

**EOF Crude Oil Trading Analytics**

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February 2009**For Internal Use Only**

Atlantic Basin Infrastructure - Europe

Synopsis:

The aim of this two part report is to build a better understanding of Atlantic basin infrastructure, fundamentals and traded instruments and quantify the extent to which fundamentals correlate with price.

Part one of the report aims to build a better understanding of the structure, constraints, fundamentals and pricing instruments that constitute the market.

Part two of the report (to follow) will explore the relationship between Atlantic basin fundamentals and pricing instruments. It is hoped we will then be able to identify the most significant fundamental factors influencing price and use these to predict future price movements.



OMV Schwedt Refinery

Acknowledgements: Thanks to Tatiana Arakcheeva for her help in conceptualising this report and her contributions to the section on N Sea pricing instruments. Thanks also to Greg Morley for his work researching N Sea upstream infrastructure.

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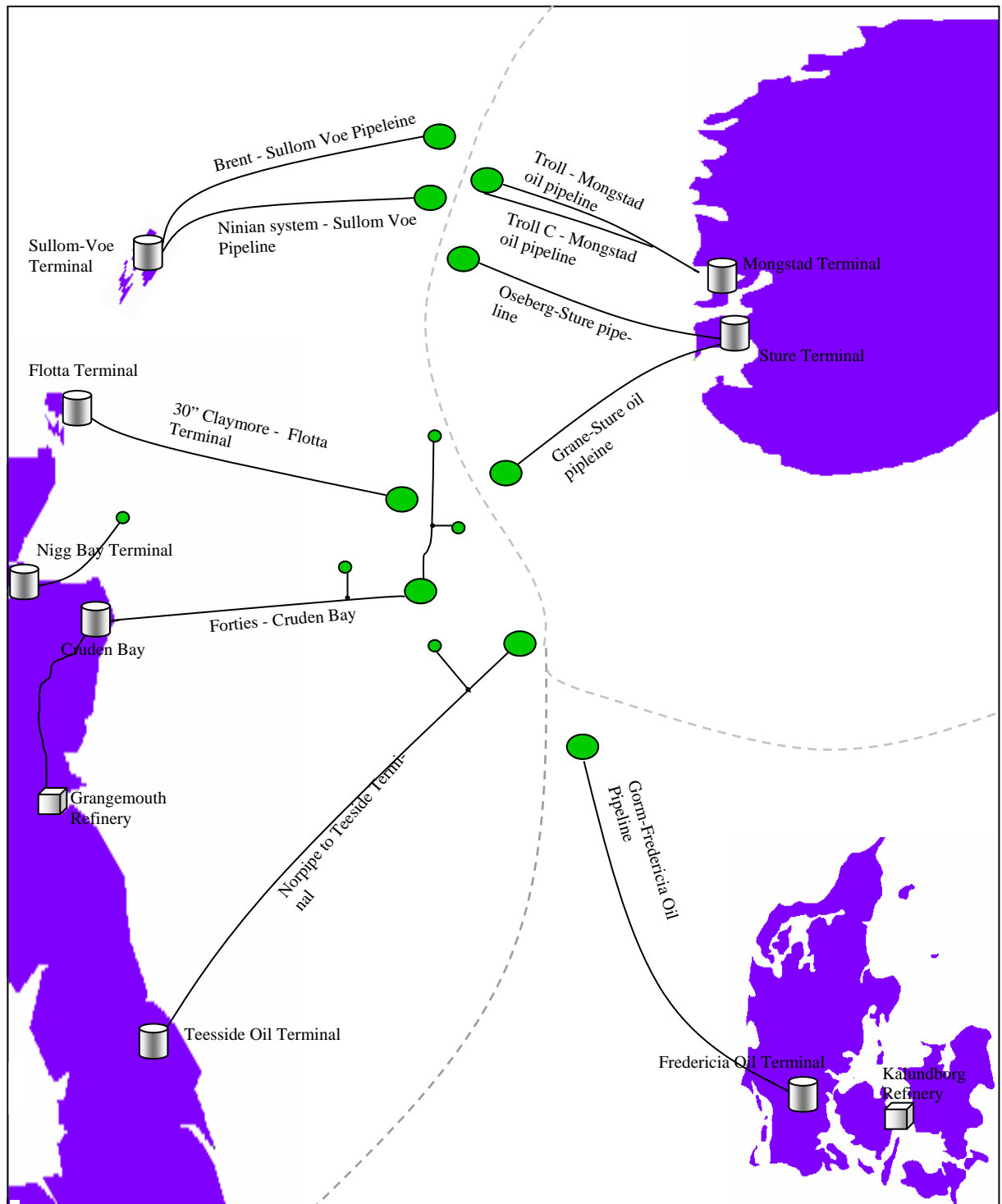
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Part 1 - North Sea Upstream Infrastructure

North Sea Infrastructure - Overview

Figure 1: Overview of Important North Sea Infrastructures



The above diagram shows the relative positioning of the main North Sea pipelines and terminals. In the following section the report will detail each individual pipeline system.

Figure 2: Overview of North Sea Crudes: Properties, Production and Decline Rates

Grade	Type	Crude Properties			Production - kbd					Y/Y Change (5 Yr)	
		API	Sul	TAN	2005	2006	2007	2008	3 Yr Av	kbd	%
ALBA	Heavy Sour	19.7	1.19	1.560	57	50	42	33	42	-9.1	-18.5
ALVHEIM	Light Sweet	37.7	0.151	0.081	0	0	0	53	18	10.7	100.0
ANASURIA	Light Sweet	39.7	0.34	0.015	15	13	6	9	9	-0.3	-2.3
ASGAARD	Light Sweet	48.9	0.0746	0.028	47	40	45	189	91	19.8	24.2
ASGAARD COND.	Light Sweet	51.3	0.0599	0.020	2	11	0	0	4	-	-
BALDER	Heavy Sour	23.2	0.685	1.490	0	0	0	0	0	-	-
BANFF	Light Sweet	38.6	0.344	0.057	2	2	0	2	1	-1.6	-71.6
BEATRICE	Light Sweet	37.8	0.0631	0.054	2	3	2	0	2	-0.9	-65.6
BERYL	Light Sweet	38.6	0.364	0.112	42	32	26	21	26	-5.2	-15.0
BRENT	Light Sweet	37.9	0.442	0.046	241	237	199	165	200	-29.9	-13.3
CAPTAIN	Heavy Sour	19.8	0.655	2.050	13	16	15	23	18	-2.1	-12.7
CHESTNUT	Medium Sour	29.3	0.664	0.632	0	3	0	1	1	0.1	19.1
CLAIR	Heavy Sweet	23.7	0.437	1.160	12	23	30	44	32	8.9	40.9
CURLEW	Light Sweet	49.4	0.0652	0.022	3	1	1	1	1	-0.8	-33.0
DE RUYTER	Light Sweet	41.8	0.182	0.029	0	0	23	18	14	3.7	44.2
DRAUGEN	Light Sweet	40.6	0.148	0.052	103	82	75	70	76	-12.2	-13.1
DUC	Medium Sweet	34.1	0.261	0.374	235	215	200	174	196	-6.0	-2.9
DUMBARTON	Light Sweet	38.3	0.273	0.016	0	0	19	23	14	4.5	54.6
EKOFISK	Light Sweet	37.7	0.208	0.104	577	543	451	419	471	-34.9	-6.8
F3 COND	Light Sweet	66.8	0.0061	0.016	0	0	0	0	0	0.0	0.0
FIFE	Light Sour	37	0.542	0.042	5	4	0	1	2	-3.1	-67.6
FLOTTA	Medium Sour	34.4	1.04	0.060	89	65	69	64	66	-8.8	-11.5
FOINAVEN	Heavy Sweet	26.8	0.369	0.133	59	54	57	42	51	-8.2	-14.7
FORTIES	Light Sour	40.9	0.536	0.092	543	478	566	611	551	-11.8	-2.1
GLITNE	Medium Sour	32.2	0.534	0.066	10	9	2	10	7	-2.5	-30.3
GRANE	Heavy Sour	18.6	0.887	2.040	95	181	176	149	169	27.2	20.6
GRYPHON	Heavy Sweet	23	0.378	2.990	35	33	23	24	27	-0.3	-0.9
GULLFAKS A	Light Sweet	37.5	0.287	0.072	306	291	314	273	293	7.3	2.5
GULLFAKS C	Light Sweet	37.5	0.287	0.072	45	0	0	0	0	-31.4	-85.0
HANZE	Light Sweet	39.2	0.303	0.292	17	11	8	8	9	-4.6	-32.6
HARDING	Heavy Sour	20.7	0.594	2.860	33	25	19	17	20	-7.5	-28.1
HEIDRUN	Heavy Sour	24.5	0.561	2.870	0	0	0	9	3	1.3	73.6
JOTUN	Light Sweet	40.8	0.182	0.056	48	56	45	35	45	2.8	5.8
KITTIWAKE	Light Sour	36.4	0.9	0.018	0	0	0	0	0	-	-
KYLE CURLEW	Light Sweet	44.5	0.159	0.036	3	0	0	0	0	0.0	0.0
LEADON	Heavy Sweet	17.8	0.45	3.310	4	1	0	0	0	-	-
LIVERPOOLBAY	Light Sweet	44.8	0.201	0.026	31	22	12	12	16	-7.9	-34.8
NJORD	Light Sweet	43.8	0.0644	0.028	25	15	5	14	12	-2.1	-12.0
NORNE	Medium Sweet	31	0.241	0.183	68	77	37	68	61	-7.1	-11.5
OSEBERG	Light Sweet	37.4	0.269	0.195	288	242	209	207	219	-33.3	-12.9
PIERCE	Light Sweet	40.5	0.124	0.054	12	9	13	8	10	-1.2	-10.3
ROSS	Medium Sweet	31.3	0.311	0.066	29	18	10	19	16	-3.0	-13.1
SCHIEHALLION	Heavy Sweet	25.6	0.468	0.296	77	70	57	46	58	-13.8	-19.5
SIRI	Light Sweet	38	0.194	0.071	27	12	10	16	13	-1.8	-8.1
SOUTH ARNE	Light Sweet	37	0.21	0.044	34	23	10	14	16	-4.7	-19.8
STATFJORD	Light Sweet	39	0.236	0.050	347	290	270	241	267	-59.5	-18.8
TRITON	Light Sweet	37.5	0.324	0.067	58	47	42	27	39	-7.1	-15.0
TROLL	Medium Sweet	30.6	0.233	0.760	269	263	210	218	230	13.1	5.5
VARG	Light Sweet	37.6	0.218	0.046	16	11	3	14	9	0.4	3.5
VOLVE	Heavy Sour	27.8	1.82	0.106	0	0	0	22	7	-	-
WYTCH	Light Sweet	41.2	0.0808	0.042	30	24	23	23	23	-3.5	-13.0
Total Production (kbd):					3,951	3,602	3,325	3,437	3,455		
N Sea Average (Crude Quality):		35.49	0.38	0.49						Total Y/Y Decline Rate:	
										-226.28	-7.00

Source: CTFO

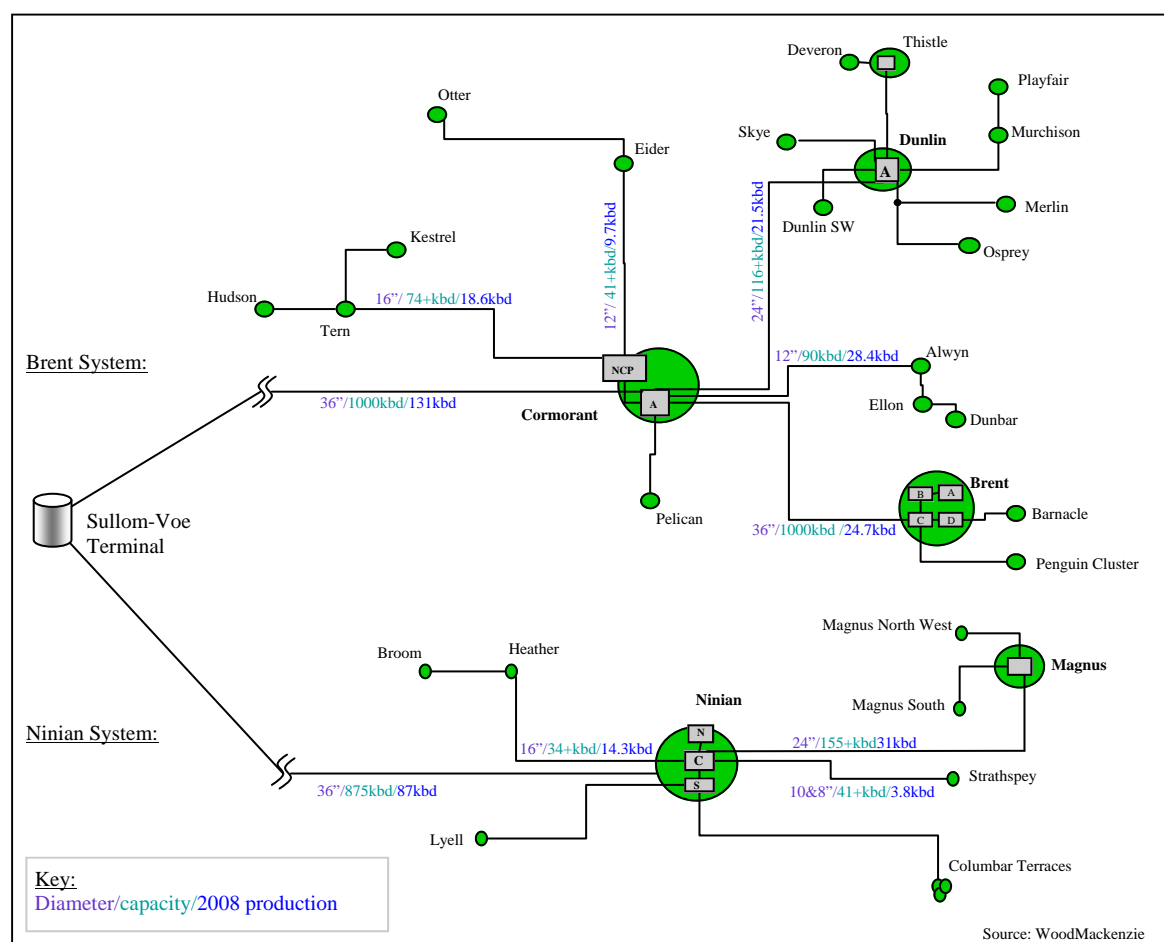
The majority of N Sea crudes are light-sweet with relatively low acidity. The main exceptions to this are Alba, Balder, Captain, Grane, Heidrun, Leadon and Volve.

Over the last 5 yrs the average yearly decline rate has been 226kbd, or 7% of total N Sea production (including growth from new field start-up). This decline is even more pronounced when looking just at the BFOE grades, which have declined at 8.8% annually over the last five years.

According to data from CTFO 2008 actually bucked the trend of declining production. However this should not necessarily be taken at face value as reporting of information into the BP system improved in 2008. Better data reporting aside there were a number of fundamental factors in 2008 which offset decline rates in mature fields. These included new field start-ups (Alvheim & Volve), increased Buzzard production and a lower summer maintenance program compared to 2007.

North Sea Infrastructure - Brent

Figure 3: Infrastructure of fields contributing to Brent Blend



Brent

The Brent blend is made up of the Brent and Ninian Pipeline Systems, both in the Northern North Sea. The Brent Pipeline System runs from Sullom-Voe to Brent 'Charlie' via Cormorant 'Alpha', which is the focal point of the system. A total of 32 fields are linked via the Brent and Ninian systems. These are all commingled into Brent blend with the exception of around 90% of Brent field NGL's, which are transported separately to St Fergus.

The Brent system has 13 platforms in total, the main ones being:

- Thistle platform - 280kbd processing capacity;
- Brent's four platforms - three of which can process up to 150kbd, one can process up to 100kbd. These also have combined storage for 2.8 million barrels;
- Dunlin's platform - processing capacity of 150kbd and storage for 838,000 barrels;
- Cormorant - two platforms (North Platform and Alpha) with processing capacity of 180kbd and 60kbd respectively. Alpha also has storage space for 1 million barrels.

The Ninian system has four platforms, these are:

- Magnus 'Alpha' platform - 140kbd processing capacity
- Ninian field has three platforms (Northern, Central and Southern) with processing capacities of 90kbd, 276kbd, 160kbd respectively.

Both Brent and Ninian systems combine at Sullom-Voe terminal (SVT). SVT also receives oil from the Clair system (37kbd in 2008), to the West of the Shetland Islands and handles shuttle-tankered oil from BP's Schiehallion and Loyal fields (61kbd in 2008). SVT has a total throughput capacity of 1,410kbd and has storage for 9.1 million barrels.

The quality of Brent is expected to remain largely unchanged in coming years, although in 2012 the extra relative output from Dunbar field (constituting 5% of the Brent blend in 2011 and 15% 2012) will make the Brent blend slightly lighter (35.3° in 2011 to 36.4° in 2012).

North Sea Infrastructure - Brent

Figure 4: Brent Production - History and future (in kbd)

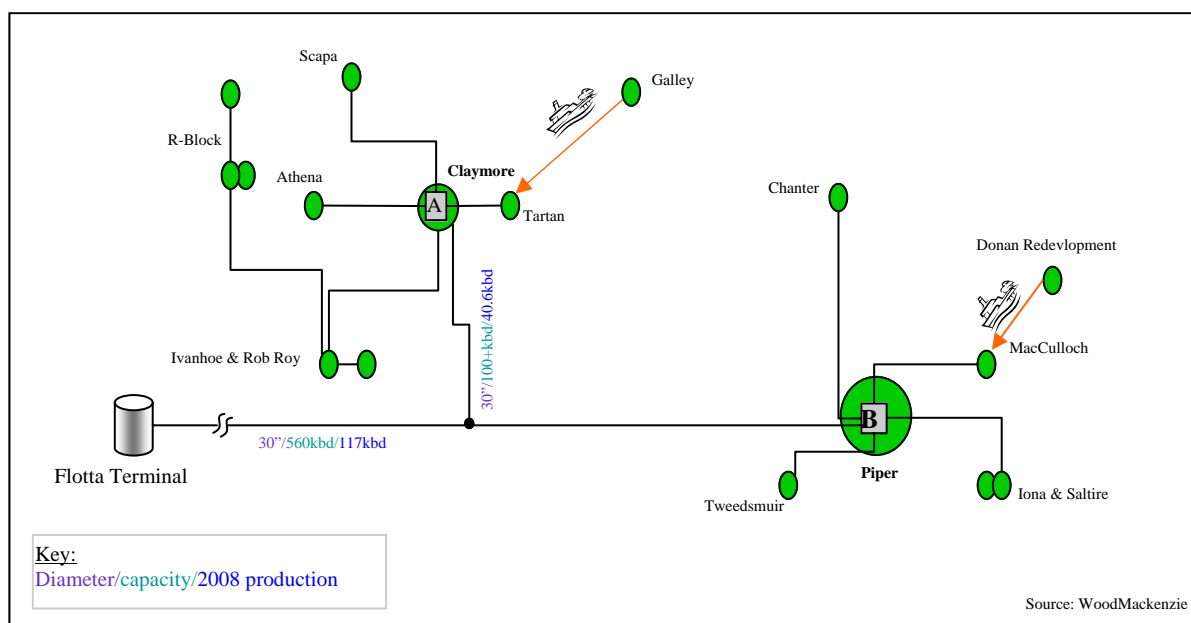
			Production												
Area		Field Name	Type	2005	2006	2007	2008E	2009E	2010E	2011E	2012E	Sulphur Level (%w)	API (°)	TAN (mgKOH/g)	General Classification
Brent System	Alwyn Area	Alwyn North	Oil	9.5	6.5	10.3	10.5	11.5	12.5	9.0	7.0	0.4	43.5	0.1	Light Sweet
Brent System		Dunbar	Oil	14.6	13.4	17.2	14.0	12.0	11.5	11.0	23.8	0.4	43.5	0.1	Light Sweet
Brent System		Ellon	Oil	0.7	1.9	1.4	0.8	0.7	0.6	0.6	0.5	0.4	43.5	0.1	Light Sweet
Brent System		Forvie North	Condensate	0.0	3.6	2.8	3.1	2.6	2.3	2.0	1.7	n/a	n/a	n/a	-
Brent System		Grant	Condensate	2.8	2.2	1.6	1.1	1.0	0.9	0.8	0.8	n/a	n/a	n/a	-
Brent System		Cormorant	Oil	15.7	18.8	17.6	22.0	20.9	19.9	18.0	16.6	0.5	34.9	0.1	Light Sour
Brent System		Cormorant	NGL	1.6	1.3	1.4	1.9	1.8	1.8	1.6	1.5	n/a	n/a	n/a	-
Brent System		Barnacle	Oil	0.0	0.0	0.0	2.0	3.0	1.8	0.0	0.0	0.4	38.0	0.1	Light Sweet
Brent System		Brent	Oil	10.0	8.0	9.0	5.0	4.0	4.0	3.0	2.0	0.3	37.6	0.1	Light Sweet
Brent System		Brent	NGL	24.0	24.0	20.0	17.0	12.0	8.0	5.0	3.0	n/a	n/a	n/a	-
Brent System		Dunlin	Oil	4.5	3.8	3.4	2.5	1.5	0.8	0.3	0.0	0.3	33.5	0.1	Light Sweet
Brent System		Dunlin SW	Oil	1.0	1.0	0.7	0.4	0.3	0.2	0.1	0.0	0.5	33.0	0.1	Light Sour
Brent System		Thistle	Oil	3.0	3.8	4.1	6.3	12.7	8.4	5.4	4.2	0.3	38.4	0.1	Light Sweet
Brent System		Deveron	Oil	0.4	0.3	0.4	0.3	0.3	0.3	0.3	0.2	0.3	38.0	0.1	Light Sweet
Brent System		Eider	Oil	2.5	2.5	2.0	1.7	1.5	1.3	1.1	0.0	0.7	34.0	0.1	Light Sour
Brent System		Hudson	Oil	9.6	7.8	9.7	7.0	4.3	2.0	1.0	0.8	1.0	34.0	0.1	Light Sour
Brent System		Tern	Oil	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.4	33.5	0.1	Light Sweet
Brent System		Kestrel	Oil	3.4	1.7	1.6	1.6	1.5	1.4	1.2	1.0	0.4	31.0	0.1	Medium Sweet
Brent System		Merlin	Oil	2.3	1.3	2.0	2.0	1.8	1.3	0.8	0.0	0.4	31.5	0.1	Light Sweet
Brent System		Osprey	Oil	3.4	4.2	3.0	4.3	5.0	4.5	2.8	0.0	0.4	30.5	0.1	Medium Sweet
Brent System	Otter	Oil	18.4	15.8	13.7	8.0	6.0	3.2	1.8	0.0	0.4	37.0	0.1	Light Sweet	
Brent System	Penguin	Oil	10.0	12.0	11.0	13.0	11.0	10.0	8.0	3.0	0.3	38.0	0.1	Light Sweet	
Brent System	Penguin	NGL	3.0	3.0	2.0	3.0	3.0	3.0	2.0	1.0	n/a	n/a	n/a	-	
Brent System	Skye	Oil	0.0	0.0	0.0	0.0	5.0	3.5	1.5	0.0	0.5	32.0	0.1	Light Sour	
Brent System	Murchison UK	Oil	5.3	5.4	5.2	5.1	4.9	4.8	4.6	4.4	0.3	38.2	0.1	Light Sweet	
Brent System	Playfair	Oil	6.0	0.5	1.1	0.6	0.4	0.0	0.0	0.0	0.4	40.0	0.1	Light Sweet	
Brent System	Pelican	Oil	5.1	5.4	4.2	4.2	6.0	4.0	3.0	2.3	0.1	35.0	0.1	Light Sweet	
Brent System	Pelican	NGL	0.3	0.5	0.7	0.7	0.7	0.4	0.3	0.2	n/a	n/a	n/a	-	
Ninian System	Heather	Oil	2.7	2.3	1.9	2.3	4.5	4.0	3.7	3.2	0.7	34.5	0.5	Light Sour	
Ninian System	Ninian	Oil	23.0	26.0	25.0	25.0	24.0	24.0	23.0	22.0	0.4	36.0	0.2	Light Sweet	
Ninian System	Strathspey	Oil	5.8	7.6	5.5	3.5	6.0	3.2	2.8	2.2	0.3	42.0	0.1	Light Sweet	
Ninian System	Strathspey	Condensate	1.0	0.3	0.3	0.3	1.3	1.1	1.0	0.5	n/a	n/a	n/a	-	
Ninian System	Columba Terraces	Oil	12.6	6.6	6.0	5.6	5.1	4.6	4.2	3.8	0.5	36.0	1.0	Light Sour	
Ninian System	Lyell	Oil	2.0	2.0	4.0	7.0	7.0	7.0	7.0	7.0	0.3	36.5	0.1	Light Sweet	
Ninian System	Broom	Oil	27.0	19.0	16.0	12.0	10.0	14.0	10.0	8.0	0.3	26.5	0.5	Medium Sweet	
Ninian System	Magnus	Oil	33.0	29.0	20.0	30.0	32.0	34.0	34.0	34.0	0.3	39.0	0.1	Light Sweet	
Ninian System	Magnus South	Oil	3.0	4.0	2.0	1.0	1.0	0.0	0.0	0	0.3	39.0	0.1	Light Sweet	
Ninian System	Magnus NW	Oil	0.0	0.0	0.0	0	3.0	3.0	2.0	2.0	0.3	39.0	0.1	Light Sweet	
		Total Brent Blend:	Production	245.6	223.9	208.8	219.5	218.5	200.1	168.4	154.0				
			Sulphur level	0.4	0.4	0.4	0.4	0.35	0.35	0.4	0.4				
			API	34.6	34.3	34.9	34.7	35.0	34.9	35.3	36.4				
			TAN	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
Source: WoodMackenzie															

Source: WoodMackenzie

= no data available, average taken

North Sea Infrastructure - Flotta

Figure 5: Infrastructure of fields contributing to Flotta Blend



Flotta

The Claymore-Piper pipeline begins at Piper Bravo platform, in the Central North Sea, and transports oil to the Flotta Terminal. A total of 20 fields feed into the system, all of these are commingled into Flotta Blend, except for crude from the Donan redevelopment. The Donan redevelopment exports its oil via a shuttle-tanker and only its NGLs are commingled into Flotta blend, via the MacCulloch field.

There are six platforms in the Claymore - Piper system, the main ones are:

- Claymore 'Alpha' - 160kbd processing capacity;
- Piper 'Bravo' - 140kbd processing capacity;
- MacCulloch - FPS (Floating Production System) capable of processing 60kbd.

The Flotta Terminal handles oil from the Claymore - Piper pipeline and the Foinaven field (West of Shetland, 48kbd in 2008). The terminal can handle up to 560kbd and has storage facilities for 4.5 million barrels.

Figure 6: Infrastructure of fields contributing to Flotta Blend

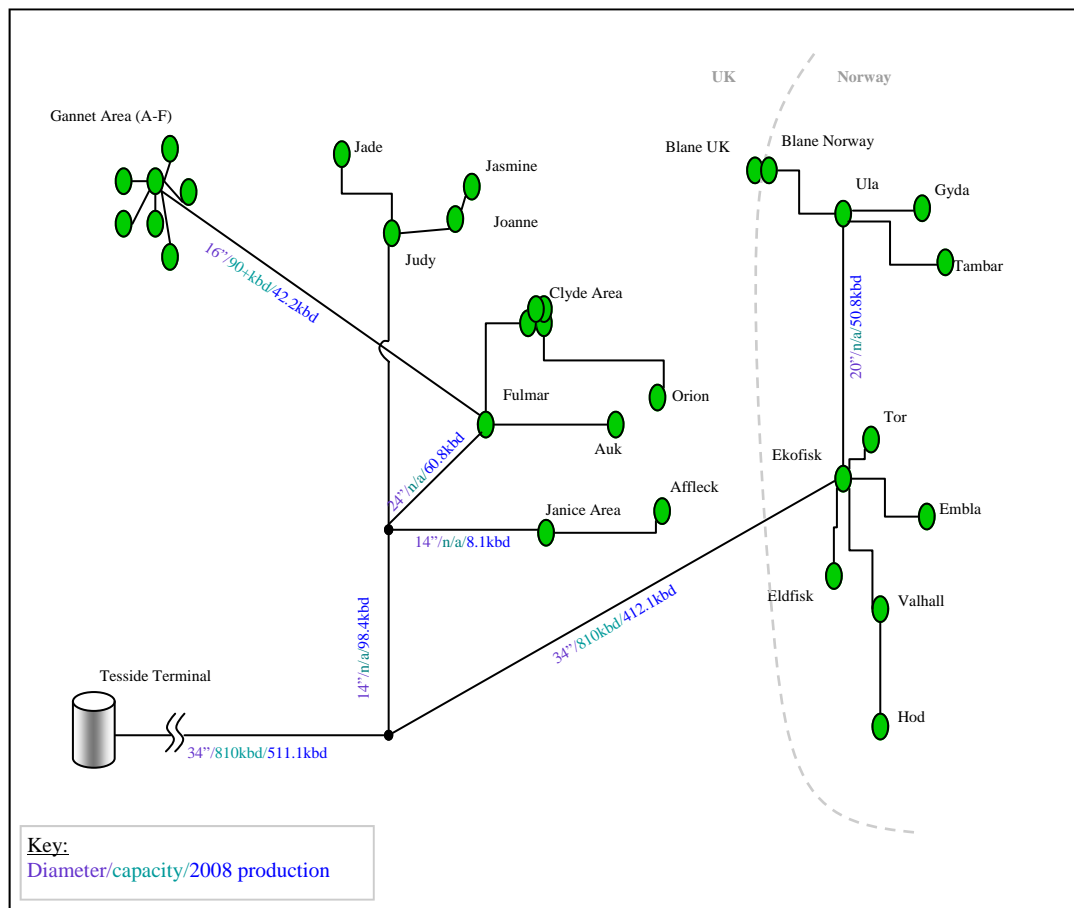
Area	Field Name	Type	Production								Sulphur Level (ppm)	API (°)	TAN (mg/kg)	General Classification
			2005	2006	2007	2008E	2009E	2010E	2011E	2012E				
Claymore-Piper system	Claymore	Oil	23.2	22.8	20.6	21.0	20.0	19.0	18.0	15.5	1.9	29.0	0.1	Medium Sour
Claymore-Piper system	Claymore East	Oil	0.5	0.5	0.6	0.6	0.5	0.5	0.7	3.3	1.9	29.0	0.1	Medium Sour
Claymore-Piper system	Tartan	Oil	1.4	3.0	2.8	4.6	4.1	5.0	5.3	4.5	0.8	39.5	0.5	Light Sour
Claymore-Piper system	Highlander	Oil	2.7	2.5	1.1	1.5	2.7	3.2	2.4	2.1	1.0	34.0	0.5	Light Sour
Claymore-Piper system	Petronella	Oil	0.9	1.2	0.6	0.5	0.6	0.8	0.9	0.8	0.9	36.5	0.5	Light Sour
Claymore-Piper system	Tartan North Terrace	Oil	2.1	0.8	0.4	0.6	0.6	0.4	0.0	0.0	0.9	36.5	0.5	Light Sour
Claymore-Piper system	Duart	Oil	0.0	0.0	1.5	2.5	1.4	1.3	1.2	1.1	0.9	36.5	0.5	Light Sour
Claymore-Piper system	Chanter	Oil	0.1	0.0	0.6	1.0	0.7	0.6	0.5	0.4	0.3	44.9	0.1	Light Sweet
Claymore-Piper system	Athena	Oil	0.0	0.0	0.0	0.0	3.5	12.0	11.0	10.5	0.8	25.0	0.2	Medium Sour
Claymore-Piper system	Galley	Oil	7.5	5.1	2.3	2.2	2.0	3.4	3.6	3.1	0.8	41.0	0.1	Light Sour
Claymore-Piper system	Iona	Oil	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.4	0.3	41.5	0.1	Light Sweet
Claymore-Piper system	Saltire	Oil	2.7	3.2	3.5	2.5	1.6	1.5	1.4	1.3	0.3	41.5	0.1	Light Sweet
Claymore-Piper system	Ivanhoe	Oil	1.3	1.3	0.9	0.9	0.9	0.8	0.8	0.7	1.2	30.0	0.1	Medium Sour
Claymore-Piper system	Rob Roy	Oil	1.9	2.0	1.1	1.1	1.1	1.0	1.0	0.9	0.5	40.0	0.1	Light Sweet
Claymore-Piper system	MacCulloch	Oil	23.0	16.0	11.0	10.0	11.0	7.0	5.0	3.0	0.8	34.5	0.1	Light Sour
Claymore-Piper system	Piper	Oil	11.6	9.2	8.8	9.0	8.4	8.2	8.0	7.8	0.9	36.5	0.1	Light Sour
Claymore-Piper system	Renee	Oil	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	38.0	0.1	Light Sweet
Claymore-Piper system	Rubie	Oil	2.3	1.0	0.8	0.8	4.5	3.5	2.5	2.0	0.2	44.0	0.1	Light Sweet
Claymore-Piper system	Rochelle	Oil	0.0	0.0	0.0	0.0	0.0	5.0	3.8	2.3	0.0	36.5	0.1	Light Sweet
Claymore-Piper system	Scapa	Oil	4.3	2.2	5.4	4.3	3.8	3.6	5.0	4.5	1.7	32.5	0.5	Light Sour
Claymore-Piper system	Tweedsmuir	Oil	0.0	0.0	6.0	35.0	35.0	23.0	18.0	13.0	0.3	40.0	0.1	Light Sweet
Shuttle - Tankered	Donan Redevelopment	Oil	0.0	0.0	33.0	35.0	33.0	25.0	15.0	12.0	0.3	39	0.1	Light Sweet
Claymore-Piper system		NGL	0.0	0.0	3.0	2.0	1.0	1.0	1.0	1.0	n/a	n/a	n/a	-
Total Flotta Blend:			Production:	86.1	71.0	104.0	135.1	136.4	125.8	105.1	90.2			
			Sulphur level:	1.1	1.2	0.8	0.7	0.7	0.8	0.8	0.9			
			API:	34.4	34.1	34.9	36.4	36.5	35.3	34.8	34.3			
			TAN:	0.2	0.2	0.1	0.0	0.1	0.2	0.2	0.2			

Source: WoodMackenzie

= no data available, average taken

North Sea Infrastructure - Ekofisk

Figure 7: Infrastructure of fields contributing to Norpipe Blend (Ekofisk)



Source: WoodMackenzie

Ekofisk

There are over 30 fields linked to the Norpipe oil pipeline, all of which produce oil that is commingled and transported to the Teesside Oil Terminal. Although Ekofisk is exported from Tees Terminal in the UK it is actually a Norwegian crude.

There are a total of 16 processing platforms in the system, the main ones being:

- Fulmar 'Alpha' - 180kbd processing capacity;
- Valhall - three platforms with combined 168kbd processing capacity;
- Ekofisk - 600kbd processing capacity.

Teesside Terminal, the export point for Ekofisk, is capable of processing 780kbd of unstabilised crude and has storage facilities for 7.5 million barrels.

The oil produced is largely dependent on Ekofisk II's oil, as this makes up 40-45% of the blend. Ekofisk is a light, sweet crude with a very low TAN. The quality of the crude is set to remain largely unchanged in coming years, with a slight change due when 'Jasmine' comes online in 2011. This will make up around 7% of the blend making it slightly more acidic.

