UKpia Statistical Review 2015

UKpia

Statistical Review

2015

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About UKPIA

UKPIA represents the non-commercial interests of and speaks for eight companies involved in the UK downstream industry, whose activities cover refining, storage and distribution, and marketing of petroleum products.

Our members are:

bp

PHILLIPS 66

ESSAR ENERGY

ExxonMobil

TOTAL

petroineos REFINING AND TRADING

VALERO

Associates:

certas energy

Chevron

Greenergy

murco

UKpia

Contents

All data is updated as far as possible. Where data is not available the most recent statistics have been used.

Introduction from the Energy Minister

I welcome the publication of UKPIA's thirteenth Annual Statistical Review of the UK oil market. This year has seen a strengthening of UKPIA's relationship with government as it has played a significant role in contributing to the Midstream Oil Sector Government and Industry Task Force.

The Task Force was set up last year as a joint venture to allow government and industry to work together in identifying the issues adversely affecting the sector and to look for low cost solutions that will help the industry retain its global competitiveness. UKPIA has supported this work by taking an active role in identifying regulatory burdens and other issues and has provided positive contributions and industry insight into what needs to be done.

The UK government acknowledges the competitive pressure on the UK refining sector and is keen to ensure that the UK retains a resilient fuel supply chain. The UK government recognises that the UK benefits from supply diversity with a mix of both domestic refining and imports. Ultimately, it will be market forces that will decide what supply configuration and balance prevails in the UK, but by working together, industry and government can ensure that the refining and imports sectors remain competitive and continue to deliver fuel resilience to the UK, both now and in the future.

Andrea Leadsom
Energy Minister
June 2015

Introduction from the President

I am delighted to write once again the introduction to the UKPIA Statistical Review, now in its thirteenth year of publication.

The Review remains a valuable source of reference and information on the downstream oil industry in the UK, both for those inside the industry and for others seeking to understand this important sector.

Of course, this Statistical Review would not be possible without the combined and excellent work of the DECC (Department of Energy and Climate Change) statistics group, UKPIA's Secretariat and our member companies. Given the scope of activities and complexity of the downstream sector, producing accurate statistics is an essential and integral part of identifying changing patterns in energy demand and use. Furthermore, the information contained in the Statistical Review highlights the substantial contribution our downstream oil industry makes to the wider UK economy and its strategic role in providing energy security and in maintaining our country's vital fuel supplies. Accordingly, our sector, its structure and its future viability must be considered as matters of national interest.

Yet, our sector remains under enormous pressure from a combination of three critical issues, namely a tough operational climate, a structural imbalance in supply and demand and a challenging regulatory burden both in the EU and the UK.

Since 2009, the UK has seen two refineries close and more recently the Murco Milford Haven refinery in Wales has ceased operation. This has occurred in spite of our UK refineries being amongst some of the most efficient and competitive internationally, assuming a level playing field with EU and non-EU competitors. It is therefore imperative that we address these challenges. Most crucially, getting the policy and legislative framework for our industry right today will ensure that oil products can continue to be supplied reliably and securely, while meeting Britain's current and future energy needs.

I am pleased to see the new Energy Minister's positive words. We look forward to working with the new Minister and her team at DECC to address these important matters.

Finally, I would like to record my thanks and those of the Secretariat for everyone's continuing input into all the valuable work of UKPIA's committees and the work of UKPIA generally.

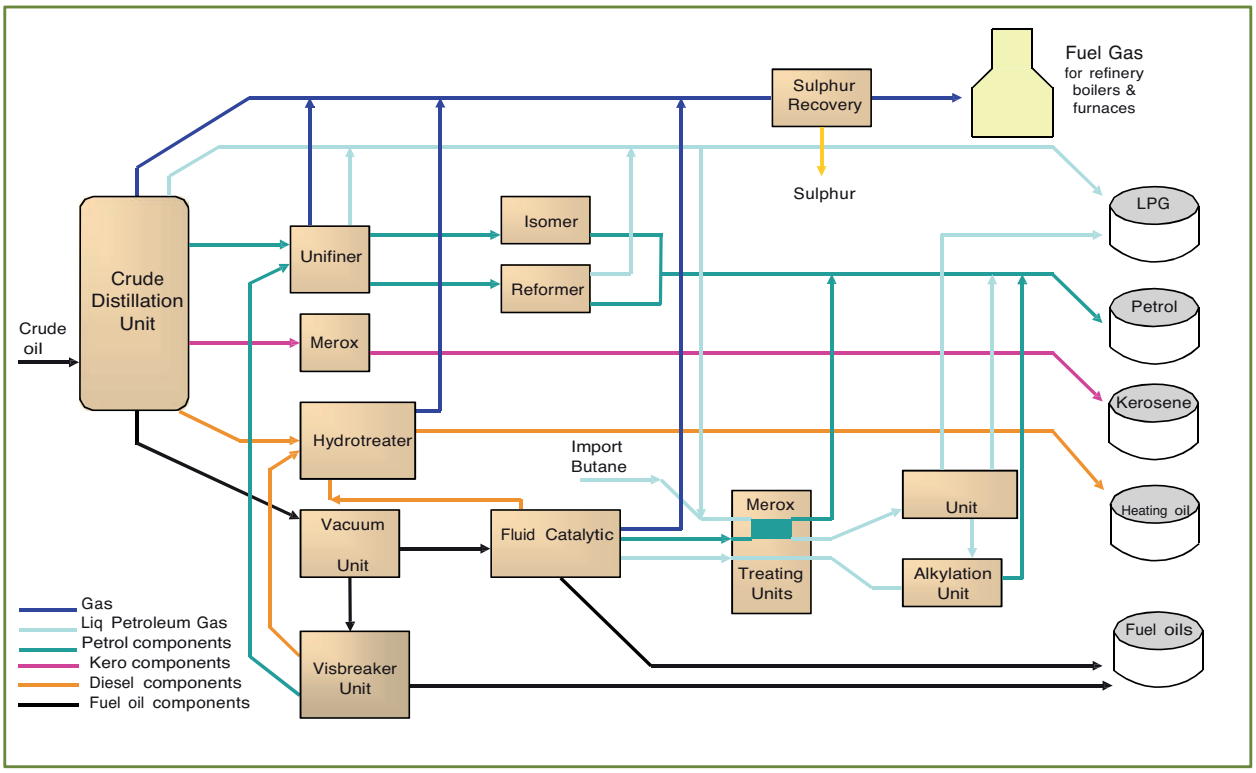
Roy Murray
June 2015

Processing Crude Oil in a Typical UK Refinery

Many refineries in the UK came on stream in the 1950s and 1960s. Since that time they have evolved to meet the growing demand for transport fuels and reducing demand for heating and power generation from oil. The composition of fuels has also changed over recent years to reduce the environmental impact of their use. In addition to transport fuels, refineries produce a wide variety of important feedstocks used in the manufacture of other products, such as petrochemicals, lubricating oils, solvents, bitumen and petroleum coke for aluminium smelting.

No two refineries are identical. They share common technology such as crude distillation, but each UK refinery takes a slightly different route to achieve the common goal of extracting maximum value from each barrel of crude oil processed.

Typical refinery process units



Refinery operations can be broken down into five main processes:

- Distillation which separates crude oil into different refinery streams
- Conversion and reforming which improve the quality of these streams and adjusts the yields to meet market demand
- Desulphurisation which reduces the sulphur in the streams to the required level
- Blending of the refinery streams to produce the final products meeting current regulations and specifications
- Waste treatment ensures that all waste meets current regulations and standards

Distillation

The starting point for all refinery operations is the crude distillation unit (CDU). Crude oil is boiled in a distillation column, which separates the crude down into fractions with different boiling points. The crude oil enters the column near the bottom and is heated to around 380°C. The lighter fractions are vaporised and rise up the column. As they rise, they are cooled by a downward flow of liquid and condense at different boiling points. This enables fractions with different boiling points to be drawn off at different levels in the column. These fractions range from lighter, low boiling point gases such as propane and butane to heavier, higher boiling point diesel and gas oil. They are then sent on to other refinery units for further processing. What is left over at the bottom of the column is a liquid residue, which requires further processing to be turned into more valuable, lighter products or blending components. This residue is first sent to a second stage of fractional distillation in the vacuum distillation unit (VDU). This unit performs the distillation under reduced pressure which allows the distillation of the crude residue at lower temperatures.

Using the same approach as before the VDU separates into different components from gas oil to a heavy liquid residue.

The streams from the CDU and VDU are then processed further by the remaining refinery units to provide the high quality products that consumers expect and that comply with all relevant legislation.

Conversion, Reforming, Desulphurisation and Blending of Different Streams

Distillation does not produce enough of the lighter, more valuable products such as petrol that the market wants. Therefore conversion units, eg fluidised catalytic cracking (FCC), are used to process some of the streams from the vacuum distillation column with the aim of turning the heavy components into lighter transport fuels. Reforming units are used to upgrade the octane number of the petrol components produced from the CDU.

Desulphurisation units are then used to remove sulphur from the products. This enables the products to meet today's tighter fuel specifications. Extra desulphurisation will be required to allow the refinery additional flexibility to process higher sulphur 'sourer' crude oils. Reliance on low sulphur crude oils alone limits the flexibility of a refinery.

Main Products

LPG (liquified petroleum gas) is produced by compressing and cooling gas from the crude distillation unit and the FCC unit.

Petrol streams from the distillation process are cleaned in the unifiner. This unit strips out excess sulphur and nitrogen compounds as hydrogen sulphide and ammonia.

The streams are then sent on to the catalytic reformer and isomer units for processing to raise the octane number of the petrol by modifying its molecular structure. The reformer produces a large amount of hydrogen as a by-product, and this is recycled for use in desulphurisation (hydrotreater) units.

Finally the petrol streams from the reformer, fluidised catalytic cracking unit, the isomerisation unit and the alkylation unit are blended to meet fuel specifications and current regulations.

Jet fuel/kerosene streams from distillation are cleaned in the merox unit. This uses a caustic wash and additives to remove sulphur compounds and to inhibit gum formation.

Diesel/heating oil streams are processed in the hydrotreater, which removes sulphur and other unwanted compounds using hydrogen and a catalyst. The hydrotreater (desulphuriser) is supplied with recycled hydrogen from other process units such as the reformer. The diesel/heating oil streams are separately blended to meet fuel specifications and current regulations.

The lighter **fuel oil** streams from the VDU are processed in the FCC unit whilst the heavier residues from the VDU can be processed in the visbreaker.

In the FCC unit, heavy oils are reacted at high temperature with a catalyst which breaks the heavy fractions into more valuable lighter products. The gaseous and petrol components are then cleaned in a merox unit and some of the gaseous is converted in an isomerisation or alkylation unit into high octane petrol blending components. The FCC's products are blended into petrol, gaseous, diesel/gas oil and fuel oil product streams.

In the visbreaker, the heavy fractions are held at high temperature until they become less viscous. This stream is then blended into other fuel oil product streams.

The **fuel oil** components from the different units are then blended to give fuel oil meeting current regulations and specifications.

Desulphurisation and Waste Treatment

The sulphur recovery unit takes waste hydrogen sulphide from the units which remove sulphur from product streams. The hydrogen sulphide is then reacted with oxygen to give solid elemental sulphur and water vapour. After treatment, this sulphur is sold to other process industries.

All other waste streams are treated according to the current regulations.

Refineries in the UK

The members of UKPIA run the six major operating refineries in the UK, which are situated around the coast for ease of crude tanker access. UKPIA members supply about 85% of the inland market demand for petroleum products. The UK has the fourth largest total refining capacity in the EU and some UK refineries are among the largest in Europe.

Over the years, the refining sector has sought to minimise its impacts upon the environment and improvements continue to be made to reduce emissions.

Section 2 covers refining in more detail, with key figures on production, changing product demand and refinery emissions.

Distribution of Products

Around 50 major oil terminals are supplied by pipeline (51% of the volume), rail (15%) and sea (34%) from UK refineries. There is an extensive network of private and Government owned pipelines in the UK, with around 3,000 miles of pipeline currently in use.

The 1500 miles of privately owned UK pipeline network carries a variety of oil products, from road transport fuels to heating oil and aviation fuel. It provides an efficient and robust distribution system across the UK and directly provides jet fuel for some of the UK's main airports. It can take several days for fuel to travel from the refinery to the terminal by pipeline. At the terminal, products are stored in large above-ground tanks and are transported to the filling station by road tankers.

The Government Pipelines and Storage System (GPSS) was largely designed to meet the needs of military airfields. On 20th March 2015, it was announced that Spain's CLH had acquired GPSS.

Privately owned oil pipelines in England and Wales

U.K.O.P.
Shell
BP
Valero
Total

ESSO PIPELINE SYSTEM

MAINLINE PIPELINE SYSTEM
Valero

WALTON GATWICK PIPELINE
BP
Shell
Valero

WEST LONDON PIPELINE
BP
Shell
Valero
Total

FINA-LINE
Total

GPSS in England and Wales

On 20th March 2015, it was announced that CLH had acquired the Government Pipeline and Storage System (GPSS).

INGRESS LOCATIONS:

KILLINGHOLME
(Total, Conoco, BP)

BACKFORD
(Shell)

AVONMOUTH

HAMBLE
(BP, Esso)

ISLE OF GRAIN
(BP, BA)

THAMES HAVEN
(BP, Shell, O.I.K.O.S.)

Product Distribution

The UK has a number of oil-company and independently-owned terminal facilities, linked either by pipeline, rail or road. Around a half of all terminals are supplied by pipelines, 15% by rail and around a third by sea.

The south of the country heavily relies on pipelines that connect Fawley, Coryton, Stanlow and Milford Haven, with distribution terminals serving major demand centres. The north tends to be more dependent on road transport with large road terminals at Stanlow and on the Humber. Scotland is dependent on supplies from Grangemouth and Northern Ireland on imports delivered to the Belfast port.

1. Economics Contribution and Refinery Economics

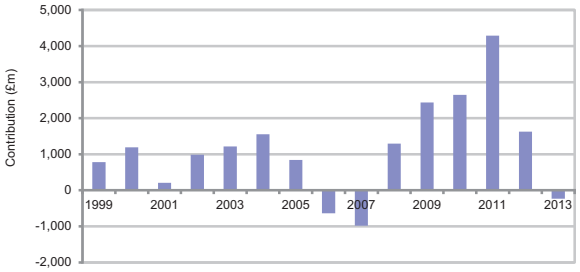
The UK refining industry is one of the largest in Europe, comprising 6 operating refineries, 50 terminals and an extensive pipeline carrying over 30 million tonnes of fuel each year. The sector has undergone a number of changes over the years. During the 70s and 80s refiners moved from atmospheric distillation towards the production of gasoline and distillate to take advantage of the changing economic and legislative landscape. More recently, refiners have had to increasingly adapt and focus on reducing emissions due to a growing number of environmental legislation and tighter fuel specifications, and changing consumer needs with the growth of diesel demand driven partly by fiscal policy.

Despite the strong economic growth seen in the late 90s and early 00s, refining margins continued to fall in both the UK and North West Europe as a whole. Increased environmental and energy policy reforms and taxes squeezed the sector further, with rates of return over a ten-year period remaining on average below 8%. The 2008 financial crisis added to the industry's continued pressures, from volatile crude prices to increased motor fuel taxation and rise in VAT. Reported margins have shown some signs of recovery since the crisis, but dipped again in 2013/14 – as shown in graph 1.8.

