapidly. All diesels registered from 2002 are assumed to be direct injection. The development of gasoline direct injection (G-DI), however, has been slower, but progress continues to be made, and uptake of G-DI is projected to progress further. Some models are starting to appear in showrooms, although considering current economic conditions sales are expected to remain relatively sluggish.

A small number of new car registrations already are gasoline hybrid-powered, most of which are used mainly in city centres. The share of registrations is forecast to rise modestly over the forecast period. However, although the rate of introduction could be speeded up significantly if traffic restrictions are introduced for inner cities that require, or at least favour, low- or zero-emission vehicles – such as in London, for example, where such vehicles are exempt from the city centre's Congestion Charge – there remain long-term questions over the viability of these drive trains, such that a move to full electric vehicles for inner cities remains quite possible. Furthermore, the advantage of such vehicles in terms of fuel economy and CO_2 emissions continues to be eroded considerably by new technologies in conventional gasoline and diesel engines.

The rate of introduction of non-conventionally fuelled vehicles (mainly fuel cell vehicles) is assumed to remain marginal, at best. Research activity has continued but there is still much to be achieved to reduce the cost of the vehicles, develop fuels and their distribution infrastructure and win customer acceptance. Our forecasts have assumed minimal uptake of fuel cells over the forecast period; however, if technology moves faster than anticipated, or if legislation makes conventional-engined vehicles more expensive or unable to be used in city centres, fuel cell-powered vehicles may enter the parc more quickly.

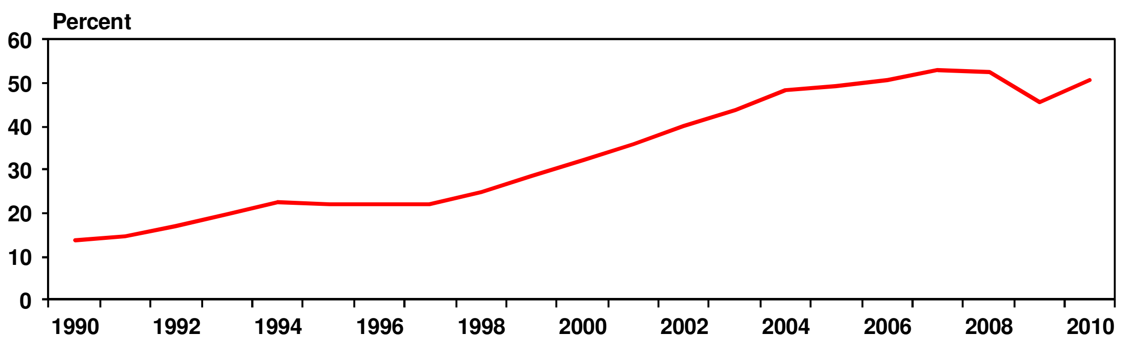
The rate of uptake of LPG or natural gas (CNG)-powered vehicles in each country depends on national taxation policies and the existence or development of a fuel distribution infrastructure, such that they are only a significant market in very few countries, such as Italy, Poland and Turkey. As vehicle engines have become more complex, the cost of conversion to LPG or CNG has risen, increasing the annual distance that has to be driven before the conversion cost is recovered by fuel cost savings. Furthermore, the significant improvements in the fuel economy of gasoline and diesel engine cars that have been seen and are expected over the coming years reduces considerably the incentive to use gaseous fuels, such that even in those countries where they are already established the proportion of these vehicles in the car parc is likely to decline in the longer term.

Diesel Vehicles

The penetration of diesel engine cars varies considerably from country to country. The highest penetration is in Belgium, where 75% of new vehicles registered in 2009 and 2010 had diesel engines, which contrasts with the Netherlands at about 17%. It should be noted that the share of diesels in Greece is only 3%, but this may be regarded as an exception because up until 2011 diesel cars were banned from the main Athens market. The level of uptake of diesels in any country depends on many factors, including the relative prices of gasoline and diesel at the pump, the relative cost and resale value of equivalent diesel - and gasoline - powered vehicles, the relative levels of duty and other annual vehicle taxes and the extent to which diesel cars are promoted by car manufacturers.

Up until 2007, the average share of diesels in new vehicle registrations had increased steadily since 1990, before levelling off in 2007, as shown in Figure IV-3. The average share across Europe levelled off at about 53% in 2007 and 2008, although the past few years have hidden some diverging trends. Registrations in Austria, at one time the market with the largest share of diesels in 2003, declined from over 71% in 2003 to only 46% in 2009, although this recovered slightly in 2010 to almost 50%, as improving gasoline technology persuaded some drivers to switch back to gasoline-powered cars. Countries such as Norway and Sweden, on the other hand, have seen a sharp increase in the share of diesels, owing to changes in vehicle taxation policies.

FIGURE IV-3
SHARE OF DIESELS IN EUROPEAN NEW CAR REGISTRATIONS



Note: Data for 2010 is for January -August only *Data source: ACEA*

The plateau between 1994 and 1998 represents the period that followed the initial uptake of diesels by a relatively small sector of the population, but which preceded the large-scale introduction of high-pressure direct injection turbodiesels, and the more widespread introduction of cleaner non-commercial fuelling points which led to greater consumer acceptance of diesel powered cars.

In 1998 European motor manufacturers entered into a voluntary agreement to reduce average CO_2 emissions from new vehicles to 140g CO_2/km driven by 2008. (In 1999, Japanese and Korean manufacturers also entered the agreement - in their case to meet this target by 2009). In addition to this target was the intention to reduce emissions further, to 120g CO_2/km by 2012 (equivalent to a fuel economy of 5.0 litres/100 kilometres [47 US miles per gallon] for gasoline engines and about 4.5 l/100km [52 US mpg] for diesel engines). As a result of this agreement, manufacturers began to make more diesel powered passenger cars available as the greater efficiency of diesel engines compared to gasoline engines meant that achieving the new more stringent efficiency targets was easier

Although initial progress towards the targets was good, progress in the 2002 to 2006 period slowed. The technical difficulties of achieving greater fuel economy, whilst at the same time meeting consumer and regulatory demands for greater safety and consumer preferences for larger, higher-performing vehicles, were challenging for the car industry. As a result, in 2008 the Commission amended its previous timetables, such that the following agreement (Regulation EC 443/2009) is now in place:

- There will now be a phase-in of the 120g CO_2/km target between 2012 and 2015. Each car manufacturer has its own CO_2 reduction target which takes into account the weight of the cars sold by that manufacturer

- Car manufacturers had to ensure average emissions of 65% of their fleets complied with the 120g CO_2/km target in January 2012. This increased to 75% in January 2013, and increases to 80% in January 2014 and 100% in January 2015

- If the average CO_2 emissions of a car manufacturer's fleet exceed its target from 2012, the manufacturer has to pay an excess emissions premium for each car registered. This premium amounts to €5 for the first g/km of excess, €15 for the second g/km, €25 for the third g/km, and €95 for each subsequent g/km. From 2019, the first g/km of excess will cost €95

- Individual manufacturers' targets are differentiated on the basis of the mass of the cars produced in the target year, such that if a manufacturer's cars are 100kg heavier than the industry average by 2015 it is allowed a 4.6g/km higher CO_2 target (e.g. 134.6 g/km compared with 130 g/km). Conversely, if a manufacturer's cars are lighter than the average they have to meet a tougher target

- Manufacturers are also able to file for joint-compliance, or 'pooling' with other manufacturers in order to average emissions over a larger pool of vehicles

- There is a new long-term target of 95g CO_2/km for 2020. Previously this target had been referred to under general parlance of "support for research to reduce emissions further", with an aim of 95g CO_2/km by 2020.

- The new obligations on the car industry have already resulted in some dramatic progress in new car fleet efficiency, with average CO_2 emissions falling by 3.7% in 2011 compared with 2010 to reach an average of 140 g CO_2/km. The industry is now only 7% away from hitting the 2015 130g CO_2/km target, compared with a gap of 11% in 2010.

In 2009, the share of diesel registrations fell significantly, to an average of 46%. We believe there were two factors behind this trend, and which also explain the recovery shown for 2010 (the last year for which such data is available):

- The economic downturn in 2009 resulted in a fall in new car registrations, and a trend to smaller average engine sizes – which tend to favour gasoline technology. In 2008, the average engine size of new registrations was 1.71 litres; in 2009, this fell to 1.63 litres – the lowest since 1991.

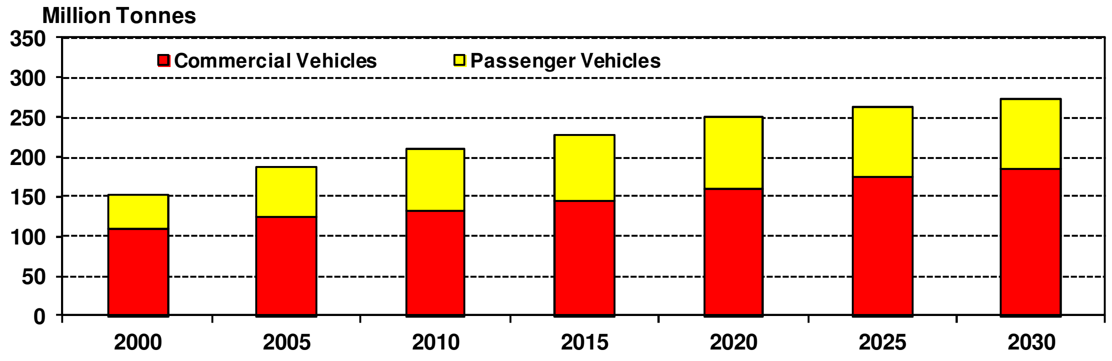
- The car scrappage/replacement scheme introduced in Germany and the United Kingdom worked on the basis of a fixed cash rebate; this is likely to have favoured the purchase of smaller cars – and hence a greater proportion of gasoline-engined vehicles – than larger cars, as the cash amount represents a greater proportion of the initial purchase price than for a more expensive, larger car.

As a result, we believe the dip in 2009 was more of a one-off occurrence than the signal of a terminal decline in the share of diesels in new registrations. Looking ahead, there are a couple of factors that are likely to continue to stand in their favour, especially in those countries where registration levels remain relatively low.

- The greater efficiency and fuel economy of diesels compared with gasoline engines reduces CO_2 emissions per mile/kilometre travelled, which help manufacturers meet their agreed emissions targets.
- As fuel prices rise, diesels continue to become more economically attractive, primarily owing to their greater fuel economy – provided that the cars themselves do not command a significantly higher initial price tag. This advantage for diesels is increased in countries where tax on motor fuels is high, as the fuel economy savings apply to both the underlying fuel cost and the fuel excise duty.
- In many European countries excise duty on diesel is lower than on gasoline (even though both are relatively high). As a result in most countries diesel fuel is at a lower price per litre than gasoline at the retail pump. (see Table IV-3)

The forecast of diesel registrations has been made on a country-by-country basis, recognising local factors such as taxation regimes, etc. However, it should be noted that despite the increase in the number of diesel-powered cars, passenger car diesel still remains a relatively small proportion of road diesel consumption (Figure IV-4). In this figure the consumption of passenger car vehicles includes small commercial vans that would refuel via retail sites. Commercial vehicles include primarily large trucks and buses/coaches that would refuel via commercial deliveries at their own depots or designated truck-refuelling stations.

FIGURE IV-4
EUROPE DIESEL CONSUMPTION PROFILE



Historical data source: ACEA

In 2011, 63% of road diesel is estimated to have been used by commercial vehicles. Despite the forecast increase in the diesel car population, the proportion of diesel used in commercial vehicles is projected to remain broadly unchanged, at 64% by 2030, a result chiefly of vehicle efficiency improvement.

EUROPEAN REFINED PRODUCT DEMAND

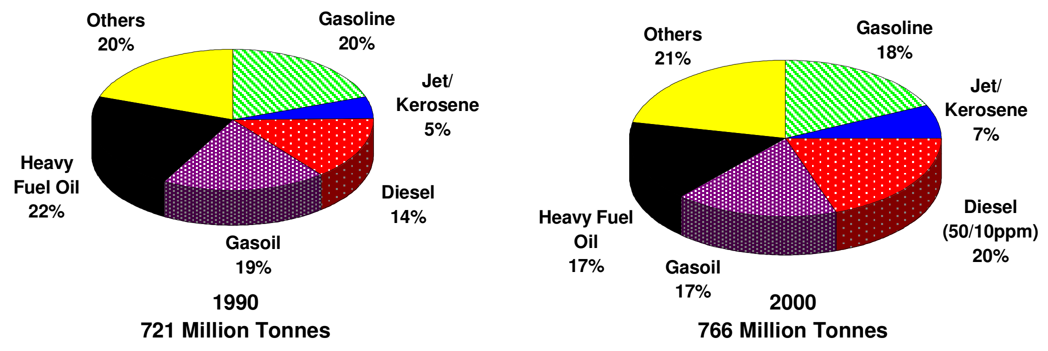
A summary of European product supply, demand and trade balances is shown in Table IV-2

In 2011, refined product demand in Europe, including 36 million tonnes of refinery fuels and 56 million tonnes of bunker demand, is estimated to have been 724 million tonnes. As noted above, demand has declined each year since 2006, with the largest fall being for inland heavy fuel oil consumption (an average of 11.8% per year) and for gasoline (3.9%), which has continued its structural decline. Road diesel, on the other hand, has grown by an average of 1.6% per year despite the effects of the recession, while demand for jet/kerosene (+0.1%) and naphtha (+1.7%) have been broadly flat, although each suffered a sharp, recession-related fall of 6.8% in 2009 and 6.6% in 2008 respectively.

As a result of the weak economic situation, demand overall in 2012 is unlikely to recover from 2011 levels. Of the major refined products, the structural trends witnessed over the past decade will continue to be apparent: demand for gasoline and heavy fuel oil is expected to decline further, while that for road diesel and jet/kerosene is forecast to increase. A greater recovery is expected in 2013, in line with forecasts of improving GDP growth, with increasing growth rates of diesel and jet/kerosene, as well as of bunker fuel (Table IV-2).

Figure IV-5a and IV-5b illustrate the changing pattern of demand in Europe over the long term. Including refinery fuels, total demand grew from 721 million tonnes to 766 million tonnes from 1990 to 2000, driven primarily by growth in diesel and jet/kerosene demand. The gasoline share of total demand dropped from 20% to 18%, but owing to total demand growth, the absolute reduction in gasoline demand was relatively small, from 142 million tonnes to 137.6 million tonnes.

FIGURE IV-5a
TOTAL EUROPEAN PRODUCT DEMAND AND PRODUCT SHARES: 1990 AND 2000



Note: Includes Bunker Demand and Refinery Fuels. "Others" includes Naphtha, LPG, Petcoke, Lubes, Bitumen, Waxes *Historical data source: IEA*

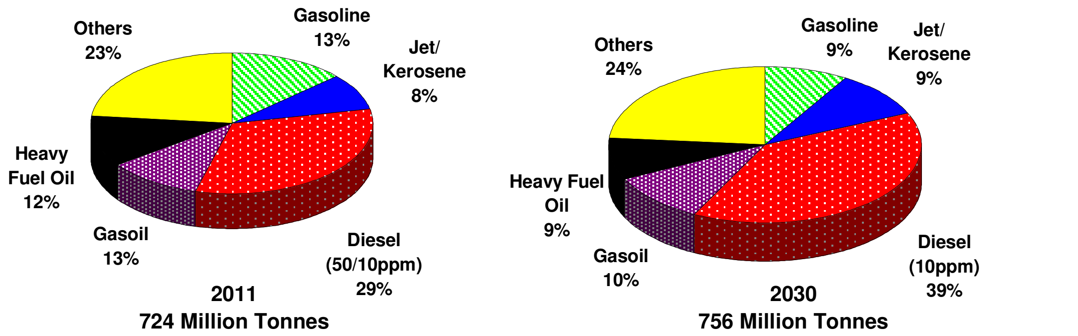
The changes in demand patterns over 2000 to 2011 were more dramatic. Total demand dropped from 766 million tonnes to 724 million tonnes (mainly due to reduction in demand over 2008 to 2010 as a result of the recession/slowdown). Gasoline market share dropped from 18% to 13%, a reduction of 41 million tonnes, whereas diesel market share rose from 20% to 29%, an increase of 83 million tonnes. Fuel oil demand also declined significantly, from 128 million tonnes down to 83 million tonnes.

These changes took place over a relatively short time span, 11 years, at a significantly faster pace than the refining industry was able to respond. Almost all of the refineries in

Europe were commissioned before 1990 and designed to deliver products required by the market at that time.

The European demand forecast is for a continuation of trends seen over the last decade. Middle distillates demand – jet/kerosene, gasoil and diesel – is forecast to increase from an estimated 50% of total product demand in 2011 to 58% by 2030, with increases in diesel (+62 million tonnes p.a.) and jet/kerosene (+ 13 million tonnes p.a.) marginally off-set by decrease in gasoil (- 2 million tonnes p.a.). The share of gasoline demand over the same period is projected to fall from 13% to 9%, a fall of 31 million tonnes per annum. This change is primarily a result of the above-mentioned switch from gasoline-powered private cars to diesel power. Heavy fuel oil demand, including bunkers, is expected to decline slightly in absolute terms, such that its share of total refined product demand in 2030 is projected to fall from the current level of 12% to 9%.

FIGURE IV-5b
TOTAL EUROPEAN PRODUCT DEMAND AND PRODUCT SHARES: 2011 AND 2030



Note: Includes Bunker Demand and Refinery Fuels. "Others" includes Naphtha, LPG, Petcoke, Lubes, Bitumen, Waxes *Historical data source: IEA*

GASOLINE

Gasoline demand in Europe fell to 96 million tonnes in 2011, which compares markedly with the peak of 145 million tonnes in 1997, a reflection of the increasing use of diesel in the private automotive fleet. As discussed above, the share of diesels in new registrations has generally been increasing in nearly all European countries, such that, even allowing for the one-off decline in 2009, their share of the total car parc continues to increase while that of gasoline-powered cars declines. With car manufacturers expected to continue promoting sales of diesel-powered cars to comply with legislation to reduce average CO_2 emissions from the new car fleet, and gasoline-powered engines themselves becoming considerably more fuel efficient, our projection is that gasoline demand will continue to decline over the forecast period, although the rate of decline is likely to slow in the long term as the proportions of gasoline cars and diesel cars in the total fleet stabilises. Forecast rates of decline are of 3.5% in 2012 as a result of weak economic conditions, easing to 3.0% in 2013 and then to about 2.5% annually on average towards 2016, before slowing further to an annual rate of decline towards 1.5% by 2030.

JET/KEROSENE

Jet/kerosene demand grew very strongly and consistently from the mid-1990s to 2007, supported by the liberalization of the aviation industry and the arrival of many low-cost carriers, with the trend interrupted only by the decline in air travel in 2001 and 2002. However, the recession in 2009 resulted in a drop in jet fuel demand of 6.8%, and although it recovered slightly in 2010 and 2011, at 55 million tonnes it remains below the 2008 peak of 57 million tonnes. Further growth is likely to be modest, at rates of 1.0-1.6% per year from 2015 onwards, compared with previous high growth rates of over 5% per year, a result of current congestion at many major airports and the move towards more fuel-efficient airliners in absolute terms and passenger-mile terms.

There is still a limited market in Europe for burning kerosene, of 5.5-6.0 million tonnes. This is primarily in Ireland and the United Kingdom where it is used for domestic heating systems rather than gasoil. These markets are expected to decrease very slightly, with further penetration of natural gas and renewable energy sources, as well as increasing energy efficiency, all factors constraining demand.

GASOIL AND DIESEL

Gasoil and diesel are used primarily in the transport sector for road (diesel), rail and domestic marine use (gasoil and diesel) and in the residential/commercial sector (gasoil) as a heating fuel. There are also sizeable industrial and agricultural markets, but minimal use for power generation. Total consumption in 2011 is estimated to have been 314 million tonnes, including about 7.6 million tonnes of bunker fuel demand. Of this 234.5 million tonnes was road diesel quality and 79.4 million tonnes gasoil quality.

The Purvin & Gertz forecast outlook includes a step-change increase in gasoil based marine bunker (marine diesel) demand in 2015 of around 11 million tonnes. The October 2008 adoption of the Amendment to Annex VI of the MARPOL 73/78 convention calls for the sulphur content of marine fuel used in Emissions Control Areas (ECAs), which currently applies to the Baltic Sea, North Sea and English Channel, to be a maximum of 0.1%wt. sulphur from 2015. With further changes to global marine fuel content to 0.5%wt. sulphur currently scheduled for the 2020-2025 timeframe, and taking into account that some of this may be met by the use of sulphur scrubbers onboard ship, we are also expecting a further switch of about two million tonnes of fuel from heavy fuel oil to marine diesel (i.e. a gasoil type fuel) in 2020.

The use of heating gasoil has been in general decline for many years, with annual variations being driven by weather patterns – this was especially a major factor in 2007, because of the very mild first quarter – and high end-user prices. A continuing reduction in demand is expected in our projections, as a result of continuing substitution by natural gas and renewable energy sources, such as biomass, and improving efficiency by existing users as old gasoil fired heating systems are replaced with more efficient new gasoil fired systems. In some markets, however, housing developments outside city and town centres that are beyond current natural gas distribution systems are likely to result in some additional heating oil demand, although once such developments reach a certain size it is probable that the gas network would be expanded to accommodate them, resulting in a subsequent decline.

Limited quantities of gasoil are used in power generation, as a standby fuel for gas turbines and for small-scale island power plant, and this market is expected to remain a minor one. Gasoil use in industry has shown a very moderate rate of increase for the last seven years, and the forecast assumes that total consumption will continue roughly at current levels as natural gas and, increasingly, electricity renewable energy sources are likely to be the growth fuels in the industrial sector. The use of gasoil and diesel in the agriculture sector is split between use as a vehicle fuel and use for heating and crop drying. The limited data available indicates an approximately equal split, although this varies considerably between countries, with drying likely to be a higher share in northern countries. Some growth in the use of gasoil and diesel in this sector is forecast particularly in former eastern European countries, as farmers increase automation.

There has been a significant shift in gasoil quality since January 2010 as a result of legislation in the Fuels Quality Directive. Part of the industrial sector switched to ultra-low sulphur fuel (10 ppm wt. sulphur) in January 2010, as had part of the agriculture sector; furthermore, all gasoil used in non-road mobile machinery, including use in inland waterway transportation, switched to the 10 ppm grade by 1st January 2011. As a result of these changes, an extra 21 million tonnes of gasoil is now estimated to have switched to the 10 ppm diesel grade.

Following a decline in 2009 as result of the recession, transport diesel demand growth resumed in 2010, and further in 2011, helped by a recovery in the use of commercial diesel as well as the effects of the number of diesel cars in the car parc, as discussed above. Overall, total European gasoil and diesel demand is projected to reach 374 million tonnes by 2030 and 389 million tonnes by 240, of which 315 million tonnes is forecast to be 10 ppm road/off-road diesel.

DIESEL AND GASOIL MARKET DIFFERENCES

Historically in national and international data submissions, diesel and gasoil have been grouped together, since in the past these were very similar products, with similar specifications. However with the advent of tighter regulation concerning fuel quality and emissions, particularly vehicle emissions over the last twenty years, while the quality of both diesel and gasoil fuels has improved, road quality diesel in mature advanced markets such as Europe has become a significantly cleaner fuel than burning or industrial gasoil. A summary of key properties/specifications for road diesel industrial gasoil and some gasoil components are shown below

Diesel, Gasoil, and Gasoil Component Property Differences

	Sulphur (ppm wt.)	Cetane No.	Density (kg/m^3)
Diesel (specifications)	10 max.	50 min.	845 max.
Gasoil (specifications)	1000 max.	45 min.	860-865 (typical)
Cracked Gasoils (Cycle Oils) (typical properties)	>> 1000	35-40	920
Straight Run gasoil for processing (typical properties)	> 1000	>50	840 - 845

In national statistics, production, import and export of all these materials are grouped together under a combined gasoil/diesel banner, when in fact only the diesel and gasoil material are finished products, and the gasoil components require further processing.

On a refinery both diesel and gasoil may be produced by a combination of blending and desulphurising intermediate gasoil streams that are produced from crude distillation, together with cracked gasoil streams produced by units such as thermal crackers, cat-crackers, and hydrocrackers. Some kerosene material is also included in the blends. Cracked gasoil material from cat-crackers and thermal crackers will usually have a higher density, higher sulphur content and lower cetane number than gasoil streams produced from crude distillation and hydrocrackers. This is because these cracked gasoil molecules are more cyclical in nature (= more aromatic, less saturated), as they are produced by thermal/catalytic cracking of heavier molecules to lighter molecules. These cracked materials therefore require more processing than straight-run gasoils.

The higher cetane number specification, lower sulphur specification, lower maximum density specification make road diesel a more difficult product to produce than industrial gasoil. The higher cetane number and lower density specifications in particular mean that less cracked gasoil material can be blended into road diesel than can be blended into industrial gasoil. The 10 ppm sulphur road diesel specification means that all streams blended into road diesel must be desulphurised. The 1000 ppm sulphur specification for industrial gasoil does allow some un-desulphurised material to be blended into industrial gasoil.

Therefore road diesel and industrial gasoil are now two very different products, although they are produced from a number of similar intermediate streams. Road diesel has more restrictions on the amount/type of heavier cracked material that can be in the blend compared to gasoil. In addition, road diesel requires more processing, particularly deep desulphurisation down to 10 ppm wt. sulphur level.

In our projections, demand for road diesel quality material is expected to increase, whereas demand for industrial quality gasoil material is expected to decrease. Overall combined demand for gasoil and diesel is expected to increase. (See Table IV-2).

HEAVY FUEL OIL

Overall fuel oil use has declined steadily for many years, with the largest falls in electricity generation and the industrial sectors; however, growth in bunker fuel use has partially offset that decline, driven by the increase in global trade from the beginning of the previous decade in line with the rapid rise in manufacturing in the Far East. Demand in this sector fell from 2008 to 2010 as the slowdown in world economies and world trade took effect, but a recovery of 4.8% is estimated to have taken place in 2011. Overall, heavy fuel oil demand is expected to continue to decline in all sectors except for bunkers over the longer term, although the rate of decline is expected to ease as the potential for further substitution had reduced considerably.

Bunker fuel oil demand is forecast to grow only slightly in 2012, by 0.5% from 2011 levels, as worldwide trade continues to pick up only weakly. Demand is projected to increase further out to and including 2014 but, as discussed previously, is then expected to fall in 2015, by about 10-11 million tonnes, as a result of the October 2008 adoption of the Amendment to Annex VI of the MARPOL 73/78 convention. A further loss of three million tonnes by 2020 is also expected. After this time and out towards 2040, few further major changes are forecast; an assumed continuation of increasing world trade is likely to result in a small increase in bunker demand, although demand itself may prove to be limited by the general availability of fuel oil (owing to increased conversion to meet distillate demand) such that refinery supplies will probably be the limiting factor for bunker demand.

NAPHTHA

The predominant use of naphtha is as a petrochemical feedstock, with only limited amounts used as specialty products such as paint and other solvents. The use of oil-based paint solvents is expected to reduce as measures are taken to control atmospheric emissions of volatile organic compounds.

Following on from the rapid decline in the fourth quarter of 2008, naphtha demand fell further in 2009, by 1.0%, as stocks of petrochemical products continued to be run down. However, demand recovered strongly in 2010, growing by 3.4%, only to contract again in 2011, by 2.8%, as a result of weakening economic conditions, such that demand now stands at 53 million tonnes. Over the longer term, European petrochemical producers are expected to remain under increasing pressure from producers in Asia, such that prospects for a sustainable recovery are few. As a result, following an estimated recovery in demand of 3.1% in 2013 after forecast growth of only 0.8% in 2012 as stocks are built back up again, naphtha demand is likely to be broadly flat from about 2015 onwards, staying at around the 50 million tonnes mark.

A more detailed breakdown of European refined product demand by European region (North Europe, Central Europe and South Europe) is provided in Annex 1 of this report.

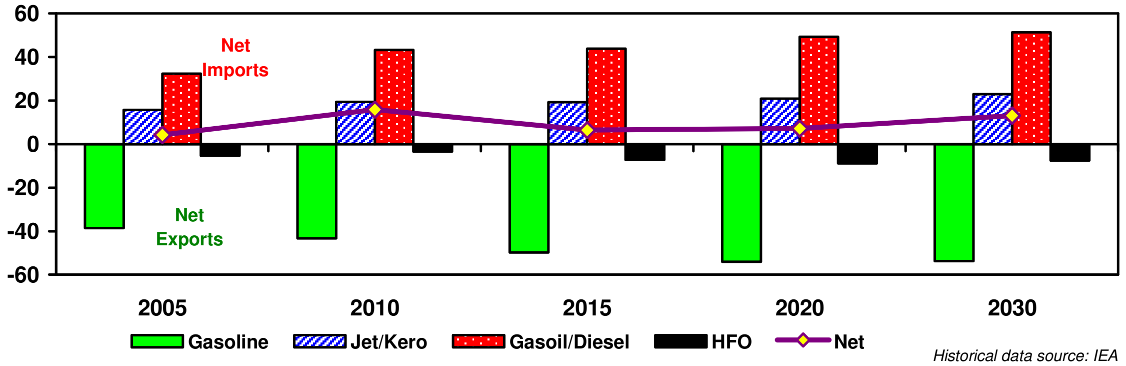
EUROPEAN REFINED PRODUCT TRADE FLOWS

The European refining industry has become increasingly out of balance with domestic demand, with the result that the region is increasingly reliant on trade flows to balance demand with supply. As a result of the decline in gasoline demand and increase in diesel and jet fuel demand, Europe is structurally long on gasoline and structurally short on both jet/kerosene and gasoil and diesel. It is in approximate balance for heavy fuel oil.

Although overall crude runs in Europe are expected to decline gradually in the long term, some countries with higher-than-average demand growth are likely to add distillation capacity along with conversion projects. Offsetting this, capacity will probably reduce in other locations where economics become unfavourable; such changes are consistent with the long-term rationalization of the refining industry, which results in the concentration of capacity into larger, more efficient refining sites. The main new distillation projects are in Spain and Poland, which are both growing markets in the long term.

The future trade flows for the main products for Europe are shown in Figure IV-6, followed by specific details on flows for each of the major products for Northern Europe.

FIGURE IV-6
EUROPEAN PRODUCT TRADE BALANCE, 2005 - 2030
(Million Tonnes)



Historical data source: IEA

The decline in gasoline demand is likely to have a significant impact on several European refiners, resulting in the rationalization of some gasoline-making facilities, especially in inland markets with few export opportunities. As an example, the closure of one FCC unit at the Bayernöl facility in southern Germany was completed in 2009, and other refineries will either continue to rely on exports to balance their production or be forced either to reduce operations or close, such as has been seen with the Petroplus refineries in 2011 and early 2012. However, additional export opportunities, especially to traditional markets such as the United States, are likely to remain extremely limited, and owing to a lack of significant additional export markets net exports are expected to remain broadly constant at about 50-55 million tonnes.

Despite the projected increases in hydrocracking capacity, the continued rise in European demand for middle distillates is forecast to result in increasing volumes of net imports for both jet/kerosene and gasoil and diesel to 2020. Net European jet/kerosene imports are projected to increase from an estimated 19 million tonnes in 2010 to 21 million tonnes in 2030 and 22 million tonnes in 2040; the Middle East is expected to remain the principal source, but increasing volumes are also projected to be required from Asia.

Europe is already a large net importer of gasoil and diesel, of about 41 million tonnes. France and Germany are the largest markets and import to meet both seasonal heating requirements and increasing diesel demand. The UK is also a net importer. Belgium and the Netherlands, with their large refining bases compared with the sizes of their domestic markets, are both net exporters, as is Italy; however the surplus in all of these markets is diminishing as domestic consumption increases. Combined gasoil and diesel net imports are projected to rise further, to 51 million tonnes by 2020, increasing slightly to 54 million tonnes by 2030. Of these import sources, the CIS region is expected to remain the most significant source, but there is likely to be an increasing diversity of supply, with additional imports being sourced from the United States, the Middle East and Asia. Indeed, our outlook for capacity requirements also depends on assumptions regarding the make-up of refinery feedstocks in the future, as there is a high dependence in Europe on gasoil imports from the CIS region. If these fail to materialize, the alternatives are likely to be either increased imports from other sources or increased imports of long residue feedstock which would require additional conversion capacity.

There is considerable trade of fuel oil in Europe, both as cracked or finished product and as unfinished refinery feedstocks. Similar to gasoil trade flows, the CIS Region is the primary supplier of fuel oil to Europe; however Libya is also a large supplier as it produces a good quality low sulphur residue for upgrading, although supplies of this effectively ceased in 2011 as a result of the troubles and are only slowly resuming. Net European fuel oil trade is in approximate balance, exporting only about 2.8 million tonnes, although these could increase slightly over the forecast period.

Likewise, the European naphtha balance, currently net short of about 11 million tonnes, is expected to change only slightly.

Detailed product balances for North, Central and South Europe can be found in Annex 1 of this report.

EUROPE PRICES AND MARGINS

Northwest Europe (Rotterdam) has the largest proportion of refining capacity and product demand, and so is considered the primary price-setting location in Europe. Product prices and refining economics in the Mediterranean reflect local product supply and demand, but are also strongly influenced by northern Europe through trade.

Crude oil production from the North Sea peaked in 2000 and by 2010 had fallen to around 3.5 million B/D. The crude slate in Northern Europe is expected to become somewhat heavier, and higher in sulphur content, as a result of mainly Russian crude oil replacing North Sea crude oil. However, in the Mediterranean, the trend is towards processing lighter crude oils due to the strong increase in crude production from the Caspian and North African regions. In addition, recent analysis in our new Global Crude Oil Market Outlook service indicates that the flow of Russian crude oil into the Mediterranean is likely to decline in the future as volumes are switched to North West Europe and the Far East.

Our balances indicate that only a modest rate of residue conversion capacity additions will have to take place in Europe and already announced conversion capacity additions appear to be adequate through 2020. The economic downturn has resulted in lower demand growth and combined with the still extensive project announcements worldwide the risks of global over-investment in the next five years remain high. In 2011 the market was disrupted, particularly in the Mediterranean, due to the effects of the Libyan crisis.

Refining margins improved significantly in 2012, particularly over the summer months, compared to the low margins of 2011 which largely resulted from the loss of Libyan crude oil supply. Closures of around 1.4 million B/D (70 MT/year) of refinery capacity have already taken place and a further 0.3 million B/D remains idled with an uncertain future, helping to support margins in the short term. In Q3 additional short-term margin support came from refinery disruptions in Venezuela and California (refinery fires), and the US Gulf Coast (Hurricane Isaac). These disruptions, combined with a significant level of planned maintenance shutdowns in European refineries, led to tight supply of both middle distillates and gasoline in the third quarter, boosting margins in both Europe and North America. Margins remained high entering the fourth quarter before declining somewhat towards year end.

We expect that the difficult economic environment, combined with the outlook for further legislation changes affecting the refining industry in Europe, will result in further capacity reductions in the next five years. These capacity reductions are expected to be a mixture of some total plant closures and some reductions of capacity where multiple trains are employed in some refineries. By 2015, we expect margins to recover to our projected long-term equilibrium levels, supported by the additional demand for gasoil resulting from the bunker fuel specification change in 2015 but this is based on the assumption that further capacity will close in the intervening period to restore capacity utilization to more profitable levels.

NORTHWEST EUROPE REFINING MARGINS

Brent crude is used for assessing Northwest European refining economics on sweet crude owing to the fact that its quality is representative of overall North Sea production. We differentiate between Brent and Dated Brent due to the Dated Brent price being set for the majority of time by Forties Blend since early 2007. Accordingly, the sweet crude margins presented use a Brent price as the feedstock basis rather than Dated Brent. Sour crude processing economics are based on 100% Urals from 2007 while a combination of Urals and

Arabian Light crudes is used as representative of sour crudes processed in the region in the pre-2007 economics. The three key refinery configurations used to characterize the industry in Northwest Europe are hydroskimming, catalytic cracking and hydrocracking. The refinery economics presented reflect configurations that changed to meet new product specifications in 2000, 2004 and 2007.

The table below describes some of Purvin & Gertz' Northwest Europe theoretical benchmark refineries. These benchmark refineries help to show which type of refineries processing which type of crudes are likely to be competitive going forward.

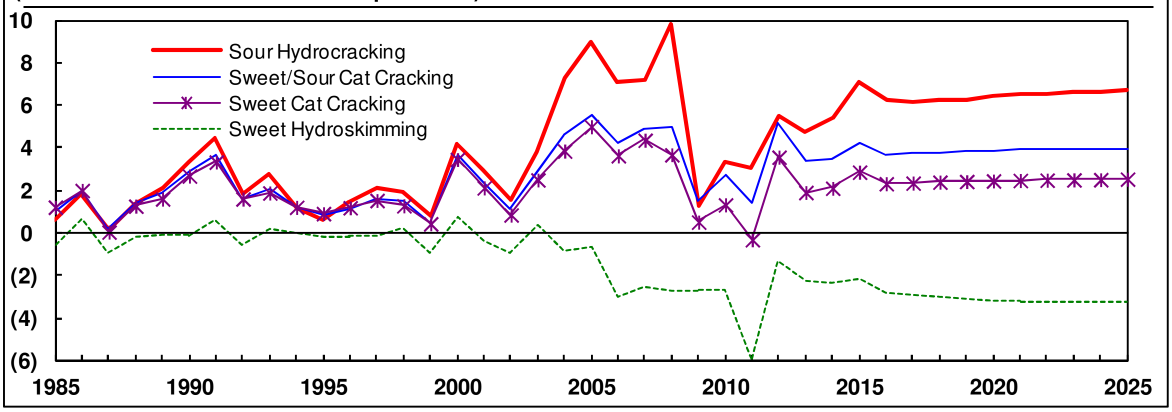
PGI NORTH WEST EUROPE BENCHMARK REFINERIES

Refinery	Description
Sour Hydrocracking	200,000 B/D, 100% Urals crude, products sold inland at CIF prices, competitive yield and cost structure *
Sweet/Sour Cat-cracking	200,000 B/D, 70% Brent 30% Urals crude, products sold inland at CIF prices, competitive yield and cost structure *
Sweet Cat-cracking	200,000 B/D, 100% Brent crude, products sold inland at CIF prices, competitive yield and cost structure *
Marginal Cat-cracking	100,000 B/D, Brent crude, middle distillates sold inland at CIF prices other products exported at FOB prices, less competitive yield and cost structure *
Sweet Hydroskimming	200,000 B/D, 100% Brent crude, products sold inland at CIF prices, competitive yield and cost structure*

Note: * competitive yield and cost structure for that type of refinery i.e. hydroskimming yields are not competitive with hydrocracking yields

Figure IV-7 below shows the net cash margin that our benchmark refineries would have earned based on actual historical crude and refined product prices, and provides a projection of future margins based on our predicted crude and refined product price set.

FIGURE IV-7
CIF NWE NET CASH REFINING MARGINS
(Forecast in Constant 2011 Dollars per Barrel)

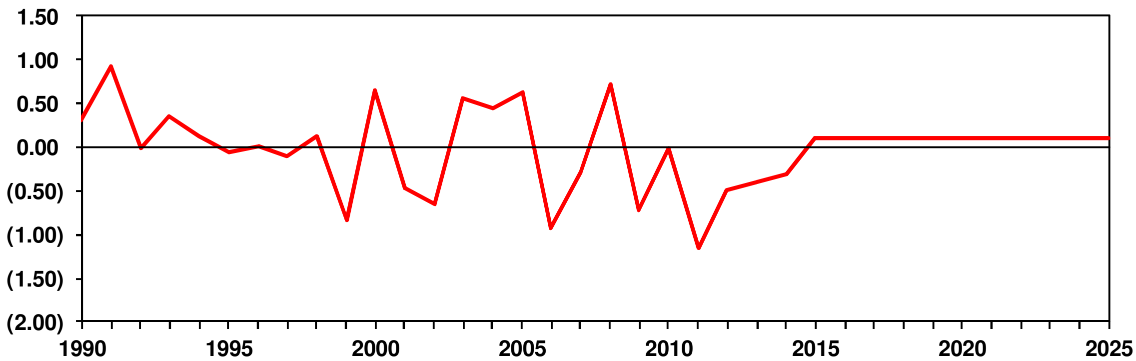


In the 2005 to 2008 period, European margins were supported by the high utilization rates that were needed to meet worldwide demand. In addition, the changes to 50 ppm sulphur diesel and then 10 ppm sulphur diesel in Europe in 2005 and 2008, along with worldwide strength of middle distillates, continued wide price differentials between light and heavy products, and hurricane-related disruptions combined to result in record high margins. Margins fell dramatically in 2009 as the economic recession reduced demand and refinery utilization levels. Margins improved somewhat in 2010, but were strongly impacted in 2011 by the disruptions in Libya, which removed a significant supply of light sweet crude oil from Europe's doorstep. As a result, the price of benchmark Dated Brent rose and prices of very low sulphur crudes strengthened even more as Europe needed to attract crude supplies from further afield to replace the lost Libyan production. 2011 was therefore a poor year for refining margins in Europe.

2012 saw a significant margin recovery, supported by recent refining capacity closures and a number of refinery disruptions in the US and Venezuela. Margins are expected to fall back slightly from 2012 levels through 2013 as the global impact of new refining capacity coming on-stream and slow demand recovery results in continued low levels of refinery utilization. Some margin support is likely to come from recent capacity closures. In the longer term, margins are expected to remain higher than pre-2004 historical levels for hydrocracking refineries processing sour crudes as these refineries produce a higher proportion of diesel and kerosene products.

Post 2015, the expected hydrocarbon export duty changes announced in Russia are likely to reduce the utilization of simple refining capacity in Russia, and hence reduce the availability of feedstocks to the European market. In order to maintain conversion capacity utilization levels, this feedstock would need to be replaced by an increase in crude distillation utilization. Therefore, post 2015, our incremental hydroskimming margin, with full residue premium, moves to slightly positive territory to allow for the production of feedstocks required by upgrading capacity. This allows marginal distillation capacity on existing complex refineries to be fully utilised to produce feedstock for the upgrading units (i.e. cat-crackers and hydrocrackers).

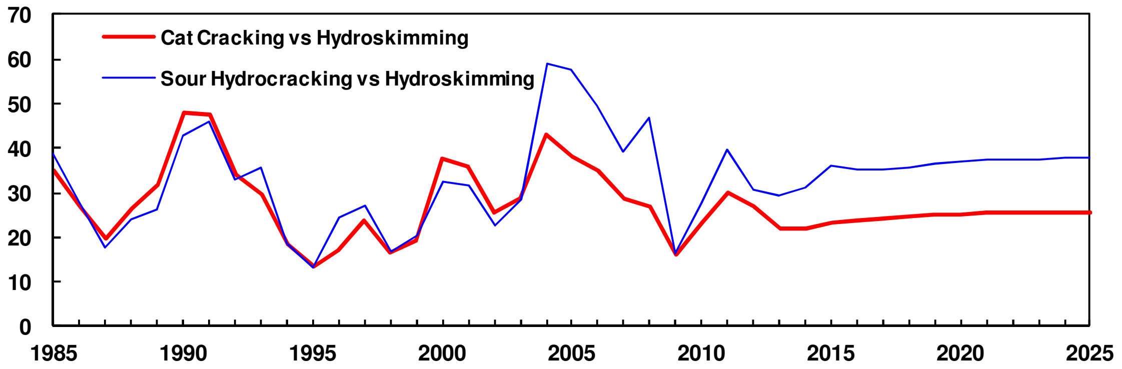
FIGURE IV-8
BRENT VARIABLE COST HYDROSKIMMING MARGIN FOB BASIS WITH FULL RESIDUE PREMIUM
(Forecast in Constant 2011 Dollars per Barrel)



The return on replacement cost (Capital Recovery Factor - CRF) provides an inflation-adjusted measure of refining profitability. Simple financial returns are also measured on the difference in margin and replacement cost between two types of refineries. For example, the incremental CRF between hydroskimming and catalytic cracking gives an indication of the incentive for upgrading a hydroskimming refinery to a cat cracking refinery. A project with an incremental CRF of 25% would have a simple payback time of 4 years.

Historically, the return on investment for the incremental addition of hydrocracking facilities to a hydroskimming refinery, as indicated by Purvin & Gertz' Incremental Capital Recovery Factor (ICRF), was lower than for catalytic cracking due to the high capital cost of hydrocrackers. However this situation has reversed in recent years. Strong export-oriented gasoline markets supported cat cracking returns in Europe through much of the 2000-2003 period. In 2004, strong middle distillate prices produced a high average margin for the hydrocracking configuration. From 2004 through 2009, the ICRF for sour crude hydrocracking versus hydroskimming consistently exceeded that for catalytic cracking. Stronger middle distillate prices, particularly for Ultra Low Sulphur Diesel, contributed to this. In addition, the requirement to produce 50 ppm sulphur content and subsequently 10 ppm sulphur content diesel and gasoline has narrowed the capital cost difference between the catalytic cracking and hydrocracking facilities. The weaker middle distillate prices and very strong sour crude prices in 2009 brought the hydrocracking ICRF down to the same low level as for cat cracking before it improved again in 2010. In the long term, the hydrocracking ICRF is expected to remain higher than for cat cracking reflecting Europe's need for additional diesel and jet fuels, and excess of gasoline supply.

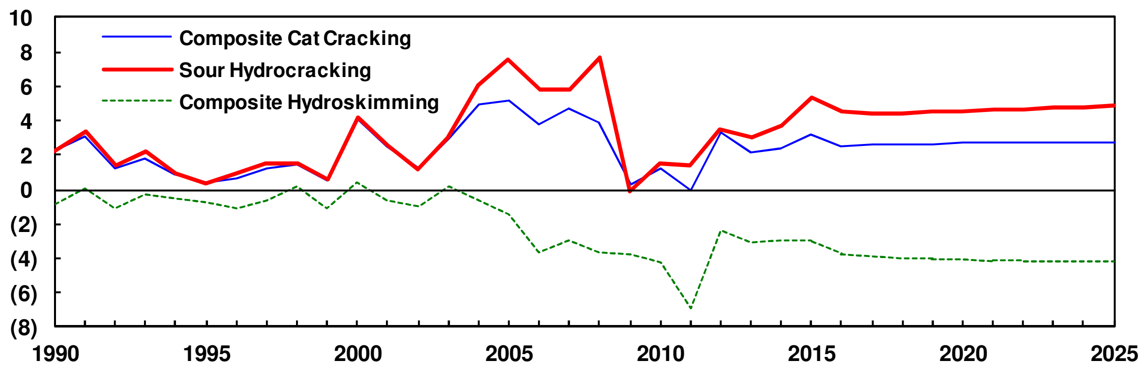
FIGURE IV-9
CIF NWE INCREMENTAL CAPITAL RECOVERY FACTOR
(Percent)



MEDITERRANEAN REFINING MARGINS

In the Mediterranean region, a mixture of sweet and sour crudes is typically processed, and so the yardstick refining economics are based on a mixture of 40% sweet and 60% sour. The same three types of refinery configurations are analyzed in the Mediterranean market as in Northwest Europe. Since 2008, we have been using Azeri (also referred to BTC Blend) crude as an indicator of sweet crude prices in the region and 100% Urals for sour crude pricing. The key Mediterranean configurations are hydroskimming, catalytic cracking and hydrocracking. Although similar in basic configuration to the configurations used in Northwest Europe, the Mediterranean refineries are slightly less complex and somewhat smaller in capacity than in Northwest Europe.

FIGURE IV-10
CIF MED COMPOSITE REFINERY NET CASH MARGINS
(Forecast in Constant 2011 Dollars per Barrel)



As in Northwest Europe, margins in the Mediterranean were hit by the Libyan disruptions in 2011. As indicated above, we expect the volumes of Russian crude oil flowing into the Mediterranean from the Black Sea to decline in the future. As a result, we expect stronger sour crude oil prices relative to sweet crude prices in the Mediterranean in the longer term. Mediterranean refining economics have followed the same patterns as Northwest Europe and are expected to follow the trends in Northwest Europe in the future, aside from the Russian crude supply changes discussed above.

TABLE IV-1

GLOBAL PRODUCT PRICES (Delivered at Location)

(US$ per tonne)

		2000	2005	2006	2007	2008	2009	2010	2011	2012
Gasoline	North West Europe (ULG95)	304	538	632	709	852	591	743	988	1039
	Mediterranean Europe (ULG95)	316	528	622	697	848	591	739	989	1033
	New York Harbor (Regular) (1)	298	543	635	720	863	584	732	980	1031
	Singapore (ULG95)	272	520	610	690	860	586	737	998	1028
Diesel	North West Europe (ULSD)	276	545	608	676	956	543	696	964	986
	Mediterranean Europe (ULSD)	281	553	613	674	959	542	695	971	983
	US Gulf Coast 50ppm to 2006 then 15ppm	257	524	582	667	913	518	672	925	954
	Singapore (10ppm)	254	519	627	663	929	536	681	949	962
Gasoil	North West Europe (0.2% to 2007 then 0.1%)	259	514	589	642	929	524	676	936	957
	Mediterranean Europe	264	519	597	662	943	527	680	940	962
	US Gulf Coast Gasoil No 2	252	506	563	624	878	505	654	908	933
	Singapore (0.05%)	247	505	591	649	918	524	673	940	954
Jet	North West Europe	295	568	651	712	1006	567	724	1014	1027
	Mediterranean Europe	287	566	646	707	1009	565	723	1015	1029
	US Gulf Coast	279	564	633	699	975	548	707	986	1009
	Singapore	270	534	634	682	960	551	709	988	997
Fuel Oil	North West Europe (3.5%)	132	227	283	335	457	344	439	605	627
	Mediterranean Europe (3.5%)	140	234	292	352	473	354	448	615	638
	US Gulf Coast (3%)	131	230	287	335	460	353	439	604	631
	Singapore (3.5%)	154	257	308	365	500	361	456	630	666

(1) Note: US Regular Gasoline has lower overall quality than European ULG 95

TABLE IV-2
REFINED PRODUCT BALANCE
TOTAL EUROPE
(Million Tonnes)

		2000	2005	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035
Gasoline	Production	157	163	148	143	135	132	131	129	128	128	122	117	112	107
	Imports	39	35	30	29	29	29	30	30	30	29	29	28	28	27
	Exports	(53)	(73)	(75)	(72)	(72)	(72)	(75)	(76)	(77)	(79)	(83)	(82)	(81)	(80)
	Biogasoline supply	-	1	3	3	5	4	5	5	5	5	6	6	5	5
	Supply Adjustments	(6)	(4)	4	2	4	2	3	3	3	3	2	2	1	1
	Inland Consumption	138	121	109	106	100	96	93	90	88	86	77	70	65	61
Jet/Kerosene	Production	48	48	50	45	46	47	48	48	49	49	51	52	53	55
	Imports	19	30	34	36	35	33	33	35	35	36	37	38	38	39
	Exports	(11)	(14)	(15)	(16)	(15)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(15)
	Supply Adjustments	(1)	(5)	(6)	(5)	(6)	(4)	(4)	(4)	(4)	(4)	(4)	(3)	(3)	(2)
	Inland Consumption	54	59	63	60	60	60	61	62	64	64	68	71	74	76
Gasoil/Diesel	Production	270	288	291	271	269	271	272	276	280	284	295	302	309	317
	Imports	81	116	122	127	134	134	131	132	133	137	144	147	147	146
	Exports	(68)	(83)	(88)	(87)	(91)	(93)	(95)	(97)	(99)	(93)	(94)	(94)	(95)	(97)
	Int'l Bunkers	(9)	(8)	(7)	(7)	(8)	(8)	(8)	(8)	(8)	(19)	(23)	(23)	(24)	(24)
	Biodiesel supply	-	3	9	11	13	13	14	15	15	16	20	21	22	23
	CTL/GTL diesel supply	-	-	-	-	0	0	0	0	0	0	0	0	0	0
	Supply Adjustments	(2)	(9)	(10)	(10)	(10)	(12)	(7)	(7)	(7)	(7)	(8)	(8)	(8)	(8)
	Inland Consumption	272	306	317	305	307	307	308	311	315	318	334	345	351	357
	of which: Diesel	152	188	210	209	215	234	238	242	247	252	273	288	297	306
	of which: Gasoil	120	118	107	96	92	72	70	69	68	66	61	57	54	51
Heavy Fuel Oil	Production	132	125	110	94	90	89	86	84	82	82	79	79	77	76
	Imports	51	61	66	66	67	70	72	72	73	67	46	46	47	48
	Exports	(48)	(66)	(67)	(62)	(70)	(73)	(70)	(70)	(68)	(74)	(54)	(55)	(54)	(54)
	Int'l Bunkers	(38)	(50)	(53)	(48)	(46)	(48)	(48)	(49)	(50)	(39)	(36)	(37)	(38)	(39)
	Supply Adjustments	(7)	(3)	(5)	(6)	(3)	(3)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)
	Inland Consumption	90	67	50	44	38	35	34	33	32	31	29	27	26	26
Other Products	Production	157	168	156	146	148	149	149	148	148	149	149	149	148	148
	Imports	71	85	84	82	80	78	80	82	83	83	84	85	85	86
	Exports	(48)	(61)	(62)	(61)	(61)	(61)	(61)	(59)	(58)	(58)	(57)	(56)	(56)	(55)
	Int'l Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CTL/GTL supply	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	(15)	(10)	3	5	3	3	3	2	2	2	1	1	1	1
	Inland Consumption	165	182	181	171	170	170	171	174	175	176	178	179	179	179
Total	Production	765	792	754	699	689	689	686	686	688	692	696	699	700	702
	Imports	261	326	336	340	345	345	346	351	353	351	339	344	345	347
	Exports	(229)	(297)	(307)	(298)	(310)	(315)	(317)	(318)	(319)	(320)	(304)	(304)	(302)	(301)
	Int'l Bunkers	(47)	(58)	(60)	(55)	(54)	(56)	(56)	(57)	(57)	(58)	(59)	(60)	(62)	(64)
	Biofuels/CTL/GTL supply	-	4	12	15	17	18	19	19	20	21	26	27	28	28
	Supply Adjustments	(31)	(31)	(14)	(15)	(12)	(13)	(10)	(11)	(11)	(11)	(13)	(13)	(14)	(14)
	Inland Consumption	718	736	720	686	675	668	667	671	674	675	685	692	695	698
	Inland Consumption + Bunk	766	793	780	741	729	724	723	727	732	733	744	752	757	761

Note: Total includes Refinery Fuel and Ethane
Historical data source: IEA. Projections Purvin & Gertz

TABLE IV-3

ANNUAL AVERAGE GASOLINE AND DIESEL PRICES AND TAXES IN SELECTED EUROPEAN COUNTRIES

(Euro per Litre)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Germany											
Gasoline (95 RON)											
Pre-tax price	0.289	0.279	0.287	0.324	0.399	0.456	0.472	0.525	0.433	0.536	0.656
Excise Tax	0.593	0.624	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655	0.655
Vat	0.141	0.145	0.151	0.157	0.169	0.178	0.214	0.224	0.207	0.226	0.249
Total Tax	0.734	0.769	0.806	0.812	0.824	0.833	0.869	0.878	0.862	0.881	0.904
Pump Price	1.024	1.048	1.093	1.136	1.223	1.289	1.341	1.403	1.295	1.417	1.560
Automotove Diesel											
Pre-tax price	0.300	0.284	0.294	0.338	0.448	0.492	0.512	0.650	0.446	0.560	0.727
Excise Tax	0.409	0.440	0.470	0.470	0.470	0.470	0.470	0.470	0.470	0.470	0.470
Vat	0.114	0.116	0.122	0.129	0.147	0.154	0.187	0.213	0.174	0.196	0.228
Total Tax	0.523	0.556	0.592	0.599	0.617	0.624	0.657	0.683	0.644	0.666	0.698
Pump Price	0.822	0.840	0.886	0.937	1.065	1.116	1.169	1.333	1.090	1.226	1.425
France											
Gasoline (95 RON)											
Pre-tax price	0.294	0.267	0.261	0.298	0.382	0.445	0.462	0.528	0.403	0.518	0.643
Excise Tax	0.572	0.581	0.589	0.589	0.589	0.589	0.602	0.606	0.606	0.606	0.611
Vat	0.170	0.166	0.167	0.174	0.190	0.203	0.209	0.222	0.198	0.220	0.246
Total Tax	0.742	0.747	0.756	0.763	0.779	0.792	0.811	0.828	0.804	0.826	0.857
Pump Price	1.036	1.014	1.017	1.061	1.161	1.237	1.273	1.356	1.207	1.344	1.500
Automotove Diesel											
Pre-tax price	0.293	0.262	0.271	0.323	0.438	0.485	0.487	0.634	0.410	0.529	0.679
Excise Tax	0.375	0.383	0.392	0.417	0.417	0.417	0.426	0.428	0.428	0.428	0.437
Vat	0.131	0.126	0.130	0.145	0.168	0.177	0.179	0.208	0.164	0.188	0.219
Total Tax	0.506	0.509	0.522	0.562	0.585	0.594	0.605	0.636	0.592	0.616	0.656
Pump Price	0.799	0.771	0.793	0.885	1.023	1.079	1.092	1.270	1.002	1.145	1.335
Italy											
Gasoline (95 RON)											
Pre-tax price	0.354	0.331	0.341	0.379	0.453	0.507	0.518	0.586	0.462	0.572	0.694
Excise Tax	0.524	0.542	0.542	0.559	0.564	0.564	0.564	0.564	0.564	0.564	0.598
Vat	0.175	0.175	0.177	0.188	0.203	0.214	0.216	0.230	0.205	0.227	0.262
Total Tax	0.699	0.717	0.719	0.747	0.767	0.778	0.780	0.794	0.769	0.791	0.860
Pump Price	1.053	1.048	1.060	1.126	1.220	1.285	1.298	1.379	1.232	1.363	1.554
Automotove Diesel											
Pre-tax price	0.339	0.310	0.328	0.379	0.512	0.557	0.549	0.697	0.478	0.589	0.744
Excise Tax	0.385	0.403	0.403	0.403	0.412	0.414	0.420	0.422	0.423	0.423	0.459
Vat	0.145	0.143	0.146	0.156	0.185	0.194	0.194	0.224	0.180	0.202	0.244
Total Tax	0.530	0.546	0.546	0.559	0.597	0.608	0.614	0.645	0.603	0.625	0.703
Pump Price	0.869	0.856	0.877	0.938	1.108	1.165	1.163	1.342	1.081	1.214	1.447
Spain											
Gasoline (95 RON)											
Pre-tax price	0.324	0.306	0.308	0.353	0.427	0.483	0.496	0.559	0.442	0.556	0.676
Excise Tax	0.372	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.422	0.439	0.443
Vat	0.111	0.112	0.113	0.120	0.132	0.141	1.143	0.153	0.138	0.169	0.202
Total Tax	0.483	0.508	0.509	0.516	0.528	0.537	0.539	0.549	0.560	0.608	0.645
Pump Price	0.807	0.814	0.817	0.869	0.955	1.020	1.035	1.108	1.002	1.165	1.321
Automotove Diesel											
Pre-tax price	0.327	0.300	0.304	0.357	0.476	0.522	0.524	0.672	0.459	0.578	0.730
Excise Tax	0.270	0.294	0.294	0.294	0.294	0.294	0.302	0.302	0.326	0.341	0.346
Vat	0.096	0.095	0.096	0.104	0.123	0.131	0.132	0.156	0.126	0.157	0.194
Total Tax	0.366	0.389	0.390	0.398	0.417	0.425	0.434	0.458	0.452	0.497	0.540
Pump Price	0.693	0.689	0.694	0.755	0.893	0.947	0.958	1.130	0.911	1.075	1.270
UK (prices in Euro)											
Gasoline (95 RON)											
Pre-tax price	0.291	0.263	0.269	0.313	0.391	0.447	0.459	0.512	0.358	0.493	0.610
Excise Tax	0.746	0.729	0.666	0.695	0.689	0.692	0.715	0.633	0.610	0.667	0.671
Vat	0.182	0.173	0.163	0.175	0.189	0.199	0.206	0.198	0.146	0.203	0.256
Total Tax	0.928	0.902	0.830	0.870	0.878	0.891	0.921	0.832	0.755	0.870	0.927
Pump Price	1.219	1.167	1.098	1.183	1.268	1.339	1.380	1.343	1.114	1.363	1.537
Automotove Diesel											
Pre-tax price	0.322	0.294	0.292	0.333	0.442	0.496	0.491	0.622	0.404	0.516	0.662
Excise Tax	0.745	0.729	0.666	0.695	0.689	0.692	0.715	0.633	0.610	0.667	0.671
Vat	0.187	0.178	0.168	0.180	0.197	0.208	0.210	0.218	0.153	0.208	0.266
Total Tax	0.931	0.909	0.834	0.875	0.886	0.900	0.925	0.852	0.763	0.874	0.937
Pump Price	1.253	1.202	1.126	1.208	1.329	1.396	1.416	1.474	1.165	1.391	1.599
UK (prices in Sterling)											
Gasoline (95 RON)											
Pre-tax price	0.181	0.165	0.186	0.212	0.267	0.305	0.314	0.408	0.319	0.423	0.529
Excise Tax	0.464	0.458	0.461	0.471	0.471	0.472	0.489	0.505	0.544	0.572	0.582
Vat	0.113	0.109	0.113	0.119	0.129	0.136	0.141	0.158	0.130	0.174	0.222
Total Tax	0.577	0.567	0.574	0.590	0.600	0.608	0.630	0.663	0.673	0.746	0.804
Pump Price	0.758	0.733	0.760	0.802	0.867	0.913	0.944	1.071	0.993	1.169	1.333
Automotove Diesel											
Pre-tax price	0.200	0.185	0.202	0.226	0.302	0.338	0.336	0.496	0.360	0.443	0.574
Excise Tax	0.463	0.458	0.461	0.471	0.471	0.472	0.489	0.505	0.544	0.572	0.582
Vat	0.116	0.112	0.116	0.122	0.135	0.142	0.144	0.174	0.136	0.178	0.231
Total Tax	0.579	0.571	0.577	0.593	0.606	0.614	0.633	0.679	0.680	0.750	0.813
Pump Price	0.779	0.755	0.779	0.819	0.909	0.952	0.969	1.175	1.039	1.193	1.387

Data Source IEA

TABLE IV-4

GASOLINE MINUS DIESEL PRICE DIFFERENTIAL AND CAR POPULATION TRENDS IN SELECTED EUROPEAN COUNTRIES

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Germany											
Gasoline - Diesel differential (€/l)	0.202	0.208	0.207	0.199	0.158	0.173	0.172	0.070	0.205	0.191	0.135
New Car Registrations											
% Gasoline	65.5	62.1	60.1	56.0	58.0	55.8	52.2	55.9	69.3	57.7	no data
% Diesel	34.5	37.9	39.9	44.0	42.0	44.2	47.8	44.1	30.7	42.3	no data
Car Population											
% Gasoline	84.3	83.0	81.6	80.0	78.1	76.7	75.5	74.9	73.8	73.0	no data
% Diesel	15.7	17.0	18.4	20.0	21.9	23.3	24.5	25.1	26.2	27.0	no data
France											
Gasoline - Diesel differential (€/l)	0.237	0.243	0.224	0.176	0.138	0.158	0.181	0.086	0.205	0.199	0.165
New Car Registrations											
% Gasoline	43.5	36.5	32.3	30.6	30.5	28.2	25.7	22.2	27.9	27.6	27.2
% Diesel	56.2	63.3	67.5	69.3	69.1	71.2	73.8	77.2	70.5	70.4	72.1
Car Population											
% Gasoline	62.1	59.5	56.9	54.5	52.3	50.2	48.1	45.7	43.8	42.0	no data
% Diesel	37.9	40.5	43.1	45.5	47.7	49.8	51.9	54.3	56.2	58.0	no data
Italy											
Gasoline - Diesel differential (€/l)	0.184	0.192	0.183	0.188	0.112	0.120	0.135	0.037	0.151	0.149	0.107
New Car Registrations											
% Gasoline	63.9	57.5	52.7	42.6	41.5	41.4	42.2	45.4	52.6	50.7	no data
% Diesel	35.0	41.5	47.0	57.3	58.4	58.4	55.8	51.0	42.0	46.0	no data
Car Population											
% Gasoline	82.3	80.0	77.4	74.2	70.7	67.7	65.0	63.1	61.5	60.4	no data
% Diesel	16.7	19.0	21.7	24.9	28.3	31.2	33.8	35.5	36.7	37.8	no data
Spain											
Gasoline - Diesel differential (€/l)	0.114	0.125	0.123	0.114	0.062	0.073	0.077	-0.022	0.091	0.090	0.051
New Car Registrations											
% Gasoline	48.0	42.8	39.7	35.0	32.4	31.2	30.4	30.7	29.9	no data	no data
% Diesel	52.0	57.2	60.3	65.0	67.6	68.8	69.6	69.3	70.1	no data	no data
Car Population											
% Gasoline	70.5	67.9	64.7	61.3	58.3	55.5	52.9	51.2	49.6	no data	no data
% Diesel	29.5	32.1	35.3	38.7	41.7	44.5	47.1	48.8	50.4	no data	no data
UK											
Gasoline - Diesel differential (€/l)	-0.034	-0.035	-0.027	-0.025	-0.061	-0.057	-0.037	-0.130	-0.052	-0.028	-0.062
Gasoline - Diesel differential (£/l)	-0.021	-0.022	-0.019	-0.017	-0.042	-0.039	-0.025	-0.104	-0.046	-0.024	-0.054
New Car Registrations											
% Gasoline	82.2	76.5	72.7	67.5	63.2	61.7	59.9	56.4	58.3	53.7	no data
% Diesel	17.8	23.5	27.3	32.5	36.8	38.3	40.1	43.6	41.7	46.2	no data
Car Population											
% Gasoline	86.2	84.7	83.1	81.3	79.5	77.8	76.0	74.4	72.8	70.9	no data
% Diesel	13.8	15.2	16.7	18.5	20.3	22.0	23.7	25.3	27.0	28.8	no data
Europe											
New Car Registrations											
% Gasoline	65.2	61.0	57.9	54.0	52.1	49.9	46.9	46.8	52.7	46.0	no data
% Diesel	33.8	38.0	41.1	45.0	46.4	48.4	50.7	50.5	46.3	49.0	no data
% Other	0.9	0.9	1.0	1.0	1.5	1.7	2.4	2.8	1.1	5.0	no data
Car Population											
% Gasoline	78.1	76.5	74.8	70.3	68.5	66.8	64.7	64.1	62.6	60.8	no data
% Diesel	18.7	20.3	22.0	24.3	26.0	27.7	29.8	31.8	33.1	34.3	no data
% Other	3.2	3.2	3.2	5.4	5.4	5.5	5.5	4.1	4.3	4.9	no data

Data Source EUROSTAT and ACEA for car population

V. UNITED KINGDOM REFINED PRODUCT DEMAND PROJECTION

INTRODUCTION

In this section we analyse the outlook for the UK economy and UK refined product demand. The information and forecast presented in this section is entirely consistent with Purvin & Gertz 2012 Global Petroleum Market Outlook, with an adjustment for the closure of Coryton refinery in mid 2012, which affects supply, but not demand. This analysis makes certain assumptions on world economic growth (country by country GDP growth), together with an assumption that global, regional and national refining capacity will implement changes over time in response to market requirements. In this report for the UK the information presented in this section is equivalent to the “modest investment scenario” detailed in Section VI.

We also discuss the outlook for product demand for each of the major refined products, summarise the status of the UK refining industry and provide an outlook and discussion on current and future product trade flows. Refined product demand, supply and the net trade balance for the United Kingdom has evolved considerably over the past ten years. Similar to most European countries the United Kingdom is increasingly reliant on trade flows to balance national refined product supply to product demand, as the industry adapts to changing demand trends. In this context, it is important to stress that as the United Kingdom is a key player in the northern European region, and future trade flows and balances should be regarded in conjunction with the outlook for northern European trade in the longer term. These are discussed in Section IV.

ECONOMY

Prior to the 2008-2009 recession, the United Kingdom enjoyed relatively strong and consistent economic growth for a number of years. However, much of that growth was fuelled by high consumer borrowing and spending, and the onset of the serious financial crisis in 2008 resulted in a significant drop in both consumer and corporate credit, severely impacting the economy. GDP, which declined by 4.9% in 2009, recovered modestly in 2010 with growth of around 1.8%, and growth of 0.9% in 2011. Predicted growth of 0.8% is expected in 2012. Looking ahead, the economy is expected to recover further in 2013-2014, returning to the average long-term trend growth rate of 2.0-2.5% per year thereafter, although growth prospects remain uncertain. These will be influenced by both global and European economic performance together with Government fiscal programmes. Any positive factors will be offset in part by the on-going substantial cuts in public expenditure.

UK GDP, GDP growth and population growth rates utilised in PGI’s forecast are shown in the table below.

UK GDP and Population Prediction
(data from World Bank)

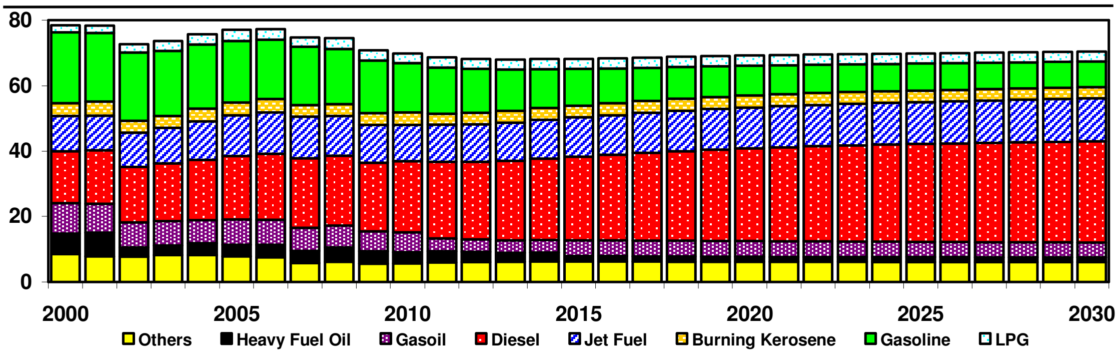
	2000	2005	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030
GDP (Billion 2007 US$)	2014.8	2279.3	2404.2	2287.0	2317.9	2338.9	2358.5	2405.2	2463.5	2528.2	2837.3	3156.0	3501.0
GDP grow th (%)	3.9	2.2	(0.1)	(4.9)	1.4	0.9	0.8	2.0	2.4	2.6	2.3	2.1	2.1
Population (millions)	58.89	60.23	61.41	61.84	62.25	62.60	62.94	63.26	63.56	63.85	65.10	66.15	67.15

REFINED PRODUCT DEMAND

The share of petroleum in UK total primary energy supply has remained relatively unchanged since 2000 at 32-33% and currently stands at 69 million tonnes per year (excluding refinery fuel consumption of 4.6 million tonnes per year) – a fall of about five million tonnes from 2008. Total petroleum demand is expected to remain flat until 2015 before continuing to grow very slowly, as increasing transportation fuel demand offsets declining use in the residential/commercial and industrial sectors. A summary of UK historical and forecast demand for refined products is presented in Table V-1. Note that the demand figures are final consumption figures and so include consumption of bio-fuels blended in the main fuels such as gasoline and diesel.

Although long-term overall demand growth is projected to be relatively modest, there are several distinct trends in the forecast that should be noted. These include continuing growth in middle distillate demand for transportation that will continue to offset declining gasoline demand, a function of changing private vehicle registrations and improved efficiency of gasoline cars. Over the forecast period to 2030, total refined product growth is expected to average only about 0.2% per year (Figure V-1).

FIGURE V-1
UK REFINED PRODUCT DEMAND
(Million Tonnes per Year)



Note: Excludes Refinery Fuels. "Others" includes Naphtha, LPG, Petcoke, Lubes, Bitumen, Waxes *Historical data source: IEA*

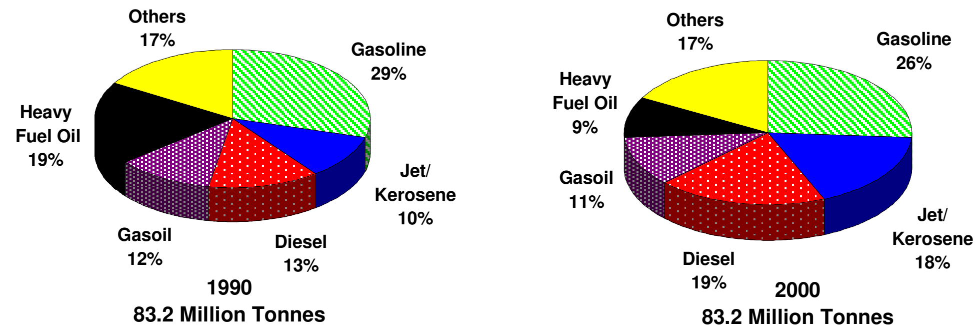
Figures V-2A and V-2B illustrate the nature of the changes to UK demand from 1990 to 2000 to 2011 and then our forecast from 2011 to 2030.

The most significant changes are the fall of the share of gasoline demand, from 29% in 1990 to 26% in 2000, 19% in 2011, and then to 10.4% in 2030, while that for diesel (including off-road, 50/10ppm diesel) increases substantially, from only 13% of demand in 1990, to 19% by 2000, 32% in 2011 and rising to 41% in 2030. These changes are a result of economic growth driving commercial diesel demand, combined with the increased popularity of diesel-powered passenger cars, as discussed below.

The share of jet fuel demand has also increased substantially from 1990 levels, particularly over 1990 to 2000, with slower growth since 2000 forecast to continue.

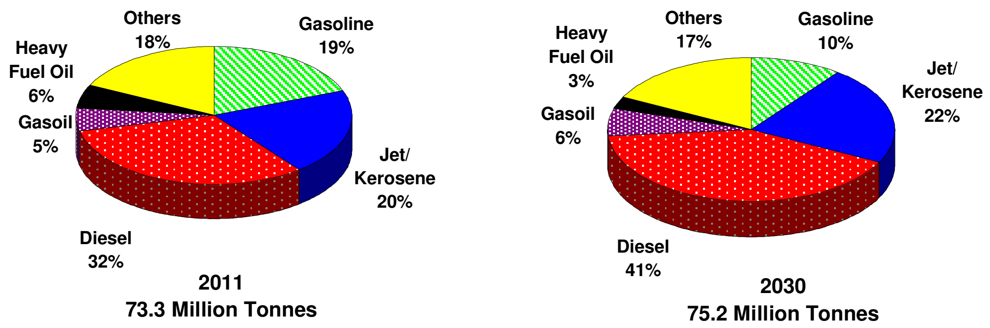
Heavy fuel oil demand by contrast has fallen substantially from 1990 levels, with rapid decline over 1990 to 2000 and significant decline over 2000 to 2011. By 2030 heavy fuel oil is forecast to make up only 3% of total demand (including refinery fuels).

FIGURE V-2A
UK PRODUCT DEMAND AND PRODUCT SHARES: 2000 AND 2010



Note: Includes Bunker Demand and Refinery Fuels. "Others" includes Naphtha, LPG, Petcoke, Lubes, Bitumen, Waxes *Historical data source: IEA*

FIGURE V-2B
UK PRODUCT DEMAND AND PRODUCT SHARES: 2010 AND 2030



Note: Includes Bunker Demand and Refinery Fuels. "Others" includes Naphtha, LPG, Petcoke, Lubes, Bitumen, Waxes *Historical data source: IEA*

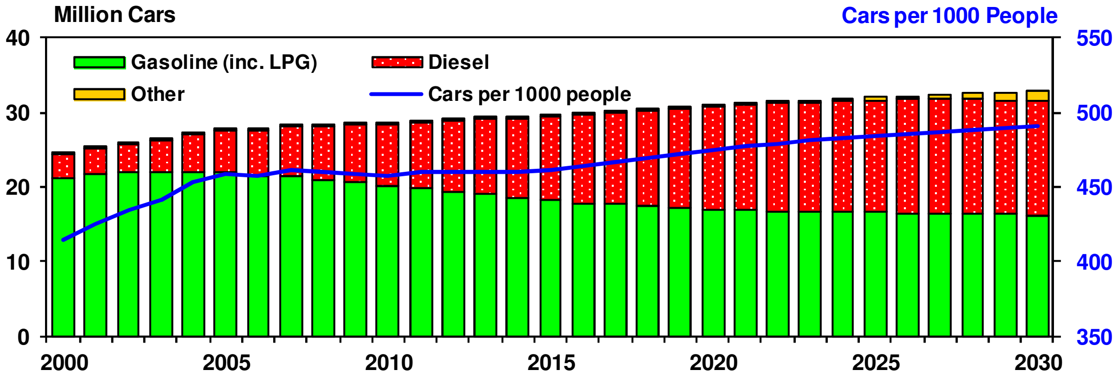
As with the European analysis shown in Section IV, the changes to the UK refined product market demand profile shown above have taken place at a much more rapid rate than the refining industry is able to respond. Refinery major plants are designed with a lifespan of 20 years or more and with proper maintenance can often operate for significantly longer. In addition, the design and construction of new major plant would take around 4 – 5 years. The existing UK refineries were either constructed or expanded from early origins in the 1960's with further major additions of distillation and cat-cracking capacity in the 1970's and 1980's. Since then most investment has been focused on environmental, safety, and product quality improvements with additional diesel and gasoline desulphurisation capacity. As a result the UK industry configuration remains more suitable for supplying the UK demand profile of the 1990s rather than for 2012.