North Sea Infrastructure - Ekofisk

Figure 8: Ekofisk (Norpipe) Oil Production - History and future (kbd)

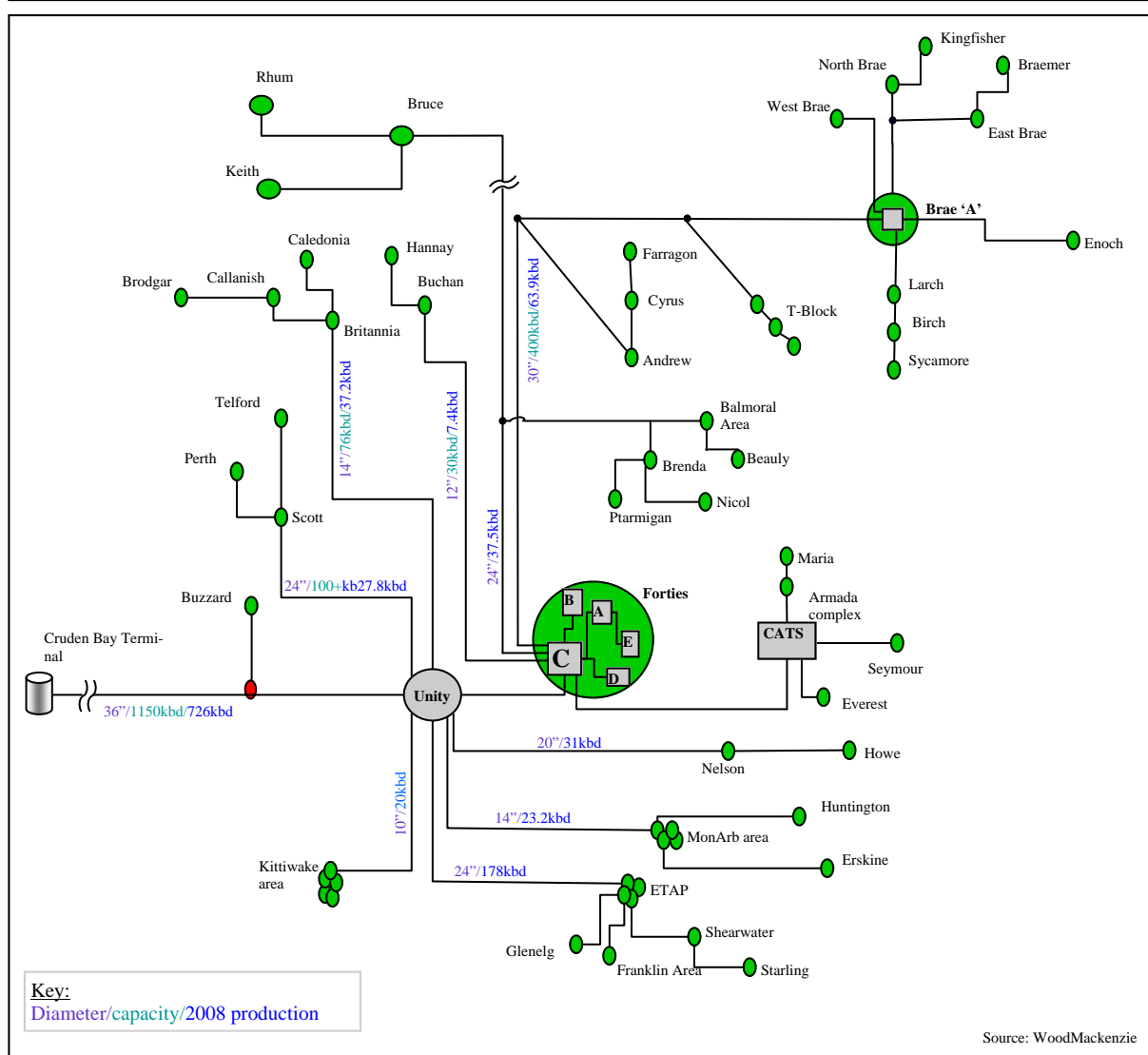
				Production												
Area		Field Name	Type	2005	2006	2007	2008E	2009E	2010E	2011E	2012E	Sulphur Level (%w)	API (°)	TAN (mgKOH/g)	General Classification	
UK- Norpipe	Gannet Area	A	Oil	15.3	17.3	13	11.8	12.4	10.8	9.3	8.3	0.2	39.8	0.1	Light	Sweet
UK- Norpipe		B	Oil	9.1	1.4	3.4	3.7	3.6	4.2	4	1.8	0.2	40	0.1	Light	Sweet
UK- Norpipe		C	Oil	4.6	6.3	7.1	6.1	8.8	6.9	8.2	8.5	0.2	38	0.1	Light	Sweet
UK- Norpipe		D	Oil	4.7	7.9	6.1	5.4	6.5	5.1	4	2.8	0.2	43	0.1	Light	Sweet
UK- Norpipe		E	Oil	8.5	9.2	3	8.3	7.3	7.8	6.8	5.3	0.2	20	0.1	Heavy	Sweet
UK- Norpipe		F	Oil	0.8	2.3	3.8	2.7	2.2	4.3	3.5	2.7	0.2	35	0.1	Light	Sweet
UK- Norpipe		G	Oil	3.1	4	4.6	4.2	3.1	2.6	1.8	1.3	0.2	39	0.1	Light	Sweet
UK- Norpipe	Clyde Area	Clyde	Oil	5.6	4.5	3.2	4.5	5.5	5	4.5	4.2	0.4	38	0.1	Light	Sweet
UK- Norpipe		Levan	Oil	1.7	0.7	0.2	0.5	0.5	0.3	0.3	0.2	0.4	38	0.1	Light	Sweet
UK- Norpipe		Nethan	Oil	0	0	0	0.3	0.3	0.2	0	0	0.4	38	0.1	Light	Sweet
UK- Norpipe		Medwin	Oil	0.1	1.9	0.6	1.3	1.3	1	0.8	0.7	0.4	38	0.1	Light	Sweet
UK- Norpipe	Janice Area	Fulmar	Oil	3.7	3.4	1.7	3.3	3.4	3.2	3.1	3	0.25	40.8	0.1	Light	Sweet
UK- Norpipe		Auk	Oil	4.5	4.7	2.7	3.6	9.8	29.3	28	23	0.4	38	0.1	Light	Sweet
UK- Norpipe		Orion	Oil	4.4	7	5.4	5.1	4.9	3.9	3.5	3.2	0.3	43.9	0.1	Light	Sweet
UK- Norpipe		Janice	Oil	5.1	6.8	3.3	3	3.5	3.2	2.9	2.6	0.3	38	0.1	Light	Sweet
UK- Norpipe		James	NGL	0.2	0.2	0.1	0.1	0	0	0	0				-	-
UK- Norpipe		Affleck	Oil	3.2	1	1.1	1.5	1.5	1	0.8	0.4	0.3	30	0.1	Medium	Sweet
UK- Norpipe		Blane UK	Oil	0	0	0	3.5	10	7	5	4	0.3	36.5	0.1	Light	Sweet
UK- Norpipe	J-Block	Joanne	Oil	0	0	4	10.3	8.5	6.6	5.7	4.9	0.3	42	0.1	Light	Sweet
UK- Norpipe		Joanne	Oil	10	4	5	5	4	3	2	2	0.2	44	0.1	Light	Sweet
UK- Norpipe		Judy	Oil	12	26	20	16	13	9	5	3	0.2	44	0.1	Light	Sweet
UK- Norpipe		Jasmine	Oil	0	0	0	0	0	0	35	32	0.2	44	0.1	Light	Sweet
UK- Norpipe	Jade	Condensate	18.8	14.2	8.3	8.5	7	5.8	4.5	4	0.26	47	0.1			
Norway- Norpipe	Ekofisk Area	Ula	Oil	20	18	14.6	11.5	15.9	19.3	17.1	15	0.1	38	0.1	Light	Sweet
Norway- Norpipe		Gyda	Oil	13	11	9	13	14	14	14	13	0.1	43.6	0.1	Light	Sweet
Norway- Norpipe		Ekofisk II	Oil	272.7	272.1	237.8	220	215	210	200	195	0.2	41.1	0	Light	Sweet
Norway- Norpipe		Ekofisk II	NGL	10.6	10.1	8.3	10	10	10	10	9					
Norway- Norpipe		Eldfisk II	Oil	60.5	51.9	45.5	52	56	61	58	55	0.2	41.1	0.1	Light	Sweet
Norway- Norpipe		Tor II	Oil	2.3	2.1	4	2.9	2.2	1.8	1.4	1.1	0.2	38	0.1	Light	Sweet
Norway- Norpipe		Tor	Oil	0.8	0.7	1.4	1.1	0.8	0.6	0.5	0.4	0.2	38	0.1	Light	Sweet
Norway- Norpipe		Valhall	Oil	84	70	59	70	85	82	79	72	0.3	35	0.1	Light	Sweet
Norway- Norpipe		Hod	Oil	4	3.3	2.2	4.8	6.1	6.4	7.2	6	0.26	40.4	0.1	Light	Sweet Acidic
Norway- Norpipe		Blane Norway	Oil	0	0	0.9	2.3	1.9	1.5	1.3	1.1	0.3	42	0.1	Light	Sweet
Norway- Norpipe		Embla	Oil	4.7	5.7	3.4	0.5	5.3	5	4.5	4	0.2	42	0.1	Light	Sweet
Norway- Norpipe	LPG		0.7	0.6	0.4	0.6	0.5	0.5	0.5	0.5						
Norway- Norpipe	Oil		21.4	16.1	11.2	13	12	10	7	4	0.3	38	0.1	Light	Sweet	
Norway- Norpipe	Tambar	NGL	1.2	0.9	0.6	0.7	0.9	0.8	0.7	0.6						
		Total	Production:	611.3	585.3	494.9	511.1	542.7	543.1	539.9	494.6					
			Sulphur:	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2					
			API:	39	39.2	39.4	38.9	38.8	38.6	38.9	39					
			TAN:	0	0	0	0	0.1	0.1	0.1	0.1					
Source: WoodMackenzie																

Source: WoodMackenzie

= no data available, average taken

North Sea Infrastructure - Forties

Figure 9: Fields contributing to Forties Blend



The **Forties** system is made up of over 75 fields in the Central and Northern North Sea. They all join to the Forties pipeline system via Forties 'Charlie' or 'Unity' platforms, with the exception of the Buzzard field which is linked directly into the pipeline via a subsea 'hot-tap' tie-in.

The Forties pipeline system comprises 25 platforms, the main ones being:

- Marnock (in the ETAP area) - 250kbd processing capacity;
- Brae 'Alpha' platform - 120kbd processing capacity;
- Forties field - six platforms, four with 155kbd processing capacity and 'Unity' with a 1000kbd processing capacity;
- CATS (Central Area Transmission System) riser platform processes and transports wet gas to the CATS terminal in Teeside. However, the heavier condensates and NGL's are transported via the Forties pipeline.

Forties blend is transported to Cruden Bay Terminal, which has a processing capacity of 1,150kbd and storage facilities for 4.08 million barrels. Once in Cruden Bay terminal crude can be exported via tanker from Hound Point, or piped directly to Grangemouth Refinery. Grangemouth used to process 6 cargoes/m (3.6m bbls) but this is believed to be lower since introduction of Buzzard into Forties blend - i.e. need to dilute Forties more with sweeter crudes.

For a N Sea crude Forties blend has quite a high sulphur content, mainly due to the Buzzard field (1.2% sulphur content) which contributes to 25% of Forties production. Forties will become even more sour in coming years due to other fields deteriorating more rapidly than Buzzard.

North Sea Infrastructure - Forties

Figure 10: Forties Production - History and Future (kbd)

The following table shows historical and future Forties production and quality. It assumes that all the condensates are commingled into Forties blend. However, as the properties of the condensates are largely unknown, we have given them an average value for their sulphur content, API and TAN. These averages, along with qualities and production volumes for individual fields enables the prediction of forward Forties qualities.

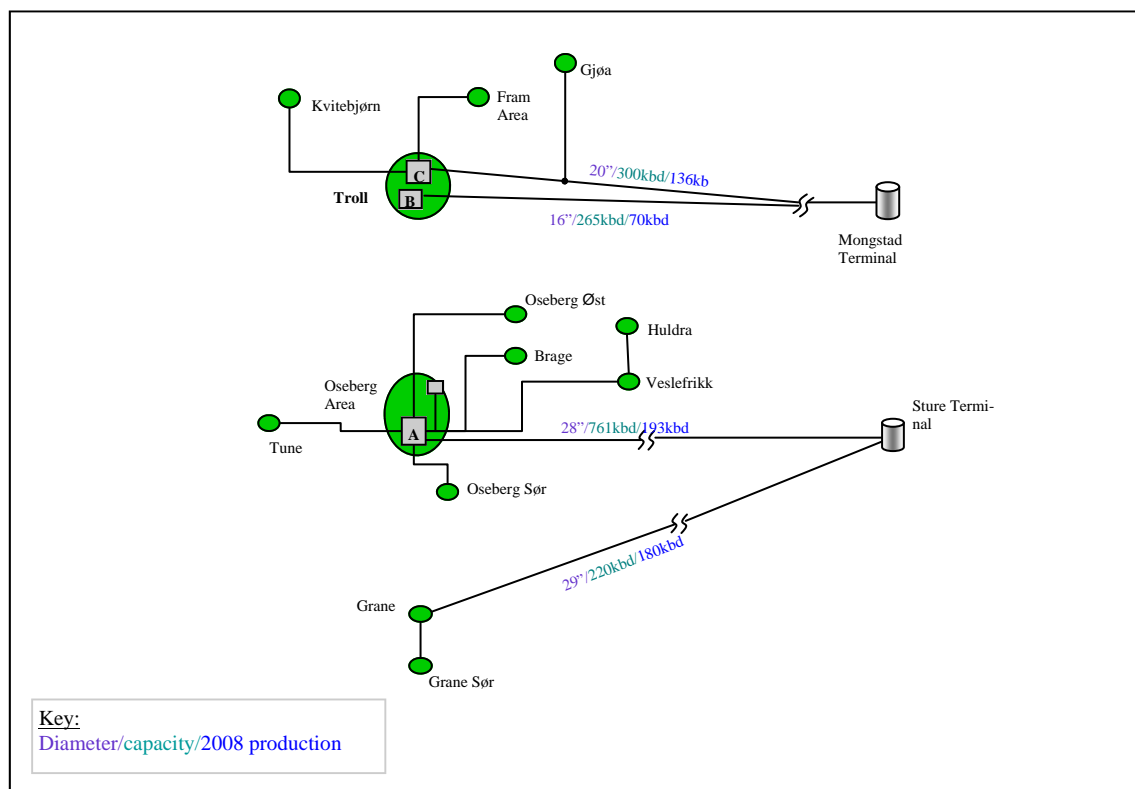
Area	Field Name	Type	Production								Sulphur Level (‰)	API (°)	TAN (mg/KOH/g)	General Classification	
			2005	2006	2007	2008E	2009E	2010E	2011E	2012E					
Forties Blend	Nelson	Oil	40	31	30	28	25	21	20	17	0.2	41	0.1	Light	Sweet
Forties Blend	Howe	Oil	9.7	4.5	3.5	3	2.5	2	1.5	0.5	0.3	41	0.1	Light	Sweet
Forties Blend	Buzzard	Oil	0	0	145	195	195	185	180	160	1.4	32.6	0.1	Light	Sour
Forties Blend	Montrose	Oil	1.3	1.4	1.3	1.5	3.3	3.9	4.7	4.2	0.2	39	0.1	Light	Sweet
Forties Blend	Arbroath	Oil	10.7	8	7.5	7.8	7.1	6.5	6	5.5	0.2	39	0.1	Light	Sweet
Forties Blend	Arkwright	Oil	2.2	2	3.5	4	4.8	3.5	2.7	2.2	0.2	39	0.1	Light	Sweet
Forties Blend	Brechin	Oil	3	3.4	2.3	1.1	0.6	0.3	0.4	0.4	0.2	39	0.1	Light	Sweet
Forties Blend	Wood	Oil	0	0	0	3.8	4.6	3.8	1.3	1	0.2	39	0.1	Light	Sweet
Forties Blend	Kittiwake	Oil			0.2	1.2	1	0.6	0.5	0.4	0.6	38.5	0.1	Light	Sour
Forties Blend	Mallard	Oil			5.9	5	3	2.3	2	1.8	0.4	38	0.1	Light	Sweet
Forties Blend	Gadwell	Oil			0.1	3.5	2.5	2	1.5	1	0.5	37	0.1	Light	Sweet
Forties Blend	Goosander	Oil			8.1	6.5	5.5	3.5	3	2.5	0.5	36.7	0.1	Light	Sweet
Forties Blend	Grouse	Oil			0	0	7.5	5.5	4	2	0.5	37.6	0.1	Light	Sweet
Forties Blend	Brodgar	Condensate	0	0	0	6	23	18	14	9	0.387	40.5	0.127		
Forties Blend	Callanish	Oil	0	0	0	17	29	24	19	15	0.3	39	0.1	Light	Sweet
Forties Blend	Machar	Oil	13.9	18.9	11.9	14	12	11	10.5	9.5	0.1	40.5	0.1	Light	Sweet
Forties Blend	Marnock	Oil	2.3	2.2	1.2	2.2	2	2	1.9	1.9	0.1	45	0.1	Light	Sweet
Forties Blend	Monan	Oil	0.2	0	0	0	0	0	0	0	0.1	41	0.1	Light	Sweet
Forties Blend	Mungo	Oil	34.5	27.8	24.1	24	24	20	15	10	0.1	34	0.1	Light	Sweet
Forties Blend	Madoes	Oil	18.1	10.7	5.3	8.5	6.5	3.5	2	1	0.3	40.5	0.1	Light	Sweet
Forties Blend	Mirren	Oil	6.2	6.5	4.1	5	4.2	3	2	1.6	0.3	40.5	0.1	Light	Sweet
Forties Blend	Egret	Oil	1.9	1.3	0.5	0.4	0.3	0.2	0	0	0.3	38.5	0.1	Light	Sweet
Forties Blend	Heron	Oil	7.6	6.9	4.2	4.4	3.9	3.1	2.4	0	0.3	38.5	0.1	Light	Sweet
Forties Blend	Huntington	Oil	0	0	0	0	35	43	48		0.387	40.5	0.127	Light	Sweet
Forties Blend	Nicol	Oil	0	0	1.5	2.5	2.2	2	1.7	1.4	0.3	39	0.1	Light	Sweet
Forties Blend	Perth	Oil	0	0	0	0	0	15	13		2	31.5	0.5	Light	Sour
Forties Blend	Tiffany	Oil	3.1	3.6	3.1	2.9	2.7	2.6	2.4	2.2	0.6	38.5	0.1	Light	Sour
Forties Blend	Toni	Oil	4.2	3.9	3.8	3.7	3.5	3.3	3.1	2.9	0.6	38.5	0.1	Light	Sour
Forties Blend	Thelma	Oil	5.9	5.7	5.5	5.3	4.8	4.7	4.4	4.1	0.6	38.5	0.1	Light	Sour
Forties Blend	Brae Area	Oil	8.9	7.9	7.2	6.9	6	5.1	4.3	3.5	0.6	39	0.1	Light	Sour
Forties Blend	Brae East	Oil	3.8	3.2	2.2	2.1	1.9	1.6	1.4	1.2	0.6	44	0.1	Light	Sour
Forties Blend	Brae West	Oil	16.4	12.8	11.5	10	9	7	5	3.5	0.5	30.1	0.1	Medium	Sweet
Forties Blend	Beinn	Condensate	0.8	1	0.6	4.6	4	3.4	2.9	2.3	0.387	45	0.127		
Forties Blend	Brae Area	Condensate	5.9	5.3	4.8	0.6	0.9	0.7	0.6	0.5	0.387	39	0.127		
Forties Blend	Kingfisher	Oil	5.4	5.2	3.6	2.9	2.4	2.2	1.8	1.5	0.4	40	0.1	Light	Sweet
Forties Blend		Condensate	0.7	0.6	0.5	0.4	0.3	0.2	0.2	0.2	0.38	40.5	0.127		
Forties Blend	Birch	Oil	5	4.7	4.3	3.4	2.2	0.9	0.5	0.4	0.3	42.5	0.1	Light	Sweet
Forties Blend	Larch	Oil	0.7	0.8	0.9	0.7	0.5	0.3			0.2	35.2	0.1	Light	Sweet
Forties Blend	Central Sycamore	Oil	0.1	0.1	1.1	0.9	0.6	0.4	0.3	0.2	0.3	35	0.1	Light	Sweet
Forties Blend	South Sycamore	Oil	0.3	2.3	0.7	2.8	2.4	2.2	1.1	0.8	0.3	35	0.1	Light	Sweet
Forties Blend	Balmoral										0.3	39.3	0.1		
Forties Blend	Blair										0.2	37.7	0.1		
Forties Blend	Glamis										0.3	39.4	0.1	Light	Sweet
Forties Blend	Stirling										0.3	37	0.1		
Forties Blend	Beaulieu	Oil	2	1.2	1	0.9	0.8	0.8	0.7	0.6	0	38.7	0.1	Light	Sweet
Forties Blend	Ptarmigan	Oil	0	0	0	0	3	4.5	3.8	3.2	0.3	43.8	0.1	Light	Sweet
Forties Blend	Brenda	Oil	0	0	10	19	18	15	12	9	0.3	40	0.1	Light	Sweet
Forties Blend	Britannia	Condensate	18	14	13	14	11	9	7	6	0.387	47.5	0.127		
Forties Blend	Caledonia	Oil	2.5	0.8	0.4	0.2	0	0	0	0	0.5	33	0.1	Light	Sweet
Forties Blend	Andrew	Oil	18.1	10.8	13.1	8	6	4	2.5	1.8	0.3	41	0.1	Light	Sweet
Forties Blend	Cyrus	Oil	2.3	0.6	0.7	1.1	0.9	0.6	0.4		0.4	34	0.1	Light	Sweet
Forties Blend	Farragon	Oil	1.9	18.9	13.6	8	5.5	4	3	2	0.3	36	0.1	Light	Sweet
Forties Blend	Maria	Oil	0	0	3.8	16	12	9	6	3	0.3	60	0.1	Light	Sweet
Forties Blend	Drake	Condensate	0.9	1.4	0.6	0.8	0.7	0.5	0.4	0.3	0.387	53.5	0.127		
Forties Blend	Hawkins	Condensate	1	0.5	0.1	0	0	0	0	0	0.387	53.5	0.127		
Forties Blend	Fleming	Condensate	6.2	7.3	3.3	4.8	4.3	3.3	2.8	1.5	0.387	53.5	0.127		
Forties Blend	NW Seymour	Oil	0	0.9	0.8	1.8	1.4	1.3	0.8	0.6		52.5	0.127	Light	Sweet
Forties Blend	SW Seymour	Condensate	2.1	1.3	0.4	0.9	0.8	0.6	0.5	0.4	0.387	52.5	0.127		
Forties Blend	Bruce	Condensate	17.2	10.5	10.3	10	8.8	8	7.2	6.4	0.3	45	0.127		
Forties Blend	Rhum	Condensate	0.1	1	2.1	2.4	2.4	2.8	2.8	2.8	0.387	40.5	0.127		
Forties Blend	Keith	Oil	2.1	1.6	2.3	7	5	3.2	2	1.1	0.3	38	0.1	Light	Sweet
Forties Blend	Everest Complex	Condensate	3	2	2	2	2	2	2	1	0.387	55	0.1		
Forties Blend	Forties	Oil	68	61	54	65	63	60	55	50	0.35	39	0.4	Light	Sweet
Forties Blend		Oil	8.3	7.1	5.1	4.7	3.4	2.6	2.3	2	0.1	38.2	0.1	Light	Sweet
Forties Blend	Telford Area	NGL	1.4	1.2	0.9	0.8	0.6	0.4	0.4	1	0.387	40.5	0.127		
Forties Blend	Scott	Oil	17	20.2	28	23	21	18.5	16.5	14	0.6	37.5	0.5	Light	Sour
Forties Blend	Erskine	Condensate	12	7	4	5	5	4	3	3	0	33.5	0.127		
Forties Blend	Franklin Area	Condensate	120	107	101	93	86	75	60	46	0.3	40.5	0.127		
Forties Blend	Braemar	Condensate	5.5	4.6	3	2.6	1.8	1.5	1.3	1.1	0.6	42.5	0.127		
Forties Blend	Buchan Area	Oil	6.9	6.6	5.7	5.9	6.4	6.7	6	5.3	0.8	34	0.5	Light	Sour
Forties Blend	Hannay	Oil	4.1	4.5	2.2	1.5	1.3	1.2	1.1	1	0.9	32	0.1	Light	Sour
Forties Blend	Glenelg	Condensate	0	6.3	12.8	8.5	6	3.5	2	1.2	0.387	44.1	0.127		
Forties Blend	Lomond	NGL	0.1	0.1	0.1	0.1	0.1	0	0	0	0.2	53	0.1		
Forties Blend		Condensate	2.4	2.4	1.5	1.4	1.3	1.3	1.2	1.1	0.387	40.5	0.127		
Forties Blend	Scoter	Condensate	5.6	5.8	3	2	1	0.5	0.2	0.2	0.387	40.5	0.127		
Forties Blend	Shearwater	Condensate	32	22	12	13	17	17	15	10	0.387	49	0.127		
Forties Blend	Starling	Condensate				5	5	4	3	2	0.387	40	0.127		
Forties Blend	Enoch UK	Oil			4.7	4.2	3.7	2.6	2	1.5	0.3	37	0.1	Light	Sweet
Forties Blend	Total Forties Blend	Production:	576.60	513.20	627.70	726.20	717.50	664.90	606.00	512.10					
		Sulphur:	0.27	0.27	0.55	0.58	0.58	0.57	0.63	0.65					
		API:	31.1	30.8	31.2	32.5	31.8	32.2	32.6	32.9					
		TAN:	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1					

Source: WoodMackenzie

= no data available, average taken

North Sea Infrastructure - Troll, Oseberg & Grane

Figure 11: Fields contributing to Troll, Oseberg and Grane Grades



Source: WoodMackenzie

Troll

The Troll Oil Pipeline transports oil from Troll B and C to Mongstad Terminal. Kvitebjørn and the Fram area feed into Troll C, and Gjøa feeds directly into the pipeline. There are two main platforms in this system: Troll B (capable of processing 265kbd) and Troll C (capable of processing 190kbd). Mongstad terminal has storage capacity of 1.5 million barrels whilst the refinery can process up to 200 kbd.

The quality of Troll is set to remain largely unchanged in coming years, becoming slightly lighter and less acidic as Gjøa comes online. Currently it is a Medium-Sweet blend with above average acidity (for a N Sea grade).

Oseberg & Grane

The Oseberg blend and the Grane blend are transported separately to the Sture Terminal, as shown above. The Oseberg system has a total of 7 platforms, the main ones being:

- Oseberg Alpha - 360kbd processing capacity;
- Brage's platform - 120kbd processing capacity;
- Oseberg Sør - 95kbd processing capacity.

The Grane system has just one platform, on the Grane field, with a processing capacity of 234kbd.

Both pipelines transport oil to the Sture Terminal. The terminal can store up to 5 million barrels of Oseberg and has a separate underground cavern (1.2m bbl capacity) for storage of Grane.

The qualities of the two oils are very different. Oseberg is a light-sweet, non-acidic oil and is set to remain largely unchanged in coming years, however it should become slightly heavier as Tune and Huldre condensate slow down. By contrast Grane is a heavy-sour, acidic oil which will become slightly lighter, sweeter and less acidic as Grane Sør comes online in 2011.

See table overleaf:

North Sea Infrastructure - Troll, Oseberg & Grane

Figure 12: Production of Troll, Oseberg and Grane Oil - History and Future (in kbd)

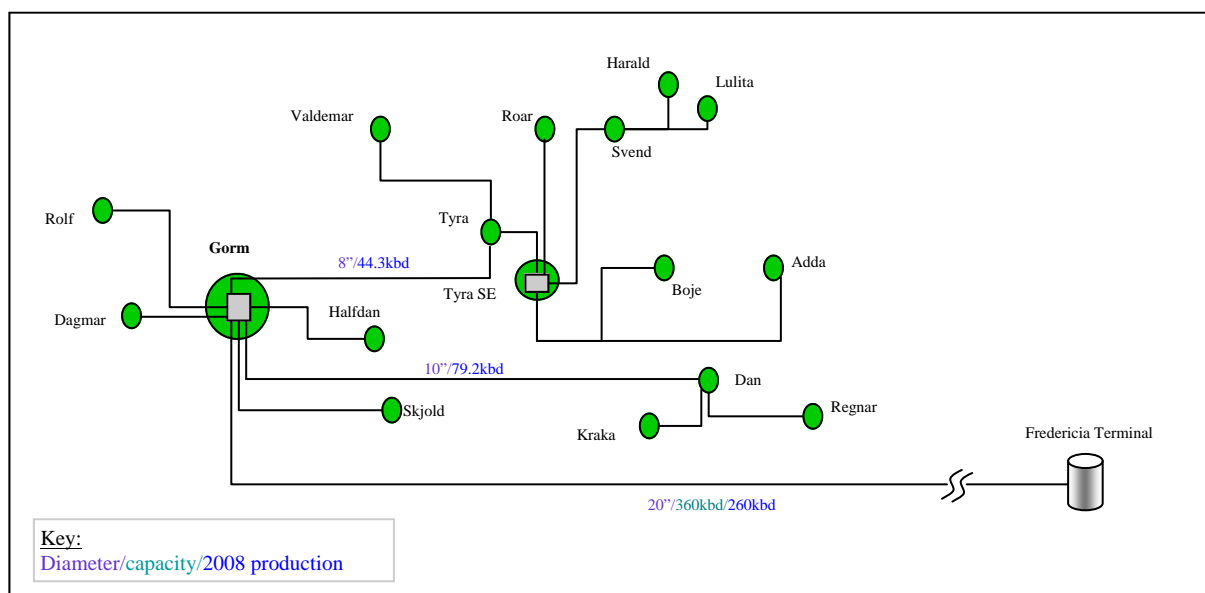
Area		Field Name	Type	Production								Sulphur Level (%w)	AR (°)	TAN (mgKOH/g)	General Classification		
				2005	2006	2007	2008E	2009E	2010E	2011E	2012E						
Norway - Troll	Fram Area	Kviteseid	Condensate	38	49	9	22	50	50	45	30	0.3	38.8	0.9	Light Sweet Acidic		
Norway - Troll		Fram Est	Oil	32	26	22	13	10	8	6	5	0.3	39	1			
Norway - Troll		Fram Øst	Oil	0	3	24	31	30	22	17	13	0.3	39	1			
Norway - Troll		Gjøa	Oil	0	0	0	0	0	8	28	28	0.3	41	0.1			
Norway - Troll		Troll	Oil	243	186	162	140	130	121	121	115	0.3	30	0.8			
Troll Oil				Production:	313	264	217	206	220	209	217	191					
				Sulphur:	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3					
				API:	32	32.6	32.3	32.9	33.6	33.8	34.2	33.8					
				TAN:	0.8	0.8	0.8	0.9	0.9	0.8	0.8	0.7					
Norway - OTS	Oseberg Area	Oseberg	Oil	127	98	65	51	46	44	37	19	0.4	37	0.2	Light Sweet		
Norway - OTS		Oseberg Delta	Oil	0	0	0	1	8	8	8	8	0.4	37	0.2	Light Sweet		
Norway - OTS		Oseberg Kappa North	Oil	0	3	7	5	3	2	2	1	0.4	41	0.2	Light Sweet		
Norway - OTS		Oseberg Gamme Vest	Oil	0	4	10	8	6	4	3	2	0.4	36	0.2	Light Sweet		
Norway - OTS		Oseberg Kappa	Oil	0	2	6	4	2	2	1	0	0.4	41	0.2	Light Sweet		
Norway - OTS		Oseberg Vest	Oil	2	1	1	1	1	1	0	0	0.4	36	0.2	Light Sweet		
Norway - OTS		Oseberg Unit	LPG	20	22	22	21	16	15	14	12	0.3	42	0.2			
Norway - OTS		Oseberg Sør	Oil	72	70	55	45	40	35	31	27	0.4	37	0.2	Light Sweet		
Norway - OTS		Oseberg Øst	Oil	18	11	9	15	22	22	20	18	0.4	37	0.2	Light Sweet		
Norway - OTS		Veslefrikk	Oil	27	19	16	15	15	15	15	14	0.3	37	0.3	Light Sweet		
Norway - OTS		Brage	Oil	26	19	21	22	20	19	18	16	0	37	0.1	Light Sweet		
Norway - OTS		Huldra	Condensate	8	5	3	4	3	2	1	0	0.3	56	0.1			
Norway - OTS		Tune	Condensate	9	5	3	1	1	1	1	1	0.3	70	0.1			
Total Oseberg				Production:	309	259	218	193	183	170	151	118					
				Sulphur:	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.3					
				API:	38.8	38.5	38.4	38.4	38.2	38.0	37.9	37.9					
				TAN:	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2					
Norway - OTS		Grane	Oil	178	217	207	180	160	145	130	110	0.8	18.5	2.2	Heavy Sour Acidic		
Norway - OTS		Grane Sør	Oil	0	0	0	0	0	0	8	20	0.3	23	0.1	Medium Sweet		
Total Grane				Production:	178	217	207	180	160	145	138	130					
				Sulphur:	0.8	0.8	0.8	0.8	0.8	0.8	0.77	0.72					
				API:	19	19	19	18.5	18.5	18.5	18.8	19.19					
				TAN:	2.2	2.2	2.2	2.2	2.2	2.2	2.08	1.88					
Source: WoodMackenzie																	

Source: WoodMackenzie

no data available,
average taken

North Sea Infrastructure - Gorm

Figure 13: Fields contributing to Gorm Blend Oil



Source: WoodMackenzie

Gorm

The Gorm-Frederica Pipeline runs from the Gorm field to the Fredericia Terminal, in Northern Denmark. It is the major export grade from the Danish part of the North Sea. The system is comprised of 17 fields, all commingled into the Gorm blend.

There are 25 platforms throughout the system with processing capacities ranging from 5kbd to 220kbd. The main platforms are:

- Gorm platforms - six platforms, three of which are capable of processing up to 170kbd. Also one riser platform, capable of pumping 300kbd to the Frederica Terminal;
- Dan - Five platforms in total, the largest can process up to 220kbd.

The Fredericia Terminal has storage for 1.65 million barrels and can handle more than 10.8 million tonnes of crude oil per year. Gorm is a light-sweet blend and its quality is projected to remain constant.