The oil refining and marketing industry plays a very important role in the UK's economy, supporting the employment over 150,000 people at refineries, head offices, forecourts and as contractors, and sourcing over 85% of the primary energy used in the UK from a secure supply base. Over 100 million litres of petrol and diesel are sold in the UK each day to an estimated 4 million customers. Today, our industry collects around £37 billion in fuel duty and VAT each year, which contributes to around 6% of the Exchequer's total receipts.

1.1 Contribution to Balance of Payments

Contribution to Balance of Payments from Imports and Exports of Petroleum Products (excluding crude)

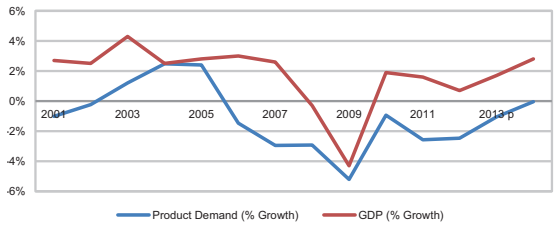


Source: DECC

- The graph illustrates the value of imports and exports of crude oil and petroleum products
- Oil refining has historically been a major contributor to the UK's balance of payments
- However, the growing demand for diesel and jet fuel has resulted in the UK becoming increasingly reliant on large-scale imports
- Imports of jet fuel rose by 25% in the last year alone, principally due to the loss of Coryton Refinery in 2012
- Exported oil products, on the other hand, are heavily dependent on international markets. Recent trends have seen decline in exports of gas oil most notably, down 14% in the last year, and fuel oil, down 8%
- Oil products will remain central to the nation's energy needs for decades to come, alongside a developing role for alternative fuels and energy sources

1.2 Annual Oil Trade

GDP Growth vs. Oil Product Demand Growth

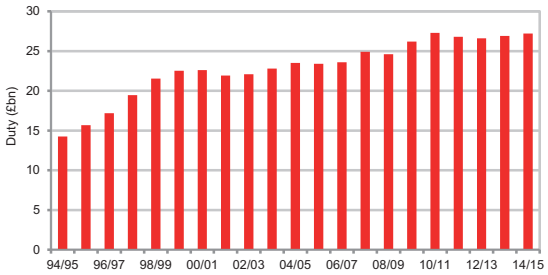


Source: DECC/ONS

- Oil product demand growth is a key indicator to an economy's health, and reflects loosely both cyclical and growth trends
- The impact of the 2008 credit-crisis can clearly be seen by both the GDP and product demand growth curve; they indicate a deep recession in 2008 and another downward trend in 2012
- As economic recovery started picking up in 2013 and continued into 2014, the decline in product demand slowed down but has remained negative

1.3 Duty from Road Fuels

Duty from Road Fuels



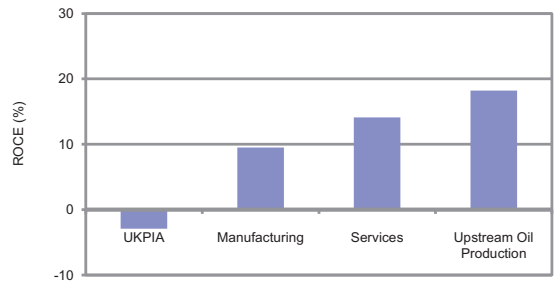
	02/03	04/05	06/07	08/09	10/11	11/12	12/13	13/14	14/15	Change y/y
Duty(£bn)	22.10	23.5	23.6	24.6	27.3	26.8	26.6	26.9	27.2	1.1%

Source: HM Treasury/HRMC

- The 2015 Budget estimated fuel duty receipts for 2014/15 at £27.2 billion. The slight increase on the previous year is a result of increased road fuel sales – there was no duty increase in 2014
- In addition to the duty on road fuels, around £9.6 billion was collected as VAT
- This combined figure is around 6% of total public sector current receipts and would cover over 26% of the public sector's total spending on health or 83% of the country's total spending on defence

1.4 5 year Average Return on Capital Employed

5 Year Average Return on Capital Employed

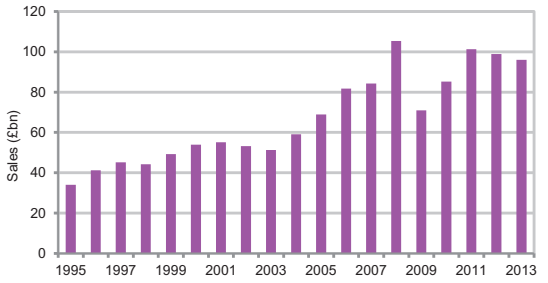


Source: UKPIA/Office for National Statistics

- The return on capital employed between 2009-2013 was on average -2.9% in part due to large investments coinciding with the economic recession and poor returns
- Over the same time period, the average return on capital employed for other three comparable industries was approximately 13.9%, with manufacturing at 9.5%, services at 14.1% and upstream at 18.2%
- Service industries include communications, hotels, catering, distribution, transport and storage

1.5 Gross Sales

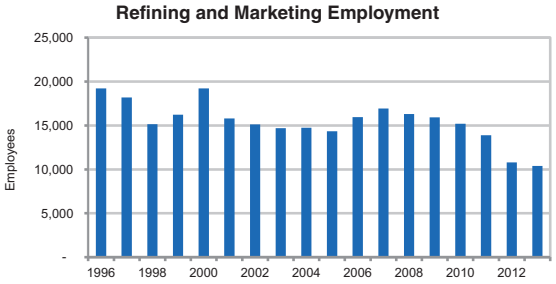
Gross Sales



Source: UKPIA

- In 2013, gross sales by UKPIA member companies was £96 billion, including duty
- This is a slight decline compared to real numbers from the previous year, partly as a result of a decline in sales of petroleum products in 2013

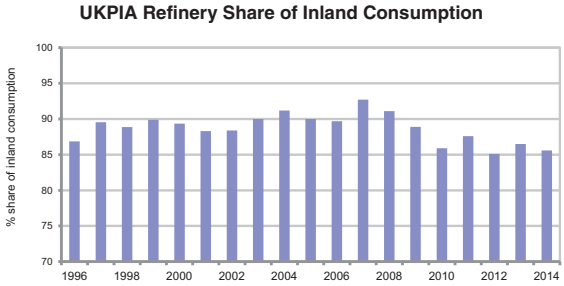
1.6 Refining and Marketing Employment



Source: UKPIA

- The refining and marketing industry is a major employer in the UK, with approximately 11,000 people directly employed by UKPIA members in 2013
- The downstream sector as a whole supports the employment of over 150,000 people in other roles, such as service station staff, contractors and road tanker drivers

1.7 UKPIA Refinery Share of Inland Consumption



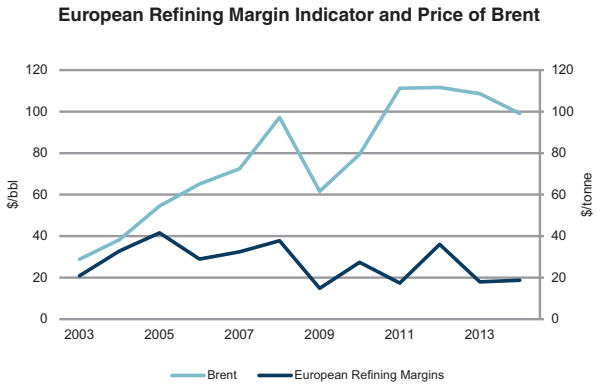
	2001	2003	2005	2007	2009	2010	2011	2012	2013	2014	Change y/y
Consumption	88.3	90.0	91.2	89.7	88.9	85.90	87.60	85.10	86.50	85.60	-1.0%

Source: UKPIA

- In 2014, around 85% of inland oil consumption in the UK was supplied by UKPIA member companies

  This provided vital energy resilience and security of supply to the nation, along with the provision of high quality fuels at competitive prices
- The UK has consistently had one of the lowest pre-tax prices for diesel and petrol in Europe

1.8 Regional Refining Margins



Source: Total Ltd 'European Refining Margin Indicator' (ERMI)

- The underlying trend for European refining margins over the last decade has been cyclical. However, recent periods have shown more severe and frequent cycles, notably in 2009, 2011 and 2013/14
- The refining margin is the difference between cost of crude purchased and value of product sales, and is needed to cover fixed costs of operator and maintenance, and to remunerate capital
- The Total European Refining Margin Indictor (ERMI) is an indicator intended to represent the margin after variable costs for a hypothetical complex refinery located in Northern Europe that processes a mix of crude oil and other inputs commonly supplied to this region to produce and market the main refined products at prevailing prices in this region

2. Refineries

There are six major crude oil refineries in the UK, situated around the coast for ease of crude tanker access. Onwards distribution is achieved via an extensive pipeline system plus road, rail and sea transport.

The UK's crude feedstock is primarily low sulphur crude from the North Sea, although in recent years there has been an increasing diversification trend. Imported crude accounted for 54% of total processing in 2013*, with UK's dependency on imports set to rise as domestic production declines – as it has almost every year since 1999. Europe is still the largest region from which the UK imports crude oil, with Norway continuing to be the single largest source, with Africa now accounting for over 28% of imports – an increase from previous years of 10% on average.

The current economic and legislative climate continues to prove difficult for all European refiners, including those in the UK. Although the country's utilisation rate improved slightly in 2012, moving above the 80% range, latest figures show a return to the mid-70% range seen in recent years. Industry investments have continued in the UK in spite of a challenging economic backdrop, with Total's Lindsey Refinery having undertaken one of the largest recent investments in 2010/11 for a new diesel hydrotreater.

The recent economic and financial downturn has also had direct impact on global demand for oil products. Despite the reported economic recovery seen in 2014, demand in the UK continues to be subdued, combined with the drive to reduce emissions in the transport sector and improved vehicle efficiency. Total demand for petroleum products was 66 m tonnes in 2014, down by approximately 14% since the start of the recession.

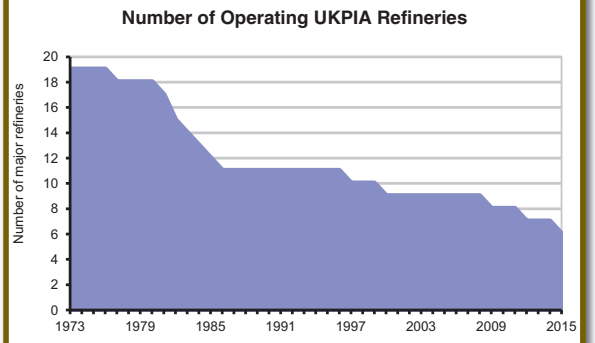
** Latest figures available at time of going to print*

2.1 UK Refineries

Source: UKPIA

- There are six major crude oil refineries operating in the UK which supply the bulk of the inland market demand for petroleum products
- The refineries are situated around the coast and most are connected to pipelines for product distribution
- The Petroplus Coryton refinery closed in June 2012 and Murco's Milford Haven refinery ceased operation in December 2014

2.2 Number of Refineries

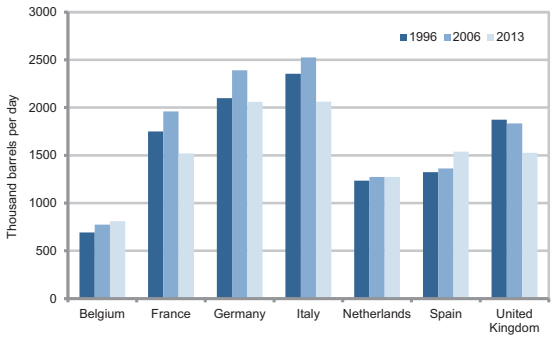


Source: UKPIA

- The number of major oil refineries in the UK has fallen from a high of 19 in 1975 to 6 currently in operation
- There is one further smaller speciality refinery in the UK producing bitumen and other products
- In 2011, two refineries were sold; Chevron's Pembroke refinery to Valero and Shell's Stanlow refinery to Essar

2.3 European Capacity

European Capacity: Comparing years 1996, 2006 & 2013

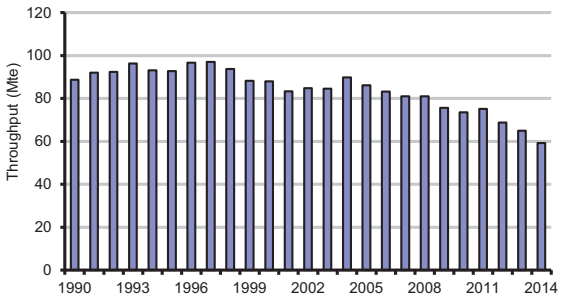


Source: BP Statistical Review of World Energy 2014

- The UK's refining capacity has declined in recent years due in part to refinery rationalisation and closures
- It now has the fourth largest refining capacity in Western Europe, with total refining capacity at approximately 1.6 million barrels per day
- Western European refining has seen a steady decline in recent years with capacity going from 16 million barrels per day in the 1980s to 10.7 million in 2013
- The closure of several French refineries in recent years has seen capacity drop by around 30% in 10 years, whilst the likes of Germany and Italy have seen a 10% decline

2.4 Refinery Throughput

Refinery Throughput

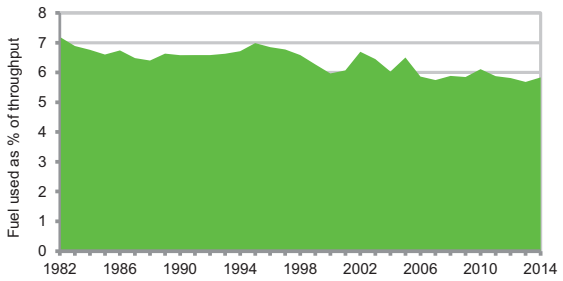


Source: DECC (DUKES)

- Since the refinery closures in 1997, 1999, 2009, and most recently in 2012 and 2014, UK refining throughput has fallen from its late 90s' peak of 97 million tonnes of crude oil
- UK refining throughput has continued to decline over the last 6 years, dropping by 27% to the current volume of 59 million tonnes. This is partly due to the economic recession and refinery closures
- Throughput depends on product demand, capacity and other factors, such as timing of maintenance shutdowns

2.5 Refinery Energy Efficiency

Refinery Energy Efficiency

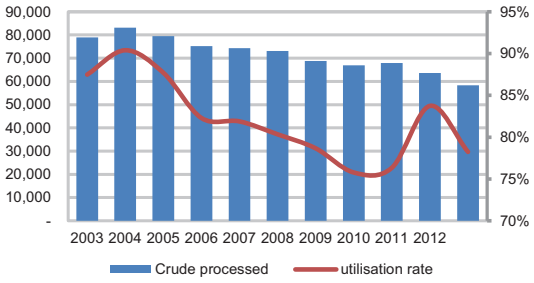


Source: DECC (DUKES)

- Refineries use the equivalent of 5-6% of throughput as fuel, to provide energy to refine crude oil into products for consumers
- More energy is required to meet the current high demand for cleaner transport fuels and to meet challenging environmental standards, but this has been offset by improved energy efficiency at refineries

