



OIL AND GAS PRODUCTION  
IN DENMARK

2014







# 1. EXPLORATION



---

The Danish part of the North Sea must be considered a mature area. Nevertheless, there are still interesting new exploration prospects and existing exploration targets that remain to be intensively explored. A high exploration activity level in the North Sea is also key to creating the opportunities needed to make new discoveries while utilizing the existing North Sea infrastructure as best possible. This can help generate economic growth and new revenue for Danish society.

In recent years, exploration has increasingly focused on hydrocarbons in sandstone of Late and Middle Jurassic age, and the Geological Survey of Denmark and Greenland (GEUS) has carried out a major project to shed light on Jurassic exploration potential in these layers. In addition, GEUS is now working on a project to identify Cretaceous exploration prospects. However, younger parts of these layers may also hold interesting prospects. Several oil companies are currently evaluating exploration targets in layers of Paleogene age just above the chalk and in even younger layers of Neogene age.

#### **EXPLORATORY SURVEYS**

Oil companies depend on seismic data to identify the prospects of making new oil and gas discoveries. As a result of the keen interest shown in the 7th Licensing Round, major 2D and 3D seismic surveys were carried out in the North Sea in 2013 and 2014. When the deadline for applying for new oil and gas exploration and production licences expired on 20 October 2014, the DEA had received 25 applications.

The applicants consisted of 15 oil companies, several of which had not previously held licences in Denmark.

Geochemical surveys have been performed in connection with onshore hydrocarbon exploration in Mid-and South Denmark, and onshore seismic surveys have also been conducted with the aim of identifying opportunities for producing geothermal energy.

#### **EXPLORATION AND APPRAISAL WELLS**

Eight exploration and appraisal wells were drilled in 2014 and the first half of 2015 – seven in the western part of the North Sea and one onshore in North Jutland. Therefore, 2014 was a year of particularly high exploration activity in the Danish area.

The six exploration wells led to two new discoveries, and the two appraisal wells confirmed previous discoveries. The Xana-1 exploration well demonstrated the presence of hydrocarbons in Upper Jurassic sandstone under licence 9/95, while the Vendsyssel-1 exploration well encountered gas in alum shale in North Jutland. The findings from the wells will now undergo closer evaluation before a decision regarding further exploration is made. The two appraisal wells, Lille John-2 and Jude-1, confirmed the presence of hydrocarbons in the Lille John accumulation and Bo South. The results from both wells are now being closely evaluated, and the information will be used to assess the potential for initiating recovery from the accumulation.

# EXPLORATORY SURVEYS

TABLE 1.1. EXPLORATORY SURVEYS IN 2014

SURVEY LICENCE	OPERATOR CONTRACTOR	ON-/OFFSHORE TYPE	INITIATED COMPLETED	AREA	ACQUIRED IN 2014
CGG2013DK § 3	CGG Services SA CGG Services (Norway) AS	Offshore 3D seismic	14-12-2014 11-03-2014	The North Sea	1084,8 km <sup>2</sup>
ROENNE-RVG-2D-2014 G2012-02	Rønne Varne A/S DMT GmbH & Co. KG	Onshore 2D seismic	20-05-2014 26-05-2014	Bornholm	28,6 km
NWR-GEOCHEM-2014 1/08	New World Resources ApS Danica Resources APS.	Onshore Geochemical	15-06-2014 10-08-2014	Als, Langeland, Lolland and Falster	275 samples
NWR-GEOCHEM-1-2014 1/09	New World Operations ApS Danica Resources APS	Onshore Geochemical	26-07-2014 22-08-2014	Mid-Jutland	55 samples
NWR-GEOCHEM-2-2014 2/09	New World Operations ApS Danica Resources APS	Onshore Geochemical	26-07-2014 22-08-2014	Mid-Jutland	285 samples
HESS-3DOBS-2014 7/89	Hess Denmark ApS Magseis	Offshore 3D OBN seismic	19-09-2014 12-12-2014	The Syd Arne Field, The North Sea	NA
ENERETSBEVILLINGEN	Mærsk Olie og Gas A/S Gardline Geosurvey Ltd.	Offshore 3D seismic	12-10-2014 NA	The Svend Field, The North Sea	NA
ENERETSBEVILLINGEN + § 3	Mærsk Olie og Gas A/S Gardline Geosurvey Ltd.	Offshore 2D seismic	NA NA	The North Sea	NA

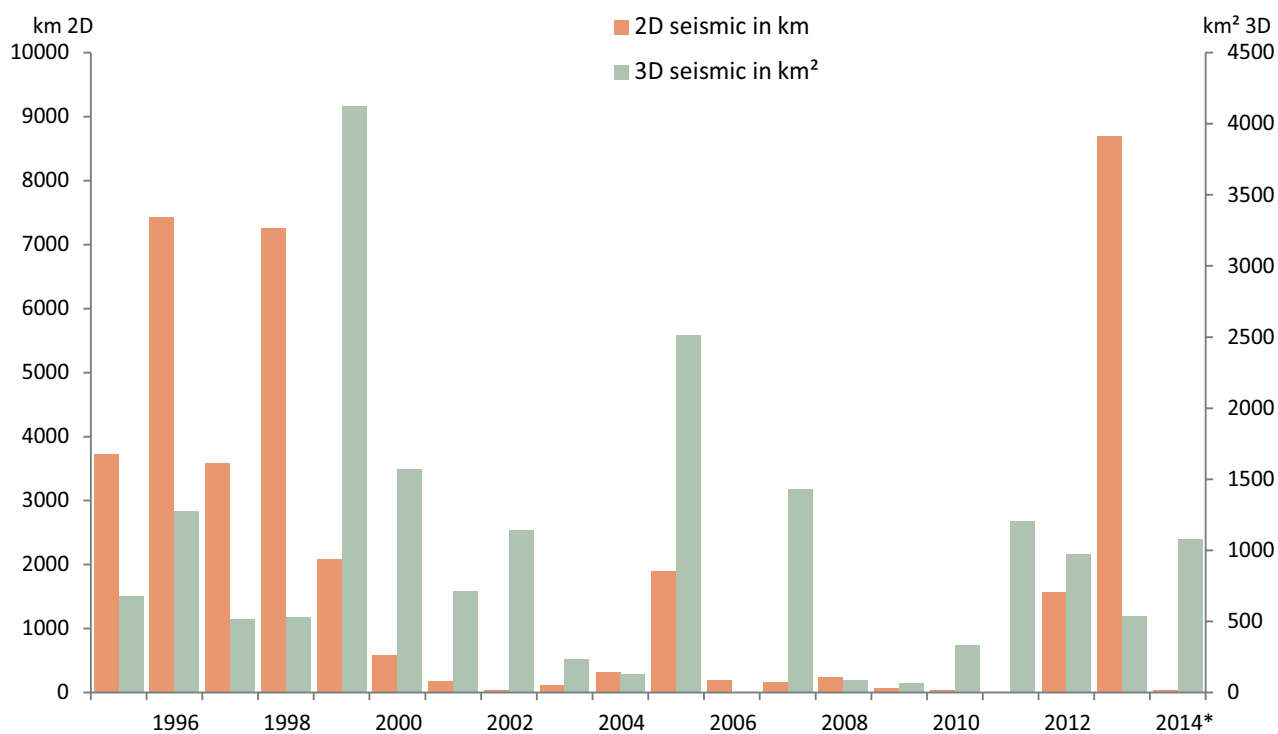


Figure 1.1. Seismic data acquired 1995 til 2014.

\* Data not complete.

# WELLS

TABLE 1.2. EXPLORATION AND APPRAISAL WELLS IN 2014/15

WELL NUMBER	PURPOSE	LICENCE	OPERATOR	DRILLING PERIOD	ON-/OFFSHORE AREA	DRILLING RESULT
Nena-1 5605/14-01	Exploration	1/12	DONG E&P A/S	24-01-2014 14-02-2014	Offshore Norwegian-Danish Basin	Dry well
Chabazite-1 5503/03-04	Exploration	4/06 area B	Wintershall Noordzee B.V.	02-06-2014 20-09-2014	Offshore The Central Graben	Dry well
Dany-1X 5505/17-18	Exploration	Sole Concession	Mærsk Olie og Gas A/S	04-07-2014 08-08-2014	Offshore The Central Graben	Dry well
Siah NE-1X 5504/07-17	Exploration	Sole Concession	Mærsk Olie og Gas A/S	03-09-2014 02-12-2014	Offshore The Central Graben	Dry well
Xana-1X 5604/26-07	Exploration	9/95	Mærsk Olie og Gas A/S	08-12-2014 25-05-2015	Offshore The Central Graben	Hydrocarbons in Upper Jurassic sandstone
Lille John-2 5504/20-06	Appraisal	12/06	Dana Petroleum B.V.	13-12-2014 13-02-2015	Offshore The Central Graben	Oil in Miocene sandstone
Vendsyssel-1 5710/22-02	Exploration	1/10	TOTAL E&P Denmark B.V.	04-05-2015 02-09-2015	Onshore Nordjylland	Gas in Alum Shale
Jude-1 5504/07-18	Appraisal	8/06 area B	Mærsk Olie og Gas A/S	02-06-2015 21-08-2015	Offshore The Central Graben	Oil in Lower Cretaceous

