Rijkswaterstaat
Ministerie van Infrastructuur en Milieu

***Economic and social analyses for the Marine Strategy Framework Directive. Part 1: Initial Assessment*.**

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Beleidssamenvatting

Om een inschatting te maken van het sociale en economische belang van het gebruik van de Noordzee is een sociale en economische analyse van de Noordzee uitgevoerd. Hieronder volgt een beschrijving gegeven van het huidig gebruik, verwachte toekomstige ontwikkelingen en de jaarlijkse kosten die de samenleving maakt om de huidige staat van het mariene ecosysteem te bereiken of te behouden. Tevens wordt de sociale betekenis van de Noordzee geschetst.

Onderstaande tekst is ook opgenomen in paragrafen 2.3.1 (Economische analyse), 2.3.2 (Sociale analyse) en 2.5 (Aan de aantasting van het mariene milieu verbonden kosten) van de 'Ontwerp Mariene Strategie voor het Nederlandse deel van de Noordzee, Deel I' (Ministerie van Infrastructuur en Milieu, Ministerie van Economische Zaken, Landbouw en Innovatie, 2012).

1. Economische en sociale analyse van het gebruik van de Noordzee

1.1 Economische analyse

Figuur 1 laat het huidige gebruik zien van het Nederlandse deel van de Noordzee. Het Centraal Bureau voor de Statistiek (CBS) heeft op basis van een internationaal afgestemde aanpak[1] een kwantitatieve economische beschrijving gegeven van het gebruik van het Nederlandse deel van de Noordzee door de verschillende economische sectoren die direct of indirect van de Noordzee afhankelijk zijn.[2] De analyse hanteert de termen productiewaarde, toegevoegde waarde en werkgelegenheid. Deze beschrijving is uitgevoerd voor scheepvaart, visserij, olie- en gaswinning, zand- en grindwinning, windenergie, en activiteiten in de havens en de recreatiesector langs de kust. Voor al deze activiteiten is de omvang weergegeven voor 2007 – het meest recente jaar waarvoor het CBS definitieve cijfers beschikbaar heeft – en ook voor de jaren 1995 en 2000. Zo ontstaat een beeld van de trendmatige ontwikkelingen in de verschillende sectoren.

[1] EU Working Group on Economic Assessment, *Economic and Social Analysis for the Initial Assessment for the Marine Strategy Framework Directive: the Guidance document* (Brussel, 2010).
[2] CBS, *Economic description of the North Sea for the Netherlands*, (Voorburg, 2011).

Figuur 1. **Huidig ruimtegebruik op het Nederlandse deel van de Noordzee**

Bron: Ministerie van Verkeer en Waterstaat, *Beleidsnota Noordzee* (Den Haag 2009).

Tabel 1 laat zien dat de totale toegevoegde waarde van het gebruik van de het Nederlandse deel van de Noordzee in 2007 ruim 26 miljard euro bedroeg.De toegevoegde waarde van de activiteiten op de Noordzee zelf bedroeg in totaal zo"n 7 miljard euro. De sector olie- en gaswinning kent de hoogste toegevoegde waarde van alle gebruiksfuncties in het Nederlandse deel van de Noordzee (5,9 miljard euro in 2007). Ook valt de relatief sterke toename van de productiewaarde van de olie- en gaswinning op. Deze wordt deels verklaard door de sterke prijsstijgingen in deze periode. Daarnaast is de scheepvaart van groot economisch belang voor Nederland. Deze sector was in 2007 goed voor een toegevoegde waarde van 1,2 miljard euro. De werkgelegenheid in de scheepvaart bedraagt rond de 6000 FTE. Dit is ongeveer 60 procent van de totale werkgelegenheid van de gebruiksfuncties op zee.

Tabel 1. **Economische beschrijving van het gebruik van het Nederlandse deel van de Noordzee, 1995, 2000 en 2007.**

	1995			**2000**			**2007**		
	Productie-waarde (x mln €)	Toegevoegde waarde (x mln €)	Werkgelegenheid (FTE)	Productie-waarde (x mln €)	Toegevoegde waarde (x mln €)	Werkgelegenheid (FTE)	Productie-waarde (x mln €)	Toegevoegde waarde (x mln €)	Werkgelegenheid (FTE)
Scheepvaart	2.626	630	7.000	3.689	927	7.000	4.588	1.208	6.000
Visserij	102	61	500	111	58	300	113	45	200
Olie- en gaswinning	2.692	2112	3.000	4.306	3.313	3.000	7.644	5.866	2.800
Zandwinning	33	9	110	57	15	195	69	17	154
Windenergie	0	0	0	0	0	0	23	11	pm
Totaal	*5.453*	*2.812*	*10.610*	*8.163*	*4.313*	*10.495*	*12.437*	*7.147*	*9.154*
Zeehavens	32.793	10.198	126.000	49.211	11.510	123.000	80.159	17.806	121.000
Kustzone	1.810	955	23.000	2.426	1.265	24.000	2.901	1.447	25.000
Totaal op land	*34.603*	*11.152*	*149.000*	*51.637*	*12.775*	*147.000*	*83.060*	*19.253*	*146.000*
Totaal NCP + land	**40.056**	**13.964**	**159.610**	**59.800**	**17.088**	**157.495**	**95.497**	**26.400**	**155.154**

De totale toegevoegde waarde van direct aan de zee gerelateerde economische activiteiten op het land was in 2007 circa 19 miljard euro. Onder de activiteiten op het land die een directe relatie hebben met de Noordzee zijn de zeehavens van groot economisch belang. Iets meer dan de helft van de toegevoegde waarde van de activiteiten in de zeehavens wordt gegenereerd in de haven van Rotterdam.[3] Daarnaast zijn de Nederlandse zeehavens knooppunten voor internationale goederenstromen en een vestigingsplaats voor industrie en dienstverlening. Ook andere activiteiten in de kustzone[4], zoals toerisme en recreatie, zijn van economisch belang.[5]