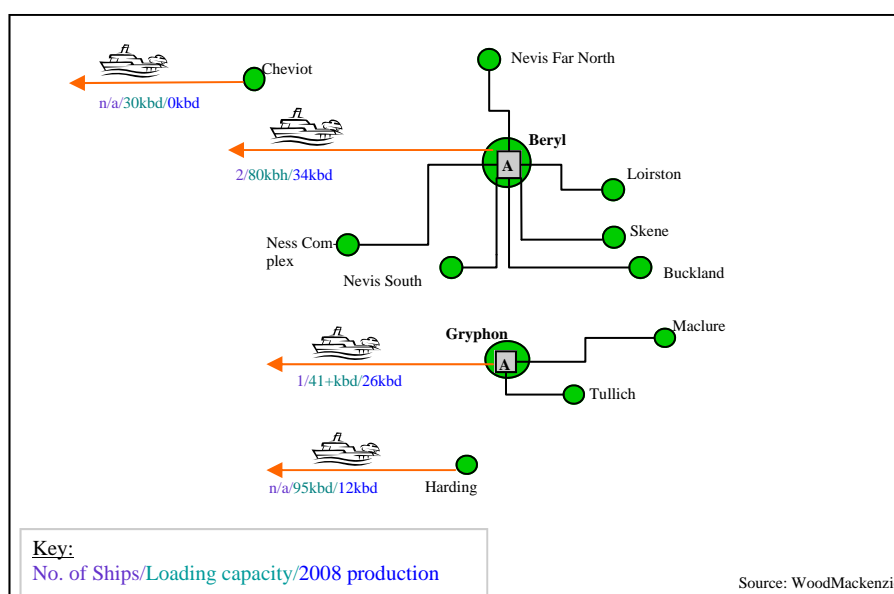
Figure 14: Production of Gorm Blend Oil - History and Future (in kbd)

			Production												
Area	Field Name	Type	2005	2006	2007	2008E	2009E	2010E	2011E	2012E	Sulphur Level (%w)	API (°)	TAN (mgKOH/g)	General Classification	
Denmark- Gorm	Valdemar	Oil	7	8	15	26	20	18	16	13	0.2	42	0.4	Light	Sweet
Denmark- Gorm	Tyra	Oil	8	8	7	6	5	5	5	4	0.1	51	0.4	Light	Sweet
Denmark- Gorm	Tyra SE	Liquids	10.6	7.7	7.5	6	5.5	13	13	13	0.2	33	0.4		
Denmark- Gorm	Gorm	Oil	34	33	26	23	20	18	16	15	0.2	34	0.4	Light	Sweet
Denmark- Gorm	Dagmar	Oil	0	0	0.1	0.2	0.1	0	0	0	2	37	0.4	Light	Sour
Denmark- Gorm	Rolf	Oil	1.4	2	1.6	1.3	1	0.9	0.8	0.7	0.3	33	0.4	Light	Sweet
Denmark- Gorm	Halfdan Area	Oil	107	105	100	96	93	75	95	130	0.2	32	0.4	Light	Sweet
Denmark- Gorm	Skjold	Oil	23	21	17	16	14	12	11	10	0.3	29	0.4	Medium	Sweet
Denmark- Gorm	Dan	Oil	99	87	80	76	71	70	65	62	0.3	31	0.4	Medium	Sweet
Denmark- Gorm	Regnar	Oil	0.3	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	33	0.4	Light	Sweet
Denmark- Gorm	Kraka	Oil	4	4	3	3	4	3	3	3	0.2	33	0.4	Light	Sweet
Denmark- Gorm	Adda	Oil	0	0	0	0	0	8.3	1.7	1	0.2	37	0.4	Light	Sweet
Denmark- Gorm	Boje	Oil	0	0	0	0	0	0	2.2	2.7	0.2	42	0.4	Light	Sweet
Denmark- Gorm	Harald	Condensate	4	3	3	2	6	6	6	4	0.2	52	0.4		
Denmark- Gorm	Svend	Oil	5.6	5.1	3	2.4	2	1.6	1.3	0.9	0.2	36	0.4	Light	Sweet
Denmark- Gorm	Lulita	Oil	0.6	1.4	1.2	0.9	0.5	0.4	0.4	0.4	0.2	32	0.4	Light	Sweet
Denmark- Gorm	Roar	Condensate	2	1	1	1	1	1	0	0		52			
	Gorm Blend Total	Production:	306.5	286.4	265.5	260	243.3	232.4	236.6	259.9	Source: WoodMackenzie				
		Sulphur:	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2					
		API:	32.9	32.9	33.2	33.5	33.6	33.8	33.5	33.1					
		TAN:	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4					

Source: WoodMackenzie

North Sea Infrastructure - Northern North Sea

Figure 15: Oil exports via tanker, Northern North Sea (UK)



The diagram above shows the fields in the Northern North Sea area whose oil is exported directly by tanker. Some fields are linked together (e.g. the Beryl complex), with oil exported as a blend whereas others are stand alone fields which export oil directly (Harding, Cheviot).

The **Beryl** system has two main platforms, both situated on the Beryl field. These are capable of processing a total of 400 kbd with storage facilities for up to 900,000 barrels. Oil is exported via two Single Point Mooring Systems (SPMS) with a loading capacity of 40kbh each.

The **Gryphon** system links 3 fields and has one main platform, capable of processing 85kbd. Oil is exported via Gryphon's floating production vessel (FPSO) to various terminals. This has a storage capacity of 525kb. Peak production from this system has been 41kbd.

Harding has a platform capable of processing 95kbd, with storage for 500,000 barrels. Peak production was 86.2kbd in 1998 but volumes in 2008 were around just 18kbd. Oil is exported directly from Harding's platform via tanker.

Cheviot is due online in 2010. Crude expected to be exported directly via tanker (as the oil is not of pipeline quality) from a small FPSO, with a processing capacity of 30kbd, and storage facilities for 300,000 barrels.

Figure 16: Production of Cheviot, Beryl Blend, Gryphon Blend and Harding Oil - History and Future (in kbd)

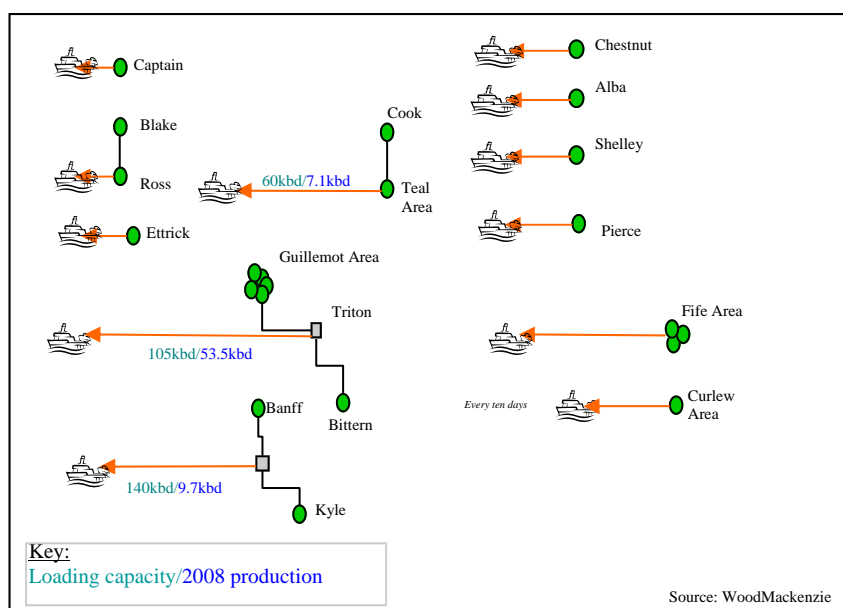
Area	Field Name	Type	Production								Sulphur Level (ppm)	API (°)	TAN (mg/kg)	General Classification
			2005	2006	2007	2008E	2009E	2010E	2011E	2012E				
NNS - UK	Cheviot	Oil	0	0	0	0	0	20	24	16	0.8	22	0.1	Heavy Sour
NNS- Beryl Area	Beryl	Oil	23.3	20.2	16.9	14	16.5	16.5	15	14	0.35	33	0.1	Light Sweet
NNS- Beryl Area	Loirston	Oil	0	0	0	0	0	1.5	1.6	0.8	0.4	36	0.1	Light Sweet
NNS- Beryl Area	Skene	Condensate	2.6	1.8	1.6	1.6	1.5	1.5	1.4	1.2	0.33	42	0.1	Light Sweet
NNS- Beryl Area	Ness Complex	Oil	2.1	1.2	5.8	3.2	1.9	1.5	1.1	0.5	0.4	37.6	0.1	Light Sweet
NNS- Beryl Area	Buckland	Oil	5.6	4.3	3.4	2.5	1.2	0.5	0	0	0.3	39	0.1	Light Sweet
NNS- Beryl Area	Ness South	Oil	0	0.7	0.2	1.4	2	1.5	1	0.2	0.4	39	0.1	Light Sweet
NNS- Beryl Area	Ness South	Oil	16.2	14.2	13.1	11	9	7	5.5	4.5	0.4	33.4	0.1	Light Sweet
Total Beryl Blend			Production:	50	42	41	33.7	32.1	30	25.6	21.2			
			Sulphur:	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4			
			API:	34.5	34.4	34.7	34.7	34.4	34.3	34.2	33.9			
			TAN:	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1			
NNS- Beryl Area	Gryphon	Oil	18	16	14	10	8	6	5	4	0.4	21	3.1	Heavy Sweet Acidic
NNS- Beryl Area	Maclure	Oil	10.7	9.9	6.9	9.5	6	5.5	3	1	0.3	27	1	Heavy Sweet Acidic
NNS- Beryl Area	Tullich	Oil	6.7	6	8.6	6.5	4.8	4	3.3	2.5	0.35	25.8	2	Heavy Sweet Acidic
Total Gryphon Blend			Production:	35	32	30	26	18.8	15.5	11.3	7.5			
			Sulphur:	0.4	0.4	0.4	0.35	0.36	0.35	0.36	0.37			
			API:	24	24	24	24.4	24.1	24.4	24	23.4			
			TAN:	2.3	2.2	2.3	2.06	2.15	2.07	2.22	2.45			
NNS - UK	Harding	Oil	31.7	26.6	18.6	12	10	8	7	2	0.6	21	3	Heavy Sour Acidic

Source: WoodMackenzie

= no data
available, average taken

North Sea Infrastructure - Central North Sea

Figure 17: Oil exports via Tanker, Central North Sea (UK)



The Above diagram represents the fields in the Central North Sea whose crude is transported directly via tankers (not to scale).

The **Triton** FPSO is used by the Guillemot Area and Bittern fields. It can process up to 105kbd of oil, and store up to 630kb. The oil produced is a light-sweet with no major changes due to it's quality predicted for the future.

The Ramform **Banff** is another FPSO that is linked to Banff and Kyle fields. This FPSO can process up to 95kbd and has storage facilities for 120kb. This oil is also a light, sweet blend with no change predicted in the future.

The **Fife** area utilises one FPSO, the Uisge Gorm. This is tied into four fields within the area, and can handle up to 57kbd of oil with storage for 600kb. The Fife blend is a light-sour crude which will become more sour as the Flora and Fergus fields stop producing as much sweet oil.

Most other fields shown above also utilise FPSO's to process and store the oil. The production levels and quality of these fields are shown below.

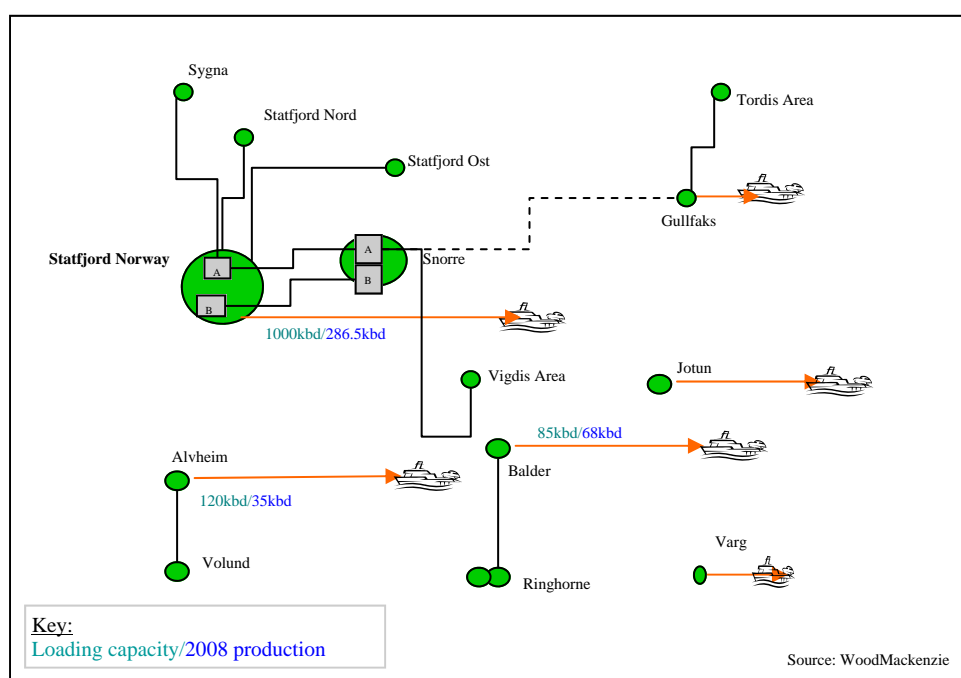
Figure 18: Production of Oseberg and Grane Blend Oil - History and Future (in kbd)

Area	Field Name	Type	Production								Sulphur Level (ppm)	API (°)	TAN (mg/KO H/g)	General Classification
			2005	2006	2007	2008E	2009E	2010E	2011E	2012E				
CNS	Captain	Oil	49	43	51	37	34	34	34	26	0.7	20	2.4	Heavy Sour Acidic
CNS	Ross	Oil	3.6	3.1	3.5	6	5.6	5.2	4.7	4.4	0.1	39	0.1	Light Sweet
CNS	Blake	Oil	25	24	24	22	19	18	14	11	0.4	30.3	0.1	Medium Sweet
CNS	Shelley	Oil				2	15	11	8	6				Heavy Sweet
CNS	Alba	Oil	54	52	43	34	33	30	30	25	1.3	19.8	1.5	Heavy Sour Acidic
CNS	Chestnut	Oil				6	13	10	4		1	30	0.5	Medium Sour
CNS	Teal Area	Oil	8.9	5.5	3.1	6.4	6.2	5.5	4.9	4.2	0.35	37.5	0	Light Sweet
CNS		Oil	0.7	0.6	0.3	0.7	0.5	0.4	0.4	0.4	0.35	37.5	0	Light Sweet
CNS	Pierce	Oil	21.7	13	15.3	22	23	21	20	24	0.2	38	0.1	Light Sweet
CNS	Guillemot West	Oil	2.7	2.2	2.8	3.8	5.5	4.5	3.8	3.3	0.4	36	0.1	Light Sweet
CNS	Guillemot North-West	Oil	1.5	1.4	0.8	0.8	1.5	4	3.5	3	0.4	36	0.1	Light Sweet
CNS	Clapham	Oil	7.3	5.1	4.8	3.7	3	2.5	2	1.8	0.4	36	0.1	Light Sweet
CNS	Pict	Oil	7.5	9.8	5.2	4	3.2	2.3	1.4	1	0.4	36	0.1	Light Sweet
CNS	Saxon	Oil	-	-	0.6	7.2	7.8	5.5	3.5	2	0.4	36	0.1	Light Sweet
CNS	Bittern	Oil	39	30	33	34	30	25	21	18	0.3	39	0.1	Light Sweet
CNS	Banff	Oil	7	5.5	8.1	7.5	7	6.5	6	5.5	0.3	39	0.1	Light Sweet
CNS	Kyle	Oil	4.9	3.7	2.5	2.2	1.6	1.1	0.7	0.5	0.2	38	0.1	Light Sweet
CNS	Angus	Oil	0.2	0.2							0.3	41		Light Sweet
CNS	Fergus	Oil	1.5	1.1	1.1	0.8	0.8				0.6	36		Light Sour
CNS	Fife	Oil	5.7	3.9	3.7	3.3	3				0.7	37		Light Sour
CNS	Flora	Oil	1.8	1.3	1.2	1.1	0.8				0.3	38.2		Light Sweet
CNS	Curlew Area	Oil	1.7	1.8	2.4	6.5	10	6	4.5	3	0.1	41.5		Light Sweet

Source: WoodMackenzie

North Sea Infrastructure - Statfjord & Gullfaks

Figure 19: Oil exports via Tanker, Norway



The **Statfjord** system consists of six fields. The Vigdis Area's oil can be transported to either the Statfjord platforms, adding extra flexibility. In total there are five platforms in the Statfjord system, two on Snorre (up to 360 kbd processing capacity) and three on Statfjord (up to 420 kbd processing capacity). These have combined storage for 5 million barrels. Statfjord, a light-sweet crude, is exported directly by tanker from Statfjord platforms. Its quality is not expected to change significantly in coming years.

Gullfaks has three platforms, with processing capacities of up to 375 kbd and storage for 3.7 million barrels. The Gullfaks field has two loading buoys to export oil.

The other fields mainly use FPSO's to process and store oil. Production and quality of these oils is shown below.

Figure 20: Production of various Norwegian, tankered oils - History and Future (in kbd)

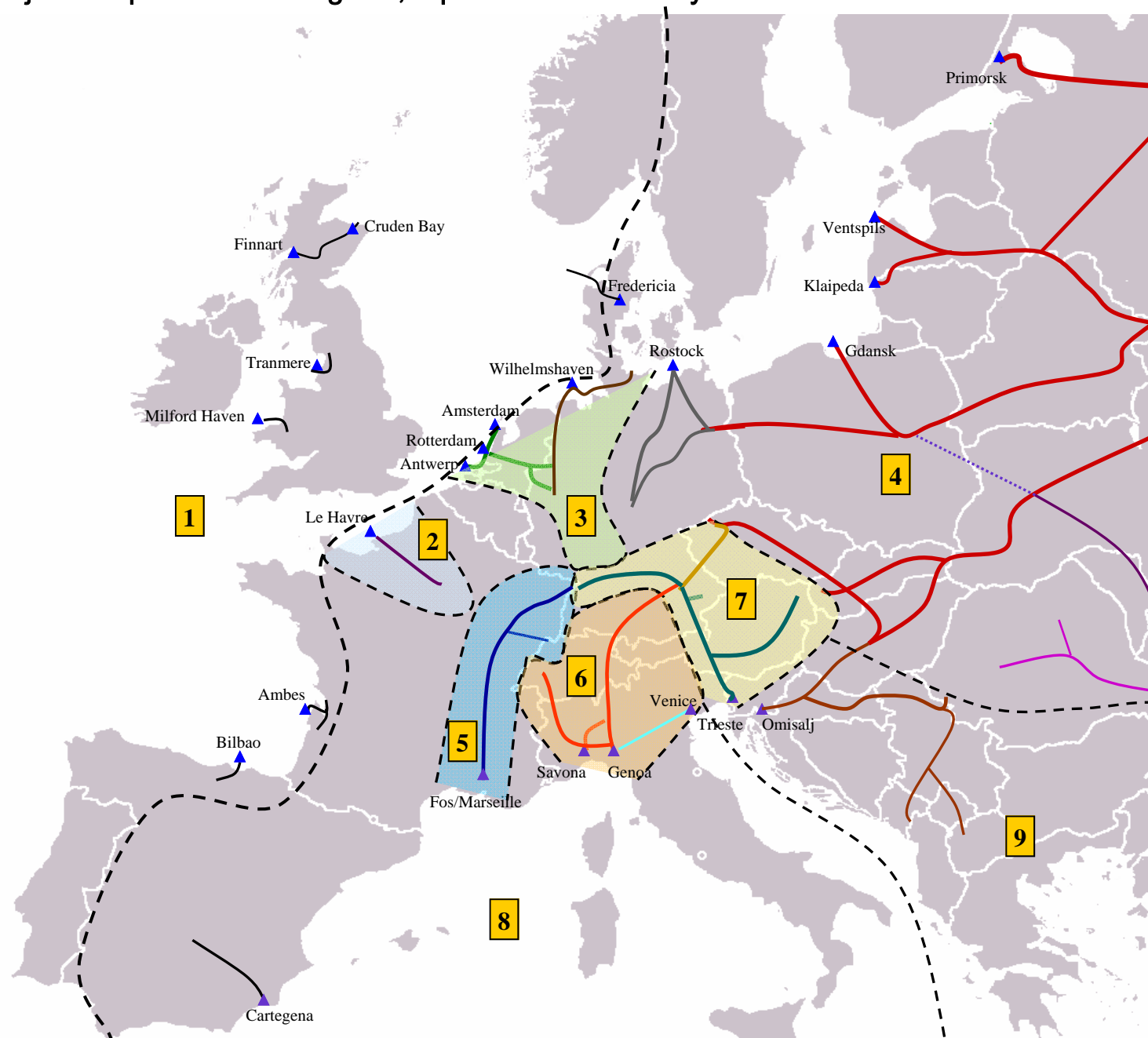
Area	Field Name	Type	Production								Sulphur Level (ppm)	API (°)	TAN (mgKOH/g)	General Classification	
			2005	2006	2007	2008E	2009E	2010E	2011E	2012E					
Norway - tanker	Statfjord Norway	Oil	96	73	69	55	30	20	17	14	0.3	38	0	Light	Sweet
Norway - tanker	Statfjord Nord	Oil	32.9	22.6	19.4	14.5	13	12	11.5	10	0.3	38	0	Light	Sweet
Norway - tanker	Statfjord Øst	Oil	19.4	19.6	20.4	17	14	10.5	9	7.5	0.3	39	0	Light	Sweet
Norway - tanker	Sygna	Oil	12	7	7	5	4	4	3	3	0.3	38.7	0	Light	Sweet
Norway - tanker	Snorre	Oil	155	143	144	140	130	140	130	115	0.1	39	0	Light	Sweet
Norway - tanker	Vigdis Area	Oil	64	65	56	55	50	40	35	30	0.3	36.5	0.1	Light	Sweet
Total Statfjord Blend			Production:	379.3	330.2	315.8	286.5	241.0	226.5	205.5	179.5				
			Sulphur:	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2				
			API:	38.2	38.2	38.3	38.3	38.3	38.4	38.4	38.4				
			TAN:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
Norway - tanker	Gullfaks	Oil	139	107	93	76	68	60	50	40	0.65	35	0.4	Light	Sour
Norway - tanker	Gullfaks Vest	Oil	5	4	3	2	2	0	0	0	0.65	35	0.4	Light	Sour
Norway - tanker	Tordis Area	Oil	52.4	28.7	41.9	40	36	32	27	21	0.1	37	0.1	Light	Sweet
Norway - tanker		NGL	3.2	1.5	1.3	0.8	1.5	1.4	1.4	1.3					
Norway - tanker	Jotun	Oil	13	11	9	7	7	6	6	6	0.3	36	0.1	Light	Sweet
Norway - tanker	Alvhheim	Oil	0	0	0	35	78	66	55	45	0.5	36	0.1	Light	Sweet
Norway - tanker	Volund	Oil	0	0	0	0	15	25	19	15	0.5	32	0.1	Light	Sweet
Norway - tanker	Balder	Oil	37	34	30	21	17	13	18	12	0.7	23.1	0.9	Medium	Sour
Norway - tanker	Ringhorne	Oil	83	75	67	47	37	25	23	16	0.2	31	0.1	Medium	Sweet
Norway - tanker	Varg	Oil	22	15	14	12	11	8	8	7	0.3	35	0.1	Light	Sweet
Norway - tanker	Lilleulv	Oil	0	0	0	1	1	1	0	0	0.3	35	0.1	Light	Sweet

Source: WoodMackenzie



Part 2 - European Refining Infrastructure

Major European Crude Regions, Pipelines and Delivery Points



Key:

▲ NW Europe Delivery Point	— RRB, PCK and MVL lines	— Adria Pipeline
▲ Mediterranean Delivery Point	— SPSE pipeline system	— Conpet Pipeline - From Constantza
— Domestic pipeline system connecting to single refinery	— Central European Pipeline system	— Odessa-Brody Pipeline
— ARA system - RRP and RAPL lines	— Genoa-Cremona-Porto Marghera line	— Odessa-Brody Pipeline extension
— NWO and NDO pipeline system	— TAL pipeline system	— — Regional dividing line
— Le Havre pipeline system	— Mero pipeline	
	— Druzhba pipeline system	

Regions:

- | | |
|--|-------------------------------------|
| 1) Norway, UK Cont. & Coastal NW Europe | 6) Central European Pipeline System |
| 2) Le Havre Pipeline System | 7) TAL Pipeline System |
| 3) ARA & Northern European Pipeline System | 8) Western Coastal Mediterranean |
| 4) Baltic and Druzhba Linked Refineries | 9) Eastern Coastal Mediterranean |
| 5) SPSE Pipeline System | 10) Black Sea (not shown) |

European Refining:

In order to understand the demand pull from the Euro Atlantic basin it is necessary to understand which refineries constitute demand in the region. In the following section Europe's refineries are divided first into NW Europe (Atlantic Basin) and Mediterranean, based on where they source their crude, and secondly into discrete import or operational hubs.

Based on an assessment of supply and demand estimate NW European domestic crude supply at c. 5.2m bpd in 2008. This is comprised of N Sea production of 3.4m bpd + Urals (Nth) exports of 1.6m bpd + Non N Sea European production of 0.135m bpd. Estimate NW European crude demand at 8.4m bpd (NW Eur refining capacity exc. Druzhba linked refineries). This leaves an import requirement of 3.2m bpd for the region which is predominantly met by North and West African grades on the sweet-side and Middle Eastern grades on the sour-side.

In the future as N Sea (and possibly Russian) production falls there will be a greater import requirement in order to balance demand. Inevitably these imports will have to be sourced from further afield than current base supply (e.g. North Sea and Baltic), which will increase the landed cost of crude. For the region as a whole this will squeeze refining margins to the point where the least competitive refineries are forced to close. These will be replaced by newer more complex refineries closer to new sources of supply and/or demand centres.

Norway, UK Cont. & Coastal NW Europe 22 Refineries; 3.34m bpd Capacity

The refineries in this region are predominantly coastal and located close to crude import terminals or pipelines.

Due to their location, with easy access to crude imports, their crude slates tend to be relatively diverse. However North Sea crude usually forms the majority of the sweet slate with Urals the major sour grade. As North Sea production continues to fall have seen increasing volumes of West African crude imported as a sweet substitute barrel.

This group also includes Portuguese and Spanish Atlantic coast refineries which import a larger than average volume of Latin American crude compared to refineries from the rest of the region.

Le Havre Pipeline System 4 Refineries; 0.8m bpd Capacity

Relatively complex refining network with majority sour processing of Urals and ME grades. Sweet bbls comprised mostly N Sea but also processes small volumes of WAF and NAF grades.

Total's Grandpuits least complex refinery but operated as hub with larger Gonfreville l'Orcher refinery which improves efficiency through mutual crude sourcing and feedstock & product exchanges.

Exxon's Port Jerome refinery processes a large volume of Exxon's ME term bbls. It is a significant part of Exxon's NW-European refining hub, operated in conjunction with it's EH and N American refining assets. Exxon able to optimise flows between these three locations (NW Eur, US, EH) based on market conditions.

2008 Import Profile (Recorded imports c. 0.7m bpd):

Urals Nth	-	100 kbd (14.2 %)
Saudi Grades	-	95 kbd (13.5%)
Sidi Kerir	-	50 kbd (7.5%)
CPC	-	40 kbd (6.0%)
Forties	-	38 kbd (5.5%)
Statfjord	-	38 kbd (5.5%)
Ekofisk	-	37 kbd (5.3%)

Remainder: WAF (70 kbd), other N Sea (115 kbd) and ME grades (60 kbd), Azeri and Med Sweet (25 kbd).

ARA & Northern European Pipeline System 19 Refineries; 3.24m bpd Capacity

Urals and N Sea crudes unsurprisingly the staple of NW Europe's most important refining hub. As well as supplying population centres in Netherlands, Belgium and much of Germany also a significant exporter of product to N America and Asia. Most common product arbitrage movements are gasoline to US and fuel oil to Singapore. As US gasoline demand declines arbitrage opportunities to US likely to decline, hitting margins in region.

2008 Import Profile (Recorded imports c. 1.9m Rotterdam)

Urals Nth	-	420 kbd (22 %)
Sidi Kerir	-	150 kbd (7.7%)
Saudi Grades	-	110 kbd(6.7%)
Kuwait	-	83 kbd (4.2%)
Iranian Grades	-	72 kbd (3.7%)
Forties	-	70 kbd (3.6%)
CPC	-	67 kbd (3.5%)
Gulfaks	-	38 kbd (2.0%)

Remainder: N Sea (240 kbd), WAF (180 kbd), North African (60 kbd), minority 'other-ME' and Latin American (Mexican and Venezuelan)

2008 Import Profile (Recorded imports c. 0.55m bpd Wilhelmshaven)

Urals Nth	-	130 kbd (24%)
Forties	-	80 kbd (15%)
Gulfaks	-	32 kbd (6%)
El Sharara	-	30 kbd (5.5%)
Statfjord	-	28 kbd (5%)
Ekofisk	-	27 kbd (5%)

Remainder: N Sea (115 kbd), WAF (40 kbd), Latin America (35 kbd), North Africa (20 kbd)

Baltic and Druzhba Linked Refineries**21 Refineries; 2.39m bpd Capacity**

Either linked directly to the Druzhba pipeline, supplying Urals from Russia, or located within the Baltic Sea, crude supply to these refineries is dominated by Urals. However Swedish refineries in Gothenburg process high volume of N Sea crude as well as small quantities from West Africa.

SPSE Pipeline System**7 Refineries; 0.82m bpd Capacity**

The SPSE pipeline runs from Marseille port complex of Fos, Lavera and Port de Bouc to 6 refineries in Southern France and Cressier refinery in Switzerland. Refineries are of average complexity for the Med region.

Total is the major player in the SPSE/Fos hub. As well as owning a majority stake in the pipeline Total operates its two refineries (Feyzin and La Mede) as a hub with feedstock exchanges commonplace between the two. This gives it greater flexibility and an advantage over isolated refineries in a highly competitive refining environment.

2008 Import Profile (Recorded imports c. 0.8m bpd Fos, Lavera & Port de Bouc)

CPC	-	133 kbd (16.5%)
Urals (Med)	-	80 kbd (10%)
Sidi Kerir	-	57 kbd (7%)
Es Sider	-	40 kbd (5%)
Azeri	-	35 kbd (4.3%)
Brega	-	31 kbd (4%)

Remainder: North African (140 kbd), West African (115 kbd), Russian & Caspian (50 kbd), ME (30 kbd) and Syrian (30 kbd)

Lavera (Ineos) is a major importer of CPC and West African grades. Fos sur Mer (Exxon) refinery is Exxon's smallest refining asset in the Med (after its two Italian refineries of S. Martino Di Trecate and Augusta) but is still a significant outlet for Exxon's ME term volume, which forms a major part of the slate along with CPC. High volumes of Libyan crude imported are likely run by Total's Feyzin and La Mede refineries along with Azeri and West African crudes.

Although Petroplus owns two refineries in the SPSE system (Reichstett and Cressier) they are not currently operated as a hub due to fact only recently acquired by the company. Slates likely to be mix of Urals, West African grades (mostly Forcados, Bonga and Bonny) & Azeri.

Central European Pipeline System**7 Refineries; 0.73m bpd Capacity**

Supplying mostly industrialised demand centres of Northern Italy and Collombery refinery in Switzerland. Also links into Bayernoil and Ingolstadt, in Southern Germany and the TAL pipeline network.

Presence of two Tamoil (Cremona, 94 kbd & Collombey, 72 kbd) refineries means crude from Libya form a high percentage of imports. AGIP's large Sannazzaro refineries also process NAF bbls as well as heavier Russian and ME grades.

2008 Import Profile (Recorded imports c. 0.26m bpd Genoa)

El Sharara	-	41 kbd (16%)
Es Sider	-	31 kbd (12%)
Mellitah	-	27 kbd (10%)
Sidi Kerir	-	26 kbd (10%)
Urals	-	20 kbd (9%)
Azeri	-	18 kbd (7%)
Amna/Sirtica	-	16 kbd (6%)
CPC	-	16 kbd (6%)
Kirkuk	-	10 kbd (3.5%)

Remainder: Small amount of West African, other Libyan grades and occasional N Sea cargo.

2008 Import Profile (Recorded imports c. 0.2m bpd Savona)

Es Sider	-	24 kbd (20%)
Azeri	-	18 kbd (15%)
Nigerian	-	18 kbd (15%)
Saharan	-	12 kbd (10%)
Zueitina	-	8 kbd (6%)
Syrian	-	8 kbd (6%)

Remainder: Small amounts of North and West African and Russian and Caspian grades

2008 Import Profile (Recorded imports c. 0.1m bpd Venice)

Sidi Kerir	-	27 kbd (27%)
Bouri	-	18 kbd (18%)
Es Sider	-	13 kbd (13%)
Urals	-	12 kbd (12%)
Iranian	-	9 kbd (9%)
Amna/Sirtica	-	8 kbd (6%)
Azeri	-	5 kbd (5%)

Remainder: Small amounts of North African and Russian & Caspian grades

TAL Pipeline System

6 Refineries; 1.03m bpd Capacity

Pipeline runs from Trieste in Northern Italy to refineries in Germany, Austria and Czech Republic (via Mero pipeline). Refineries just above average complexity for the region and process a high volume of Russian, Kazakh and Libyan crude.

OMV operates a connected refining hub between Burghausen and Bayernoil refineries with mutual crude sourcing and feed-stock exchanges. Excess FO from Bayernoil site is processed through coker at Burghausen.

2008 Import Profile (Recorded imports c. 0.65m bpd Trieste)

CPC	-	106 kbd (17%)
Azeri	-	72 kbd (12%)
Urals (Med)	-	60 kbd (9.5%)
Amna/Sirtica	-	51 kbd (8%)
Es Sider	-	50 kbd (8%)
Kirkuk	-	30 kbd (5%)
Sidi Kerir	-	30 kbd (5%)
Syrian	-	30 kbd (5%)

Remainder: North African (81 kbd), Russian and Caspian (30 kbd), West African (22 kbd) and Venezuelan (20 kbd) and small volumes of North Sea and other Middle Eastern grades.

Western Coastal Mediterranean

18 Refineries; 2.53m bpd Capacity

Italian and Spanish (mostly) coastal refineries not linked to major pipeline systems. With exception of Priolo, La Spezia, Milazzo and Tenerife refineries are of above average complexity for the Med region. Italian refineries process large volumes of Middle Eastern crude as well as Urals and have predominantly sour slates. Sweet slates consist mostly of North African crudes along with Azeri and some WAF grades. Spanish refineries also run ME grades but WAF grades also form a larger part

of most of slates.

Eastern Coastal Mediterranean **24 Refineries; 2.07m bpd Capacity**

Greek, Turkish and former Yugoslav refineries, predominantly coastal and not linked to major pipelines. Imports consist of mostly of Russian, ME and North African grades with some refineries processing domestic crudes. Most refineries of lower than average complexity for Med region and particularly exposed to downturn in margins.

Of note Adria pipeline from Omisalj supplies crude to Croatian and Serbian refineries (total linked capacity of 349 kbd).

2008 Import Profile (Recorded imports c. 115 kbd Omisalj)

Urals	-	104 kbd (90%)
CPC	-	7 kbd (6%)
Es Sider	-	2 kbd (2%)
Siberian Light	-	2 kbd (2%)

Black Sea **11 Refineries; 0.63m bpd Capacity**

Located in Europe but import crude through Black Sea ports. Comprised of Bourgas refinery in Bulgaria and Romania's refining system. Refineries are generally just above average complexity for the Med region. Refinery slates comprised almost entirely of Russian and domestic (Romania) crude.