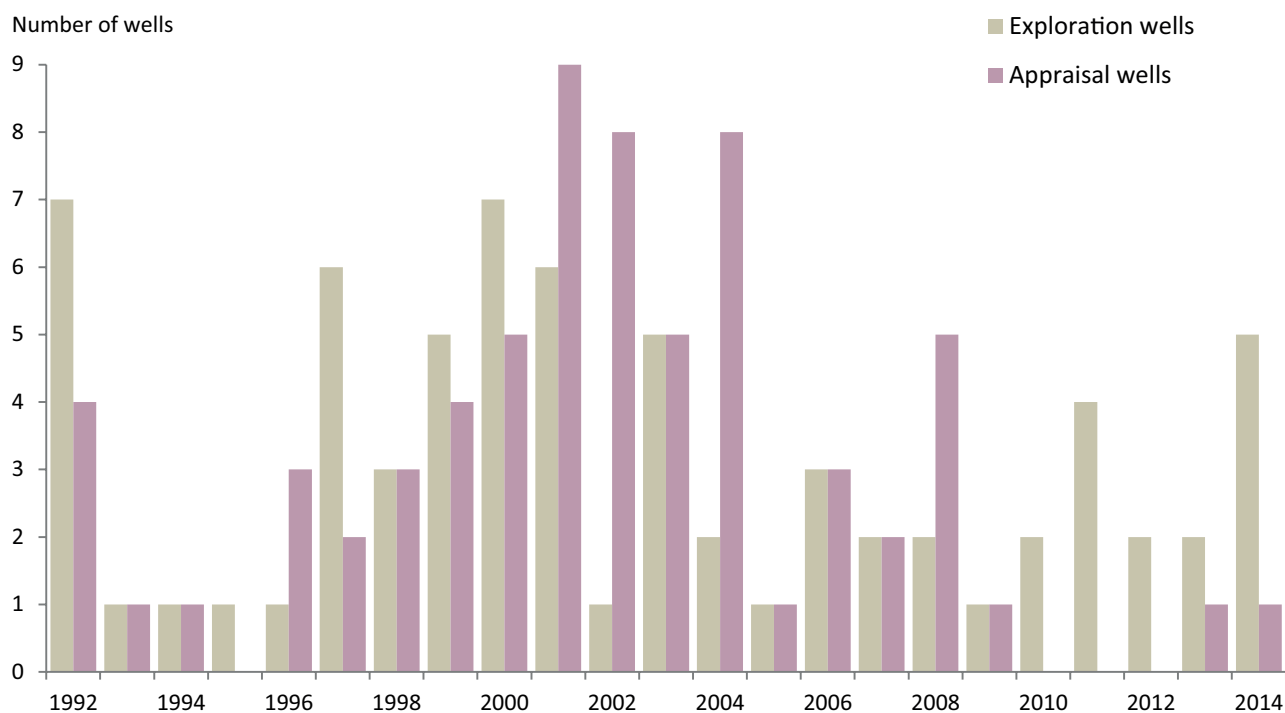
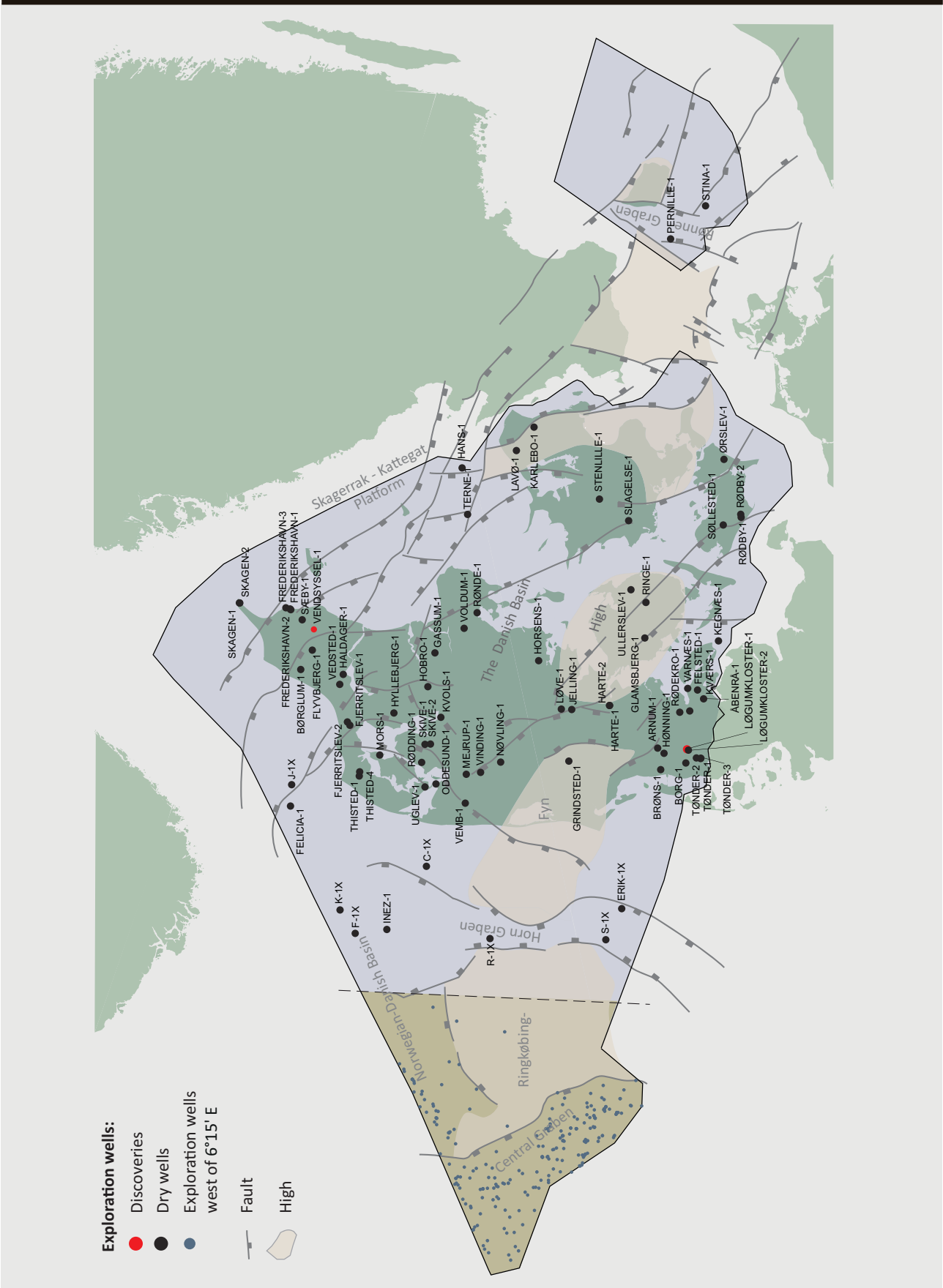


Figure 1.2. Exploration and appraisal wells drilled from 1992 til 2014.

Figure 1.3. Exploration and appraisal wells in 2014/15, 1 August 2015.



EXPLORATION WELLS AND DISCOVERIES - OPEN DOOR AREA











## 2. PRODUCTION



---

## PRODUCTION

Oil production in 2014 totalled 9.6 million m<sup>3</sup>, a 6 per cent decline compared to 2013. From 2013 to 2014 the production of sales gas fell by 4 per cent to 3.8 billion Nm<sup>3</sup>.

Sales gas were forecast to total 4.5 billion Nm<sup>3</sup> in 2014, but several unplanned shutdowns in the Tyra Field and other factors had a negative impact on production, especially gas production. Danish oil production in 2014 largely met expectations for the year, only falling 3 per cent below the forecast.

The steep decline in production since 2006 seems to have been halted in 2014. Activities in 2014 focused on preventive maintenance and well maintenance, at the same time as work proceeded on extending the South Arne Field with a northern platform and new wells.

The Siri Field was closed during the first half of 2014. A crack identified in the tank console under the Siri platform in July 2013 led to a temporary shutdown of the Siri, Nini and Cecilie Fields in the second half of 2013. Production from the Nini and Cecilie Fields was resumed in January 2014, with the production being loaded directly into tankers. In the summer of 2014, the damage was repaired and a planned reinforcement of the platform carried out. Production from all three fields was back to normal by the autumn of 2014.

The northern part of the South Arne Field was further developed in 2014. Consequently, production from the field rose steadily throughout 2014 in step with new wells coming on stream. The drilling of new wells from the northern platform, connected by a bridge to the southern platform, has continued into 2015.

The DUC has carried on production in the North Sea since 1972 under the Sole Concession, and many of their installations are now of a mature age. For the purpose of carrying out extensive maintenance work and replacing equipment, the operator, Mærsk Olie og Gas A/S, has performed planned shutdowns on selected fields during the summer for a number of years. Thus, they closed down production for almost two weeks in June 2014 in order to replace flare stacks and a bridge on the Tyra platforms, among other equipment. In addition, the new unmanned platform at Tyra Southeast, TSB, was installed. This platform can receive production from up to 16 new wells and is connected by a bridge to the existing unmanned platform at Tyra Southeast, TSA.

An outline of all 19 producing fields, including annual production figures, is available at the DEA's website. These production statistics date back to 1972, when Danish production started from the Dan Field.

PRODUCTION FACILITIES IN THE NORTH SEA

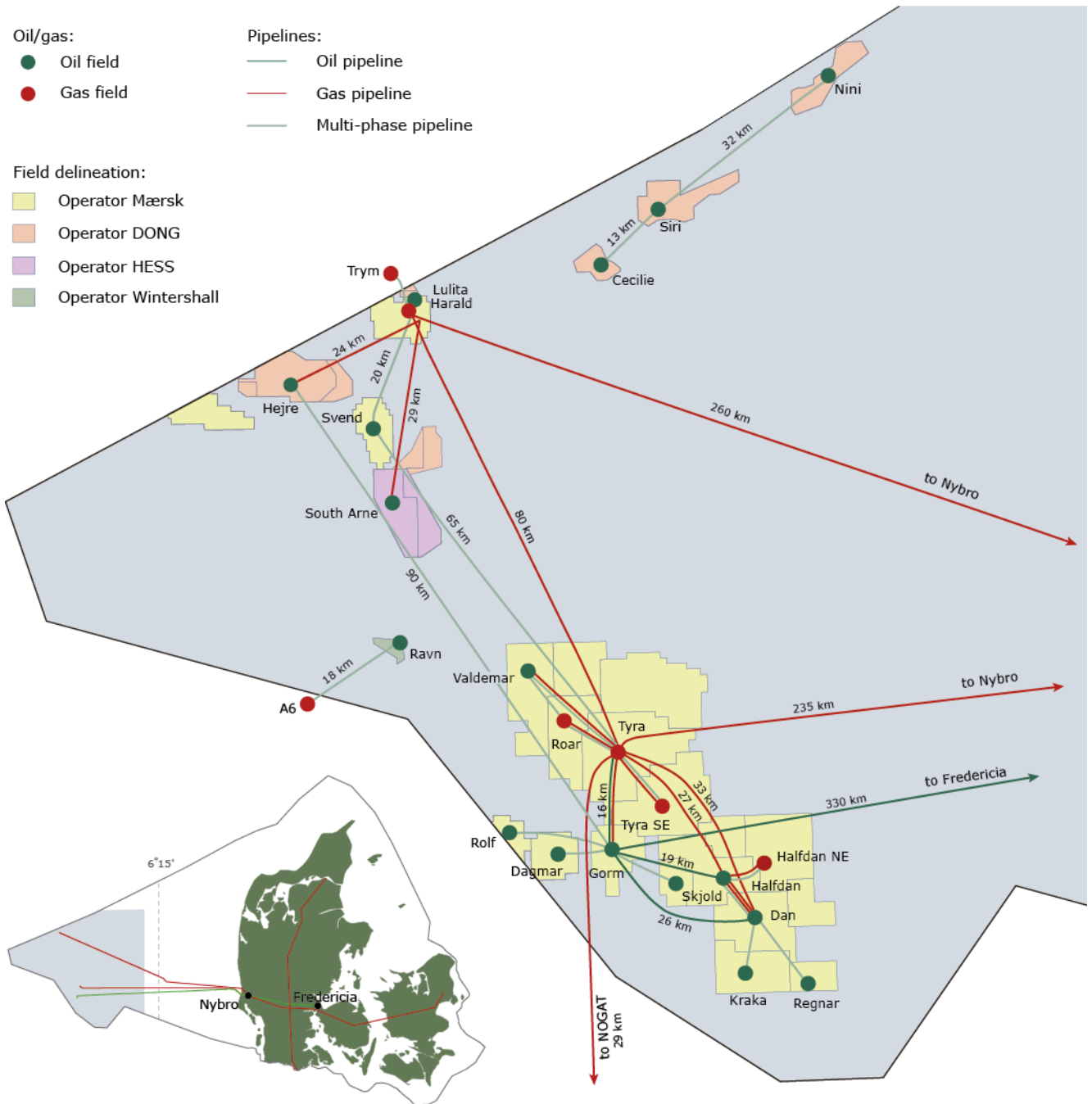


Figure 2.1. Location of production facilities in the North Sea 2014

All producing fields in Denmark are located in the North Sea and appear from this figure, which also shows the key pipelines. In total there are 19 producing fields, and three operators are responsible for production from these fields: DONG E&P A/S, Hess Denmark ApS and Mærsk Olie og Gas A/S. The fields Hejre and Ravn are under development.



## PRODUCTION IN 2014

Oil production in 2014 totalled 9.6 million m<sup>3</sup>, corresponding to 165,000 barrels per day, a 6 per cent decline compared to 2013. The production of natural gas totalled 4.5 billion Nm<sup>3</sup> in 2014, of which 3.8 billion Nm<sup>3</sup> of gas was exported ashore as sales gas, a 4 per cent decline compared to 2013.

As expected, production from the Danish part of the North Sea is in general continuing the declining trend that started in 2004. The main reason for this trend is that the majority of fields have already produced the bulk of the anticipated recoverable oil.

In addition, these ageing fields require more maintenance as regards wells, pipelines and platforms. This maintenance work often causes a loss or delay in production, as the wells and possibly even the entire platform must be shut down while the work is carried out.

The development of existing and new fields may help counter the declining production. In addition, the implementation of both known and new technology may help optimize and increase production from existing fields.