2.6 Crude Capacity and Utilisation

Crude Capacity and Utilisation Rate

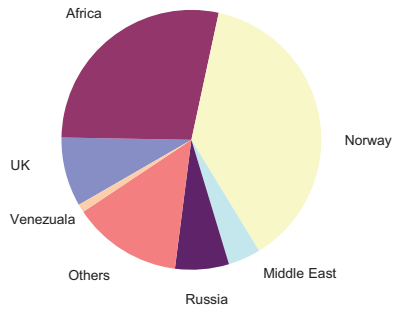


Source: DECC (DUKES)

- The capacity utilisation rate is the value of total production capacity which is actually being utilised over a specific period of time
- Crude oil capacity utilisation rate is equal to crude oil processed, divided by primary distillation capacity
- UK refineries in 2013 had a combined utilisation rate of 73% - a 7% decrease compared to the previous year as a result of a larger reduction in total volume of crude processed relative to primary distillation capacity

2.7 Sources of Crude Oil

Sources of Crude Oil 2013



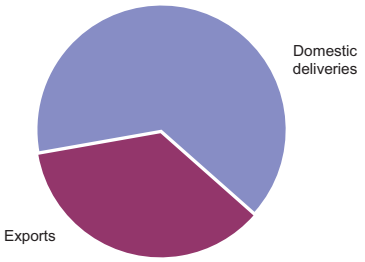
1000 tons	2005	2007	2009	2010	2011	2012	2013	change y/y
Ind. Prod.	84,721	76,575	68.199	68,962	51,972	44,561	40,624	-9%
Imports	58,885	57,357	60,041	54,587	57,586	60,559	59,183	-2%
Exports	54,099	50,999	45,202	42,196	33,745	33,961	33,852	0%
Net	-28,263	-31,781	-37,045	-33,821	-39,358	-49,959	-52,411	26.9%

Source: DECC (DUKES)

- Around 46% of UK refinery crude throughput is from the North Sea; around 38% from Norway and 8% from the UKCS. This is a significant decline when compared to 80% in 2004
- Currently, around 7% of crude oil processed at UK refineries arrives from Russia, and 4% from the Middle East – a large increase relative to an average of 1% of previous years
- Imports from Africa have almost tripled compared to previous years and now account for 28% relative to 10.5% in 2011

2.8 Destinations of Oil Products

Destination of Oil Products 2014



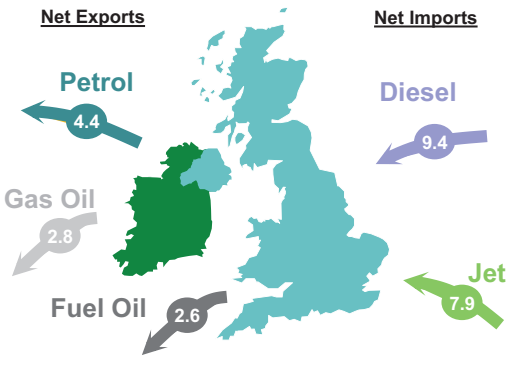
1000 tons	2008	2009	2010	2011	2012	2013	2014	change y/y
Exports	28,803	25,491	26,065	27,800	27,083	26,223	21,143	-19.4%
Imports	23,741	22,172	23,665	22,656	26,028	28,245	29,035	2.8%
Inl. Deliv.	70,456	66,948	66,204	64,178	62,771	62,599	62,883	0.5%

Source: DECC (DUKES)

- The majority of oil products processed at UK refineries are consumed in the UK market – approximately 64%
- The total volume of oil products imported into the UK is increasingly higher than the volume exported, as the table indicates
- The EU is the main destination for UK oil product exports; the UK is part of a trade triangle with Belgium and the Netherlands. The US, however, is also an important export market - particularly for excess petrol
- There is, however, increasing uncertainty over the future of the UK export market as global oversupply narrows down outlet opportunities, particularly in the US; relevant in particular to petrol, where UK's structural surplus is high

2.9 UK Net Product Flows

UK Net Product Flows: 2014

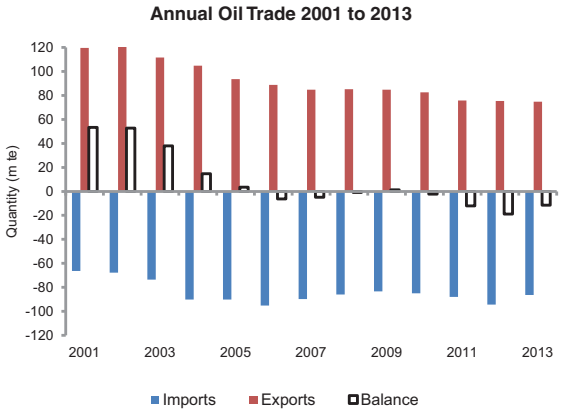


Units: Mte/y

Source: DECC (DUKES) Production for year 2014

- These are Net product flows; they represent the overall import and export balance of the various grades shown
- UK refineries, in common with those in the EU, were configured predominantly to produce petrol and therefore have a mismatch between domestic production and demand
- Fiscal policy in the EU has driven up demand for diesel and demand for air transport has dramatically increased aviation fuel use
- Consequently, the UK has a deficit of aviation fuel and diesel, whilst it exports surplus petrol and fuel oil
- Imports are key for the jet fuel market as demand is over 11m tonnes

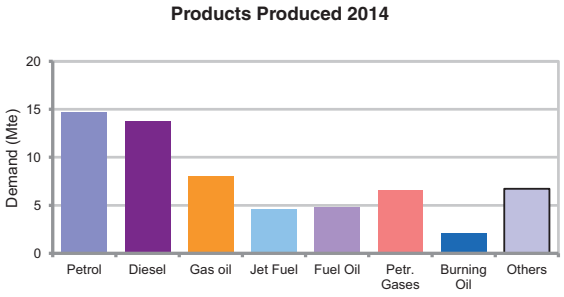
2.10 Annual Oil Trade



Source: DECC (DUKES)

- The chart illustrates UK's annual trade; imports and exports of crude oil and petroleum products
- The negative imbalance in trade from 2006 has largely been a result of increased imports and a decrease in exports of crude oil; a consequence of depletion of the UK continental shelf
- The petroleum products balance has also shifted: both diesel and aviation fuel demand have driven an increase in imports, whilst exports of fuel oil have declined and exports of petrol have increased

2.11 Products Produced

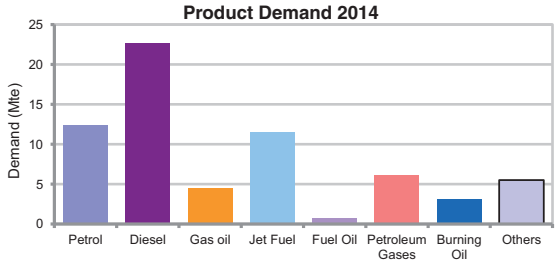


Source: DECC (DUKES - provisional data)

- UK refineries are configured to meet historically higher demand for petrol and fuel oil
- As a result of reducing demand, refineries now produce an excess of these products and are in deficit in others, such as jet fuel and diesel
- Changing refinery production to meet demand will require major investment

See UKPIA's paper "Fuelling the UK's future – the role of our refining and downstream oil industry" for more information and the IHS Purvin & Gertz report *'The Role and Future of the UK refining Sector'* which can be found on www.ukpia.vom/publications.aspx

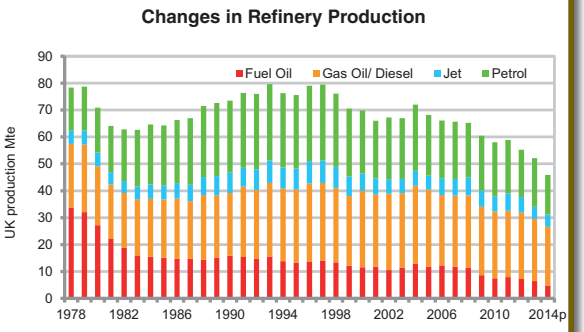
2.12 Product Demand



Source: DECC (DUKES - provisional data)

- The majority of oil product demand comes from the transport sector
- UK refineries do not produce enough jet fuel or diesel, consequently these are increasingly supplemented by imports to meet demand

2.13 Changes in Refinery Production

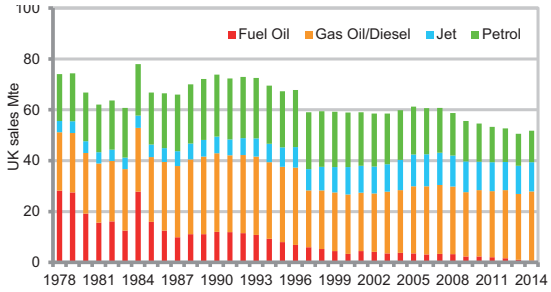


Source: DECC (DUKES)

- The major change in refinery production over the last forty years has been a significant reduction in the quantity of fuel oil produced
- The increase in gas oil/diesel and petrol seen in the 80s and 90s has since levelled off
- Over the same period, some of the surplus fuel oil has been converted into petrol and gas oil/diesel or exported

2.14 Changes in Product Demand

Changes in Product Demand

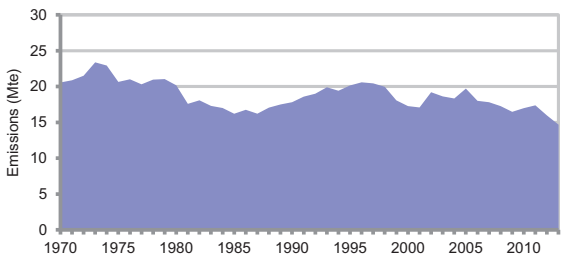


Source: DECC (DUKES)

- The major change in product demand since 1979 has been the decline of the fuel oil market - natural gas replacing fuel oil for power generation and gas oil for space heating - and the growth of transport fuels
- Since 1990 demand for petrol has almost halved, whilst jet fuel has seen demand rise by over 74%
- However, overall demand clearly shows a downward trend over the last six years, linked in part to the economic crisis, which has affected nearly all categories of oil product consumption, except diesel which has remained almost flat
- Nonetheless, 2014 was the first year to record year-on-year growth since 2007

2.15 Refinery CO_2 Emissions

Refinery CO_2 Emissions

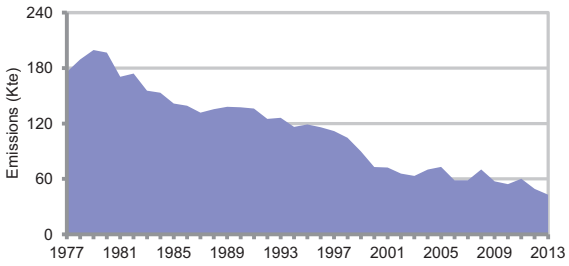


Source: DECC (GHG Emissions)

- Refineries emit around 3% of the UK's CO_2 emissions and are included in the EU Emissions Trading Scheme
- Although it takes more energy to supply low sulphur fuels in particular, refinery CO_2 emissions have fallen since 1970 as a result of improved energy efficiency and refinery closures
- CO_2 emissions decreased in 2013 by 8% compared to the previous year

2.16 Refinery SO_2 Emissions

Refinery SO_2 Emissions

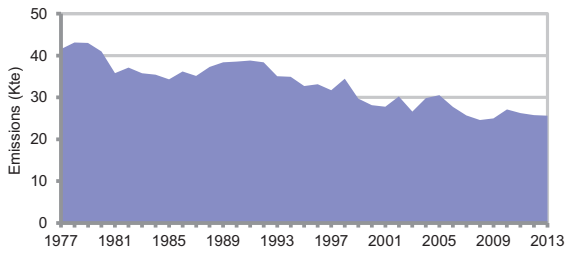


Source: DEFRA

- Refineries release SO_2 when sulphur, naturally present in crude oil, is burnt
- Refinery SO_2 emissions have fallen by 78% since the 1970s, to around 43 thousand tonnes in 2012
- This is due to investment to increase sulphur recovery at refineries and the use of low sulphur North Sea crude oil

2.17 Refinery NO_x Emissions

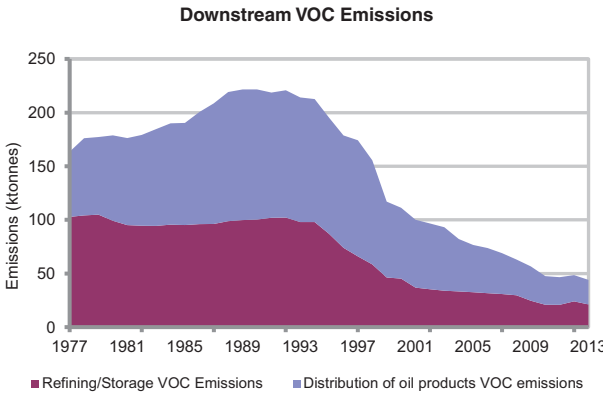
Refinery NO_x Emissions



Source: DEFRA

- NO_X is formed as a result of the combustion of fossil fuels, and hence is produced at refineries
- Refinery NO_X emissions have fallen by around 40% since the 1970s to around 25 thousand tonnes
- This is due to the installation of abatement technology at refineries

2.18 Downstream VOC Emissions



Source: DEFRA

- Volatile organic compounds are produced from the evaporation of oil products
- Since the 1970s, refinery and storage emissions have fallen by over 80%, to around 21 thousand tonnes due to leak detection and repair programmes
- Additional reductions in the downstream industry are due to the introduction of vapour recovery equipment at storage facilities, on petrol deliveries and at many of the higher throughput filling stations
- Emissions from distribution have decreased by over 60% since the 1970s or 6.5% y/y average since 1990

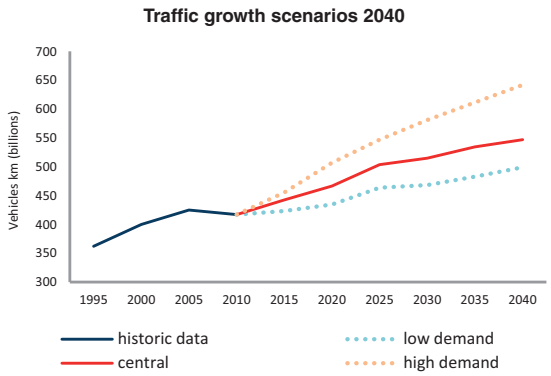
3. Road Transport Fuels

Total road transport demand grew last year for the first time since the start of the recession in 2008. Total road fuels sales today are approximately 11% lower than in 2007, in part due to the downturn, which has hit nearly all categories of oil product consumption, as well as higher oil prices and improved vehicle efficiency.

The road transport sector, prior to the recession, was growing at a steady rate, with increases in diesel use offsetting weaker petrol demand.

The increase in diesel sales is part of a Europe-wide trend, which has largely been fiscally driven for over two decades. The UK, on the other hand, has been comparatively late to the dieselisation process; in 2004, petrol sales where 4 billion litres greater than those of diesel, whilst annual registration of new diesel vehicles was still only one third of the total vehicle fleet. A key reason for this relatively slow uptake had been the lack of any tax advantage for diesel, which is taxed at the same rate as petrol. However, with the advances achieved in diesel engine performance leading to improved fuel efficiency relative to petrol, combined with changes in company car personal tax policy and VED rates, consumers in recent years have increasingly favoured diesel cars. Today, approximately 53% of new registered vehicles in the UK are diesel fuelled (up from 49% in 2013), and over 61% of the 44 billion litres of road fuels sold last year was diesel.

