ECORYS
Research and Consulting

Baseline Scenario Marine Strategy Framework Directive

Cliënt: Rijkswaterstaat Waterdienst

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Executive summary

1 Background and objective

In 2008 the Marine Strategy Framework Directive (MSFD) came into force. The aim of the MSFD is to establish good environmental conditions in the water system and to achieve sustainable balance between ecology and economy.

Article 24 of the MSFD states that: *"As a first step in the preparation of programmes of measures, Member States across a marine region or subregion should undertake an analysis of the features or characteristics of, and pressures and impacts on, their marine waters, identifying the predominant pressures and impacts on those waters,* ***and an economic and social analysis of their use*** *and of the cost of degradation of the marine environment."*

So, an economic and social analysis of the use of marine waters is a requirement in implementing the MSFD. This requirement applies also for the Dutch section of the North Sea. This area of approximately 58,000 km^2 is used intensively by, among others, the following uses: fishing, shipping, oil and gas exploration, surface mining and quarrying, dredging spread, wind power, cables and pipelines, defence, recreation and tourism. For these human uses there is a potential conflict with the marine environment of the North Sea.

Study objective

Against this background it is important to have a thorough understanding of the current and future level of human activities on the North Sea.

The primary objective of the study is to:

> "describe the expected developments in the socio-economic sectors in and around the Dutch section of the North Sea area, based on the most recent economic insight, so the effects of the economic crises are included in the baseline scenario for economic activities on the North Sea"

2 Scope and approach

This study has made use of available information on economic activities in the Dutch part of the North Sea. In particular, statistics from the Central Bureau of Statistics Netherlands (CBS) and the Netherlands Bureau for Economic Policy Analysis (CPB) were used. In addition, several other research reports and policy documents were consulted.

Furthermore, to complete the information, interviews were conducted with experts from the relevant use sectors. These interviews were also used to gain more insight into the effects of the economic crisis on the development of the sector.

The report addresses all activities that potentially impose pressures on the marine environment. Besides economic activities, the North Sea is also used for other purposes, e.g. defence and dredging. Because the focus in this study is on economic aspects, particular attention is paid to economic uses.

For a clear understanding about the economic importance of the North Sea, a distinction is made between direct and indirect activities. When we refer to direct activities in this study, we mean all economic activities that take place on the Dutch Continental Shelf (DCS). The key sectors of interest are:

- Oil and natural gas
- Sand extraction
- Shipping
- Fishery
- Wind energy
- Piping and cables

Indirect economic activities are activities that are sea-related but do not take place on the DCS. For a good understanding of the total economic importance of the North Sea, however, it is also relevant to look at the indirect economic use value. The analysis focuses on coastal tourism and seaport areas.

3 Economic significance

Direct economic significance

Table 1 summarises the current economic significance of North Sea activities (2007) and projections for the short term (2015) and medium/ long term (2020/2040).

The results of the study indicate that in terms of direct economic value the largest sector is oil and natural gas, whereas in terms of employment shipping is the largest sector. The economic significance in terms of value added of the other uses of the North Sea is relatively small compared to oil and gas and shipping. In terms of employment the sectors are more equal in size.

The scenario-based projections of the future status of the sectors indicate that oil and gas production will most likely decline in the baseline period (2007-2015). For the other sectors, the changes are less substantial. With the exception of off shore wind energy, which will be considerably larger in 2015 compared to 2007.

Some caution should be made when comparing the sectors. For example, the values for shipping concern the whole sector and not just shipping in the Dutch part of the North Sea. Also employment in oil and gas is dependent of the definition used. In this study only employees working on oil and gas platform on the DCS are taken into account.

Future sector development

Oil and gas

The economic crisis did have a small impact on DCS production of oil and natural gas. In 2009 the production of gas from DCS was approximately 7% less than the year before. Due to high energy prices, however, production value was comparable to pre-crisis levels (2006 and 2007). Both natural gas and oil prices are likely to increase the coming years, where a tight market will result in higher demand and higher prices. Taking into account the most recent economic outlook for the Dutch economy to the year 2015, until 2015 the SE and RC scenario are considered as most likely (all other things being equal).

Sand extraction

The economic crisis does not have any reported impact on the extraction of sand for suppletion purposes. For commercial sand, the economic crisis has led to a drop in demand. Construction projects are delayed or being postponed, so overall less fill sand is needed. Based on recent socio-economic scenarios, however, the volume of fill sand extracted is expected to return to the pre-crisis level by 2015.

Shipping

By the end of 2008, as result of the global crisis, cargo volumes began dropping and dropped even further in the course 2009. This has also affected the Dutch sea shipping sector. Most Dutch traders ended in red numbers at the end of 2009. In 2010, however, freight volumes are again rising. The total handling is now almost at the level of the record year 2008, just before the outbreak of the global recession. Taking into account the most recent economic outlook for the Dutch economy to the year 2015, until 2015 the SE and RC scenario are considered as most likely (all other things being equal).

Fishery

For fisheries, fuel costs have an important impact on the performance of the sector. Although lower fuel prices, also revenues have declined due to a drop in demand and the price of fish. For the short term (2015), economic recovery will restore demand and price. As fresh fish is a luxury good, the return to pre-crisis levels is expected to be somewhat slower than for other products.

Wind energy

The future economic significance depends on the installed capacity. For the short term (2010-2015), the estimate is based on the existing wind power capacity and the construction of two new facilities (600 MW). Recently, under the Crisis and Recovery Law, € 2.4 billion has been allocated to the realisation of an extra 500 MW on the DCS. In this way, the economic crisis thus stimulates the development of offshore wind energy.

Piping and cable

For piping and cable, the economic importance has been detailed only in qualitative terms. The economic significance of piping and cable is rising especially due to globalisation of the markets for telecom and electricity and a rising demand for telecom and electricity facilities. The financial and economic crisis did not seem to have influenced the pipeline and cable sector.

Table 1 Summary of current economic significance (2007) and future projections 2015, 2020 and 2040

Part a) Value added (€ million, nominal values)

	2007	2015				2020	2040
	2007	GE	TM	SE	RC		
Oil and natural gas	5,867	4,594	4,817	5,034*	5,034	3,943 - 4,574	1,262 - 2,050
Sand extraction	17	15				27	27 - 40
Shipping	1,208	1,368	1,291	1,179*	1,034	938 - 1,478	853 - 2,201
Fishery	45	32	38	38*	38	26 - 34	17 - 26
Wind energy	4,7	36				43 - 130	0 - 433
Piping and cable	N/A	N/A				N/A	N/A

Part b) Employment (fulltime jobs)

	2007	2015				2020	2040
	2007	GE	TM	SE	RC		
Oil and natural gas	800**	531	565	609*	624	410 - 534	87 - 150
Sand extraction	154	138				247	247 - 370
Shipping	7,635	7,321	7,019	6,615*	5.941	5.079 - 7.132	3.636 - 7.006
Fishery	594	442	480	495*	507	399 - 478	263 - 377
Wind energy	36	273				330 - 990	0 - 3,300
Piping and cable	N/A	N/A				N/A	N/A

Notes:

* = most likely value 2015, based on recent economic outlook 2011-2015 CPB (CPB, 2010a)

** = The employment according to NOGEPA is 3,000 fte which is based on a census of State Supervision of Mines (Dutch acronym: SodM)

N/A = not available

GE = Global Economy, TM = Transatlantic Market, SE = Strong Europe, RC = Regional Communities

Indirect economic significance

Indirect economic activities are activities which do not take place on the DCS but depend on the DSC due to the geographic location and nature of these activities. In this study the economic impact of two main activities was analysed: tourism and recreation in coastal areas and economic activities in seaports.

Tourism and leisure related to the North Sea are a considerable part of the total Dutch tourism and leisure sector. The direct employment in the tourism and leisure sector is estimated at 80,000 jobs, the indirect employment at about 30,000 jobs. However, it is unclear which part is connected to coastal tourism. The expenses in the coastal area are estimated at € 770 million per year.

The sector showed disappointing results in 2008 and 2009 due to the financial and economic crisis. The Dutch Bureau for Tourism and Congresses (NBTC), however, expects an increase in visits of foreign tourists (both business and tourism ground) in the near future. From 2012, a growth of 2.6 percent per year is expected.

The Dutch seaports provide a major contribution to the national economy. Annually, they contribute about € 30 billion directly. Besides their direct economic significance, the seaport areas have a substantial indirect economic significance in the form of added value and employment opportunities among suppliers and companies operating in the seaport area. Indirectly seaports contribute to € 15 billion national income. In 2009, Dutch seaports handled over 500 million tonnes of cargo. The seaports provide employment to some 300,000 people work, directly (170,000) or indirectly (130,000).

The economic development of seaports depends on the world trade. In the first six months of 2010, the seaports took advantage of the improving world trade. Profitability, however, is still below the level of 2008. For the long run, the Port of Rotterdam estimates a yearly transshipment of 575 to 740 million tons in 2030. Especially transshipment of containers is expected to show substantial growth.

1 Introduction

1.1 Background

In 2008 the Marine Strategy Framework Directive (MSFD) came into force. The aim of the MSFD is to establish good environmental conditions in the water system and to achieve sustainable balance between ecology and economy.

Article 24 of the MSFD states that: *"As a first step in the preparation of programmes of measures, Member States across a marine region or subregion should undertake an analysis of the features or characteristics of, and pressures and impacts on, their marine waters, identifying the predominant pressures and impacts on those waters,* ***and an economic and social analysis of their use*** *and of the cost of degradation of the marine environment."*

On the basis of the MSFD, the good environmental status of the North Sea will be defined in 2012. A monitoring programme will be available in 2014 followed by a programme of measures and implemented from then on to attain the good environmental status by 2020.

The requirement applies also for the Dutch section of the North Sea. This area of approximately 58,000 km^2 is used intensively by, among others, the following uses: fishing, shipping, oil and gas exploration, surface mining and quarrying, dredging spread, wind power, cables and pipelines, defence, recreation and tourism. For these human uses there is a potential conflict with the marine environment of the North Sea.

1.2 Objective

Against this background it is important to have a thorough understanding of the current and future level of human activities on the North Sea.

