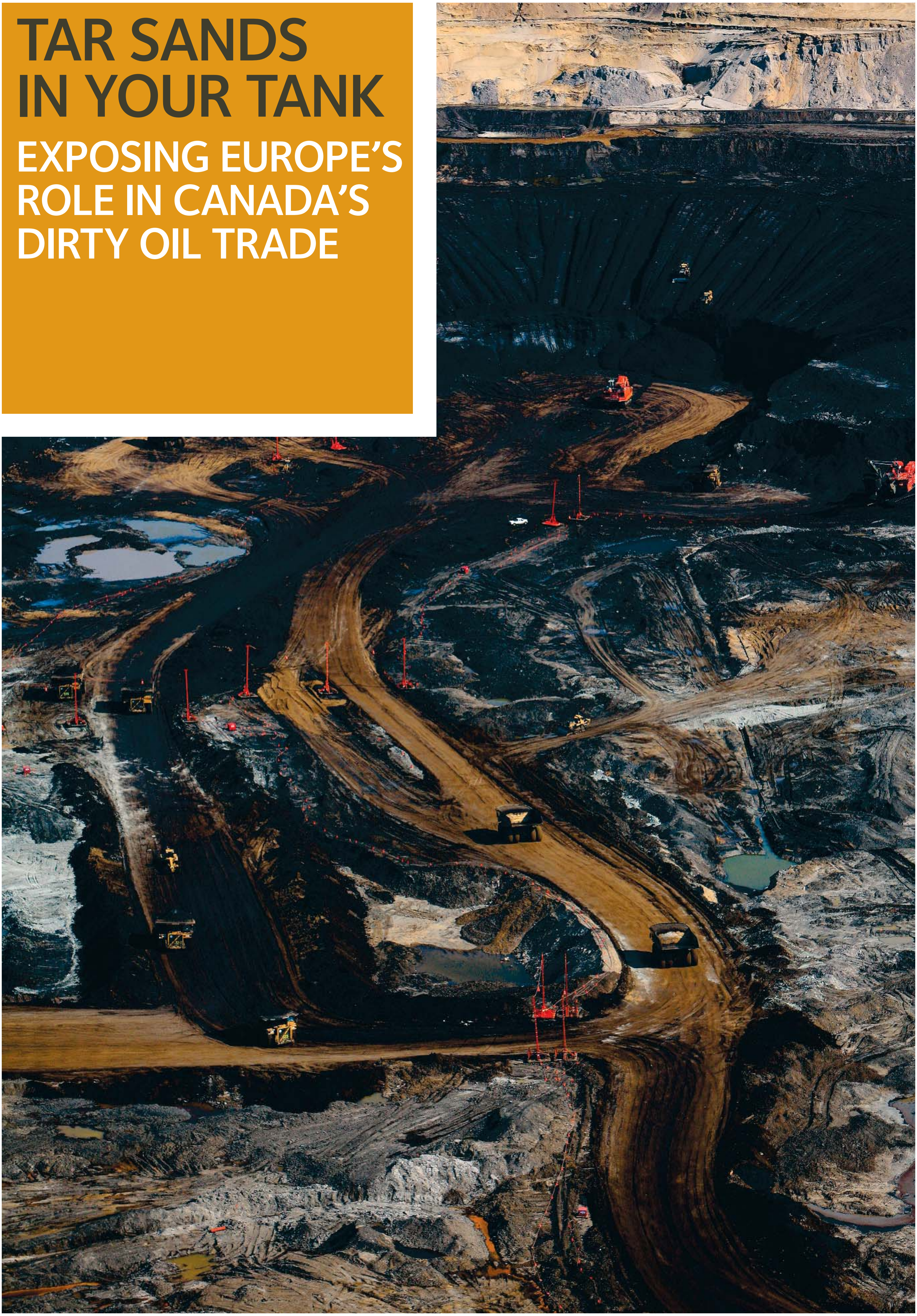
TAR SANDS IN YOUR TANK

EXPOSING EUROPE'S ROLE IN CANADA'S DIRTY OIL TRADE



EXECUTIVE SUMMARY

Extracting tar sands bitumen from the forest wilderness in Alberta, Canada has major environmental impacts. Not least of these is the significant increase in greenhouse gases (GHG) produced by extracting and processing the bitumen into a usable product. On average the extraction process is thought to produce three times the GHGs than average conventional oil production.[1]

Oil produced from tar sands is generally consumed only in Canada and the USA, but public concern in Europe has been growing, particularly around the financial links between European financial institutions and the tar sands industry.[2]

Greenpeace can now reveal that petroleum products containing tar sands crude oil have been regularly entering the EU's petroleum supply chain for some time, primarily through imports of diesel from the US Gulf Coast (USGC). A significant rise in the trade in diesel fuel between the USGC and the EU since 2008 is likely to continue to provide crucial support for the struggling refinery industry in the region. The trade is supported by a structural diesel deficit in the EU market and a similar surplus in the US.

While the level of contamination with tar sands crude in the diesel reaching Europe from the USGC is currently low, the construction of the Keystone XL pipeline could change this significantly. The proposed pipeline could deliver up to 500,000 barrels per day (b/d) of tar sands crude directly from Alberta to Texas by 2013. Currently only around 100,000 b/d enters the region.

RECOMMENDATIONS

i) Implement changes to the EU Fuel Quality Directive

European legislators must seize the opportunity provided by this directive and:

- introduce and implement a set of conservative default values for the GHG intensity of different sources of crude oil, including tar sands
- establish a GHG intensity ceiling at the earliest opportunity in the review of the Directive in 2012. This would guarantee that the most polluting fuels do not contaminate the European supply chain
- introduce the opportunity to take into account improvements in refinery efficiency
- Enable fuel suppliers to prove that they are performing better than the default values by investing in better technology, reducing flaring and switching to cleaner fuels and;
- introduce, with immediate effect, accurate and robust reporting of the carbon intensity of oil. This is necessary to create transparency for future reviews of the law.

ii) Reduce oil demand

While reducing the GHG content in transport fuels is helpful, much more can also be done to reduce oil demand. This will not only help tackle climate change and reduce the environmental impacts of extracting and refining petroleum products, but can also increase the resilience of the EU economy and its transportation system.

To reduce emissions and increase energy security, Greenpeace advocates the following hierarchy of principles for the transport sector:

- localise services and reduce the need to travel
- use fuel more wisely; and
- harness and develop clean technologies

These principles can be applied to both passenger transport and freight.

FRONT COVER AND LEFT: TAR SANDS MINING PROJECTS, ALBERTA, CANADA

INTRODUCTION

The extraction of tar sands (also known as oil sands) in Alberta, Canada has been described as the most destructive project on earth and images of the open cast mining that has dominated the industry to date have shocked people around the world.

But while the impacts on land and water resources in the region are disturbing, the implications for climate change are of equal concern. While the worldwide extraction and processing of oil and gas is responsible for around 6%[3] of global greenhouse gases (GHGs) and oil use in road transport alone is responsible for another 12%,[4] producing tar sands increases oil's impact still further because the process of extracting it is on average three times more GHG intensive than for conventional oil.[5]

Outside of Canada and the United States, concern about tar sands production has been growing. Investors in London-listed oil giants Shell and BP have been questioning the companies about their role in tar sands extraction, concerned that the flow of capital from London to Alberta carries with it greater risk than the firms are prepared to admit.[6] But because it is widely believed that Canadian tar sands crude is currently only consumed in Canada and the US, public concern has not been focused on markets outside the region.

Greenpeace can now reveal, however, that the reach of tar sands crude is wider than previously thought. In fact, petroleum products derived partly from tar sands crude oil have been regularly entering the EU's petroleum supply chain for some time. What is more, this trade is set to grow significantly, meaning access to the European petroleum products market will help bolster the growth in tar sands production. This places European regulators in a unique position to stem the growth in tar sands production.

In this report we reveal how petroleum products, primarily diesel, are being regularly exported to the EU from US Gulf Coast (USGC) refineries that frequently process tar sands crude oil. We also detail how the leading company involved in this trade, Valero Energy Corporation, plans to significantly increase its supply of tar sands crude through a controversial new tar sands pipeline to the USGC from Canada, while maintaining its position as the leading exporter of diesel and other products from the USGC to the EU.

The EU does in fact have legislation in development that should restrict these imports of high carbon intensity petroleum products, the Fuel Quality Directive, but this needs significant strengthening – and rigorous implementation – to do the job. If European regulators fail to get this right, European consumers will be increasingly putting tar sands fuel in their tanks and playing a major role in driving the destructive growth of tar sands production.

BOX 1: TAR SANDS: WHAT ARE THEY AND HOW ARE THEY TURNED INTO OIL?

Tar sands (also known as oil sands[7]) are deposits of sand and clay saturated with bitumen and water. Bitumen is oil in a solid or semi-solid state. Because it is in this less fluid state, the bitumen requires specialised methods of extraction, which fall into two categories: mining and in situ.

Today around 55% of tar sands production is mined. But of the 173 billion barrels of technically recoverable tar sands in Alberta, about 80% can only be retrieved through in situ production.

Mining: Where tar sands are close to the surface, generally at depths of less than 100 metres, the reserves are mined. This involves excavating the bitumen out of the ground in an open cast mine. The land is cleared and the bitumen soaked earth is dug out with giant mechanical shovels and loaded into trucks to be taken to a separation plant. It takes on average about two tonnes of mined tar sands to extract a barrel of bitumen.

Only about 20% of the ultimately recoverable tar sands are in deposits shallow enough to be mined. The rest requires in situ production.

In situ production: More deeply buried bitumen requires drilling wells to pump it out, somewhat like conventional oil production. However, unlike conventional production, getting the bitumen to flow more like oil generally requires injecting steam into the reservoir. In situ production therefore requires steam generating plants, a large number of wells, often spread out in groups known as pads, and extensive roads, pipelines and product collection areas.

The two main methods of in situ production are cyclic steam stimulation (CSS) and steam assisted gravity drainage (SAGD).

CSS involves pumping high-pressure steam into a well for an extended period to fluidise the bitumen. The fluidised bitumen is then pumped to the surface through the same well.

SAGD also pumps steam into the reservoir but it does so by continuously injecting steam through one pipe while pumping the fluidised bitumen to the surface via an adjacent one.

Creating the steam for these processes consumes huge quantities of natural gas. It is primarily the steam-to-oil ratio, the amount of steam needed to produce a unit of oil, that determines the amount of natural gas needed and the associated GHG emissions. In situ tar sands production is generally more GHG intensive than tar sands mining and is among the most GHG intensive forms of oil extraction commercially operating today.

Upgrading: Once the bitumen has been extracted it needs to be diluted with solvents or lighter oils in order to be piped to an upgrader. Upgrading is the process of converting bitumen into synthetic crude oil, or syncrude, which can then be refined into petroleum products.

All bitumen produced from tar sands needs to be upgraded before it can be refined into traditional petroleum products. This has primarily been carried out in dedicated upgraders in Alberta with the resultant syncrude piped to refineries to be further processed into petroleum products. However, increasing quantities of diluted bitumen (dilbit) are being shipped to complex refineries in the US, where it is upgraded and refined in the same plant.

Whether it is upgraded and refined in a two-step or one-step process, the process of converting bitumen into petroleum products is significantly more energy intensive than the refining of lighter conventional oils.[8]

Sources: Pembina Institute, Alberta Energy and Canadian Association of Petroleum Producers

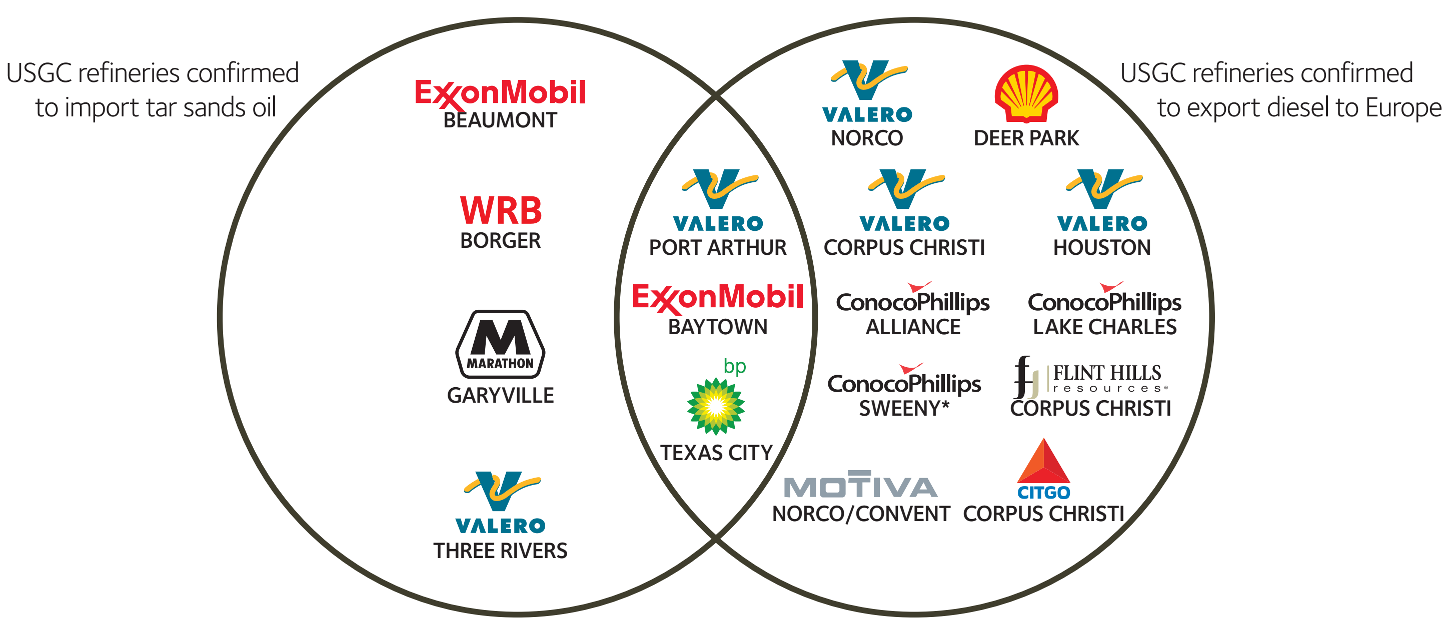
TAR SANDS IN EUROPE: RESEARCH FINDINGS

This report reveals for the first time that petroleum products, in part derived from Canadian tar sands crude, are being regularly imported into the EU from the US. It also explains that unless we regulate against this, the trade will grow and could become one of a number of drivers leading to an expansion in tar sands production. This is primarily due to the growing importance of transatlantic trade to some of the same refineries that are planning to increase their commitment to tar sands processing.