Veel economische activiteiten zijn op een meer indirecte manier afhankelijk van de Noordzee. Dat geldt bijvoorbeeld voor de binnenvaart en andere transportactiviteiten, maar ook voor de visverwerkende industrie, de handel in scheepsonderdelen, enzovoorts. Deze indirecte waarde, ongeveer 50 procent van de directe waarde, is niet meegenomen in Tabel 1. Wanneer de indirecte waarde wel wordt meegenomen, bedraagt de totale economische waarde van de hier beschreven economische sectoren in 2007: productiewaarde 124 miljard euro, toegevoegde waarde 35 miljard euro en werkgelegenheid 246.000 FTE. Ter vergelijking, dit is ongeveer 7 procent van de totale toegevoegde waarde van de gehele Nederlandse economie en 5 procent van de totale werkgelegenheid.[6]

Enkele kanttekeningen dienen te worden gemaakt. De gehanteerde sectorindeling is ook gebruikt voor de analyse van de kosten die aan het tegengaan van de aantasting van het mariene milieu zijn verbonden (zie paragraaf 2.5). De indeling is conform internationale afspraken over hoe om te gaan met statistieken van Eurostat en de Verenigde Naties. Door gebruik te maken van deze indeling is internationale vergelijkbaarheid van gegevens mogelijk. Dit heeft meerwaarde in internationale samenwerking en analyses. Deze indeling heeft echter als nadeel dat recreatie niet herkenbaar is als aparte sector, maar over andere sectoren is verdeeld. Daarnaast moet worden benadrukt dat de cijfers alleen betrekking hebben op het Nederlandse deel van de Noordzee. Dat geeft enige vertekening. Uit de studie van het Landbouw-

[3] CBS, *Environmental accounts of the Netherlands 2010*, (Voorburg, 2010) 127.
[4] De kustzone is hier gedefinieerd als de strook land 1 kilometer landinwaarts van het strand en de duinen, inclusief de Waddeneilanden (CBS, *Economic description, 19).*
[5] Voor meer informative hierover, zie: p 85.
[6] CBS, *Environmental accounts*, 133.

Economisch Instituut (LEI) blijkt bijvoorbeeld dat ongeveer 21 procent van de totale opbrengst in de visserij afkomstig is van het Nederlandse deel van de Noordzee.[7] Dit percentage is meegenomen in tabel 1. De werkgelegenheidscijfers hebben betrekking op het aantal fte-werknemers. Voor de visserij betekent dit een onderschatting van de totale werkgelegenheid, die in werkelijkheid – door het grote aantal zelfstandigen – veel hoger is. Volgens CBS bestond in 2007 56 procent van de totale werkgelegenheid in de sector „landbouw, bosbouw en visserij" uit zelfstandigen (landelijke bestaat 12 procent van de werkgelegenheid uit zelfstandigen).[8] Verder geldt dat de hier gepresenteerde gegevens betrekking hebben op in Nederland geregistreerde bedrijven. Deze kunnen eenvoudig worden opgeteld bij de cijfers van de andere Noordzeestaten om tot totalen voor de Noordzee te komen. Buitenlandse bedrijven zoals buitenlandse scheepvaartrederijen, transporteurs en vissers die hun geld op het Nederlandse deel van de Noordzee en daaraan gelegen havens verdienen, zijn niet meegenomen. Ten slotte brengt de geografische afbakening van de analyses met zich mee dat sommige bedrijven die hun (hoofd)kantoor buiten de kustzone hebben (bijvoorbeeld de NAM in Assen), buiten beeld blijven.

Dit alles in ogenschouw nemend, is de conclusie dat de werkelijke betekenis van de Noordzee voor de Nederlandse economie groter is dan de gepresenteerde cijfers.

Ontwikkelingen tot 2040
Op basis van de meest recente publicatie *Welvaart en Leefomgeving* van het Centraal Planbureau en het Milieu- en Natuurplanbureau[9] heeft Ecorys een „baseline scenario" opgesteld. Hierbij is ingeschat hoe de productiewaarde, toegevoegde waarde en werkgelegenheid in verschillende sectoren die direct of indirect afhankelijk zijn van de Noordzee, zich tot 2040 zullen ontwikkelen.[10] Ecorys heeft deze informatie aangepast op basis van interviews met de verschillende sectoren, om rekening te houden met de gevolgen van de economische crisis zoals die in 2010 bekend waren.

Uit deze analyse blijkt dat voornamelijk de sectoren scheepvaart en zandwinning in economisch belang zullen toenemen. Dat komt door een verwachte toename van de goederenstromen en de verwachte intensivering van zandsuppletie na 2020 ten behoeve van bescherming tegen zeespiegelstijging. Daar staat een afname van de olie- en gassector tegenover door uitputting van de productievelden.

De winstmarges in de visserijsector komen naar verwachting onder druk te staan door hogere kosten in de sector. Mede als gevolg hiervan wordt verwacht dat de toegevoegde waarde en werkgelegenheid van deze sector zullen afnemen. In tegenstelling tot deze verwachting, die is gebaseerd op scenario"s van het CPB en die betrekking heeft op de gehele visserijsector, verwacht het Productschap Vis dat de productiewaarden van de belangrijkste commerciële vissoorten in deNoordzee (tong en schol, maar ook haring en makreel) als gevolg van het beheer op Maximaal Duurzame Opbrengst (MSY) zullen stijgen.[11]

De ontwikkeling van windenergie op zee is zeer onzeker. Eind 2009 waren vergunningen afgegeven voor in totaal 3250 Megawatt (MW). Daarvan zal ongeveer 700 MW vóór 2020 worden gerealiseerd (drie windturbineparken). De toekomstige ontwikkeling van de windenergie op zee is ondermeer afhankelijk van de mate waarin deze vorm van energie concurrerend kan worden ten opzichte van andere vormen van energieopwekking.