The primary objective of the study is to:

"describe the expected developments in the socio-economic sectors in and around the Dutch section of the North Sea area, based on the most recent economic insight, so the effects of the economic crises are included in the baseline scenario for economic activities on the North Sea"

1.3 Approach

- This study has made use of available information on economic activities in the Dutch part of the North Sea. In particular, statistics from the CBS were used. To be able to compare across sectors economic data is reported for the years 1995, 2000 and 2007. In addition, several other reports were consulted (e.g. VERON, WLO).

- Furthermore, to complete the information, interviews were conducted with experts from the sectors. These interviews were also used to gain more insight in the effects of the economic crisis on the development of the sector.

- The report addresses all activities that potentially impose pressures on the marine environment. Besides economic activities, the North Sea is also used for other purposes, e.g. defence and dredging. Because the focus in this study is on economic aspects, particular attention is paid to economic uses.

- For a clear understanding about the economic importance of the North Sea, a distinction is made between direct and indirect activities. When we refer to direct activities in this study, we mean all economic activities that take place on the Dutch Continental Shelf (DCS). Indirect economic activities are activities that are sea-related but do not take place on the DCS. For a good understanding of the total economic importance of the North Sea, however, it is also relevant to look at the indirect economic use value. The analysis focuses on coastal tourism and seaport areas.

1.4 Outline of the report

This report contains the following chapters:

- Chapter 2 - baseline scenario direct use

- Chapter 3 - indirect (land-based) economic use

- Chapter 4 - conclusions

2 Baseline scenario direct users

2.1 Introduction

In this chapter possible scenarios are presented for the development of economic activities that take place in the Dutch section of the North Sea.

The analysis consists of three parts:

First, for each function we look into the current economic significance and how the sector has developed the last years.

Then, on the basis of the most recent collaborative scenario study of the Dutch planning bureaus for the future development of the economy and the physical environment (known as the WLO study; see text box), possible futures for the relevant activities are presented for the short- and (middle-)long term.

Finally, since in the WLO study the current financial and economic crisis is not (at least not explicitly) taken into account, the consequences of the economic crisis are analysed. An important question is whether there are reasons for adjusting the long term economic projections and if so, how the adjusted baseline for the economic activities would look like.

WLO scenario study

The Welfare and Living Environment (WLO) scenario study portrays how certain defining aspects of Dutch society will unfold until 2040 in a trend driven way and if policies stay the same (CPB, MNP and RPB, 2006).

To take into account future uncertainty, the analysis in this study is based on four scenarios that have a horizon to 2040: Global Economy, Strong Europe, Transatlantic Market and Regional Communities. These scenarios build on a CPB study released in 2003: Four Futures of Europe. They are organized around two key uncertainties: the extent to which countries are willing and able to cooperate internationally and the response by governments to the pressure on the welfare states.

In 2010, it was concluded in a Memorandum by the authors of the WLO scenario study that, also after the current financial and economic crisis, the scenarios for 2020 are still valid (CPB, 2010b). For the moment, the advice is to leave the scenarios as they are and make no corrections.

Strong Europe

Reforming the process of EU decision-making lays the foundation for a successful, strong European Union. The enlargement is a success and integration proceeds further, both geographically, economically and politically. Strong Europe is important for achieving broad international cooperation, not only in the area of trade but also in other areas such as climate change. European countries maintain social cohesion through public institutions, accepting that this limits the possibilities to improve economic efficiency. Yet, governments respond to the growing pressure on the public sector by undertaking selective reforms in the labour market, social security and public production. Combined with early measures to accommodate the effects of ageing, this helps to maintain a stable and growing economy.

Global Economy

Economic integration becomes broader as countries find it in their mutual interest. Closer cooperation in non-trade areas is not feasible as governments assign a high value to their national sovereignty in these areas. The problem of climate change is not tackled while European taxes on capital gradually decline under the pressure of tax competition.

National institutions are increasingly based on private initiatives and market solutions. European governments concentrate on their core tasks, such as the provision of pure public goods and the protection of property rights. They engage less in income redistribution and public insurance so that income inequality grows.

Transatlantic Market

Countries primarily focus on national interests. Reforms of EU decision making fail. Instead, the European Union redirects its attention to the United States; they agree upon transatlantic economic integration. This yields welfare gains on both sides of the Atlantic, sharpening the split between the club of rich countries and the group of developing countries.

European countries limit the role of the state and rely more on market exchange. This boosts technology-driven growth. At the same time, it increases inequality. The heritage of a large public sector in European countries is not easily dissolved. New markets, e.g. for education and social insurance, lack transparency and competition. The elderly dominate political markets. This makes it difficult to dismantle the pay-as-you-go systems in continental Europe.

Regional Communities

The European Union cannot adequately cope with the Eastern enlargement and fails to reform her institutions. As an alternative, a core group of rich European countries emerges. More generally, the world is fragmented in a number of trade blocks and multilateral cooperation is modest.

European countries rely on collective arrangements to maintain an equitable distribution of welfare. At the same time, in this scenario governments are unsuccessful in modernizing welfare-state arrangements. A strong lobby of vested interests blocks reforms in various areas. Together with an expanding public sector, this puts a severe strain on European economies.

2.2 Oil and natural gas

2.2.1 Current economic significance

Oil and gas reserve

The North Sea provides Europe's largest natural oil and gas reserve. Part of this oil and gas is contained in the Dutch offshore subsurface. The total (developed and undeveloped) reserve on the Dutch Continental Shelf (DCS) adds up to 184 billion Sm3 gas and 12.9 million Sm3 oil[1]. This reserve is based on proven accumulations which are in production or in the development phase. Gas prospects add up to 95 to 220 billion Sm3. This the producible volume that may be assumed to be present in as yet undiscovered accumulations in the subsurface of the Netherlands on the basis of geological information. The exploration potential for oil is not reported in the EZ annual review 'Oil and Gas in the Netherlands'. Large oil discoveries are not expected (EZ, 2010).

Table 2.1 Dutch gas reserve per January 2010

	Reserve (billion Sm3)	# fields
Developed	141	135
Not developed	44	69
- production start 2010-2014		29
- other		40
Total reserve	**184**	**204**
Prospects (exploration potential)	95-220	-

Source: Annual Review EZ 2009

Table 2.2 Dutch oil reserve per January 2010

	Reserve (million Sm3)	# fields
Developed	4.7	19
Not developed	8.2	13
- production start 2010-2014		2
- other		11
Total	**12.9**	**32**

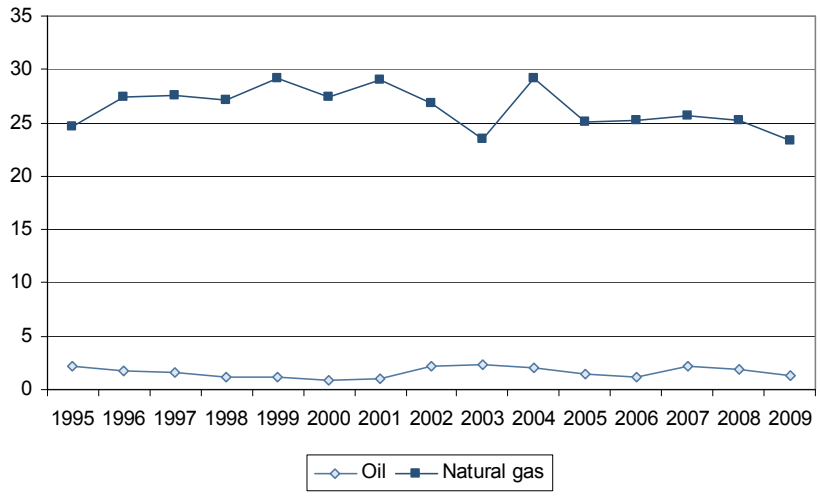
Source: Annual Review EZ 2009

Oil and gas production

The figure below presents the development of the volumes of gas and oil produced annually in the period 1995 - 2009. As can be seen from the figure, as a result of governmental production policies both oil and gas production from DCS is (almost) stable over time. The production of gas and oil from the DCS in 2009 was respectively 23.4 billion Sm3 and 1.3 million Sm3.

[1] Sm3 = standard cubic meter

Figure 2.1 Production of oil (million Sm3) and gas (billion Sm3) on DCS



Source: NLOG

Turnover, value added and employment

The most recent economic value for the production of oil and gas on the North Sea area, calculated by CBS, is € 7.7 billion in 2007. The added value is approx. € 5.8 billion, which has been more than doubled since 1995 (€ 2.1 billion).

The employment increased from 500 fte in 1995 to 800 fte in 2007. According to CBS this only concerns employees working offshore. According to NOGEPA[2] the figure must exceed by a factor of 4[3].

The economic significance of the oil and gas sector is relatively high compared to other sectors on the North Sea. In terms of value added oil and gas for example outweighs shipping (the next sector in terms of economic value) by approximately five times.

Table 2.3 Production value, added value en manpower of oil and gas on DCS

	1995	2000	2007*
Production value (million euro)	2,692	4,306	7,741
Added value (million euro)	2,112	3,313	5,867
Man years (fte)	500	500	800

* Preliminary

- The production value is based on the production amount and oil and gas prices of the dates in question.
- The value of Energie Beheer Nederland (EBN), a state owned energy company, is included in the production value and added value.

Source: CBS, 2010

[2] Dutch Oil and Gas Exploration and Production Association

[3] The employment according to NOGEPA is 3,000 fte which is based on a census of State Supervision of Mines (Dutch acronym: SodM)

2.2.2 Future prospects of the sector

Factors influencing the future production

The future production (especially gas) is determined by the following factors:

- **The possibility to reduce development and operation costs;**
  New techniques are available at this moment, which increase production and also decrease the operation costs. Fields are longer profitable with lower operation costs. More oil and gas can be extracted from the existing fields.

- **The possibility to reduce costs of exploration;**
- New seismic techniques are available to reduce the risk of exploration and also to reduce the costs of drilling exploration wells. Technological progress makes it possible to identify gas prospects more easily, place wells more effectively, reduce the number of dry holes drilled, reduce drilling costs, and cut exploration time. This leads to both economic and environmental benefits.

- **Incentives policy of the government for small and marginal fields;**
  Financial measures are in place to stimulate exploration and production of economically marginal fields. The incentives make marginal fields more interesting for development and exploitation from the point of view of profit gain. The GasTerra Company is obliged to purchase the produced gas from marginal fields at market related prices, if that is requested by a producer[4].