UK demand trends and projections for each of the major refined products are discussed in detail below.

GASOLINE

The primary driver of gasoline demand in the United Kingdom is the car population and the trend of new registrations and scrappage. The total number of cars in the United Kingdom is currently about 28.9 million, an average of 460 per thousand people (Figure V-3), with growth since 2007 having declined after a period of steady increases of 2.0% per year on average since 2000. New car registrations were down 11.3% in 2008 compared with 2007, and fell further in 2009 by 6.4%, despite the government incentive scheme providing £2,000 towards the purchase of a new car in exchange for scrapping a car more than 10 years old. However new registrations increased by 1.8% in 2010, decreased by 4.4% in 2011 and are up 5.4% versus 2011 in 2012. Our expectation is that the current population will remain static out to 2015, held back by the current economic slowdown before further long-term growth at moderate rates as car ownership levels in the UK are already relatively high.

FIGURE V-3
UK PASSENGER VEHICLE OUTLOOK



Historical data source: ACEA

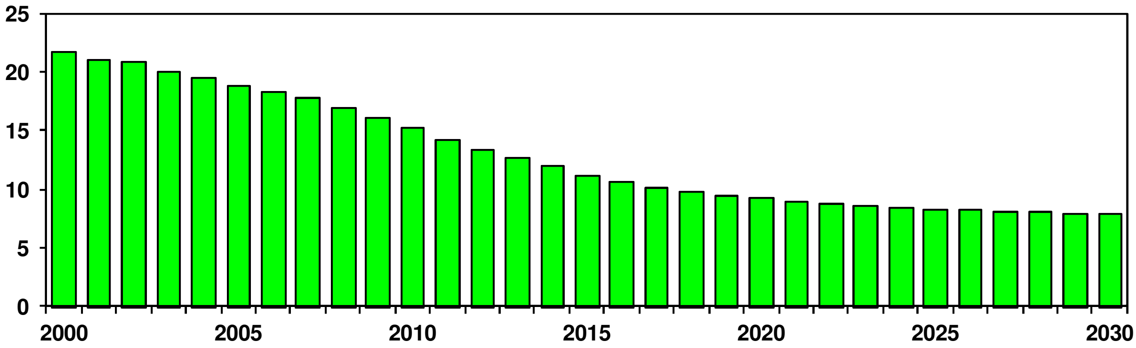
The level of diesel cars in new car registrations has continued to grow strongly since 2000, following the introduction of a tax regime for company cars that reduces the tax payable by the company car driver for lower CO_2 emissions cars. Since 2001 UK road tax has also favoured lower CO_2 emission cars. This therefore structurally favours diesel powered cars over gasoline powered cars, as the diesel engine combustion cycle is inherently more efficient than the gasoline engine combustion cycle.

Higher fuel prices have also increased the attractiveness of fuel-efficient diesels among both company car drivers and the general population even though the United Kingdom, unlike many other European countries, has equal levels of excise duty for petrol and diesel (see Table IV-1 in Section IV). For drivers with medium to high mileage the cost of running a diesel car is lower than the cost of running a gasoline car primarily because of more efficient fuel consumption.

The share of diesels in new registrations reached 44% in 2008, compared with 33% in 2004 and only 14% in 2000; however, a combination of high retail diesel prices in 2008, the recession and the incentives of the car replacement scheme which tended to favour the purchase of small, gasoline-engined cars temporarily reversed this trend, such that the share of diesel cars in new registrations decreased to 42% in 2009. In 2010 this level recovered and in June 2010 the number of diesel cars newly registered exceeded the number of gasoline cars for the first time. Diesel cars represented 50.5% of new registrations in 2011 and similar levels are expected to be reported for 2012 In the medium term, some recovery in gasoline-car registrations is expected as more efficient gasoline engines are able to compete effectively with diesels on fuel cost, but only to the extent that in the longer term we expect new car registrations to average 50:50 for gasoline and diesel. As a result, taking into account annual fleet turnover we expect the diesel car population to continue to grow from the current level of around 33% towards 45% of the total car population by 2020 and 47% of the total car population by 2030.

Reflecting the increasing share in total car population of diesel cars and the improving efficiency of gasoline cars, gasoline demand has been in steady decline over the past few years (Figure V-4). Demand fell to about 14 million tonnes in 2011, and because of both continuing diesel car penetration and the introduction of more efficient gasoline-fuelled cars, demand is projected to decline steadily to around 7.8 million tonnes by 2030.

FIGURE V-4
UK GASOLINE PRODUCT DEMAND
(Million Tonnes per Year)



Historical data source: IEA

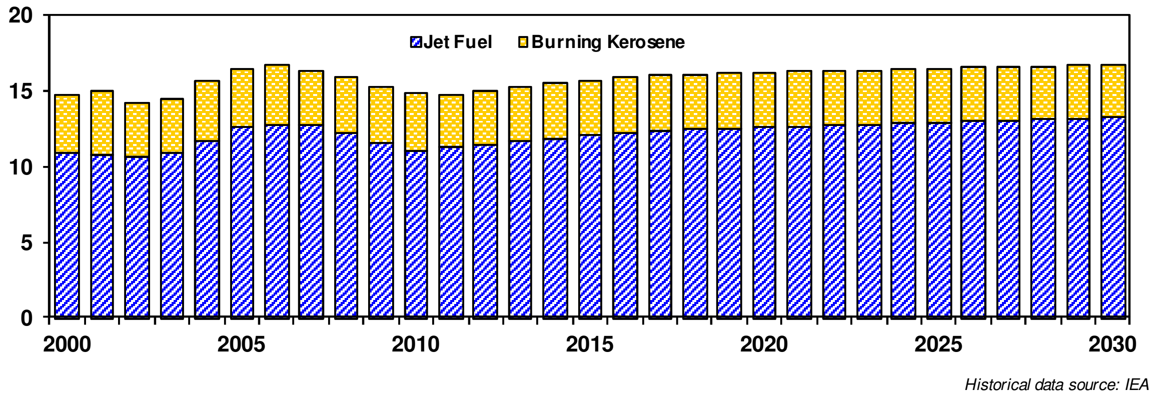
KEROSENE/JET FUEL

Burning kerosene represents around 23% of total kerosene/jet fuel demand in the United Kingdom, reflecting its use as heating oil in the domestic residential sector as opposed to gasoil. Base demand for burning kerosene has changed little over the past few years, excepting changes in annual temperatures, averaging approximately 3.8 million tonnes per year, although as would be expected it is very seasonal, with the majority of demand being in the winter months. The exceptionally cold weather in the beginning of 2010 and the early start to the 2010-2011 winter boosted demand in 2010. Demand dropped to 3.4 million tonnes in 2011. Improving home insulation standards, replacement of old boilers with new more efficient boilers and some substitution by natural gas will result in a long-term slow structural decline.

Jet fuel demand grew very strongly up to 2006, buoyed by the rapid growth of low-cost airlines in the previous five years and as a result of London's role as a major transit hub. However, growth stopped in 2006-2007, partly as result of the loss of the Buncefield terminal, north of London, in December 2005, which eliminated a significant part of the infrastructure that supplied jet fuel to Heathrow airport and resulted in some severe rationing, as well as a general easing in the rate of aviation growth. A decline of 3.9% was recorded in 2008 just before the onset of the recession, with a further decline of 5.2% in 2009, to around 11.5 million tonnes, and in 2010 a combination of flight stoppages because of the Eyjafjallajökull volcano eruption and strike action by British Airways cabin crews resulted in a further decline of 0.7%. Demand remained static in 2011 at around 11.3 million tonnes. Recorded demand in 2006 - 2010 is likely to be lower than potential demand (or actual UK consumption) owing to the practice of "tankering" at Heathrow, whereby short-haul flights land at the airport with more fuel on board than necessary for the in-bound flight in order to reduce their fuel loading requirement at that airport for the out-bound flight. This enabled priority allocation of supply to long haul flights to achieve a better balance between constrained supply and airport demand.

Future growth is likely to be slower than pre 2006 trend rates owing to the introduction of more efficient aircraft, lower growth from the budget airlines as their market share matures and the impact of increased taxation on flying. Long-term jet demand is projected to grow by 0.5-1.0% per year (see Figure V-5).

FIGURE V-5
UK JET/KEROSENE PRODUCT DEMAND
(Million Tonnes per Year)



The expansion of capacity from Heathrow's Terminal 5, together with on-going renovation of Terminals 1 and 2, will contribute towards continuing growth in air traffic. Approval for a third runway at Heathrow was granted in January 2009, but this decision was then reversed in May 2010 by the new government. Although the jet fuel supply infrastructure to London Heathrow has improved since the Buncefield incident, supply capacity is still limited; this would need to be resolved before significant expansion of traffic at Heathrow is possible.

GASOIL AND DIESEL

Diesel and gasoil have historically been grouped together in national and international refined product supply and demand data, as historically they were very similar products. Purvin & Gertz monitors consumption of each fuel separately and projects each fuel demand separately.

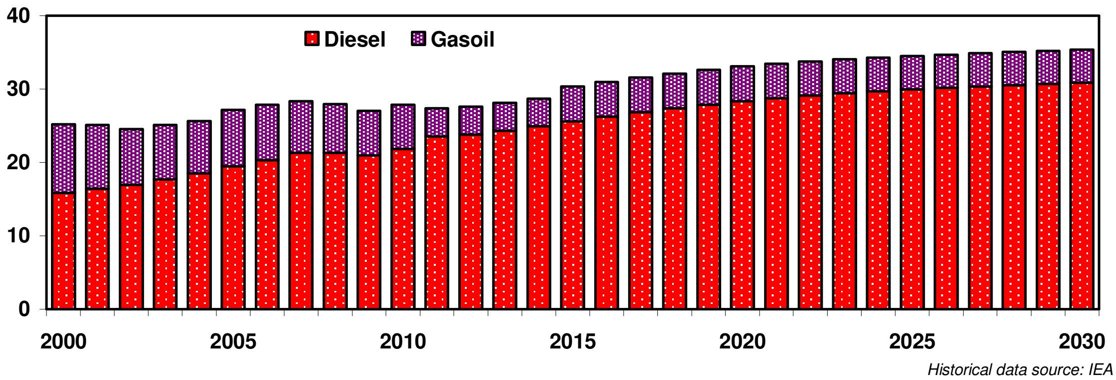
The transportation sector accounts for about 78% of total gasoil/diesel demand. Diesel demand growth for commercial vehicles is strongly linked to GDP, and demand for both commercial and passenger vehicles has been growing strongly, averaging over 4% per year from 2000 to 2007. However, as previously discussed, a combination of high prices and the onset of recession resulted in stagnating diesel/gasoil demand in 2008, with a decline of 1.8% in 2009. There was a rebound in 2010 with an increase in demand of 3.2%. Provisional data for 2011 indicates that demand fell again slightly in 2011, by about 1.8%. Current total diesel and gasoil demand is around 27.4 million tonnes, 23.5 million tonnes road diesel and 3.9 million tonnes gasoil, of which 0.8 million tonnes is for marine bunkers.

As the economy recovers, so we expect diesel demand growth to resume over the next few years. Diesel demand has been boosted by the EU-wide switch in both off-road diesel and domestic marine gasoil from high-sulphur gasoil quality to road-diesel quality from 1st January 2009 and 1st January 2011 respectively. In the long term, diesel demand growth is expected to slow from 2.0%-2.5% per year to under 1.0% per year, as the percentage of diesels in the car population nears a plateau, and both commercial and passenger vehicle efficiencies improve further.

Gasoil demand in the industrial sector has declined slightly from 2005 levels, although use in this sector is small compared with other fuels. Demand in the residential/commercial sector has also been declining, although again this sector is quite small as the main home heating market for liquid fuels, unlike most of continental Europe, is burning kerosene rather than gasoil. The scope for further substitution by natural gas is becoming limited as the gas grid in the UK is already extensive. The switch to diesel for off-road vehicles on 1st January 2009 reduced gasoil use in the agriculture sector significantly, and a further reduction in gasoil demand took place with the change in 2011 for domestic marine gasoil to diesel quality.

As the UK borders the North Sea ECA zone, gasoil bunker demand is expected to increase significantly in 2015 to 1.9 million tonnes, when all marine fuel burnt within ECA zones will have to meet a maximum of 0.1% wt. sulphur specification. Continued growth in diesel demand, albeit offset partially by a small decline in gasoil demand, results in our forecast of total diesel/gasoil demand reaching 35.4 million tonnes by 2030, of which 30.9 million tonnes is road diesel and 4.5 million tonnes gasoil, which includes 2.2 million tonnes of gasoil quality marine bunker fuel. (Figure V-6).

FIGURE V-6
UK GASOIL/DIESEL PRODUCT DEMAND
(Million Tonnes per Year)



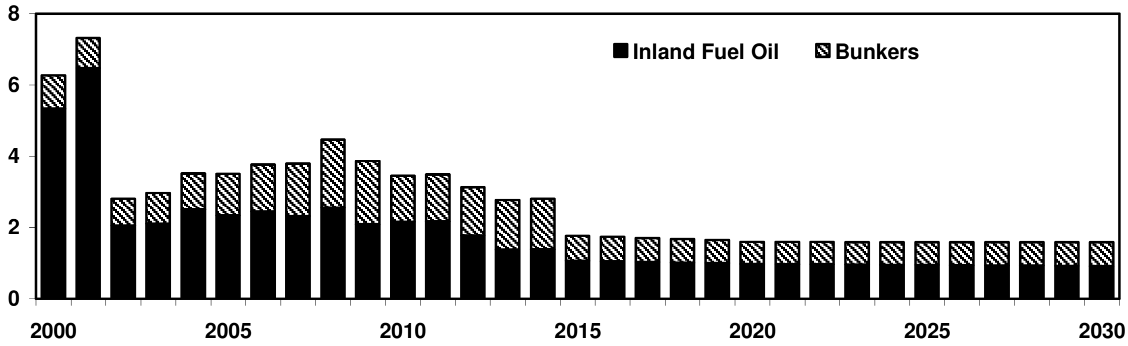
HEAVY FUEL OIL

Inland heavy fuel oil demand is declining. Most of the historical decline in demand has occurred in the power generation sector and in industry as new combined-cycle gas turbine facilities have replaced older fuel oil fired facilities. Demand fell rapidly from 13 million tonnes in 1990 to 2 million tonnes in 2002 and has remained between 2 and 2.5 million tonnes per annum since. Two out of the three remaining fuel oil-fired power stations are due to close by 2014 as a result of the Large Combustion Plant Directive, with a further fall to 1.3 million tonnes expected. Scope for further fuel oil substitution thereafter is minimal, such that we expect little substantial change in inland fuel oil demand in the longer term.

Demand for international marine bunkers (fuel oil quality bunkers) has been growing steadily since 2002 and accounted for about 1.3 million tonnes in 2010. This was a decline of over 0.5 million tonnes, or 28% from the 2009 level. Nevertheless bunker demand was still greater in 2010 than it was in 2005. A likely explanation is that the majority of UK bunker fuel is produced at less than 1.5 % wt. sulphur, and that the UK may be preferentially supplying bunkers into the North Sea and Baltic ECAs, which had to meet a maximum sulphur specification of 1.0 % wt. as from 1st July 2010. Falmouth has already seen significant demand increases for marine gas oil on introduction of the North Sea ECA zone. (Falmouth is just outside the North Sea ECA zone and is a convenient deep water anchorage with bunkering facilities).

As the world economy recovers, we are expecting some long-term steady underlying growth in marine fuel oil demand, but significant reductions in heavy fuel oil bunkers demand are likely in 2015 and, to a lesser extent, in 2020 when IMO regulation changes result in a large shift towards lower-sulphur, gasoil-based bunkers. See (Figure V-7).

FIGURE V-7
UK HEAVY FUEL OIL PRODUCT DEMAND
(Million Tonnes per Year)



Historical data source: IEA

REFINING INDUSTRY

A summary of the UK refining capacity is shown in the table below. There are currently seven operational main-fuels refineries in the UK and two bitumen refineries, with a total distillation capacity of about 74 million tonnes per year (1.5 million B/D).

Summary of UK Refining Capacity 2012

Refinery	Owner	Primary Distillation Capacity (MT/A)	(KB/D)	Nelson Complexity Factor
Fawley	ExxonMobil	12.0	246	11.6
Stanlow	Essar	11.2	230	10.0
South Killingholme (Humber)	Phillips 66	10.8	221	11.5
Lindsey	Total	10.8	221	6.4
Grangemouth	PetroChina / Ineos	10.2	210	7.8
Pembroke	Valero	10.2	210	9.2
Milford Haven	Murphy	6.3	130	7.0
Eastham *	Nynas / Shell	1.4	27	3.5
Dundee *	Nynas	0.6	12	3.5
Total		**73.5**	**1507**	

* Note Bitumen refinery, no main fuels production

Five UK refineries have changed hands in recent years. BP sold Grangemouth to Ineos in 2005 and Coryton to Petroplus in 2007. Total sold their share of Milford Haven to co-owner Murphy who then became sole owners in 2007. In 2011 Shell sold Stanlow to Essar and Chevron sold Pembroke to Valero and in addition Petrochina acquired 50% of Grangemouth from Ineos to form a 50:50 joint venture (“PetroIneos”) for the Grangemouth refinery.

Aside from the sales above, in 2010 the Total Lindsey refinery and the Murphy Milford Haven refineries were put up for sale. Total subsequently withdrew the offer after failing to find a buyer while Murphy continues to seek a buyer for the Milford Haven refinery.

In 2009, Petroplus announced that they would close the Teesside Port Clarence refinery – which had been mothballed since March 2009 – and convert the facility to an import terminal.

In 2012, as a result of bankruptcy of Petroplus the Coryton refinery closed after the administrators were unable to find a buyer to take the refinery on as a going concern. The Coryton site was acquired by a joint venture consortium comprising of Shell, Greenergy and Vopak, and will be converted to an import terminal to be called Thames Oil Port. Also in 2012 Esso Fawley announced the permanent closure of a small older crude distillation unit, reducing the capacity of the refinery by 80,000 B/D down to 246,000 B/D.

No significant refinery capacity projects are currently planned for the United Kingdom. The only major upgrading addition in recent years was a new 1.0 million tonne per year (21,000 B/D) gasoil desulphurisation unit at the Total Lindsey refinery, which came on-stream in late 2010.

TABLE V-1
UK REFINED PRODUCT DEMAND
(Thousand Tonnes per Annum)

Product	Flow	2000	2005	2010	2015	2020	2025	2030	2040
Gasoline	Consumption	21,655	18,850	15,035	11,163	9,187	8,265	7,800	7,170
Jet Fuel	Consumption	10,838	12,497	11,472	11,985	12,533	12,850	13,174	13,848
	of which: Int'l Bunkers	10,161	11,713	10,249	10,707	11,197	11,480	11,770	12,372
Kero	Consumption	3,838	3,870	3,860	3,654	3,611	3,550	3,507	3,466
Diesel/Gasoil	Consumption	25,233	27,353	27,891	30,338	33,090	34,525	35,380	36,862
	of which: Road Diesel	15,881	19,465	21,835	25,601	28,355	29,938	30,902	32,692
	of which: Gasoil	9,344	7,682	6,056	4,737	4,736	4,587	4,478	4,338
	of which: Int'l Bunkers	1,141	888	804	1,859	2,078	2,131	2,185	2,296
Residual Fuel	Consumption	7,476	5,084	4,062	2,415	2,251	2,247	2,249	2,265
	of which: Int'l Bunkers	938	1,165	1,279	699	617	642	668	724
Naphtha	Consumption	2,817	1,919	996	1,073	1,078	1,051	1,025	975
Lubes	Consumption	804	749	578	701	697	690	683	670
Bitumen	Consumption	1,975	1,906	1,370	1,639	1,649	1,665	1,682	1,716
PetCoke	Consumption	1,753	2,249	2,467	2,545	2,582	2,592	2,592	2,592
Other	Consumption	2,754	4,185	3,621	3,854	3,852	3,829	3,808	3,772
Total	Consumption	79,143	78,662	71,353	69,367	70,530	71,265	71,900	73,336
	of which: Int'l Bunkers	12,241	13,767	12,332	13,264	13,893	14,253	14,623	15,392

VI. UNITED KINGDOM REFINED PRODUCT SUPPLY DEMAND PROJECTIONS

INTRODUCTION

In this section we will analyse the outlook for the UK Supply Demand Balances for main refined products under four different pre-defined scenarios. These scenarios are:-

1 **Steady State**: The number of operating refineries and their primary distillation and secondary conversion capabilities remains at current 2012 levels.

2 **Enhanced Complexity**: The number of operating refineries and primary distillation capacity remains the same but a secondary conversion upgrade occurs across the sector consistent with that assumed in the 2011 PGI report scenario.

3 **Significantly Enhanced Complexity**: The number of operating refineries and primary distillation capacity remains the same but secondary conversion capacity is upgraded across the sector beyond that assumed in the 2011 PGI report scenario (i.e. improving the gasoline/middle distillate balance and improving the product trade balances vs. those set out in the 2011 report).

4 **Reduced Capacity**: Three further UK refineries close with loss of the associated primary distillation/secondary conversion capacity.

In all four scenarios, the refined product demand for main fuels is projected as described in Section V of this report, and remains constant. Therefore changes to the supply demand balance and therefore the import or export requirements are due to the changes to refinery capability to supply that occur under the different scenarios.

REFINED PRODUCT SUPPLY DEMAND BALANCES

HISTORICAL BALANCES

The table below shows historical trade balances for the UK for main refinery fuels. These are also shown in more detail in Tables VI-1 through VI-8.

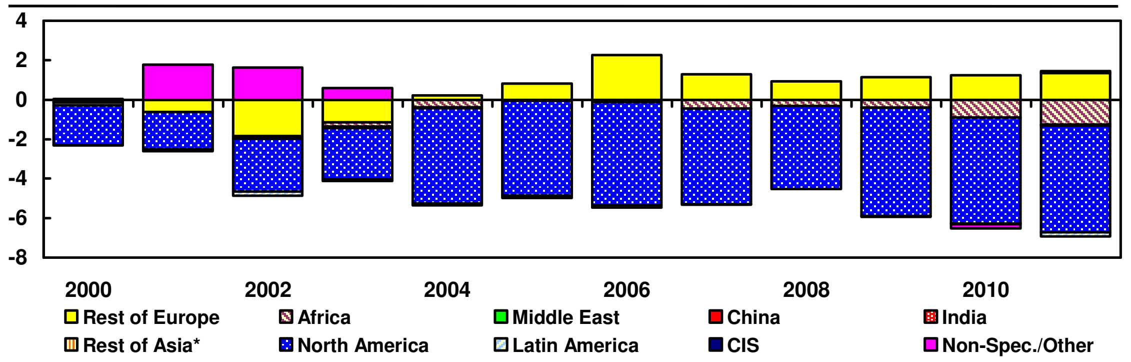
UNITED KINGDOM HISTORICAL TRADE FLOWS
(Million Tonnes)

		1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Gasoline	Imports	1.50	2.46	3.62	2.32	2.03	2.19	2.39	3.81	3.29	3.32	2.99	3.36	3.82
	Exports	(7.00)	(4.71)	(4.45)	(5.54)	(5.61)	(7.34)	(6.59)	(7.00)	(7.34)	(7.02)	(7.81)	(8.62)	(9.27)
	Net Import/(Export)	(5.50)	(2.25)	(0.84)	(3.22)	(3.57)	(5.15)	(4.20)	(3.20)	(4.05)	(3.70)	(4.82)	(5.26)	(5.45)
Diesel/Gasoil	Imports	1.34	3.82	4.10	3.22	3.50	4.22	4.92	8.06	8.25	7.47	6.62	8.44	9.37
	Exports	(5.86)	(6.42)	(5.29)	(6.35)	(5.53)	(6.62)	(6.32)	(5.82)	(6.53)	(7.28)	(6.03)	(6.48)	(7.79)
	Net Import/(Export)	(4.52)	(2.60)	(1.19)	(3.13)	(2.03)	(2.41)	(1.39)	2.24	1.72	0.19	0.58	1.96	1.58
Diesel	Imports	-------------------- no split available ---------------------						3.15	7.12	6.57	6.78	5.82	7.71	7.81
	Exports	-------------------- no split available ---------------------						(1.93)	(1.13)	(1.36)	(2.36)	(1.85)	(2.12)	(3.13)
	Net Import/(Export)	-------------------- no split available ---------------------						1.21	6.00	5.21	4.42	3.97	5.59	4.68
Gasoil	Imports	-------------------- no split available ---------------------						1.81	0.94	1.39	0.86	0.75	0.70	1.24
	Exports	-------------------- no split available ---------------------						(4.38)	(4.69)	(5.16)	(4.88)	(4.18)	(4.38)	(4.67)
	Net Import/(Export)	-------------------- no split available ---------------------						(2.57)	(3.75)	(3.77)	(4.03)	(3.43)	(3.67)	(3.43)
Jet/Kerosene	Imports	0.90	4.76	6.32	7.00	7.67	8.02	9.49	8.65	8.16	8.49	8.18	8.33	7.49
	Exports	(1.08)	(0.69)	(0.62)	(0.99)	(1.14)	(1.40)	(1.68)	(1.31)	(1.50)	(2.12)	(1.69)	(1.68)	(1.40)
	Net Import/(Export)	(0.18)	4.08	5.70	6.01	6.53	6.62	7.81	7.34	6.66	6.37	6.49	6.65	6.10
Fuel Oil	Imports	2.40	0.60	0.98	0.56	0.39	0.61	1.53	1.33	1.13	1.20	1.24	1.02	0.84
	Exports	(4.42)	(5.36)	(5.44)	(5.78)	(6.39)	(8.94)	(8.45)	(8.37)	(7.74)	(7.30)	(5.55)	(4.90)	(5.12)
	Net Import/(Export)	(2.02)	(4.76)	(4.46)	(5.22)	(5.99)	(8.32)	(6.93)	(7.04)	(6.61)	(6.11)	(4.31)	(3.88)	(4.28)

Gasoline

The United Kingdom is currently a major exporter of gasoline (Figure VI-1). Net exports peaked in 1997 at 7.2 million tonnes before decreasing, partly due to the closure of the Shell Haven refinery in 1999, reaching a low point of 0.8 million tonnes in 2001. However exports increased strongly again over the previous decade as UK gasoline demand declined, with the major export market being the United States. Gasoline imports are typically from Scandinavia and the Rotterdam area, mostly for local blending and supply into the Thames. Despite the closure of Coryton (and therefore an increase in imports of gasoline to the Thames) the UK would be expected to continue to be a large net gasoline exporter throughout the forecast period.

FIGURE VI-1
NET UK GASOLINE TRADE, 2000-2011
(Million Tonnes: -ve = Exports)



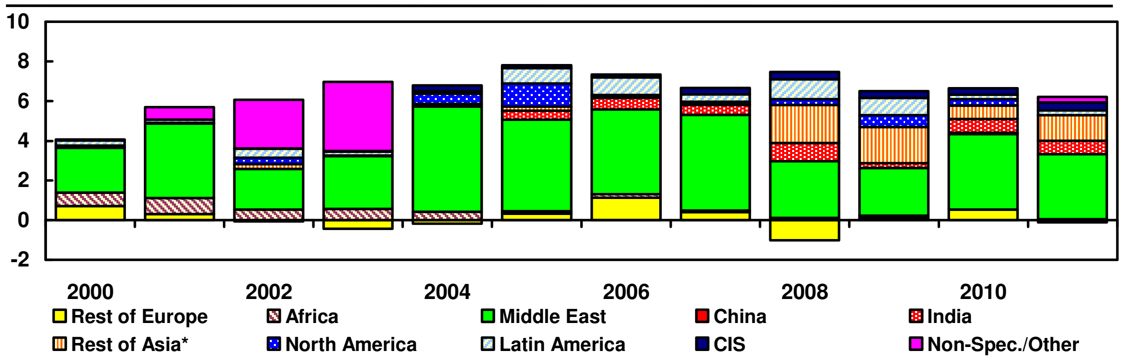
**Includes Oceania* *Historical data source: IEA*

Jet/Kerosene

Net imports of jet/kerosene are considerable, averaging 6.1 million tonnes in 2011, lower than the peak of 7.8 million tonnes in 2005 (Figure VI-2). This is primarily due to the huge demand for jet fuel in the London area owing to the presence of Heathrow, Gatwick and Stansted airports. There is a small structural export market, of both jet fuel and burning kerosene to Ireland, as the United Kingdom currently provides all of the required refined product import to the Irish market.

Although the Middle East is the primary source of imports, most noteworthy is the increase in volumes from India and the Rest of Asia (excluding China) starting in 2005 and gathering pace since 2008, a route made economical with the greater use of ships of over 100,000 dwt. These trends are significant, as they indicate increasing diversity of supply and less reliance on one particular region, but also show that the UK now imports jet/kerosene from all other major refining regions of the world.

FIGURE VI-2
NET UK JET/KEROSENE TRADE, 2000-2011
(Million Tonnes: -ve = Exports)



*Includes Oceania   Historical data source: IEA

Gasoil and Diesel

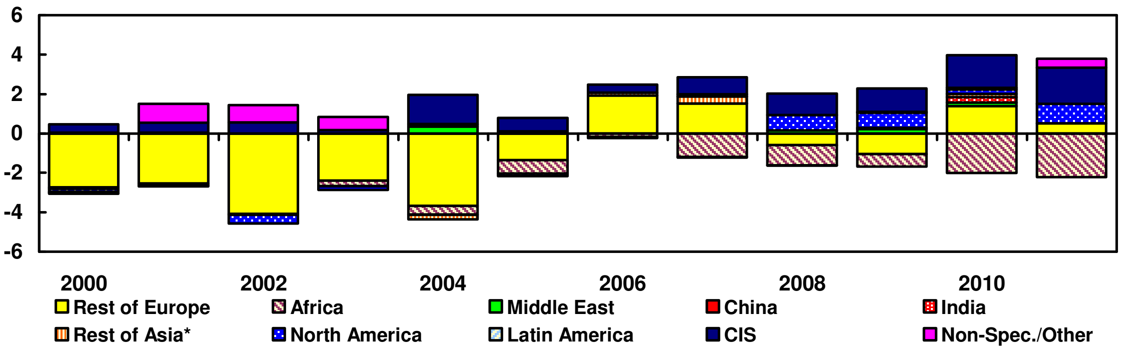
Note in this section UK supply, demand and import/export data for diesel and gasoil is provided separately from 2005 onwards, rather than as combined diesel/gasoil. This level of granularity on diesel and gasoil split has been made available in the latest UK government statistical data set "DUKES"[1] for the years 2005 through to 2011. This data split is not yet available for other countries in the IEA data set. Consequently UK gasoil and diesel trade data information with other countries/regions can only be presented as combined gasoil/diesel. However the UK net position for gasoil and diesel can be shown separately.

The United Kingdom has been a large trader of diesel and gasoil over the past decade; however, during that time the country moved from a position of being a net exporter to a net importer. On a combined gasoil/diesel basis this move from net exporter to net importer took place from 2005 to 2006. 2006 was also the net import peak at 2.2 million tonnes, due primarily to increasing diesel demand, before, before easing back over 2007 to 2009. However net imports increased significantly again in 2010 and 2011 (Figure VI-3). Significant quantities of unfinished gasoils are imported for upgrading, from other parts of Europe and the CIS region, as well as quantities of 10 ppm sulphur road diesel, while the United Kingdom exports 0.1% sulphur heating-oil grade gasoil to northern France and Germany (via the Netherlands) being the significant markets. The United Kingdom also currently supplies all diesel and gasoil imports into the Irish market.

The diesel import/export data shows that the UK has been a net importer of diesel since at least 2005. The highest net import was recorded in 2006 at 6 million tonnes, falling back to 4 million tonnes by 2009, before increasing again in 2010/2011.

The gasoil import/export data (which will also include unfinished gasoil components) shows that the UK is a net exporter of gasoil, with net exports between 3 and 4 million tonnes per annum. Gasoil imports are likely to be primarily straight run component material for additional processing to make diesel, while the exports are likely to be finished gasoil blends containing cracked gasoil material, and cracked gasoil components.

FIGURE VI-3
NET UK GASOIL/DIESEL TRADE, 2000-2011
(Million Tonnes: -ve = Exports)



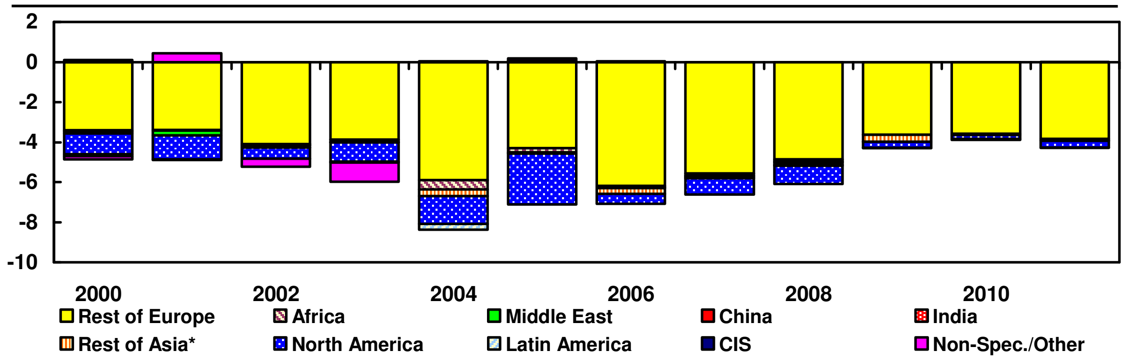
*Includes Oceania Historical data source: IEA

The closure of Coryton refinery and reduction in capacity at Esso Fawley refinery will naturally result in a combination of increased imports (primarily of diesel) and reduced exports (primarily of gasoil). With diesel demand expected to rise significantly, the UK is expected to remain a net importer of diesel over the longer term.

Fuel Oil

The United Kingdom is a large net exporter of heavy fuel oil. Throughout much of the past decade net exports averaged 6.0-8.0 million tonnes, but a large drop in UK refining production in 2009 as a result of the closure of the Petroplus Teesside refinery resulted in exports falling to 3.3 million tonnes. UK refineries are able to make low-sulphur bunker fuels, such that the majority of UK exports are to neighbouring European markets. Additional exports have also been seen to the United States, primarily for utilities. Very few cargoes are exported directly to the Middle East or Asia; shipping economics dictate that for these distances cargoes are usually sent to Rotterdam for bulk-building into larger cargos for onwards transportation.

FIGURE VI-4
NET UK HEAVY FUEL OIL TRADE, 2000-2011
(Million Tonnes: -ve = Exports)

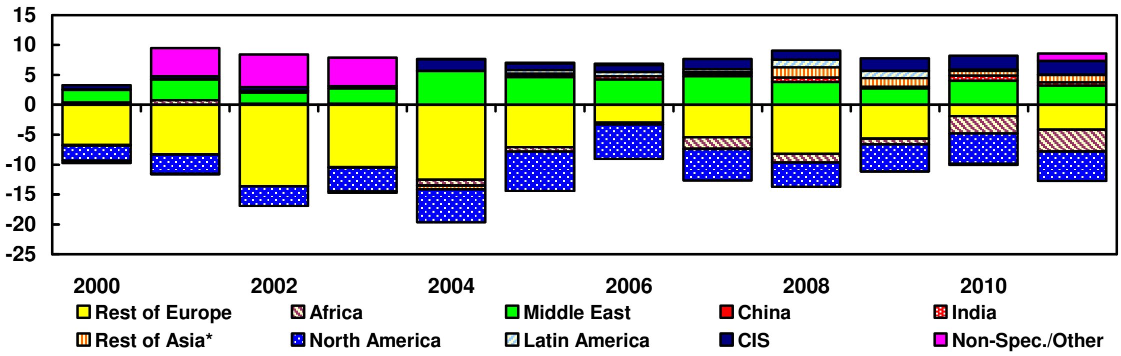


*Includes Oceania Historical data source: IEA

There are some regional differences to the national net trade picture. The south east of England is constrained by infrastructure issues, especially following the 2005 Buncefield terminal fire. As a result there are a number of terminals located on the Thames estuary that import large volumes of gasoline and diesel in order to meet the local market demand. Significant import volumes of jet fuel also take place on the Thames estuary, as well as via Southampton and Humber estuaries and Avonmouth, with jet fuel being moved to Heathrow and other London airports primarily by pipeline. Elsewhere in the country, regional jet/kerosene supply and demand is more balanced. The UK west coast refineries export significant volume of jet/kerosene and gasoil/diesel to Ireland.

Figure VI-5 shows the net UK balance for all refined products for the 2000-2011 period and the major import/export markets. These show a general east-west trading pattern; the Middle East, CIS and parts of Asia are the main suppliers, primarily of middle distillates, while Europe, the United States and Africa are the principal export destinations, mostly of gasoline but also of some fuel oil and, in the case of Africa, gasoil/diesel.

FIGURE VI-5
NET UK TOTAL PRODUCTS TRADE, 2000-2011
(Million Tonnes: -ve = Exports)



*Includes Oceania Historical data source: IEA

PROJECTION OF BALANCES IN FUTURE SCENARIOS

For all the future scenarios it is necessary to predict the production level of the UK refining industry. To do this we take current production data, and then project forward based on known capacity changes that are likely to occur in the near future, and then apply the assumptions defined above for the different scenarios.

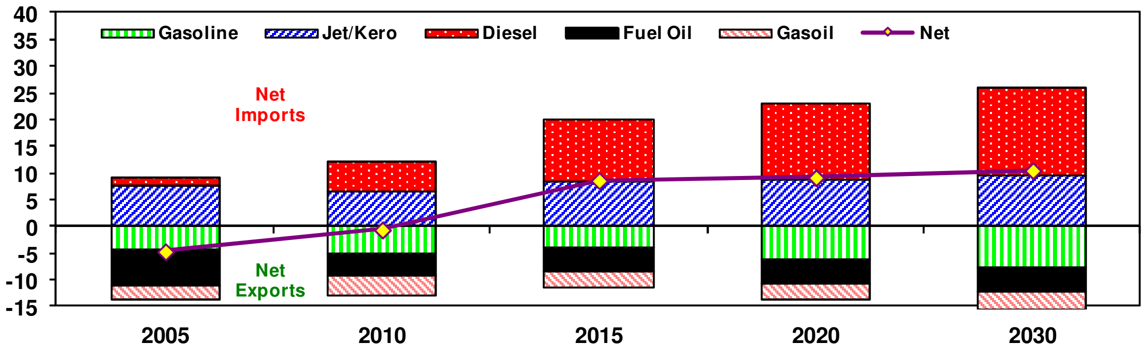
However 2012 saw the closure of Coryton refinery and a reduction in capacity at Fawley refinery. This means that there is not currently any historical data available that allows us to see the current state of the industry. Provided that no further changes take place to refining capacity in the UK, the earliest set of annual production data that will reflect the current capability of the UK industry will be full year data for 2013 – which will not be available until 2014. Full year data for 2012 will reflect a year when Coryton was operational for approximately 6 months and the Fawley refinery was running at the new lower distillation capacity for around 3 months.

Therefore PGI has first been forced to produce an estimate of current UK refinery capability based on 2011 full year data, and information on the capacity/production of Coryton refinery. To do this we took our projection of UK refined product balances with Coryton operational from our 2012 Global Petroleum Market Outlook (GPMO) product. These were then adjusted so that the UK refinery throughput and yield structure remained at 2011 levels. Table VI-6 shows this projection. Table VI-7 shows typical operation of Coryton refinery, taken from Petroplus annual reports. By subtracting the typical Coryton activity shown in Table VI-7 from the balance shown in Table VI-6 a base case projection for UK crude and refined product balances can be produced. This is shown in Table VI-8, and represents our projection of UK refined product supply demand balances under Scenario 1.

SCENARIO 1. STEADY STATE SCENARIO

A historical and projected supply demand balance for the United Kingdom for each of the major products under this scenario is shown in Table VI-8 and is illustrated in Figure VI-6 below.

FIGURE VI-6
SCENARIO 1: UK PRODUCT TRADE BALANCE, 2005 - 2030, NO INVESTMENT
(Million Tonnes per Year)



Historical data source: IEA

A step change increase in imports of diesel, and jet/kerosene together with a small reduction in gasoil exports is expected to take place in 2012 and 2013 as a result of the closure of Coryton refinery (Coryton operated for around 6 months in 2012, so the changes will be seen in both 2012 and 2013 figures).

With long-term diesel and jet demand projected to grow and with no change to current UK production then net imports of these materials (often called middle distillates) must increase. Consequently by 2030 net imports of jet/kerosene would be expected to rise to 9.5 million tonnes up from a net figure of 7.2 million tonnes in 2012. Diesel net imports would be expected to rise from 9 million tonnes in 2012 to 16.4 million tonnes by 2030. Gasoil net exports would be expected to drop from 4.3 million tonnes in 2012 to 3.4 million tonnes by 2030.

The expected continuing decline in UK gasoline demand would result in increased gasoline exports. A significant reduction in net gasoline exports is expected to take place in 2013 as a result of the closure of Coryton refinery (although local imports in the Thames area are expected to increase). Gasoline net exports in 2013 are expected to decrease to 2.5 million tonnes, down from 5.4 million tonnes in 2011 and 3.4 million tonnes in 2012. Thereafter gasoline exports would be expected to increase, reaching 7.5 million tonnes by 2030.

A major issue under this scenario would be the availability of export markets for the surplus gasoline. US gasoline demand is likely to decline in the long term as a result of mandated improvements in Corporate Average Fuel Economy (CAFE) standards for passenger cars and light trucks, combined with the increasing use of ethanol blending in US gasoline, which will have the effect of reducing further the potential market for refinery-based gasoline. Although it is likely that exports to West Africa will continue we are not expecting significant increases in African trade volumes, owing to relatively modest increases in West African domestic demand.

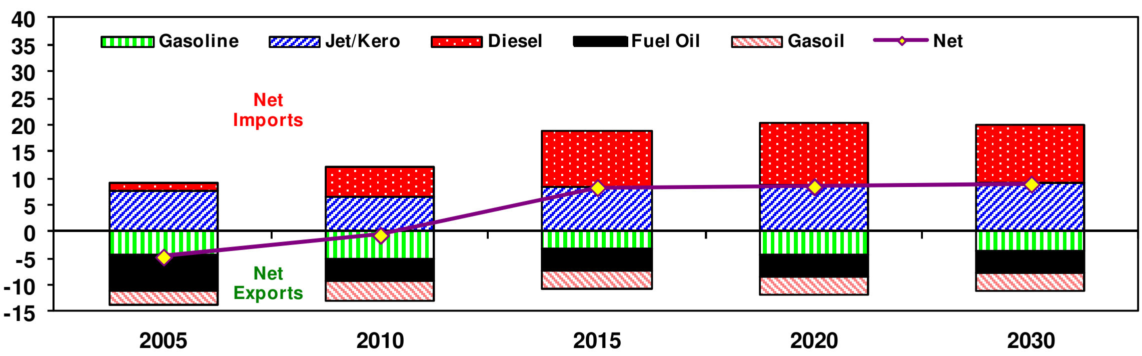
Aside from a modest reduction in fuel oil net exports in 2013 as a result of the Coryton closure, the net fuel oil balance would not be expected to change significantly over the forecast period. Exports would be expected to increase in 2015 as the North Sea and Baltic ECA zones switch from 1% sulphur fuel oil to 0.1% sulphur distillate material, but this change only returns fuel oil net exports to the same level as 2011. Thereafter the net position is not expected to change significantly with a projected net export of around 4.5 million tonnes per year.

SCENARIO 2. ENHANCED COMPLEXITY SCENARIO

Scenario 2 (Enhanced Complexity Scenario, with modest investment in refining) is consistent with Purvin & Gertz long term global supply demand balances for 2012 as published in our Global Product Market Outlook multi-client study (apart from the adjustment made for the UK reflecting the closure of Coryton refinery). This scenario is also therefore also consistent with Purvin & Gertz long term predictions for supply/demand balances for other countries and regions across the globe and therefore this scenario is also consistent with the comparisons of refining cover for different countries shown later in this Section.

A historical and projected supply demand balance for the United Kingdom for each of the major products under this scenario is shown in Table VI-9 and is illustrated in Figure VI-7 below.

FIGURE VI-7
SCENARIO 2: UK PRODUCT TRADE BALANCE, 2005 - 2030, ENHANCED COMPLEXITY
(Million Tonnes per Year)



Historical data source: IEA

The moderate investment in refining increases diesel production from 13.4 million tonnes in 2012 to 17.8 million tonnes in 2030 but demand increases from 23.8 million tonnes to 30.9 million tonnes. Net imports of diesel therefore increase from 9 million tonnes in 2012 to 11.1 million tonnes by 2030.

Gasoil production remains constant, and gasoil net exports would be expected to drop from 4.3 million tonnes in 2012 to 3.5 million tonnes by 2030.

Net imports of jet/kerosene would be expected to rise to 9.5 million tonnes up from a net figure of 7.2 million tonnes in 2012.

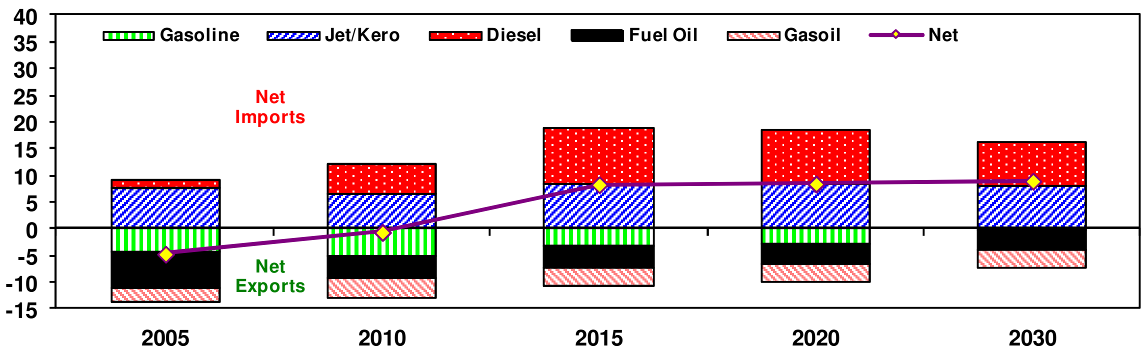
The expected continuing decline in UK gasoline demand would result in increased gasoline exports, but the increase is lower than in Scenario 1. Gasoline net exports reach 3.5 million tonnes by 2030, up from the expected 2.1 million tonnes in 2013 following the Coryton closure.

In this scenario the fuel oil balance would not be expected to change significantly compared to Scenario 1. A modest reduction in fuel oil production takes place as a result of the refinery investment such that net exports drop to 4.1 million tonnes by 2030 compared to 4.5 million tonnes in Scenario 1

SCENARIO 3. SIGNIFICANTLY ENHANCED COMPLEXITY SCENARIO

This scenario assumes a significantly greater amount of investment in the UK refining industry directed at correcting the imbalances in trade. This is modelled by starting with Scenario 2, and then replacing cat-cracking capacity with additional hydrocracking capacity. The scenario assumes that one 60,000 B/D hydrocracker is constructed in 2020 and a further 60,000 B/D hydrocracker constructed in 2025, both replacing equivalent capacity of cat-cracking. The impact of such changes on the UK refined product balance is shown in Table VI-10. An historical and projected supply demand balance for the United Kingdom for each of the major refined products under this scenario is shown in Table VI-11 and is illustrated in Figure VI-8 below.

FIGURE VI-8
SCENARIO 3: UK PRODUCT TRADE BALANCE, 2005-2030, SIGNIFICANTLY ENHANCED COMPLEXITY
(Million Tonnes per Year)



Historical data source: IEA

The significant investment in refining increases diesel production from 13.4 million tonnes in 2012 to 16.3 million tonnes in 2020 and 20.5 million tonnes by 2030. Net imports of diesel increase from 9 million tonnes in 2012 to 10.7 million tonnes by 2015, but then decline as the hydrocracker investments take place, such that net imports reduce to 8.4 million tonnes by 2030.

Gasoil production remains constant, and gasoil net exports would be expected to drop from 4.3 million tonnes in 2012 to 3.5 million tonnes by 2030.

Jet/kerosene production increases from 7.7 million tonnes in 2012 to 8.6 million tonnes in 2030. Net imports of jet/kerosene would be expected to rise to 8.3 million tonnes by 2015 before also being held steady by the hydrocracker investments, falling marginally to 8.0 million tonnes by 2030.

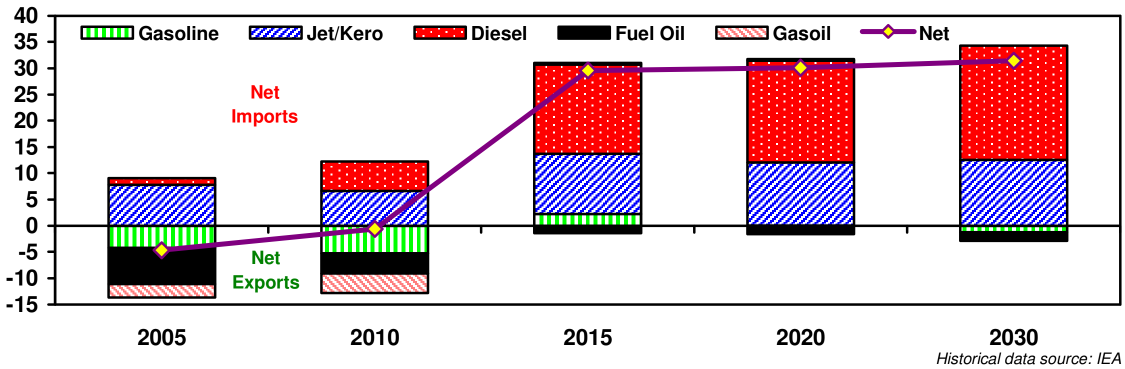
The expected continuing decline in UK gasoline demand would result in increased gasoline exports until 2020 when the first reduction in cat-cracking capacity takes place. Gasoline net exports reach 4.2 million tonnes by 2019 up from the expected 2.1 million tonnes in 2013 following the Coryton closure, then drop to 2.7 million tonnes in 2020 and remain at this level until 2025 when net exports drop to 1 million tonnes with the second reduction in cat-cracking capacity takes place. By 2030 net exports fall to 0.4 million tonnes.

A reduction in fuel oil production takes place as a result of the refinery investment. Fuel oil net exports drop from 4.2 million tonnes in 2015 to 3.5 million tonnes by 2030, lower than in both scenario 1 and 2 above.

SCENARIO 4. REDUCED REFINERY CAPACITY

This scenario assumes the closure of a further three refineries in the UK by 2030. This would mean a reduction of between 550 and 763 KB/D (27 and 37 MTA) of refining capacity, depending on which combination of the existing refineries was to close. For this analysis we have simply taken three-sevenths of the current (2013) production capacity away from the supply/demand balance from 2015 onwards, to show the impact such a closure case would have on the UK supply demand balances. This represents a reduction in distillation capacity of 594 KB/D (29 MTA). While this analysis would not show the exact impact of a further three UK refineries closing, it would certainly show a reasonable estimate of this impact. An historical and projected supply demand balance for the United Kingdom for each of the major refined products under this scenario is shown in Table VI-12 and is illustrated in Figure VI-9 below.

FIGURE VI-9
SCENARIO 4: UK PRODUCT TRADE BALANCE, 2005-2030, REDUCED REFINERY CAPACITY
(Million Tonnes per Year)



This scenario makes a significant change to the UK balances from the assumed point of closure of the refineries (2015). Production of all main fuels is reduced and as a result net import requirements for all fuels increase significantly.

Diesel net imports jump from 11.1 million tonnes in 2014 to 17.0 million tonnes in 2015 and would then continue to increase reaching 21.7 million tonnes by 2030.

Gasoil moves from a 4 million tonne net export in 2014 to 0.3 million net import in 2015. Gasoil imports then decline slowly with reduction in demand such that the UK reaches a balanced position by 2030.

Jet/kerosene net imports jump from 8.3 million tonnes in 2014 to 11.5 million tonnes in 2015 and would then continue to increase reaching 12.5 million tonnes by 2030

The gasoline net export length would disappear, with the UK requiring a net import of 2.2 million tonnes in 2015. As demand reduces the net import requirement also reduces and the UK would move into a net balanced position by 2020 and to a net export of 1.3 million tonnes by 2030.

The fuel oil net length would reduce to around 1.5 million tonnes and remain close to this level over the forecast period.

Under this scenario, such significant changes to the UK balances would require investment in additional import infrastructure to handle the additional import volumes of diesel and jet/kerosene.

UK REFINING COVER UNDER EACH SCENARIO

In this section we look at the UK's production of refined products and compare this with the UK's consumption of the same products. Refining cover is defined as the total production of a refined product divided by its consumption, within the same country or region. A figure of greater than 100% indicates that the country is producing more of the product than it needs and so is a net exporter. A figure of less than 100% indicates that the country is short of the product and is having to import to cover its demand.

$$\textbf{Refining Cover} = \frac{\textbf{Production of Product}}{\textbf{Demand for Product}} * 100\ \%$$

Table VI-13 shows the UK refining cover for gasoline, jet, kerosene, and diesel and gasoil together with diesel/gasoil combined under each scenario, and is summarised in the table below.

UNITED KINGDOM REFINING COVER (percent of demand supplied by UK refineries)

		2000	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030
Scenario 1: Steady State												
	Gasoline	108	120	131	137	123	116	123	131	159	177	187
	Jet	60	41	49	55	48	44	44	43	41	40	39
	Diesel	no split	98	70	71	57	52	50	49	44	42	41
	Gasoil	no split	122	157	225	218	206	208	164	164	169	174
	Kerosene	80	86	69	74	62	56	55	55	56	57	57
Scenario 2: Modest Investment												
	Gasoline	108	120	131	137	121	113	117	123	138	141	136
	Jet	60	41	49	55	48	45	44	44	43	43	42
	Diesel	no split	98	70	71	57	53	53	53	53	55	58
	Gasoil	no split	122	157	225	218	211	214	169	169	174	179
	Kerosene	80	86	69	74	62	56	55	55	55	56	57
Scenario 3: Enhanced Investment												
	Gasoline	108	120	131	137	121	113	117	123	121	103	96
	Jet	60	41	49	55	48	45	44	44	47	51	50
	Diesel	no split	98	70	71	57	53	53	53	57	64	66
	Gasoil	no split	122	157	225	218	211	214	169	169	174	179
	Kerosene	80	86	69	74	62	56	55	55	55	56	57
Scenario 4: Three Refineries Close												
	Gasoline	108	120	131	137	123	116	123	75	91	101	107
	Jet	60	41	49	55	48	44	44	25	23	23	22
	Diesel	no split	98	70	71	57	52	50	28	25	24	23
	Gasoil	no split	122	157	225	218	206	208	94	94	97	99
	Kerosene	80	86	69	74	62	56	55	31	32	32	33

Steady State Scenario

Under the steady state scenario, the current imbalances in the UK supply demand balance become worse. Gasoline production reaches 159% of demand by 2020 and 187% of demand by 2030. Jet supply cover declines from 48% in 2012 (already relatively low) to 41% by 2020 and 39% by 2030. Diesel cover declines from 57% in 2012 down to 44% by 2020 and 41% by 2030. Gasoil cover declines from 218% in 2012 down to 164% by 2020 and recovers to 174% by 2030. Burning kerosene (domestic heating oil) cover declines from 62% in 2012 to 56% by 2020 and remains steady thereafter.

Under this scenario the UK would be in an insecure supply position, with significant exposure to the international refined product markets in terms of securing supply of diesel and jet and disposal of excess gasoline. Disposal of excess gasoil into the relatively short European market (in particular Germany and France) would be unlikely to be a problem.

Modest Investment Scenario

Under the modest investment scenario, the imbalances in the UK supply demand also become worse, although not as imbalanced as in the steady state scenario. Gasoline production reaches 138% of demand by 2020 and then falls back to 136% of demand by 2030. Jet supply cover declines from 48% in 2012 to 43% by 2020 and 42% by 2030. Diesel cover declines from 57% in 2012 down to 53% by 2020 but then recovers to 58% by 2030. Gasoil cover declines from 218% in 2012 down to 169% in 2020 and then recovers to 179% by 2030. Burning kerosene cover declines from 62% in 2012 to 55% by 2020 and remains steady thereafter.

Under this scenario the UK would be in a slightly better supply position than the present (2013), but worse than in 2011. There remains exposure to the international refined product markets, with significant imports of diesel and jet required to balance demand.

Enhanced Investment Scenario

Under the enhanced investment scenario, the imbalances in the UK supply demand balances improve compared to the present day (2013) and are kept at similar levels to 2011 (i.e. before the Coryton refinery closure). Gasoline cover stays steady over the 2012 to 2020 period at around 120% before declining to a balanced position by 2025-2030. Jet supply cover stays steady at 45-48% from 2012 to 2020 before improving to 50% by 2025 to 2030. Diesel cover declines from 57% in 2012 down to 53% by 2015 before recovering to 57% by 2020 and recovering further to 66% by 2030. Gasoil cover declines from 218% in 2012 down to 169% in 2020 and then recovers to 179% by 2030. Burning kerosene cover declines from 62% in 2012 to 55% by 2020 and remains steady thereafter.

Under this scenario the UK would be in an improved supply position compared to the present. Exposure to limited gasoline export markets would be eliminated and exposure to the jet and diesel import markets is limited to what should be normally manageable levels. Nevertheless significant imports of diesel and jet are still required to balance demand.

Refinery Closure Scenario

Under the refinery closure scenario (three refineries close in 2015), the imbalances in the UK supply demand would put the UK in a precarious supply position.

Gasoline cover would drop to 75% in 2015 before improving to 100% by 2025 as UK consumption declined. Jet cover would drop to 23% in 2015 and decline further to 22% by 2030. Diesel cover would drop to 28% in 2015 and then decline further to 23% by 2030. Gasoil cover would drop to 94% in 2015 and then slowly recover up to 99% by 2030.

The UK gasoline shortage over 2015 to 2025 would likely be manageable with imports from a regional and international market that is long gasoline, although some periodic disruption to supply driven by external events would occasionally occur. However the exposure to the jet and diesel international import markets would be extremely high and at this level regular disruptions to UK supply from an import market that is itself relatively tight could be expected.

In our opinion the level of refined product supply cover in this scenario should be considered unacceptable. This is reinforced by the analysis shown in Section VIII on UK Supply Robustness and Resilience.

CAPITAL EXPENDITURE REQUIREMENTS FOR SCENARIOS 3 AND 4

We have estimated the total capital expenditure incurred by the UK downstream industry to implement Scenario 3 and Scenario 4. In the following we provide a description of the main assumptions and we present the estimates.

METHOD AND ACCURACY OF THE ESTIMATES

The estimates were made using what is commonly referred to as a “curve type” methodology. The cost of each unit is estimated from a curve that expresses cost as a function of capacity. The methodology relies upon an historical database of the cost of various process units. The curves allow only for minimal adjustments to take into account specific design features of the unit. As an example, our curves make adjustments for the severity of hydrocrackers or hydrotreaters and a few other parameters of this nature. The accuracy of this cost estimating methodology can be considered to be +/-50%. The low accuracy is not solely related to the low inherent accuracy of the curves, but also to the fact that this method relies upon a very low level of definition of the project, so omissions are likely.

A more rigorous description of this methodology and its accuracy is provided by the Recommended Practice 18R-97 published by the Association for the Advancement of Cost Engineering, International” (aacei).[17]

LOCATION FACTOR AND COST INFLATION

The estimating curves are normalized to a common location, which is the US Gulf Coast (USGC), and are in US Dollars. Starting from these curves, we estimate costs in other part of the world by applying a “Location Factor”, which is the ratio between the cost of construction at any given location and the cost of construction in the USGC. A number of factors make the USGC a low cost construction region. As an example, the USGC enjoys generally good weather on a year round basis, a good trade-off between labour costs and productivity, access to local suppliers for most conceivable needs, good logistics and low cost for the mobilization/demobilization of resources. As such, most world locations, including Europe, tend to have location factors above 1.00.

[17] http://www.aacei.org/non/rps/18R-97.pdf

For this study we have used a location factor of 1.35, which can be considered representative for the UK in a scenario with a $/€ exchange rate at 1.33 and a £/€ exchange rate at 1.20. Hence, the $/£ exchange rate implied in the estimates is 1.60. It is important to observe that exchange rate movements would not be passed in full to higher or lower cost estimates denominated in Sterling. This because a hypothetical contractor building a project in the UK would still source a large amount of equipment and services paying US Dollars or Euros and also because UK suppliers have to be compete internationally against suppliers that price their services in different currencies. The correct way to reflect different exchange rate assumptions in the estimates would be to re-estimate the location factor.

We have executed this study on a completely generic basis in respect of the actual locations in the UK where the projects would be implemented. Different locations would have somewhat different location factors, but we feel that in the context of a +/-50% estimate such differences can be considered irrelevant.

The cost estimating curves rely upon data accumulated over many years. Data points acquired at different times are normalized to a common point in time using cost inflation indexes. The estimates presented here are based on a cost inflation index that is representative of costs in Q1 2013. The estimates do not allow for any cost escalation that will occur between Q1 2013 and the point in time when the projects would be built. Hence, the estimates are in “constant Q1-2013 money”.

CAPITAL COST ESTIMATE FOR SCENARIO-3

Scenario 3 envisages the implementation of two identical projects at two different points in time (2020 and 2025). Each of those projects envisages that 60,000 B/D of FCC capacity is mothballed and is replaced by 60,000 B/D of hydrocracking capacity. The most important cost estimating assumptions are discussed below.

The hydrocrackers are assumed to be “full conversion” units, i.e. the amount of unconverted feed is minimal (e.g. 2-3 wt %). Hydrocrackers of this kind have “chemical hydrogen consumption” in excess of 2 wt % of feed. The amount of hydrogen to feed to the unit would have to be in excess of that to allow for losses. The estimate assumes that the project would build a hydrogen plant with capacity equivalent to 3.0 wt% of hydrocracker feed. This is equivalent to approximately 11 t/hr or 130,000Nm3/hr.

A side effect of the hydrocracking reactions is that nearly 100% of the sulphur is removed from the feed. The sulphur is removed as H_2S, which is lethal gas. Any gaseous stream that contain H_2S must be processed in a “sulphur recovery unit” that converts H_2S to sulphur, a low value by-product that has uses in the production of tyres, fertilizers, sulphuric acid and some others. The only alternative to sulphur recovery is flaring, which would burn the H_2S into SO_x. Current environmental regulation specifies that sulphur must be recovered with 99% efficiency as a way to minimize SO_x emissions. The functioning of the FCC technology is such that over 50% of the sulphur in the feed ends up into products from which sulphur is normally not removed (slurry), it may be removed (gasoil), or is burnt by combustion (coke). Therefore, replacing an FCC with a hydrocracker invariably increases the amount of H_2S produced by the refinery and requires the construction of new sulphur recovery capacity.

The other factor to consider is that an FCC refinery would tend to see a better incentive than a hydrocracking refinery to process crudes with a paraffinic nature. Many paraffinic crudes have a low content of sulphur. By contrast, once a refinery has been redeveloped into a hydrocracking refinery, it would most likely process crudes with higher content of sulphur. We have estimated the project cost on the basis that the refinery would build new sulphur plants dedicated to the hydrocracker. The size of the sulphur plants has been assumed on the basis that the feed to the hydrocracker would have a content of sulphur of 2.0wt%. The most commonly available high sulphur crude in Europe is the Russian Export Blend (also referred to as Urals), which produces hydrocracking feed with about 1.6wt% sulphur. Middle Eastern crudes would produce hydrocracking feed with sulphur content in the region of 2.0wt% or slightly in excess of that. Therefore, our assumption reflects the cost of a project devised to give the refinery a certain amount of feed selection flexibility.

In case of a prolonged outage to the sulphur recovery units, the hydrocracker would have to be shut down. The cost of sulphur recovery units is low in comparison to the daily margins earned by the hydrocracker. Therefore, projects tend to split the necessary sulphur recovery capacity over multiple units and also build some overcapacity. This is because a risk-based analysis would tend to say that is worth spending the extra cost to have a system which ensures that some sulphur recovery capacity will always be on stream. In this case, we have assumed that the refinery would build two sulphur recovery units, each sized at 60% of the capacity needed to support the hydrocracker (2x105 t/d). Some additional sulphur recovery capacity would be available in the refinery as a result of H_2S that is not produced because of the FCC shut down.

The cost estimate allows for approximately $66million (£41 million) to be spent in possible needs for revamping. Part of the crude diet of most FCC refineries would include crudes with quality that makes it possible to feed atmospheric residue to the FCC. This is not possible with a hydrocracker, so the balance of probability suggests that reconfiguring a refinery from FCC to hydrocracking would require some expansion of vacuum distillation capacity. To the extent the refinery will process more high sulphur crude, then a revamping of the gasoil hydrotreaters may also be required.

Hydrocrackers consume more electricity than FCCs, so a project of this nature would require an increase of electricity generation. However, we have assumed that incremental electricity would be purchased.

We have not attempted to estimate the possible impact on the off-sites from a project of this nature. Our model includes “off-site factors”, i.e. factors to make an allowance of the typical cost of the off-sites needed to support a certain process units. The off-site factors are meant to capture items such as cooling water system, steam boilers, air and nitrogen, interconnecting piping, product blending, logistics, buildings, roads, etc. The refinery would already have infrastructure, as needed to function in its FCC configuration. With the FCC, the refinery would mothball an FCC gasoline hydrotreater, and possibly an alkylation unit and/or an MTBE unit. This would make off-sites capacity available in a number of existing systems and pieces of infrastructure. This capacity would be utilised to reduce the cost of the hydrocracking project. Therefore, we have assumed that 50% of the off-sites associated with the FCC + ancillaries can be reutilised by the hydrocracking refinery. This represents a credit of $82million (£51million) against the estimated cost of the project.

The table below summarizes the estimated cost of the project in US Dollars, Euros and Sterling at the assumed exchange rates.

ESTIMATED PROJECT COST
(Million)

	Sterling	USD	Euro
Hydrocracking unit	513	821	617
Ancillary units	200	320	240
Allowance of revamps	41	66	50
Cost of additional off-sites	102	164	123
Total construction cost	856	1,370	1,030
Owner's costs	158	253	190
Contingency (10%)	101	162	122
Total project cost	1,116	1,786	1,342

The total construction costs capture those costs that are normally included in the scope of an Engineering Procurement and Construction (EPC) contract to build the units. Owner's costs are the additional costs incurred by the project sponsor for anything that is outside of the scope of the EPC contract. Same examples of items that are part of the owner's costs but must be included in the estimate are: license fees, front end engineering, catalysts' initial fill, site preparation, the cost of the project management team set-up by the project sponsor, insurance, stocking the warehouse, operators' training, start-up expenses, etc. The owner's costs as shown above are based on typical factors that we use in our cost estimating model.

Contingency is an allowance that is normally made to capture possible omissions from the estimate that may be the result of the low level of project definition. Contingency may also be used to fund possible adverse and unforeseen developments that could cause the project cost to increase during execution. A 10% contingency allowance would be typical for a project that has been approved by management and is about to enter the EPC phase.

Therefore, our estimate of the cost to replace two cat-crackers with hydrocrackers (2 * 60,000 B/D) would be £2.2 Billion, (US$3.6 Billion) plus or minus 50%.

CAPITAL COST ESTIMATE FOR SCENARIO 4

As noted earlier, Scenario 4 envisages the closure of three refineries at an assumed loss of 3/7 of the UK refining capacity.

Any refinery would supply part of its production into the domestic market, with the remaining part going to export. Any refinery closure would leave a certain geographical area of the UK in need to find alternative sources of supply. Therefore, when a refinery closes it would be possible to consider reutilizing some of the refinery facilities to build an import terminal. All UK refineries are located on the coast. The system composed by the refinery jetties, tanks, truck (or rail) loading racks and connection into pipelines would typically be a viable system to keep supplying the portion of the domestic market that used to be served by the refinery. An example of this is provided by the recent closure of Coryton refinery. After closure, the refinery logistics remain as a viable system to supply imported products into the London area and beyond. After failing to sell the refinery as a crude oil processing entity, the administrators sold the site for use as a future import terminal.

In a lot of cases the UK refineries deliver into the domestic market with pipelines that connect into inland terminals (see Section VIII) that may also be served by other refineries. Therefore, the closure of a refinery may in some cases lead to a rearrangement of product flows, such that the optimal location to import the incremental products may be at a different site. However, most of the UK products pipelines are typically used at capacity and it is not realistic to assume that a new pipeline would be built. If pipeline utilization was to reduce, then some part of the UK would see a shortage of products. Prices in the marketplace would move to create an incentive to use the pipeline. Therefore, the most plausible assumption is that the logistics necessary to keep the existing pipeline and inland terminal network utilized would certainly be implemented.

If three refineries were to close in the UK, we think that the balance of probability is that at least two of them would be converted into terminals. Some additional import capacity would be built elsewhere. We consider it unlikely that there would be any construction of a new greenfield terminal in the UK. However, construction of new tanks at other existing terminals could be possible.

Lost refinery production would certainly have to be replaced with supply from terminals when the product is to be imported. However, terminal capacity may also be needed for the re-delivery of product from a UK refinery or terminal. As an example, the closure of the first of the three refineries would still leave the UK as a net exporter of gasoline. There may not be any need to import gasoline, but there may be a need to deliver gasoline by sea from another UK refinery to the site of the closed refinery.

The difference between trade flows in Scenario 4 and trade flows in the base case suggests that the terminal capacity that will replace the 3 refineries would need to make it possible to deliver approximately the following volume of products:

- 6 MTA of net diesel import, plus an allowance for some volumes that may be transhipped
- 3 MTA of jet fuel, plus an allowance for transhipment
- Some gasoil and some gasoline
- Some capacity for niche products and specialties

The reduction of distillation capacity is 29 MTA (594kb/d), so less than half of this capacity is replaced with terminal capacity. The balance is processing losses and production of products (mainly gasoline) that are surplus to requirements and will not have to be replaced by import volumes.

The average capacity of a UK main fuels refinery is about 220kb/d. A refinery of this size should have enough storage capacity to be converted to a terminal of 1 million m^3 of capacity, or even more. Based on one "turn per month", i.e. the monthly throughput of the terminal is one time its storage capacity, a 1 million m^3 terminal would supply close to 10 MTA of products in the domestic market. A terminal used for the sole purpose of importing products would achieve more than one turn per month, so 2 terminals with capacity of 500,000m3 each could be considered sufficient for capacity that is "functional" to the additional import. The additional storage capacity could be used for other purposes, e.g. holding compulsory stocks or holding stocks for forward sales etc, providing the tankage were to be maintained in acceptable condition.

We would expect that the conversion of a recently closed refinery into a 1 million m^3 terminal would cost in the region of £45-60 million, if feasible without construction of new tanks. The refinery would have more than 1 million m^3 of storage capacity, so there would be options to decommission tanks in poorer maintenance condition and select those that meet required standards.

The cost of two of such projects would be in the range of £90-120 million. Making an allowance for investment at some of other terminals to fill the gap in the marketplace left by the third refinery, a capital expenditure in the region of £150 million should be expected.

Note this estimate is based on the concept of as far as possible re-using existing facilities on the closed refineries, such as road and rail racks, pipeline connections, existing jetties etc together with existing off-sites facilities (roads, drainage system etc.). The cost of a new "Greenfield" terminal where jetties, tanks, off-sites, and road/rail delivery systems have to be constructed would be significantly higher. This cost estimate also does not include the very high additional costs required to meet the new standards for containment post Buncefield as described in the UK Environment Agency revised Containment Policy under the Control of Major Accident Hazards (COMAH) Regulations 1999 in February 2008.

ESTIMATE OF SCENARIO PROBABILITY

PGI has been asked to provide an estimate of the most likely scenario, or combination of scenarios. Such an estimate is difficult to make as much of the information it can be based on is by nature uncertain – forecasts of supply and demand and economic activity over many years. The likelihood of each scenario occurring would also be influenced by whether the legislative items described in Section X are implemented of not.

Scenario probability under current legislative environment (i.e. proposed legislation detailed in Section X is not implemented in its current form)

We believe that Scenario 1, Steady State is the least likely scenario. This is because the existing refineries can and do respond to market pressures and are constantly looking for improvements in performance and profitability. Some of the improvements can be achieved with low or modest investment/cost and so some modest improvements will take place. Hence this scenario, while interesting as a comparator benchmark, has a very low possibility of actually occurring.

Of the four defined scenarios, we believe Scenario 2 is the most likely. Scenario 2 is consistent with our 2012 regional and global forecasts for refined product supply demand and trade as published in our Global Petroleum Market Outlook multi-client study. This scenario envisages continuous improvement in refinery capability over a number of years, (2013 through to 2030) combined with some major capital investment. Nevertheless this scenario still requires significant investment of the order 2.4 to 3.6 billion US$ over the next 20 years.

Scenario 3 we believe has a should have a limited probability of occurring, as under this scenario, the competitiveness and profitability of the UK refining industry would improve, while the UK would still have an import price related market for middle distillate grades. However as well as the on going continuous improvement in refinery capability this scenario would require very significant investment in the UK refining industry over the next 20 years, with capital costs of the order of 4.8 to 6.0 billion US$. The sheer scale of investment required makes this scenario less likely.

Scenario 4 – a further three UK refineries close, we believe to be highly unlikely under the existing legislative environment. Closure of this many refineries would move the UK to a wholly import market for all products over the 2015 to 2025 period. This would have the impact of boosting local refining margins, as the refinery gate value for gasoline would move from export related to import related price, with the middle distillates also remaining at import related prices and fuel oil moving away from export related pricing. Logistical issues in some areas could also result in localised price increases also boosting the margins of the nearest refineries able to supply into these areas.

Looking at all four scenarios combined with our projected refinery margin outlook the most likely combination of scenarios would be some kind of combination of scenarios 2 and 4. Since the act of closure of refineries would boost local margins, a more likely outcome would be the closure of one or possibly two refineries that would bring the gasoline refining cover close to 100% over 2015 to 2025. Closure of two refineries would move the entire UK market pricing for gasoline to import parity (diesel, jet and kerosene are already at import parity). On a country basis, gasoil and fuel oil would remain at export parity pricing (although there could be regional exceptions). Approximately this would give an increase in UK gasoline price of 10 $/tonne. Based on the average gasoline yield of UK refineries of 22.2% wt. in 2012 this would result in an increase in UK refinery margins of approximately 2.3 $/tonne or 0.3 $/B of crude processed. While this would be a welcome margin boost for the surviving refineries it is not a large enough change to guarantee their long term survival, particularly if significant additional costs are added to the bottom line by legislation.

Scenario probability under potential future legislative environment (i.e. proposed legislation detailed in Section X is implemented in its current form)

In Section X, the additional cost of legislation on UK refiners over 2013 to 2030 is calculated to be an average of 1.85 $/B, with the average from 2015 to 2030 being 2.0 $/B, and with a five year period from 2016 to 2020 where additional costs average 2.6 $/B.

Furthermore the legislative items would require immense capital expenditure, £3.9 billion between 2015 and 2020 and £5.5 billion overall between 2013 and 2030, for no return on investment. (See Section X, Table X-6).

PGI believe that no industry would bear such an investment burden for no return. Therefore if such legislation were to be implemented when faced with such a large mandatory capital expenditure requirement that provides no return on investment, a number of UK refiners would be forced to close UK refineries. Firstly many refiners may not have access to adequate finance, and secondly those refiners fortunate to have access to adequate finance would still be likely to conclude that operating in the UK (and Europe) would not provide adequate return on investment compared to other regions and voluntarily decide to close UK and European operations.

In this situation, Scenario 4 (with possibly more closures) would become the most likely scenario.

COMPARISON OF UK REFINING COVER LEVEL WITH OTHER COUNTRIES

The analysis below looks at existing and projected refined product cover in different countries. The analysis is consistent with Purvin & Gertz long term global supply demand balances for 2012 as published in our Global Product Market Outlook multiclient study. For the UK this corresponds to Scenario 2, Modest Investment Scenario.

We will compare the Refining Cover in the UK with other major European countries and also with various regions and groups of countries across the world. We will review not only how the coverage has changed in the past but also how it is forecast to change in the future and whether the level of coverage should be of any cause for concern. The output from this analysis is then discussed further in Section VIII UK Supply Robustness and Resilience.

In 2011 the demand for refined products in the UK was 69.7 million tonnes, equivalent to approximately 1.5 million barrels per day. The UK's total production of refined products was 70.5 million tonnes, so overall the UK is roughly balanced in terms of Refining Cover. However, within this there are imbalances within specific products, leading to significant imports and exports.