[7] LEI, *Compendium voor de leefomgeving,* (Den Haag, 2006) 11.
[8] CBS, *Environmental accounts.* Bijlage F.
[9] Centraal Planbureau, Natuur- en Milieuplanbureau, *Welvaart en Leefomgeving* (2006).
[10] Ecorys, *Baseline Scenario Marine Strategy Framework Directive* (Rotterdam, 2010).
[11] Persoonlijke mededeling Productschap Vis

1.2 Sociale analyse

De activiteiten op en langs de Noordzee vertegenwoordigen niet alleen een belangrijke economische waarde, maar ook een belangrijke sociale waarde.

In het onderzoek *Beleving van de Noordzee: Een kwantitatieve consultatie onder Nederlandse burgers over de Noordzee* van TNS-NIPO (2011) is steekproefsgewijs een enquête gehouden onder zeshonderd Nederlanders, waarbij hun kennis over en affiniteit met de Noordzee zijn bekeken. Ook is hen gevraagd welke prioriteiten zij zouden geven aan verschillende mogelijke oplossingen (met gegeven consequenties) voor een aantal gepresenteerde (potentiële) milieuproblemen. Uit het rapport blijkt dat 46 procent van de respondenten de Noordzee persoonlijk (heel) belangrijk vindt, ook al lijken zij zich niet heel bewust te zijn van de verschillende potentiële milieuproblemen. Als Nederlanders aan de Noordzee denken, noemen zij alleen positieve dingen, zoals het strand, de zee en strandwandelingen die je kunt maken. Echter, als zij worden geïnformeerd over verschillende (potentiële) problemen, vinden zij het wel belangrijk dat er iets aan wordt gedaan. Nederlanders denken dat de visserij van groot economisch belang is voor Nederland.

De meerderheid van de Nederlanders geeft aan dat zowel de overheid als de burger zelf een verantwoordelijkheid heeft voor het oplossen van de gepresenteerde (potentiële) milieuproblemen rondom de Noordzee. Onder de overheid verstaan zij zowel de Nederlandse overheid als de Europese Unie. In de betalingsbereidheid van de Nederlanders lijkt een discrepantie te zitten tussen het sociaal wenselijke antwoord en het werkelijke gedrag. Dit blijkt uit het feit dat de helft van de ondervraagden aangeeft bereid te zijn geld te betalen om iets te doen tegen de geschetste milieuproblemen. Wanneer echter de keuze wordt gegeven tussen verschillende maatregelen, neigen zij er toch toe te kiezen voor maatregelen die voor hen geen extra kosten met zich meebrengen. Bijvoorbeeld, om plastic afval in zee tegen te gaan, wordt een prijsverhoging van plastichoudende producten minder geaccepteerd dan het niet meer kunnen krijgen van plastic tasjes in de supermarkt. Dit soort gedrag lijkt een aanwijzing te zijn dat men toch het meest gevoelig is voor maatregelen die uiteindelijk geld kosten.

De bodem van het Nederlandse deel van de Noordzee is rijk aan archeologische resten die een tastbare herinnering vormen aan ons verleden. Deze resten variëren van historische scheepswrakken uit de middeleeuwen tot vliegtuigwrakken uit de Tweede Wereldoorlog. De bodem van de Noordzee herbergt een prehistorisch landschap waarin nog resten van onze verre voorouders te vinden zijn. Ook worden jaarlijks vele botten van prehistorische dieren, zoals mammoeten, uit de Noordzee opgevist. De archeologie van de Noordzee is wetenschappelijk van grote betekenis. De wrakken zijn ook geliefde locaties voor sportduikers en sportvissers.

2. Aan de aantasting van het mariene milieu verbonden kosten

Op basis van een internationaal afgestemde aanpak[12] heeft het LEI een kwantitatieve analyse uitgevoerd van de (financiële) kosten die worden gemaakt om de huidige milieutoestand van het mariene ecosysteem op het Nederlandse deel van de Noordzee te realiseren en te handhaven.[13] Het overzicht is een grove weergave van de kosten van het in paragraaf 2.4 van de Mariene Strategie beschreven huidige beleid om verstoringen van menselijke activiteiten tegen te gaan, ten opzichte van wat deze activiteiten de samenleving opleveren (paragraaf 2.3.1). Deze kosten

[12] „Cost based Approach" *Europese handreiking economische analyses KRM, §4*.3.
[13] LEI, *The current cost of avoiding degradation of the Dutch North Sea Environment* (Den Haag 2010).

kunnen worden gezien als een ondergrens voor de huidige mate van bescherming van het mariene ecosysteem.[14]

Uit tabel 2 blijkt dat de verschillende sectoren jaarlijks minimaal 147 miljoen euro uitgeven om aantasting van het mariene milieu te voorkomen of te verminderen.

Een dergelijk overzicht kent inherent afbakeningsproblemen. Zo is voor scheepvaart aangenomen dat slechts 10 procent van de kosten die de Nederlandse scheepvaart maakt ter bescherming van het mariene milieu moet worden toegerekend aan de bescherming van het Nederlandse deel van de Noordzee. De schepen zijn immers slechts een beperkt deel van de tijd in Nederlandse wateren, maar de sector zal wel het volledige bedrag moeten betalen en is dus meer dan 150 miljoen euro kwijt aan huidige maatregelen. Tachtig procent van de scheepvaart op het Nederlandse deel van de Noordzee wordt uitgevoerd door buitenlandse rederijen. De gerelateerde kosten blijven buiten beeld. Verder betekent de keuze om alleen te kijken naar de kosten van al uitgewerkte maatregelen, dat de kosten die de visserij zal moeten maken voor Natura 2000-maatregelen niet zijn meegenomen in bovenstaand overzicht. Ditzelfde geldt voor bestaande en aankomende wetgeving op gebied van zwavel.

Behalve sectoren op en langs de Noordzee treffen ook sectoren op het land veel maatregelen en maken kosten. Hierbij gaat het onder meer om maatregelen en kosten voor de Kaderrichtlijn Water, om maatregelen die de landbouw moet treffen voor de Nitraatrichtlijn, en om investeringen in rioleringszorg en rioolwaterzuivering. Deze maatregelen worden niet in de eerste plaats getroffen voor het verbeteren van de milieukwaliteit van de Noordzee, maar dragen daar wel aan bij. Volgens het LEI gaat het hier om minimaal het tienvoudige van bovengenoemde bedragen.[15]

Dit soort kanttekeningen over sectoren die meer kosten maken om aantasting van het mariene milieu te voorkomen dan in de studie van het LEI zijn gepresenteerd, rechtvaardigt de conclusie dat de werkelijk gemaakte kosten groter zijn dan de gepresenteerde cijfers.