- **The reserves available;**
  The reserves available at this moment are not fixed. New reserves might or might not be found in the future. According to EBN at least 30 billion m3 per year gas can still be produced with new techniques from small fields (excl. Groningen field) by 2030.

- **The possibilities of carbon capture storage in the oil and gas fields.**
  Depleted gas fields offer substantial storage capacity. Further development by the EU and national regulations on carbon capture and storage is required for this technique to become a feasible option. The advantage for the oil- and gas sector is the fact that in case installations are used for CO2 storage the decommissioning costs of the infrastructure do not have to be paid by the sector. The infrastructure can be reused for CO2 storage.

Production prognoses

Gas

The table below presents the estimated supply of gas produced from the DCS in the period 2010-2040. These production prognoses are based on the WLO scenarios (CPB, MNP, RPB, 2006).

All four scenarios show a decline of the gas reserves and production (WLO, 2006). However, after 2040 gas is still available in all scenarios. The highest remaining reserves

[4] Source: Annual Report EBN 2009

are expected in scenario Transatlantic Market. The Global economy scenario shows a more rapid decline of the off shore gas reserves, due to finalizing of the current policy giving priority to the exploration of small and marginal fields, increasing domestic demand and a constant export level.

Table 2.4 Production prognoses for gas in the period 2010 - 2040

	2009	2015				2020	2040
		GE	TM	SE	RC		
billion Sm3	23.4	19.8	20.6	21.5	21.5	17.2 - 20.0	5.5 - 8.9
Index: 2009 = 100	100	85	88	92	92	74 - 85	24 - 38

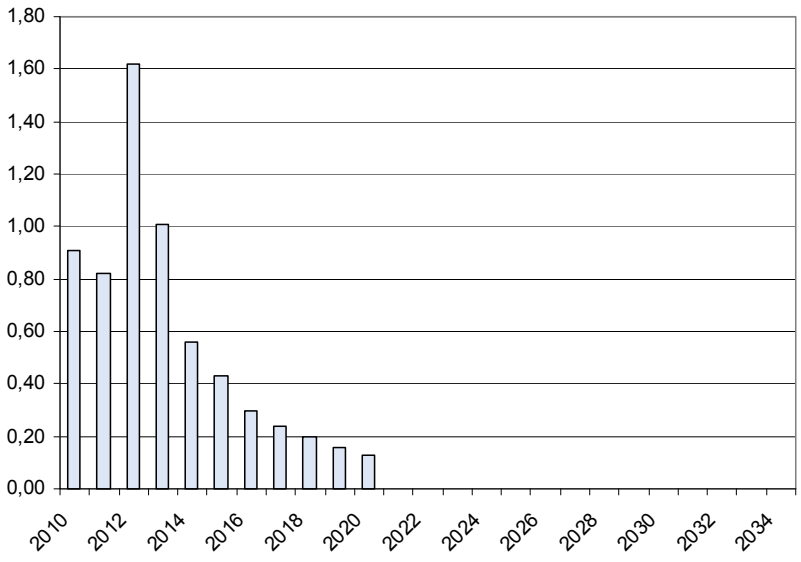
Source: ECORYS, based on WLO study

Oil

The figure below gives values for the future production of oil from developed reserves and (proven, but yet) undeveloped reserves that are on a list of being developed. Total production in the period up until 2020 adds up to 6.37 million Sm3. In the current situation, extraction of the undeveloped reserves is economically not viable. It is likely that due to rising oil prices technological development, these fields are taken into production in foreseeable future (period 2011-2020).

After 2020, oil reserves will have run out and production is hence zero. Discovery of new significant oil reserves is not expected (EZ, 2010).

Figure 2.2 Production form developed and undeveloped oil reserves



Source: TNO – Built Environment and Geosciences (2010).

Future economic value

Table 2.5 displays estimates for the production value, added value and number of man years for the period 2007-2015-2020-2040. The forecasts are based on the expected

development of the supply of gas from small field accumulations on the DCS (see table 2.4). Values are expressed in terms of 2007 price level, thus showing changes in output.

Table 2.5 Prognoses for production value, added value and employment oil and gas DCS (nominal values)

	2007	2015				2020	2040
		GE	TM	SE	RC		
Production value (million euro)	7.741	6.062	6.356	6.642	6.642	5.203 - 6.035	1.665 - 2.705
Added value (million euro)	5.867	4.594	4.817	5.034	5.034	3.943 - 4.574	1.262 - 2.050
Employment (fte)	800	531	565	609	624	410 - 534	87 - 150

Source: ECORYS, based on WLO study

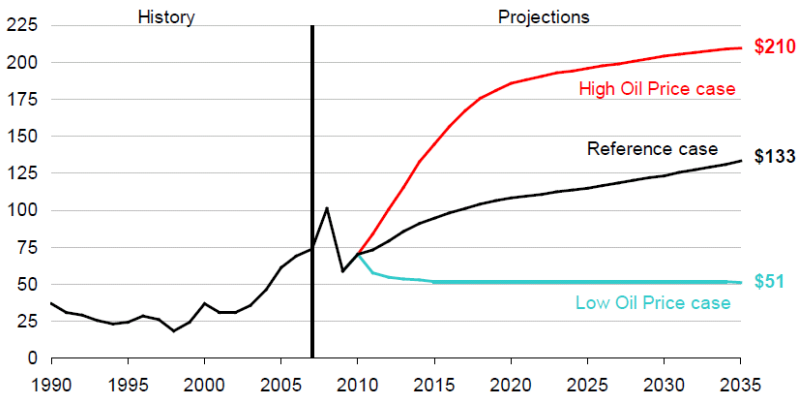
2.2.3 Effects of economic crisis

The economic crisis did have a small impact on *DCS production* of oil and gas. In 2009 the production of gas from DCS was approximately 7% less than the year before. The money earned dropped by 27% (EBN, 2010). However, the investments in the oil and gas sector, in monetary terms increased (€ 1 billion in 2007). On activity level the investments remained stable since large contracts continued. In spite of the crisis, most oil and gas companies did not adjust their investment budgets and maintained the level of development and evaluation drillings.

The economic value of the sector depends not only on the volume of oil and gas produced, but also on oil and gas prices. The year 2008 was an extraordinary year due to high oil and gas prices. In the first half of 2009, lower energy demands led to decreasing oil and gas prices and hence lower production value. However, the 2009 production value is still comparable to 2006 and 2007 (EBN, 2010).

Both gas and oil prices are likely to increase the coming years (from 2011 onwards), where a tight market will result in higher demand and higher prices. Taking this into account, the real value of production will increase proportionally.

Figure 2.3 Development oil price



International Energy Outlook 2010

2.3 Sand extraction[5]

2.3.1 Current economic significance

Current activities

The Netherlands is Western Europe's largest marine sand extractor. On average about 25 Mm3 of sand is extracted per year (RWS, 2010).

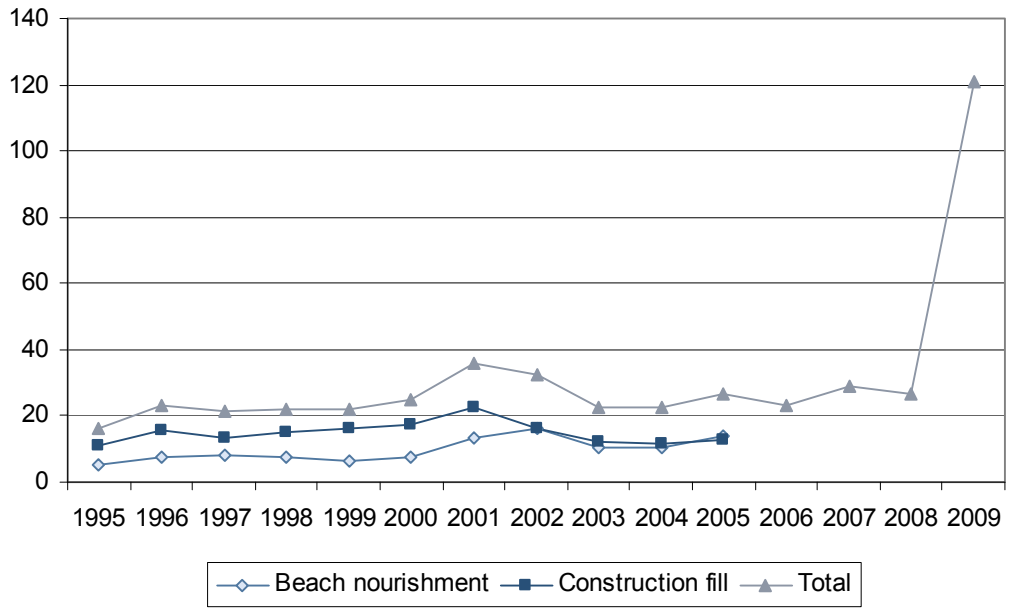
Sand from the North Sea is mainly used for two purposes:

- **beach nourishment (sand suppletion)**
  For the protection of the Dutch coast against flooding 12 million m3 sand is used annually for beach nourishment (RWS, 2010). The sand is added to the Dutch coast, to compensate for sand loss in areas susceptible for erosion and to keep pace with sea level rise. Sand suppletion needs to be repeated regularly for coastline protection to compensate for erosion , usually every five years. The sand for the suppletions is extracted from the bottom from sand pits with a concession from Rijkswaterstaat (RWS).

- **land filling (commercial sand)**
  Besides beach nourishment, sand is extracted for land filling and construction works. For this purpose, annually approximately 13 Mm3 of commercial sand is extracted. Two main locations that are currently operational are: Location 1016 (Rotterdam) and the Fort location (IJmuiden). Until 2009, annually respectively 2.2 and 4 million m3 was extracted from these locations. Besides these two, sand is extracted from other locations in the North Sea as well, for instance to match the demand for sand from large infrastructure projects like Maasvlakte 2. For extraction, a permit is required from RWS Noordzee. The extraction rights are tendered on the market. The winner of the contract is legally bound to deliver sand to the market.

[5] Besides sand, also extraction of shells and gravel is allowed. At the moment, no gravel is extracted from the North Sea and the volume of shells extracted is very limited. It is not expected that in the coming decades the extraction of shells and gravel will change significantly. For this reason this paragraph focuses solely on sand extraction.

