

Transport av kol och olja

Föreläsning 2010-08-31
Energitransporter MVKN10
Svend Frederiksen
LTH



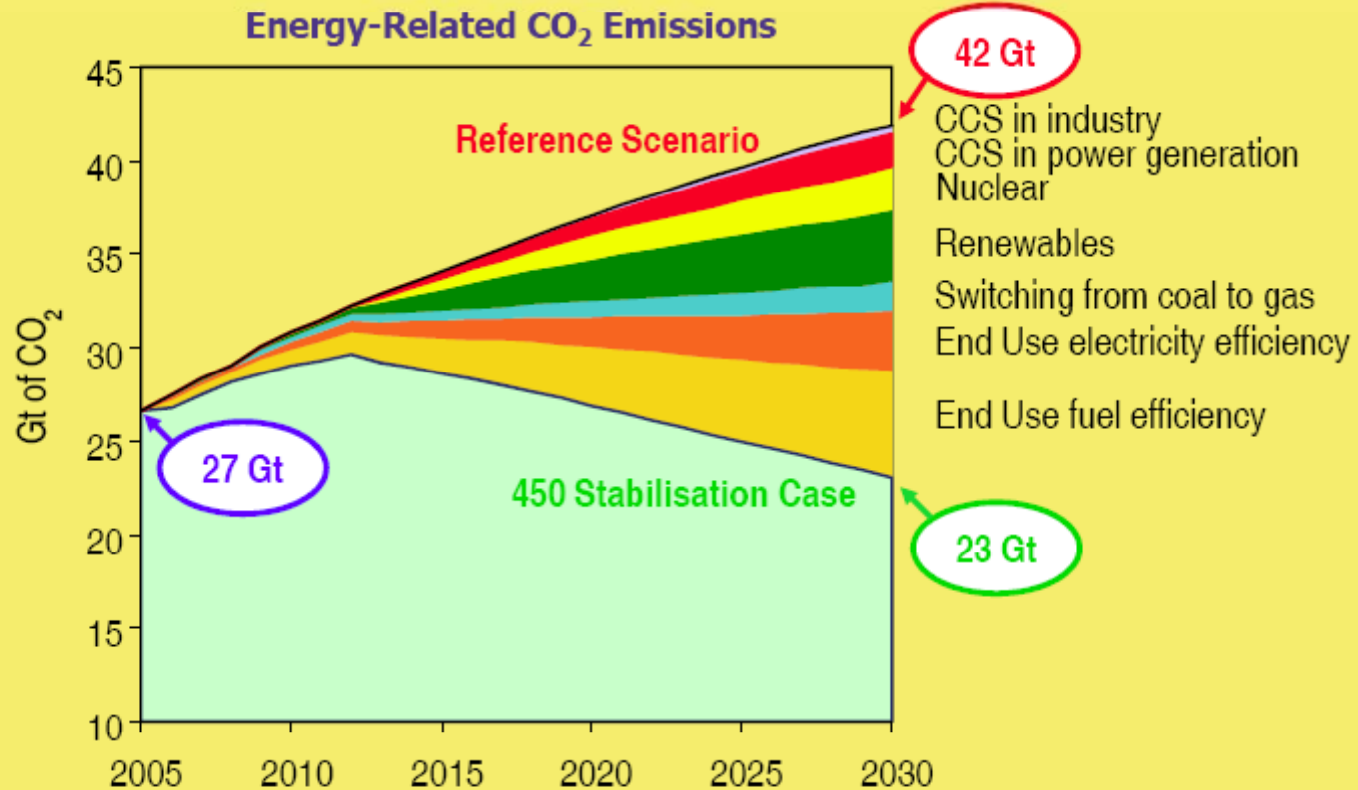
INTERNATIONAL
ENERGY AGENCY

WORLD
ENERGY
OUTLOOK
2007

China
and India
Insights

© OECD/IEA - 2007

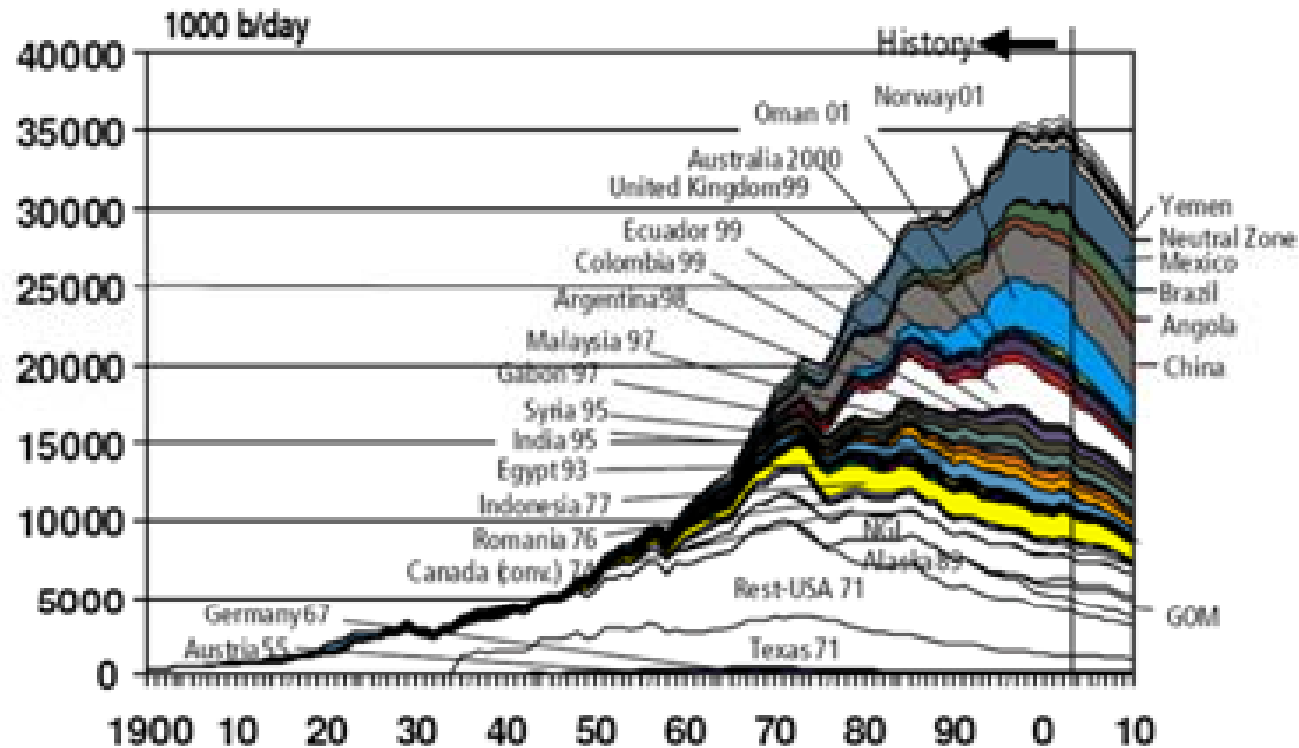
CO₂ Emissions - 450 Stabilisation Case



In line with G-8 appeal in Heiligendamm, by 2030 emissions are reduced to some 23 Gt

Peak oil

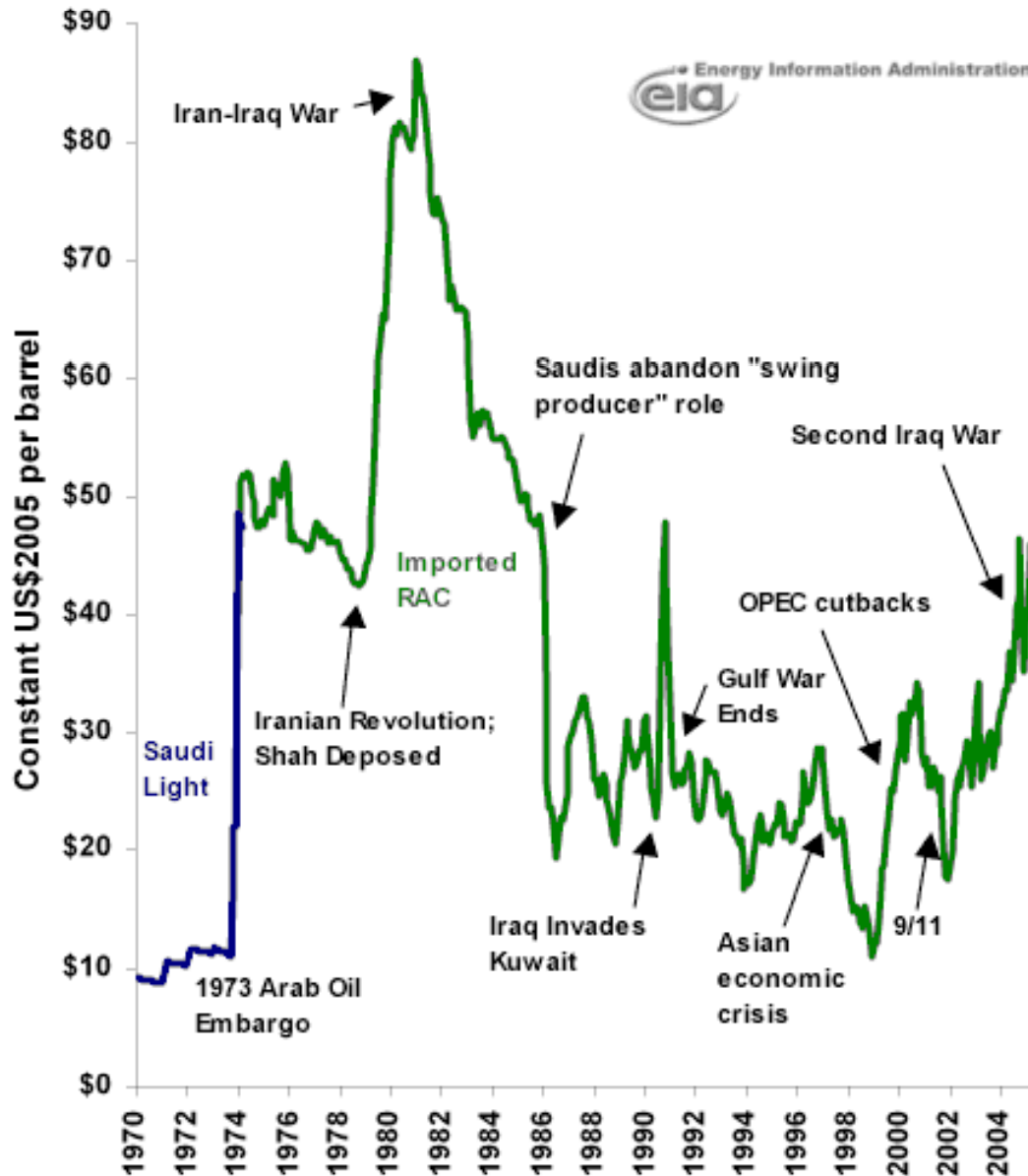
From Wikipedia, the free encyclopedia



Source: Industry database, 2003 (IHS 2003)
OGI, 9 Feb 2004 (Jan-Nov 2003)

Major Events and Real World Oil Prices, 1970-2005

(Prices adjusted by CPI for all Urban Consumers, 2005)



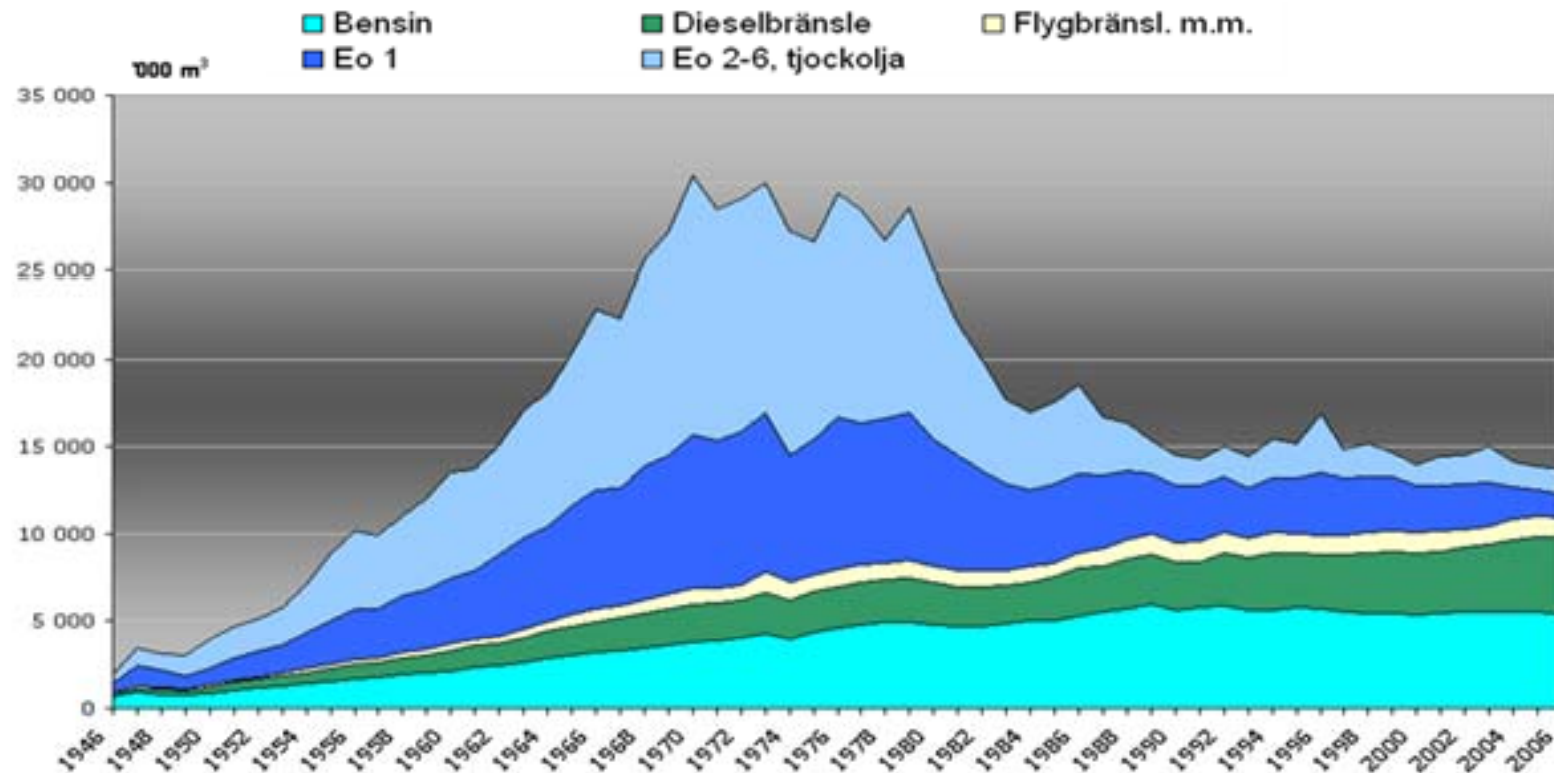
Crude Oil and Commodity Prices

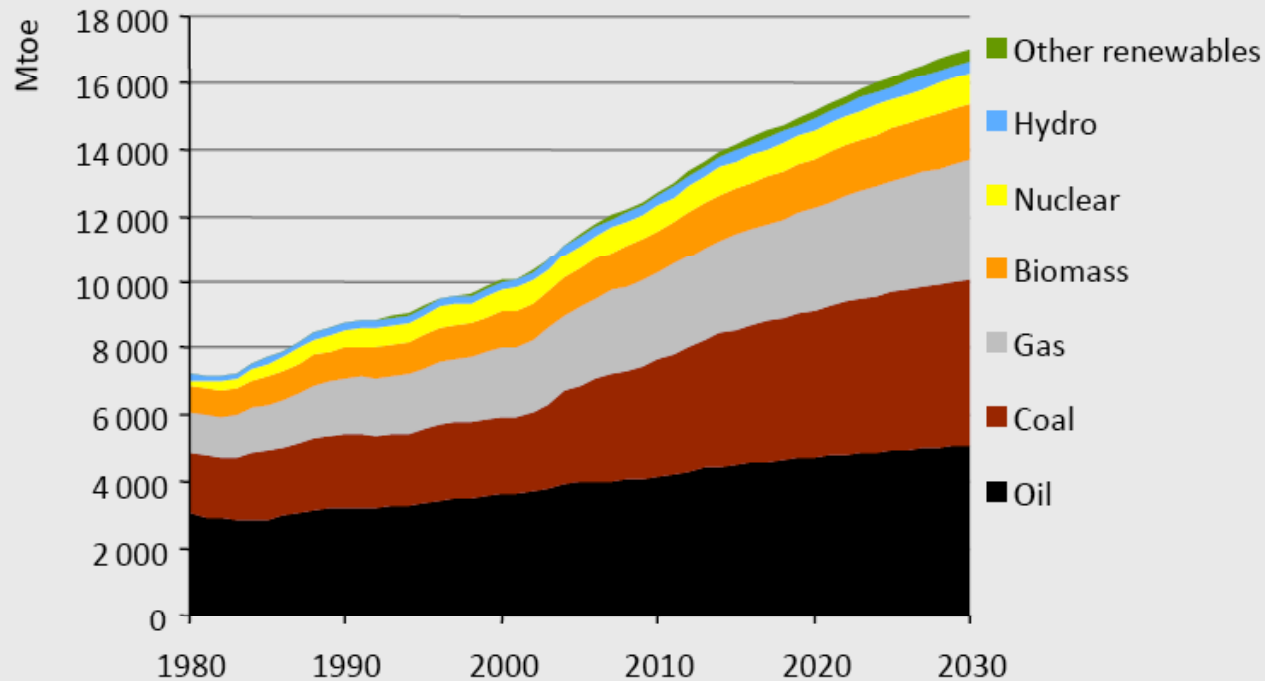
August, Tuesday 31 2010 - 04:17:34



Långtidsserie oljeprodukter

Leveranser av oljeprodukter i Sverige, långtidsserie





World energy demand expands by 45% between now and 2030 – an average rate of increase of 1.6% per year – with coal accounting for more than a third of the overall rise