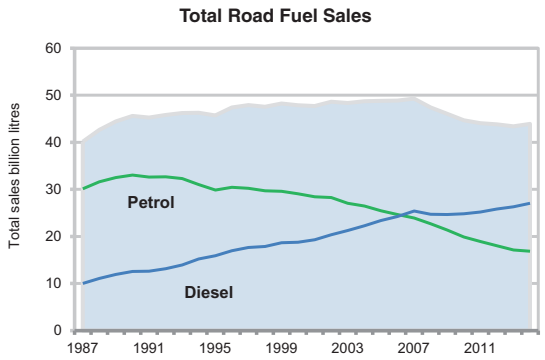
3.1 Demand for Road Travel



Source: DfT (DfT Road Transport Forecast 2015)

- Road travel demand has been on an upward trend for decades and, despite a flattening in growth during the recession, demand is forecast to increase in the future
- However, due to advances in engine efficiency, this trend is not reflected in product demand
- By 2035, central demand is predicted to grow by over 50% from 1995 levels

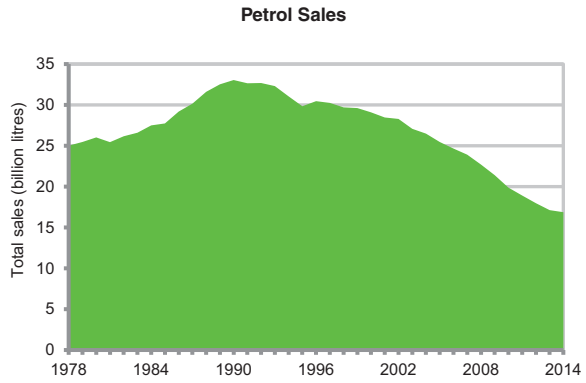
3.2 Road Fuel Sales



Source: DECC

- Whilst total road fuel sales have shown a long term increase since the early 1970s, demand dropped by 12% between 2007 and 2014 due to a combination of higher prices - driven by cost of crude oil - and the economic recession
- During the recession, the decline in petrol consistently outstripped growth in diesel demand
- 2014 was the first year that total road fuel sales grew relative to the previous year, with diesel sales alone increasing by 3% whilst demand for petrol declined by 1.5% year on year
- Share between petrol and diesel continues to shift in favour of diesel, which in 2014 accounted for over 61% of total fuel sales

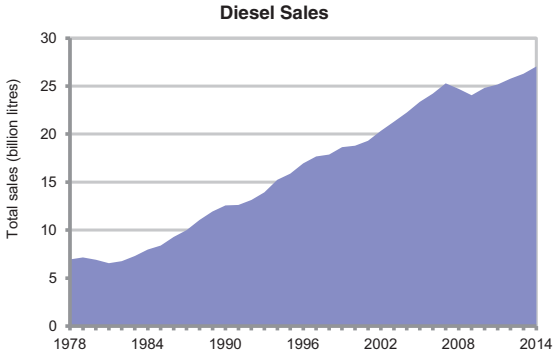
3.3 Petrol Sales



Source: DECC

- Sales of petrol have been falling since reaching a peak of 33 billion litres in 1990, which was equivalent to 73% market share of transport fuels
- Today, sales of petrol have fallen to below 17 billion litres as a result of declining demand for petrol vehicles
- Average annual decline almost doubled during the recession to over 5% per annum

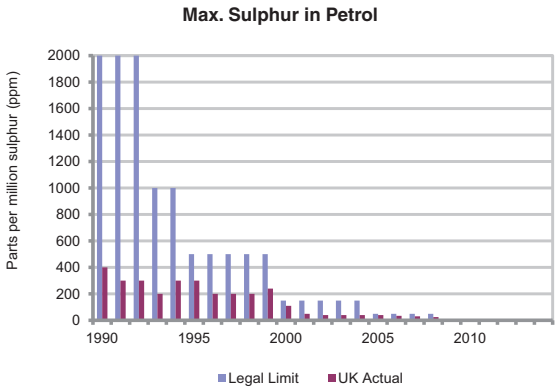
3.4 Diesel Sales



Source: DECC

- Sales of diesel have been steadily increasing for the last twenty years, with demand exceeding 27 billion litres in 2014
- This is the result of the increased popularity of diesel vehicles due to their high efficiencies, perceived lower running costs, and increased demand for commercial vehicles
- Diesel sales fell slightly in recent years due to the economic recession and higher diesel prices but returned to growth since 2012
- Prior to 2008, diesel was replacing petrol on a like for like basis, with an average annual growth rate of 3% in the last 20 years, barring a short decline period in 2008 and 2009

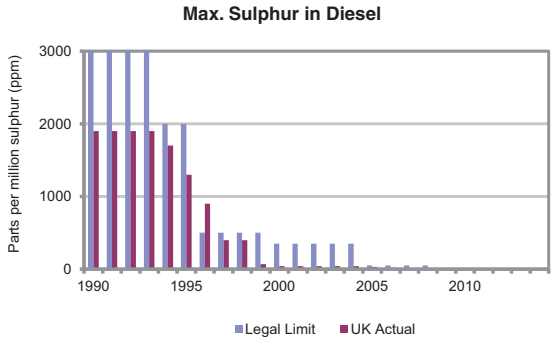
3.5 Maximum Sulphur in Petrol



Source: BSI/UKPIA

- The level of sulphur in road fuels is limited by law
- From January 2009, all UK petrol was “sulphur free”, containing less than 10 parts per million sulphur

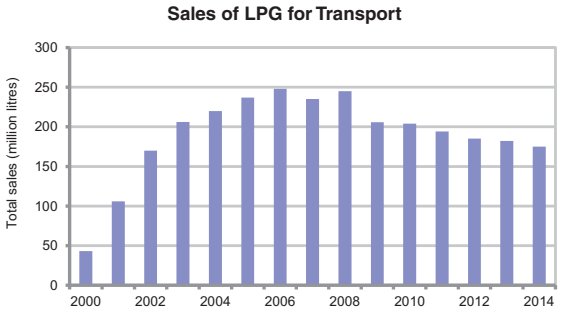
3.6 Maximum Sulphur in Diesel



Source: BSI/UKPIA

- The level of sulphur in diesel is also limited by law
- All diesel in the UK became "sulphur free" by January 2009 (below 10ppm)

3.7 Sales of LPG for Transport



Source: HM Revenue and Customs

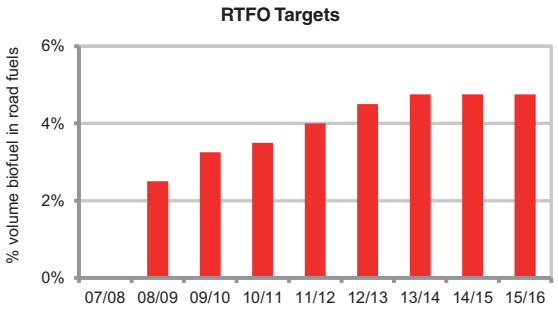
- As well as petrol and diesel, liquefied petroleum gas (LPG) is used as a road fuel in the UK
- Sales of LPG rose rapidly between 2000 and 2006 based on a favourable duty incentive, a conversion grant scheme and favourable treatment under the London Congestion Charge
- However, the removal of the grant scheme and gradual reduction in the duty differential between LPG and standard fuels has impacted the sale of LPG/petrol cars, which in turn has affected sales of LPG, lowering sales to 175 million litres down from a 2006 peak of almost 250 million litres

4. Biofuels

As a member of the European Union, the UK is committed to reducing its carbon emissions as initially mandated by the 2003 EU Biofuels Directive that set an EU-wide target of 5.75% of the market share of transport fuels by 2010. This was followed by the Renewable Energy Directive (RED) that sets out a target of 10% by energy for all forms of transport to be from renewable sources by 2020. Fuel suppliers are also required to reduce the greenhouse gas intensity of the EU fuel mix by 6% by 2020 in comparison to 2010.

Given that over 25% of the UK's carbon emissions come from the transport sector, with some 14% from the private car fleet alone, the transition to a low carbon model has been particularly challenging. In addition, an enormous amount of work has been undertaken by the downstream oil industry to ensure that the Government's targets are met under the Renewable Transport Fuels Obligation (RTFO) and that fuel quality standards are maintained. Key considerations are the amount of carbon saved by different biofuels, the sustainability of the source material, food crop production and the carbon balance associated with land use change. In December 2011, the RTFO was amended to allow only biofuels to meet the RED carbon and sustainability criteria to count towards the obligation, and, from April 2013, the obligation was extended to include fuel consumed by Non-Road Mobile Machinery (NRMM) – for example, cranes and generators.

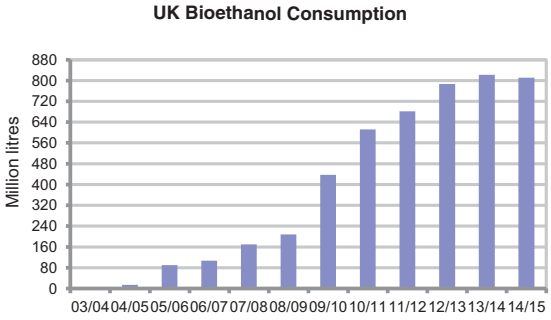
4.1 RTFO Targets



Source: HMT

- The RTFO was introduced in April 2008, with an original target of 5% biofuel content (by volume) in road fuels by 2010/11
- However, this was revised due to sustainability concerns and the targets for the biofuel content of road fuels were 4.5% for 2012/13, and 4.75% for 2013/14 and 2014/15
- From April 2013, the RTFO started to include NRMM
- The means by which the RED obligation is met are yet to be decided. For this reason future RTFO obligation is still unknown

4.2 UK Bioethanol Consumption

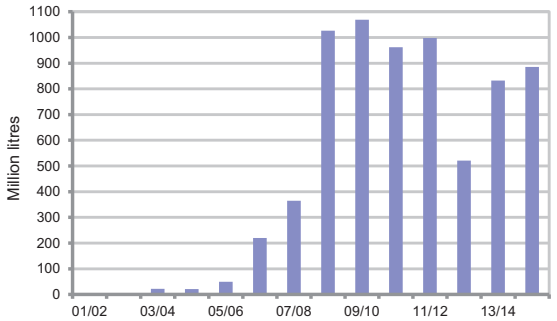


Source: HMRC

- Between January 2005 and March 2010, the Government introduced a 20 pence per litre duty reduction on bioethanol
- The duty differential of 20 pence per litre was removed in 2010
- In 2014/15, UK bioethanol consumption stood at a little over 800 million litres, which represents around 4.6% of all petrol sales by volume
- The relatively low sales volumes reflect the current logistical difficulties of adding bioethanol to petrol
- There are various other renewable petrol fuels which obligated companies use to meet their targets, such as methanol
- The buyout price in the RTFO is set at 30 pence per litre

4.3 UK Biodiesel Consumption

UK Biodiesel Consumption

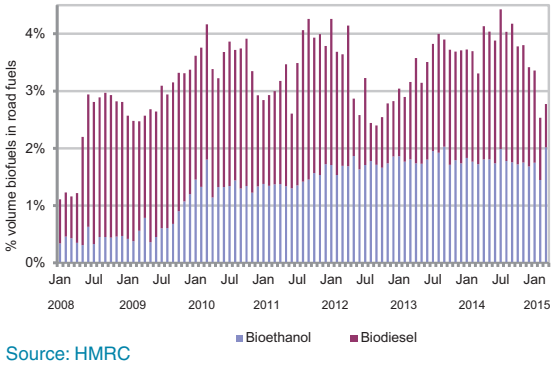


Source: HMRC

- Between July 2002 and March 2010, the Government introduced a 20 pence per litre duty reduction on biodiesel
- The duty differential of 20 pence per litre was removed in 2010
- In 2012/13, UK biodiesel consumption fell to around 520 million litres from previous year's 992 million litres as a result of fuels derived from waste oil being used to fulfil the RTFO obligation, which in fact account for twice the value of regular biofuels
- In 2014/15 however consumption increased again to 885 million litres, representing around 3.1% of total diesel sales by volume
- The buyout price in the RTFO is set at 30 pence per litre
- However, the governing regulation is the Renewable Transport Fuel Obligation (RTFO)

4.4 UK Progress towards RTFO Targets

UK Progress towards RTFO Targets



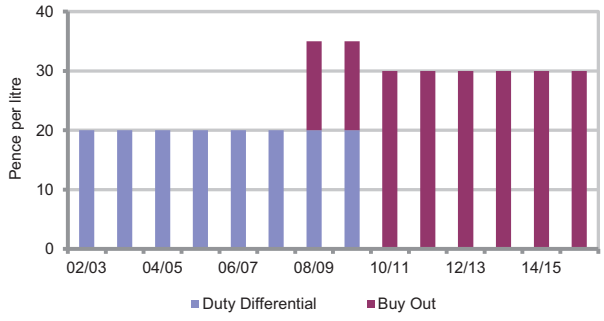
Source: HMRC

- The UK added 2.6% of biofuels during the first year of the RTFO (2008/09), exceeding the target of 2.5%
- In the 2nd year of the RTFO (2009/10), the UK again met its target of 3.25% of biofuels

  In the 2011/2012 period, biofuel use increased to 3.7% of total road transport but fell below 3% in year 4 as a result of fuels derived from waste now double counting
- In this last accounting period (April 2014 – March 2015), volumes recovered again reaching an average of 3.7%

4.5 Duty and Buy Out for Biofuels

Duty Differentials and Buy Out for Biofuels



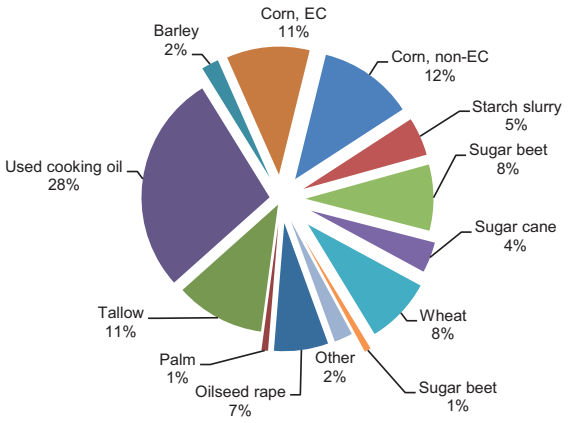
Source: HMT

- A duty differential of 20 pence per litre had been in place for biodiesel since 2002 and for bioethanol since 2005
- In addition, a 'buy out' price for the RTFO was introduced at 15 pence per litre in 2008/09, giving a combined incentive of 35 pence per litre
- The duty differential was removed in 2010*, with the buy out price at 30 pence per litre
- The buy out price is effectively a penalty on the fuel supplier if the bio component is not added to the final blend (or the fuel does not meet the carbon and sustainability criteria)

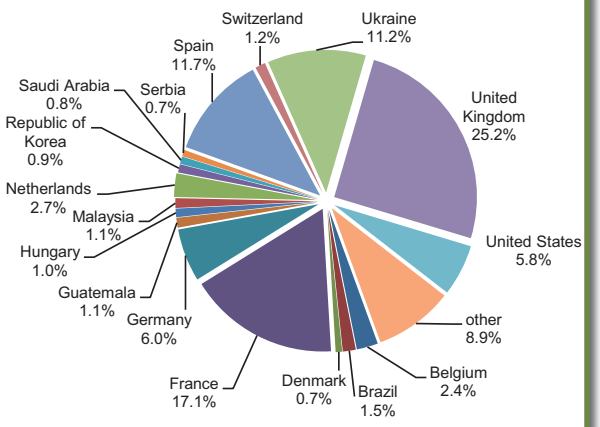
** Except for cooking oil where the duty differential of 20 pence per litre remained until April 2012*

4.6 Sources of Biofuels used in the UK

Sources of Biofuels by Crop



Sources of Biofuels by Country



Source: DfT (covering period 15th April 2013 - 14th April 2014

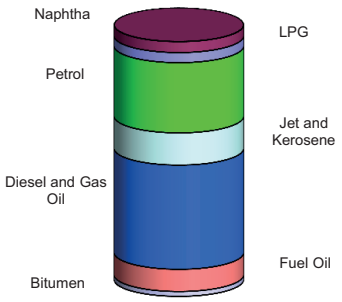
- A little over 25% of biofuels used in the UK are domestically produced, a 5% increase on last year
- The second single largest source of biofuels for the UK is from France
- Ethanol is mostly sourced from sugarcane and sugar beet
- Biodiesel is mostly sourced from used cooking oil and tallow

5. Other Products

A wide range of products are produced from crude oil, ranging from transport and domestic/industrial fuels to chemical feedstocks. Over time, refinery configurations have developed to increase the quantities of high value transport fuels that can be produced. In contrast, the domestic/industrial markets for other fuels have altered markedly over the last twenty years as sales of fuel oil and gas oil have reduced, being displaced in power generation and industrial applications by natural gas.