Figure 2.4 Aggregate marine sand extraction from the Dutch section of the North Sea*



* 2009 peak includes sand extraction for Maasvlakte 2 (78.6 Mm3)

Source: RWS Noordzee

Although there is also concrete and construction sand present in the sea bottom, extraction in the short term is not expected. This sand is located in deeper layers covered under large volumes of top sand. Extraction is only economically viable in combination with the extraction of large volume of top sand, under the condition that this sand is suitable for coastal defence measures or land filling.

Turnover, value added and employment

Based on the volume of sand extracted and a price per m3, the net turnover is estimated at approximately € 69.2 million in 2007. This figure includes only the sale of sand actually extracted from locations in the North Sea. The value added of sand extraction is calculated at € 16.8 million[6].

Although, the total volume of sand extracted each year is relatively constant, as can be seen from table 2.6 the output value (strongly) fluctuates. This is due to fluctuations in the prices of sand.

The total employment related to off shore sand extraction is calculated at approximately 154 fte's. This only concerns employees working offshore.

[6] Value added is calculated as labour cost, depreciation and net operating profits. In this case, value added was estimated based on the ratio between value addded and production value for the non-energetic mining sector (CBS, 2010).

Table 2.6 Economic indicators sand extraction NCP

	1995	2000	2007
Production value (million euro)	33,0	57,0	69,2
Added value (million euro)	8,8	15,2	16,8
Man years (fte)	110	195	154

Source: ECORYS, based on RWS Noordzee

2.3.2 Future prospects of the sector

Factors influencing future use of the sea for sand extraction

For the MSFD it is important how the economic use of the North Sea with respect to sand extraction will develop autonomously in the coming decades. The main relevant factors to consider in this context are:

- Strong (potential) growth in the demand for sand used for coastal defence purposes (sand suppletion);
- An additional demand for sand due to large infrastructural and/ or land reclamation projects (construction projects);
- Shift to (cheaper or more environmentally sustainable) alternatives for sand extracted from the marine area.

ad 1) sand suppletion

RON2 (Regionale Ontgrondingenplan Noordzee 2) provides different scenarios and volumes for future need of sand for beach nourishment. Although the demand forecast in RON2 are dated to some extent, it is the most recent forecast available.

Depending on the scenario used, an average of 11.4 - 15.2 Mm3 a year (between 2010 and 2030) is estimated (see table 2.7) to be produced. However, recent insights show that on average 20 Mm3 per year is needed to keep pace with current sea level rise. Due to an expected further rise in sea level in the coming decades annually an extra approx. 40 - 80 million m3 will be required for beach nourishment[7].

Based on recent scenarios for the demand for sea sand, future extraction of sand for coastal defence purposes is expected to show an increase from approximately 12 Mm3 per year in 2015 to a maximum of 40 Mm3 in 2040.

Table 2.7 Total and annual (between brackets) demand for suppletion sand (in million m3) per period

Period	Minimum	Average	Maximum
1996 – 2010	147 (10.5)	166 (11.9)	185 (13.2)
2010 – 2020	114 (11.4)	133 (13.3)	152 (15.2)
2020 – 2030	114 (11.4)	133 (13.3)	152 (15.2)
1996 – 2030	**375 (11.0)**	**432 (12.7)**	**489 (14.4)**

Source: RON2, RWS Noordzee (2004)

[7] Based on Deltaprogramma, sea level rise 0,65 – 1.30 m in the year 2100.

ad 2) construction fill

The need for fill sand is much more difficult to predict. RON2 contains scenario's for the total need for fill sand from the North Sea in the period until 2030 (see table 2.8), based on economic growth and other factors.

Large infrastructural projects like e.g. Maasvlakte 2 and WCT Vlissingen could increase demand significantly. For the foreseeable future however, no large construction projects of this kind are foreseen. Medium scale projects which might increase demand for North Sea sand are IJburg, as well as projects of Randstad Urgent, the A6/A9 diversion and the development of Almere (Watercity Almere). It is likely, however, that these projects make use of sand coming out of the IJsselmeer.

Hence, in developing a base line for the extraction of commercial sand we take RON2 as our starting point. Based on recent socio-economic scenarios, extraction of fill sand is expected to increase to 13 Mm3 per year in 2015 to a maximum of 25 Mm3 in 2040 (RWS, 2010).

Table 2.8 Total and annual (between brackets) need of fill sand (in million m3) per period

Period	Minimum	Average	Maximum
1996 – 2010	140 (9)	173 (12)	268 (18)
2010 – 2020	123 (12)	192 (19)	336 (34)
2020 – 2030	178 (18)	224 (22)	411 (41)
1996 – 2030	**441 (13)**	**589 (17)**	**1015 (29)**

Source: RON2, RWS Noordzee (2004)

ad 3) shift to alternatives

In recent years, a trend towards the use of cheaper or more environmentally sustainable filling materials other than sea sand can be observed (e.g. demolition waste, debris, other used materials). As a result demand for fill sand from the North Sea might decrease slightly over time. It is, however, not expected that this will have a large impact on extraction volumes, so no correction was made on the volumes reported above. Also, it is expected that less fill sand from land will be available in the future, so there will be an opposite effect on the demand for sea sand as well.

Future economic value

Table 2.9 shows how, based on the assumptions above, the economic value of sand extraction in the North Sea area (in terms of production value, added value and employment) is expect to develop over time. For the years 2015 and 2020 a single value is given. For 2040, minimum and maximum estimates are shown.

Table 2.9 Baseline economic value sand extraction (2007-2040)

	2007	2015				2020	2040
		GE	TM	SE	RC		
Production value (million euro)	69	62				111	111 - 166
Added value (million euro)	17	15				27	27 - 40
Man years (fte)	154	138				247	247 - 370

Source: ECORYS, based on WLO study

2.3.3 Effects of economic crisis

The economic crisis does not have any reported impact on the extraction of sand for suppletion purposes. Coastal defence is a responsibility of the national government. Every year sand is added to consolidate the coastline where it is today. This is necessary to prevent deterioration of the protection level against flooding. Given the interests that are at stake, no budget cuts are foreseen in the future.

With respect to commercial sand (fill sand), the economic crisis has led to a drop in demand. Construction projects are delayed or being postponed, so overall, less fill sand is needed. The fact that Well 1016 (Rotterdam) – in a 'normal' situation producing 2.2 Mm2/ year – has been closed, gives some idea of the impact of the crisis. Extraction from the Fort location, however, is stable at 4.0 million m3.

The low fare rates in the inland shipping sector, has led to some import of sand from abroad. Because of this the competition on the market for commercial sand has increased somewhat. However, this poses no real threat for the economic viability of the sector.

Based on recent socio-economic scenarios, however, the volume of fill sand extracted is expected to return to the pre-crisis level by 2015.

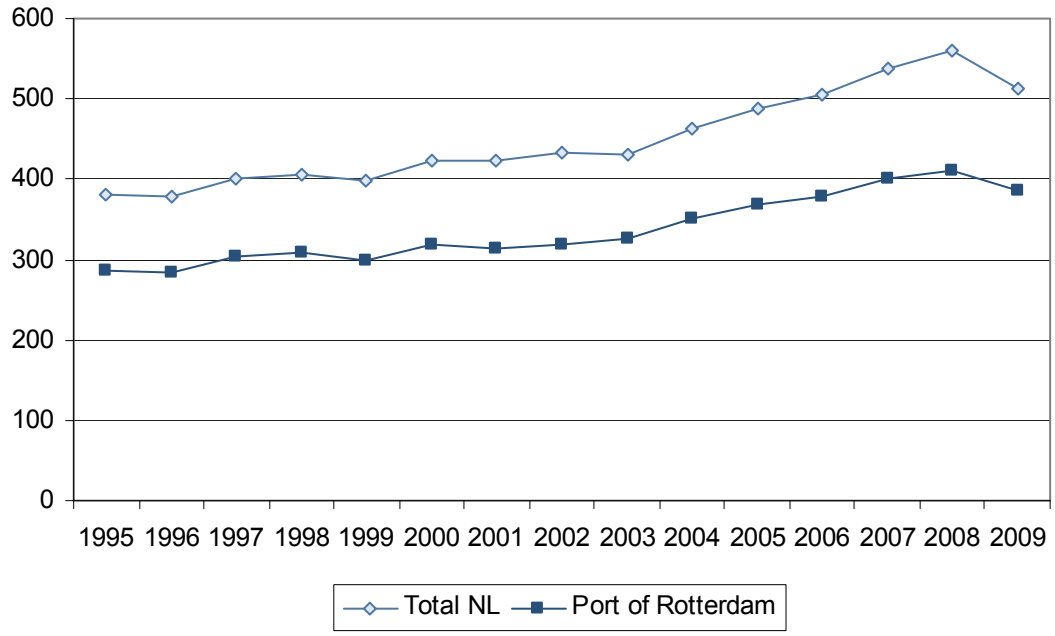
2.4 Shipping

2.4.1 Current economic significance

Goods throughput

With some 260,000 ship movements per year, the North Sea has one of the highest shipping activities in the world (V&W, 2009). Over 110,000 of these movements are to and from Dutch Seaports (National Ports Council, 2010). As shown in figure 2.5 below, overall throughput in sea ports in the Netherlands has increased in the period 1995-2009. The increase of port throughput showed clear signs of slowdown around the 2001 economic crisis. Since then, however, throughput levels have been on the rise. In 2008, a record quantity of 560 million tonnes was handled, of which around 75% in the port of Rotterdam. In 2009, as a result of the current crisis, goods throughput showed a sharp decline (-8%). In 2010, however, there is recovery.

Figure 2.5 Goods throughput in Dutch seaports (Netherlands, Port of Rotterdam, million tonnes)



Source: CBS (2010)

Turnover, value added and employment

The economic significance of sea shipping is relatively large in comparison with the other economic activities that depend on the North Sea, such wind energy or sand extraction. From 2002, shipping shows an increasing line. Production value grew from € 2.6 billion in 1995 to € 4.6 billion in 2007. The added value almost doubled in this period up to € 1.2 billion in 2007 (CBS, 2010).