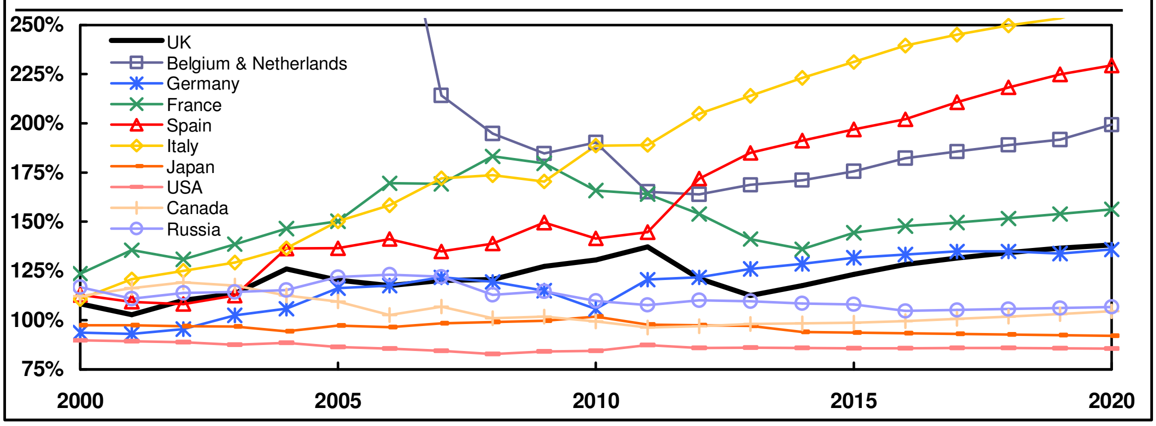
Of the refined product demand in the UK in 2011, 57% was for road transportation fuel. By far the three largest demands for individual products were for diesel, 34%, gasoline at 20% and jet fuel at 16% of the total refined production demand. Therefore these are the three products which we will focus on in this section looking at refining cover.

Tables VI-13, VI-14 and VI-15 show refining cover for the UK and other major countries for gasoline, diesel/gasoil, and jet fuel, and the information is discussed below.

GASOLINE REFINING COVER

Figure VI-10 show the Refining Cover for gasoline for the UK compared to some of the other major gasoline producing and consuming countries.

FIGURE VI-10
GASOLINE REFINING COVER COUNTRY COMPARISON



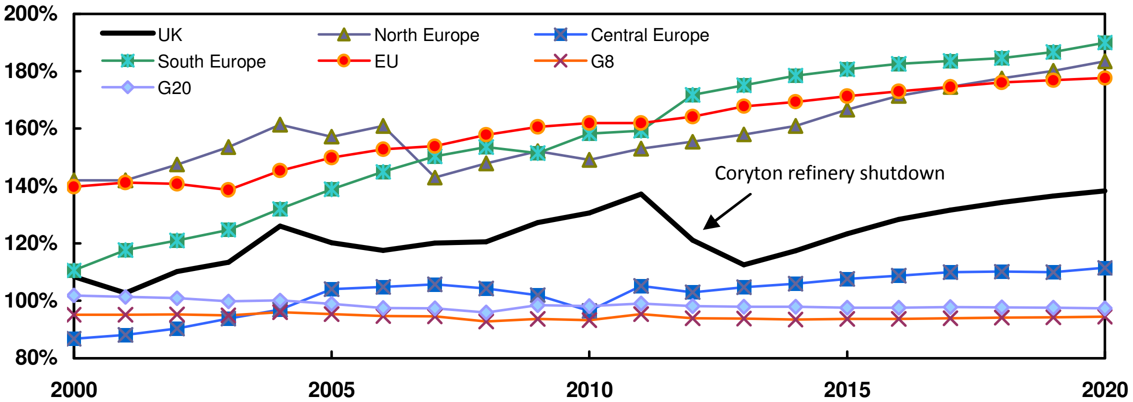
As can be seen, with the exception of Belgium and the Netherlands (which had cover greater than 300%), most of the countries were fairly balanced for gasoline refining cover in 2000 but virtually all countries become more imbalanced in the years following and we forecast that this will continue.

Belgium and the Netherlands have a large excess of refining capacity, forming the trade hub of Amsterdam, Rotterdam and Antwerp (ARA). One of the major trade flows from the ARA region is gasoline across to North America, this peaked in 2007 at 6.1 million tonnes. This trade flow has fallen rapidly in subsequent years as US demand for refinery sourced gasoline has fallen; the production of gasoline in ARA has reduced due to this falling demand.

Although efforts have been made to re-adjust to the falling demand for gasoline, by modifying refineries yield slate and with some refinery closures, in general the European gasoline imbalance continues to worsen and as a result gasoline exports from most countries are increasing. The closure of Coryton refinery in 2012 reduced the UK's gasoline refining cover imbalance from 137% to 121%, but without further structural changes the UK gasoline imbalance will increase leading to a level of refining cover of around 138% by 2020. Nevertheless, this is expected to be substantially lower than that of France, Spain, Italy, and Belgium and Netherlands.

Figure VI-11 compares with UK's gasoline refining cover with some of the major regions and groups of countries.

FIGURE VI-11
GASOLINE COVER REGION COMPARISON



Europe has a surplus of gasoline and this situation continues to increase. Although the UK also has an excess of gasoline it is in a more balanced position than Europe in general.

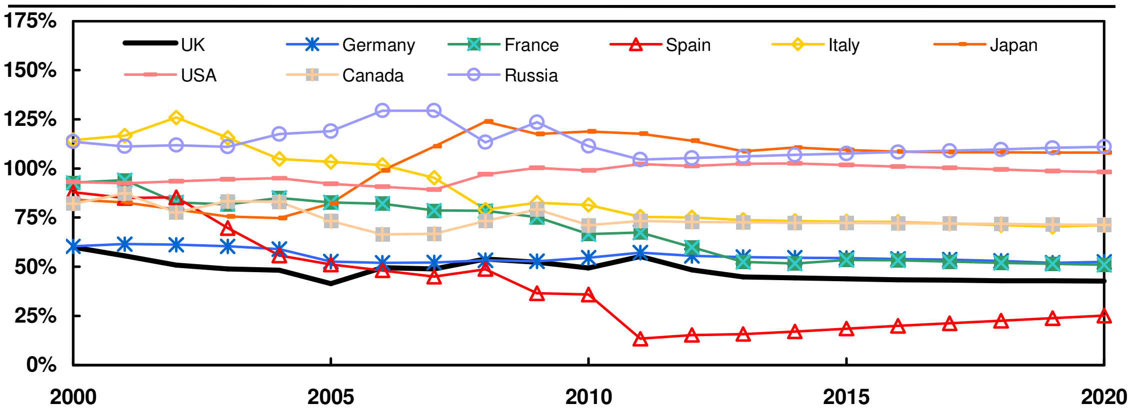
The G8 and G20 groups of the highest GDP countries appear to be well balanced for gasoline, however, the reason for this is the presence of the USA in this grouping. The USA has a significant deficit of gasoline and also has a very high demand, currently constituting 65% of G8 and 45% of G20 gasoline demand. The remaining countries generally have a surplus of gasoline and supply into the deficit in the USA. We would expect to see the G20 having refining cover close to 100% because it covers most of the world's major trading economies and therefore by definition overall it should be close to balanced.

Although being an exporter is not necessarily an unsustainable situation, it tends to lead to lower profitability for a refiner because the exported products are sold at a lower price than products sold inland, in order to cover the product freight transportation costs. The projected overcapacity of gasoline production for UK refiners is of significant concern, but other European countries have more reason for concern.

JET REFINING COVER

Analysing the refining cover for jet fuel shows a more varied picture. Figure VI-12 shows the Refining Cover for jet for the UK compared to other major jet consuming countries.

FIGURE V-12
JET COVER COUNTRY COMPARISON



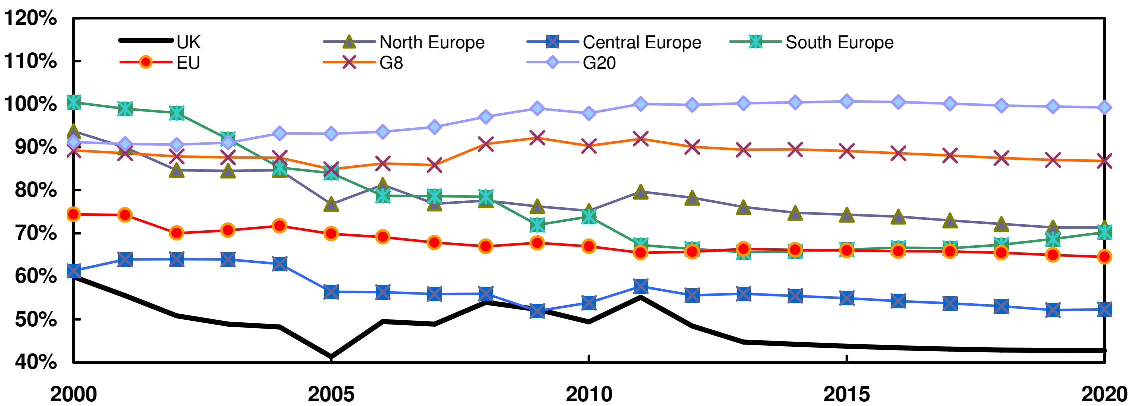
The UK currently has one of the lowest levels of supply cover for jet in Europe, with only Spain having a lower level of cover. Currently (2012) UK supply cover for jet is 48%. The UK's jet demand is very heavily concentrated in the south-east, supplying Heathrow, Gatwick and Stansted airports and this represents a significant logistical issue.

As can be seen from Figure VI-12, the UK has been in this situation for many years; however, the pressure on the jet supply system is gradually increasing. In the year 2000 the UK had a jet refining cover of 60%; with increasing demand and the closure of Coryton refinery this has now fallen to 45% (2013). This change represents an extra 2.4 million tonnes of jet fuel that needs to be imported and then transported to the airports each year.

We forecast that as jet demand continues to increase then the jet refining cover in the UK will continue to gradually decline, down to around 43% by 2020.

Figure VI-13 compares jet cover for the UK and European and global groups/regions.

FIGURE VI-13
JET COVER REGION COMPARISON



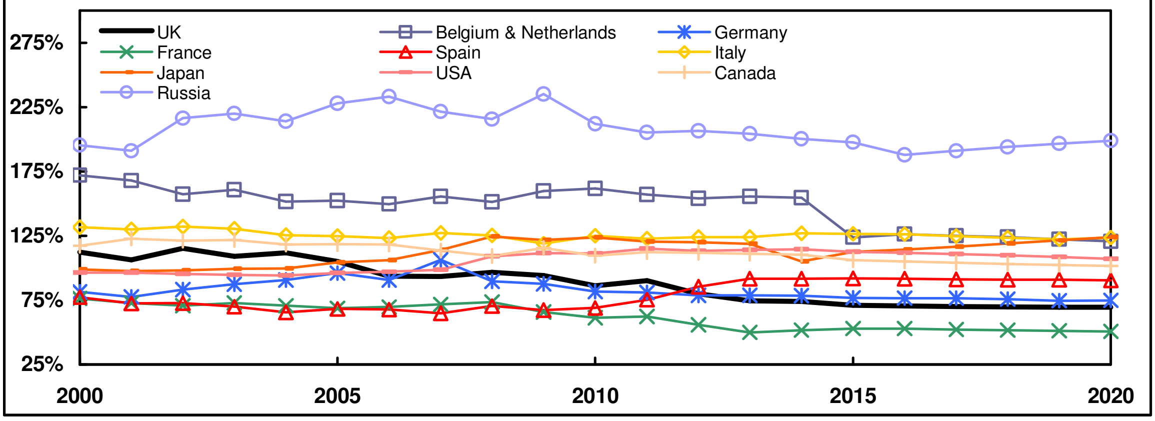
The chart shows that shows that jet refining cover in the G8 group of nations is around 90%, declining slowly to 87% by 2020, with the G20 unsurprisingly showing cover of 100%.

Europe overall is short of jet fuel with refining cover for the EU now steady at around 66%. The UK is thus well below the levels of refining cover for jet than Europe and other regions – partly due to lower production from refineries, but more to due to significant increase in demand at the major hub airports.

MIDDLE DISTILLATE REFINING COVER

A comparison of the diesel/gasoil refining cover for some of the major consuming and producing countries is shown in Figure VI-14. Note that no split into "diesel" and "gasoil" as individual products is available for other countries or country groupings such as the G8 or G20. Therefore the only comparison that can be made is for diesel/gasoil combined refining cover.

FIGURE VI-14
DIESEL/GASOIL REFINING COVER COUNTRY COMPARISON



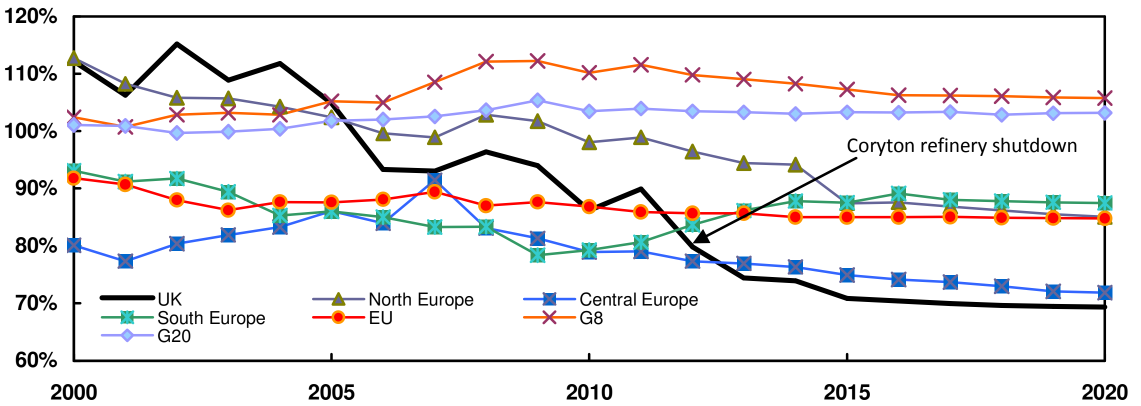
Russia is a large exporter of middle distillate, producing around double the amount it consumes. Until recently almost all of the export from Russia was gasoil or gasoil component quality and needed treatment or further refining to supply the European diesel market. More recently investment in some Russian refineries has improved their capabilities and Russia now also exports some 10ppm sulphur diesel ready to directly supply the European market. However, at present this only makes up a relatively small proportion of their middle distillate exports.

Belgium and the Netherlands are also net exporters of middle distillate. As shown in Figure V-12, a step change down in their diesel/gasoil refining cover is forecast between 2014 and 2015, this is due to a change in the marine bunker fuel emission specifications (IMO), which is likely to mean that a significant amount of bunker fuel consumers will switch to gasoil from fuel oil. Italy has excess diesel/gasoil refining cover and supplies a significant amount to Spain, to help meet their shortfall.

In 2000 the UK had an excess of diesel/gasoil production, with a refining cover of 112%. This has gradually declined as UK diesel demand has increased and in 2006 the UK became a net diesel/gasoil importer for the first time. The closure of Coryton refinery has reduced the UK's diesel/gasoil cover to 74% (2013) and we forecast that this will continue to decline to around 69% by 2020. The UK's decline in refining cover is steeper than that of comparable countries, and results in the UK having the second lowest refining cover for gasoil/diesel in Europe, with only France in a poorer position.

Figure VI-15 below shows the UK in comparison to European and worldwide regions.

FIGURE VI-15
DIESEL/GASOIL COVER REGION COMPARISON



The steady decline in the UK's diesel/gasoil refining cover can be clearly seen and is significantly steeper than the decline in Europe and other major regions/groupings. The EU refining cover is steady at around 85% as some refinery investment has taken place in parts of the EU to increase diesel production, namely with the construction of hydrocracking units and a few coking units. As was seen with gasoline and jet, the refining cover of the G20 is close to 100%.

IDEAL LEVEL OF REFINING COVER

It is difficult to define an ideal level of refining cover. Arguably refining cover of 100% or greater provides a greater level of security of supply than refining cover below 100%, simply because it puts the supply within the territory and therefore ultimately under the control of the country. It is also clear that having no refining cover and relying 100% on imported material for main fuels supply leaves a country very exposed to supply disruption as a result of international politics or incidents.

It is important to recognise that as long as the UK has significant demand for refined products then the UK needs refineries. The issue is the location of these refineries – should they be in the UK or can the UK's need for refineries be "contracted out" to other countries? If this is the case, why should it be this way?

To help answer these issues PGI has conducted interviews with several senior representatives of the industry. A summary of these interviews is shown in Annex 3. The consensus view appears to be that a level of competition from imports into the marketplace is good for consumers as it keeps bulk product prices down (at least to the level of the international market). However for a country to import more than 50% of its refined product demand would be a high risk approach.

Refiners themselves are active in the import and throughput of supplies to the market place, supplementing their own production. The presence of a significant refining industry is also good for security of supply.

The reasons for this are several fold:-

- Crude oil infrastructure is generally built to move large volumes internationally, as the consumers (refineries) are usually not located at the site of the crude production.
- Crude oil is easier to ship because the quality requirements are generally less than when shipping finished products
- Crude oil is usually moved in much larger ships than refined products. Therefore it is more cost effective to ship large volumes of crude oil than large volumes of products
- The global crude oil market is more fungible than the global product markets. This can be seen by looking at Tables VI-16 and VI-17. Total world crude oil production in 2012 was 74.4 million barrels per day, with 42.4 million barrels per day of crude imported and exported. Total refined product production in 2012 was 78.9 million barrels per day, but with only 21.3 million barrels per day imported and 22.7 million barrels per day exported.
- Crude oils are produced in all regions of the world and disruption to one source of supply can be reasonably quickly replaced with additional production from other sources. Five regions (Africa, Canada, CIS, Latin America and the Middle East) have significant surplus of crude oil.
- Surplus products often are only sourced from one or two global regions and disruption of supply from one region can not usually be made up by refineries in other regions in the short term. Four regions (Canada, CIS, Middle East and the US) have a surplus of refined products. Four regions (Asia, Canada, US, and CIS) have a surplus of middle distillates. (Table VI-18).

A crude oil supply shock will disproportionately impact those who rely on product imports. This is because refineries will tend (in times of supply disruption) to favour their local markets. The first casualty of a restriction in crude supply as refineries turn down is the export of surplus product to outside markets.

A reduction in crude oil supply causes a similar reduction in overall total refined product supply – e.g. if crude supplies are restricted to 70% of normal, then refined product production will also be limited to (close to) 70% of normal. If the inland market normally took 80% of the refinery production, with 20% exported, then in the supply restricted case, all production is likely to go into the inland market. The inland market therefore sees a refined product supply reduction down to 70/80 or 87% of normal. The export market sees a reduction of 100% of supply, as all exports would likely be stopped.

Thus a crude supply disruption disproportionately impacts the surplus refined product availability, and so will hit countries or regions that rely on a higher proportion of refined product imports much harder than those that have majority refining cover.

A refined product supply shock (caused for example by the loss of significant proportion of regional refining capacity by fire or hurricane damage) also disproportionately impacts countries or regions that rely on product imports. The reduction in available refining capacity tightens the local/regional and even global market with much greater competition for available supplies, which usually causes a price spike. Importers may not be able to purchase sufficient volumes compared to normal as significant volume is sucked away to plug the gap in supply caused by the disruption. In contrast countries or regions where refineries are still operating would not see any disruption in supply – indeed those refineries would attempt to increase production if possible to take advantage of the price spike caused by the tight market.

Perhaps the most well known example of a major import market is gasoline into the United States. This market has been short of gasoline for many years. Yet historical data shows that since the year 2000, refining cover for gasoline has ranged from 83 to 90% (See Table VI-14). This is well above the levels of refining cover that the UK now has for diesel and jet/kerosene fuels.

PGI's view is that importing 50% of refined product demand would be a high risk approach for a country, particularly if that country has the opportunity to ensure that its exposure to refined product markets could be lower than this.

Hydrocarbon fuels, especially transport fuels, are vital to the functioning of a modern economy and any significant disruption would have a major impact on the country both in terms of GDP and quality of life. The vast majority of goods are delivered across the UK by diesel powered truck, with commercial diesel representing around 55% of UK diesel demand. While deliveries of some consumer goods can be delayed without major harm to life (albeit with an impact on GDP), should deliveries of food to supermarkets and grocery stores be curtailed then the political and social consequences would be enormous. To support UK business-as-usual, essential services need to continue functioning; these include hospitals, public utility workers (gas, electricity, water, sewage), social workers, commercial transport drivers, and cash dispensing machines; which all depend in many cases on gasoline and diesel being readily available at forecourts.

The emergency services underpin UK business-as-usual, but these under normal conditions have a relatively low fuel demand, and contingency plans are in place should normal fuel supplies be disrupted for a short period of time.

Given the very serious consequences of interruption to diesel supply on both GDP and quality of life, and delivery of essential goods, PGI believe that a refining cover level for this fuel of at least 65% should be maintained to ensure functioning of modern society in a crisis situation.

TABLE VI-1
UNITED KINGDOM: GASOLINE TRADE FLOWS
(Thousand Tonnes per Year)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Refinery Production	23,541	21,483	22,970	22,658	24,621	22,645	21,443	21,313	20,319	20,404	19,629	19,341
Imports												
Rest of Europe	2,354	1,818	672	666	2,158	2,288	3,805	3,283	3,324	2,990	3,194	3,508
Africa	26	13	-	-	-	60	-	-	-	-	2	4
Middle East	-	-	-	-	-	-	-	-	-	-	-	-
China	-	-	-	-	-	-	-	-	-	-	-	-
India	-	-	-	-	-	-	-	-	-	-	-	-
Rest of Asia	8	-	-	-	-	-	-	-	-	-	-	-
North America	-	7	10	6	36	-	-	3	-	2	162	105
Latin America	-	-	-	26	-	41	-	-	-	-	-	-
CIS	71	-	-	-	-	-	-	-	-	-	-	-
Oceania	-	-	-	-	-	-	-	-	-	-	-	-
Non-Specified / Other	-	1,780	1,634	1,336	-	-	-	-	-	-	-	199
Total	2,459	3,618	2,316	2,034	2,194	2,389	3,805	3,286	3,324	2,992	3,358	3,816
Exports												
Rest of Europe	2,447	2,433	2,511	1,814	1,917	1,471	1,523	1,967	2,371	1,809	1,929	2,131
Africa	67	23	130	203	374	114	118	436	305	388	903	1,265
Middle East	138	-	-	79	57	-	-	-	-	-	-	37
China	-	-	-	-	-	-	-	-	-	-	-	-
India	-	-	-	-	-	-	-	-	-	-	-	-
Rest of Asia	-	-	-	-	-	37	-	61	117	38	-	-
North America	2,028	1,898	2,690	2,600	4,851	4,813	5,216	4,844	4,217	5,506	5,542	5,511
Latin America	13	98	205	129	108	154	144	30	9	51	34	219
CIS	15	-	-	-	-	-	-	-	-	-	-	-
Oceania	-	-	-	40	35	-	-	-	-	20	-	-
Non-Specified / Other	-	1	2	743	-	-	-	-	-	-	211	107
Total	4,708	4,453	5,538	5,608	7,342	6,589	7,001	7,338	7,019	7,812	8,619	9,270
Net Imports / (Exports)	(2,249)	(835)	(3,222)	(3,574)	(5,148)	(4,200)	(3,196)	(4,052)	(3,695)	(4,820)	(5,261)	(5,454)

Note: Comprises Aviation Gasoline and Motor Gasoline

TABLE VI-2
UNITED KINGDOM: JET/KEROSENE TRADE FLOWS
(Thousand Tonnes per Year)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Refinery Production	9,562	8,998	8,871	8,798	9,228	8,492	9,635	9,144	9,641	8,852	8,351	8,741
Imports												
Rest of Europe	1,392	916	925	550	1,188	1,936	2,433	1,891	1,063	1,721	2,140	1,271
Africa	686	817	523	553	409	132	182	88	143	142	-	48
Middle East	2,252	3,759	2,062	2,670	5,331	4,667	4,284	4,832	2,861	2,414	3,826	3,274
China	-	-	-	-	-	-	-	-	-	-	62	-
India	-	-	-	-	129	465	581	500	919	241	692	687
Rest of Asia	29	-	235	-	-	207	88	39	1,915	1,828	678	1,295
North America	72	38	334	35	539	1,150	43	121	288	598	383	-
Latin America	274	154	433	198	126	785	895	375	1,017	914	221	251
CIS	37	-	16	32	296	148	147	313	357	342	323	396
Oceania	-	-	-	-	-	-	-	-	-	-	-	-
Non-Specified / Other	19	636	2,471	3,635	-	-	-	-	-	-	-	271
Total	4,761	6,320	6,999	7,673	8,018	9,490	8,653	8,159	8,563	8,200	8,325	7,493
Exports												
Rest of Europe	686	623	988	983	1,362	1,622	1,309	1,501	2,093	1,633	1,623	1,284
Africa	-	-	1	-	-	-	-	-	28	15	-	-
Middle East	-	-	-	-	-	56	-	-	-	-	-	-
China	-	-	-	-	-	-	-	-	-	-	-	-
India	-	-	-	-	-	-	-	-	-	-	-	-
Rest of Asia	-	-	-	-	-	-	-	-	-	-	-	15
North America	-	-	-	-	34	-	-	-	-	3	55	99
Latin America	-	-	-	-	-	-	-	-	-	41	-	-
CIS	-	-	-	-	-	-	-	-	-	-	-	-
Oceania	-	-	-	-	-	-	-	-	-	-	-	-
Non-Specified / Other	-	-	1	160	-	-	-	-	-	-	-	-
Total	686	623	990	1,143	1,396	1,678	1,309	1,501	2,121	1,692	1,678	1,398
Net Imports / (Exports)	4,075	5,697	6,009	6,530	6,622	7,812	7,344	6,658	6,442	6,508	6,647	6,095

Note: Comprises Jet fuel and other Kerosene

TABLE VI-3
UNITED KINGDOM: GASOIL/DIESEL TRADE FLOWS
(Thousand Tonnes per Year)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Refinery Production	28,298	26,796	28,396	27,596	28,857	28,691	26,080	26,397	26,971	25,393	24,034	24,628
Imports												
Rest of Europe	3,285	2,560	1,715	2,231	2,197	4,058	7,488	6,668	5,482	4,271	5,799	6,004
Africa	-	11	17	19	-	78	-	-	88	-	-	-
Middle East	80	-	-	-	378	-	25	-	159	265	178	-
China	-	-	-	-	-	-	-	-	-	-	-	-
India	-	-	-	-	-	-	-	-	-	60	299	-
Rest of Asia	-	30	-	-	1	106	141	376	-	-	157	9
North America	28	40	-	84	142	-	-	277	818	786	270	1,002
Latin America	-	-	-	-	21	-	-	-	-	57	82	-
CIS	422	498	556	172	1,477	678	409	851	1,085	1,177	1,658	1,848
Oceania	-	-	-	-	-	-	-	-	-	-	-	-
Non-Specified / Other	-	959	931	997	-	-	-	-	-	-	-	508
Total	3,815	4,098	3,219	3,503	4,216	4,920	8,063	8,172	7,632	6,616	8,443	9,371
Exports												
Rest of Europe	6,025	5,103	5,794	4,620	5,883	5,413	5,554	5,163	6,080	5,317	4,423	5,493
Africa	82	-	69	302	431	759	183	1,191	1,115	647	2,004	2,225
Middle East	38	-	-	11	23	-	51	34	-	36	-	-
China	-	-	-	-	-	-	-	-	-	-	-	-
India	-	-	-	-	17	-	-	-	-	-	-	-
Rest of Asia	-	-	-	-	225	-	-	-	9	-	-	-
North America	172	151	433	268	35	142	32	163	42	32	52	27
Latin America	35	32	-	-	5	-	-	-	-	-	-	-
CIS	5	-	-	-	-	-	-	-	-	-	-	-
Oceania	-	-	-	-	4	-	-	-	-	-	-	-
Non-Specified / Other	59	1	56	327	-	-	-	-	-	-	-	48
Total	6,416	5,287	6,352	5,528	6,623	6,314	5,820	6,551	7,246	6,032	6,479	7,793
Net Imports / (Exports)	(2,601)	(1,189)	(3,133)	(2,025)	(2,407)	(1,394)	2,243	1,621	386	584	1,964	1,578

TABLE VI-4
UNITED KINGDOM: HEAVY FUEL OIL TRADE FLOWS
(Thousand Tonnes per Year)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Refinery Production	11,621	11,912	10,551	11,517	12,988	11,728	12,277	11,809	11,349	8,648	7,484	8,015
Imports												
Rest of Europe	455	506	200	106	481	1,139	1,298	1,066	1,215	1,241	1,020	824
Africa	-	-	-	-	43	136	-	64	-	-	-	-
Middle East	-	-	-	-	-	24	-	-	-	-	-	-
China	-	-	-	-	-	-	-	-	-	-	-	-
India	-	-	-	-	-	-	-	-	-	-	-	-
Rest of Asia	-	-	-	-	-	-	-	-	-	-	-	-
North America	38	-	-	-	14	74	-	-	-	-	-	1
Latin America	-	-	-	-	-	-	-	-	-	-	-	-
CIS	103	-	-	-	74	37	34	-	-	-	-	15
Oceania	-	-	-	-	-	-	-	-	-	-	-	-
Non-Specified / Other	-	474	358	288	-	117	-	-	-	-	-	-
Total	596	980	558	394	612	1,527	1,332	1,130	1,215	1,241	1,020	840
Exports												
Rest of Europe	3,862	3,890	4,306	3,971	6,380	5,440	7,486	6,631	6,073	4,871	4,606	4,659
Africa	35	36	67	132	511	343	59	183	96	-	-	80
Middle East	44	246	110	-	-	-	60	61	63	-	-	-
China	-	-	-	-	1	-	-	-	-	-	-	-
India	-	-	-	-	-	-	-	-	116	-	-	-
Rest of Asia	87	-	-	5	327	74	272	63	47	343	52	17
North America	1,069	1,191	554	972	1,404	2,595	491	801	909	326	200	339
Latin America	99	40	-	47	279	-	-	-	-	7	-	-
CIS	-	-	-	-	34	-	-	-	-	-	-	-
Oceania	-	-	-	-	-	-	-	-	-	-	-	-
Non-Specified / Other	164	38	743	1,258	-	-	-	-	-	-	37	27
Total	5,360	5,441	5,780	6,385	8,936	8,452	8,368	7,739	7,304	5,547	4,895	5,122
Net Imports / (Exports)	(4,764)	(4,461)	(5,222)	(5,991)	(8,324)	(6,925)	(7,036)	(6,609)	(6,089)	(4,306)	(3,875)	(4,282)

TABLE VI-5
UNITED KINGDOM: TOTAL PRODUCTS TRADE FLOWS
(Thousand Tonnes per Year)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Refinery Production	83,471	79,465	81,023	81,644	86,817	82,762	79,979	78,684	77,656	71,962	68,308	70,514
Imports												
Rest of Europe	9,201	6,710	3,999	4,463	8,137	12,968	19,153	16,010	13,221	12,320	14,637	13,085
Africa	770	901	556	919	647	559	198	152	266	167	53	52
Middle East	2,332	3,759	2,062	2,691	5,715	4,691	4,339	4,861	3,906	2,781	4,009	3,274
China	-	3	-	-	2	-	-	7	-	2	62	-
India	-	-	-	-	129	465	581	500	919	351	991	687
Rest of Asia	40	30	295	34	2	313	229	419	1,915	1,845	845	1,305
North America	841	94	350	137	1,254	1,263	43	643	1,132	1,449	987	1,151
Latin America	284	164	466	242	565	827	895	565	1,320	1,385	303	251
CIS	717	498	572	384	2,026	1,126	1,186	1,698	1,497	2,073	2,322	2,351
Oceania	-	-	-	4	-	-	-	-	-	-	-	-
Non-Specified / Other	27	4,788	6,600	7,599	66	159	200	-	-	19	-	1,434
Total	14,212	16,947	14,900	16,473	18,543	22,371	26,824	24,855	24,176	22,392	24,209	23,590
Exports												
Rest of Europe	15,920	14,944	17,601	14,867	20,695	20,037	22,121	21,439	21,436	17,978	16,530	17,210
Africa	388	125	413	759	1,586	1,305	430	2,094	1,681	1,123	2,999	3,702
Middle East	232	272	151	110	103	71	111	95	63	36	-	37
China	13	43	2	11	27	16	23	25	1	28	42	59
India	32	25	-	-	100	66	56	59	204	83	116	150
Rest of Asia	91	1	43	94	559	111	272	142	185	384	79	74
North America	3,334	3,336	3,717	4,105	6,788	7,820	5,834	5,891	5,196	5,965	5,988	6,082
Latin America	188	268	370	481	545	233	161	69	14	115	54	219
CIS	20	1	-	7	51	-	-	4	-	1	-	-
Oceania	-	-	-	40	40	-	-	-	-	20	-	-
Non-Specified / Other	459	73	1,147	2,842	-	63	-	-	-	-	258	209
Total	20,677	19,088	23,444	23,316	30,494	29,722	29,008	29,818	28,780	25,733	26,066	27,742
Net Imports / (Exports)	(6,465)	(2,141)	(8,544)	(6,843)	(11,951)	(7,351)	(2,184)	(4,963)	(4,604)	(3,341)	(1,857)	(4,152)

TABLE VI-6
UK CRUDE OIL AND REFINED PRODUCT BALANCE WITH CORYTON REFINERY OPERATIONAL
No Additional Investment
(Thousand Tonnes per Annum)

Product	Flow	2000	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030
Crude	Production	123,386	79,043	59,855	61,015	61,975	62,998	63,991	64,804	55,141	38,587	30,086
	Imports	48,868	52,210	47,669	48,841	42,069	40,028	38,017	36,185	40,757	52,220	55,630
	Exports	(86,533)	(48,879)	(36,650)	(29,050)	(28,032)	(27,014)	(25,995)	(24,977)	(19,886)	(14,795)	(9,704)
	Int'l Marine Bunkers	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	(5,030)	(2,153)	(927)	(927)	(927)	(927)	(927)	(927)	(927)	(927)	(927)
	Consumption	80,691	80,221	69,947	79,879	75,085	75,085	75,085	75,085	75,085	75,085	75,085
Condensate	Production	8,363	7,543	4,885	4,980	5,058	5,142	5,223	5,289	4,500	3,149	2,455
	Imports	-	-	569	593	593	593	593	593	593	593	593
	Exports	(3,549)	(3,226)	(2,187)	(2,229)	(2,264)	(2,302)	(2,338)	(2,368)	(2,015)	(1,410)	(1,099)
	Supplied as Crude	(3,131)	(3,324)	(2,265)	(2,309)	(2,345)	(2,384)	(2,422)	(2,452)	(2,087)	(1,460)	(1,138)
	Splitter Cons.	1,683	993	1,002	1,034	1,041	1,049	1,056	1,062	992	872	811
Feedstocks	Production	-	-	-	-	-	-	-	-	-	-	-
	Imports	9,012	6,827	6,804	9,018	8,028	8,028	8,028	8,028	8,028	8,028	8,028
	Exports	(2,836)	(1,993)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)
	Int'l Marine Bunkers	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	(536)	88	(487)	-	-	-	-	-	-	-	-
	Consumption	5,640	4,922	3,467	6,168	5,178	5,178	5,178	5,178	5,178	5,178	5,178
Refinery Ops.	Crude+Cond. Runs	82,374	81,214	70,949	80,914	76,127	76,134	76,141	76,147	76,077	75,958	75,896
	Crude+Cond+Feedstock Run	88,014	86,136	74,416	87,082	81,305	81,312	81,319	81,325	81,255	81,135	81,074
	Refinery Capacity	89,234	91,527	89,818	91,034	86,734	82,434	82,434	82,434	82,434	82,434	82,434
	Refinery Distiller Utilization, %	92.3	88.7	79.0	88.9	87.8	92.4	92.4	92.4	92.3	92.1	92.1
	Refinery Total Utilisation, %	98.6	94.1	82.9	95.7	93.7	98.6	98.6	98.7	98.6	98.4	98.3
Gasoline	Production	23,470	22,652	19,629	19,341	18,181	18,181	18,181	18,181	18,181	18,181	18,181
	Imports	2,459	2,389	3,356	3,384	3,384	3,384	3,384	3,384	3,385	3,385	3,386
	Exports	(4,708)	(6,589)	(8,619)	(8,833)	(8,732)	(9,533)	(10,262)	(11,010)	(13,131)	(14,057)	(14,481)
	Ethanol Supplied	-	67	494	499	531	558	583	602	747	750	708
	Supply Adjustments	434	331	175	(296)	6	6	6	6	6	6	6
	Consumption	21,655	18,850	15,035	14,095	13,369	12,596	11,891	11,163	9,187	8,265	7,800
Jet Fuel	Production	6,485	5,167	5,671	6,232	5,858	5,858	5,858	5,858	5,858	5,858	5,858
	Imports	4,675	9,082	7,353	6,873	7,143	7,371	7,546	7,723	8,272	8,588	8,913
	Exports	(487)	(1,396)	(1,487)	(1,366)	(1,366)	(1,366)	(1,366)	(1,366)	(1,366)	(1,366)	(1,366)
	Biojet	-	-	-	-	-	-	-	-	-	-	-
	F-T Jet Fuel	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	165	(356)	(65)	(446)	(230)	(230)	(230)	(230)	(230)	(230)	(230)
	Consumption	10,838	12,497	11,472	11,292	11,405	11,633	11,807	11,985	12,533	12,850	13,174
	of which: Int'l Bunkers	10,161	11,713	10,249	10,088	10,189	10,393	10,549	10,707	11,197	11,480	11,770
Kero	Production	3,077	3,325	2,680	2,509	2,358	2,358	2,358	2,358	2,358	2,358	2,358
	Imports	86	408	972	779	1,066	1,137	1,173	1,173	1,129	1,068	1,026
	Exports	(199)	(282)	(192)	(154)	(154)	(154)	(154)	(154)	(154)	(154)	(154)
	Supply Adjustments	874	419	400	277	277	277	277	277	277	277	277
	Consumption	3,838	3,870	3,860	3,411	3,547	3,618	3,654	3,654	3,611	3,550	3,507
Diesel/Gasoil	Production	28,298	28,691	24,034	24,628	23,149	23,148	23,147	23,146	23,142	23,137	23,132
	Imports	3,815	4,922	8,443	9,371	11,152	11,592	12,063	13,595	15,926	17,260	18,054
	Exports	(6,416)	(6,315)	(6,479)	(7,793)	(7,793)	(7,793)	(7,793)	(7,793)	(7,793)	(7,793)	(7,793)
	Biodiesel Supplied	-	29	924	1,023	1,103	1,198	1,293	1,390	1,816	1,921	1,986
	F-T Diesel Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	(464)	26	969	168	-	-	-	-	-	-	-
	Consumption	25,233	27,353	27,891	27,397	27,612	28,146	28,711	30,338	33,090	34,525	35,380
	of which: Int'l Bunkers	1,141	888	804	808	812	816	820	1,859	2,078	2,131	2,185
Residual Fuel	Production	11,621	11,728	7,484	8,015	7,534	7,534	7,534	7,534	7,534	7,534	7,534
	Imports	596	1,527	1,020	896	896	896	896	896	896	896	896
	Exports	(5,360)	(8,452)	(4,895)	(5,315)	(4,655)	(5,019)	(4,974)	(6,015)	(6,180)	(6,183)	(6,181)
	Supply Adjustments	619	281	453	527	-	-	-	-	-	-	-
	Consumption	7,476	5,084	4,062	4,123	3,775	3,411	3,456	2,415	2,251	2,247	2,249
	of which: Int'l Bunkers	938	1,165	1,279	1,314	1,349	1,385	1,423	699	617	642	668
Naphtha	Production	3,099	3,023	1,484	1,600	1,504	1,504	1,504	1,504	1,504	1,504	1,504
	Imports	348	1,380	609	383	383	383	383	383	383	383	383
	Exports	(973)	(3,168)	(1,254)	(1,175)	(1,040)	(1,010)	(989)	(978)	(973)	(1,000)	(1,026)
	F-T Naphtha Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	343	684	157	164	164	164	164	164	164	164	164
	Consumption	2,817	1,919	996	972	1,011	1,041	1,062	1,073	1,078	1,051	1,025
Lubes	Production	703	936	346	395	373	374	375	376	381	386	391
	Imports	211	424	710	710	710	710	710	710	710	710	710
	Exports	(636)	(709)	(478)	(470)	(409)	(389)	(384)	(384)	(394)	(406)	(417)
	Supply Adjustments	526	98	-	-	-	-	-	-	-	-	-
	Consumption	804	749	578	636	674	694	701	701	697	690	683
Bitumen	Production	1,438	1,912	1,323	1,511	1,421	1,421	1,421	1,421	1,421	1,421	1,421
	Imports	255	216	243	155	327	384	414	414	424	440	457
	Exports	(283)	(242)	(324)	(324)	(324)	(324)	(324)	(324)	(324)	(324)	(324)
	Supply Adjustments	565	20	128	128	128	128	128	128	128	128	128
	Consumption	1,975	1,906	1,370	1,471	1,552	1,609	1,639	1,639	1,649	1,665	1,682
PetCoke	Production	1,796	1,867	2,203	2,374	2,232	2,232	2,232	2,232	2,232	2,232	2,232
	Imports	657	947	742	514	955	970	985	995	1,031	1,042	1,042
	Exports	(502)	(570)	(686)	(681)	(681)	(681)	(681)	(681)	(681)	(681)	(681)
	Supply Adjustments	(198)	5	208	279	-	-	-	-	-	-	-
	Consumption	1,753	2,249	2,467	2,486	2,506	2,520	2,535	2,545	2,582	2,592	2,592
Other	Production	3,484	3,461	3,453	3,907	3,673	3,673	3,673	3,673	3,673	3,673	3,673
	Imports	1,110	1,078	513	375	381	382	383	384	386	388	389
	Exports	(1,113)	(2,000)	(1,486)	(1,582)	(1,275)	(1,279)	(1,278)	(1,272)	(1,277)	(1,301)	(1,324)
	Supply Adjustments	(727)	1,646	1,141	1,154	1,069	1,069	1,069	1,069	1,069	1,069	1,069
	Consumption	2,754	4,185	3,621	3,855	3,848	3,845	3,848	3,854	3,852	3,829	3,808
Total	Production	83,471	82,762	68,308	70,514	66,282	66,282	66,282	66,282	66,283	66,283	66,283
	Imports	14,212	22,373	23,960	23,440	26,397	27,210	27,937	29,657	32,542	34,161	35,256
	Exports	(20,677)	(29,723)	(25,900)	(27,692)	(26,430)	(27,548)	(28,205)	(29,978)	(32,272)	(33,265)	(33,747)
	Ethanol Supplied	-	67	494	499	531	558	583	602	747	750	708
	Biojet Supplied	-	-	-	-	-	-	-	-	-	-	-
	Biodiesel Supplied	-	29	924	1,023	1,103	1,198	1,293	1,390	1,816	1,921	1,986
	F-T Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	2,137	3,154	3,567	1,955	1,414	1,414	1,414	1,414	1,414	1,414	1,414
	Consumption	79,143	78,662	71,353	69,737	69,299	69,114	69,304	69,367	70,530	71,265	71,900
	of which: Int'l Bunkers	12,241	13,767	12,332	12,210	12,350	12,594	12,792	13,264	13,893	14,253	14,623

TABLE VI-7
CORYTON REFINERY OPERATION

Product	Flow	Coryton Average (KB/D)	Coryton Average (KT/A)
Crude	Production	-	-
	Imports	173.2	7,468
	Exports	-	-
	Int'l Marine Bunkers	-	-
	Supply Adjustments	-	-
Crude	Consumption	173.2	7,468
Condensate	Production	-	-
	Imports	-	-
	Exports	-	-
	Supplied as Crude	-	-
Condensate	Splitter Cons.	-	-
Feedstocks	Production	-	-
	Imports	30.7	1,508
	Exports	-	-
	Int'l Marine Bunkers	-	-
	Supply Adjustments	-	-
Feedstocks	Consumption	30.7	1,508
Refinery Ops.	Crude+Cond. Runs	173	7,468
	Crude+Cond+Feedstock Run	204	8,975
	Refinery Capacity	172	7,416
	Refinery Distiller Utilization, %	100.7	100.7
	Refinery Total Utilisation, %	117.7	120.2
Gasoline	Production	94	3,590
	Imports	1	25
	Exports	-	-
	Ethanol Supplied	-	-
	Supply Adjustments	-	-
	Consumption	-	-
Jet Fuel	Production	25	1,053
	Imports	-	-
	Exports	-	-
	Biojet	-	-
	F-T Jet Fuel	-	-
	Supply Adjustments	-	-
	Consumption	-	-
	of which: Int'l Bunkers	-	-
Kero	Production (included with Jet above)	-	-
	Imports	-	-
	Exports	-	-
	Supply Adjustments	-	-
	Consumption	-	-
Diesel/Gasoil	Production	63	2,789
	Imports	-	-
	Exports	-	-
	Biodiesel Supplied	-	-
	F-T Diesel Production	-	-
	Supply Adjustments	-	-
	Consumption	-	-
	of which: Int'l Bunkers	-	-
Residual Fuel	Production	15	803
	Imports	-	-
	Exports	-	-
	Supply Adjustments	-	-
	Consumption	-	-
	of which: Int'l Bunkers	-	-
Naphtha	Production	-	-
	Imports	4	150
	Exports	-	-
	F-T Naphtha Production	-	-
	Supply Adjustments	-	-
	Consumption	-	-
Lubes	Production	-	-
	Imports	-	-
	Exports	-	-
	Supply Adjustments	-	-
	Consumption	-	-
Bitumen	Production	5	269
	Imports	-	-
	Exports	-	-
	Supply Adjustments	-	-
	Consumption	-	-
PetCoke	Production	-	-
	Imports	-	-
	Exports	-	-
	Supply Adjustments	-	-
	Consumption	-	-
Other	Production	14	453
	Imports	6	178
	Exports	-	-
	Supply Adjustments	-	-
	Consumption	-	-
Total	Production	216	8,956
	Imports	-	-
	Exports	-	-
	Ethanol Supplied	-	-
	Biojet Supplied	-	-
	Biodiesel Supplied	-	-
	F-T Production	-	-
	Supply Adjustments	-	-
	Consumption	-	-
	of which: Int'l Bunkers	-	-

TABLE VI-8
UK CRUDE OIL AND REFINED PRODUCT BALANCE
Scenario 1 Steady State: No Additional Investment Case
(Thousand Tonnes per Annum)

Product	Flow	2000	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030
Crude	Production	123,386	79,043	59,855	61,015	61,975	62,998	63,991	64,804	55,141	38,587	30,086
	Imports	48,868	52,210	47,669	48,841	39,269	34,427	32,416	30,585	35,156	46,619	50,029
	Exports	(86,533)	(48,879)	(36,650)	(29,050)	(28,965)	(28,880)	(27,862)	(26,844)	(21,753)	(16,662)	(11,570)
	Int'l Marine Bunkers	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	(5,030)	(2,153)	(927)	(927)	(927)	(927)	(927)	(927)	(927)	(927)	(927)
	Consumption	80,691	80,221	69,947	79,879	71,352	67,618	67,618	67,618	67,618	67,618	67,618
Condensate	Production	8,363	7,543	4,885	4,980	5,058	5,142	5,223	5,289	4,500	3,149	2,455
	Imports	-	-	569	593	593	593	593	593	593	593	593
	Exports	(3,549)	(3,226)	(2,187)	(2,229)	(2,264)	(2,302)	(2,338)	(2,368)	(2,015)	(1,410)	(1,099)
	Supplied as Crude	(3,131)	(3,324)	(2,265)	(2,309)	(2,345)	(2,384)	(2,422)	(2,452)	(2,087)	(1,460)	(1,138)
	Splitter Cons.	1,683	993	1,002	1,034	1,041	1,049	1,056	1,062	992	872	811
Feedstocks	Production	-	-	-	-	-	-	-	-	-	-	-
	Imports	9,012	6,827	6,804	9,018	7,274	6,520	6,520	6,520	6,520	6,520	6,520
	Exports	(2,836)	(1,993)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)
	Int'l Marine Bunkers	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	(536)	88	(487)	-	-	-	-	-	-	-	-
	Consumption	5,640	4,922	3,467	6,168	4,424	3,670	3,670	3,670	3,670	3,670	3,670
Refinery Ops.	Crude+Cond. Runs	82,374	81,214	70,949	80,914	72,393	68,667	68,674	68,680	68,610	68,490	68,429
	Crude+Cond+Feedstock Run	88,014	86,136	74,416	87,082	76,817	72,337	72,344	72,350	72,280	72,160	72,099
	Refinery Capacity	89,234	91,527	89,818	91,034	86,734	78,488	78,488	78,488	78,488	78,488	78,488
	Refinery Distiller Utilization, %	92.3	88.7	79.0	88.9	83.5	87.5	87.5	87.5	87.4	87.3	87.2
	Refinery Total Utilisation, %	98.6	94.1	82.9	95.7	88.6	92.2	92.2	92.2	92.1	91.9	91.9
Gasoline	Production	23,470	22,652	19,629	19,341	16,386	14,591	14,591	14,591	14,591	14,591	14,591
	Imports	2,459	2,389	3,356	3,384	4,807	6,231	6,231	6,231	6,232	6,232	6,233
	Exports	(4,708)	(6,589)	(8,619)	(8,833)	(8,374)	(8,815)	(9,544)	(10,292)	(12,413)	(13,339)	(13,763)
	Ethanol Supplied	-	67	494	499	531	558	583	602	747	750	708
	Supply Adjustments	434	331	175	(296)	19	31	31	31	31	31	31
	Consumption	21,655	18,850	15,035	14,095	13,369	12,596	11,891	11,163	9,187	8,265	7,800
Jet Fuel	Production	6,485	5,167	5,671	6,232	5,505	5,152	5,152	5,152	5,152	5,152	5,152
	Imports	4,675	9,082	7,353	6,873	7,496	8,077	8,599	8,776	9,325	9,641	9,966
	Exports	(487)	(1,396)	(1,487)	(1,366)	(1,366)	(1,366)	(1,366)	(1,366)	(1,366)	(1,366)	(1,366)
	Biojet	-	-	-	-	-	-	-	-	-	-	-
	F-T Jet Fuel	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	165	(356)	(65)	(446)	(230)	(230)	(578)	(578)	(578)	(578)	(578)
	Consumption	10,838	12,497	11,472	11,292	11,405	11,633	11,807	11,985	12,533	12,850	13,174
	of which: Int'l Bunkers	10,161	11,713	10,249	10,088	10,189	10,393	10,549	10,707	11,197	11,480	11,770
Kero	Production	3,077	3,325	2,680	2,509	2,185	2,011	2,011	2,011	2,011	2,011	2,011
	Imports	86	408	972	779	1,239	1,484	1,173	1,173	1,129	1,068	1,026
	Exports	(199)	(282)	(192)	(154)	(154)	(154)	(154)	(154)	(154)	(154)	(154)
	Supply Adjustments	874	419	400	277	277	277	277	277	277	277	277
	Consumption	3,838	3,870	3,860	3,411	3,547	3,618	3,654	3,654	3,611	3,550	3,507
Diesel/Gasoil	Total Production	28,298	28,691	24,837	25,484	21,755	20,359	20,358	20,357	20,352	20,348	20,343
	Diesel Production	no split	19,056	15,332	16,801	13,444	12,582	12,581	12,580	12,577	12,575	12,572
	Gasoil Production	no split	9,635	9,505	8,683	8,310	7,777	7,777	7,777	7,775	7,773	7,771
	Total Imports	3,815	4,955	8,414	9,047	12,547	14,382	14,852	15,550	18,138	19,765	20,844
	Diesel Imports	no split	3,146	7,709	7,806	11,163	12,795	13,213	13,835	16,136	17,584	18,544
	Gasoil Imports	no split	1,809	705	1,242	1,384	1,587	1,639	1,716	2,001	2,181	2,300
	Exports	(6,416)	(6,314)	(6,500)	(7,794)	(7,793)	(7,793)	(7,793)	(6,959)	(7,215)	(7,509)	(7,793)
	Diesel Exports	no split	(1,935)	(2,121)	(3,127)	(2,111)	(2,111)	(2,111)	(2,111)	(2,111)	(2,111)	(2,111)
	Gasoil Exports	no split	(4,379)	(4,379)	(4,667)	(5,682)	(5,682)	(5,682)	(4,848)	(5,104)	(5,398)	(5,682)
	Biodiesel Supplied	-	29	924	1,023	1,103	1,198	1,293	1,390	1,816	1,921	1,986
	F-T Diesel Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments Diesel	(464)	(831)	(10)	1,042	193	(101)	(11)	(92)	(64)	(31)	(89)
	Supply Adjustments Gasoil		823	226	(1,405)	(193)	101	11	92	64	31	89
	Consumption	25,233	27,353	27,891	27,397	27,612	28,146	28,711	30,338	33,090	34,525	35,380
	of which: Int'l Bunkers	1,141	888	804	808	812	816	820	1,859	2,078	2,131	2,185
	Diesel Consumption	15,881	19,465	21,835	23,544	23,792	24,362	24,966	25,601	28,355	29,938	30,902
	Gasoil Consumption	9,352	7,888	6,056	3,853	3,820	3,783	3,744	4,737	4,736	4,587	4,478
Residual Fuel	Production	11,621	11,728	7,484	8,015	7,133	6,731	6,731	6,731	6,731	6,731	6,731
	Imports	596	1,527	1,020	896	896	896	896	896	896	896	896
	Exports	(5,360)	(8,452)	(4,895)	(5,315)	(4,254)	(4,216)	(4,171)	(5,212)	(5,377)	(5,380)	(5,378)
	Supply Adjustments	619	281	453	527	-	-	-	-	-	-	-
	Consumption	7,476	5,084	4,062	4,123	3,775	3,411	3,456	2,415	2,251	2,247	2,249
	of which: Int'l Bunkers	938	1,165	1,279	1,314	1,349	1,385	1,423	699	617	642	668
Naphtha	Production	3,099	3,023	1,484	1,600	1,504	1,504	1,504	1,504	1,504	1,504	1,504
	Imports	348	1,380	609	383	308	233	233	233	233	233	233
	Exports	(973)	(3,168)	(1,254)	(1,175)	(1,040)	(1,010)	(989)	(978)	(973)	(1,000)	(1,026)
	F-T Naphtha Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	343	684	157	164	164	164	164	164	164	164	164
	Consumption	2,817	1,919	996	972	936	891	912	923	928	901	875
Lubes	Production	703	936	346	395	373	374	375	376	381	386	391
	Imports	211	424	710	710	710	710	710	710	710	710	710
	Exports	(636)	(709)	(478)	(470)	(409)	(389)	(384)	(384)	(394)	(406)	(417)
	Supply Adjustments	526	98	-	-	-	-	-	-	-	-	-
	Consumption	804	749	578	636	674	694	701	701	697	690	683
Bitumen	Production	1,438	1,912	1,323	1,511	1,286	1,152	1,152	1,152	1,152	1,152	1,152
	Imports	255	216	243	155	395	519	548	548	558	575	592
	Exports	(283)	(242)	(324)	(324)	(257)	(190)	(190)	(190)	(190)	(190)	(190)
	Supply Adjustments	565	20	128	128	128	128	128	128	128	128	128
	Consumption	1,975	1,906	1,370	1,471	1,552	1,609	1,639	1,639	1,649	1,665	1,682
PetCoke	Production	1,796	1,867	2,203	2,374	2,232	2,232	2,232	2,232	2,232	2,232	2,232
	Imports	657	947	742	514	955	970	985	995	1,031	1,042	1,042
	Exports	(502)	(570)	(686)	(681)	(681)	(681)	(681)	(681)	(681)	(681)	(681)
	Supply Adjustments	(198)	5	208	279	-	-	-	-	-	-	-
	Consumption	1,753	2,249	2,467	2,486	2,506	2,520	2,535	2,545	2,582	2,592	2,592
Other	Production	3,484	3,461	3,453	3,907	3,447	3,220	3,220	3,220	3,220	3,220	3,220
	Imports	1,110	1,078	513	375	292	204	205	206	208	210	211
	Exports	(1,113)	(2,000)	(1,486)	(1,582)	(1,049)	(826)	(825)	(820)	(824)	(849)	(871)
	Supply Adjustments	(727)	1,646	1,141	1,154	1,069	1,069	1,069	1,069	1,069	1,069	1,069
	Consumption	2,754	4,185	3,621	3,855	3,759	3,667	3,670	3,676	3,674	3,651	3,630
Total	Production	83,471	82,762	69,111	71,370	61,804	57,326	57,326	57,326	57,326	57,327	57,327
	Imports	14,212	22,406	23,931	23,116	29,645	33,705	34,432	35,319	38,460	40,372	41,752
	Exports	(20,677)	(29,722)	(25,922)	(27,694)	(25,376)	(25,440)	(26,098)	(27,036)	(29,587)	(30,873)	(31,640)
	Ethanol Supplied	-	67	494	499	531	558	583	602	747	750	708
	Biojet Supplied	-	-	-	-	-	-	-	-	-	-	-
	Biodiesel Supplied	-	29	924	1,023	1,103	1,198	1,293	1,390	1,816	1,921	1,986
	F-T Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	2,137	3,119	2,814	1,424	1,591	1,767	1,767	1,767	1,767	1,767	1,767
	Consumption	79,143	78,662	71,353	69,737	69,299	69,114	69,304	69,367	70,530	71,265	71,900
	of which: Int'l Bunkers	12,241	13,767	12,332	12,210	12,350	12,594	12,792	13,264	13,893	14,253	14,623

TABLE VI-9
UK CRUDE OIL AND REFINED PRODUCT BALANCE
Scenario 2: Moderate Investment Case
(Thousand Tonnes per Annum)

Product	Flow	2000	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030
Crude	Production	123,386	79,043	59,855	61,015	61,975	62,998	63,991	64,804	55,141	38,587	30,086
	Imports	48,868	52,210	47,669	48,841	39,282	34,441	32,430	30,598	35,170	46,633	50,043
	Exports	(86,533)	(48,879)	(36,650)	(29,050)	(28,965)	(28,880)	(27,862)	(26,844)	(21,753)	(16,662)	(11,570)
	Int'l Marine Bunkers	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	(5,030)	(2,153)	(927)	(927)	(927)	(927)	(927)	(927)	(927)	(927)	(927)
	Consumption	80,691	80,221	69,947	79,879	71,365	67,632	67,632	67,632	67,632	67,632	67,632
Condensate	Production	8,363	7,543	4,885	4,980	5,058	5,142	5,223	5,289	4,500	3,149	2,455
	Imports	-	-	569	593	593	593	593	593	593	593	593
	Exports	(3,549)	(3,226)	(2,187)	(2,229)	(2,264)	(2,302)	(2,338)	(2,368)	(2,015)	(1,410)	(1,099)
	Supplied as Crude	(3,131)	(3,324)	(2,265)	(2,309)	(2,345)	(2,384)	(2,422)	(2,452)	(2,087)	(1,460)	(1,138)
	Splitter Cons.	1,683	993	1,002	1,034	1,041	1,049	1,056	1,062	992	872	811
Feedstocks	Production	-	-	-	-	-	-	-	-	-	-	-
	Imports	9,012	6,827	6,804	9,018	7,278	6,524	6,524	6,524	6,524	6,524	6,524
	Exports	(2,836)	(1,993)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)
	Int'l Marine Bunkers	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	(536)	88	(487)	-	-	-	-	-	-	-	-
	Consumption	5,640	4,922	3,467	6,168	4,428	3,674	3,674	3,674	3,674	3,674	3,674
Refinery Ops.	Crude+Cond. Runs	82,374	81,214	70,949	80,914	72,407	68,680	68,688	68,693	68,624	68,504	68,442
	Crude+Cond+Feedstock Run	88,014	86,136	74,416	87,082	76,835	72,354	72,362	72,368	72,298	72,178	72,116
	Refinery Capacity	89,234	91,527	89,818	91,034	86,734	78,488	78,488	78,488	78,488	78,488	78,488
	Refinery Distiller Utilization, %	92.3	88.7	79.0	88.9	83.5	87.5	87.5	87.5	87.4	87.3	87.2
	Refinery Total Utilisation, %	98.6	94.1	82.9	95.7	88.6	92.2	92.2	92.2	92.1	92.0	91.9
Gasoline	Production	23,470	22,652	19,629	19,341	16,180	14,175	13,966	13,756	12,708	11,660	10,612
	Imports	2,459	2,389	3,356	3,384	4,807	6,243	6,244	6,244	6,244	6,245	6,245
	Exports	(4,708)	(6,589)	(8,619)	(8,833)	(8,167)	(8,399)	(8,919)	(9,457)	(10,531)	(10,408)	(9,784)
	Ethanol Supplied	-	67	494	499	531	558	583	602	747	750	708
	Supply Adjustments	434	331	175	(296)	19	19	19	19	19	19	19
	Consumption	21,655	18,850	15,035	14,095	13,369	12,596	11,891	11,163	9,187	8,265	7,800
Jet Fuel	Production	6,485	5,167	5,671	6,232	5,529	5,198	5,221	5,243	5,356	5,468	5,581
	Imports	4,675	9,082	7,353	6,873	7,473	8,031	8,183	8,338	8,774	8,978	9,190
	Exports	(487)	(1,396)	(1,487)	(1,366)	(1,366)	(1,366)	(1,366)	(1,366)	(1,366)	(1,366)	(1,366)
	Biojet	-	-	-	-	-	-	-	-	-	-	-
	F-T Jet Fuel	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	165	(356)	(65)	(446)	(230)	(230)	(230)	(230)	(230)	(230)	(230)
	Consumption	10,838	12,497	11,472	11,292	11,405	11,633	11,807	11,985	12,533	12,850	13,174
	of which: Int'l Bunkers	10,161	11,713	10,249	10,088	10,189	10,393	10,549	10,707	11,197	11,480	11,770
Kero	Production	3,077	3,325	2,680	2,509	2,184	2,010	2,009	2,008	2,004	2,000	1,996
	Imports	86	408	972	779	1,240	1,485	1,522	1,523	1,484	1,427	1,388
	Exports	(199)	(282)	(192)	(154)	(154)	(154)	(154)	(154)	(154)	(154)	(154)
	Supply Adjustments	874	419	400	277	277	277	277	277	277	277	277
	Consumption	3,838	3,870	3,860	3,411	3,547	3,618	3,654	3,654	3,611	3,550	3,507
Diesel/Gasoil	Production	28,298	28,691	24,837	25,484	21,755	20,937	21,223	21,509	22,940	24,370	25,800
	Diesel Production	no split	19,056	15,332	16,801	13,444	12,939	13,225	13,511	14,941	16,372	17,802
	Gasoil Production	no split	9,635	9,505	8,683	8,310	7,998	7,998	7,998	7,998	7,998	7,998
	Total Imports	3,815	4,955	8,414	9,047	12,547	13,803	13,987	14,335	15,231	15,277	14,736
	Diesel Imports	no split	3,146	7,709	7,806	11,163	12,281	12,464	12,812	13,708	13,754	13,213
	Gasoil Imports	no split	1,809	705	1,242	1,384	1,523	1,523	1,523	1,523	1,523	1,523
	Exports	(6,416)	(6,314)	(6,500)	(7,794)	(7,793)	(7,793)	(7,793)	(6,896)	(6,896)	(7,043)	(7,143)
	Diesel Exports	no split	(1,935)	(2,121)	(3,127)	(2,111)	(2,111)	(2,111)	(2,111)	(2,111)	(2,111)	(2,111)
	Gasoil Exports	no split	(4,379)	(4,379)	(4,667)	(5,682)	(5,682)	(5,682)	(4,785)	(4,785)	(4,932)	(5,032)
	Biodiesel Supplied	-	29	924	1,023	1,103	1,198	1,293	1,390	1,816	1,921	1,986
	F-T Diesel Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments Diesel	(464)	(831)	(10)	1,042	193	56	95	(0)	1	2	11
	Supply Adjustments Gasoil		823	226	(1,405)	(193)	(56)	(95)	0	(1)	(2)	(11)
	Consumption	25,233	27,353	27,891	27,397	27,612	28,146	28,711	30,338	33,090	34,525	35,380
	of which: Int'l Bunkers	1,141	888	804	808	812	816	820	1,859	2,078	2,131	2,185
	Diesel Consumption	15,881	19,465	21,835	23,544	23,792	24,362	24,966	25,601	28,355	29,938	30,902
	Gasoil Consumption	9,352	7,888	6,056	3,853	3,820	3,783	3,744	4,737	4,736	4,587	4,478
Residual Fuel	Production	11,621	11,728	7,484	8,015	7,115	6,694	6,675	6,656	6,559	6,463	6,367
	Imports	596	1,527	1,020	896	896	896	896	896	896	896	896
	Exports	(5,360)	(8,452)	(4,895)	(5,315)	(4,236)	(4,179)	(4,115)	(5,136)	(5,205)	(5,112)	(5,014)
	Supply Adjustments	619	281	453	527	-	-	-	-	-	-	-
	Consumption	7,476	5,084	4,062	4,123	3,775	3,411	3,456	2,415	2,251	2,247	2,249
	of which: Int'l Bunkers	938	1,165	1,279	1,314	1,349	1,385	1,423	699	617	642	668
Naphtha	Production	3,099	3,023	1,484	1,600	1,494	1,484	1,474	1,464	1,414	1,365	1,315
	Imports	348	1,380	609	383	308	383	383	383	383	383	383
	Exports	(973)	(3,168)	(1,254)	(1,175)	(1,030)	(990)	(959)	(939)	(883)	(860)	(836)
	F-T Naphtha Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	343	684	157	164	164	164	164	164	164	164	164
	Consumption	2,817	1,919	996	972	936	1,041	1,062	1,073	1,078	1,051	1,025
Lubes	Production	703	936	346	395	373	374	375	376	381	386	391
	Imports	211	424	710	710	710	710	710	710	710	710	710
	Exports	(636)	(709)	(478)	(470)	(409)	(390)	(384)	(385)	(394)	(406)	(417)
	Supply Adjustments	526	98	-	-	-	-	-	-	-	-	-
	Consumption	804	749	578	636	674	694	701	701	697	690	683
Bitumen	Production	1,438	1,912	1,323	1,511	1,284	1,148	1,146	1,144	1,133	1,122	1,112
	Imports	255	216	243	155	396	523	555	557	577	605	632
	Exports	(283)	(242)	(324)	(324)	(257)	(190)	(190)	(190)	(190)	(190)	(190)
	Supply Adjustments	565	20	128	128	128	128	128	128	128	128	128
	Consumption	1,975	1,906	1,370	1,471	1,552	1,609	1,639	1,639	1,649	1,665	1,682
PetCoke	Production	1,796	1,867	2,203	2,374	2,231	2,229	2,228	2,226	2,218	2,211	2,203
	Imports	657	947	742	514	956	972	989	1,000	1,045	1,063	1,071
	Exports	(502)	(570)	(686)	(681)	(681)	(681)	(681)	(681)	(681)	(681)	(681)
	Supply Adjustments	(198)	5	208	279	-	-	-	-	-	-	-
	Consumption	1,753	2,249	2,467	2,486	2,506	2,520	2,535	2,545	2,582	2,592	2,592
Other	Production	3,484	3,461	3,453	3,907	3,422	3,170	3,145	3,119	2,992	2,865	2,738
	Imports	1,110	1,078	513	375	292	205	207	208	213	218	222
	Exports	(1,113)	(2,000)	(1,486)	(1,582)	(1,025)	(777)	(751)	(721)	(601)	(501)	(399)
	Supply Adjustments	(727)	1,646	1,141	1,154	1,069	1,069	1,069	1,069	1,069	1,069	1,069
	Consumption	2,754	4,185	3,621	3,855	3,759	3,667	3,670	3,676	3,674	3,651	3,630
Total	Production	83,471	82,762	69,111	71,370	61,566	57,420	57,461	57,501	57,705	57,909	58,113
	Imports	14,212	22,406	23,931	23,116	29,625	33,252	33,675	34,194	35,557	35,800	35,473
	Exports	(20,677)	(29,722)	(25,922)	(27,694)	(25,118)	(24,919)	(25,312)	(25,924)	(26,900)	(26,721)	(25,985)
	Ethanol Supplied	-	67	494	499	531	558	583	602	747	750	708
	Biojet Supplied	-	-	-	-	-	-	-	-	-	-	-
	Biodiesel Supplied	-	29	924	1,023	1,103	1,198	1,293	1,390	1,816	1,921	1,986
	F-T Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	2,137	3,119	2,814	1,424	1,591	1,605	1,605	1,605	1,605	1,605	1,605
	Consumption	79,143	78,662	71,353	69,737	69,299	69,114	69,304	69,367	70,530	71,265	71,900
	of which: Int'l Bunkers	12,241	13,767	12,332	12,210	12,350	12,594	12,792	13,264	13,893	14,253	14,623

TABLE VI-10
HYDROCRACKER AND CAT CRACKER PRODUCT YIELD PROFILES

Product	Flow	60 KBD Cat Cracker = 3129 KT/A	Cat Cracker (yield wt%)	60 KBD Hydrocracker = 3129 KT/A	Hydrocracker (yield wt%)	Remove 60 KBD Cat Cracker Capacity and replace with Hydrocracker Capacity. (KT/A)	Remove 120 KBD Cat Cracker Capacity and replace with Hydrocracker Capacity. (KT/A)
Crude	Production	-	-	-	-	-	-
	Imports	-	-	-	-	-	-
	Exports	-	-	-	-	-	-
	Int'l Marine Bunkers	-	-	-	-	-	-
	Supply Adjustments	-	-	-	-	-	-
Crude	Consumption	-	-	-	-	-	-
Condensate	Production	-	-	-	-	-	-
	Imports	-	-	-	-	-	-
	Exports	-	-	-	-	-	-
	Supplied as Crude	-	-	-	-	-	-
Condensate	Splitter Cons.	-	-	-	-	-	-
Feedstocks	Production	-	-	-	-	-	-
	Imports	-	-	-	-	-	-
	Exports	-	-	-	-	-	-
	Int'l Marine Bunkers	-	-	-	-	-	-
	Supply Adjustments	-	-	-	-	-	-
Feedstocks	Consumption	3,129	100	3,129	100	-	-
Refinery Ops.	Crude+Cond. Runs	-	-	-	-	-	-
	Crude+Cond+Feedstock Run	-	-	-	-	-	-
	Refinery Capacity	-	-	-	-	-	-
	Refinery Distiller Utilization, %	-	-	-	-	-	-
	Refinery Total Utilisation, %	-	-	-	-	-	-
Gasoline	Production	1,576	50	-	-	(1,576)	(3,151)
	Imports	-	-	-	-	-	-
	Exports	-	-	-	-	(1,576)	(3,151)
	Ethanol Supplied	-	-	-	-	-	-
	Supply Adjustments	-	-	-	-	-	-
	Consumption	-	-	-	-	-	-
Jet Fuel	Production	-	-	527	17	527	1,053
	Imports	-	-	-	-	(527)	(1,053)
	Exports	-	-	-	-	-	-
	Biojet	-	-	-	-	-	-
	F-T Jet Fuel	-	-	-	-	-	-
	Supply Adjustments	-	-	-	-	-	-
	Consumption	-	-	-	-	-	-
	of which: Int'l Bunkers	-	-	-	-	-	-
Kero	Production (included with Jet above)	-	-	-	-	-	-
	Imports	-	-	-	-	-	-
	Exports	-	-	-	-	-	-
	Supply Adjustments	-	-	-	-	-	-
	Consumption	-	-	-	-	-	-
Diesel/Gasoil	Production	499	16	1,855	59	1,355	2,711
	Imports	-	-	-	-	(1,355)	(2,711)
	Exports	-	-	-	-	-	-
	Biodiesel Supplied	-	-	-	-	-	-
	F-T Diesel Production	-	-	-	-	-	-
	Supply Adjustments	-	-	-	-	-	-
	Consumption	-	-	-	-	-	-
	of which: Int'l Bunkers	-	-	-	-	-	-
Residual Fuel	Production	246	8	(50)	(2)	(296)	(592)
	Imports	-	-	-	-	-	-
	Exports	-	-	-	-	(296)	(592)
	Supply Adjustments	-	-	-	-	-	-
	Consumption	-	-	-	-	-	-
	of which: Int'l Bunkers	-	-	-	-	-	-
Naphtha	Production	-	-	597	19	597	1,194
	Imports	-	-	-	-	-	-
	Exports	-	-	-	-	597	1,194
	F-T Naphtha Production	-	-	-	-	-	-
	Supply Adjustments	-	-	-	-	-	-
	Consumption	-	-	-	-	-	-
Lubes	Production	-	-	-	-	-	-
	Imports	-	-	-	-	-	-
	Exports	-	-	-	-	-	-
	Supply Adjustments	-	-	-	-	-	-
	Consumption	-	-	-	-	-	-
Bitumen	Production	-	-	-	-	-	-
	Imports	-	-	-	-	-	-
	Exports	-	-	-	-	-	-
	Supply Adjustments	-	-	-	-	-	-
	Consumption	-	-	-	-	-	-
PetCoke	Production	-	-	-	-	-	-
	Imports	-	-	-	-	-	-
	Exports	-	-	-	-	-	-
	Supply Adjustments	-	-	-	-	-	-
	Consumption	-	-	-	-	-	-
Other	Production	644	21	56	2	(588)	(1,176)
	Imports	-	-	-	-	412	823
	Exports	-	-	-	-	(176)	(353)
	Supply Adjustments	-	-	-	-	-	-
	Consumption	-	-	-	-	-	-
Total	Production	2,965	95	2,984	95	20	39
	Imports	-	-	-	-	(1,470)	(2,941)
	Exports	-	-	-	-	(1,451)	(2,901)
	Ethanol Supplied	-	-	-	-	-	-
	Biojet Supplied	-	-	-	-	-	-
	Biodiesel Supplied	-	-	-	-	-	-
	F-T Production	-	-	-	-	-	-
	Supply Adjustments	-	-	-	-	-	-
	Consumption	-	-	-	-	-	-
	of which: Int'l Bunkers	-	-	-	-	-	-

TABLE VI-11
UK CRUDE OIL AND REFINED PRODUCT BALANCE
Scenario 3: Significant Investment Case
(Thousand Tonnes per Annum)