Our analysis of US government and industry data for petroleum imports and exports[9] revealed that at least seven refineries located in the US Gulf Coast region (USGC) – primarily Texas and Louisiana – imported Canadian tar sands crude oil in the 12 month period from 1 November 2008 to 31 October 2009. Similarly, we identified 13 refineries in this same region that exported diesel and other distillates to Europe in the 12 month period from 1 December 2009 to 30 November 2009.[10] The one month time lag allows for the crude to travel through the pipeline and refinery system.

By cross referencing these two lists, we found that there are at least three refineries which both source from the Alberta tar sands and export products to Europe. These are dominated by Valero Energy's Port Arthur refinery, which since at least June 2009, has regularly processed tar sands crude while exporting diesel to Europe (see Figure 1).

Figure 1: USGC refineries that process tar sands crude and export diesel to Europe



*ConocoPhillips Lake Charles and Sweeny refineries used tar sands oil in 2008. It is unlcear if they have continued to use tar sands crude in 2009.

Valero currently exports diesel from four of its USGC refineries. One of these, in Port Arthur, Texas, is the second largest tar sands user in the USGC. At least 20% of tar sands crude imports into Texas and Louisiana and nearly all of Valero's USGC imports of tar sands crude go there.[11] We estimate that about 24,000 barrels per day (b/d), or 9.5% of the crude oil used at this refinery, currently originates from the Alberta tar sands.[12]

BP's Texas City refinery is a regular exporter of diesel and other products to Europe. In the period of study, it purchased only one consignment of tar sands crude. BP is also a major trader of petroleum products and we traced at least two BP shipments of diesel to Europe back to Valero's Port Arthur refinery.

ExxonMobil's 573,000 b/d refinery in Baytown near Houston, Texas is currently the largest in the US and is integrated with one of the biggest petrochemical complexes in the world.[13] This refinery purchased about 11% of the tar sands crude entering the USGC and made at least one shipment of diesel to Europe in the time period. It also made over 100 shipments to Europe of lubricants, solvents and other petrochemicals.[14]

Four other refineries received tar sands crude in the time period but these sites do not directly export products. Only 46% of the diesel exports from the USGC are made directly from refining companies – the rest are exported by independent traders such as Mabanaft, Westport Petroleum, Trafigura, Glencore and many others (see Table 3). Therefore, it is possible that some of the products from these refineries are exported to Europe by traders.

The Marathon Garyville refinery in Louisiana is a significant user of tar sands crude, but the refinery does not appear in US export data. However, many traders ship petroleum products from the Port of South Louisiana where this refinery is located.

Similarly, the WRB Borger refinery, 50% owned by ConocoPhillips and 50% owned by Canadian tar sands company Cenovus Energy Inc., is the largest user of tar sands oil in Texas (see Table 1) – up to one quarter of its crude supply – but as it is located far inland and not directly linked to a port, it is not identifiable in US export data as a shipper to Europe.

ConocoPhillips' Sweeny, Texas and Alliance/Westlake, Louisiana refineries also ship products including diesel, jet fuel and petroleum coke to various European countries including the UK, Spain and Italy, but it is unclear if these products are made using tar sands crude. These refineries have used tar sands crude in the past, but not during the one year time frame in this study.

Tables 1, 2, 3 and 4 detail the data we have gathered on tar sands use in the USGC and exports of diesel to Europe from the region.

Table 1: USGC refineries that import crude oil from the tar sands (1 November 2008 – 31 October 2009)

Refinery	Confirmed tar sands crude usage (b/d)[15]	Estimated Sunoco allocation	Estimated Unnamed allocation	Estimated total tar sands crude usage (b/d)	Percentage of total
WRB Borger	20,016		46%	33,870	36%
Valero Port Arthur*	2,370	82%	29%	19,057	20%
ExxonMobil Beaumont	6,830	18%	23%	15,523	17%
Marathon Garyville	11,921			11,921	13%
ExxonMobil Baytown	10,679			10,679	11%
BP Texas City	907			907	1%
Other	0		2%	610	1%
Valero Three Rivers	477			477	1%
Sunoco Nederland Terminal	9,710				
Unnamed	30,134				
TOTAL	93,044	100%	100%	93,044	99%**

* These figures differ from Table 2 as they are spread across a full year, whereas this refinery only appeared in the data in the last five months of the study period. Table 2 provides a more accurate picture of this refinery's tar sands consumption. ** where percentages have been rounded to one decimal place, columns may not total 100%

Table 1 explanation: The US Department for Energy's, Energy Information Administration (EIA) data show tar sands crude going either directly to named refineries, unnamed refineries or the Sunoco oil terminal in Nederland, Texas. The tar sands crude delivered to the Sunoco terminal went on to either Valero Port Arthur or to ExxonMobil Beaumont.[16] Unnamed deliveries also went to those refineries as well as to WRB Borger.[17] One unnamed shipment went to a small refinery in Alabama (other). Personal communications with Valero Energy have confirmed our calculations of tar sands crude consumption at Port Arthur.

Table 2: Valero Port Arthur: tar sands crude consumption in detail

Capacity (b/d, 2008)[18]	310,000
Est. operable utilisation rate* (percent, 2008)[19]	81.3%
Est. operable capacity (b/d)	252,030
Est. tar sands usage (b/d, June 2009–October 2009)[20]	23,963
Confirmed tar sands usage[21]	*5,654*
Est. 'Sunoco' allocation[22]	*9,937*
Confirmed 'unnamed' allocation[23]	*8,373*
Est. Level of contamination (tar sands crude usage as a percentage of total crude)[24]	9.5%

*percentage of the total refinery capacity currently being utilised ** totals may not add up due to rounding

Table 3: USGC diesel exports to Europe by company type[25]

Type of company	Exports (million metric tonnes)	Percentage of total
Refiners	4.747	46%
Traders	5.566	54%

Table 4: USGC refiners that directly export diesel to Europe[26]

Company	Weight (mt)	Percentage of total
Valero	1,913,607	40%
Shell	974,588	21%
BP	708,359	15%
ConocoPhillips	548,500	12%
Flint Hills	256,953	5%
Chevron	147,978	3%
ExxonMobil	80,338	2%
Citgo	72,730	2%
Statoil	43,862	1%
Total	4,746,915	100%

* Nationwide company-level US export data is only available from third party providers which in turn source data from vessel bills of ladings retrieved at all major US ports. Greenpeace is not responsible for any errors that may originate from inaccurate vessel reporting. **totals may not add up due to rounding.

WHERE DOES IT GO?

We tracked a sample of vessels that shipped diesel from Valero's Port Arthur refinery to Europe. Most of this (130,000 mt) was delivered to Eurotank Amsterdam (owned by the Dutch trader Vitol Inc.). Another offload point was Vesta Terminal Antwerp (owned by the Swiss-based Mercuria Energy Group).[27]

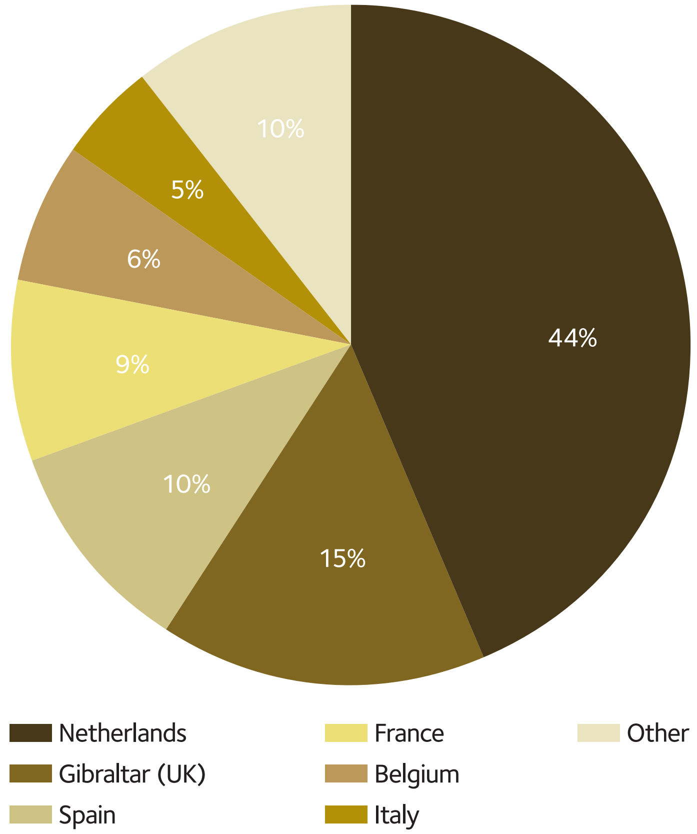
Some 60,000 mt of diesel that BP shipped from Valero's Port Arthur refinery was delivered to the BP Terminal in Amsterdam and elsewhere in Europe.[28] Shortly after BP's Texas City refinery received its one tar sands crude consignment, it shipped diesel to Vopak's terminal in London.[29]

It should be noted that this search is far from exhaustive; we tracked only a small number of shipments that are clearly identifiable as having originated at Valero Port Arthur. We were not able to investigate the refinery source of an additional 1.4 million tons of deliveries from Port Arthur by third party shippers such as Vitol Inc., Morgan Stanley Capital and Merrill Lynch Commodities.

We also tracked vessels from other Valero refineries. We found that in addition to the above mentioned terminals, Valero ships significant quantities of diesel to Vopak Terminal London and numerous other depots throughout Europe. While these particular deliveries are not currently from tar sands derived sources, this does show that if Valero increases tar sands processing at most of its USGC refineries, as it plans to do[i], the tainted fuel may be distributed throughout Europe, including the UK.

From the Netherlands and Belgium, petroleum products are transported to Germany and elsewhere either via barges on the Rhine or via one of two pipelines: RRP-RMR (N.V. Rotterdam-Rijn Pijpleiding Maatschappij and Rhein-Main-Rohrleitung) and CEPS (Central European Pipeline System), both of which deliver diesel to various depots throughout western Germany.

Figure 2: EU countries receiving diesel fuel from the US (by volume, 2008)[30]



Diesel is a fungible commodity (i.e. can be traded interchangeably, so each barrel has an identical value) and a significant amount is sold on the spot market. It is therefore impossible to trace exactly where this tar sands derived diesel ends up once it leaves the port of arrival and enters the European petroleum products distribution system. Needless to say, European diesel supplies are today tainted with tar sands, albeit by a small proportion of the overall supply. However, in the not too distant future, the amount of diesel coming from USGC is likely to increase and its level of contamination with tar sands crude could also grow significantly.

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i See p15 'Valero targets Europe with tar sands'

A TRICKLE NOW BUT A FUTURE FLOOD

Only around 100,000 b/d of tar sands crude reaches USGC today, a small amount of the region's total refining capacity, which at 8.4 million b/d is the most concentrated in the world. With seven refineries currently sharing that supply, the level of contamination of the region's diesel exports to Europe is relatively low. But the potential demand in the region for Canada's tar sands crude is in fact much greater. Valero Energy in particular is heavily committed to a proposed tar sands pipeline called Keystone XL, which could potentially ship 500,000 b/d of tar sands crude direct to USGC. Additionally, many USGC refiners including Valero are planning to expand their diesel trade with Europe in order to gain some advantage in a future that many predict will be increasingly treacherous for refiners.

ALBERTA TO TEXAS: HOW TAR SANDS CRUDE REACHES THE GULF COAST

In our research period, an average of 93,000 b/d of tar sands crude reached USGC refineries, entering the region via two channels. The primary channel is through the ExxonMobil owned Pegasus Pipeline, which runs 858 miles from Patoka, Illinois to Nederland, Texas. This pipeline was reversed in 2006 to carry crude south and initially had a 66,000 b/d capacity. In June 2009, Exxon completed an expansion of the pipeline's capacity to 96,000 b/d.[31] Since the 2006 reversal of flow, the pipeline has carried Canadian tar sands crude which arrives in Patoka primarily through the Enbridge and Exxon owned Mustang pipeline system.[32]

The other channel is by tanker from the Westridge Terminal in Vancouver. Tar sands crude reaches Vancouver through the Kinder Morgan Trans Mountain Pipeline. In 2008, about 22,800 b/d of western Canadian crude was shipped to the USGC from here.[33] However in our research period, with the Pegasus Pipeline expansion coming on stream, tanker shipments reduced to around 12,000 b/d. This would suggest a limited capacity for tar sands crude in the Gulf Coast's refineries. However, proponents of the Keystone XL pipeline envisage demand coming from 15 refineries in the region.[34]

KEYSTONE XL: THE TAR SANDS FLOODGATES OPEN

Many Gulf Coast refineries are configured to process heavy crudes and have been doing so for many years with sources originating primarily from Mexico and Venezuela. Today Mexican crude is in decline and refiners feel nervous about production stability in Venezuela and the increasing bilateral oil trade that that country has pursued.[35] Consultants for TransCanada, the company proposing to build and operate the Keystone XL pipeline, calculated that the 15 refineries that XL could service processed around 1.4 million b/d of heavy oil in 2007.[36] Some of those refineries, including Valero Port Arthur, have increased or are in the process of increasing their coking capacity.[37] Consequently the potential market for tar sands crude in the Keystone XL delivery area is actually expanding.