[14] Deze methode is vergelijkbaar met de manier waarop Nederland de analyse van de milieu- en hulpbronkosten heeft uitgevoerd voor de Europese Kader Richtlijn Water: R. Van der Veeren, W. Dekking, *Kostenterugwinning van waterdiensten in Nederland* (2008). De basisgedachte is gebaseerd op R. Hueting, *Nieuwe Schaarste en Economische Groei* (Amsterdam, Brussel, 1974).
[15] LEI, *The current cost of avoiding degradation*, 8.

Tabel 2. **Ondergrens van de jaarlijkse kosten om aantasting van het Nederlandse Noordzeemilieu te voorkomen.**

Kostensoort	Kosten: Mln € per jaar
Scheepvaart - verzekeringskosten - contributies voor het International Oil Pollution Compensation Fund - TBT-vrije antifouling coating - ballastwaterbehandelingsinstallaties - havenontvangstinstallaties	17
Visserij en maricultuur - verduurzaming van de visserij (o.a. aanpassingen techniek, experimenten) - voorkomen van het introduceren van niet-inheemse soorten in het mariene milieu - sluiten van gebieden op de Noordzee	8
Olie- en gaswinning[16] - maatregelen gerelateerd aan de exploratie van olie en gas, het productieproces en de ontmanteling van platforms, inclusief maatregelen gerelateerd aan productiewater	20
Zand- en schelpenwinning - restricties in de locaties	3
Windenergie - milieueffectrapportages (m.e.r.)	4
Recreatie[17] - schoonmaken van stranden	9
Defensie - onderzoek naar het effect van onderwatergeluid - technische maatregelen aan boord van schepen	1
Baggeren - opslaan van verontreinigde zoute bagger op land in plaats van verspreiden op zee	30
Landaanwinning: Maasvlakte 2 - m.e.r.-en - natuurcompensatie - monitoring van de effecten op het Noordzeemilieu - uitsluiten van visserij in het Maasvlakte 2 en natuurcompensatiegebied - uitvoeren en handhaven van bovenstaande maatregelen	21
Overheid - beleidsontwikkeling/voorbereiding en coördinatie - beheeractiviteiten - beleidsevaluatie-/monitoring - kennisontwikkeling	35
Totaal kosten zeegerelateerde maatregelen	**147**

Bron: LEI, *The current cost of avoiding degradation of the Dutch North Sea Environment* (Den Haag, 2010) 9.

[16] Cijfers met betrekking tot olie- en gaswinning zijn gebaseerd op de 4-jaarlijkse bedrijfsmilieuplannen van de sector. Zie p 48.

[17] Voor Nederland en België samen komen Mouat et. al op 10,4 miljoen euro voor kosten voor het opruimen van de kust. Wanneer wordt aangenomen dat 85 procent van dit bedrag kan worden toegerekend aan de Nederlandse kust, dan worden kosten voor de Nederlandse geschat op 8,8 miljoen euro. Zie: J. Mouat, J., R.L. Lozano, en H. Bateson, *Economic impacts of marine litter* (2010) 45.

Management summary

In order to estimate the social and economic importance of the use of the Dutch part of the North Sea a social and economic analysis has been carried out. The next paragraphs present a description of current use, expected future developments, and the annual cost society incurres to achieve or maintain the current state of the marine ecosystem. Also, the social significance of the North Sea is outlined.

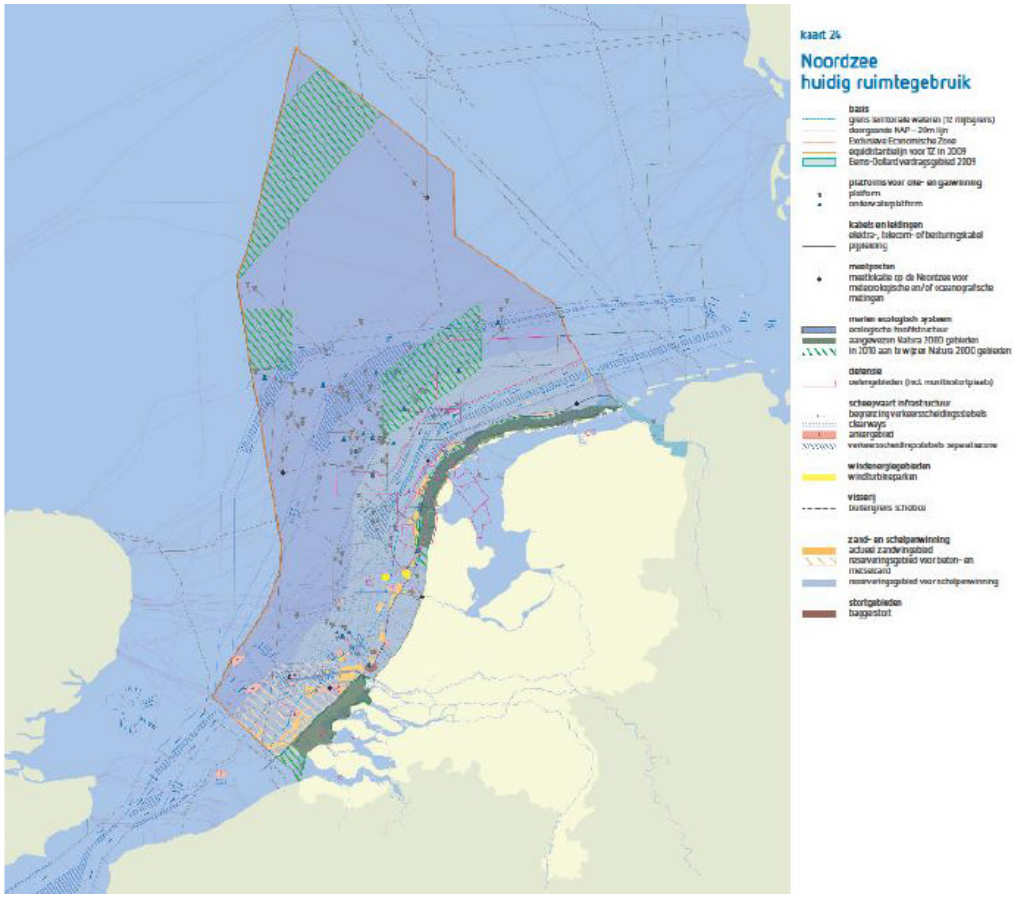
The text below is also included in sections 2.3.1 (Economic Analysis), 2.3.2 (Social Analysis) and 2.5 (Cost of degradation of the marine environment) of the 'Draft Marine Strategy for the Dutch North Sea, Part I '(Ministry of Infrastructure and Environment, Ministry of Economic Affairs, Agriculture and Innovation, 2012).