Due to larger vessels and ongoing innovations in the sector, the number of people employed in the Dutch shipping sector has decreased over the years. For 2007 the number of employees working in the Dutch sea shipping sector adds up to about 7.600 full time workers (direct employment).

For 2009, the image is expected to be less positive. By the end of 2008, as a result of the global crisis, cargo volumes began dropping and dropped even further in the course of 2009. This has also affected the profitability of the Dutch sea shipping sector. In 2010, however, there is a recovery.

Important to notice here, is that the values referred to in table 2.10 are not specifically related to activities in the Dutch part of the North Sea (DCS). The reason for this, is that it is not possible to establish an exact relationship between Dutch sea shipping on the one hand and the DCS on the other. The values relate to the whole sector, including Dutch ships that never or seldom are to be found in the Netherlands.

Table 2.10 Production value, added value and employment sea shipping

	1995	2000	2007*
Production value (million euro)	2.626	3.689	4.588
Added value (million euro)	630	927	1.208
Man years (fte)	9.508	8.295	7.635

* Preliminary

Source: CBS, 2010

2.4.2 Future prospects of the sector

Factors influencing the future

Factors that have an influence on the development of the sector are:

- **More attention for environmental issues;**
  In recent years, environmental issues are becoming more important. At least two environmental issues are important for the shipping sector right now. Firstly, the future decisions about the CO2-emmissions, secondly the content of sulphur in fuel used in the sector. A potential issue is sub aquatic noise.

  CO2-emissions

  In the past 60 years the shipping sector succeeded in decreasing its CO2-emission per tonne/mile with 70%. For the future new goals are formulated. However, the World Climate Top in Copenhagen in December 2009 didn't result in a decision about reduction objectives for CO2-emissions for sea shipping. However, the European Commission remains committed to its requirement to the IMO, which has to complete their decision about reduction policies at the end of 2011.

  In 2010, together with the Dutch national authorities, the sector is working on a Declaration of Intend aimed at saving energy and reducing CO2-emmissions. The ambition of the KVNR is having an operational zero-emission ship in 2050. Dependent on the sectors covered, inclusion of shipping in the EU Emission Trading Scheme (EU ETS) could have a significant (negative) impact on the competitiveness of the sector.

  Sulphur in fuel

  A decision has been made already by the IMO about the content of sulphur in fuel. Starting January 1st 2015, the sulphur content in shipping fuel may not exceed 0.1 percent in the Emission Control Areas (North Sea, Canal, East Sea). Recent studies show that as a result of higher unit costs, there may be a 'modal back shift' – a shift from transport by (sea) ship to transport by truck (over the road) (ECSA, 2010).

- **Administrative burden short sea;**
  More than 40% of all intra-European transport takes place via short sea shipping. It is generally assumed that in the coming decade short sea shipping will further increase. Given the potential for short sea shipping, priority is given to the removal of unnecessary administrative rules; both in the EU (between countries) and national. This will increase the cost effectiveness of the sector and thus might enhance growth of this sector.

Scenarios for goods throughput in Dutch sea ports

Table 2.11 contains estimates for throughput of goods in Dutch sea ports for the period 2010-2040, based on the WLO scenarios (Centraal Planbureau, Milieu- en Natuurplanbureau, Ruimtelijk Planbureau 2006).

Although the relationship between the goods handled in Dutch sea ports and the Dutch sea shipping sector is not one on one[8], in the past, this has been a good indicator of how the sector develops. Besides, particularly of interest for the MSFD is the development of ship movements in the DCS area. The amount of tons of goods handled in Dutch sea ports is a good indicator for this.

Table 2.11 Prognoses for goods throughput in Dutch sea ports 2010-2040

	2009	2015				2020	2040
		GE	TM	SE	RC		
Throughput (million tons)	513	585	546	491	421	417 - 657	379 - 978
Index: 2009 = 100	100	114	107	96	82	81 - 128	74 - 191

Source: ECORYS, based on WLO study

Future economic value

Table 2.12 displays estimates for the production value, added value and number of full time equivalents for the period 2007-2015-2020-2040. Because specific projections for the Dutch sea shipping sector are not available, the forecasts are based on the expected development of the amount of tonnes of goods handled in Dutch sea ports (see table 2.11). The assumption here is that the goods throughput in Dutch sea ports will keep pace with world throughput, and that the share of Dutch sea shipping in the total volume of cargo shipped by sea remains constant.

Table 2.12 Future production value, added value and employment shipping (nominal values)

	2007	2015				2020	2040
		GE	TM	SE	RC		
Production value (million euro)	4.588	5.195	4.903	4.478	3.928	3.564 - 5.615	3.239 - 8.359
Added value (million euro)	1.208	1.368	1.291	1.179	1.034	938 - 1.478	853 - 2.201
Employment (fte)	7.635	7.321	7.019	6.615	5.941	5.079 - 7.132	3.636 - 7.006

Source: ECORYS, based on WLO study

[8] Not all goods are landed by domestic ships.

2.4.3 Effects of economic crisis

After several good years, there was a decrease in the cargo volume at the end of 2008 because of the economic crisis. During 2009, a further reduction of the cargo volume was a fact (ECORYS, 2009).

Over 2009 world trade volume fell by over 12%. With less trade to handle and an increasing world fleet, the prices paid for cargo declined very fast. The international maritime sector ended in a large crisis, with freight prices below the 'break-even point'. Some traders decided to leave their vessels at the quayside.

This trend for the maritime sector as a whole, also applied for to the Dutch sea shipping sector. Most Dutch traders faced losses in 2009.

In 2010, however, freight volumes are again rising. In the first six months of 2010, the amount of cargo handled in the port of Rotterdam increased rapidly. In total, 213 million tonnes of freight was handled, almost 15 percent more than over the same period in 2009. The total handling is now almost at the level of the record year 2008, just before the start of the global recession. Cargo prices are not fully recovered yet due to overcapacity in the sector. Because of this, the economic value of the sector stays somewhat behind, as compared to pre-crisis values. It can be expected, however, that when economic recovery continues, prices will again return to their pre-crisis level. For the coming years, the Port of Rotterdam Authority has calculated that (mainly as a result of expanding the container capacity at Maasvlakte 2) throughput could rise from the current approximately 420 million tonnes, to around 575 à 740 million tonnes by 2030.

2.5 Fisheries

2.5.1 Current economic significance

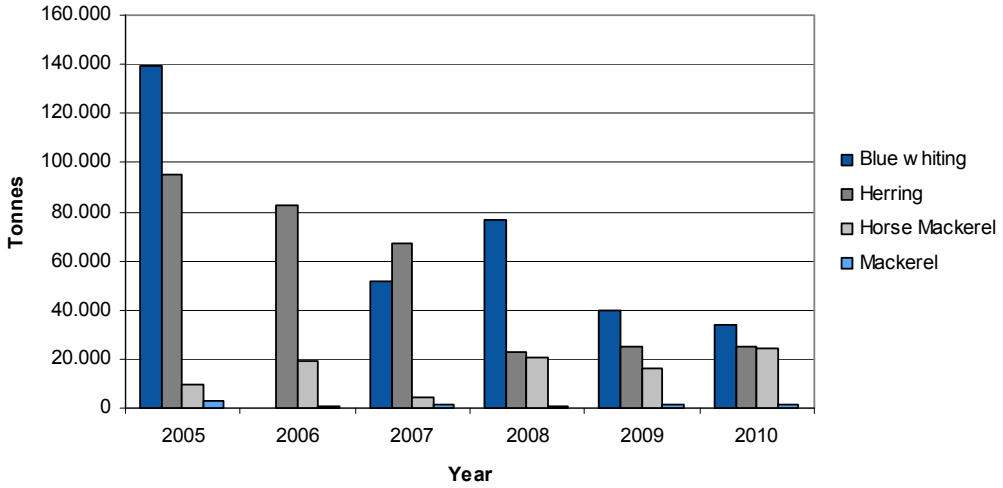
Fishing quota

The fishery sector is a highly regulated sector. Coastal and marine fisheries are mainly regulated from the EU, through the Common Fisheries Policy, which is aiming for sustainable fisheries. Special attention is given to the discussion of Maximum Sustainable Yield (MSY). MSY is the maximum yield that can be achieved, year after year. This approach is laid down in the Common Fisheries Policy (CFP), on which discussion is still ongoing. In 2012, the ongoing reform of the CFP is finalized.

Because several fish species are overfished, for a number of quota fish catches are further limited the coming years until fish restocking takes place and a sustainable fish stock is achieved. This also means that, in order to keep the industry profitable, adjustments and improvements have to be made to the fishing fleet to reduce costs and in this way compensate for the decline in revenue. The Dutch government has included the reorganization of the cutter fleet in its policies.

EU Fishing quotas are updated every year. The quota for pelagic fish types such as herring, mackerel and blue whiting were lower in 2010 than in the previous years (see figure 2.6 below).

Figure 2.6 Development of fishing quota in the North Sea 2005-2010*



* For 2006 no information about the blue whiting was collected

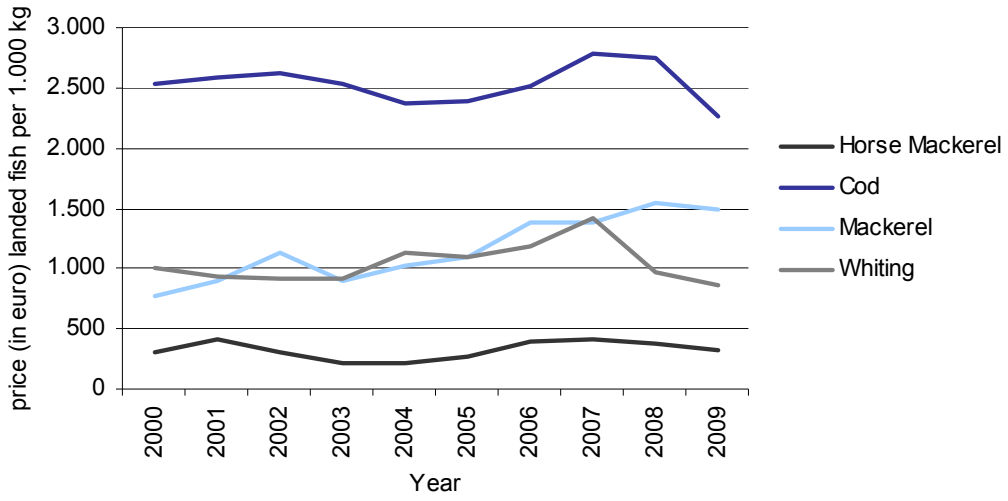
Source: PVIS

Although the fishing quota declined over recent years, the prices of landed fish didn't increase. The prices of landed fish for cod, horse mackerel and whiting reduced since 2008. The only price that rose until 2008 was for mackerel (figure 2.7). In 2009 prices for all fished species declined.