5.1 Refining Production

Refining Production in 2014*



*excludes refinery use and losses

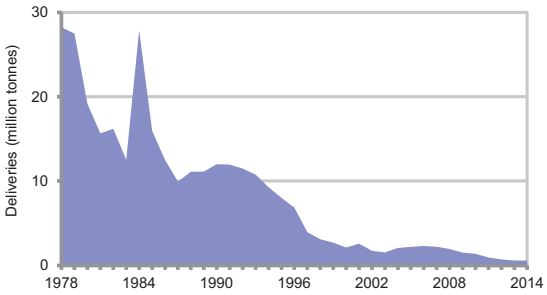
Source: DECC

- Refineries produce naphtha, LPG, road fuels, kerosene, jet fuel, heating oil, diesel, gas oil, fuel oil, bitumen and other products such as chemical feedstocks
- The current trend of production is away from heating fuels (fuel and gas oils) and towards transport fuels (petrol, diesel and jet fuel)
- Refineries will require major investment to meet the increased demand for diesel and jet fuel – estimated at up to £700 million at each major refinery

(Deloitte report for DECC on Downstream oil April 2010)

5.2 Fuel Oil Deliveries

Inland Fuel Oil Deliveries

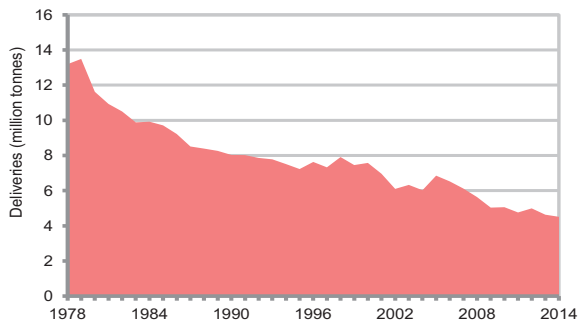


Source: DECC

- The market for fuel oil has reduced significantly since 1970 – rising only briefly in 1984 due to the miners' strike
- The reduction in demand is mainly due to fuel switching to natural gas by electricity generators – the 'dash for gas'
- In 2014 fuel oil consumption amounted to just 4.5m tonnes.

5.3 Gas Oil Deliveries

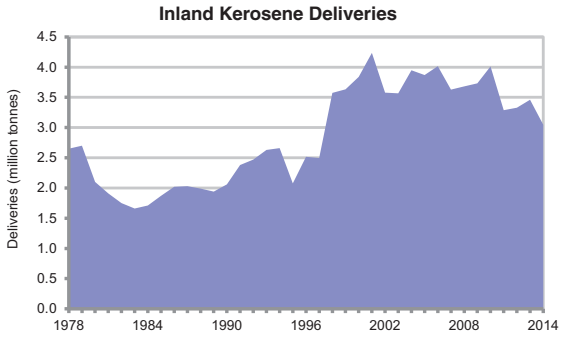
Inland Gas Oil Deliveries



Source: HMT

- The UK demand for gas oil has fallen since 1970 to a little under 5 million tonnes
- Gas oil is produced from a similar fraction of crude oil as diesel and so production is limited
- The reduction in demand is mainly due to fuel switching to natural gas for power generation
- In 2011, the sulphur level of fuel delivered for Non Road Mobile Machinery (NRMM) reduced from 1000 to 10ppm. Fuel for heavy and stationary engines remained at 1000ppm sulphur

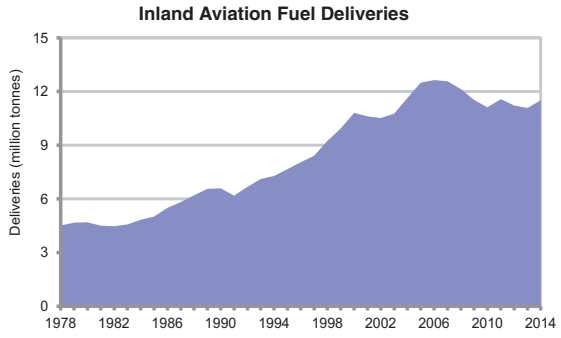
5.4 Kerosene Deliveries



Source: DECC

- Kerosene (also called burning oil) is used as fuel for domestic and industrial heating, and sales are typically higher during the winter
- Inland sales of kerosene have steadily increased since 1980, from a little over 1.5 million tonnes to over 4 million tonnes in recent years
- However deliveries dipped to 3.3 million tonnes in 2011 and 2012, but recovered slightly in 2014 to 3.5 m
- New legislation introduced in January 2008 restricted the sulphur levels in kerosene to 0.1%

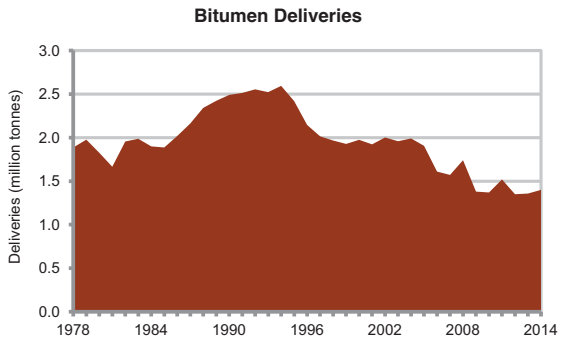
5.5 Aviation Fuel Deliveries



Source: DECC

- Aviation turbine kerosene is used in jet engines
- Sales of AVTUR have been rising steadily since 1970 with growth projected to continue
- Aviation fuel demand has slightly dipped in last the last six years – relative to 2007 levels – mostly as a result of the recession and more efficient engines

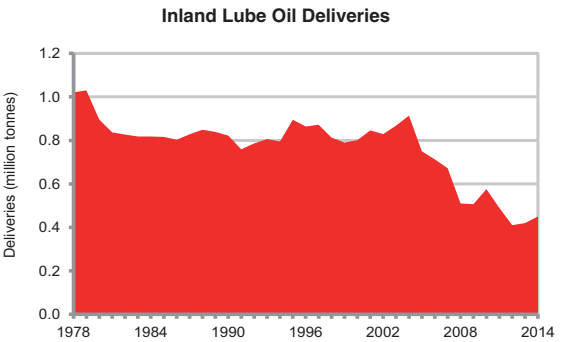
5.6 Bitumen Deliveries



Source: DECC

- Demand for bitumen has declined to just 1.4 million tonnes/pa
- Bitumen is produced from some of the heaviest fractions of crude oil and is mainly used for road surfacing and roofing

5.7 Lube Oil Deliveries



Source: DECC

- Sales of lubes and greases have more than halved since 1970s to around 0.4 million tonnes/pa
- Improved engines require fewer oil changes and the use of synthetic lubricating oils has also contributed to this reduction
- The increased use of biodiesel could see oil drain intervals reducing and demand for lubes increasing

6. Petrol Prices

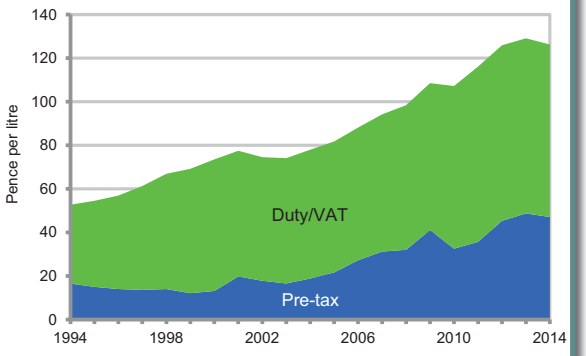
As a result of the UK's competitive road fuels retail market and efficient distribution facilities, the pre-tax price of major brand petrol in the UK is consistently amongst the lowest in Europe. However, despite this competition, the price paid by consumers at the pump is one of the highest in Europe, due to the higher levels of duty applied by the Government. The retail/ex-refinery price spread on average has been around 6 pence per litre on petrol for most of the last decade.

It should also be noted that data hides variations between remote rural regions and urban areas, in part due to higher transportations costs. The government sought to address this by setting up a pilot scheme to provide a 5 pence per litre fuel rebate for very remote areas. The scheme launched on 1st March 2012 with more than 90 businesses in the Inner & Outer Hebrides, Northern Isles, Islands in the Clyde and Isles of Scilly taking part.

The Rural Fuel Rebate was approved in March 2015 by the European Union following a year-long approval process and residents across 17 of the UK's most rural areas with the highest fuel prices will now benefit from a 5 pence per litre fuel price cut from 31st May 2015.

6.1 Petrol Pump Price

UK Petrol Pump Price Breakdown



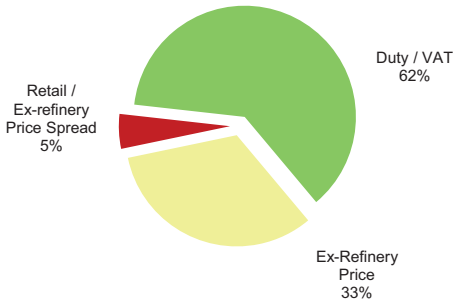
** The price of petrol is in money of the day*

Source: Wood Mackenzie/OPAL

- The price of petrol at the pump has steadily increased over the last 20 years with the exception of the most recent spike in 2008: a result of crude oil prices reaching record levels
- Since the petrol price-dip of 2009 – as a result of prices levelling-off from the previous year – the increase in petrol price has grown at a much faster rate in the last 3 years; an average of 6.6% from 2003-2008 vs. 11% between 2010 and 2012
- Consistent growth until late 2013 was due in part to the general rise in crude oil prices, reflecting increased global demand and regular increases in duty from 2006 up until 2011
- Due to a decline in crude price through the latter part of 2014 and duty freeze, petrol pump prices declined by 5%

6.2 Average Contribution to Pump Price

Average Contribution to Pump Price 2014

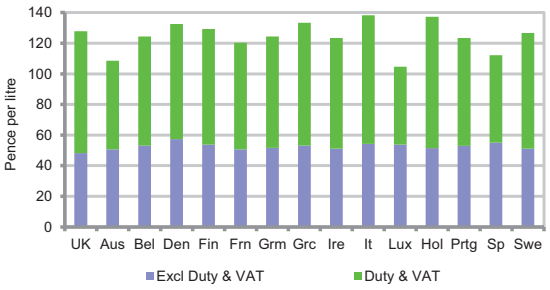


Source: Wood Mackenzie

- Duty and VAT are the main components of the pump price of petrol in the UK, making up almost two thirds of the total
- VAT increased to 20% in January 2011 after a temporary cut to 15% in 2008 and increase to 17.5% in 2010
- Duty was charged at 57.95 pence in 2014
- The average retail/ex-refinery price spread for 2014 was around 6.4 pence per litre

6.3 European Prices

Pump Prices of Unleaded Petrol 2014

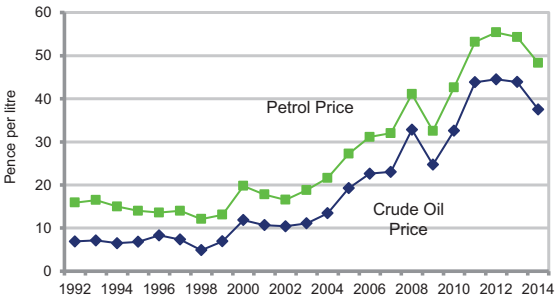


Source: Wood Mackenzie

- In 2014 the UK pre-tax price of major brands of unleaded petrol was again the lowest in Europe at 48.3 pence per litre, whilst the average of the 14 major EU countries was 53 pence by comparison
- The price paid at the pump by UK consumers was however considerably higher due to the levels of fuel duty. Duty and VAT, on average, in 2014 amounted to a little under 80 pence per litre

6.4 Pre-Tax Petrol and Crude Prices

Pre-Tax Petrol and Crude Prices

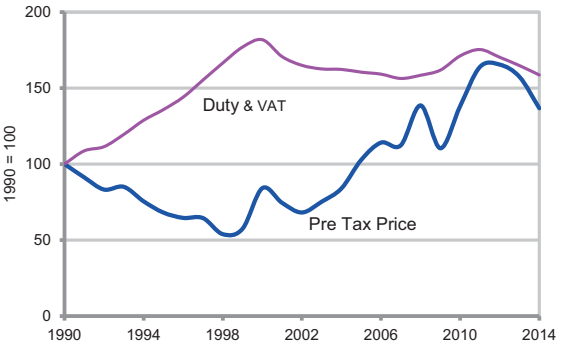


Source: Wood Mackenzie

- The pre-tax price of petrol is related to the cost of crude oil
- The effect of crude prices on the final pump price is lessened by the high levels of fuel duty
- The £/$ exchange has a significant influence on fuel prices

6.5 Fuel Price and Tax Comparison

Fuel Price and Tax Comparison



Source: Wood Mackenzie/UK Statistics Authority

- The pre-tax price of petrol only recently increased relative to 1990 levels, having remained below RPI adjusted 1990 prices until 2005
- Duty and VAT steadily increased relative to 1990 levels throughout the 90s, until they were effectively frozen following protests in September 2000
- They have recently risen again, and continue to show a greater increase over the past 18 years than the pre-tax price. 2010 saw the largest growth since 1999
- In 2013 and 2014, duty was effectively frozen, with VAT only increasing the tax curve, whilst pre-tax price declined due to falling crude prices in 2014

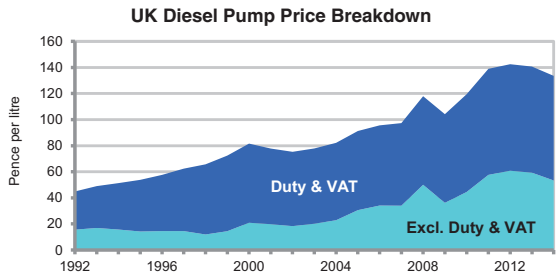
7. Diesel Prices

The UK road fuels retail market is highly competitive and distribution facilities are efficient; consequently, the pre-tax price of major brand diesel in the UK is consistently amongst the lowest in Europe. Despite this competition, diesel prices remain among the highest in Europe, but while a much larger share of the price is taken up by tax compared to other European markets, the refining margin remains higher relative to petrol.