1. Social and economic analysis of the use of the North Sea

1.1 Economic analysis

Figure 2 shows the current use of the Dutch North Sea. Based on an internationally agreed approach (Marine water accounts approach, paragraph 2.3 in the European guideline economic analysis MSFD) the Central Bureau of Statistics (CBS) presented a quantitative economic description of the use of the Dutch part of the North Sea by various economic sectors that are directly or indirectly depending on the North Sea in terms of output, value added and employment. A description of the production value, value added and employment is given for various sectors which directly or indirectly depend on the presence of the North Sea. The following sectors are described: oil and gas exploration, shipping, fishing, sand and gravel extraction, wind energy, activities in sea ports and coastal recreation. For all these activities, the economic importance is presented for 2007 - the most recent year for which the CBS has final data available - and also for the years 1995 and 2000. In this way, it is possible to get a picture of the developments in the various sectors.

Figure 2. Current use in of the Dutch part of the North Sea



Source: Ministry of Transport, Beleidsnota Noordzee (The Hague 2009).

Table 3 shows that the total added value of the use of the Dutch North Sea in 2007 amounted over € 26 billion. The value added of the activities in the North Sea itself totaled about 7 billion. The oil and gas sector represents the highest value added of all uses in the Dutch North Sea (5.9 billion euros in 2007). Remarkable is the relatively strong increase in the production value of oil and gas. This is partly explained by the strong price increases in this period. In addition, shipping is of great economic importance for the Netherlands. In the year 2007, this sector had a value of 1.2 billion euros. Employment in shipping is around 6,000 FTE. This is about 60 percent of the total employment of the use of the North Sea.

Table 3. **Economic description of the use of the Dutch part of the North Sea, in 1995, 2000 and 2007.**

	1995			2000			2007		
	Production value (x mln €)	Value added (x mln €)	Employment (FTE)	Production value (x mln €)	Value added (x mln €)	Employment (FTE)	Production value (x mln €)	Value added (x mln €)	Employment (FTE)
Shipping	2.626	630	7.000	3.689	927	7.000	4.588	1.208	6.000
Fisheries	102	61	500	111	58	300	113	45	200
Oil and gas	2.692	2112	3.000	4.306	3.313	3.000	7.644	5.866	2.800
Sand and gravel extraction	33	9	110	57	15	195	69	17	154
Wind energie	0	0	0	0	0	0	23	11	pm
Total	*5.453*	*2.812*	*10.610*	*8.163*	*4.313*	*10.495*	*12.437*	*7.147*	*9.154*
Sea ports	32.793	10.198	126.000	49.211	11.510	123.000	80.159	17.806	121.000
Coastal zone	1.810	955	23.000	2.426	1.265	24.000	2.901	1.447	25.000
Total on land	*34.603*	*11.152*	*149.000*	*51.637*	*12.775*	*147.000*	*83.060*	*19.253*	*146.000*
Total DCS + land	**40.056**	**13.964**	**159.610**	**59.800**	**17.088**	**157.495**	**95.497**	**26.400**	**155.154**

In 2007, total value added of all land based economic activities directly related to the sea was around 19 billion euros. Among these activities, seaports are of great economic importance. Slightly more than half of the added value of activities in seaports is generated in the port of Rotterdam. In addition, Dutch seaports are nodes for international transport of goods and a location for industry and services. Also other activities in the coastal zone, such as tourism and recreation are of economic importance.

Many economic activities are dependent on the North Sea in a more indirect manner. This is true for inland waterways and other transport, but also for fish processing industry, shipyards, etc. This indirect value, about 50 percent of the direct value, is not included in Table 1. If indirect values would be included, the total economic value of the described economic sectors for 2007 would be: 124 billion euro production value, added value 35 million and employment 246,000 FTE. This is about 7 percent of the total value added of the entire Dutch economy and 5 percent of total employment.

Some remarks should be made. The sectoral classification used is also used for the analysis of the costs of degradation of the marine environment (see section 2). The classification is according to international agreements on statistics of Eurostat and the United Nations. By using this format, international comparability of data is possible. This has added value in international cooperation and analyses. However, this format has the disadvantage that recreation is not recognisable as a separate sector, but is divided among other sectors. It should also be emphasized that the figures relate only to the Dutch part of the North Sea. That gives some distortion. A study by the Agricultural Economics Institute (LEI) shows that around 21 percent of the total yield in fisheries comes from the Dutch part of the North Sea. This percentage is used for the number in Table 1. Employment figures refer to the number of FTE employees. For fisheries, this means an underestimation of total employment, which in reality - because of the large number of self employment - is much higher. According to CBS, in 2007 56 percent of total employment in the

sector "agriculture, forestry and fisheries" was self-employed (cf. the national average of self-employment is 12 percent). Furthermore, the data presented here relate to companies registered in the Netherlands. This can easily be added to the figures of other North Sea states to create totals for the entire North Sea. However, this means that foreign companies such as foreign shipping companies, hauliers and fishermen earning money on the Dutch part of the North Sea or in the ports, are not included. Finally, the geographical scope of the analysis means that some companies with their (head) office outside the coastal area (eg, the NAM in Assen), are ignored.