Product	Flow	2000	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030
Crude	Production	123,386	79,043	59,855	61,015	61,975	62,998	63,991	64,804	55,141	38,587	30,086
	Imports	48,868	52,210	47,669	48,841	39,282	34,441	32,430	30,598	35,170	46,633	50,043
	Exports	(86,533)	(48,879)	(36,650)	(29,050)	(28,965)	(28,880)	(27,862)	(26,844)	(21,753)	(16,662)	(11,570)
	Int'l Marine Bunkers	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	(5,030)	(2,153)	(927)	(927)	(927)	(927)	(927)	(927)	(927)	(927)	(927)
	Consumption	80,691	80,221	69,947	79,879	71,365	67,632	67,632	67,632	67,632	67,632	67,632
Condensate	Production	8,363	7,543	4,885	4,980	5,058	5,142	5,223	5,289	4,500	3,149	2,455
	Imports	-	-	569	593	593	593	593	593	593	593	593
	Exports	(3,549)	(3,226)	(2,187)	(2,229)	(2,264)	(2,302)	(2,338)	(2,368)	(2,015)	(1,410)	(1,099)
	Supplied as Crude	(3,131)	(3,324)	(2,265)	(2,309)	(2,345)	(2,384)	(2,422)	(2,452)	(2,087)	(1,460)	(1,138)
	Splitter Cons.	1,683	993	1,002	1,034	1,041	1,049	1,056	1,062	992	872	811
Feedstocks	Production	-	-	-	-	-	-	-	-	-	-	-
	Imports	9,012	6,827	6,804	9,018	7,278	6,524	6,524	6,524	6,524	6,524	6,524
	Exports	(2,836)	(1,993)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)
	Int'l Marine Bunkers	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	(536)	88	(487)	-	-	-	-	-	-	-	-
	Consumption	5,640	4,922	3,467	6,168	4,428	3,674	3,674	3,674	3,674	3,674	3,674
Refinery Ops.	Crude+Cond. Runs	82,374	81,214	70,949	80,914	72,407	68,680	68,688	68,693	68,624	68,504	68,442
	Crude+Cond+Feedstock Run	88,014	86,136	74,416	87,082	76,835	72,354	72,362	72,368	72,298	72,178	72,116
	Refinery Capacity	89,234	91,527	89,818	91,034	86,734	78,488	78,488	78,488	78,488	78,488	78,488
	Refinery Distiller Utilization, %	92	89	79	89	83	88	88	88	87	87	87
	Refinery Total Utilisation, %	99	94	83	96	89	92	92	92	92	92	92
Gasoline	Production	23,470	22,652	19,629	19,341	16,180	14,175	13,966	13,756	11,133	8,509	7,461
	Imports	2,459	2,389	3,356	3,384	4,807	6,243	6,244	6,244	6,244	6,245	6,245
	Exports	(4,708)	(6,589)	(8,619)	(8,833)	(8,167)	(8,399)	(8,919)	(9,457)	(8,955)	(7,257)	(6,633)
	Ethanol Supplied	-	67	494	499	531	558	583	602	747	750	708
	Supply Adjustments	434	331	175	(296)	19	19	19	19	19	19	19
	Consumption	21,655	18,850	15,035	14,095	13,369	12,596	11,891	11,163	9,187	8,265	7,800
Jet Fuel	Production	6,485	5,167	5,671	6,232	5,529	5,198	5,221	5,243	5,882	6,521	6,634
	Imports	4,675	9,082	7,353	6,873	7,473	8,031	8,183	8,338	8,247	7,925	8,137
	Exports	(487)	(1,396)	(1,487)	(1,366)	(1,366)	(1,366)	(1,366)	(1,366)	(1,366)	(1,366)	(1,366)
	Biojet	-	-	-	-	-	-	-	-	-	-	-
	F-T Jet Fuel	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	165	(356)	(65)	(446)	(230)	(230)	(230)	(230)	(230)	(230)	(230)
	Consumption	10,838	12,497	11,472	11,292	11,405	11,633	11,807	11,985	12,533	12,850	13,174
	of which: Int'l Bunkers	10,161	11,713	10,249	10,088	10,189	10,393	10,549	10,707	11,197	11,480	11,770
Kero	Production	3,077	3,325	2,680	2,509	2,184	2,010	2,009	2,008	2,004	2,000	1,996
	Imports	86	408	972	779	1,240	1,485	1,522	1,523	1,484	1,427	1,388
	Exports	(199)	(282)	(192)	(154)	(154)	(154)	(154)	(154)	(154)	(154)	(154)
	Supply Adjustments	874	419	400	277	277	277	277	277	277	277	277
	Consumption	3,838	3,870	3,860	3,411	3,547	3,618	3,654	3,654	3,611	3,550	3,507
Diesel/Gasoil	Production	28,298	28,691	24,837	25,484	21,755	20,937	21,223	21,509	24,295	27,081	28,511
	Diesel Production	no split	19,056	15,332	16,801	13,444	12,939	13,225	13,511	16,297	19,082	20,513
	Gasoil Production	no split	9,635	9,505	8,683	8,310	7,998	7,998	7,998	7,998	7,998	7,998
	Total Imports	3,815	4,955	8,414	9,047	12,547	13,803	13,987	14,335	13,876	12,566	12,026
	Diesel Imports	no split	3,146	7,709	7,806	11,163	12,281	12,464	12,812	12,353	11,043	10,503
	Gasoil Imports	no split	1,809	705	1,242	1,384	1,523	1,523	1,523	1,523	1,523	1,523
	Exports	(6,416)	(6,314)	(6,500)	(7,794)	(7,793)	(7,793)	(7,793)	(6,896)	(6,896)	(7,043)	(7,143)
	Diesel Exports	no split	(1,935)	(2,121)	(3,127)	(2,111)	(2,111)	(2,111)	(2,111)	(2,111)	(2,111)	(2,111)
	Gasoil Exports	no split	(4,379)	(4,379)	(4,667)	(5,682)	(5,682)	(5,682)	(4,785)	(4,785)	(4,932)	(5,032)
	Biodiesel Supplied	-	29	924	1,023	1,103	1,198	1,293	1,390	1,816	1,921	1,986
	F-T Diesel Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments Diesel	(464)	(831)	(10)	1,042	193	56	95	(0)	1	2	11
	Supply Adjustments Gasoil		823	226	(1,405)	(193)	(56)	(95)	0	(1)	(2)	(11)
	Consumption	25,233	27,353	27,891	27,397	27,612	28,146	28,711	30,338	33,090	34,525	35,380
	of which: Int'l Bunkers	1,141	888	804	808	812	816	820	1,859	2,078	2,131	2,185
	Diesel Consumption	15,881	19,465	21,835	23,544	23,792	24,362	24,966	25,601	28,355	29,938	30,902
	Gasoil Consumption	9,352	7,888	6,056	3,853	3,820	3,783	3,744	4,737	4,736	4,587	4,478
Residual Fuel	Production	11,621	11,728	7,484	8,015	7,115	6,694	6,675	6,656	6,263	5,871	5,775
	Imports	596	1,527	1,020	896	896	896	896	896	896	896	896
	Exports	(5,360)	(8,452)	(4,895)	(5,315)	(4,236)	(4,179)	(4,115)	(5,136)	(4,909)	(4,520)	(4,422)
	Supply Adjustments	619	281	453	527	-	-	-	-	-	-	-
	Consumption	7,476	5,084	4,062	4,123	3,775	3,411	3,456	2,415	2,251	2,247	2,249
	of which: Int'l Bunkers	938	1,165	1,279	1,314	1,349	1,385	1,423	699	617	642	668
Naphtha	Production	3,099	3,023	1,484	1,600	1,494	1,484	1,474	1,464	2,012	2,559	2,509
	Imports	348	1,380	609	383	308	383	383	383	383	383	383
	Exports	(973)	(3,168)	(1,254)	(1,175)	(1,030)	(990)	(959)	(939)	(286)	334	358
	F-T Naphtha Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	343	684	157	164	164	164	164	164	164	164	164
	Consumption	2,817	1,919	996	972	936	1,041	1,062	1,073	1,078	1,051	1,025
Lubes	Production	703	936	346	395	373	374	375	376	381	386	391
	Imports	211	424	710	710	710	710	710	710	710	710	710
	Exports	(636)	(709)	(478)	(470)	(409)	(390)	(384)	(385)	(394)	(406)	(417)
	Supply Adjustments	526	98	-	-	-	-	-	-	-	-	-
	Consumption	804	749	578	636	674	694	701	701	697	690	683
Bitumen	Production	1,438	1,912	1,323	1,511	1,284	1,148	1,146	1,144	1,133	1,122	1,112
	Imports	255	216	243	155	396	523	555	557	577	605	632
	Exports	(283)	(242)	(324)	(324)	(257)	(190)	(190)	(190)	(190)	(190)	(190)
	Supply Adjustments	565	20	128	128	128	128	128	128	128	128	128
	Consumption	1,975	1,906	1,370	1,471	1,552	1,609	1,639	1,639	1,649	1,665	1,682
PetCoke	Production	1,796	1,867	2,203	2,374	2,231	2,229	2,228	2,226	2,218	2,211	2,203
	Imports	657	947	742	514	956	972	989	1,000	1,045	1,063	1,071
	Exports	(502)	(570)	(686)	(681)	(681)	(681)	(681)	(681)	(681)	(681)	(681)
	Supply Adjustments	(198)	5	208	279	-	-	-	-	-	-	-
	Consumption	1,753	2,249	2,467	2,486	2,506	2,520	2,535	2,545	2,582	2,592	2,592
Other	Production	3,484	3,461	3,453	3,907	3,422	3,170	3,145	3,119	2,404	1,689	1,562
	Imports	1,110	1,078	513	375	292	205	207	208	625	1,041	1,045
	Exports	(1,113)	(2,000)	(1,486)	(1,582)	(1,025)	(777)	(751)	(721)	(424)	(148)	(46)
	Supply Adjustments	(727)	1,646	1,141	1,154	1,069	1,069	1,069	1,069	1,069	1,069	1,069
	Consumption	2,754	4,185	3,621	3,855	3,759	3,667	3,670	3,676	3,674	3,651	3,630
Total	Production	83,471	82,762	69,111	71,370	61,566	57,420	57,461	57,501	57,725	57,949	58,153
	Imports	14,212	22,406	23,931	23,116	29,625	33,252	33,675	34,194	34,087	32,860	32,533
	Exports	(20,677)	(29,722)	(25,922)	(27,694)	(25,118)	(24,919)	(25,312)	(25,924)	(25,450)	(23,820)	(23,084)
	Ethanol Supplied	-	67	494	499	531	558	583	602	747	750	708
	Biojet Supplied	-	-	-	-	-	-	-	-	-	-	-
	Biodiesel Supplied	-	29	924	1,023	1,103	1,198	1,293	1,390	1,816	1,921	1,986
	F-T Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	2,137	3,119	2,814	1,424	1,591	1,605	1,605	1,605	1,605	1,605	1,605
	Consumption	79,143	78,662	71,353	69,737	69,299	69,114	69,304	69,367	70,530	71,265	71,900
	of which: Int'l Bunkers	12,241	13,767	12,332	12,210	12,350	12,594	12,792	13,264	13,893	14,253	14,623

TABLE VI-12
UK CRUDE OIL AND REFINED PRODUCT BALANCE
Scenario 4: Closure Case Three Refineries Close in 2015
(Thousand Tonnes per Annum)

Product	Flow	2000	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030
Crude	Production	123,386	79,043	59,855	61,015	61,975	62,998	63,991	64,804	55,141	38,587	30,086
	Imports	48,868	52,210	47,669	48,841	39,269	34,427	32,416	17,477	20,089	26,639	28,588
	Exports	(86,533)	(48,879)	(36,650)	(29,050)	(28,965)	(28,880)	(27,862)	(42,715)	(35,665)	(25,661)	(19,108)
	Int'l Marine Bunkers	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	(5,030)	(2,153)	(927)	(927)	(927)	(927)	(927)	(927)	(927)	(927)	(927)
	Consumption	80,691	80,221	69,947	79,879	71,352	67,618	67,618	38,639	38,639	38,639	38,639
Condensate	Production	8,363	7,543	4,885	4,980	5,058	5,142	5,223	5,289	4,500	3,149	2,455
	Imports	-	-	569	593	593	593	593	593	593	593	593
	Exports	(3,549)	(3,226)	(2,187)	(2,229)	(2,264)	(2,302)	(2,338)	(2,368)	(2,015)	(1,410)	(1,099)
	Supplied as Crude	(3,131)	(3,324)	(2,265)	(2,309)	(2,345)	(2,384)	(2,422)	(2,452)	(2,087)	(1,460)	(1,138)
	Splitter Cons.	1,683	993	1,002	1,034	1,041	1,049	1,056	1,062	992	872	811
Feedstocks	Production	-	-	-	-	-	-	-	-	-	-	-
	Imports	9,012	6,827	6,804	9,018	7,274	6,520	6,520	3,726	3,726	3,726	3,726
	Exports	(2,836)	(1,993)	(2,850)	(2,850)	(2,850)	(2,850)	(2,850)	(1,629)	(1,629)	(1,629)	(1,629)
	Int'l Marine Bunkers	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	(536)	88	(487)	-	-	-	-	-	-	-	-
	Consumption	5,640	4,922	3,467	6,168	4,424	3,670	3,670	2,097	2,097	2,097	2,097
Refinery Ops.	Crude+Cond. Runs	82,374	81,214	70,949	80,914	72,393	68,667	68,674	39,701	39,631	39,511	39,449
	Crude+Cond+Feedstock Run	88,014	86,136	74,416	87,082	76,817	72,337	72,344	41,798	41,728	41,608	41,547
	Refinery Capacity	89,234	91,527	89,818	91,034	86,734	78,488	78,488	44,850	44,850	44,850	44,850
	Refinery Distiller Utilization, %	92.3	88.7	79.0	88.9	83.5	87.5	87.5	88.5	88.4	88.1	88.0
	Refinery Total Utilisation, %	98.6	94.1	82.9	95.7	88.6	92.2	92.2	93.2	93.0	92.8	92.6
Gasoline	Production	23,470	22,652	19,629	19,341	16,386	14,591	14,591	8,338	8,338	8,338	8,338
	Imports	2,459	2,389	3,356	3,384	4,807	6,231	6,231	3,561	3,561	3,561	3,562
	Exports	(4,708)	(6,589)	(8,619)	(8,833)	(8,374)	(8,815)	(9,544)	(1,368)	(3,489)	(4,415)	(4,838)
	Ethanol Supplied	-	67	494	499	531	558	583	602	747	750	708
	Supply Adjustments	434	331	175	(296)	19	31	31	31	31	31	31
	Consumption	21,655	18,850	15,035	14,095	13,369	12,596	11,891	11,163	9,187	8,265	7,800
Jet Fuel	Production	6,485	5,167	5,671	6,232	5,505	5,152	5,152	2,944	2,944	2,944	2,944
	Imports	4,675	9,082	7,353	6,873	7,496	8,077	8,599	10,399	10,948	11,264	11,589
	Exports	(487)	(1,396)	(1,487)	(1,366)	(1,366)	(1,366)	(1,366)	(781)	(781)	(781)	(781)
	Biojet	-	-	-	-	-	-	-	-	-	-	-
	F-T Jet Fuel	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	165	(356)	(65)	(446)	(230)	(230)	(578)	(578)	(578)	(578)	(578)
	Consumption	10,838	12,497	11,472	11,292	11,405	11,633	11,807	11,985	12,533	12,850	13,174
	of which: Int'l Bunkers	10,161	11,713	10,249	10,088	10,189	10,393	10,549	10,707	11,197	11,480	11,770
Kero	Production	3,077	3,325	2,680	2,509	2,185	2,011	2,011	1,149	1,149	1,149	1,149
	Imports	86	408	972	779	1,239	1,484	1,173	2,316	2,272	2,211	2,169
	Exports	(199)	(282)	(192)	(154)	(154)	(154)	(154)	(88)	(88)	(88)	(88)
	Supply Adjustments	874	419	400	277	277	277	277	277	277	277	277
	Consumption	3,838	3,870	3,860	3,411	3,547	3,618	3,654	3,654	3,611	3,550	3,507
Diesel/Gasoil	Production	28,298	28,691	24,837	25,484	21,755	20,359	20,358	11,633	11,630	11,627	11,624
	Diesel Production	no split	19,056	15,332	16,801	13,444	12,582	12,581	7,189	7,187	7,185	7,184
	Gasoil Production	no split	9,635	9,505	8,683	8,310	7,777	7,777	4,444	4,443	4,442	4,441
	Total Imports	3,815	4,955	8,414	9,047	12,547	14,382	14,852	21,292	23,768	25,267	26,222
	Diesel Imports	no split	3,146	7,709	7,806	11,163	12,795	13,213	18,229	20,558	22,038	22,938
	Gasoil Imports	no split	1,809	705	1,242	1,384	1,587	1,639	3,063	3,209	3,230	3,284
	Exports	(6,416)	(6,314)	(6,500)	(7,794)	(7,793)	(7,793)	(7,793)	(3,977)	(4,123)	(4,291)	(4,453)
	Diesel Exports	no split	(1,935)	(2,121)	(3,127)	(2,111)	(2,111)	(2,111)	(1,206)	(1,206)	(1,206)	(1,206)
	Gasoil Exports	no split	(4,379)	(4,379)	(4,667)	(5,682)	(5,682)	(5,682)	(2,770)	(2,917)	(3,085)	(3,247)
	Biodiesel Supplied	-	29	924	1,023	1,103	1,198	1,293	1,390	1,816	1,921	1,986
	F-T Diesel Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments Diesel	(464)	(831)	(10)	1,042	193	(101)	(11)	(92)	(64)	(31)	(89)
	Supply Adjustments Gasoil		823	226	(1,405)	(193)	101	11	92	64	31	89
	Consumption	25,233	27,353	27,891	27,397	27,612	28,146	28,711	30,338	33,090	34,525	35,380
	of which: Int'l Bunkers	1,141	888	804	808	812	816	820	1,859	2,078	2,131	2,185
	Diesel Consumption	15,881	19,465	21,835	23,544	23,792	24,362	24,966	25,601	28,355	29,938	30,902
	Gasoil Consumption	9,352	7,888	6,056	3,853	3,820	3,783	3,744	4,737	4,736	4,587	4,478
Residual Fuel	Production	11,621	11,728	7,484	8,015	7,133	6,731	6,731	3,846	3,846	3,846	3,846
	Imports	596	1,527	1,020	896	896	896	896	512	512	512	512
	Exports	(5,360)	(8,452)	(4,895)	(5,315)	(4,254)	(4,216)	(4,171)	(1,943)	(2,108)	(2,111)	(2,110)
	Supply Adjustments	619	281	453	527	-	-	-	-	-	-	-
	Consumption	7,476	5,084	4,062	4,123	3,775	3,411	3,456	2,415	2,251	2,247	2,249
	of which: Int'l Bunkers	938	1,165	1,279	1,314	1,349	1,385	1,423	699	617	642	668
Naphtha	Production	3,099	3,023	1,484	1,600	1,504	1,504	1,504	859	859	859	859
	Imports	348	1,380	609	383	308	233	233	133	133	133	133
	Exports	(973)	(3,168)	(1,254)	(1,175)	(1,040)	(1,010)	(989)	(234)	(229)	(255)	(281)
	F-T Naphtha Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	343	684	157	164	164	164	164	164	164	164	164
	Consumption	2,817	1,919	996	972	936	891	912	923	928	901	875
Lubes	Production	703	936	346	395	373	374	375	215	217	220	223
	Imports	211	424	710	710	710	710	710	710	710	710	710
	Exports	(636)	(709)	(478)	(470)	(409)	(389)	(384)	(224)	(231)	(240)	(250)
	Supply Adjustments	526	98	-	-	-	-	-	-	-	-	-
	Consumption	804	749	578	636	674	694	701	701	697	690	683
Bitumen	Production	1,438	1,912	1,323	1,511	1,286	1,152	1,152	1,152	1,152	1,152	1,152
	Imports	255	216	243	155	395	519	548	548	558	575	592
	Exports	(283)	(242)	(324)	(324)	(257)	(190)	(190)	(190)	(190)	(190)	(190)
	Supply Adjustments	565	20	128	128	128	128	128	128	128	128	128
	Consumption	1,975	1,906	1,370	1,471	1,552	1,609	1,639	1,639	1,649	1,665	1,682
PetCoke	Production	1,796	1,867	2,203	2,374	2,232	2,232	2,232	1,275	1,275	1,275	1,275
	Imports	657	947	742	514	955	970	985	1,659	1,696	1,706	1,706
	Exports	(502)	(570)	(686)	(681)	(681)	(681)	(681)	(389)	(389)	(389)	(389)
	Supply Adjustments	(198)	5	208	279	-	-	-	-	-	-	-
	Consumption	1,753	2,249	2,467	2,486	2,506	2,520	2,535	2,545	2,582	2,592	2,592
Other	Production	3,484	3,461	3,453	3,907	3,447	3,220	3,220	1,840	1,840	1,840	1,840
	Imports	1,110	1,078	513	375	292	204	205	1,235	1,235	1,226	1,218
	Exports	(1,113)	(2,000)	(1,486)	(1,582)	(1,049)	(826)	(825)	(468)	(471)	(485)	(498)
	Supply Adjustments	(727)	1,646	1,141	1,154	1,069	1,069	1,069	1,069	1,069	1,069	1,069
	Consumption	2,754	4,185	3,621	3,855	3,759	3,667	3,670	3,676	3,674	3,651	3,630
Total	Production	83,471	82,762	69,111	71,370	61,804	57,326	57,326	33,252	33,252	33,252	33,252
	Imports	14,212	22,406	23,931	23,116	29,645	33,705	34,432	42,366	45,393	47,167	48,412
	Exports	(20,677)	(29,722)	(25,922)	(27,694)	(25,376)	(25,440)	(26,098)	(9,661)	(12,098)	(13,245)	(13,878)
	Ethanol Supplied	-	67	494	499	531	558	583	602	747	750	708
	Biojet Supplied	-	-	-	-	-	-	-	-	-	-	-
	Biodiesel Supplied	-	29	924	1,023	1,103	1,198	1,293	1,390	1,816	1,921	1,986
	F-T Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	2,137	3,119	2,814	1,424	1,591	1,767	1,767	1,420	1,420	1,420	1,420
	Consumption	79,143	78,662	71,353	69,737	69,299	69,114	69,304	69,367	70,530	71,265	71,900
	of which: Int'l Bunkers	12,241	13,767	12,332	12,210	12,350	12,594	12,792	13,264	13,893	14,253	14,623

TABLE VI-13
UK MAIN FUELS REFINING COVER
(Percent of Total Demand)

Product	Flow	2000	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030
Scenario 1: Steady State												
	Gasoline	108%	120%	131%	137%	123%	116%	123%	131%	159%	177%	187%
	Jet	60%	41%	49%	55%	48%	44%	44%	43%	41%	40%	39%
	Diesel/Gasoil	112%	105%	89%	93%	79%	72%	71%	67%	62%	59%	57%
	Diesel	no split	98%	70%	71%	57%	52%	50%	49%	44%	42%	41%
	Gasoil	no split	122%	157%	225%	218%	206%	208%	164%	164%	169%	174%
	Kerosene	80%	86%	69%	74%	62%	56%	55%	55%	56%	57%	57%
	All Oil Products	105%	105%	97%	102%	89%	83%	83%	83%	81%	80%	80%
Scenario 2: Modest Investment												
	Gasoline	108%	120%	131%	137%	121%	113%	117%	123%	138%	141%	136%
	Jet	60%	41%	49%	55%	48%	45%	44%	44%	43%	43%	42%
	Diesel/Gasoil	112%	105%	89%	93%	79%	74%	74%	71%	69%	71%	73%
	Diesel	no split	98%	70%	71%	57%	53%	53%	53%	53%	55%	58%
	Gasoil	no split	122%	157%	225%	218%	211%	214%	169%	169%	174%	179%
	Kerosene	80%	86%	69%	74%	62%	56%	55%	55%	55%	56%	57%
	All Oil Products	105%	105%	97%	102%	89%	83%	83%	83%	82%	81%	81%
Scenario 3: Enhanced Investment												
	Gasoline	108%	120%	131%	137%	121%	113%	117%	123%	121%	103%	96%
	Jet	60%	41%	49%	55%	48%	45%	44%	44%	47%	51%	50%
	Diesel/Gasoil	112%	105%	89%	93%	79%	74%	74%	71%	73%	78%	81%
	Diesel	no split	98%	70%	71%	57%	53%	53%	53%	57%	64%	66%
	Gasoil	no split	122%	157%	225%	218%	211%	214%	169%	169%	174%	179%
	Kerosene	80%	86%	69%	74%	62%	56%	55%	55%	55%	56%	57%
	All Oil Products	105%	105%	97%	102%	89%	83%	83%	83%	82%	81%	81%
Scenario 4: Three Refineries Close												
	Gasoline	108%	120%	131%	137%	123%	116%	123%	75%	91%	101%	107%
	Jet	60%	41%	49%	55%	48%	44%	44%	25%	23%	23%	22%
	Diesel/Gasoil	112%	105%	89%	93%	79%	72%	71%	38%	35%	34%	33%
	Diesel	no split	98%	70%	71%	57%	52%	50%	28%	25%	24%	23%
	Gasoil	no split	122%	157%	225%	218%	206%	208%	94%	94%	97%	99%
	Kerosene	80%	86%	69%	74%	62%	56%	55%	31%	32%	32%	33%
	All Oil Products	105%	105%	97%	102%	89%	83%	83%	48%	47%	47%	46%

TABLE VI-14
REFINED PRODUCT COVER
COUNTRY COMPARISON
(Million Tonnes)

		2000	2005	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030
UK														
Gasoline	Production	23,470	22,652	20,319	20,404	19,629	19,341	16,180	14,175	13,966	13,756	12,708	11,660	10,612
	Consumption	21,655	18,850	16,856	16,034	15,035	14,095	13,369	12,596	11,891	11,163	9,187	8,265	7,800
	Cover	108%	120%	121%	127%	131%	137%	121%	113%	117%	123%	138%	141%	136%
Jet	Production	6,485	5,167	6,549	6,022	5,671	6,232	5,529	5,198	5,221	5,243	5,356	5,468	5,581
	Consumption	10,838	12,497	12,142	11,514	11,472	11,292	11,405	11,633	11,807	11,985	12,533	12,850	13,174
	Cover	60%	41%	54%	52%	49%	55%	48%	45%	44%	44%	43%	43%	42%
Gasoil/Diesel	Production	28,298	28,691	26,761	25,395	24,837	25,484	21,755	20,937	21,223	21,509	22,940	24,370	25,800
	Consumption	25,233	27,353	27,990	27,016	27,891	27,397	27,612	28,146	28,711	30,338	33,090	34,525	35,380
	Cover	112%	105%	96%	94%	89%	93%	79%	74%	74%	71%	69%	71%	73%
Germany														
Gasoline	Production	26,972	27,240	24,822	23,485	20,940	20,991	20,013	19,658	19,307	19,011	17,184	15,603	14,096
	Consumption	28,806	23,431	20,778	20,439	19,826	17,401	16,447	15,600	15,016	14,445	12,652	11,616	10,537
	Cover	94%	116%	119%	115%	106%	121%	122%	126%	129%	132%	136%	134%	134%
Jet	Production	4,311	4,252	4,760	4,591	4,878	4,991	4,892	4,939	4,984	5,042	5,206	5,383	5,528
	Consumption	7,142	8,085	8,924	8,683	8,945	8,722	8,809	8,985	9,120	9,257	9,913	10,481	10,853
	Cover	60%	53%	53%	53%	55%	57%	56%	55%	55%	54%	53%	51%	51%
Gasoil/Diesel	Production	46,445	52,137	48,709	45,697	43,331	42,602	41,200	41,054	40,906	40,867	39,777	38,987	38,132
	Consumption	57,137	54,393	54,378	52,255	53,064	52,691	52,425	52,261	52,149	53,216	53,148	51,985	50,424
	Cover	81%	96%	90%	87%	82%	81%	79%	79%	78%	77%	75%	75%	76%
France														
Gasoline	Production	17,041	16,271	16,356	15,427	13,354	12,653	11,513	10,262	9,614	9,965	9,571	9,410	9,247
	Consumption	13,791	10,831	8,927	8,585	8,053	7,714	7,483	7,272	7,068	6,903	6,121	5,432	4,860
	Cover	124%	150%	183%	180%	166%	164%	154%	141%	136%	144%	156%	173%	190%
Jet	Production	6,030	5,478	5,571	4,944	4,359	4,523	4,070	3,674	3,697	3,874	3,925	4,069	4,216
	Consumption	6,507	6,615	7,102	6,576	6,535	6,699	6,799	7,003	7,143	7,250	7,696	7,922	8,041
	Cover	93%	83%	78%	75%	67%	68%	60%	52%	52%	53%	51%	51%	52%
Gasoil/Diesel	Production	34,531	33,590	35,693	31,719	28,971	29,533	26,358	23,727	24,765	25,856	25,755	26,273	26,795
	Consumption	45,288	48,931	48,628	48,363	47,392	47,469	47,353	47,528	47,916	48,953	50,819	51,058	50,114
	Cover	76%	69%	73%	66%	61%	62%	56%	50%	52%	53%	51%	51%	53%
Spain														
Gasoline	Production	9,615	10,152	8,729	8,973	8,013	7,653	8,619	8,885	8,819	8,754	8,420	8,076	7,723
	Consumption	8,524	7,437	6,287	6,002	5,666	5,288	5,011	4,803	4,614	4,447	3,670	3,350	3,083
	Cover	113%	137%	139%	150%	141%	145%	172%	185%	191%	197%	229%	241%	251%
Jet	Production	3,841	2,653	2,749	1,875	1,881	756	858	913	1,019	1,125	1,661	2,209	2,769
	Consumption	4,368	5,183	5,631	5,133	5,246	5,692	5,635	5,804	5,949	6,068	6,602	7,112	7,549
	Cover	88%	51%	49%	37%	36%	13%	15%	16%	17%	19%	25%	31%	37%
Gasoil/Diesel	Production	20,066	23,457	24,792	22,390	22,900	23,536	26,857	29,069	29,236	29,404	30,248	31,103	31,970
	Consumption	25,961	34,492	35,303	33,345	33,227	31,288	31,462	31,755	31,942	32,043	33,526	34,387	34,982
	Cover	77%	68%	70%	67%	69%	75%	85%	92%	92%	92%	90%	90%	91%
Italy														
Gasoline	Production	19,096	21,189	19,921	18,721	18,920	17,826	18,214	18,052	17,891	17,731	16,569	15,919	15,267
	Consumption	17,235	14,115	11,474	10,977	10,030	9,433	8,890	8,436	8,022	7,669	6,340	5,618	5,142
	Cover	111%	150%	174%	171%	189%	189%	205%	214%	223%	231%	261%	283%	297%
Jet	Production	4,114	3,910	3,219	3,050	3,175	3,011	3,049	3,086	3,123	3,160	3,273	3,477	3,682
	Consumption	3,594	3,781	4,069	3,692	3,895	4,000	4,060	4,182	4,266	4,330	4,596	4,759	4,879
	Cover	114%	103%	79%	83%	82%	75%	75%	74%	73%	73%	71%	73%	75%
Gasoil/Diesel	Production	36,487	39,844	39,586	35,985	37,720	36,808	36,988	37,045	38,035	38,161	37,953	37,910	38,750
	Consumption	27,729	31,927	31,625	30,311	30,168	29,967	29,831	29,872	29,972	30,212	30,740	30,698	30,331
	Cover	132%	125%	125%	119%	125%	123%	124%	124%	127%	126%	123%	123%	128%
Belgium & Netherlands														
Gasoline	Production	19,574	19,290	11,241	10,326	10,948	9,371	9,182	9,238	9,149	9,153	9,131	9,103	9,073
	Consumption	6,276	5,859	5,772	5,595	5,754	5,674	5,602	5,475	5,348	5,211	4,582	4,217	3,990
	Cover	312%	329%	195%	185%	190%	165%	164%	169%	171%	176%	199%	216%	227%
Jet	Production	9,341	8,668	8,014	7,364	8,082	8,627	8,590	8,616	8,518	8,511	8,468	8,446	8,423
	Consumption	4,736	4,820	5,656	5,289	5,215	5,290	5,325	5,375	5,425	5,457	5,623	5,771	5,883
	Cover	197%	180%	142%	139%	155%	163%	161%	160%	157%	156%	151%	146%	143%
Gasoil/Diesel	Production	34,495	33,060	33,397	32,632	34,163	33,320	32,702	33,174	33,109	33,380	34,915	36,053	37,201
	Consumption	20,049	21,697	22,074	20,424	21,127	21,238	21,238	21,323	21,436	26,996	28,943	29,946	31,190
	Cover	172%	152%	151%	160%	162%	157%	154%	156%	154%	124%	121%	120%	119%
USA														
Gasoline	Production	325,010	338,121	318,190	323,366	324,610	326,287	320,034	319,450	317,981	315,835	290,072	255,055	236,408
	Consumption	362,519	391,924	384,648	384,960	384,795	373,748	373,226	371,970	370,696	368,525	339,276	301,128	277,703
	Cover	90%	86%	83%	84%	84%	87%	86%	86%	86%	86%	85%	85%	85%
Jet	Production	73,920	71,138	68,703	64,261	65,243	67,218	67,272	68,686	69,710	70,485	71,774	72,949	75,093
	Consumption	79,399	77,266	70,803	64,114	65,884	65,768	66,444	67,045	68,011	69,303	73,104	76,721	78,929
	Cover	93%	92%	97%	100%	99%	102%	101%	102%	102%	102%	98%	95%	95%
Gasoil/Diesel	Production	175,130	193,463	210,070	198,045	206,619	218,300	217,703	220,882	224,619	227,662	230,933	234,777	245,023
	Consumption	182,102	201,468	193,024	177,646	185,925	189,989	192,224	194,115	196,238	202,357	215,630	223,227	228,626
	Cover	96%	96%	109%	111%	111%	115%	113%	114%	114%	113%	107%	105%	107%
Canada														
Gasoline	Production	31,630	32,976	30,973	31,762	31,884	30,613	30,735	31,164	31,255	31,228	30,832	29,344	28,389
	Consumption	28,193	30,115	30,714	31,206	32,102	31,824	31,702	31,792	31,768	31,664	29,517	26,321	24,381
	Cover	112%	109%	101%	102%	99%	96%	97%	98%	98%	99%	104%	111%	116%
Jet	Production	3,887	3,966	3,714	3,677	3,431	3,472	3,471	3,517	3,575	3,625	3,788	3,897	3,988
	Consumption	4,735	5,418	5,070	4,643	4,818	4,741	4,765	4,847	4,943	5,019	5,312	5,552	5,781
	Cover	82%	73%	73%	79%	71%	73%	73%	73%	72%	72%	71%	70%	69%
Gasoil/Diesel	Production	27,877	30,710	29,422	28,591	29,100	30,558	30,296	30,598	30,946	31,248	31,968	32,610	33,121
	Consumption	23,800	25,972	26,930	24,806	26,599	27,257	27,114	27,567	28,092	29,505	31,484	33,707	35,814
	Cover	117%	118%	109%	115%	109%	112%	112%	111%	110%	106%	102%	97%	92%
Japan														
Gasoline	Production	41,913	43,201	41,852	42,186	43,077	40,967	40,443	39,918	38,283	37,770	35,182	33,512	31,817
	Consumption	43,007	44,421	42,270	42,350	42,316	41,900	41,522	41,140	40,747	40,344	38,196	36,828	35,335
	Cover	97%	97%	99%	100%	102%	98%	97%	97%	94%	94%	92%	91%	90%
Jet	Production	8,267	8,894	12,414	10,621	10,979	10,365	10,134	9,725	9,923	9,792	9,135	8,681	8,222
	Consumption	9,824	10,809	10,026	9,038	9,242	8,802	8,879	8,955	8,976	8,954	8,452	7,942	7,403
	Cover	84%	82%	124%	118%	119%	118%	114%	109%	111%	109%	108%	109%	111%
Gasoil/Diesel	Production	59,861	57,695	54,568	50,044	50,148	48,087	50,044	49,787	44,050	46,819	48,339	47,171	45,849
	Consumption	60,593	55,284	43,883	41,072	40,533	39,951	41,737	41,969	41,934	41,694	38,992	37,970	36,854
	Cover	99%	104%	124%	122%	124%	120%	120%	119%	105%	112%	124%	124%	124%
Russia														
Gasoline	Production	27,152	32,011	35,602	35,827	36,034	36,445	38,281	39,050	39,518	40,122	42,517	43,062	43,607
	Consumption	23,259	26,260	31,573	31,279	32,843	33,828	34,759	35,627	36,429	37,158	39,832	41,245	41,784
	Cover	117%	122%	113%	115%	110%	108%	110%	110%	108%	108%	107%	104%	104%
Jet	Production	8,717	10,036	11,394	10,445	11,927	11,441	11,774	12,088	12,384	12,718	14,080	15,040	15,722
	Consumption	7,669	8,435	10,058	8,455	10,706	10,952	11,182	11,395	11,589	11,820	12,671	13,121	13,292
	Cover	114%	119%	113%	124%	111%	104%	105%	106%	107%	108%	111%	115%	118%
Gasoil/Diesel	Production	49,249	60,003	68,879	67,233	69,922	70,586	74,023	75,919	77,038	78,486	90,408	92,093	94,276
	Consumption	25,211	26,327	31,968	28,604	32,991	34,380	35,837	37,180	38,480	39,723	45,460	49,965	53,087
	Cover	195%	228%	215%	235%	212%	205%	207%	204%	200%	198%	199%	184%	178%

TABLE VI-15
REFINED PRODUCT COVER
REGIONAL COMPARISON
(Million Tonnes)

		2000	2005	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030
UK														
Gasoline	Production	23,470	22,652	20,319	20,404	19,629	19,341	16,180	14,175	13,966	13,756	12,708	11,660	10,612
	Consumption	21,655	18,850	16,856	16,034	15,035	14,095	13,369	12,596	11,891	11,163	9,187	8,265	7,800
	Cover	108%	120%	121%	127%	131%	137%	121%	113%	117%	123%	138%	141%	136%
Jet	Production	6,485	5,167	6,549	6,022	5,671	6,232	5,529	5,198	5,221	5,243	5,356	5,468	5,581
	Consumption	10,838	12,497	12,142	11,514	11,472	11,292	11,405	11,633	11,807	11,985	12,533	12,850	13,174
	Cover	60%	41%	54%	52%	49%	55%	48%	45%	44%	44%	43%	43%	42%
Gasoil/Diesel	Production	28,298	28,691	26,761	25,395	24,837	25,484	21,755	20,937	21,223	21,509	22,940	24,370	25,800
	Consumption	25,233	27,353	27,990	27,016	27,891	27,397	27,612	28,146	28,711	30,338	33,090	34,525	35,380
	Cover	112%	105%	96%	94%	89%	93%	79%	74%	74%	71%	69%	71%	73%
North Europe														
Gasoline	Production	70,130	69,485	59,225	58,165	55,216	54,057	53,039	51,887	50,982	50,821	48,495	46,431	44,384
	Consumption	49,410	44,219	40,049	38,249	37,025	35,326	34,120	32,853	31,682	30,512	26,437	23,950	22,260
	Cover	142%	157%	148%	152%	149%	153%	155%	158%	161%	167%	183%	194%	199%
Jet	Production	22,282	20,041	21,250	19,284	19,194	20,574	20,416	20,211	20,155	20,289	20,393	20,596	20,797
	Consumption	23,777	26,086	27,387	25,288	25,523	25,824	26,079	26,568	26,956	27,299	28,588	29,418	30,104
	Cover	94%	77%	78%	76%	75%	80%	78%	76%	75%	74%	71%	70%	69%
Gasoil/Diesel	Production	111,010	109,437	111,096	105,720	103,509	103,734	101,800	101,003	102,053	103,472	106,960	110,582	114,192
	Consumption	98,466	106,889	108,053	103,925	105,571	104,888	105,575	106,924	108,397	118,318	125,706	129,145	131,364
	Cover	113%	102%	103%	102%	98%	99%	96%	94%	94%	87%	85%	86%	87%
Central Europe														
Gasoline	Production	37,771	38,795	35,833	34,749	31,624	31,405	29,668	29,164	28,711	28,313	25,959	24,015	22,109
	Consumption	43,571	37,297	34,359	34,076	32,786	29,862	28,827	27,859	27,105	26,320	23,289	21,277	19,356
	Cover	87%	104%	104%	102%	96%	105%	103%	105%	106%	108%	111%	113%	114%
Jet	Production	6,128	6,134	6,887	6,113	6,527	6,937	6,766	6,948	6,995	7,056	7,234	7,448	7,624
	Consumption	10,000	10,871	12,304	11,778	12,119	12,037	12,168	12,407	12,620	12,835	13,833	14,620	15,136
	Cover	61%	56%	56%	52%	54%	58%	56%	56%	55%	55%	52%	51%	50%
Gasoil/Diesel	Production	65,922	74,704	74,248	70,554	69,248	69,311	68,175	68,273	68,311	68,460	68,629	68,885	68,954
	Consumption	82,296	86,827	89,318	86,757	87,730	87,709	88,140	88,760	89,502	91,421	95,512	97,438	98,077
	Cover	80%	86%	83%	81%	79%	79%	77%	77%	76%	75%	72%	71%	70%
South Europe														
Gasoline	Production	49,202	54,940	52,302	50,069	48,500	46,792	48,302	48,154	48,450	48,419	47,870	46,814	45,716
	Consumption	44,474	39,578	34,073	33,069	30,649	29,372	28,121	27,502	27,140	26,806	25,199	24,048	22,980
	Cover	111%	139%	154%	151%	158%	159%	172%	175%	179%	181%	190%	195%	199%
Jet	Production	14,412	13,578	13,787	11,657	12,434	11,274	11,466	11,624	11,906	12,216	14,101	15,318	16,551
	Consumption	14,349	16,165	17,573	16,210	16,832	16,767	17,275	17,715	18,107	18,452	20,066	21,469	22,732
	Cover	100%	84%	78%	72%	74%	67%	66%	66%	66%	66%	70%	71%	73%
Gasoil/Diesel	Production	93,435	103,532	105,227	94,693	96,202	98,095	102,489	106,576	110,130	111,768	119,590	122,432	126,224
	Consumption	100,316	120,412	126,241	120,798	121,375	121,656	122,444	123,721	125,390	127,672	136,652	142,622	146,355
	Cover	93%	86%	83%	78%	79%	81%	84%	86%	88%	88%	88%	86%	86%
EU														
Gasoline	Production	142,635	120,150	116,840	115,709	114,685	112,091	111,203	111,154	109,679	108,660	102,868	98,034	93,270
	Consumption	102,116	80,156	74,035	72,071	70,810	69,209	67,756	66,261	64,769	63,450	57,912	53,222	49,072
	Cover	140%	150%	158%	161%	162%	162%	164%	168%	169%	171%	178%	184%	190%
Jet	Production	38,968	35,620	35,923	37,061	36,760	36,835	37,214	37,968	38,221	38,494	39,121	40,478	41,730
	Consumption	52,388	50,999	53,684	54,678	54,944	56,243	56,626	57,239	57,810	58,353	60,623	62,442	63,969
	Cover	74%	70%	67%	68%	67%	65%	66%	66%	66%	66%	65%	65%	65%
Gasoil/Diesel	Production	266,318	252,523	265,150	271,781	272,240	270,055	271,508	275,147	274,312	275,598	279,149	285,270	291,133
	Consumption	290,193	288,256	304,721	310,096	313,530	314,510	316,847	321,097	322,758	324,158	329,185	331,653	335,771
	Cover	92%	88%	87%	88%	87%	86%	86%	86%	85%	85%	85%	86%	87%
G8														
Gasoline	Production	512,284	533,661	508,035	511,178	508,447	505,124	495,412	491,729	487,814	485,418	454,635	413,565	389,445
	Consumption	538,464	559,946	547,240	545,830	545,000	529,943	527,397	524,432	521,635	517,870	481,121	436,453	407,541
	Cover	95%	95%	93%	94%	93%	95%	94%	94%	94%	94%	94%	95%	96%
Jet	Production	115,732	112,842	116,324	107,612	109,664	111,254	110,189	110,913	112,618	113,939	116,535	118,964	122,031
	Consumption	129,708	132,906	128,195	116,716	121,498	120,977	122,343	124,045	125,855	127,918	134,278	139,348	142,353
	Cover	89%	85%	91%	92%	90%	92%	90%	89%	89%	89%	87%	85%	86%
Gasoil/Diesel	Production	457,879	496,134	513,687	482,709	490,648	501,958	498,367	499,948	501,581	510,607	528,072	534,192	547,747
	Consumption	447,093	471,655	458,428	430,073	444,563	449,102	454,132	458,638	463,491	475,998	499,365	513,134	520,631
	Cover	102%	105%	112%	112%	110%	112%	110%	109%	108%	107%	106%	104%	105%
G20														
Gasoline	Production	690,984	709,012	703,979	728,454	736,114	740,669	740,153	746,023	752,650	756,419	765,963	770,550	780,908
	Consumption	678,627	717,368	734,323	739,783	750,312	748,014	754,433	761,738	768,966	775,203	786,916	785,286	797,510
	Cover	102%	99%	96%	98%	98%	99%	98%	98%	98%	98%	97%	98%	98%
Jet	Production	164,244	169,282	177,660	174,629	180,000	186,542	189,254	193,133	197,223	201,496	212,538	225,371	237,129
	Consumption	180,053	181,814	183,085	176,285	183,908	186,504	189,538	192,778	196,402	200,226	214,222	227,261	236,022
	Cover	91%	93%	97%	99%	98%	100%	100%	100%	100%	101%	99%	99%	100%
Gasoil/Diesel	Production	815,815	893,884	974,556	975,984	1,003,990	1,033,646	1,052,914	1,078,345	1,101,388	1,134,063	1,248,293	1,361,507	1,437,577
	Consumption	807,209	878,047	940,089	926,447	970,833	994,681	1,017,633	1,044,109	1,069,231	1,098,283	1,210,242	1,306,638	1,379,154
	Cover	101%	102%	104%	105%	103%	104%	103%	103%	103%	103%	103%	104%	104%

Notes: G8 includes UK, Germany, France, Italy, USA, Canada, Japan and Russia
G20 includes USA, Canada, Japan, Russia, China, India, Turkey, Australia, Saudi Arabia, South Korea, Brazil, Argentina, Mexico and the EU

TABLE VI-16
TOTAL WORLD TOTAL CRUDE OIL SUPPLY/DEMAND
(Thousand Barrels Per Day)

	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030	2040
Total Runs	72,515	73,307	74,106	74,247	75,231	76,577	77,738	82,001	86,959	90,272	96,249
Crude Production	73,090	72,029	73,043	74,183	75,131	76,451	77,655	81,925	86,829	90,184	96,236
Segregated Cond. Pro	364	552	272	268	263	259	254	231	208	185	139
Total Production	73,454	72,581	73,315	74,451	75,394	76,709	77,909	82,156	87,037	90,369	96,375
Imports (from)											
Africa	7,670	8,320	7,069	7,556	7,940	8,186	8,504	9,793	10,637	11,234	11,819
Asia	1,520	1,097	888	924	1,059	1,178	1,275	1,136	1,028	925	727
Canada	1,612	2,026	2,210	2,396	2,613	2,772	2,934	3,873	4,177	4,214	4,386
China	161	61	49	48	48	48	48	46	45	45	45
Europe	3,732	2,648	2,384	2,297	2,208	2,103	2,034	1,868	1,563	1,250	1,138
CIS Region	6,310	7,264	7,155	7,363	7,668	8,057	8,402	9,424	10,223	10,186	9,601
Japan	-	-	-	-	-	-	-	-	-	-	-
Latin America	5,155	4,905	5,030	4,965	4,870	4,681	4,786	4,176	5,017	5,392	4,483
Middle East	17,003	16,034	17,090	16,964	16,488	16,479	16,182	15,739	18,188	21,257	28,900
United States	29	39	42	55	63	66	67	138	139	146	189
Subtotal Imports	43,121	42,306	41,775	42,429	42,822	43,485	44,103	46,067	50,881	54,505	61,164
Exports (to)											
Africa	848	852	867	884	885	885	884	983	1,061	1,139	1,288
Asia	8,355	9,410	9,419	9,310	9,425	9,647	9,887	10,689	12,634	14,093	16,229
Canada	923	777	745	718	724	734	745	757	780	796	859
China	2,522	4,601	4,820	5,149	5,592	6,028	6,456	8,223	10,995	12,417	15,191
Europe	13,143	11,761	11,629	11,541	11,533	11,556	11,616	11,948	12,234	12,336	12,294
CIS Region	801	522	625	631	638	645	653	695	733	769	835
Japan	4,067	3,481	3,285	3,335	3,239	3,106	3,062	2,841	2,695	2,549	2,256
Latin America	1,782	1,367	1,472	1,263	1,291	1,299	1,321	1,520	1,666	1,799	2,140
Middle East	544	555	544	520	520	520	520	538	571	606	647
United States	10,074	9,275	8,884	8,888	8,964	8,900	8,792	7,919	7,765	8,298	9,686
Subtotal Exports	43,121	42,306	41,775	42,429	42,822	43,485	44,103	46,067	50,881	54,505	61,164
Total Supply	73,454	72,581	73,315	74,451	75,394	76,709	77,909	82,156	87,037	90,369	96,375

Source: Purvin & Gertz GPMO analysis

TABLE VI-17
WORLD REFINED PRODUCT SUPPLY & DEMAND BY REGION
(Thousand Barrels per Day)

Region	Flow	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030	2040
Africa	Production	2,575	2,552	2,336	2,507	2,591	2,665	2,702	2,824	2,945	3,061	3,297
	Imports	741	1,078	1,157	1,134	1,172	1,208	1,254	1,409	1,552	1,639	1,900
	Exports	772	742	640	735	752	766	766	779	775	798	832
	Ethanol Supplied	-	-	-	0	1	1	2	2	2	2	2
	Biojet Supplied	-	-	-	-	-	-	-	-	-	-	-
	Biodiesel Supplied	-	-	-	-	-	-	-	-	-	-	-
	F-T Production	28	16	18	18	18	21	21	20	19	18	17
	Supply Adjustments	6	45	23	21	30	31	31	33	35	35	37
	Consumption	2,578	2,949	2,894	2,945	3,060	3,160	3,244	3,509	3,778	3,958	4,420
	of which: Int'l Bunke	247	265	271	277	285	292	299	325	356	381	436
Asia (1)	Production	21,102	24,008	24,650	25,155	25,742	26,357	27,173	29,772	34,269	36,911	40,961
	Imports	5,085	7,024	7,232	7,225	7,334	7,434	7,584	7,793	8,052	8,283	8,496
	Exports	3,930	5,785	6,198	6,157	6,174	5,991	6,112	5,643	6,769	7,150	7,602
	Ethanol Supplied	6	61	70	72	73	74	77	126	151	171	198
	Biojet Supplied	-	-	-	-	-	-	-	-	-	-	-
	Biodiesel Supplied	0	32	39	45	48	52	55	73	89	96	103
	F-T Production	7	19	28	31	34	38	42	188	193	198	205
	Supply Adjustments	322	(9)	43	104	207	222	231	223	233	248	276
	Consumption	22,593	25,350	25,863	26,474	27,263	28,186	29,051	32,531	36,217	38,755	42,638
	of which: Int'l Bunke	1,924	2,333	2,433	2,504	2,596	2,687	2,750	3,138	3,545	3,844	4,336

Note (1) Asia includes China, Japan and Oceania

Region	Flow	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030	2040
Canada	Production	1,930	1,826	1,841	1,828	1,845	1,839	1,813	1,824	1,811	1,811	1,867
	Imports	280	223	311	311	311	347	347	337	336	340	340
	Exports	435	409	466	465	463	497	486	530	542	525	464
	Ethanol Supplied	4	33	37	39	39	41	42	40	35	33	32
	Biojet Supplied	-	-	-	-	-	-	-	-	-	-	-
	Biodiesel Supplied	-	12	6	7	10	16	17	17	17	17	17
	F-T Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	104	232	198	194	187	181	181	235	251	249	249
	Consumption	1,884	1,916	1,926	1,914	1,930	1,927	1,913	1,923	1,909	1,925	2,041
	of which: Int'l Bunke	11	11	11	11	11	11	11	11	11	11	11
Europe	Production	16,132	13,991	13,982	13,914	13,919	13,951	14,025	14,099	14,121	14,137	14,170
	Imports	6,854	7,246	7,254	7,291	7,385	7,436	7,407	7,187	7,287	7,306	7,358
	Exports	6,332	6,557	6,666	6,723	6,739	6,758	6,777	6,499	6,488	6,455	6,381
	Ethanol Supplied	16	88	98	101	103	105	109	131	128	118	101
	Biojet Supplied	-	-	-	-	-	-	-	-	-	-	-
	Biodiesel Supplied	31	222	268	285	299	313	329	402	425	436	457
	F-T Production	-	0	0	0	0	0	0	0	0	0	0
	Supply Adjustments	(529)	(84)	(187)	(113)	(133)	(132)	(132)	(128)	(123)	(118)	(108)
	Consumption	16,171	14,906	14,749	14,755	14,833	14,915	14,962	15,193	15,350	15,425	15,596
	of which: Int'l Bunke	2,031	1,973	2,012	2,033	2,065	2,095	2,149	2,237	2,314	2,389	2,524
CIS Region	Production	5,563	5,793	5,853	5,986	5,978	5,936	5,911	5,533	5,633	5,733	6,144
	Imports	164	307	334	319	326	333	338	374	404	424	436
	Exports	2,380	2,437	2,454	2,464	2,413	2,336	2,277	1,746	1,654	1,611	1,793
	Ethanol Supplied	-	-	-	-	-	-	-	-	-	-	-
	Biojet Supplied	-	-	-	-	-	-	-	-	-	-	-
	Biodiesel Supplied	-	-	-	-	-	-	-	-	-	-	-
	F-T Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	30	61	43	53	55	59	62	108	124	128	131
	Consumption	3,377	3,724	3,775	3,893	3,946	3,991	4,034	4,269	4,508	4,674	4,918
	of which: Int'l Bunke	195	279	289	298	306	315	324	369	411	448	520
Latin America	Production	6,976	6,436	6,559	6,438	6,640	6,953	7,036	8,204	8,509	8,815	9,588
	Imports	1,524	2,155	2,310	2,286	2,234	2,112	2,129	2,103	2,293	2,449	2,837
	Exports	2,356	1,703	1,758	1,573	1,586	1,622	1,610	2,187	2,165	2,194	2,367
	Ethanol Supplied	142	132	157	164	181	186	190	209	226	239	267
	Biojet Supplied	-	-	-	-	-	-	-	-	-	-	-
	Biodiesel Supplied	0	58	66	66	69	72	75	88	101	107	122
	F-T Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	157	5	26	45	46	46	47	48	48	49	51
	Consumption	6,444	7,082	7,360	7,427	7,584	7,747	7,867	8,463	9,012	9,465	10,498
	of which: Int'l Bunke	452	513	539	551	567	583	599	665	730	784	887
Middle East	Production	6,347	6,564	6,785	6,925	6,974	7,242	7,512	8,633	8,998	9,357	10,153
	Imports	959	1,118	1,117	1,091	1,148	1,154	1,132	1,128	1,250	1,369	1,454
	Exports	2,512	2,138	2,217	2,267	2,234	2,336	2,430	2,879	2,813	2,834	2,956
	Ethanol Supplied	-	-	-	-	-	-	-	-	-	-	-
	Biojet Supplied	-	-	-	-	-	-	-	-	-	-	-
	Biodiesel Supplied	-	-	-	-	-	-	-	-	-	-	-
	F-T Production	-	26	45	100	120	126	129	132	134	134	135
	Supply Adjustments	178	240	231	264	280	295	309	364	398	416	461
	Consumption	4,973	5,809	5,961	6,113	6,288	6,482	6,652	7,377	7,967	8,442	9,247
	of which: Int'l Bunke	516	615	631	650	671	693	714	802	886	959	1,090
United States	Production	16,442	16,063	16,346	16,159	16,292	16,386	16,446	15,991	15,380	15,219	15,317
	Imports	2,585	1,789	1,626	1,684	1,664	1,667	1,629	1,575	1,593	1,542	1,509
	Exports	1,049	2,071	2,515	2,358	2,477	2,529	2,488	2,255	2,170	2,285	2,194
	Ethanol Supplied	265	839	840	855	875	890	900	910	890	850	840
	Biojet Supplied	-	-	-	-	-	-	-	-	-	-	-
	Biodiesel Supplied	6	6	15	59	65	67	69	78	86	92	102
	F-T Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	24	12	45	(10)	(0)	(2)	(3)	7	6	3	(3)
	Consumption	18,273	16,638	16,356	16,388	16,419	16,480	16,554	16,307	15,785	15,422	15,571
	of which: Int'l Bunke	469	449	448	452	456	463	472	498	522	537	562
Total World	Production	77,066	77,233	78,351	78,912	79,980	81,329	82,618	86,879	91,666	95,044	101,497
	Imports	18,193	20,939	21,340	21,340	21,575	21,691	21,821	21,906	22,768	23,351	24,330
	Exports	19,766	21,842	22,915	22,742	22,838	22,835	22,946	22,518	23,376	23,852	24,589
	Ethanol Supplied	433	1,153	1,202	1,231	1,273	1,297	1,320	1,417	1,431	1,413	1,440
	Biojet Supplied	-	-	-	-	-	-	-	-	-	-	-
	Biodiesel Supplied	38	329	394	462	491	520	545	659	718	749	802
	F-T Production	35	62	91	149	172	185	192	340	347	351	357
	Supply Adjustments	293	501	422	557	671	700	727	890	973	1,010	1,094
	Consumption	76,293	78,375	78,885	79,909	81,324	82,888	84,277	89,573	94,526	98,065	104,930
	of which: Int'l Bunke	5,846	6,438	6,634	6,776	6,958	7,139	7,317	8,044	8,776	9,353	10,366

Source: Purvin & Gertz GPMO analysis

TABLE VI-18
WORLD GASOIL/DIESEL SUPPLY & DEMAND BY REGION
(Thousand Barrels per Day)

Region	Flow	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030	2040
Africa	Production	770	807	774	830	858	884	889	950	1,004	1,053	1,151
	Imports	283	475	525	500	521	540	572	647	734	782	945
	Exports	97	32	31	30	30	30	30	32	31	30	28
	Biodiesel Supplied	-	-	-	-	-	-	-	-	-	-	-
	F-T Diesel Production	21	12	13	13	13	16	16	15	14	14	12
	Supply Adjustments	(3)	(28)	(23)	(23)	(23)	(23)	(23)	(23)	(23)	(23)	(23)
	Consumption	973	1,234	1,258	1,289	1,339	1,387	1,424	1,556	1,700	1,796	2,058
	of which: Int'l Bunkers	31	27	29	30	30	30	31	34	38	43	54
Asia (1)	Production	6,877	8,410	8,774	9,070	9,354	9,524	10,020	11,256	13,328	14,574	16,237
	Imports	969	1,276	1,358	1,382	1,451	1,479	1,518	1,627	1,739	1,824	1,835
	Exports	1,047	1,816	1,958	1,962	1,979	1,812	1,987	1,639	2,286	2,520	2,900
	Biodiesel Supplied	0	32	39	45	48	52	55	73	89	96	103
	F-T Diesel Production	7	16	21	24	26	29	32	140	144	148	153
	Supply Adjustments	5	30	(21)	8	30	29	29	30	32	35	38
	Consumption	6,812	7,948	8,212	8,567	8,929	9,301	9,668	11,488	13,047	14,158	15,467
	of which: Int'l Bunkers	113	143	127	175	196	218	239	629	648	668	663
Note (1) Asia includes China, Japan and Oceania												
Canada	Production	628	595	625	619	625	633	639	653	667	677	694
	Imports	20	15	46	46	48	44	42	51	61	71	126
	Exports	132	140	165	167	166	162	142	188	184	160	142
	Biodiesel Supplied	-	12	6	7	10	16	17	17	17	17	17
	F-T Diesel Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	15	62	46	49	46	44	47	110	129	127	125
	Consumption	531	544	557	554	563	574	603	644	689	732	821
	of which: Int'l Bunkers	2	2	2	2	2	2	2	2	2	2	2
Europe	Production	5,880	5,497	5,542	5,569	5,638	5,733	5,798	6,033	6,170	6,323	6,628
	Imports	2,365	2,746	2,747	2,685	2,706	2,713	2,791	2,934	3,006	3,001	2,990
	Exports	1,703	1,861	1,906	1,947	1,985	2,022	1,894	1,928	1,928	1,952	2,001
	Biodiesel Supplied	31	222	268	285	299	313	329	402	425	436	457
	F-T Diesel Production	-	0	0	0	0	0	0	0	0	0	0
	Supply Adjustments	(152)	(173)	(229)	(130)	(130)	(129)	(129)	(128)	(128)	(128)	(128)
	Consumption	6,420	6,431	6,423	6,462	6,528	6,607	6,896	7,314	7,546	7,681	7,946
	of which: Int'l Bunkers	170	160	155	156	159	161	385	462	472	485	509
CIS Region	Production	1,676	1,827	1,868	1,941	1,983	2,009	2,042	2,302	2,353	2,415	2,681
	Imports	46	129	146	136	140	142	143	154	166	175	183
	Exports	878	956	969	1,001	1,009	1,002	1,004	1,118	1,047	1,016	1,150
	Biodiesel Supplied	-	-	-	-	-	-	-	-	-	-	-
	F-T Diesel Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	(10)	(4)	(8)	-	-	-	-	-	-	-	-
	Consumption	834	995	1,035	1,077	1,114	1,149	1,181	1,338	1,473	1,574	1,713
	of which: Int'l Bunkers	10	18	22	27	31	35	38	56	74	92	137
Latin America	Production	2,043	1,952	1,958	1,903	1,990	2,145	2,200	2,835	2,994	3,070	3,370
	Imports	433	755	827	824	801	711	703	686	762	805	912
	Exports	478	311	306	221	223	221	217	578	584	519	508
	Biodiesel Supplied	0	58	66	66	69	72	75	88	101	107	122
	F-T Diesel Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	73	(35)	(12)	-	-	-	-	-	-	-	-
	Consumption	2,072	2,419	2,533	2,572	2,637	2,706	2,762	3,030	3,273	3,463	3,895
	of which: Int'l Bunkers	77	74	77	80	83	85	87	95	101	107	119
Middle East	Production	1,951	2,007	2,068	2,112	2,126	2,257	2,445	3,027	3,157	3,289	3,578
	Imports	258	366	429	417	429	444	416	409	473	512	563
	Exports	565	467	507	500	482	564	665	974	942	922	895
	Biodiesel Supplied	-	-	-	-	-	-	-	-	-	-	-
	F-T Diesel Production	-	21	30	56	67	69	71	72	74	74	74
	Supply Adjustments	(33)	19	18	18	18	18	18	18	18	18	18
	Consumption	1,611	1,946	2,038	2,103	2,158	2,224	2,284	2,552	2,779	2,971	3,337
	of which: Int'l Bunkers	27	28	28	36	38	41	43	115	120	125	135
United States	Production	3,954	4,223	4,462	4,450	4,515	4,591	4,653	4,720	4,799	5,008	5,198
	Imports	329	228	178	195	203	213	224	268	280	274	274
	Exports	138	656	831	742	813	858	803	654	600	700	684
	Biodiesel Supplied	6	6	15	59	65	67	69	78	86	92	102
	F-T Diesel Production	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	(33)	(1)	59	(32)	(2)	(2)	(7)	(4)	(2)	(1)	(1)
	Consumption	4,118	3,800	3,883	3,929	3,968	4,011	4,136	4,407	4,563	4,673	4,889
	of which: Int'l Bunkers	-	-	-	-	-	-	-	-	-	-	-
Total World	Production	23,778	25,319	26,069	26,494	27,089	27,776	28,687	31,775	34,472	36,409	39,536
	Imports	4,704	5,991	6,255	6,185	6,298	6,286	6,409	6,776	7,223	7,445	7,828
	Exports	5,039	6,239	6,673	6,569	6,687	6,672	6,741	7,111	7,602	7,818	8,308
	Biodiesel Supplied	38	329	394	462	491	520	545	659	718	749	802
	F-T Diesel Production	28	49	65	93	106	114	119	228	232	235	240
	Supply Adjustments	-138	-130	-171	-111	-61	-64	-64	3	26	28	29
	Consumption	23,371	25,318	25,940	26,553	27,236	27,961	28,955	32,330	35,069	37,048	40,127
	of which: Int'l Bunkers	429	452	439	506	539	572	825	1,394	1,456	1,523	1,619

Source: Purvin & Gertz GPMO analysis

VII. UK REFINERIES COMPETITIVE POSITION

There are many factors that can contribute to a refinery having a competitive position. These include refinery size, refinery complexity, refinery complexity type, workforce competency and refinery management competency, as well as competitive access to crude oil and feedstocks and access to market to sell refined products.

Some of these elements such as workforce and management competency are difficult to measure and can vary significantly over a few years as personnel change. What we can expect for UK refinery personnel is that they are usually well educated and well trained, with professional staff usually having technical degrees and often additional qualifications, and the operations and maintenance staff also highly literate and numerate, with years of specific training and often Higher National Certificate or Higher National Diploma qualifications. As a result UK refineries should be as well run as any others in the world, and might be expected to be more effectively run than refineries in less developed countries.

Previous work undertaken in 2011 and published in the report "Developments in the International Downstream Oil Markets and their Drivers: Implications for the UK Refining Sector" looked at the key drivers that impact Refinery Competitiveness in some detail, and provided an assessment of the ability of the UK refiners to compete with key competitors from Europe and beyond in supplying the UK market. This report concluded that the margin performance of UK refineries was reasonable when compared with peer-group refineries in North West Europe – a peer group that was on average larger and more complex than the European average. The report also demonstrated that when delivering products into the UK market, the UK refiners were more than capable of delivering products at lower cost than most of their international competitors, since these competitors have to overcome freight cost of between $1.2 to $3.5 per barrel to get the products to the UK market.

In this report we look again at the UK refineries in terms of size, complexity, and complexity type, and compare expected margin performance of the UK refineries based on the data submitted by the UK refineries with our Purvin & Gertz benchmark refineries.

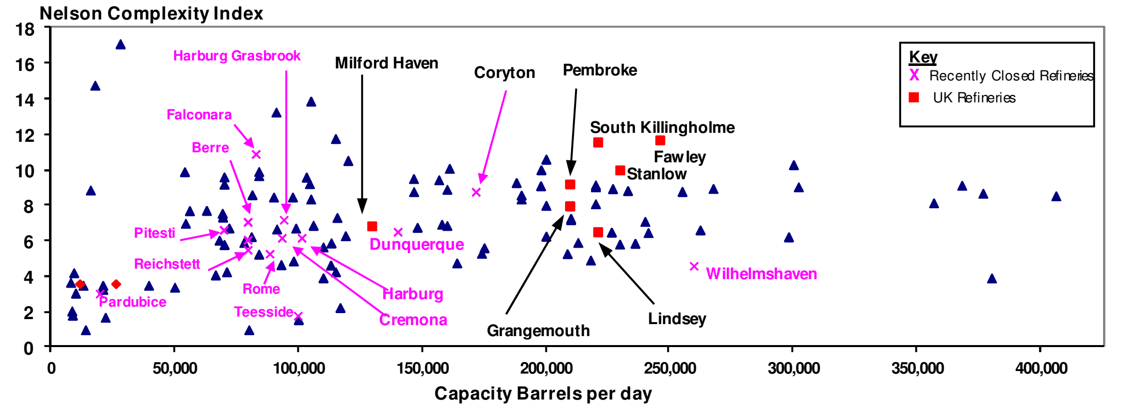
REFINERY SIZE AND COMPLEXITY

The average capacity of operating refineries in Europe is 144,000 barrels per day, and the average nelson complexity index[18] is 7.63. For the UK the average operating capacity is 175,000 barrels per day (including the two small bitumen refineries) and the average nelson complexity index is 8.26. The UK refineries are therefore on average both larger and more complex than the European average.

Figure VII-1 below shows a plot of refinery crude distillation capacity versus refinery complexity for European refineries, including data on some that have recently closed.

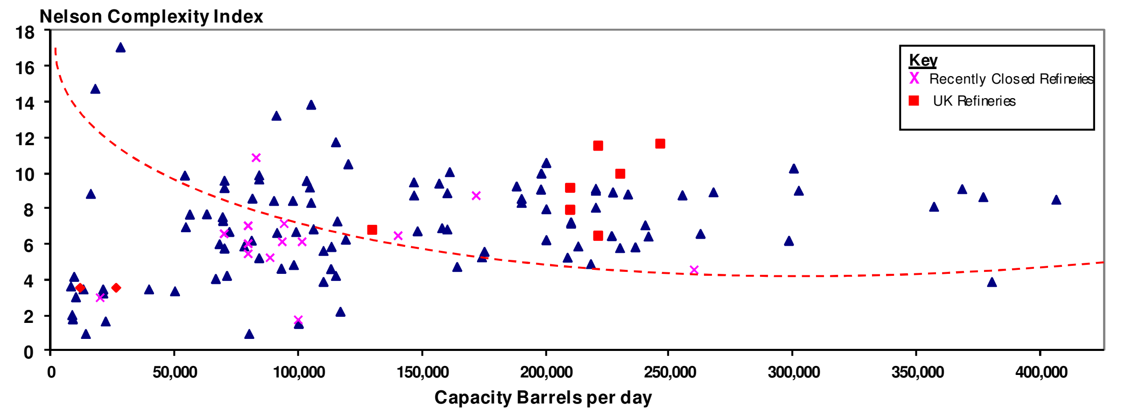
[18] **Nelson Complexity Index**: A measure of conversion capacity on a refinery, relative to crude distillation capacity, developed by Wilbur Nelson of the Oil and Gas Journal in the 1960s. Crude distillation is defined as having a complexity index of 1.0. Each unit on a refinery has a defined complexity factor. The complexity of each main refinery unit is calculated by multiplying its complexity factor by its capacity divided by total crude distillation capacity. The sum of the complexity values of each piece of equipment including the crude distillation unit determines the refinery complexity on the Nelson Complexity Index.

FIGURE VII-1
EUROPEAN REFINERY CAPACITY AND COMPLEXITY 2012



It can be seen from the chart above that the vast majority of refineries that have closed in recent years across Europe have been relatively small (distillation capacity below 100,000 B/D) and of low to medium complexity. The two main exceptions are Coryton in the UK and Wilhelmshaven in Germany. While the Wilhelmshaven refinery was large it was relatively simple and so would not have a high margin potential. Coryton closed owing to the financial difficulties of its parent company Petroplus despite being one of the most competitive refineries in the parent company portfolio. The chart below separates the refineries into two groups. Those above the line would generally be expected to survive, whereas those below the line are more likely to come under pressure to close.

FIGURE VII-2
EUROPEAN REFINERY CAPACITY AND COMPLEXITY 2012

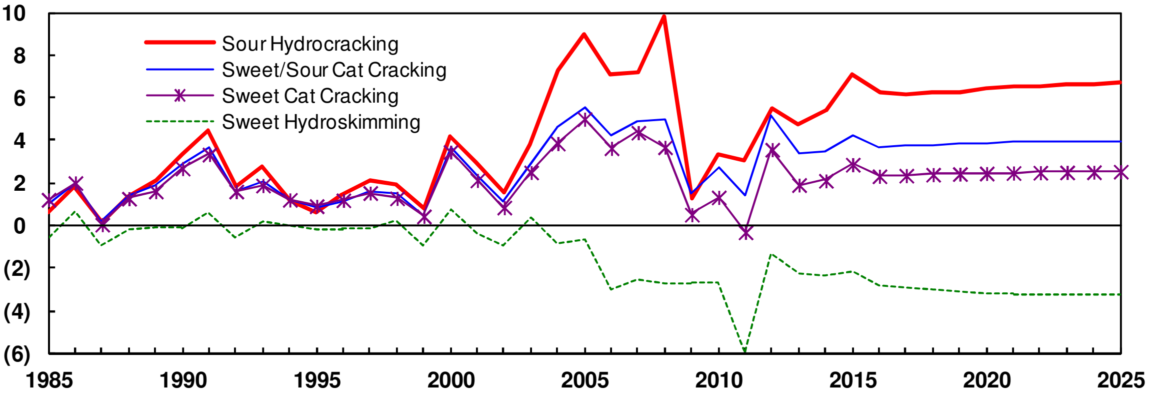


Higher capacity refineries are usually more cost competitive than lower capacity refineries as they benefit from the economies of scale. This is because a significant proportion of refinery operating costs are fixed costs, i.e. costs that do not change significantly with throughput – such as maintenance costs and staff salaries. A larger process unit requires similar manpower, maintenance activity and management time as a smaller unit, but processes greater amount of hydrocarbon in the same time. Therefore for two similar refineries with the only difference being crude oil processing capacity, the higher throughput refinery would have lower overall operating costs while the upgrading margin earned per barrel would be the same. The higher throughput refinery would therefore be more profitable.

In general, more complex refineries have a higher margin potential because they produce more of the more valuable lighter products such as gasoline and diesel and less low value products such as fuel oil. However complexity does not tell the whole story – the type of complexity is also important.

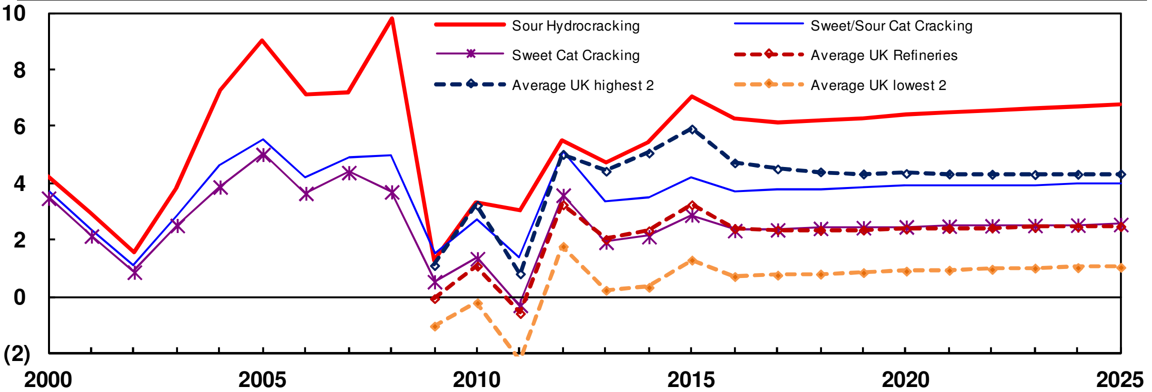
As shown in Section IV, the refinery types that would be expected to have better margins would be those refineries that produce a higher proportion of middle distillates (diesel, gasoil, kerosene) rather than gasoline. Therefore hydrocracking and coking refineries would be expected to have higher margins than cat-cracking refineries. This is shown in Figure VII-3 below.

FIGURE VII-3
CIF NWE NET CASH REFINING MARGINS
(Forecast in Constant 2011 Dollars per Barrel)



Predominantly, the UK refineries are of cat-cracking configuration. Based on the data submitted, Purvin & Gertz have modelled the UK refineries and compared the projected margins with our benchmark refineries.

FIGURE VII-4
COMPARISON OF UK REFINERY AND PGI BENCHMARK NET CASH REFINING MARGINS
(Forecast in Constant 2011 Dollars per Barrel)



In Figure VII-4 it can be seen that the average net cash margin performance of the UK refineries follows almost exactly our sweet cat cracking refinery benchmark, with a long term net cash margin of around 2.6 $/barrel. Given that the UK refineries are predominantly cat-cracking based and process predominantly sweet (low sulphur) crude then this is unsurprising. The average margins of the highest 2 and lowest 2 UK refineries show the potential expected range of performance. It should be pointed out that over the range of real-price data (2009 to 2012) the "highest 2" and "lowest 2" refineries were not the same refineries each year.

Note that the margin projections above assume the continuation of the current cost structure of the UK refiners, and do not include the potential additional operating costs associated with future legislation discussed in Section X.

The analysis in Figure VII-4 has some limitations. The UK refinery performance is calculated by taking the submitted refinery data for 2011 and projecting those mass balances forward using our future price set. Thus the projections have a constant mass balance and changing prices. In reality refineries would react to changing prices and re-optimise, changing the mass balance to improve overall margin performance.

Nevertheless the analysis does show that the UK refineries margin performances are at least comparable with a well run, 200,000 barrel per day cost-competitive cat-cracking benchmark refinery that sells its product inland at inland (CIF) prices. While such a refinery does not have the highest margins, it would form part of what Purvin & Gertz defines as core refining capacity – i.e. refining capacity that we would expect to survive in the long term, and that is actually needed in order to keep the European and Global markets adequately supplied.

Clearly there would be scope for improvement of the UK refiners' competitive position, for example by being able to run a higher proportion of sour crude, or increasing further middle distillate production by expansion of diesel/gasoil desulphurisation capacity. All the UK refineries interviewed for this project have plans to improve performance over the next few years by implementation of a number of small performance improvements, rather than large capital intensive projects.

In conclusion, the UK refineries are expected to be competitive going forward. Providing UK refineries are not subjected to additional costs that refineries in other countries do not have to bear, then there are many refineries in Europe that owing to their smaller size and less complex configuration would be expected to close before the existing UK refineries would be expected to come under pressure to close.

VIII. UK SUPPLY ROBUSTNESS AND RESILIENCE

In this chapter we look at the ability of the UK refined product supply system to cope with disruption to supply. Supply robustness is defined as the long term ability to keep the UK supplied, and resilience as the ability of the system to withstand short term disruptions to supply.

The International Energy Agency has developed a model to enable member countries to evaluate and compare their energy security. It defines countries' energy security profiles and groups them according to their levels of risks and resilience. Each evaluation is based on a set of quantitative indicators that reflect both the risks of energy supply disruptions and the energy system's resilience, and ability to cope with such disruptions. The Model of Short Term Energy Security (MOSES) can be used to assess the UK main refined fuels supply security.

Oil products consumed can either be refined domestically or imported, with each route having specific risks and resilience factors involved. Analysis for oil product security is based on nine indicators for each oil product – MOSES divides oil products into 3 categories; middle distillates, motor gasoline and "other" oil products.

In the case of oil product security, the MOSES model puts most emphasis on net product import dependence i.e. product deficit, when combining all considered indicators. Deficits/surpluses are calculated for each product category, and banded according to lowest, low, medium and high fuel deficit.

MOSES MODEL DEFINED RISK FACTORS FOR REFINED PRODUCTS

	Low	Medium	High
Total deficit (gasoline/middle distillate/other products)	<5% and 5-25%	25%-45%	≥ 45%

In Section VI, Table VI-13 it can be seen that the UK currently (2013) has a total refined product cover of 83% i.e. a net deficit of 17% for all products. Using the MOSES model definition, this would put the UK in the low risk category.