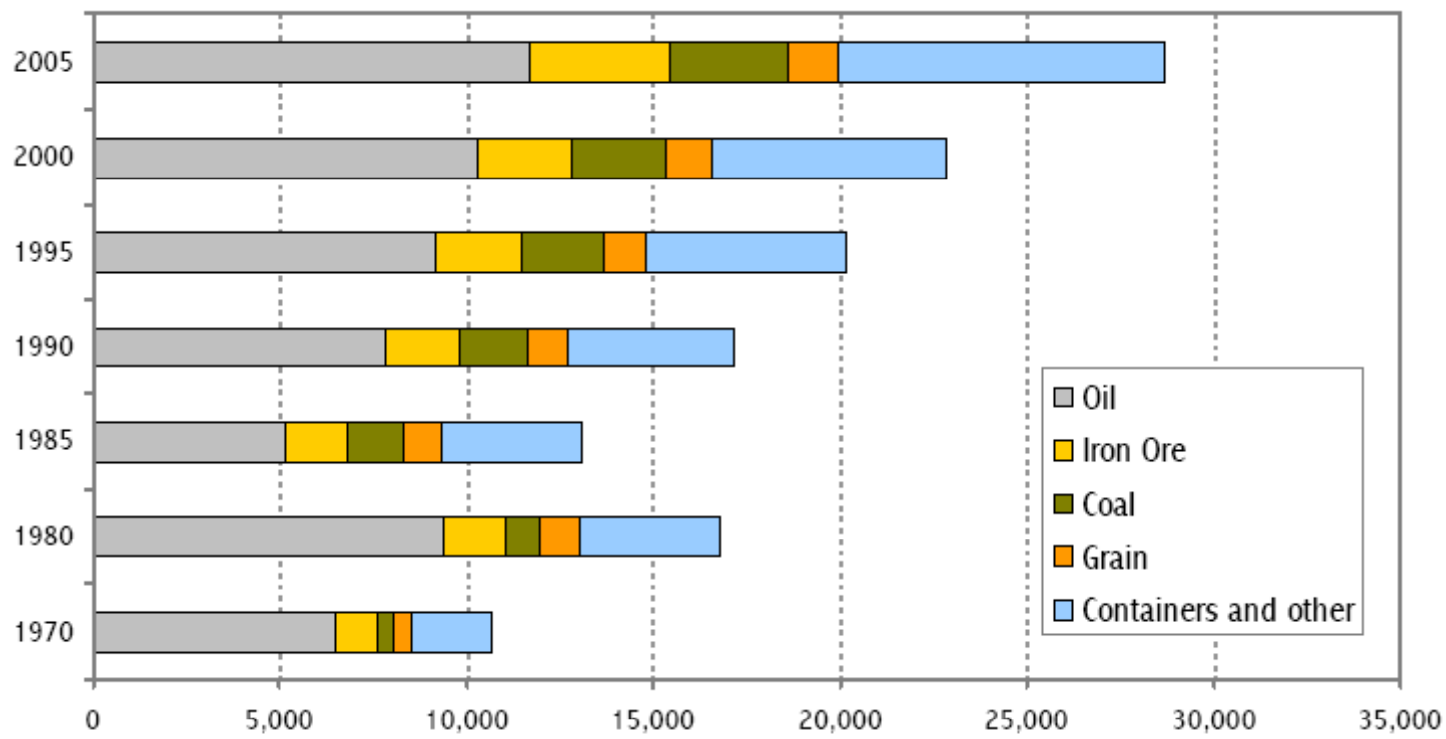

















Figure 1 Ton-miles Shipped by Maritime Transportation, 1970-2005 (in billions)

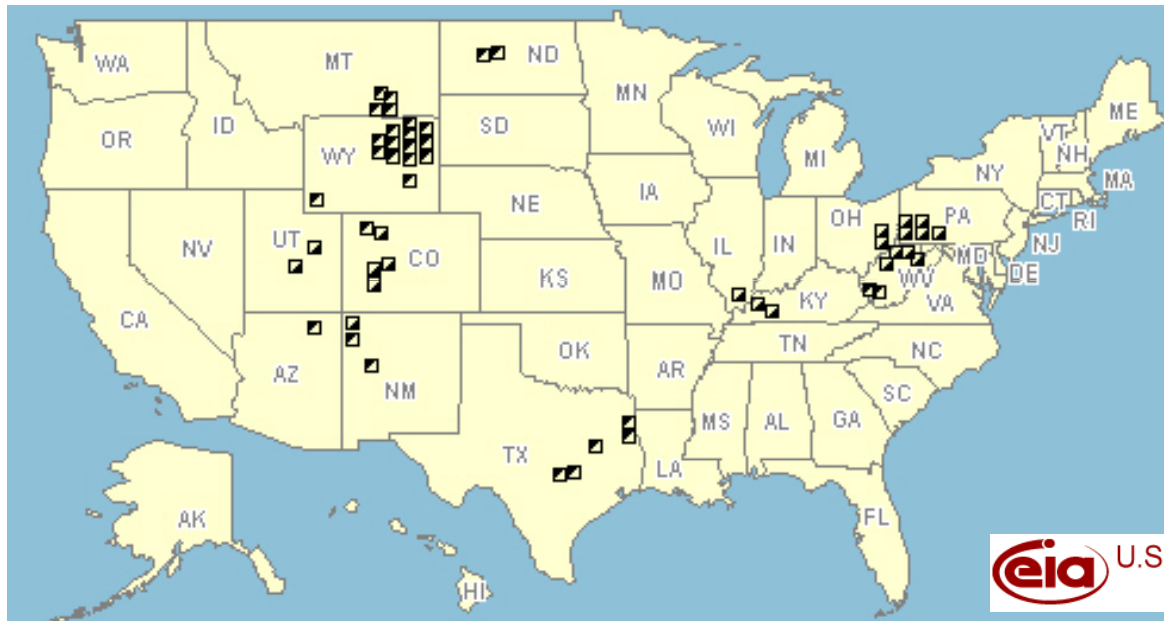
Källa: Rodrigue & Browne:
 "International Maritime Freight Transport and Logistics",
 Chapter 10, "Transport Geographics"

Vilket land har mest reserver av kol?

(Samma land som producerar mest naturgas)

Proved recoverable coal reserves at end-2006 (million tonnes (teragrams))^[62]

Country ✉	Bituminous & anthracite ✉	SubBituminous & lignite ✉	TOTAL ✉	Share ✉
 United States	111,338	135,305	246,643	22.51
 Russia	49,088	107,922	157,010	14.33
 China	62,200	52,300	114,500	10.45
 India	90,085	2,360	92,445	8.44
 Australia	38,600	39,900	78,500	7.17
 South Africa	48,750	0	48,750	4.44
 Ukraine	16,274	17,879	34,153	3.12
 Kazakhstan	28,151	3,128	31,279	2.86
 Poland	14,000	0	14,000	1.28
 Brazil	0	10,113	10,113	0.92
 Germany	183	6,556	6,739	0.62
 Colombia	6,230	381	6,611	0.6
 Canada	3,471	3,107	6,578	0.6
 Czech Republic	2,094	3,458	5,552	0.5
 Indonesia	740	4,228	4,968	0.45

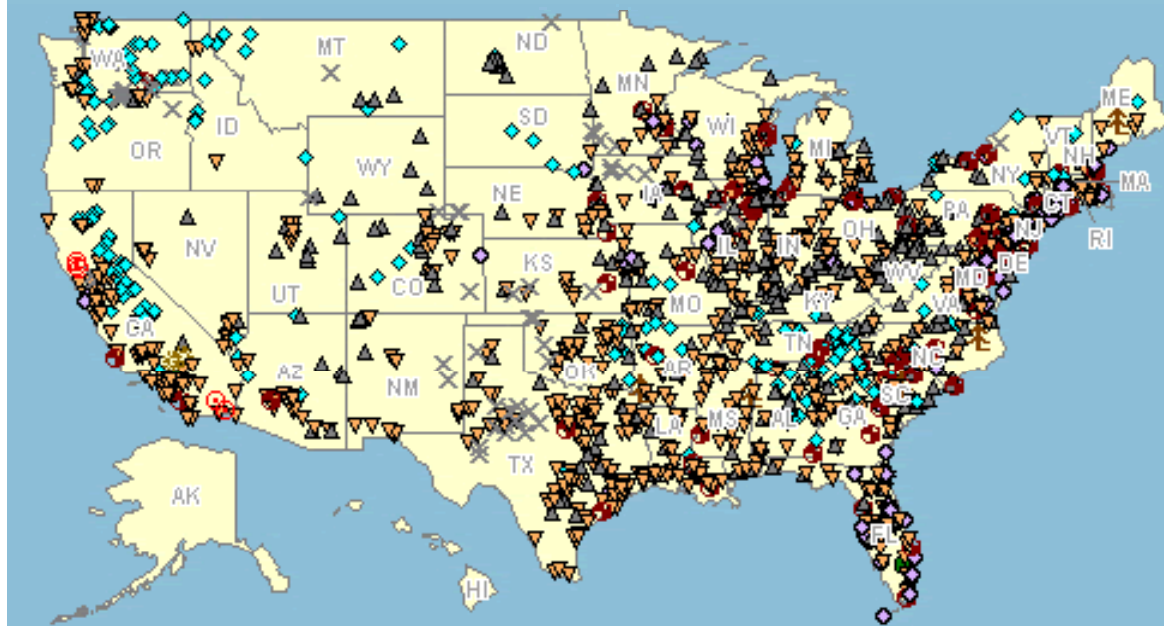


Coal Mines

Min. production of 4 million short tons in 2007
(Values below are U.S. totals)

- ▣ Surface (31)
- Underground (21)

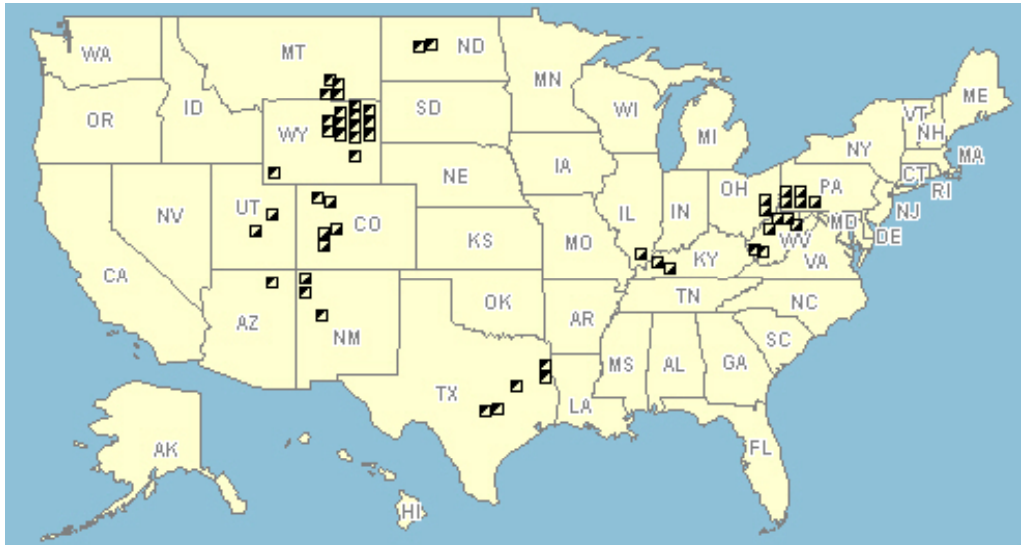
 U.S. Energy Information Administration
Independent Statistics and Analysis



Electric Power Plants

Min. net summer capacity of 100 megawatts
(Values below are U.S. totals)

- ▽ Natural Gas (748)
- ▲ Coal (390)
- ◆ Hydro (182)
- ◇ Petroleum (105)
- ⊕ Nuclear (66)
- × Wind (59)
- 🌲 Wood (5)
- ⊙ Geothermal (5)
- ☀ Solar (2)
- Other Renewable (2)



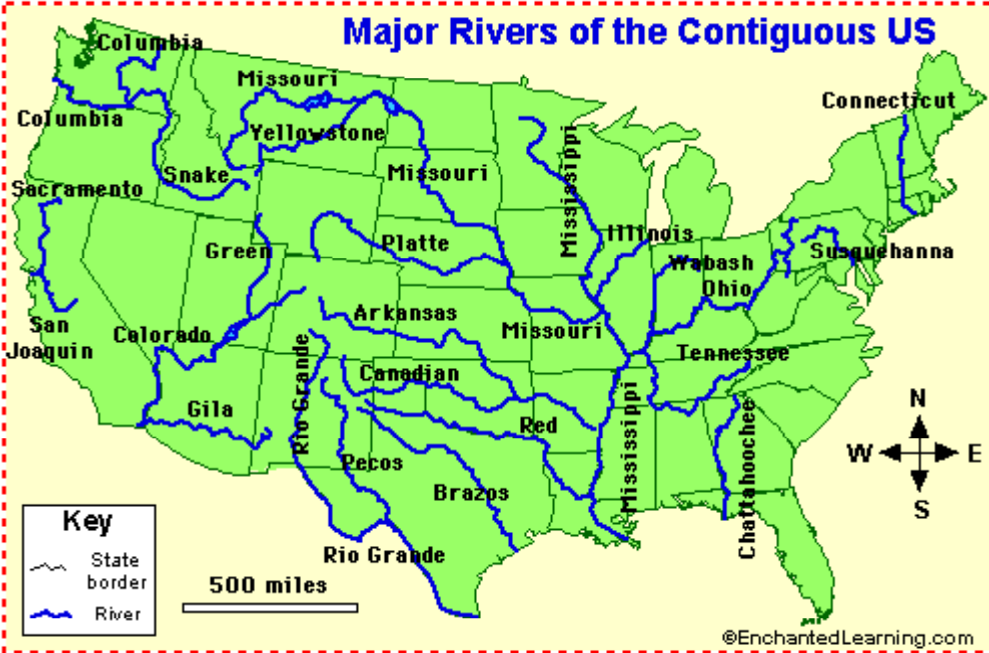
Coal Mines

Min. production of 4 million short tons in 2007
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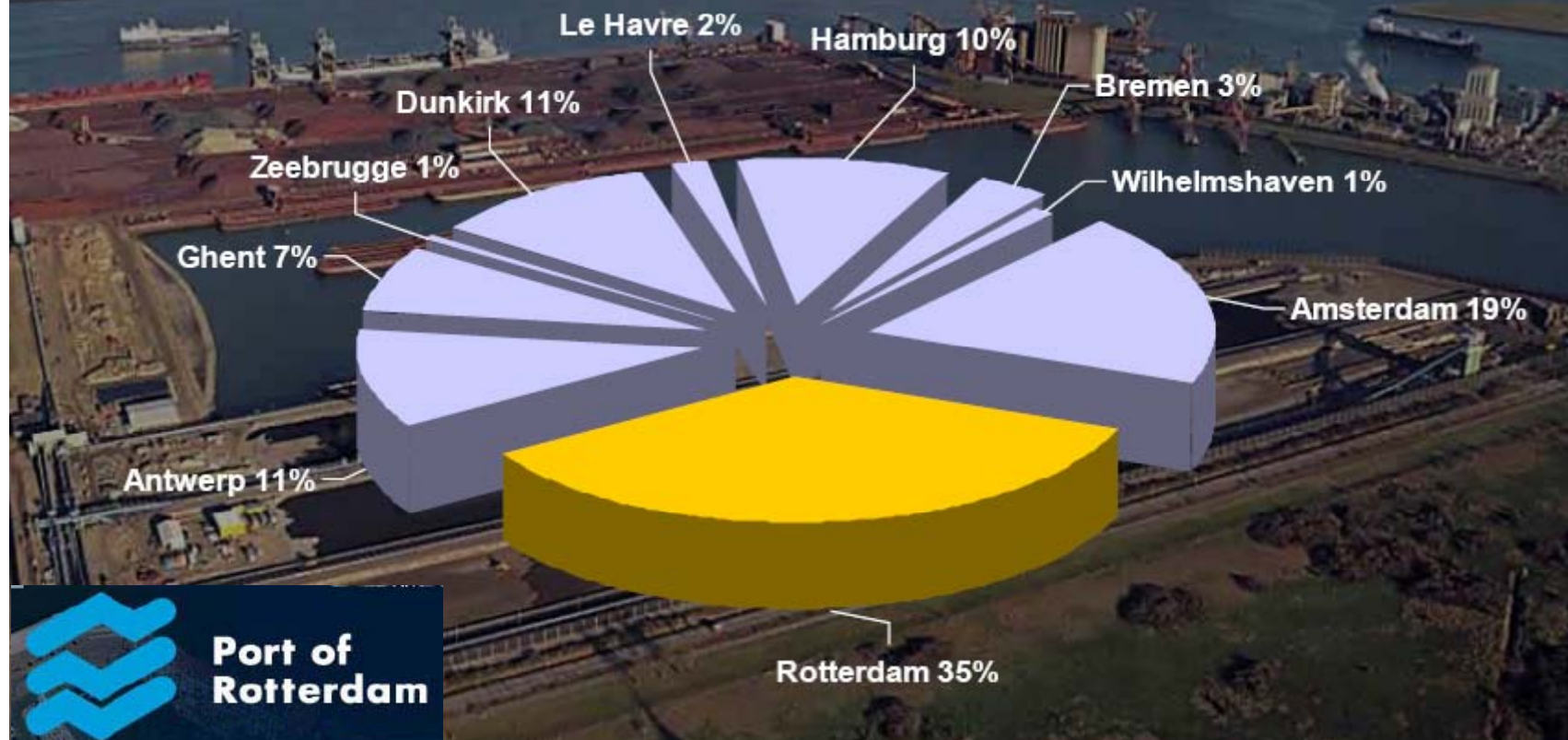
 U.S. Energy Information Administration
Independent Statistics and Analysis

49% of US electric power production is based on coal



Coal Barge on The Mississippi River
800 x 627 - 70k - jpg
outdoors.webshots.com

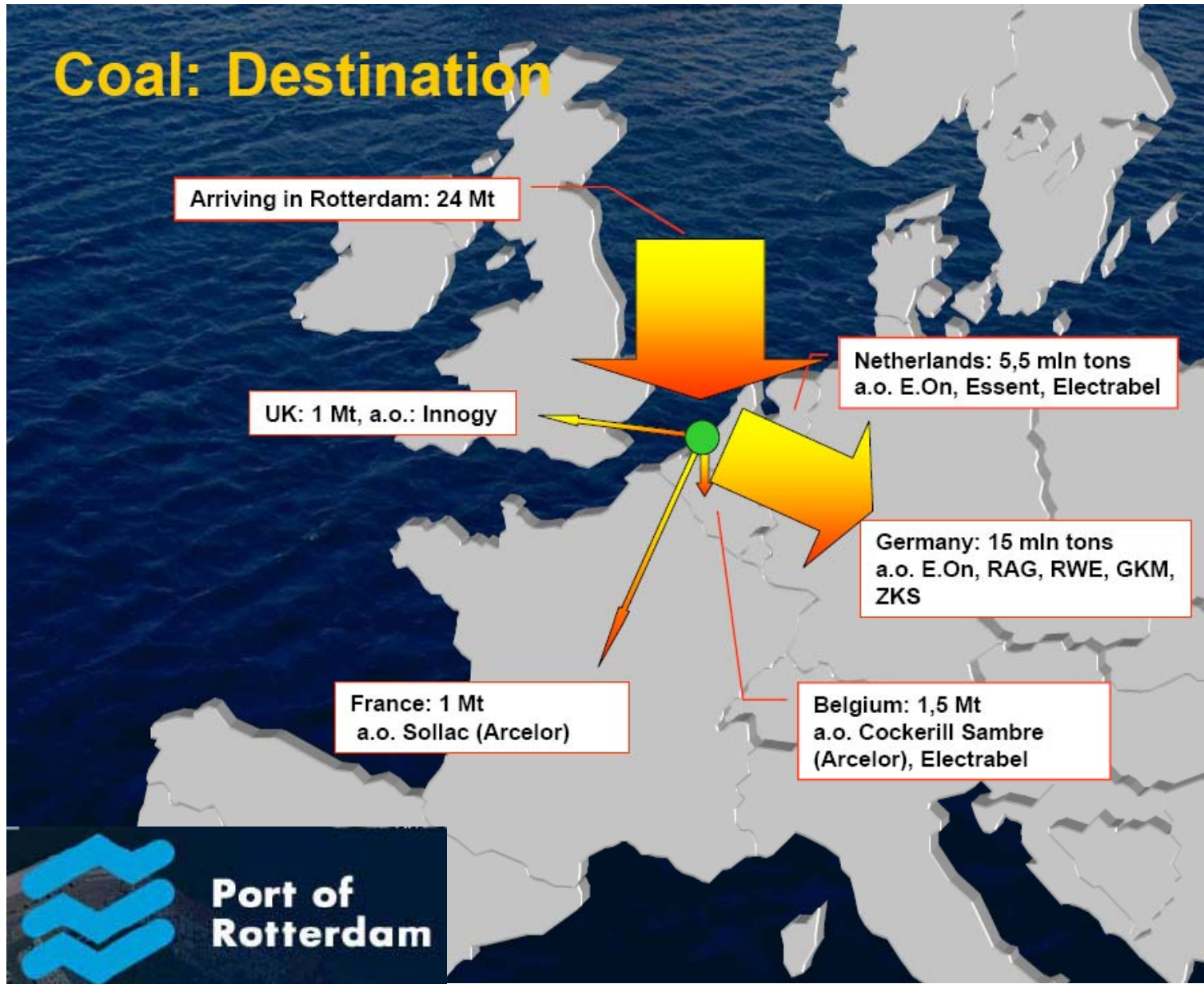
Rotterdam is by far Europe's largest dry bulk port (2004)



EECV



Coal: Destination



01/30/2007

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End of an Industrial Era

Germany to Close its Coal Mines

Germany will shut down its eight remaining black coal mines by 2018 under a plan which seals the fate of the sector that powered the country's industrial revolution and post-war economic miracle. Unlike in Britain, Germany's mining phase-out has been gentle.