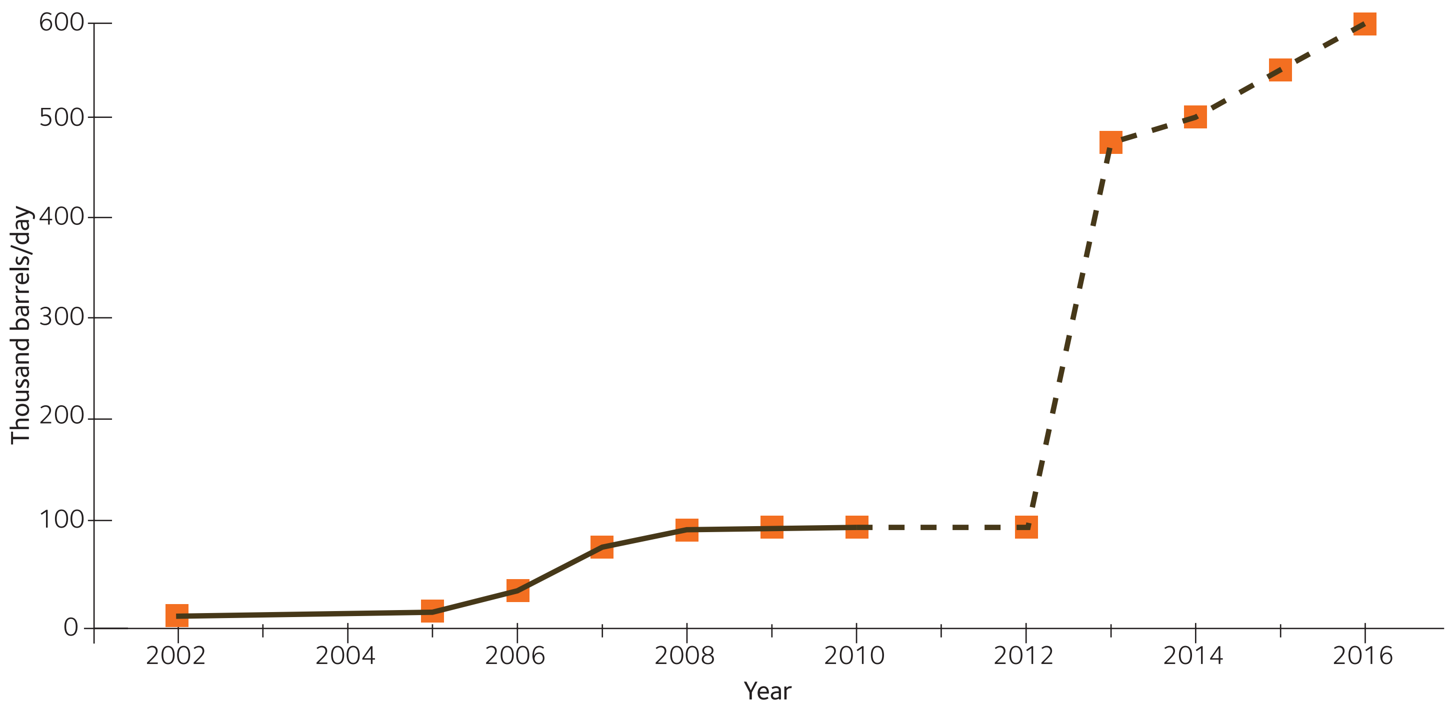
Therefore the main barrier to increasing tar sands crude processing in the USGC is the current lack of sufficient pipeline capacity.[38] Keystone XL is the industry's answer to this and the proposal has considerable industry support. Regulatory approval has already been granted in Canada, and the process is underway in the US. TransCanada expects it to be completed by mid-2010.[39] If regulatory approval is granted and financing secured, construction could start in late 2010 and the pipeline could be in service in 2012–2013.

XL will have the capacity to pump 500,000 b/d the 1,980 miles from Hardisty, Alberta to Nederland, Texas (near Port Arthur), with a possible addition running to the Houston area. It will also indirectly supply the Texas City and Lake Charles, Louisiana regions via separate pipelines.[40]

Tar sands crude will be the primary source of oil for the Keystone XL pipeline.[41] Tar sands producers which have committed to supply Keystone XL include Canadian Natural Resources Limited (CNRL)[42] and EnCana Corporation.[43] Shell and ConocoPhillips are also backing the plan.[44]

At the other end of the pipeline, TransCanada says that USGC refiners have already committed to long term contracts for delivery of 380,000 b/d from XL.[45] Valero is cited as having major commitments[46] and in the past year its executives have frequently referred to their support for the pipeline.[47] The Port Arthur refinery is likely to be the main taker; up to 80% of its 310,000 b/d capacity is configured to process heavy sour crude.[48,49] Valero has supply commitments in place from several Canadian oil companies to deliver tar sands oil via XL,[50] including at least 100,000 b/d from CNRL alone.[51]

Figure 3: Historical and projected growth of western Canadian crude oil to the USGC (thousand b/d)[52]



According to Valero Energy executives, the commitment to tar sands crude via Keystone XL is aligned with its plans to increase ultra-low sulphur diesel production at the Port Arthur refinery.[53]

The 15 refineries that will have access to XL deliveries together account for around half of the entire capacity of the USGC, approximately 4.3 million b/d. They include BP Texas City and Shell's Motiva Port Arthur refinery[ii], which although slowed, is still undergoing a major expansion that will make it the biggest refinery in the US with a significant expansion of heavy oil capacity.[54] It also includes Shell's Deer Park refinery and Total's Port Arthur refinery.[55] A full list of the refineries that could be served by XL is shown in Table 5. Several of these are regular exporters to Europe.[56]

If XL is built, the proportion of tar sands crude that will be processed by these refineries will certainly increase. Judging by Valero's statements regarding its contractual commitments to the new pipeline, it appears likely that its supply chain will be significantly tilted towards tar sands crude once XL comes on stream, particularly at the Port Arthur refinery. While our research to date has shown that Valero Port Arthur is currently running on 9.5% tar sands crude, it could potentially be running up to 80% with XL on stream.[iii]

Of concern to Europeans should be the possibility that not only is Valero poised to dominate tar sands processing in the USGC, but it is also the biggest USGC exporter of diesel to EU countries (see Table 4) and has plans to expand that trade. The next chapter explains why USGC refiners are likely to increase the transatlantic trade and how Valero and other heavy oil refiners in the USGC are likely to dominate that trade.

GLOBAL REFINING IN FLUX: WHY THE DIESEL TRADE TO EUROPE IS INCREASING

In the past year the refining industry has come to realise that an economic recovery will probably not bring with it a return to the boom years that the industry was enjoying prior to the recession. While during those years, refineries ran close to full capacity and margins were high, today they are cutting throughput and struggling with low margins. The immediate cause of this is the slump in demand caused by the recession, particularly in the US.

But as economic recovery begins many industry analysts are pessimistic about the future.[57] The ill portents for the industry derive from three main factors:

- an excess of capacity following expansions that were sanctioned during the boom years, many of which were well into construction when the recession hit
- a structural downward shift in demand for oil derived transport fuels due to market encroachment from biofuels and improvements to vehicle efficiency; and
- increasing competition from new refineries based in Asia and the Middle East.

ii 50% owned by Shell and 50% by Saudi Aramco
iii Based on it running all of its potential heavy sour capacity (248,000 b/d) on tar sands crude.

Table 5: USGC refineries that will potentially be served by the Keystone XL Pipeline

Refinery	Capacity b/d	Known processor of tar sands crude	Known diesel exporter to EU
Valero Port Arthur	310,000	X	X
Motiva Port Arthur	285,000		
Motiva PA Expansion (2012)	325,000		
Total Port Arthur	232,000		
ExxonMobil Beaumont	349,000	X	
Valero Houston	83,000		X
Houston (Lyondell)	271,000		
Pasadena Refining	100,000		
Shell Deer Park	330,000		X
ExxonMobil Baytown	567,000	X	X
BP Texas City	478,000	X	X
Marathon Texas City	76,000		
Valero Texas City	200,000		
Calcasieu Refining	53,000		
CITGO Lake Charles	430,000		
ConocoPhillips Lake Charles	239,000		X
Total: 15	4,328,000		

Note: Motiva Port Arthur's expansion will make it the biggest refinery in the US. The new capacity is included in this table as it should come on stream around the same time XL does should it go ahead.

Decreasing demand

The US and European refining industries are facing the consequences of a peak in demand for their products. US oil demand is thought to have peaked in 2007,[58] while demand in member countries of the Organisation for Economic and Cooperation Development (OECD) as a whole probably peaked in 2005.[59] The demand slump derives from a long standing downward trend in oil demand for power generation and a trend towards greater efficiency in transportation.

The use of oil in power generation in OECD countries has decreased 40% since 2000 and is forecast to continue its decline.[60] In transportation, the source of the majority of oil demand, oil's share of the liquid fuels market is being challenged by increasing use of biofuels, mandated by government policy, while overall liquid fuels demand is set to decline due to improved vehicle efficiency standards and the growing market penetration of hybrid and electric vehicle technologies. As the IEA stated in its February 2010 *Oil Market Report*, *'demand growth in the OECD may well have peaked, with all the negative consequences for OECD refining this implies'*.[61]

New sources of competition

On top of this decline in demand, refiners in these countries are also having to contend with increasing competition from new export-orientated refineries based in Asia and the Middle East. One refinery in India, Reliance's massive 1.2 million b/d Jamnagar refinery in Gujarat, has a clearly articulated strategy to target OECD markets.[62] Meanwhile, planned refineries in the Middle East are also likely to target market share in Europe and the Americas.[63]

At a refining seminar in London in February 2010, Alan Gelder, the head of downstream consulting at energy market consulting firm Wood Mackenzie, told those gathered that the outlook for refining was extremely weak for the next four to five years. He explained that after that period US and European refiners would face competition from new export-oriented refineries in the Middle East and Asia. He added that, *'export focused plants currently under construction in the Middle East will benefit from lower crude and product export costs and [sic] well as being less burdened with growing environmental legislation.'*[64]

The slowdown in demand, new capacity and rising biofuel production has led to a global refinery capacity surplus of some 6 million b/d, according to the Wood Mackenzie consultant.

So with refiners in the US and EU competing with a growing number of players for a shrinking domestic market, are there strategies that some of them could implement to claw back some advantage? It would appear that a persistent deficit of diesel in Europe could provide respite for certain well positioned US refiners. But the potential for this to link Europe with Canadian tar sands production threatens to undermine European ambitions to decrease the environmental impact of its energy use.

THE ALBERTA-TEXAS-EUROPE CONNECTION

The US is a net petroleum importer but nevertheless exports a considerable quantity of petroleum products. For example, in 2008 the US exported 1.77 million b/d of petroleum products, equivalent to 9.7% of total refinery and blender production.[65] More than 22% of this entered the EU.[66] The vast bulk of these exports are distillates[iv] (various grades of diesel for transport and heating), residual fuel oil (mainly used for shipping and heavy machinery) and petcoke (a coal like substance used in cement kilns and other industrial furnaces).

The EU suffers from a diesel fuel deficit.[67] While some diesel fuel is used for freight, heating buildings and fuelling off-road vehicles, it is the continued popularity of the diesel engine in private car use that is primarily responsible for the persistent market imbalance. In 2007 the EU imported 26.8 million tonnes of diesel fuel, equivalent to more than 530,000 b/d.[68]

Two-way traffic

The reason European refineries do not make enough diesel to satisfy demand is that the refining process inevitably produces a range of products from heavy residual fuel oil to light gasoline and diesel, and liquid petroleum gas.[69] While complex refineries can produce a greater proportion of diesel to other products from each run of crude oil, the imbalance in EU demand is such that European refineries persistently produce a surplus of gasoline and a deficit of diesel for domestic markets. As a result the EU imports diesel, primarily from Russia, and exports gasoline, primarily to the US.[70]

In 2007 Russia was the source of 89% of the EU's diesel imports, equivalent to about 10% of diesel consumption.[71] But in 2008, Russia diverted around four million tonnes of diesel, nearly 17% of its 2007 EU exports, to China and Ukraine without a commensurate increase in production.[72] This meant less Russian diesel was available for the EU market, allowing other suppliers to fill the gap.

In March 2009 Wood Mackenzie's Gelder told the US refining industry that this situation will continue at least in the short term: *'Our outlook for Russia is that diesel/gasoil exports will decline short term, before increasing again in the 2011–12 timeframe – so providing a window of opportunity for US refiners capable of exporting diesel to Europe.'*[73]

But he went on to explain that the structural shifts in the Atlantic Basin petroleum products market may well favour a continuing diesel trade between the USGC and the EU beyond that time frame. His reasoning was as follows.

With gasoline demand in decline in the US, due to biofuel mandates and higher vehicle efficiency standards, there is excess gasoline capacity in the US system. This is exacerbated by European refiners pushing their surplus gasoline to the US at competitive prices. Some refineries will have to shut down and until they do, margins will remain low and many refineries will be operating at reduced capacity. Refineries that are able to increase diesel production and access export markets are less likely to face production cuts or closure.