Considering all this, the conclusion is that the real economic importance of the Dutch part of the North Sea to the Dutch economy is larger than represented by the the figures presented in this table.

Developments until the year 2040

Based on their most recent publication 'Welvaart en Leefomgeving' of the Central Planning Bureau and the Environmental Planning Bureau, Ecorys developed a "baseline scenario". This baseline scenario estimates how production value, value added, and employment will develop until 2040 in the various sectors that are directly or indirectly depending on the Dutch part of the North Sea. Ecorys adapted this information based on interviews with the various sectors (stakeholders), to take into account the likely impacts of the economic crisis, as they were known in 2010.

This analysis shows that shipping and sand mining are likely to increase in economic importance, due to an expected increase in trade flows and the expected intensification of sand replenishment after 2020 for protection against sea level rise. A decrease is expected in the economic importance of the oil and gas sector due to the exhaustion of production fields.

The profit margins in the fisheries sector are expected to remain under pressure due to increasing costs in the sector. Partly as a result of this, added value and employment in this sector are expected to decrease. In contrast to this expectation, based on scenarios by the Dutch Central Planning Bureau, which describe the entire fishing industry, the Fish Product Board (Productschap Vis; stakeholder organization) expects that production values of the main commercial fish species in the North Sea (sole and plaice, but also herring and mackerel) will increase as a result of sustainable fisheries policies aimed at Maximum Sustainable Yield (MSY).

The development of offshore wind energy is very uncertain. End of 2009 permits for a total of 3250 megawatts (MW) were granted. Of this, approximately 700 MW will be realized before 2020 (three wind farms). The future development of wind energy at sea, is depending – among other things – on the extent to which this form of energy can be competitive compared to other forms of energy.

1.2 Social Analysis

Activities on and along the North Sea represent not only an important economic value but also an important social value.

The study Perception of the North Sea: A quantitative consultation among Dutch citizens on the North Sea (In Dutch: Beleving van de Noordzee: Een kwantitatieve consultatie onder Nederlandse burgers over de Noordzee) by TNS-NIPO (2011)

presented the results of a random survey of six hundred Dutch citizens. This study analysed their knowledge of and affinity with the North Sea. The respondents were presented a number of (potential) environmental problems, and asked what priorities they would give to different possible solutions (with given consequences). The report shows that 46 percent of the respondents think that the North Sea is (very) important to them personally, even if they do not seem to be very aware of the various potential environmental problems. When the respondents think of the Dutch part of the North Sea, they only mention positive associations, such as the beach, and walks you can make along the sea and beaches. However, if they are informed of various (potential) problems, they find it important that something should be done. The repondents believe that fisheries are a very important sector in the Netherlands.

The majority of the respondents indicate that the government and the citizens themselves have a shared responsibility for solving the presented (potential) environmental problems around the North Sea. Under 'the government' they understand both the Dutch government and the European Union. With respect to the willingness to pay, there is an important discrepancy between socially desirable responses and actual behavior. This is evident from the fact that half of respondents state they are willing to pay money to do something against the environmental problems outlined. However, when given the choice between different measures, they nevertheless tend to opt for measures that entail no additional costs for them. For example, to reduce the amount of plastic waste at sea, a price increase for products containing plastic is less accepted than not longer getting plastic bags at supermarkets. This type of behavior seems to be an indication that repspondents do not accept measures that eventually cost money.

The bottom of the Dutch part of the North Sea is rich in archaeological remains which form a tangible reminder of our past. These remains vary from historic shipwrecks from the Middle Ages to plane wrecks from World War II. The bottom of the North Sea contains a prehistoric landscape where remains of our ancestors can still be found. In addition, each year many bones of prehistoric animals such as mammoths are dredged from the North Sea. The archeology of the North Sea is of great scientific significance. And the wrecks are popular locations for recreational divers and anglers.

2. Analysis of the costs of degradation

Based on an internationally agreed approach, LEI performed a quantitative analysis of the (financial) costs incurred to achieve and maintain the current environmental status of the marine ecosystem in the Dutch part of the North Sea. The review presents a rough estimate of the costs of current policies aimed at reduction of distortion by human activities, as described in section 2.4 in the Marine Strategy. These costs can be seen as a lower limit for the current level of protection of the marine environment.

Table 4 shows that the different sectors spend at least €147 million per annum to prevent or reduce degradation of the marine environment.

Such a survey has inherent problems of demarcation. For example, for shipping it is assumed that only 10 percent of the costs incurred by the Dutch shipping companies to protect the marine environment should be allocated to the protection of the Dutch part of the North Sea. This is done because ships are in Dutch waters only for a limited part of the time. However, the sector will have to pay the full amount and therefore has to pay more than €150 million on current measures. In addition, eighty percent of shipping on the Dutch part of the North Sea is carried out by foreign shipping companies. The related costs are not included. Furthermore, the choice to only look at the cost of implemented measures, that the costs the fisheries will face because of upcoming Natura 2000 measures are not included in the table above. The same applies to existing and upcoming legislation with respect to sulfur emissions.

Except sectors active at the North Sea and along the North Sea, also many sectors located inland implement measures and are faced with expenses to protect the marine environment. These include i.a. measures and costs for the Water Framework Directive, agricultural measures for the Nitrates Directive, and investments in sewerage and sanitation. These measures are not primarily made to improve the environmental quality of the North Sea, but do contribute to this. According to the LEI, the costs involved are at least ten times the above mentioned amounts.

This type of comments about sectors that incur more costs to prevent degradation of the marine environment than presented in the study of the LEI, justifies the conclusion that actual costs are larger than the figures presented.