The UK, unlike other European markets, does not tax diesel at a lower rate than petrol, this results in diesel prices being slightly higher compared to petrol – primarily driven by UK supply/demand pressures. Nonetheless, as briefly discussed in Chapter 3, diesel demand has continued to gain market share since the late '90s, partly as a result of the fuel efficiency advantage of diesel engines over petrol.

However, as petrol engine efficiency improvements continue to catch up with that of diesel, forecasting the current 'dieselisation' trend long-term is difficult. Particularly as the growing drive for a reduction in carbon emissions from transport will increasingly result in tax levels becoming more aligned with vehicle carbon emission levels, and most likely lead to a marginal increase in the attraction of smaller capacity gasoline fuelled vehicles. For these reasons, along with emerging air quality arguments, analysts contend that the growth in diesel's market share will slowly cease and reach a peak in 2017, followed by a gradual reversal in trend.

7.1 Diesel Pump Price

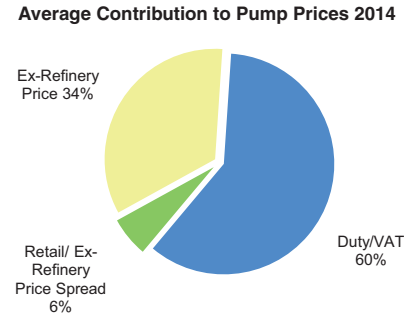


** The price of petrol in figure 7.1 is in money of the day*

Source: Wood Mackenzie/OPAL

- Diesel pump prices have steadily increased over the last 20 years, most notably in 2008 and 2011 as a direct consequence of crude oil prices reaching record levels and duty/VAT increasing sharply
- Diesel prices in recent years have grown at quite a considerable rate, averaging over 11% between the end of 2009 and 2012 due to rising crude oil prices and supply/demand pressure
- However, in 2014, diesel prices declined on average by 5% due to continued strong decline in crude prices and duty freeze

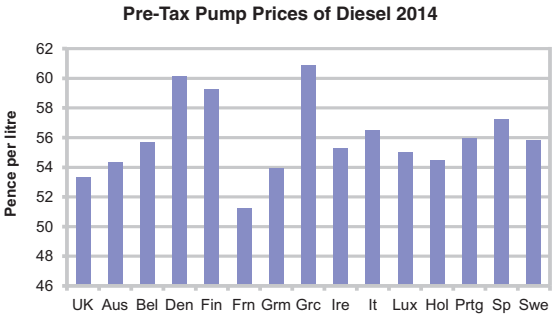
7.2 Average Contribution to Pump Prices



Source: Wood Mackenzie/OPAL

- In 2014 duty and VAT made up almost two thirds of the pump price of diesel in the UK
- The retail/ex-refinery price spread was a little over 7 pence per litre
- From this, the oil company and retailer must cover all site, distribution and storage expenses

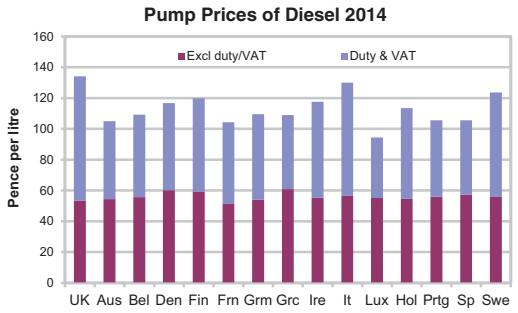
7.3 European Pre-Tax Pump Prices



Source: Wood Mackenzie

- In 2014, the UK once again had one of the lowest pre-tax diesel prices in the EU; around 3 pence lower compared to the average
- The low UK pre-tax price is a result of strong competition amongst retailers and an efficient fuel distribution network

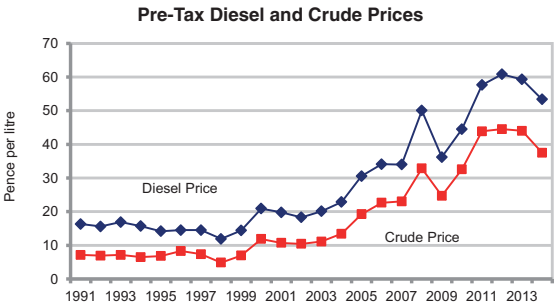
7.4 European Pump Prices



Source: Wood Mackenzie

- The final pump price of major brand diesel in the UK was the highest compared to major European countries in 2014, reflecting the high level of duty paid on fuel in the UK
- The UK is the only major European country to apply the same duty rate to diesel and petrol
- Duty is taxed at different levels except for the UK and Switzerland

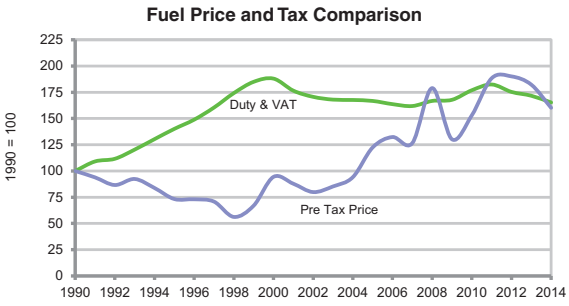
7.5 Pre-Tax Diesel and Crude Prices



Source: Wood Mackenzie

- The pre-tax price of diesel is closely related to the price of crude oil
- The £/$ exchange is a key factor in determining fuel prices

7.6 Fuel Price and Tax Comparison



Source: Wood Mackenzie/UK Statistics Authority

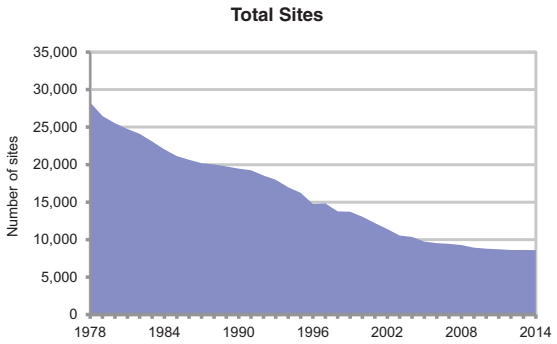
- The pre-tax price of diesel only increased relative to 1990 levels in 2004 and has since picked up the pace
- Despite the large price-drop in 2009, following a rally in 2008, diesel prices superseded the Duty and VAT 1990 base indicator in 2011, suggesting that the total price increase for that year was mainly driven by cost of crude oil along with a continued squeeze in the diesel market across Europe
- Duty and VAT steadily increased relative to 1990 levels throughout the '90s, until they were effectively frozen in September 2000 and again in 2012
- Following an almost 7 year hiatus, duty was again increased from December 2006 through to, and including, 2011 whilst VAT was briefly lowered to 15% in 2009 but increased to 20% in 2011; this explains the slightly higher gradient in duty and VAT from 2006, as shown in the chart

8. Filling Stations Statistics

Over the last forty years the number of filling stations in the UK has reduced dramatically, from over 37,500 in 1970 to 8,591 at the end of 2014. In the last ten years, on average more than 176 filling stations closed each year due to strong competition between fuel retailers and the increasing costs of compliance with environmental regulation. This favours large service stations with lower overheads per litre sold. As a result many smaller filling stations have become economically unviable.

The only section of the retail market that is currently growing is large supermarket sites. In 2014, hypermarkets accounted for around 44% of market share by volume, despite only owning 16% of all petrol stations versus the oil companies' 24% market share by volume with ownership of 21% of all petrol stations.

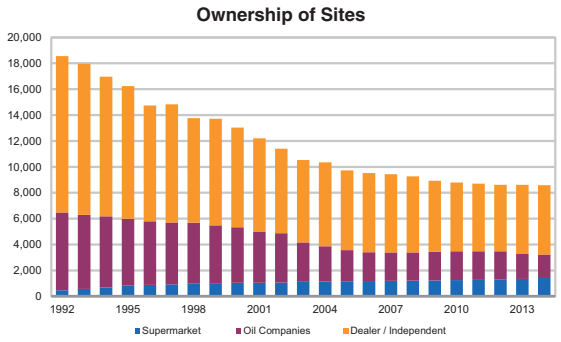
8.1 Number of Sites



Source: Energy Institute until 2005; Catalist onwards

- At the end of 2014 there were 8,591 filling stations in the UK
- The number of filling stations is now less than a quarter of the 1970 total
- Over the past ten years, the number of sites has been falling at a rate of approximately 176 per year

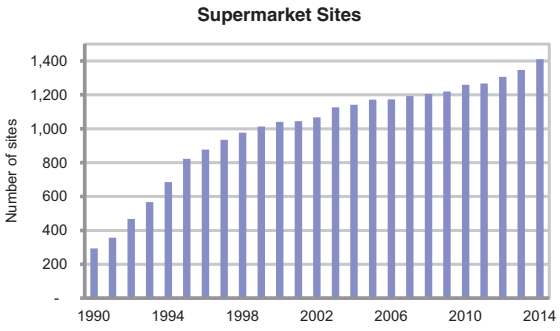
8.2 Ownership of Sites



Source: Energy Institute until 2005; Catalist onwards

- Many filling stations owned and operated by both oil companies and independent retailers have closed due to competition and low profits
- The number of supermarket sites is increasing at a steady rate of 3% p/y
- Independent sites still account for the majority of petrol stations at around 62% of total number but only 32% of sales volume
- In the last few years several oil majors have exited the UK retail market

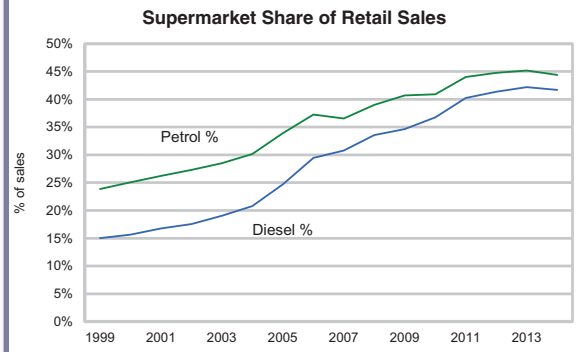
8.3 Supermarket Sites



Source: Energy Institute until 2005; Catalist onwards

- At the end of 2014 there were 1,410 supermarket filling stations in the UK
- A little over 16% of all filling stations are now owned by supermarkets
- Although numerically in the minority, volume sales are the significant factor and account for 44% of market share

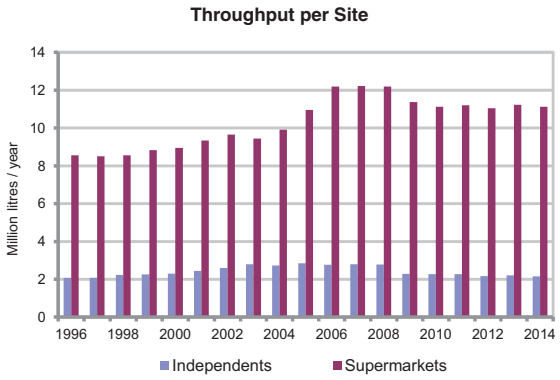
8.4 Supermarket Share of Retail Sales



Source: DECC (ETS)

- As the retail market continues its decline for the 4th consecutive year, supermarket share of retail sales has continued to grow
- Supermarkets now account for 44% of all petrol sold and 42% of diesel

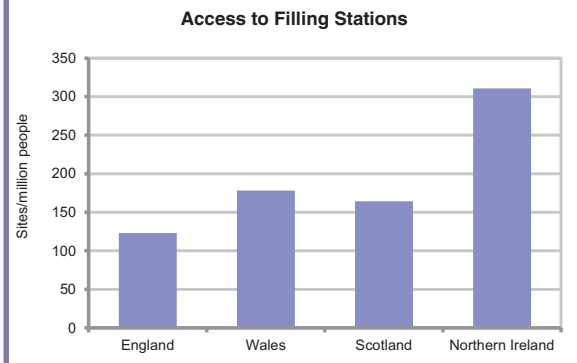
8.5 Throughput per Site



Source: Catalist

- The average throughput of all filling stations has risen by over a third since 1994 to a little under 7 million litres per year. However, there is a huge disparity between company, independent and supermarket sites
- The average supermarket site's throughput is currently around 11 million litres per year whilst independent sites average just over 2 million litres

8.6 Access to Filling Stations



Source: ONS / Catalist

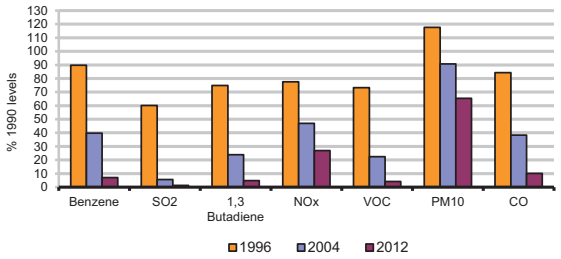
- The number of filling stations per capita is highest in Northern Ireland with around 311 filling stations per million relative to England with 123 per million
- For the last few years, the number of filling stations has consistently reduced in all but one region, Northern Ireland
- See UKPIA briefing paper – *'Fuel Supply to Rural Filling Stations'* for more information

9. Air Quality

One of the key drivers for the oil industry is reducing the environmental pollution from the use of fuels. Since 1990 road fuels and vehicles have become significantly cleaner, resulting in much lower exhaust emissions despite an increase in traffic levels of around 21%, as recorded in 2014.