The persistent deficit in domestic EU diesel supply and generally sluggish demand for diesel in the US means that wholesale diesel prices in the EU are higher than those in the US.

Many of the USGC refineries that have recently expanded capacity have also increased complexity. This favours diesel production and these refineries can use that advantage to access export markets for some of that diesel.

An added factor that favours sending diesel to Europe is that with the EU pushing its surplus gasoline on the US market, shipping rates for tankers that would otherwise return to the EU empty are at a discount.

So as Gelder sees it: *'The situation of surplus European gasoline being pushed into the US whilst promoting a reverse diesel trade will remain for the foreseeable future'.*[74]

The trend that Gelder spoke of is clearly demonstrated in the US Department of Energy data for US diesel exports over the past decade. Between 2000 and 2007, US diesel exports to EU countries averaged 29,000 b/d. But in 2008 this jumped to 184,000 b/d and in 2009 it reached 276,000 b/d.[75]

iv From here on we shall refer to all distillates and gasoil as diesel or diesel fuel

The percentage of overall US diesel exports that were going to the EU rose from an average of 17% between 2000 and 2007, to 35% in 2008 and 46% in 2009. The EU market was clearly driving the growth in US diesel exports.

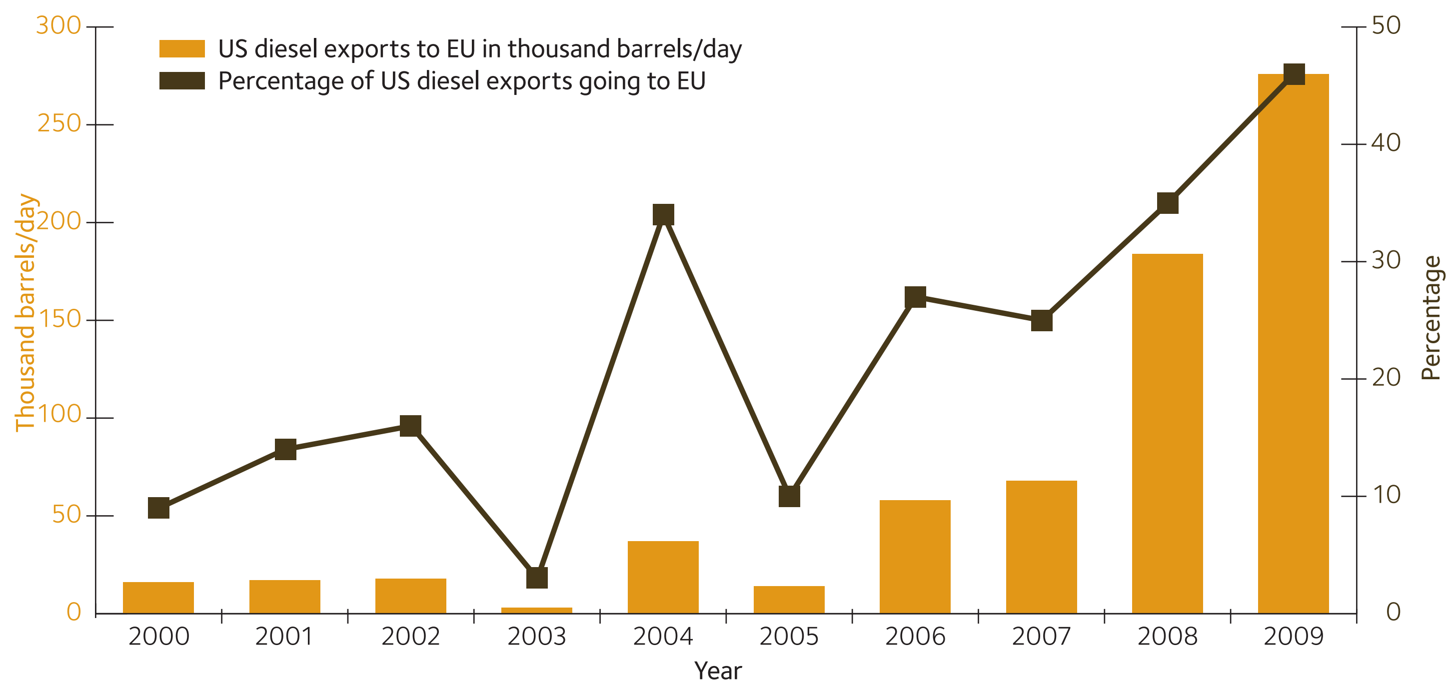
Similarly, the percentage of US diesel exports coming out of the USGC also rose from 62% between 2000 and 2007 to 71% in 2008–09.[76]

The increasing complexity of USGC refineries means that many of those that are configured to process tar sands crude are the same ones that are poised to take advantage of the diesel trade to the EU. In fact judging by the difficulties the US refining industry is facing, this trade may be a significant lifeline for certain of these refineries.

Valero targets Europe with tar sands

Our research revealed that Valero is currently the second biggest consumer of tar sands crude in the USGC (see Table 1). We also found that Valero dominates USGC refinery exports of diesel to Europe (see Table 4). We have also explained that Valero is a major backer of the proposed Keystone XL pipeline that would increase access to tar sands crude in the USGC by up to 500% (see page 11).

Figure 4: Growth in diesel exports from US to EU



Source: US Department of Energy – Energy Information Administration

The EU will find it has become a significant market for a highly polluting fuel it thought it had nothing to do with.

Since the middle of 2008, Valero has, on average, shipped between 150,000 and 200,000 b/d of diesel to Europe.[77] In an investor presentation in July 2009, CEO Bill Kleese told analysts that, '*We look at Europe as a good trading, good arbitrage, good opportunity for us to work more aggressively in the Atlantic Basin.*' In a number of recent presentations to industry analysts Valero has stressed, among other things, that part of its strategic focus is to refine low quality crudes into high quality products.[78] In part that means tar sands crude processed into products such as ultra-low sulphur diesel. In its presentations it has frequently reiterated its perception that 'world demand favors diesel' and that '*growing global diesel demand is an export opportunity for US refineries*'.[79]

If Keystone XL becomes a reality and Valero continues to dominate USGC exports to the EU, the latter will find it has become a significant market for a highly polluting fuel it thought it had nothing to do with.

While the world desperately needs to cut GHG emissions, tar sands production undeniably makes oil production dirtier.

TAR SANDS: THE PROBLEM

The exploitation of tar sands is a retrogressive step for the oil industry as rather than assisting the push towards cleaner oil production and the development of cleaner fuels, the extraction and processing methods required are actually significantly dirtier than for conventional oil.

The harmful effects include high GHG emissions; high levels of other air pollutants such as volatile organic compounds (VOCs), nitrogen oxide (NOx) and sulphur dioxide (SO_2); health and livelihood impacts on local populations including First Nations communities; unsustainable consumption and pollution of water resources; forest clearance and land devastation. Industry and government claims concerning carbon capture and storage, land reclamation and the amelioration of pollution issues have been shown to inadequately address the great scale of these problems.

GREENHOUSE GASES (GHGS)

Just as the world is starting to get serious about tackling climate change, the production of oil from tar sands is significantly increasing the GHG intensity of oil use.

Whether we look at the well-to-refinery emissions (three times worse on average[80]) or the well-to-wheel emissions that include the burning of the fuel in motor vehicles (around 17% worse on average[81]), the fact is that emissions are higher than for conventional oil (see box 2). Therefore, rather than reducing GHG emissions per unit of energy produced, oil from tar sands is more polluting than ever. The higher emissions from in situ extraction methods are of particular concern (see table 6), because if the exploitation of tar sands oil grows in line with industry plans, in situ production will expand significantly, forming a greater share of overall production than it does today. This will lead to a rise in the average carbon intensity of tar sands production and absolute emissions will soar.

A 2009 peer reviewed study of the emissions intensity of tar sands extraction and processing up to the refinery gate puts the average at three times that of conventional production.[82] The range of figures from this study is shown in Table 6. The total emissions for the industry, including our own calculations based on current production forecasts is shown in Table 7.

Table 6: GHG emissions for crude oil production[83]

Method of production	GHG emissions – kg CO_2e / barrel
Tar sands mining and upgrading	62–164
Tar sands in situ and upgrading	99–176
Conventional oil production	27–58

TAR SANDS TAILINGS POND, ALBERTA, CANADA

BOX 2: COMPARING OIL PRODUCTION EMISSIONS

Measuring the GHG intensity of tar sands production and comparing it with conventional oil production is a contested exercise. The result of any comparison depends on what range of activities are included in the analysis as well as what kind of oil production is being compared with tar sands production. The vast range of different crude oil qualities and production, processing and transport methods worldwide also makes a definitive comparison very difficult.

It is important to be clear about whether the comparison is of well-to-refinery (up to refinery entrance gate), well-to-tank (all processes prior to combustion in an engine), or well-to-wheel (entire life cycle including combustion) emissions. As about 80% of the entire life cycle emissions occur when the fuel is combusted in an engine, comparing well-to-wheel emissions increases the total emissions being compared and thereby makes the difference between production methods appear much smaller – a method commonly used by the tar sands industry to attempt to trivialise the issue.

Figures in this report are based on a 2009 peer reviewed paper[84] that reviews 13 previously published studies comparing emissions from tar sands production and conventional production. The paper finds there is a wide range of reported emissions for both tar sands and conventional production and that there is not yet a consensus on the 'characterization of life cycle emissions of the oil sands industry'.[85] Using the range of figures in the peer reviewed paper, we calculated an average increase between conventional oil production and tar sands production of 195% (just under three times) for well-to-refinery emissions and 17% for well-to-wheel emissions.

Since California's Low Carbon Fuel Standard[86] was introduced to reduce the life cycle GHG emissions of transport fuels sold in the state, the Alberta government and tar sands industry have been at pains to show a minimal difference between emissions from tar sands derived fuels and other fuels. In July 2009, the Alberta government commissioned two studies from oil industry consultants.[87] Based on the results, the government claimed that well-to-wheel emissions for tar sands derived fuels are '*comparable to other crude oils*'.[88] The government further claimed that '*emissions from the oil sands are generally about 10% higher than direct emissions from other crudes in the US*'.[89]

Oil companies have repeatedly cited these studies in response to concerns expressed about the climate impact of tar sands production. Recently both Shell and BP cited them to counter claims by shareholders that the high carbon emissions associated with their tar sands projects (proposed projects in BP's case) poses a risk to future shareholder value.[90]

However the assertion that these reports are more accurate than extensive studies carried out by both the US and Canadian governments lacks credibility. These studies suggest that the well-to-wheels figure is between 13 and 27%.[91] The Alberta commissioned reports used a small selection of conventional crude oils for comparison, a significant proportion of which were heavy crude oils, which have higher emissions than other conventional oils. In contrast, the government studies use a larger number of different crude oils which more accurately reflect the range of crude oil consumed in the US. The two Albertan studies differed by about 10% in their calculation of average conventional oil emissions, throwing into question the Albertan government's claim that the studies are comparable.

While the Albertan studies were weighted towards dirtier conventional production, some of the tar sands projects studied were in fact not yet in operation. Using theoretical data from proposed projects rather than actual operations data is a tactic not used in any other study and significantly skews the results towards theoretical best practise. If we accept such tactics we could equally skew the figures the other way by discounting Nigerian oil production emissions significantly as *in theory*, the high levels of gas flaring associated with Nigerian oil production can be greatly reduced and has been proposed.[92] This would serve to make Nigerian emissions figures much lower and consequently the percentage increase for tar sands emissions would widen. Any comparison of theoretical best practice should surely apply to all the examples in a study.

Neither of the Albertan government's studies was peer reviewed. The study we base our estimate on is the most recent study to our knowledge to be published in a peer reviewed journal.

The debate about how much worse for the climate tar sands production is compared with conventional oil production is likely to continue. The striking thing about the Albertan government's attempt to make light of the issue is that it claims that the best possible tar sands production is only a little worse than the worst possible conventional; hardly an achievement to be proud of.

Whichever analysis you base your conclusions on, tar sands production is a step in the wrong direction. While the world desperately needs to cut GHG emissions, tar sands production undeniably makes oil production dirtier. Industry's efforts to trivialise this are a distasteful example of blatant self-interest.

Table 7: Total GHG emissions from tar sands extraction and upgrading[93]

2006	2007	2008e	2015f	2020f	2030f	2041f
29	36	40	51	75	135	160

(Million tonnes of CO_2 equivalent/year) e=estimate f= forecast

Tar sands production is the fastest growing source of GHG emissions in Canada[94] and is a key contributor to Canada's failure to achieve its Kyoto Protocol commitments.[95] Canada's emissions rose by 26.2% between 1990 and 2007, and in 2007 were 32.2% above its Kyoto target.[96] Around 44% of the projected increase in Canada's GHG emissions from 2006 to 2020 is expected to derive from new tar sands projects.[97]

Bio-carbon: so far unaccounted for

The atmospheric carbon created by clearing the boreal forests, peatlands and wetlands from tar sands project sites are not included in the official estimates of emissions from tar sands extraction. Most of the land is covered in boreal forest, beneath which lies carbon rich peat and muskeg. Devastating this land through mining and other land use changes, releases into the atmosphere carbon locked up in these soils as well as destroying their carbon absorption potential.[98]

Government and industry have not attempted to adequately measure or study this issue. The most comprehensive attempt do so has estimated that under a full development scenario, an average of 8.7 million tonnes of CO_2 per year should be added to the official annual emissions figures.[99] An earlier study concluded that on a per barrel basis, up to 11% of the well-to-tank emissions should be added in the case of existing tar sands mining projects.[100]

OTHER AIR POLLUTANTS

Alberta is becoming Canada's industrial air pollution hotspot as a result of tar sands extraction and processing.[101] The processes produce nitrogen oxides (NOx) and sulphur dioxide (SO_2) which are not only respiratory irritants in their own right, but also contribute to smog and acid rain. Benzene, a volatile organic compound (VOC), is associated with tar sands operations and is a known carcinogen.[102]

NOx and SO_2 emissions per barrel are double those for conventional oil. Despite reductions in emissions intensity per barrel, industry expansion has caused total emissions of NOx, SO_2, VOCs and particulates from the oil sands to increase sharply.[103]

There is increasing concern that acid deposition in Saskatchewan, partially caused by tar sands operations, could exceed the buffering capacity of lakes and soils in the region[104] – that is, their ability to absorb and neutralise the acid without experiencing a change in pH value.