With less fish to catch on the North Sea and lower prices on the auction, the Dutch fishery sector on the North Sea is facing a hard time. Besides this, also the pressure for sustainable catch is becoming more and more important.

The only way to stay competitive in the future is with innovations in the sector. There are two main driving forces in the drive for innovation in the fishery sector. The first one is to reduce costs (for example for gasoline and manpower). The second is the transition towards a more sustainable society, challenging also fisheries to become more sustainable.

Figure 2.7 Development of prices of landed fish (in Euro/ 1,000 kg landed fish)



Bron: CBS, 2010

Turnover, added value and employment

In the North Sea the fisheries industry is still active. The North Sea is one of the world's most important fishing grounds. For the MSFD only fisheries on the DCS are important. CBS (2010) has made calculations about the production value, the added value and the number of man-years in the Dutch fisheries within the DCS.

Table 2.13 displays production value, added value and employment within the fisheries industry in 1995, 2000 and 2007. In this period, net turnover has increased, while added value and the number of people employed declined. The table presents only the Dutch fishing fleet. Some ships, however, are reflagged and now sailing under another country flag (for example Germany or Ireland). Although, the ship-owner is Dutch and the fish is landed at a fish auction in NL, this activity is not included in the estimates. As a result, in table 2.13 the economic significance of the DCS for fishing is underestimated.

Table 2.13 Production value, added value en manpower of see fishery on DCS

	1995	2000	2007*
Production value (million euro)	102	111	113
Added value (million euro)	64	58	45
Man years (fte)	804	770	594

* Priliminary

Source: CBS, 2010

2.5.2 Future prospects of the sector

Factors influencing future use of the sea for fishing

The future fish production depends on the following influence factors:

- **The development of fish quota allocated to the Netherlands;**
  The main limiting factor for fisheries is the European quota for pelagic fish. Every year the quota are revised for the next year, on the basis of current fish stocks for the

different species. The sector is going through a transition towards more sustainability. Vessels are becoming more 'green' and modern and use modern techniques. This also reduces the level of discards.

Recently, the pressure of the fishery sector on the fish stocks in the North Sea has decreased. The stock of plaice has increased and is above the precautionary level. The herring stock is stabilizing. The condition of the cod in the North Sea is still worrisome. The Ministry of LNV expects that the quota in 2011, as previous years, will follow the EU management plan.

- **Changing (fish)consumption patterns;**
  Fresh fish is a luxury good, meaning that with income rising the demand for fish increases more than proportionally. In the last few years, fish consumption in the Netherlands as well as abroad, increased. In a 'normal' market when demand is rising, the market moves towards a new equilibrium with higher quantities and prices. For the fish market, the situation is different because, given the fish quota, supply is restricted. Whilst demand is rising, production reaches its limits. The maximum of the quota will then be placed inside the market at a higher price. Future price levels also depend on import and substitution effects.

- **Fleet, capacity and effort.**
  In the first part of 2008 a major reorganisation of the Dutch fishing fleet took place. For the future no new reorganisations like this are expected. However, the existing fleet will become more sustainable in the near future. The efforts being made have a strong focus on reducing fuel consumption, discards and sea bed distortian.

  In the social contract North-Sea fishing 'Sustainable fishing' (June 2008), is agreed that the Dutch fishery sector will be certified according the MSC standard[9]. Participating parties are the demersal trawling industry, the Dutch Fish Product Board, WWF, the North Sea Foundation and the Ministry of Agriculture, Nature, and Food. In 2010 a full-assessment of the plaice-sole fishery will start. It is expected that by the end of 2012 the plaice-sole fleet will be completely certified.

Future economic value

Table 2.14 presents estimates for production value, added value and employment for the period 2007-2015-2020-2040. The forecasts are based on the possible development paths for the Dutch fishery sector as depicted in the WLO study. Values are expressed in 2007 fish prices.

In all scenarios, production value for the fishery sector on the DCS declines. The loss of production is relatively limited, however, due to persistent demand for North Sea fish and stabilizing future quota levels because of more sustainable fisheries. However, due to higher costs (not likely to be passed fully onto consumers) the financial position of the sector is deteriorating, causing a (further) drop in economic activity. Also, because there is little potential for achieving large economies of scale.

[9] Environmental standard for sustainable fishing developed by the Marine Stewardship Council. The MSC meets the highest benchmarks for credible certification and ecolabelling programs, including the UN Food and Agriculture Organization (FAO) guidelines.

Table 2.14 Prognoses for production value, added value and employment fisheries DCS (nominal values)

	2007	2015				2020	2040
		GE	TM	SE	RC		
Production value (million euro)	113	80	96	96	96	65 - 86	43 - 65
Added value (million euro)	45	32	38	38	38	26 - 34	17 - 26
Employment (fte)	594	442	480	495	507	399 - 478	263 - 377

Source: ECORYS, based on WLO study

2.5.3 Effects of economic crisis

For fisheries, fuel costs have an important impact on the performance of the sector. After the fuel crisis in 2008 (with extremely high fuel prices), the price of a barrel of oil declined in the first quarter of 2009. For the fish vessels, this means lower operational costs and, when prices remain the same, higher profits.

However, in the first quarter of 2009 also the price of fish fell (as shown in figure 2.7). The lowest price in years was reached. Exact figures are not available yet, but as demand for North Sea fish has fallen, also revenues will be lower. Furthermore, higher depreciation costs (through investments in 2009) and higher operational costs makes it likely that the net result will be negative (LNV, 2010).

For the short term, economic recovery will restore demand and price. As fresh fish is a luxury good, the return to pre-crisis levels is expected to be somewhat slower than for other products. Full recovery for the demand for fish, however, is expected. For the long term, especially the development of the cost structure is important for the viability of the sector. The expectation is that, although fish quotas are stabilizing, costs will continue to rise and more pressure is put on the already low profit margins. At the same time the industry is looking for ways to become more sustainable in the near future. Recent experiments point out that a reduction of fuel consumption (and hence fuel costs) is possible of up to 50% (LEI, 2009).

2.6 Wind energy

2.6.1 Current economic significance

Current offshore sites for wind farms

At this moment two wind farms are in operation on DCS:

- Offshore Wind farm Egmond aan Zee (OWEZ); and
- Offshore Wind farm Prinses Amalia (WP Q7).

Since 2006, energy is produced in the North Sea using offshore wind turbines. The offshore Wind Farm Egmond aan Zee was the first wind farm on the DCS, with an installed capacity of 108 MW. The wind farm Prinses Amalia has an installed capacity of 120 MW. The total capacity of the wind farms is 228 MW. The maximum annual generation potential is approximately 735 GWh/ year, which is sufficient for the energy consumption of 215,000 households.

Table 2.15 Capacity and energy production by wind turbines on DCS

Wind energy	2006	2007	2008	2009
Wind energy capacity on DCS (MW)	108	108	228	228
Wind energy production on DCS (GWh)	68	330	596	735

Source: CBS

Turnover, added value and employment

The production value in 2007 is calculated at € 16.5 million. Added value from wind energy is estimated at € 4.7 million. Employment directly related to operation and maintenance of the wind farms corresponds to 36 full-time jobs.

Table 2.16 Production value, added value en employment in the wind energy on DCS

	1995	2000	2007
Production value (million euro) *	0	0	16.5
Added value (million euro) **	0	0	4.7
Man years (fte) ***	0	0	36

* Based on a commodity price of € 0.05 per KWh

** Based on ratio production and added value for total energy and water sector (National Accounts, CBS)

*** Based on ECORYS, Employment in the wind energy sector (2009).

2.6.2 Future prospects of the sector

Factors influencing future of offshore wind energy

The future production is determined by an number of factors, e.g.:

- **Dutch Renewable Energy Policy and objectives;**
  The national target for electricity from renewable resources is 9% (VROM, 2010). As part of the program 'Clean and Efficient', the government has the ambition for the Netherlands to achieve energy savings of 2% per year and a share of renewable energy of 20% in 2020 (VROM, 2010). The government is working on incorporating the working programme's spatial target of approximately 6,000 MW of offshore wind energy installed capacity in the North Sea in 2020 (EZ, 2009b).

- **Permits and subsidies;**
  The installation of an offshore wind farm requires a permit. By the end of 2009, twelve construction permits with a total of 3,250 MW were granted to initiators. The parties which acquired a permit, were able to submit a bid for the requested level of production subsidy from the SDE subsidy[10]. Since the allocated budget for the subsidy is limited, only two parties were able to get a subsidy. The construction of the two offshore wind facilities with a total capacity of 600 MW will start mid 2013. Both wind farms are an initiative of the German Bard Engineering Group.

[10] Stimulering Duurzame Energieproductie (SDE).

The Dutch government is working on a new scheme for future wind farms for the time frame from 2010 onwards. The development of the capacity from 2015 onwards depends on this new scheme. However, given the long preparation time, realisation of 6,000 MW by 2020 does not seem very likely.

The pace of technological progress in the wind industry is rapid. The general expectation for the sector is that – also because of increasing future fossil fuel prices – around 2030 wind energy could be competitive with other power sources, so subsidies will not longer be necessary.

Prognoses for offshore wind energy capacity

Table 2.17 presents estimates for installed offshore wind capacity in the period 2010-2040. For the short term (2010-2015), the estimate is based on the existing wind power capacity and the construction of two new facilities (600 MW). Since the new scheme for future wind farms is unknown at the moment, for the long term scenario's for installed capacity of wind energy are presented, based on projections in the WLO study.