However if the refined products are looked at individually a very different (and more accurate and useful) picture emerges – a surplus of one product does not help with a deficit of another. In 2013 the UK is expected to have a jet fuel deficit of 55%, a diesel deficit of 47% and a kerosene deficit of 44%. If we apply the MOSES definitions individually to refined products this would put diesel and jet fuel in the high risk category and burning kerosene just below at the top end of the medium risk category. (See table below)

UNITED KINGDOM REFINED PRODUCT IMPORT DEPENDENCY (percent of demand imported)

		2000	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030
Scenario 1: Steady State												
	Gasoline	-8	-20	-31	-37	-23	-16	-23	-31	-59	-77	-87
	Jet	40	59	51	45	52	56	56	57	59	60	61
	Diesel	no split	2	30	29	43	48	50	51	56	58	59
	Gasoil	no split	-22	-57	-125	-118	-106	-108	-64	-64	-69	-74
	Kerosene	20	14	31	26	38	44	45	45	44	43	43
Scenario 2: Modest Investment												
	Gasoline	-8	-20	-31	-37	-21	-13	-17	-23	-38	-41	-36
	Jet	40	59	51	45	52	55	56	56	57	57	58
	Diesel	no split	2	30	29	43	47	47	47	47	45	42
	Gasoil	no split	-22	-57	-125	-118	-111	-114	-69	-69	-74	-79
	Kerosene	20	14	31	26	38	44	45	45	45	44	43
Scenario 3: Enhanced Investment												
	Gasoline	-8	-20	-31	-37	-21	-13	-17	-23	-21	-3	4
	Jet	40	59	51	45	52	55	56	56	53	49	50
	Diesel	no split	2	30	29	43	47	47	47	43	36	34
	Gasoil	no split	-22	-57	-125	-118	-111	-114	-69	-69	-74	-79
	Kerosene	20	14	31	26	38	44	45	45	45	44	43
Scenario 4: Three Refineries Close												
	Gasoline	-8	-20	-31	-37	-23	-16	-23	25	9	-1	-7
	Jet	40	59	51	45	52	56	56	75	77	77	78
	Diesel	no split	2	30	29	43	48	50	72	75	76	77
	Gasoil	no split	-22	-57	-125	-118	-106	-108	6	6	3	1
	Kerosene	20	14	31	26	38	44	45	69	68	68	67

Note: A negative % indicates product surplus, i.e. no import dependency

The MOSES model also looks at external risks through import infrastructure i.e. the number and type of entry points, and through diversity of the products' suppliers. MOSES also takes into consideration the vulnerability of crude oil supply (which for the UK is low - the UK produces around 85% of current crude demand, and a significant proportion of imports come from Norway, a stable source of supply).

Internal resilience indicators are the number of domestic working refineries, the flexibility of the refining infrastructure, and the storage levels for respective oil products measured as the average number of weeks of forward demand (consumption) stored. To assess the flexibility of the refining infrastructure the Nelson complexity index is used for each individual refinery and then weighted accordingly. UK refineries score fairly high with an average complexity of 8.26, (see Section VI), falling in the medium resilience category but narrowly missing the high resilience band (Nelson complexity index above 9.0).

UKPIA has estimated that the UK has around 19/20 days of demand storage of finished products (i.e. not including crude oil). UKPIA calculated product storage using two different methodologies – only to enable a confirmation of results. The first test used total CSO obligation as approximated by DECC by product category. To get an average number of days' worth of storage, CSO volumes (by category) were divided by average daily demand. The second methodology used inland consumption i.e. product demand, divided by working refinery storage capacity (UKPIA data set on refinery storage capacity). Both methodologies indicated an average of 19/20 days' worth of storage for each of the categories. However, due to the complexity and unavailability of data, only middle distillates and gasoline were tested. The 'other oil products' were assumed to have the same number of days' worth of storage.

The level of imports a country has is obviously the single biggest factor that affects a country's oil product energy security. The 'deficit' benchmark of high risk is quite clearly set by MOSES at 45% (i.e. refining cover of 100 - 45 = 55%). Worryingly for the UK, in 2013 both diesel and jet fuel are already above this threshold, with burning kerosene in the medium risk category, only just outside of the high risk category.

Under Scenario 2, the Modest Investment Scenario, the UK import dependency remains relatively unchanged, with the refinery improvements more or less keeping pace with changes in middle distillate demand. Only in Scenario 3, the Enhanced Investment Scenario does the import dependency for middle distillates decline, such that the UK would move into the medium risk category for diesel and burning kerosene as defined by the MOSES methodology. Clearly in Scenario 4, the refinery closures case, import dependency for diesel jet and kerosene would be very high at 67 to 78%, well above the high risk benchmark of 45%

In many cases there will be regional differences to the supply chain resilience, owing to the nature of regional supply. It is therefore important to look at the UK refined product supply chain and supply balances for different UK regions.

DESCRIPTION OF UK SUPPLY REFINED PRODUCT SUPPLY CHAIN

Figure VIII-1 shows a map of the UK main fuels supply chain showing refineries, import terminals, inland terminals and pipeline infrastructure.

All UK refineries are situated on the coast. A network of pipelines allows transport of products from coastal refineries to inland terminals in Central and Southern England. No such pipeline network exists for Northern England and Scotland and Northern Ireland. These and other more remote areas are supplied by ship-fed coastal terminals. The source of product for these ship-fed terminals is however usually the main UK refineries. Some additional supply in the Thames region comes from Scandinavia, The Baltics, and the Amsterdam / Rotterdam / Antwerp (ARA) market.

REGIONAL MAIN FUELS PRODUCT SUPPLY

Scotland

Physical supply of main fuels in Scotland is dominated by Grangemouth Refinery, located on the Firth of Forth, 25 miles north east of Glasgow and 20 miles west north west of Edinburgh. Approximately 50% of the population of Scotland live within a 50 mile radius of the refinery.

Grangemouth is connected by pipeline to the Forties field system in North Sea, via the Forties Pipeline System. Grangemouth is also connected by pipelines to Finnart on the west coast that allows import of alternative crude supplies, and provides deep sea export for finished fuels. The jetty terminal at Grangemouth also allows import and export of finished products via the UK east coast. This is also a main supply route for three other Scottish oil terminals at GB Oils Aberdeen, Aberdeen Asco and GB Oils Inverness. These terminals are fed by small (~5000 tonne) multiproduct coaster ships from Grangemouth. Additional supply is also provided by coaster from the Humberside refineries.

Grangemouth has both a road and rail rack for onward distribution of finished products. The road rack allows the refinery to service local demand (50% of Scottish population). Jet fuel is delivered by truck to Glasgow and Edinburgh airports and to Glasgow Prestwick airport by rail. Grangemouth refinery also delivers product to Dalston terminal in Cumbria North West England by rail, and to the NuStar Ross terminal at Grangemouth by pipeline.

The NuStar terminal at Clydebank is ship fed by coasters.

It is very clear that Grangemouth refinery is extremely important in supplying main fuels to Scotland. Not only does the refinery supply the immediate local demand in the major cities of Glasgow and Edinburgh, but a number of the other terminals in Scotland also receive a significant proportion of their supply from Grangemouth.

Grangemouth is connected by pipeline to the Forties system in the North Sea, via the Forties Pipeline System (FPS), a crude transportation system operated by BP. This system brings un-stabilised crude oil from various North Sea fields to Cruden Bay. Natural gas liquids separated from natural gas processing facilities nearby at St. Fergus are also pumped by pipeline to Cruden Bay where they enter the FPS. The oil and gas liquids are then pumped by pipeline to the FPS Kinneil terminal, Grangemouth. At Kinneil light gases and water are removed from the crude oil/gas mixture and the stabilised crude is pumped either to Grangemouth refinery or to the Forties crude loading system at Hound Point for onward sale.

In some cases, the flows of gas from the North Sea platforms (via different pipelines, and ultimately into the NTS system) are dependent on the flow of oil from these platforms into the FPS. That is, if the oil flow is interrupted, then the related gas flow is also interrupted.

Various utilities used within the Kinneil processing plant, including steam and cooling water, are supplied by various facilities on the Grangemouth site that are also used in common by the Grangemouth refinery and other Grangemouth site chemicals businesses. The provision of these utilities is of vital importance to both crude oil and natural gas production from the UK Continental Shelf via the FPS Kinneil processing facility.

FIGURE VIII-1 UK MAIN FUELS DISTRIBUTION INFRASTRUCTURE

Northern Ireland

Northern Ireland has no refinery so all refined products are imported. There are two main terminals, one in Belfast and one in Londonderry (Derry). These are the two largest cities in Northern Ireland, with around 55% of the population living in these cities.

Product supply to Northern Ireland mainly comes from refineries based on the west coast of England, Wales and Scotland, including Pembroke, Stanlow, Milford Haven, Grangemouth via the Finnart export terminal and Fawley. Supply is from the UK west coast refineries as these refineries provide the most economical freight of finished product to Northern Ireland. The Belfast terminal can only accept ships up to 12,000 tonnes, while Londonderry can accept ships up to 24,000 tonnes. Normal deliveries would be on small (4,000 to 10,000 tonne) ships with multi-product delivery.

In an emergency situation additional product could be sourced from the North West Europe market, most likely from the ARA region, or possibly from Northern France (Le Havre). This would be significantly more expensive than supply from the UK mainland west coast, due to the longer journey giving additional freight costs. The supply would also be subject to more delays (particularly in winter) owing to the additional journey times and higher likelihood of stormy weather.

Note that the Whitegate refinery in Cork, Republic of Ireland, supplies around 25 – 30% of the Republic's refined product requirements and therefore does not provide supply to Northern Ireland.

North West England

The main supply is from Stanlow refinery via its road distribution terminal. Stanlow's supply envelope extends up to Scottish borders and down towards the Midlands, and covers the major population centres of Greater Manchester and Merseyside.

Valero will re-open the Manchester terminal during second quarter 2013. Valero can supply to Manchester Terminal via the Mainline pipeline from Pembroke. Esso could supply via the Midline pipeline from Fawley refinery to Manchester terminal although they no longer have any equity in the Manchester terminal. Phillips 66 supply from Immingham refinery via the GPSS pipeline to Bramhall terminal. Greenergy supply into the region via imports to Eastham terminal. Grangemouth refinery supplies Dalston terminal in Cumbria by rail.

Jet is supplied to Manchester airport via pipeline from Stanlow refinery and Backford which is in turn supplied from Immingham via GPSS pipeline. Liverpool airport is supplied from Stanlow via truck.

While there are alternative supply routes as described above, main fuels product supply in this region is primarily from Stanlow refinery.

Wales

North Wales is supplied from Shell Stanlow refinery by truck. Greenergy also supply into the region by truck from Eastham terminal. Valero and Murco supply up into North Wales by truck from the refineries at Pembroke and Milford Haven.

South Wales is supplied primarily from Pembroke and Milford Haven refineries by truck. The Valero Cardiff terminal is supplied by coastal shipping from Pembroke refinery. Greenergy supply into their Cardiff terminal (at Inver Energy) via coastal shipping and via rail freight, and Mabanaft also supply to their Cardiff terminal (at HCB Storage) by rail from Immingham.

Both Pembroke refinery and Milford Haven refinery supply envelopes extend into the Midlands and across the Irish Sea to Northern Ireland and to the Irish republic. Pembroke now also supplies into the North West via the Mainline pipeline to Valero Manchester terminal.

South West England

Refined products are trucked into the region from terminals in the Bristol area (Esso Avonmouth, and Valero Avonmouth (previously known as BOSL)). The Esso Avonmouth terminal is supplied by pipeline from Fawley refinery, Valero Avonmouth is supplied by coastal ship from Milford Haven and Pembroke. Murco Westerleigh is supplied by rail from Milford Haven refinery.

There are two small terminals in Plymouth. Valero Plymouth is supplied by ship from Pembroke refinery. Greenergy Plymouth is supplied by ship with product from the ARA or other North West Europe market by small coasters.

It is well established that supply of refined product into this region is constrained.

South England

The main supply in South England is from Fawley refinery via the road distribution terminal. The BP Hamble terminal adjacent to Fawley refinery is supplied from Fawley via pipeline, but can also be supplied by coastal shipping. The small coastal terminal at Brighton closed in 2013.

Esso Fawley refinery's supply envelope extends to London, Bristol, the Midlands and Manchester owing to its excellent company owned pipeline network and terminals.

South East England and London

With the closure of Coryton refinery there are no refineries situated in this region. Refined product supply is therefore entirely dependent on imports from other regions.

Esso supply into London by pipeline and by ship to their Purfleet terminal on the Thames. Esso also supply to their West London terminal by pipe from Fawley. In addition numerous independent operators in terminals on the Thames are supplied by product imports from the North West Europe market. Murco supply to their Theale terminal near Reading by rail from Milford Haven refinery.

(The Buncefield terminal was previously supplied by pipeline from Stanlow, Pembroke, Lindsey and Coryton. The road fuels terminal at Buncefield was destroyed by explosion and fire in December 2005)

Owing to the fact that this region faces severe supply constraints, product is trucked into the London and the South East from the West Midlands terminals.

This region is also home to the London airports, and therefore the associated very high jet fuel demand. Heathrow airport is supplied by pipeline from Esso Fawley refinery, by pipeline from Shell Haven and BP Isle of Grain jet import terminals, by pipeline from Avonmouth and by pipeline from Total Lindsey refinery via Buncefield. Valero also supplies Heathrow via pipeline from Kingsbury, in turn supplied via pipeline from Pembroke.

Gatwick airport is supplied by pipeline from Esso Fawley and by pipeline from BP Isle of Grain. Stansted is supplied by pipeline from Shell Haven and BP Isle of Grain via sections of UKOP South and the Government Pipeline and Storage System GPSS. Luton airport and London City airport are supplied by truck loading at the import terminals.

Midlands

There are no refineries situated in the Midlands. Product supply is via a number of secondary distribution terminals

The Shell/BP Kingsbury terminal is supplied by pipe from Stanlow. It is also connected to Coryton, so could be supplied in future from the import terminal that emerges on the site of the now closed refinery. Valero supply to Valero Kingsbury by pipe from Pembroke. Total supply to WOSL by rail from Lindsey and Phillips 66 supply by rail from Immingham refinery to WOSL. The BP Northampton terminal was previously supplied by pipe from Coryton. Esso supply to Bromford terminal by pipeline from Esso Fawley. Murco Milford Haven could also supply via mainline pipeline to WOSL and Valero Kingsbury terminals. The Murco Bedworth terminal is supplied by rail from Milford Haven refinery.

Birmingham airport is supplied by truck from BP Kingsbury and by pipeline from Esso Fawley.

Although this region has no refineries, the terminals in the region are connected to all six refineries in England. This makes this region the most competitive market in the UK, and also the most robust and resilient from the point of view of product supply.

Material from the West Midlands terminals is often supplied by truck to north and north-west London to make up product shortfalls due to logistics constraints in the South East.

North East England

The main product supply in North East England is from Lindsey and Immingham refineries both situated at Immingham in the south of this region. In addition these two refineries supply product to the Shell Jarrow terminal by rail, and occasionally supply product to the Aberdeen terminals by small coaster. The supply envelope for the two refineries extends across the North East of England and into the Midlands and down towards London.

Other major supply into the region includes the new Greenergy import and blending facility terminal at Teesside. In the far North East of the region there may be some supply from Grangemouth refinery by truck.

REGIONAL SUPPLY ROBUSTNESS AND RESILIENCE

Regional demand data for gasoline and diesel is collated and published by DECC in the Digest of United Kingdom Energy Statistics (DUKES). Data is provided down to Local Administrative Unit level 1, and summed to regional level. For road transport fuels these are published in “Regional and Local Authority Road Transport Consumption Statistics 2005 to 2010”

Regional data is also reported by DECC for domestic energy consumption, including petroleum products which would primarily represent domestic kerosene consumption. These may be found in “Estimates of non gas, non electricity and non road transport fuels at regional and local authority level 2005 to 2010”.

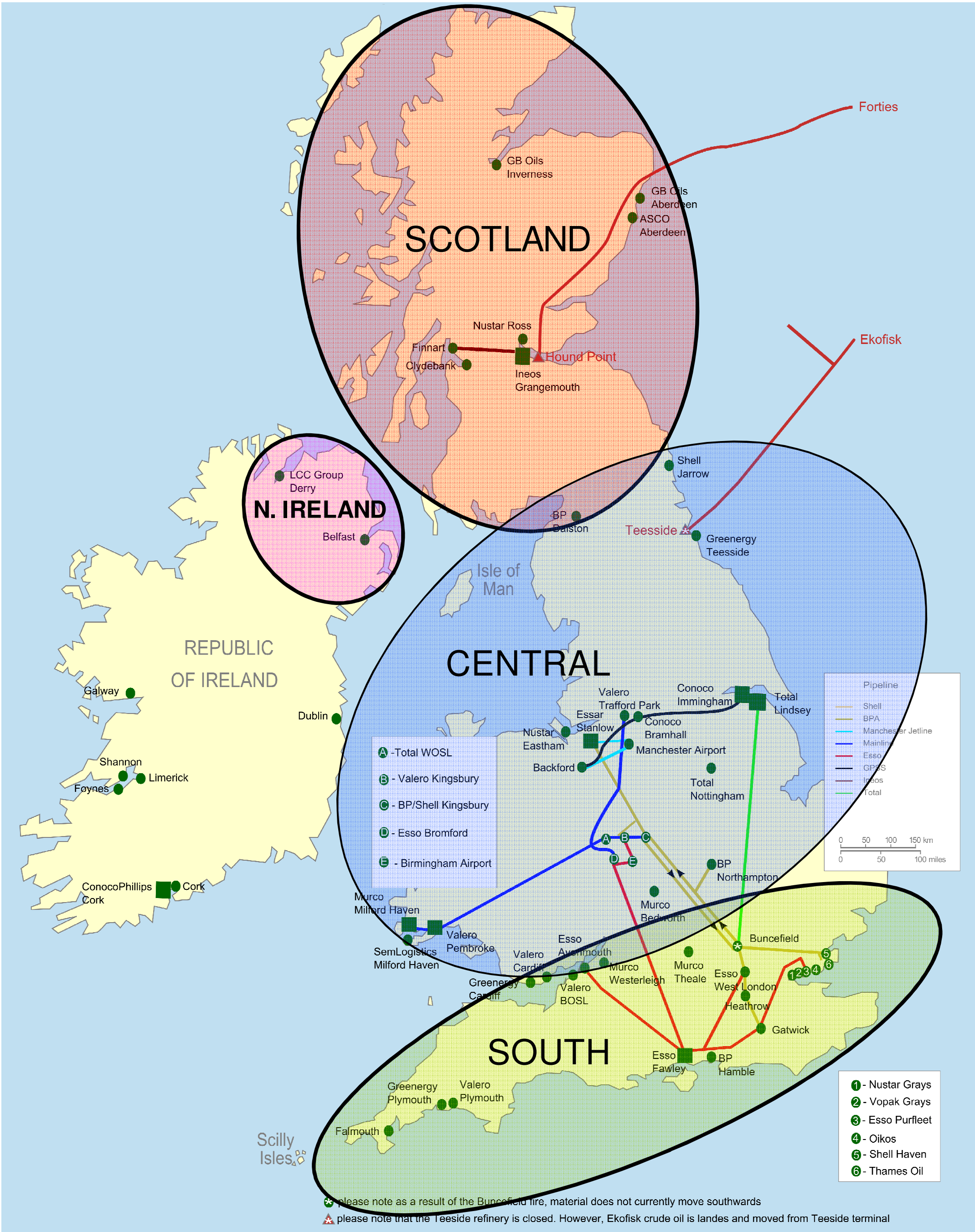
Regional jet fuel consumption can be collated by mapping the jet fuel demand at airports to the regions or in this case supply envelope in which the airports are situated.

The different UK regions can be mapped to different main fuels supply envelopes. These UK regions and main fuel supply envelopes are shown in the table below and in Figure VIII-2. The supply envelopes are defined based on their potential to be supplied from the different UK refineries, which in turn depends on the existing logistic infrastructure.

UK Government Regions and Main Fuel Supply Envelopes

Official Region	Defined Main Fuels Supply Envelope
North East England	Central
North West England	Central
Yorkshire and Humber	Central
East Midlands	Central
West Midlands	Central
East of England	South
Greater London	South
South East England	South
South West England	South
Wales	Central
Northern Ireland	Northern Ireland
Scotland	Scotland

FIGURE VIII-2: DEFINED UK SUPPLY ENVELOPES



Northern Ireland and Scotland are defined as individual supply envelopes. This is because in the case of Northern Ireland it is isolated from the rest of the UK by geography, and has no own refinery supply. As described above, Scotland is very much dependent on Grangemouth for its main fuel supply, and is also isolated by geography from other sources of supply, with only limited volumes provided by ship into the region from other refineries.

The Central supply envelope has been defined as consisting of North East England, North West England, Yorkshire and Humber, East Midlands, West Midlands and Wales. This is because these regions are connected to each other by existing main fuels distribution infrastructure. There are many existing supply routes from UK refineries into this envelope. Wales can be supplied by Stanlow, Pembroke and Milford Haven refineries. These three refineries are also connected by pipelines to the Midlands. Stanlow and Pembroke supply into North West England, as does Immingham refinery. Immingham and Lindsey refineries supply Yorkshire and Humberside and North East England, and both are connected by rail to the Midlands.

The South supply envelope is defined as consisting of Greater London, East England, South East England, and South West England. The only refinery in this envelope is Fawley refinery, and there are limited connections into this envelope from other envelopes. The UKOP south pipeline potentially connects Buncefield to Stanlow, Pembroke and Milford Haven. The FINA line connects Lindsey to Buncefield. However the main-fuels facility at Buncefield has been out of action since the explosion and fire of December 2005. Prior to its closure, Coryton refinery was a key supplier into this envelope, but this has now ceased. Other important supply comes into the various import terminals on the Thames.

Based on DUKES data for 2005 to 2010 for diesel, gasoline and kerosene and a 2010 estimate for UK airports demand, the following demand profile for these fuels across the country can be determined.

% of UK demand by Fuel by Supply Envelope

Envelope	Gasoline	Diesel	Kerosene	Jet
Central	45.2	47.1	21.1	15.2
South	44.0	40.6	29.6	79.8
Scotland	7.7	8.7	8.9	3.3
Northern Ireland	3.1	3.5	40.4	1.7

Source: Gasoline, Diesel, Kerosene, DECC 2005-2010

The demand split across the supply envelopes for each product is shown in Table VIII-1. To approximate supply in each envelope we have taken the UK national average refined product production yield profile and applied this to the published refinery capacities in each envelope, adjusting this for overall UK refinery throughput. This allows us to determine the approximate supply for each refined product in each supply envelope. Then refining cover for gasoline, diesel, kerosene and jet has been calculated for each supply envelope. (Naturally refining cover in Northern Ireland is zero, as there is no refinery situated in Northern Ireland). The full calculation is shown in Table VIII-1, and summarised below. The projections correspond to Scenario 2, the modest investment scenario.

UNITED KINGDOM REGIONAL REFINED PRODUCT COVER (percent of demand produced)

		2000	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030
Gasoline	Central estimate	144	163	175	185	171	176	184	193	216	220	213
	South estimate	68	73	81	84	64	40	41	43	49	50	48
	Scotland estimate	172	186	205	213	197	203	211	222	249	254	245
	Northern Ireland	0	0	0	0	0	0	0	0	0	0	0
Jet	Central estimate	237	167	197	222	204	208	206	204	199	198	197
	South estimate	21	14	17	19	14	9	9	8	8	8	8
	Scotland estimate	220	148	181	199	184	187	185	183	179	178	177
	Northern Ireland	0	0	0	0	0	0	0	0	0	0	0
Kerosene	Central estimate	229	249	199	213	187	186	184	184	186	189	190
	South estimate	75	78	64	67	49	29	29	29	29	29	30
	Scotland estimate	110	115	95	99	87	87	86	86	87	88	89
	Northern Ireland	0	0	0	0	0	0	0	0	0	0	0
Diesel	Central estimate	-	127	90	92	77	80	79	79	79	82	86
	South estimate	-	65	47	47	33	20	20	20	20	21	22
	Scotland estimate	-	134	98	98	82	85	84	84	84	87	92
	Northern Ireland	-	0	0	0	0	0	0	0	0	0	0

It can be seen that the South envelope is short of all products, and that the level of refining cover dropped substantially in 2012 with the closure of Coryton refinery. If the South envelope were to be ranked using the MOSES methodology described above, it would be very much in the high risk category (imports > 45%, or refined cover < 55%). In addition the import facilities into this region are running at or very close to their maximum capacity, and could not bridge the gap if supply were to be lost from the Fawley refinery. Therefore supply in this region is neither robust nor resilient.

The central envelope has a surplus of all products except diesel. Thus it is not surprising that refineries in this envelope supply product to Northern Ireland (and the Irish Republic) by ship, and also by truck and pipeline into the South envelope. If ranked using the MOSES methodology the Central envelope would be in the low risk category (import dependency < 25%). The central envelope overall is both robust and resilient. It has many sources of supply and so the potential loss of one of these sources can be largely compensated for by short term additional supply from other sources but this would not be sustainable on a long term basis. The North West region within this envelope would struggle to maintain local supply in the event of loss of supply from Stanlow refinery, although the re-opening of the Valero Manchester terminal will provide more security of supply for the region.

Scotland also has a surplus of gasoline and jet but nominally not kerosene (based on average national yield estimates). In fact some surplus jet would be transferred to kerosene to keep kerosene cover at demand. Therefore it is unsurprising that surplus product moves from the Scotland envelope to Northern Ireland. If ranked using the MOSES methodology the Scotland envelope would also be in the low risk category (import dependency < 25%). However the Scotland envelope has low resilience. The import capacity of the other terminals is not sufficient to compensate for the loss of supply from Grangemouth refinery.

Note it is likely that some surplus product from the Scotland and Central envelopes gets exported, rather than transferred to the south envelope. There are two main reasons for this, 1) constrained logistics (e.g. pipelines, rail facilities) that limit the volumes that can be physically moved down into the south envelope, and 2) the application of hydrocarbon duties, VAT and duty paid losses to ship movements that makes it more attractive to import directly from the continent than to undertake a UK-UK shipping movement

UK to UK shipping movements

Finished products that cross the duty point from a UK refinery (in this case the bonded refinery boundary) for delivery to another UK destination are liable to both excise duty and VAT. Currently the excise duty payable in the UK for unleaded gasoline and diesel is £0.5795 per litre.

On an ocean voyage a small portion of the hydrocarbon on ship is lost, during loading, discharge, and the voyage itself. For the purpose of assessing duty losses this is defined as 0.3% of the cargo. Note this is a nominal accounting loss, not an actual physical loss of 0.3%. For a UK-UK movement, hydrocarbon excise duty has to be paid on this nominal ocean loss of 0.3%. VAT also has to be paid on both the physical hydrocarbon loss and the excise duty paid on this hydrocarbon loss. For an import from overseas, the ocean losses are not subject to UK excise duty or VAT. This creates a significant disadvantage for UK refiners moving product to another UK port compared to overseas refiners. The table below shows an example calculation of this impact for a gasoline movement.

Duty Paid Losses Example: Impact on delivered price

	UK-UK	Europe-UK	Difference
Hydrocarbon Price ($/t)	1000.0	1000.0	0.0
UK excise duty ($/t)	1227.6	paid when product leaves import terminal	0.0
Nominal Hydrocarbon loss (0.3%) ($/t)	3.0	3.0	0.0
Duty Paid Loss (0.3%) ($/t)	3.7	0.0	3.7
VAT on Duty Loss ($/t)	0.7	0.0	0.7
VAT on hydrocarbon loss ($/t)	0.6	0.0	0.6
Total Cost of duty, duty losses ($/t)	***5.0***	***0.0***	***5.0***
Total Cost ($/t)	**8.0**	**3.0**	**5.0**

Note. 0.3% is the standard charge applied for UK duty loss. Exchange rate £1 = $1.6. 1325 litres per tonne

The application of UK duties and VAT on ocean losses creates a significant cost for UK - UK movement compared to a Europe – UK movement. As a result, UK refiners are better off exporting the product to Europe (or other location) whereby the product is loaded on ship with no UK excise duty and VAT. Likewise importers can obtain more cost effective product by importing direct from the European (or International) market.

In addition to the duty paid losses issue above, there is also a large cash-flow disadvantage for UK refiners selling to each other or a UK based importer compared to purchasing from a European source. For bulk UK-UK movements the customer usually purchases “duty paid” or “duty deferred”.

- Duty Paid: Customer is invoiced for product, excise duty, VAT on product and VAT on excise duty.
- Duty Deferred: Customer is invoiced for product, VAT on product and VAT on excise duty. Customer pays excise duty at later date.

For a purchase from the European market, excise duty is not payable until after the product leaves the bonded import terminal (duty suspended). The following table shows the cash flow position for a purchase of 20,000 tonnes of diesel at an example price of $1000 per tonne. One purchase is a UK-UK movement with duty paid, the second is for a UK-UK movement with duty deferred, and the third is for an EU-UK movement where duty and VAT are not incurred until the product leaves the bonded import terminal.

Example Diesel Cargo Comparison: Cash Flow Analysis

	UK-UK Duty Paid	**UK-UK Duty Deferred**	**EU-UK Duty Suspended**
Quantity (tonnes)	20000	20000	20000
Quantity (litres)	23668639	23668639	23668639
Hydrocarbon Price ($/t)	1000.0	1000.0	1000.0
Exchange Rate ($ per £)	1.5	1.5	1.5
Excise Duty (£/litre)	0.5795	0.5795	0.0000
Hydrocarbon Value ($)	20,000,000.00	20,000,000.00	20,000,000.00
VAT on Hydrocarbon ($)	4,000,000.00	4,000,000.00	-
Excise Duty (£)	*13,715,976.33*	-	-
VAT on Excise Duty (£)	*2,743,195.27*	*2,743,195.27*	-
Excise Duty ($)	20,573,964.50	-	-
VAT on Excise Duty ($)	4,114,792.90	4,114,792.90	-
Total Invoice Value ($)	**48,688,757.40**	**28,114,792.90**	**20,000,000.00**
Payment Terms	5 days after bill of lading	Product and VAT 5 days after bill of lading. Excise duty at end of duty period	Product 5 days after bill of lading. Excise duty and VAT chargeable on exit from terminal

It can be seen that a customer has to pay significantly more money up-front for a delivery into terminal sourced from a UK refiner than for the same volume of delivery from a European (or other overseas) refiner. Overall the total paid for each cargo would be the same over time (here we are not taking into account any duty losses), as the excise duty and VAT are eventually charged either at the end of the duty period (i.e. monthly) or at the imported product leaves the import terminal for inland delivery. The difference to the buyer is that the time between buyer incurring the duty and VAT liability and the time the buyer in turn collects this from buyer's on-sale customer is very much reduced.

Given the above duty loss differential of around $5/tonne and cash flow disadvantage it is not surprising that UK refiners only have limited movements of product by ship to other UK import terminals and that many terminals import directly from the International market.

This situation could be altered by allowing finished grade products to move between UK bonded locations under duty suspension. Such an action would have little impact on the UK treasury as excise duty and VAT would still be collected on all main fuels sales in the UK. However such an action would make it economically viable for UK refiners to move surplus product from the Central and Scotland envelopes, to the South envelope, improving the resilience of South envelope supply.

CONCLUSIONS

Overall the UK has a robust and resilient supply of gasoline and gasoil as these products are in surplus, with many suppliers across the country. However the supply of diesel and in particular jet fuel and kerosene are not robust. The IEA defines an import dependency of greater than 45% of demand as being high risk. Worryingly for the UK, in 2013 both diesel and jet fuel is above this threshold at 47% and 55% respectively. Burning kerosene would be in just the medium risk category with import dependency of 44%.

The UK picture is different across different regions. Northern Ireland has very poor robustness, with 100% import dependency on the rest of the UK. However the fact that Northern Ireland has a number of potential suppliers within the UK and its demand is relatively small, means that its supply is resilient – short term disruption to one supply source can be replaced by supply from another UK based supplier.

Scotland has good robustness, with surplus supply of gasoline, jet, and gasoil, and a modest deficit of diesel. However Scotland has poor resilience, with very high dependency on Grangemouth refinery.

The Central supply envelope (comprising North West and North East England, Wales, Yorkshire and Humberside, West Midlands and East Midlands) is the most robust and resilient region in the UK. The region has a surplus of gasoline, jet and kerosene and a modest deficit of diesel. In addition the region has multiple suppliers and would therefore be resilient to a short term disruption to a single supplier.

The South envelope, comprising of London, South East England and South West England is neither robust nor resilient. The region is short of all products, with even gasoline having an import dependency of 60% and jet fuel an import dependency of 91%! Although there are multiple importers supplying product into the region, the import infrastructure is running at capacity, and could not cope with additional demand if there were a disruption to supply from Fawley refinery. Jet fuel would be more resilient than other fuels simply because such a large volume is already imported through existing dedicated infrastructure that loss of refinery supply would be less significant. However short term resilience would remain poor as it would take time to arrange for additional large volume imports from the distant supply regions of the Middle East, India, USA, and Asia.

TABLE VIII-1
UK REGIONAL REFINED DEMAND, PRODUCTION, AND REFINING COVER SPLIT
(Thousand Tonnes per Annum)

	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2025	2030
UK Refinery Capacity	89,234	91,527	89,818	91,034	86,734	78,488	78,488	78,488	78,488	78,488	78,488	78,488	78,488	78,488	78,488
Refinery Total Utilisation, %	98.6	94.1	82.9	95.7	88.6	92.2	92.2	92.2	92.2	92.2	92.2	92.1	92.1	92.0	91.9
Regional Refinery Capacity															
Central	53,720	56,013	54,304	55,520	55,462	55,404	55,404	55,404	55,404	55,404	55,404	55,404	55,404	55,404	55,404
South	24,564	24,564	24,564	24,564	20,322	12,134	12,134	12,134	12,134	12,134	12,134	12,134	12,134	12,134	12,134
Scotland	10,950	10,950	10,950	10,950	10,950	10,950	10,950	10,950	10,950	10,950	10,950	10,950	10,950	10,950	10,950
Northern Ireland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gasoline															
UK Demand	21,655	18,850	15,035	14,095	13,369	12,596	11,891	11,163	10,557	10,137	9,776	9,462	9,187	8,265	7,800
Central	9,782	8,515	6,791	6,367	6,039	5,690	5,371	5,043	4,769	4,579	4,416	4,274	4,150	3,734	3,523
South	9,526	8,292	6,614	6,201	5,881	5,541	5,231	4,911	4,644	4,459	4,300	4,162	4,042	3,636	3,431
Scotland	1,678	1,461	1,165	1,092	1,036	976	921	865	818	786	758	733	712	641	604
Northern Ireland	669	582	464	435	413	389	367	345	326	313	302	292	284	255	241
UK Production	23,470	22,652	19,629	19,341	16,180	14,175	13,966	13,756	13,546	13,337	13,127	12,918	12,708	11,660	10,612
Central estimate	14,129	13,863	11,868	11,796	10,346	10,006	9,858	9,710	9,562	9,414	9,266	9,119	8,971	8,231	7,491
South estimate	6,461	6,079	5,368	5,219	3,791	2,191	2,159	2,127	2,094	2,062	2,029	1,997	1,965	1,803	1,641
Scotland estimate	2,880	2,710	2,393	2,326	2,043	1,978	1,948	1,919	1,890	1,861	1,831	1,802	1,773	1,627	1,481
Northern Ireland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gasoline Refining Cover %															
Central estimate	144	163	175	185	171	176	184	193	201	206	210	213	216	220	213
South estimate	68	73	81	84	64	40	41	43	45	46	47	48	49	50	48
Scotland estimate	172	186	205	213	197	203	211	222	231	237	242	246	249	254	245
Northern Ireland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jet Fuel															
UK Demand	10,838	12,497	11,472	11,292	11,405	11,633	11,807	11,985	12,140	12,274	12,384	12,471	12,533	12,850	13,174
Central	1,644	1,896	1,740	1,713	1,730	1,765	1,791	1,818	1,842	1,862	1,879	1,892	1,901	1,949	1,999
South	8,650	9,974	9,156	9,012	9,103	9,285	9,424	9,565	9,690	9,796	9,884	9,954	10,003	10,256	10,515
Scotland	361	417	382	376	380	388	394	399	405	409	413	416	418	428	439
Northern Ireland	182	210	193	190	192	196	199	202	204	207	208	210	211	216	222
UK Production	6,485	5,167	5,671	6,232	5,529	5,198	5,221	5,243	5,266	5,288	5,311	5,333	5,356	5,468	5,581
Central estimate	3,904	3,162	3,429	3,801	3,535	3,670	3,685	3,701	3,717	3,733	3,749	3,765	3,781	3,860	3,939
South estimate	1,785	1,387	1,551	1,682	1,295	804	807	811	814	818	821	825	828	845	863
Scotland estimate	796	618	691	750	698	725	728	732	735	738	741	744	747	763	779
Northern Ireland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jet Fuel Refining Cover %															
Central estimate	237	167	197	222	204	208	206	204	202	200	200	199	199	198	197
South estimate	21	14	17	19	14	9	9	8	8	8	8	8	8	8	8
Scotland estimate	220	148	181	199	184	187	185	183	182	180	180	179	179	178	177
Northern Ireland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kerosene															
UK Demand	3,838	3,870	3,860	3,411	3,547	3,618	3,654	3,654	3,652	3,646	3,637	3,625	3,611	3,550	3,507
Central	809	816	814	719	748	763	771	771	770	769	767	765	761	749	740
South	1,137	1,146	1,143	1,010	1,050	1,071	1,082	1,082	1,081	1,080	1,077	1,074	1,069	1,051	1,039
Scotland	342	345	344	304	316	323	326	326	326	325	324	323	322	317	313
Northern Ireland	1,550	1,563	1,559	1,377	1,432	1,461	1,476	1,476	1,474	1,472	1,468	1,464	1,458	1,433	1,416
UK Production	3,077	3,325	2,680	2,509	2,184	2,010	2,009	2,008	2,007	2,006	2,006	2,005	2,004	2,000	1,996
Central estimate	1,852	2,035	1,620	1,530	1,397	1,419	1,418	1,417	1,417	1,416	1,416	1,415	1,415	1,412	1,409
South estimate	847	892	733	677	512	311	311	310	310	310	310	310	310	309	309
Scotland estimate	378	398	327	302	276	280	280	280	280	280	280	280	280	279	278
Northern Ireland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kerosene Refining Cover %															
Central estimate	229	249	199	213	187	186	184	184	184	184	185	185	186	189	190
South estimate	75	78	64	67	49	29	29	29	29	29	29	29	29	29	30
Scotland estimate	110	115	95	99	87	87	86	86	86	86	86	86	87	88	89
Northern Ireland	-	5	10	11	12	13	14	15	16	17	18	19	20	25	30
Diesel															
UK Demand	15,881	19,465	21,835	23,544	23,792	24,362	24,966	25,601	26,244	26,850	27,403	27,903	28,355	29,938	30,902
Central	7,485	9,174	10,291	11,096	11,213	11,482	11,767	12,066	12,369	12,654	12,915	13,151	13,364	14,110	14,564
South	6,443	7,897	8,859	9,552	9,653	9,884	10,129	10,387	10,648	10,894	11,118	11,321	11,504	12,147	12,538
Scotland	1,389	1,703	1,910	2,060	2,082	2,132	2,184	2,240	2,296	2,349	2,398	2,441	2,481	2,619	2,704
Northern Ireland	563	691	775	835	844	864	886	908	931	953	972	990	1,006	1,062	1,096
UK Production		19,056	15,332	16,801	13,444	12,939	13,225	13,511	13,797	14,083	14,369	14,655	14,941	16,372	17,802
Central estimate		11,662	9,270	10,246	8,597	9,133	9,335	9,537	9,739	9,941	10,143	10,345	10,547	11,557	12,566
South estimate		5,114	4,193	4,533	3,150	2,000	2,045	2,089	2,133	2,177	2,221	2,266	2,310	2,531	2,752
Scotland estimate		2,280	1,869	2,021	1,697	1,805	1,845	1,885	1,925	1,965	2,005	2,045	2,085	2,284	2,484
Northern Ireland		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Refining Cover %															
Central estimate		127	90	92	77	80	79	79	79	79	79	79	79	82	86
South estimate		65	47	47	33	20	20	20	20	20	20	20	20	21	22
Scotland estimate		134	98	98	82	85	84	84	84	84	84	84	84	87	92
Northern Ireland		-	-	-	-	-	-	-	-	-	-	-	-	-	-

IX. UK REFINERIES CONTRIBUTION TO UK ECONOMY AND SOCIETY

MODELLING APPROACH

To assess the economic contribution of the UK refineries to the UK economy, IHS has developed a macro-economic model to capture the direct, indirect and induced effects produced by the refineries based upon industry standard Input-Output (I-O) techniques, for which economist Wassily Leontief earned a Nobel Prize in 1973.

- **Direct Effects**: are the direct responses of an economy to changes in the final demand of a given industry or set of industries. In the model developed for this project, direct effects capture the impacts of direct employment and production associated with the refineries.

- **Indirect Effects** (also known as **Supplier Effects**): refer to the "ripple responses" of an economy to subsequent final demand shifts within industries that serve the direct industries. In essence, the indirect effects capture the response of the refineries' extended domestic supply chain.

- **Induced Effects** (also known as **Income Effects**): refer to the response of an economy to changes in household spending attributable to income generated by the direct and indirect effects. Employees within the direct and indirect industries also act as consumers in the general UK economy. Induced effects capture the impacts of this consumer activity.

An explanation of the full range of I-O techniques, which includes the manipulation and inversion of data matrices using matrix algebra, is beyond the scope of this report. However in Annex 2, a detailed description of the modelling approach used is described.

For this project, IHS developed a partial Social Accounting Matrix (SAM) for the UK economy, based primarily on data available from the Office of National Statistics (ONS). A Social Accounting Matrix provides a complete, consistent and balanced representation of all activity within an economy.

The model developed for this project covered 110 distinct industry sub-sectors of the UK economy. The results of the economic impact analysis were aggregated into 14 industry super-sectors, based on International Standard Industrial Classification (ISIC) Revision 3 conventions. The most recent 2010 data from the Office of National Statistics on the economic activity and employment for each of these sectors were complied and used in the development and calibration of the model.

When considering the contribution of the refineries to the UK economy, there are two primary areas of concern. The first is that consumption of refined petroleum products in the UK will most likely be unaffected by the closure of any of the UK refineries. Rather, any decline in domestic refined product production will be offset by a corresponding increase in imports of refined products. Second, closure of any UK refineries will not impact global demand for crude oil produced in the UK. In other words, any crude oil that the UK refineries would have purchased will be exported to the world market. It stands to reason that the value of imported refined product would normally be greater than the value of equivalent volume crude oil exports. Thus a first-order effect of closing a UK refinery is the lowering of UK GDP. The amount of this decrease would be the difference in net exports (i.e. crude oil exports minus refined product imports) which in principle is equivalent to the refinery gross hydrocarbon margin.

The I-O model developed for this engagement utilises output (or industry sales) as a primary input. These include refinery production, capital expenditures and operating expenses. The model then quantifies the subsequent direct and induced changes in output experienced by any of the 110 industry sub-sectors. Employment impacts were assessed by applying industry sub-sector output per worker data compiled from ONS data to quantify the number of workers required to support these changes in output. The changes in industry sub-sector output are then used to determine the value-added into the economy and labour income. Finally, the employment, value added and labour income are aggregated by the 14 super-sectors and reported out by direct, indirect and induced impacts.

ESTIMATE OF DIRECT CONTRIBUTION OF UK REFINING INDUSTRY TO UK ECONOMY

A comprehensive survey of UK refinery performance in 2011 was undertaken to provide as accurate as possible input data to the macro-economic model. Information was collected on number of personnel employed, number of contractors employed (including during major turnarounds), average employee and contractor remuneration, refinery throughput and product production, refinery gross margin, refinery operating costs, refinery net margin, and capital expenditure. The aim was to as accurately as possible determine the economic contribution in terms of money input into the UK economy.

As shown in Section IV, 2011 was a poor year for refining margins in Europe (and elsewhere) and this is confirmed by the UK refinery submissions. As a result, 2011 was not a typical year and earnings (and therefore net contribution to the UK economy) would have been down on previous years. It is already known that 2012 was a better year for refinery margins. Therefore as well as using actual data supplied by the refineries for 2011, Purvin & Gertz also utilised the refinery data to compile a future data set under a more normal refinery margin scenario. This future data set (actually 2025, but could be any year from 2016 through to 2030) corresponds to Purvin & Gertz long term pricing forecasts for crude oils and refined products in Europe.

The aggregated data collected from UK refineries for 2011 together with the future normal year projection compiled by Purvin & Gertz is shown in Table IX-1, and summarised in the table below. This information forms the refining industry specific input data to the IHS macro-economic model.

SUMMARY OF AGGREGATED UK REFINERY DATA

		2011	Future Normal Year (2025)
No. of Direct Employees		4162	4162
No. of Contractors Employed		4380	4380
Total Salaries Paid	£M	416	416
Total Income Tax Paid	£M	95	95
Total National Insurance Paid	£M	35	35
Total Employer National Insurance Contribution	£M	49	49
Total Refinery Throughput	kbbl	521,939	561,205
Gross Refinery Margin	$M	1705	3727
Total Operating Costs	$M	2195	2254
Net Cash Margin	$M	-490	1473
Gross Refinery Margin	$/bbl	3.27	6.64
Total Operating Costs	$/bbl	4.21	4.02
Net Cash Margin	**$/bbl**	**-0.94**	**2.62**
Annualised Turnaround Costs	$M	214	214
Depreciation	$M	236	236
Calculated Operating Result	$M	-939	1024
Estimated Corporation Tax Paid	$M	-244	266
Estimated Corporation Tax Paid	£M	-152	166
Capital Expenditure	£M	355	355
Total Input to UK Economy	£M	**1702**	**2057**

In 2011 the refining industry directly employed 4162 people with a further 4380 people working on the refinery sites as contractors. These personnel were paid a total of 416 million pounds, generating 95 million pounds income tax and 35 million pounds national insurance contributions. In addition the refining industry and contractor employers paid an additional 49 million pounds in employer national insurance contributions.

Owing to the poor margin environment in 2011, this was a very difficult year for UK refiners. The industry earned a gross margin of around 3.27 $/bbl but operating costs were 4.21 $/bbl giving a net cash margin of minus 0.94 $/bbl.

Despite this the industry also spent $214M (£134M) on maintenance turnarounds and had capital expenditure of £355M, 82% of which was sustaining capital (i.e. licence to operate) rather than on profit improvement. Our estimate of the total contribution of the main fuels refining industry in terms of money provided into the UK economy in 2011 is £1,702 million.

Purvin & Gertz have taken the 2011 UK industry performance, and projected this forward based on our long term crude oil and refined product price sets, to provide a similar set of data for a more normal margin year. The main change between this future normal year data and 2011 data is the underlying refinery margins, which are expected to be significantly better than 2011. Some minor changes to refinery throughput and variable operating costs are also included.

In this future normal year (2025), the industry would be expected to earn a gross margin or around 6.6 $/bbl, with operating costs of 4.0 $/bbl, giving a net cash margin of 2.6 $/bbl. With other contributions being held at the same level as in 2011, our estimate of the total contribution of the main fuels refining industry in terms of money provided into the UK economy in a future normal year would be £2,057 million.

Table IX-1 also shows that, in 2011, the refineries' spent about £1.4 billion on intermediate goods and services (i.e. cash operating costs - chemicals, supplies, other opex, sustaining capex, etc.), exclusive of crude oil purchases. In deriving the contributions the refineries make to the UK economy, the impact of crude oil purchases was not included. The rationale for this criterion is that global demand for crude oil is such that any decline in demand from UK refineries will simply shift to refineries elsewhere. Thus, the economic impact of UK crude oil production will remain, regardless of whether all seven UK refineries are running at full capacity or completely shut down. Therefore, to derive a more realistic view of the refineries' economic contribution, crude oil purchases were not included in the final assessment. The remaining expenditures, which were mapped to their corresponding commodity industries in the SAM model, result in the indirect, or supply chain, impacts.

MODEL OUTPUT

CONTRIBUTION OF UK REFINERIES TO UK ECONOMY IN 2011

Tables IX-2 – IX-4 present the intermediate and final results of the procedure used to derive the 2011 economic impact of refineries on the UK economy.

The value added to the GDP of the UK economy is defined as the refineries' collective sales revenues less the cost of intermediate input goods and services. Alternatively, value added can be viewed as the sum of the Gross Operating Surplus (GOS) of a company and the Wages/Compensation paid to employees. GOS serves as the source from which taxes are paid and profits are retained. Based on the survey data collected for this project, the refineries' direct value added for 2011 was £6M on the UK economy – reflecting the very poor margin environment.

Table IX-2 shows that the Refinery Business ecosystem currently supports close to 88,100 jobs, and contributes approximately £10.1 billion to the UK economy. Table IX-3 shows that over 61,500 of the jobs and £9 billion of the GDP contribution are tied to the production of crude oil and, therefore, are not necessarily at risk if UK refineries were to close – providing that this level of refining activity continues to take place somewhere else in the world.

{Ultimately production of crude oil and oil refining are completely linked to each other. On an individual refinery basis, or even country basis, the argument can be made that closure of refineries does not impact the production of crude oil as other refineries elsewhere pick up the slack in order to continue to supply the required refined products. However closure of enough refineries would impact crude oil production and refined product supply. So if this study were focused on larger region such as Europe or the USA instead of the UK it would not be possible to argue that closure of refineries would not impact crude oil production. Some crude oil production somewhere in the world is dependent on UK refined product demand and hence the UK refineries.}

This leaves (Table IX-4) some 26,400 jobs and £1.1 billion of GDP contribution remaining. Only 8,500 are direct refinery jobs; the remaining 18,000 are indirect and induced jobs. The low margins experienced by the UK refineries in 2011 have resulted in only £6 million net contribution to UK GDP owing to the actual activity of refining. The refinery supply chain (indirect effects which includes refinery operational expenditure) accounted for £0.79 billion, almost three-quarters of the £1.1 billion of GDP contribution.

In conclusion, in 2011 the total contribution to the UK GDP attributable to the existence of the UK refineries was £1.1 billion.

CONTRIBUTION OF UK REFINERIES TO UK ECONOMY IN FUTURE NORMAL YEAR (2025)

Tables IX-5 – IX-7 present the intermediate and final results of the procedure used to derive the economic contribution of the refineries on the UK economy in a more normal margin year. In this case 2025 was selected as being representative of our Long Term Refining Margins forecast, but any year from 2016 through to 2030 would provide the same result.

Note that the employment tables for our normal year are the same as for the 2011 case. The main change to the 2011 case is the expected improvement in refinery margins. This together with a slight increase in processing volume and increase in operating costs results in an increased contribution to the UK economy.

Table IX-5 shows that in a normal year the Refinery Business ecosystem would contribute approximately £12 billion to the UK economy. Table IX-6 shows that £9.7 billion of the GDP contribution are resultant on the production of crude oil.

This leaves (Table IX-7) £2.3 billion of GDP contribution remaining. Of this £1.2 billion is the net contribution to UK GDP owing to the actual activity of refining, with the refinery supply chain (indirect effects which includes refinery operational expenditure) accounting for a further £0.8 billion and the induced effects accounting for a further £0.3 billion.

Therefore in a normal margin year the total contribution to the UK GDP attributable to the existence of the UK refineries would be just over £2.3 billion.

TABLE IX-1
SUMMARY OF AGGREGATED UK REFINERY DATA

			Units	2011	Future Normal Year
Employees		No. of Employees		4,162	4,162
		Average Annual Salary	£	58,895	58,895
		Total Salaries Paid	M£	245.1	245.1
	a	Estimated Employee Income Tax Paid	M£	62.7	62.7
	b	Estimated Employee National Insurance Paid	M£	18.8	18.8
	c	Estimated Refinery National Insurance Paid	M£	29.5	29.5
	d	Estimated Employee Take-Home Pay	M£	163.6	163.6
Contractors		No. of Contractors on site		4,380	4,380
		Average Annual Salary (£)	£	39,083	39,083
		Total Contractor Salaries Paid (£)	M£	171.2	171.2
	e	Estimated Contractor Income Tax Paid	M£	32.7	32.7
	f	Estimated Contractor National Insurance Paid	M£	15.8	15.8
	g	Estimated Contractor Employer National Insurance Paid	M£	19.1	19.1
	h	Estimated Contractor Take-Home Pay	M£	122.7	122.7
Refinery Throughput		Crude (kbbl)	kbbl	475,177	493,784
		Feedstocks (kbbl)	kbbl	46,762	67,421
		Total (kbbl)	kbbl	521,939	561,205
Refinery Margins		Gross Refinery Margin (MUS$)	MUS$	1,705	3,727
(note refinery margins are reported in		Total Operating Costs (MUS$)	MUS$	2,195	2,254
US$)		Net Cash Margin (MUS$)	MUS$	(490)	1,473
		Annualised Turnaround Costs	MUS$	214	214
		Depreciation	MUS$	236	236
		Calculated Operating Result	MUS$	(939)	1,024
	i	Estimated Corporation Tax Paid	MUS$	(244)	266
		Estimated Corporation Tax Paid	M£	(152)	166
		Gross Refinery Margin ($/bbl)	US$/bbl	3.27	6.64
		Total Operating Costs ($/bbl)	US$/bbl	4.21	4.02
		Net Cash Margin ($/bbl)	US$/bbl	(0.94)	2.62
Refinery Operating Cost Detail		Fixed Costs			
	j	Total Fixed Costs (excluding Turnaround costs)	M£	921.5	921.5
	k	Variable Costs			
		Total Variable Costs	M£	445.2	481.5
	l	Annualised Turnaround Costs	M£	133.2	133.2
		Total Cash Operating Costs (M£)	M£	1,366.7	1,403.1
		Total Operating Costs including Turnaround (M£)	M£	1,500.0	1,536.3
Capital Expenditure		Sustaining	M£	292.4	292.4
		Profit Improvement	M£	62.4	62.4
	m	Total	M£	354.7	354.7
Sum of all inputs to UK Economy		**(a+b+c+d+e+f+g+h+i+j+k+l+m)**	**M£**	**1,702.4**	**2,057.0**

Note: 2011 Exchange Rate: £1 = $1.604

TABLE IX-2
ECONOMIC IMPACT OF REFINERY BUSINESS ECOSYSTEM 2011

	Employment (number of workers)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	105	655	760
Mining (includes crude oil extraction)	0	11,921	47	11,969
Manufacturing	0	5,935	1,927	7,862
Refineries	8,541	0	0	8,541
Utilities	0	1,768	329	2,098
Construction	0	7,403	1,062	8,466
Wholesale and Retail Trade	0	14,392	9,865	24,257
Transport, Storage	0	4,009	1,266	5,275
Hotels and Restaurants	0	1,086	3,481	4,566
Information and Communication	0	1,136	948	2,085
Financial Services	0	1,658	2,681	4,338
Services	0	3,079	1,101	4,180
Public administration and defence services; compulsory social security services	0	471	300	772
Health, Education and Social Services	0	921	2,016	2,936
Total	**8,541**	**53,886**	**25,678**	**88,106**

	Value Added (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	2	12	14
Mining (includes crude oil extraction)	0	6,470	25	6,495
Manufacturing	0	335	103	437
Refineries	6	3	2	11
Utilities	0	201	38	239
Construction	0	289	41	331
Wholesale and Retail Trade	0	474	323	797
Transport, Storage	0	160	53	213
Hotels and Restaurants	0	23	72	95
Information and Communication	0	80	63	142
Financial Services	0	198	314	512
Services	0	522	179	701
Public administration and defence services; compulsory social security services	0	19	12	31
Health, Education and Social Services	0	27	51	78
Total	**6**	**8,802**	**1,288**	**10,096**

	Labour Income (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	1	5	6
Mining (includes crude oil extraction)	0	546	3	548
Manufacturing	0	252	73	325
Refineries	446	0	0	446
Utilities	0	69	13	82
Construction	0	161	23	184
Wholesale and Retail Trade	0	290	199	489
Transport, Storage	0	124	38	162
Hotels and Restaurants	0	15	49	64
Information and Communication	0	55	39	94
Financial Services	0	73	63	136
Services	0	325	117	442
Public administration and defence services; compulsory social security services	0	16	10	26
Health, Education and Social Services	0	24	45	69
Total	**446**	**1,952**	**675**	**3,073**

TABLE IX-3
ECONOMIC IMPACT OF CRUDE OIL PRODUCTION 2011

	Employment (number of workers)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	82	512	595
Mining (includes crude oil extraction)	0	11,789	37	11,826
Manufacturing	0	2,696	1,507	4,204
Refineries	0	0	0	0
Utilities	0	366	257	623
Construction	0	4,286	831	5,117
Wholesale and Retail Trade	0	12,221	7,716	19,937
Transport, Storage	0	3,206	990	4,196
Hotels and Restaurants	0	932	2,722	3,655
Information and Communication	0	928	742	1,670
Financial Services	0	1,397	2,097	3,494
Services	0	2,545	861	3,406
Public administration and defence services; compulsory social security services	0	385	235	620
Health, Education and Social Services	0	745	1,576	2,321
Total	**0**	**41,578**	**20,084**	**61,662**

	Value Added (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	1	9	11
Mining (includes crude oil extraction)	0	6,400	20	6,420
Manufacturing	0	152	80	232
Refineries	0	0	0	0
Utilities	0	35	30	65
Construction	0	167	32	200
Wholesale and Retail Trade	0	403	253	656
Transport, Storage	0	128	41	169
Hotels and Restaurants	0	19	56	76
Information and Communication	0	65	49	114
Financial Services	0	167	246	413
Services	0	436	140	575
Public administration and defence services; compulsory social security services	0	15	9	25
Health, Education and Social Services	0	22	40	62
Total	**0**	**8,012**	**1,006**	**9,017**

	Labour Income (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	1	4	4
Mining (includes crude oil extraction)	0	538	2	540
Manufacturing	0	112	57	169
Refineries	0	0	0	0
Utilities	0	13	10	24
Construction	0	93	18	111
Wholesale and Retail Trade	0	246	156	402
Transport, Storage	0	102	30	131
Hotels and Restaurants	0	13	38	51
Information and Communication	0	45	31	76
Financial Services	0	63	49	112
Services	0	267	91	359
Public administration and defence services; compulsory social security services	0	13	8	21
Health, Education and Social Services	0	20	35	55
Total	**0**	**1,527**	**528**	**2,055**

TABLE IX-4
NET BASELINE ECONOMIC IMPACT OF REFINERY ACTIVITY ON THE UK ECONOMY 2011

Baseline Scenario: 2011	Employment (number of workers)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	23	143	166
Mining (includes crude oil extraction)	0	132	10	143
Manufacturing	0	3,239	420	3,659
Refineries	8,541	0	0	8,541
Utilities	0	1,403	72	1,474
Construction	0	3,118	231	3,349
Wholesale and Retail Trade	0	2,171	2,149	4,320
Transport, Storage	0	803	276	1,079
Hotels and Restaurants	0	153	758	911
Information and Communication	0	208	207	415
Financial Services	0	261	584	844
Services	0	535	240	774
Public administration and defence services; compulsory social security services	0	86	65	152
Health, Education and Social Services	0	176	439	615
Total	**8,541**	**12,308**	**5,594**	**26,443**

Baseline Scenario: 2011	Value Added (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	0	3	3
Mining (includes crude oil extraction)	0	70	5	76
Manufacturing	0	183	22	206
Refineries	6	3	2	11
Utilities	0	166	8	174
Construction	0	122	9	131
Wholesale and Retail Trade	0	71	70	142
Transport, Storage	0	32	11	44
Hotels and Restaurants	0	3	16	19
Information and Communication	0	14	14	28
Financial Services	0	31	68	99
Services	0	87	39	126
Public administration and defence services; compulsory social security services	0	3	3	6
Health, Education and Social Services	0	5	11	16
Total	**6**	**791**	**282**	**1,079**

Baseline Scenario: 2011	Labour Income (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	0	1	1
Mining (includes crude oil extraction)	0	7	1	8
Manufacturing	0	140	16	155
Refineries	446	0	0	446
Utilities	0	56	3	59
Construction	0	68	5	73
Wholesale and Retail Trade	0	44	43	87
Transport, Storage	0	23	8	31
Hotels and Restaurants	0	2	11	13
Information and Communication	0	10	9	18
Financial Services	0	10	14	24
Services	0	58	25	83
Public administration and defence services; compulsory social security services	0	3	2	5
Health, Education and Social Services	0	5	10	14
Total	**446**	**425**	**147**	**1,018**

TABLE IX-5
ECONOMIC IMPACT OF REFINERY BUSINESS ECOSYSTEM 2025

	Employment (number of workers)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	112	697	808
Mining (includes crude oil extraction)	0	12,820	50	12,870
Manufacturing	0	6,155	2,049	8,203
Refineries	8,541	0	0	8,541
Utilities	0	1,913	350	2,263
Construction	0	7,739	1,129	8,868
Wholesale and Retail Trade	0	15,342	10,488	25,830
Transport, Storage	0	4,257	1,346	5,603
Hotels and Restaurants	0	1,160	3,700	4,860
Information and Communication	0	1,211	1,008	2,219
Financial Services	0	1,770	2,850	4,619
Services	0	3,281	1,170	4,451
Public administration and defence services; compulsory social security services	0	502	319	821
Health, Education and Social Services	0	982	2,143	3,124
Total	**8,541**	**57,243**	**27,299**	**93,083**

	Value Added (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	2	13	15
Mining (includes crude oil extraction)	0	6,958	27	6,985
Manufacturing	0	347	109	456
Refineries	1,230	3	2	1,235
Utilities	0	215	40	255
Construction	0	302	44	346
Wholesale and Retail Trade	0	506	343	849
Transport, Storage	0	170	56	226
Hotels and Restaurants	0	24	77	101
Information and Communication	0	85	66	152
Financial Services	0	211	334	545
Services	0	557	190	747
Public administration and defence services; compulsory social security services	0	20	13	33
Health, Education and Social Services	0	29	55	84
Total	**1,230**	**9,429**	**1,369**	**12,028**

	Labour Income (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	1	5	6
Mining (includes crude oil extraction)	0	587	3	590
Manufacturing	0	261	77	338
Refineries	446	0	0	446
Utilities	0	74	14	88
Construction	0	169	25	193
Wholesale and Retail Trade	0	309	212	521
Transport, Storage	0	132	40	173
Hotels and Restaurants	0	16	52	68
Information and Communication	0	59	42	100
Financial Services	0	78	67	145
Services	0	346	124	470
Public administration and defence services; compulsory social security services	0	17	11	28
Health, Education and Social Services	0	26	48	74
Total	**446**	**2,076**	**718**	**3,239**

TABLE IX-6
ECONOMIC IMPACT OF CRUDE OIL PRODUCTION 2025

	Employment (number of workers)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	88	551	639
Mining (includes crude oil extraction)	0	12,676	40	12,716
Manufacturing	0	2,899	1,621	4,520
Refineries	0	0	0	0
Utilities	0	393	277	670
Construction	0	4,608	893	5,502
Wholesale and Retail Trade	0	13,140	8,296	21,437
Transport, Storage	0	3,447	1,065	4,511
Hotels and Restaurants	0	1,003	2,927	3,930
Information and Communication	0	998	798	1,796
Financial Services	0	1,502	2,254	3,757
Services	0	2,736	926	3,662
Public administration and defence services; compulsory social security services	0	414	253	667
Health, Education and Social Services	0	801	1,695	2,496
Total	**0**	**44,706**	**21,595**	**66,301**

	Value Added (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	2	10	12
Mining (includes crude oil extraction)	0	6,882	21	6,903
Manufacturing	0	163	86	249
Refineries	0	0	0	0
Utilities	0	38	32	70
Construction	0	180	35	215
Wholesale and Retail Trade	0	433	272	705
Transport, Storage	0	138	44	182
Hotels and Restaurants	0	21	61	81
Information and Communication	0	70	53	123
Financial Services	0	180	264	444
Services	0	468	150	619
Public administration and defence services; compulsory social security services	0	16	10	26
Health, Education and Social Services	0	24	43	67
Total	**0**	**8,614**	**1,081**	**9,695**

	Labour Income (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	1	4	5
Mining (includes crude oil extraction)	0	579	2	581
Manufacturing	0	121	61	182
Refineries	0	0	0	0
Utilities	0	14	11	25
Construction	0	100	19	120
Wholesale and Retail Trade	0	265	168	432
Transport, Storage	0	109	32	141
Hotels and Restaurants	0	14	41	55
Information and Communication	0	49	33	82
Financial Services	0	67	53	120
Services	0	288	98	386
Public administration and defence services; compulsory social security services	0	14	8	22
Health, Education and Social Services	0	21	38	59
Total	**0**	**1,642**	**568**	**2,210**

TABLE IX-7
NET ECONOMIC IMPACT OF REFINERY ACTIVITY ON THE UK ECONOMY 2025

Future Scenario: 2025	Employment (number of workers)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	23	146	169
Mining (includes crude oil extraction)	0	144	10	155
Manufacturing	0	3,255	428	3,683
Refineries	8,541	0	0	8,541
Utilities	0	1,520	73	1,593
Construction	0	3,131	236	3,367
Wholesale and Retail Trade	0	2,202	2,191	4,393
Transport, Storage	0	811	281	1,092
Hotels and Restaurants	0	157	773	930
Information and Communication	0	213	211	424
Financial Services	0	268	595	863
Services	0	544	245	789
Public administration and defence services; compulsory social security services	0	88	67	154
Health, Education and Social Services	0	181	448	628
Total	**8,541**	**12,537**	**5,703**	**26,782**

Future Scenario: 2025	Value Added (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	0	3	3
Mining (includes crude oil extraction)	0	77	6	82
Manufacturing	0	184	23	207
Refineries	1,230	3	2	1,235
Utilities	0	177	8	186
Construction	0	122	9	131
Wholesale and Retail Trade	0	72	72	144
Transport, Storage	0	33	12	44
Hotels and Restaurants	0	3	16	19
Information and Communication	0	15	14	29
Financial Services	0	32	70	101
Services	0	88	40	128
Public administration and defence services; compulsory social security services	0	3	3	6
Health, Education and Social Services	0	5	11	17
Total	**1,230**	**815**	**288**	**2,333**

Future Scenario: 2025	Labour Income (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	0	1	1
Mining (includes crude oil extraction)	0	8	1	9
Manufacturing	0	140	16	156
Refineries	446	0	0	446
Utilities	0	60	3	63
Construction	0	68	5	73
Wholesale and Retail Trade	0	44	44	89
Transport, Storage	0	23	8	31
Hotels and Restaurants	0	2	11	13
Information and Communication	0	10	9	19
Financial Services	0	11	14	25
Services	0	59	26	85
Public administration and defence services; compulsory social security services	0	3	2	5
Health, Education and Social Services	0	5	10	15
Total	**446**	**434**	**150**	**1,029**

X. ANALYSIS OF THE COST OR IMPACT OF FUTURE LEGISLATIVE REQUIREMENTS

INTRODUCTION

The UK's intentional obligations and legislative requirements arising from EU Directives and UK Government policies may have the potential to significantly impact costs in the UK refining sector. These are listed below.

International
- MARPOL Annex VI / IMO (low sulphur shipping fuel)
- Compulsory oil stocking obligations (CSO)

EU
- EU Emission Trading System (ETS) Directive – Phase III
- Fuel Quality Directive – Article 7a
- Industrial Emissions (IPPC) Directive
- Fuel Quality Directive – product quality/vapour pressure specifications
- Renewable Energy Directive
- Energy Efficiency Directive

UK
- Environment Agency Containment Policy
- Carbon Floor Pricing
- CRC Energy Efficiency Scheme
- Rating revaluation

This section of the study analyses the impacts of these legislative requirements both individually and in aggregate. Where the availability of data permits we have included discussion on the potential capital and operating cost requirements for UK refineries to meet the legislative requirements. Our analysis has focused on reviewing figures provided by the refineries and relevant analyses conducted by UKPIA and other third parties.

MARPOL ANNEX VI

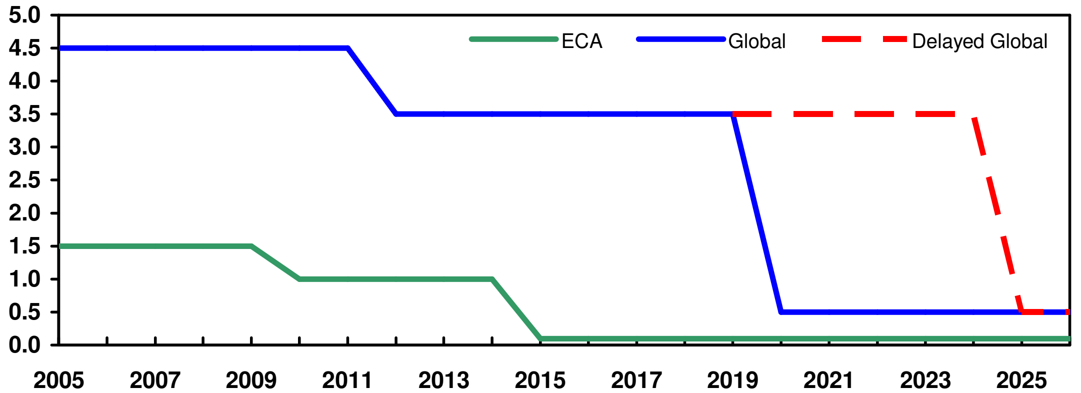
BACKGROUND

In October 2008, the International Maritime Organization (IMO) adopted a revised version of the MARPOL Annex VI regulations to reduce harmful emissions from ships. The main changes mandate a progressive reduction in sulphur oxide (SO_x) emissions, with stepped reductions in permitted sulphur levels for marine fuel oil from the current 3.5% mass max. (previously 4.5% prior to 1st January 2012), with a further reduction to 0.5% max., effective from 1st January 2020, subject to a feasibility review to be completed no later than

2018. This review could defer the implementation until 2025. There is flexibility within the legislation to use onboard ship technology to achieve the same emissions limits as use of the lower sulphur content fuels. This is primarily directed at use of stack gas scrubbers on ships.

The fuel sulphur limits applicable in Emission Control Areas (ECAs) are currently controlled at 1.0% max. and will be further reduced to 0.1% max. from 1st January 2015. In the current Annex VI, there are two ECAs designated; the Baltic Sea and the North Sea area, which includes the English Channel. Given the U.K.'s location adjacent to an ECA area, this legislation is particularly important. More recently, the IMO officially designated waters off North American coasts (the United States and Canada) as an ECA on 26th March 2010; this came into effect in August 2012.

FIGURE X-1
MAXIMUM SULFUR CONTENT OF MARINE BUNKER FUEL
(wt%)



The changes in permitted sulphur levels and the introduction of new ECAs is likely to reduce high sulphur (HS) residual fuel oil demand dramatically from 2015 onwards, unless ship owners make significant investment in exhaust gas scrubbing technology. In the absence of such investment, demand for marine gas oil with much lower sulphur content will increase.

The UK is projected to require net imports of approximately 17 million tonnes of jet fuel and diesel by 2020, and the increased demand for middle distillates as marine fuel on a global basis is likely to reduce the availability for the UK to make these imports. The increased demand for low sulphur (LS) distillates in marine fuel application will further distort the gasoline and middle distillate supply balance that currently exists and will likely prompt investment in additional residue conversion capacity to alleviate the supply imbalance.

PGI ASSESSMENT

PGI is of the view that the MARPOL Annex VI regulations will reduce the demand of residual fuel oil; however the extent of this occurring depends on the types of bunker fuel demanded by ships. The relative demand trends for residual bunker and marine gas oil fuels are expected to be technology dependent, i.e. the extent of adoption of on ship stack gas scrubbers.

We expect few refineries will be able to produce the 0.1% sulphur ECA quality bunker from traditional bunker blending streams e.g. residual fuel blending components. Most will need to produce some type of middle distillate fuel to produce this low sulphur fuel. Similarly, the vast majority of refineries do not have low sulphur residual streams that they can divert to bunker blending to produce the 0.5% LS bunker fuel. Those that do have very LS residual streams, for example from very sweet crude oils, may not find it economic to divert these streams from their current higher value dispositions, generally into FCC/RFCC units. Therefore refineries looking to produce the LS bunker fuels will need to upgrade lower quality streams and commit to significant investments.

In 2009, PGI published a Residual Fuel Market Outlook (RFMO) which examined the outlook for the residual fuel market supply and demand and the uncertainty of the future adoption of on-board scrubber installations. Drawing on the RFMO analyses, we applied the supply and demand outlook for bunker fuel in Europe through to the year 2025, and referenced the corresponding refinery capacity projections contained in the RFMO to establish a comparative view on the future capacity requirements at UK refineries. We consider a Fuels Compliance Scenario; whereby there is a significant shift in bunker fuel quality to low sulphur fuels to meet IMO requirements, would have the greatest impact to refineries. Under this scenario, 160,000 B/D of additional hydrocracker capacity would be required by 2025, but of this 89,000 B/D is attributed to capacity to meet the underlying road transport fuel demand[19]. Therefore the actual hydrocracker capacity requirements as a result of tightening marine fuel oil sulphur limits are 71,000 B/D equating to approximately 1.5 hydrocracker units. Substantial capacity increases in Delayed Coking, Distillate Hydrotreating, Sulphur Plants and Hydrogen Plants are also required. The approach and findings are discussed in greater detail below.

Amongst other issues, PGI's Residual Fuel Market Outlook assessed the uncertainty of the future adoption of on-board scrubber installations by examining three scenarios:

- **Scrubber Compliance Scenario** – Envisioned wide-spread adoption of scrubbers on a significant share of the shipping fleet in terms of residual bunker consumption, with moderate need for fuel quality improvements to meet IMO quality changes.

- **Fuels Compliance Scenario** – Significant shift in bunker fuel quality to low sulphur fuels to meet IMO requirements due to very limited adoption of on-board scrubbers

- **Status Quo** – This case provides a reference capacity from a separate petroleum analysis report. This case includes the North Europe, U.S. and Canada ECAs but no global LS bunker quality change.

In all three scenarios, it is assumed that ship owners and refiners respond in a timely fashion to meet the new emissions and fuels requirements but a transition period is expected.

Scrubber Compliance Scenario (SCS)

Under the Scrubber Compliance Scenario, the adoption of ship scrubbers limits the need for ECA quality (0.1% sulphur) bunker and low sulphur (LS) bunker fuels, and high sulphur (HS) residual bunker remains the primary fuel. Quality transitions in 2015 and 2020 result in reductions in high sulphur residual demand but the underlying trend of increasing marine bunker demand and trade remains. Demand for lower sulphur bunker fuels will expand on a global basis as residual bunker fuel consumed in ECAs shifts from 1.0% sulphur to 0.1%

[19] Underlying road transport fuel projections assumes current sulphur limits remain unchanged

sulphur, which is expected to be mainly middle distillate, in 2015. Demand for ECA bunker has already increased recently due to the addition of the U.S. market in 2012. ECA quality bunker demand is projected to decline in 2020 but then stabilizes as new ECAs are added and smaller regional ship consumption remains. LS bunker demand of over 55 million tonnes is forecast for 2020 when the fuel is first required and then expected to gradually decline as more scrubbers are installed on new and existing vessels. High sulphur residual bunker remains the dominant fuel, although consumption is relatively flat until after 2020.

By 2015, European demand is forecast to be affected by the ECA bunker quality switch to middle distillate fuel. The intra-regional trade is higher in Europe than in the U.S. and the moderate-sized ships servicing this trade are expected to install a higher proportion of scrubbers thereby limiting the additional distillate demand somewhat. Longer-term, the IMO global specifications will encourage more ship-board scrubbing in this scenario. Residual fuel oil bunker demand in Europe in the long term is likely to be limited by the general availability of fuel oil in Europe, such that refinery supplies will probably be the limiting factor for bunker demand in the region. PGI project the bunker growth in Europe to be below the trade-derived growth rate based on the supply available.

The total demand of ECA bunker in the Baltic and North Sea-English Channel ECAs assumes a high level of compliance that may not be present today. In 2011 ECA bunker (1.5% sulphur) bunker sales were estimated to be below 10 million tonnes based on our understanding of port sales. No large Mediterranean ECA is included in the analyses.

Fuels Compliance Scenario (FCS)

Under the Fuels Compliance Scenario, a significant shift in bunker quality creates a sharp decrease in high sulphur bunker demand with the introduction of the LS bunker (0.5% sulphur) requirements in 2020. While the quality changes, the total demand for global bunker fuel remains the same as the Scrubber Compliance Scenario. A small portion of HS bunker remains with some minor levels of ship scrubbing and domestic consumption. LS bunker demand is forecast at 180 million tonnes in 2020 and grows to over 260 million tonnes by 2030. ECA quality bunker demand is also greater as ships increase middle distillate fuel purchases without the aid of large-scale scrubber adoption.

LS bunker and ECA bunker fuel demand in Europe is very large. Europe’s role as a low cost supplier of bunker fuel (HS bunker) is expected to wane in this scenario as bunker fuels switch to low sulphur supplies. Europe is one of the highest cost regions for diesel fuel and this will deter bunkering in European ports to the degree that other supplies can be used on a given ship route. A portion of this lost demand is shifted to the U.S., Middle East and Asian markets. The marine bunker demand for Europe for both the Scrubber Compliance Scenario and Fuel Compliance Scenario is shown in the table below and was extracted from PGI’s RFMO study.