TAR SANDS AND INDIGENOUS POPULATIONS

First Nations and Métis people in Alberta are affected by tar sands development through the loss of habitats for hunting and fishing, the contamination of water and habitats leading to contamination of fish and game, and by high levels of air pollution. One downstream community in particular is concerned that tar sands pollution is the cause of unusually high levels of cancer in the area.[105]

Given the destructive nature and high toxicity of tar sands production it is remarkable that not a single project application has ever been turned down by the Alberta government. First Nations have called for a moratorium on further development[106] and at present there are three legal challenges in progress citing alleged treaty violations.

A recent study of company practice has found that not a single company operating tar sands projects has adopted the principles of free prior and informed consent – in which local people are granted a formal role, and some form of veto, with regard to decisions about local development projects – as a goal in its consultation process.[107]

There is currently no coordinated programme for monitoring pollution in the environment of Alberta. This is exacerbated by the failure of the Albertan government to conduct baseline studies prior to tar sands development.[108] The only programme for monitoring and measuring the impact of tar sands production on the aquatic environment is oil industry funded and has been found to use an analytically weak, biased and inconsistent approach.[109]

WATER

Tar sands extraction and processing takes a heavy toll on the region's water resources. Tar sands mining operations are currently licensed to divert 445 million m^3 of fresh water each year from the Athabasca River, roughly the annual water needs for a city of three million people. Serious concerns have been expressed about the continued draw of water during periods in the winter when the river drops to about a tenth of its spring and summer flow.[110]

The mining process has already created tailings lakes formed by leftover slurry covering 130 km^2, an area larger than the entire metropolitan area of Manchester. They are filled with toxins including naphthenic acids, phenolic compounds, ammonia-ammonium and trace metals, such as copper, zinc and iron. These are suspected to be leaking at least 11 million litres a day into the Athabasca watershed. The lakes could grow to 310 km^2 by 2040.[111]

LAND CLEARANCE

We begin to comprehend the sheer scale of the tar sands industry, which has been labelled the largest industrial project on earth, when we look at figures for land use. The scars and toxic lakes created by mining in the region can be seen from space. The resource in Alberta lies beneath a land mass greater than that of England, indicating the vast area that could be affected should all possible development go ahead. There are also tar sands deposits in neighbouring Saskatchewan that are as yet undeveloped.

Only about 20% of the bitumen is shallow enough to mine. The remaining 80% requires in situ methods of production, usually involving injecting steam into the reservoir. Although less visually dramatic than the destruction caused by tar sands mining, in situ production still has a devastating impact on the forests and wildlife in which it is located. Seismic exploration lines, complex networks of pipelines carrying steam and oil, power and steam generation plants, product collection tanks, well pads and roads mean that in most project areas you are never much further than 250 metres from an industrial feature.[112]

The fragmentation of the forest poses a severe threat to wildlife, which has suffered a noticeable decline in areas affected by in situ production.[113] The kind of forest destruction caused by in situ extraction methods has been described by Canadian think tank, the Pembina Institute, as 'death by a thousand cuts'. The total area that could be impacted if all projects go ahead is 13.8 million hectares, which is roughly the size of Florida.[114]

Potential area to be impacted by tar sands projects

Mining:	488,968 hectares (ha)[115]
In situ:	13,800,000 ha[116]
Total area:	14,076,000 ha
Total area of England:	13,039,500 ha

Area impacted to date[117]

Mining in operation (June 2009):	68,574 ha
Mining approved and proposed:	94,850 ha
In situ in operation and approved:	644,373 ha

Land reclamation: fact or fantasy?

The companies and Canadian government point to plans and experiments with land reclamation to claim that one day the land impacted by mining will recover. To date there is little firm evidence that this is possible. For example, claims made by Suncor that its Tar Island Pond has been reclaimed have been shown to be misleading. The toxic contents of the pond were simply pumped to another site.[118]

Much of the mined land was wetland habitat that will be extremely difficult to restore. E.A. Johnson, a professor of biological sciences at the University of Calgary and co-author of a report on the science behind reclamation in the tar sands region explained the enormity of the task at hand to *Environmental Health Perspectives* in April 2009.

'Restorations are usually small projects, a few hectares in size, but now we are confronted with whole landscapes in which the reconstruction must start with the central template, the groundwater, and then the soil... We are going to have to reconstruct the drainage, the groundwater flow, and these are things about which we have little knowledge. It is not clear to me that everybody understands how complicated this is'.[119]

CARBON CAPTURE AND STORAGE: WILL IT REALLY MAKE A DIFFERENCE?

Industry and government point to the development of carbon capture and storage (CCS) as the answer to the high GHG emissions of tar sands production. However, a recent report suggests that the potential of CCS to address the GHG emissions of tar sands operations may be limited. It states that, *'the overall reductions from upstream operations could be in the 10% to 30% range at the best process locations by 2020 and the 30% to 50% range industry wide by 2050.'*[120]

Furthermore, the cost of making these marginal reductions could be prohibitively expensive at $110 to $290 per tonne. This compares unfavourably with estimates for CCS for coal fired generation at $60 to $150 per tonne[121] and throws into question whether it will ever be implemented.

BOREAL FOREST DESTRUCTION IN ALBERTA, CANADA

TAR SANDS IN DEVELOPING COUNTRIES: A RECIPE FOR DISASTER

Canada is the world's only major tar sands producer but it is not the only country with tar sands resources. Russia, Madagascar, the Republic of Congo (also called Congo-Brazzaville), Trinidad and Tobago, Nigeria and Venezuela also have significant tar sands reserves and all are actively exploring the potential to develop this dirty fuel.

Russia's Tatneft oil company was in talks with both Shell and Chevron over tar sands reserves in the Republic of Tatarstan in 2006–2007. The talks fell through but the reserves are thought to be capable of supporting up to 500,000 b/d of production and Tatneft has talked of developing the resource alone.[122]

The Italian oil company Eni is involved in plans to develop tar sands resources in the Republic of Congo. The company is exploring a land area of 1,790 km^2 and is bizarrely linking the project to plans to simultaneously develop palm oil plantations across 70,000 hectares. In the words of Congolese human rights activist Brice Mackosso, from the Justice and Peace Commission in Pointe-Noire: *'Local people, already suffering the impacts of oil development, have not been meaningfully consulted over the new projects. This violates Eni's own human rights and environmental policies.'*[123]

French oil company Total, already a big player in the Canadian tar sands, is exploring similar reserves in Madagascar. The company announced plans in June 2009 to drill 130 exploration wells in Bemolanga in the Morondava Basin. If production were to go ahead, it could reach 200,000 b/d over 30 years, all of which the company expects to export unrefined.[124]

Elsewhere, the governments of Trinidad and Tobago[125] and Nigeria[126] have urged national and foreign oil companies to develop their tar sands reserves. Venezuela was recently assessed by the US Geological Survey, which announced in October 2009 that the country's technically recoverable tar sands resources were double previous estimates at more than 500 billion barrels.[127] Some limited commercial production is already underway in Venezuela.[128]

Given the immense destructive power of tar sands mining and the increased pollution associated with all forms of tar sands production, the prospect of this industry expanding into countries with poor regulatory frameworks and histories of inadequate governance of natural resources is of great concern.

As we explain in the next section, the oil industry's assertion that these resources have to be exploited to meet future demand is inaccurate and dangerous.

THE MACROECONOMICS OF OIL AND CLIMATE: CAN WE AFFORD TO EXPLOIT TAR SANDS OIL?

Tar sands production involves some of the highest capital and operating costs in the industry, making it the most expensive source of oil worldwide. As such, future projects can only come on stream if oil prices stay high. The minimum price of oil needed to support new tar sands projects in Canada, for example, is often cited as being between $80 and $90 per barrel.[129] Prices required for specific projects depend on the technology used for extraction and upgrading, the quality of the resource and the prevailing prices of equipment and labour in the Albertan market.

Before the recession Alberta was among the most expensive labour and equipment markets in the oil industry.[130] Costs have declined due to project cancellations following the recession, but it is becoming clear that a resumption of activity in Alberta is also seeing a return to unsustainable inflation in the region.[131] One forecast has placed the long term oil price needed for production growth at more than $120 per barrel.[132]

The assumption that the global economy will sustain oil prices on an inexorable upward curve appears misguided. High oil prices cause a slowdown in economic activity and thereby suppress oil demand. High oil prices also increase the take up of new technologies that use oil more efficiently and encourage consumers to switch to alternatives and more efficient patterns of use. Compounding this is the effect that high oil prices have on the energy policies of economies that are dependent on imported oil.

Concerned about high oil prices and energy security, countries such as China and the US are starting to tackle the issue of excessive dependence on oil. For the US in particular, this means addressing the extreme inefficiency with which oil is used in transportation in that country as well as diversifying a proportion of transportation to other sources of energy such as electricity. Some progress has already been made in this regard and as a result projections for oil demand in the future have been significantly revised in recent years. As new technologies gain ground these forecasts could be revised further.[133]

There is therefore a growing consensus that oil demand in developed countries has peaked.[134] There is also fervent debate about how far the burgeoning growth in oil demand in developing countries will go.[135]

With oil demand growth slower than previously expected, it might be assumed that the problem of tar sands production should also diminish, but with traditional supplies of oil from giant fields in Mexico, the North Sea and elsewhere in decline, tar sands oil is expected to play a major role in filling the gap.

CONTROLLING CLIMATE CHANGE REQUIRES LESS NOT MORE OIL

Allowing tar sands oil to fulfil such a role, however, would fail to take account of the trajectory of oil demand that will be necessary to limit the concentration of carbon in the atmosphere in order to prevent average global temperatures rising above the critical 2ºC level. To achieve this crucial goal we need strong policies that will not merely constrain the growth in oil demand but actually shrink demand significantly.

In the IEA 2009 annual report[136] the choice facing the world regarding energy use and climate change was clearly outlined. The IEA presented two scenarios, the Reference Scenario and the 450ppm scenario. The Reference Scenario discusses energy use and GHG emissions on the basis that no new government policies aimed at reducing GHG emissions come into force; in other words business as usual. In this scenario oil demand grows from about 86 million b/d in 2010 to 105 million b/d in 2030. Canadian tar sands production is cited as growing strongly to meet this rising demand in the face of a limited increase in conventional oil supplies. The figures cited for future tar sands production are similar to those which the Albertan government and industry bodies such as the Canadian Association of Petroleum Producers (CAPP) predict.[137] But there are some aspects of this that the IEA discusses that Alberta and CAPP fail to mention. The IEA states:

'But these Reference Scenario trends have profound implications for environmental protection, energy security and economic development. The continuation of current trends would have dire consequences for climate change. They would also exacerbate ambient air quality concerns, thus causing serious public health and environmental effects, particularly in developing countries'.[138]

'Continuing on today's path, without new policies, would mean rapidly increasing dependence on fossil fuels and continuing wasteful use of energy, taking us towards a concentration of greenhouse gases in the atmosphere in excess of 1000 parts per million (ppm) of CO_2-equivalent (CO_2-eq). This, the outcome of the Reference Scenario, would almost certainly lead to massive climatic change and irreparable damage to the planet'.[139]

The IEA's 450ppm Scenario is one in which the organisation expects atmospheric concentrations of GHGs to be stabilised and the catastrophic consequences of the Reference Scenario avoided. This scenario sees fossil fuel consumption and its associated GHG emissions peaking by 2020.[140] US oil demand in 2030 is predicted to be 30% less than it was in 2007.[141] The contraction in oil demand is expected to impact tar sands production particularly hard.[142]

But to achieve these reductions requires stronger emissions regulations and more aggressive efficiency policies than are in place today. Achieving a stable climate, reducing oil demand and stopping the growth in tar sands production are all clearly linked by polices and actions that need to be taken by governments not only in North America but in Europe and all around the world.

The urgency with which we need to control GHG emissions and the decline in easy-to-produce oil suggests that the world is at a critical juncture in which society's relationship with oil requires a new approach. The decline in easy-to-produce oil presents policy makers with a choice between two pathways: to either perpetuate an unsustainable supply based approach by pursuing increasingly expensive and polluting sources such as tar sands and other difficult-to-produce oils, or to constrain demand for oil through a combination of vehicle efficiency improvements, a shift to hybrid and electric vehicles, greater support for public transport and changes in spatial planning that reduce the need to travel. The latter option is really the only one that provides a long term solution to both the oil supply problem and climate change.

The assumption that the global economy will sustain oil prices on an inexorable upward curve appears misguided.

But it is a long term strategy. While progress has already begun on some of these areas, a significant transition will take time. Although OECD oil demand is in decline, the decline will be slow unless more aggressive efficiency policies are pursued. In non-OECD countries, the growth in demand will continue for some time but this growth can be curtailed through greater support for the efficiency transition.

In the meantime there are policy tools available that can help to ensure that the oil based fuels we are using are becoming cleaner not dirtier. In the EU there is already a Fuel Quality Directive, a significant part of which is aimed at reducing GHG content in transport fuels. But will it stop tar sands derived diesel and other products entering the EU?