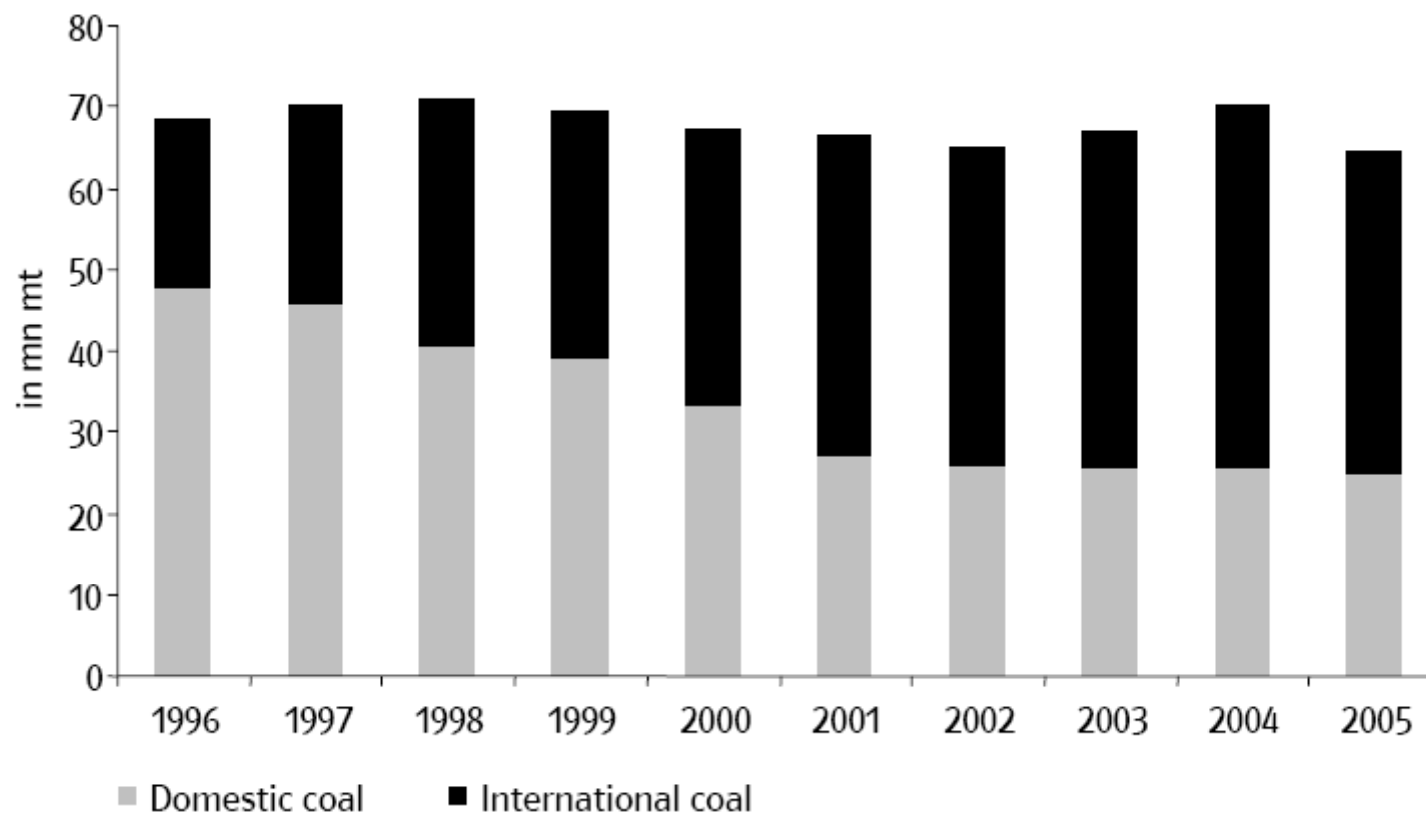


DPA

Chancellor Angela Merkel's government has decided to close Germany's eight remaining coal mines by 2018, sounding the death knell for a sector that still employs 35,000 people.












However, the phase-out will be reviewed by parliament again in 2012 to see if it still makes economic sense. And the agreement pledges to avoid forced redundancies. "The miners are definitely secure," said Social Democrat leader Kurt Beck, who took part in the talks.

Situation of hard coal in Germany (- 2010)

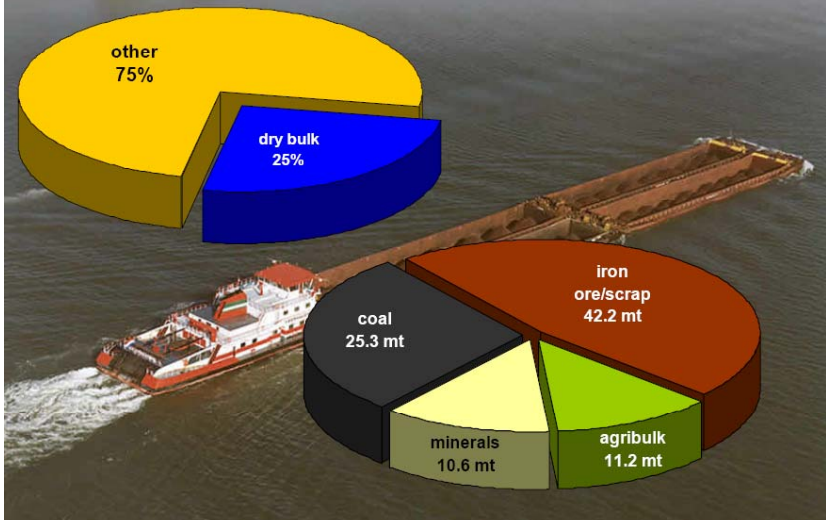


Vilket land exporterar mest kol?

Exports of Coal by Country and year (million short tons)

Country 	2008 	Share 
 Australia	278.0	25.6%
 Indonesia	228.2	21.0%
 Russia	115.4	10.6%
 USA	83.5	7.7%
 Colombia	81.5	7.5%
 China	68.8	6.3%
 South Africa	68.2	6.3%
 Canada	36.5	3.4%
Total	1,087.3	100%

Throughput 2004: 352 mln tons
dry bulk: 89 mln tons



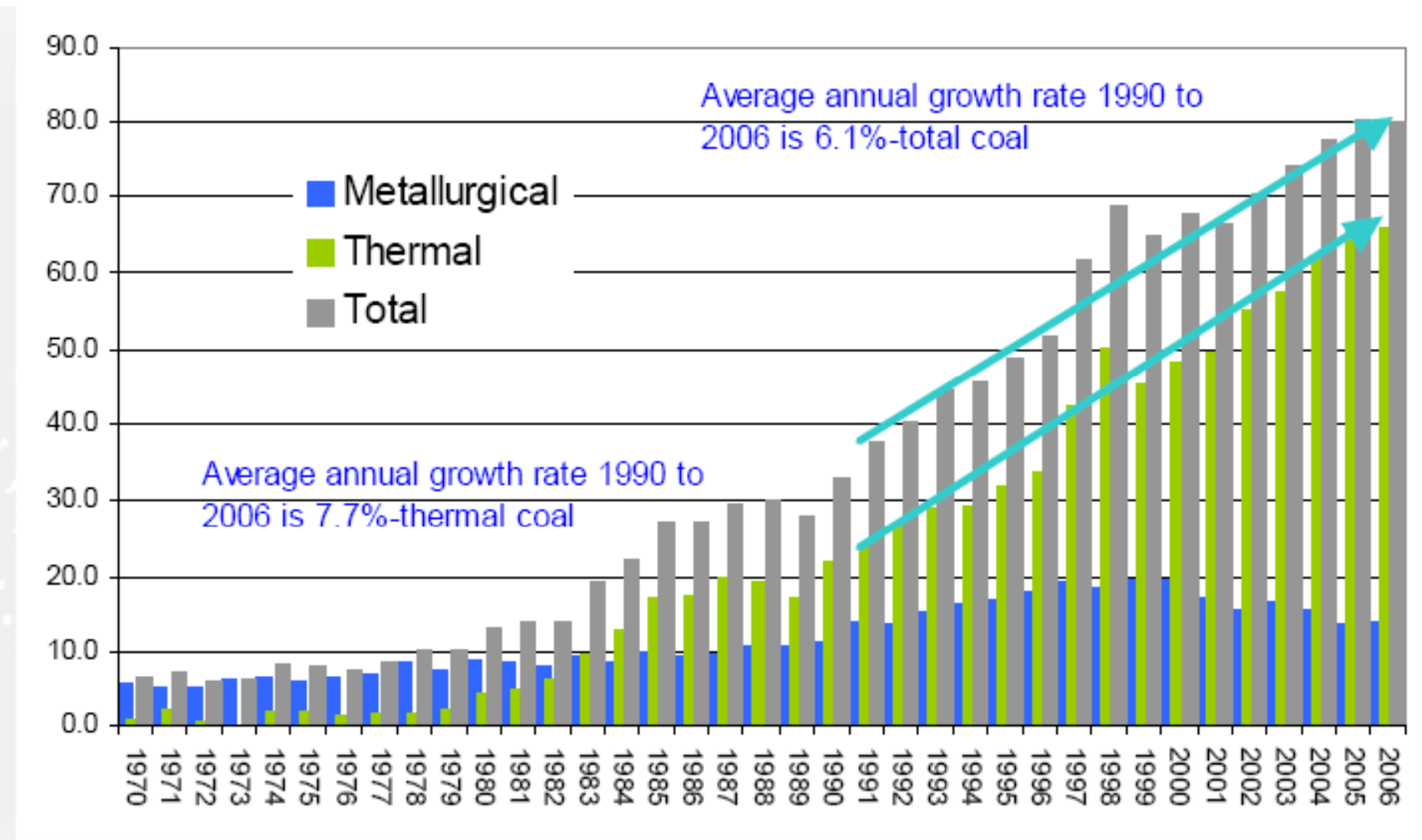
Iron Ore

Coal

Origin	%	Origin	%
Brazil	62	South Africa	34
Canada	15	Australia	24
Australia	10	Columbia	18
Mauretania	6	USA	10
Norway	4	Indonesia	9
South Africa	3	Other	5



Newcastle Coal Exports (Mt)



Source: Barlow Jonker

COALFIELDS OF NEW SOUTH WALES

CIC
Coal Industry
Centre













GREENPEACE
Australia Pacific

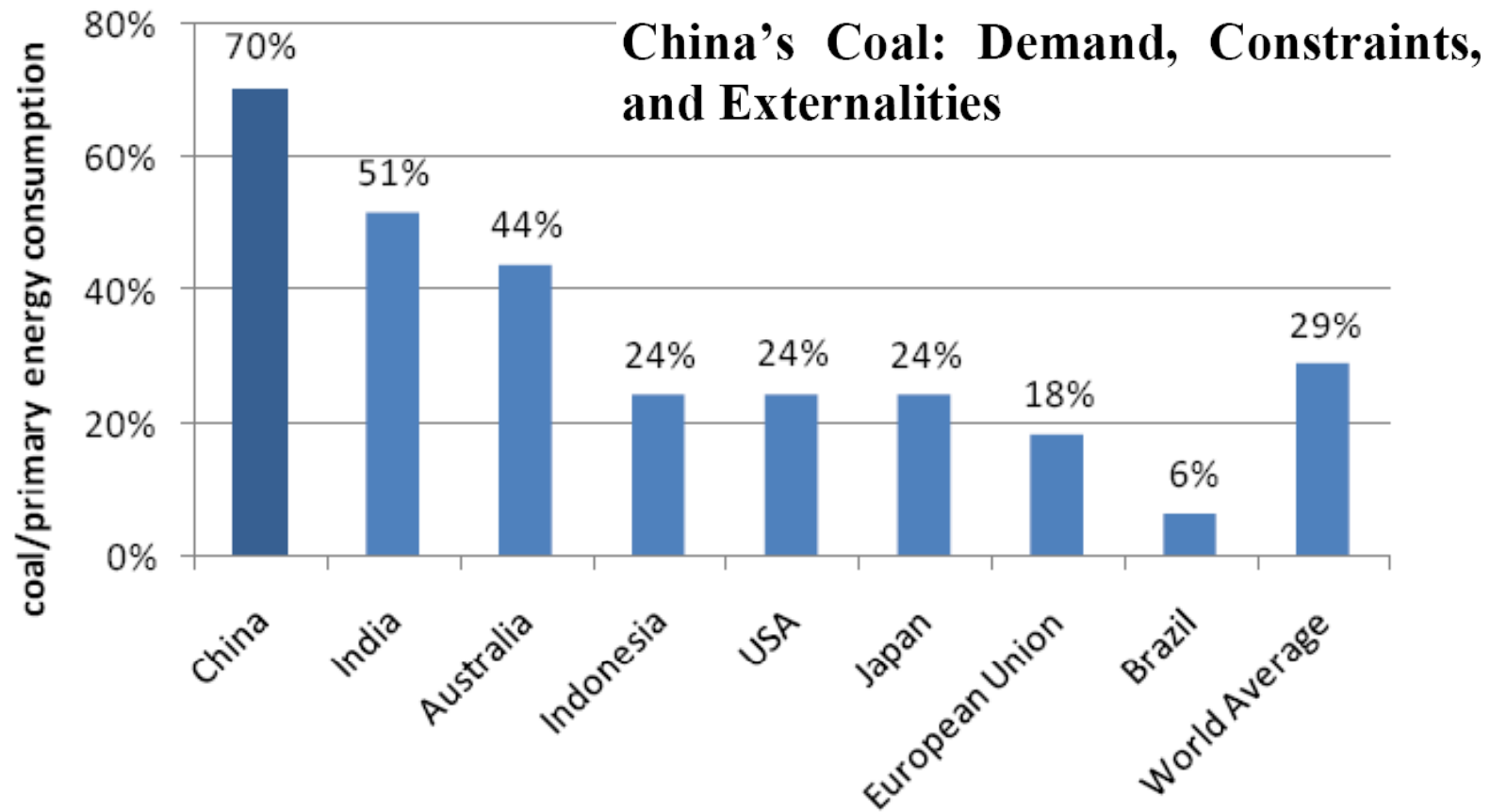
The coal chain



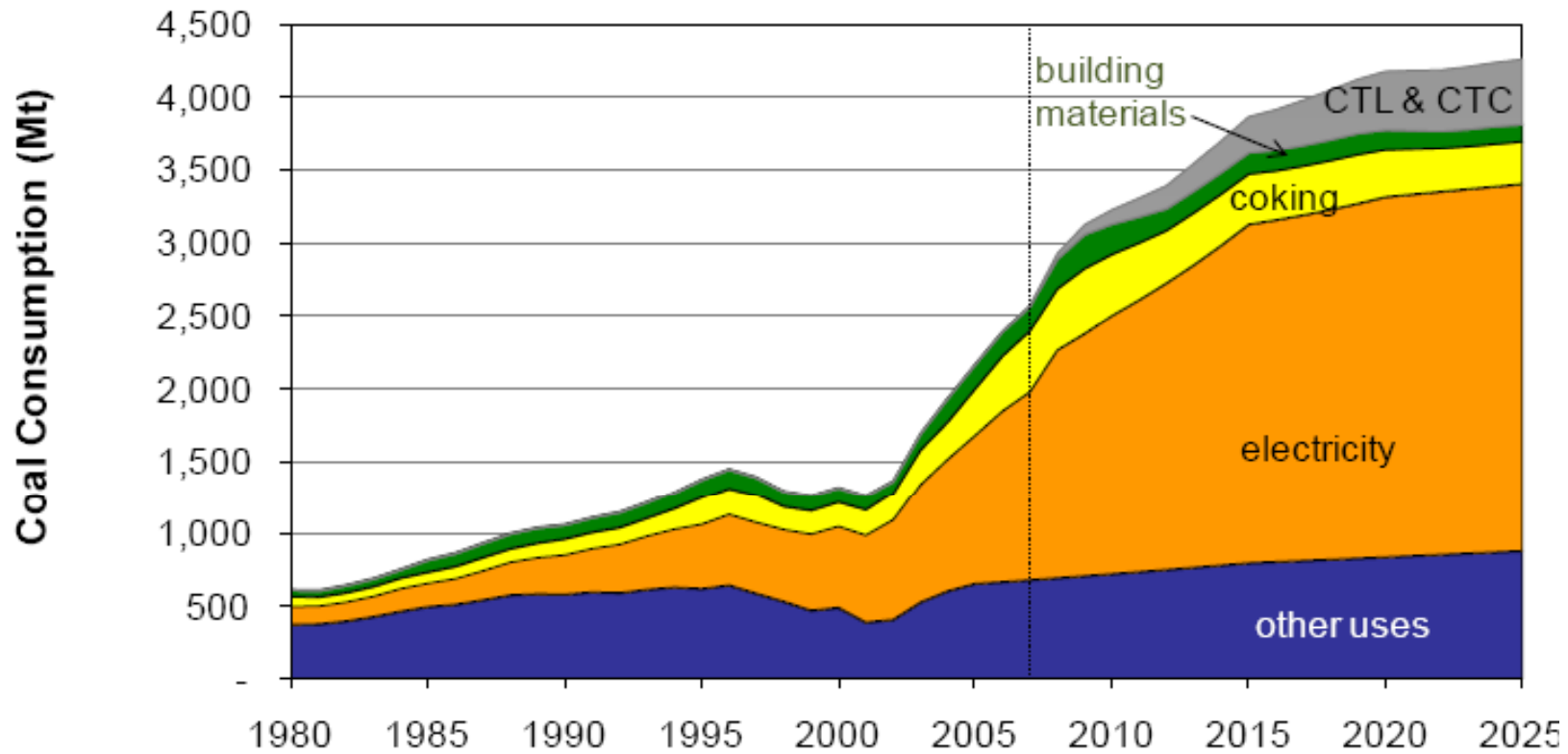
Vilket land är mest beroende av kol?