Future Outlook and Vulnerable Refineries

The outlook for refining over the medium term does not look good. As the global refining system becomes unconstrained spare refining capacity is projected to increase significantly – by almost 2m bpd in 2009 alone. This harder operating environment will be particularly felt in Western Europe where oil product consumption has likely peaked due to a combination of mature markets and a high level of environmental consciousness.

This worsening operating environment for Atlantic basin refiners is particularly acute for gasoline. We are seeing growing gasoline surplus in Europe. This has been traditionally offset by growing gasoline deficit in US but this no longer the case. Atlantic basin gasoline demand may have peaked in 2007, especially if US consumers move to lighter, more fuel efficient vehicles.

Historically the Atlantic basin as a whole has been short gasoline (concentrated in the US). However the combination of continued dieselization in Europe and declining gasoline demand in the US has reduced this excess significantly in 2008. Furthermore the combination of extra refining capacity additions in the US and increased ethanol volumes (which back out gasoline from the motor fuels pool) will serve only to speed up the rate at which the gasoline deficit is reduced. It is highly likely that Atlantic basin gasoline demand peaked in 2007 and over next few years the Atlantic basin will develop a gasoline surplus.

Current balances, which see Europe short on middle distillates but long on gasoline and fuel oil are a legacy of Europe's ageing, low complexity, gasoline oriented refining assets. Most of these refineries were built to process light, sweet North Sea crudes and meet demand for gasoline and fuel oil. With the structural changes that have taken place over the last 15 years these refineries are looking increasingly exposed.

Declining N Sea production forces refineries designed to process N Sea bbls to source replacement barrels from further afield (e.g. North or West Africa and the Caspian) at higher costs or invest in conversion and hydrotreating capacity to process heavier sourer crudes such as Urals. However even the viability of processing higher Russian volumes looks doubtful given stagnant Russian production, increased Russian volumes moving East and an unwillingness amongst Western European policy makers to become too reliant on Russian energy.

With the current shift in product demand and refiners reluctance to commit money to conversion projects imbalances are set to grow. Globally the increased refining capacity and depth will increase competition and reduce margins. This should force the least profitable refineries to close, restructure or significantly reduce their operations.

Geographically Europe is perhaps the most at risk due to declining product demand and domestic production. In particular NW Europe seems more exposed than most. Demand in the Med and central Europe has continued to grow, spurred by growth markets in Eastern Med, North Africa, and Eastern European countries such as Poland. NW Europe on the other hand has seen declining demand for several years combined with an increased uptake of biofuels, strong reliance on declining N

Sea production and higher exposure to the global financial crisis.

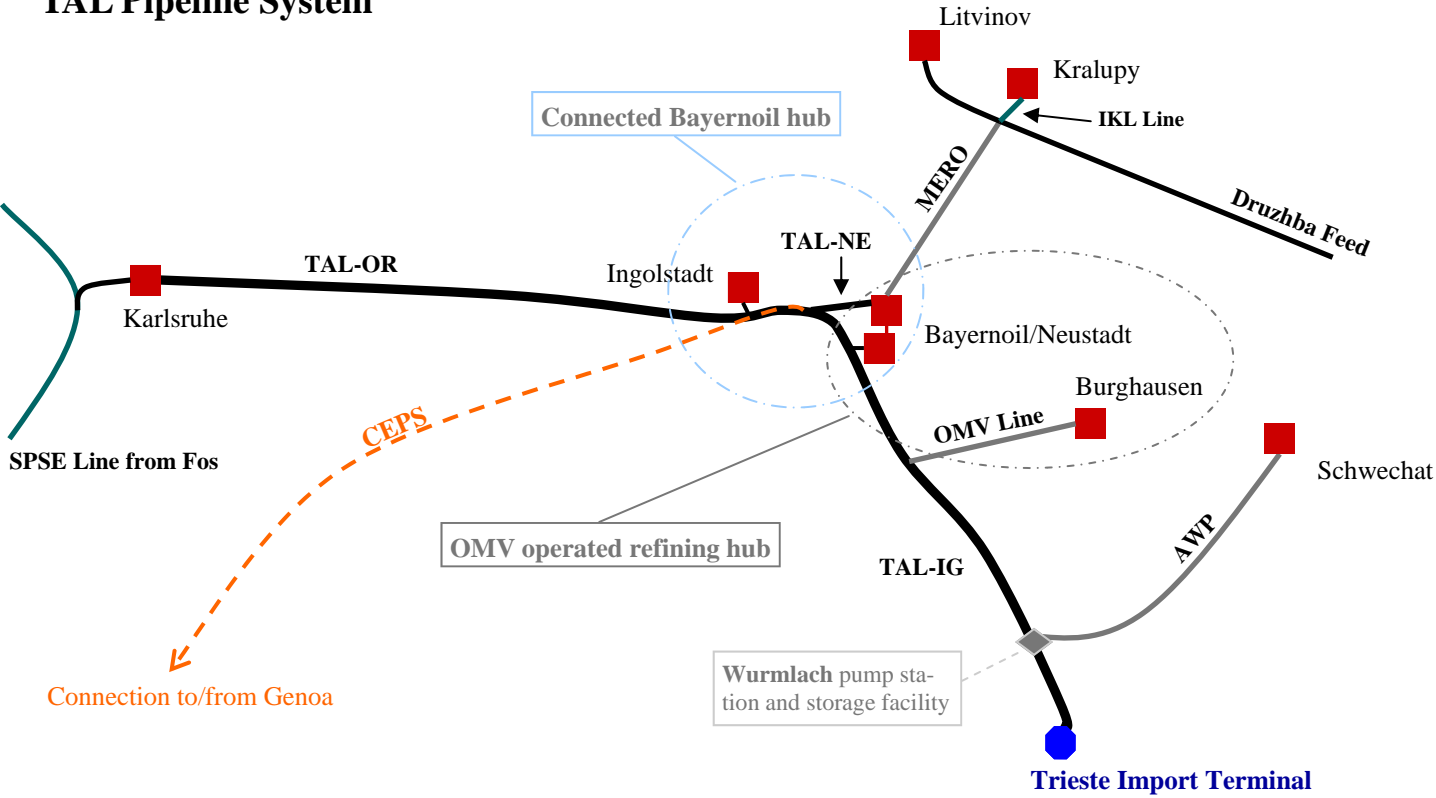
The following types of refineries are seen as the most at risk from closure:

- a) Small scale, low complexity refiners
- b) Refiners that are major exporters of gasoline – particularly refineries in UK, Netherlands and Northern France as traditional export markets in the US dry up
- c) Inland refiners in areas of growing surplus – producers in Germany and Italy seen as most exposed due to rapid build in product surpluses and lack of export outlets.

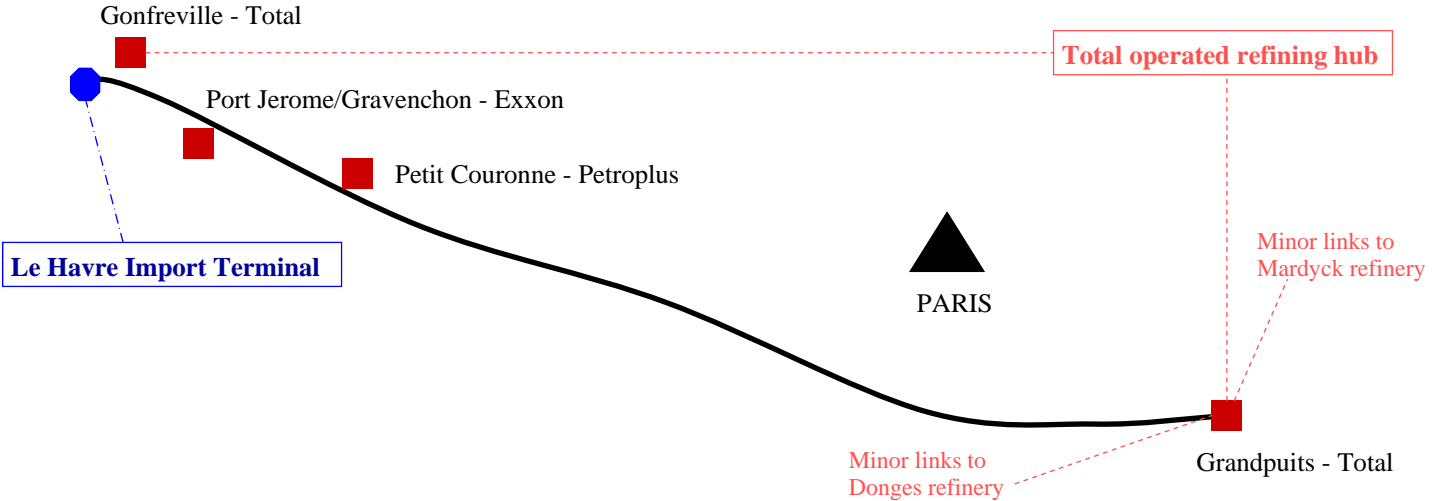
Major factors affecting refinery profitability:

- 1) Size of refinery (processing capacity) – Significant economies of scale achieved in operating costs.
- 2) Technology (refining depth) – Allows refinery to produce larger volumes of higher value products and/or process lower value crude.
- 3) Access to crude supply – essentially affecting the delivered cost of crude, advantages to be obtained through proximity to upstream resources but also points of crude delivery such as ports or pipelines.
- 4) Access to product markets – proximity to centres of product demand (e.g. Major urban areas, ports (bunker demand) etc.). Reduces the delivered cost of end products increasing competitiveness and margins.
- 5) Refinery Flexibility – Ability of refinery to process wide range of crudes through supply agreements or refinery technology and available tankage to take advantage of market structure.
- 6) Proximity to other refineries – Isolation from alternative product supply reducing competition and increasing margins.
- 7) Refinery connections – to crude and product pipelines and end user markets.
- 8) Petro-Chemical Integration – Refineries strongly integrated with local petchem sites benefit from steady demand.
- 9) Ability to exploit niche markets – through specialist refining capacity such as lubes, asphalt or bitumen units.
- 10) Integration – ability to operate in hub with other refineries to co-ordinate crude sourcing, product supply, feedstock exchange etc.
- 11) Labour and other running costs.

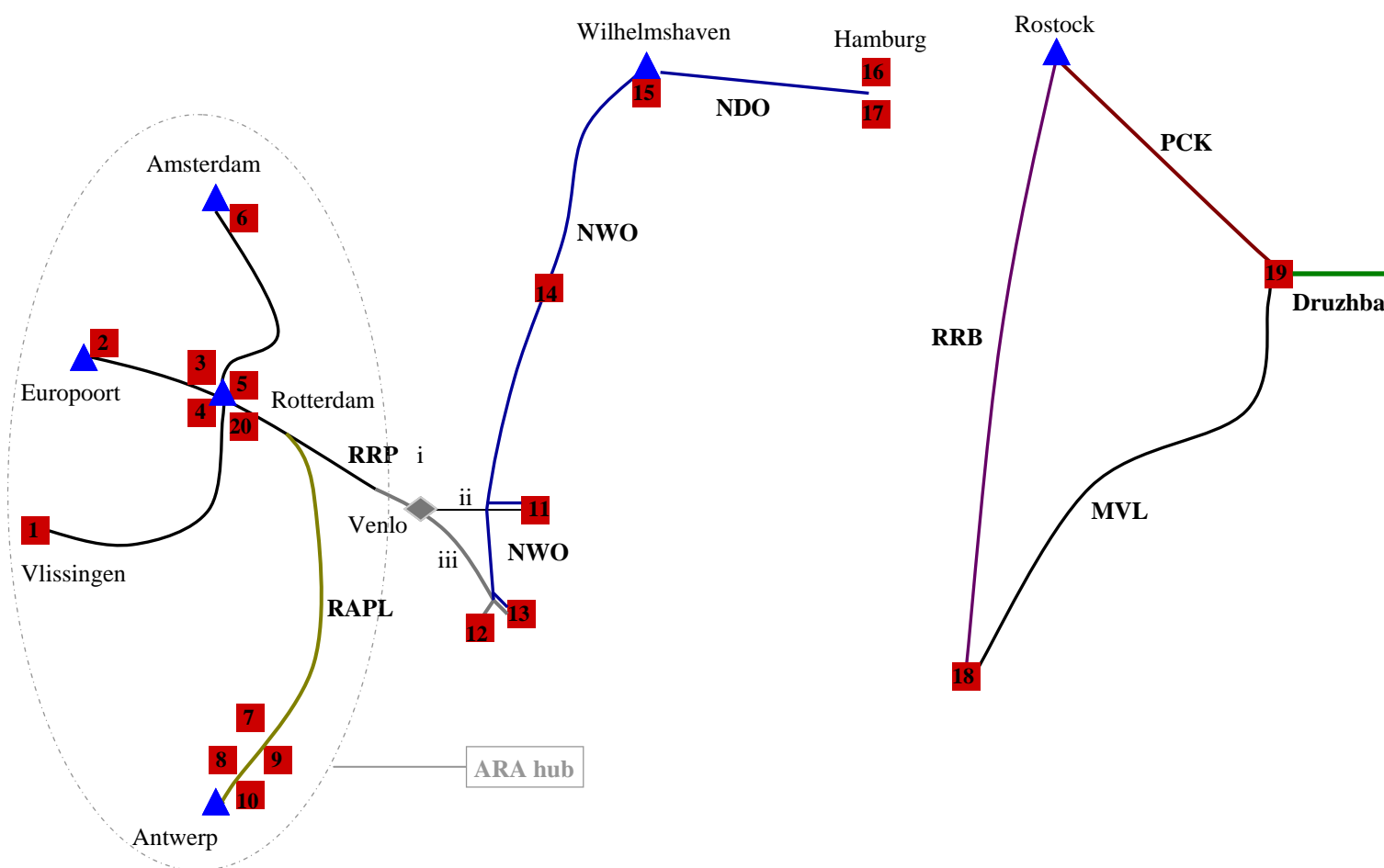
TAL Pipeline System



Le Havre Pipeline System



ARA and Northern European Crude Pipeline System



Refineries:

- | | |
|--|---|
| 1) Vlissingen - Total/Dow Chemicals | 11) Gelsenkirchen - BP/PDVSA |
| 2) Pernis - Shell/Statoil | 12) Godorf - Shell |
| 3) Nerefco - BP | 13) Wesseling - Shell |
| 4) Rotterdam - Exxon | 14) Lingen - BP |
| 5) Rotterdam - KPI | 15) Wilhelmshaven - Conoco |
| 6) Smid & Hollander - Amsterdam (*Asphalt) | 16) Hamburg/Holborn - Oilinvest/Coastal |
| 7) Antwerp (BRC) - Petroplus | 17) Hamburg/Harburg - Shell |
| 8) Antwerp - Total | 18) Leuna - Total |
| 9) Antwerp - Exxon | 19) Schwedt - Shell/BP/PDVSA/Total/Eni |
| 10) Antwerp - Petroplus (*Asphalt & Storage) | 20) Rotterdam - Koch (*Condensate splitter) |

Pipelines:

RRP - Rotterdam-Rijn Pijpleiding Maatschappij (or Rotterdam-Rhein Pipeline)

RRP i - Dutch Line

RRP ii - North Line

RRP iii - South Line

RAPL - Rotterdam-Antwerp Pipeline

NWO - Nord-West Oelleitung Pipeline

NDO - Nord-Deutsche Oelleitung Pipeline

RRB - Rostock-Bohlen Pipeline

MVL - Mineralolverbundleitung Pipeline

PCK - Petrochemical & Fuel Pipeline (PCK is name given to operators of Schwedt refinery)

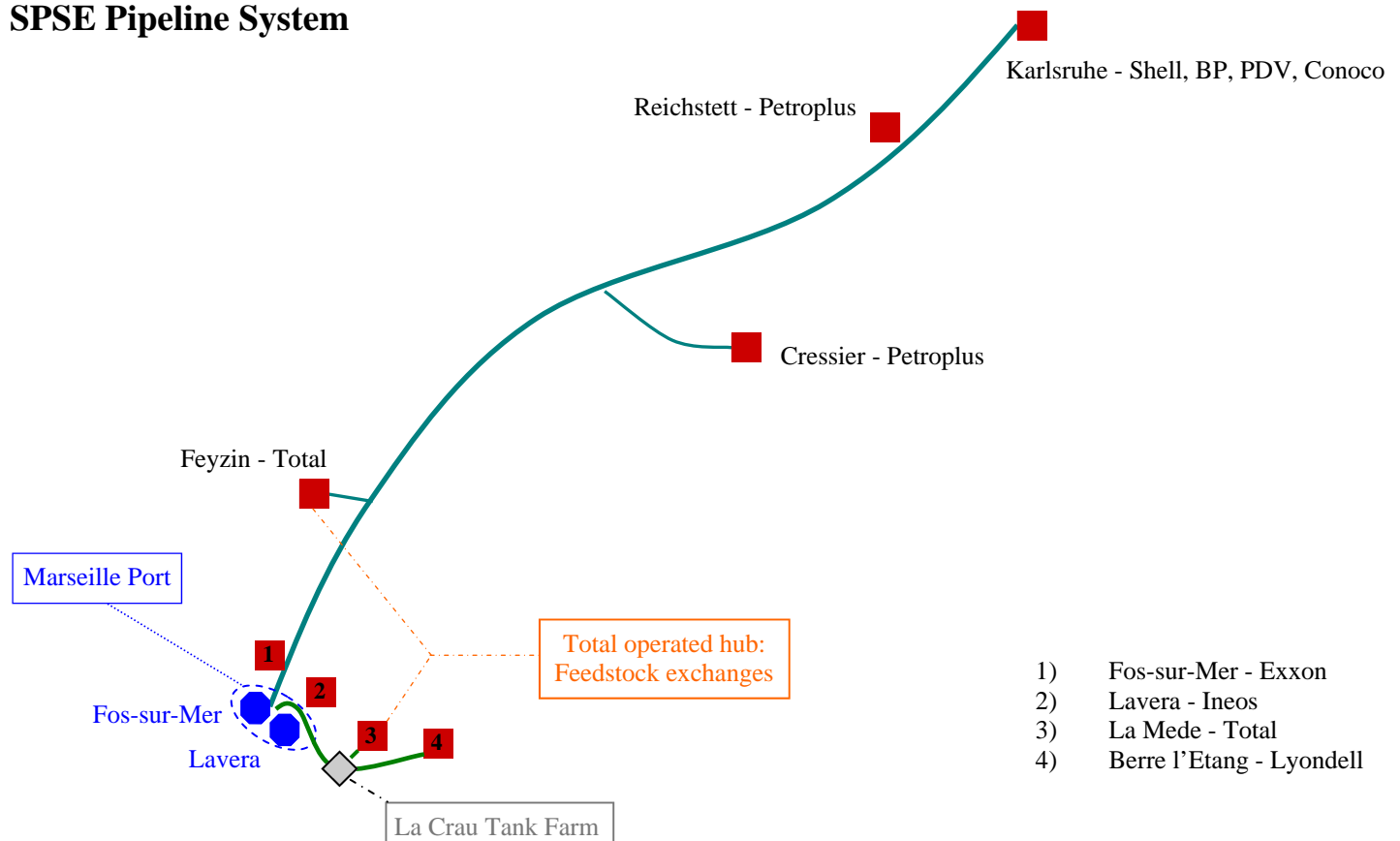
Other:

Venlo - Storage, pumping and operation centre of RRP

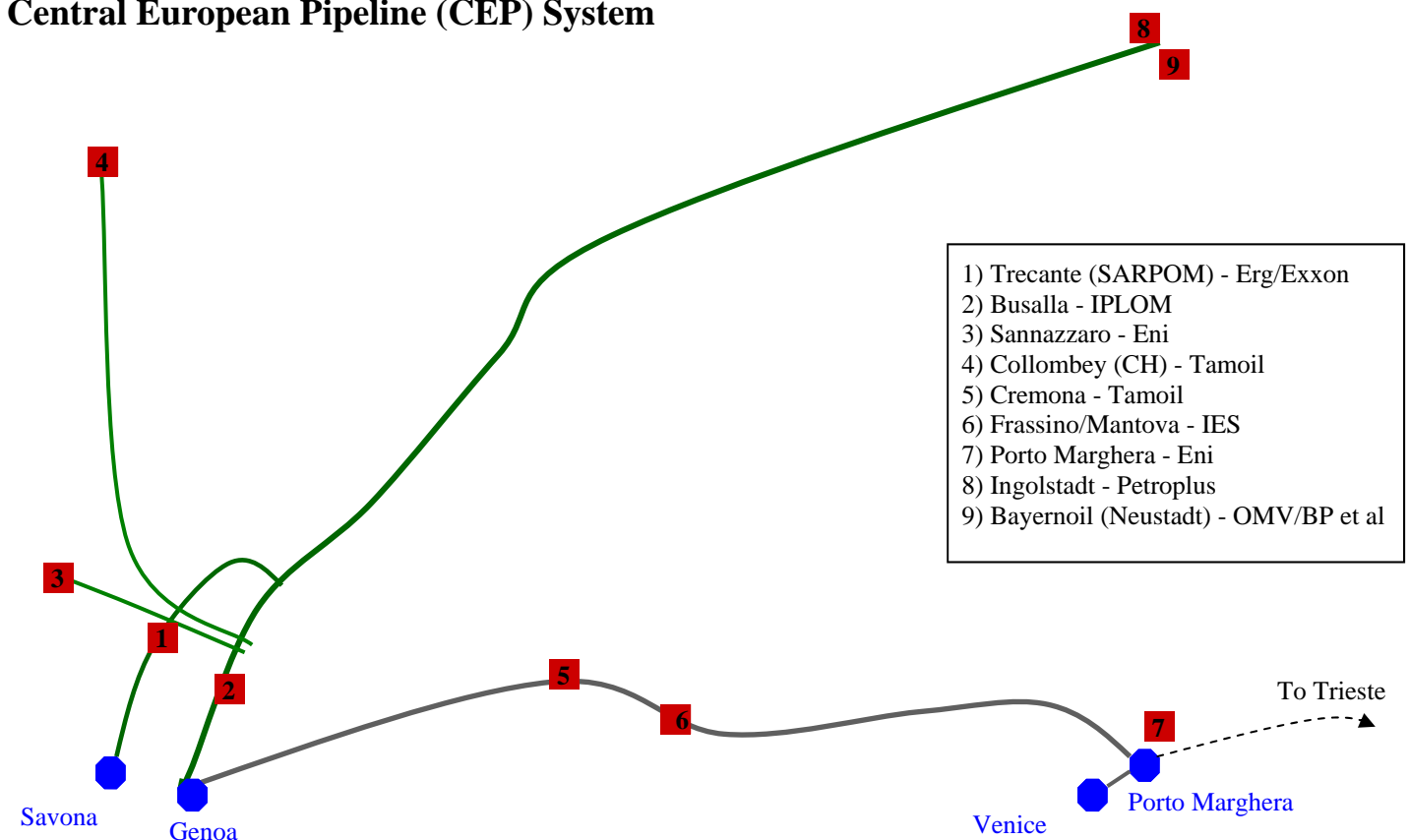
■ - Refinery

▲ - Port

SPSE Pipeline System



Central European Pipeline (CEP) System



North-West European Refineries

Refinery Location (Alternate Name)	Refinery Owner (Share Holders)	Country	Region	Cat		Hydro Cracking & Treating	Therm. Cracking & Vis Break.	Coking	Nelson Complex. Index	Notes	
				CDU	VDU						
Dunkirk	ExxonMobil Refining & Supply Co.	France	Norway, UK Cont. & Coastal NW Europe (1)	0	22	0	5	0	0	22.0	Lubes
Donges	Total SA	France	Norway, UK Cont. & Coastal NW Europe (1)	230	103	86	125	30	0	6.2	
Dunkirk (Mardyck)	Total SA	France	Norway, UK Cont. & Coastal NW Europe (1)	141	39	70	96	0	0	9.0	
Heide	Shell Deutschland Oil GmbH	Germany	Norway, UK Cont. & Coastal NW Europe (1)	83	37	18	42	15	0	8.9	
Whitegate (Cork)	ConocoPhillips	Ireland	Norway, UK Cont. & Coastal NW Europe (1)	71	0	11	45	0	0	5.1	
Slagen	ExxonMobil Refining & Supply Co.	Norway	Norway, UK Cont. & Coastal NW Europe (1)	116	0	12	70	32	0	3.8	
Mongstad	Mongstad Refining (Statoil)	Norway	Norway, UK Cont. & Coastal NW Europe (1)	199	0	73	54	0	25	5.4	
Leca da Palmeira, Porto	Galp Energia	Portugal	Norway, UK Cont. & Coastal NW Europe (1)	91	11	25	75	0	0	7.9	
Sines	Galp Energia	Portugal	Norway, UK Cont. & Coastal NW Europe (1)	213	71	65	134	23	0	5.9	
Muskiz Vizcaya (Bilbao)	Petronor SA (Repsol YPF, BBK)	Spain	Norway, UK Cont. & Coastal NW Europe (1)	220	90	72	182	40	0	7.4	
La Coruna	Repsol YPF SA	Spain	Norway, UK Cont. & Coastal NW Europe (1)	120	52	51	90	0	19	7.7	
Coryton Essex	Petroplus Holdings AG	United Kingdom (E)	Norway, UK Cont. & Coastal NW Europe (1)	172	94	95	106	0	0	14.1	*4
South Killingholme (Humber)	ConocoPhillips	United Kingdom (E)	Norway, UK Cont. & Coastal NW Europe (1)	221	157	102	252	55	65	12.0	
Eastham	AB Nynas Petroleum	United Kingdom (E)	Norway, UK Cont. & Coastal NW Europe (1)	27	27	0	0	0	0	4.0	Asphalt
Fawley	ExxonMobil Refining & Supply Co.	United Kingdom (E)	Norway, UK Cont. & Coastal NW Europe (1)	326	143	154	291	0	0	9.9	
Teesside	Petroplus International NV	United Kingdom (E)	Norway, UK Cont. & Coastal NW Europe (1)	100	0	0	24	0	0	1.6	
Stanlow	Shell U.K. Ltd.	United Kingdom (E)	Norway, UK Cont. & Coastal NW Europe (1)	267	130	125	157	0	0	8.4	
Killingholme South Humberside (Lindse	Total SA	United Kingdom (E)	Norway, UK Cont. & Coastal NW Europe (1)	221	97	82	117	26	0	6.2	
Dundee	AB Nynas Petroleum	United Kingdom (S)	Norway, UK Cont. & Coastal NW Europe (1)	12	12	0	0	0	0	4.0	Asphalt
Grangemouth	Ineos	United Kingdom (S)	Norway, UK Cont. & Coastal NW Europe (1)	196	65	40	93	0	0	5.0	
Pembroke, Dyfed	Chevron Corp.	United Kingdom (W)	Norway, UK Cont. & Coastal NW Europe (1)	210	105	129	158	26	0	11.6	
Milford Haven	Murco Petroleum Ltd.	United Kingdom (W)	Norway, UK Cont. & Coastal NW Europe (1)	106	53	55	103	0	0	10.3	
Port Jerome/NDG (Gravenchon)	ExxonMobil Refining & Supply Co.	France	Le Havre Pipeline System (2)	233	103	69	215	0	0	10.2	
Petit Couronne	Petroplus Holdings AG	France	Le Havre Pipeline System (2)	141	76	50	48	13	0	8.2	
Gonfreville l'Orcher	Total SA	France	Le Havre Pipeline System (2)	331	90	105	306	20	0	9.6	
Grandpuits	Total SA	France	Le Havre Pipeline System (2)	101	48	43	70	13	0	6.9	
Antwerp	Petroplus Holdings AG	Belgium	ARA & Northern European Pipeline System (3)	21	21	0	0	0	0	4.0	Asphalt
Antwerp	ExxonMobil Refining & Supply Co.	Belgium	ARA & Northern European Pipeline System (3)	305	137	73	274	0	0	5.9	
Antwerp (BRC)	Petroplus Holdings AG	Belgium	ARA & Northern European Pipeline System (3)	115	56	11	64	23	0	5.4	
Antwerp Processing Facility (APF)	Petroplus Holdings AG	Belgium	ARA & Northern European Pipeline System (3)	*CDU closed in 2003 now operated in conjunction with PP+ asphalt refinery							
Antwerp	Total SA	Belgium	ARA & Northern European Pipeline System (3)	357	93	153	333	30	0	6.9	
Gelsenkirchen	BP PLC	Germany	ARA & Northern European Pipeline System (3)	266	163	61	228	20	33	9.1	
Wilhelmshaven	ConocoPhillips	Germany	ARA & Northern European Pipeline System (3)	260	103	44	207	0	0	5.1	
Lingen	Deutsche BP AG Erdol Raffinerie GMBH	Germany	ARA & Northern European Pipeline System (3)	91	41	30	106	0	24	14.9	
Harburg	Deutsche Shell AG	Germany	ARA & Northern European Pipeline System (3)	93	44	33	47	13	0	9.9	
Rheinland (Godorf & Wesseling)	Deutsche Shell AG	Germany	ARA & Northern European Pipeline System (3)	346	178	66	411	55	0	9.6	
Salzbergen	HR Chemisch-Pharmazeutische Spezialaten GMBH	Germany	ARA & Northern European Pipeline System (3)	0	7	0	5	0	0	0.0	Lubes
Hamburg	HR Oelwerke Schindler GMBH	Germany	ARA & Northern European Pipeline System (3)	0	15	0	2	0	0	0.0	Lubes
Harburg	Holborn Europa Raffinerie GMBH (Oilinvest, Coastal)	Germany	ARA & Northern European Pipeline System (3)	78	15	33	74	0	0	6.1	
Rotterdam (Nerefco)	BP PLC	Netherlands	ARA & Northern European Pipeline System (3)	392	85	30	338	37	59	5.5	
Rotterdam	ExxonMobil Refining & Supply Co.	Netherlands	ARA & Northern European Pipeline System (3)	191	80	33	190	0	41	10.8	
Rotterdam (Europoort)	Kuwait Petroleum Europoort BV	Netherlands	ARA & Northern European Pipeline System (3)	81	39	22	83	16	0	11.5	
Rotterdam (Europoort)	Koch HC Partnership B.V.	Netherlands	ARA & Northern European Pipeline System (3)	80	0	0	18	0	0	0.0	*1
Pernis	Shell Nederland Raffinaderij BV (Shell, Statoil)	Netherlands	ARA & Northern European Pipeline System (3)	406	440	90	309	45	0	9.0	
Amsterdam	Smid & Hollander Raffinaderij BV	Netherlands	ARA & Northern European Pipeline System (3)	10	8	0	0	0	0	3.5	Asphalt
Vlissingen (Flushing)	Total SA (Total, Dow Chemicals)	Netherlands	ARA & Northern European Pipeline System (3)	147	86	26	124	0	0	10.2	
Litvinov	Czech Refining Co. (Unipetrol, Agip, Conoco, Shell)	Czech Republic	Baltic and Druzhba Linked Refineries (4)	101	59	20	86	17	0	9.7	
Kolin (Chemopetrol Litvinov)	Koramo Kolin (Unipetrol)	Czech Republic	Baltic and Druzhba Linked Refineries (4)	0	0	0	0	0	0	0.0	Petchem
Pardubice	Paramo AS (Unipetrol, PKN Orlen)	Czech Republic	Baltic and Druzhba Linked Refineries (4)	20	7	0	6	0	0	3.6	
Fredericia	AS Dansk Shell	Denmark	Baltic and Druzhba Linked Refineries (4)	68	0	13	23	37	0	5.7	
Kalundborg	Dansk Statoil AS	Denmark	Baltic and Druzhba Linked Refineries (4)	106	22	9	20	28	0	3.1	
Naantali	Neste Oil	Finland	Baltic and Druzhba Linked Refineries (4)	52	28	20	39	7	0	6.8	
Porvoo	Neste Oil	Finland	Baltic and Druzhba Linked Refineries (4)	200	70	50	218	23	0	10.1	
Schwedt	PCK Raffinerie GMBH	Germany	Baltic and Druzhba Linked Refineries (4)	219	141	85	219	48	0	10.1	
Leuna, Spargau	Total SA	Germany	Baltic and Druzhba Linked Refineries (4)	227	119	84	209	24	0	7.2	
Szazhalombatta (Duna)	MOL Hungarian Oil & Gas Co.	Hungary	Baltic and Druzhba Linked Refineries (4)	161	78	54	121	14	17	11.0	
Tiszaújváros	MOL Hungarian Oil & Gas Co.	Hungary	Baltic and Druzhba Linked Refineries (4)	0	0	0	14	0	0	0.0	*2
Mazeikiai	AB Mazeikiu Nafta (PKN Orlen, Government)	Lithuania	Baltic and Druzhba Linked Refineries (4)	190	89	89	154	29	0	9.1	
Gdansk	Grupa Lotos SA	Poland	Baltic and Druzhba Linked Refineries (4)	120	60	25	87	0	0	11.8	
Gorlice	Grupa Lotos SA	Poland	Baltic and Druzhba Linked Refineries (4)	*Closed in 2005 due to bankruptcy							
Jaslo	Grupa Lotos SA	Poland	Baltic and Druzhba Linked Refineries (4)	0	0	0	0	0	0	0.0	*3
Plock/Trezebina	PKN Orlen SA	Poland	Baltic and Druzhba Linked Refineries (4)	373	205	75	318	0	0	9.4	
Bratislava	MOL Hungarian Oil & Gas Co. (Slovnaf)	Slovakia	Baltic and Druzhba Linked Refineries (4)	115	55	39	130	0	0	12.3	
Gothenburg	AB Nynas Petroleum	Sweden	Baltic and Druzhba Linked Refineries (4)	13	13	0	0	0	0	4.0	Bitumen
Nynashamn	AB Nynas Petroleum	Sweden	Baltic and Druzhba Linked Refineries (4)	28	28	0	9	0	0	5.1	Bitumen
Brofjorden-Lysekil	Preem Raffinaderi AB	Sweden	Baltic and Druzhba Linked Refineries (4)	210	65	62	143	38	0	7.5	
Gothenburg	Preem Raffinaderi AB	Sweden	Baltic and Druzhba Linked Refineries (4)	106	0	21	104	0	0	6.2	
Gothenburg	Shell Raffinaderi AB	Sweden	Baltic and Druzhba Linked Refineries (4)	80	30	18	61	29	0	6.5	
Total NW Europe				9,774	4,305	2,902	7,629	825	282	7.2	
Total Atlantic Basin (Euro)	(Excludes Druzhba linked refineries)			8,439	3,580	2,520	6,439	722	265	7	

Specialist refinery processing limited crude

Marginal refinery susceptible to run cut or future closure

- *1 = Condensate splitter
- *2 = Delayed coker processing FO only
- *3 = Refinery no longer active - Plastic recycling and storage only
- *4 = High gasoline exposure