THE FUEL QUALITY DIRECTIVE: A TOOL IN NEED OF SHARPENING

The Fuel Quality Directive (FQD) was adopted by the EU Council and Parliament on 22 April 2009 as a modification of an earlier directive (98/70) on the quality of petrol and diesel. One of the aims of the legislation is to reduce the well-to-tank GHG intensity of transport fuels used in the EU.

The FQD intends to reduce the life cycle GHG content of fuels used in the EU by 10% by 2020 with 6% of this target being mandatory and 4% voluntary. While the legislation is now law, the way it will be implemented is yet to be decided and the methodology chosen will make a significant difference to its effectiveness.

The legislation has the potential in the short term to drive technological and structural change across the oil industry through, for example, reducing flaring of associated gas in the Niger Delta and Russia and improving refinery efficiency.

In addition, the FQD has the potential to encourage a shift towards less GHG-intense fuels and away from the most damaging fuels such as tar sands. But it can only do this effectively if specific fuel sources are given separate, maximum GHG values and a ceiling is implemented restricting the most polluting fuels.

The methodology currently proposed is inadequate. It proposes one default GHG value for all oil-based transport fuels sold in the EU based on an average derived from all fuels sold in 2010.

The methodology currently proposed is inadequate. It would potentially leave the EU market wide open to tar sands derived fuels.

This is unlikely to adequately restrict imports of fuels with the highest life-cycle carbon content because as the proposed reductions are based on the average for all, their effect will be much weaker on the fuels with the highest value. This would potentially leave the EU market wide open to tar sands derived fuels and other fuels with high life-cycle carbon content. Using differentiated values for different categories of sources would provide an incentive for all high carbon sources to improve or would discourage their entry into the EU market by imposing a penalty.

As a matter of urgency Greenpeace is asking the commission to implement a series of recommendations on the GHG methodology of the FQD, which are shown in the 'Conclusion and recommendations' section that follows.

With the adoption of Article 7a of the Fuel Quality Directive, the EU has sent a clear signal that the GHG intensity of transport fuels is a target for significant reductions.[143] It is crucial that Europe does not allow this legislation and its leadership on this issue to be undermined by lobbying from the oil industry or the Canadian and Albertan governments.[144]

CONCLUSIONS AND RECOMMENDATIONS

This report reveals that petroleum products partly derived from tar sands crude are regularly entering the EU and have been for at least one year. It shows that the trade from the USGC to the EU, particularly in diesel, is likely to become entrenched and if the Keystone XL pipeline is built, the contamination of this trade with tar sands crude is bound to grow significantly. The trend suggests the Canadian tar sands industry needs the EU petroleum products market for its growth strategy. This poses a dilemma for the EU and its member countries that have sought to position themselves as leaders in the effort to fight climate change.

The EU has adopted legislation that could restrict the import of the most carbon intensive fuels by giving them differentiated default values under the Fuel Quality Directive. This legislation must enshrine the strictest default values possible for diesel sourced from refineries that process high carbon tar sands crude. If the legislation fails to do this, it will encourage an increase not a decrease in the environmental impact of oil and make a mockery of Europe's claim to be leading the world in the fight against climate change. Without effective legislation Europe will send the wrong signals to the global market, locking in a high carbon infrastructure that will be in place for decades to come.

Greenpeace urges EU legislators to strengthen the Fuel Quality Directive so that petroleum products with any link to tar sands crude cannot find a market in the EU. We also encourage EU legislators and European governments to take bold steps to tackle the issue of declining conventional oil production through demand reduction measures. Strengthening support for vehicle efficiency, diversifying transport technologies through electric vehicles and hybrids, increasing and improving public transport and pursuing spatial planning policies that reduce wasteful travel will speed the decline in oil demand, improve air quality in our cities and towns, and enhance energy security.

RECOMMENDATIONS

i) Implement changes to the EU Fuel Quality Directive

European legislators must seize the opportunity provided by this directive and:

- introduce and implement a set of conservative default values for the GHG intensity of different sources of crude oil, including tar sands
- establish a GHG intensity ceiling at the earliest opportunity in the review of the Directive in 2012. This would guarantee that the most polluting fuels do not contaminate the European supply chain
- introduce the opportunity to take into account improvements in refinery efficiency
- Enable fuel suppliers to prove that they are performing better than the default values by investing in better technology, reducing flaring, switching to cleaner fuels and;
- introduce, with immediate effect, accurate and robust reporting of the carbon intensity of oil. This is necessary to create transparency for future reviews of the law.

ii) Reduce oil demand

While reducing the GHG content in transport fuels is helpful, much more can also be done to reduce oil demand. This will not only help tackle climate change and reduce the environmental impacts of extracting and refining petroleum products, but can also increase the resilience of the EU economy and its transportation system.

To reduce emissions and increase energy security, Greenpeace advocates the following hierarchy of principles for the transport sector:

- localise services and reduce the need to travel
- use fuel more wisely; and
- harness and develop clean technologies

These principles can be applied to both passenger transport and freight.

For Greenpeace's UK transport policy paper see appendix.

APPENDIX THE UK LEADING THE WAY: DECARBONISING ROAD TRANSPORT

Over the next two decades, given the right policies in the next parliament, Britain will be able to make the transformation to a healthy clean energy economy. Climate change, energy security and volatile oil prices demand that the country reduces its fossil fuel dependence. For the transport sector, this will require bold policies and clear vision. This challenge will bring huge opportunities: creating jobs in the development of new technologies, improving quality of life and strengthening local communities, and contributing to the health of Britain's people, industries and environment.

ROAD TRANSPORT POLICY FOR THE FUTURE

It is globally acknowledged that oil supply will be subject to huge pressures over the coming decades, which Deutsche Bank reports will lead to volatile prices.[145] Since 2005, the UK has returned to being a net-importer of primary oils. Exports in 2008 were 19% lower than imports, a difference of 12 million tonnes. As indigenous production continues to decline, the UK will be forced to import more and more oil[146] and the International Energy Agency (IEA) forecasts that OPEC's domination of the global oil trade is set to rise.[147] This, by implication, alerts us to the potential problems of a low diversity of supply.

Added to this, Britain faces other challenges: meeting our emissions targets, the obesity crisis, the fragmentation of local communities, a huge national deficit and an ageing population. These are all issues that affect and are affected by transport, and together, they offer compelling reasons why Britain must reduce oil demand, improve people's use of transport, decarbonise the transport sector and bring holistic thinking into transport policy. The results will provide huge benefits for both the economy and society as a whole.

The 2008 Climate Change Act commits the UK to reducing greenhouse gas (GHG) emissions by 80% below 1990 levels by 2050. Transport currently accounts for around one fifth to one quarter of the UK's total domestic emissions.[148] The majority of these (92%) come from road transport (52.5% from passenger cars, 19.8% from heavy goods vehicles, 15.2% from light goods vehicles and 4.5% from other road transport such as buses).[149] A carbon test needs to be placed at the heart of transport policy making in order to ensure we are on track to meet our emissions reduction targets. Given the dependence of road transport on high carbon oil, this approach will also help to re-orient the UK away from its damaging dependence on oil.

By 2050 the road transport sector can be better integrated, totally de-carbonised, economically efficient and powered from clean, secure energy sources. There are no technical, financial, organisational or other obstacles that would put this objective out of reach. All it requires is the political will to move boldly and decisively; for central government to give the right lead and allow local government and communities to implement effective solutions.

COSTS

Many of the initiatives that could make UK transport more resilient, healthy and low carbon, are low or zero cost on the public purse. Where investment is required, however, public finance could be redirected via the following programmes:

- Implement a two year moratorium on road expansion – saving £2.4bn over two years

- Cut the roads budget by a further £2.8bn once the method for calculating costs and benefits has been reformed to properly price costs of carbon and other negative impacts on society and the climate.

- Instigate a moratorium on fulfilling our biofuels obligation until sustainability standards are in place to protect forests, biodiversity and food prices. The money that would have been paid to biofuel producers in an increased fuel price could instead be levied by government and used elsewhere; and

- Put into practice other reforms to public expenditure as outlined in a recent Green Alliance paper.[150]

GUIDING PRINCIPLES

To reduce emissions and increase energy security, the following hierarchy of principles for the transport sector, both passenger and freight, must be adopted:

- localise services and reduce the need to travel

- use fuel more wisely, and

- harness and develop clean technologies.

POLICY GOALS

Below, we outline *why* each of these guiding principles is important, *what can be achieved* if this principle is applied and provide key examples of the kinds of *policies that can be employed* to achieve it. A short briefing cannot provide all the answers but shows key policies underlining the most desirable direction of travel. For clarity we have placed the policies under individual headings below, but they are in reality a package, working together to deliver the desired outcomes. We also recommend other analysis that would deliver supportive policies.[151]

Localise services and reduce the need to travel

Why?

There is currently huge inefficiency within the transport system, exacerbated by a mismatch between transport and planning policy. The result is that money and fuel are being wasted, communities are cut off from essential services (such as health centres and post offices) and, as we saw as recently as January 2010, vital UK distribution networks have been shown to be far from robust.[152] Some 57% of household car journeys are less than five miles, a further 37% are between five and 25 miles, and together they account for around two thirds of emissions from cars. Increasing car use has been linked to a rising obesity problem,[153] something which is expected to cost the National Health Service £6.3bn by 2015 if no action is taken.[154] Around one quarter of emissions from passenger journeys are due to commuting and a high proportion of these are single occupancy trips. Large numbers of lorries clog up traffic and cause significant physical damage to roads.

What can be achieved?

Localising services and reducing the need to travel (shrinking both the number of journeys made and the distances travelled) will have a huge impact: improving quality of life, creating more resilient and motivated communities, reducing carbon emissions as well as local air pollution, cutting the costs and improving the productivity of businesses and helping address the obesity problem.

Policies that can be employed

- **Adopt spatial and urban development strategies based on compact development.** Also known as smart growth,[155] this emphasises mixing land uses, clustering development, providing services locally and offering multiple transportation choices. The result is reduced congestion, less pollution and stronger, more motivated communities. If design is orientated around pedestrians and if road space is reallocated to bikes, buses and high occupancy vehicles, then urban car vehicle kilometres travelled (VKT) can be reduced by 10%[156] and urban car CO_2 emissions reduced by 11%.[157]

- **Prioritise walking and cycling and extend the smarter choices programme**. Implementing a 20mph speed limit on all residential roads in urban areas, would create the safe, calm conditions for walking and cycling needed to help people overcome their real fears about moving around sustainably in dangerous car-centric environments. The current government's smarter choices programme has had success, but requires political vision for it to be extended across the country to encourage greater walking, cycling and bus use.[158]

- **Implement a regional cooperation model for HGVs:** Greater cooperation, through better planning guidance and regulation, will stop large numbers of half empty vehicles making the same journeys by pooling available capacity to ensure the minimum journeys are made to distribute goods and services. Initial research suggests this has the capacity to reduce the kilometres driven by HGVs by up to 67%.[159]

- **Focus fresh attention on work related travel.** Workplace travel plans should be made mandatory and home working and tele-working promoted with the help of tax incentives. Increased home working and teleworking increases productivity, cuts costs for businesses and individuals, and improves quality of life for individuals who are able to spend more time at home.

Use fuel more wisely

Why?

Millions of tonnes of fuel are currently wasted by inefficient vehicles, unnecessary journeys and imports, and irresponsible use of these vital resources. The UK must drive to change this culture of waste as it prepares to make the transition away from fossil fuels to an economy based on clean and independent energy.

What can be achieved?

With the right incentives, the UK population can be encouraged to use fuel more wisely, which will bring savings for consumers and businesses, increase energy security, produce huge cuts in emissions, and help to drive forward the clean energy economy.

Policies that can be employed

- Implement a new European efficiency target of 80gCO_2/km average emissions by 2020. This achievable target will be an essential mechanism to drive the decarbonisation of road transport, encourage cleaner technologies and help to use remaining fuel more wisely

- Adopt strong targets for publicly owned fleets. The government should lead the way by setting an average level of CO_2 emissions from government procured cars. This level should reflect the range of lower emission vehicles available and should initially be set at 110g CO_2/km for cars purchased in 2011. The fleet average should go down to 100g CO_2/km by 2015 and to 80gCO_2/km or lower by 2020.

- Make public transport more accessible. London's transport system is an example of initiatives that could be taken across the country. By introducing and increasing workplace car parking charges, there will be greater uptake of public transport options, which will help cut congestion and emissions.[160] The revenue raised can be used to help improve public transport and so cut transport emissions. A 30% reduction in fares is predicted to cut car CO_2 emissions by 2%.[161] Local authorities should be given the power to re-regulate bus services to ensure that, as has happened in London, all routes are still served even though buses are provided by the private sector. This will ensure that all communities are connected and that consumers will still be able to expect a good standard of service, regular technological upgrades and fair prices.

- Give communities the power to run their own bus services. A German scheme in the state of North Rhine-Westphalia know as the 'Bürgerbus' or Citizens' bus has empowered local communities, provided vital connections, particularly for the older population, and reduced bureaucracy for local government.[162]

- Introduce a new lorry tax. Around 25% of our lorry capacity runs around empty. In Germany, a new lorry tax, the Lastkraftwagen Maut, has started to change this by using GPS satellite technology to charge all lorries a small tax per kilometre. This provides an incentive to businesses to reduce the number of trips by making better use of lorry capacity and improving efficiency.[163]

- Reintroduce the fuel price escalator. The practice of automatically increasing fuel tax ahead of inflation sends a clear message that it is in the interests of both the individual and the country as a whole to reduce oil dependency and CO_2 emissions. A 5% per annum fuel price escalator introduced from 2010 would result in a 40% reduction in CO_2 emissions for all fossil fuel powered road vehicles by 2050. In the absence of other supportive measure this will be unpopular, emphasising the need for a package approach to support access to services.