9.1 Vehicular Emissions

Relative Vehicular Emissions of Pollutants - 1990 base



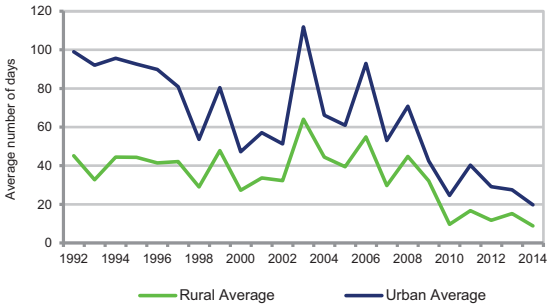
Source: DEFRA/Ricardo AEA

- Emissions of exhaust gas pollutants have been significantly reduced from 1990 levels
- The largest reduction has been made for SO_2 through the introduction of zero sulphur petrol and diesel (the move to zero sulphur fuels for off-road machinery vehicles was introduced in 2011)

** 2012 was the latest available data at time of print*

9.2 Air Pollution

Number of Days when Air Pollution is Moderate or Higher

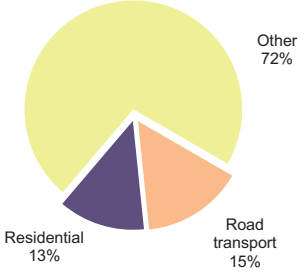


Source: DEFRA/Ricardo AEA

- Air pollution in urban areas has fluctuated over time but there has been a general long term decline in high air pollution days at both urban and rural monitoring sites despite the slight increase in 2011
- Days of moderate or higher air pollution for urban areas have shown a clear downward trend
- The variability of weather from year to year plays an important role; for example, the hot summers of 2003 and 2006 resulted in high pollution levels mainly caused by ozone, some associated with trans-boundary sources. The comparatively cooler summers in 2007, 2010 and 2012 ensured air pollution reverted to low levels

9.3 Primary Particulate Matter

Primary Particulate Matter Sources 2012

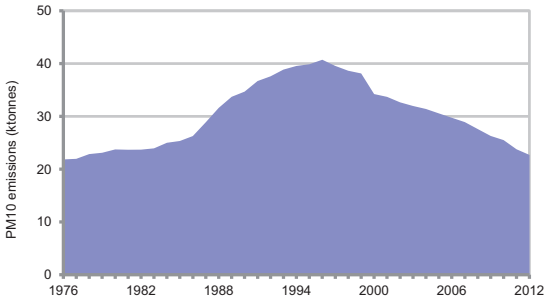


Source: DEFRA/Ricardo AEA

- In 2012 the combustion of road fuels contributed 15% of the UK's primary emissions of particulate matter, slightly lower compared to previous year
- The residential sector produced 13% of the emissions, with the rest produced by other sources including industry and power generation
- Ambient levels of PM_{10} include fine particles from primary (around a third), secondary and other sources

9.4 Road Transport PM_{10} Emissions

Road Transport PM_{10} Emissions

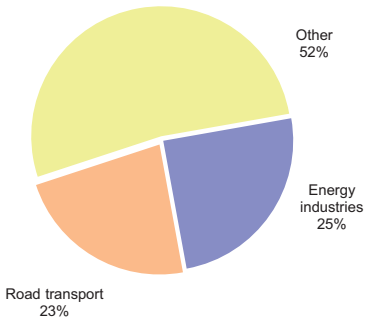


Source: DEFRA/Ricardo AEA

- Emissions of particulate matter (PM_{10}) from road transport peaked in 1996 at 40 thousand tonnes
- Since then, emissions have fallen by 44% due to tighter standards for vehicular emissions and the move to 'sulphur free' road fuels
- However, the increased dieselisation of the car park will continue to impact this trend since PM_{10} emissions are higher from diesel than petrol

9.5 Sources of NO_x

Sources of NO_x 2012

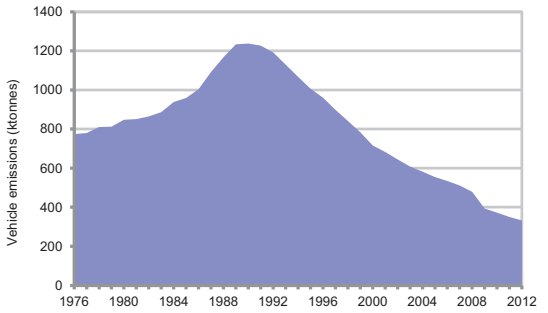


Source: DEFRA/Ricardo AEA

- Nitrogen oxides (NO_X) are mainly formed as a by-product from the combustion of fossil fuels
- 23% of UK's total NO_X emissions in 2012 was from road transport
- The largest single source of emissions was from the energy industries, producing 25% of the total
- Tighter EU exhaust emission standards will reduce vehicle NO_X emissions

9.6 Road Transport NO_x Emissions

Road Transport NO_x Emissions

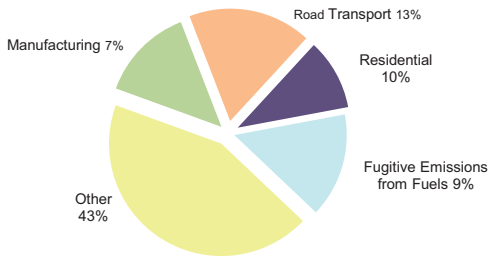


Source: DEFRA/Ricardo AEA

- Nitrogen oxides are acidifying and eutrophying gases and give rise to ground-level ozone
- Road transport NO_X emissions have fallen by around 73% from their peak in 1990 to around 332k tonnes in 2012
- The overall gradual decline in NO_X emissions is as a result of oxidation catalysts (diesel vehicles) and catalytic converters (petrol vehicles) which have been enabled by 'sulphur-free' diesel and unleaded petrol

9.7 Sources of Benzene

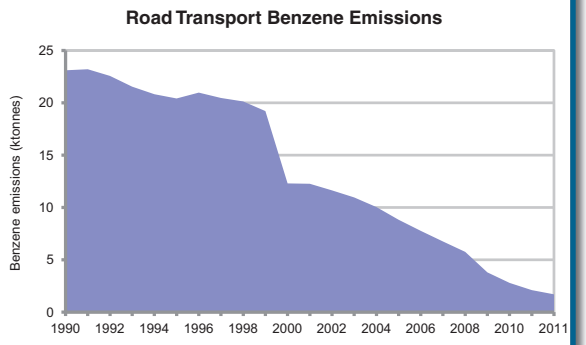
Sources of Benzene 2012



Source: DEFRA/Ricardo AEA

- In 2012, road transport was responsible for 13% of the UK's benzene emissions
- Stage II Vapour Recovery has been fitted to large petrol stations
- Benzene is naturally present in crude oil and is also formed during refining
- Most benzene is removed to comply with specifications

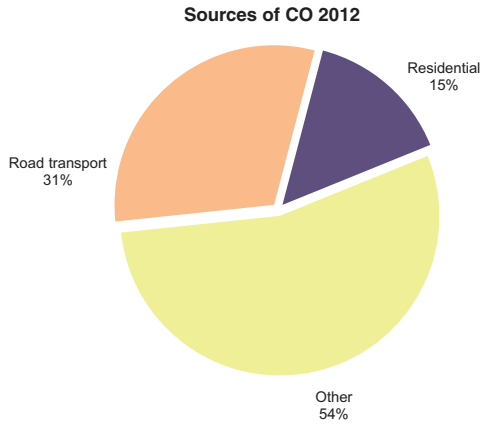
9.8 Road Transport Benzene Emissions



Source: DEFRA/Ricardo AEA

- Emissions of benzene from road transport have reduced significantly since 1990 due to the introduction of exhaust after-treatment technology enabled by unleaded petrol
- In 2000 emissions of benzene were further reduced following the lowering of the benzene and aromatics limits in petrol

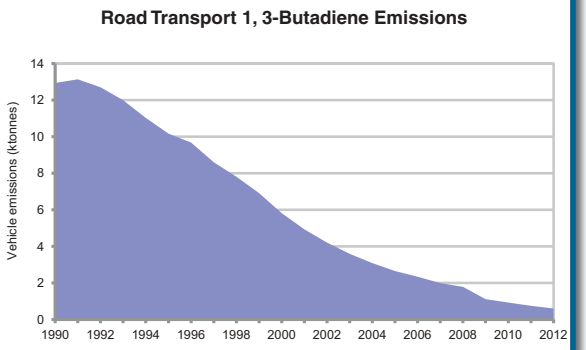
9.9 Sources of CO



Source: DEFRA/Ricardo AEA

- Carbon monoxide is formed from the incomplete combustion of fossil fuels
- In 2012 road transport was responsible for 31% of the UK's carbon monoxide emissions – down 13% in real volume from the previous year
- The residential sector was responsible for 15% of emissions

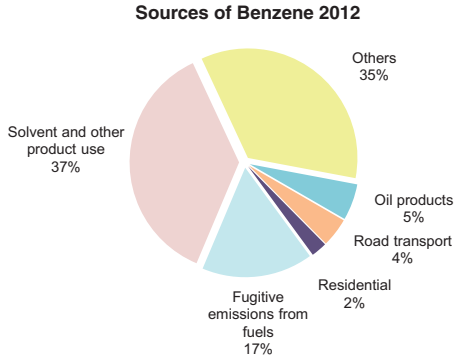
9.10 Road Transport 1,3-Butadiene Emissions



Source: DEFRA/Ricardo AEA

- Emissions of 1,3-butadiene have reduced by more than 95% since 1990
- Further reductions are expected as a greater proportion of vehicles meet new car exhaust emissions standards

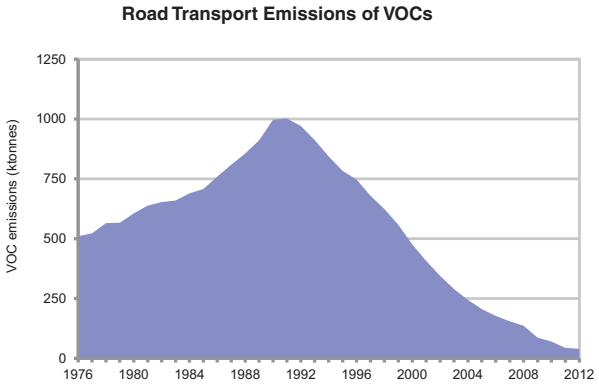
9.11 Sources of VOCs



Source: DEFRA/Ricardo AEA

- In 2012, road transport was responsible for 4% of the UK's volatile organic compound emissions, a decrease of 9% in real volume compared to previous year
- The main source of emissions is from the use of solvents and paints

9.12 Road Transport Emissions of VOCs



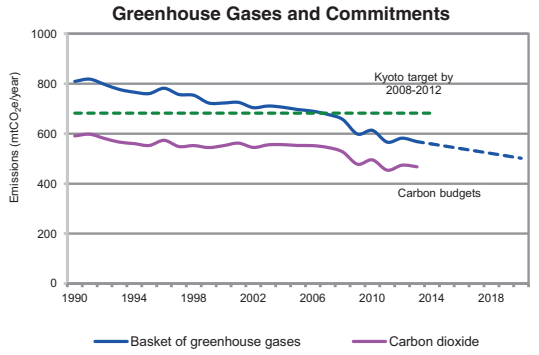
Source: DEFRA/Ricardo AEA

- Road transport emissions of VOCs have dramatically reduced since their peek in 1991, falling by around 90%
- This reduction has resulted from the introduction of catalytic converters on cars and the switch to more diesel vehicles

10. Greenhouse Gases

A key driver for the downstream oil industry is the UK Government's commitment to reduce emissions of greenhouse gases by 80% by 2050 relative to 1990 levels. The main greenhouse gas is carbon dioxide, CO_2. Emissions of CO_2 from road transport have significantly been reduced when compared to the overall increasing mileage. In the last seven years, the average new car CO_2 emissions is around 40% lower compared to 18 years ago, reflecting the improvements in vehicle efficiency enabled in part by cleaner fuels.

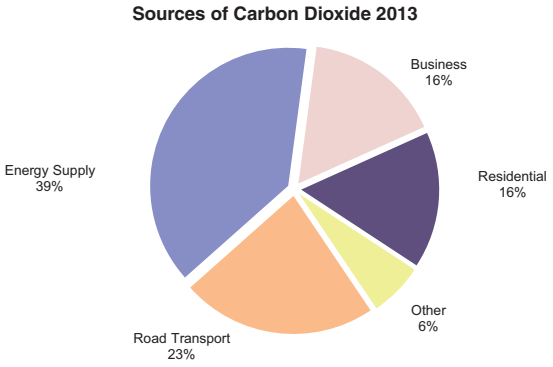
10.1 Greenhouse Gases and Commitments



Source: DECC

- The UK met the targets identified under the Kyoto protocol in 1999 – 13 years ahead of the target year - delivering a 12.5% reduction in greenhouse gases compared to 1990
- The 2009 UK Low Carbon Transition Plan set a target to reduce greenhouse gas emissions by 34% by 2020 relative to 1990
- Latest emissions data (2013) measure UK's carbon footprint at 467.5 million tonnes-per year, and basket of greenhouse gases at 568.3 million tonnes
- Emissions recorded in 2012 are 21% lower relative to carbon dioxide levels in 1990, and 30% lower relative to basket of greenhouse gases in 1990

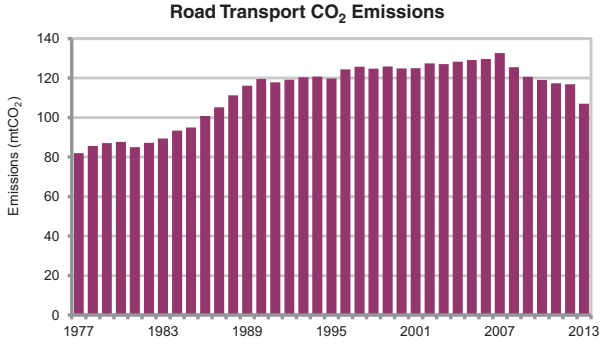
10.2 Sources of Carbon Dioxide



Source: DECC/Ricardo AEA

- Road transport produces approximately 23% of the UK's CO_2 emissions – around 107 million tonnes
- The energy supply industry, along with the residential and business sectors are also major sources of CO_2
- Carbon dioxide accounted for an estimated 82% of the UK's man-made greenhouse gas emissions in 2013

10.3 Road Transport CO_2 Emissions

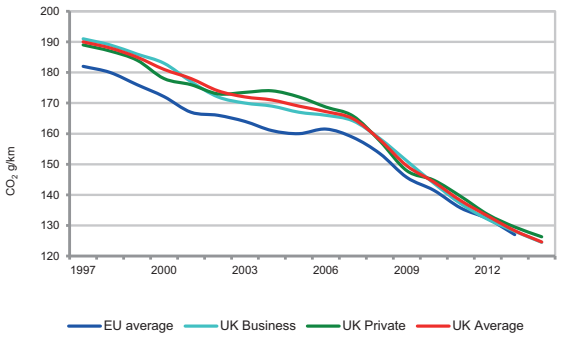


Source: DEFRA/Ricardo AEA

- CO_2 road transport emissions decreased for a sixth year running in 2013 in part due to the 2008 economic crisis and lower demand for road transport fuels
- Since 1990, emissions from road transport have risen at a much lower rate than vehicle mileage
- This can be attributed to the use of more efficient vehicle technologies enabled by cleaner fuels, and an increased proportion of diesel vehicles
- The Renewable Energy Directive (RED) mandates that 10% of transport energy is to be from renewable sources, whilst the Fuel Quality Directive (FQD), mandates a reduction in emission by 6%, all to be completed by 2020

10.4 CO_2 from New Cars

New Car Fleet Average CO_2 Emissions

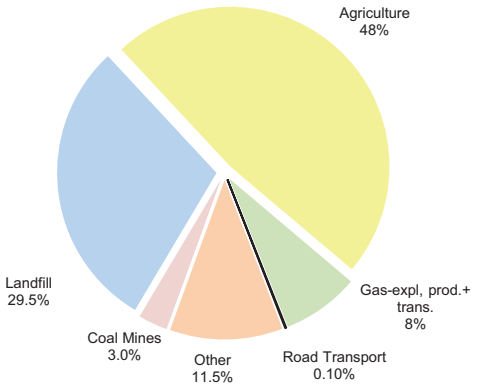


Source: SMMT/European Commission

- UK average new car CO_2 emissions have fallen every year on record, and in 2012 the UK average level of CO_2 emissions was 124.6g/km
- Future emissions of CO_2 from road transport will continue to be lowered by further improvements in vehicle efficiency
- As the UK's older vehicles are replaced and more diesel cars purchased, the fleet efficiency will improve
- The current trend to smaller vehicles will also contribute to lower emissions