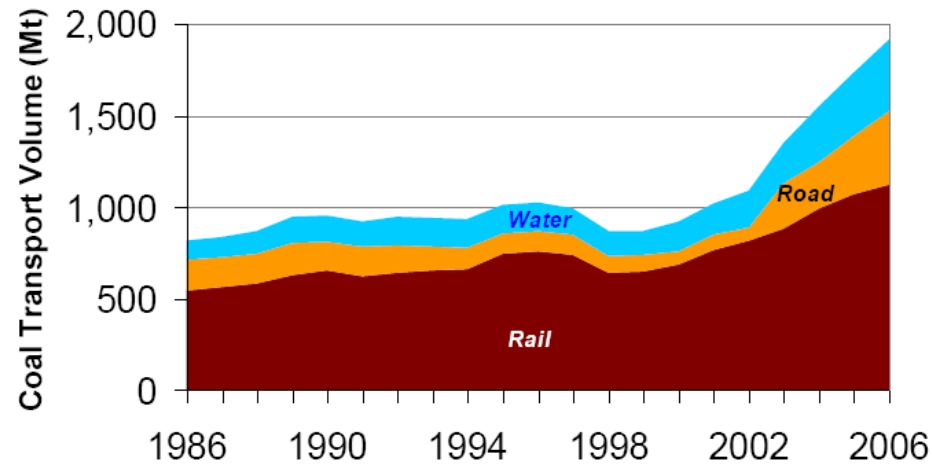
Production of Coal by Country and year (million tonnes)[[]

Country ✕	2008 ✕	Share ✕	Reserve Life (years) ✕
 China	2782.0	42.5 %	41
 USA	1062.8	18.0 %	224
 EU	587.7	5.2 %	51
 India	521.7	5.8 %	114
 Australia	401.5	6.6 %	190
 Russia	326.5	4.6 %	481
 South Africa	250.4	4.2 %	121
 Indonesia	229.5	4.2 %	19
 Germany	192.4	3.2 %	35
 Poland	143.9	1.8 %	52
Total World	6781.2	100 %	142

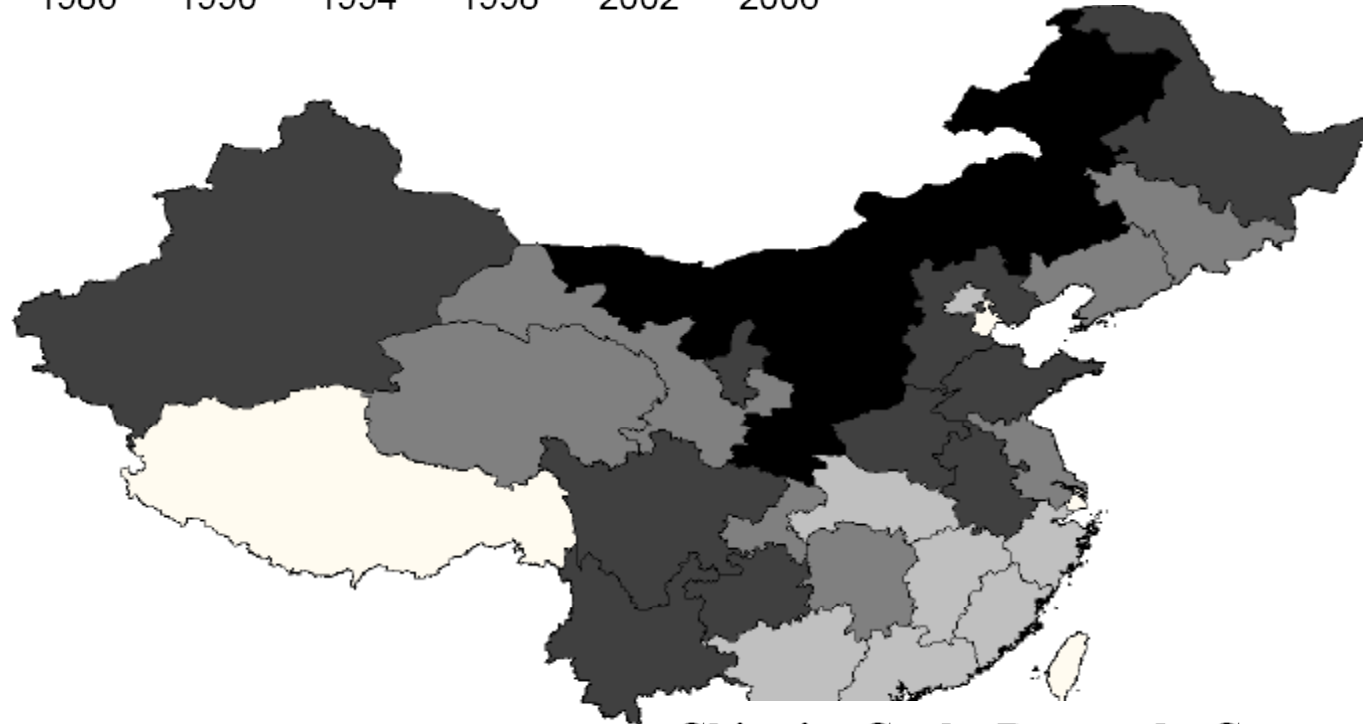


**China's Coal: Demand, Constraints,
and Externalities**





www.treehugger.com/files/2009/07/missouri-sen...



Provincial Coal Reserves (million tonnes), 2003

- No Coal/Insufficient Data
- 1 - 500
- 500 - 3,000
- 3,000 - 15,000
- 15,000 - 58,921

China's Coal: Demand, Constraints, and Externalities

File:OilCleanupAfterValdezSpill.jpeg

From Wikipedia, the free encyclopedia

[File](#)



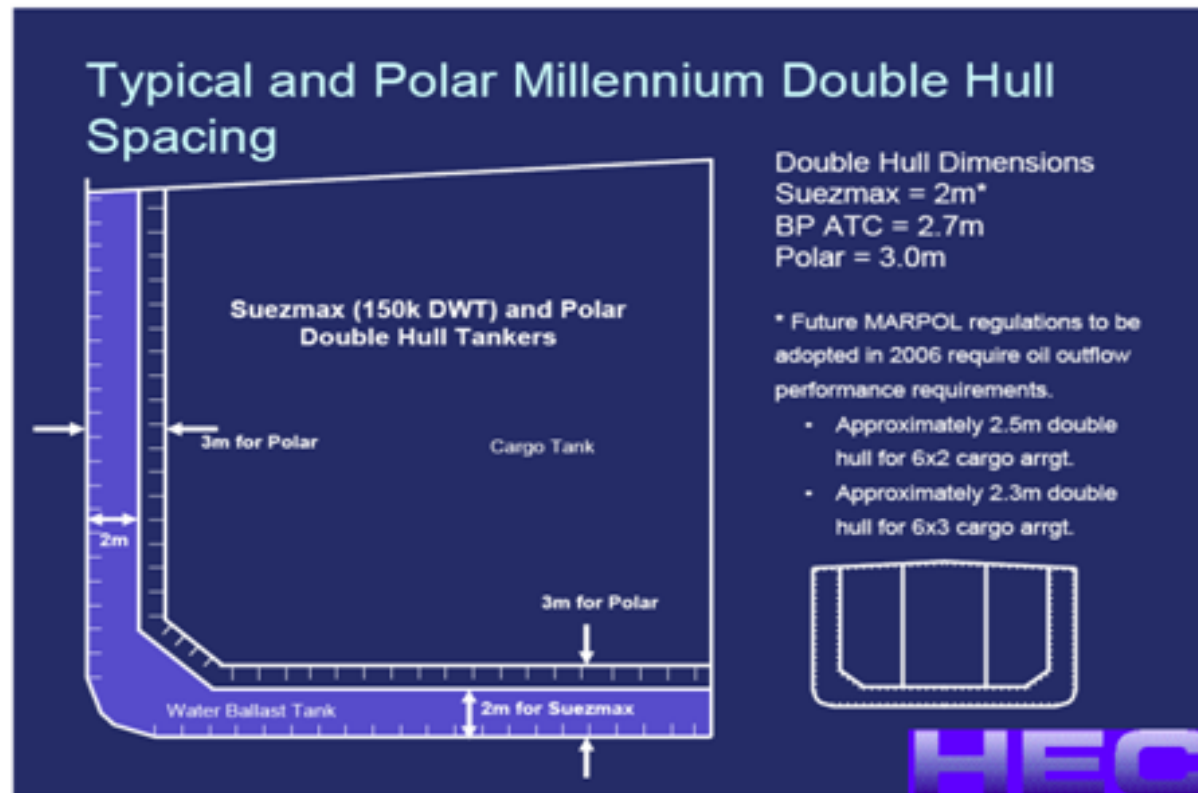
1000 higher resolution available

Exxon Valdez oil spill

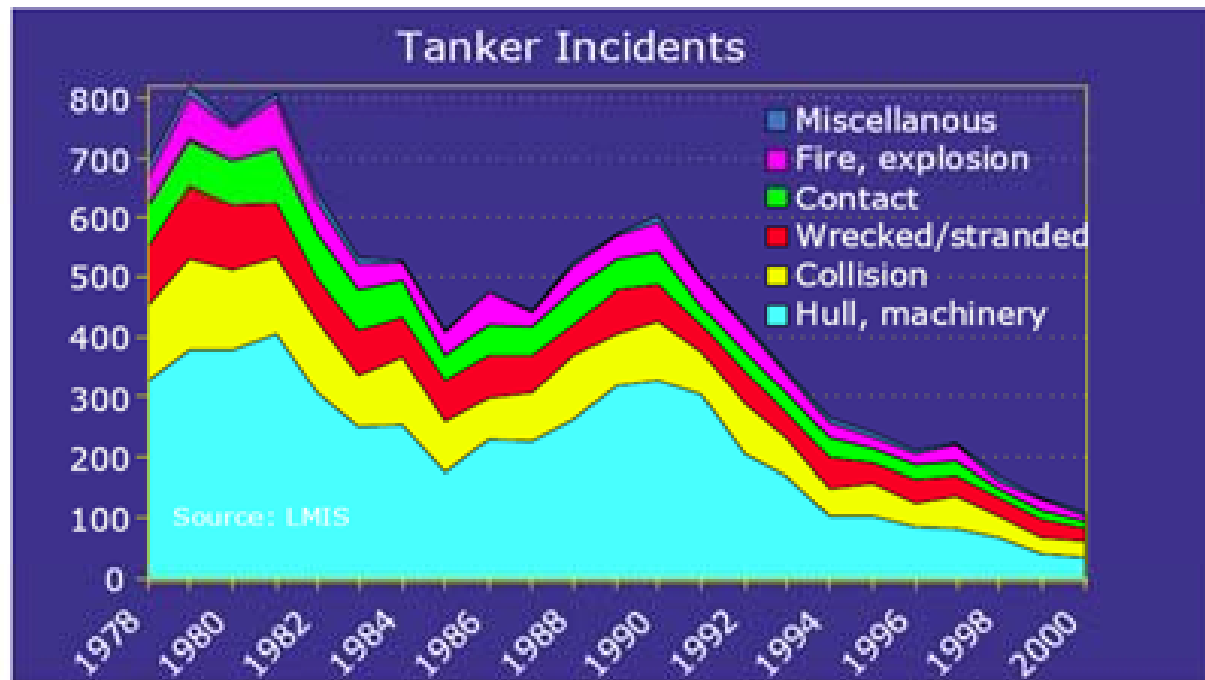
From Wikipedia, the free encyclopedia

The *Exxon Valdez* oil spill occurred in the [Prince William Sound, Alaska](#), on March 24, 1989. It is considered one of the most devastating human-caused [environmental disasters](#) ever to occur at sea.

Tankfartyg – dubbla skrov



Tanker Safety – Improving



**”Att frakta olja som spannmål”
S/S Zoroaster, världens första oljetankfartyg**

**Byggt 1878 för bröderna Nobels företag Branobel i Baku vid Kaspiska Havet,
för att kunna frakta olja till Sverige via bl.a. floden Volga**

Källa: B. Åsbrink: "Ludwig Nobel: Petroleum har en lysande framtid"
Wahlström & Widstrand 2001.

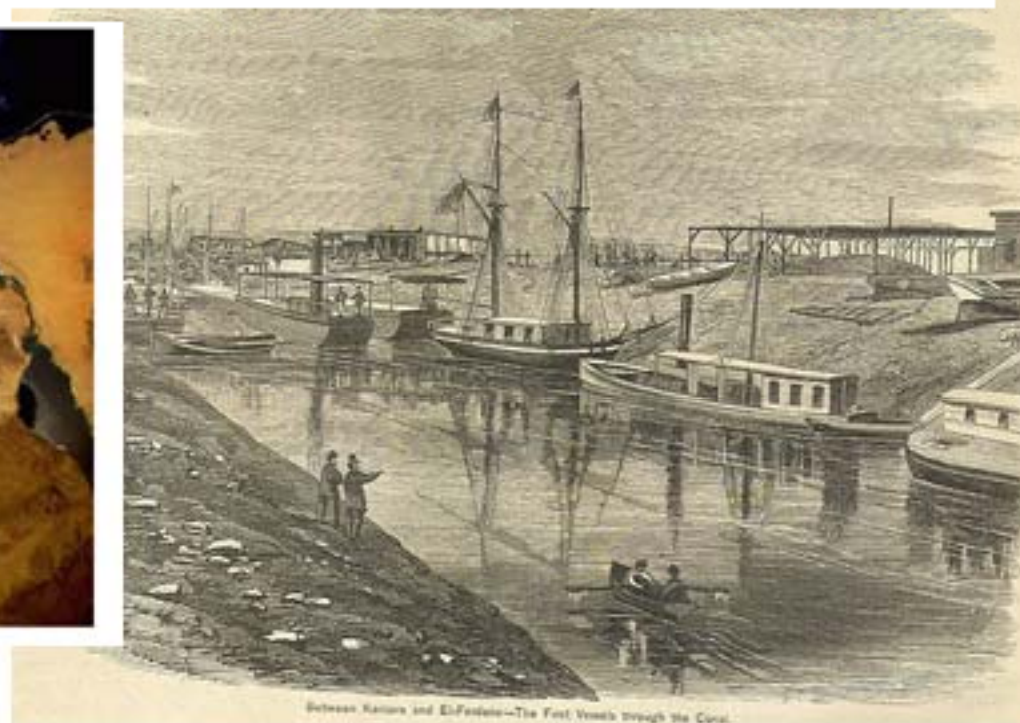


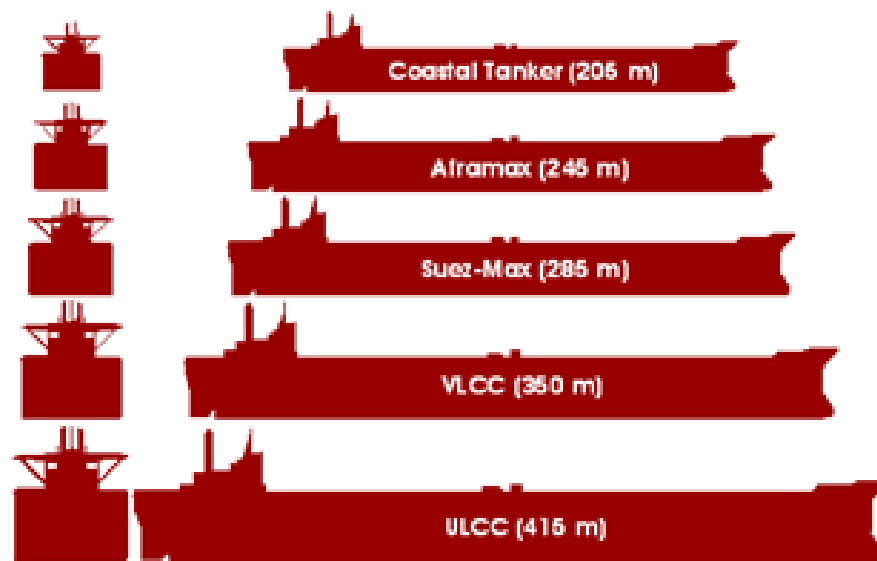
Om Suez (Wikipedia):

Its importance as a port increased after the Suez Canal opened in 1869. The city was virtually destroyed during battles in the late 1960s and early 1970s between Egyptian and Israeli forces occupying the [Sinai Peninsula](#). The town was deserted following the [Third Arab-Israeli War](#) in 1967. Reconstruction of Suez began soon after Egypt reopened the Suez Canal, following the October 1973 war with Israel.

Suez Canal

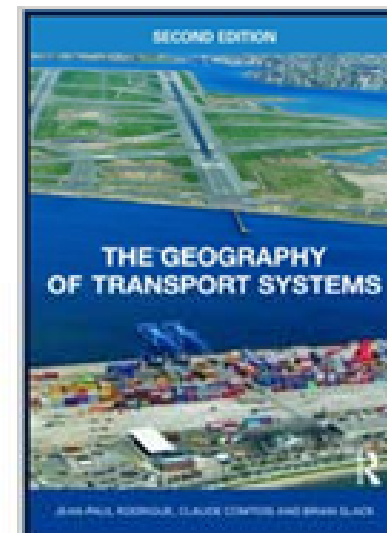
[\[edit\]](#)





Tanker Size

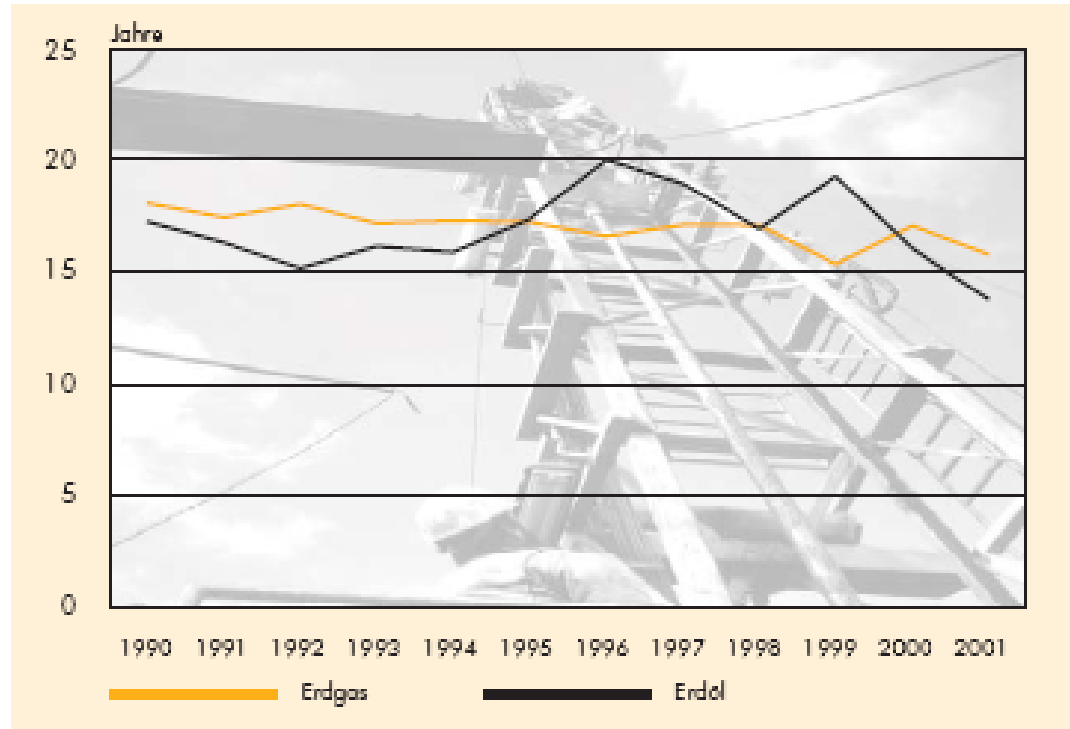
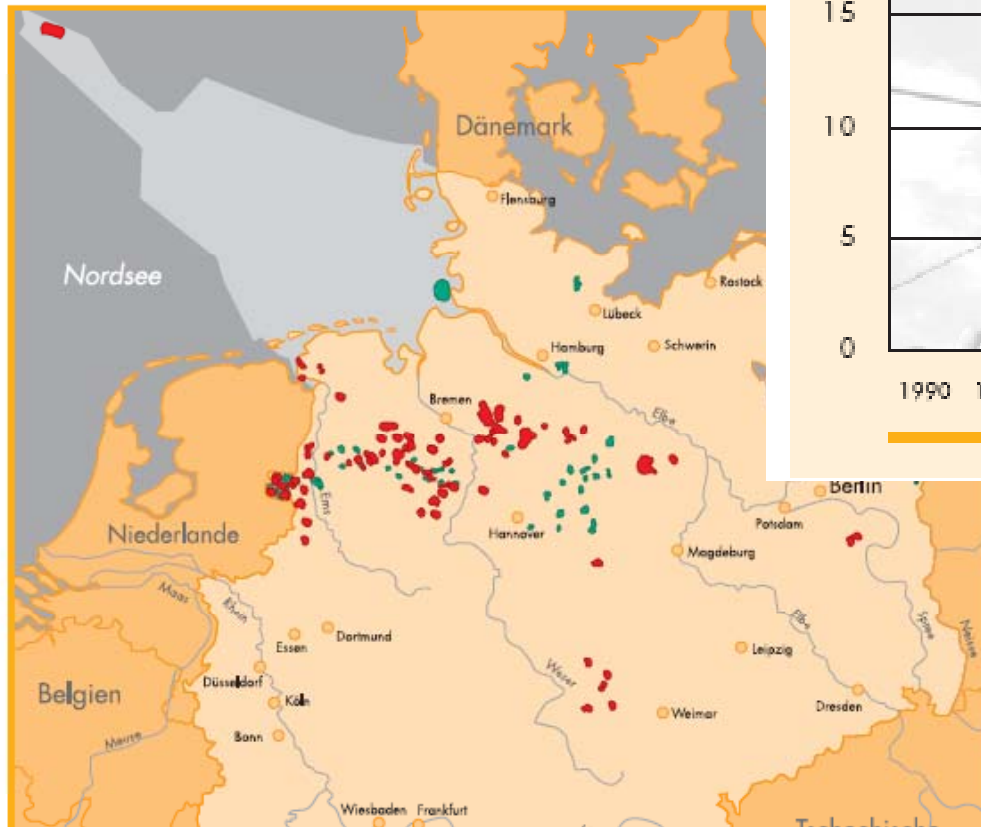
Class	Length	Beam	Draft	Overview
Coastal Tanker	205 m	29 m	16 m	Less than 50,000 deadweight tons, mainly used for transportation of refined products (gasoline, gasoil).
Aframax	245 m	34 m	20 m	Approximately 80,000 deadweight tons (American Freight Rate Association).
Suezmax	285 m	45 m	23 m	Between 125,000 and 180,000 deadweight tons, originally the maximum capacity of the Suez Canal.
VLCC	350 m	55 m	28 m	Very Large Crude Carrier. Up to around 300,000 deadweight tons of crude oil.
ULCC	415 m	63 m	35 m	Ultra Large Crude Carrier. Capacity exceeding 300,000 deadweight tons. The largest tankers ever built have a deadweight of over 550,000 deadweight tons.