- Implement a package of fiscal measures to drive innovation in the vehicle supply chain and incentivise efficient vehicles. This can either be revenue neutral or it can be used to raise fresh money. The measures should include increasing the spread in vehicle excise duty between low and high efficiency vehicles, and the possible introduction of a car purchase tax – common in other EU countries – which does the same.

- Promote more responsible driving. Information campaigns, better vehicle maintenance, in-car information systems and courses on driving style (smoother driving) can all help reduce fuel use. Vehicle CO_2 emissions vary with speed: a reduction in the motorway speed limit to 60 mph, for example, would result in a 10% reduction in motorway CO_2 emissions.[164]

Harness new technologies

Why?

Developing new technologies will be vital in helping to bring the UK out of recession and on to a path towards a healthy long term clean energy economy. In an oil-scarce world, where policy demands a steep reduction in emissions, new technologies need to be employed to ensure we can continue to have clean mass transit where necessary, a healthy economy and energy independence. The New Automotive Innovation and Growth Team (NAIGT) has set out a roadmap, agreed by UK industry, that shows how automotive technology will need to develop to 2050 in order to tackle the CO_2 challenge.[165] Already Nissan has decided to use its plant in Sunderland as a base for the manufacture of its electric vehicles. Although innovations in internal combustion engine vehicles and types of electric hybrids will play a role in the intervening years, by 2050, road transport will be significantly made up of some combination of plug-in hybrids, electric vehicles and possibly hydrogen fuel cell vehicles.

What can be achieved?

A transport system that is driven by and is driving the clean energy economy; new jobs; increased energy independence.

Policies that can be employed

- Help to bring about a flourishing market for electric vehicles. Introduce a new car tax and business-in-kind company car tax band of 75g/km or less to help stimulate electric vehicles and hybrids. Raise the level of differentiation between bands by a factor of five.

- Continue to support the consumer rebate scheme for hybrid and electric vehicles and invest in a national electric vehicle recharging infrastructure.

- Support regulation such as the adoption of new European efficiency targets for car emissions. This not only drives efficiency in conventionally fuelled vehicles but also stimulates the uptake of very low carbon technologies.

- Invest in new technologies. Maintain and enhance low carbon economic areas (LCEA) to create regions in UK which can drive innovation and help stimulate research and development of low carbon vehicles.

- Raise standards. All passenger cars, vans, motorcycles and HGVs should be subject to standards on fuel efficiency that are progressively tightened over time, giving long term signals for innovation.

REFERENCES

1 Alex D. Charpentier, Joule A. Bergerson, and Heather L. MacLean. *Understanding the Canadian oil sands industry's greenhouse gas emissions*, in Environmental Research Letters 1 (2009)
2 Financial Times, Charlie Kirby, 17 January 2010. *Shell investors call for clarity*. And http://blog.platformlondon.org/rbstarsands
3 Based on 2005 figures in McKinsey and Company (2009). *Pathways to a low-carbon economy: version 2 of the global greenhouse gas abatement cost curve*
4 Ibid
5 Alex D. Charpentier, Joule A. Bergerson, and Heather L. MacLean. *Understanding the Canadian oil sands industry's greenhouse gas emissions*, in *Environmental Research Letters 1* (2009)
6 *Financial Times*, Charlie Kirby, 17 January 2010. *Shell investors call for clarity*
7 For the industry's view of why oil sands is their preferred term see www.capp.ca/canadaIndustry/oilSands/Pages/OilSands-or-TarSands.aspx#pbvLnWtDFEQG
8 See for example: Department of Energy, National Energy Technology Laboratory, 27 March 2009. *An evaluation of the extraction, transport and refining of imported crude oils and the impact on life cycle greenhouse gas emissions*. Analysis uses an average for Canadian oil sands that includes pre-upgraded and dilbit. This averaged figure is an underestimate as the upgrading step of pre-upgraded sources is not included. Even so, Canadian oil sands comes out as 38% more energy intensive to process into diesel than the average US feedstock based on 2005 figures
9 US Energy Information Administration, Company Level Imports data. Tar sands data origin determined using the following sources: US Customs, Automated Manifest Systems (AMS) data; CrudeMonitor.ca, Heavy Crude Monitoring Project data; Personal communication, Canadian Association of Petroleum Producers (CAPP)
10 Compiled from vessel bills of lading data, TradeIntelligence/UBM Global Trade
11 See Table 1
12 See Table 2; See also: *The Globe and Mail*, 28 January 2008. *The kinder, gentler energy superpower: Canada is the kind of oil supplier the US can rely on, and no one knows it better than the Texans*
13 *ExxonMobil Baytown area fact sheet*. Available at: www.exxonmobil.com/NA-English/files/Baytown_Area_Fact_Sheet.pdf
14 Data compiled from vessel bills of lading data, TradeIntelligence/UBM Global Trade.
15 US Energy Information Administration, Company Level Imports data. Tar sands data origin determined using the following sources: US Customs, Automated Manifest Systems (AMS) data; CrudeMonitor.ca, Heavy Crude Monitoring Project data; Personal communication, Canadian Association of Petroleum Producers (CAPP)
16 Personal communication, US Energy Information Administration, January 2010. Based on a sample size of five shipments
17 Personal communication, US Energy Information Administration, January 2010. Based on a sample size of 20 shipments
18 www.valero.com/OurBusiness/OurLocations/Refineries/Pages/PortArthur.aspx
19 Texas Gulf Coast average operable utilisation rate in 2008. Source: Energy Information Administration, *Petroleum Supply Annual* 2008, Volume 1, Table 17b. Refinery net input of crude oil and petroleum products by PAD and refining districts, 2008
20 A five month instead of 12 month time frame is used here because the Valero Port Arthur refinery does not appear in public data prior to June 2009. Coincidentally, the Pegasus pipeline expansion also opened in June 2009
21 Compiled from US Energy Information Administration, Company Level Imports data
22 Personal communication, US Energy Information Administration, January 2010. Based on a sample size of five shipments
23 Personal communication, US Energy Information Administration, January 2010
24 Overall industry utilisation rates are expected to have dropped in 2009. A lower utilisation rate for Valero Port Arthur in the latter half of 2009 will result in a higher level of contamination calculation
25 Data compiled from vessel bills of lading data, TradeIntelligence/UBM Global Trade
26 Ibid
27 Vessel bills of lading data, TradeIntelligence/UBM Global Trade; Vessel Automatic Identification System (AIS) data
28 Ibid
29 Ibid
30 US Energy Information Administration, *Distillate fuel oil exports by destination*, 2008
31 *ExxonMobil Pipeline Company expands capacity on its Pegasus pipeline to Gulf Coast region* www.businesswire.com/portal/site/exxonmobil/index.jsp?ndmViewId=news_view&ndmConfigId=1001106&newsId=20090617006156&newsLang=en
32 Canadian Association of Petroleum Producers, June 2009. *Crude Oil: Forecasts, Markets & Pipeline Expansions*
33 Ibid
34 TransCanada Keystone Pipeline GP Ltd., Keystone XL Pipeline application, submitted to the National Energy Board on 27 February 2009. Section 3: Supply and markets. Table 3-1: USGC refining market available to the Keystone XL Pipeline and Appendix 3-1: Supply and market assessment by Purvin & Gertz Inc., Table 3: PADD III refinery crude capacity 2008, Group 1 (Coastal refineries with direct pipeline access to Canadian crude)
35 BBC News, Will Grant, 17 September 2009. *China in huge Venezuela oil deal* http://news.bbc.co.uk/1/hi/8260200.stm. Also see: *The Globe & Mail*, Shawn McCarthy, 7 November 2009. *Deep in the refining heart of Texas, oil sands producers fight for their share*
36 TransCanada Keystone Pipeline GP Ltd., Keystone XL Pipeline application, submitted to the National Energy Board on 27 February 2009. Section 3: Supply and markets
37 Ibid
38 Canadian Association of Petroleum Producers, June 2009. *Crude oil: forecast, markets & pipeline expansions*
39 TransCanada website: www.transcanada.com/keystone/kxl.html
40 TransCanada website: www.transcanada.com/keystone
41 TransCanada Keystone Pipeline GP Ltd., Keystone XL Pipeline Application, submitted to the National Energy Board on 27 February 2009. Section 3: Supply and markets
42 Application for intervenor status submitted by Canadian Natural Resources Limited to the National Energy Board on 6/5/2009. File number OF-Fac-Oil-T241-2009-01 01. ['CNRL is a Keystone XL shipper']
43 Application for intervenor status submitted by Encana Corporation to the National Energy Board on 6 August 2009. File number OF-Fac-Oil-T241-2009-01 01. ['EnCana is a Keystone XL shipper']
44 *Globe and Mail*, Shawn McCarthy 1 December 2009. *In Texas, oil sands firms fight for their share: pipeline extension to Gulf Coast refineries is key for Canadian producers*; National Energy Board, regulatory documents C-10 relating to intervenors of TransCanada's application for the Keystone XL Pipeline (OH-1-2009)
45 TransCanada Keystone Pipeline GP Ltd., Keystone XL Pipeline application, submitted to the National Energy Board on 27 February 2009. Section 3: Supply and markets
46 Valero news release, 16 July 2008. ['Once the Keystone pipeline expansion is complete, Valero expects to be one of the largest recipients of heavy sour crude oil from this expansion']; Canadian Natural Resources Limited (CNRL), 2008 second-quarter results, 7 August 2008
47 See, for example ,Valero presentation at the Simmons Energy Conference, 1-2 March 2010, available at www.valero.com/NewsRoom/Events_Presentations/Pages/Home.aspx accessed on 9 March 2010. Similar presentations were made at Credit Suisse Energy Conference on 4 February 2010 and at Barclays Commodities Investor Conference in 2009
48 Application for intervenor status submitted by Valero Marketing and Supply Company to the National Energy Board on 6/8/2009. File number OF-Fac-Oil-T241-2009-01 01; written evidence of James Malott, director of trading for Valero Marketing and Supply Company, submitted to the National Energy Board on 30 July 2009. File number OF-Fac-Oil-T241-2009-01 01
49 Valero Energy website: www.valero.com/OurBusiness/OurLocations/Refineries/Pages/PortArthur.aspx
50 Application for intervenor status submitted by Valero Marketing and Supply Company to the National Energy Board on 6/8/2009. File number OF-Fac-Oil-T241-2009-01 01; Valero Energy, 2008 10-K SEC filings
51 Government of Canada, National Energy Board, *Canada's energy future: infrastructure changes and challenges to 2020 – an energy market assessment*. October 2009. ['CNRL and Valero have entered into an agreement where CNRL will supply crude oil to Valero refineries in Texas']; Dow Jones newswires, *Oil sands project delays could be boon for US refiners*, 8 January 2009. ['Canadian Natural Resources Ltd... agreed to supply 'a major US refiner' for 20 years via the Keystone pipeline. Several observers reckon the partner is Valero Energy Corp']; CNRL 2008 second quarter results, 7 August 2008. [CNRL has committed 120,000 bpd to Keystone XL, 100,000 bpd of which it has agreed to supply to 'an unnamed Gulf Coast refiner']
52 Compiled using source data from the government of Canada, National Energy Board (2003, 2006) and the Canadian Association of Petroleum Producers (2007, 2008, 2009)
53 Valero news release, 16 July 2008. ['The additional crude strategically aligns with our projects to increase ultra low sulfur diesel production at our Port Arthur refinery, which can process heavy feedstocks into clean products.']; Rich Marcogliese, executive VP and COO, Valero Energy Corporation, 4 September 2008. *Session 1: Today's vision – tomorrow's reality?*, presentation given at the 40th Annual Engineering and Construction Contracting Association Conference in Scottsdale, Arizona
54 Platts Oilgram News, Katharine Fraser, 31 December 2008. *Motiva Port Arthur expansion slows: Shell; Evaluating options for plans to create US' biggest refinery*
55 TransCanada Keystone Pipeline GP Ltd., Keystone XL Pipeline application, submitted to the National Energy Board on 27 February 2009. Section 3: Supply and markets. Table 3-1: USGC refining market available to the Keystone XL pipeline; and Appendix 3-1: Supply and market assessment by Purvin & Gertz Inc., Table 3: PADD III refinery crude capacity 2008, Group 1 (Coastal refineries with direct pipeline access to Canadian crude)
56 Compiled from vessel bills of lading data, TradeIntelligence/UBM Global Trade
57 See, for example, Platts Commodity News. 16 February 2010. *Global refiners facing four to five year margin slump: Wood Mac*; and *Galveston Daily News*, 28 February 2010. *Refiners facing tough times*
58 Cambridge Energy Research Associates, 19 June 2008. *'Peak Demand' – US gasoline demand likely peaked in 2007* www.cera.com/aspx/cda/public1/news/pressReleases/pressReleaseDetails.aspx?CID=9568
59 Cambridge Energy Research Associates, 29 September 2009. *Peak oil demand in the developed world: it's here* www.cera.com/aspx/cda/public1/news/researchHighlights/researchHighlights.aspx?CID=10635#10635
60 International Energy Agency. *World Energy Outlook 2009*
61 International Energy Agency, 11 February 2010. *Oil market report*
62 JBC Energy, June 2009. *Market Watch: special oil market analysis and outlook*. Subscription only
63 Platts Commodity News. 16 February 2010. *Global refiners facing four to five year margin slump*
64 Ibid
65 Calculated from US Department of Energy-Energy Information Administration data available at: www.eia.doe.gov/oil_gas/petroleum/info_glance/petroleum.html
66 Ibid
67 European Petroleum Industry Association (EUROPIA) *Annual Report 2008*
68 Ibid
69 See: *How an Oil Refinery Works* at www.europia.com/content/default.asp?PageID=412&DocID=13974
70 European Petroleum Industry Association (EUROPIA) *Annual Report 2008*
71 Ibid
72 *Diesel Fuel News*, Volume 13, Number 7. Jack Peckham, 30 March 2009. *Despite recent price fall, diesel will resume premium to gasoline: WoodMac*. Hart Energy Publishing
73 Ibid
74 Alan Gelder, Wood Mackenzie, March 2009. *US refining: prospect for recovery*. Presentation at the National Petrochemical & Refiners Association annual meeting, 22-24 March 2009, San Antonio, Texas
75 Calculated from US Department of Energy-Energy Information Administration data available at: http://tonto.eia.doe.gov/dnav/pet/pet_move_expc_a_EP00_EEX_mbbl_m.htm
76 EIA data does not show exports by destination for US regions
77 CQFD Disclosure. 28 July 2009. Transcript from Q2 2009 Valero Energy Corp. Earnings Conference Call – Final.
78 See for example Valero presentation at the Simmons Energy Conference, 1-2 March 2010, available at www.valero.com/NewsRoom/Events_Presentations/Pages/Home.aspx accessed on 9 March 2010. Similar presentations were made at Credit Suisse Energy Conference on 4 February 2010 and at Barclays Commodities Investor Conference on 9 December 2009 but have since been removed from Valero's website
79 Ibid
80 Alex D. Charpentier, Joule A. Bergerson, and Heather L. MacLean, *Understanding the Canadian oil sands industry's greenhouse gas emissions*, in *Environmental Research Letters* January 2009
81 Ibid.
82 Alex D. Charpentier, Joule A. Bergerson, and Heather L. MacLean, *Understanding the Canadian oil sands industry's greenhouse gas emissions*, in *Environmental Research Letters* January 2009
83 Based on Charpentier et al (2009)
84 Alex D. Charpentier, Joule A. Bergerson, and Heather L. MacLean, *Understanding the Canadian oil sands industry's greenhouse gas emissions*, in *Environmental Research Letters* (January 2009)
85 Page 1.
86 www.energy.ca.gov/low_carbon_fuel_standard/index.html
87 www.albertainnovates.ca/energy/major-initiatives/lca
88 www.albertainnovates.ca/media/15735/lca%20news%20release%20and%20backgrounder.pdf
89 Ibid.
90 See www-static.shell.com/static/can-en/downloads/aboutshell/aosp/unique_resource/CO2.pdf for Shell and www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/set_branch/set_investors/STAGING/local_assets/downloads/pdf/IC_AGM_oil_sands_resolution.pdf for BP.
91 See http://switchboard.nrdc.org/blogs/sclefkowitz/studies_confirm_tar_sands_dirt.html Also, see Charpentier et al and http://www.netl.doe.gov/energy-analyses/pubs/PetrRefGHGEmiss_ImportSourceSpecific1.pdf
92 All Africa.com 10 February 2010, Nigeria: FG Reiterates Commitment to End Gas Flaring. http://allafrica.com/stories/201002110421.html
93 Based on 2007 intensity of CO2e/barrel and production forecasts from Canadian Energy Research Institute (CERI), 3 November 2009. *Oil sands industry update: production outlook and supply costs 2009-2043, Media Brief*. CERI suggests that efficiency improvements could bring the 2041 figure down below 140 million tonnes per year
94 Northwest & Ethical Investments, November 2009. *Lines in the sands: oil sands sector benchmarking* www.ethicalfunds.com/en/Investor/ChangingTheWorld/HowWeWork/ResearchAndLobbying/Pages/LinesInTheSands.aspx
95 The Pembina Institute, November 2005, *Oil Sands Fever: The Environmental Implications of Canada's Oil Sands Rush*, p.21.
96 http://knowledge.allianz.com/en/globalissues/climate_change/top_climate_stories/g8_climatescorecards_2009_canada.pdf
97 Pembina Institute, March 2010. *Drilling deeper: the in situ oil sands report card*
98 Peter Lee and Ryan Cheng, Global Forest Watch Canada. September 2009. *Bitumen and biocarbon: land use conversions and loss of biological carbon due to bitumen operations in the boreal forests of Alberta, Canada* www.globalforestwatch.ca/climateandforests/bitumenbiocarbon/BioCarbon_WEB_LR.pdf
99 Ibid
100 *GHGenius update: final report*, 2008. Office of Energy Efficiency. Available at: www.ghgenius.ca/reports/FinalReportGHGenius2008Update.pdf
101 The Ethical Funds Company, October 2008. *Sustainability perspectives. unconventional risks: an investor response to Canada's oil sands* www.ethicalfunds.com/SiteCollectionDocuments/docs/Albertaoilsands_whitepaper.pdf
102 Ibid
103 Ibid
104 Pembina Institute, March 2010. *Drilling deeper: the in situ oil sands report card.* www.oilsandswatch.org/pub/1981
105 www.albertahealthservices.ca/files/rls-2009-02-06-fort-chipewyan-study.pdf
106 www.canada.com/topics/news/national/story.html?id=00686d4c-24d9-417d-9dd1-714592491e7f
107 Northwest & Ethical Investments, November 2009. *Lines in the sands: oil sands sector benchmarking* www.ethicalfunds.com/en/Investor/ChangingTheWorld/HowWeWork/ResearchAndLobbying/Pages/LinesInTheSands.aspx
108 Kevin P. Timoney and Peter Lee, 2009. *Does the Alberta tar sands industry pollute? The scientific evidence* in *The Open Conservation Biology Journal*. Volume 3, 2009. Pp 65-81(17)
109 Ibid
110 Pembina Institute, 2009. *Clearing the air on oil sands myths.* http://climate.pembina.org/pub/1839
111 Ibid
112 The Pembina Institute, August 2006. *Death by a thousand cuts: impacts of in situ oil sands development on Alberta's boreal forests.* www.oilsandswatch.org/pub/1262
113 Pembina Institute, 2009. *Clearing the air on oil sands myths.* http://climate.pembina.org/pub/1839
114 Ibid
115 Peter Lee and Ryan Cheng, Global Forest Watch Canada. September 2009. *Bitumen and Biocarbon: Land Use Conversions and Loss of Biological Carbon Due to Bitumen Operations in the Boreal Forests of Alberta, Canada.* www.globalforestwatch.ca/climateandforests/bitumenbiocarbon/BioCarbon_WEB_LR.pdf
116 The Pembina Institute, August 2006. Death by a Thousand Cuts: Impacts of in situ oil sands development on Alberta's boreal forests. www.oilsandswatch.org/pub/1262
117 Peter Lee and Ryan Cheng, Global Forest Watch Canada, September 2009. *Bitumen and biocarbon: land use conversions and loss of biological carbon due to bitumen operations in the boreal forests of Alberta, Canada* www.globalforestwatch.ca/climateandforests/bitumenbiocarbon/BioCarbon_WEB_LR.pdf
118 The Pembina Institute, June 2009. *Clearing the air on oil sands myths.* www.oilsandswatch.org/pub/1839
119 David J. Tenenbaum, April 2009. *Oil sands development: a health risk worth taking?* In *Environmental Health Perspectives* volume 117, number 4, April 2009
120 WWF-UK and The Co-operative Financial Services October 2009. *Carbon capture and storage in the Albertan oil sands: a dangerous myth.* www.co-operative.coop/Corporate/PDFs/Tar%20Sands%20CCS.pdf
121 Ibid
122 *International Oil Daily*, 29 September 2008. *Russia's Tatneft considers developing bitumen reserves alone.*
123 Heinrich Boll Stiftung, Sarah Wykes, 2009. *Energy futures? Eni's investments in tar sands and palm oil in the Congo Basin*
124 Economist Intelligence Unit – ViewsWire, 3 July 2009. *Madagascar industry: Total announces drilling programme at Bemolanga tar sands concession*
125 Reuters News, 13 February 2009. *Trinidad's Petrotrin to explore tar sands*
126 Diezani Alison-Madueke (Mrs.) Honourable minister of mines and steel development, Abuja, Nigeria, 26 June 2009. Presentation at seminar on *New strategic investment opportunities in Nigeria mining sector*, London. *Investment opportunities in Nigeria's bitumen resources*
127 US Geological Survey, October 2009. An estimate of recoverable heavy oil resources of the Orinoco oil belt, Venezuela. Available at http://pubs.usgs.gov/fs/2009/3028/pdf/FS09-3028.pdf
128 http://ostseis.anl.gov/guide/tarsands/index.cfm
129 Goldman Sachs Research, November 2009; and Deutsche Bank, Global Markets Research, October 2009
130 *Reuters fact box: oil production cost estimates by country* www.reuters.com/article/idUSLS12407420090728; and BMI Industry Insights – Oil & Gas, Americas, 9 February, 2009. *Special report – impact of global financial crisis on unconventional projects: the Canadian oil sands.*
131 *The Globe & Mail*, Nathan Vanderklippe, 5 March 2010. *Rising oil sands costs 'a worry'*
132 Canadian Energy Research Institute, 3 November 2009. *Oil sands industry update:production outlook and supply costs 2009-2043, Media Brief*
133 For more details on this, please see our previous report: *Shifting Sands: how a changing economy could bury the tar sands industry*. www.greenpeace.org.uk/files/pdfs/climate/shifting-sands-bp-shell-rising-risks-update-2.pdf
134 Cambridge Energy Research Associates, 29 September 2009. *Peak oil demand in the developed world: it's here* www.cera.com/aspx/cda/public1/news/researchHighlights/researchHighlights.aspx?CID=10635#10635
135 Financial Times Energy Source, Kate Mackenzie, *China's fears about imported oil.* http://blogs.ft.com/energy-source/2010/01/21/chinas-fears-about-imported-oil/ ; and Arthur D Little, February 2009. *The beginning of the end for oil? Peak oil: a demand-side phenomenon?* Available from www.adl.com/reports.html?&no_cache=1&view=356 following free registration
136 International Energy Agency, *World Energy Outlook 2009*
137 Op Cit. p.147
138 International Energy Agency, *World Energy Outlook 2009 Fact Sheet.* www.iea.org/weo/docs/weo2009/fact_sheets_WEO_2009.pdf
139 International Energy Agency, *World Energy Outlook 2009*. p.168
140 Op Cit p.195
141 Op Cit. P.332
142 Op Cit. P.216
143 For more information on Article 7a of the FQD, see www.transportenvironment.org/Publications/prep_hand_out/lid/550
144 Reuters Canada, 24 March 2010. EU yields to Canada over oil trade 'barriers': sources. http://ca.reuters.com/article/domesticNews/idCATRE62N3T920100324 See p15 'Valero targets Europe with tar sands', 50% owned by Shell and 50% by Saudi Aramco. Based on it running all of its potential heavy sour capacity (248,000 b/d) on tar sands crude. From here on we shall refer to all distillates and gasoil as diesel or diesel fuel