EUROPE MARINE BUNKER DEMAND
(Thousand Metric Tonnes)

	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030
Scrubber Compliance Scenario (SCS)										
ECA Fuel	-	6,977	8,788	9,853	11,344	12,643	11,361	5,349	4,651	3,967
Medium Speed MGO/MDO (DMA/DMB)	13,419	11,389	11,468	11,609	11,723	11,730	11,876	11,378	11,415	11,561
LS Bunker (0.5% S)	-	-	-	-	-	-	-	10,005	8,184	6,436
HS Bunker (RMG)	53,255	42,570	41,707	41,883	41,574	40,997	43,529	40,379	44,838	49,905
Total	66,675	60,936	61,962	63,345	64,641	65,370	66,766	57,106	60,904	65,432
Fuel Compliance Scenario (FCS)										
ECA Fuel	-	6,977	8,788	10,717	12,904	15,076	16,253	12,917	13,362	13,282
Medium Speed MGO/MDO (DMA/DMB)	13,419	11,389	11,468	11,609	11,723	11,730	11,876	8,218	8,025	7,641
LS Bunker (0.5% S)	-	-	-	-	-	-	-	22,511	23,167	23,369
HS Bunker (RMG)	53,255	42,570	41,707	41,019	40,014	38,564	38,637	3,465	2,534	1,577
Total	66,675	60,936	61,962	63,345	64,641	65,370	66,766	47,111	47,088	45,869

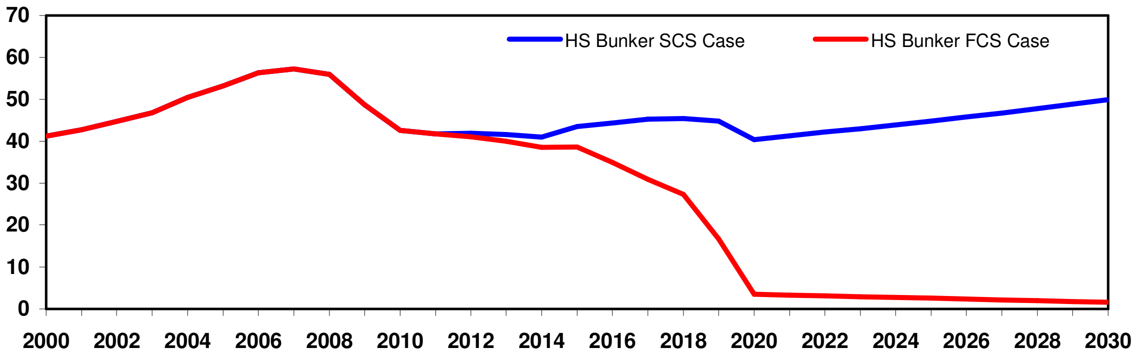
Note: Marine Bunker Basis - includes domestic and international bunkers supplied to vessels

The 1.5%, 1.0% and 0.1% sulphur ECA bunkers are shown from 2010 onwards as ECA Fuel in line with the timing of the ECA specification changes. The level of scrubber adoption in the ECAs before 2020 is not particularly significant due to the limited time spent in the ECAs by large oceangoing vessels. Therefore, the increase in the European ECA quality bunker demand in these early years of the Fuels Compliance Scenario is only marginally higher than in the Scrubber Compliance Scenario.

As 2020 approaches and more large vessels have scrubbers in the Scrubber Compliance Scenario, the ECA quality bunker demand difference between the two scenarios becomes much larger. By 2030, as ship scrubbing further penetrates the market through new construction and retrofits, the ECA quality bunker demand decreases to about 13 million tonnes in the Fuel Compliance Scenario while the Scrubber Compliance Scenario ECA quality bunker demand decreases to about 4 million tonnes.

In 2020, the implementation of the global low sulphur bunker specification requires nearly 23 million tonnes of LS bunker, more than twice the 10 million tonnes required for the Scrubber Compliance Scenario. The European demand for marine diesel/gasoil (MDO/MGO) decreases in the Fuel Compliance Scenario, as ships shift bunkering to lower cost ports outside of Europe, since we expect European ports to have the highest price for diesel/gasoil. The demand for high sulphur residual bunkers for Europe is shown in Figure X-2.

FIGURE X-2
EUROPE HIGH SULPHUR BUNKER DEMAND
(Million Tonnes)



The high sulphur residual bunker demand for Europe peaked in 2007 at 57.2 million tonnes which represented 83% of the total bunker consumption. In the Fuel Compliance

Scenario the high sulphur residual bunker demand for Europe falls to less than 4 million tonnes by 2020 and less than 2 million tonnes by 2030. This compares to a relatively stable HS residual bunker demand in the Scrubber Compliance Scenario.

Refinery Capacity Requirements

The PGI RFMO examined the required refining capacity to meet Europe's refined product demand in light of changing product demand and specifications. The need for refinery modifications and expansions was estimated by simulating European refinery operations (broken down in to Northern, Central and Southern Europe) with PGI's proprietary refinery LP model. Overall operations data were used to calibrate each region's LP model, using available trade statistics to estimate the region's crude quality. Details on the refinery modelling can be found in the RFMO.

A summary of the projected refining capacity requirements for 3 scenarios are presented below. The Status Quo requirements through to 2025 include the U.S., Canada and North Europe ECAs but no global LS bunker quality change. Therefore, the Status Quo case provides a reference capacity to highlight the additional capacities required under the Scrubber Compliance Scenario and Fuel Compliance Scenario.

ADDITIONAL EUROPEAN REFINERY CAPACITY REQUIREMENT
(Thousand Barrels per Day, Unless Noted)

	2012 - 2025 (Status Quo)	(Scrubber Compliance Scenario)	Additions (Fuel Compliance Scenario)
		Scrubber Compliance	Fuels Compliance
Crude Distillation	90	-	-
Vacuum Distillation	75	-	-
Thermal Cracking	-	-	-
Visbreaking	-	-	-
Solvent Deasphalting	25	-	-
Residue HDS	-	9	-
Residue Hydrocracking	43	-	-
Fluid Coker	20	-	-
Delayed Coker	188	(62)	340
VGO HDS	-	-	-
Fluid Catalytic Cracking	-	-	-
Resid Catalytic Cracking	-	-	-
Hydrocracker	740	83	73
Distillate Hydrotreating	70	-	300
Sulphur Plant (Long Tons Per Day)	-	660	1,026
Hydrogen Plant (Million Standard Cubic Feet per Day)	1,331	166	746

UK refining capacity is equivalent to around 10.5% of the total capacity in the EU based on PGI data. The UK's projected share of European refinery capacity expansion has been estimated using this approximation, and the results are presented the table below.

ADDITIONAL UK REFINERY CAPACITY REQUIREMENTS
(Thousand Barrels per Day, Unless Noted)

	2012 - 2025 (Status Quo)	(Scrubber Compliance Scenario)	Additions (Fuel Compliance Scenario)
		Scrubber Compliance	Fuels Compliance
Crude Distillation	9	-	-
Vacuum Distillation	8	-	-
Thermal Cracking	-	-	-
Visbreaking	-	-	-
Solvent Deasphalting	3	-	-
Residue HDS	-	1	-
Residue Hydrocracking	5	-	-
Fluid Coker	2	-	-
Delayed Coker	20	(7)	36
VGO HDS	-	-	-
Fluid Catalytic Cracking	-	-	-
Resid Catalytic Cracking	-	-	-
Hydrocracker	78	9	8
Distillate Hydrotreating	7	0	32
Sulphur Plant (Long Tons Per Day)	-	69	108
Hydrogen Plant (Million Standard Cubic Feet per Day	140	17	78

The Fuel Compliance Scenario will impact European refineries the greatest and under this scenario the UK refineries will have to make substantial investments in delayed coking (~36,000 B/D) and sulphur recovery capacity. It should also be noted that a significant amount of hydrocracking and coking capacity is already anticipated under the status-quo scenario, and applying the same apportioning logic as above implies that UK refineries should already be expecting to develop approximately 78,000 B/D of hydrocracking capacity.

COST IMPACT ON UK REFINERIES

The estimated capital expenditure required to install the identified additional unit capacities under a Fuel Compliance Scenario has been estimated at £905 million, with annual operational costs at £132 million based on our capital cost estimation model used for estimation of onsite and offsite costs. The breakdown is shown in the table below.

ESTIMATED COST IMPACT ON UK REFINERIES UNDER A FUEL COMPLIANCE SCENARIO
(Thousand of £, Unless Noted)

Unit	Required Unit Capacity (MB/D)	Capital Costs	Operational Costs
Crude Distillation	-	-	-
Vacuum Distillation	-	-	-
Thermal Cracking	-	-	-
Visbreaking	-	-	-
Solvent Deasphalting	-	-	-
Residue HDS	-	-	-
Residue Hydrocracking	-	-	-
Fluid Coker	-	-	-
Delayed Coker	36	435,511	29,981
VGO HDS	-	-	-
Fluid Catalytic Cracking	-	-	-
Resid Catalytic Cracking	-	-	-
Hydrocracker	8	80,897	8,336
Distillate Hydrotreating	32	179,131	15,841
Sulfur Plant	108	82,859	4,795
Hydrogen Plant	78	127,523	72,622
Total		**905,920**	**131,575**

Note: Capital costs includes allowances for owners costs

COMPULSORY OIL STOCKING OBLIGATIONS (CSO)

BACKGROUND

As a member of the EU and the IEA, the UK is required to hold emergency stocks of oil and to take part in any collective reaction to a major international disruption of oil supplies. The introduction of the new EU directive on 31st December 2012 has brought the EU calculation of requirement more closely in line with the IEA's.

Under the International Energy Programme in the Governing Treaty of the IEA, the UK commits to maintaining emergency oil reserves equivalent to at least 90 days of net oil imports. Similarly, the new EU obligation requires the UK to hold oil reserves equivalent to 90 days of average net daily imports, or 61 days of average daily inland consumptions if higher of the two[20]. As an oil producing country, the current overriding obligation is based on 'daily inland consumption' and its specific requirements[21].

Since mid-2009, Industry and DECC have worked together to explore future CSO policy options. In the initial phase, Deloitte were appointed as consultants to assess the

[20] Under the terms of the EU Directive, 10% of stocks are deemed to be inaccessible. Accordingly, Member States are in effect required to hold 67 days of net daily consumption, or 99 days of net imports.

[21] Under the terms of the Oil Stocking Order 2012 and as required by the EU, the UK must meet its obligation in part as finished products - 22.5 days of stocks of petrol, gasoil and diesel, and aviation fuel. The remainder of the obligation can be met through crude oil or any other of a wide range of petroleum products.

current system and alternative models for meeting the UK's stocking obligations[22]. The findings, which were published in January 2010, showed that as the UK's indigenous oil production declines its oil stocking obligations are expected to increase from the current level of 11.1 million tonnes to 15.0 million tonnes in 2025[23].

COST IMPACT ON UK REFINERIES

The UK historically met its international stocking requirements by imposing the obligation on industry. No delegation to a central stock agency is currently possible, so companies manage their own stocks and bear the full cost of building and maintaining storage (or of buying stock tickets). Operators pass through as far as possible the cost of the stockholding obligations to the consumers in the final price. This model was previously defined by Deloitte as the UK "As-Is" model, and represents the Base Case of their 2010 study which estimated the potential cost of meeting the UK's future CSO.

Deloitte used a four stage approach (shown below in Figure X-3) to analyse the potential cost of meeting the incremental CSO requirements.

FIGURE X-3
STRUCTURE OF INCREMENTAL COST ANALYSIS USED BY DELOITTE
(Million of tonnes)

Source: Deloitte (2010)

Deloitte's CSO scenarios were formed by varying assumptions of the following parameters:

- UK consumption of oil products
- UK's decline in the domestic oil production
- Costs of new storage capacity
- Availability of tickets and bilateral agreements to meet incremental CSO

The assumptions used by Deloitte under the Base Case scenario were:

- UK consumption of oil products was based on the Low Carbon Transition Plan with flat demand post 2020 - a moderate demand scenario

[22] The Deloitte report "Assessing the Current System and Alternative Models for Meeting the UK's Stocking Obligations" (January 2010).
[23] The IEA obligation will reach 15.0 million tonnes by 2025 in the scenario of post Low Carbon Transition Plan (LCTP) with flat demand 2020 onwards.

- UK domestic oil production declining at a rate of 8% per annum – provided by DECC
- Tickets[24] providing 10% of incremental CSO with the remaining 90% met by new-build storage
- New storage tanks constructed with a 30,000 m^3 capacity - large tanks to benefit from economies of scale. Build cost estimated at £243 per tonne, operating cost at £31 per tonne annually and cost of capital at 8.5%

Under the Base Case, the undiscounted cash requirement attributed to the UK downstream oil industry to meet the UK's incremental CSO up to 2030 was estimated by Deloitte at approximately £3.5 billion.

IMCREMENTAL CSO COSTS TO THE UK DOWNSTREAM OIL INDUSTRY UNDER EXISTING INDUSTRY MODEL (BASE CASE)
(Thousand of £, real 2009)

	Total cash requirement (2013 - 2030)		
	Refiners	**Non-Refiners**	**Total**
Capital cost	995,000	177,000	1,172,000
Stocks	1,107,000	188,000	1,295,000
Tickets	57,000	11,000	68,000
Operating cost	813,000	146,000	959,000
Total cost	**2,972,000**	**522,000**	**3,494,000**

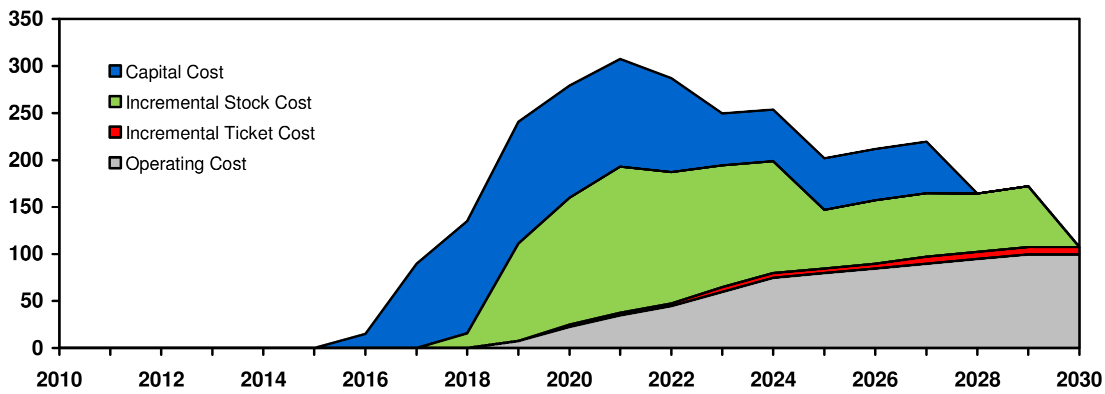
Note: Capital allowances from the UK Government are not included

Source: Deloitte (2010)

Over the forecast period, the most significant cost item attributed to UK refiners in meeting the incremental CSO is for stock purchase estimated at £1.1 billion. Capital cost of additional tankage and operating costs are also very significant, estimated at £1.0 billion and £0.8 billion respectively. The total cost of stock-tickets is projected to be relatively low at £57 million. The expenditure profile of these costs over the forecast period is shown in Figure X-4 below.

[24] Tickets are rights to withdraw oil from stocks held in locations other than facilities operated by the obligated companies. In the case of obligated companies in the UK, these locations are typically in another part of the UK or in other EU countries.

FIGURE X-4
ESTIMATED CASH REQUIRED BY UK REFINERIES TO MEET IMCREMENTAL CSO
(Millions of £, real 2012, undiscounted)



Source: Deloitte (2010)

With reference to PGI's in-house economic models, between 2009 and 2012 construction costs in Europe declined by approximately 3.08%. After adjusting capital and operating costs, the total cash required by UK refiners to meet incremental CSO up to 2030 is now projected to reach £2.93 billion. The cash requirement is projected to peak at £308 million in 2021, which is equivalent to around 0.45 p/litre of refined product produced in UK refineries[25].

The conversion of incremental CSO costs to p/litre is based on PGI's projections of refined product production in the UK. Production in 2021 is estimated at 58 million tonnes which is equivalent to approximately 433 million barrels. The conversion to barrels takes into account the different densities of each refined product category by applying typical conversion factors ranging from 5.5 to 9.0 barrel per tonne; whereby a high conversion factor represents a light product such as naphtha or gasoline and a low conversion factor representing a heavier product such as petroleum coke or bitumen. The final conversion to litres is based on approximately 159 litres in a barrel.

Since incremental CSO affects both refiners and non-refiners there is the potential for the costs to be passed onto UK consumers. The extent by which incremental CSO could increase refined product prices in the UK is shown in the table below.

INCREMENTAL CSO COST IMPACT ON REFINERY GATE PRICE (BASE CASE)
(Thousand of £, Unless Noted, real 2012)

Scenarios		2020	2025	2030
Annual cash requirement	(£k)	279,000	202,000	107,000
UK refined product production	(kB/a)	433,000	433,000	434,000
Impact on refinery gate price	(£/B)	0.65	0.47	0.25
	($/B)	1.03	0.74	0.39
	(p/litre)	0.41	0.29	0.16

Note: £1.00 = $1.59

[25] Refined products categories include: gasoline, jet fuel/kerosene, diesel/gasoil, residual fuel oil, naphtha, lubricants, bitumen and petroleum coke.

This additional cost represents a very significant impact on the profitability of UK refiners if it cannot be fully passed onto the market in the refinery gate price. It is worth highlighting that access to finance will depend on the refiners' credit ratings and existing capital structures, and the fact that a number of refiners in the UK that are highly geared may limit the capacity for some companies to meet the incremental CSO under the current approach.

INDUSTRIAL EMISSIONS (IPPC) DIRECTIVE

BACKGROUND

In order to take further steps to reduce emissions from industry, the EU has recently recast seven existing pieces of legislation to develop the Industrial Emissions (IPPC) Directive (or IED, Directive 2010/75/EC). The aim is to achieve significant benefits to the environment and human health by reducing harmful industrial emissions across the EU and forms one of the prime legislative instruments to achieve targets identified under the EU Thematic Strategy on Air Pollution (TSAP), published in September 2005. The IED entered into force in January 2011 and must be transposed into national legislation by Member States by January 2013.

The IED regulates emissions by requiring each of the industrial installations concerned to have a permit covering emissions to air, water and soil, along with waste management and energy efficiency. Permit conditions and pollutant emission limit values (ELVs) included under permit conditions must be set on the basis of the application of best available techniques (BAT). Over the period 2001-2007, 29 European reference documents (BREFs[26]) on BAT were published, each drawing conclusions on what represents BAT for the sector or installation in question. The BREFs are drawn up by a technical author on the basis of information supplied and considered by technical experts from throughout the EU in a technical working group (TWG). Information incorporated in the BREFs can only come from the real-life experience of operators of installations; much of the information contained in the Refining BREF has been provided by CONCAWE, drawn from the 98 European refineries covered by the document.

Alongside the IED transposition and implementation process, the Refinery BREF is undergoing revision by the European Integrated Pollution Prevention and Control (IPPC) Bureau (EIPPCB). Following publication of an agreed BREF (currently expected in Q1 2014) and a review of ELVs for installations firing non-commercial fuels (including refineries), which is a requirement identified under the IED, IPPC permits will be revised to incorporate revised ELVs from 2014/2015 onwards.

COST IMPACT ON UK REFINERIES

PGI received high level cost estimates of emission abatement projects proposed by the refineries that are necessary for compliance with revised permit requirements. The proposed projects are strongly focussed towards tackling air emissions (NO_x, SO_x and particulates). The most capital intensive projects are gas scrubbers to remove SO_x from FCC flue gas streams and tail gas from sulphur recovery units (SRU), electrostatic precipitators or scrubbers to reduce FCC particulate emissions and biotreaters to process water effluent. Abatement projects to reduce waste and emissions to the soil were not identified.

[26] An acronym drawn from "best available techniques reference document".

The capital cost of projects identified by the refineries totalled £884 million (undiscounted). The timeframe of capital costs were described by the refineries in varying levels of detail but overall are expected to occur before 2022. Similarly, total operational costs for identified projects are estimated at £52 million.

In 2011, UKPIA compiled a similar list of known emission abatement projects based on information provided by the refineries. The aggregated capital costs completed by UKPIA totalled £900 million (undiscounted) which is approximately 2% higher than the more recent budget obtained by PGI; demonstrating a high degree of consistency in the estimates provided by the refineries. Annual operational costs were projected at £93 million, and are significantly higher due to UKPIA's assumption that this will typically be 10% of capital costs. Based on PGI's experience we consider a ratio closer to the equivalent average of 6.1% provided by the refineries to be more appropriate. The resulting indicative projections for capital and operating costs are shown in the table below. It should be noted that these estimates could increase as the abatement projects move beyond their feasibility stage and also once projects to reduce waste and emissions to the soil are included.

ESTIMATED CASH REQUIREMENT TO MEET IED EMISSION LIMITS
(Thousand of £, real 2012, undiscounted)

Type of Emission	Best Available Technique (BAT)	CAPEX (2013 - 2030)	Annual OPEX
Air			
SOx	Wet gas scrubbers (e.g. for FCC flue gas)	176,000	9,000
	Recovery of SOx from FCC sour water stripper off gas	12,000	1,000
	FCC de-SOx catalyst	-	5,000
	Tail gas clean-up for SRU (SCOT, Super Claus)	81,000	6,000
	Boiler conversion for natural gas firing	38,000	2,000
	Flare gas recovery	14,000	-
NOx	Low NOx burners on heater and boilers	64,000	3,000
	Boiler conversion for natural gas firing	N/A	N/A
	Flare gas recovery	N/A	N/A
Particulates	Electrostatic preciptator or scrubber to reduce FCC particulate emissions	215,000	12,000
Other	Replacement of CFC etc. refrigerants	3,000	-
Water	Waste water treatment plant	162,000	13,000
Soil		N/A	N/A
Waste		N/A	N/A
Undefined items		135,000	6,000
	Total	**900,000**	**57,000**

Capital costs of between £884 million and £900 million compare to a negative net cash margin for UK refineries in 2011 and a projected net cash margin of around £920 million in 2025.

EU EMISSION TRADING SYSTEM (ETS) DIRECTIVE – PHASE III

BACKGROUND

The EU Directive 2009/29/EC has introduced far reaching changes to the EU Emissions Trading Scheme (ETS) for the period 2013-2020 (Phase III). Under the current Phase II rules of EU ETS, EU Member States have been required to set an emission cap for all installations covered by the scheme (ranging from large combustion plants, to refineries and other energy intensive processes) and to issue a National Allocation Plan showing the allocation of European Union Allowances (EUAs) to each installation for the period 2008-2012. Most EUAs have been issued free based on projected need, with a small amount of auctioning, consistent with the Commission's objective of both meeting Kyoto targets and not being more than required for 'business as usual'. Under the revised Directive, an EU-wide, harmonised approach will be introduced for the allocation of EUAs in Phase III and a single EU-wide cap on EUAs will apply from 2013. This will be reduced annually by 1.74% (based on the 2010 cap) annually limiting the number of EUAs available to 21% below the 2005 level by 2020. A number of additional changes have also been made - the number of sectors and greenhouse gases covered by the system will be expanded and there will be no free allocation of EUAs for emissions derived from electricity generation. For sectors determined to be exposed to international competition, and therefore at risk of carbon leakage, a transitional system will be introduced for free allocation of EUAs based on stringent sector benchmarks (these sectors include refining). Full auctioning of EUAs will be established for the power sector and virtually all electricity production from 2013 onwards and for other sectors post 2020.

The Commission has taken steps to mitigate against carbon leakage[27] in the refining sector under the EU ETS allocation rules, which define a benchmark based on a concept of complexity weighted tonne (CWT) used to assess emission performance. This allows for the different levels of complexity found in EU refineries.

ALLOCATION OF EUAs TO UK REFINERIES

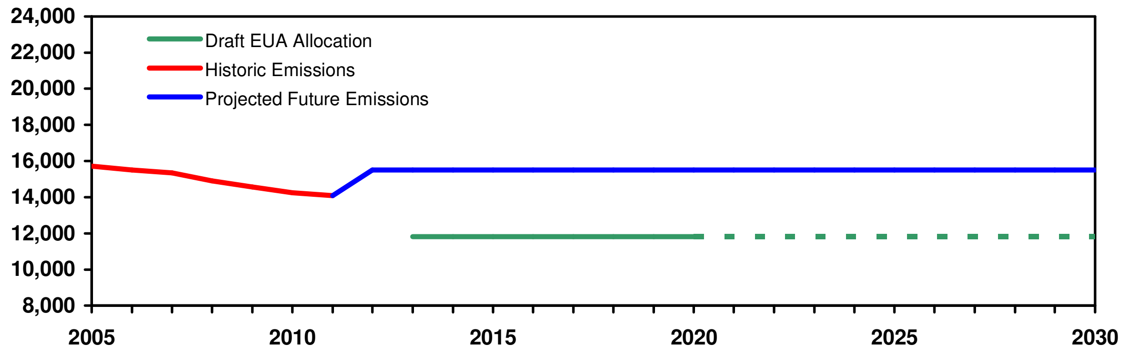
Using the EU ETS allocation rules, the UK Government has made draft allocations for each EU ETS installation as included in the UK draft National Implementation Measures (NIMs), which were submitted to the Commission in April 2012 for approval. UK refineries have been allocated 11.95 million EUAs annually during the Phase III period.

Applying the draft allocations, UKPIA have calculated that the total additional costs for UK refineries would be up to €86 million (£75 million) per year assuming an average EUA cost of €15/tCO_2e. The calculation is based on the difference between projected future emissions (median of verified emissions from the 2005 - 2008 benchmark period - extracted from submissions to the National Atmospheric Emissions Inventory (NAEI)) and the draft allocation.

Figure X-5 shows the shortfall between the projected annual future emissions estimated at 15.51 million tCO_2e and the 11.95 million EUAs expected to be allocated in each year of Phase III. The quantity of EUAs that will therefore need to be purchased annually by UK refineries is calculated to be 3.55 million. Note that the projected future emissions do not take into account of future refinery investments to meet new legislation or product demand and quality changes.

[27] Carbon leakage is when an increase in carbon dioxide (CO_2) emissions occurs in one country (or region) as a result of emissions reduction in a different country or region that usually has a stricter climate change policy.

FIGURE X-5
PROJECTED CO_2 EMISSIONS FROM UK REFINERIES
($ktCO_2e$ per year)

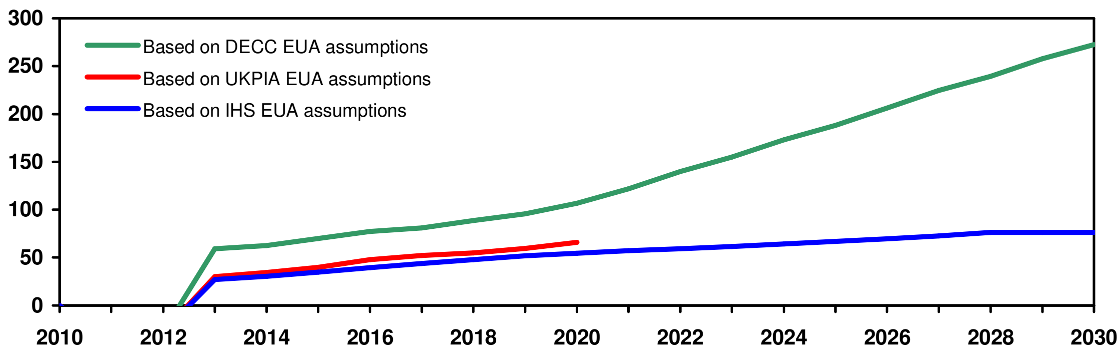


COST IMPACT ON UK REFINERIES

IHS published an EUA price forecast for the EU ETS Phase III in November 2012. Using the IHS forecast generates an annual cost to UK refineries at £53 million by 2020, but applying DECC's assumption for EUAs (Carbon Values Used in DECC's Energy Modelling, Oct 2011) generates a much higher cost of £103 million by 2020. The DECC, UKPIA and IHS EUA assumptions are available in Table X-5.

A comparison of the cost impacts based on EUA price forecasts from DECC, UKPIA (only available up to 2020) and IHS is presented in Figure X-6 below.

FIGURE X-6
PROJECTED VALUE OF EUA PURCHASES BY UK REFINERIES IN EU ETS PHASE III
(Million of £, real 2011)



PGI has previously evaluated the potential impact on refinery margins that a charge or cost on CO_2 emissions would produce. The requirement for the majority of EU refiners to have to purchase EUAs would put them at a disadvantage to refiners situated outside the EU, particularly those that are close by such as in North Africa, Ukraine or Belorussia. In the longer term this could further discourage operation and investment in EU refineries leading to an increased reliance on sourcing products from other regions.

Oil refining is a global business and refined oil products can and do move from region to region on a large scale. There are few barriers to the movement of products around the globe, other than the transport and logistics costs involved. This freedom of movement of oil products means that oil refining is subject to carbon leakage which has been recognised by the EU authorities[28]. Typically refineries in Europe and North America are among the most energy efficient globally. Refineries in Latin America, the Middle East and CIS generally have poorer (and in the case of CIS refineries sometimes substantially poorer) energy efficiency performance. Perversely the introduction of EU ETS Phase III and its application to EU refineries could result in an increase in overall CO_2 emissions per barrel of refined product produced as production migrates to less energy efficient refineries outside the EU that are not subject to a CO_2 emissions cost.

RENEWABLE ENERGY DIRECTIVE (RED)

BACKGROUND

Under Article 3(4) of the Renewable Energy Directive (Directive 2009/28/EC) a requirement is placed on Member States to "*ensure that the share of energy from renewable sources in the total amount of energy consumed in transport (petrol, diesel, biofuels consumed in road and rail transport, and electricity) in 2020 is at least 10% (energy) of the final consumption*".

In the UK the RED came into force by amendment to the Renewable Transport Fuel Obligation (RTFO) on 15th December 2011. The volume and trajectory of biofuels to be blended with fossil fuel remains unchanged from the previous RTFO in that the volume of biofuels in road transport fuel is on average 4.0% volume until 14th April 2012, then increasing to 4.5% volume and then 5.0% volume between April 2013 - 2014. The major amendment was that all biofuel crossing the duty point from 15th December 2011 has to meet the RED Carbon and Sustainability criteria. Further any biofuel produced from wastes, residues, non-food and lingo-cellulosic material will count double (i.e. 2 certificates awarded for each litre of biofuel added).

UKPIA POSITION

Current vehicle capability for gasoline powered vehicles is E10 (a maximum of 10% ethanol by volume) and for diesel, B7 (a maximum of 7% FAME by volume). These maxima, assuming some blending tolerance, equate to around 6% by energy content. To achieve 10% by energy content will therefore require a substantial volume of new vehicles designed to use higher levels of biofuels (e.g. E15+ and possibly B30) in the mass market by 2020, as well as a consumer incentive to purchase these higher bioblend fuels, which in the case of high ethanol content blends, give significantly worse fuel economy.

Under this scenario, four fuels grades will need to be supplied to the market; E10 and B7 for older vehicles, as well as higher bioblends for the new vehicles. This introduces supply and logistic difficulties, both at distribution terminals and retail stations. Refineries are also impacted, due to the requirement for additional tankage and the need to adjust the base fuel blends to ensure that final fuel specifications are met after incorporation of the different amounts of biofuel components.

[28] The manufacture of refined petroleum products has been categorized by the EC as a sector that is deemed to be exposed to a significant risk of carbon leakage (Official Journal of the European Union: *determining, pursuant to Directive 2003/87/EC of the European Parliament and of the Council, a list of sectors and subsectors which are deemed to be exposed to a significant risk of carbon leakage* - 24 December 2009)

COST IMPACT ON UK REFINERIES

Both UKPIA and the UK refineries are still awaiting advice from the UK Government on the future trajectories for the RED, so there is presently little information available for PGI to comment on the cost impact of implementation of the RED on UK refineries. Currently it is difficult to see any viable alternatives to the use of hydrotreated vegetable oils (HVO) by 2020. As an indication of the cost of plant to produce such fuel, the estimated cost of Neste's plant in Rotterdam was reported to be €670 million (around £580 million) with production of 800,000 tonnes per year. 800,000 tonnes of production would represent around 3% of UK diesel demand in 2020 so 1-2 plants of this size would be required to increase the biofuel content to the RED 2020 target level at a cost of around £1 billion. This investment would need to be completed by 2020 so we have assumed an annual investment of £200 million per year over the 2015 to 2020 period.

FUEL QUALITY DIRECTIVE – ARTICLE 7A

BACKGROUND

The EU Fuel Quality Directive (FQD) (Directive 98/70/EC, as amended by 2009/30/EC) mandates the reduction of the carbon footprint of road and non-road transport fuels in Europe. Article 7a of the FQD places an obligation on Member States to require suppliers to reduce as gradually as possible life cycle greenhouse gas emissions (GHG) per unit of energy from fuel and energy supplied by 10% by 31st December 2020 relative, to the EU wide 2010 fossil fuel baseline. There is flexibility as to how the 10% reduction can be delivered in that 2% can be achieved through use of technologies, including carbon capture and storage and electric vehicles, and 2% through purchase of credits through the Clean Development Mechanism of the Kyoto Protocol. Member States may require suppliers, for this reduction, to comply with the following intermediate targets: 2% by 31st December 2014 and 4% by 31st December 2017.

The FQD and the RED are interlinked, and the DfT in its consultation on proposals to implement Articles 7a to 7e of the FQD[29], identified that a reduction in GHG intensity of fuels will come largely from the increased supply of the same sustainable biofuels that will simultaneously make up the majority of the renewable energy required to meet the transport target imposed by the RED. The Directives have a slightly differing scope, with the FQD not covering aviation. However, it has been the DfT's intention that the Directives should mirror each other as far as possible, and both be implemented through an amended RTFO which the Department for Transport (DfT) believes will also minimise costs to UK business. On 11th September 2012, the DfT advised in a written statement relating to its response to the comments received in the consultation[30] that the UK will rely on the amended RTFO Order 2007 to deliver the GHG savings necessary under the FQD for the period up to 2014. The DfT will also put in place a requirement for fuel suppliers to report on the GHG intensity of both the biofuel and fossil fuels they supply for use in land-based transport and for the associated uses listed in the Directive.

[29] Consultation on proposals to implement Articles 7a to 7e of the EU Fuel Quality Directive (FQD) (Directive 98/70/EC as amended by 2009/30/EC) requiring suppliers to reduce the lifecycle greenhouse gas intensity of transport fuels and introducing sustainability criteria for biofuels, DfT (Sept 2011)

[30] Fuel Quality Directive Transposition. written statement by Norman Baker MP, Parliamentary Under-Secretary of State for Transport (Sept 2012)

DEFINING THE EU WIDE 2010 BASELINE

How the GHG reduction targets are met depends on the method chosen for calculating the GHG intensity of the fuels. The main components that contribute to the total life cycle of emissions are:

- Crude oil production (extraction, flaring and venting, fugitive emissions)
- Transportation of crude oil
- Refining of crude oil
- Refined product distribution and marketing
- Fuel consumption in vehicles.

However it should be noted that according to the JRC/CONCAWE/EUCAR (JEC) 'well-to-wheels' study in 2007, emissions related to fuel combustion in vehicles accounts for around 85% of total emissions. The remaining 15% is made up from emissions associated with crude oil production, transportation, refining and distribution.

Very few GHG emissions data associated with crude oil production are available. Whilst estimates of GHG emissions for a few specific fields exist, it is not possible to generalise regarding GHG emissions for crude oil production from a given area, country or region. PGI's own analysis, confirmed by others, indicates that there can be a very wide variation from field to field. For example, GHG emissions from some West African fields, but by no means all of them, can be much higher than GHG emissions from oil sands due to the high levels of flaring at some West African fields. As a result, attempting to differentiate between GHG emissions for different feedstock sources is very likely to result in unintended results. At the same time, this differentiation is unlikely to result in any reduction in GHG emissions at the production facilities since high GHG crude oils previously processed in Europe will be processed elsewhere due to the global nature of crude oil trade. In addition, this "crude shuffling" is likely to increase actual GHG emissions due to de-optimisation of transportation and sub-optimisation of European refinery feedstock selection resulting in a disadvantage for European refineries compared to those located where such legislation is not applicable.

The rules for calculating the GHG emissions for fossil fuels are currently still under discussion. A number of proposals (including the UK Three band proposal, Draft EU directive and Netherlands national target) have been put forward for possible definition of the baseline on a lifecycle basis and the implementation of Article 7a, and all proposed the use of default GHG intensity values for gasoline and diesel, specific to the type of crude oil from which each finished product is derived.

UKPIA jointly with EUROPIA proposed to the DfT on 19th January 2012 that one European default GHG intensity value, based on the average GHG intensity of crude oils actually refined in the EU at certain defined times, for Gasoline, and one for Diesel will provide the most effective implementation of Article 7a, by ensuring the UK and EU refining competitiveness is not affected and minimizes administration and reporting.

In March 2012, a consortium led by CE Delft[31] concluded that fuel supplier reporting of CO_2 intensity along the lines of the draft FQD proposal can be implemented at an annual cost of approximately €40-80 million to EU fuel suppliers. This figure is relatively small when spread across the industry, but a single default value for the EU wide 2010 fossil fuel baseline would further reduce this figure. Note that this is the estimated cost of the fuel supplier reporting only and not the potential cost of the impact of the implementation of Article 7a.

The application of Article 7a is still under discussion. In particular, the degree to which there is differentiation of GHG emissions between different feedstocks is still being debated. As discussed above full differentiation, whereby an assessment of GHG emissions for each feedstock is made, is likely to penalise the EU refining industry with no impact on GHG emissions at the field.

COST IMPACT ON UK REFINERIES

UKPIA consider the following as potential impacts arising from the implementation of EU-only legislation requiring a reduction in GHG intensity:

- Refiners and importers are likely to become more selective in crude and finished product selection. Competition for low GHG intensity sources is likely to increase market prices.
- Due to alternative non-EU supply options for crude producers there will be very limited incentive to reduce CO_2 emissions at source. Some redistribution in crude supply would occur, with shipping emissions likely to increase.
- The decrease of crude supply sources will be detrimental to EU security of supply. Many EU refiners would be forced either to pay higher crude costs than their non EU competitors, or to pay a CO_2 penalty under the provisions made under FQD Article 7a.
- The cost impact for EU refineries, especially those which are logistically “locked in” to a fixed crude diet, could have a strong adverse impact on their current margins
- Products imported to the EU by external EU refiners and traders would become more competitive.

In prior analysis PGI concluded that a modest cost of CO_2 of between €14 to €48 per tonne would be sufficient to dis-incentivise European refiners from switching from conventional crudes to the higher greenhouse gas intensity feedstocks as identified in Article 7a, such as synthetic crudes produced from oil sands and oil shale. Consequently this moderate CO_2 cost would be high enough to prevent European refiners from being able to fully optimise their crude slate, with a resulting disadvantage compared to refineries in other regions where such legislation is not present.

Wood Mackenzie has carried out a study on behalf of EUROPIA “Impact of FQD Crude GHG Differentiation – October 2012” which considers the case where full differentiation between feedstocks is applied. The impact on EU refinery margins was estimated to be in the range of $1.5 to $7.0 per barrel. This figure would be reduced considerably if an average GHG intensity approach was used for feedstocks, or the more limited differentiation of 3 categories of feedstock as in the last Commission proposal, but still with no benefit in terms of GHG

[31] Oil reporting for the FQD: An assessment of effort needed and cost to oil companies, CE Delft, Carbon Matters and ECN (March 2012) – commissioned by the European Federation for Transport and Environment

emissions reduction since high GHG emission feedstocks will simply be routed to other markets.

FUEL QUALITY DIRECTIVE – PRODUCT QUALITY/VAPOUR PRESSURE SPECIFICATIONS

BACKGROUND

The FQD (Directive 98/70/EC, as amended by Directive 2009/30/EC) includes a number of non-carbon measures concerning product quality specifications, each of which has a cost impact on refineries. Fuels used in non-road mobile machinery (NRMM) applications are required to be supplied at a sulphur content of 10ppm maximum from January 2011 (January 2012 for rail applications). Future fuel legislation may see the maximum sulphur content for all gas oils reduced to 10 ppm, considering that the FQD states that “Member States and the Commission should take appropriate steps to facilitate the placing on the market of gasoil containing 10ppm sulphur earlier from January 2011”. Such changes in fuel quality specifications introduce additional processing requirements and/or changes in crude selection, requiring additional investment and increases in operating costs (including increased CO_2 emissions and consequent EU ETS costs).

The gasoline specifications defined in EN228 remain. However, Member States with low ambient summer temperatures can apply for a derogation from the 60 kilopascal (kPa) summer specification to enable them to increase the ethanol content of gasoline (a maximum waiver of 8 kPa at 5% ethanol content). The application for a derogation must take into account socioeconomic impacts, and environmental and health consequences. Under the FQD, the UK has successfully negotiated a derogation for gasoline summer vapour pressure to increase the permitted levels from 60 kPa to 70 kPa; this derogation lasts until 2020. Although the technical justification for this increase will still be valid in 2020, a further derogation would be required and this may not be granted.

COST IMPACT ON UK REFINERIES

Any reduction in the maximum sulphur content of middle distillate fuels would place additional demand on refinery hydro-desulphurisation units, which are already at capacity further distorting the gasoline/middle distillate imbalance seen for the UK refining sector and further increasing import requirements of diesel to balance supply and demand.

The UK’s application for a “low ambient summer temperature” gasoline vapour pressure derogation was submitted to the EC in June 2010. The application contained analysis from UKPIA on the economic implications of reducing the summer vapour pressure. UKPIA estimated that, across the whole UK refining sector, the capital cost of increased distillation tower and distillate collection and storage capacity required to meet a 60 kPa vapour pressure limit (implying a blendstock vapour pressure of 52 kPa to 53 kPa before the addition of ethanol) would be around £46 million per year over a 5 year period, plus additional operating costs of £106 million per year.

With reference to our in-house data we understand the ranges of vapour pressures for gasoline components in the UK, with the exception of reformate (typically a major component in gasoline), are higher than typical. UKPIA’s focus on additional distillation (component fractionation) capacity suggests that this is the identified approach to addressing the high vapour pressures for gasoline components. The 60 kPa limit is challenging since most gasoline blending components have vapour pressures higher than this level.

Distillation is a process to separate lighter more volatile components from heavier less volatile material. Generally a distillation column has some control flexibility to increase and decrease the separation efficiency between high and low volatility components. Depending on the process design, improvement in separation performance can be achieved at the expense of throughput or with an increase in energy consumption, and potentially reduce the vapour pressure of gasoline component streams. However this could reduce the capacity of the process unit. This may or may not be a particular difficulty if gasoline production is in excess to the immediate market needs, within the constraints of overall refinery throughput to produce sufficient quantities of other fuels.

Our capital cost estimate for a typical naphtha splitter or reformate splitter for a typical process unit throughput of around 20,000 B/D would be $28 million or approximately £18 million. So a capital cost of £230 million would represent approximately 12 distillation columns of this size. This would suggest around two distillation columns per refinery, allowing for some columns to be smaller than 20,000 B/D which is in line with the UKPIA estimates. This type of project is not particularly complex and would be within the capabilities of refiners to implement, However the additional expense to achieve the reduction in vapour pressure may not result in any environmental benefit in terms of air quality.

Should the UK lose its current derogation then the UK refining industry would certainly incur additional capital and operational costs.

ENERGY EFFICIENCY DIRECTIVE

BACKGROUND

The European Commission published a proposal for an Energy Efficiency Directive (EED) on 22nd June 2011, which sought to mandate measures to achieve further reductions in energy use, to ensure the target of a 20% saving in primary energy use by 2020 can be realised. The Directive includes measures likely to impact the downstream oil sector:

- A legal obligation to establish energy saving schemes in all Member States. Energy distributors or retail energy sales companies will be obliged to achieve a cumulative end-use energy savings target by end 2020 equivalent to at least 1.5 % of energy sales, by volume, per year (Article 7). Energy savings achieved in refinery operation can be counted against this obligation, but obligated companies may have to implement measures such as improving the efficiency of the heating system, installing double glazed windows or insulating roofs, among final energy customers.
- Mandatory audit of energy management systems (Article 8).
- A requirement for suppliers to provide easy and free-of-charge access to data on real-time and historical energy consumption for electricity, natural gas, district heating or cooling and domestic hot water (Articles 10 and 11).
- A requirement that all new or refurbished thermal electricity generation installations >20 MW should carry out a cost/benefit analysis for conversion to high

efficiency cogeneration and for connection to a district heating and cooling network (Article 14).

Agreement on the text of the draft Directive was reached via comitology and the triologue negotiation process between the European Parliament, the Council and the Commission on 13th June 2012. Directive 2012/27/EU was published in the Official Journal on 14th November 2012 and entered into force on 4th December 2012. It must be transposed by Member States into national legislation by 5th June 2014.

COST IMPACT ON UK REFINERIES

As conveyed by UKPIA, energy costs are the second most significant operating cost for refiners after feedstock costs, and energy efficiency and minimising of energy costs is a constant focus for refinery operators. PGI's yardstick catalytic cracking refinery, typical of most U.K. and European refineries, consumes around 7% of input as fuel. The majority of refineries have therefore implemented specially developed Energy Management Systems and, since they are also subject to the EU ETS, closely monitor energy use and emissions, implementing cost-effective projects to improve energy efficiency as appropriate. Examples include improvements in furnace efficiency, heat integration, use of cogeneration (combined heat and power generation or CHP) and general energy housekeeping, with the main focus being on heat use and waste heat recovery. Opportunities for energy efficiency improvement in electricity consumption are generally less important, as the total percentage savings available are small with poor cost/benefit ratios.

Only one refinery responded to the EED subject in their data submission, but only to re-clarify the intent of the Directive. The refinery confirmed that at present the cost impacts are unknown which is reasonable given that the EED was only recently published.

ENVIRONMENT AGENCY COMAH CONTAINMENT POLICY

BACKGROUND

The UK Environment Agency introduced a revised Containment Policy under the Control of Major Accident Hazards (COMAH) Regulations 1999 in February 2008. This was developed following a number of incidents, in particular, the explosion and fire at the Buncefield fuel storage depot in December 2005, and in response to recommendations made by the Buncefield Major Incident Investigation Board in their Design and Operations report, published in March 2007. The Policy applies to the bulk storage of hazardous liquids at sites which are subject to regulation under COMAH and sets out requirements for primary, secondary and tertiary containment.

Primary containment measures have the highest priority in recognition of their importance in preventing accidents. It is achieved by the equipment that has direct contact with the substances being stored or transported such as storage vessels, pipework, valves, pumps and associated management and control systems. It also includes equipment that prevents the loss of primary containment under abnormal conditions, such as high-level alarms linked to shut down systems.

Secondary containment measures are important in preventing the loss of primary containment escalating into a major accident. Secondary containment prevents the uncontrolled spread of the hazardous liquid by using equipment that is external to and independent of the primary containment system, such as concrete or clay bunds around storage tanks (a bund is an enclosure designed to contain fluids should they escape from the tank or vessel inside the bund). Secondary containment will also provide limited storage capacity for firewater management.

Tertiary containment minimises the consequences of a failure in the primary and secondary containment systems by providing an additional barrier preventing the uncontrolled spread of hazardous liquid. Tertiary containment is achieved by means external to and independent of the primary and secondary containment systems, such as site drainage and sumps, diversion tanks, impervious liners and/or flexible booms. Tertiary containment will be utilised when there is an event that causes the loss of containment (e.g. bund joint failure or firewater overflowing from a bund during a prolonged tank fire), and is intended to ensure that loss of control of hazardous materials does not result from such an event.

COST IMPACT ON UK REFINERIES

The projected capital costs required for compliance with the COMAH containment policy have been received from six refineries, which when aggregated total £374 million. The estimates were generally provided with little supporting assumptions on how the estimates were derived, in particular details such as the number and size of tanks. A simple breakdown of the capital cost estimates provided to PGI is shown in the table below.

ESTIMATED CAPITAL COSTS FOR COMPLIANCE WITH COMAH CONTAINMENT POLICY
(Thousand of £, undiscounted)

Refinery	Primary and Secondary Containment	Total CAPEX (2013 to 2030)
Refinery A	8,566	8,566
Refinery B	100,000	100,000
Refinery C	85,000	85,000
Refinery D	62,854	62,854
Refinery E	103,300	103,300
Refinery F	14,000	14,000
Refinery G	N/A	N/A
Total	**373,720**	**373,720**

In general, no cost estimates have been provided separately for primary and secondary containment – therefore these have been combined in the table above. No estimates were provided for tertiary containment.

Estimated expenditure has been provided by refineries A through F which are assumed to include primary and secondary containment measures for the period 2012-230. Whilst there are significant differences in the estimates provided, this is not unexpected as the work that may be required in order to comply with the containment policy is greatly influenced by the topography and geology of the individual sites. Without more detailed estimates it is not possible to deduce whether the scope of improvement works is sufficient. PGI has also not seen any references to the potential replacement of tank foundations as part of the containment improvement works.'

In 2011, UKPIA estimated the capital costs (undiscounted) for compliance with the COMAH Containment Policy, and arrived at over £263 million for primary containment and (potentially) over £996 million for improvements in secondary and tertiary containment, with this investment spread over the next 20 years. UKPIA's projections were based on a bottom up approach, which applied the survey data of UK storage tanks collected by the Process Safety Leadership Group (PSLG) to estimate the number of tanks in the UK that require containment improvement works. Suitable unit costs to install primary and secondary containment measures were then derived for small, medium and large tanks.

Prior to receiving the capital costs projections from the refineries, PGI applied UKPIA's methodology to confirm the cost estimates, and where appropriate costs were escalated and the basis of assumptions revised. PGI's revised capital cost estimate for primary containment improvement works by UK refineries came to £387 million with associated annual operational costs of £19 million. The capital cost estimate for secondary containment improvement works were also revised to £859 million with associated annual operational costs of £43 million.

UKPIA also estimated the cost of tertiary containment measures for UK refineries at £300 million. The basis of this estimate is unknown but if escalated to 2012 costs it will increase to £316 million. Since no further estimates were provided by the refineries it has not been possible for PGI to make an assessment of the potential tertiary containment costs.

Overall, PGI considers the capital costs estimates provided by the refineries to be the most applicable, but notes that the budget £374 million could increase should tertiary containment measure be identified. Furthermore based on the assumption that the potential capital costs required by Refinery G are equivalent to the average per a refinery, the budget should be increased by £62 million to £436 million. Assuming operational costs are approximately 5% of capital costs, the annual operational costs after construction is estimated at £19.4 million.

CARBON FLOOR PRICING LEGISLATION

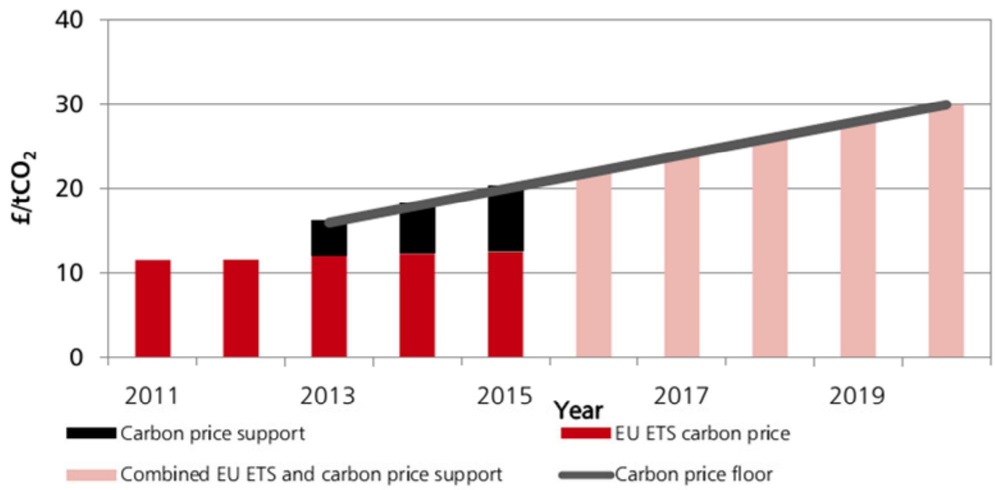
BACKGROUND

In the 2011 Budget Report, The Chancellor announced plans to introduce a carbon price floor from 1st April 2013, setting out proposed changes to the climate change levy (CCL) and fuel duty to establish a carbon price support (CPS) mechanism to help increase incentives for investment in low-carbon electricity generation. Following the announcement, the first tranche of the primary legislative provisions was included in Finance Act 2011, introducing changes to the price floor, including confirming details of some previously announced changes. It also announced the CPS rates for 2014-15 to meet the floor as set out in the 2011 Budget Report, along with indicative rates for 2015-16 and 2016-17. The Government carried out a consultation on the proposals from 16th December 2010 to 11th February 2011, with a response published in March 2011.

CPS RATE

The carbon price support rates for CCL and fuel duty to achieve the price floor reflect the differential between the future market price of carbon dioxide and the floor price, as illustrated in Figure X-9 below.

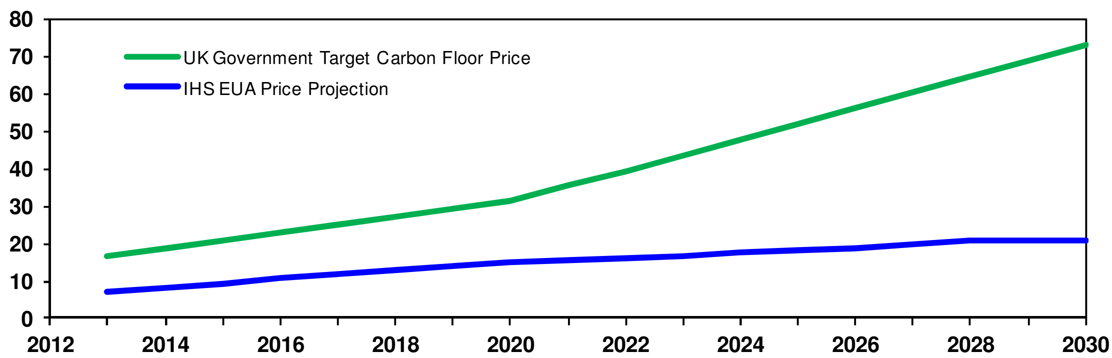
FIGURE X-7
CARBON PRICE FLOOR ILLUSTRATION
(Real 2009 prices)



Source: HM Treasury (2011)

The CPS Rate for 2013-14 was announced in the Budget 2011 and is equivalent to £4.94/tCO_2. The CPS Rate for 2014-15 was announced in the Budget 2012 to be £9.55/tCO_2. CPS Rates for subsequent years will be calculated at future Budgets and will reflect the difference between the future EU ETS carbon price and the carbon price floor. An indication how wide this difference maybe is illustrated in Figure X-10 below which shows that the CPS Rate could increase more significantly after 2020.

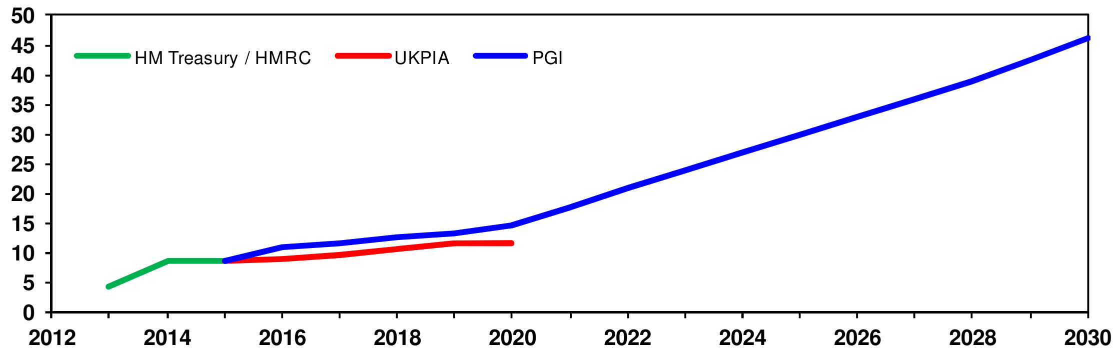
FIGURE X-8
COMPARISON OF UK GOVERNMENT TARGET FLOOR PRICE AND IHS EUA PRICE OUTLOOK
(£/tCO2e, adjusted to real 2011)



COST IMPACT ON UK REFINERIES

The introduction of CPS would incur significant additional cost on UK refineries. UKPIA, using data submitted by the refineries, has estimated UK refinery emissions from electricity consumption are approximately 1.08 million tCO_2 per year. PGI has not received data from the refineries to confirm this figure. Assuming the emissions remain unchanged the additional cost of CPS to UK refineries in 2013-2015 will be £10.3 million based on the announced CPS Rate of £9.55/tCO_2. By 2020 we project the cost impact will have risen to £17.7 million, which is slightly more than UKPIA's projection due to differing EUA prices. UKPIA have used a 2020 EUA price of £17.94 compared to IHS's projection of £14.80 which subsequently results in a lower CPS rate. The estimated annual cost impact projected by UKPIA and PGI from 2015 onwards is illustrated in Figure X-11 below. A detailed breakdown of the cost estimates are show in Table X-6.

FIGURE X-9
ESTIMATED COST IMPACT OF CARBON PRICE SUPPORT RATE ON UK REFINERIES
(Million of £, real 2012)



CRC ENERGY EFFICIENCY SCHEME

BACKGROUND

The CRC Energy Efficiency Scheme (CRC) was introduced in 2008 as a mandatory scheme aimed at improving energy efficiency and cutting emissions in large public and private sector organisations. It features a mix of reputational and financial drivers to encourage organisations to develop energy management strategies and is designed to address carbon dioxide (CO_2) emissions not already covered by Climate Change Agreements (CCAs) and the EU ETS.

Between 27th March and 18th June 2012, DECC undertook a consultation on proposals to simplify the Scheme. The Government's response to the consultation was published on the 10th December 2012[32] which stated the Government's intention to implement the proposal to dis-apply the CRC Energy Efficiency Scheme supply rules to CCA facilities and EU ETS installations and to remove the three CCA exemptions from the scheme. It is understood that should this is be the case then it would apply to Phase 2 which will commence on 1st April 2014.

COST IMPACT ON UK REFINERIES

The CRC is an organisation based scheme, which for the major oil companies, covers most of their energy use, including upstream activities, refineries, power generation and

[32] Consultation on a Simplified CRC Energy Efficiency Scheme (December 2012)
www.decc.gov.uk/en/content/cms/consultations/crc_simp_cons/crc_simp_cons.aspx#

petrochemicals sites, pipelines, distribution terminals, offices and filling stations etc. Under the current CRC supply rules, to avoid double regulation of emissions from energy use, the CO2 emissions from refinery processes covered by the EU ETS are not liable for CRC, although offices and other facilities co-located with the refinery process units are liable, along with grid electricity supplies. With the simplification of CRC from Phase II onwards, dis-applying the supply rules for refinery processes covered by EU ETS and for integrated petrochemicals activities covered by a CCA agreement, the contribution to overall company CRC liability from refining activities will be significantly reduced after Phase 1 has ended (31st March 2014). The projected CRC costs in 2013 have been received from six refineries which, when aggregated, total £10.5 million. Taking an average of £1.8 million per a refinery, the projected total CRC costs for all UK refineries in 2013 is £12.2 million, but has been reduced to zero in future projections from Phase II onwards.

RATING REVALUATION

BACKGROUND

New rateable values (RVs) for commercial properties came into effect in April 2010 for England, Wales and Scotland, based on assessed property values in April 2008, when the assessed RV of refineries and other downstream assets were particularly high.

Although a transitional rate relief scheme has been introduced, issues remain and the industry has requested that Government should introduce:

- Realism on RVs and replacement cost values for refineries, with phasing to take account of very weak refining margin outlook.
- Review of the principles used for rating of plant and machinery, such that environmental plant, security assets installed for National Security purposes and post-Buncefield compliance investment and assets are de-rated.
- Rating relief for cross-country pipelines.
- A change in the revaluation cycle to 3 yearly intervals from the current 5 yearly intervals.

COST IMPACT ON UK REFINERIES

The business rates paid by UK refineries between 2009 and 2012 are shown in the table below.

BUSINESS RATES PAID BY UK REFINERIES
(Thousand of £)

Refinery	2009	2010	2011	2012	2009 to 2010 Increase		2010 to 2011 Increase	
Refinery A	5,352	6,045	6,377	n/a	693	12.9%	332	5.2%
Refinery B	4,300	4,500	4,500	n/a	200	4.7%	-	0.0%
Refinery C	n/a	n/a	n/a	8,347	-		-	
Refinery D	n/a	n/a	n/a	n/a	-		-	
Refinery E	9,996	11,482	13,191	n/a	1,486	14.9%	1,709	13.0%
Refinery F	6,750	9,650	9,650	n/a	2,900	43.0%	-	0.0%
Refinery G	1,828	3,786	5,081	n/a	1,959	107.2%	1,295	25.5%
Total	**28,226**	**35,463**	**38,799**	**8,347**	**7,238**		**3,336**	
Average						**36.5%**		**8.7%**

Business rates were not provided by all the refineries, however five refineries did provide business rates for 2009 to 2011. Using these figures we have deduced the business rates increased by £7.2 million, or an average increase of 36.5% for each refinery, after the new RVs for commercial properties came into effect in 2010. Pro-rating the 2010 increase to include the other two refineries generates a total increase in business rates to UK refineries to £10.1 million. This aligns well to UKPIA's high level estimate at £10 million per year for the additional costs paid by UK refineries under the new RVs. On this basis we have a pro-rated the 2009 to 2011 business rate increase of £10.6 million to £14.8 million to represent all seven UK refineries.

It should be noted that the basis of UKPIA's estimate has not been clarified. The extent of transitional rate relief that the refineries have received is also unknown so the additional business rate cost may be higher.

OVERVIEW OF COST IMPACT TO UK REFINERIES

CASH REQUIREMENT

UK refineries are facing considerable future capital expenditure requirements and significantly increased operational costs to meet changing requirements from the UK's intentional obligations and legislative requirements, arising from EU Directives and UK Government policies.

From 2013 to 2030 we estimate UK refineries will need to invest close to £5.5 billion in new emission abatement equipment, new processing capacity, crude and product storage and containment improvements. These sizable investments are on top of the investments needed in new processing capacity to address the gasoline/middle distillate imbalance seen in the UK, although to date no major upgrade projects have been announced.

In the same time period, additional operational costs are projected to amount to £5.9 billion. This is partly attributed to the cost of operating new equipment described above, but over £1.4 billion (approximately 24%) of the additional costs are related to payments for additional EUAs and supporting the UK's target carbon floor price.

It should be noted that costs relating to FQD Article 7a have been excluded since the rules for calculating the GHG emissions for fossil fuels are currently still under discussion.

Furthermore preliminary assessments have shown the cost range can vary dramatically depending on the chosen rule. Taking these factors into consideration PGI is of the opinion that it is too premature to include such costs.

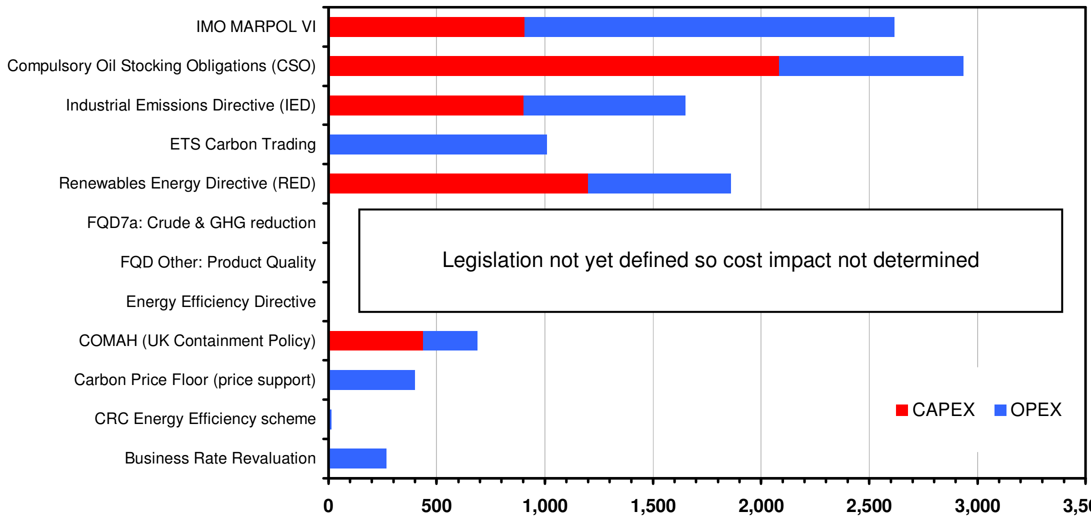
The aggregated costs are summarized in the table below and illustrated in Figure X-10. A full breakdown is available in Table X-6.

ESTIMATED COST IMPACT OF LEGISLATIVE REQUIREMENTS ON UK REFINERIES (2013 - 2030)
(Constant 2012 thousand of £ unless noted, undiscounted and excludes financing costs)

Policy Initiative		Cost Pass Through	Estimated Cost to UK Refineries (2013 - 2030) Capital Cost	Operational Cost	Total Cost	Average * ($/B)
International	IMO MARPOL VI	Yes	905,920	1,710,470	**2,616,390**	**0.42**
	Compulsory Oil Stocking Obligations (CSO)	Yes	2,084,016	850,457	**2,934,473**	**0.47**
EU Regulatory Policy	Industrial Emissions Directive (IED)	No	900,553	747,888	**1,648,442**	**0.27**
	EU ETS Carbon Trading	No	-	1,008,982	**1,008,982**	**0.16**
	Renewables Energy Directive (RED)	Yes	1,200,000	660,000	**1,860,000**	**0.30**
	FQD7a: Crude & GHG reduction	No	Legislation not yet defined and so cost impact not determined			
	FQD Other: Product Quality	Yes				
	Energy Efficiency Directive	No				
	COMAH (UK Containment Policy) - Primary	Partial	9,333	7,700	**17,033**	**0.00**
	COMAH (UK Containment Policy) - Secondary	Partial	426,673	244,150	**670,823**	**0.11**
	COMAH (UK Containment Policy) - Tertiary	Partial	Cost impacts not yet determined			
UK Regulatory Policy	Carbon Price Floor (price support)	No	-	398,563	**398,563**	**0.06**
	CRC Energy Efficiency scheme	No	-	12,192	**12,192**	**0.00**
UK Fiscal	Business Rate Revaluation	No	-	266,448	**266,448**	**0.04**
		Total	**5,526,495**	**5,906,850**	**11,433,345**	**1.85**

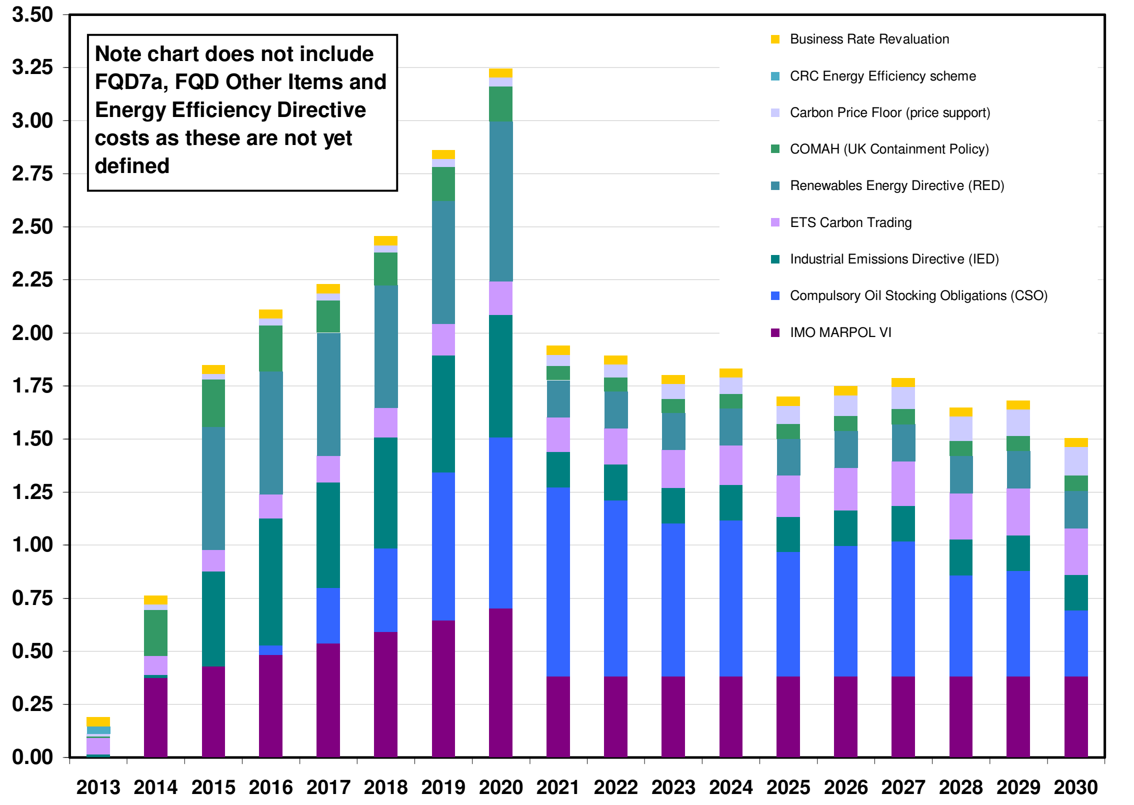
Note:
* Based on UK refinery throughput (2013 - 2030) of 1,301 million tonnes = 9,884 million barrels (using 7.6 barrels per tonne). £1.00 = $1.59

FIGURE X-10
ESTIMATED COST IMPACT OF LEGISLATIVE REQUIREMENTS ON UK REFINERIES (2013 - 2030)
(Thousand of £, undiscounted and excludes financing costs)



The additional $11.4 billion of capital and operating costs are very significant. The average annual cost increase is 1.85 $/B from 2013 to 2030, 2.0 $/B from 2015 to 2030 and is expected to be highest over 2016 to 2020 averaging 2.6 $/B, peaking at 3.25 $/B in 2020. See Figure X-11 below. Further cost information is available in Table X-7.

FIGURE X-11
ESTIMATED COST IMPACT OF LEGISLATIVE REQUIREMENTS ON UK REFINERIES (2013 - 2030)
(Forecast in Constant 2012 Dollars per Barrel)



POTENTIAL IMPACT ON REFINING MARGIN

The net refinery margin will be changed by the additional costs that are incurred by refiners that can not be passed on to UK consumers. As shown in the previous table these are considered to be:

EU
- Industrial Emissions (IPPC) Directive
- EU ETS Carbon Trading
- FQD7a: Crude & GHG reduction
- Energy Efficiency Directive

UK
- Carbon Floor Pricing
- CRC Energy Efficiency Scheme
- Rating revaluation

The total unrecoverable capital and operational costs to be absorbed by UK refinery margins up to 2030 is estimated to be £3.3 billion. The average annual impact on refinery margins between 2013 and 2030 is estimated at -0.54 $/B, peaking in 2020 at -0.82 $/B.

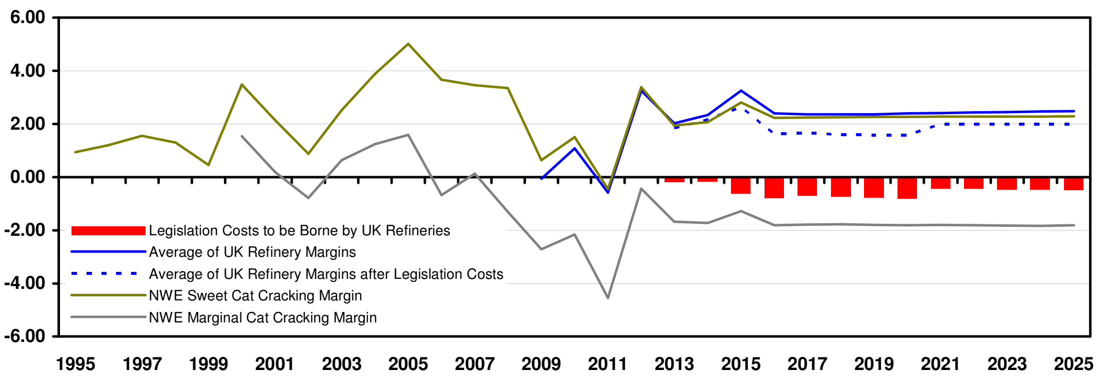
ESTIMATED IMPACT ON UK REFINERY MARGINS
(Constant 2012 prices, undiscounted and excludes financing costs)

Policy Initiative		Cost Pass Through	Total Costs (2013 - 2030) (£k)	Impact on UK Refinery Margin: Average (2013 - 2030) * ($/B)	Impact on UK Refinery Margin: 2030 ** ($/B)
EU Regulatory Policy	Industrial Emissions Directive (IED)	No	1,648,442	(0.27)	(0.17)
	EU ETS Carbon Trading	No	1,008,982	(0.16)	(0.22)
	FQD7a: Crude & GHG reduction	No	Legislation not yet defined and so cost impact not determined		
	Energy Efficiency Directive	No			
UK Regulatory Policy	Carbon Price Floor (price support)	No	398,563	(0.06)	(0.13)
	CRC Energy Efficiency scheme	No	12,192	(0.00)	-
UK Fiscal	Business Rate Revaluation	No	266,448	(0.04)	(0.04)
		Total	**3,334,626**	**(0.54)**	**(0.56)**

Note:
* Based on UK refinery throughput (2013 - 2030) of 1,301 million tonnes = 9,884 million barrels (using 7.6 barrels per tonne). £1.00 = $1.59
** Based on UK refinery throughput (in 2030) of 72 million tonnes = 548 million barrels

With the average net refining margin of the UK refining industry projected at around 2.6 $/B before any such legislative costs, these additional costs represent a very significant burden on an industry already under significant pressure, as shown in Figure X-12 below.

FIGURE X-12
IMPACT OF LEGISLATION COSTS ON PROJECTED UK NET REFINING MARGINS
(Forecast in Constant 2012 Dollars per Barrel)



The costs that could not be passed on would reduce the average UK net refinery margin from 2.6 $/B to 1.9 $/B; i.e. wiping out 25% of the net margin.

However more significant than this average net margin impact is the fact that the UK refiners would have to find some £5.5 billion in capital expenditure over this time period, £4.6 billion of which would have zero return (i.e. costs passed through to consumer) and £900 million of which would have a negative return (no potential cost pass through to consumer).

PGI believe that no industry would bear such an investment burden for no return. In a number of cases when faced with such a large mandatory capital expenditure requirement that provides no return on investment, a number of UK refiners could be forced to close UK refineries as they may not have access to adequate finance. Those refiners fortunate to have access to adequate finance would still be likely to conclude that operating in the UK would not provide adequate return on investment compared to other regions and voluntarily decide to close UK and European operations.

It is important to recognise that the legislative cost impact is likely to increase further once the impact from currently un-costed legislation, such as FQD and EED, are factored in.

PGI have undertaken a broad-brush projection of Return on Average Capital Employed (ROACE) for the UK refining industry based on the projected margins, combined with the projected capital and operating costs of the projected legislation. Over 2013 to 2030 the UK industry as a whole could expect an average simple return on investment of around 4.1% (not including any cost for FQD7a and Energy Efficiency Directive). At a simple discount rate of 3.5% this ROACE falls to 3.2%. A 10% discount rate drops the ROACE to 2.2%. This is on an estimated average capital employed of some £6.8 billion. Details of our ROACE estimate can be seen in Table X-9.

Such a low return on such a high capital investment is also very likely to make refiners conclude that operating in the UK (or Europe) would not provide adequate return on investment compared to other regions or businesses, and therefore voluntarily decide to close UK and European refining operations.

POTENTIAL IMPACT ON UK CONSUMERS

The price of UK refined products at the refinery gate will be impacted by the extent of costs that is passed on to UK consumers. These legislative cost items are considered to be:

International
- MARPOL Annex VI / IMO (low sulphur shipping fuel)
- Compulsory oil stocking obligations (CSO)

EU
- Renewable Energy Directive
- Fuel Quality Directive – product quality/vapour pressure specifications

UK
- Environment Agency Containment Policy

The total costs to be passed onto UK consumers up to 2030 are estimated at £8.1 billion. The average annual impact on product prices between 2013 and 2030 is estimated at 0.65 p/litre of refined product production, peaking at 1.22 p/litre in 2020[33]. The full projection is available in Table X-8.

[33] Refer to previous Incremental CSO section for conversion of legislation costs in £ to p/litre of refined product production.

ESTIMATED IMPACT ON REFINED PRODUCT PRICES AT REFINERY GATE
(Constant 2012 prices, undiscounted and excludes financing costs)

Policy Initiative		Cost Pass Through	Total Costs (2013 - 2030) (£k)	Impact on Refined Product Price: Average (2013 - 2030) * ($/B)	Impact on Refined Product Price: Average (2013 - 2030) * (p/litre)	Impact on Refined Product Price: 2030 ** (p/litre)
International	IMO MARPOL VI	Yes	2,616,390	0.53	0.21	0.19
	Compulsory Oil Stocking Obligations (CSO)	Yes	2,934,473	0.60	0.24	0.16
EU Regulatory Policy	Renewables Energy Directive (RED)	Yes	1,860,000	0.38	0.15	0.09
	FQD Other: Product Quality	Yes	Legislation not yet defined so cost impact not determined			
UK Regulatory Policy	COMAH (UK Containment Policy)	Partial	687,856	0.14	0.06	0.04
		Total	**8,098,719**	**1.65**	**0.65**	**0.47**

Note:
* Based on UK refined product production (2013 - 2030) of 1,040 million tonnes = 7,792 million barrels (using typical densities of individual products) = 1,239 billion litres (using 158.99 litres per barrel). £1.00 = $1.59
** Based on UK product production (in 2030) of 58 million tonnes = 434 million barrels = 69 billion litres

The chart below shows the impact of projected legislative costs on product prices in pence per litre, evenly spread across all refinery products. In practice some products (e.g. gasoline and diesel) may incur a higher share of the costs.