Table 4. **Lower limit of the annual costs to prevent degradation of the marine environment in the Dutch part of the North Sea.**

Type of measures	**Annual costs Mln €**
Shipping - Insurance costs - Contributions to the International Oil Pollution Compensation Fund - TBT-free anti-fouling materials - Ballast water treatment facilities - Port reception facilities for waste	17
Fisheries and aquaculture - More sustainable fishing methods (i.e. gear change) - Ban on dumping from marine debris from aquaculture - Limitations of cockle fisheries	8
Olie and gas extraction - Measures related to the exploration of oil and gas, the production process and the decommissioning of platforms, including measures related to production water	20
Sand and shell mining - Restrictions on side locations	3
Wind energy - Environmental Impact Assessments (EIA)	4
Recreation - Beach cleaning	9
Ministry of Defence (Royal Dutch navy) - Research into underwater noise - Technical measures on board ships	0
Dredging - Restrictions on sea based dumping of dredged materials	30
Land extention: Maasvlakte II - EIA reporting - Habitat compensation - Monitoring of environmental effects - Restricted fishing areas - Enforcement and management of these measures	21
Governance - Policy work - Management - Monitoring of the North Sea environment and economic activities - Improvement of the knowlegde about the North Sea environment	35
Total costs sea related measures	**147**

Source: LEI, 2010

Samenvatting

Achtergrond

De Europese Kaderrichtlijn Mariene Strategie (KRM) beoogt uiterlijk in 2020 een Goede Milieutoestand te bereiken in de mariene wateren van Europa. Elke lidstaat is verplicht om een sociaal-economische analyse en een maatschappelijke kosten-batenanalyse uit te voeren. Concreet kent de KRM de volgende verplichtingen:

1. Een economische en sociale analyse van het gebruik van die wateren (voor Nederland het Nederlandse deel van de Noordzee) en de aan de aantasting van het mariene milieu verbonden kosten (artikel 8.1);
2. De lidstaten moeten erop toezien dat de maatregelen (voor het bereiken van de KRM doelstellingen) kosteneffectief en technisch haalbaar zijn en dat zij alvorens een nieuwe maatregel uitvoeren een effectbeoordeling moeten opstellen inclusief een kosten-batenanalyse (artikel 13.3);
3. Uitzonderingen op te nemen maatregelen. Deze zijn denkbaar indien er sprake is van onevenredig hoge kosten (artikel 14.4).
4. Bij het vaststellen van doelen moet rekening worden gehouden met economische en sociale aspecten (Bijlage IV (9))

In de afgelopen jaren is ter voorbereiding van de Initiële Beoordeling uitvoering gegeven aan de economische en sociale analyse van het gebruik van de Noordzee en aan de aantasting van het mariene milieu verbonden kosten. De Initiële Beoordeling kan beschouwd worden als het startpunt van een cyclisch proces. Het vervolgproces bestaat o.a. uit het identificeren van mogelijke maatregelen, en het afwegen van maatregelen op basis van kosteneffectiviteit, kosten-baten en disproportionaliteit.

Methoden

In het kader van de sociaal- economische analyses voor de Initiële Beoordeling zijn drie studies verricht, namelijk[18]:

1. *Economische beschrijving van het gebruik van de Noordzee*
   Op basis van een internationaal afgestemde aanpak (Marine Accounts Approach; paragraaf 2.3 in de Europese handreiking economische analyses KRM) is een beschrijving gegeven van de productiewaarde, toegevoegde waarde en werkgelegenheid in verschillende sectoren die direct of indirect afhankelijk zijn van de aanwezigheid van de Noordzee. Er is gekeken naar scheepvaart, visserij, olie en gaswinning, zand- en grindwinning, windenergie, maar ook naar de activiteiten in de havens en de recreatiesector langs de kust. Voor al deze activiteiten is niet alleen de omvang in 2007 – het meest recente jaar waarvoor het Centraal Bureau voor de Statistiek definitieve cijfers beschikbaar heeft – maar ook voor de jaren 1995 en 2000, zodat een beeld ontstaat van de ontwikkelingen in de verschillende sectoren.

[18] CBS (2011). *Economic description of the North Sea for the Netherlands: an update version 3*, CBS, Voorburg.
http://www.noordzeeloket.nl/krm/Images/Economic%20description%20of%20the%20North%20Sea%20for%20the%20Netherlands%20%28CBS%2c%202011%29_tcm19-4952.pdf
Ecorys (2010) Baseline Scenario Marine Strategy Framework Directive, Ecorys, Rotterdam.
http://www.noordzeeloket.nl/krm/Images/Baseline%20Scenario%20Marine%20Strategy%20Framework%20Directive%20%28Ecorys%2c%202010%29_tcm19-4951.pdf
LEI (2010). *The current cost of avoiding degradation of the Dutch North Sea Environment* LEI, Den Haag.
http://www.noordzeeloket.nl/krm/Images/The%20current%20cost%20of%20avoiding%20degradation%20of%20the%20Dutch%20North%20Sea%20Environment%20(LEI%2C%202010)_tcm19-4950.pdf

2. *Beschrijving van de verwachte economische ontwikkelingen ('baseline scenario').*
   Waar het Centraal Bureau voor de Statistiek het toonaangevende instituut is op het gebied van de beschrijving van de situatie van de Nederlandse economie in het verleden, is het Centraal Plan Bureau dat voor het opstellen van scenario's voor de toekomst. Vandaar dat op basis van hun meest recente publicatie is ingeschat hoe de productiewaarde, toegevoegde waarde en werkgelegenheid in verschillende sectoren die direct of indirect afhankelijk zijn van de aanwezigheid van de Noordzee zich tot 2040 naar verwachting zullen ontwikkelen. Deze informatie is op basis van interviews met de verschillende sectoren aangepast om rekening te houden met de gevolgen van de economische crisis. Het op deze manier verkregen beeld van de toekomstige ontwikkelingen van de economische sectoren kan vervolgens worden gebruikt om de ontwikkeling in de milieudruk op de Noordzee voor de verschillende sectoren te kunnen bepalen. Op basis van deze ontwikkeling wordt duidelijk wat de milieuproblemen zijn die opgelost moeten worden.