It is not likely that the self-set target of 6,000 MW in 2020 will be reached. This conclusion was also drawn in the WLO study. In this study a capacity of 700 MW in 2010 which would triplicate in 2020 in Global Economy and Transatlantic Market scenarios, is assumed. According to the Strong Europe scenario, 3,000 MW will be realised in 2020 due to decreasing costs. In the scenario Regional Communities the capacity in 2020 is limited (1,000 MW) due to limited subsidies from the Government. Given the current capacity, this scenario seems very plausible for the year 2020.

For the period 2020-2040 there is more uncertainty. In the scenario's Regional Communities and Strong Europe offshore wind energy capacity will increase, due to overall cost reductions (knowledge spill-over effects) and continuous financial support from the government. In Global Economy and Transatlantic Market, on the other hand, governmental funding is stopped. Because offshore wind energy is still not competitive with other power sources, eventually capacity will phase out. In table 2.17 only the range for capacity for the period 2020-2040 is presented.

Table 2.17 Outlook installed capacity wind energy on DCS

	2009	2015				2020	2040
		GE	TM	SE	RC		
Wind power capacity (MW)	0.7	2.9				3.5 -10.5	0 - 35.2
Wind power (TWh)	228	828				1000 - 3000	0 - 10.000
Index: 2009 = 100	100	363				439 - 1316	0 - 4386

Source: ECORYS, based on WLO study

Future economic value

The future economic significance depends on the installed capacity as discussed above. Table 2.18 displays the production value, value added and operation and maintenance related employment for the short and (middle-) long term. It is noticed here, that likely a large part of the new wind energy farms on the DCS will be exploited by foreign companies.

Table 2.18 Prognoses for production value, added value and employment wind energy DCS (nominal values)

	2007	2015				2020	2040
		GE	TM	SE	RC		
Production value (million euro)	16.5	127				153 - 458	0 - 1.528
Added value (million euro)	4.7	36				43 - 130	0 - 433
Employment (fte)	36	273				330 - 990	0 - 3.300

Source: ECORYS, based on WLO study

2.6.3 Effects of economic crisis

In the Netherlands, the Crisis and Recovery Law provides tens of billions of additional investments in the short term. According to the Government, this is good for jobs, especially in the building industry. In this way, the law tries to deal with the economic crisis and speed up recovery of the economic structure of the Netherlands.

Recently, as part of this policy agreement, € 2.4 billion has been allocated to the realisation of an additional 500 MW on the DCS (EZ, 2009a). In this way, the economic crisis thus stimulates the development of offshore wind energy.

2.7 Piping and cables

This sector contains:

- Piping for transport of oil and gas
- Cables for electricity supply for wind turbines
- Telecom cables
- International high voltage cables

The economic value of piping and cables for electricity supply for wind turbines is part of the economic value of the oil and gas sector and wind energy sector. Therefore only the telecom cables and international high voltage cables are described in this paragraph.

2.7.1 Current economic significance

The economic significance of telecom cables and international high voltage cables is rising especially due to globalisation of the markets for telecom and electricity and a rising demand for telecom and electricity facilities.

Telecom cables

In 1922 the first telecom cable was placed in the North Sea between England and the Netherlands. From then the number of telecom cables was rising rapidly. At this moment there is 4000 kilometer of telecom cables in the North Sea, of which 2000 kilometer active cable. The cables being in use for the telecom are the older copper cables and the newer glass fiber cables. In the past, cables have been placed in combination with other works, so cost could be kept low. This has created overcapacity. This overcapacity still exists, despite the increase in data traffic.

International high voltage cables

With the opening of the European electricity market the demand for international high voltage cables increased. At this moment, there is one international high voltage cable in use, and a second one will become into use in 2011. The first one is between Norway and the Netherlands (NorNed), the second one between England and the Netherlands (BritNed). With a total length of 580 kilometres, the NorNed cable has a capacity of 700 megawatts (MW) – enough to supply power to half of Amsterdam or Oslo. The BritNed-cable will have a capacity of 1000 megawatts (MW) and a total length of 260 kilometres.

The BritNed-cable will transport electricity in both directions, induces by price differences and differences in use of electricity between both countries. Brit-Ned meets the ambition of the European Commission for more international connections. The Brit-Ned connection is therefore pointed out as a 'priority project' for the European energy sector. The connection will be built on the bottom of the North Sea, and runs from Grain, an island for the coast of Kent (Southeast England), to the Maasvlakte near Rotterdam. The costs and profits of the BritNed-cable are not 'socialised', which means that the financing and exploitation happens on commercial basis and can be separated from the regulated activities from National Grid and TenneT.

2.7.2 Future prospects of the sector

Growth of data traffic

From 2000 to 2010 the internet penetration in the Netherlands rose with 44.5 percent. In 2010, almost 90 percent of the Dutch population was connected to the internet[11]. Not only the amount of people connected, but also the use of the internet is changing. More and larger documents and data are sent all over the World using the internet. Supposing that the use of internet en telecom will also increase in the future due to more globalization, the data traffic will increase also.

No new cables, but optimization existing cables

Despite the growth of data traffic, no new cables are needed in the future until 2030. The present data capacity of the telecom cables in the North Sea is sufficient. Because of new innovations, more data can be transported through the cable with the same capacity. The newest innovation is glass fiber cable, trough which data is transported with light. The expectations are that with new innovations, the capacity is rising in the future due to glass fiber cables. At this moment, the capacity of the cables in the North Sea is enough for the future until 2030.

The emergence of alternatives

The idea of use of satellites can be regarded as a realistic one for future communication. Especially, since the costs for the construction of transatlantic telecom cables are high. But as long as the costs for a satellite connection are too high to compete with the telecom cables, this is no realistic alternative for the future.

[11] ITU, 2010: http://www.itu.int/en/pages/default.aspx

International trade in electricity

At this moment there is one international high voltage cable in use (NorNed), and a second one will be in 2011 (BritNed). There are plans for a third high voltage cable from Denmark to the Netherlands (COBRA), with a capacity of 700 MW, a length of 275 kilometres, from Eemshaven (Netherlands) to Endrup (Denmark). The goal of the COBRA-cable is to provide the Dutch and Danish electricity markets with more sustainable energy, especially wind energy.

Telecom

For the future, the existing capacity of the cables is enough. However, due to innovations, the number of active cables on the bottom of the North Sea might decrease. No actions are being taken to remove inactive cables from the bottom of the sea.

The information about the telecom sector on the North Sea is limited. Because of the small number of businesses in the sector and the strong competition between them, information about economic performance and employment is sensitive. Also, contracts regulating the use of the cable capacity are complex and rapidly changing, what makes a realistic projection of the future development of the sector nearly impossible.

Electricity

In 2015 there are at least two international high electricity connections operational: NorNed and BritNed. In 2012, a decision will be made about a third: the COBRA-cable. If it is decided to proceed with the construction of the COBRA-cable, the connection will be operational in 2016.

The costs for the construction of the NorNed and BritNed cable add up to approx. € 600 million. In 2015, the NorNed-connection will generate about € 50.7 million turnover, with an expected net profit of € 23 million.

2.7.3 Effects of economic crisis

Based on the literature review and interviews, it is concluded that the economic crisis did not influence the pipeline and cable sector.

2.8 Other sea-based human activities[12]

This last paragraph describes the remaining human activities in the Dutch part of the North Sea, not mentioned earlier in this chapter.

Carbon capture and storage

In the coming decades, fossil energy will remain an important resource but it must be cleaner. This can be achieved – as an inevitable interim step in the transition to sustainable energy management – by capturing CO2 at source and transporting it to deep underground storage facilities. Depleted gas fields and their associated pipelines are potential future spaces for CO2 storage, and the area to the north-west of Texel is a

[12] This paragraph is based on a draft version of the Initial Assessment of the status of the Dutch part of the North Sea (version 5 july 2010).

particular site for large-scale storage. Locations of certain underground water-retentive soil strata (aquifers) might also be used for CO2 storage. However, use at this scale is not expected before 2020.

Military activities

Some 7% of the DCS is used as military (training) area. These areas are: shooting ranges; flying zones; mine testing areas and former munitions dumping sites. No changes regarding requirements are expected in the near future.

Land reclamation

At present, land reclamation occurs for the extension of the Rotterdam harbor (Maasvlakte 2), and along the entire coastline beach nourishments are carried out to protect the sandy coast. These activities exert biological, physical and chemical pressures on the marine ecosystem. It is expected that some of these activities on the Dutch part of the North Sea will intensify over the coming decades, like for example, the construction of offshore wind farms and sand extraction for coastal protection.

3 Sea-dependant activities on land

3.1 Introduction

Sea-dependant (indirect) economic activities are activities which do not take place on the DCS but depend on the DCS due to the geographic location and due to the nature of these activities. In this chapter we focus on the economic impact of two main activities: tourism and recreation in coastal areas and economic activities in seaports.

Concentration of recreation and tourism can be found along the coast due to the vicinity of the North Sea. Therefore, the production value of this sector can be partly allocated to the North Sea. Also the economic value of seaports has a clear link with the North Sea. However, it is difficult to determine the actual economic value attributed to the North Sea since the extent of dependence of the sector to the North Sea is not clear.

3.2 Tourism and recreation in the coastal area

Current economic significance

With 250 km of sand beaches with dunes and a variety in beach resorts, the Dutch coastline is a tourist attraction for day trips and overnight visitors. Annually, about 8.3 million day trips and 4 million tourists stay overnight (14 million nights in total) in the beach resorts along the coast (CBS, 2010).

Furthermore, the North Sea attracts, especially in summer, wind surfers, sport fishers, sailors and divers. The economic significance of the tourism and recreation sector in the coastal area is more than only the economic value of the accommodations, water sport and beach activities. Supplying companies play an important part as well.

The direct employment in the tourism and leisure sector is estimated at 80,000 jobs, the indirect employment at about 30,000 jobs (NRIT, 2003). However, it is unclear which part is connected to coastal tourism. The expenses in the coastal area adds up to € 770 million per year (NRIT, 2002).

Future development

Tourism and leisure related to the North Sea form a considerable part of the total Dutch tourism and leisure sector. The sector showed disappointing results in 2008 due to the financial and economic crisis. The average number of holidays remained stable, however, the average length of stay and the holiday spending decreased (Kenniscentrum (Kust)toerisme, 2010). In 2009 the number of nights spent increased again compared to 2008, but it was still under the peak level of 2007. A small decrease in the number of holidays is expected for the year 2010 (NBTC, 2010). NBTC expects an increase in visits

of foreign tourists (both business and tourism ground) in the near future. From 2012, a growth of 2.6 percent per year is expected. It is not clear how this is divided between coastal tourism and non-coastal tourism.