FIGURE X-13
IMPACT OF LEGISLATION COSTS ON UK REFINED PRODUCT PRICES
(Forecast in Constant 2012 pence/litre)

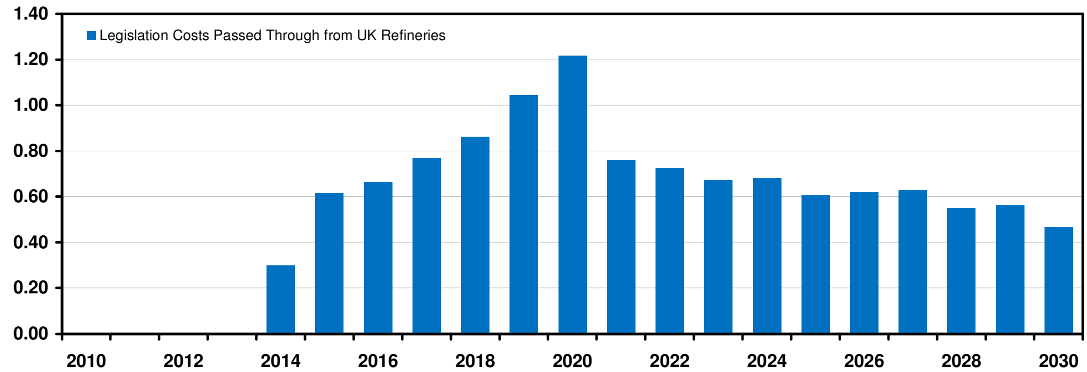


TABLE X-1
CASH EXPENDITURE REQUIRED BY THE UK REFINING SECTOR UNDER A FUEL COMPLIANCE SCENARIO
(Thousand of £, real 2012 prices, undiscounted)

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total (2013 - 2030)
Capital Expenditure	-	129,417	129,417	129,417	129,417	129,417	129,417	129,417	-	-	-	-	-	-	-	-	-	-	905,920
Operational Cost	-	-	18,796	37,593	56,389	75,185	93,982	112,778	131,575	131,575	131,575	131,575	131,575	-	-	-	-	-	1,052,597
Total	**-**	**129,417**	**148,214**	**167,010**	**185,806**	**204,603**	**223,399**	**242,195**	**131,575**	**131,575**	**131,575**	**131,575**	**131,575**	**-**	**-**	**-**	**-**	**-**	**1,958,517**

TABLE X-2
ESTIMATED CSO COSTS TO THE UK DOWNSTREAM OIL INDUSTRY
(Thousand of £, real 2012 prices, undiscounted)

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total (2013 - 2030)
Moderate cost CSO scenario - medium tanks																			
Capital cost	-	-	-	14,958	89,746	119,661	129,633	119,661	114,675	99,717	54,845	54,845	54,845	54,845	54,845	-	-	-	962,273
Incremental stock cost	-	-	-	-	-	15,544	103,625	134,713	155,438	139,894	129,531	119,169	62,175	67,356	67,356	62,175	64,766	-	1,121,742
Incremental ticket cost	-	-	-	-	-	-	-	2,538	2,538	2,538	5,076	5,076	5,076	5,076	7,614	7,614	7,614	7,614	58,375
Operating cost	-	-	-	-	-	-	7,472	22,417	34,872	44,835	59,780	74,725	79,706	84,688	89,670	94,651	99,633	99,633	792,082
Total	**-**	**-**	**-**	**14,958**	**89,746**	**135,205**	**240,730**	**279,329**	**307,522**	**286,984**	**249,232**	**253,814**	**201,802**	**211,965**	**219,485**	**164,441**	**172,013**	**107,247**	**2,934,473**

TABLE X-3
PROJECTED VALUE OF EUA PURCHASES BY UK REFINERIES IN EU ETS PHASE III
(Real 2012 prices, undiscounted)

		Phase I			Phase II					Phase III									
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2025	2030
CO2 Emissions from UK Refineries																			
Verified Historic Emissions	(£/tCO_2e/a)	15,715	15,517	15,349	14,894	14,563	14,240	14,079	-	-	-	-	-	-	-	-	-	-	-
Projected Future Emissions		-	-	-	-	-	-	-	15,505	15,505	15,505	15,505	15,505	15,505	15,505	15,505	15,505	15,505	15,505
Allocation of EUAs to UK Refineries	(kEUA/a)	18,555	18,555	18,555	17,035	17,035	17,248	17,447	17,459	11,822	11,822	11,822	11,822	11,822	11,822	11,822	11,822	11,822	11,822
Additional EUAs required by UK Refineries	(kEUA/a)	(2,840)	(3,038)	(3,206)	(2,141)	(2,472)	(3,008)	(3,368)	(1,954)	3,683	3,683	3,683	3,683	3,683	3,683	3,683	3,683	3,683	3,683
Forecast average annual EUA price																			
DECC (Oct 2011)	(£/tCO_2e)	18.11	13.90	0.53	14.77	10.46	11.47	10.43	14.00	16.00	17.00	19.00	21.00	22.00	24.00	26.00	29.00	51.00	74.00
UKPIA (Sept 2012)	(£/tCO_2e)	18.11	13.90	0.53	14.77	10.46	11.47	10.43	6.00	8.21	9.33	10.78	12.95	14.16	14.88	16.09	17.94	-	-
IHS (Nov /2012)	(£/tCO_2e)	18.11	13.90	0.53	14.77	10.46	11.47	10.43	6.00	7.32	8.29	9.49	10.70	11.91	12.95	14.00	14.80	18.18	20.68
Annual cost of additional EUAs																			
DECC	**(£k)**	**(51,444)**	**(42,235)**	**(1,696)**	**(31,622)**	**(25,862)**	**(34,503)**	**(35,129)**	**(27,350)**	**58,933**	**62,616**	**69,983**	**77,349**	**81,033**	**88,399**	**95,766**	**106,816**	**187,848**	**272,564**
UKPIA	**(£k)**	**(51,444)**	**(42,235)**	**(1,696)**	**(31,622)**	**(25,862)**	**(34,503)**	**(35,129)**	**(11,727)**	**30,225**	**34,374**	**39,707**	**47,708**	**52,153**	**54,820**	**59,265**	**66,080**	**-**	**-**
PGI	**(£k)**	**(51,444)**	**(42,235)**	**(1,696)**	**(31,622)**	**(25,862)**	**(34,503)**	**(35,129)**	**(11,727)**	**26,965**	**30,521**	**34,966**	**39,411**	**43,856**	**47,708**	**51,560**	**54,524**	**66,969**	**76,155**

TABLE X-4

ESTIMATED CASH EXPENDITURE REQUIRED BY UK REFINERIES FOR COMPLIANCE WITH UK COMAH CONTAINMENT POLICY (2013 - 2030)

(Thousand of £, real 2012 prices, undiscounted)

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total (2013 - 2030)
Capital Expenditure																			
Primary Containment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Secondary Containment	-	4,667	4,667	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9,333
Tertiary Containment	1,999	67,033	67,033	67,033	42,590	40,592	40,592	40,592	6,708	5,833	5,833	5,833	5,833	5,833	5,833	5,833	5,833	5,833	426,673
Total CAPEX (£k)	**1,999**	**71,700**	**71,700**	**67,033**	**42,590**	**40,592**	**40,592**	**40,592**	**6,708**	**5,833**	**5,833**	**5,833**	**5,833**	**5,833**	**5,833**	**5,833**	**5,833**	**5,833**	**436,006**
Operation Expenditure																			
Primary Containment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Secondary Containment	-	233	467	467	467	467	467	467	467	467	467	467	467	467	467	467	467	467	7,700
Tertiary Containment	100	3,452	5,581	7,711	9,840	11,870	13,899	15,929	16,264	16,556	16,848	17,139	17,431	17,723	18,014	18,306	18,598	18,889	244,150
Total OPEX (Approx 5% of CAPEX) **(£k)**	**100**	**3,685**	**6,048**	**8,177**	**10,307**	**12,336**	**14,366**	**16,396**	**16,731**	**17,023**	**17,314**	**17,606**	**17,898**	**18,189**	**18,481**	**18,773**	**19,064**	**19,356**	**251,850**
Total (£k)	**2,099**	**75,385**	**77,748**	**75,211**	**52,897**	**52,928**	**54,958**	**56,987**	**23,439**	**22,856**	**23,148**	**23,439**	**23,731**	**24,023**	**24,314**	**24,606**	**24,898**	**25,189**	**687,856**

TABLE X-5
ESTIMATED COST IMPACT OF CARBON PRICE SUPPORT RATE ON UK REFINERIES
(Real 2012 prices, undiscounted)

		2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total (2013 - 2020)
Forecast average annual EUA price	(£/tCO_2e)																							
DECC (Oct 2011)		18.11	11.47	10.43	14.00	16.00	17.00	19.00	21.00	22.00	24.00	26.00	29.00	33.00	38.00	42.00	47.00	51.00	56.00	61.00	65.00	70.00	74.00	
UKPIA (Sept 2012)		18.11	11.47	10.43	6.00	8.21	9.33	10.78	12.95	14.16	14.88	16.09	17.94	-	-	-	-	-	-	-	-	-	-	
IHS (Nov /2012)		18.11	11.47	10.43	6.00	7.32	8.29	9.49	10.70	11.91	12.95	14.00	14.80	15.45	16.01	16.73	17.46	18.18	18.91	19.71	20.68	20.68	20.68	
Target Carbon Floor Price	(£/tCO_2e)																							
HM Treasury / HMRC (March 2011)		-	-	-	-	16.65	18.73	20.81	22.89	24.97	27.06	29.14	31.22	35.38	39.54	43.71	47.87	52.03	56.19	60.36	64.52	68.68	72.84	
Carbon Price Support (CPS) Rate	(£/tCO_2e)																							
UK Annual Budget Report		-	-	-	-	4.94	9.55	9.55																
UKPIA		-	-	-	-	4.94	9.55	9.55	9.94	10.82	12.17	13.05	13.28											
IHS		-	-	-	-	4.94	9.55	9.55	12.19	13.07	14.10	15.14	16.42	19.93	23.53	26.97	30.41	33.85	37.29	40.64	43.84	43.84	43.84	
UK Refinery emissions from electricty consumption	(kEUA/a)					883	883	883	883	883	883	883	883	883	883	883	883	883	883	883	883	883	883	
CPS Cost																								
HM Treasury / HMRC	(£k)	**-**	**-**	**-**	**-**	**4,360**	**8,428**	**8,428**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
UKPIA	(£k)	**-**	**-**	**-**	**-**	**4,360**	**8,428**	**8,428**	**8,773**	**9,545**	**10,743**	**11,515**	**11,718**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**73,511**
IHS	(£k)	**-**	**-**	**-**	**-**	**4,360**	**8,428**	**8,428**	**10,761**	**11,533**	**12,447**	**13,361**	**14,487**	**17,593**	**20,770**	**23,804**	**26,839**	**29,873**	**32,908**	**35,871**	**38,693**	**38,693**	**38,693**	**172,812**

TABLE X-6
ESTIMATED COST IMPACT OF LEGISLATIVE REQUIREMENTS ON UK REFINERIES
(Thousand of £, undiscounted)

CAPEX

Policy Initiative		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total (2013 - 2030)
International	IMO MARPOL VI	-	129,417	129,417	129,417	129,417	129,417	129,417	129,417	-	-	-	-	-	-	-	-	-	-	905,920
	Compulsory Oil Stocking Obligations (CSO)	-	-	-	14,958	89,746	135,205	233,258	254,374	270,113	239,611	184,376	174,014	117,020	122,201	122,201	62,175	64,766	-	2,084,016
EU Regulatory Policy	Industrial Emissions Directive (IED)	-	-	150,092	150,092	150,092	150,092	150,092	150,092	-	-	-	-	-	-	-	-	-	-	900,553
	ETS Carbon Trading	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Renewables Energy Directive (RED)	-	-	200,000	200,000	200,000	200,000	200,000	200,000	-	-	-	-	-	-	-	-	-	-	1,200,000
	FQD7a: Crude & GHG reduction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	FQD Other: Product Quality (Benzene, Cetane & Vapour Pressure)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Energy Efficiency Directive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	COMAH (UK Containment Policy) - Primary	-	4,667	4,667	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9,333
	COMAH (UK Containment Policy) - Secondary	1,999	67,033	67,033	67,033	42,590	40,592	40,592	40,592	6,708	5,833	5,833	5,833	5,833	5,833	5,833	5,833	5,833	5,833	426,673
	COMAH (UK Containment Policy) - Tertiary	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UK Regulatory Policy	Carbon Price Floor (price support)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	CRC Energy Efficiency scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UK Fiscal	Business Rate Revaluation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	CAPEX Subtotal (£k)	**1,999**	**201,117**	**551,209**	**561,500**	**611,845**	**655,306**	**753,359**	**774,475**	**276,821**	**245,445**	**190,209**	**179,847**	**122,853**	**128,034**	**128,034**	**68,008**	**70,599**	**5,833**	**5,526,495**

OPEX

Policy Initiative		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total (2013 - 2030)
International	IMO MARPOL VI	-	-	18,796	37,593	56,389	75,185	93,982	112,778	131,575	131,575	131,575	131,575	131,575	131,575	131,575	131,575	131,575	131,575	1,710,470
	Compulsory Oil Stocking Obligations (CSO)	-	-	-	-	-	-	7,472	24,955	37,410	47,373	64,856	79,801	84,782	89,764	97,284	102,266	107,247	107,247	850,457
EU Regulatory Policy	Industrial Emissions Directive (IED)	5,000	5,000	5,000	13,772	22,544	31,316	40,087	48,859	57,631	57,631	57,631	57,631	57,631	57,631	57,631	57,631	57,631	57,631	747,888
	ETS Carbon Trading	26,965	30,521	34,966	39,411	43,856	47,708	51,560	54,524	56,894	58,968	61,635	64,302	66,969	69,636	72,599	76,155	76,155	76,155	1,008,982
	Renewables Energy Directive (RED)	-	-	-	-	-	-	-	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	660,000
	FQD7a: Crude & GHG reduction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	FQD Other: Product Quality (Benzene, Cetane & Vapour Pressure)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Energy Efficiency Directive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	COMAH (UK Containment Policy) - Primary	-	233	467	467	467	467	467	467	467	467	467	467	467	467	467	467	467	467	7,700
	COMAH (UK Containment Policy) - Secondary	100	3,452	5,581	7,711	9,840	11,870	13,899	15,929	16,264	16,556	16,848	17,139	17,431	17,723	18,014	18,306	18,598	18,889	244,150
	COMAH (UK Containment Policy) - Tertiary	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UK Regulatory Policy	Carbon Price Floor (price support)	4,360	8,428	8,428	10,761	11,533	12,447	13,361	14,487	17,593	20,770	23,804	26,839	29,873	32,908	35,871	38,693	42,366	46,040	398,563
	CRC Energy Efficiency scheme	12,192	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12,192
UK Fiscal	Business Rate Revaluation	14,803	14,803	14,803	14,803	14,803	14,803	14,803	14,803	14,803	14,803	14,803	14,803	14,803	14,803	14,803	14,803	14,803	14,803	266,448
	OPEX Subtotal (£k)	**63,420**	**62,437**	**88,041**	**124,517**	**159,431**	**193,795**	**235,631**	**346,802**	**392,636**	**408,142**	**431,618**	**452,556**	**463,531**	**474,506**	**488,244**	**499,895**	**508,841**	**512,807**	**5,906,850**
	Total (£k)	**65,418**	**263,555**	**639,251**	**686,017**	**771,277**	**849,101**	**988,990**	**1,121,277**	**669,457**	**653,587**	**621,827**	**632,403**	**586,384**	**602,540**	**616,278**	**567,903**	**579,441**	**518,640**	**11,433,345**

Note: Above tables exclude costs for FQD7a FQD Others and Energy Efficiency Directive as these legislative items are not yet fully defined. Additional costs would be expected when these are defined.

TABLE X-7
ESTIMATED COST IMPACT OF LEGISLATIVE REQUIREMENTS ON UK REFINERIES
(Forecast in constant 2012 prices)

			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total (2013 - 2030)
UK Refinery Throughput		(kB)	549,894	549,948	549,993	550,026	550,013	549,755	549,612	549,462	549,256	549,058	548,876	548,702	548,552	548,450	548,355	548,258	548,171	548,084	9,884,466
Policy Initiative																					**Average (2013 - 2030)**
International	IMO MARPOL VI	($/B)	-	0.37	0.43	0.48	0.54	0.59	0.65	0.70	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.42
	Compulsory Oil Stocking Obligations (CSO)	($/B)	-	-	-	0.04	0.26	0.39	0.70	0.81	0.89	0.83	0.72	0.74	0.59	0.61	0.64	0.48	0.50	0.31	0.47
EU Regulatory Policy	Industrial Emissions Directive (IED)	($/B)	0.01	0.01	0.45	0.60	0.50	0.52	0.55	0.58	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.27
	ETS Carbon Trading	($/B)	0.08	0.09	0.10	0.11	0.13	0.14	0.15	0.16	0.16	0.17	0.18	0.19	0.19	0.20	0.21	0.22	0.22	0.22	0.16
	Renewables Energy Directive (RED)	($/B)	-	-	0.58	0.58	0.58	0.58	0.58	0.75	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.30
	FQD7a: Crude & GHG reduction *	($/B)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	FQD Other: Product Quality (Benzene, Cetane & Vapour Pressure)*	($/B)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Energy Efficiency Directive*	($/B)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	COMAH (UK Containment Policy) - Primary	($/B)	-	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	COMAH (UK Containment Policy) - Secondary	($/B)	0.01	0.20	0.21	0.22	0.15	0.15	0.16	0.16	0.07	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.11
	COMAH (UK Containment Policy) - Tertiary	($/B)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UK Regulatory Policy	Carbon Price Floor (price support)	($/B)	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.10	0.11	0.12	0.13	0.06
	CRC Energy Efficiency scheme	($/B)	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
UK Fiscal	Business Rate Revaluation	($/B)	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
	Total (Impact on Refining Margin)	**($/B)**	**0.19**	**0.76**	**1.85**	**2.11**	**2.23**	**2.46**	**2.86**	**3.25**	**1.94**	**1.89**	**1.80**	**1.83**	**1.70**	**1.75**	**1.79**	**1.65**	**1.68**	**1.51**	**1.85**
		(£/B)	**0.12**	**0.48**	**1.16**	**1.33**	**1.40**	**1.54**	**1.80**	**2.04**	**1.22**	**1.19**	**1.13**	**1.15**	**1.07**	**1.10**	**1.12**	**1.04**	**1.06**	**0.95**	**1.16**

Notes: £1.00 = $1.59
* FQD7a, FQD Other and Energy Efficiency Directive Costs not included as at present time these are unknown. FQD7a has previously been estimated in the range of $1.5 to $7.0 per barrel

TABLE X-8
ESTIMATED IMPACT ON UK REFINED PRODUCT PRICE
(Forecast in constant 2012 prices)

			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total (2013 - 2030)
UK Refined Product Production		(kB)	431,781	431,914	432,046	432,179	432,312	432,445	432,577	432,710	432,843	432,975	433,108	433,241	433,373	433,506	433,639	433,772	433,904	434,037	7,792,362
Policy Initiative																					**Average (2013 - 2030)**
International	IMO MARPOL VI	($/B)	-	0.48	0.55	0.61	0.68	0.75	0.82	0.89	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.53
	Compulsory Oil Stocking Obligations (CSO)	($/B)	-	-	-	0.06	0.33	0.50	0.89	1.03	1.13	1.05	0.92	0.93	0.74	0.78	0.81	0.60	0.63	0.39	0.60
	Renewables Energy Directive (RED)	($/B)	-	-	0.74	0.74	0.74	0.74	0.74	0.96	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.38
EU Regulatory Policy	FQD Other: Product Quality (Benzene, Cetane & Vapour Pressure)	($/B)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	COMAH (UK Containment Policy) - Primary	($/B)	-	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	COMAH (UK Containment Policy) - Secondary	($/B)	0.01	0.26	0.27	0.28	0.19	0.19	0.20	0.21	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.14
	COMAH (UK Containment Policy) - Tertiary	($/B)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total (Impact on Refined Product Price)	**($/B)**	**0.01**	**0.75**	**1.57**	**1.68**	**1.94**	**2.18**	**2.64**	**3.08**	**1.92**	**1.84**	**1.70**	**1.72**	**1.53**	**1.57**	**1.60**	**1.40**	**1.42**	**1.19**	**1.65**
		(£/B)	**0.00**	**0.47**	**0.99**	**1.06**	**1.22**	**1.37**	**1.66**	**1.94**	**1.21**	**1.16**	**1.07**	**1.08**	**0.96**	**0.99**	**1.00**	**0.88**	**0.90**	**0.75**	**1.04**
		(p/litre)	**0.00**	**0.30**	**0.62**	**0.67**	**0.77**	**0.86**	**1.05**	**1.22**	**0.76**	**0.73**	**0.67**	**0.68**	**0.61**	**0.62**	**0.63**	**0.55**	**0.56**	**0.47**	**0.65**

Note: £1.00 = $1.59

TABLE X-9
ESTIMATED RETURN ON CAPITAL EMPLOYED OF UK REFINING INDUSTRY

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Refinery throughpout	mb/d	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	
	kbbl	561204.6	561204.6	561204.6	561204.6	561204.6	561204.6	561204.6	561204.6	561204.6	561204.6	561204.6	561204.6	561204.6	561204.6	561204.6	561204.6	561204.6	561204.6	
Net cash refining margin	$/bbl	2.05	2.36	3.28	2.44	2.39	2.38	2.39	2.43	2.45	2.47	2.49	2.50	2.52	2.52	2.52	2.52	2.52	2.52	
Net cash refining margin	$M	1152	1327	1841	1369	1343	1338	1342	1364	1374	1384	1395	1404	1413	1413	1413	1413	1413	1413	
Net cash refining margin	£M	719	828	1149	854	838	835	838	851	857	863	871	876	882	882	882	882	882	882	
Cost pass through																				
(Capex depreciation & Opex) £M	Pass through %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
IMO	100	0	0	0	0	0	0	0	203	222	222	222	222	222	222	132	132	132	132	
CSO	100	0	0	0	1	10	24	55	98	137	171	207	239	256	273	293	304	316	316	
IED	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ETS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
RED	100	0	0	0	0	0	80	100	180	180	180	180	180	180	180	120	60	60	60	
FQD - Art 7a	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
FQD - VP	100	0	0	0	0	0	0	0	23	23	23	23	23	23	23	0	0	0	0	
EED	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
COMAH	50	0	6	10	15	18	21	24	27	28	28	28	29	29	9	30	24	10	10	
CRC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Rates	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Additional Opex (Table X-6) £M																				
IMO	0	0	0	19	38	56	75	94	113	132	132	132	132	132	132	132	132	132	132	
CSO	0	0	0	0	0	0	0	7	25	37	47	65	80	85	90	97	102	107	107	
IED	0	5	5	5	14	23	31	40	49	58	58	58	58	58	58	58	58	58	58	
ETS	0	27	31	35	39	44	48	52	55	57	59	62	64	67	70	73	76	76	76	
RED	0	0	0	0	0	0	0	0	60	60	60	60	60	60	60	60	60	60	60	
FQD - Art 7a	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
FQD - VP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
EED	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
COMAH	0	0	4	6	8	10	12	14	16	17	17	17	18	18	18	18	19	19	19	
Carbon Price Floor	0	4	8	8	11	12	12	13	14	18	21	24	27	30	33	36	39	42	46	
Rates	0	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	
Adjusted Net cash margin	**£M**	**668**	**771**	**1071**	**746**	**707**	**766**	**781**	**1036**	**1055**	**1080**	**1100**	**1117**	**1129**	**1115**	**968**	**902**	**890**	**886**	
TAR costs	£M	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	
Existing depreciation	£M	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	
New projects depreciation	£M	0	20	80	141	207	277	357	434	462	486	505	523	536	507	342	232	208	208	
Operating result	**£M**	**387**	**470**	**711**	**325**	**220**	**209**	**144**	**321**	**312**	**313**	**314**	**313**	**313**	**327**	**346**	**390**	**401**	**397**	
	ppl	0.43	0.53	0.80	0.36	0.25	0.23	0.16	0.36	0.35	0.35	0.35	0.35	0.35	0.37	0.39	0.44	0.45	0.45	
Corporation tax etc	£M	85	103	156	71	48	46	32	71	69	69	69	69	69	72	76	86	88	87	
Net operating result	**£M**	**302**	**367**	**554**	**253**	**172**	**163**	**112**	**251**	**244**	**244**	**245**	**244**	**244**	**255**	**270**	**304**	**313**	**310**	
	ppl	0.34	0.41	0.62	0.28	0.19	0.18	0.13	0.28	0.27	0.27	0.27	0.27	0.27	0.29	0.30	0.34	0.35	0.35	**Averages**
Capital employed	**£M**	**5500**	**5681**	**6198**	**6665**	**7116**	**7541**	**7983**	**8324**	**8139**	**7898**	**7583**	**7239**	**6827**	**6447**	**6234**	**6070**	**5932**	**5729**	**6839**
Simple ROACE	**%**	**5.5**	**6.5**	**8.9**	**3.8**	**2.4**	**2.2**	**1.4**	**3.0**	**3.0**	**3.1**	**3.2**	**3.4**	**3.6**	**4.0**	**4.3**	**5.0**	**5.3**	**5.4**	**4.1**
ROACE @ 3.5% Discount Rate	%	5.5	6.2	8.4	3.4	2.1	1.8	1.1	2.4	2.3	2.3	2.3	2.3	2.4	2.5	2.7	3.0	3.0	3.0	**3.2**
ROACE @ 6% Discount Rate	%	5.5	6.1	8.0	3.2	1.9	1.6	1.0	2.0	1.9	1.8	1.8	1.8	1.8	1.9	1.9	2.1	2.1	2.0	**2.7**
ROACE @ 10% Discount Rate	%	5.5	5.9	7.4	2.9	1.6	1.3	0.8	1.5	1.4	1.3	1.2	1.2	1.1	1.1	1.1	1.2	1.1	1.1	**2.2**
ROACE @ 15% Discount Rate	%	5.5	5.6	6.8	2.5	1.4	1.1	0.6	1.1	1.0	0.9	0.8	0.7	0.7	0.6	0.6	0.6	0.6	0.5	**1.8**

ANNEX 1: DETAILED OVERVIEW OF THE EUROPEAN REFINING MARKET

This annex should be read in conjunction with Chapter IV of the main report which details overall European refined product demand. Here the European market is split into North, Central and South. The definition of the three regions is shown in the table below.

EUROPEAN SUB-REGIONS

North	Central	South
Belgium	Austria	Albania
Denmark	Czech Republic	Bosnia-Herzegovina
Estonia	Germany	Bulgaria
Finland	Hungary	Croatia
North France	Poland	Cyprus
Iceland	Slovak Republic	Gibraltar
Ireland	Switzerland	Greece
Latvia		Italy
Lithuania		FYR Macedonia
Luxembourg		Malta
Netherlands		Portugal
Norway		Romania
Sweden		Serbia + Montenegro
United Kingdom		Slovenia
		South France
		Spain
		Turkey

REFINED PRODUCT DEMAND – NORTH EUROPE

The North Europe region comprises the Baltic States (Estonia, Latvia, and Lithuania), Belgium, Luxembourg, Finland, the northern part of France, Ireland, the Netherlands, the Scandinavian countries (Sweden, Norway, Iceland and Denmark) and the United Kingdom. The population of the region is about 170 million people.

Having been broadly constant over the 2004-2008 period, refined product demand fell sharply in 2009, by 5.6% as a result of the recession. Demand fell further in 2010 and again in 2011, although by less than 1.0% in each case, such that total demand, including refinery fuels, is currently estimated at 298 million tonnes. Gasoline demand remains in structural decline, and while demand for road diesel recovered in 2010 it remained relatively subdued in 2011. Demand for jet/kerosene has also been quite flat, having been affected by the Icelandic volcanic disruption in 2010.

For 2012, we are not anticipating any growth in demand, as a result of the current economic weakness, although some recovery is forecast for 2013 and 2014, of 0.7-0.9%, in line with improving economic conditions, after which demand is expected to remain essentially flat over the remainder of the forecast period (Table AN1-1).

GASOLINE

The structural decline of gasoline demand is such that in 2011 it is estimated to have totalled 38 million tonnes in Northern Europe, a fall of 5.0% from 2010 levels, which compares strongly with the peak of 62 million tonnes in 1990. The penetration of diesel engines has been very high in northern Europe, with Belgium, Luxembourg and France having each recorded shares of new registrations in excess of 70% – levels that have been maintained despite the slight decline in the share of diesels in new registrations across Europe. With the diesel share of the total car parc expected to increase as well as continuing improvements in the fuel economy of gasoline engines, gasoline demand is set to continue to decline over the forecast period; however, the rate of decline is projected to slow by 2020, to about 2.5% per year, and then by under 2.0% per year after 2025.

There has always been a considerable amount of gasoline trade between Northern European countries as well as to other areas in Europe, such as from the Netherlands to the inland market in Germany. This is likely to continue although, as discussed in the previous section, it is likely that further opportunities for gasoline exports will become more difficult, thus minimizing the prospects for further increases.

GASOIL/DIESEL

In 2011, diesel is estimated to have accounted for 78% of total Northern European gasoil/diesel demand of 121 million tonnes, having increased from 57% of the total in 2000 and 62% in 2005. This also represents a considerable increase from the 72% recorded for 2010, but this is due to the change in off-road gasoil specifications resulting in an additional 6.2 million tonnes of gasoil demand now being of diesel grade. Road diesel demand recovered strongly in 2010 following the recession of 2009, growing by 3.3% after the 1.8% fall the previous year. In 2011, demand growth is estimated to have slipped back, however, to only 0.5%, as a result of the weaker economic environment, conditions that are expected to continue into 2012. By 2013, however, growth rates are projected to increase again towards the 2.0% per year mark, although as diesel markets mature long-term growth is projected to average nearer the 1.0% per year level by 2020.

Other gasoil use – about two-thirds of which is used in the industrial and residential / commercial sectors – has declined steadily in the same period, excluding annual temperature-related variations, mainly as a result of substitution by natural gas and, increasingly, renewable fuels such as biomass. Demand for non-automotive gasoil is projected to decline by about 1.0% per year on average, with the exception of a significant increase in demand, of an estimated nine million tonnes, taking place in 2015 as a result of additional bunker use following the marine fuel changes as discussed in the previous section. This will be felt largely in the bunker markets of Rotterdam and Antwerp owing to the presence of the ECAs in the North European area.

Historically, North Europe used to be a significant exporter of gasoil/diesel, but as regional demand increased strongly, the net surplus shrank rapidly, such that the region is now a net marginal importer. However, with demand expected to outstrip refinery production, net imports are expected to increase over the remainder of the forecast period.

KEROSENE/JET FUEL

As Northern Europe includes some of the largest European airports, in Amsterdam, London and Paris, jet fuel accounts for 85% of the region's kerosene consumption, with the remaining 15% for domestic heating, principally in the UK and Irish markets.

In 2011, total jet/kerosene demand was 33 million tonnes, the same as the 2010 total. However, of that total, demand for jet fuel increased by 3.0% over that in 2010, whilst demand for burning kerosene declined, by 14.5%. Although jet fuel demand in 2009 fell as a result of the economic recession, in 2010 it declined further, by 1.0%, as a result of the eruption of the Eyjafjallajökull volcano in Iceland, which resulted in the airspace over Northern Europe being closed for about three weeks, over separate periods. Part of the recovery in 2011, therefore, reflected a bounce-back in demand from this one-off incident. For 2012, we are expecting demand growth to be more subdued, by only 1.0%, before recovering slightly in 2013, to 2.0%, after which annual demand growth is likely to slow to below 1.0% after 2015 as a result of improving aircraft efficiency on a fuel per passenger-kilometre basis.

As with gasoil/diesel, the region is also a net importer of jet fuel, as production has failed to keep up with growing demand. Over the long term, net imports are forecast to continue to increase.

HEAVY FUEL OIL

Regional trends for heavy fuel oil consumption have followed two diverse paths over the past decade. Consumption for power generation, industrial use, refinery fuel and in the residential/commercial sectors has fallen sharply as natural gas and other fuels have penetrated those markets; as a result, demand has fallen to an estimated 8.1 million tonnes in 2011 compared with 16.7 million tonnes in 2000. Remaining use in the power generation and industrial sectors is expected to continue to decline over the forecast period, to around 5.2 million tonnes by 2035.

Bunker fuel use, on the other hand, increased steadily from 2000, driven primarily by rising GDP in Asian markets and growth in international trade, although demand declined from 2008 to 2010 as a result of a slowdown in world trade with the recession. It is estimated to have recovered again in 2011, by 7.3% to 27 million tonnes, and although a steady increase is likely towards 2014 as trade volumes continue to recover the most significant change in demand is expected to be in 2015 with the changes in marine fuel specifications, and an 8.4 million-tonne switch in demand away from heavy fuel oil and into gasoil.

Trade is active, with roughly 45-50 million tonnes each of imports and exports, and the region is now in approximate balance. This situation is not expected to change over the forecast period in general, although the anticipated switch in marine fuels in 2015 will result in an associated increase in exports.

NAPHTHA

Regional demand for naphtha, almost exclusively for petrochemical feedstocks, is currently about 21 million tonnes. In 2010 demand recovered by 9.7% from the recession-related fall in 2009 as stocks were rebuilt, only to fall back again, by 5.6%, in 2011 as demand fell away again in the second half of the year. Although some demand growth is probable over the next few years, most likely in 2013 as part of the economic recovery, long-term demand prospects are weak, as producers face growing competition from Asian manufacturers. With a finite world market for end-user plastics, low-cost Asian and Middle Eastern olefin manufacturers have been increasing production, putting European steamcrackers under pressure. As a result, although some increases in cracker capacity are due to come on-line, overall production is not expected to increase significantly.

The region is in approximate balance regarding naphtha trade, although the trend is expected to be towards a status as a net exporter as demand diminishes and refinery production increases – the latter a result of refiners attempting to balance naphtha and gasoline production with declining gasoline demand and diminishing gasoline export opportunities.

REFINED PRODUCT DEMAND – CENTRAL EUROPE

This region comprises Austria, the Czech Republic, Germany, Hungary, Poland, the Slovak Republic and Switzerland. Regional population is broadly constant at approximately 162 million people. Historically, the region had been a net importer of refined products, with products flowing from the Rotterdam market to the landlocked markets of Germany and Switzerland via the river Rhine and by product pipelines; however, with the structural change in transportation fuels demand and declining gasoline consumption, the region has become a net exporter of gasoline – a situation with significant consequences for regional refiners. There is also significant product trade within the region; both Hungary and the Slovak Republic are net exporters, while Poland and the Czech Republic are net importers.

With the region dominated by the large German market, which alone accounts for about 60% of total regional demand, trends reflect changes in the German market to a great degree. Demand growth was the least affected of the three regions by the recent recession, falling by 3.3% in 2009 and growing again by 1.0% in 2010, before remaining broadly unchanged in total in 2011, at 191 million tonnes including refinery fuels (Table AN1-2). However, this remains below the recent peak of 200 million tonnes, in 2006, with the decline in German heating oil demand being a major factor.

A small contraction in demand is expected in 2012, of about 0.4%, with all major products markets remaining weak. Thereafter demand growth is projected to average close to zero, as the German, Austrian and Swiss markets, which make up almost 80% of regional demand, are already quite mature. With only Germany and Poland having a coastline, the bunker market is minimal.

GASOLINE

Gasoline demand fell to an estimated 31 million tonnes in 2011, which compares with the peak of 46 million tonnes in 1999. As with Europe as a whole, demand is projected to continue falling as result of the increasing penetration of diesel cars and improving fuel economy of the new generation of gasoline engines, such that the rate of decline over the forecast period is projected to average close to 3.0% per year up to 2015, before slowing to the 2.0% per year level from 2025 onwards.

Up until 2005, the region was a net importer of gasoline, relying on supplies from refineries in the Netherlands to balance demand. However, the decline in demand has resulted in the region becoming a net exporter, a trend that is expected to continue and which will have important long-term consequences for some of the inland refineries. The issue of disposal of surplus product arising as a result of declining demand is likely to impact refinery economics sufficiently to impact refinery operations, with refineries seeking ways to reduce gasoline yields.

KEROSENE/JET FUEL

Jet/kerosene demand is nearly all jet fuel, demand for which increased steadily up to 2009, before falling by 4.4% as the recession took hold. Since then it has recovered slightly, to an estimated 12.1 million tonnes, although demand slipped again in 2011, by 0.7%. The market is quite small overall, as only Germany has any major airport hubs at Düsseldorf and Frankfurt, and demand in Switzerland, although recovering steadily, was affected by the collapse of Swissair in October 2001. The market was also much less affected by the volcanic eruption in 2010 than was the North European market. A recovery in demand of 1.1% is forecast for 2012 as air traffic volumes should recover, even though the economic environment remains quite weak, and is expected to increase further, by 2.0%, in 2013. In the medium to longer term, however, growth rates are projected to ease to annual averages of nearer 1.0% per year, as tourism and business travel increases are offset by increasing aircraft efficiency.

Refinery production of jet/kerosene is significantly lower than regional demand, with the result that the region relies heavily on imports from northern Europe refineries. Net imports are forecast to increase over the forecast period.

GASOIL/DIESEL

Total gasoil/diesel demand averaged an estimated 87 million tonnes in 2011 – a fall of merely 0.1% from 2010 levels.

Gasoil consumption comprises 33% of the total, being dominated by the German heating oil market. Demand in the residential/commercial sector is expected to continue its decline over the forecast period, owing mainly to increasing boiler efficiency and substitution by renewables. Demand in other sectors is minimal, with the industrial and agriculture sectors being the only two other notable areas of demand; whereas industrial demand is projected to decline slowly, that for agriculture is likely to remain more stable over the longer term.

Diesel demand remained reasonably robust in 2011, growing by 2.7%, although more modest growth of 1.6% is forecast for 2012. However, this will more than offset the decline in heating oil demand, such that combined gasoil/diesel demand is projected to increase throughout the forecast period.

There is considerable trade in Central European countries, with Germany a net exporter but most other countries in the region net importers. A sizeable share of German imports are of high-sulphur gasoil being processed into diesel and low-sulphur heating oil and then being re-exported, as well as helping to meet seasonal heating oil requirements. In the longer term, net imports are projected to increase.

HEAVY FUEL OIL

Consumption of heavy fuel oil has declined slightly but steadily since 2000 and currently averages 9.7 million tonnes. Demand is spread fairly evenly across the petrochemical and industrial sectors as well as a small amount of bunker sales in Germany and Poland. Use in power generation and combined heat and power units declined significantly in the late 1990s and now accounts for only 13% of demand, with the tightening sulphur emissions limits a contributory factor. Few major changes in total demand are expected, with the ECA-related changes to bunker fuels expected to remove about 1.0 million tonnes from the small German and Polish markets.

Apart from gasoline, heavy fuel oil is the other main product in the Central Europe region that is in surplus. Little major change in the balance is expected until the anticipated fall in demand in 2015.

NAPHTHA

Naphtha consumption is almost exclusively for petrochemical feedstocks, especially in the large German market. Demand peaked at 22 million tonnes in 2005 but, as in Northern Europe, declined once the recession took hold, to under 20 million tonnes in 2009. Since then demand has recovered slightly, to just under 22 million tonnes again, although it remains below the 2005 peak. A slight increase is forecast for 2012 and 2013, although growth in the longer term will be limited as regional steamcrackers struggle to match the competition from new plants in overseas markets.

Net imports average about 6.5 million tonnes, although in the longer term these are expected to increase towards 9.5 million tonnes, a result primarily of refinery throughput falling as refiners struggle to align supplies with an increasing gasoline surplus.

REFINED PRODUCT DEMAND – SOUTH EUROPE

South Europe comprises those countries around the Mediterranean – Albania, Cyprus, southern France, Greece, Italy, Malta, Spain, Turkey, and the former Yugoslavian countries of Bosnia-Herzegovina, Croatia, Macedonia, Serbia and Slovenia – as well as Bulgaria, Portugal and Romania. The population of the region is around 282 million people.

The region also has the greatest proportion of developing economies, which are expected to grow more strongly than the European average. These include those that acceded to the EU in 2004 – Bulgaria, Cyprus, Malta, Slovenia and Romania – as well as the other former Yugoslavian countries and Turkey. Consequently, the outlook for economic and petroleum demand growth after the current downturn is the highest of the three European regions.

As this region has a warmer climate than both North and Central Europe heating fuel demand is lower than in the more northerly regions; conversely, electricity demand for air-conditioning, which has been increasing in some of the more developed markets, is higher than in the other regions. Demand is also distinctly more seasonal, which presents a challenge to the regional refineries.

Including refinery fuels, refined product demand in South Europe is estimated to have been 235 million tonnes in 2011, a fall of 1.2% from the 2010 level. However, owing to the weakening of notable economies such as Greece, Italy and Spain, demand has fallen notably from its peak of 274 million tonnes in 2005. Virtually no recovery in demand in expected in 2012, although some modest recovery, of 0.6%, is projected for 2013 as some economic growth returns. However, because of the large number of growing and developing economies in the region the long term outlook for refined products demand is the highest of the three European regions, at annual rates of 0.6-0.8%.

The main structural demand trend in South Europe since 2000 has been the significant decline of heavy fuel oil demand, mainly owing to the switch away from fuel oil towards natural gas in the Italian power generation sector. As this substitution process nears completion, this trend will level off in the medium term, although another step change is likely in 2015 as a result of expected closure of several oil-fired power plants in Spain. Gasoline demand is also declining, but less steeply than in other regions because of increasing car ownership levels. As in the other regions, gasoil/diesel and jet/kerosene demand have both been increasing strongly, recovering in 2011 and 2010 from the recession-related fall in 2009, and are expected to continue to grow in the medium to long term. Production balances for South Europe are shown in Table AN1-3.

GASOLINE

Gasoline consumption peaked in the 1996-1998 period at 43 million tonnes, but because of the increasing penetration of diesel cars, demand has declined at an average of about 3.7% per year since 2000, to an estimated 26 million tonnes in 2011. This downwards trend is expected to continue in 2012 and 2013, but by 2015 the rate of decline is projected to ease, to about 1.1% per year, as higher levels of inwards investment to the developing economies increases both prosperity and vehicle ownership levels.

Owing to the high number of large, coastal refineries in the region, South Europe is a large net exporter of gasoline. With similar constraining factors of limited export opportunities to those facing North European refiners, net exports are projected to remain limited and eventually start to decline over the forecast period.

GASOIL/DIESEL

Overall gasoil/diesel demand grew strongly from 2000 to 2007, by 3.9% per year and peaking at 110 million tonnes, but started to decline in 2008 as the recession took hold, with road diesel demand falling by 1.4%. In 2009 gasoil/diesel demand fell further, by 4.8%, but has since recovered slightly, such that in 2011 it is estimated to have been 105 million tonnes. Currently, diesel accounts for 77% of total gasoil/diesel demand, although as with other European regions this is a marked increase from the 70% in 2010 because of the switch of off-road gasoil to on-road diesel specifications. Compared with Northern and Central Europe, however, there is a more limited demand for heating gasoil in the South region because of the warmer climate. Of the total demand, 3.2 million tonnes of gasoil is used for bunkers but, considering that Spain is the second-largest bunker market in Europe after the Netherlands, this is estimated to increase towards 5.2 million tonnes by 2020 as a result of the changes in marine fuel specifications.

The strong increase in demand has resulted in the region become a large net importer of gasoil/diesel, of about 23 million tonnes, compared with approximate net balance in 1995. Even though demand is recovering net imports are expected to fall significantly by 2015, to 14 million tonnes, as a result of several refinery projects due to come on line over the next few years.

KEROSENE/JET FUEL

Regional demand of 15 million tonnes is almost entirely for jet fuel. Demand grew very strongly from 2003 to 2007, at average rate of 5.2% per year, helped by the growth of low-cost airlines and the attraction of the Mediterranean region as a holiday destination. However, demand fell slightly in 2008, followed by a much larger 8.2% contraction in 2009, as a result of falls in business traffic and the important tourist trade. Demand recovered strongly in 2010, by 5.4%, although in 2011 demand was almost flat. Some recovery is possible in 2012 although stronger growth rates, of about 2.2%-2.4%, are expected in 2013-2015. In the long term growth is likely to moderate as airliner efficiency increases, with annual forecast rates falling to 1.0%-1.5%.

The strong increase in consumption has, like gasoil/diesel, resulted in South Europe becoming a significant net importer, of about 1.6 million tonnes, compared with approximate net balance as recently as 2000. Demand growth in the longer term is expected to result in further increases in net imports.

HEAVY FUEL OIL

The decline in demand for heavy fuel oil has been the most dramatic in South Europe, as a result of the substitution of fuel oil by natural gas in the Italian power generation sector. As an example, regional inland consumption of heavy fuel oil is estimated to have averaged 13 million tonnes in 2011, compared with 49 million tonnes in 2000 and 61 million tonnes in 1995. Further declines in heavy fuel oil are expected in the power generation and industrial sectors, although – apart from a one-off fall in Spain in 2015 – the overall rate of decline is expected to be less severe, at about 1.3% per year to 2015 and 1.4% per year from 2015 to 2020, as the substitution process in the power generation sector nears completion.

Although there are sizeable markets in Spain and Greece, the 18 million tonne bunker market in the South is considerably smaller than that in the North. As the region is a net importer of heavy fuel oil – some of it structural from sources such as North Africa for refinery feedstock purposes – there is limited potential for significant growth in the bunker sector. The changes in marine fuel specifications are expected to have a much smaller effect in South Europe than other regions owing to the lack of an ECA in the Mediterranean at present, although discussions are proceeding concerning the possible introduction of one around the European coastline.

NAPHTHA

As naphtha demand is virtually all for petrochemical use, demand trends have been similar to those across Northern and Central Europe. Demand has varied around 11-12 million tonnes since 2000, although the largest decline recently was in 2010, when demand fell by 14.0%. This was followed by a further contraction of 7.1% in 2011, a result of weak conditions in the largest economies of Italy and Spain, such that total regional demand has fallen to about 10 million tonnes. Although some recovery is likely out towards 2015 it will probably be quite weak, owing to continuing price pressure from overseas producers.

REFINED PRODUCT TRADE FLOWS

Trade flows for refined products are discussed in two subsections below. The first is a summary of trends and trade flows, including forecasts, for Europe as a whole; the second provides a more detailed product-by-product analysis and discussion for the Northern Europe region.

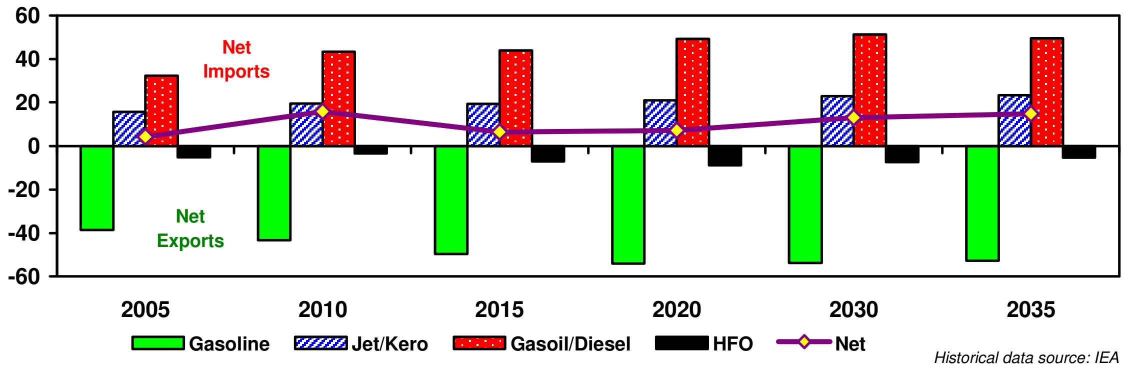
EUROPEAN SUMMARY

The European refining industry has become increasingly out of balance with domestic demand, with the result that the region is increasingly reliant on trade flows to balance demand with supply. As a result of the decline in gasoline demand and increase in diesel and jet fuel demand, Europe is structurally long on gasoline and structurally short on both jet/kerosene and gasoil/diesel. It is in approximate balance for heavy fuel oil.

Although overall crude runs in Europe are expected to decline gradually in the long term, some countries with higher-than-average demand growth are likely to add distillation capacity along with conversion projects. Offsetting this, capacity will probably reduce in other locations where economics become unfavourable; such changes are consistent with the long-term rationalization of the refining industry, which results in the concentration of capacity into larger, more efficient refining sites. The main new distillation projects are in Spain and Poland, which are both growing markets in the long term.

The future trade flows for the main products for Europe are shown in Figure AN1-1, followed by specific details on flows for each of the major products for Northern Europe.

FIGURE AN1-1
EUROPEAN PRODUCT TRADE BALANCE, 2005 - 2035
(Million Tonnes)



The decline in gasoline demand is likely to have a significant impact on several European refiners, resulting in the rationalization of some gasoline-making facilities, especially in inland markets with few export opportunities. As an example, the closure of one FCC unit at the Bayernöl facility in southern Germany was completed in 2009, and other refineries will either continue to rely on exports to balance their production or be forced either to reduce operations or close, such as has been seen with the Petroplus refineries in 2011 and early 2012. However, additional export opportunities, especially to traditional markets such as the United States, are likely to remain extremely limited, and owing to a lack of significant additional export markets net exports are expected to remain broadly constant at about 50-55 million tonnes.

Despite the projected increases in hydrocracking capacity, the continued rise in European demand for middle distillates is forecast to result in increasing volumes of net imports for both jet/kerosene and diesel/gasoil to 2020. Net European jet/kerosene imports are projected to increase from an estimated 19 million tonnes in 2010 to 21 million tonnes in 2030 and 22 million tonnes in 2040; the Middle East is expected to remain the principal source, but increasing volumes are also projected to be required from Asia.

Europe is already a large net importer of diesel/gasoil, of about 41 million tonnes. France and Germany are the largest markets and import to meet both seasonal heating requirements and increasing diesel demand. The United Kingdom is also a net importer. Belgium and the Netherlands, with their large refining bases compared with the sizes of their domestic markets, are both net exporters, as is Italy; however the surplus in all of these markets is diminishing as domestic consumption increases. Combined gasoil/diesel net imports are projected to rise further, to 51 million tonnes by 2020, increasing slightly to 54 million tonnes by 2030. Of these import sources, the CIS region is expected to remain the most significant source, but there is likely to be an increasing diversity of supply, with additional imports being sourced from the United States, the Middle East and Asia. Indeed, our outlook for capacity requirements also depends on assumptions regarding the make-up of refinery feedstocks in the future, as there is a high dependence in Europe on gasoil imports from the CIS region. If these fail to materialize, the alternatives are likely to be either increased imports from other sources or of long residue feedstock, which would require additional conversion capacity.

There is considerable trade of fuel oil in Europe, both as finished product and as unfinished refinery feedstocks. Similar to gasoil trade flows, the CIS Region is the primary supplier of fuel oil to Europe; however Libya is also a large supplier as it produces a good quality low-sulphur residue for upgrading, although supplies of this effectively ceased in 2011 as a result of the troubles and are only slowly resuming. Net European fuel oil trade is in approximate balance, exporting only about 2.8 million tonnes, although this could well increase slightly over the forecast period.

Likewise, the European naphtha balance, currently net short of about 11 million tonnes, is expected to change only slightly.

NORTHERN EUROPEAN PRODUCT BALANCES AND TRADE FLOWS

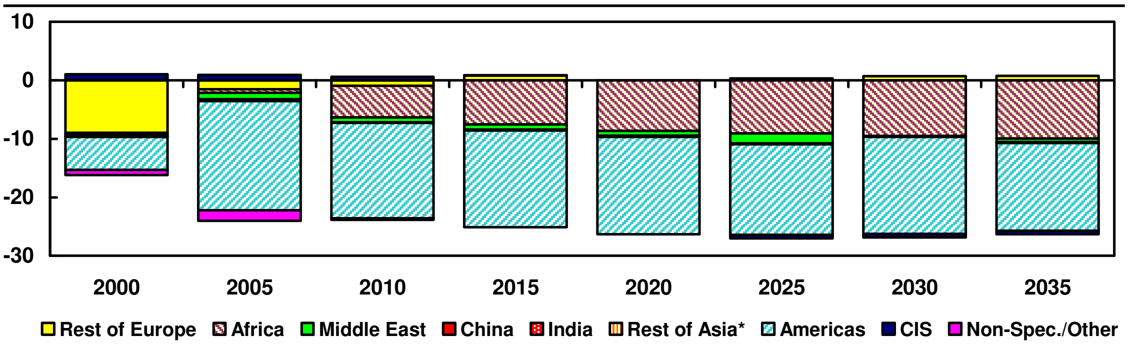
Specific historical and product trade flows for North Europe are provided in Tables AN1-4 to AN1-9.

Gasoline

As with the whole European region, Northern Europe has consistently been a net exporter of gasoline for many years, but the surplus has grown significantly in the last ten years to a level where, in 2011, Northern European refineries exported net 40% of total gasoline production (down slightly from the 42% recorded in 2010), compared with 21% in 2001. The largest market for gasoline exports is North and South America; this peaked at 23 million tonnes in 2006 but has since moderated to an estimated 15 million tonnes in 2011, of which 13 million tonnes was to North America, with increasing ethanol use in the United States as well as declining consumer demand accounting for the decline. The size of these markets relative to total net exports is shown in Figure AN1-2 below; the remainder of net exports is to Africa and Middle Eastern markets, and it can also be seen that the African market has been the largest growing market since 2005. However, the greater share of European exports to the Middle East and North Africa are from Southern Europe.

Looking ahead, the combined Americas will remain the most significant market for northern European refiners. Overall market dynamics are expected to change towards 2030, with US demand remaining relatively static but with demand in Latin America continuing to grow. As a result, the need for imports is expected to shift towards Latin America, but geographic considerations are such that northern European gasoline exports could well remain destined for the United States, but that Caribbean and northern Latin American production currently exported to the US market are diverted southwards towards Latin America. Exports are projected to continue into Africa, increasing towards 10 million tonnes by 2035, such that total net exports are expected to increase very slightly in the long term, reaching a maximum of 26 million tonnes by the end of the forecast period. Some balancing flows from Central and Southern Europe account for the small net regional imports shown.

FIGURE AN1-2
NET NORTHERN EUROPE GASOLINE TRADE, 2000-2035
(Million Tonnes: -ve = Exports)



*Includes Oceania

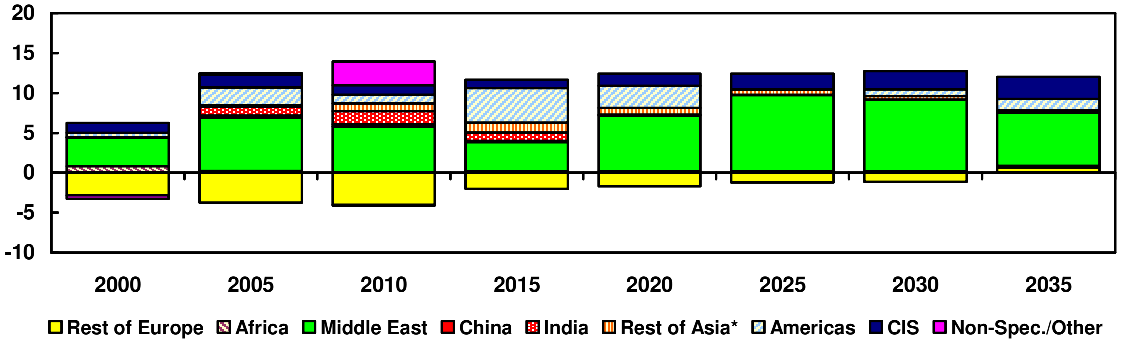
Historical data source: IEA

Jet/Kerosene

Northern European jet/kerosene trade has changed significantly over the past two decades. The region was essentially self-sufficient in jet/kerosene in the early 1990s, but the second part of that decade was notable for significant liberalisation of European air travel, resulting in the rapid growth of budget and "low-cost" airlines and a boom in leisure travel, with a resulting rapid increase in jet fuel demand. This continued into 2000, added to which was that changes to EU diesel specifications required a lower-density fuel, in turn necessitating more jet/kerosene to be blended into the diesel pool.

This resulted in demand for jet fuel increasing at rates of over 5% per year – far higher than the European refining industry could meet. As a result, net imports increased rapidly, rising from 3.0 million tonnes in 2000 to 8.7 million tonnes in 2005, and increasing further to 10.3 million tonnes in 2009 before declining slightly to an estimated 9.9 million tonnes in 2010 and 8.4 million tonnes in 2011 as demand declined (see Figure AN1-3).

FIGURE AN1-3
NET NORTHERN EUROPE JET/KEROSENE TRADE, 2000-2035
(Million Tonnes: -ve = Exports)



*Includes Oceania

Historical data source: IEA

Up to about 2004, the chief source of these imports had been the Middle East, especially countries such as Kuwait, Saudi Arabia and the UAE. Since then, however, most noteworthy is the increase in imports from India and other parts of Asia, which increased from a combined 0.9 million tonnes in 2004 to 5.4 million tonnes in 2008. Imports from North America and Latin America have also increased, averaging 1.0 million tonnes in 2011. The European exports shown above refer to jet fuel imported by the Netherlands and Belgium but subsequently exported to Germany.

As mentioned above, Northern Europe includes some of the largest European airports, with the UK market being the single largest in the European region. The United Kingdom imports approximately 6.5 million tonnes net annually; this compares with Germany and France, which report net imports of about 4 million tonnes and 2 million tonnes respectively.

Taking into account the projected increases in hydrocracking capacity future northern European jet/kerosene imports are projected to remain broadly constant, at about ten million tonnes. The Middle East is expected to remain the principal source, but volumes are also projected to be required from the Americas, India and other parts of Asia.

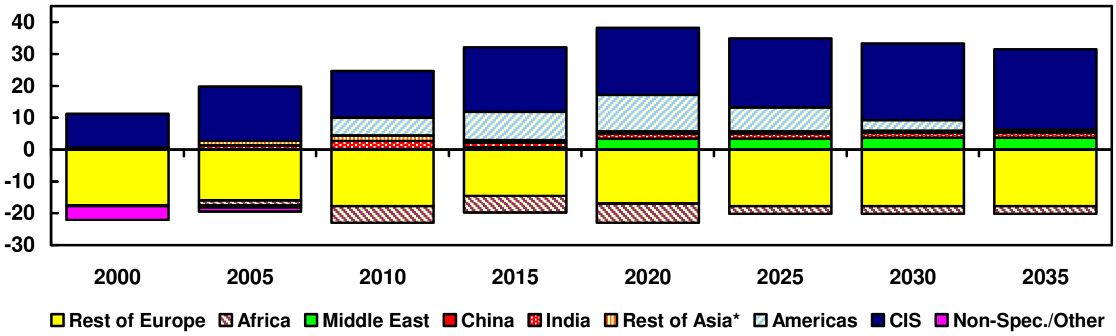
Gasoil/Diesel

The increasing levels of private diesel car ownership and higher road haulage volumes resulted in diesel fuel demand in Northern Europe alone increasing by annual average rates of approximately 4%, from 2000 to the onset of the recession in 2008-2009. Some of this increase has been offset by declining demand for heating gasoil over this period, primarily in France (Germany is included in Central Europe); however, the size of the transportation market is such that despite this decline the combined gasoil/diesel market has been increasing by an average of 1.1% a year from 2000 to 2008, and after the sluggish period from 2009 to 2012-2013 is expected to return to rates of about 1.0-1.2% up to 2015 and beyond, with the exception of a step-increase in 2015 as a result of the changes in ECA marine fuel specifications.

Although there were some refinery investments in Europe in the first part of last decade to increase diesel yields through residue destruction, most of the increase in diesel demand was met through increasing imports. At times of relatively poor refinery margins, the preferred strategy of most refiners was to invest in hydrotreating and other desulphurisation processes and import high-sulphur gasoil streams for upgrading into diesel. As shown in

Figure AN1-4, the principal source of Northern European gasoil imports has been the CIS region, with additional imports of diesel from the United States increasing notably from 2007 to 2011, reaching an estimated 10.5 million tonnes.

FIGURE AN1-4
NET NORTHERN EUROPE GASOIL/DIESEL TRADE, 2000-2035
(Million Tonnes: -ve = Exports)



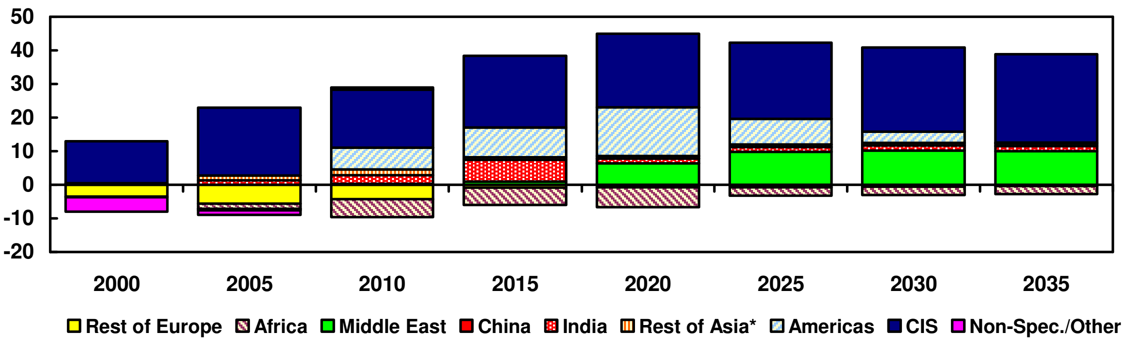
*Includes Oceania

Historical data source: IEA

As Russian gasoil is straight-run material from distillation units it is very suitable for desulphurisation into diesel compared with cracked gasoils, as it has a high cetane number and contains very low levels of aromatics. CIS gasoil import levels have varied recently, from 11 million tonnes in 2008 to 9.9 million tonnes in 2009, climbing to 15 million tonnes in 2010 before decreasing again to an estimated 12 million tonnes in 2011. They have, however, declined from a peak of 20 million tonnes in 2006, coinciding with an increase in imports from the United States and, importantly, from India and the Rest of Asia (excluding China), which together reached 5.9 million tonnes in 2009.

A major point of note in the above chart is the level of exports to other parts of Europe, which are in the order of 18 million tonnes, and which can imply that Northern Europe is in approximate balance regarding its gasoil/diesel requirements. These represent the significant levels of trade flows from Belgium and the Netherlands into Germany and, to a much lesser degree, Switzerland. If the two markets of North and Central Europe are combined, the level of import dependency of the combined region is far more evident – this is shown in Table AN1-7 and Figure AN1-5 below.

FIGURE AN1-5
NET NORTHERN AND CENTRAL EUROPE GASOIL/DIESEL TRADE, 2000-2035
(Million Tonnes: -ve = Exports)



*Includes Oceania

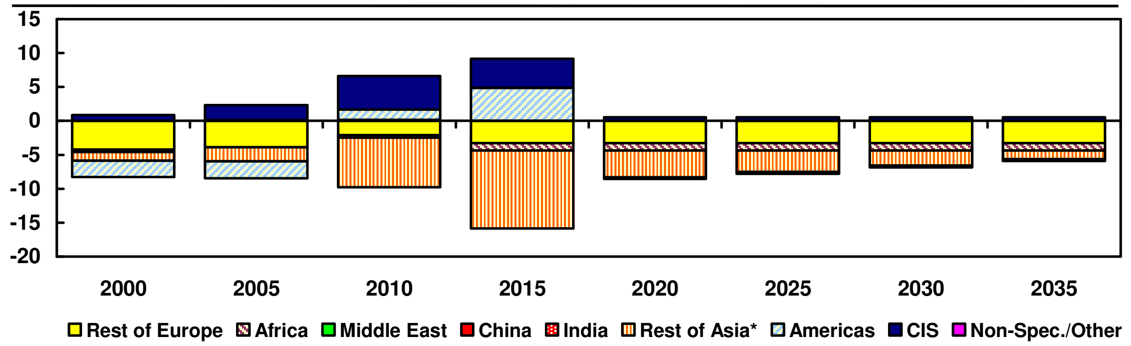
Historical data source: IEA

As referred to above, the step-change in import requirements shown in 2015 illustrates the effects that the expected nine-million tonne increase in gasoil-based marine diesel bunker fuel demand will have on the Northern European trade balance. Current expectations are that the additional imports may be sourced from the Middle East.

Heavy Fuel Oil

The largest supplier of heavy fuel oil to Northern Europe by far is Russia in the CIS region (Figure AN1-6), with imports from this source estimated to have reached 10 million tonnes in 2010. Most of the Russian supply is straight-run fuel oil, which is used both as refinery feedstock and for blending into bunker fuel, although it is almost impossible to disaggregate the quantities used as feedstock owing to the lack of statistical data.

FIGURE AN1-6
NET NORTHERN EUROPE HEAVY FUEL OIL TRADE, 2000-2035
(Million Tonnes: -ve = Exports)



*Includes Oceania

Historical data source: IEA

There is a considerable amount of trade of heavy fuel oil within Europe, as Northern Europe is a notable exporter as well. The main trade flows, and those which have been increasing substantially of late, are large-scale shipments to Singapore and Far East markets. Growing demand in East-of-Suez markets has resulted in heavy fuel oil being transported to Rotterdam for bulk-building into large carriers, including VLCCs (Very Large Crude Carriers), for long-haul shipment to Singapore. This market has grown from 2.6 million tonnes in 2006 to 7.3 million tonnes in 2010; however, in the longer term over the forecast period these are expected to decline as additional East-of-Suez refining capacity comes on line. Intra-European flows include exports to Southern Europe, which in turn is a major supplier to the Middle East market.

In the past, US East Coast utilities imported low-sulphur fuel on a seasonal basis, and US refiners also purchase straight-run fuel oil as a refinery feedstock – this was especially notable in 2004 and 2005, when high natural gas prices resulted in utilities increasing their fuel oil use. Since then, however, the subsequent fall in gas prices has seen much less of this trade, and indeed at times there have been reverse flows, from the United States to Northern Europe.

The sharp change in fuel oil trade shown after 2015 represents the sharp decline in European fuel oil use as a result of the switch to gasoil-based bunker fuels. The removal of about eight million tonnes from Northern European demand (out of a total reduction of 10 million tonnes for all of Europe, thus highlighting the impact of the northern European ECAs) is expected to result in a significant fall in the imports from the CIS region, with an associated reduction in exports in order to keep the region reasonably close to a net overall balance.

Lastly, as discussed above, the large trade of fuel oil both as a finished product and as an unfinished refinery feedstock can result in some classification issues regarding countries of origin. This is reflected in the IEA category of ‘Non-specified/Other’.

EUROPE PRICES AND MARGINS

Northwest Europe (Rotterdam) has the largest proportion of refining capacity and product demand, and so is considered the primary price-setting location in Europe. Product prices and refining economics in the Mediterranean reflect local product supply and demand, but are also strongly influenced by northern Europe through trade.

Crude oil production from the North Sea peaked in 2000 and by 2010 had fallen to around 3.5 million B/D. The crude slate in Northern Europe is expected to become somewhat heavier, and higher in sulphur content, as a result of mainly Russian crude oil replacing North Sea crude oil. However, in the Mediterranean, the trend is towards processing lighter crude oils due to the strong increase in crude production from the Caspian and North African regions. In addition, recent analysis in our new Global Crude Oil Market Outlook service indicates that the flow of Russian crude oil into the Mediterranean is likely to decline in the future.

Our balances indicate that only a modest rate of residue conversion capacity additions will have to take place in Europe and already announced conversion capacity additions appear to be adequate through 2020. The economic downturn has resulted in lower demand growth and combined with the still extensive project announcements worldwide the risks of global over-investment in the next five years remain high. In 2011 the market was disrupted, particularly in the Mediterranean, due to the effects of the Libyan crisis.

Refining margins have improved significantly in 2012, particularly over the summer months, compared to the low levels of 2011 which largely resulted from the loss of Libyan crude oil supply. Closures of around 1.4 million B/D (70 MT/year) of refinery capacity have already taken place and a further 0.3 million B/D remains idled with an uncertain future, helping to support margins in the short term. In Q3 additional short-term margin support came from refinery disruptions in Venezuela and California (refinery fires), and the US Gulf Coast (Hurricane Isaac). These disruptions, combined with a significant level of planned maintenance shutdowns in European refineries, led to tight supply of both middle distillates and gasoline in the third quarter, boosting margins in both Europe and North America. Margins remained high entering the fourth quarter before declining somewhat towards year end.

We expect that the difficult economic environment, combined with the outlook for further legislation changes affecting the refining industry in Europe, will result in further capacity reductions in the next five years. These capacity reductions are expected to be a mixture of some total plant closures and some reductions of capacity where multiple trains are employed in some refineries. By 2015, we expect margins to recover to our projected long-term equilibrium levels, supported by the additional demand for gasoil resulting from the bunker fuel specification change in 2015 but this is based on the assumption that further capacity will close in the intervening period to restore capacity utilisation to more profitable levels.