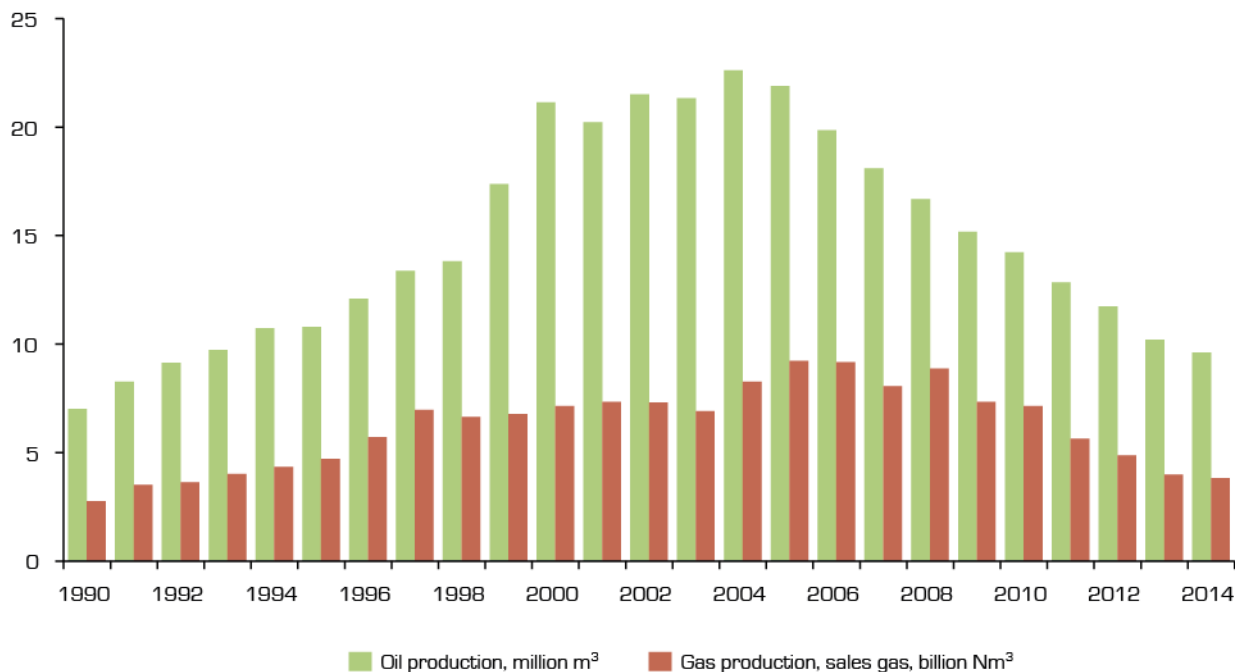


Figure 2.2. Production of oil and gas 1990-2014

## BREAKDOWN OF OIL PRODUCTION BY COMPANY IN 2014

A total of 11 companies participated in production from Danish fields in 2014. DUC is the largest producer, accounting for 85 per cent of oil production and 95 per cent of gas exports. DUC's share of production has fallen compared to

previous years, which is due to declining production in DUC's fields and increasing production from the South Arne Field as a result of its further development.

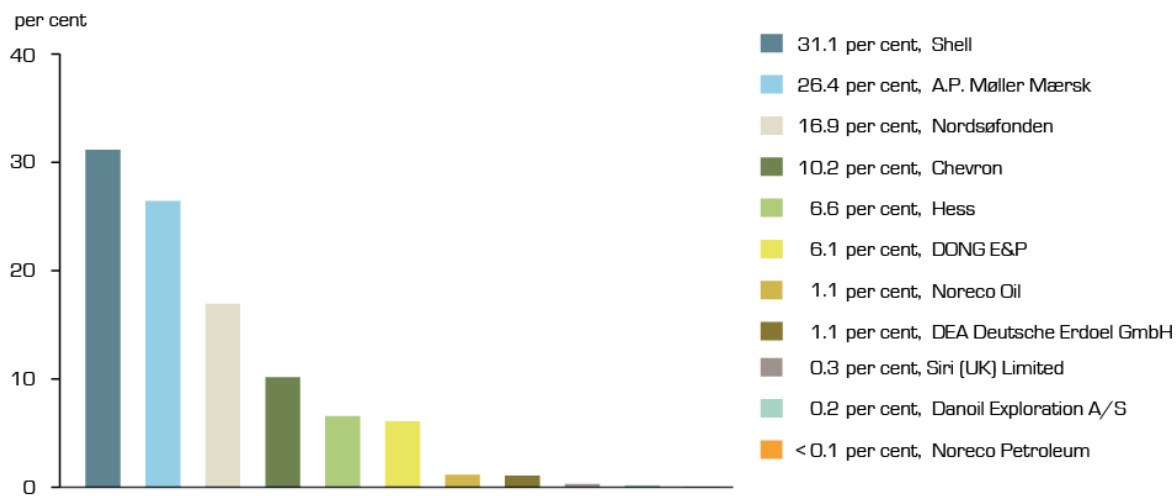


Figure 2.3. Breakdown of oil production by company in 2014

### USE OF PRODUCTION

The production of natural gas totalled 4.5 billion Nm<sup>3</sup> in 2014. 3.8 Nm<sup>3</sup> of gas was exported ashore as sales gas i.e. 84 per cent of the total gas production. The remainder of the gas produced was either reinjected into selected fields to improve recovery or used as fuel on the platforms. A small volume of unutilized gas is flared for technical and safety reasons.

13 per cent of the gas produced was used as fuel in 2014. Flaring accounted for 2 per cent of gas production, while 1 per cent was reinjected into the Siri Field because gas cannot be exported from this field. The general increase in fuel consumption until 2007 is attributable to rising oil and gas production and ageing fields. The reason for the sharp drop from 2008 is falling production combined with energy efficiency measures taken by the operators.

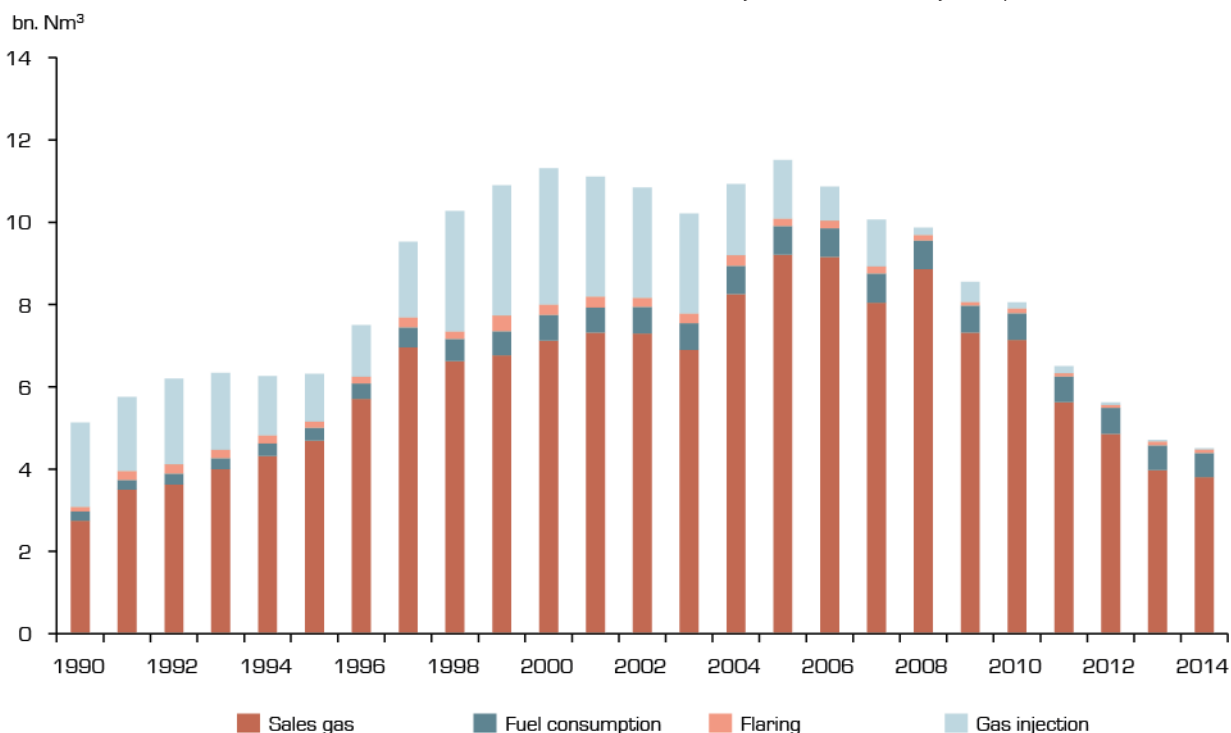


Figure 2.4. Use of gas production in the period 1990-2014

TABLE 2.1. OIL PRODUCTION

Thousand cubic metres

	1972-2006	2007	2008	2009	2010	2011	2012	2013	2014	TOTAL
DAN	86,349	4,650	4,241	3,549	2,979	2,474	2,260	2,045	1,794	110,341
GORM	54,400	1,639	1,053	924	923	713	593	543	425	61,213
SKJOLD	39,556	1,015	989	918	835	778	679	605	587	45,962
TYRA	23,450	764	551	415	856	744	626	521	501	28,430
ROLF	4,109	103	78	76	60	1	0	0	0	4,427
KRAKA	4,602	176	112	37	67	170	129	101	89	5,483
DAGMAR	1,005	0	0	0	0	0	0	0	0	1,005
REGNAR	930	0	0	0	0	0	0	0	0	930
VALDEMAR	3,454	881	1,268	1,410	909	817	844	777	762	11,122
ROAR	2,474	35	28	30	24	16	2	4	6	2,619
SVEND	6,002	299	278	195	190	145	171	183	160	7,623
HARALD	7,493	139	114	65	70	95	79	25	21	8,101
LULITA	778	55	47	24	36	36	32	17	26	1,050
HALFDAN	29,608	5,785	5,326	5,465	5,119	4,905	4,617	4,150	3,674	68,650
SIRI	9,875	508	598	326	286	161	238	131	94	12,217
SOUTH ARNE	16,539	1,245	1,139	1,164	1,066	1,004	803	700	1,023	24,683
TYRA SE	2,475	377	429	374	225	165	148	98	91	4,382
CECILIE	774	88	66	38	33	39	33	17	10	1,098
NINI	2,869	323	355	159	544	569	475	268	336	5,899
<b>TOTAL</b>	<b>296,744</b>	<b>18,084</b>	<b>16,672</b>	<b>15,169</b>	<b>14,223</b>	<b>12,834</b>	<b>11,727</b>	<b>10,185</b>	<b>9,599</b>	<b>405,237</b>



TABLE 2.2. GAS PRODUCTION

*Million normal cubic metres*

	1972-2006	2007	2008	2009	2010	2011	2012	2013	2014	TOTAL
DAN	21,075	456	467	364	360	327	330	416	408	24,204
GORM	15,056	175	119	109	99	67	52	60	36	15,772
SKJOLD	3,274	69	60	58	87	69	62	70	68	3,816
TYRA	77,552	3,916	3,130	2,007	1,664	1,320	1,404	1,618	1,474	94,085
ROLF	172	4	3	3	3	0	0	0	0	186
KRAKA	1,320	28	36	8	12	46	35	20	18	1,523
DAGMAR	158	0	0	0	0	0	0	0	0	158
REGNAR	63	0	0	0	0	0	0	0	0	63
VALDEMAR	1,453	355	593	510	791	579	515	368	343	5,507
ROAR	13,322	367	417	398	213	171	24	28	46	14,986
SVEND	712	28	24	16	27	24	27	20	16	893
HARALD	18,827	781	690	400	592	573	541	174	274	22,853
LULITA	503	33	30	15	18	20	19	11	18	668
HALFDAN	9,617	2,675	3,104	3,401	2,886	2,343	1,709	1,389	1,309	28,432
SIRI	1,011	47	63	44	67	48	48	35	13	1,376
SOUTH ARNE	4,191	234	225	271	248	238	194	167	238	6,007
TYRA SE	4,577	848	889	939	911	626	610	306	201	9,908
CECILIE	57	6	4	2	2	3	3	1	6	83
NINI	212	24	26	12	76	57	40	22	35	504
<b>TOTAL</b>	<b>173,154</b>	<b>10,046</b>	<b>9,879</b>	<b>8,559</b>	<b>8,057</b>	<b>6,511</b>	<b>5,613</b>	<b>4,704</b>	<b>4,502</b>	<b>231,024</b>

TABLE 2.3. GAS, EXPORT OF SALES GAS PRODUCED IN DENMARK

Million normal cubic metres

	1972-2006	2007	2008	2009	2010	2011	2012	2013	2014	TOTAL
TYRA EAST	105,817	5,720	6,666	5,551	6,228	4,807	3,739	2,808	3,164	144,500
SOUTH ARNE	3,656	168	167	212	199	180	130	108	182	5,002
TYRA WEST	5,164	2,161	2,032	1,560	715	648	994	1,066	467	14,806
<b>TOTAL</b>	<b>114,637</b>	<b>8,049</b>	<b>8,865</b>	<b>7,324</b>	<b>7,142</b>	<b>5,635</b>	<b>4,863</b>	<b>3,981</b>	<b>3,813</b>	<b>164,308</b>

TABLE 2.4. GAS, FUEL \*

Million normal cubic metres

	1972-2006	2007	2008	2009	2010	2011	2012	2013	2014	TOTAL
DAN	2,403	222	225	207	206	179	167	178	175	3,963
GORM	2,529	132	117	116	111	107	107	105	93	3,416
TYRA	3,574	228	233	219	208	188	171	150	149	5,120
DAGMAR	21	0	0	0	0	0	0	0	0	21
HARALD	95	7	7	4	8	16	17	12	15	181
SIRI	157	25	25	19	27	28	26	16	17	338
SOUTH ARNE	313	58	53	54	55	41	64	60	55	754
HALFDAN	98	39	38	39	36	62	76	77	76	540
<b>TOTAL</b>	<b>9,190</b>	<b>711</b>	<b>699</b>	<b>658</b>	<b>651</b>	<b>620</b>	<b>628</b>	<b>597</b>	<b>580</b>	<b>14,334</b>