Mediterranean Refineries

Refinery Location (Alternate Name)	Refinery Owner (Share Holders)	Country	Region	CDU		Cat Cracking & Reforming	Hydro Cracking & Treating	Therm. Cracking & Vis Break.	Coking	Nelson Complex Index	Notes
				CDU	VDU						
Reichstett-Vendenheim	Petroplus Holdings AG	France	SPSE Pipeline System (5)	78	34	26	61	18	0	6.4	
Fos sur Mer	ExxonMobil Refining & Supply Co.	France	SPSE Pipeline System (5)	119	41	51	122	0	0	6.6	
Lavera	Ineos	France	SPSE Pipeline System (5)	207	72	39	90	22	0	5.8	
Berre l'Etaing	Lyondell-Basell	France	SPSE Pipeline System (5)	78	51	37	38	1	0	6.3	
Feyzin	Total SA	France	SPSE Pipeline System (5)	116	51	38	59	15	0	6.0	
La Mede	Total SA	France	SPSE Pipeline System (5)	158	62	65	120	14	0	8.7	
Cressier	Petroplus Holdings AG	Switzerland	SPSE Pipeline System (5)	60	24	16	62	20	0	7.7	
Porto Marghera	AgipPetroli SPA	Italy	Central European Pipeline System (6)	80	38	15	43	41	0	6.8	
Sannazzaro, Pavia	AgipPetroli SPA	Italy	Central European Pipeline System (6)	200	85	63	110	32	0	7.2	
S. Martino Di Trecate	ExxonMobil Refining & Supply Co.	Italy	Central European Pipeline System (6)	174	28	60	125	0	0	6.2	
Busalla	Iplom SPA	Italy	Central European Pipeline System (6)	40	20	0	21	0	0	3.5	
Mantova (Frassino)	MOL	Italy	Central European Pipeline System (6)	69	25	9	72	43	0	8.2	
Cremona	Tamoil Raffinazione SPA	Italy	Central European Pipeline System (6)	94	0	24	79	36	0	7.5	
Collombey	Tamoil SA	Switzerland	Central European Pipeline System (6)	72	0	32	33	0	0	6.9	
Schwechat	OMV AG	Austria	TAL Pipeline System (7)	209	65	59	139	17	0	6.2	
Kralupy	Czech Refining Co. (Unipetrol, Agip, Conoco, Shell)	Czech Republic	TAL Pipeline System (7)	62	13	7	46	0	0	5.4	
Burghausen	OMV AG	Germany	TAL Pipeline System (7)	72	0	0	65	0	28	7.3	
Vorburg/Ingolstadt/Neustadt (Bayernoil	Bayernoil Raffineriegesellschaft GMBH (OMV, BP, PDVSA, ENI)	Germany	TAL Pipeline System (7) & CEP System (6)	262	88	117	223	49	0	8.0	
Ingolstadt	Petroplus Holdings AG	Germany	TAL Pipeline System (7) & CEP System (6)	110	39	47	95	0	0	7.4	
Karlsruhe	Mineraloelraffinerie Oberrhein GMBH (Shell, BP, PDVSA, Conoc	Germany	TAL Pipeline System (7) & SPSE System (5)	310	131	139	262	24	25	8.6	
Gela, Ragusa	AgipPetroli SPA	Italy	Western Coastal Mediterranean (8)	105	53	49	94	0	45	13.1	
Livorno	AgipPetroli SPA	Italy	Western Coastal Mediterranean (8)	84	36	14	54	0	0	12.6	
Taranto	AgipPetroli SPA	Italy	Western Coastal Mediterranean (8)	84	61	17	83	64	0	10.2	
Falconara, Marittima	Api Raffineria di Ancona SPA	Italy	Western Coastal Mediterranean (8)	83	38	14	69	61	0	9.7	
La Spezia	Arcola Petrolifera SPA	Italy	Western Coastal Mediterranean (8)	33	0	0	0	0	0	1.0	
Priolo, Sicily (ErgMed ISAB Nord)	ERG Raffinerie Mediterranee North	Italy	Western Coastal Mediterranean (8)	140	48	42	30	24	0	3.8	
Meillisi, Sicily (ErgMed ISAB Sud)	ERG Raffinerie Mediterranee South	Italy	Western Coastal Mediterranean (8)	238	106	36	229	75	0	7.5	
Augusta, Siracusa	ExxonMobil Refining & Supply Co.	Italy	Western Coastal Mediterranean (8)	198	93	70	125	0	0	11.8	
Milazzo, Messina	Raffineria di Milazzo SPA (Eni, KPC)	Italy	Western Coastal Mediterranean (8)	241	70	57	106	0	0	5.5	
Rome (Pantano)	Raffineria di Roma SPA (Total, ERG)	Italy	Western Coastal Mediterranean (8)	89	11	14	51	32	0	7.7	
Sarroch	Saras SPA	Italy	Western Coastal Mediterranean (8)	300	105	115	212	41	0	7.9	
Cadiz (Algeciras)	Cia. Espanola de Petroles SA	Spain	Western Coastal Mediterranean (8)	240	40	76	119	38	0	6.7	
Huelva (La Rabida)	Cia. Espanola de Petroles SA	Spain	Western Coastal Mediterranean (8)	100	38	36	62	9	0	10.4	
Cartagena Murcia	Repsol YPF SA	Spain	Western Coastal Mediterranean (8)	100	15	26	58	0	0	5.8	
Puertollano, Ciudad Real	Repsol YPF SA	Spain	Western Coastal Mediterranean (8)	140	56	47	137	0	24	9.9	
Tarragona	Repsol YPF SA	Spain	Western Coastal Mediterranean (8)	160	72	22	137	28	0	7.6	
Castellon de la Plana	BP PLC	Spain	Western Coastal Mediterranean (8)	110	47	47	129	0	0	10.9	
Tenerife	Cia. Espanola de Petroles SA	Spain	Western Coastal Mediterranean (8) ?	87	8	16	45	35	0	4.6	
Ballshi	Albpetrol	Albania	Eastern Coastal Mediterranean (9)	18	5	4	17	0	12	12.2	
Fieri	Albpetrol	Albania	Eastern Coastal Mediterranean (9)	9	6	0	0	0	0	2.4	
Rijeka	Ina-Industrija Naft e d.d.	Croatia	Eastern Coastal Mediterranean (9)	90	34	34	35	12	0	6.6	
Sisak	Ina-Industrija Naft e d.d.	Croatia	Eastern Coastal Mediterranean (9)	80	16	25	21	0	5	4.1	
Zagreb	Ina-Industrija Naft e d.d.	Croatia	Eastern Coastal Mediterranean (9)	2	1	0	0	0	0	0.0	*1
Aspropyrgos	Hellenic Petroleum SA	Greece	Eastern Coastal Mediterranean (9)	147	68	70	182	23	0	9.5	
Elefsis	Hellenic Petroleum SA	Greece	Eastern Coastal Mediterranean (9)	100	0	0	0	0	0	1.0	
Thessaloniki	Hellenic Petroleum SA	Greece	Eastern Coastal Mediterranean (9)	67	12	10	47	0	0	5.9	
Aghii Theodori	Motor Oil (Hellas) Corinth Refineries SA	Greece	Eastern Coastal Mediterranean (9)	110	72	45	178	26	0	15.2	
Ashdod	Oil Refineries Ltd.	Israel	Eastern Coastal Mediterranean (9)	90	45	39	50	25	0	6.7	
Haifa	Oil Refineries Ltd.	Israel	Eastern Coastal Mediterranean (9)	130	73	37	46	41	0	5.7	
Zarqa	Jordan Petroleum Refinery	Jordan	Eastern Coastal Mediterranean (9)	90	22	15	22	0	0	3.4	
Skopje	Hellenic Petroleum SA	Macedonia	Eastern Coastal Mediterranean (9)	50	0	11	22	0	0	4.5	
Novi Sad	NIS-Oil Refinery Novi Sad (NIS, Gazprom)	Serbia & Montenegro	Eastern Coastal Mediterranean (9)	117	10	11	29	0	0	2.5	
Pancevo	NIS-Rafinerija Naft e Pancevo (NIS, Gazprom)	Serbia & Montenegro	Eastern Coastal Mediterranean (9)	98	40	27	22	20	0	4.9	
Lendava	Naft e Lendava	Slovenia	Eastern Coastal Mediterranean (9)	14	0	0	0	0	0	1.0	*2
Banias	Banias Refining Co.	Syria	Eastern Coastal Mediterranean (9)	133	51	21	64	23	0	6.1	
Homs	Homs Refinery Co.	Syria	Eastern Coastal Mediterranean (9)	107	12	10	43	0	18	4.1	
Mersin	Anadolu Tasfiyehanesi AS	Turkey	Eastern Coastal Mediterranean (9)	0 (95)	0	14	32	0	0	2.6	Closed
Narli, Kahramanmaras	Ersan Petrol Sanayii AS	Turkey	Eastern Coastal Mediterranean (9)	6	4	0	0	0	0	3.1	
Aliaga-Izmir	Turkish Petroleum Refineries Corp.	Turkey	Eastern Coastal Mediterranean (9)	226	75	25	73	19	0	5.7	
Batman, Siirt	Turkish Petroleum Refineries Corp.	Turkey	Eastern Coastal Mediterranean (9)	22	2	1	1	5	0	2.4	
Izmit (Tutuncettlik)	Turkish Petroleum Refineries Corp.	Turkey	Eastern Coastal Mediterranean (9)	252	90	35	162	0	0	4.9	
Kirkkale	Turkish Petroleum Refineries Corp.	Turkey	Eastern Coastal Mediterranean (9)	113	30	20	50	0	0	5.6	
Bourgass	Neftochim (Lukoil)	Bulgaria	Black Sea (10)	115	50	27	64	21	0	5.8	
Pitesti	Arpechim SA (Petrom, OMV)	Romania	Black Sea (10)	70	38	31	32	11	0	7.3	
Ploiesti	Astra SA	Romania	Black Sea (10)	56	9	0	3	0	9	9.2	
Ploiesti	Petrobraz SA	Romania	Black Sea (10)	69	39	35	19	0	13	7.3	
Bacau	Petrolsub SA (Petrom, OMV)	Romania	Black Sea (10)	8	5	0	0	0	0	4.4	
Midia	Petromidia SA (Petromidia, Rompetrol)	Romania	Black Sea (10)	105	46	36	73	0	20	7.5	
Ploiesti	Petrotel SA (Petrotel, Lukoil)	Romania	Black Sea (10)	104	56	32	44	6	11	7.6	
Darmanesti	Rafinaria Darmanesti SA	Romania	Black Sea (10)	16	0	3	0	9	10	7.0	
Onesti, Bacau	Rafo SA	Romania	Black Sea (10)	70	70	34	68	12	6	9.8	
Ploiesti	Rompetrol SA Vega Refinery	Romania	Black Sea (10)	9	3	0	0	0	0	2.0	Asphalt
Cimpina	Steaua Romania SA	Romania	Black Sea (10)	9	6	0	0	0	0	5.3	Asphalt
Total Med				7,803	2,751	2,194	5,002	988	225	6.5	

Specialist refinery processing limited crude
Marginal refinery susceptible to run cut or future closure

*1 = Used for lube blending only
*2 = No longer in operation - possible conversion to biodiesel production plant



Part 3 - North Sea Pricing Instruments

North Sea Pricing Instruments

The purpose of this section is to describe most common Brent/BFOE pricing instruments in order to understand the underlying linkages between them and the market fundamentals they are designed to reflect.

Based on the degree of forwardness and the nature of the underlying market, all pricing instruments can be subdivided into 3 main groups:

- 1) Related to spot physical market (loading in 10-21 days),
- 2) Related to forward physical market (1-2 months forward),
- 3) Related to futures market (1-72 consecutive months+).

The information below presents basic facts about all these instruments, as well as the markets they reflect.

Dated Brent

Synonyms:

Dated BFOE

Platt's Dated BFOE

Platt's Dated Brent

The price of Dated Brent represents the price of physical Brent/Forties/Oseberg/Ekofisk cargoes loading between 10 and 21 days forward if the price assessment is done on Monday through Thursday, or the price of cargoes loading between 10 and 23 days forward if the price assessment is done on Friday. Platt's does not take into account physical cargoes traded during the first 10 days, as the cargoes sold in those days may be "distressed" and might not reflect the true value of the crude. The cargoes are loaded FOB terminal. In accordance with the Platt's methodology, the cheapest of the four grades sets the price of the benchmark.

Since all Dated BFOE transactions are spot transactions and refer to specific cargoes with specific loading windows, Dated BFOE market (or spot market) is limited by the production volume that month and normally reflects the North Sea supply/demand balance 10-21 (23) days out.

Historically Dated Brent market included only Brent cargoes but because the production of Brent declined over time, in July 2002 Platt's broadened the definition of the North Sea benchmark by including Forties and Oseberg cargoes assessments. Further, in June 2007, Ekofisk was added to the set of benchmark crudes.

Because all BFOE crudes were light and sweet, adding Forties, Oseberg and Ekofisk to the benchmark provided a cap to the price of Brent at times when it got disconnected from the prices of other North Sea grades.

In mid-2007 the quality of Forties crude has changed drastically after it started to be commingled with the medium sour crude from the newly developed Buzzard field. Currently crude from the Buzzard field represents about 24% of Forties stream and expected to reach 30% by 2010. Thus, in a very short period of time Forties effectively underwent a drastic transformation from a light sweet into a light sour crude, and as the heaviest, most sour and therefore lowest valued crude of the four benchmark crudes, it started to set the price of BFOE most of the time.

During the time of field maintenance, the quality of Forties changes considerably. Thus, when light sweet fields are on maintenance, the sulphur content of Forties stream might rise to 0.6-0.9%; and when the Buzzard field is shut down, the entire Forties stream becomes light sweet. These changes cause dramatic fluctuations in the entire European supply-demand balance as such a large quantity of crude (680 kbd) suddenly adds up either to light sweet or to light sour supply-demand balance.

For Platt's the changing quality of Forties presents a considerable challenge as Forties price has been setting the BFOE price almost all the time since the start-up of the Buzzard field. In order to address the issue, Platt's applies a sulphur de-escalator in order to assess the price of Forties unaffected by changes in sulphur.

Currently Platt's applies the quality de-escalator of 0.40 cts/bbl for every 0.10% of sulphur in order to price Forties crude with sulphur content above 0.60%.

In their price assessments Platt's uses a system commonly known as Market on Close (MOC) designed to reflect the crude price prevailing at market close on a normal working day. Thus, despite the fact that companies can submit bids and offers to Platt's from 9:00 a.m. London time, Platt's derives daily assessments only from deals that could or did take place at the end of the working day during the MOC window. Thus, Dated Brent price is determined during Platt's MOC window from 16:00—16:30.

The assessments are based on bids/offers received and published by Platt's on Global Electronic Screen service no later than the published cut-off period which is currently 16:10 London time. Prices might be changed incrementally until 16:25. Changes to bid and offers should typically not exceed 5cts/bbl per adjustment. For assessment purposes Platt's takes into account deals done, bids and offers, and may incorporate spread trades.

Prior to January 2001, Platt's averaged the price during the window in order to produce their daily assessment. However from January 2001, in order to produce the most accurate Market at Close assessment Platt's uses the highest bid and the lowest offer, regardless of the time they occur during the window.

Dated Brent (BFOE) price is conventionally quoted as a premium/discount to 21-day Brent (BFOE) contract.

21-Day Brent

Synonyms:

21-Day BFOE
21-Day Cash BFOE
Platt's 21-Day
Cash Brent
Cash BFOE
Forward Brent
Forward BFOE
Paper BFOE

21-day Brent is a forward contract for a standard parcel of crude that will be made available by the seller to the buyer on an unspecified day of the relevant month. The contracts are quoted as forward months (i.e. January, February, March contracts) and traded 21-days to 3 months forward. Forward BFOE contracts reflect the market expectations of Dated BFOE price going forward.

There are usually many more forward contracts for a given month than there are physical cargoes and their number can be reflective of the market interest rather than of the physical volume available for that month. Under the contract, the seller nominates the day of loading 21 days prior to the start of the loading window and the nomination process starts. The nomination can involve several book-outs. Book-out is an agreement between a chain of buyers and sellers to settle their forward contracts by converting them into a number of financial settlements if the contracts have been cleared through the nomination process and have not resulted in one party taking the delivery.

Normally the book-out process starts when the buyer receives a 21-day notice to take the delivery of the specified cargo. The buyer can pass the cargo on to somebody else who had entered into a buying contract with him. This process can continue between participants until 5 p.m. London time on the last day on which the notice can be validly served. If the participant who happened to take the delivery does not want to be the cargo holder, he/she can sell it now as a dated cargo with a specified days of loading at Dated Brent (BFOE) market.

Platt's assessment of the front-line (1st month) 21-day BFOE contract expires on the last day of the calendar month. For instance, September 21-day BFOE will be last assessed on August 30. On September 1, October BFOE becomes the first month contract, November BFOE becomes the second month contract and December BFOE becomes the third month contract.

Since BFOE contracts are fairly commoditized and standardized, Platt's uses an electronic platform developed in cooperation with International Petroleum Exchange (ICE) allowing individual buyers and sellers to independently submit bids and offers electronically in order to ensure maximum transparency.

CFDs

Synonym:
Dated Brent Swaps

CFDs are contracts for difference are relatively short-term swaps, quoted for each of eight weeks forward. They represent a differential between the price of the *second* month BFOE contract and the price expected in more nearby periods down to date following the current date. Thus, effectively, added in sequence to the 2nd forward month price, they reflect the market structure between the spot and forward markets.

CFDs are rolled forward every Thursday and quoted as a differential to 2nd month forward BFOE contracts. The 1st week

CFD is the closest to the current day and the 8th week's CFD prices the farthest.

Contracts for differences are swap contracts. Buyers of CFDs exchange the fixed price for the floating (market) price for the period of the swap. The floating price is determined based on the average of daily prices during the week of the swap. When the swap expires, the counterparties reimburse each other for the difference between the fixed and floating prices. If the floating (weekly average) price exceeds the CFD price, the Seller pays the difference to the buyer, and vice versa.

CFDs are used by market participants either to speculate on future prices of Dated Brent (BFOE) or to hedge their long or short exposure to the fluctuation of the diff between the between 2nd forward month and the period when their cargo is expected to price in.

Since CFDs are fairly commoditized and standardized, Platt's uses an electronic platform developed in cooperation with International Petroleum Exchange (ICE) allowing individual buyers and sellers to independently submit bids and offers electronically in order to ensure maximum transparency.

North Sea Dated Strip

Synonyms:

Dated Brent Swaps

North Sea Swaps

North Sea Dated strip is the price of BFOE cargoes traded 10-21 days out. This price is inferred from the price of the 2nd month forward contract and CFD values. North Sea strip is used by Platt's to apply individual benchmark crude quality diffs (determined by bids and offers on dated cargoes) in order to establish the lowest amongst them and to calculate the BFOE benchmark price. The way Platt's calculates the North Sea Dated Strip is explained on next page and Figures 1 & 2 overleaf illustrates those calculations.

ICE Brent Futures

The ICE Brent futures contract is a legally binding agreement to make or take delivery of crude of current pipeline export quality Brent blend supplied at Sullom Voe for future delivery at a fixed price agreed upon at the time of dealing. The contract is used both for hedging and trading purposes.

ICE Brent futures are part of Brent pricing complex, which includes previously described spot and forward markets. ICE Brent futures are deliverable contracts based on EFP delivery with an option to cash settle against the published settlement price - the ICE Futures Brent Index price (Attachment 1).

As it is stated in the contract description provided by ICE Futures Europe, "by providing a contract parallel to the physical market, the oil industry has an opportunity to separate its pricing from supply arrangements by means of EFPs and basis trading, giving greater flexibility with regards to the timing of purchases and sales".

The contract allows to trade parcels of 1,000 barrels (which are called lots). All trading activity is regulated by the Exchange which sets out the rules and establishes contracts for trading. Real-time prices are exhibited via the ICE platform and can be also obtained from major data vendors and therefore prices at which contracts are traded can be instantly known by all market participants.

The clearing house (LCH Clearnet Ltd) acts as a central counterparty for trades. It clears and manages the contract, guarantees financial performance and sets margins.

The ICE trades 72 consecutive months contracts and six additional contracts comprising June and December contracts for a further three years.

Trading of an individual contract shall cease at the close of business on the business day immediately preceding the 15th day prior to the first day of the delivery month, if such 15th day is a banking day in London. If the 15th day is a non-banking day in London (including Saturday), trading shall cease on the day immediately preceding the first business day prior to the 15th day.

Trading hours are from 1:00 to 23:00 GMT, except Sunday evening when the opening time is 23:00 GMT.

Figure 1: Calculation of N Sea Dated Strip

BFOE Calculations (on June 24, 2008)

Current CFD values:

W1	W2	W3	W4	W5	W6	W7	W8
-1.00	-0.77	-0.60	-0.44	-0.27	-0.15	-0.04	0.10

Current 2nd month forward contract:

136.70

Current swap values = 2nd month forward contract + CFDs:

W1	W2	W3	W4	W5	W6	W7	W8
135.70	135.93	136.10	136.26	136.43	136.55	136.66	136.80

Daily swap values are then interpolated from weekly swap values, and the average of 10-21 day swaps is calculated. The average of 10-21 day swaps is called North Sea strip.

	Dated Brent Swaps/CFDs (Weekly)	Dated Brent Swaps/CFD Daily Change	Dated Brent Swaps/CFD (Intraweek)	Day's Number	North Sea Dated Strip/North Sea Strip/CFD Average
25-Jun-08	135.70		135.70	1	
26-Jun-08		0.0329	135.73	2	
27-Jun-08		0.0329	135.77	3	
28-Jun-08		0.0329	135.80	4	
29-Jun-08		0.0329	135.83	5	
30-Jun-08		0.0329	135.86	6	
01-Jul-08		0.0329	135.90	7	
02-Jul-08	135.93	0.0329	135.93	8	
03-Jul-08		0.0243	135.95	9	
04-Jul-08		0.0243	135.98	10	136.11
05-Jul-08		0.0243	136.00	11	136.11
06-Jul-08		0.0243	136.03	12	136.11
07-Jul-08		0.0243	136.05	13	136.11
08-Jul-08		0.0243	136.08	14	136.11
09-Jul-08	136.10	0.0243	136.10	15	136.11
10-Jul-08		0.0229	136.12	16	136.11
11-Jul-08		0.0229	136.15	17	136.11
12-Jul-08		0.0229	136.17	18	136.11
13-Jul-08		0.0229	136.19	19	136.11
14-Jul-08		0.0229	136.21	20	136.11
15-Jul-08		0.0229	136.24	21	136.11
16-Jul-08	136.26	0.0229	136.26	22	
17-Jul-08		0.0243	136.28	23	
18-Jul-08		0.0243	136.31	24	
19-Jul-08		0.0243	136.33	25	
20-Jul-08		0.0243	136.36	26	
21-Jul-08		0.0243	136.38	27	
22-Jul-08		0.0243	136.41	28	
23-Jul-08	136.43	0.0243	136.43	29	
24-Jul-08		0.0171	136.45	30	
25-Jul-08		0.0171	136.46	31	
26-Jul-08		0.0171	136.48	32	
27-Jul-08		0.0171	136.50	33	
28-Jul-08		0.0171	136.52	34	
29-Jul-08		0.0171	136.53	35	
30-Jul-08	136.55	0.0171	136.55	36	
31-Jul-08		0.0157	136.57	37	
01-Aug-08		0.0157	136.58	38	
02-Aug-08		0.0157	136.60	39	
03-Aug-08		0.0157	136.61	40	
04-Aug-08		0.0157	136.63	41	
05-Aug-08		0.0157	136.64	42	
06-Aug-08	136.66	0.0157	136.66	43	
07-Aug-08		0.0200	136.68	44	
08-Aug-08		0.0200	136.70	45	
09-Aug-08		0.0200	136.72	46	
10-Aug-08		0.0200	136.74	47	
11-Aug-08		0.0200	136.76	48	
12-Aug-08		0.0200	136.78	49	
13-Aug-08	136.80	0.0200	136.80	50	

North Sea Dated Strip =
10-21 day CFD average

Finally Platt's applies individual crude diffs, established as a result of bids and offers, to the North Sea strip (136.11 \$/bbl) to calculate the values of Brent, Forties, Oseberg and Ekofisk:

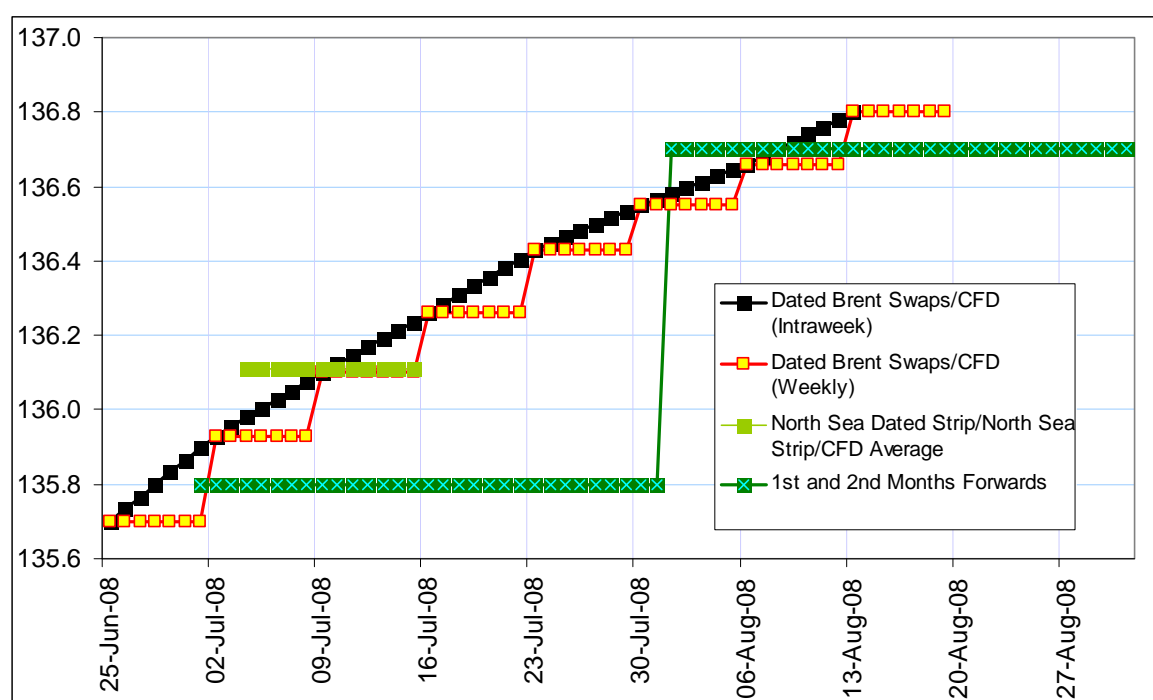
DTD Brent Diff (Spread) vs. fwd Dated Brent	0.25
DTD Forties Diff (Spread) vs. fwd Dated Brent	-0.45
DTD Ekofisk Diff (Spread) vs. fwd Dated Brent	2.25
DTD Oseberg Diff (Spread) vs. fwd Dated Brent	2.40

DTD Brent	136.36
DTD Forties	135.66
DTD Ekofisk	138.36
DTD Oseberg	138.51

And the lowest price (Forties price in this case) determines the price of the BFOE benchmark:

DTD BFOE	135.66
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Figure 2: Linkage between Dated Brent Swaps (CFDs), North Sea Strip and Forwards



Sources: Platt's, BP Crude Oil Trading Analytics

ICE Futures Brent Weighted Average (BWAVE)

The ICE Futures Brent Weighted Average is a benchmark price produced on a daily basis and used by several major oil producing countries as the basis for crude exports to Europe. It represents the average price of all trades executed for each contract each business day.

The BWAVE is published each day after the close of business for that day. The average for each traded month is calculated using trades executed during ICE Futures opening hours in accordance with the following formula:

$$\frac{\sum(\text{Trade Volume} \times \text{Trade Price})}{\text{Total Daily Volume}}$$

Additionally, a real-time weighted average price (WAP) is calculated throughout each trading day.

Exchange of Futures for Physical (EFPs)

Exchange of Futures for Physical is a mechanism available to market participants to enable physical delivery of crude against the IPE Brent Crude contract. EFP mechanism also enables the market participants to initiate futures posi-

tions, close futures positions and to swap a futures position for a similar physical position.

EFP trades work on the basis that counterparties agree that they wish to complement their physical transaction with an accompanying futures transaction. They advise the brokers to register their transactions with the ICE Futures. When EFPs are registered, the volume is attributed to that trading day but the price is not declared to the market. When the ICE Futures Brent Index Price is calculated, EFP volume is excluded.

The ICE website (www.theice.com) provides a detailed description of the EFP mechanism but since it is a mechanism rather than a pricing instrument, we will leave its description out of the scope of this report.

The EFP mechanism should not be confused with EFP swaps, which are financial instruments that allow market participants to trade and hedge the difference between futures contracts and forward contracts. The seller of EFP sells the forward contract and buys the future, and the buyer of EFP buys the forward and sells the future.

EFP is a swap transaction. Buyers of EFPs exchange the fixed price for the floating (market) price for the period of the swap. The floating price is determined based on the average of daily prices during the week of the swap. When the swap expires, the counterparties reimburse each other for the difference between the fixed and floating prices. If the floating (weekly average) price exceeds the EFP price, the Seller pays the difference to the buyer, and vice versa.

Brent Dated-to-Frontline Swaps (DFLs)

Similar to CFDs and EFPs, DFLs are swap transactions. DFLs are used to trade or speculate on the basis risk between the spot physical market (Dated Brent market) and Brent futures. The DFL market has also been supplemented by the Dated to BWAVE market, a similar instrument linking the Dated with BWAVE futures.

Buyers of DFLs exchange the fixed price for the floating (market) price for the period of the swap. The floating price is determined based on the average of daily prices during the week of the swap. When the swap expires, the counterparties reimburse each other for the difference between the fixed and floating prices. If the floating (weekly average) price exceeds the DFL price, the Seller pays the difference to the buyer, and vice versa.

Attachment 1: The ICE Futures Brent Index Price

Source: ICE Futures Europe - Brent Index - v1.0 - January 21, 2008

The ICE Futures Brent Index Price

The cash settlement price for the ICE Brent Future is based on ICE Futures Brent index at expiry. The index represents the average price of trading in the 21 day BFOE market in the relevant delivery month as reported and confirmed by the industry media. Only published cargo size (600,000 barrels) trades and assessments are taken into consideration.

Calculation

The index is calculated as an average of the following elements:

1. A weighted average of **first** month cargo trades in the 21-day BFOE market.
2. A weighted average of **second** month cargo trades in the 21 day BFOE market plus or minus a straight average of the spread trades between the first and second months.
3. A straight average of designated assessments published in media reports.

1. First Month Weighted Average

This is an average of the cargo trade prices reported, weighted to include multiple trades at any one price level. If media sources should conflict as to how many trades took place at a given price, then ICE Futures will endeavour to clarify the actual amount of trades through contact with the media sources and market users, whilst reserving the right to omit trades that cannot be substantiated to the satisfaction of the Exchange.

Example: Should media sources report the following 21 day trades for the first month:

Media Source (1)	Media Source (2)	Media Source (3)	Media Source (4)	Media Source (5)	ICE Summary
88.46	88.64	88.64	88.64	88.64	88.46
88.65	88.65	88.65	88.64		88.64
88.66	88.66		88.65		88.64
			88.66		88.65
					88.66

First month weighted average = 88.610

2(a) Second Month Deals Plus or Minus Spread Trades

This second element in the calculation produces an implied average price for the first month of the 21-day market, by averaging the second month traded cargo prices plus or minus an average of the spread trades between the first and second months. Trades in the second month of the 21-day market are also taken into consideration in this second element of the calculation, after having been adjusted by the size of the differential between the first and second 21-day months. Trade prices for the second month are averaged in the same way as above, and the average 1st-2nd month spread value is determined by the straight average price of spread trades documented by media sources.

Example: Should media sources report the following 21 day cargo trades for the second month:

Media Source (1)	Media Source (2)	Media Source (3)	Media Source (4)	Media Source (5)	ICE Summary
88.51	88.70	88.53	88.51	88.53	88.51
88.53		88.68	88.53	88.68	88.53
88.53			88.68	88.58	88.53
			88.70		88.58
					88.68
					88.70

Second month weighted average = 88.588

2(b) Average Spread Trade Prices

Example: Should media sources report the following 21-day trades for the first-second month spread:

Media Source (1)	Media Source (2)	Media Source (3)	Media Source (4)	Media Source (5)
0.04	0.04	0.03	0.03	0.03
		0.04	0.04	0.03
		0.04		0.04

$$(6 \times 0.04 + 4 \times 0.03) / 10$$

Average spread trade price = 0.036

In a backwardated market, the average spread trade price will be added to the weighted average trade price for the second month, in order to construct the implied first month price level. The spread price would be subtracted from the average second month price in the event of a contango market.

Thus, the second month weighted average of \$88.588 plus the average differential of \$0.0362 would give an implied first month price of \$88.624.

3. Intra-Day Price Assessments

The industry media publish 21-day BFOE price assessments throughout the trading day. The midpoint of each quote is used to calculate an average for the whole trading day.

The trading day is taken from 09:30 GMT (10.30 BST) – 19.30 inclusive.

Example: Should media sources publish the following quotes throughout the day for the first 21-day BFOE month, these would be averaged to give the following results:

Time GMT/ BST	Media Source (1)		Media Source (2)		Media Source (3)	
09.30/ 10.30	88.560	88.610	88.550	88.620	88.570	88.610
12.30	88.570	88.630	88.570	88.620	88.560	88.600
14.30	88.580	88.630	88.600	88.650	88.610	88.650
17.30	88.600	88.650	88.620	88.670	88.620	88.650
19.30	88.700	88.750	88.710	88.760	88.700	88.750
Average	88.628		88.637		88.632	

Average market assessment = 88.632

SUMMARY

The Brent Index is calculated as an average of three elements:

1. The first month average price \$88.610
2. The second month average price (adjusted by spread value) \$88.624
3. The average market assessment \$88.632

Average \$88.622

This would be rounded down to produce a Brent Index of \$88.62.

Appendix 1: European Refineries

Scandinavia and Baltic

[Denmark](#)
[Finland](#)
[Lithuania](#)
[Norway](#)
[Sweden](#)

North Western Europe

[Austria](#)
[Belgium](#)
[France](#)
[Germany](#)
[Ireland](#)
[Netherlands](#)
[Switzerland](#)
[U.K.](#)

Eastern Europe

[Albania](#)
[Bulgaria](#)
[Czech Republic](#)
[Croatia](#)
[Greece](#)
[Hungary](#)
[Macedonia](#)
[Poland](#)
[Romania](#)
[Serbia](#)
[Slovakia](#)
[Turkey](#)

Southern Europe

[Italy](#)
[Portugal](#)
[Spain](#)

Scandinavia and Baltic

Denmark

Fredericia – Shell (68 kbd)

- NW Europe hub – Baltic
- Very energy efficient but due to small size lacks profitability
- Crude direct from N Sea via pipeline – Very sweet slate
- High gasoil (inc. marine gasoil) production
- Integration into NW Europe refining hub with connections to Shell's 2 N German refineries
- Conversion ratio: 38% - complexity indicator: 5.7

Kalundborg – Statoil (118 kbd)

- NW Europe hub – Baltic
- Close integration with Statoil's upstream N Sea assets and refinery in Mongstad
- Connected by pipeline to Statoil's terminal at Hedehusene nr. Copenhagen
- Exports product to Germany, France and Baltic plus strong links to Statoil downstream operation in Sweden and Denmark
- Production focused on mid-distillates – asphalt unit limits HFO output
- Strong integration with local industry to improve energy conservation
- Conversion ratio: 12% - complexity indicator: 3.4

Pipelines & Storage:

Total storage capacity of 3.44 cu.m

Biggest storage complex is Statoil's 548,160 cu.m facility at Kalundborg

One pipeline runs from Kalundborg refinery to Hedehusene distribution centre nr Copenhagen.