Apendix References
145 *The peak oil market: price dynamics at the end of the oil age*. Deutsche Bank Global Markets Research, 4 October 2009
146 Digest of United Kingdom energy statistics (DUKES): 2009 edition, Chapter 3: *Petroleum*
147 International Energy Agency, *Medium-term oil market report*, June 2009
148 In 2008, transport was responsible for 21% of all GHG emissions, and 22% of carbon dioxide emissions (the most important GHG gas). In 2006, transport was responsible for 24% of emissions. Source: DECC, UK final 2008 GHG emissions, 2 February 2010
149 *Carbon pathways: informing development of a carbon reduction strategy for transport*, DfT analysis, June 2008
150 Hewett, C. *Cutting back on carbon spending*. Green Alliance. February 2010. www.green-alliance.org.uk/grea1.aspx?id=3938
151 See for example, *Improving everyday transport: a manifesto for change,* Campaign for Better Transport, Campaign to Protect Rural England, CTC, Friends of the Earth and Living Streets, January 2010. This publication also contains suggestions for finding other sources of revenue. www.bettertransport.org.uk/system/files/Manifesto_Jan10.pdf
152 www.guardian.co.uk/environment/2010/jan/15/carrots-vegetable-shortage-predicted-supermarkets
153 www.nationalschool.gov.uk/policyhub/news_item/obesity_cars07.asp
154 *Healthy weight, healthy lives toolkit: a toolkit for developing local strategies*. DoH, PCT figures, October 2008
155 See for example, Smart Growth America www.smartgrowthamerica.org/sghowto.html
156 Dierkers, G., Silsbe, E., Stott, S., Winkelman, S., & Wubben, M. CCAP. *Transportation emissions guidebook – Part one: land use, transit & travel demand management*, Center for Clean Air Policy, Washington, DC. 2005
157 Cairns *et al.*, 1998
158 www.dft.gov.uk/pgr/sustainable/smarterchoices/
159 Holzapfel, H (1995) Potential forms of regional economic co-operation to reduce goods transport, World Transport Policy and Practice, 1,2,34-39 www.eco-logica.co.uk/pdf/wtpp01.2.pdf
160 Litman, 2009
161 UKERC, 2009b
162 www.vbn.de/en/busse/05-buergerbus.shtml
163 www.bmvbs.de/en/Transport/Roads-,2955/Innovative_-ecological-and-fai.htm
164 Commission for Integrated Transport. *Transport and climate change: CfIT Response to DEFRA Consultation*. 2005 www.thepep.org/ClearingHouse/docfiles/Transport.and.Climate.Change.pdf
165 NAIGT, *An independent report on the future of the automotive industry in the UK*. New Automotive Innovation and Growth Team. 2009

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Written and researched by Lorne Stockman on behalf of Greenpeace.
With thanks to The Borealis Centre for the substantial additional research provided. www.borealiscentre.org

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May 2010

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