TABLE 2.5. GAS, FLARING\*

Million normal cubic metres

	1972-2006	2007	2008	2009	2010	2011	2012	2013	2014	TOTAL
DAN	1,995	29	25	17	12	13	13	14	15	2,132
GORM	1,709	48	41	19	12	14	15	18	22	1,898
TYRA	1,092	56	44	32	23	28	25	41	30	1,371
DAGMAR	135	0	0	0	0	0	0	0	0	135
HARALD	135	2	2	2	3	3	2	11	2	161
SIRI	215	7	7	4	58	6	4	3	4	307
SOUTH ARNE	223	11	7	7	6	11	5	3	5	278
HALFDAN	64	17	8	4	5	6	6	7	8	124
<b>TOTAL</b>	<b>5,567</b>	<b>169</b>	<b>132</b>	<b>85</b>	<b>119</b>	<b>81</b>	<b>71</b>	<b>97</b>	<b>85</b>	<b>6,406</b>

TABLE 2.6. GAS, INJECTION

Million normal cubic metres

	1972-2006	2007	2008	2009	2010	2011	2012	2013	2014	TOTAL
GORM	8,164	0	0	0	0	0	0	0	0	8,164
TYRA	34,667	1,094	119	451	89	94	0	0	0	36,514
SIRI	910	45	61	35	57	74	62	41	21	1,306
CECILIE	0	0	0	0	0	0	0	0	14	14
NINI	0	0	0	0	0	0	0	0	1	1
<b>TOTAL</b>	<b>43,741</b>	<b>1,139</b>	<b>180</b>	<b>486</b>	<b>146</b>	<b>168</b>	<b>62</b>	<b>41</b>	<b>36</b>	<b>45,999</b>

\* Including Trym



## WATER PRODUCTION AND WATER INJECTION

Water is produced as a by-product in connection with the production of oil and gas. The water can originate from natural water zones in the subsoil and from the water injection that is carried out in order to enhance oil production.

The content of water relative to the total liquids produced in the Danish part of the North Sea is increasing and reached 77 per cent in 2014. Energy is required to handle these large volumes of produced water, which is up to 90 per cent of the production for some of the old fields. In 2014 water

production totalled 32.5 million Nm<sup>3</sup>, a decline of 2 per cent compared to 2013. Water injection in 2014 increased by 3 per cent relative to 2013.

Since 2008 water production has declined mainly due to falling oil and gas production. The water content of total liquid production is increasing for most fields. The operators are attempting to reduce the water production by closing off production from zones in the wells with high water production.

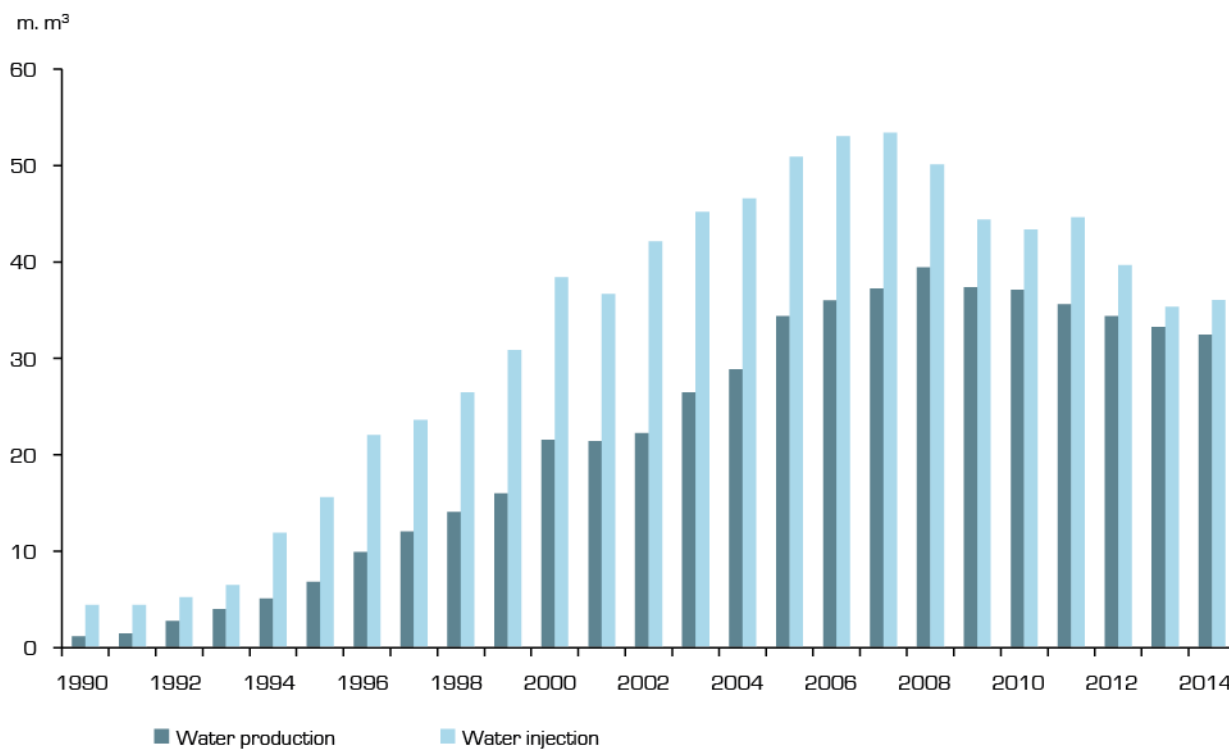


Figure 2.5. Water production and water injection 1990-2014

TABLE 2.7. WATER, PRODUCTION

Thousand cubic metres

	1972-2006	2007	2008	2009	2010	2011	2012	2013	2014	TOTAL
DAN	69,190	12,152	13,946	12,889	12,111	11,059	10,468	11,207	11,494	164,515
GORM	49,815	4,708	3,976	4,737	4,904	4,654	3,897	3,658	2,833	83,183
SKJOLD	43,517	3,885	3,636	3,855	3,895	3,861	3,978	4,023	3,865	74,517
TYRA	34,818	2,725	3,103	2,677	1,980	1,811	1,516	2,063	1,678	52,370
ROLF	5,460	383	349	381	281	8	0	0	0	6,861
KRAKA	4,209	359	436	183	166	358	237	170	214	6,332
DAGMAR	3,914	0	13	0	0	0	0	0	0	3,927
REGNAR	4,063	1	0	0	0	0	0	0	0	4,064
VALDEMAR	3,079	854	925	812	1,207	1,026	893	916	873	10,583
ROAR	3,748	560	586	624	275	200	34	59	98	6,184
SVEND	9,156	1,200	1,022	804	664	585	685	712	650	15,479
HARALD	318	18	21	11	37	113	152	47	20	737
LULITA	215	96	91	49	65	73	86	48	76	798
HALFDAN	10,149	4,086	4,766	4,814	5,519	6,149	6,139	6,099	6,574	54,295
SIRI	16,227	2,528	2,686	1,778	2,868	2,593	2,879	1,481	943	33,983
SOUTH ARNE	6,160	1,861	2,174	2,285	2,068	1,883	2,317	2,198	2,369	23,314
TYRA SE	2,126	669	602	716	568	485	440	235	286	6,127
CECILIE	1,643	576	456	266	317	452	390	179	138	4,417
NINI	1,615	619	660	522	195	330	297	166	376	4,781
<b>TOTAL</b>	<b>269,421</b>	<b>37,280</b>	<b>39,448</b>	<b>37,402</b>	<b>37,121</b>	<b>35,640</b>	<b>34,408</b>	<b>33,260</b>	<b>32,487</b>	<b>556,466</b>

TABLE 2.8. WATER, INJECTION

Thousand cubic metres

	1972-2006	2007	2008	2009	2010	2011	2012	2013	2014	TOTAL
DAN	187,878	20,230	19,275	16,712	15,148	14,508	11,684	10,148	11,568	307,153
GORM	104,003	6,678	5,251	4,777	4,408	5,459	3,709	3,549	2,735	140,569
SKJOLD	91,093	6,098	4,989	5,285	4,155	4,374	5,093	4,956	4,624	130,669
HALFDAN	34,905	12,107	12,727	11,485	11,945	12,277	10,912	10,921	11,403	128,683
SIRI	22,420	3,499	2,695	1,692	2,692	3,201	3,020	1,592	1,788	42,598
SOUTH ARNE	27,697	4,296	4,279	3,872	3,427	3,240	4,104	3,660	3,368	57,944
NINI	2,412	413	883	501	1,558	1,365	1,151	549	575	9,407
CECILIE	322	91	42	97	47	221	35	0	0	854
<b>TOTAL</b>	<b>470,731</b>	<b>53,412</b>	<b>50,141</b>	<b>44,420</b>	<b>43,379</b>	<b>44,646</b>	<b>39,709</b>	<b>35,376</b>	<b>36,062</b>	<b>817,877</b>



## EMISSIONS TO THE ATMOSPHERE

Emissions to the atmosphere consist of such gases as CO<sub>2</sub>, carbon dioxide, and NO<sub>x</sub>, nitrogen oxide.

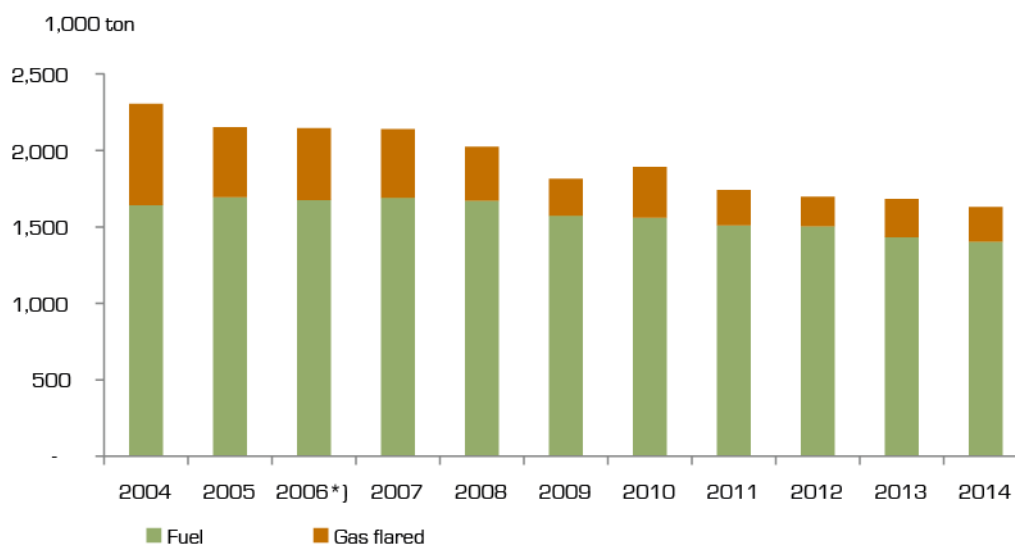
The combustion of natural gas and diesel oil and gas flaring produce CO<sub>2</sub> emissions to the atmosphere. Producing and transporting oil and gas require substantial amounts of energy. Furthermore, a certain volume of gas has to be flared for safety or plant-related reasons.

Gas is flared on all offshore platforms with production facilities, and for safety reasons gas flaring is necessary in cases where installations must be emptied of gas quickly. The Danish Subsoil Act regulates the volumes of gas flared, while CO<sub>2</sub> emissions (including from flaring) are regulated by the Danish Act on CO<sub>2</sub> Allowances.

The volume emitted by the individual installation or field depends on the scale of production as well as plant-related and natural conditions.

Energy consumption per produced ton oil equivalent (t.o.e.) increases the longer a field has carried on production. This is because the water content of production increases over the life of a field. Assuming unchanged production conditions, the rising water content results in an increased need for injecting lift gas, and possibly water, to maintain pressure in the reservoir. Both processes are energy-intensive.

CO<sub>2</sub> emissions from the production facilities in the North Sea totalled about 1.630 million tons in 2014, thus confirming the falling emissions trend over the past decade.



\*) As from 2006, the figures have been based on verified CO<sub>2</sub> emission data from reports filed under the Act on CO<sub>2</sub> Allowances and have included CO<sub>2</sub> emission from diesel combustion on the production facilities.