Finland

Both Finnish refineries operated by Neste Oil. Neste processes around 50% Russian Export Blend (Urals) at its refineries. Finland exports around 40% of its oil products and more than 50% of gasoline production is exported to European markets. Most products are very high spec.

Porvoo – Neste Oil (200 kbd)

- NW Europe hub – Baltic
- Located 20km east of Helsinki
- Crude imports through Porvoo/Skoldvik harbour – Processes mostly Russian but also N Sea crudes (esp. Forties)
- Significant crude and product storage
- Good petchem links
- Complex refinery, focus on high quality, low emission motor fuels
- Has small asphalt unit and also large base oil capacity => very little HFO output
- New diesel unit completed in 2007 – complexity means able to process heavy sour crudes
- Conversion ratio: 39.7% - complexity indicator: 9.9

Naantali – Neste Oil (57 kbd)

- NW Europe hub – Baltic
- Crude imported through Naantali port
- Processes only heavy sour crudes (Urals + some Duc and Siri)
- Speciality product refinery gives better margins than other refineries of similar spec. Focus on bitumen, solvents, racing gasoline and sulphur-free LFO
- Much of product is exported – good links (via Baltic) to Euro and Baltic countries.
- Seaborne connections to Porvoo refinery
- Middle Distillates (35%), gasoline (20%)
- Conversion ratio: 28.4% - complexity indicator:

Pipelines & Storage:

Finland has no crude or product pipelines

Neste operates 80% of country's storage – mostly at Porvoo and Naantali refineries

66% of crude imported from Russia and 87% of crude delivered by sea with remanding 13% delivery by rail.

Lithuania

Mazeikiu Nafta – PKN Orlen/Government (190 kbd – nominal capacity 295 kbd)

- NW Europe hub – Baltic
- Crude no longer supplied through Druzhba pipeline into Lithuania and thus all crude has to be imported through Butinge terminal
- PKN Orlen operates joint crude supply for Plock refinery in Poland and Mazeikiu Nafta
- Also possible that PKN uses spare capacity in Plock-Gdansk pipeline to ship Russian crude from Gdansk to Butinge
- Some big political issues impairing supply of Russian crude by pipeline to refinery – crude cut off as result of a) access to Kaliningrad b) sale of refinery to Polish rather than Russian company
- Conversion ratio: 16.5% - complexity indicator:

Pipelines and Storage:

1) Polotsk (Belarus) – Birzai (Lithuania) – Ventspils (Latvia) has capacity of 260-280 kbd and is linked into Druzhba. Russia cut off supply through Druzhba pipeline in summer 2006.

2) Polotsk-Birzai-Mazeikiu (325 kbd capacity) links Russian crude production to MN refinery and extension on to Butinge crude terminal (no longer supplied with Russian crude)

3) Butinge Terminal is bottleneck – now refinery back up to full capacity and receives no pipeline imports the entire capacity of the terminal is taken up through crude imports for refinery, leaving no room for exports of Russian crude which contribute to Lithuania's revenue. (Max 150,000 dwt – largest in Baltic)

Terminal capacity also affected by weather conditions leading to temporary shutdowns

In future Brody-Plock pipeline, which may carry Kazakh crude, could link into Plock-Gdansk line and then crude could be shipped onwards to Klaipeda or Butinge in Lithuania.

Butinge has storage of 204,000 cu.m ; Klaipeda has product storage of 405,000 cu.m.

Norway

Mongstad – Statoil (199 kbd)

- NW Europe hub
- Crude terminal w/ storage of 9.5m bbls
- Connected by 2 pipelines to Hydro's Troll B & C platforms
- Connected by 3 pipelines to Vestprosess NGL and Condensate development
- Conversion ratio (in FCC equivalent) 48.1% - complexity indicator: 6.6

Slagen – ExxonMobil (110 kbd)

- NW Europe hub
- Main supply Exxon's Norwegian N Sea production
- 100km south of Oslo => good location for domestic demand but 60% exported and for this at disadvantage to Mongstad
- Exports via 540m jetty – max 250,000 dwt
- Crude storage of 400,000 cu.m.
- Part of NW European refining cluster allowing it to take large amounts of (mostly gasoline) components from Benelux refineries and supply UK market with ultra low sulphur fuels.
- Conversion ratio (in FCC equivalent) 10.2% - complexity indicator: 2.9

Mongstad Port

- Max 380,000 dwt crude and 90,000dwt product
- End terminal for following pipelines:
- Troll Oil Pipeline I (250 kbd)
- Troll Oil Pipeline II (150 kbd)
- Heidrun transshipment (240 kbd) and also Stat's Gullfaks, Norne and Asgard fields

Sture Port

- Max 300,000 dwt
- Crude storage of 1m cu.m
- Export point for Oseberg

No Internal pipelines – all supply is by sea.

Sweden

Premraff Lysekil – Preem (210 kbd)

- NW Europe hub – Baltic
- Located in Lysekil W. coast Sweden at port of Brofjorden
- Crude imported to Brofjorden from N Sea, Russia and ME
- Advantages are size and complexity plus links with other Preem refineries
- Produces ULS diesel (10 ppm) for export to Germany – gasoil = 45% of output
- Conversion ratio: 60.1% - complexity indicator: 8.0

Premraff Goteborg (Gothenburg) – Preem (121 kbd)

- NW Europe hub – Baltic
- Crude imports and good export opportunities through Gothenburg port – linked by pipeline to refinery
- Close to large Goteborg market
- Exposure to competition from Shell's Goteborg refinery and also direct competition from Danish and Norwegian refineries.
- Relatively simple refinery, lacking secondary refining capacity
- Little integration with Petchem and no product niche advantages
- 40% gasoil, 20% gasoline both generally good quality
- Conversion ratio: 0% - complexity indicator: 3.9

Nynashamn – Nynas AB (36 kbd)

- NW Europe hub - Baltic
- Bitumen refinery
- Configured for use of Venezuelan crude but diversification to heavy N Sea crude as well
- Location just south of Stockholm
- Nynas is a 50:50 JV between PDVSA and Neste Oil (formerly Fortnum)
- Nynas aims to be global leader in naphthenics and Bitumen
- Bitumen accounts for 70% of production , 10% speciality oil and 10-20% fuel distillates
- Significant product niche advantage in essentially over supplied region with most products destined for export markets
- Conversion ratio: 0% - complexity indicator:

Goteborg (Gothenburg) – Nynas AB (10.1 kbd)

- NW Europe hub – Baltic
- Bitumen refinery
- Crude imported through Gothenburg port – runs mostly Venezuelan (Laguna) crude
- 90% of bitumen destined for road paving
- See above for further details of Nynas
- Conversion ratio: 0% - complexity indicator:

Goteborg (Gothenburg) – Shell (80 kbd)

- NW Europe hub – Baltic
- Crude imported through port of Gothenburg
- Good quality diesel and gasoline output – esp. sulphur content
- Competition from Preem refinery for product exports
- Conversion ratio: 25% - complexity indicator: 6.0

Pipelines & Storage:

Gothenburg and Brofjorden are two major oil ports in Sweden. 40 storage deposits are all located close to coast and domestic transport is by water.

Preem has major storage hubs and is biggest distributor.

Gothenburg could potentially become storage centre for Russian crude to be re-loaded onto larger vessels.

North Western Europe

Austria

Schwechat – OMV (200 kbd)

- Med hub
- Linked to TAL pipeline from Trieste
- Competes with fuel imports from Germany and central Europe
- Coordinated crude supply and product distribution with OMV's refineries in Germany (Bayernoil and Burghausen)
- Estimated crude slate: Russian (45%), Saudi (10%), Nigerian (10-20%), Libyan (8%), Iranian (6%) and Algerian (2%).
- Potential pipeline link to Druzhba pipeline
- Pipeline links into OMV's Borealis petchem site
- Conversion ratio: 16% - complexity indicator:

Pipelines and Storage:

Major pipeline is TAL which has three independent lines:

TAL-IG from Trieste to Ingolstadt

TAL-OR from Ingolstadt to Karlsruhe

TAL-NE from Ingolstadt to Neustadt

AWP links Schwechat to TAL

GSU from Zistersdorf to Schwechat ships domestically produced crude

AWP-Lannach ships crude to Strategic deposit in Lannach (S. Austria)

AWP-Druzhba – still under construction

Belgium

Antwerp (BRC) – Petroplus (110 kbd)

- NW Europe – ARA hub
- Imports through Antwerp port
- Little integration with petchem or other refineries
- High FO output from refinery (c. 20%) cleared through Bunker sales at Antwerp port.
- Conversion ratio: 6% - complexity indicator: 4.5

Antwerp – ExxonMobil (298 kbd)

- NW Europe – ARA hub
- Connected to RAPL (Rotterdam-Antwerp Pipeline) owned by Fina & Exxon for crude transportation from Rotterdam to Antwerp
- Crude imports through Antwerp and Rotterdam
- Operated in conjunction with Exxon refinery in Rotterdam
- Heavily geared towards petchem production and linked to Exxon's Antwerp petchem site (pipeline connects refinery to petchem site)
- Exports components for gasoline production to Exxon's Slagen plant in Norway
- Conversion ratio: 12% - complexity indicator: 4.8

Antwerp – Total (350 kbd)

- NW Europe – ARA hub
- Large size = econs of scale
- Imports through Antwerp port
- Connected to RAPL (Rotterdam-Antwerp Pipeline) owned by Fina & Exxon for crude transportation from Rotterdam to Antwerp
- Linked to Total's Vlissingen refinery and integration into petchem at Antwerp
- Extensive links into crude and products pipelines
- Exports large amounts of gasoline to US => vulnerable to Atlantic basin balances
- Like all Antwerp refineries HFO output can be shifted through Antwerp's bunker market
- Conversion ratio: 30% - complexity indicator: 6.8

Antwerp – Petroplus (65 kbd)

- CDU closed down in 2003
- Now mostly Asphalt plant operated in conjunction with Petroplus' BRC refinery and Asphalt refinery (formerly Nynas)
- Site used heavily for product storage – both for PP+ and third parties

Pipelines and Storage

Pipelines:

Antwerp refining complex linked by pipeline to Rotterdam and Amsterdam.

Port complex has 350km of crude, product & petchem pipelines.

Port also has links to Rhine and large proportion of products are transported by barge.

Storage:

Naphtha has total storage capacity of 830,000 cu.m at Antwerp port.

Oil tanking has 264,000 cu.m of product storage at Antwerp and 30,000 cu.m at Ghent.

Other storage operators include: ADPO, LBC Antwerpen, Noord Natie Terminals and Vopak.

France

Fos-sur-Mer – ExxonMobil (119 kbd)

- Fos-Med hub (imports via Fos/Marseille port)
- Demand centre around Marseille plus connection to major pipelines (ODC, SPSE, SMPR and Puget)
- Some petchem links and asphalt capacity
- Poor gasoil yields
- Should be able to meet gasoline and diesel 10 ppm (SCANfining unit)
- Conversion ratio: 24% - complexity indicator: 5.2

Dunkirk – ExxonMobil (CDU 0 kbd – VDU 22 kbd)

- NW Europe Hub
- Lube plant - imports AtRes for upgrading to Lubes with some FO output

Port Jerome/Gravenchon – ExxonMobil (233 kbd)

- NW Europe Hub – Le Havre
- Two sites connected by 18 pipelines allowing for feedstock, intermediates and product exchange
- Direct crude and product pipelines to Le Havre
- Supply into greater Paris region + access to several product pipelines serving central France
- Linked to Exxon's nearby Petchem site
- Production geared towards on-spec mid distillates (41%), gasoline and HFO
- SCANfining will allow it to meet 10 ppm
- Conversion ratio: 15% - complexity indicator: 6.5

Lavera – Ineos (218 kbd)

- Fos-Med hub
- Pipeline to Fos/Marseille port – crude imports + product export potential
- Linked to Switzerland and Lyon markets via SMPR pipeline
- Puget pipeline connects it to S. France
- NATO pipeline can transport product to Strasbourg and Germany
- 65% of output into pipeline
- Full integration with petchems (Innovene) give naphtha outlet
- Mid distillates (48%), gasoline (17%)
- Morgan Stanley supply contract
- Conversion ratio: 28% - complexity indicator: 5.0

Berre L'Etang – Lyondell-Basell (80 kbd)

- Fos-Med hub
- Pipeline to Fos/Marseille port
- Geared towards petchem supply and mid Distillates. Naphtha (15%), mid distillates (38%) and low HFO due to asphalt unit
- Connected to several product pipelines (PRM links to storage in Rhone valley, the Deuphine, Savoie and Vernier in Switzerland).
- Conversion ratio: 24% - complexity indicator: 7.1

Petit Couronne – Petroplus (141 kbd)

- NW Europe hub –Le Havre
- Pipeline connection to Le Havre for crude imports and product pipelines to Paris region
- Extensive petchem integration and speciality output (lube and bitumen)
- Geared towards mid distillate (47%) but has gasoline surplus (cleared through exports or sales to hypermarkets)
- Long term supply agreements with Shell's French distribution network
- Conversion ratio: 18% - complexity indicator: 6.0

Reichstett – Petroplus (82 kbd)

- Located in Strasbourg close to trans national demand centre
- Fos-Med hub: imports via crude via pipeline from Fos/Marseille port.
- Product pipelines to Northern and Eastern France & Germany.
- Predominantly geared towards on-spec mid distillates
- Supplies BP service stations in region
- Competition from Karlsruhe (Ger) and N. France/Benelux hubs.
- Long term supply agreements with Shell's French distribution network
- Conversion ratio: 27% - complexity indicator: 5.7

Donges – Total (229 kbd)

- NW Europe hub - Donges
- Supply via Donges port – exports to NW Eur and US.
- Pipeline (product) connections to Paris and Lorraine areas + regional areas of Brittany and Loire Valley.
- Excess of gasoline output => exports to US or domestic hypermarkets
- Gasoil production 48% (50:50 diesel/heating oil), HFO (17%)
- Conversion ratio: 27% - complexity indicator: 5.1

Feyzin – Total (116 kbd)

- Fos-Med hub
- Located in SE France supplies Lyon market.
- Well connected via crude and product pipelines to Med and integrated into petchem industry in region
- High competition with other refineries in Fos-Med hub (oversupply issue in region)
- Product exports to Switzerland and Germany through SPMR and ODC product pipelines.
- Total operates feedstock exchanges between Feyzin, La Mede and Pantano (Italy) refineries.
- HFO inline with French demand gasoline (18.5%), diesel (29%)
- Conversion ratio: 29% - complexity indicator: 5.6

La Mede – Total (158 kbd)

- Fos-Med hub
- Crude received through Fos deepwater port (then transported to refinery through SPSE crude oil pipeline) or directly on smaller vessels at Lavera
- Operates as hub with Feyzin
- Integration into Petchem: close to Naphthachimie and Montell's petchem complex in Marseille.
- Product exports via sea/barge (40%), pipeline (35%) or road/rail (25%)
- Connected to SPMR product pipeline which supplies SE France and Swiss market and also ODC products pipeline which supplies markets in North France.
- Generally long gasoline (particularly in Fos region) thus exports excess.
- Auto Gasoil (35%), gasoline (29%), HFO (21%)
- Conversion ratio: 27% - complexity indicator: 7.7

Gonfreville – Total (331 kbd)

- NW Europe hub – Le Havre
- Crude supplied through Le Havre, varied slate of N Sea, ME and WAF/NAF grades
- 80% of production transported via pipeline – TRAPIL network to Rouen, Paris, Orleans, Tours and Caen and LHP (Le Havre-Paris) pipeline
- Good location with pipeline access and integration into petchem (pipeline to Gonfreville Atofina petchem site).
- Output of some high margin products such as asphalt and lubes + new hydrocracker further increase sites value
- Operational hub with Grandpuits (major) and Mardyck and Donges (minor)
- Gasoil (40%), HFO (14.5%), gasoline (16%) – excess HFO and gasoline exported
- Conversion ratio: 35% - complexity indicator: 6.2

Grandpuits – Total (99 kbd)

- NW Europe hub – Le Havre
- Crude supplied through Le Havre
- Located in Paris region and in operational hub with Gonfreville (major) and Mardyck and Donges (minor)
- Connected by pipeline to Paris/Ile de France regions and to DMM (Donges-Melun-Metz) line.
- Problems include size (poor economies of scale) and product slate mismatch with region
- Diesel (28%), gasoline (21%) and HFO (9%)
- Conversion ratio: 35% - complexity indicator: 6.6

Mardyck (Dunkirk) – Total (159 kbd)

- NW Europe hub
- Crude imported through Gravelines (Dunkirk) port at APF facilities owned by Total and linked by pipeline to refinery.
- Products exported by pipeline (41%), road and rail (31%) and sea (28%).
- Imports mostly N Sea crudes
- Strong competition from ARA region
- Some integration with Gonfreville, Donges and Grandpuits + petchems
- Diesel (31%), gasoline (24%) and HFO (17%)
- Conversion ratio: 27% - complexity indicator: 6.4

Pipelines & Storage:

Pipeline (51.7%) and trucking (31%) major methods of product transportation.

Most storage capacity held at refineries with less than 1/3 held within wider distribution network. Total crude and product storage is 46.1m t.

Pipelines:

- TRAPIL Complex
- D.M.M. (Donges-Melun-Metz)
- S.P.M.R. (Mediterranean-Rhone)

Germany

German refineries can be broken up into 5 regions:

- i. South – Bavarian refineries (Bayernoil, Ingolstadt & Burghausen) are best hedged against imports from Rotterdam and historically have best margins.
- ii. West – refineries close to Rhine (Godorf, Wesseling and Gelsenkirchen) are exposed to direct competition from ARA imports shipped by pipeline and barge but region also has highest import requirement.
- iii. South West – Karlsruhe and Miro refineries between South and West centres mentioned above.
- iv. North – refineries (Hamburg, Heide & Wilhelmshaven) face competition from Scandinavian imports.
- v. East – Refineries (Schwedt & Leuna) have direct pipeline supply of Russian crude but facing increasing competition from imports of Central European product.

Bayernoil – OMV, BP, PDVSA, ENI (269 kbd)

- Med hub
- Imports crude through pipeline from Trieste
- Processes mostly NAF, Nigerian and Kazak crudes
- Integrated structure of 3 pipeline connected refineries around Ingolstadt and Neustadt in Bavaria btw demand centres of Munich and Nuremberg and mostly supplies S. Germany and W. Austria
- Also has access to Russian crude – Integration of Druzhba and Western Crude Pipeline system (through link btw Austria and Slovakia) could open up possibility of direct supply of Russian crude.
- Combination of low complexity and little local demand for HFO means generally need to refine sweet crudes – may hinder extra processing of Russian crude (refinery upgrades due 08 should address this)
- OMV supplies Libyan crude to Bayernoil and combined crude supply with Burghausen refinery – excess HFO sent to Burghausen for processing through its coker while coker gasoil processed at Bayernoil
- Construction of pipeline link btw Bratislava and Schwechat opens up possibility of Caspian supply
- Relatively shielded from low cost imports
- Long gasoline with little export outlet, need to adapt to increased mid distillate demand in region
- Conversion ratio: 31% - complexity indicator: 6.1 – *recent upgrades

Burghausen – OMV (69 kbd)

- Med hub
- Imports through pipeline from Trieste – coordinated crude supply btw Bayernoil and Burghausen sites
- Processes mostly Libyan crude (80-90% of supply)
- Operated as hub with Bayernoil refinery
- Naphtha and distillate orientated and 2/3 of production is straight run – High jet yield to supply Munich airport (connected via product pipeline)
- Naphtha goes mostly to local industry (Borealis complex)
- No VDU and no gasoline production, mostly heating oil and Jet
- Coker keeps HFO output low
- Conversion ratio: 65.9% - complexity indicator: 6.0

Gelsenkirchen – BP/PDVSA (272 kbd)

- NW Europe hub
- Crude supplied by pipeline from Wilhelmshaven and Rotterdam
- Processes mostly Russian crude (50%) and also Norwegian grades + large amount of feedstocks
- Supplies densely populated Ruhr area – also large petchem industry
- Competition from product imports via RMR pipeline from Rotterdam
- Gasoil orientation and high integration with petchem in region – surplus diesel shipped/barged to Karlsruhe region
- Conversion ratio: 57.7% - complexity indicator: 6.4

Godorf/Wesseling – Shell (145 kbd & 199 kbd)

- NW Europe – ARA
- Two refineries 10 km apart now operated together after Shell – DEA merger.
- Integrated stock, crude acquisition and optimisation
- Petchem integration – naphtha supply (Wesseling in particular)
- Godorf runs high level of feedstocks
- Product competition from ARA region

- Run mostly N Sea & Russian crude + 15-35% ME crude
- Conversion ratio: 34% - complexity indicator: 7.1 (Godorf)
- Conversion ratio: 37.8% - complexity indicator: 5.6 (Wesseling)

Hamburg/Holborn – Oilinvest/Coastal (94 kbd)

- NW Europe hub
- Crude imports via NDO pipeline from Wilhelmshaven
- Runs mostly Nigerian UK N Sea & Libyan grades as config requires low-sulphur crude
- Product exports via port of Hamburg (max 110,000 dwt)
- 20% HFO output => feeds local bunker market
- Conversion ratio: 23% - complexity indicator: 5.5

Hamburg/Harburg – Shell (93 kbd)

- NW Europe hub
- Crude imports through Wilhelmshaven port and pipeline to refinery
- Processes mostly N Sea and Russian crude
- Hamburg/N Germany has strong competition from product importers and thus traditionally has low margins – often imports from large Scandinavian refineries
- 20% HFO => feeds local bunker market
- Conversion ratio: 19.7% - complexity indicator: 7.7

Heide – Shell (83 kbd)

- NW Europe hub
- Crude imports through Brunsbuttel port – Storage and pipeline to refinery
- Located in North Germany and close of Germany's largest crude field (Mittelplate)
- Processes 35% Mittelplate and c. 60% UK N Sea
- Integration into Petchem which takes most of heavy yields + bitumen base oil production
- Links to product pipelines
- Conversion ratio: 31% - complexity indicator: 7.8

Ingolstadt – Petroplus (101 kbd)

- Med hub
- Imports crude through Trieste – mostly runs AG and Russian crudes
- Pipeline links from Bratislava and Schwechat => potential for Caspian crude supplies
- Location in Bavaria S. Germany close to Bayeroil complex.
- HFO to nearby E.ON power station
- Region well shielded from product imports => good margins
- Conversion ratio: 26.4% - complexity indicator: 6.3

Karlsruhe – Shell, BP, PDVSA, Conoco (322 kbd)

- Med hub
- Crude imported through TAL/RDO pipeline from Trieste and SPSE pipeline from Fos/Marseille
- Processes mostly Syrian, Libyan Saudi & Russian crudes
- Pipeline links from Bratislava and Schwechat => potential for Caspian crude supplies
- No petchem integration => all naphtha to gasoline pool
- Operated through Mineraloelraffinerien (Miro) JV
- Southern-most refinery in Rhine network
- Exposed to product imports from ARA region – particularly from product pipeline which ending North of Karlsruhe
- Excess gasoline exported (e.g. to US), constrained by other refiners being closer to market
- Good links into strong product demand from local markets => good margins
- Conversion ratio: 45.2% - complexity indicator: 8.3

Leuna – Total (225 kbd) – Total Raffinerie Mitteldeutschland (TRM)

- NW Europe hub - Druzhba
- Russian crude supplied through links to Druzhba pipeline – also pipeline links to Rostock and Gdansk ports in Baltic.
- Located near Eastern Germany's economic and petchem centres
- Isolated from competing product imports due to location.
- HFO to powergen
- Conversion ratio: 29.7% - complexity indicator: 5.6

Lingen – BP (87 kbd)

- NW Europe hub
- Processes German crude but majority of slate is N Sea
- Located on river Ems and serves N German market
- Integrated with BASF petchem plants
- Complex refinery produces no HFO and now mostly geared towards gasoil output, 30% of naphtha output to petchem
- Conversion ratio: 89.8% - complexity indicator: 11

Schwedt – Shell, BP, PDVSA Total, Eni (215 kbd)

- NW Europe hub - Druzhba
- Crude supplied through Druzhba pipeline
- Product pipeline to storage in Seefeld (nr Berlin) and forward base to supply operation in Poland for Shell and BP
- Low population density locally means higher transportation costs for products
- Conversion ratio: 33.4% - complexity indicator: 7.8

Wilhelmshaven – Conoco (260 kbd)

- NW Europe hub
- Imports via Wilhelmshaven crude terminal
- Large amount of diesel exports to Scandinavia, UK and US
- HFO output to bunker market at port
- Processes N Sea crudes and no feedstocks
- Plans for upgrades to refinery recently announced
- Conversion ratio: 0% - complexity indicator: 3.4

Pipelines and Storage:

With exception of Wilhelmshaven all refineries supplied through crude pipelines. Major lines are:

TAL – supplying Bavarian refineries and Karlsruhe (Trieste)

MVL (Druzhba) – to Schwedt and Leuna

RRP – Rotterdam-Rhine

NWO – Wilhelmshaven-Rhine

SPSE – Marseille-Karlsruhe

NDO – Wilhelmshaven-Hamburg

Brunsbüttel-Heide

Storage:

In addition to refinery storage have 50 sites with storage over 50,000 cu.m

160 sites with storage btw 5,000-50,000 cu.m

12 of biggest sites linked to product pipelines

Total storage of 70m cu.m

Bayernoil has storage cap of 3.4m cu.m

Miro crude storage of 0.87m cu.m and product storage of 3.9m cu.m

Ireland**Whitegate/Cork – Conoco (71 kbd)**

- NW Europe hub
- Links to Bantry Bay deepwater port (max VLCC)
- Runs mainly light sweet crude (Oseberg and Forties)
- HFO and gasoline shipped to West coast UK refineries
- Hydrotreater allows production of 10ppm diesel

No internal pipelines but has 26 storage terminals around the country. All storage terminals are on coast and road tankers supply inland market.

Netherlands**Nerefco (Europoort) – BP (400 kbd)**

- NW Europe – ARA hub
- Crude imported through port of Rotterdam (max 285,000 dwt)
- Part of BP's Rhine areas refining zone including Gelsenkirchen and Karlsruhe refineries

- Exports gasoline and diesel via barge to France and Germany, HFO for bunkers at Rotterdam port, naphtha via pipeline to Germany and Jet via pipeline to Dutch and German airports
- Can process any type of crude through lines (including acidic) which means diversified crude slate
- Closed Pernis refinery site now used as cargo loading facility (3 jetties and truck loading)
- Large VDU capacity weighted towards mid distillate production (esp. Jet/Kero)
- Conversion ratio: 19% - complexity indicator: 4.2

Pernis (Europoort) – Shell/Statoil (403 kbd)

- NW Europe – ARA hub
- Crude imported through port of Rotterdam (max 285,000 dwt)
- Part of Ruhr-Rotterdam refining hub which includes Wesseling and Godorf sites.
- Excess gasoline exported to US and direct links to Shell's Moerdijk petchem site.
- Hydrogen plant (60% used for hydrocracking).
- Conversion ratio: 59% - complexity indicator: 6.5

Rotterdam – ExxonMobil (188 kbd)

- NW Europe – ARA hub
- Wide range of crude imported through Rotterdam port
- Barge and pipeline access to German, French and Belgium markets, also sends components to Slagen refinery in Norway.
- Has Europe's only coker
- Located in Boltek area site integrated with Rotterdam chemical cluster – specifically Exxon's chemical plant.
- Integrated with Exxon's Antwerp refinery in Belgium (product and component exchange).
- Has high light and mid distillate production (mostly for export) and low HFO yields.
- Conversion ratio: 72% - complexity indicator: 8.0

Rotterdam (Europoort) – KPI (80 kbd)

- NW Europe – ARA hub
- Imports through Rotterdam port
- Processes large amount of Kuwaiti crude, essentially subsidised by KPC
- Strong links to retail outlets in Europe (Q8)
- Least complex of regions refineries
- Conversion ratio: 10.5% - complexity indicator: 6.2

Rotterdam (Europoort) – Koch (80 kbd)

- NW Europe – ARA Hub
- CDU is condensate splitter so runs combination of condensate and crude
- Main outputs are Naphtha, Jet and Gasoil as well as residuals.

Vlissingen – Total/Dow Chemicals (145.5 kbd)

- NW Europe – ARA hub
- Crude imports through Maasvlakte terminal (part of Rotterdam port) and pipeline to refinery.
- 90% of output barged to Benelux & Germany
- Has four large storage tanks for crude/feedstock, intermediates and finished product
- Total operates Vlissingen as part of its ARA hub also integrated with nearby petchem sites.
- Hydrocracker = relatively high diesel vs. gasoline output
- Conversion ratio: 46% - complexity indicator: 6.2

Pipelines and Storage:

Port major hub for transshipment – transit of products from Germany and Scandinavia.

Pipelines:

RMR (Rhein-Maine-Rohrleitung) connect Rotterdam to central Germany.

Crude pipeline are: Rotterdam-Rhein, Rotterdam-Amsterdam and Rotterdam-Antwerp.

Also major connection by barge – Rhine and Maas rivers which carry significant volumes to Germany, Belgium, Switzerland and France.

1400km of pipelines connecting industries in area.

Links from storage hubs to Central European oil product pipeline and Rhine Main Pipeline + naphtha and crude lines.

Storage:

6 Separate oil terminals in port.

Total capacity of 8m tonnes controlled by: KPC, Maasvlakte, Maatschap, Nerefco, Shell and TEAM.
12 storage and distribution operators have facilities in port area. Links to Central European oil product pipeline and Rhine Main Pipeline.

Petroplus:

155,000 cu.m at Vlissingen
35,000 cu.m at Dordrecht

Royal Vopak:

Major oil and chemical storage at Rotterdam
11 terminals in Netherlands
2.9m cu.m at Europoort

Oiltanking:

1.6m cu.m at Amsterdam – mostly crude

Switzerland

Around 80% of total crude imports into Switzerland come from Africa – 47.8% from Libya due to presence of Tamoil in refining sector. Most of the remainder come from either Russia or Saudi. As result pretty light sweet slate which means both refineries able to produce 10 ppm motor fuels

Cressier – Petroplus (68 kbd)

- Med hub – Fos/Marseille
- Crude supplied by pipeline (SPSE) from Fos/Marseille port
- Situated nr Neuchatel in Western Switzerland
- Product supply to Bern and Zurich and well hedged against cheap product imports
- Output weighted towards mid-distillates
- Despite small asphalt plant HFO yields remain high
- Conversion ratio: 15% - complexity indicator: 5.7

Collombey – Tamoil (57 kbd)

- Med hub – Genoa
- Crude supplied by pipeline from Genoa (CEP)
- No direct access to major product markets and compete with products supplied by pipeline from France's Feyzin refinery (Total)
- Storage of 520,000 cu.m with 80 tanks
- Conversion ratio: 36% - complexity indicator: 8.1

Pipelines and Storage:

Deliveries to Cressier mostly through SPLSE (Societe du Pipelie Sud-Europeen) via Jura pipeline across French border.

Deliveries into Collombey via CEP (Central European Pipeline).

Product imports through Sappro pipeline to Vernier nr Geneva.