10.5 Sources of Methane

Sources of Methane 2013

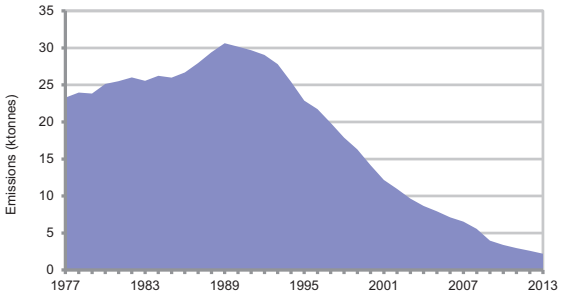


Source: DECC/Ricardo AEA

- Road transport is a minor contributor to methane emissions, producing around 0.10% of the UK total in 2013
- The main contributing sector is agriculture which accounted for over 48%

10.6 Emissions of Methane

Road Transport Emissions of Methane

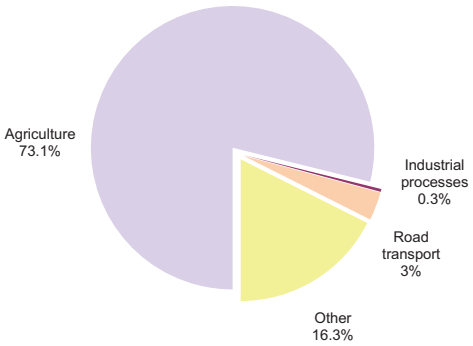


Source: DEFRA/AEA Energy & Environment

- Despite the low level of emissions, reductions are still being achieved as a result of the introduction of exhaust after-treatment technologies
- Emissions in 2013 were over 92% lower than the peak around 1989

10.7 Sources of N_2O

Sources of N_2O 2013



Source: DEFRA/AEA Energy & Environment

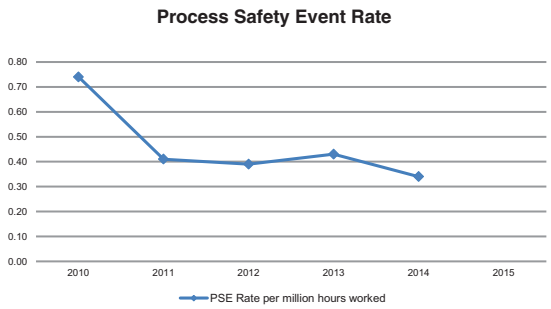
- In 2013 road transport was responsible for around 3 thousand tonnes of nitrous oxide (N_2O), or 3% of total emissions
- Agriculture is the main source accounting for 73.1% of emissions, mainly from agricultural soils
- Weighted by global warming potential, nitrous oxide emissions accounted for around 5% of the UK's man-made greenhouse gas emissions in 2013

11. Process Safety

This section has been produced as one of the key objectives of UKPIA's commitment to process safety, and in response to the challenges set by the Buncefield Major Incident Investigation Board regarding sector level reporting for key process safety performance indicators.

To ensure consistency in reporting these indicators as an industry sector, UKPIA members have adopted the American Petroleum Institute's (API) Recommended Practice (RP) 754, 'Process Safety Performance Indicators for the Refining and Petrochemical Industries'. It is on the indicators classified as Tier 1, Tier 2 and Tier 3 that this section is based.

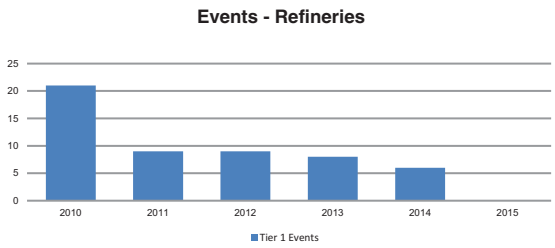
11.1 Tier 1 PSE Rate



Source: UKPIA

- The Tier 1 PSE Rate provides an indication of the number of Tier 1 Process Safety Events (PSE) that have occurred against the total number of hours worked, this is normalised per million hours
- The number of Tier 1 events over the last five years have almost halved

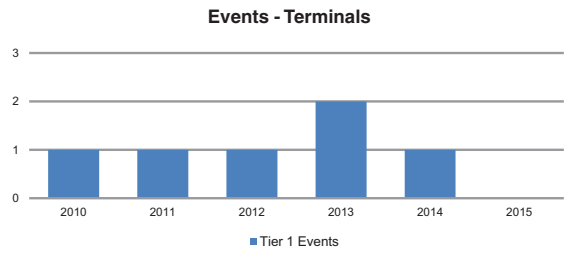
11.2 Tier 1 events, refineries



Source: UKPIA

- The number of Tier 1 events reported at refineries in the 12 month period
- The number of Tier 1 refinery events declined from 21 in 2010 to 6 in 2014

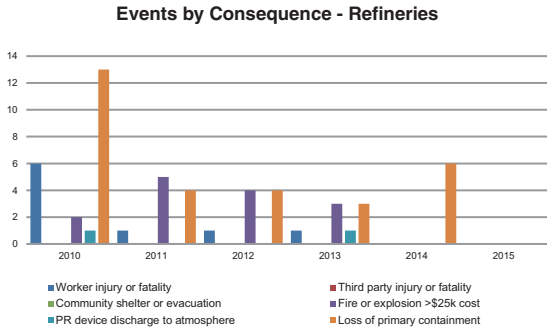
11.3 Tier 1, events, terminals



Source: UKPIA

- The number of Tier 1 events reported at terminals in a 12 month period
- In 2014, only one Tier 1 terminal event was reported

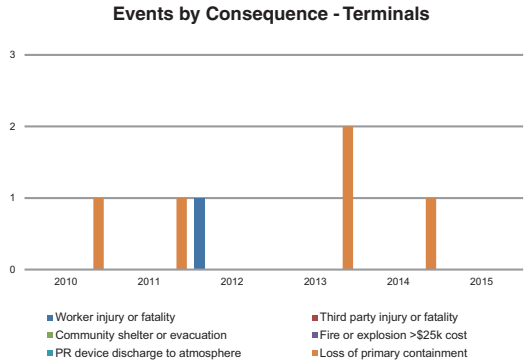
11.4 Tier 1 events by consequence, refineries



Source: UKPIA

- The consequences of Tier 1 events at refineries for a 12 month period. Note that there may be more than one consequence per Tier 1 event

11.5 Tier 1 events by consequence, terminals



Source: UKPIA

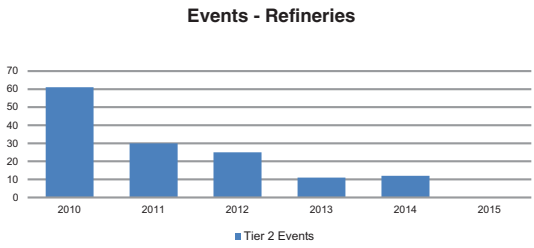
- The consequences of Tier 1 events at terminals for the 12 month period. Note that there may be more than one consequence per Tier 1 event

11.6 Tier 2 PSE Rate

Source: UKPIA

- The Tier 2 PSE Rate provides an indication of the number of Tier 2 Process Safety Events (PSE) that have occurred against the total number of hours worked, this is normalised per million hours
- The number of Tier 2 events increased slightly in 2014 compared to a declining trend since 2010

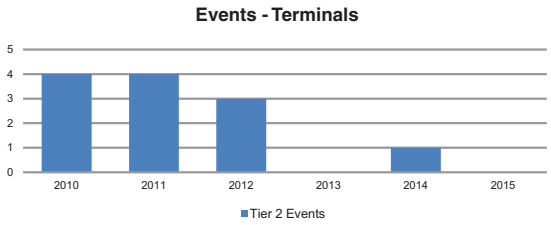
11.7 Tier 2 events, refineries



Source: UKPIA

- The number of Tier 2 events reported at refineries in a 12 month period
- Despite the slight increase in Tier 2 events in 2014, the average number of reported events has decreased by almost 80% over the last five years

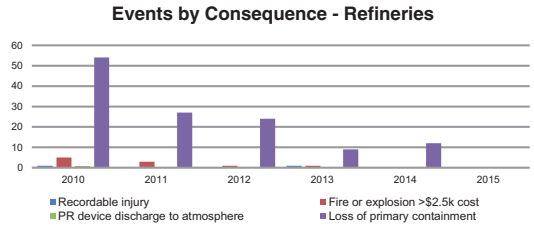
11.8 Tier 2 events, terminals



Source: UKPIA

- The number of Tier 2 events reported at terminals in a 12 month period

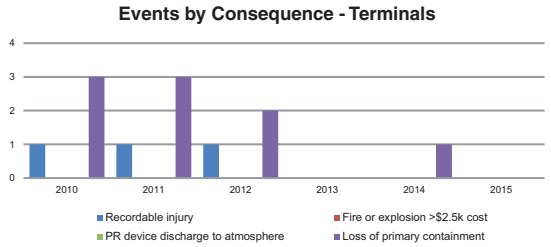
11.9 Tier 2 events by consequence, refineries



Source: UKPIA

- The consequences of Tier 2 events at refineries for a 12 month period. Note that there may be more than one consequence per Tier 2 event

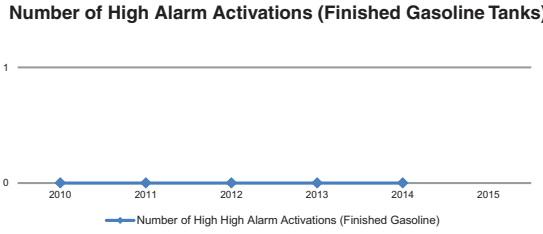
11.10 Tier 2 events by consequence, terminals



Source: UKPIA

- The consequences of Tier 2 events at terminals for a 12 month period. Note that there may be more than one consequence per Tier 2 event

11.11 Tier 3 Number of High High Alarm Activations on PSLG Scope Finished Gasoline Tanks*



*Notes:
1. Excludes spurious trips and activations due to planned alarm testing
2. The definition of PSLG scope finished gasoline tanks can be found in the final PSLG report, paragraph 24

Source: UKPIA

- High High alarm activation provides an indication of the number of times a safety related (or instrumented) system has been activated on finished gasoline tanks which fall under the scope of the PSLG report
- No activation of the High High alarm has been reported in the last 5 years

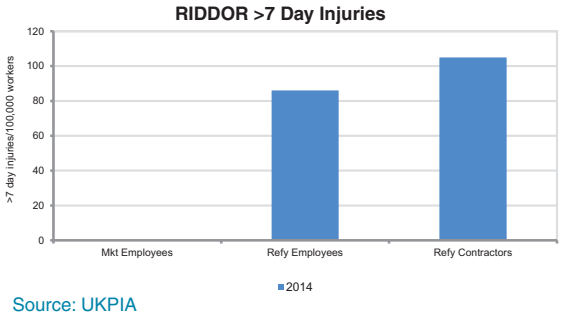
12. Occupational Health and Safety

The Refining and Marketing sector remains one of the safest manufacturing industries in the UK, with proportionately fewer injuries occurring than in the manufacturing sector as a whole. The UK downstream industry also compares favourably, in terms of refining employee safety performance, with European competitors. Particularly strong improvements have been made in contractor safety since the 1990s and these have been helped by the introduction of Contractor Safety Passport Schemes.

Due to changes in reporting of RIDDOR (reporting of injuries, disease and dangerous occurrences regulations), data provided in this chapter have been reconfigured and restarted. Reporting requirements mostly remained unchanged. However the requirement for an employer to record accidents that result in the incapacitation of a worker (inability to work) changed from 'for more than 3 days' to 7 days.

Note: *CONCAWE (Conservation of Clean Air and Water in Europe) is the European oil industry technical body focussed on environment, health and safety.*

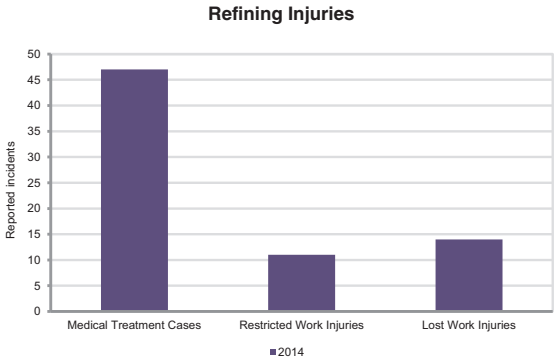
12.1 RIDDOR >7 day Injuries by Category of Worker



Source: UKPIA

- RIDDOR >7 day shows the frequency of injuries in three downstream categories: marketing employees, refinery employees and refinery contractors

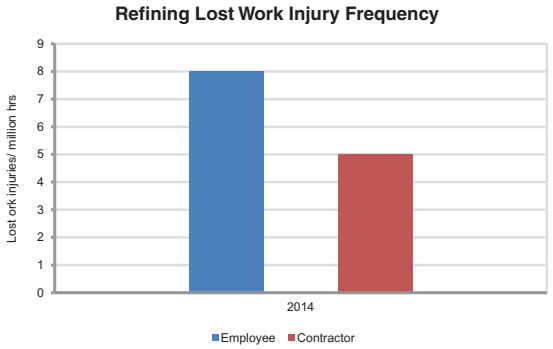
12.2 Refining Injuries



Source: UKPIA

- Refining Injuries are reported according to impact severity of injury. This includes required medical treatment, restricted work injury and lost work injury

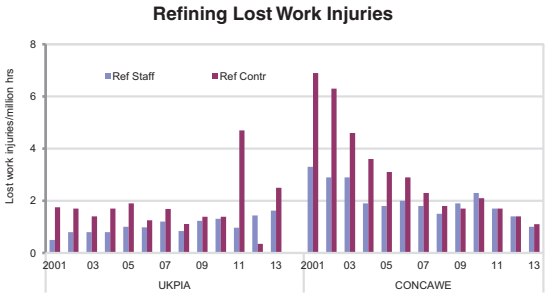
12.3 Refining Lost Work Injury Frequency



Source: UKPIA

- Refining Lost Work Injury Frequency compares lost work incidents relative to millions of hours of work between refinery contractors and employees

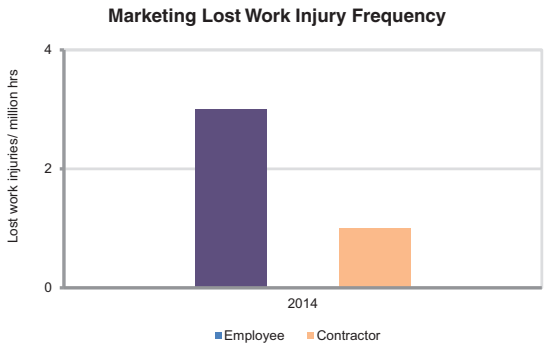
12.4 Refining Lost Work Injuries



Source: UKPIA / CONCAWE

- Comparing UKPIA with European safety data (CONCAWE) indicates that UK refinery employees are less likely to suffer a lost work injury than European counterparts
- This graph was generated using the previous RIDDOR data. In 2013, the frequency of lost work injuries was double for UK refining contractors and employees relative to their European counterparts, unlike in 2012

12.5 Marketing Lost Work Injury Frequency



Source: UKPIA

- The Lost Work Injury Frequency for the marketing division of the downstream oil sector compares injuries of contractors and employees

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