SECOND EDITION
 Jean-Paul Rodrigue, Claude Comtois
 and Brian Slack (2009), New York:
 Routledge, 352 pages. ISBN 978-0-
 415-48324-7

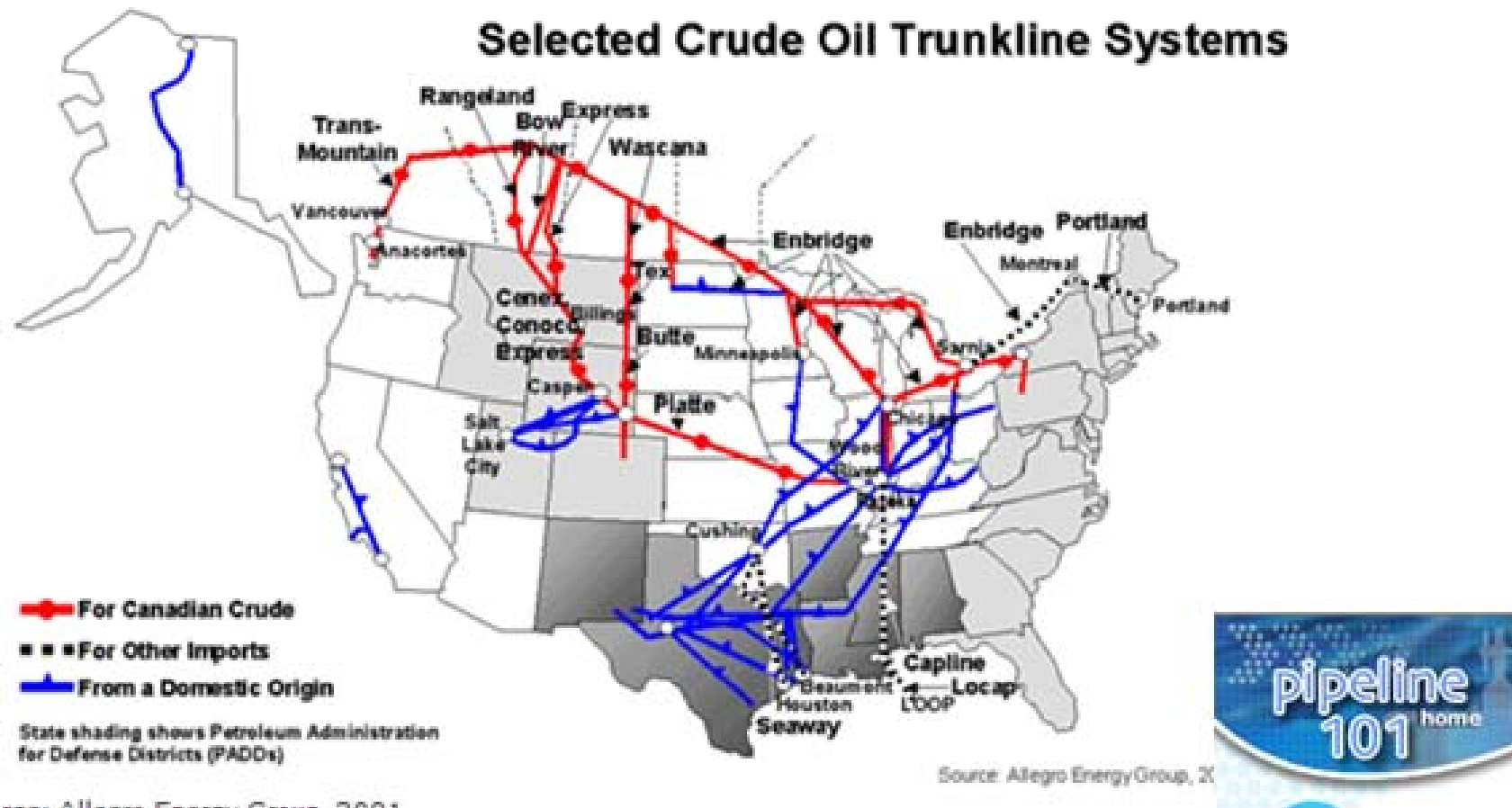
Reichweite der Erdöl- und Erdgasreserven

Erdgas- und Erdölfelder in Deutschland

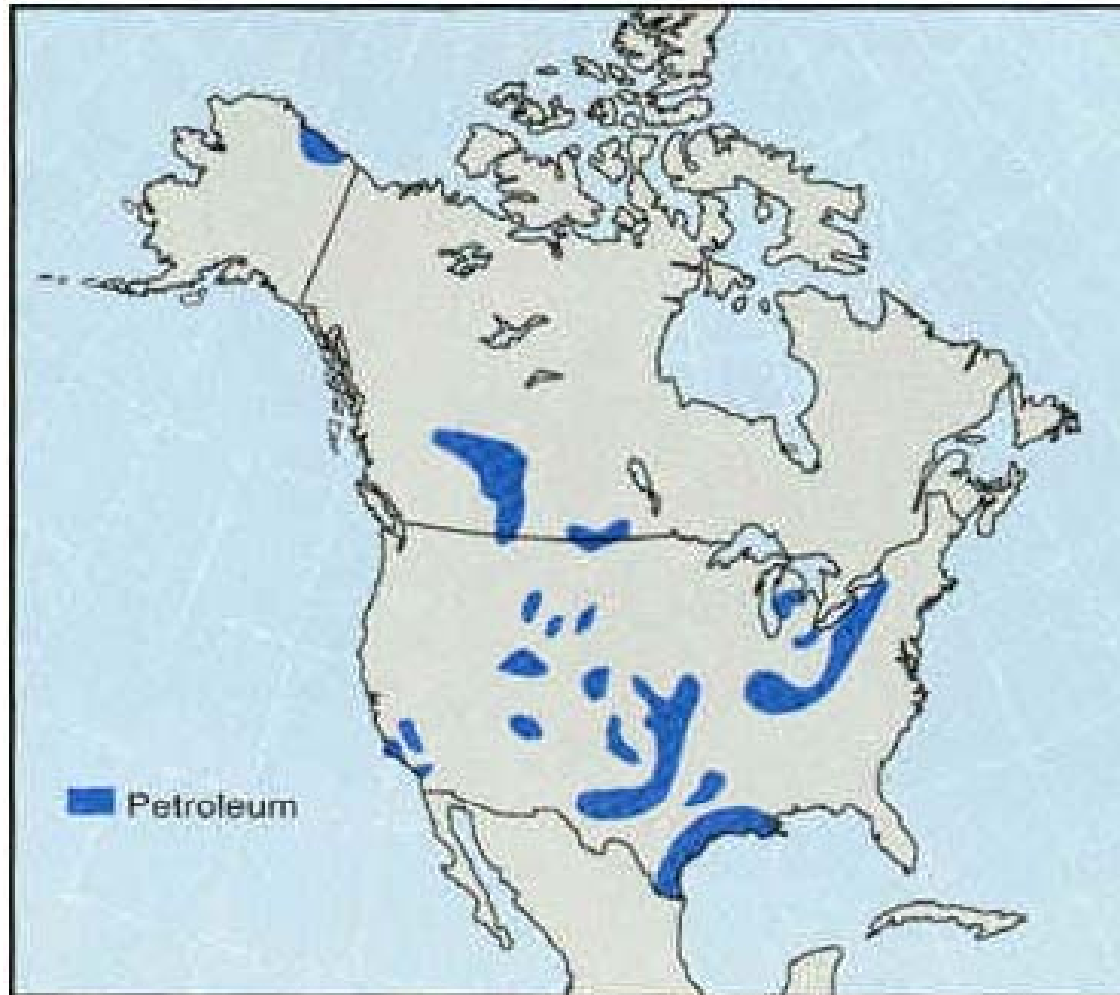


Wirtschaftsverband Erdöl- und Erdgasgewinnung e.V.

The United States has the largest network of energy pipelines - both oil and natural gas -- of any nation in the world. The oil pipeline network alone in the U.S. is more than 10 times larger than that in Europe.

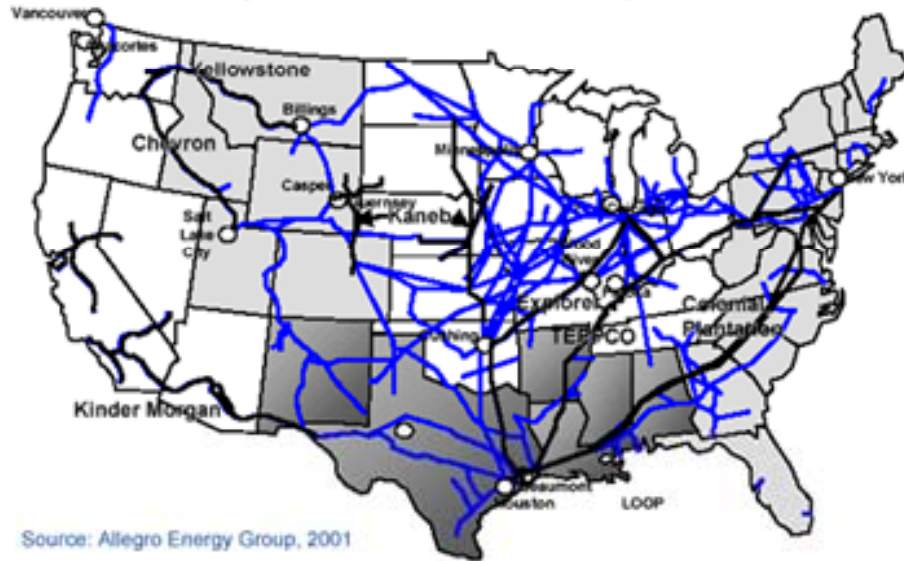


Nordamerikanska oljefält

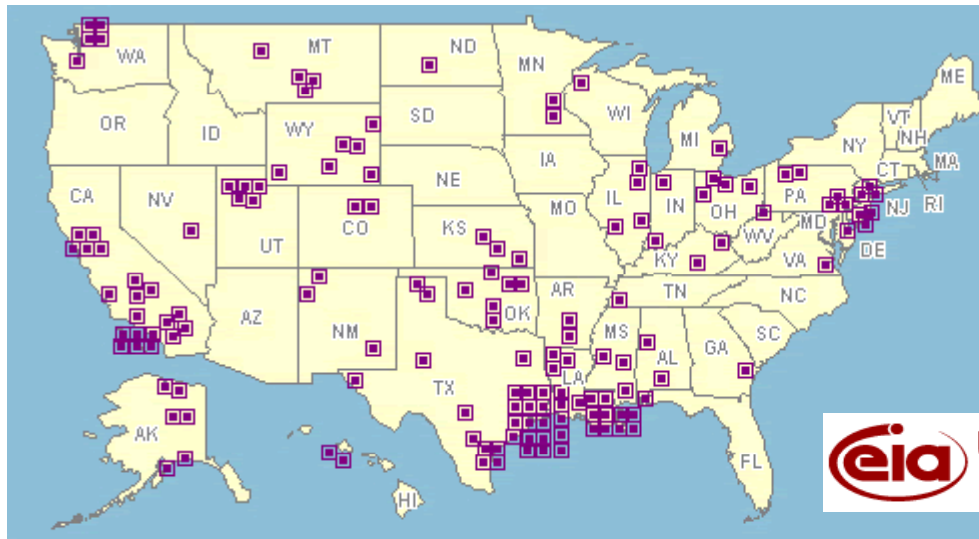


www.geo.msu.edu/geogmich/Oil&gas.html

Major Refined Products Pipelines



Source: Allegro Energy Group, 2001



Petroleum Refineries

- Operable Petroleum Refinery
- U.S. Total = 148



U.S. Energy Information Administration
Independent Statistics and Analysis

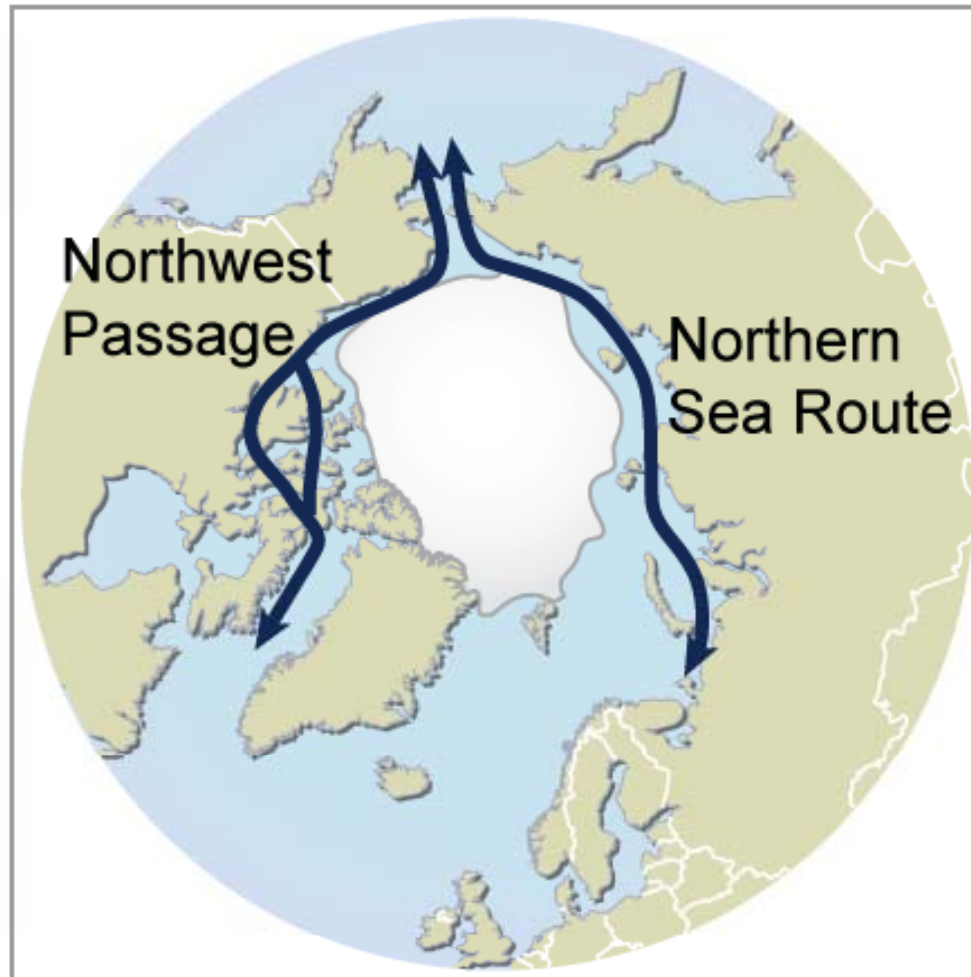


Trans-Alaska Pipeline



Valdez Marine Terminal





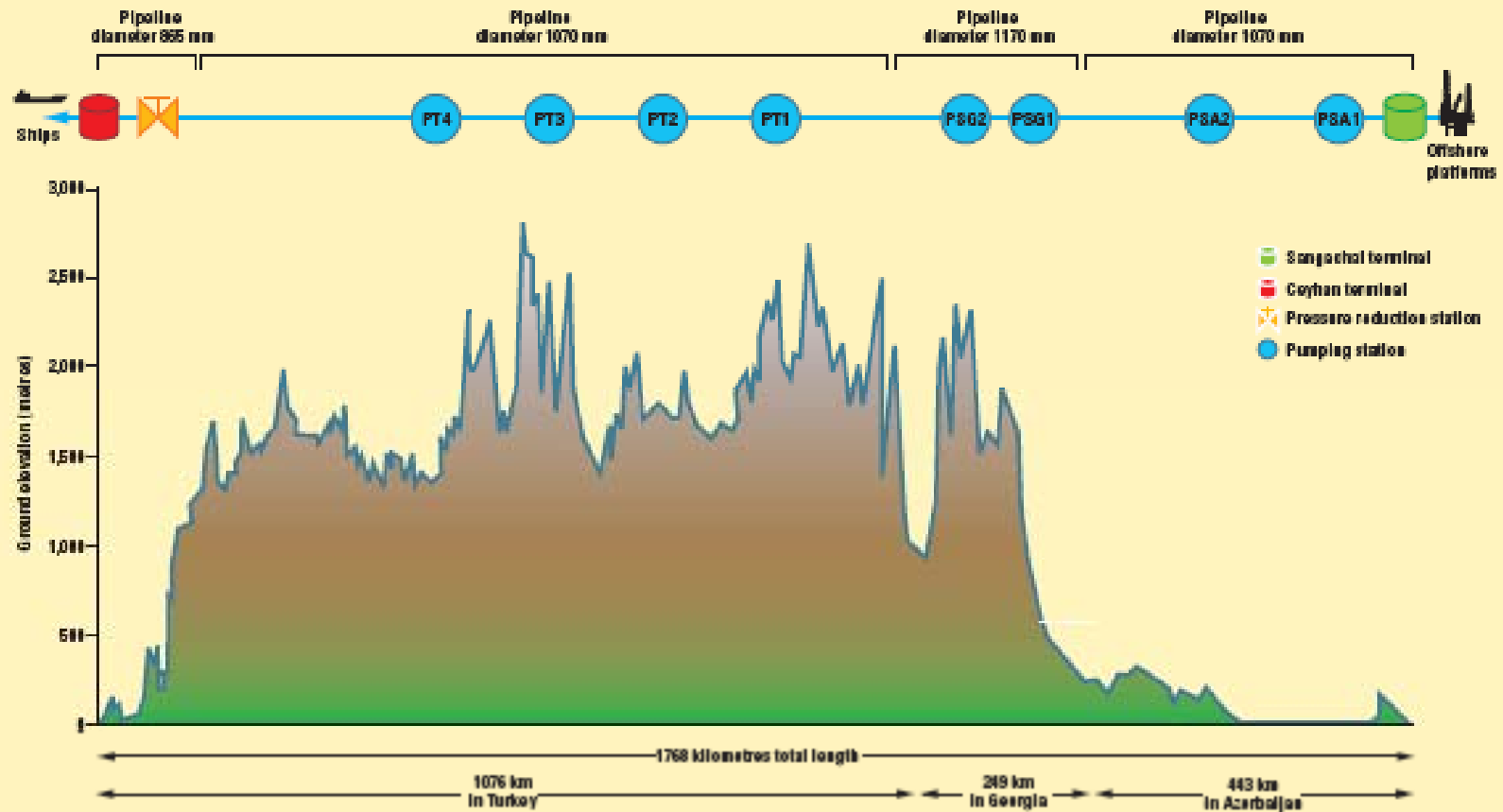
Baku-Tbilisi-Ceyhan (BTC) Pipeline Project