Figure 2.6. CO<sub>2</sub> emissions from production facilities in the North Sea



Gas flaring totalled 85 million Nm<sup>3</sup> in 2014, a 13 per cent decrease on 2013. The volume of gas flared depends in part on the design and layout of the individual installation, but not on the volumes of gas or oil produced.

Generally, the flaring of gas has declined substantially in the past ten years due to more stable operating conditions on the installations, changes in operations and focus on energy

efficiency, such as the use of flare gas recovery systems at South Arne and Siri. However, flaring may vary considerably from one year to another, frequently because of the tie-in of new fields and the commissioning of new facilities. Moreover, when platforms are shut down temporarily, the pressure must be vented and the gas evacuated from the inter-field pipelines must be flared.

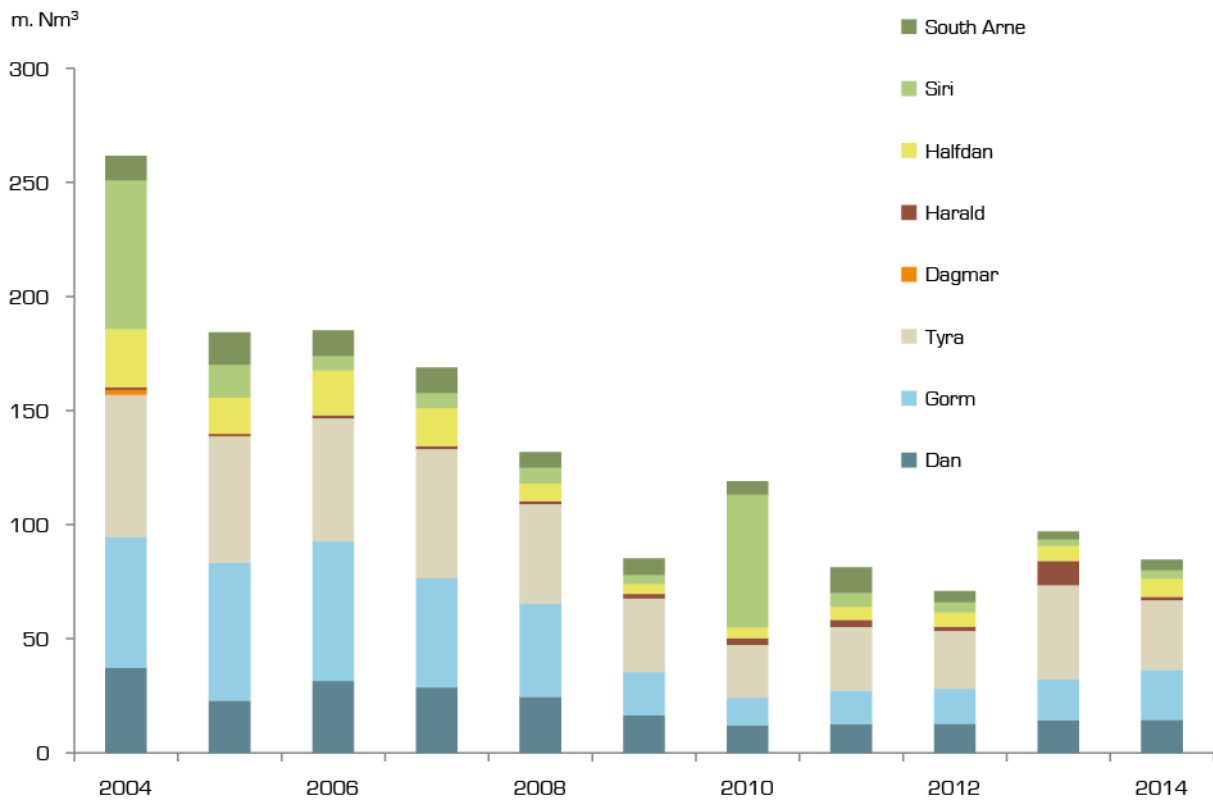
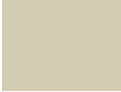


Figure 2.7. Gas flaring



## 3. RESOURCES AND FORECASTS



### **RESOURCES AND FORECASTS**

The DEA uses a classification system for hydrocarbons to assess Denmark's oil and gas resources. The aim of the classification system is to determine resources in a systematic way. A description of the classification system is available at the DEA's website, [www.ens.dk](http://www.ens.dk). Based on the assessment of resources, the DEA prepares short- and long-term oil and gas production forecasts.

In spring every other year, the DEA prepares an assessment of Danish oil and gas resources and a long-term production forecast. In the alternate years, the DEA prepares a short-term production forecast, the so-called five-year forecast, in spring.

### **RESOURCES**

The DEA's most recent assessment of Danish oil and gas resources forms part of the report "Denmark's Oil and Gas Production – and Subsoil Use 2013", which is available at the DEA's website.

### **FORECASTS**

In spring 2015, the DEA prepared a short-term forecast of oil and gas production, the five-year forecast.

As no long-term forecast has been prepared in 2015, the production forecast from spring 2015 thus consists of the long-term forecast from spring 2014 and the five-year forecast from spring 2015.

The above-mentioned report included an oil and gas consumption forecast, which has subsequently been revised. The most recent consumption forecast derives from "The DEA's baseline scenario, 2014". The DEA uses this consumption forecast together with its oil and gas production forecasts to determine whether Denmark is a net importer or exporter of oil and gas.





---

## SHORT-TERM FORECAST, FIVE-YEAR FORECAST

The DEA prepares annual five-year forecasts of oil and gas production to be used by the Danish Ministry of Finance for its forecasts of state revenue.

	2015	2016	2017	2018	2019
<b>OIL, m. m<sup>3</sup></b>	9.6	9.5	9.6	8.9	8.7
<b>SALES GAS, bn. Nm<sup>3</sup></b>	4.1	3.6	3.7	3.7	4.0

**Table 3.1.** Expected production profile for oil and sales gas.

### Oil

For 2015 the DEA expects oil production to total 9.6 million m<sup>3</sup>, equal to about 165,000 barrels of oil per day; see table 1. Compared to last year's estimate for 2015, this constitutes an upward revision of 1 per cent, mainly attributable to the higher production figure expected by the DEA for the Dan Field.

The DEA anticipates almost constant production in the first half of the forecast period, due mainly to production from the Hejre Field, which is currently under development. In the second half of the forecast period, the DEA expects oil production to decline.

Compared to last year's forecast, the DEA has revised the oil production estimate downwards for the period from 2015 to 2019 by an average of 3 per cent, mainly as a result of the postponed commissioning date for the Hejre Field.

### Sales gas

The DEA expects the production of sales gas to total 4.1 billion Nm<sup>3</sup> in 2015, equal to about 74,000 barrels of oil equivalent per day; see table 1. This is an increase of 8 per cent relative to 2014, when production totalled 3.8 billion Nm<sup>3</sup>. Compared to the estimate for 2015 made by the DEA last year, this is an upward revision of about 3 per cent based mainly on the DEA's expectation of higher gas production in the Halfdan Field.

During the forecast period until 2019, the DEA expects a general production level of about 3.8 billion Nm<sup>3</sup>. The production level is expected to stabilize after 2016, in part due to production from the Hejre Field.

Compared to last year's forecast, the production of sales gas is estimated to remain almost unchanged for the period from 2015 to 2019.

---

## LONG-TERM FORECAST

The long-term forecast is divided into three contributions, the expected production profile, technological resources and prospective resources.

**The expected production profile** is a forecast of production from existing fields and discoveries based on existing technology.

**Technological resources** are an estimate of the volumes recoverable by means of new technology. The DEA's estimate of technological oil resources is based on an increase of the average recovery factor for Danish fields and discoveries of 5 percentage points from 26 to 31 per cent.

**Prospective resources** are an estimate of the volumes recoverable from future new discoveries made as a result of ongoing exploration activity and future licensing rounds. The estimate is based on the exploration prospects known today in which exploration drilling is expected to take place. Moreover, the estimate includes assessments of the additional prospects expected to be demonstrated later in the forecast period.

**The consumption forecast** is based on the consumption of oil and gas estimated in "The DEA's baseline scenario, 2014". The consumption according to the 2014 baseline scenario is an estimate based on the assumption that no measures will be taken other than those already decided with a parliamentary majority. Therefore, the baseline scenario is not a forecast of future energy consumption, but a description of the development that could be expected during the period until 2025 based on a number of assumptions regarding technological developments, prices, economic trends, etc., assuming that no new initiatives or measures are taken.

The DEA uses the oil and gas production forecasts together with its consumption forecast to determine whether Denmark is a net importer or exporter of oil and gas. Denmark is a net exporter of energy when energy production exceeds energy consumption, calculated on the basis of energy statistics.

## LONG-TERM FORECAST AND CONSUMPTION FORECAST

The production forecast from spring 2015 consists of the long-term forecast from spring 2014 and the five-year forecast from spring 2015.

Long-term oil and sales gas forecasts are shown together with the consumption forecast based on "The DEA's baseline scenario, 2014"; see figure 1. The 2014 baseline scenario covers the period until 2025. To illustrate whether Denmark will be a net importer or exporter after 2025, consumption for the period from 2026 to 2035 is assumed to be on a par with consumption in 2025.

Denmark is anticipated to be a net exporter of oil for seven years up to and including 2021, based on the expected production profile. If technological and prospective resources are included, Denmark is estimated to remain a net exporter until after 2035. However, it should be noted that around 2025, the amount produced, based on all contributions, is not expected to differ significantly from the amount consumed.

Based on the forecasts published in the report "Denmark's Oil and Gas Production – and Subsoil Use 2013", Denmark was expected to remain a net exporter of oil up to and including 2021, based on the expected production profile. When including technological and prospective resources, Denmark was expected to cease being a net exporter of oil for a period of time around 2025.

As concerns the period from 2020 onwards, only the consumption forecast has been revised relative to the forecasts used in the above-mentioned report. The revision of the consumption forecast means that – based on the expected production profile – in 2022 Denmark will cease being a net exporter of oil by a slim margin. If technological and prospective resources are included, the revised consumption figure will have the major implication that Denmark will remain a net exporter of oil during the entire forecast period.

## PRODUCTION AND POSSIBLE PRODUCTION PROFILES FOR OIL AND SALES GAS

Denmark is anticipated to be a net exporter of sales gas for nine years up to and including 2023, based on the expected production profile. If technological and prospective resources are included, Denmark is estimated to remain a net exporter until after 2035

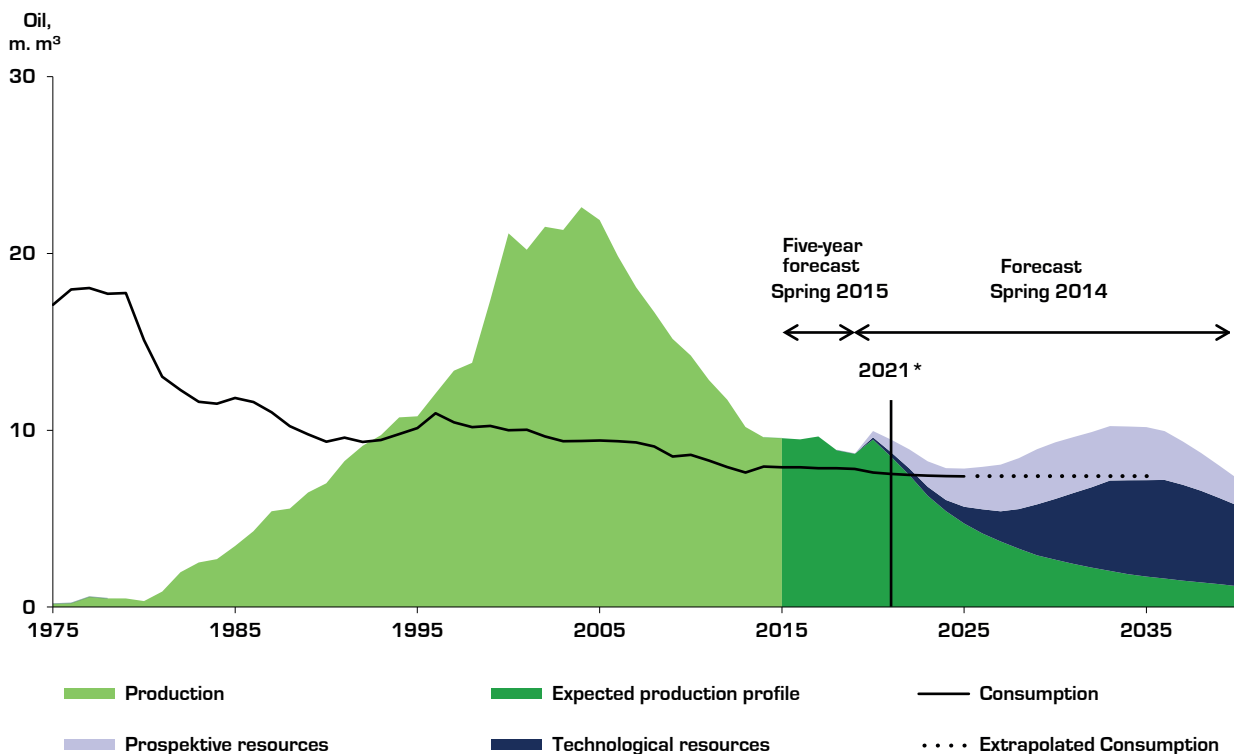


Figure 3.1. Production and long-term oil forecast

\* Based on the expected production profile, in 2022 Denmark will cease being a net exporter of oil by a slim margin.