UK

Coryton – Petroplus (172 kbd)

- 40% of product exported
- Linked to UKOP product pipeline but mainly supplies SE England
- 4m bbls of crude storage
- Processes mix of N Sea (60%), ME (20%), WAF (10%) and Russian (10%) crudes
- Gasoline heavy in configuration
- Also has bitumen plant
- Conversion ratio: 28% - complexity indicator: 10.7

Grangemouth – Ineos (196 kbd)

- Connected directly to Forties pipeline
- Used to process 6 Forties cargoes per month (3.6m bbls) but this has reduced since introduction of Buzard to blend - i.e, need to dilute with sweeter crudes

- Connected to Finnart sea terminal via pipeline => additional crude supply source + product export terminal
- Exports a lot of production
- Conversion ratio: 33% - complexity indicator: 5.9

Llamdarcy - BP

- Bitumen production plant
- Feedstocks from Coryton

Pembroke – Chevron (210 kbd)

- Max 275,000 dwt
- Imports Doba from Chad also process Chevrone equity Caspian-blend crudes
- Exports to Ireland and Gasoline to US, FO pipeline to Pembroke power station
- Conversion ratio: 47% - complexity indicator: 9.7
- Produces lots of Gasoline (c. 40%) => swing supplier to US

Humber (S. Killingholme) – Conoco (221 kbd)

- 50% of product exported
- Connected to Midlands by pipeline
- Crude supply from Tetney Terminal
- 1m bbl crude and 6m bbls product storage
- Complex refinery, 180 kbd of VDU and large FCC => mid distillate focus
- Coking units produce Pet Coke for graphite electrode use
- Can process acidic crude e.g. Heidrun (N Sea)
- Conversion ratio: 99% - complexity indicator: 11.8

Fawley – ExxonMobil (326 kbd)

- Connected to UK pipeline network => 85% of output distributed via pipelines
- Slate mostly Forties and Urals + other N Sea, WAF & CPC
- Conversion ratio: 23% - complexity indicator: 6.9
- Equipped to produce high quality gasoline and diesel

Dundee & Eastham – Nynas (32 kbd)

- Nynas JV between Fortum of Finland and PDVSA.
- Mostly Bitumen production
- Eastham site processes heavy naphthenic crudes from PDVSA to produce bitumen, base oils and marine diesel

Teeside (Port Clarence) – Petroplus (117 kbd)

- Supplied with N Sea crude from Ekofisk fields by pipeline and via Seal Sands Terminal
- S/R FO output sold FOB Tees to various European refineries
- Teeside production mainly geared towards feedstocks – No gasoline output but Naphtha go to Huntsman chemical complex.
- High 10 ppm diesel output
- Conversion ratio: N/A - complexity indicator: 1.4

Stanlow – Shell (270 kbd)

- Crude supplied through Tranmere oil terminal
- Crude from N Sea, ME, NAF and Russia
- Connected to UK mainline giving product export access to SE markets
- 40% exports via pipeline, rest is shipped (exported) or trucked
- Also produces petchems for Shell's Carrington plant 40km away
- Not that complex - lacks unit to produce light products and low desulf capacity
- Conversion ratio: 27% - complexity indicator: 5.5

Lindsey (South Killingholme) – Total (221 kbd)

- Connected to Midlands via pipeline (product export) and direct private pipeline to SE England
- Refinery located close to deepwater docks and two pipelines run from docks to refinery
- Processes mostly N Sea crude – Ekofisk major grade
- Asphalt production reduces FO output and increases gasoil – est. 30% gasoline and 50% mid distillates
- Conversion ratio: 30% - complexity indicator: 5.1
- 2009 new distillate hydrotreater desulfurisation unit will raise proportion of high sulphur crude processed from 10% to 70%

Milford Haven – Murco (105 kbd)

- Linked by pipeline to deepwater terminal in Milford Haven – crude imports and product exports
- Mostly imports N Sea and WAF crudes
- Not ideally placed and relatively small sized – no petchem linkages
- Operational costs reduced through hub operation with Lindsey refinery
- Some gasoline shipped to Antwerp for further desulfurisation and export to US
- Conversion ratio: 34% - complexity indicator: 8.3
- Roughly 30% yield for gasoline and diesel

Pipelines & Storage:**Storage (product):**

Kingsbury (several majors) – W Midlands
 Manchester/Trafford Park (Esso/Texaco) – NW England
 Avonmouth (Esso) – SW England
 Buncefield (Total/Chevron) – SE England
 VOPAK – London, SE England
 Cardiff (Texaco) – Wales

Pipelines:

UK Oil Pipelines Ltd (UKOP)
 West London (UKOP)
 Mainline System
 Esso Midline
 Finaline
 Government Pipeline System
 Southeast Pipeline

Southern Europe**Italy****Augusta – ExxonMobil (198 kbd)**

- Med – Sicily hub
- Good location for ME imports and product distribution but competition from nearby refineries – exposed due to relatively unsophisticated unit
- Competitive advantage from lubricants capacity and some chemicals production from cogen capacity. Also decent desulfurization capacity.
- Output roughly 40% Mid distillates and 30% gasoline, high base oil and bitumen capacity keep FO output low at c. 10%
- 10 ppm fuel compatible
- Conversion ratio: 23%- complexity indicator: 5.9

Busalla – IPLOM (36 kbd)

- Med – Genoa hub
- Small refinery located in industrial heartland. Most output destined for local consumption.
- Pipeline link to Genoa port – crude imports
- Small but complex, specialises in getting value out of bottom end products
- Asphalt production and processes imported fuels to improve quality
- 10 ppm compatible
- Has 600k bbl/m term deal for Kirkuk
- Rest of slate comprised: Lokelle (Cameroon), Urals, Mellitah
- Conversion ratio: 37%- complexity indicator:

Cremona – Tamoil (101 kbd)

- Med – Genoa hub
- Pipeline link to Tamoil's coastal terminal at Genoa – receives crude, feedstock and products to be up-graded through the line.
- Low-medium conversion capacity with 40% mid distillate, 25% gasoline and 25% FO output.
- 2 CDU towers and a visbreaker unit – output is only of average quality
- Conversion ratio: 14%- complexity indicator: 4.8

Falconara – API (79 kbd)

- Med hub – East coast Italy
- Crude imported through Falconara port (max. 400k dwt)
- 1.5m cu.m of storage
- Mid distillate weighting: c. 50% output
- Large visbreaking (reduces FO yields) but no FCC capacity => low gasoline output.
- Conversion ratio: 27%- complexity indicator: 6.2

Gela – Eni (120 kbd)

- Med – Sicily hub
- Very complex site with good integration into Eni's petchem plant.
- High local competition
- Big consumer of domestic crude, also purchases heavy sour crudes as well as term contract for Urals
- VDU, FCC and delayed coker mean slate can be roughly 80% heavy sour and 20% light.
- Over 50% output diesel and gasoline; 7% petcoke output and also manufactures petchem feedstocks
- Conversion ratio: 105%- complexity indicator: 11.2

ErgMed – ISAB Nord & Sud (Erg) (380 kbd: 238 kbd Sud & 140 kbd Nord)

- Med – Sicily hub
- Complex consists of two formerly separate refineries: Priolo Gargallo and Priolo Siracusa => now fully integrated
- Output intended mostly for export (like most Sicilian refineries)
- Product yield weighted towards mid distillates – gasoil and jet 50%, gasoline at 20%
- Conversion cap lower than surrounding refineries but Erg plans to increase this.
- Crude slate thought to be 50% light and 50% medium/heavy => mostly Russian
- Conversion ratio: 11%- complexity indicator: 4.5 (Sud)
- Conversion ratio: 27.3%- complexity indicator: 4.4 (Nord)

Livorno – Eni (94 kbd)

- Med hub – West coast Italy
- Crude imported through Leghorn/Livorno port
- Strong local product demand – pipeline to Florence industrial centre.
- Eni's only domestic base oil site
- Both of above mean profitable site and one of Eni's core assets.
- No conversion capacity but does have gasoline enhancement
- Slate mostly light/medium crudes, esp. Libya and spot grades
- Output 68% gasoline and gasoil and 11-13% FO but has bunker sales outlet
- Conversion ratio: 0%- complexity indicator: 5.9

Mantova/Frassinò - MOL (53 kbd)

- Med – Venice/Porto Marghera hub
- Good location close to industrial areas but competes with several other larger facilities in the region
- Crude imported through Porto Marghera – IES has terminal linked to Eni's infrastructure and IES pipeline to Mantova
- Imports mostly heavy crude from ME (Sidi), Egypt, Syria & Russia
- On site storage for 0.2m cu.m crude and 0.46m cu.m product
- Heavy mid distillate focus (47%), light products 17%
- Conversion ratio: 58%- complexity indicator: 6.7

Milazzo – Eni/KPC (202 kbd)

- Med – Sicily hub
- Complex, good location and petchem integration
- Imports through Milazzo port (max. 420k dwt)
- Large crude storage capacity: 4.1m cu.m
- Processes mostly heavy crudes
- Conversion ratio: 70%- complexity indicator: 6.8

Pantano/Rome – Total/Erg (89 kbd)

- Med hub – West coast Italy
- Crude imported through Fiumicino port
- Product output to Rome and Fiumicino airport
- Lack conversion capacity; just has visbreaker

- Mid distillate focus (gasoil and jet) matched to local markets but also asphalt production for bottom end, although HFO believed to be relatively high
- Processes mostly sour crudes
- Conversion ratio: 12%- complexity indicator: 6.8

Porto Marghera – Eni (91 kbd)

- Med – Venice/Porto Marghera hub
- Close to large demand centres and within reach of Austria, Croatia and Slovenia networks
- Connection to crude and product pipelines
- Operates a light/medium slate
- Relatively little conversion cap (visbreaking and thermal cracking), asphalt production reduces HFO output
- Conversion ratio: 9.4%- complexity indicator: 6.7

S. Martino di Trecate – Exxon/Erg (174 kbd)

- Med – Genoa hub (Savona)
- Good location in industrial centre
- Crude imported through Exxon's Savona terminal
- 60% of output leaves through pipeline to nearby deposits and Malpensa airport
- Mid distillate main output. 65% diesel and gasoline output, HFO 20%
- Conversion ratio: 18.4%- complexity indicator: 5.2

Sannazzaro – Eni (203 kbd)

- Med – Genoa hub
- Complex refinery with wide slate and close to demand centres of Milan and Switzerland
- Connection to CEP gives access to Russian medium and heavy crudes. Also pipeline to Genoa which supplies WAF and other grades – Slate flexibility allow refinery to monetise light/heavy spreads
- Processes crude from Eni's Villafortuna field
- Also processes CPC from CPC pipeline
- Product exports through pipeline to Genoa
- New developments looking to improve ability to process hvy sour crude and heavy feedstocks
- Conversion ratio: 44%- complexity indicator: 6.7

Sarroch – Saras (315 kbd)

- Med hub – Sardinia
- Major exporter of product with much heading to Spain. Only 20-25% output absorbed by local Sardinian market
- Can process wide range of feedstocks and heavy sour or acidic crudes
- Relatively complex: 4 conversion units (FCC, 2 mild hydrocrackers and Visbreaker)
- 46% gasoil, 25% gasoline, 8% petchem feedstock, 7% FO
- Estimated 56% of output to Italian market, 24% to Sardinia and 44% to international markets (of which 33% to Spain)
- Investment to improve conversion of hvy crude and met sulphur specs.
- Conversion ratio: 76%- complexity indicator: 7.8

Taranto – Eni (110 kbd)

- Med hub – South Italy
- Good access to Med and Adriatic (Greece and Balkans) markets
- Good connections to domestic Italian grades and feedstocks
- Poor access to local markets and competes with Sicilian refineries
- Mid distillate focus and visbreaker and asphalt unit minimise FO output
- Conversion ratio: 57%- complexity indicator: 6.7

Portugal

Sines – Galp Energia (213 kbd)

- NW Europe hub
- Imports through Sines port
- Linked by pipeline to Lisbon
- Location good for exports – gasoline meets RBOB specs for exports to US (which is main export destination)
- Storage of 1.5m cu.m (crude) and 1.6m cu.m (intermediate and finished product)
- Configured mainly for gasoline production but gasoline and mid distillates accounting for 80% of output –

Asphalt unit provides value at bottom end

- Conversion ratio: 28.5% - complexity indicator: 8.0

Porto – Galp Energia (91.3 kbd)

- NW Europe hub
- Imports through offshore terminal (max 135,000 dwt) + crude and product also imported and exported through nearby port of Leixoes
- Relatively small and simple refinery
- Suffer from import competition from Repsol's more complex La Coruna site and also from distance from demand centres and lack of pipeline links
- Gasoline and mid distillates account for 65% of production yield; HFO output high despite bitumen and lube facilities due to simple nature of refinery
- Investment will allow processing of heavier crudes
- VGO exported to Sines to feed into Hydrocracker
- Conversion ratio: 0%- complexity indicator:

Spain

Spain has a gasoline surplus and gasoil deficit. Repsol YFP's refineries generally have conversion units geared towards gasoline production – forward investments aimed at restructuring product yield. Cepsa's two refineries (Huelva and Algeciras) organised as a refining hub.

Algeciras – Cepsa (245 kbd)

- Med hub
- Crude imported through Algeciras port (max 350,000 dwt)
- Imports mostly WAF, NAF and ME crude
- Operated as hub with Huelva refinery
- Located in industrial centre of Algeciras and exports product via CLH pipeline link to Madrid and Andalusian coast
- Good integration with petchem
- Produces mostly mid distillates, gasoline and relatively high FO output
- Conversion ratio: 21.3% - complexity indicator: 5.7

Huelva/La Rabida – Cepsa (98 kbd)

- Med hub
- Crude imported through Huelva port
- Operated as a single refinery hub with Algeciras refinery
- Product exports via CLH pipeline to Guadalquivir valley (Seville) and onto Madrid – big demand centres – also able to export excess production via ship
- Site used as a central storage unit. Has 900,000 cu.m of storage and crude reserves part of Strategic Oil Reserves Corporation (CORES)
- Production of some speciality products (lube and Bitumen)
- Integration with petchem plants close by
- Conversion ratio: 22% - complexity indicator: 5.8

Tenerife – Cepsa (82 kbd)

- Located in Canary Islands
- Crude imported through Santa Cruz de Tenerife port
- Supplies local demand but also main supplier for the bunker market
- High HFO output not too much of issue due to significant bunker market
- Excess gasoil production exported, 12% gasoline output largely supplies domestic mkt
- Conversion ratio: 14.9% - complexity indicator: 3.7

Cartagena Murcia – Repsol YPF (100 kbd)

- Med hub
- Crude imports through Cartagena port and only refinery on SE coast
- Product pipeline link to Alicante
- Yields of mainly mid distillate and FO
- Connection to Repsol YFP crude pipeline to Puertollano refinery – aid integration btw the two sites
- Big expansion and conversion capacity plan for refinery
- Conversion ratio: 0% - complexity indicator: 3.9

La Coruna – Repsol YPF (120 kbd)

- NW Europe hub
- Crude imported through Coruna port – imports Latin America, Libyan and N Sea crudes
- Product supplied to NW region of Spain and also pipeline connection to Vigo, N Portugal
- Only refinery in region but does face some competition from Porto refinery
- Conversion ratio: 53% - complexity indicator: 6.2

Petronor/Bilbao – Repsol YPF (86%), BBK (14%) (220 kbd)

- NW Europe hub
- Refinery linked by pipeline to crude import terminal at Bilbao port (max 500,000 dwt)
- Good location for product exports (1/3 of which to US) and connection to CLH pipeline giving access to product market of Madrid
- CLH pipeline also links refinery to Tarragona refinery
- Integration into petchem in region
- Produces mostly mid distillates (c. 40%)
- Conversion ratio: 26% - complexity indicator: 5.1

Puertollano – Repsol YPF (140 kbd)

- Med hub
- Crude imported through Repsol YPF pipeline from Cartagena port and refinery
- Some hub operation with Cartagena refinery
- Only inland refinery, location 230km south of Madrid
- Good product pipeline access to central markets and also connections to nearby petchem plants
- Conversion ratio: 83% - complexity indicator: 9.3

Tarragona – Repsol YPF (160 kbd & 23 kbd)

- Med hub
- Crude imported through Tarragona port/terminal – pipeline to refinery
- Repsol has two refineries on Tarragona site: Main refinery and also 23 kbd Asphalt unit (Repsol 50% & Cepsa 50%) operated by Asfaltos Espanoles
- Well positioned to serve industrial and population centres in Barcelona region
- Integration into Repsol's petchem operations nearby
- Hydrocracker enable production of high quality motor fuels
- Conversion ratio: 41% - complexity indicator: 6.0

Castellon de la Plana – BP (110 kbd)

- Med hub
- Crude imported through Castellon port
- Not connected to CLH product pipeline thus reliant on regional product demand
- Product pipeline connection to Valencia
- 95% of production sold domestically
- Big supplier of bunker fuels in region
- Large crude slate flexibility but mostly processes Nigerian and Russian crudes
- Pipeline connections into nearby petchem complex
- Coker unit (20 kbd) due end 2008 will increase diesel production and reduce FO
- Conversion ratio: 27.3% - complexity indicator: 8.0

Pipelines and Storage:

CLH (Compania Logistica de Hidrocarburos is major operator of pipelines in Spain.

6.5m cu.m storage

3,483km of product pipelines

28 Jet fuel storage facilities at Spanish airports

Total Spanish storage capacity just over 10m cu.m.

Repsol has 4.8m cu.m of crude storage and 7m cu.m of white product storage.

Most storage concentrated in Med region.

Eastern Europe

Albania

Ballshi – Albpetrol (18 kbd)

- Med Hub – East
- Linked to domestic fields by pipeline – processes only domestic crude
- Significant upgrading capacity in form of 12 kbd coking unit

Fieri – Albpetrol (9 kbd)

- Med Hub – East
- Linked to domestic fields by pipeline – processes only domestic crude

Bulgaria

Bourgaz – Lukoil/Neftochim (140 kbd)

- Black Sea
- Crude imported through Bourgas port
- Lukoil is exclusive supplier of crude – Slate entirely Russian
- Products exported through pipeline to Sophia and also along Danube.
- Main competitors are Tupras Izmit and larger Romanian refineries
- Strong integration with connected Petchem site – petchem sales account for 20% of turnover
- Processes some HFO (0.4Mt/y) from Lukoil Odessa refinery
- Product exports to Italy, Greece, Turkey, Serbia and Macedonia + some motor fuels to US on spot basis
- Light product yield of around 62% and HFO output c. 20%
- Upgrades to allow to produce some volume at 10ppm
- Conversion ratio: 24.7% - complexity indicator:

Pleven – Nova Plama (24 kbd)

- Black Sea
- Now bankrupt – no longer in operation
- Crude shipped by rail from port of Varna
- Specialises in production of base oils and lubricants
- Processes high paraffin and low sulphur crude from N Africa (Sahara and Zarzaitine) and Russia (Sib Light and Kumkol)
- Conversion ratio: 17.9% - complexity indicator:

Rousee – Bimas ()

- Located on river Danube
- Very small refinery producing bitumen and lubricants

The Czech Republic

Czech refining industry largely under control of PKN Orlen after it acquired stakes in Unipetrol which itself has a 51% stake in Ceska Rafinerska which operates Litvinov and Kralupy refineries

Litvinov - Unipetrol, Agip, Conoco, Shell (111 kbd)

- NW Europe hub – Druzhba
- Imports through Druzhba pipeline and processes mostly Urals
- Integration into Chemopetrol petchem plant at Litvinov
- Fairly high upgrading capacity mean little HFO production
- Conversion ratio: 41.9% - complexity indicator:

Kralupy - Unipetrol, Agip, Conoco, Shell (67 kbd)

- Med hub - Trieste
- Imports crude from Trieste via TAL pipeline which feeds into IKL pipeline feeding refinery
- Processes mainly medium-heavy low sulphur crudes. Biggest grade thought to be Azeri light but also processes ME and NAF grades
- Some links to Chemopetrol petchem site
- Focus on gasoline production but also produces above 10% HFO
- Conversion ratio: 41.6% - complexity indicator:

Paramo Pardubice – Unipetrol, PKN Orlen (20 kbd)

- NW Europe hub – Druzhba
- Produces diesel, asphalt, lubes and fuel oils

Chemopetrol Litvinov – Unipetrol

- NW Europe hub – Druzhba
- Petchem production of olefins, polyolefins, hydrogen, oxygen etc. through steam cracker.

Pipelines and Storage:

1) Mero owned IKL pipeline to link Kralupy to TAL pipeline.

2) Links to Druzhba pipeline.

3) Potential pipeline for supply of Kazakh crude through territory and also supply to Kralupy and Litvinov refineries.

Storage: crude storage at Nelahozeves where IKL and Druzhba pipelines meet – total 1.3m cu.m. Used for short term storage and blending of crudes.

Croatia**Rijeka – INA (101 kbd)**

- Med Hub – East
- Imports through Omisalj terminal (INA owned – INA now majority owned by MOL) – Adria pipeline
- Crude slate c. Urals (70%), domestic grades (10%), Siberian Light and Syrian Light (20%)
- Good access to product markets in surrounding countries – Reliant on exporting large proportion of output due to mismatch with domestic product demand.
- Relatively low conversion capacity: high gasoline and HFO output and relatively low mid-distillate production
- Undergoing upgrading work to increase desulfurization cap.
- Conversion ratio: 22.5%- complexity indicator: 5.7

Sisak – INA (81 kbd)

- Med Hub – East
- Imports through Omisalj terminal – Adria pipeline
- Generally run well under capacity and potential candidate for shutdown if upgrading capacity not increased.
- Potential to link to MOL's petchem plant nearby.
- HFO output around 2% because of coker and asphalt units.
- Conversion ratio: 20.4%- complexity indicator: 4.5

Greece**Aghii Theodori – Motor Oil Hellas (100 kbd)**

- Med Hub – East
- Crude imports through Agioi Theodori port – also has extensive storage facilities (pipeline link to storage capacity operated by Avin)
- Close to demand base of Athens and also Greece's only Base oil/lubes supplier
- Wide crude slate due to flexibility of refinery and supply. Estimated half of crude Saudi with Russia and Iran accounting for most of remainder
- Refinery primarily export orientated due to southern Greek product surpluses (unfavourably placed compared to better integrated Hellenic units)
- Large bunker supplier to Athens port
- Relatively complex site with 38 kbd resid hydrocracker + FCC and visbreaker. Lubricant base oils account for most of heavy output with gasoline and mid distillates accounting for rest of product output
- Can meet 10ppm
- In 2005 Aramco divested its stake in Refinery – likely to see less Saudi bbls as result
- Conversion ratio: 119.4% - complexity indicator:

Aspropyrgos – Hellenic Petroleum (146 kbd)

- Med Hub – East
- Located close to Athens and best place to supply that market due to pipeline links with several storage and distribution facilities.
- Well placed for crude supplies and product exports due to proximity to Athens port. Also pipeline linkage to Athens airport.

- High integration with Hellenic's Thessaloniki and Elefsis refineries & petchem facilities under Hellenic's Integrated Operational Scheme which allows refinery to upgrade heavier output from two simpler sites
- HFO output largely supplies bunker markets at Athens and Thessaloniki ports
- Upgrades to FCC and hydrocracker allow to process cheaper, higher sulphur grades, also runs S/R At. Res from Thessaloniki through FCC.
- Gasoline and mid distillates account for 60% of yield – able to meet both gasoline and diesel 10 ppm
- Shared tankage with Elefisis
- Slate: Urals, Sib Light, Es Sider (main sweet grade - purchased spot), Iranian Heavy & Light (term contract), Arab Light & Extra Light (term contract), Azeri light.
- Conversion ratio: 35.8% - complexity indicator:

Elefsis – Hellenic Petroleum (100 kbd)

- Med Hub - East
- Crude imported through Elefisis port
- Linked by pipeline to Aspropyrgos and country largest product storage site (3.3m cu.m)
- Crude mostly sourced from Saudi, Iran and Russia
- Simple refinery lacking conversion capacity and produces mostly mid distillates and HFO – no finished gasoline output (currently meet 50 ppm for fuel output) - some of S/R FO output fed into Asprogyros for upgrading (around 56kt/m)
- Produces 165kt/m AtRes of which 109kt/m exported, remainder to Asprogyros
- Significant upgrading due to be completed by 2010 allowing light product yield to increase from 52% to 100%
- Slate: Urals, Sib Light, Es Sider (main sweet grade - purchased spot), Iranian Heavy & Light (term contract), Arab Light & Extra Light (term contract), Azeri light.
- Conversion ratio: 19.5% - complexity indicator:

Thessaloniki – Hellenic Petroleum (72 kbd)

- Med Hub - East
- Crude imported through Thessaloniki port (crude terminal at Dendropotamos)
- Operations closely linked to Aspropyrgos – intermediate feedstock (e.g. S/R At Res go to Aspropyrgos for FCC processing)
- Simple hydroskimming refinery although upgrading to increase topping capacity, increase light fuel production and improve fuel quality (to meet 10 ppm) supposed to be completed by 2009.
- Conversion ratio: 0% - complexity indicator:

n.b. - All Hellenic refineries run off the same LP model.

Hungary

Duna/Szazhalombatta – Mol (164 kbd)

- Druzhba linked refinery
- Also links to Adria pipeline (although not currently used for crude imports)
- Commercial co-ordination with Bratislava refinery – integrated crude supply
- Processes c. 90% Russian crude and 10% Hungarian crude
- Mol has crude production in Siberia (supplying 18% of intake) and thus only pays full Urals price on 2/3 of input.
- Lukoil major crude supplier to refinery
- Good captive product market although some competition from Schwechat
- Main market is Budapest although also has product pipeline links to other demand centres.
- Strong links with petchem (Mol has controlling stake in TVK)
- High clean product output – HFO < 3%, able to meet 10ppm
- Conversion ratio: 35.8%- complexity indicator: 7.8

Macedonia

Skopje/Okta – Hellenic (50 kbd)

- Med Hub – East
- Crude delivered through pipeline from Hellenic's Thessaloniki refinery
- Simple hydroskimming refinery – output mostly gasoline, diesel and FO.

Poland

Plock – PKN Orlen (361 kbd)

- NW Europe hub – Druzhba
- Crude supply through Druzhba pipeline
- Product pipelines link refinery to demand centres of Warsaw and Pozan
- JV with Basell for petchem supply => increased petchem production since the this JV

Gdansk – Lotos (122 kbd)

- NW Europe – Druzhba
- Linked to Druzhba pipeline slate thought to be c. 80% Urals, and remainder N Sea and Kuwaiti
- Some crude imports through port of Gdansk
- Good location for exports to W. Europe but supplies only N Poland

Southern Poland:

All 5 have advantage of being close to Silesia region (industrial demand) but small size and lack of technology mean unable to meet quality requirements for oil products. Increasingly moving into niche markets to avoid shutdown

Czechowice – Lotos

- Distillation units shut down
- Now focus on biofuels and operates as a storage centre and bitumen and lubes production
- 750,000 cu.m of storage

Jaslo – Lotos

- Very small refinery with some fuel production but specialising in plastic recycling
- Also 100,000mt of fuel storage

Gorlice/Glimar – Lotos

- Bankrupt in 2005

Jedlicze – PKN Orlen (4 kbd)

- Mainly HFO production
- Also recycles waste oil into lubricants

Trzebinia – PKN Orlen (16 kbd)

- Crude supplied from local fields
- Mostly produces bitumen, paraffins and lubes
- Increasing production and blending of biodiesel
- Product pipeline to Orlen's storage centre in Boronowa

Pipelines and Storage:

- i. Potential reversal of Odessa-Brody pipeline. Would ensure more diverse crude supplies and stabilise crude supply into PKN Orlen's Mazeikiu refinery in Lithuania which has suffered supply disruptions.
- ii. Druzhba pipeline crosses Poland (feeding into Plock refinery) on way to Schwedt and Leuna refineries in Germany.
- iii. PERN operated pipeline from Druzhba to Odessa refinery.

Storage:

PERN operates 2.8m cu.m of crud storage at 3 sites (Adamowo, Plock nad Gdnask).

PKN Orlen has 2 ubderground caverns for crude storage in Gora – linked to Druzhba pipeline (2 x 580,000 cu.m).

Romania

Low utilization of refineries but still a net product exporter. Poor margins due to lack of connection to Druzhba pipeline system. Roughly half crude processed is domestic Romanian with other half mostly Russian.

Possible construction of South East European Line (SEEL) to connect Constanta to Trieste.

Pipelines operated by Conpet – 2 pipeline systems: 1) for handling imported crude from Constanta and 2) for handling domestic crude to refineries at Cimpina, Darmanesti, Onesti and Ploiesti.

Midia – Petromidia/Rompetrol (100 kbd)

- Black Sea
- Located nr Constanta port through which it imports its crude
- Processes mostly Urals crude and has 83% clean product output
- Romania's biggest and most advanced refinery with above average utilization rates.
- Strong integration with Petromidia's petchem plant
- 60% of diesel yield meets 50ppm sulphur
- Conversion ratio: 61.1%- complexity indicator:

Barcau – Petrolsub/Eurohouse/Fertinvest (8 kbd)

- Black Sea
- Processes domestic crude from Petrom's Suplacul de Barcau fields
- Simple refinery with no upgrading capacity – output mostly HFO
- Now focused mostly on storage
- Conversion ratio: 0%- complexity indicator:

Ploeisti – Petrotel/Lukoil (104 kbd)

- Black Sea
- Crude imported through Constanta
- Operated by Lukoil – access to some of Lukoil own crude production
- Lukoil
- Supplies bunker market in Turkey as well as product exports to Hungary and W. Europe
- Recent investment upped clean product output to almost 95% and allows to meet 50ppm gasoline and diesel
- Conversion ratio: 60.5%- complexity indicator:

Vega – Rompetrol (10 kbd)

- Black Sea
- Some imports through Constanta although 80% of intake is feedstocks rather than crude
- Located in Ploiesti, nr. Bucharest, and is mainly geared to supply Bucharest, whilst Midia site exports
- Conversion ratio: 0%- complexity indicator:

Poliesti – Astra (56 kbd)

- Black Sea
- Very low utilization rates (2003 was 20%)
- Produces mostly Naphtha and HFO, no gasoline and v poor quality diesel
- Conversion ratio: 26.1%- complexity indicator:

Poliesti: Petrobrazii – Petrom/OMV (69 kbd)

- Black Sea
- Some crude imports through Constanta (c. 20%)
- Processes mostly domestic grades with utilization of around 75%
- Should be able to produce 50ppm
- Uses some feedstocks from Arpechim site
- Some petchem integration
- Conversion ratio: 62.3%- complexity indicator:

Pitesti: Arpechim – Petrom/OMV (70 kbd)

- Black Sea
- Linked by crude and product pipelines to network of refineries around Bucharest and also Constanta
- Processes about 75% imported crude and 25% domestic crude supplied via pipeline from Oltenia fields
- Utilization of around 90%
- Exports about 30% of diesel and 15% of gasoline output

- Operated in conjunction with Petrobraz
- Strong links to Petrom's Oltchim chemical site – supplies propylene and ethylene through pipeline but also olefins, polyolefins, benzene and others
- Produces 10ppm fuels for export
- Conversion ratio: 70%- complexity indicator:

Onesti – Rafo (70 kbd)

- Black Sea
- Not linked to any export outlets – short product pipeline allow refinery to supply local demand centres
- Competes with Petrolsub and Darmanesti which both benefit from supply of local crude and also linked to Constanta => relatively uncompetitive compared to neighbouring refineries
- Conversion ratio: 49.4% - complexity indicator:

Serbia

Novi Sad – NIS (Rafinerija Nafte Novi Sad)/Gazprom (60 kbd)

- Med Hub – East
- Crude imported through Adria pipeline from Omisalj
- Runs almost entirely Urals + small amounts of domestic crude (by river barge)
- Hydroskimming plant producing mostly fuel oil and lubes
- Relatively close to product market but little integration with petchem, low desulphurization capacity
- Utilization c. 65% of capacity
- Crude now supplied direct from Gazprom rather than Glencore
- Conversion ratio: 0% - complexity indicator:

Pancevo – NIS (Rafinerija Nafte Pancevo)/Gazprom (107 kbd)

- Med Hub – East
- Crude imported through Adria pipeline from Omisalj
- Two crude pipelines also link refinery to domestic fields in N Serbia (Vojvodina)
- All imported crude is Urals
- Conversion refinery producing traditional fuels and Bitumen
- Relatively close to product market but little integration with petchem, low desulphurization capacity => very poor quality fuels
- Utilization c. 65% of capacity
- Product output: gasoline 25%, gasoil 33%, HFO 20%
- Crude now supplied direct from Gazprom rather than Glencore
- Conversion ratio: 57.4% - complexity indicator:

Slovakia

Bratislava – Mol/Slovanaf (115 kbd)

- Druzhba linked refinery
- Imports through Belarusian pipeline network (operated by Gomeltransneft)
- Also links to Adria pipeline (although not currently used for crude imports)
- Slate approximately 75% Urals + 15% lighter Siberian grades & 10% heavy Volga/Tartar grades
- Much of oil supplied through Lukoil
- Commercial co-ordination with Duna refinery – integrated crude supply
- Clean product output thought to be 85% of total output - Gasoil 51% (should be able to meet 10ppm), Gasoline 24%, HFO <5%
- Faces competition for product output from Schwechat (Austria) and Duna (Hungary)
- Product exports to Czech Rep, Poland, Hungary & Austria
- Full Petchem integration and produces high volumes of base oils
- Conversion ratio: 31%- complexity indicator: 10.9

Turkey

Izmit (Tutunceftlik) – Tupras (234 kbd)

- Med Hub – East
- Crude imported from Black Sea (Russian) and also ME and Med grades, predominantly Iranian and Libyan.
- Has crude storage of 915,000 cu.m in 14 tanks
- Output weighted towards mid distillates which account for over 40% of output, with HFO at 24% and gasoline just 14%
- New diesel de-sulf unit mean can produce 50 & 10 ppm diesel
- Conversion ratio: 19% - complexity indicator: 4.7

Izmir (Aliaga) – Tupras (226 kbd)

- Med Hub – East
- Crude imported through Aliaga port. Mostly imports Saudi and Libyan crudes
- Has crude storage of 590,000 cu.m in 10 tanks
- Well placed to supply demand centres of Marmara and Central Anatolia
- Izmir has Turkey's only base oil lubricant complex (330 kt/yr) and also supplies feedstocks to Turkish petchem industry
- Proximity to other Med refiners mean susceptible to import competition
- Output yield c. 45% mid distillates, 16% gasoline and 20% HFO (relatively low due to asphalt production)
- Refinery upgrades should allow 10ppm production by 09
- Conversion ratio: 19% - complexity indicator: 4.8

Kirikkale – Tupras (113 kbd)

- Med Hub – East
- Located in central Anatolia region well placed to supply central Turkey including Ankara.
- Linked to Ceyhan BOTAS terminal which supplies both domestic Turkish grades (around 30% of capacity) and also Iraqi crude (Kirkuk).
- Capacity utilization believed to be c. 75%
- Product slate heavily weighted towards gasoil while HFO output lowest of Tupras refineries
- New diesel hydrosulfurization unit and CCR gasoline reformer will allow 10 & 50 ppm diesel and gasoline production
- Conversion ratio: 16.7% - complexity indicator: 4.5

Batman – Tupras (22 kbd)

- Med Hub – East
- Located in far East of country
- Runs Turkish domestic crude and produces mainly HFO and asphalt for local consumption
- Connected to Raman, Garzan and Kahta fields by Batman-Dortyol pipeline and also Dortyol storage terminal
- Crude storage of 32,000 cu.m in four tanks
- HFO and asphalt account for 75% of output with gasoline less than 4% output
- Recent increases in asphalt capacity means asphalt production now exceeds that of HFO
- Conversion ratio: 0% - complexity indicator: 2.7

Appendix 2: North Sea Arbitrage

The following section highlights current (2008) arbitrage flows of North Sea crude out of NW Europe detailing volumes and destinations.

What drives differences in arbitrage volumes?

Historical data show that arb flows are relatively range bound and seem to move within bands. Arbitrage flows broadly fall into two categories:

1) Term-flows are those shipments moved by customers with term supply contracts in North Sea crudes. These flows generally are placed into term holders refining assets and are quite stable. Term holders may have operational flexibility to vary the amount that they lift and also to place their bbls in NW European asset but generally these flows represent the base level of N Sea arbitrage movements.

2) Speculative flows – These flows are much more volatile and are essentially linked to market movements. Specifically they will increase when N Sea crude is deemed price competitive versus local crudes in other regions. The two main factors driving the competitiveness of N Sea crude versus other crudes (outside of NW Europe) and effectively 'opening the arb' are freight rates (most commonly cross-Atlantic) and WTI-Brent diffs.

Freight rates obviously affect the delivered cost of N Sea bbls in various end user markets whilst the WTI-Brent diff affects the relative price of N Sea crudes (priced as a differential to Brent) compared to North American crudes (priced as a differential to WTI). Thus if the difference between WTI and Brent is high (i.e. WTI more expensive than Brent) then N Sea crudes become more price competitive in N America.

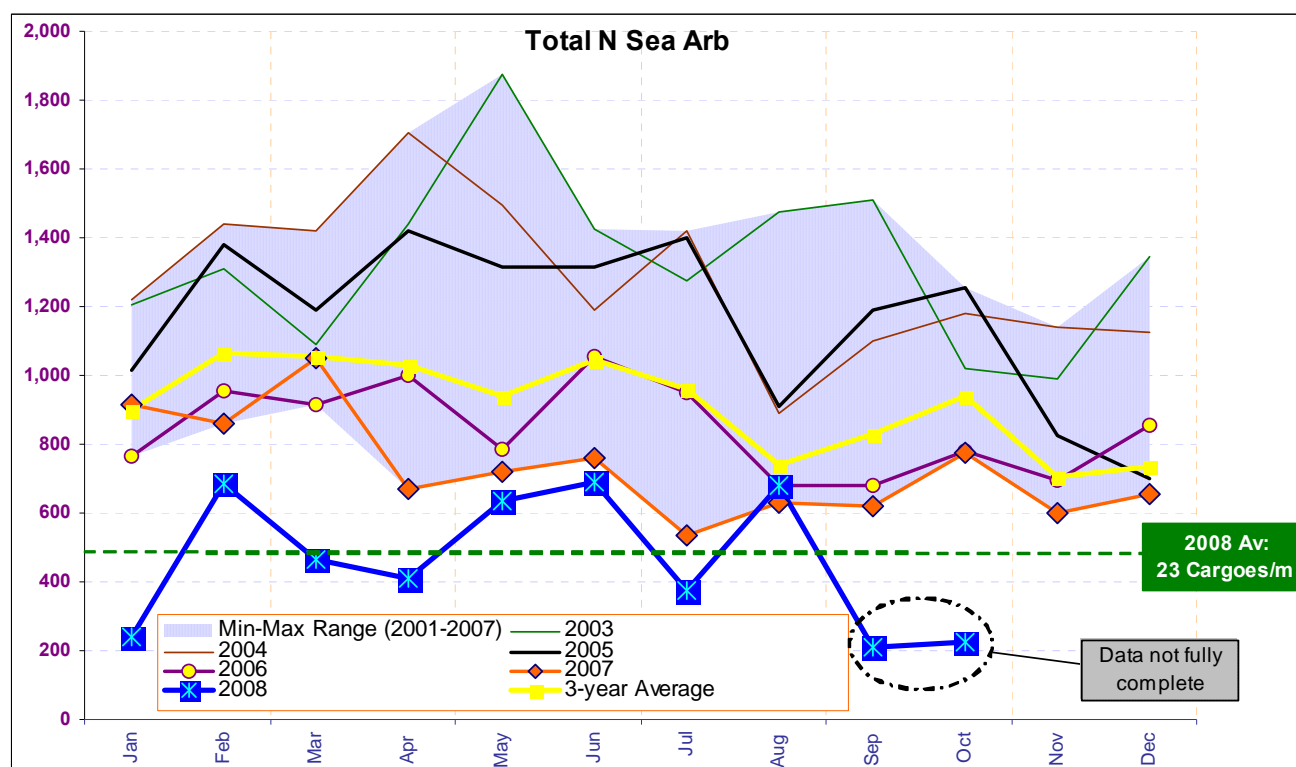
Regressing cross-Atlantic Suezmax rates and WTI-Brent diffs with total N Sea arb volumes results in a statistically significant correlation => an R sq. of 0.453 (with t-stat of 14 and p-value well below 0.05) indicates that these two factors explain 45% of the variance observed in total arb volumes since 2003.