<http://www.warandpeace.ru/en/analysis/view/47363/>

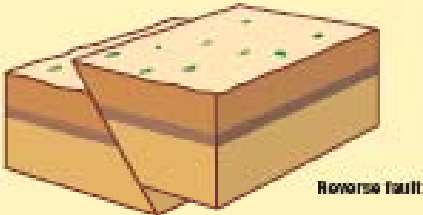
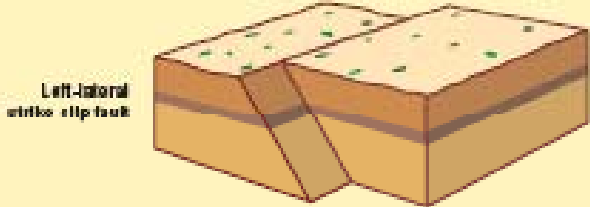
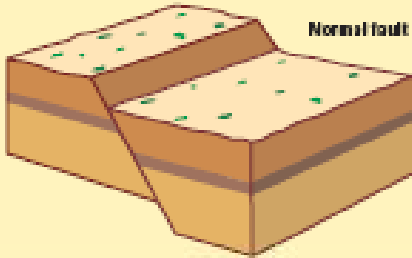
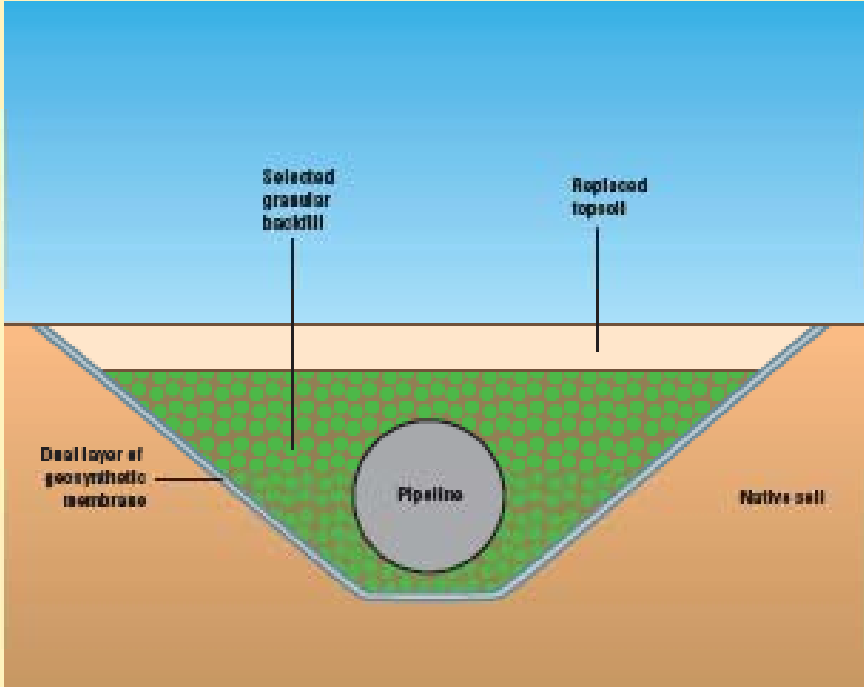
Scaling the heights

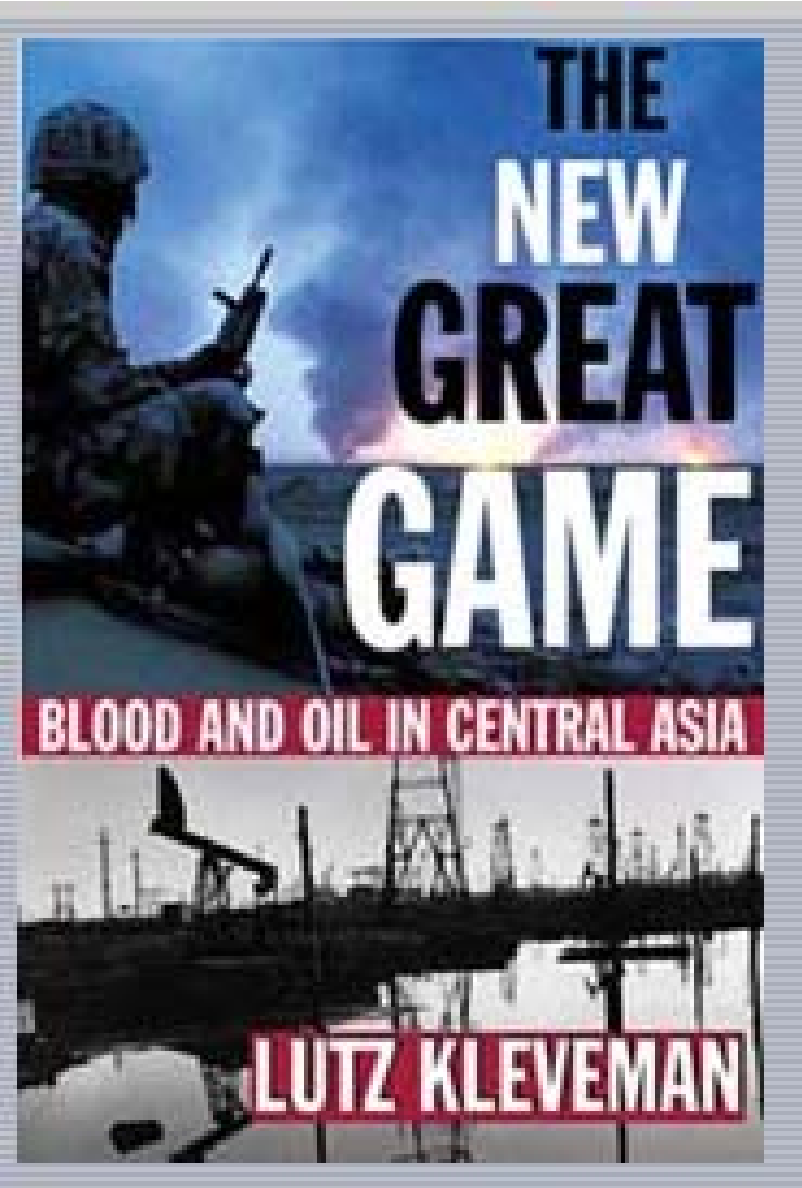
Ground elevation changes dramatically along the pipeline route, reaching 2830m in Turkey. Eight pumping stations will transport the oil through the line, which changes diameter four times in its 1768km journey.



Finding faults

Shown on the right are three examples of the many types of seismic faults which can occur in the region. In these areas the pipeline will be trenched as shown below to allow movement relative to the ground, reducing stresses imposed on the line.





**THE
NEW
GREAT
GAME**

BLOOD AND OIL IN CENTRAL ASIA

LUTZ KLEVEMAN

Trans-Caspian Oil Pipeline Moves Closer

Preparation of tender documents for the proposed 700-km Trans-Caspian oil pipeline is nearing completion, said KazMunaiGaz President Kayrgeldi Kabildin.

The pipeline would transport oil from the offshore Kashagan field, running from the port of Aktau to Baku in Azerbaijan where it would connect to the 1,770-km Baku–Tbilisi–Ceyhan (BTC) oil pipeline. Project development is also planned to include oil terminals at Kuryk on Kazakhstan's coast as well as on the Azerbaijani coast.

The Trans-Caspian oil pipeline is part of a larger joint endeavor between KazMunaiGaz and State Oil Company of Azerbaijan to develop Kazakh oil transportation via the BTC pipeline, which will also include a 750-km pipeline connecting Kuryk to the oil processing facility at Eskene. Feasibility studies for this pipeline are near completion.

**Pipeline &
Gas Journal**

2009



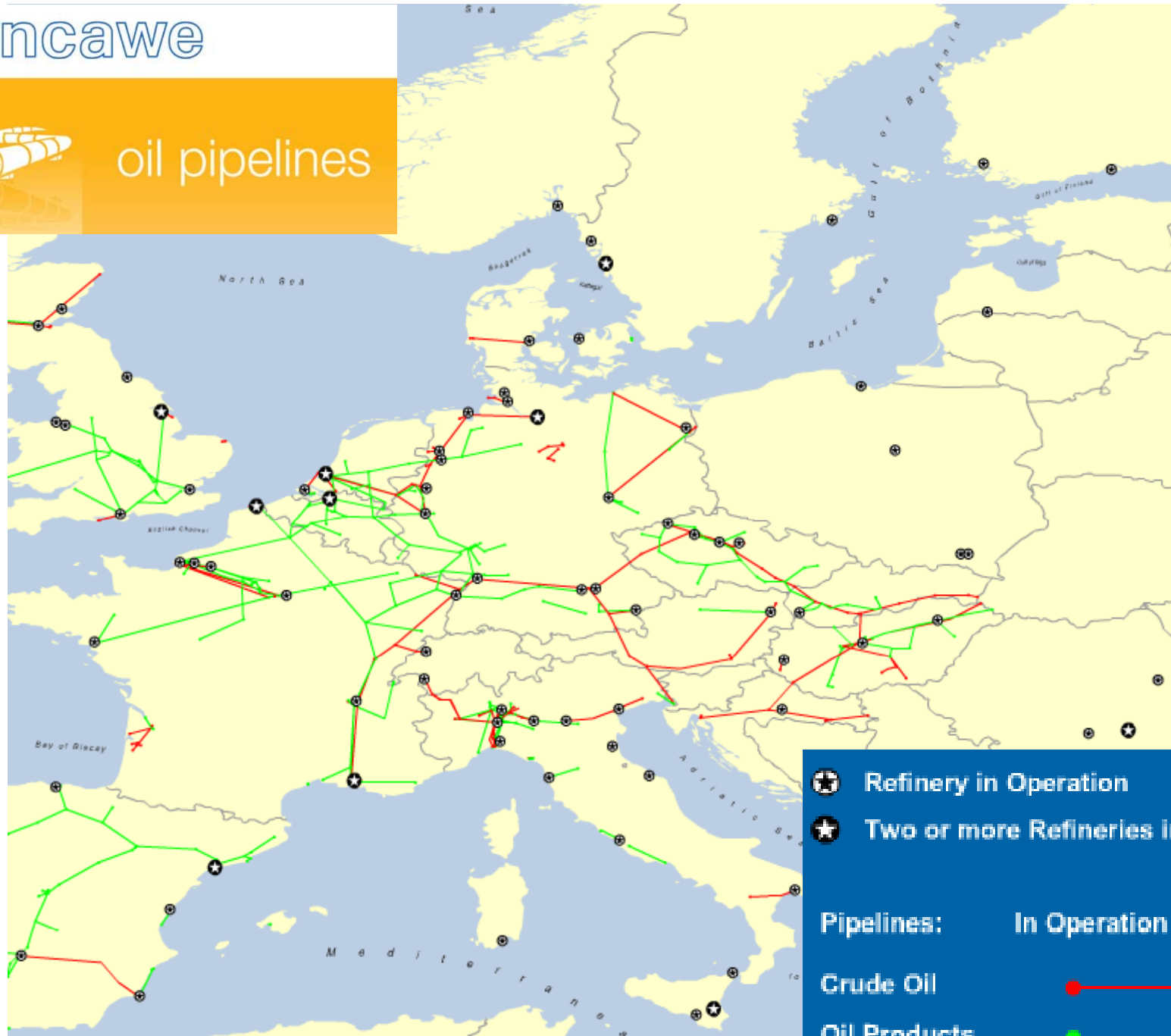
Kazakhstan–China oil pipeline

From Wikipedia, the free encyclopedia

concaawe

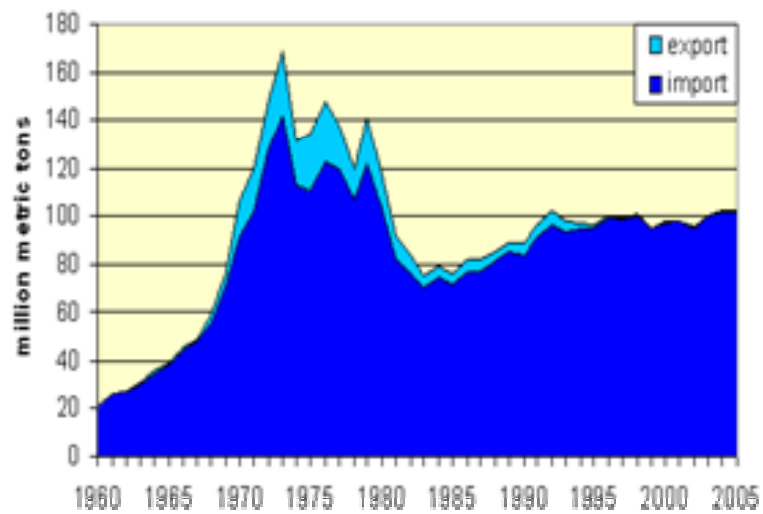


oil pipelines

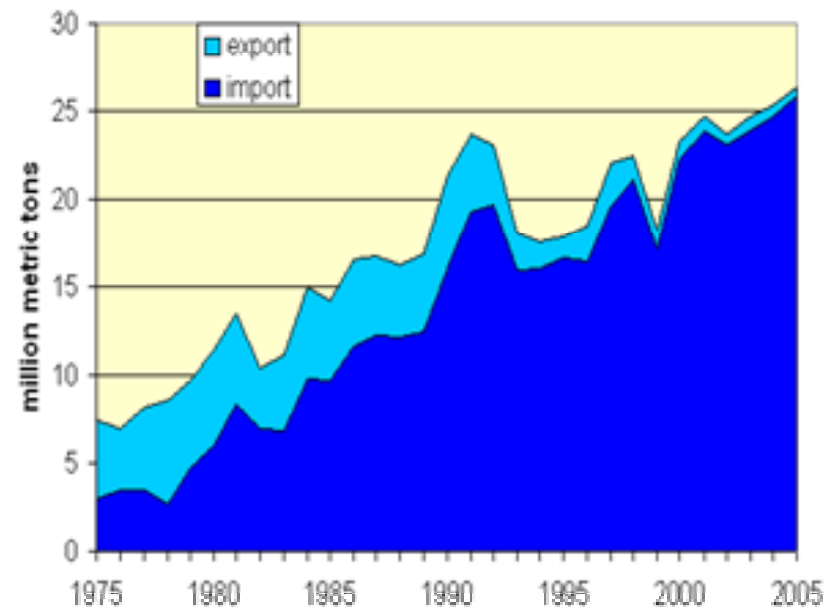


CRUDE OIL:
throughput at the Port of Rotterdam

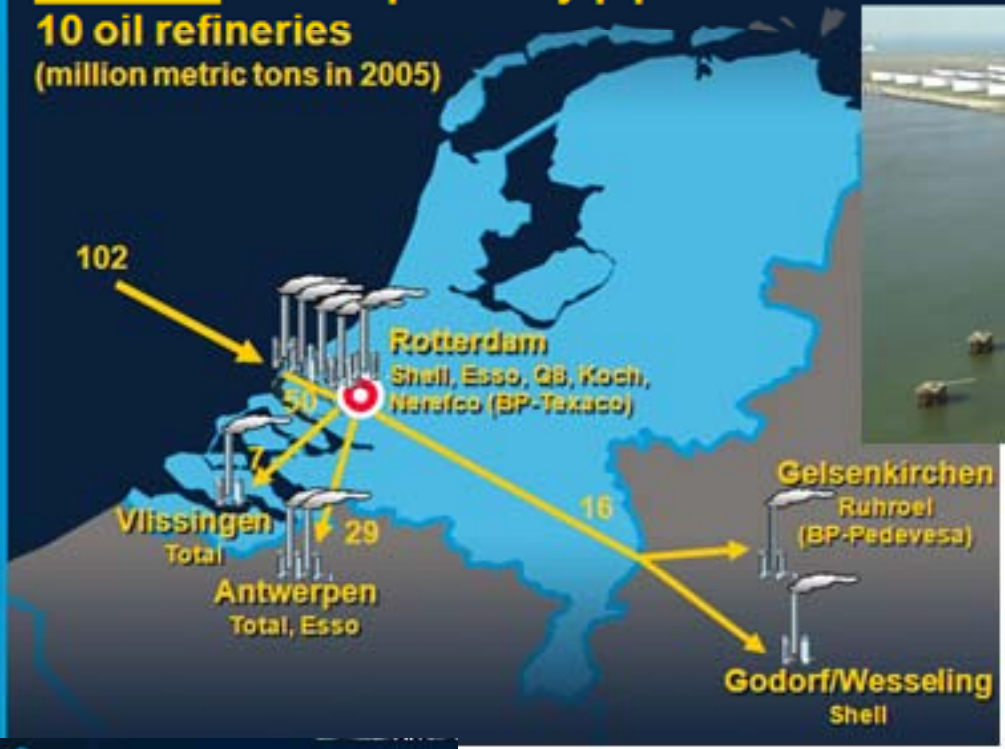
Rise in 60's, Peak in 70's, Fall in 80's, Stable since 90's



COAL:
throughput at the Port of Rotterdam

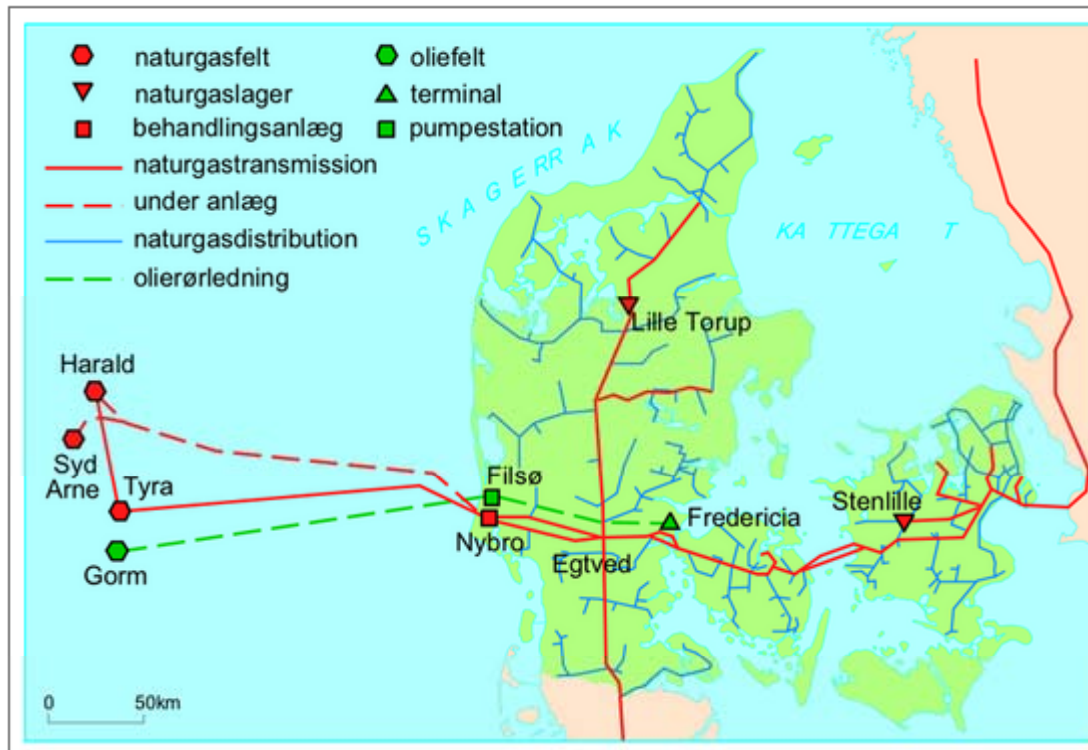


Crude oil is transported by pipelines to 10 oil refineries
(million metric tons in 2005)