TABLE AN1-1
REFINED PRODUCT BALANCE
NORTH EUROPE
(Million Tonnes)

		2000	2005	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035
Gasoline	Production	70	70	59	58	55	54	53	52	51	51	49	47	44	42
	Imports	19	20	20	19	19	19	19	19	19	19	19	19	19	19
	Exports	(34)	(43)	(42)	(42)	(42)	(41)	(42)	(42)	(43)	(44)	(46)	(46)	(45)	(44)
	Biogasoline supply	-	0	1	1	2	2	2	2	2	2	3	3	2	2
	Supply Adjustments	(1)	1	6	6	6	4	4	4	4	4	4	4	3	3
	Inland Consumption	54	48	44	42	40	38	37	35	34	33	29	26	24	22
Jet/Kerosene	Production	26	24	25	23	23	24	24	23	23	23	24	24	24	24
	Imports	11	19	22	22	22	20	19	20	21	21	22	22	22	23
	Exports	(8)	(11)	(12)	(12)	(12)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(10)
	Supply Adjustments	2	0	0	1	0	1	2	2	2	2	2	2	2	2
	Inland Consumption	31	34	35	34	33	33	33	34	35	35	36	37	38	38
Gasoil/Diesel	Production	111	109	111	106	104	104	102	101	102	103	107	111	114	118
	Imports	35	50	52	57	63	66	65	67	67	69	72	72	71	69
	Exports	(46)	(50)	(55)	(57)	(61)	(63)	(63)	(63)	(63)	(57)	(56)	(57)	(57)	(58)
	Int'l Bunkers	(6)	(5)	(4)	(3)	(4)	(4)	(4)	(4)	(4)	(13)	(15)	(15)	(16)	(16)
	Biodiesel supply	-	0	3	3	4	4	4	5	5	5	6	6	7	7
	CTL/GTL diesel supply	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	14	14	13	12	13	11	14	14	14	14	15	15	15	15
	Inland Consumption	108	119	122	118	118	118	118	120	121	123	129	132	134	135
	of which: Diesel	65	77	85	86	88	95	96	98	99	101	109	113	116	118
Heavy Fuel Oil	Production	51	53	48	40	41	41	39	39	38	39	38	37	37	36
	Imports	24	38	44	44	47	51	52	53	54	51	30	30	31	31
	Exports	(31)	(44)	(45)	(44)	(50)	(53)	(52)	(52)	(52)	(57)	(38)	(38)	(37)	(36)
	Int'l Bunkers	(23)	(30)	(32)	(28)	(26)	(27)	(28)	(29)	(29)	(21)	(19)	(19)	(20)	(21)
	Supply Adjustments	(0)	(0)	(2)	(2)	(1)	(1)	(2)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
	Inland Consumption	21	16	13	11	11	10	9	9	9	8	8	8	7	7
Other Products	Production	70	73	62	59	54	55	54	53	53	53	52	52	51	50
	Imports	31	38	36	34	36	35	36	37	37	37	38	38	38	39
	Exports	(30)	(16)	(16)	(16)	(10)	(11)	(10)	(7)	(6)	(6)	(6)	(6)	(7)	(7)
	Int'l Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CTL/GTL supply	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	(5)	(25)	(11)	(12)	(12)	(11)	(12)	(13)	(14)	(14)	(14)	(13)	(13)	(12)
	Inland Consumption	66	71	71	65	68	68	68	70	71	71	71	70	70	70
Total	Production	329	329	305	286	276	277	272	268	267	269	269	269	270	271
	Imports	121	166	174	177	187	191	192	197	198	197	180	181	181	180
	Exports	(150)	(164)	(170)	(171)	(176)	(180)	(179)	(176)	(174)	(174)	(157)	(157)	(157)	(156)
	Int'l Bunkers	(29)	(35)	(35)	(31)	(29)	(31)	(32)	(32)	(33)	(33)	(33)	(34)	(35)	(36)
	Biofuels/CTL/GTL supply	-	1	4	5	6	6	6	7	7	7	9	9	9	9
	Supply Adjustments	10	(9)	7	4	7	3	6	4	4	4	4	5	4	5
	Inland Consumption	281	288	284	270	271	266	266	268	269	270	272	273	272	272

Note: Total includes Refinery gas and Ethane
Historical data source: IEA

TABLE AN1-2
REFINED PRODUCT BALANCE
CENTRAL EUROPE

(Million Tonnes)

		2000	2005	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035
Gasoline	Production	38	39	36	35	32	31	30	29	29	28	26	24	22	20
	Imports	14	9	6	6	6	6	7	7	7	7	6	5	5	5
	Exports	(6)	(9)	(8)	(8)	(7)	(8)	(7)	(8)	(8)	(9)	(9)	(8)	(8)	(8)
	Biogasoline supply	-	0	1	1	2	2	2	2	2	2	2	2	2	2
	Supply Adjustments	(2)	(2)	(0)	(0)	0	0	0	0	0	0	(0)	(1)	(1)	(1)
	Inland Consumption	44	37	34	34	33	32	31	30	29	28	25	22	20	18
Jet/Kerosene	Production	6	6	7	6	7	7	7	7	7	7	7	7	8	8
	Imports	4	6	7	7	6	6	6	7	7	7	8	8	9	9
	Exports	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
	Supply Adjustments	(0)	(0)	(0)	(0)	0	0	0	0	0	0	0	0	0	0
	Inland Consumption	10	11	12	12	12	12	12	12	13	13	14	15	15	16
Gasoil/Diesel	Production	66	75	74	71	69	69	68	68	68	68	69	69	69	69
	Imports	24	29	30	29	29	27	29	29	30	31	34	35	35	35
	Exports	(9)	(15)	(15)	(13)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
	Int'l Bunkers	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(2)	(3)	(3)	(3)	(3)
	Biodiesel supply	-	2	4	4	4	5	5	5	5	5	6	6	7	7
	CTL/GTL diesel supply	-	-	-	-	0	0	0	0	0	0	0	0	0	0
	Supply Adjustments	1	(4)	(4)	(3)	(4)	(2)	(2)	(2)	(2)	(3)	(4)	(4)	(4)	(4)
	Inland Consumption	82	86	89	86	87	87	87	88	88	89	92	93	94	94
	of which: Diesel	38	45	51	52	54	59	59	61	62	63	68	72	74	76
Heavy Fuel Oil	Production	21	19	17	15	13	13	12	12	12	12	11	11	10	10
	Imports	4	4	3	3	3	3	4	4	4	3	3	4	4	5
	Exports	(7)	(7)	(7)	(5)	(4)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)
	Int'l Bunkers	(2)	(2)	(3)	(2)	(2)	(3)	(3)	(2)	(2)	(1)	(1)	(1)	(1)	(1)
	Supply Adjustments	(2)	(1)	(1)	(0)	0	0	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
	Inland Consumption	14	12	11	10	10	9	9	9	9	9	8	8	8	8
Other Products	Production	36	39	41	38	39	40	38	38	38	38	38	37	37	36
	Imports	14	15	14	14	14	15	16	16	16	16	17	18	18	18
	Exports	(7)	(9)	(10)	(8)	(8)	(8)	(7)	(7)	(7)	(8)	(8)	(8)	(8)	(8)
	Int'l Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CTL/GTL supply	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	1	2	1	2	1	1	2	2	2	2	2	2	2	2
	Inland Consumption	44	48	47	45	47	48	48	48	49	49	49	49	49	49
Total	Production	167	177	175	164	160	161	155	155	154	154	151	148	146	143
	Imports	61	63	60	59	60	57	62	63	63	64	68	70	71	72
	Exports	(30)	(41)	(41)	(36)	(32)	(33)	(32)	(32)	(33)	(33)	(33)	(33)	(32)	(32)
	Int'l Bunkers	(2)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(4)	(4)	(4)	(4)
	Biofuels/CTL/GTL supply	-	2	5	6	6	6	6	6	7	7	8	8	8	8
	Supply Adjustments	(2)	(5)	(4)	(3)	(2)	1	(1)	(1)	(1)	(1)	(2)	(3)	(3)	(3)
	Inland Consumption	194	194	193	187	189	188	188	187	188	188	187	187	186	185

Note: Total includes Refinery gas and Ethane
Historical data source: IEA

TABLE AN1-3
REFINED PRODUCT BALANCE
SOUTHERN EUROPE
(Million Tonnes)

		2000	2005	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035
Gasoline	Production	49	55	52	50	49	47	48	48	48	48	48	47	46	45
	Imports	6	6	4	4	4	4	3	3	3	3	3	3	3	3
	Exports	(12)	(21)	(24)	(22)	(23)	(23)	(25)	(26)	(27)	(27)	(28)	(28)	(28)	(28)
	Biogasoline supply	-	0	0	1	1	1	1	1	1	1	1	1	1	1
	Supply Adjustments	(3)	(4)	(2)	(3)	(3)	(2)	(2)	(2)	(2)	(2)	(1)	(1)	(1)	(1)
	Inland Consumption	40	36	31	30	27	26	26	25	25	24	23	22	21	20
Jet/Kerosene	Production	15	18	18	16	17	17	18	18	18	19	20	21	22	23
	Imports	3	4	6	7	7	7	7	8	8	8	8	8	8	8
	Exports	(2)	(2)	(3)	(3)	(3)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)
	Supply Adjustments	(3)	(5)	(6)	(6)	(6)	(5)	(5)	(6)	(6)	(6)	(6)	(5)	(5)	(5)
	Inland Consumption	13	14	16	14	15	15	16	16	16	17	18	19	21	22
Gasoil/Diesel	Production	93	104	105	95	96	98	102	107	110	112	120	122	126	130
	Imports	24	29	30	29	29	27	29	29	30	31	34	35	35	35
	Exports	(9)	(15)	(15)	(13)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
	Int'l Bunkers	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(4)	(5)	(5)	(6)	(6)
	Biodiesel supply	-	0	2	4	4	5	5	5	6	6	8	8	9	9
	CTL/GTL diesel supply	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	(25)	(14)	(12)	(9)	(14)	(13)	(19)	(23)	(25)	(27)	(31)	(30)	(31)	(30)
	Inland Consumption	82	100	106	101	101	102	103	104	105	106	114	119	123	127
	of which: Diesel	49	67	75	72	73	81	82	84	85	88	96	103	107	112
Heavy Fuel Oil	Production	60	53	45	39	36	35	34	33	32	32	30	31	30	30
	Imports	24	19	19	19	17	17	15	15	15	13	12	12	12	13
	Exports	(10)	(14)	(16)	(13)	(16)	(15)	(13)	(13)	(12)	(12)	(11)	(13)	(13)	(13)
	Int'l Bunkers	(13)	(17)	(19)	(18)	(18)	(18)	(18)	(18)	(18)	(17)	(16)	(17)	(17)	(18)
	Supply Adjustments	(6)	(1)	(3)	(4)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
	Inland Consumption	55	39	27	23	17	16	16	15	15	14	13	12	11	11
Other Products	Production	51	53	54	49	52	51	54	55	55	55	56	57	58	58
	Imports	26	29	30	31	26	26	26	26	26	26	26	26	26	26
	Exports	(11)	(13)	(13)	(15)	(16)	(16)	(17)	(17)	(17)	(16)	(15)	(15)	(15)	(15)
	Int'l Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CTL/GTL supply	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Supply Adjustments	(11)	(6)	(7)	(5)	(7)	(8)	(8)	(8)	(9)	(9)	(9)	(9)	(9)	(10)
	Inland Consumption	55	64	63	61	55	54	55	55	56	57	58	59	60	60
Total	Production	269	283	275	250	250	248	256	261	263	266	274	278	282	286
	Imports	82	87	89	89	83	80	80	81	83	82	84	85	85	85
	Exports	(44)	(66)	(71)	(65)	(69)	(69)	(71)	(71)	(70)	(71)	(70)	(71)	(70)	(70)
	Int'l Bunkers	(16)	(20)	(22)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(22)	(23)	(24)
	Biofuels/CTL/GTL supply	-	1	2	4	5	6	6	6	7	7	9	9	10	10
	Supply Adjustments	(47)	(30)	(30)	(27)	(32)	(29)	(36)	(41)	(44)	(45)	(49)	(48)	(48)	(47)
	Inland Consumption	244	253	243	230	216	213	214	215	217	218	226	232	236	240

Note: Total includes Refinery gas and Ethane
Historical data source: IEA

TABLE AN1-4
NORTHERN EUROPE: GASOLINE TRADE FLOWS
(Million Tonnes per Year)

	2000	2005	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035
Refinery Production	70.2	69.6	59.3	58.2	55.3	54.1	53.1	52.0	51.1	50.9	48.6	46.5	44.5	42.4
Imports														
Rest of Europe	2.5	2.5	1.8	2.3	1.5	1.4	2.1	2.4	2.8	2.8	1.9	1.9	1.9	1.7
Africa	0.2	1.1	0.0	0.1	0.2	0.1	0.2	0.2	0.1	-	-	-	-	-
Middle East	0.1	0.2	0.1	0.0	0.0	-	0.0	0.0	-	-	-	-	-	-
China	0.1	0.0	-	0.0	-	-	-	-	-	-	-	-	-	-
India	0.0	0.0	0.0	0.2	0.0	0.0	0.2	-	-	-	-	-	-	-
Rest of Asia	0.0	-	0.0	0.0	0.0	0.1	0.1	-	-	-	-	-	-	-
North America	0.0	0.0	0.1	0.1	0.2	0.4	0.9	0.9	0.9	0.5	-	-	-	-
Latin America	0.1	0.1	0.2	0.4	0.1	0.1	0.4	0.2	-	-	-	-	-	-
CIS	1.0	1.0	0.7	0.8	0.6	1.2	1.4	1.2	0.6	0.6	0.6	-	-	-
Non-Specified / Other	-	-	8.3	6.1	5.3	4.3	-	-	-	-	-	-	-	-
Total	4.1	4.9	11.3	9.9	7.9	7.5	5.3	4.8	4.4	3.9	2.6	1.9	1.9	1.7
Exports														
Rest of Europe	11.4	4.1	1.8	2.0	2.4	2.1	2.1	2.1	2.0	1.9	1.9	1.5	1.2	0.9
Africa	0.7	1.6	5.0	6.5	5.5	5.1	5.6	7.2	7.4	7.6	8.6	9.1	9.5	9.9
Middle East	0.4	1.3	1.0	2.5	0.9	1.1	0.9	0.9	0.9	0.9	0.9	1.7	-	0.6
China	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-
India	-	0.0	0.0	0.0	-	-	-	-	-	-	0.0	0.0	0.0	0.0
Rest of Asia	0.1	0.3	0.2	0.4	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
North America	5.6	18.0	16.9	15.7	13.6	12.9	16.4	15.0	15.2	16.2	16.2	15.0	13.3	10.9
Latin America	0.2	0.8	3.8	3.7	3.1	3.0	2.1	1.7	1.3	0.9	0.4	0.4	3.3	4.1
CIS	0.0	0.1	0.0	0.0	0.0	0.3	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Non-Specified / Other	0.9	1.8	5.3	2.7	5.6	4.7	-	-	-	-	-	-	-	-
Total	19.2	27.9	34.1	33.6	31.2	29.2	27.9	27.7	27.6	28.2	28.9	28.5	28.1	27.3
Net Imports / (Exports)	(15.2)	(23.1)	(22.8)	(23.7)	(23.3)	(21.8)	(22.6)	(22.8)	(23.2)	(24.2)	(26.3)	(26.7)	(26.2)	(25.5)

Note: Comprises Aviation Gasoline and Motor Gasoline

Historical data source: IEA

TABLE AN1-5
NORTHERN EUROPE: JET/KEROSENE TRADE FLOWS
(Million Tonnes per Year)

	2000	2005	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035
Refinery Production	26.2	24.3	25.2	22.9	22.7	23.6	23.5	23.3	23.3	23.4	23.5	23.7	23.9	24.1
Imports														
Rest of Europe	1.3	1.5	1.4	2.2	1.7	1.9	2.7	2.9	2.9	2.8	2.7	2.6	2.5	2.5
Africa	0.9	0.2	0.3	0.2	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.3	0.3	0.3
Middle East	3.5	6.7	5.2	4.6	5.8	5.5	3.2	3.1	3.1	3.6	7.0	9.5	9.0	6.6
China	0.1	0.3	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.0	0.0
India	-	1.1	2.0	2.7	1.6	1.4	2.1	1.6	1.1	1.1	-	-	-	-
Rest of Asia	0.1	0.3	3.0	2.0	1.0	2.0	1.5	1.4	1.3	1.2	0.8	0.6	0.4	0.3
North America	0.0	0.9	0.4	0.5	0.5	0.5	1.8	2.8	3.5	3.2	1.6	0.0	0.0	0.0
Latin America	0.5	1.5	1.2	1.3	0.7	0.5	1.2	1.2	1.2	1.2	1.2	0.5	1.2	3.6
CIS	1.2	1.6	1.4	2.2	1.2	1.2	0.6	0.8	0.9	1.1	1.5	1.9	2.3	2.7
Non-Specified / Other	0.0	0.2	0.8	1.0	3.0	0.5	-	-	-	-	-	-	-	-
Total	7.6	14.3	16.1	16.8	15.8	13.8	13.4	14.1	14.4	14.6	15.2	15.5	15.7	16.0
Exports														
Rest of Europe	4.1	5.2	6.0	6.0	5.7	5.0	5.1	5.1	4.9	4.8	4.4	3.8	3.7	1.8
Africa	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Middle East	-	0.1	-	-	0.0	0.0	-	-	-	-	-	-	-	-
China	-	-	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-
India	-	0.0	-	-	-	-	-	-	-	-	-	-	-	-
Rest of Asia	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-
North America	0.0	0.2	0.1	0.1	0.0	-	-	-	-	-	-	0.0	0.0	0.0
Latin America	0.0	0.0	0.2	0.2	0.0	0.0	-	-	-	-	-	0.3	0.3	2.1
CIS	0.0	0.0	-	0.0	0.0	0.2	-	-	-	-	-	-	-	-
Non-Specified / Other	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	4.6	5.6	6.5	6.5	5.9	5.4	5.2	5.2	5.0	4.9	4.5	4.2	4.1	4.0
Net Imports / (Exports)	3.0	8.7	9.6	10.3	9.9	8.4	8.2	9.0	9.5	9.7	10.7	11.2	11.6	12.0

Historical data source: IEA

TABLE AN1-6
NORTHERN EUROPE: GASOIL/DIESEL TRADE FLOWS
(Million Tonnes per Year)

	2000	2005	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035
Refinery Production	111.0	109.4	111.1	105.7	103.5	103.7	101.8	101.0	102.1	103.5	107.0	110.6	114.2	117.8
Imports														
Rest of Europe	2.8	5.4	4.0	3.4	3.5	3.1	3.0	3.0	3.0	3.3	3.3	3.0	3.0	3.0
Africa	0.5	0.2	0.3	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Middle East	0.3	0.2	0.4	0.5	0.7	1.2	0.2	0.2	0.2	1.0	3.7	3.7	3.7	3.7
China	-	-	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-
India	-	1.3	1.9	3.8	2.4	1.7	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Rest of Asia	0.1	1.4	1.7	2.2	1.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
North America	1.1	0.7	6.6	9.8	7.1	10.6	5.4	6.8	7.8	10.1	11.4	7.4	3.1	-
Latin America	0.1	0.5	0.3	0.5	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4
CIS	10.6	17.1	11.4	9.9	14.6	12.1	17.2	17.5	18.6	20.3	21.0	21.6	24.1	25.3
Non-Specified / Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	15.5	26.7	26.5	30.2	30.5	29.9	28.4	30.1	32.2	37.2	41.9	38.3	36.5	34.7
Exports														
Rest of Europe	20.4	21.5	20.1	19.8	21.3	17.6	18.6	18.2	17.9	17.9	20.3	20.8	20.8	20.8
Africa	0.8	1.7	4.1	3.8	5.4	7.0	6.1	6.1	6.1	5.2	6.1	2.4	2.4	2.4
Middle East	0.1	0.3	0.1	0.1	0.5	0.3	0.2	0.2	0.2	0.2	0.2	0.2	-	-
China	-	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-
India	-	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-
Rest of Asia	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-
North America	0.8	1.6	0.2	0.4	0.4	0.1	0.1	0.3	2.6	1.0	0.1	0.1	0.1	0.1
Latin America	0.1	0.1	0.2	0.3	1.4	0.8	0.5	0.5	0.5	0.5	-	-	-	-
CIS	0.0	0.0	-	0.0	0.0	0.4	-	-	-	-	-	-	-	-
Non-Specified / Other	4.3	1.3	4.1	5.3	0.0	0.7	0.7	0.7	0.7	-	-	-	-	-
Total	26.4	26.5	28.8	29.8	29.0	26.9	26.3	26.1	28.1	24.8	26.8	23.6	23.3	23.3
Net Imports / (Exports)	(10.8)	0.3	(2.3)	0.4	1.5	2.9	2.1	4.0	4.1	12.4	15.2	14.7	13.1	11.4

Historical data source: IEA

TABLE AN1-7
NORTHERN AND CENTRAL EUROPE: GASOIL/DIESEL TRADE FLOWS
(Million Tonnes per Year)

	2000	2005	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035
Refinery Production	176.9	184.1	185.3	176.3	172.8	173.0	170.0	169.3	170.4	171.9	175.6	179.5	183.1	186.7
Imports														
Rest of Europe	1.9	3.2	2.4	2.5	3.1	2.9	2.9	3.0	3.0	3.3	3.4	3.4	3.6	3.8
Africa	0.5	0.2	0.3	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Middle East	0.3	0.2	0.4	0.5	0.7	1.2	0.3	0.4	0.5	1.2	6.6	10.0	10.2	10.0
China	-	-	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-
India	-	1.3	1.9	3.9	2.5	1.7	3.7	4.4	4.9	6.5	1.5	1.5	1.5	1.5
Rest of Asia	0.1	1.5	1.7	2.3	1.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
North America	1.1	0.8	6.9	10.0	7.9	11.3	6.0	6.9	7.9	10.2	11.5	7.4	3.1	-
Latin America	0.1	0.5	0.3	0.5	0.3	0.3	0.2	0.2	0.2	0.2	3.0	0.3	0.3	0.4
CIS	12.5	20.2	14.0	12.9	17.3	14.2	18.2	18.4	19.6	21.3	22.0	22.6	25.0	26.3
Non-Specified / Other	-	-	-	-	0.6	-	-	-	-	-	-	-	-	-
Total	16.5	27.9	28.0	32.6	34.5	32.6	32.1	34.2	36.9	43.5	48.9	46.0	44.6	42.8
Exports														
Rest of Europe	5.4	8.9	6.9	6.8	7.4	4.9	4.9	4.5	4.2	4.2	4.2	4.2	4.2	4.2
Africa	0.8	1.7	4.1	3.8	5.4	7.0	6.1	6.1	6.1	5.2	6.1	2.4	2.4	2.4
Middle East	0.1	0.3	0.1	0.1	0.5	0.3	0.2	0.2	0.2	0.2	0.2	0.2	-	-
China	-	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-
India	-	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-
Rest of Asia	0.1	0.0	0.0	0.1	0.0	0.0	-	-	-	-	-	-	-	-
North America	0.9	1.6	0.2	0.4	0.4	0.1	0.1	0.3	2.6	1.0	0.1	0.1	0.1	0.1
Latin America	0.1	0.1	0.2	0.3	1.4	0.8	0.5	0.5	0.5	0.5	-	-	-	-
CIS	0.0	0.0	0.0	0.0	0.0	0.4	-	-	-	-	-	-	-	-
Non-Specified / Other	4.3	1.3	4.1	5.3	0.0	0.7	0.7	0.7	0.7	-	-	-	-	-
Total	11.6	13.9	15.7	16.8	15.1	14.3	12.6	12.4	14.4	11.1	10.6	6.9	6.7	6.7
Net Imports / (Exports)	4.9	14.0	12.3	15.7	19.3	18.3	19.5	21.8	22.5	32.4	38.3	39.0	37.9	36.1

Historical data source: IEA

TABLE AN1-8
NORTHERN EUROPE: HEAVY FUEL OIL TRADE FLOWS
(Million Tonnes per Year)

	2000	2005	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035
Refinery Production	51.2	52.5	47.5	40.1	40.5	40.6	39.4	38.9	38.5	38.6	37.6	37.1	36.6	36.1
Imports														
Rest of Europe	2.6	2.4	4.1	2.8	3.5	4.3	4.4	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Africa	0.3	0.7	0.3	0.4	0.6	0.3	-	0.5	0.5	0.5	-	-	-	-
Middle East	0.0	0.1	0.1	0.4	0.0	0.1	-	-	-	-	-	-	-	-
China	0.0	0.0	0.4	0.3	0.2	0.4	-	-	-	-	-	-	-	-
India	-	-	0.0	0.0	-	-	-	-	-	-	-	-	-	-
Rest of Asia	0.0	-	0.0	0.0	0.1	0.2	-	-	-	-	-	-	-	-
North America	0.3	0.3	2.0	2.2	1.8	3.4	6.8	7.1	7.6	5.1	-	-	-	-
Latin America	0.6	0.3	1.6	0.9	1.0	1.6	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
CIS	0.9	2.3	7.3	10.3	4.9	4.0	4.4	4.9	4.9	4.3	0.5	0.5	0.5	0.5
Non-Specified / Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	4.7	6.2	15.7	17.2	12.1	14.2	16.6	17.8	18.2	15.2	5.8	5.8	5.8	5.8
Exports														
Rest of Europe	6.8	6.3	6.7	7.3	5.6	6.5	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
Africa	0.4	0.6	1.2	1.2	0.9	1.4	1.6	1.6	1.6	1.6	1.1	1.1	1.1	1.1
Middle East	0.3	0.1	0.6	0.1	-	0.4	-	-	-	-	-	-	-	-
China	0.1	0.0	-	-	0.1	-	-	-	-	-	-	-	-	-
India	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-
Rest of Asia	1.2	2.1	6.3	6.2	7.4	6.6	5.5	6.3	5.7	11.4	3.9	3.1	2.2	1.2
North America	3.2	2.7	1.0	0.9	1.1	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Latin America	0.1	0.4	0.8	1.0	0.2	0.3	-	-	-	-	-	-	-	-
CIS	0.0	0.0	0.1	0.1	-	-	-	-	-	-	-	-	-	-
Non-Specified / Other	-	-	-	-	-	-	0.8	-	-	-	-	-	-	-
Total	12.1	12.3	16.8	16.7	15.2	16.3	16.8	16.7	16.1	21.9	13.8	13.0	12.0	11.1
Net Imports / (Exports)	(7.4)	(6.1)	(1.1)	0.5	(3.1)	(2.1)	(0.2)	1.1	2.1	(6.7)	(8.0)	(7.2)	(6.3)	(5.3)

Historical data source: IEA

TABLE AN1-9
NORTHERN EUROPE: TOTAL PRODUCTS TRADE FLOWS
(Million Tonnes per Year)

	2000	2005	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035
Refinery Production	328.7	329.3	304.8	286.2	275.9	277.5	271.5	268.1	267.4	269.2	268.9	269.5	270.1	270.6
Imports														
Rest of Europe	12.2	15.7	15.1	13.3	12.8	13.2	15.7	14.3	13.5	14.9	15.2	11.9	11.9	11.6
Africa	3.4	3.4	3.2	3.3	4.1	3.1	3.9	4.5	4.5	4.4	3.9	3.9	9.8	8.9
Middle East	5.2	8.0	6.5	5.6	7.0	7.1	6.6	8.4	9.4	9.2	12.7	17.1	12.9	10.5
China	0.1	0.3	0.7	0.6	0.5	0.7	0.2	0.2	0.2	0.2	0.1	0.1	0.0	0.0
India	0.1	2.4	4.0	6.6	4.1	3.0	3.8	3.0	2.6	2.5	1.4	1.4	1.4	1.4
Rest of Asia	0.3	1.6	4.7	4.1	2.7	3.0	2.3	2.1	2.0	1.9	1.6	1.3	1.1	1.0
North America	1.3	2.0	8.5	11.9	9.1	14.1	13.8	16.6	19.0	18.6	14.5	10.2	7.2	5.4
Latin America	1.4	2.5	3.2	3.1	2.1	2.5	3.1	2.8	2.6	2.6	2.6	1.9	2.7	5.0
CIS	13.7	23.3	19.5	21.5	20.2	17.7	22.4	23.2	23.7	25.0	23.0	23.2	26.0	27.6
Non-Specified / Other	2.8	2.7	16.7	14.4	17.0	11.7	1.0	-	-	-	-	-	-	-
Total	40.5	61.8	82.2	84.4	79.5	76.0	72.8	75.1	77.4	79.3	75.0	70.9	73.1	71.5
Exports														
Rest of Europe	49.6	42.8	39.2	39.2	39.7	37.3	40.6	37.8	36.6	36.4	38.1	37.4	40.5	38.2
Africa	1.8	4.0	10.7	11.9	12.2	13.6	13.5	15.3	15.5	14.8	16.4	13.4	13.8	14.3
Middle East	0.7	1.9	1.7	3.2	1.5	1.9	1.2	1.2	1.2	1.2	1.2	2.1	-	0.7
China	0.1	0.0	0.1	0.5	0.5	0.6	-	-	-	-	-	-	-	-
India	0.0	0.0	0.1	0.0	0.0	0.0	-	-	-	-	0.0	0.0	0.0	0.0
Rest of Asia	1.2	2.2	6.5	6.7	7.2	6.4	5.5	6.2	5.7	10.6	4.2	3.5	2.7	1.9
North America	10.1	24.6	20.0	18.6	16.4	15.6	19.4	17.9	20.4	20.0	19.1	17.8	15.9	13.2
Latin America	0.4	1.3	5.5	6.1	5.0	4.5	3.1	2.6	2.1	1.6	0.7	1.0	4.2	6.9
CIS	0.1	0.1	0.1	0.1	0.0	0.9	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Non-Specified / Other	7.6	3.7	16.6	11.0	9.8	8.5	1.4	0.7	0.7	-	-	-	-	-
Total	71.6	80.7	100.5	97.3	92.4	89.5	85.4	82.4	82.8	85.3	80.3	75.9	77.8	75.8
Net Imports / (Exports)	(31.1)	(18.9)	(18.3)	(12.9)	(12.9)	(13.5)	(12.6)	(7.3)	(5.4)	(6.0)	(5.3)	(5.0)	(4.7)	(4.4)

Historical data source: IEA

ANNEX 2: UK REFINERIES CONTRIBUTION TO UK ECONOMY AND SOCIETY

MACROECONOMIC MODELLING ASSUMPTIONS

Economies are complex adaptive systems. A typical representation of the circular flow of transactions that occur within a simplified economic structure is depicted in Figure AN2-1. Generally considered the broadest gauge of an economy's health, Gross Domestic Product (GDP) can be extracted from Figure AN2-1 using a method known as the "expenditure approach." Under this approach, GDP is expressed as a function of five expenditure components:

$$GDP = C + G + I + E - M$$

The GDP expenditure components are defined as follows:

- **Private Consumption (C)** is typically the largest GDP component in the economy, consisting of expenditures on durable goods (e.g., appliances and automobiles), non-durable goods (e.g., food and clothing), and services (e.g., doctors, lawyers, mechanics, and so on);

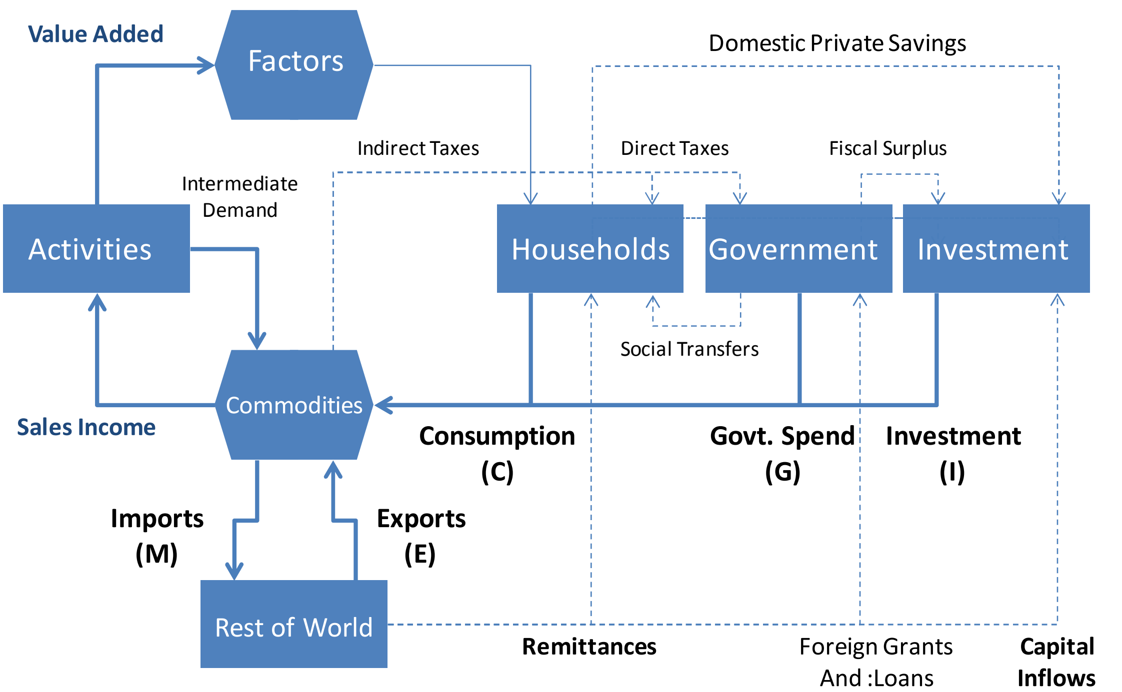
- **Government Spending (G)**, the sum of government expenditures on final goods and services, includes investment expenditure by a government, salaries of public servants, public projects (such as road and bridge construction), and military spending. It does not include any transfer payments, such as social security or unemployment benefits;

- **Investment (I)** includes business investment in equipment (such as software or machinery). Spending by households on new houses is also included in Investment;

- **Exports (E)** captures the amount a country produces, including goods and services produced for other nations' consumption;

- **Imports (M)** represents gross imports, which are subtractive to GDP.

FIGURE AN2-1 – FLOW DIAGRAM OF AN ECONOMY

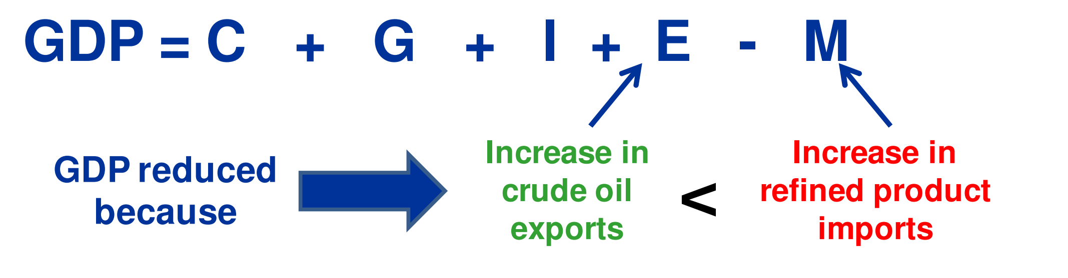


Also shown in Figure AN2-1 are ***Activities*** and ***Commodities***. Activities represent the entities that produce goods and services, while commodities are the goods and services produced by activities. Industry sectors are represented in both activities and commodities. The model developed for this project covered 110 distinct industry sub-sectors of the UK economy. The results of the economic impact analysis were aggregated into 14 industry super-sectors, based on International Standard Industrial Classification (ISIC) Revision 3 conventions. The sub-sector and super-sector scheme is shown in Table 8-1. As discussed later in this section, the most recent 2010 data from the Office of National Statistics (ONS) on the economic activity and employment for each of these sectors were compiled and used in the development of the model.

Activities combine ***Factors*** of Production (such as labour wages and gross operating surplus/profits) with intermediate commodity purchases to produce goods and services. The factors are equivalent to the value added by the activity. Thus, the cumulative value added across all sectors is equivalent to the Gross Domestic Product of an economy.

When considering the contribution of the refineries to the UK economy, there are two primary areas of concern. The first is that consumption of refined petroleum products in the UK will most likely be unaffected by the closure of any of the UK refineries. Rather, any decline in domestic refined product production will be offset by a corresponding increase in imports of refined products. Second, closure of any UK refineries will not impact global demand for crude oil produced in the UK. In other words, any crude oil that the UK refineries would have purchased will be exported to the world market. It stands to reason that the value of imported refined product would be greater than the value of crude oil exports. Thus, referring to Figure AN2-2, a first-order effect of closing a UK refinery is the lowering of UK GDP. The amount of this decrease would be the difference in net exports (i.e., crude oil exports - refined product imports) which in principle is equivalent to the refinery gross hydrocarbon margin.

FIGURE AN2-2 – FIRST-ORDER EFFECTS OF REFINERY CLOSURES ON THE UK ECONOMY



While Figure AN2-1 is useful in depicting the general structure of an economy, it doesn't fully convey the ripple effects that the UK economy would experience due to closing of refineries. The second-order effects on the UK economy stem from the loss of economic activity within the supply chain of the refineries. Isolating the baseline net economic impact of the UK refineries required a two-stepped approach. The first step was determining the impact of the refineries' business ecosystem on the UK economy. Because crude oil will shift to the export category, the economic contribution of crude oil production to the UK is not at risk. Therefore, the economic contribution of crude oil was deducted from the business ecosystem assessments to derive the net economic contributions of UK refineries. In essence, this leaves the economic contribution of the remaining transactions related to operating expenditures (chemicals, supplies, utilities, and so on), capital spending and wages along the refinery supply chain. In addition, the loss of refinery and supplier jobs will dampen consumer spending by the affected employees.

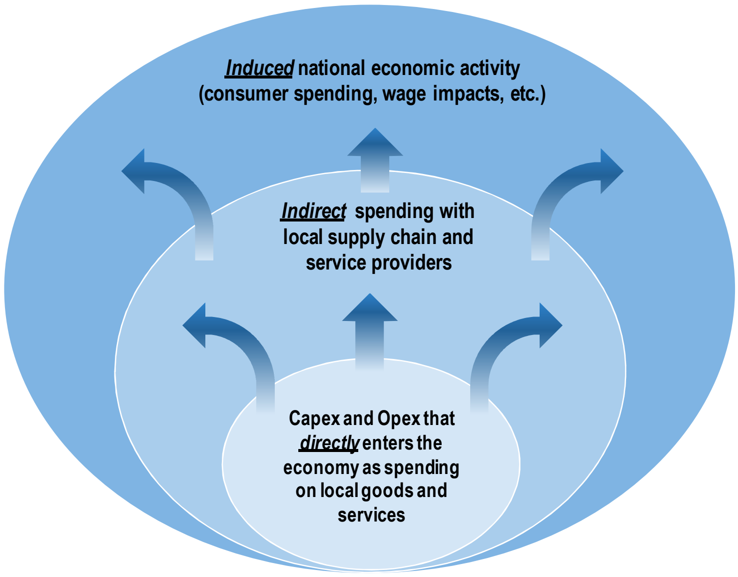
To determine these second-order effects, IHS developed a model to assess the baseline impact of the UK refineries on jobs, GDP and Labour Income on the three distinct levels described below. Scenario-based changes to the baseline (i.e., closing of refineries) were also entered into the model. The difference from the baseline represents the second-order economic impact of a particular scenario.

Figure AN2-3 illustrates the ever-expanding interrelationship between direct effects and the follow-on indirect and induced effects.

- **Direct Effects**: are the direct responses of an economy to changes in the final demand of a given industry or set of industries. In the model developed for this project, direct effects capture the impacts of direct employment and production associated with the refineries.
- **Indirect Effects** (also known as **Supplier Effects**): refer to the "ripple responses" of an economy to subsequent final demand shifts within industries that serve the direct industries. In essence, the indirect effects capture the response of the refineries' extended domestic supply chain.

- **Induced Effects** (also known as **Income Effects**): refer to the response of an economy to changes in household spending attributable to income generated by the direct and indirect effects. Employees within the direct and indirect industries also act as consumers in the general UK economy. Induced effects capture the impacts of this consumer activity.

FIGURE AN2-3: THREE LEVELS OF SECONDARY ECONOMIC IMPACT

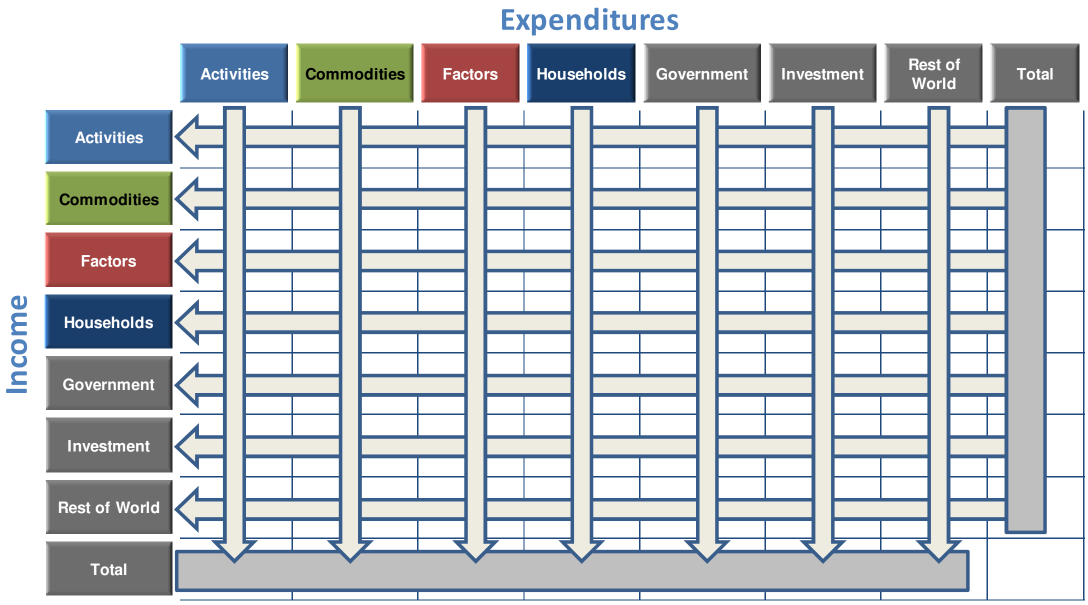


MODELLING APPROACH

To assess the economic contribution of the UK refineries, IHS developed a model to capture the direct, indirect and induced effects based upon industry standard Input-Output (I-O) techniques, for which economist Wassily Leontief earned a Nobel Prize in 1973. While an explanation of the full range of I-O techniques, which includes the manipulation and inversion of data matrices using matrix algebra, is beyond the scope of this report, it is instructive to discuss two of the initial components required to develop the model: the Social Accounting Matrix (SAM) and the Direct Requirements Matrix

Figure AN2-4 shows the structure and fiscal flows of a typical SAM, which presents the transactions that occur within an economy as a matrix. The columns of a SAM represent expenditures (or spending), while the rows represent income. The key components (or accounts) of Figure AN2-1 appear in both the Columns and the Rows of the SAM, representing the dual role each account plays in the economy. As such, a SAM not only captures the transactional activity within an economy, but all of the linkages between industrial sectors, households and institutions as well. For this project, IHS developed a partial SAM for the UK economy, based primarily on data available from the Office of National Statistics. As explained below, a fully-populated SAM was not required to develop the model used to assess the direct, indirect and induced impacts.

FIGURE AN2-4 – SOCIAL ACCOUNTING MATRIX EXPENDITURE-TO-INCOME FLOWS



A Social Accounting Matrix provides a complete, consistent and balanced representation of all activity within an economy. An ***Expenditure*** (or spending) within an economy flows down a column and then leftward along the corresponding ***Income*** row. For example, consider Consumer Spending. Expenditures flow down the "Household" column and then left across the appropriate "Commodity" row.

Figure AN2-5 populates the SAM framework with the classes of transactions that link expenditures (columns) to income (rows). A SAM is a form of double entry bookkeeping where each entry is a transaction that has both a price and a quantity dimension, and that identifies both its source and destination. Therefore, the total expenditures by each account must be exactly equal to the total receipts for the account, i.e. the respective row and column totals must equate. This means, for example, that total domestic demand (the commodity row) equals total domestic supply (the commodities column). It is this characteristic that makes a SAM a tool that can be used for modelling purposes. IHS used data from the UK Office of National Statistics to populate the SAM. The industry sector scheme used for both activities and commodities is shown in Table AN2-1.

FIGURE AN2-5 – SOCIAL ACCOUNTING MATRIX STRUCTURE

Expenditures

Income	Activities	Commodities	Factors	Households	Gov't	Investment	Rest of World	Total
Activities		Domestic Supply						
Commodities	Intermediate Demand			Consumption (C)	Gov't Spending (G)	Investment (I)	Exports (E)	Total Demand
Factors	Value-Added (GDP)							Total Factor Income
Households			Factor Payments to Households		Social Transfers		Foreign Remittances	Total Household Income
Government		Sales Tax and Import tariffs		Direct Taxes			Foreign Grants and Loans	Governmen t Income
Investment				Private Savings	Fiscal Surplus		Current Account Balance	Total Savings
Rest of World		Imports (M)						Foreign Exchange Outflow
Total	Gross Output	Total Supply	Total Factor Spending	Total Household Spending	Gov't Expenditure	Total Investment Spending	Foreign Exchange Inflow	

The first step in building a SAM-based economic impact model is to transform the SAM into a Direct Requirements Matrix. This is done by dividing each cell in the matrix by the sum of its column. Recall that each column in the original SAM represents expenditures, which flow into various income rows. Thus, the Direct Requirements Matrix depicts the proportions by which a given expenditure flows into various income rows. In the case of the Activity columns, the Direct Requirements Matrix also provides insight into the percentage of industry output (or sales revenue) that flows to value-added factors such as employee compensation. Indeed, the Direct Requirements Matrix is the core upon which the rest of the modelling built. Referring to Figure AN2-6, the Direct Requirements Matrix based on the partial SAM that IHS developed for the UK shows that 61.82% of the expenditures within the Manufacture of Coke and Refined Petroleum Products (sub-sector 19) flows to Extraction of Crude Petroleum (sub-sectors 06 and 07), 12.09% to Mining Support Services (sub-sector 09), 2.45% to employee compensation and so on.

FIGURE AN2-6 - DETAIL FROM UK DIRECT REQUIREMENTS MATRIX

Commodity		Activity: 19 Manufacture Of Coke And Refined Petroleum Products
06 & 07	Extraction Of Crude Petroleum And Natural Gas & Mining Of Metal Ores	0.6182
09	Mining support services	0.1209
19	Coke and refined petroleum products	0.0823
35.1	Electricity, transmission and distribution	0.0165
Factor		
Value Added	Employee Compensation	0.0245

As implied by the transactions presented in Figure AN2-5, building a complete SAM requires a significant amount of data. Fortunately, a fully-populated SAM was actually not required for the analysis conducted for this engagement. Economic impact analyses focus on inter-industry interactions (Activity-Commodity-Factors) and consumer transactions (Activity-Commodity-Factors-Households). The inter-industry interactions, which encompass direct and indirect effects, are highlighted in purple region of Figure AN2-7. Similarly, the consumer transactions are enclosed by the red box in Figure AN2-7. Ultimately, these two regions of the SAM will be transformed into the portions of the Direct Requirements Matrix that were used in the subsequent stages of model development.

FIGURE AN2-7 – PORTION OF SAM NEEDED FOR THE ECONOMIC IMPACT ASSESSMENT

Expenditures

Income	Activities	Commodities	Factors	Households	Gov't	Investment	Rest of World	Total
Activities		Domestic Supply						Activity Income
Commodities	Intermediate Demand			Consumption (C)	Gov't Spending (G)	Investment (I)	Exports (E)	Total Demand
Factors	Value-Added (GDP)							Total Factor Income
Households			Factor Payments to Households		Social Transfers		Foreign Remittances	Total Household Income
Government		Sales Tax and Import tariffs		Direct Taxes			Foreign Grants and Loans	Governmen t Income
Investment				Private Savings	Fiscal Surplus		Current Account Balance	Total Savings
Rest of World		Imports (M)						Foreign Exchange Outflow
Total	Gross Output	Total Supply	Total Factor Spending	Total Household Spending	Gov't Expenditure	Total Investment Spending	Foreign Exchange Inflow	

To ensure that the area Activity-Commodity-Factors-Household sub-matrix of the SAM is accurately populated, it is necessary to recall that corresponding rows and columns of the overall SAM must balance. Figure AN2-8 shows the regions of the SAM that were balanced using data from the ONS.

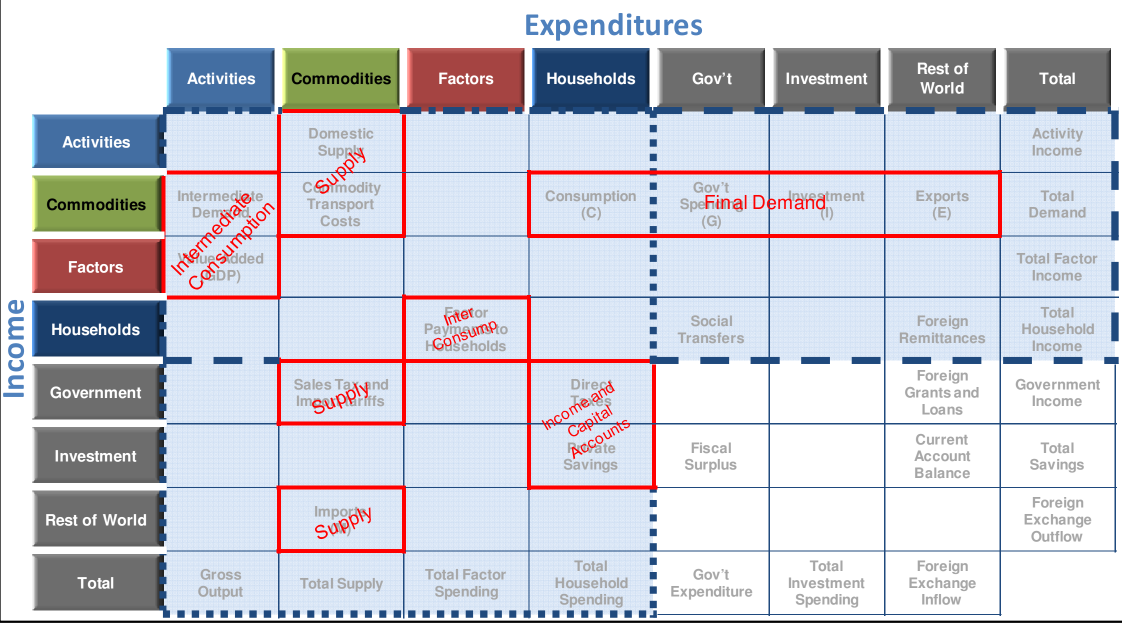
FIGURE AN2-8 – ROWS AND COLUMNS TO BALANCE FOR EIA ANALYSIS

Expenditures (columns) / Income (rows)

	Activities	Commodities	Factors	Households	Gov't	Investment	Rest of World	Total
Activities		Domestic Supply						Activity Income
Commodities	Intermediate Demand	Commodity Transport Costs		Consumption (C)	Gov't Spending (G)	Investment (I)	Exports (E)	Total Demand
Factors	Value-Added (GDP)							Total Factor Income
Households			Factor Payments to Households		Social Transfers		Foreign Remittances	Total Household Income
Government		Sales Tax and Import tariffs		Direct Taxes			Foreign Grants and Loans	Government Income
Investment				Private Savings	Fiscal Surplus		Current Account Balance	Total Savings
Rest of World		Imports (M)						Foreign Exchange Outflow
Total	Gross Output	Total Supply	Total Factor Spending	Total Household Spending	Gov't Expenditure	Total Investment Spending	Foreign Exchange Inflow	

Finally, Figure AN2-9 maps the data sourced from the ONS to the corresponding cells in the SAM. Specifically, using data on Supply, Intermediate Consumptions, Final Demand as well as data from the Income and Capital Accounts, IHS was able to accurately populate the region of the SAM needed to produce the proportion of the Direct Requirements Matrix used at the core of the Economic Impact Analysis Model.

FIGURE AN2-9 – ONS SOURCES FOR SAM DATA



As implied by its name, the I-O model developed for this engagement utilizes output (or industry sales) as a primary input. These include refinery production, capital expenditures and operating expenses. The model then quantifies the subsequent direct and induced changes in output experienced by any of the 110 industry sub-sectors. Employment impacts were assessed by applying industry sub-sector output per worker data compiled from ONS to quantify the number of workers required to support these changes in output. The changes in industry sub-sector output then applied to the appropriate ratios from the Direct Requirements Matrix to determine the value-added and labour income. Finally, the employment, value added and labour income were aggregated by the 14 super-sectors and reported out by direct, indirect and induced impacts.

Data submitted by the UK refineries has been used as input to the model, and in some cases to provide a calibration from the 2010 ONS data to 2011 data – particularly on refinery margins where there is not a direct relationship from year to year. The aggregated data collected from UK refineries is shown in Table AN2-2.

MODEL INPUTS

Purvin & Gertz surveyed all seven UK refineries to develop a composite profile of the industry's high-level financial, operational and employment data within the UK (Table AN2-2). These data were used to derive the inputs into the economic impact models. For example, in 2011 the refineries employed 4,162 direct workers and 4,380 contractors, for an aggregate direct employment of 8,541. These employees received £446M in compensation, as follows:

- Direct workers: the refineries paid these workers £245M in wages. The refineries also paid £30M in National Insurance (a benefit to the workers). Total compensation for direct workers was £275M.
- Contractors received wages of £171M. Any benefits were assumed to be paid by the contractors' companies, not the refineries.
- £275M + £171M = £446M

The value added to the GDP of the UK economy is defined as the refineries' collective sales revenues less the cost of intermediate input goods and services. Alternatively, value added can be viewed as the sum of the Gross Operating Surplus (GOS) of a company and the Wages/Compensation paid to employees. GOS serves as the source from which taxes are paid and profits are retained. Based on the survey data collected for this project, the refineries' direct value added for 2011 was £6M calculated as follows:

Pre-tax Operating Result	(£587M)
+ Employee/Contractor Salaries and Benefits	£446M
+ Depreciation (not a cash expense!)	£147M
= Direct Value Added	£6M

Fortunately, the indirect (supply chain) and induced (consumer) value added contributions were quite positive: £791M and £282M, respectively. Thus, the total contribution to the UK GDP attributable to the existence of the UK refineries was just over £1.0 billion in 2011.

Table AN2-2 also shows that, in 2011, the refineries' spend about £1.4 billion on intermediate goods and services (i.e. cash operating costs - chemicals, supplies, other opex, sustaining capex, etc.), exclusive of crude oil purchases. In deriving the contributions the refineries make to the UK economy, the impact of crude oil purchases was not included. The rationale for this criterion is global demand for crude oil is such that any decline in demand from refineries will simply shift to other sectors. Thus, the economic impact of crude oil production will remain, regardless of whether all nine UK refineries are running at full capacity or completely shut down. Therefore, to derive a more realistic view of the refineries' economic contribution, crude oil purchases were not included in the final assessment. The remaining expenditures, which were mapped to their corresponding commodity industries in the SAM model, initiated the indirect, or supply chain, impacts.

MODEL RESULTS

CONTRIBUTION OF UK REFINERIES TO UK ECONOMY IN 2011

Tables AN2-2a – AN2-3c present the intermediate and final results of the procedure used to derive the net baseline economic impact of refineries on the UK economy. For example, Table AN2-3a shows that the Refinery Business ecosystem currently supports close to 88,100 jobs, and contributes approximately £10.1 billion to the UK economy. Table AN2-3b shows that over 61,500 of the jobs and £9 billion of the GDP contribution are tied to the production of crude oil and, therefore, are not necessarily at risk if UK refineries were to close – providing that this level of refining activity continues to take place somewhere else in the world.

{Ultimately production of crude oil and oil refining are completely linked to each other. On an individual refinery basis, or even country basis, the argument can be made that closure of refineries does not impact the production of crude oil as other refineries elsewhere pick up the slack in order to continue to supply the required refined products. However closure of enough refineries would impact crude oil production and refined product supply. So if this study were focused on larger region such as Europe or the USA instead of the UK it would not be possible to argue that closure of refineries would not impact crude oil production. Some crude oil production somewhere in the world is dependent on UK refined product demand and hence the UK refineries.}

This leaves (Table AN2-3c) some 26,400 jobs and £1.1 billion of GDP contribution remaining. Only 8,500 are direct refinery jobs; the remaining 18,000 are indirect and induced jobs. The low margins experienced by the UK refineries in 2011 have resulted in only £6 million net contribution to UK GDP owing to the actual activity of refining. As a result, in 2011, the refinery supply chain (indirect effects which includes refinery operational expenditure) accounted for £0.79 billion, almost three-quarters of the £1.1 billion of GDP contribution.

In conclusion, in 2011 the total contribution to the UK GDP attributable to the existence of the UK refineries was £1.1 billion.

CONTRIBUTION OF UK REFINERIES TO UK ECONOMY IN FUTURE NORMAL YEAR (2025)

Tables AN2-4a – AN2-4c present the intermediate and final results of the procedure used to derive the economic contribution of the refineries on the UK economy in a more normal margin year. In this case 2025 was selected as being representative of our Long Term Refining Margins forecast, but any year from 2016 through to 2030 would provide the same result.

Note that the employment figures for our normal year are the same as for the 2011 case. The main change to the 2011 case is the expected improvement in refinery margins.

This together with a slight increase in processing volume and increase in operating costs results in an increased contribution to the UK economy.

Table AN2-4a shows that in a normal year the Refinery Business ecosystem would contribute approximately £12 billion to the UK economy. Table AN2-4b shows that £9.7 billion of the GDP contribution are resultant on the production of crude oil.

This leaves (Table AN2-4c) £2.3 billion of GDP contribution remaining. Of this £1.2 billion is the net contribution to UK GDP owing to the actual activity of refining, with the refinery supply chain (indirect effects which includes refinery operational expenditure) accounting for a further £0.8 billion and the induced effects accounting for a further £0.3 billion.

Therefore in a normal margin year the total contribution to the UK GDP attributable to the existence of the UK refineries would be as just over £2.3 billion.

TABLE AN2-1
UK INDUSTRY SUB-SECTOR AND SUPER-SECTOR SCHEME

Industry Code	Industry Sub-Sector Description	Super-Sector
01	Products of agriculture, hunting and related services	Agriculture
02	Products of forestry, logging and related services	Agriculture
03	Fish and other fishing products; aquaculture products; support services to fishing	Agriculture
05	Coal and lignite	Mining
06 & 07	Extraction Of Crude Petroleum And Natural Gas & Mining of Metal Ores	Mining
08	Other mining and quarrying products	Mining
09	Mining support services	Manufacturing
10.1	Preserved meat and meat products	Manufacturing
10.2-3	Processed and preserved fish, crustaceans, molluscs, fruit and vegetables	Manufacturing
10.4	Vegetable and animal oils and fats	Manufacturing
10.5	Dairy products	Manufacturing
10.6	Grain mill products, starches and starch products	Manufacturing
10.7	Bakery and farinaceous products	Manufacturing
10.8	Other food products	Manufacturing
10.9	Prepared animal feeds	Manufacturing
11.01-6	Alcoholic beverages	Manufacturing
11.07	Soft drinks	Manufacturing
12	Tobacco products	Manufacturing
13	Textiles	Manufacturing
14	Wearing apparel	Manufacturing
15	Leather and related products	Manufacturing
16	Wood and of products of wood and cork, except furniture; articles of straw and plants	Manufacturing
17	Paper and paper products	Manufacturing
18	Printing and recording services	Manufacturing
19	Coke and refined petroleum products	Manufacturing
20.3	Paints, varnishes and similar coatings, printing ink and mastics	Manufacturing
20.4	Soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations	Manufacturing
20.5	Other chemical products	Manufacturing
20A	Industrial gases, inorganics and fertilisers (all inorganic chemicals)	Manufacturing
20B	Petrochemicals	Manufacturing
20C	Dyestuffs, agro-chemicals	Manufacturing
21	Basic pharmaceutical products and pharmaceutical preparations	Manufacturing
22	Rubber and plastic products	Manufacturing
23.5-6	Manufacture of cement, lime, plaster and articles of concrete, cement and plaster	Manufacturing
23OTHER	Glass, refractory, clay, other porcelain and ceramic, stone and abrasive products	Manufacturing
24.1-3	Basic iron and steel	Manufacturing
24.4-5	Other basic metals and casting	Manufacturing
25.4	Weapons and ammunition	Manufacturing
25OTHER	Fabricated metal products, excl. machinery and equipment and weapons & ammunitions	Manufacturing
26	Computer, electronic and optical products	Manufacturing
27	Electrical equipment	Manufacturing
28	Machinery and equipment n.e.c.	Manufacturing
29	Motor vehicles, trailers and semi-trailers	Manufacturing
30.1	Ships and boats	Manufacturing
30.3	Air and spacecraft and related machinery	Manufacturing
30OTHER	Other transport equipment	Manufacturing
31	Furniture	Manufacturing
32	Other manufactured goods	Manufacturing
33.15	Repair and maintenance of ships and boats	Real Estate and Business Activities
33.16	Repair and maintenance of aircraft and spacecraft	Real Estate and Business Activities
33OTHER	Rest of repair; Installation	Real Estate and Business Activities
35.1	Electricity, transmission and distribution	Utilities
35.2-3	Gas; distribution of gaseous fuels through mains; steam and air conditioning supply	Utilities
36	Natural water; water treatment and supply services	Utilities
37	Sewerage services; sewage sludge	Utilities

TABLE AN2-1
UK INDUSTRY SUB-SECTOR AND SUPER-SECTOR SCHEME
(continued)

Industry Code	Industry Sub-Sector Description	Super-Sector
38	Waste collection, treatment and disposal services; materials recovery services	Utilities
39	Remediation services and other waste management services	Utilities
41	Buildings and building construction works	Construction
42	Constructions and construction works for civil engineering	Construction
43	Specialised construction works	Construction
45	Wholesale and retail trade and repair services of motor vehicles and motorcycles	Wholesale and Retail Trade
46	Wholesale trade services, except of motor vehicles and motorcycles	Wholesale and Retail Trade
47	Retail trade services, except of motor vehicles and motorcycles	Wholesale and Retail Trade
49.1-2	Rail transport services	Transport, Storage and Communication
49.3-5	Land transport services and transport services via pipelines, excluding rail transport	Transport, Storage and Communication
50	Water transport services	Transport, Storage and Communication
51	Air transport services	Transport, Storage and Communication
52	Warehousing and support services for transportation	Transport, Storage and Communication
53	Postal and courier services	Transport, Storage and Communication
55	Accommodation services	Hotels and Restaurants
56	Food and beverage serving services	Hotels and Restaurants
58	Publishing services	Transport, Storage and Communication
59	Motion picture, video and TV programme production services, sound recording &	Transport, Storage and Communication
60	Programming and broadcasting services	Transport, Storage and Communication
61	Telecommunications services	Transport, Storage and Communication
62	Computer programming, consultancy and related services	Transport, Storage and Communication
63	Information services	Transport, Storage and Communication
64	Financial services, except insurance and pension funding	Financial Intermediation
65.1-2 & 65.3	Insurance and reinsurance, except compulsory social security & Pension funding	Financial Intermediation
66	Services auxiliary to financial services and insurance services	Financial Intermediation
68.1-2	Real estate services, excluding on a fee or contract basis and imputed rent	Real Estate and Business Activities
68.2IMP	Owner-Occupiers' Housing Services	Real Estate and Business Activities
68.3	Real estate activities on a fee or contract basis	Real Estate and Business Activities
69.1	Legal services	Real Estate and Business Activities
69.2	Accounting, bookkeeping and auditing services; tax consulting services	Real Estate and Business Activities
70	Services of head offices; management consulting services	Real Estate and Business Activities
71	Architectural and engineering services; technical testing and analysis services	Real Estate and Business Activities
72	Scientific research and development services	Real Estate and Business Activities
73	Advertising and market research services	Real Estate and Business Activities
74	Other professional, scientific and technical services	Real Estate and Business Activities
75	Veterinary services	Real Estate and Business Activities
77	Rental and leasing services	Real Estate and Business Activities
78	Employment services	Real Estate and Business Activities
79	Travel agency, tour operator and other reservation services and related services	Real Estate and Business Activities
80	Security and investigation services	Real Estate and Business Activities
81	Services to buildings and landscape	Real Estate and Business Activities
82	Office administrative, office support and other business support services	Real Estate and Business Activities
84	Public administration and defence services; compulsory social security services	Public administration and defence
85	Education services	Education
86	Human health services	Health and Social Services
87	Residential care services	Social and Personal Services
88	Social work services without accommodation	Social and Personal Services
90	Creative, arts and entertainment services	Social and Personal Services
91	Libraries, archives, museums and other cultural services	Social and Personal Services
92	Gambling and betting services	Social and Personal Services
93	Sports services and amusement and recreation services	Social and Personal Services
94	Services furnished by membership organisations	Social and Personal Services
95	Repair services of computers and personal and household goods	Social and Personal Services
96	Other personal services	Social and Personal Services
97	Services of households as employers of domestic personnel	Social and Personal Services

TABLE AN2-2
AGGREGATED UK REFINERY DATA

		Units	2011	Future Normal Year
Employees	No. of Employees		4,162	4,162
	Average Annual Salary	£	58,895	58,895
	Total Salaries Paid	M£	245	245
	Estimated Employee Income Tax Paid	M£	62.7	62.7
	Estimated Employee National Insurance Paid	M£	18.8	18.8
	Estimated Refinery National Insurance Paid	M£	29.5	29.5
	Estimated Employee Take-Home Pay	M£	163.6	163.6
Contractors	No. of Contractors on site		4,380	4,380
	Average Annual Salary (£)	£	39,083	39,083
	Total Contractor Salaries Paid (£)	M£	171.2	171.2
	Estimated Contractor Income Tax Paid	M£	32.7	32.7
	Estimated Contractor National Insurance Paid	M£	15.8	15.8
	Estimated Contractor Employer National Insurance Paid	M£	19.1	19.1
	Estimated Contractor Take-Home Pay	M£	122.7	122.7
Refinery Throughput	Crude (kbbl)	kbbl	475,177	493,784
	Feedstocks (kbbl)	kbbl	46,762	67,421
	Total (kbbl)	kbbl	521,939	561,205
Refinery Margins	Gross Refinery Margin (MUS$)	MUS$	1,705	3,727
	Total Operating Costs (MUS$)	MUS$	2,195	2,254
	Net Cash Margin (MUS$)	MUS$	(490)	1,473
	Annualised Turnaround Costs	MUS$	214	214
	Depreciation	MUS$	236	236
	Calculated Operating Result	MUS$	(939)	1,024
	Estimated Corporation Tax Paid	MUS$	(244)	266
	Estimated Corporation Tax Paid	M£	(152)	166
	Gross Refinery Margin ($/bbl)	US$/bbl	3.27	6.64
	Total Operating Costs ($/bbl)	US$/bbl	4.21	4.02
	Net Cash Margin ($/bbl)	US$/bbl	(0.94)	2.62
Refinery Operating Cost Detail	Fixed Costs			
	Total Fixed Costs (excluding Turnaround costs)	M£	921.5	921.5
	Variable Costs			
	Total Variable Costs	M£	445.2	481.5
	Annualised Turnaround Costs	M£	133.2	133.2
	Total Cash Operating Costs (M£)	M£	1,366.7	1,403.1
	Total Operating Costs including Turnaround (M£)	M£	1,500.0	1,536.3
Capital Expenditure	Sustaining	M£	292.4	292.4
	Profit Improvement	M£	62.4	62.4
	Total	M£	354.7	354.7
Sum of all inputs to UK Economy		M£	**1,702.4**	**2,057.0**

TABLE AN2 - 3A
ECONOMIC IMPACT OF REFINERY BUSINESS ECOSYSTEM 2011
(Inclusive of Crude Oil Production)

	Employment (number of workers)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	105	655	760
Mining (includes crude oil extraction)	0	11,921	47	11,969
Manufacturing	0	5,935	1,927	7,862
Refineries	8,541	0	0	8,541
Utilities	0	1,768	329	2,098
Construction	0	7,403	1,062	8,466
Wholesale and Retail Trade	0	14,392	9,865	24,257
Transport, Storage	0	4,009	1,266	5,275
Hotels and Restaurants	0	1,086	3,481	4,566
Information and Communication	0	1,136	948	2,085
Financial Services	0	1,658	2,681	4,338
Services	0	3,079	1,101	4,180
Public administration and defence services; compulsory social security services	0	471	300	772
Health, Education and Social Services	0	921	2,016	2,936
Total	**8,541**	**53,886**	**25,678**	**88,106**
	Value Added (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	2	12	14
Mining (includes crude oil extraction)	0	6,470	25	6,495
Manufacturing	0	335	103	437
Refineries	6	3	2	11
Utilities	0	201	38	239
Construction	0	289	41	331
Wholesale and Retail Trade	0	474	323	797
Transport, Storage	0	160	53	213
Hotels and Restaurants	0	23	72	95
Information and Communication	0	80	63	142
Financial Services	0	198	314	512
Services	0	522	179	701
Public administration and defence services; compulsory social security services	0	19	12	31
Health, Education and Social Services	0	27	51	78
Total	**6**	**8,802**	**1,288**	**10,096**
	Labour Income (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	1	5	6
Mining (includes crude oil extraction)	0	546	3	548
Manufacturing	0	252	73	325
Refineries	446	0	0	446
Utilities	0	69	13	82
Construction	0	161	23	184
Wholesale and Retail Trade	0	290	199	489
Transport, Storage	0	124	38	162
Hotels and Restaurants	0	15	49	64
Information and Communication	0	55	39	94
Financial Services	0	73	63	136
Services	0	325	117	442
Public administration and defence services; compulsory social security services	0	16	10	26
Health, Education and Social Services	0	24	45	69
Total	**446**	**1,952**	**675**	**3,073**

TABLE AN2 - 3B
ECONOMIC IMPACT OF CRUDE OIL PRODUCTION 2011

	Employment (number of workers)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	82	512	595
Mining (includes crude oil extraction)	0	11,789	37	11,826
Manufacturing	0	2,696	1,507	4,204
Refineries	0	0	0	0
Utilities	0	366	257	623
Construction	0	4,286	831	5,117
Wholesale and Retail Trade	0	12,221	7,716	19,937
Transport, Storage	0	3,206	990	4,196
Hotels and Restaurants	0	932	2,722	3,655
Information and Communication	0	928	742	1,670
Financial Services	0	1,397	2,097	3,494
Services	0	2,545	861	3,406
Public administration and defence services; compulsory social security services	0	385	235	620
Health, Education and Social Services	0	745	1,576	2,321
Total	**0**	**41,578**	**20,084**	**61,662**

	Value Added (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	1	9	11
Mining (includes crude oil extraction)	0	6,400	20	6,420
Manufacturing	0	152	80	232
Refineries	0	0	0	0
Utilities	0	35	30	65
Construction	0	167	32	200
Wholesale and Retail Trade	0	403	253	656
Transport, Storage	0	128	41	169
Hotels and Restaurants	0	19	56	76
Information and Communication	0	65	49	114
Financial Services	0	167	246	413
Services	0	436	140	575
Public administration and defence services; compulsory social security services	0	15	9	25
Health, Education and Social Services	0	22	40	62
Total	**0**	**8,012**	**1,006**	**9,017**

	Labour Income (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	1	4	4
Mining (includes crude oil extraction)	0	538	2	540
Manufacturing	0	112	57	169
Refineries	0	0	0	0
Utilities	0	13	10	24
Construction	0	93	18	111
Wholesale and Retail Trade	0	246	156	402
Transport, Storage	0	102	30	131
Hotels and Restaurants	0	13	38	51
Information and Communication	0	45	31	76
Financial Services	0	63	49	112
Services	0	267	91	359
Public administration and defence services; compulsory social security services	0	13	8	21
Health, Education and Social Services	0	20	35	55
Total	**0**	**1,527**	**528**	**2,055**

TABLE AN2 - 3C
NET BASELINE ECONOMIC IMPACT OF REFINERY ACTIVITY ON THE UK ECONOMY 2011

Baseline Scenario: 2011	Employment (number of workers)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	23	143	166
Mining (includes crude oil extraction)	0	132	10	143
Manufacturing	0	3,239	420	3,659
Refineries	8,541	0	0	8,541
Utilities	0	1,403	72	1,474
Construction	0	3,118	231	3,349
Wholesale and Retail Trade	0	2,171	2,149	4,320
Transport, Storage	0	803	276	1,079
Hotels and Restaurants	0	153	758	911
Information and Communication	0	208	207	415
Financial Services	0	261	584	844
Services	0	535	240	774
Public administration and defence services; compulsory social security services	0	86	65	152
Health, Education and Social Services	0	176	439	615
Total	**8,541**	**12,308**	**5,594**	**26,443**

Baseline Scenario: 2011	Value Added (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	0	3	3
Mining (includes crude oil extraction)	0	70	5	76
Manufacturing	0	183	22	206
Refineries	6	3	2	11
Utilities	0	166	8	174
Construction	0	122	9	131
Wholesale and Retail Trade	0	71	70	142
Transport, Storage	0	32	11	44
Hotels and Restaurants	0	3	16	19
Information and Communication	0	14	14	28
Financial Services	0	31	68	99
Services	0	87	39	126
Public administration and defence services; compulsory social security services	0	3	3	6
Health, Education and Social Services	0	5	11	16
Total	**6**	**791**	**282**	**1,079**

Baseline Scenario: 2011	Labour Income (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	0	1	1
Mining (includes crude oil extraction)	0	7	1	8
Manufacturing	0	140	16	155
Refineries	446	0	0	446
Utilities	0	56	3	59
Construction	0	68	5	73
Wholesale and Retail Trade	0	44	43	87
Transport, Storage	0	23	8	31
Hotels and Restaurants	0	2	11	13
Information and Communication	0	10	9	18
Financial Services	0	10	14	24
Services	0	58	25	83
Public administration and defence services; compulsory social security services	0	3	2	5
Health, Education and Social Services	0	5	10	14
Total	**446**	**425**	**147**	**1,018**

TABLE AN2 - 4A
ECONOMIC IMPACT OF REFINERY BUSINESS ECOSYSTEM 2025

	Employment (number of workers)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	112	697	808
Mining (includes crude oil extraction)	0	12,820	50	12,870
Manufacturing	0	6,155	2,049	8,203
Refineries	8,541	0	0	8,541
Utilities	0	1,913	350	2,263
Construction	0	7,739	1,129	8,868
Wholesale and Retail Trade	0	15,342	10,488	25,830
Transport, Storage	0	4,257	1,346	5,603
Hotels and Restaurants	0	1,160	3,700	4,860
Information and Communication	0	1,211	1,008	2,219
Financial Services	0	1,770	2,850	4,619
Services	0	3,281	1,170	4,451
Public administration and defence services; compulsory social security services	0	502	319	821
Health, Education and Social Services	0	982	2,143	3,124
Total	**8,541**	**57,243**	**27,299**	**93,083**

	Value Added (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	2	13	15
Mining (includes crude oil extraction)	0	6,958	27	6,985
Manufacturing	0	347	109	456
Refineries	1,230	3	2	1,235
Utilities	0	215	40	255
Construction	0	302	44	346
Wholesale and Retail Trade	0	506	343	849
Transport, Storage	0	170	56	226
Hotels and Restaurants	0	24	77	101
Information and Communication	0	85	66	152
Financial Services	0	211	334	545
Services	0	557	190	747
Public administration and defence services; compulsory social security services	0	20	13	33
Health, Education and Social Services	0	29	55	84
Total	**1,230**	**9,429**	**1,369**	**12,028**

	Labour Income (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	1	5	6
Mining (includes crude oil extraction)	0	587	3	590
Manufacturing	0	261	77	338
Refineries	446	0	0	446
Utilities	0	74	14	88
Construction	0	169	25	193
Wholesale and Retail Trade	0	309	212	521
Transport, Storage	0	132	40	173
Hotels and Restaurants	0	16	52	68
Information and Communication	0	59	42	100
Financial Services	0	78	67	145
Services	0	346	124	470
Public administration and defence services; compulsory social security services	0	17	11	28
Health, Education and Social Services	0	26	48	74
Total	**446**	**2,076**	**718**	**3,239**

TABLE AN2 - 4B
ECONOMIC IMPACT OF CRUDE OIL PRODUCTION 2025

	Employment (number of workers)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	88	551	639
Mining (includes crude oil extraction)	0	12,676	40	12,716
Manufacturing	0	2,899	1,621	4,520
Refineries	0	0	0	0
Utilities	0	393	277	670
Construction	0	4,608	893	5,502
Wholesale and Retail Trade	0	13,140	8,296	21,437
Transport, Storage	0	3,447	1,065	4,511
Hotels and Restaurants	0	1,003	2,927	3,930
Information and Communication	0	998	798	1,796
Financial Services	0	1,502	2,254	3,757
Services	0	2,736	926	3,662
Public administration and defence services; compulsory social security services	0	414	253	667
Health, Education and Social Services	0	801	1,695	2,496
Total	**0**	**44,706**	**21,595**	**66,301**

	Value Added (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	2	10	12
Mining (includes crude oil extraction)	0	6,882	21	6,903
Manufacturing	0	163	86	249
Refineries	0	0	0	0
Utilities	0	38	32	70
Construction	0	180	35	215
Wholesale and Retail Trade	0	433	272	705
Transport, Storage	0	138	44	182
Hotels and Restaurants	0	21	61	81
Information and Communication	0	70	53	123
Financial Services	0	180	264	444
Services	0	468	150	619
Public administration and defence services; compulsory social security services	0	16	10	26
Health, Education and Social Services	0	24	43	67
Total	**0**	**8,614**	**1,081**	**9,695**

	Labour Income (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	1	4	5
Mining (includes crude oil extraction)	0	579	2	581
Manufacturing	0	121	61	182
Refineries	0	0	0	0
Utilities	0	14	11	25
Construction	0	100	19	120
Wholesale and Retail Trade	0	265	168	432
Transport, Storage	0	109	32	141
Hotels and Restaurants	0	14	41	55
Information and Communication	0	49	33	82
Financial Services	0	67	53	120
Services	0	288	98	386
Public administration and defence services; compulsory social security services	0	14	8	22
Health, Education and Social Services	0	21	38	59
Total	**0**	**1,642**	**568**	**2,210**

TABLE AN2 - 4C
NET ECONOMIC IMPACT OF REFINERY ACTIVITY ON THE UK ECONOMY 2025

Future Scenario: 2025	Employment (number of workers)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	23	146	169
Mining (includes crude oil extraction)	0	144	10	155
Manufacturing	0	3,255	428	3,683
Refineries	8,541	0	0	8,541
Utilities	0	1,520	73	1,593
Construction	0	3,131	236	3,367
Wholesale and Retail Trade	0	2,202	2,191	4,393
Transport, Storage	0	811	281	1,092
Hotels and Restaurants	0	157	773	930
Information and Communication	0	213	211	424
Financial Services	0	268	595	863
Services	0	544	245	789
Public administration and defence services; compulsory social security services	0	88	67	154
Health, Education and Social Services	0	181	448	628
Total	**8,541**	**12,537**	**5,703**	**26,782**

Future Scenario: 2025	Value Added (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	0	3	3
Mining (includes crude oil extraction)	0	77	6	82
Manufacturing	0	184	23	207
Refineries	1,230	3	2	1,235
Utilities	0	177	8	186
Construction	0	122	9	131
Wholesale and Retail Trade	0	72	72	144
Transport, Storage	0	33	12	44
Hotels and Restaurants	0	3	16	19
Information and Communication	0	15	14	29
Financial Services	0	32	70	101
Services	0	88	40	128
Public administration and defence services; compulsory social security services	0	3	3	6
Health, Education and Social Services	0	5	11	17
Total	**1,230**	**815**	**288**	**2,333**

Future Scenario: 2025	Labour Income (millions of £)			
Sector	Direct	Indirect	Induced	Total
Agriculture	0	0	1	1
Mining (includes crude oil extraction)	0	8	1	9
Manufacturing	0	140	16	156
Refineries	446	0	0	446
Utilities	0	60	3	63
Construction	0	68	5	73
Wholesale and Retail Trade	0	44	44	89
Transport, Storage	0	23	8	31
Hotels and Restaurants	0	2	11	13
Information and Communication	0	10	9	19
Financial Services	0	11	14	25
Services	0	59	26	85
Public administration and defence services; compulsory social security services	0	3	2	5
Health, Education and Social Services	0	5	10	15
Total	**446**	**434**	**150**	**1,029**

ANNEX 3: SUMMARY OF QUOTES FROM INDUSTRY REPRESENTATIVES

Note these are actual quotes from numerous individual industry representatives and do not represent the views of UKPIA or IHS Global Insight Purvin and Gertz. They are shown here anonymously purely to show the reader the range of opinions from different industry representatives.

QUOTES

"Crude infrastructure is generally built to move it"

"Refining infrastructure is generally built close to market"

"If all else is equal, crude is easier to ship because it's homogenous"

"All else equal, refining infrastructure is cheaper to build near to market"

"Check for evidence of this like Crude & Feedstock vs. Product volumes shipped or Crude & Feedstock vs. Product volumes traded"

"One way of presenting an analysis of the different risks & benefits of the different levels of refining cover might be to take some levels of cover for example: 0%, 25%, 50%, 75%, 100%, 125%; or 0-120 in steps of 20%. And then for each level of refining cover make a costs / benefits analysis or a risks analysis (likelihood vs. impact, for instance), potentially using a risk matrix"

"A crude supply shock will disproportionately impact those who rely on products. This because refineries will tend (in times of supply disruption) to favour local markets"

With respect to Compulsory Stock Obligations:

"CSO of crude + feedstock + product is fairly robust. For National CSO with refineries operating this can make money. CSO of product + international tickets is less robust. CSO without refineries (product & tickets) costs money"

"One idea may be to incentivise 'resilience projects' like Finnart pipeline reversal"

"A significant supply disruption scenario would be Saudi Crude processing facility going down (i.e. temporarily out of action). Another actual recent scenario was Venezuela refinery shutdown + hurricane in Gulf coast + Petroplus refineries closure (some temporary) + California refinery fire + market backwardation (so low stocks)"

"It may be UK should maintain sufficient refinery capacity to cover domestic production"

"A look at Government Airport expansion plans would be helpful for future JET demand"

"We are not asking for money or a subsidy. All we want is a level playing field to be able to compete with our international competitors"

"Key challenges with adverse impact on profitability are driven by Carbon floor pricing (which is UK specific), EU IED directive (risk of gold plating), other ETS costs".

"There is a non-level playing field for UK refiners vs. EU and international competitors owing to event based Environmental legislation"

"Moving crude into refinery and product to market can be a challenge"

"With respect to stock level; contango and backwardation likely prevails over working capital requirements"

"Pipelines operated by 3rd parties extract high rents and are not open access"

"No facility is willing to re-batch JET for Heathrow, and Buncefield option is not yet in operation"

"Our understanding is that pipeline operators have to pay high (local) rates"

"Our port charges are fairly heavy, and no alternative 'supplier' of port facilities is available"

"Note in the US the pipeline infrastructure is administered under FIRC law"

"The lower at pump diesel tax in other EU nations adversely impacts already bad EU diesel supply imbalance"

"Some competition from product that's imported is good for consumers"

"For a country to import more than 50% of product would be a high risk approach"

"Future incremental sources of diesel and JET are likely to be Saudi Arabia, Kuwait and Russia, while imports from the US will continue"

"A self-sufficient US would be less likely to intervene overseas for oil supply security reasons"

"US will move from deficit gasoline to balanced, removing a key gasoline export market for European refineries"

"European refineries will remain disadvantaged for export into remaining Latin America and African gasoline markets versus brand new world-scale Middle Eastern & Indian refineries, tax subsidised Russian refiners and natural gas & crude advantaged US refineries"

"China is expected to ensure all demand to be met from Chinese refineries"

"Indian refineries are expected to invest ahead of demand (thus cyclically needing to export product"

"Middle Eastern refineries will be built as export facilities to upgrade equity crude and improve balance of payments"

"Other refining sectors at risk due to Environmental regulatory costs are Australia and California"

"Multi port or downsized port-fuel-injector turbo technology will push car fleet back to petrol, however total petrol demand will continue to fall despite this, due to improving fuel efficiency"

"New petrol technologies will still not provide torque that trucks and buses require, and so a commercial core of diesel consumers will remain"

"International Oil Companies look for a structural advantage like low gas or crude costs (US Midwest), or growth markets (e.g. China, India)"

"The ideal product mix for any EU refinery would be long in middle distillates, short in petrol"

"A hydrocracker investment at xxx refinery would require ~$1.5bn; if margin was at 0.3p/litre level then investment might be viable; if government could incentivise to level of + 0.1 to 0.2 p/litre then investment would be viable"

"Regulations need to be fit for purpose. We need to identify any excessive burden and overlaps or gaps"

"Closure of FCC partly addresses the excess gasoline issue but also impacts the diesel and gasoil shortage"

"Hydrocarbons will remain dominant in the transport sector until at least 2030"

"EU capacity is closing faster than demand contraction, resulting in higher imports and requiring more import facilities"