Total N Sea Arb Flow Summary:

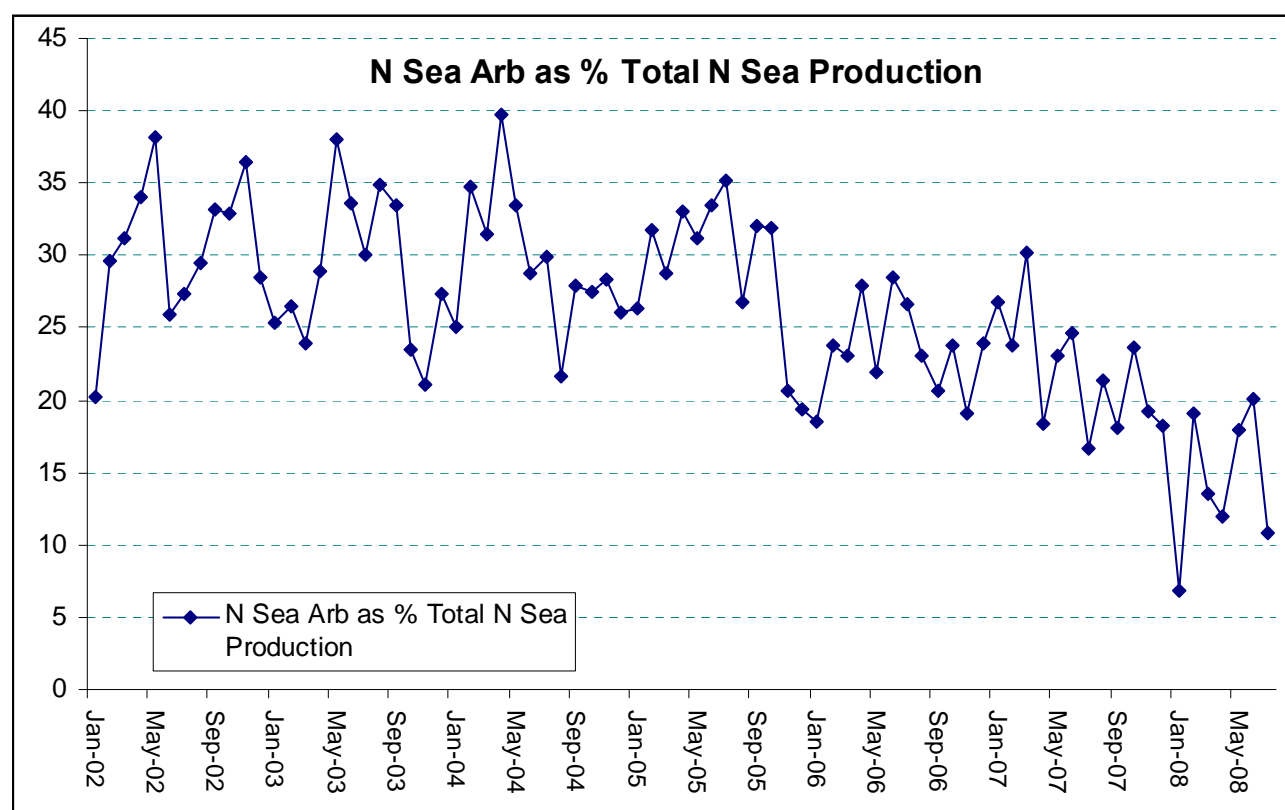
- 2008 average arb volume is 500 kbd (accounting for slightly incomplete Sep & Oct data) or 23 cargoes a month (@ 600k bbls cargo)
- As total N Sea arb volumes have fallen the relative volatility of the arb has increased. In 2008 arb has moved within the 250-700 kbd range but at three distinct levels:
 - 1) Low = 200-300 kbd (10-15 cargoes)
 - 2) Medium = 400-500 kbd (20-25 cargoes)
 - 3) High = 600-700 kbd (30-35 cargoes)
- Arbs tend to be highest in the first half of the year and historically hit low point during August maintenance and November.
- On average (2008) see monthly distribution of arb volumes as follows (see separate regional sections for more detail):
 - N American Atlantic Coast = 13 Cargoes
 - US Gulf = 5 Cargoes
 - Mediterranean = 4 Cargoes
 - East = 3 Cargoes (this could be over-estimated due to counting FO shipments as crude)
- Main grades that arb out of region are (07 and Jan-Aug 08):

- Heidrun, Aasgard, Gullfaks, Statfjord, Troll & Norne (from Mongstad)	= 175 kbd or 9 cargoes per month.
- Forties (from Hound Point)	= 93 kbd or 4.75 cargoes per month.
- Brent (from Sullom Voe)	= 91 kbd or 4.65 cargoes per month
- Oseberg and Grane (from Sture)	= 88 kbd or 4.45 cargoes per month
- Flotta (from Flotta Terminal)	= 47 kbd or 2.2 cargoes per month
- Ekofisk (from Tees)	= 34 kbd or 1.7 cargoes per month

=> Together these grades accounted for over 80% of all grades arbed out of N Sea during 2007-2008.



Unsurprisingly the % of N Sea production that arbs out of the region has fallen as N Sea production has fallen – the average so far in 2008 is 15% of total volume vs. an average of 26% for the last 7 years. Thus should expect absolute and relative (to total N Sea production) arb volumes to keep falling y-o-y as N Sea production declines.

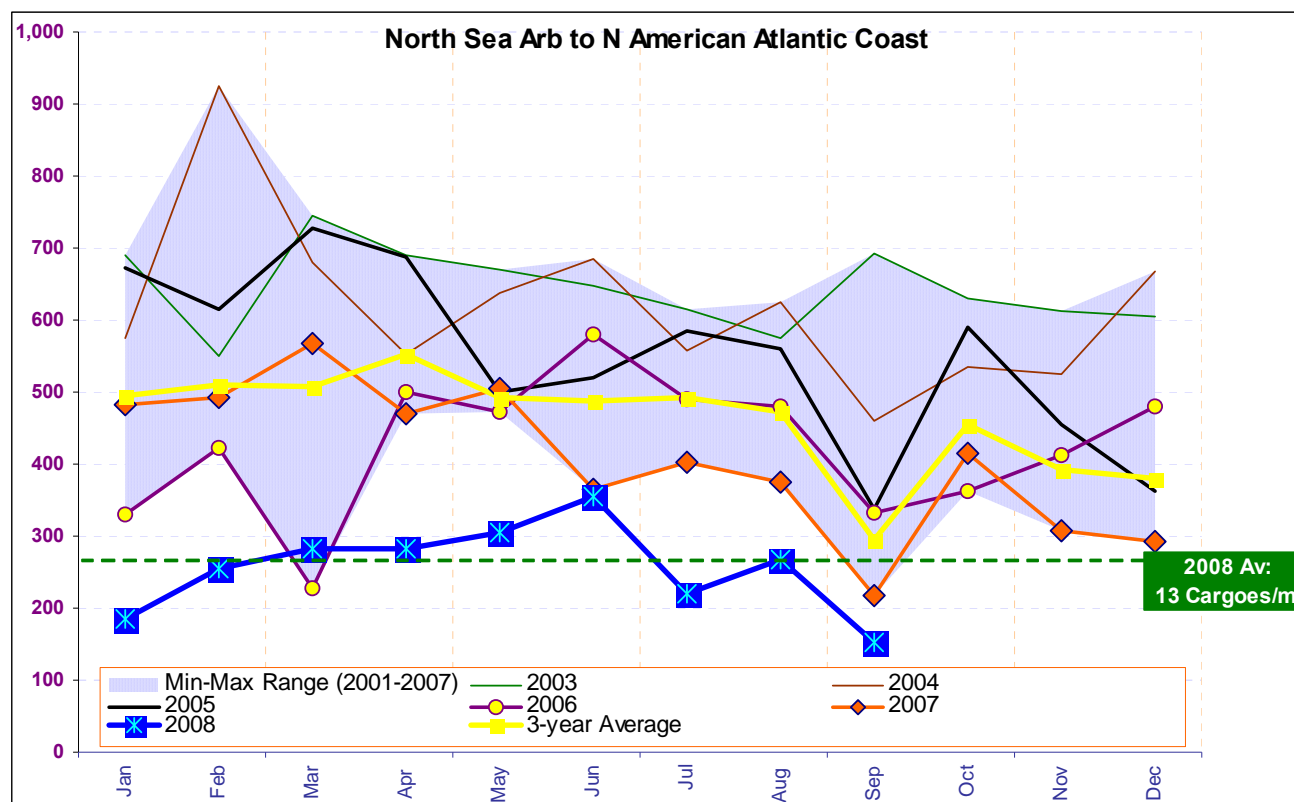


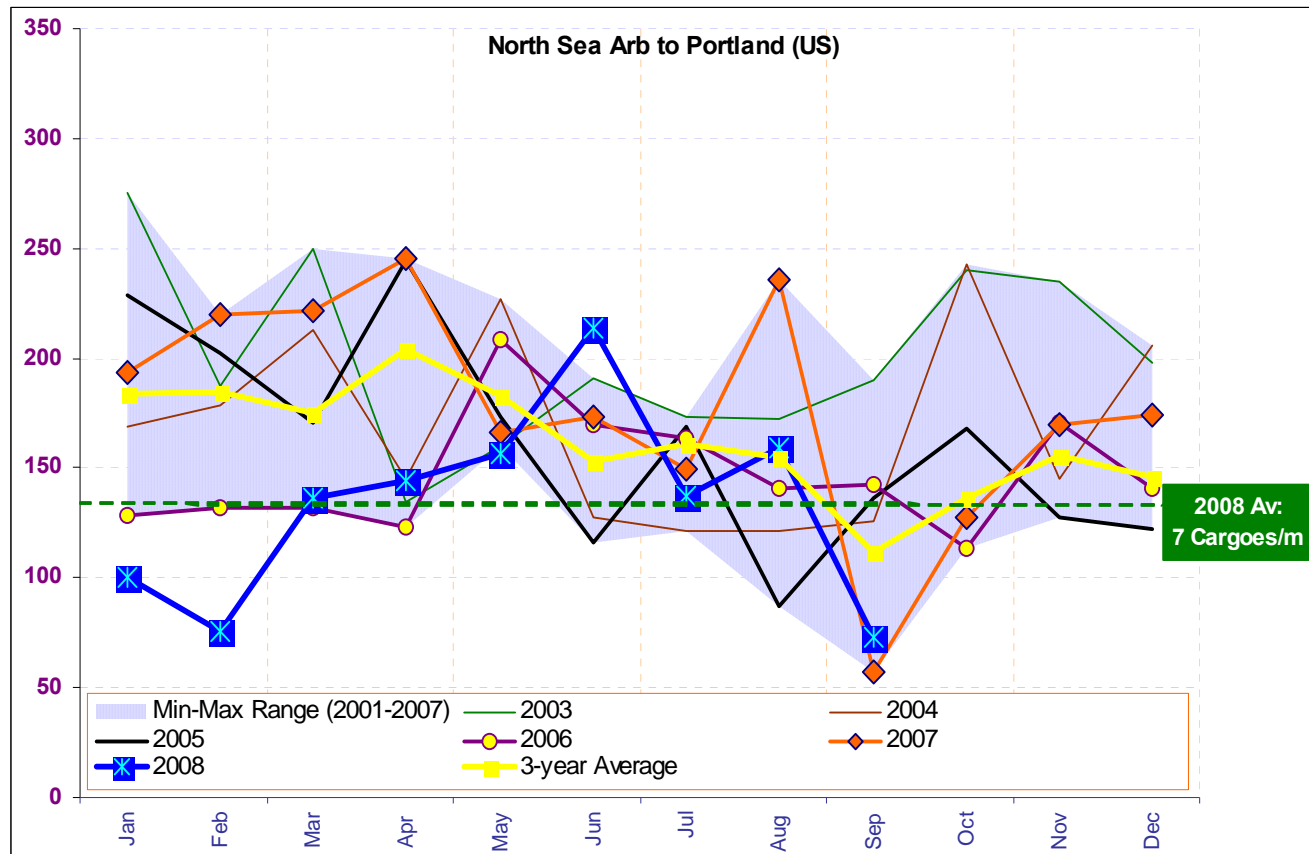
N Sea Arb to US/Can Atlantic Coast:

- 2008 average arb to US/Can Atlantic coast is 255 kbd or 13 cargoes a month.
- Major grades exported in 2008 are as follows :
 - Heidrun, Asgard, Gullfaks, Statfjord, Troll & Norne (from Mongstad) = 130 kbd or 6.5 cargoes per month.
 - Brent (from Sullom Voe) = 50 kbd or 2.5 cargoes per month
 - Forties (from Hound Point) = 45 kbd or 2.3 cargoes per month
 - Flotta (from Flotta Terminal) = 27 kbd or 1.4 cargoes per month

These grades have accounted for 95% of all measured N Sea exports (to US/Can Atl.) so far in 2008. Other grades exported are DUC, Ekofisk, Grane and Oseberg. Of note 2008 has seen a 43 kbd y/y drop in exports out of Sture (Oseberg and Grane) to US/Can Atl.

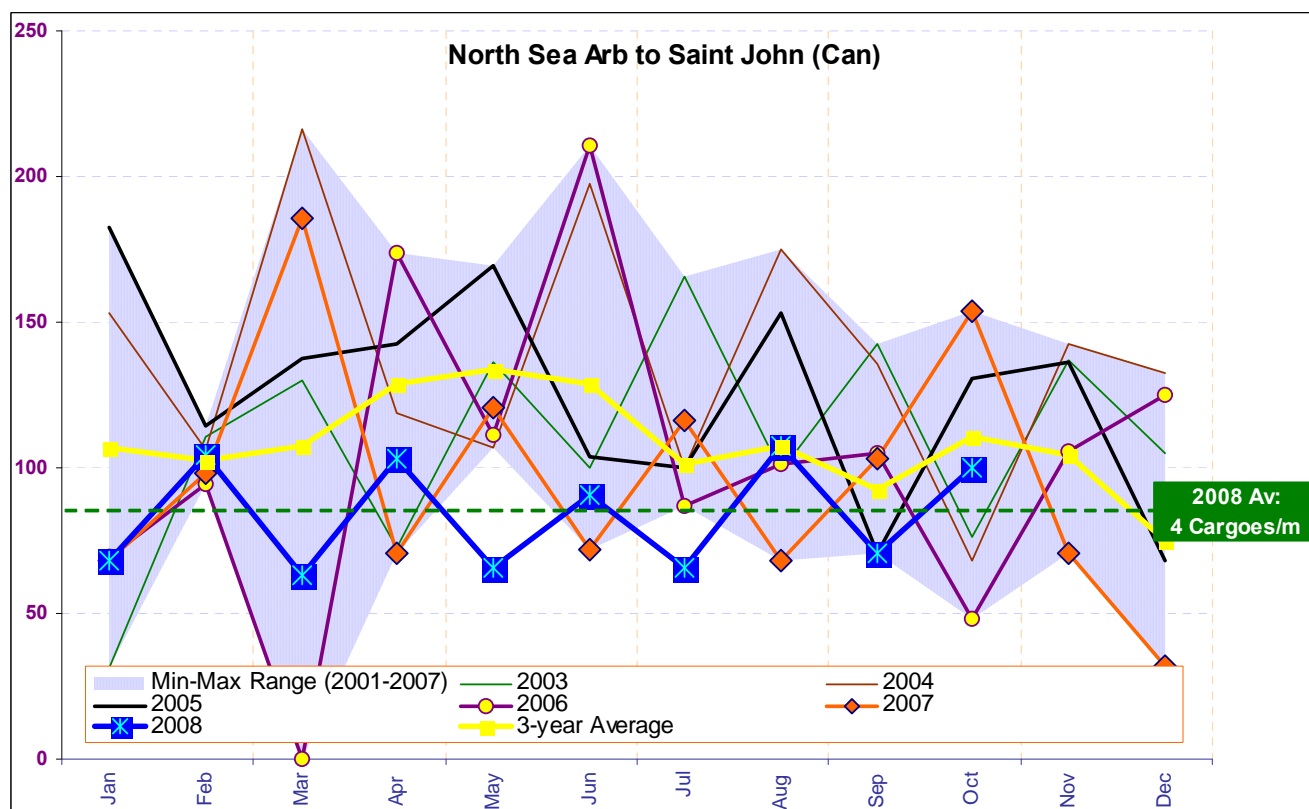
- 85% of N Sea exports to N American Atlantic go to two discharge ports:
 - Portland (feeding the Portland-Montreal Pipeline) = 132 kbd or 7 cargoes/m
*Primary Refineries: Montreal – Shell Canada Ltd (130kbd);
 Montreal – Petro-Canada Products Ltd (105 kbd)*
*Secondary Refineries: Nanticoke – Imperial oil (112 kbd)
 Oakville – Petro-Canada Products Ltd (83 kbd)*
 - Saint John in Canada = 84 kbd or 4 cargoes/m
Primary Refinery: Saint John – Irving Oil (250 kbd)





- Main Grades to Portland in 2008:
 - Brent (from Sullom Voe) = 55 kbd or 2.8 cargoes/m
 - Forties (from Hound Point) = 40 kbd or 2.1 cargoes/m
 - Heidrun, Asgard, Gullfaks, Statfjord, Troll & Norne (from Mongstad) = 35 kbd or 1.8 cargoes/m
 - Flotta (from Flotta Terminal) = 17 kbd or 0.8 cargoes/m
 - Oseberg and Grane (from Sture) = 13 kbd or 0.6 cargoes/m

=> These grades account for over 95% of all N Sea arbs to Portland.

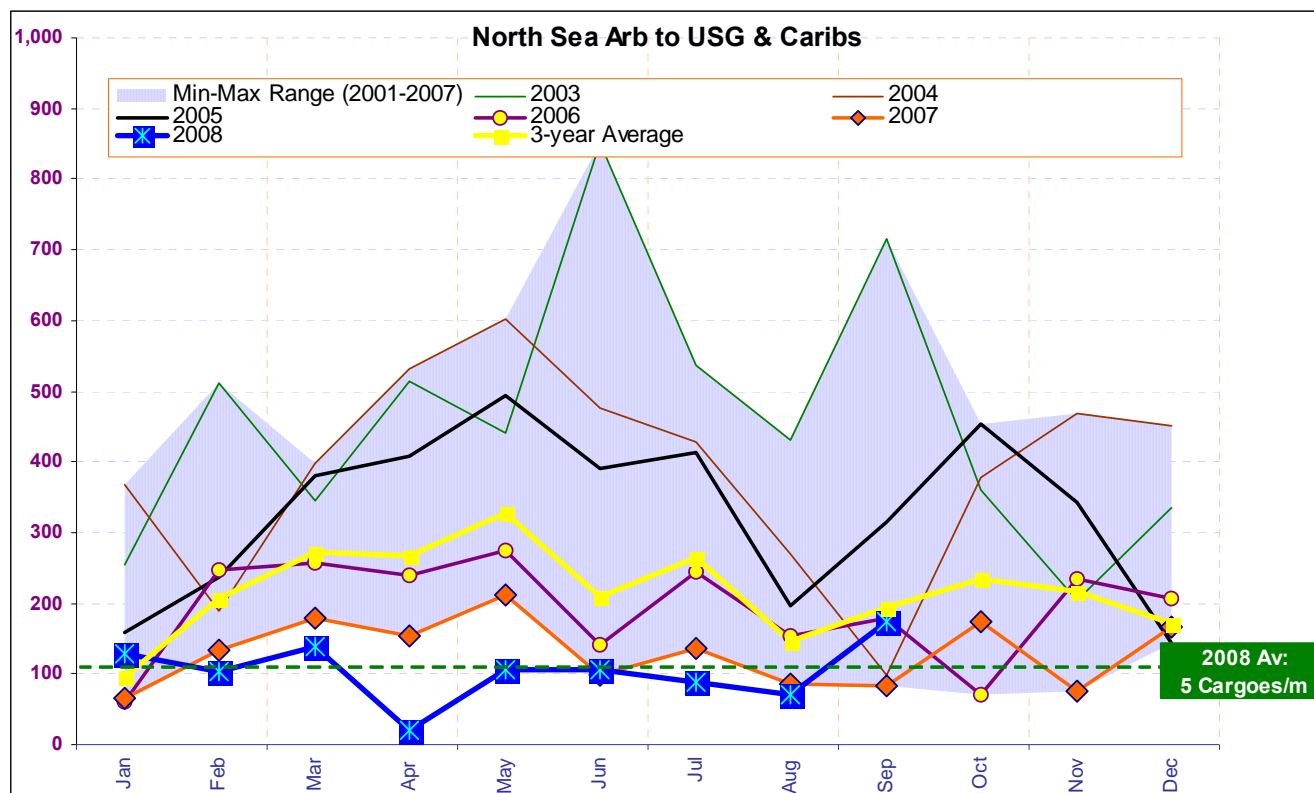


- Main Grades to Saint John in 2008:
 - Heidrun, Asgard, Gullfaks, Statfjord, Troll & Norne (from Mongstad) = 78 kbd or 4 cargoes/m

=> Exports from Mongstad account for 95% of all N Sea exports to Saint John.

N Sea Arb to USG:

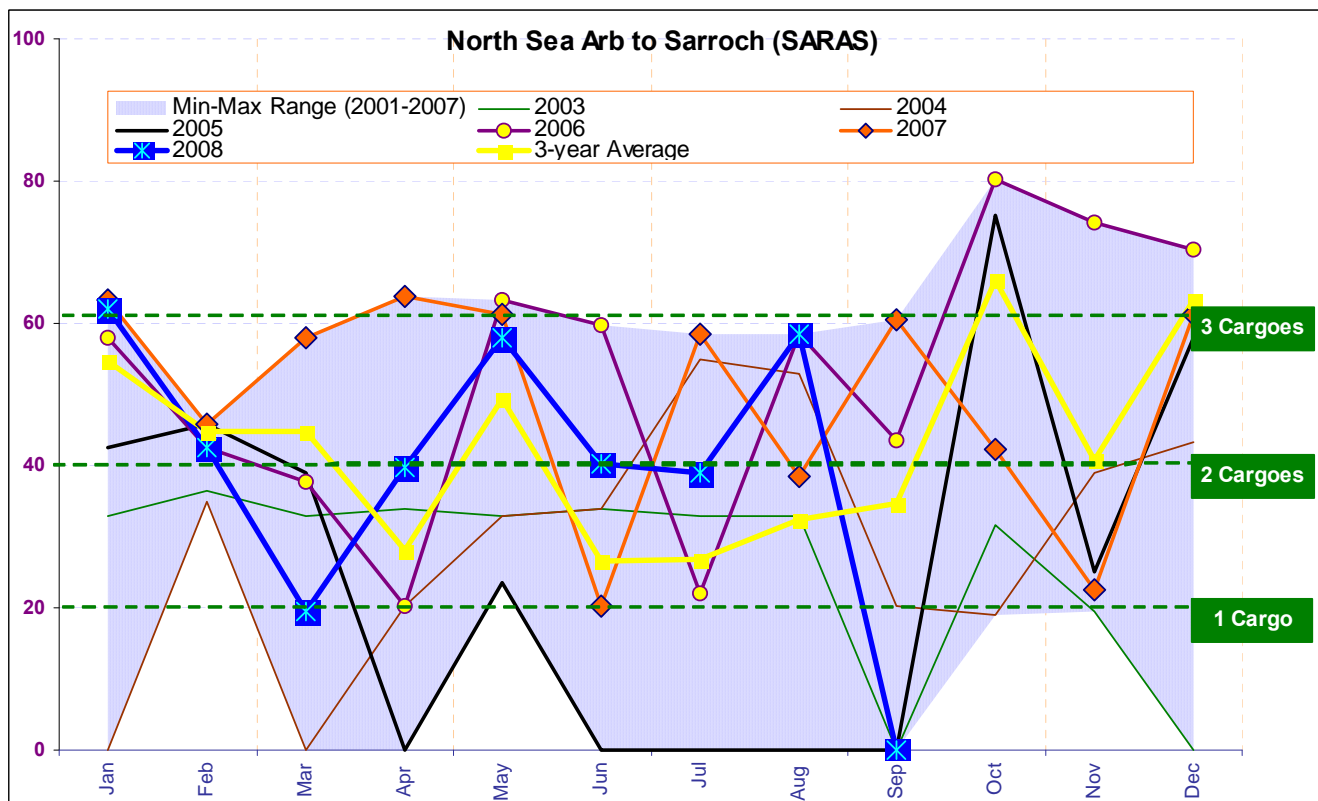
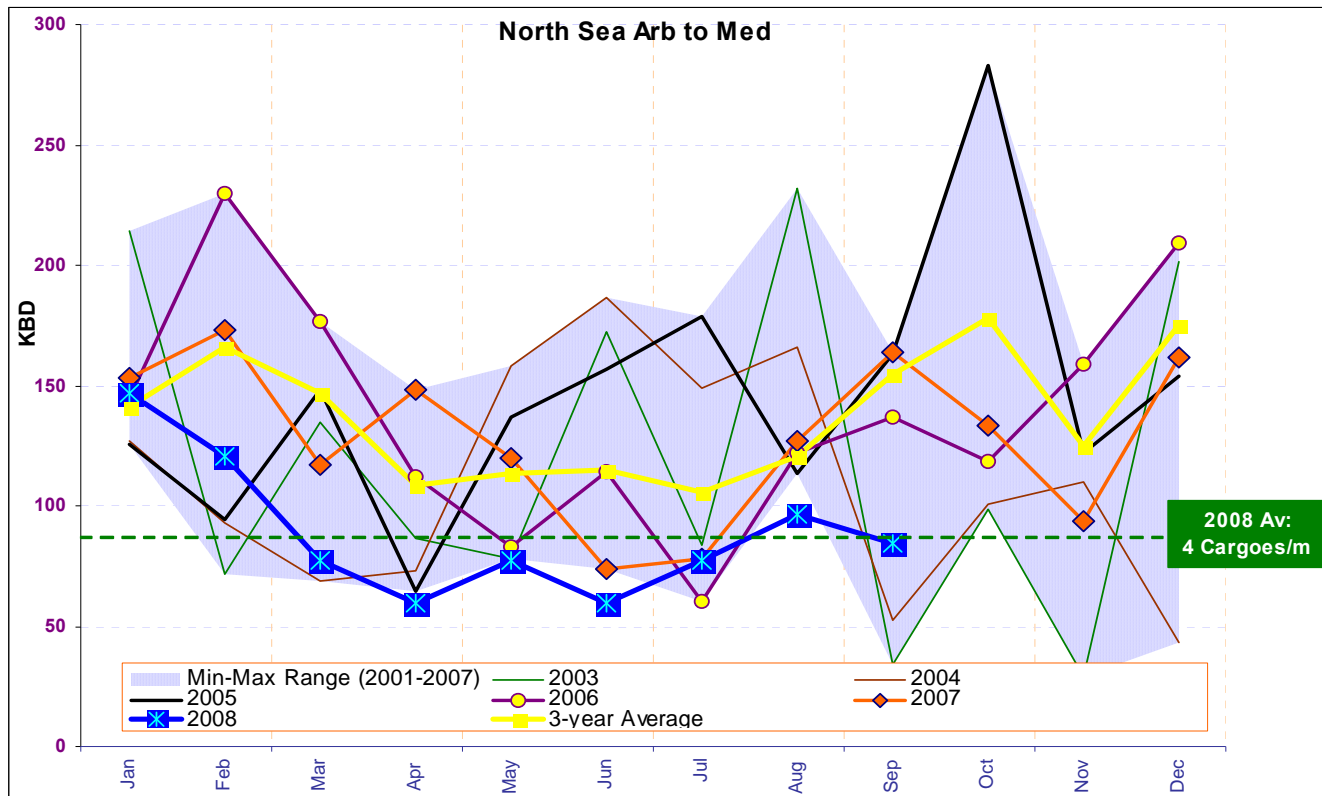
- 2008 average arb to USG is 103 kbd or 5 cargoes/m
- Major grades exported in 2008 are as follows :
 - Forties (from Hound Point) = 31 kbd or 1.6 cargoes per month
 - Flotta (from Flotta Terminal) = 16 kbd or 0.8 cargoes per month
 - Beatrice + other N Sea STS (from Nigg term) = 10 kbd or 0.5 cargoes per month



N Sea Arb to Med:

- 2008 average arb to Med is 80 kbd or 4 cargoes/m
- Major Grades exported in 2008 are as follows:
 - Oseberg and Grane (from Sture) = 45 kbd or 2.3 cargoes/m
 - Brent (from Sullom Voe) = 20 kbd or 1 cargo/m
 - Alba (from Alba term.) = 10 kbd or 0.5 cargo/m
- The majority (68%) of these flows feed three refineries:
 - 1) Sarroch – SARAS (315 kbd) = 40 kbd or 2 cargoes/m
 - 2) Cartagena Murcia – Repsol (100 kbd) & Puertollano – Repsol (140 kbd) = 14 kbd or 0.75 cargo/m

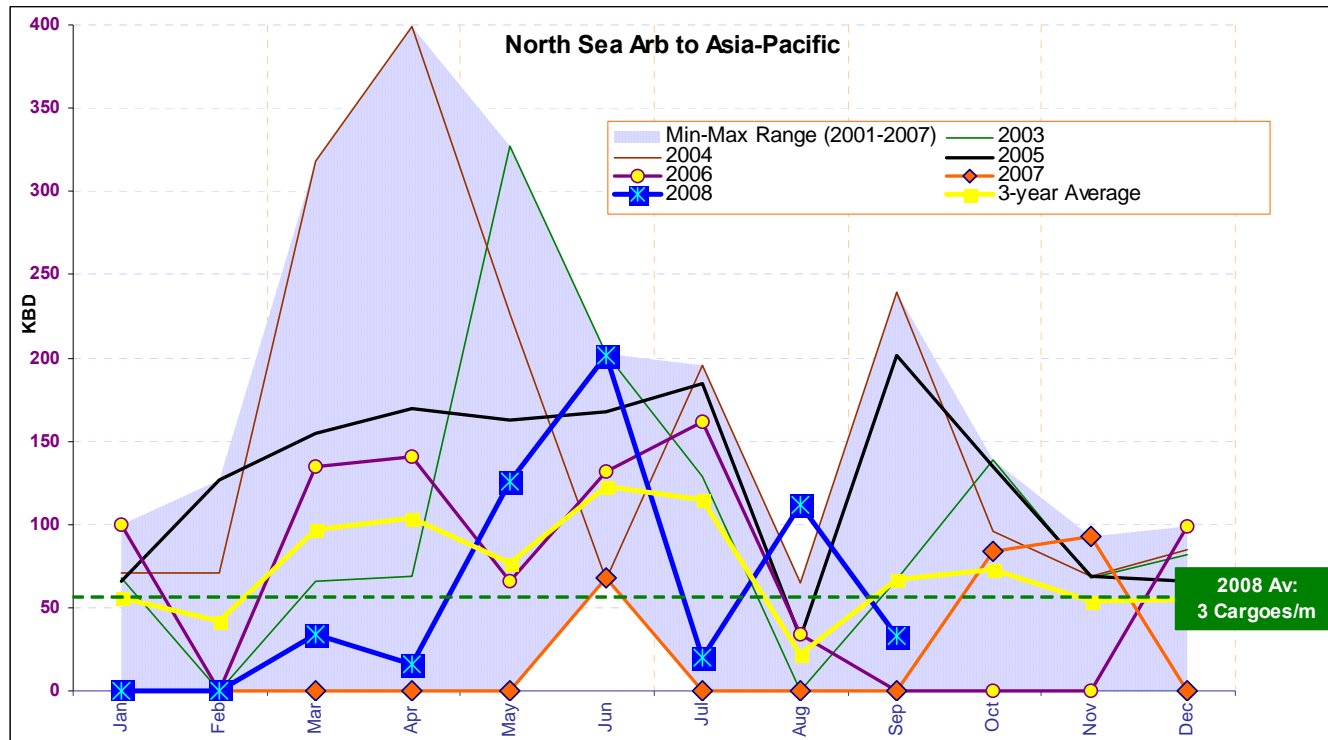
*(See graphs overleaf)



- In 2008 N Sea grades to Saras virtually all from Sture (i.e. Oseberg and/or Grane)

N Sea Arb to East:

- 2008 average arb to Asia-Pacific has been 55 kbd or 3 cargoes/m
- Arb hit highest point June when Statoil moved 4m bbls of Forties to S Korea => movements of N Sea crude into AP are much more volatile than other arb flows.
- I suspect that the shipping figures are overstated as with the exception of Forties (Hound Point exports) all other 2008 exports have been from Rotterdam. With this in mind believe that good chance these cargoes could be FO rather than N Sea crude.



Appendix 3: NW Europe Run Cuts

As suspected it is difficult to draw conclusions about the length of time run cuts need to occur for in order for crude diffs to drop off and margins to begin to increase again (i.e. for demand recovery to take place). This is due to large number of other factors impacting margin environment (i.e. TAR level, supply etc). However some broad-brush conclusions can be drawn:

- Max level of run cuts in NW Europe is around 200 kbd. This is based on historical records from BP's refinery and TAR database. In addition it is also possible to estimate maximum run cuts by looking at refineries vulnerable to a low margin environment. The North West European Refinery table in this report highlights 14 such refineries, with a total CDU capacity of 1.4m bpd. Assuming a 20% cut in runs this would equate to 280kbd of lost demand.
- Effect on fundamentals relatively small compared to TARs, import levels or arbitrage movements. In NW Europe we typically see TAR impacts up to 1000 kbd, with an impact on sweet demand up to 550 kbd. As stated in Appendix 2 N Sea arbitrage ranges between 200kbd and 700 kbd, i.e. a potential 500 kbd swing; Sweet imports in range: 400 – 950 kbd, i.e. potential 550 kbd swing).
- Fundamentally run cuts have a smaller impact on balances than either TARs, arbitrage out of region or imports in. However likely that run cuts also act as indicator of sentiment and can thus have greater impact than fundamentals suggest.
- Length and size of run cuts will depend on level of TARs – i.e. Low TARs coincide with the longest and largest run cuts – Given we are moving into a very low TAR environment in NW Europe (December 08) potential for a sustained period of run cuts at the moment is high.
- A typical run cut period lasts between 3 and 10 weeks depending on external market fundamentals – Volume of TARs, supply-demand balance.

*All data based on observations over last 2 years.

Relationship btw Refining Margins, Sweet Crude Diffs, TARs and Run Cuts