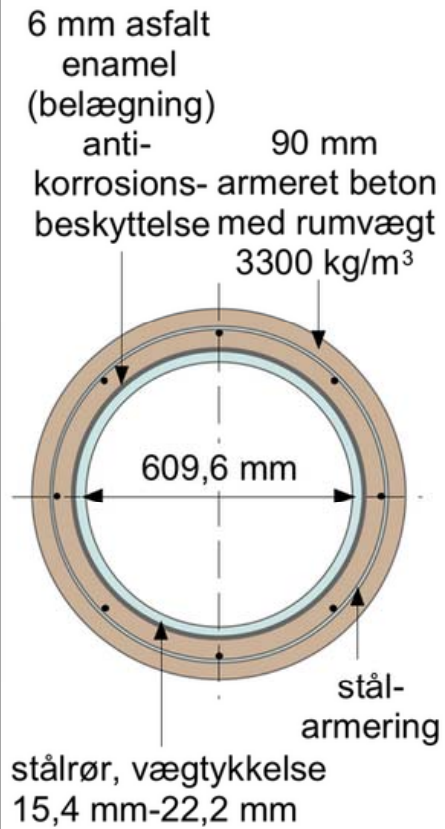


IMPORT PRIMARY ENERGY: CRUDE OIL



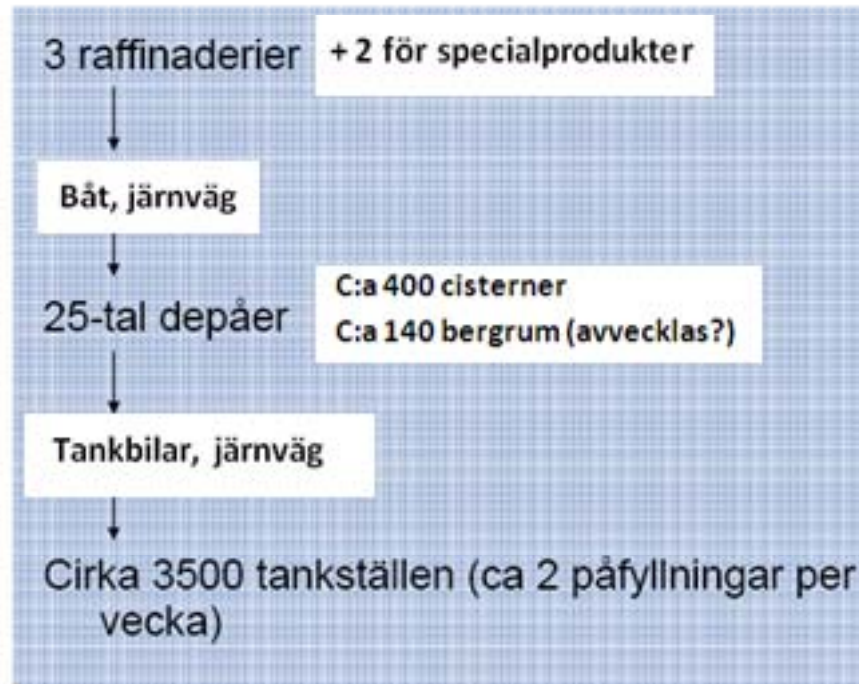


Rørledninger. Olie- og naturgasnettet i Danmark (1998).



Rørledninger. Tværsnit af en 24 tommer gasrørledning fra den danske del af Nordsøen.

Oljebaserade bränslen och drivmedel



Bergrumsanläggningar under avveckling



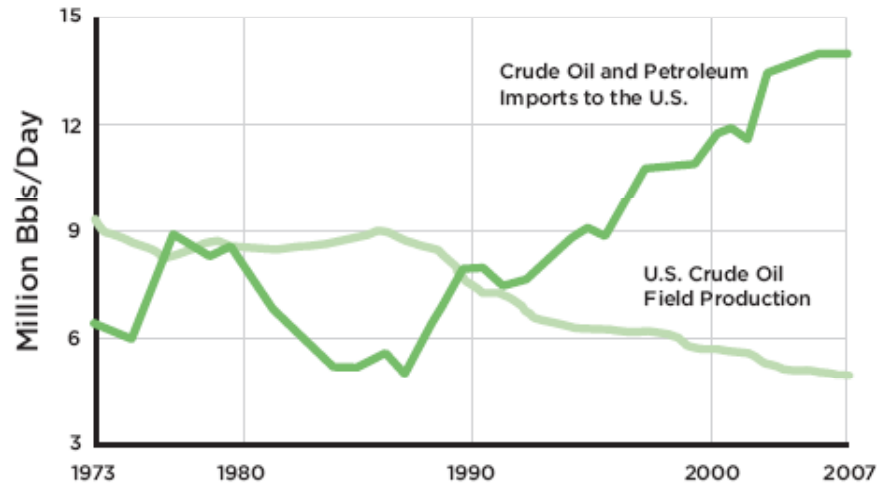
Ont om spekulanter på statens bergum

<http://www.aftonbladet.se/nyheter/9807/13/telegram/inrikes15.html>

Loudden används huvudsakligen som oljehamn d.v.s. tillförsel, lagring och distribution av petroleumprodukter. Stockholms kommunfullmäktige har beslutat att all oljehantering på Loudden skall upphöra 2011 under förutsättning att ett acceptabelt alternativ kan skapas.

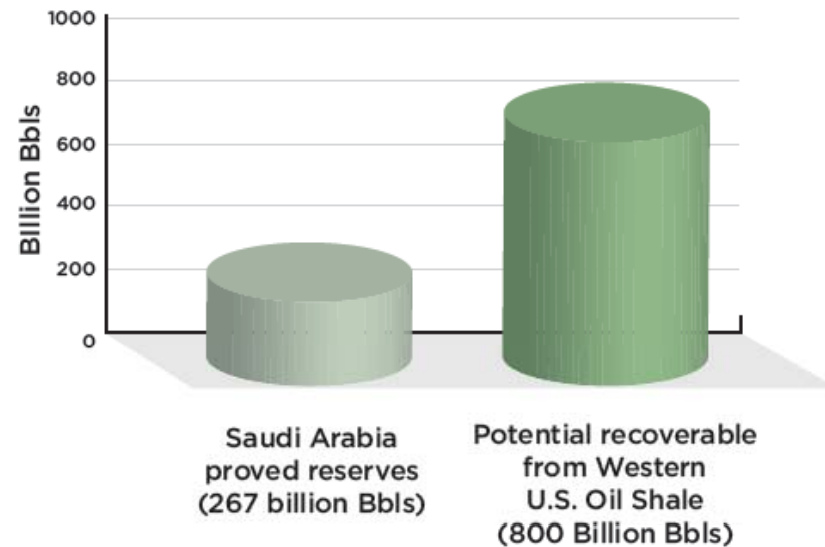


Figure 3. U.S. oil production and imports.

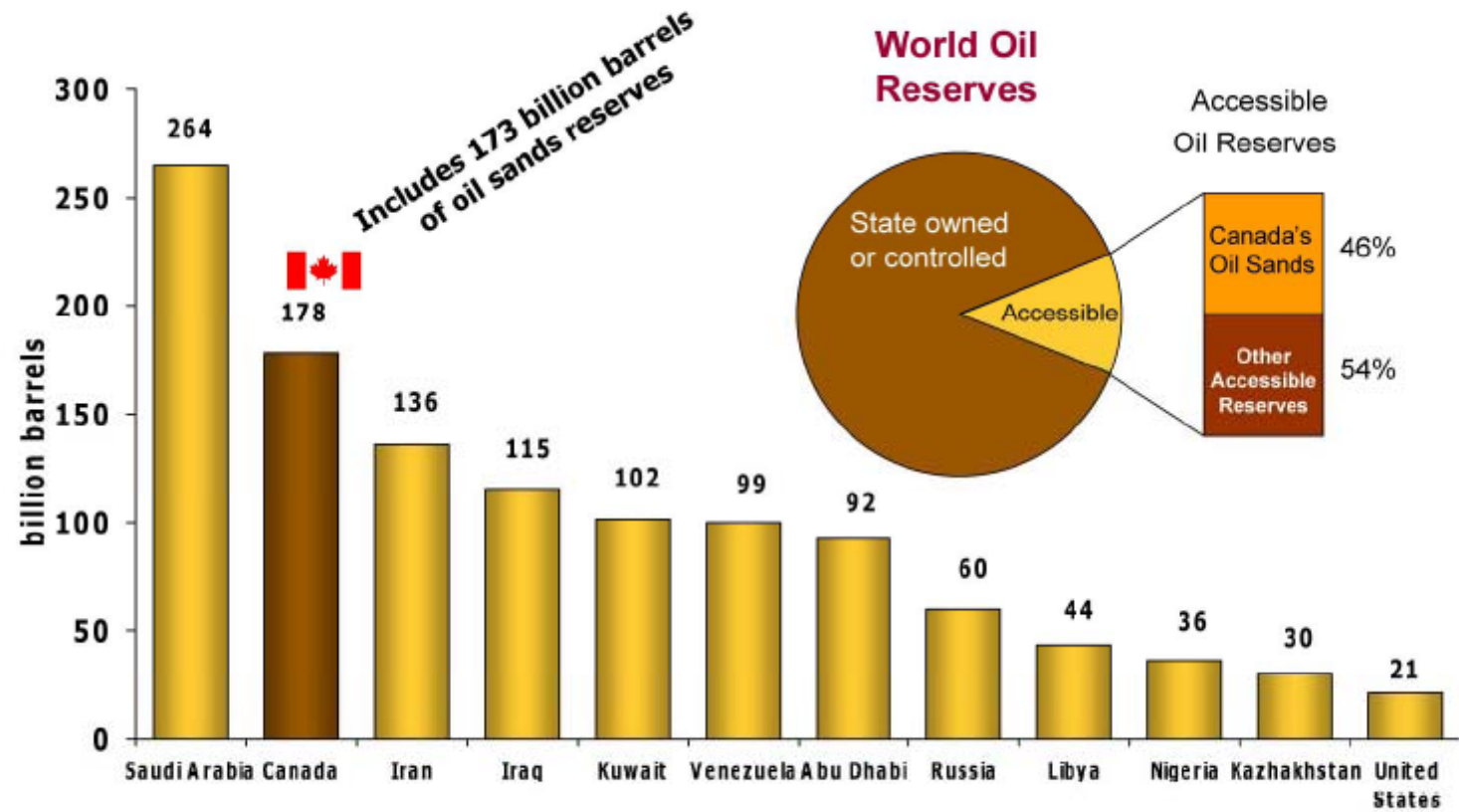


U.S. oil production has been on the decline since the mid-1980s, while imports have risen dramatically.¹

Figure 2. Oil reserves of Saudi Arabia vs. Western U.S. oil shale.



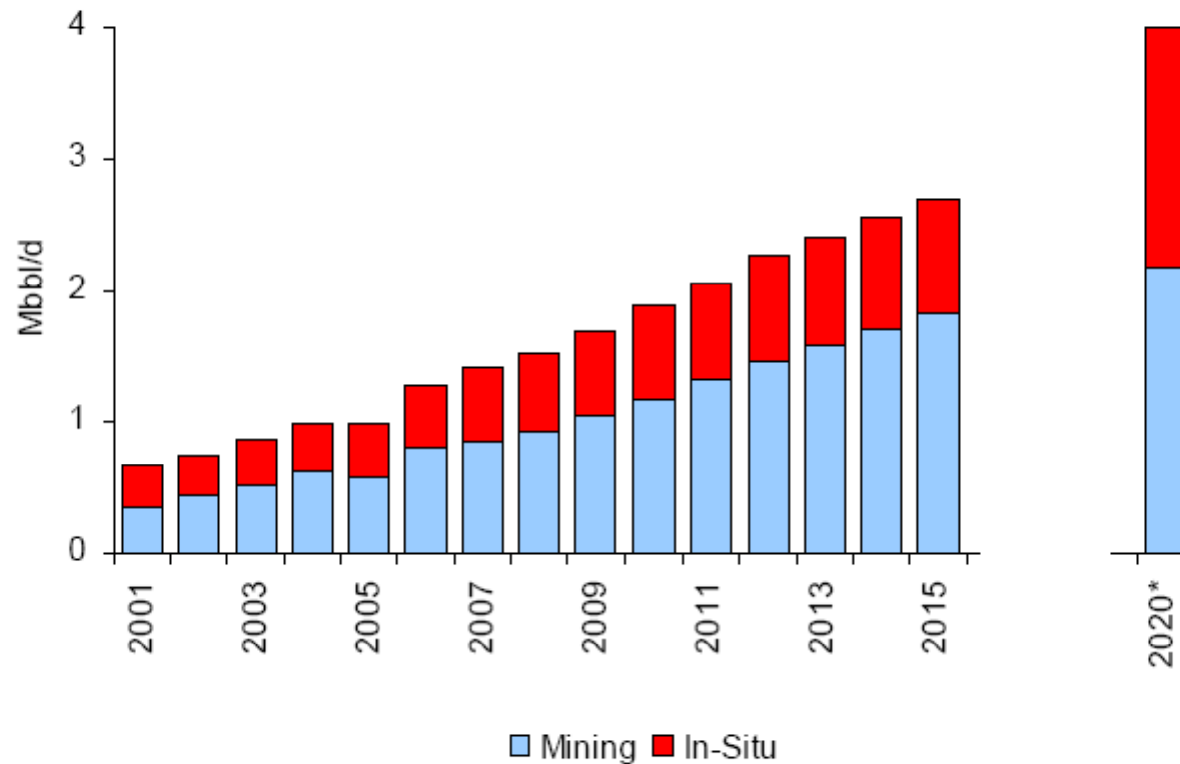
AMERICAN PETROLEUM INSTITUTE



Source: Oil & Gas Journal Dec. 2008

Production forecast to grow rapidly over the medium term

Canadian Heavy Oil Production



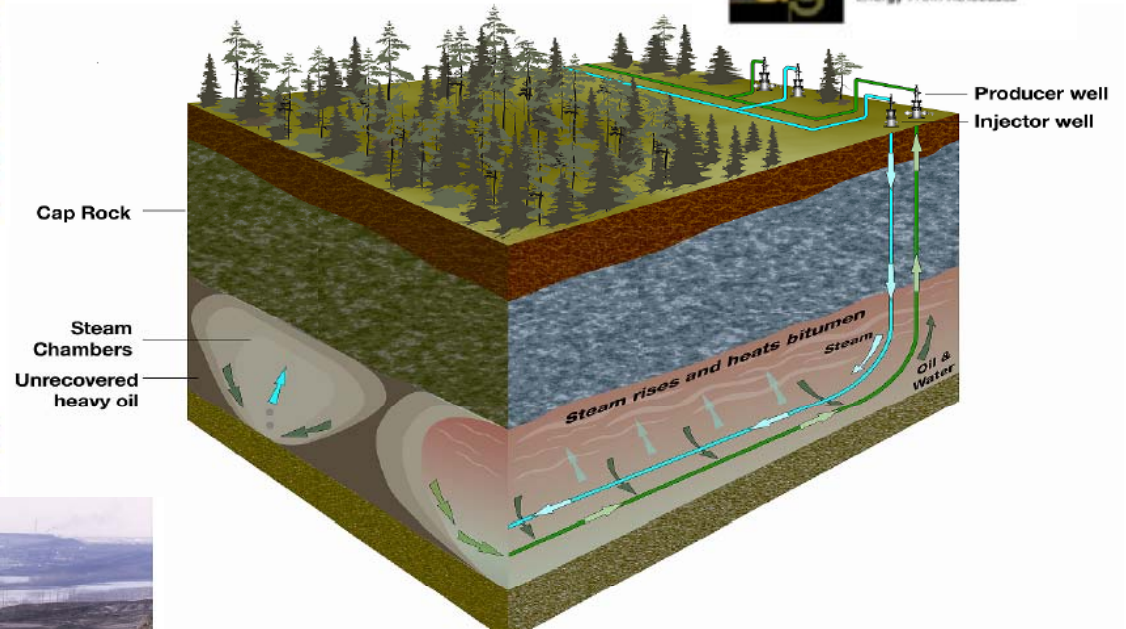
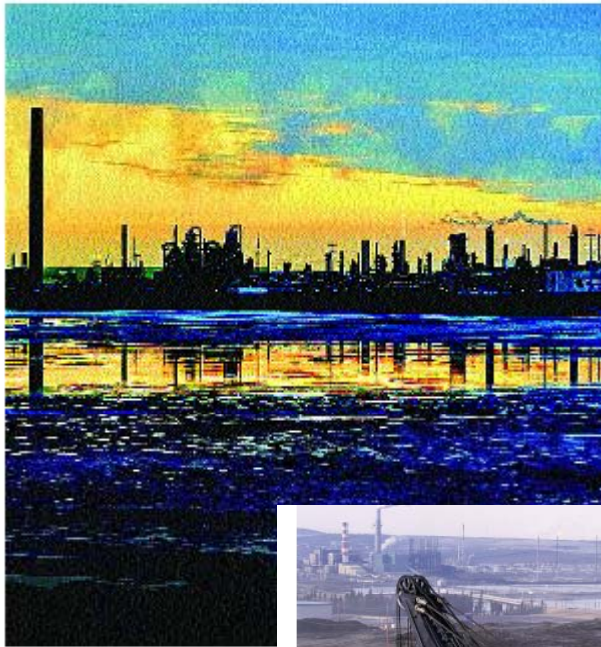
Source: Canadian Association of Petroleum Producers
* Raymond James, The Oil Sands of Canada (28 July 2005)



Canada needs to kick its dirty-oil habit

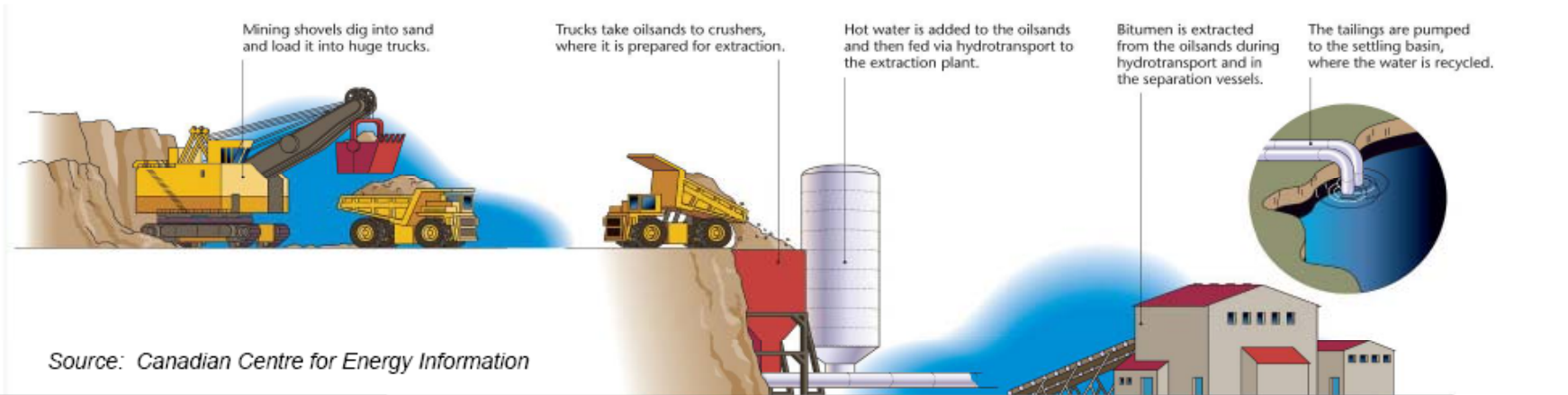
Canada has become an oil junkie, hooked on the tarsands and in desperate need of detox.