As is the case for oil, only the consumption forecast for the period from 2020 has been revised relative to the forecasts used in the above-mentioned report. The revision of the consumption forecast means that Denmark will now lose its status as a net exporter of sales gas from 2023, as opposed to 2025, based on the expected production profile. If technological and prospective resources are included, the revised consumption forecast will not result in any significant change to Denmark's status as either a net exporter or importer of sales gas.

The production of sales gas is subject to the condition that sales contracts have been concluded. Such contracts may

either be long-term contracts or spot contracts for very short-term delivery of gas. As opposed to this, oil is most frequently sold as individual tanker loads from the North Sea at the prevailing market price.

The sales gas forecast indicates the quantities that the DEA expects it will be technically feasible to recover. However, the actual production depends on the sales based on existing and future gas sales contracts.

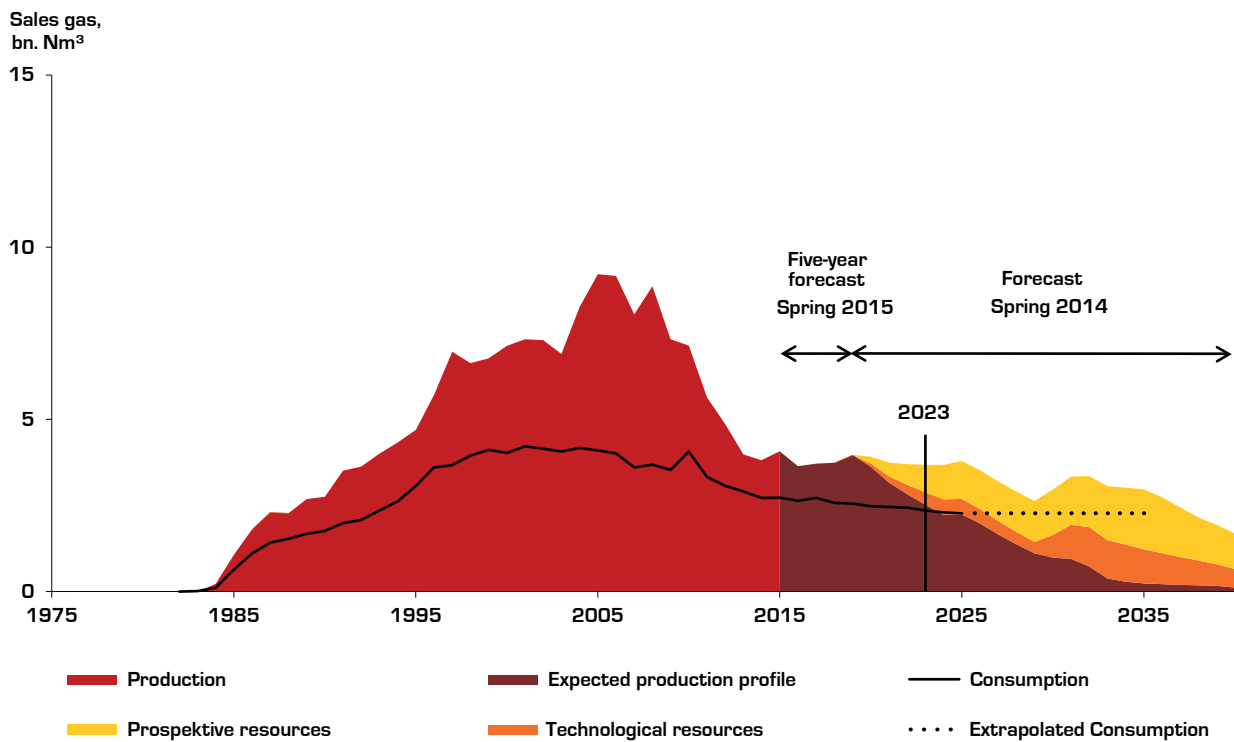
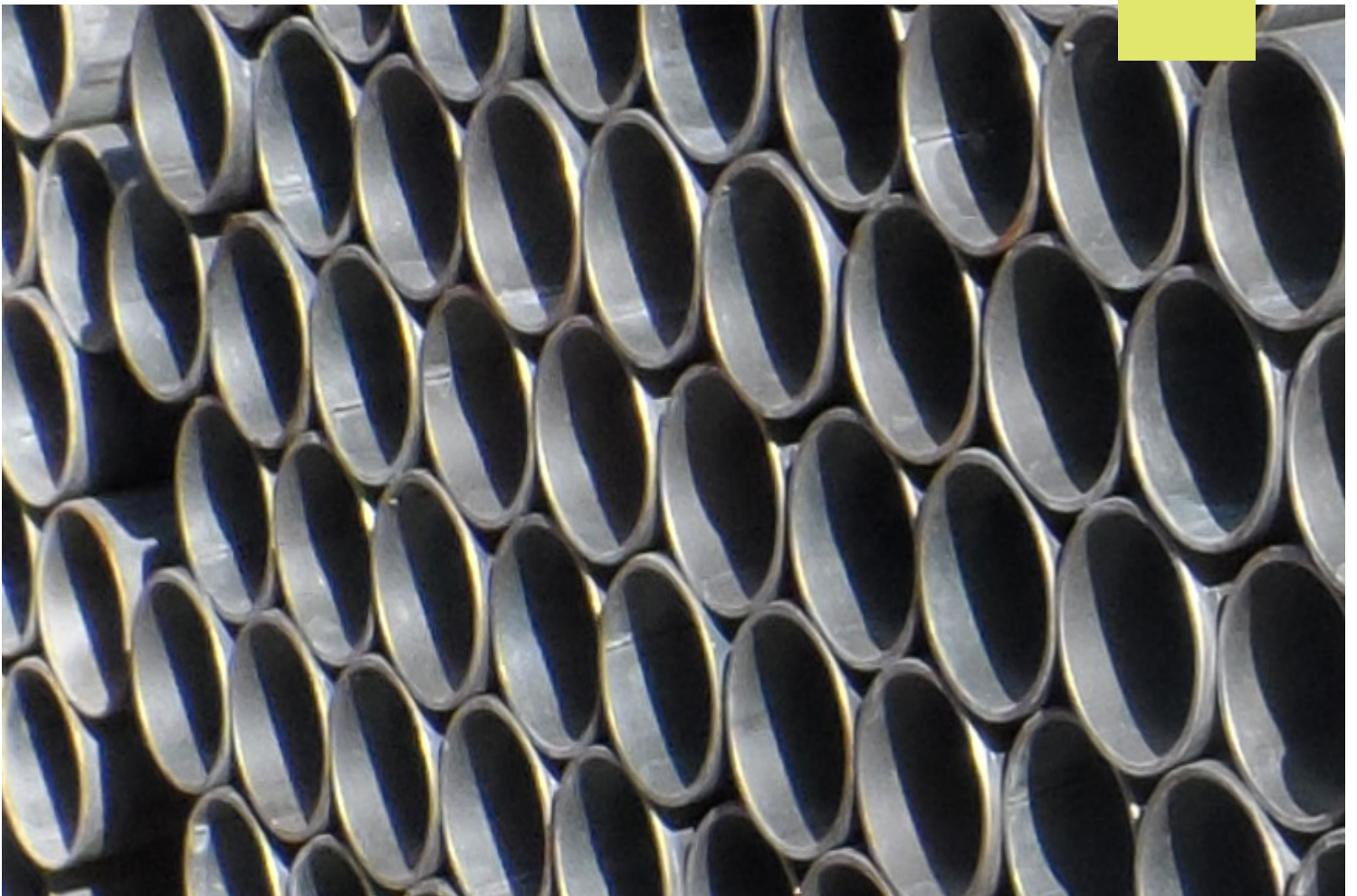


Figure 3.2. Production and long-term sales gas forecast





## 4. ECONOMY



---

For many years, oil and gas production from the North Sea has made a positive contribution to the balance of trade for oil and gas and contributed to Denmark's status as a net exporter of oil and gas. Tax revenue and the profits made by the oil and gas sector have a positive impact on the Danish economy, while the North Sea activities also create workplaces both on- and offshore.

#### **State revenue**

The Danish state generated revenue of DKK 18.8 billion from North Sea oil and gas production in 2014, equal to about 62 per cent of total profits on the activities. State revenue was down by almost 15 per cent on 2013, due to lower production and a plunge in oil prices in the second half of the year. The forecast for 2015 foresees a continued decline in state revenue from oil and gas production because of a sustained drop in production and expectations for a low oil price level. In the period 1963-2014, state revenue from hydrocarbon production in the North Sea aggregated DKK 404 billion in 2014 prices.

#### **Value of oil and gas production**

The cumulative production value was about DKK 1,010 billion during the period under review. The total estimated value of Danish oil and gas production in 2014 is DKK 40.7 billion, a decline of 18 per cent compared to the production value in 2013. According to the estimate, oil production accounts for about DKK 33.6 billion and gas production for DKK 7.1

billion of the total production value. The production value is determined by supply and demand in oil and gas, the dollar exchange rate and the volume of production.

#### **Investments and operating costs**

The licensees' investments and expenses for exploration, field developments and operations totalled about DKK 355 billion (2014 prices) during the period 1963-2014. Investments in field developments amounted to about DKK 187 billion in 2014 prices, thus accounting for more than half the licensees' aggregate costs.

Investments in field developments are estimated to come to almost DKK 8.8 billion for 2014, up about 31 per cent on 2013, which is mainly attributable to the development of the South Arne, Hejre, Valdemar and Tyra Fields. By comparison, annual investments in field developments have averaged about DKK 5.8 billion in the past ten years.

The preliminary figures for 2014 show that exploration costs slightly exceeded DKK 1.3 billion in 2014, an increase of about 4 per cent on 2013. These costs comprise the oil and gas companies' total exploration costs, including for exploration wells and seismic surveys.

According to the forecast, total investments for the period 2015-2019 will come to about DKK 51 billion.

## OIL PRICE DEVELOPMENT 2014

Figure 1 shows that the first half of 2014 was characterized by a relatively stable oil price averaging around USD 109 per barrel. However, increasing oil production and waning global demand are some of the reasons that the price dropped over the year to an average price of just below USD 63 per barrel in December 2014.

This resulted in an average oil price of slightly more than USD 99 per barrel for the whole of 2014, 8.9 per cent down on the average oil price for 2013.

Oil is usually traded in USD on the world market. Therefore, to some extent the impact of the falling oil price on state revenue was offset by the sharp increase in the USD exchange rate in the second half of 2014. In mid-2014 the USD exchange rate stood at about DKK 5.5 per USD, compared to about DKK 6.00 at the end of the year. The exchange rate continued to climb and peaked at almost DKK 7 per USD in April 2015.

The fluctuating oil price and dollar exchange rate caused the average oil price, in terms of Danish kroner, to drop from

DKK 610.2 per barrel in 2013 to DKK 556.7 per barrel in 2014, equal to a decline of almost 8.8 per cent.

Generally, the drop in the oil price is explained by a combination of supply and demand factors. The supply factors most frequently reported are the supply of shale oil, high production levels in the OPEC countries, and – most recently – the prospect that trading sanctions against Iran will be lifted.

As concerns demand, the price drop is explained by lower economic growth worldwide and increasing consumption of energy from renewable resources. In the short term, the supply of oil is fairly resilient to price fluctuations.

Despite lower oil prices, in the short term it pays for producers to carry on production for as long as the crude oil price exceeds the marginal operating costs. Therefore, it may be profitable to produce oil even when oil prices are very low. However, in the longer term, the supply of oil and the oil price will be more greatly impacted by factors such as investments in exploration activities and the exploitation of new accumulations.