The consequences of the crisis for sport fishery and beach visits are limited. In the long run, as a result of economic development and demographic change (ageing) a considerable growth of tourism is expected. The coastal area provides opportunities to meet this growth. The number of yachts (including marinas) and sport fishery boats in territorial waters is expected to increase. An increase in number of divers is expected as well.

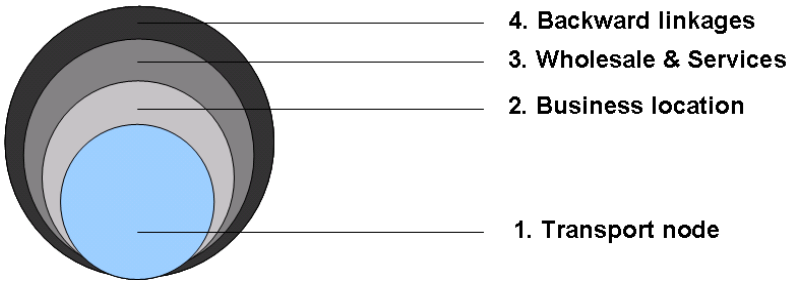
3.3 Economic activities in seaports

Current economic significance

The economic value of the seaports has a clear relation with the North Sea. The Netherlands has four large seaport areas: Northern Seaports (e.g. Delfzijn, Den Helder), North Sea Canal area (e.g. Amsterdam, IJmuiden), Rotterdam, Rhine and Meuse Estuary and Scheldebekken (e.g. Vlissingen, Terneuzen).

The whole of maritime activities can be regarded as a circle with multiple circles within (see figure 3.1). The inner circle - the core - consists of the activities that are focused on the primary function of the port: goods throughput and transhipment (transportation and distribution sector). Around it, is a second circle: the industry. Numerous industries are located in or near seaports, because due to the nature of the activities the presence of a sea port is a decisive location factor. Examples of port related industrial activities are the (petro) chemical industry, the crude-oil industry and basic metals industry. The wholesale and commercial and non-commercial services form a third circle. These activities facilitate the first two circles. The direct economic significance of seaports relates to these three circles. The fourth circle concerns the indirect effects on the suppliers of the port related activities; the so-called effect of backward linkages of the Dutch sea port areas on the rest of the Dutch economy.

Figure 3.1 Overview maritime activities



The Dutch seaports provide a major contribution to the economy. Annually, they contribute about € 30 billion directly, being 5% of the BNP (see table 3.1).

Besides their direct economic significance, the seaport areas have a substantial indirect economic significance in the form of added value and employment opportunities among

suppliers and companies operating in the seaport area (the various circles described above). Indirectly seaports contribute to € 15 billion to national income. They provide a quick and efficient loading and unloading of goods. They also provide space for large-scale activities (including logistics and manufacturing).

In 2009, Dutch seaports handled over 500 million tonnes of cargo. The seaports provide employment to some 300,000 people work, directly (170,000) or indirectly (130,000).

Table 3.1 Economic value seaports

	Employment (working people)	Added Value (€ million)
Transport node		
- transport*	52,388	4,127
- services	16,117	4,407
- transshipment/storage	15,382	4,155
Industry	59,084	14,494
Wholesale	14,451	1,264
Commercial and non-commercial services	11,798	1,118
Total	**169,219**	**29,565**

* This category includes sea shipping as described in paragraph 2.4.

Source: Erasmus Universiteit Rotterdam (2010)

Expectations for the future

The economic development of seaports depends on the world trade. In the first six months of 2010, the seaports took advantage of the improving world trade. The transshipment in for instance Rotterdam seaport is almost at the same level as in the first half year of 2008 (which was a record year), before the financial and economic crisis started. The transshipment of almost all types of load showed a growth.

In spite of the increase in volume, prices are still low due to strong competition. The profitability of the sector is still below the level of 2008.

For the long run, the Port of Rotterdam estimates a yearly transshipment of 575 to 740 million tons in 2030. Especially the transshipment of containers is expected show substantial growth.

4 Conclusions

Direct economic use value

The results of the study indicate that in terms of direct economic value the largest sector is oil and gas, whereas in terms of employment shipping is the largest sector. The economic significance in terms of value added of the other uses of the North Sea is relatively small compared to oil and gas and shipping. In terms of employment the sectors are more equal in size.

The scenario-based projections of the future status of the sectors indicate that oil and gas production will most likely decline in the baseline period (2007-2015). For the other sectors, the changes are less substantial. With the exception of off shore wind energy, which will be considerably larger in 2015 compared to 2007.

Table 4.1 Summary of current economic significance (2007) and future projections 2015, 2020 and 2040

Value added *(€ million, nominal values)*	**2007**	**2015**				**2020**	**2040**
		GE	**TM**	**SE**	**RC**		
Oil and natural gas	5,867	4,594	4,817	5,034*	5,034	3,943 – 4,574	1,262 – 2,050
Sand extraction	17	15				27	27 – 40
Shipping	1,208	1,368	1,291	1,179*	1.034	938 – 1.478	853 – 2.201
Fishery	45	32	38	38*	38	26 – 34	17 – 26
Wind energy	4,7	36				43 – 130	0 – 433
Piping and cable	N/A	N/A				N/A	N/A

Employment *(fulltime jobs)*	**2007**	**2015**				**2020**	**2040**
		GE	**TM**	**SE**	**RC**		
Oil and natural gas	800	531	565	609*	624	410 – 534	87 – 150
Sand extraction	154	138				247	247 – 370
Shipping	7,635	7,321	7,019	6,615*	5.941	5.079 - 7.132	3.636 - 7.006
Fishery	594	442	480	495*	507	399 - 478	263 - 377
Wind energy	36	273				330 - 990	0 - 3,300
Piping and cable	N/A	N/A				N/A	N/A

Notes:

* = most likely value 2015, based on recent economic outlook 2011-2015 CPB

N/A = not available

GE = Global Economy, TM = Transatlantic Market, SE = Strong Europe, RC = Regional Communities

Future sector development

Oil and gas

The economic crisis did have a small impact on DCS production of oil and natural gas. In 2009 the production of gas from DCS was approximately 7% less than the year before. Due to high energy prices, however, production value was comparable to pre-crisis levels (2006 and 2007). Both natural gas and oil prices are likely to increase the coming years, where a tight market will result in higher demand and higher prices. Taking into account the most recent economic outlook for the Dutch economy to the year 2015, until 2015 the SE and RC scenario are considered as most likely (all other things being equal).

Sand extraction

The economic crisis does not have any reported impact on the extraction of sand for suppletion purposes. For commercial sand, the economic crisis has led to a drop in demand. Construction projects are delayed or being postponed, so overall less fill sand is needed. Based on recent socio-economic scenarios, however, the volume of fill sand extracted is expected to return to the pre-crisis level by 2015.

Shipping

By the end of 2008, as result of the global crisis, cargo volumes began dropping and dropped even further in the course 2009. This has also affected the Dutch sea shipping sector. Most Dutch traders ended in red numbers at the end of 2009. In 2010, however, freight volumes are again rising. The total handling is now almost at the level of the record year 2008, just before the outbreak of the global recession. Taking into account the most recent economic outlook for the Dutch economy to the year 2015, until 2015 the SE and RC scenario are considered as most likely (all other things being equal).

Fishery

For fisheries, fuel costs have an important impact on the performance of the sector. Although lower fuel prices, also revenues have declined due to a drop in demand and the price of fish. For the short term (2015), economic recovery will restore demand and price. As fresh fish is a luxury good, the return to pre-crisis levels is expected to be somewhat slower than for other products.

Wind energy

The future economic significance depends on the installed capacity. For the short term (2010-2015), the estimate is based on the existing wind power capacity and the construction of two new facilities (600 MW). Recently, under the Crisis and Recovery Law, € 2.4 billion has been allocated to the realisation of an extra 500 MW on the DCS. In this way, the economic crisis thus stimulates the development of offshore wind energy.

Piping and cable

For piping and cable, the economic importance has been detailed only in qualitative terms. The economic significance of piping and cable is rising especially due to globalisation of the markets for telecom and electricity and a rising demand for telecom and electricity facilities. The financial and economic crisis did not seem to have influenced the pipeline and cable sector.

Some caution should be made when comparing the sectors. For example, the values for shipping concern the whole sector and not just shipping in the Dutch part of the North Sea. Also employment in oil and gas is dependent of the definition used. In this study only employees working on oil and gas platform on the DCS are taken into account.

Indirect economic significance

Indirect economic activities are activities which do not take place on the DCS but depend on the DSC due to the geographic location and nature of these activities. In this study the economic impact of two main activities was analysed: tourism and recreation in coastal areas and economic activities in seaports.

Tourism and leisure related to the North Sea are a considerable part of the total Dutch tourism and leisure sector. The direct employment in the tourism and leisure sector is estimated at 80,000 jobs, the indirect employment at about 30,000 jobs. However, it is unclear which part is connected to coastal tourism. The expenses in the coastal area are estimated at € 770 million per year.

The Dutch seaports provide a major contribution to the national economy. Annually, they contribute about € 30 billion directly. Besides their direct economic significance, the seaport areas have a substantial indirect economic significance in the form of added value and employment opportunities among suppliers and companies operating in the seaport area. Indirectly seaports contribute to € 15 billion national income. In 2009, Dutch seaports handled over 500 million tonnes of cargo. The seaports provide employment to some 300,000 people work, directly (170,000) or indirectly (130,000).

Annexes

Annex 1 Experts consulted

Sector	Organization	Expert
Petroleum and gas	Nogepa	Mr. A. Tacoma
Sand	Boskalis	Mr. D. Hof Mr. F. Taverne
	RWS Noordzee	Mr. A. Stolk Mr. M. de Bruijn
Shipping	KVNR	Mr. M. Dorsman
Fishery	Productschap Vis	Mrs. C. Seip
Wind energy	NWEA	Mr. E. Arends
Piping and cable	Ministry of Economic Affairs, DG Energy and Telecom	Mr. S. van Merkom

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