BY THE VANCOUVER SUN NOVEMBER 11, 2008 BE THE FIRST TO POST A COMMENT



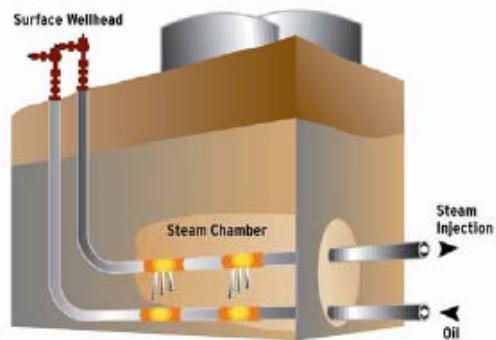
Oil Sands Production Technologies

Mining – 20% of the oil sands resource is less than 200 feet deep - 2.5% of Surface Area

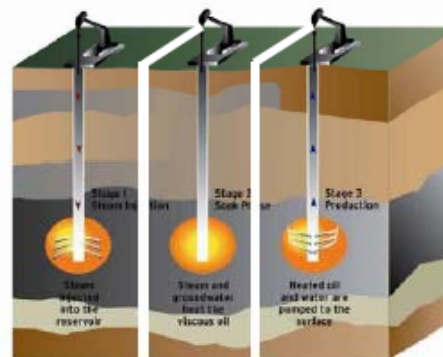


***In situ* – 80% of the oil sands resource is more than 200 feet deep**

Steam Assisted Gravity Drainage

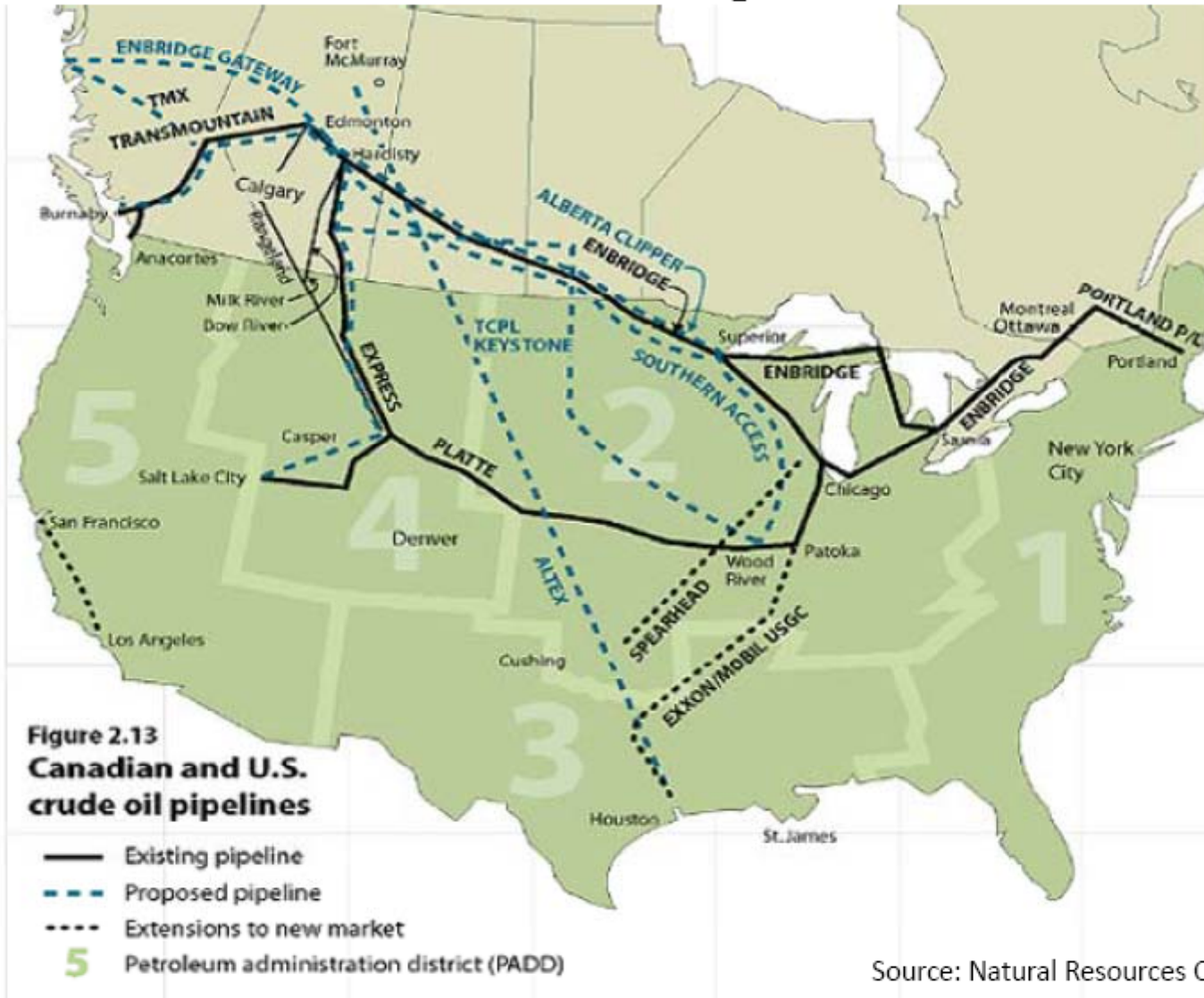


Cyclic Steam Process



- No mines
- No tailings pond
- No water from the Athabasca River

Canadian Oil Pipelines



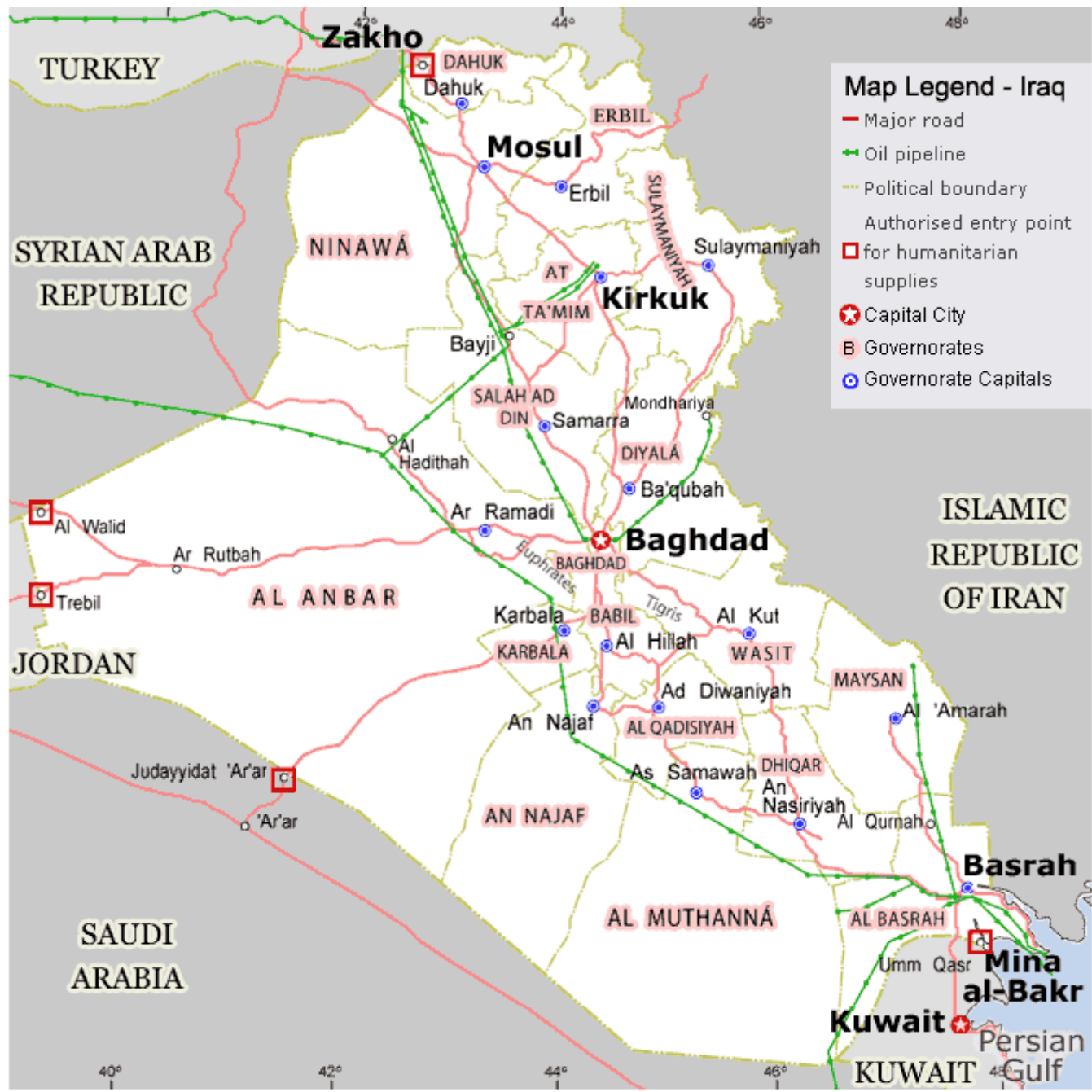
Source: Natural Resources Canada⁹

Keystone Pipeline Project

On June 30, 2010, TransCanada commenced commercial operation of the first phase of the Keystone Pipeline System. Keystone's first phase was highlighted by the 864 kilometre (537 mile) conversion of natural gas pipeline to crude oil pipeline and construction of an innovative bullet line that brings the crude oil non-stop from Canada through North Dakota, South Dakota, Nebraska, Kansas, Missouri and Illinois to market hubs in the U.S. Midwest.



<http://transcanada.essentialtal.com/media/4/>



Source: UN



IRAQ PIPELINE WATCH

Attacks on Iraqi pipelines, oil installations, and oil personnel:

2003

1. June 12 — attack along the 600 mile (960 km) pipeline that carries crude oil from Iraq's northern fields near Kirkuk to Turkey's port of Ceyhan on the Mediterranean Sea
2. June 19 — explosion in Bayji refinery complex about 125 miles (200 km) north of Baghdad
3. June 22 — explosion in natural gas line near Hit, a city about 95 miles (152 km) northwest of Baghdad
4. June 23 - gas pipeline explosion outside the town of Abidiyah Gaarbiga, near the Syrian border in western Iraq

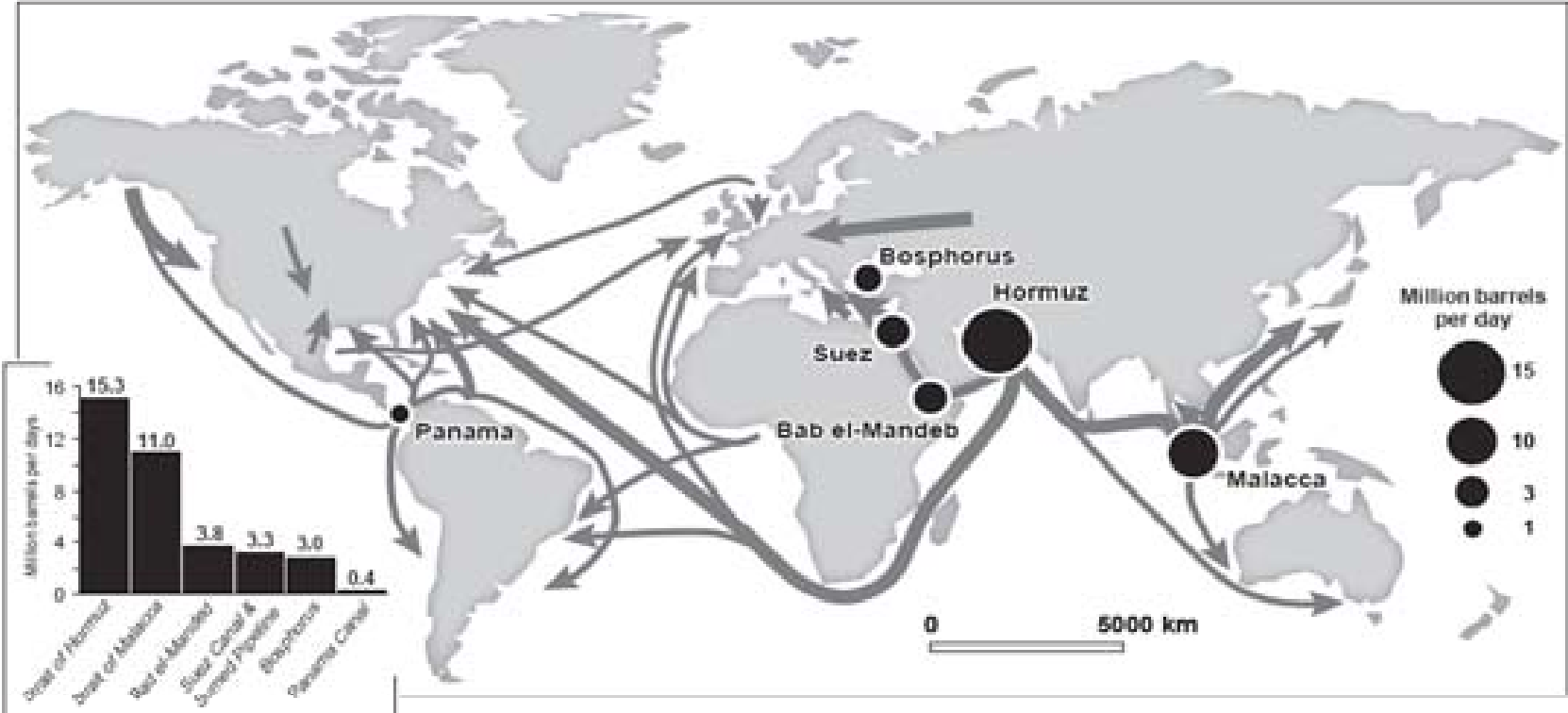
2008

466. Jan. 7 - An explosion at a fuel storage tank caused a huge blaze at the Bayji refinery, injuring at least 36 workers.
467. Feb 10 - A car bomb exploded at a power station in Mosul, killing four civilians and causing power outages.
468. Feb. 11 - An explosion struck a gas pipeline transporting unrefined gas from Kirkuk to the Bayji refinery.
469. March 27 - Gunmen blew up an oil pipeline in Zubair area west of Basra.

Iraq Pipeline Watch is now being updated only sporadically and may not be a complete log of attacks. Feel free to send information about attacks to info@iags.org.

Note: Permanent URL for this page is <http://www.iags.org/iraqpipelinewatch.htm>

Figure 3 Oil Flows, Major Chokepoints and Oil Transited at Major Strategic Locations, 2003



Source: Energy Information Administration (2003)

Figure 9: Map of Abqaiq



Source: Lehman Brothers

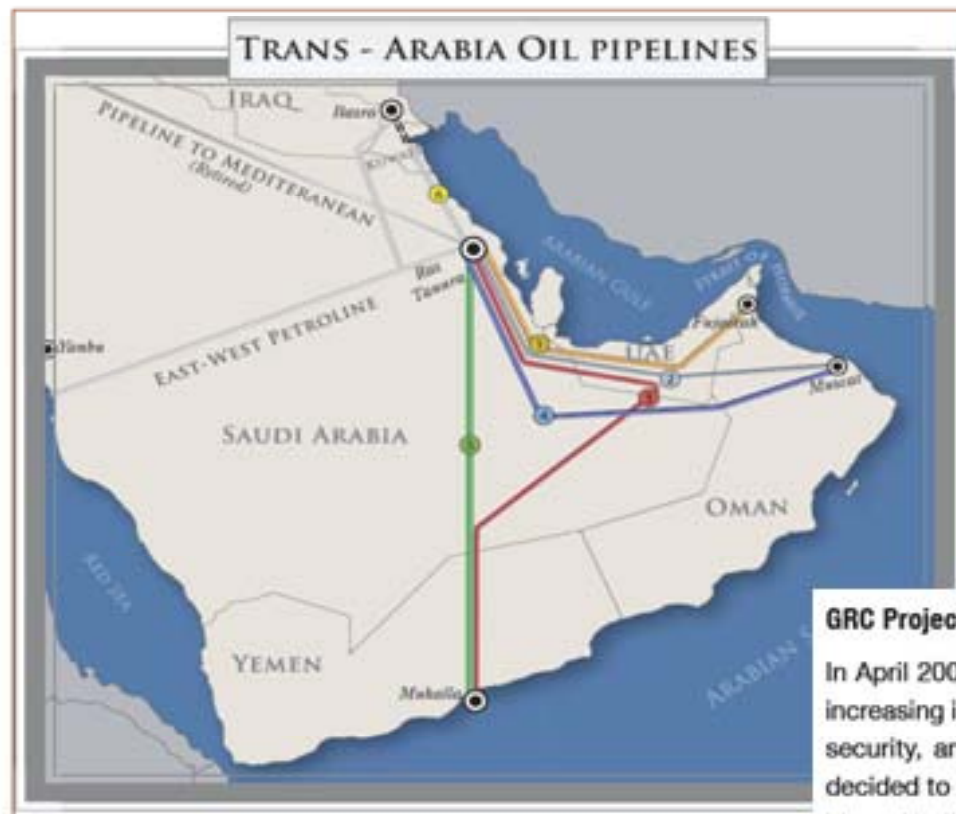
Tidsåtgång för militära operationer vid tänkbar iransk blockad av Hormuz-Sundet

International Security, Vol. 33, No. 1 (Summer 2008), pp. 82–117

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Table 1. Summary of Estimated Campaign Lengths and Military Commitments

Iranian Threat	Estimated Time (optimistic)	Estimated Time (pessimistic)	Military Commitment
Mines	28 days	40 days	All mine countermeasure capabilities, plus allies' (to clear 80 percent of mines)
Antiship cruise missiles	9 days	72 days	Multiple Aegis ships, port support, AWACS, JSTARS, UAVs, tankers, jammers, at least one carrier battle group
Air defense	—	—	2–3 squadrons F-16CJ, 30+ Prowlers, Compass Call, Rivet Joint
Total	37 days	112 days	



GRC Project

In April 2007, the Gulf Research Center, encouraged by the increasing interest of the GCC oil-producing states in energy security, and the growing global concern about the issue, decided to prepare a preliminary study on the long-standing idea of building multi-states oil pipelines that would bypass the world's most vulnerable energy choke point, the Strait of Hormuz. In the past five decades, the Strait of Hormuz has been a lifeline- and at times, an 'Achilles' heel, - for the national, regional and global economies. It forms a strategic link between the rich oil fields of the Gulf region and the waters of the Arabian Sea and the Indian Ocean.

Figure 7: Straits of Malacca Map



Source: Lehman Brothers



Strategic Petroleum Reserve Storage Sites

Emergency crude oil is stored in the Strategic Petroleum Reserve in salt caverns. Created deep within the massive salt deposits that underlie most of the Texas and Louisiana coastline, the caverns offer the best security and are the most affordable means of storage, costing up to 10 times less than aboveground tanks and 20 times less than hard rock mines.

Storage locations along the Gulf Coast were selected because they provide the most flexible means for connecting to the Nation's commercial oil transport network. Strategic Reserve oil can be distributed through interstate pipelines to nearly half of the Nation's oil refineries or loaded into ships or barges for transport to other refineries.



Due to elevated security concerns, detailed information on SPR sites has been removed from this web site.

Fallande lagernivåer inom IEA (dagar nettoimport)