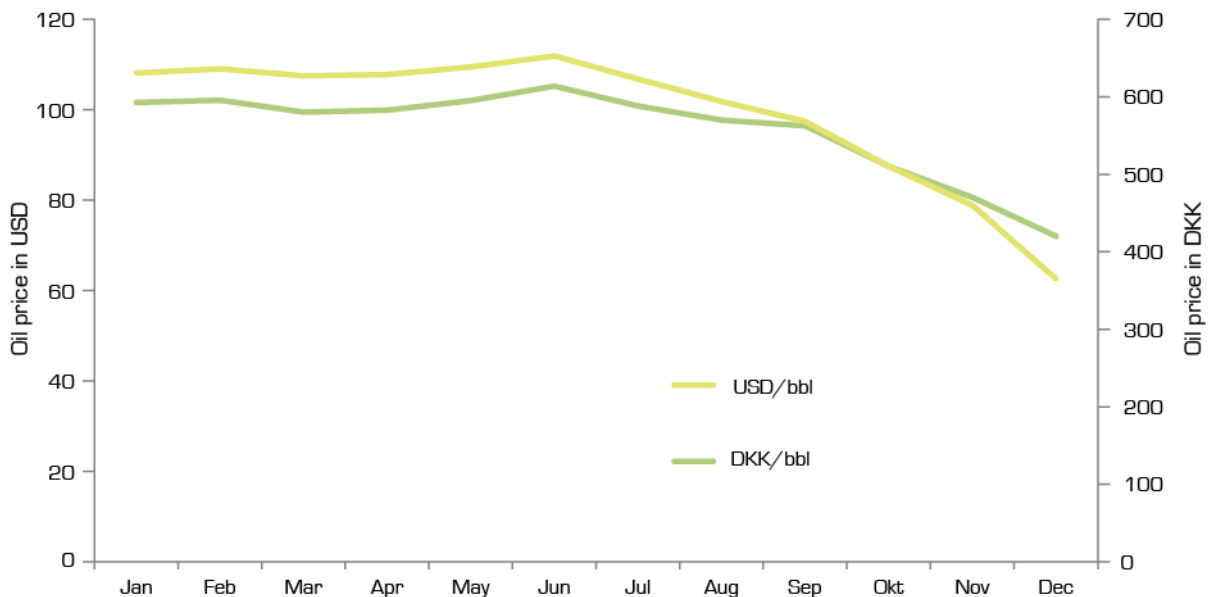


Figure 4.1. Monthly development in the Brent spot oil price in 2014

Note: The oil price for 2014 has been calculated as an average of the monthly Brent spot oil price. The monthly Brent spot oil price is an average of the daily Brent spot price.



## HISTORICAL OIL PRICE DEVELOPMENT

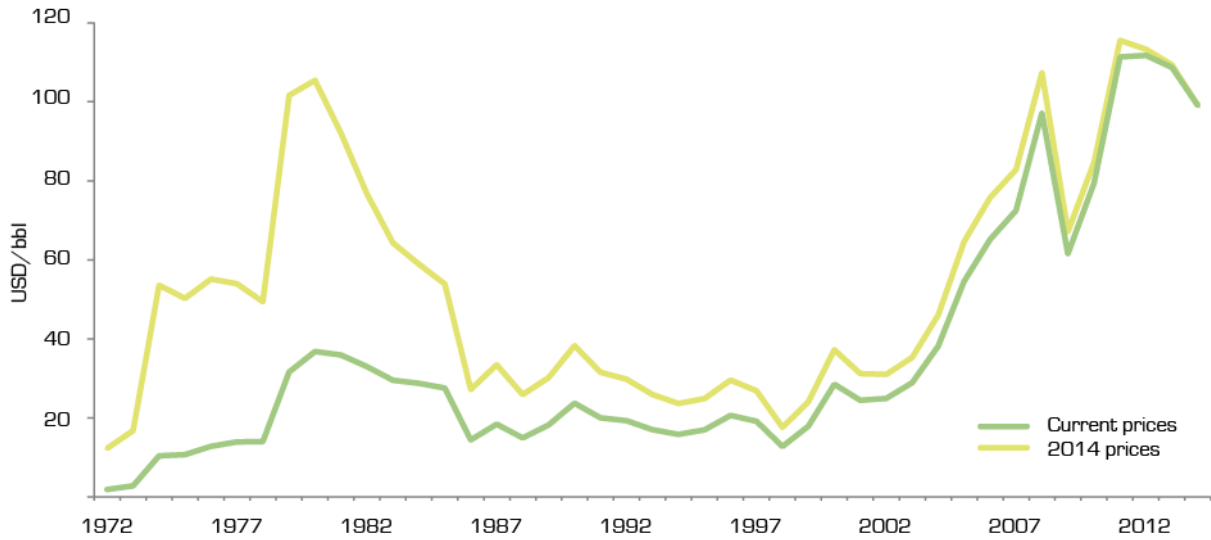


Figure 4.2. Oil price development 1972-2014, USD per barrel

Figure 2 shows oil price developments in USD per barrel in fixed and current prices. The soaring oil prices in 1973 and 1979 were triggered by political unrest in the Middle East. During these crises, the OPEC countries curtailed the supply

of crude oil to the world's markets, thus driving prices up. The figure also shows that the oil price reached a record high in 2011, peaking at about USD 116 per barrel in 2014 prices.

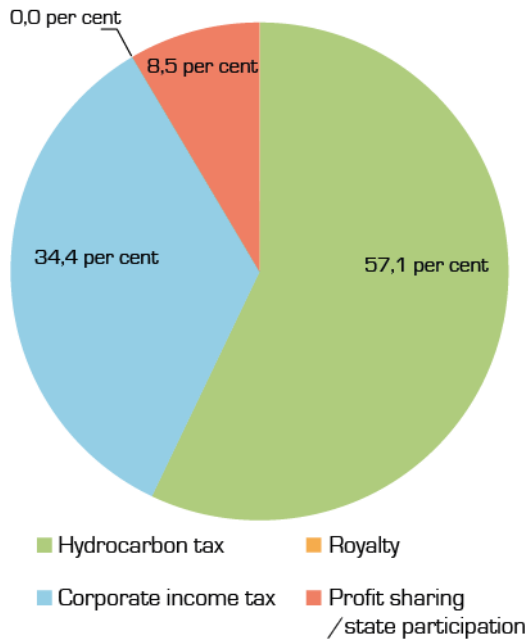


Figure 4.3. Breakdown of state revenue from oil and natural gas production from the North Sea in 2014

## STATE REVENUE

State revenue from the North Sea activities derives from hydrocarbon tax, corporate income tax and royalty, of which hydrocarbon tax and corporate income tax are the main sources of revenue, accounting for 57 and 34 per cent, respectively.

In addition to taxes and fees, the Danish state receives revenue from the North Sea through Nordsøfonden, which has managed the state's 20 per cent share of all new licences since 2005. Since 9 July 2012, Nordsøfonden has also managed the state's 20 per cent share of Dansk Undergrunds Consortium (DUC), whose other partners are A.P. Møller - Mærsk, Shell and Chevron.

In addition, the state may generate indirect revenue from oil and gas production through its shareholding in DONG Energy, as this company's subsidiary, DONG E&P A/S, participates in oil and gas exploration and production in the North Sea.



## EXISTING FINANCIAL CONDITIONS

Table 4.1.

	Sole Concession at 1 January 2004	Licences granted before 1 January 2004	Licences granted after 1 January 2004
Corporate income tax	25 per cent  Deductible from the hydrocarbon tax base	25 per cent  Deductible from the hydrocarbon tax base	25 per cent  Deductible from the hydrocarbon tax base
Hydrocarbon tax	52 per cent  Allowance of 5 per cent over 6 years (a total of 30 per cent) for investments  Transitional rules for investments and unutilized losses from before 1 January 2004	52 per cent  Allowance of 5 per cent over 6 years (a total of 30 per cent) for investments  Transitional rules for investments and unutilized losses from before 1 January 2004	52 per cent  Allowance of 5 per cent over 6 years (a total of 30 per cent) for investments
Royalty	No	No	No
Oil pipeline tariff/ compensatory fee	No	No	No
State participation	20 per cent	20 per cent *)	20 per cent
Profit sharing	No	No	No

\*) The state's share in a few of the remaining licences has increased due to a licence condition regarding increased state participation relative to the volume of production.

## CENTRAL GOVERNMENT (CIL) BALANCE

Figure 4 shows state revenue from the North Sea relative to the central government balance on the current investment and lending account (CIL balance), which is the difference between total central government revenues and expenditures. As appears from the figure, revenue from the Danish part of the North Sea contributed to generating a central government surplus in 2014.

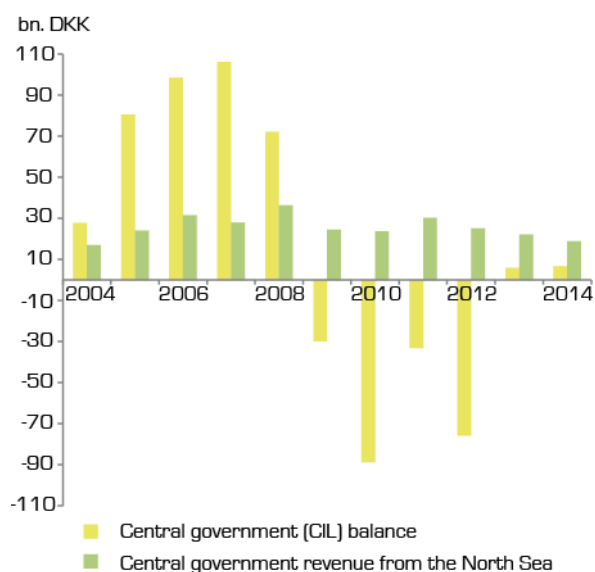


Figure 4.4. Central government (CIL) balance and central government revenue from the North Sea, current prices.

## DEVELOPMENT IN STATE REVENUE

State revenue from hydrocarbon production in the North Sea aggregated close to DKK 404 billion in 2014 prices in the period 1972-2014. In 2014 state revenue fell by slightly

more than 15 per cent relative to 2013, due mainly to the oil price drop and declining production. State revenue is estimated at DKK 18.8 billion for 2014.

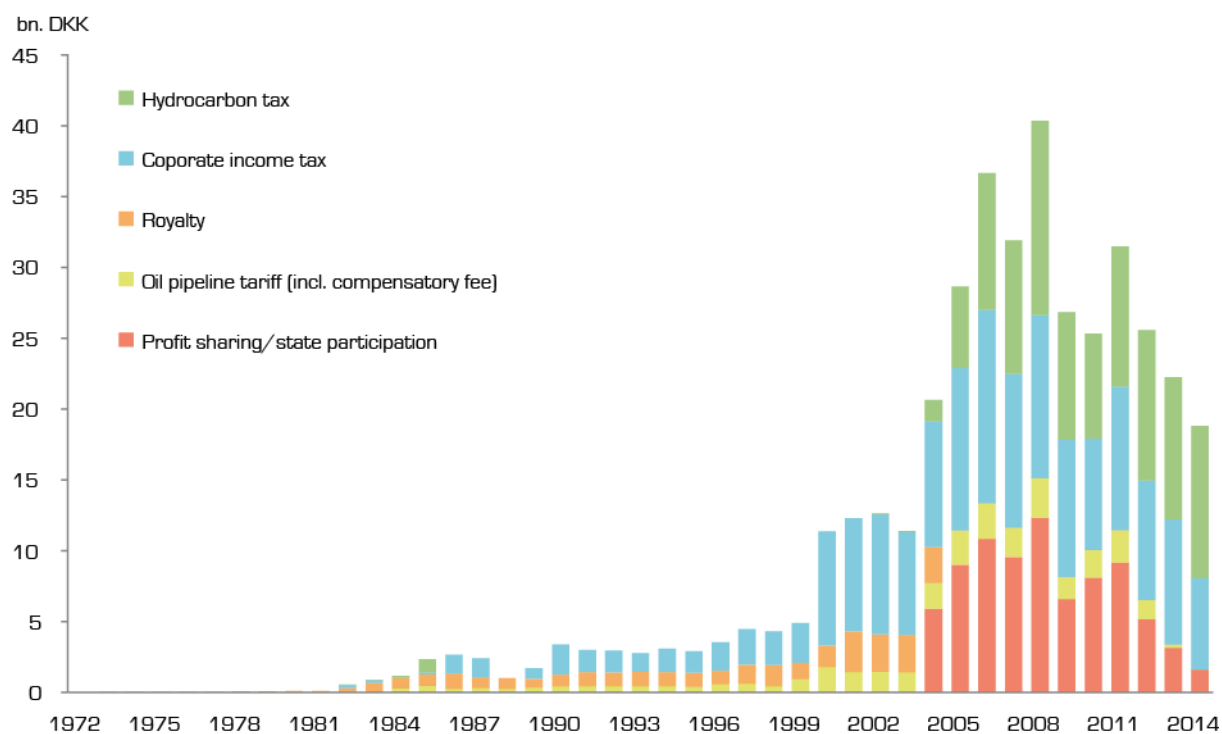


Figure 4.5. Development in total state revenue from oil and gas production 1972-2014

## STATE REVENUE OVER THE PAST FIVE YEARS

The state's share of oil company profits is estimated at 62 per cent for 2014, including state participation. The marginal income tax rate is about 64 per cent according to the new rules, excluding state participation. When including state participation, about 71 per cent of earnings in the top tax bracket accrues to the state according to the new rules.

From 1 January 2014, all companies are taxed according to the new rules. However, transitional rules apply to licences being transferred from the old to the new tax regime, such that the new tax rules are phased in over a period of time.

	2010	2011	2012	2013	2014
<b>HYDROCARBON TAX</b>	6,940	9,521	10,467	9,951	10,734
<b>CORPORATE INCOME TAX</b>	7,377	9,754	8,304	8,782	6,459
<b>ROYALTY</b>	0	1	2	1	1
<b>OIL PIPELINE TARIFF *</b>	1,824	2,201	1,337	239	0
<b>PROFIT SHARING/STATE PARTICIPATION **</b>	7,594	8,819	5,090	3,116	1,600
<b>TOTAL</b>	<b>23,736</b>	<b>30,296</b>	<b>25,200</b>	<b>22,089</b>	<b>18,794</b>

Table 4.2. State revenue over the past five years, DKK million, current prices

\* Incl. 5 per cent compensatory fee.

\*\* The figures from 2009 until mid-2012 relate to profit sharing. The calculation as from 9 July 2012 until 2013 covers state participation (Nordsøfonden's post-tax profits). The figure for 2013 includes an expenditure of DKK 202 million in the form of profit sharing repaid for the years 2004-2006 and DKK 18 million in revenue from post-adjustments of profit sharing for the years 2009-2012.

Note: Accrual according to the Finance Act (year of payment).

## STATE REVENUE FORECAST

Based on oil price fluctuations in 2014 and the DEA's production forecast, an estimate of the development in state revenue from the North Sea over the next five years has been prepared together with the Ministry of Taxation. The figures in the table merely illustrate the possible sensitivity to fluctuations in the oil price. The figures should be interpreted

with great caution in the scenarios where the assumed oil price differs significantly from the assumptions used in the production forecast, see the note below, as no allowance has been made for the effect of oil price fluctuations on costs, etc.

**Table 4.3.** State revenue from oil and gas production, DKK billion, current prices\*

M. DKK.	OIL PRICE/BBL	2015	2016	2017	2018	2019
CORPORATE INCOME TAX BASE	120 USD	42,345	43,791	42,527	37,551	34,875
BEFORE TAXES AND FEES	95 USD	29,707	31,153	29,807	25,928	23,192
AND TAX LOSS CARRYFORWARDS **	70 USD	17,511	17,564	17,178	14,476	12,075
	45 USD	5,741	6,780	4,681	2,898	1,356
<b>STATE REVENUE</b>						
	120 USD	10,213	10,871	10,632	9,388	8,621
CORPORATE INCOME TAX	95 USD	7,214	7,573	7,429	6,482	5,771
	70 USD	4,315	4,272	3,928	3,619	3,019
	45 USD	1,435	1,695	1,118	399	67
	120 USD	13,502	13,129	12,203	11,392	10,733
HYDROCARBON TAX	95 USD	9,502	9,256	7,903	5,720	5,193
	70 USD	5,502	5,011	4,511	2,798	1,670
	45 USD	1,138	1,558	1,109	0	0
	120 USD	2,435	2,486	1,582	710	511
DIVIDENDS FROM NORDSØFONDEN ***	95 USD	1,697	1,762	934	144	0
	70 USD	958	779	318	0	0
	45 USD	0	332	0	0	0
	120 USD	26,151	26,486	24,417	21,491	19,864
<b>TOTAL</b>	95 USD	18,413	18,591	16,266	12,346	10,964
	70 USD	10,776	10,062	8,757	6,417	4,689
	45 USD	2,573	3,585	2,227	399	67
	120 USD	61.8	60.5	57.4	57.2	57.0
<b>THE STATE'S SHARE INCL.</b>	95 USD	62.0	59.7	54.6	47.6	47.3
<b>STATE PARTICIPATION (PER CENT)</b>	70 USD	61.5	57.3	51.0	44.3	38.8
	45 USD	44.8	52.9	47.6	13.8	4.9

\* Based on an annual inflation rate of 1.8 per cent and existing Danish legislation.

\*\* The tax base comprises positive incomes only.

\*\*\* Nordsøfonden is liable to pay tax, for which reason the revenue from state participation appears under different headings, including in corporate income tax and hydrocarbon tax revenue. Nordsøfonden's post-tax profits accrue to the state. However, it should be noted that Nordsøfonden must first repay its loans and finance its continuous investments before delivering any profits to the state.

Note: The calculations are based on the DEA's five-year production forecast, which includes estimates of production from the Danish sector of the North Sea and the companies' operating costs and investments. The budgets for all hydrocarbon exploration and production licences in Denmark are included in the basis used for making the forecast. These budgets were prepared in autumn 2014 when the oil price was considerably higher. The companies' expectations for the future oil price are used as a basis for the budgets, among other factors. The subsequent significant oil price drop has greatly influenced earnings and will impact the amount of investments and operating costs, both in the short and the long term. Therefore, these figures cannot be expected to remain constant, as assumed in the forecast, in the price scenarios ranging from USD 45 to 120 per barrel.

Source: The Danish Ministry of Taxation.

## INVESTMENTS AND COSTS

Investments in field developments totalled slightly more than DKK 187 billion in 2014 prices, thus accounting for more than half the licensees' aggregate costs. The costs of operations, including administration and transportation, exploration and field developments account for 36, 11 and 53 per cent, respectively, of total costs.

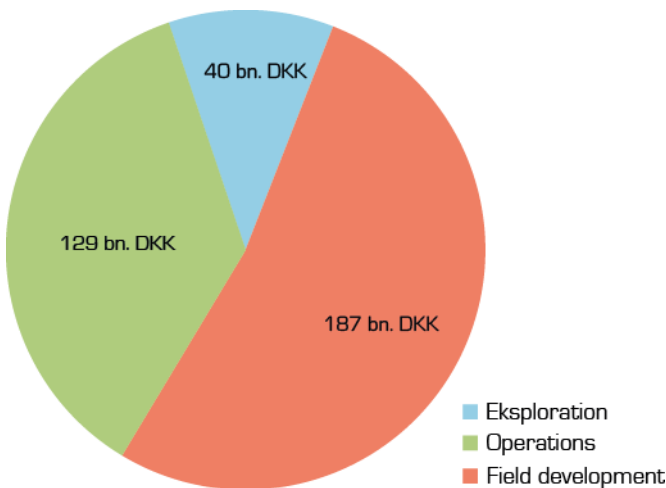


Figure 4.6. All licensees' total costs 1963-2014, DKK billion, 2014 prices.

The licensees' investments in field developments are the single largest budget item, being estimated at almost DKK 8.8 billion for 2014, an increase of about 31 per cent on 2013. Over the past five years, annual investments in field developments have averaged close to DKK 6.2 billion.

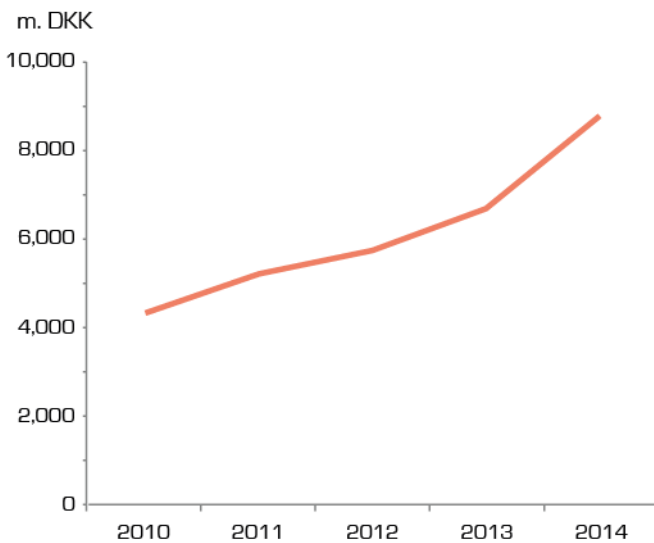


Figure 4.8. Investments in field developments 2010-2014, current prices

Exploration costs include the oil companies' expenses for both exploration wells and seismic surveys. The preliminary figures for 2014 show that exploration costs increased about 4 per cent compared to the year before, amounting to about DKK 1.3 billion

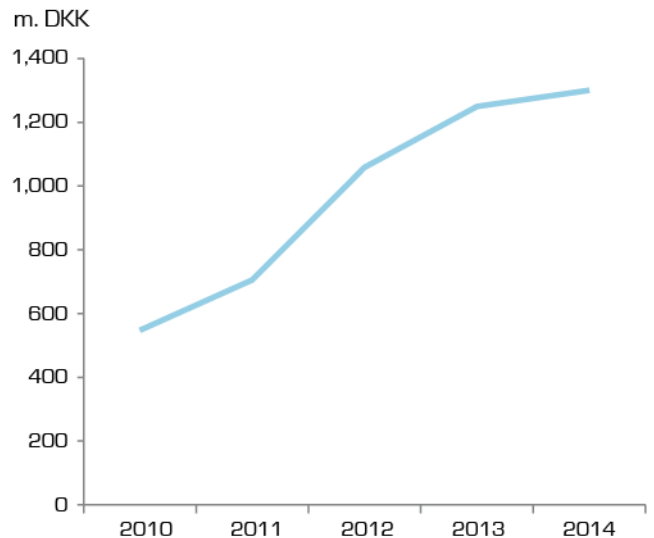


Figure 4.7. Exploration costs 2010-2014, current prices

Figure 9 shows the development in investments and the costs of operations and hydrocarbon transportation from 2015 to 2019. The estimate is based on the following resource categories: ongoing recovery and approved for development, justified for development, risk-weighted contingent resources and the category technological resources. For the next five years, investments in field developments are estimated to total DKK 51 billion.

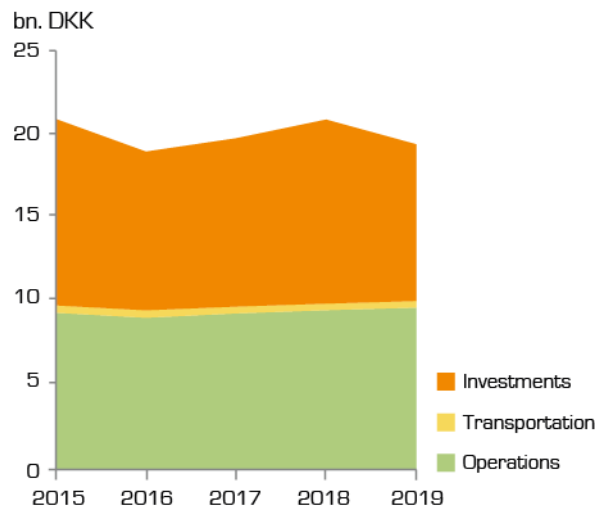


Figure 4.9. Expected development in investments and operating and transportation costs 2015-2019



**Table 4.4.** Investments in field developments 2015-2019, DKK million, 2014 prices

	2015	2016	2017	2018	2019
<b>ONGOING AND APPROVED</b>	10,715	6,696	2,994	452	34
<b>JUSTIFIED FOR DEVELOPMENT</b>	0	0	512	0	0
<b>RISK-WEIGHTED CONTINGENT RESOURCES AND TECHNOLOGICAL RESOURCES</b>	401	2,768	6,533	10,525	9,314
<b>TOTAL</b>	<b>11,116</b>	<b>9,464</b>	<b>10,038</b>	<b>10,977</b>	<b>9,348</b>