3. *Analyse van de aan de aantasting van het mariene milieu verbonden kosten*
   Deze analyse valt uiteen in twee delen. Ten eerste een beschrijving van de kosten die momenteel al worden gemaakt om de huidige milieukwaliteit te realiseren. Dit kan worden gezien als een ondergrens voor wat de Nederlandse samenleving bereid is te betalen voor de bescherming van het mariene milieu. Ondanks deze inspanningen zijn er nog steeds milieuproblemen op de Noordzee, waar de komende jaren ook maatregelen voor zullen worden getroffen. Het tweede deel van deze analyse bestaat daarom uit een globale (kwalitatieve) beschrijving van de belangrijkste knelpunten die er nu nog bestaan. De totale kosten van de aan de aantasting van het mariene milieu verbonden kosten zijn gelijk aan de kosten van huidige en eventueel aanvullende maatregelen. Indien wordt besloten om geen aanvullende maatregelen te treffen dan is kennelijk de huidige situatie al duurzaam.

4. *Sociale analyse*
   De activiteiten die op en langs de Noordzee plaatsvinden, vertegenwoordigen niet alleen een belangrijke economische waarde, maar ook een belangrijke sociale waarde. In Nederland worden sommige dorpen en steden sterk bepaald door de aanwezigheid van bepaalde activiteiten. De haven van Rotterdam, de grootste haven van Europa, is niet alleen bepalend voor het aanzien van de stad, maar ook van groot sociaal belang. Veel mensen werken daar, vaak al generaties lang. Een andere stad met een grote sociale binding is Zandvoort. Zandvoort is een typische Noordzee badplaats, waar in de zomer veel Amsterdammers naar toe gaan. Zandvoort wordt sterk gedomineerd door de recreatiesector. Scheveningen kent naast recreatie ook een sterke visserijtraditie met de bekende Vlaggetjesdag; de viering van de vangst van de eerste nieuwe haring. Een dorp met een nog sterkere visserijtraditie is Urk. Een groot deel van de bevolking op dit voormalige eiland heeft familieleden die werkzaam zijn in de visserijsector. Het eilandkarakter en de sterke binding met en afhankelijkheid van de grillen van de zee zorgen voor een zeer sterke onderlinge sociale binding binnen de Urker samenleving. Den Helder is een ander voorbeeld van een dorp/stad dat een sterke binding heeft met een bepaalde sector. In Den Helder is de Koninklijke Marine altijd een belangrijke opdrachtgever geweest.

   In het onderzoek Beleving van de Noordzee: Een kwantitatieve consultatie onder Nederlandse burgers over de Noordzee van TNS-NIPO (2011) werd een enquête gehouden onder een steekproef van 600 burgers, waarbij hun kennis

over en affiniteit met de Noordzee werden bekeken. De algemene conclusie van het onderzoek is dat burgers zich niet bewust zijn van mogelijke problemen op de Noordzee. Echter, wanneer ze bewust worden gemaakt van verschillende (potentiële) problemen, vinden ze het wel belangrijk dat er iets aan wordt gedaan. De meerderheid van de burgers geeft aan dat de burgers zelf en de overheid (Nederlandse overheid en Europese Unie) verantwoordelijk zijn voor het oplossen van de gepresenteerde problemen rond de Noordzee. De helft van de ondervraagden geeft aan dat ze bereid zijn geld te betalen om iets te doen tegen de geschetste milieuproblemen, maar wanneer de keuze wordt gegeven tussen verschillende maatregelen, neigen ze toch te kiezen voor de maatregelen die geen extra kosten voor hen meebrengen. Een ander resultaat van de studie is dat burgers niet echt bewust zijn van de werkelijke economische belangen van de verschillende sectoren. Burgers denken dat de visserijsector van belangrijke economische waarde is voor Nederland, ook al is deze in werkelijkheid veel kleiner ten opzichte van de olie- en gaswinning en de scheepvaartsector. Hieruit blijkt o.a. dat de sociale waarde van de visserij heel groot is.

Resultaten algemeen

Deze sectie bespreekt beknopt de resultaten van de uitgevoerde studies. De paragraven hierna bespreken de resultaten per sector in iets meer detail.

Huidig en toekomstig economisch belang van de economische activiteiten op en langs de zee

Tabel 5 geeft een overzicht van het economisch belang in termen van productiewaarde, toegevoegde waarde en werkgelegenheid voor zowel sectoren op het Nederlands Continentaal Plat (NCP) als sectoren op het land die een directe relatie hebben met de zee. Hierbij is gebruik gemaakt van de sectorindeling van het CBS, waardoor de cijfers internationaal vergelijkbaar zijn. De tabel laat zien dat voornamelijk olie- en gaswinning, zeehavens en scheepvaart van groot economisch belang zijn voor Nederland.

In de toekomst neemt het economisch belang van zowel olie- en gaswinning als visserij af (zie volgende secties). De sector zandwinning neemt daarentegen in de toekomst naar verwachting sterk toe. De ontwikkeling van windenergie is erg onzeker; de overheidsdoelstelling van 6.000MW in 2020 lijkt gezien het huidige tempo niet haalbaar. De scheepvaartsector en de zeehavens blijven in de toekomst ook van groot economisch belang. De economische ontwikkelingen van deze sectoren zijn grotendeels afhankelijk van de wereldhandel. De sectoren in de kustzone, met name toerisme en recreatie, nemen naar alle waarschijnlijkheid in de toekomst aan economisch belang toe. In de paragraaf 'resultaten per sector' wordt uitgebreider op de toekomstige ontwikkelingen per sector ingegaan.

Tabel 5| Economisch belang sectoren (CBS, 2011)

	1995			**2000**			**2007**		
	Productie-waarde (x mln €)	Toegevoegde waarde (x mln €)	Werkgelegenheid (FTE)	Productie-waarde (x mln €)	Toegevoegde waarde (x mln €)	Werkgelegenheid (FTE)	Productie-waarde (x mln €)	Toegevoegde waarde (x mln €)	Werkgelegenheid (FTE)
Scheepvaart	2.626	630	7.000	3.689	927	7.000	4.588	1.208	6.000
Visserij	102	61	500	111	58	300	113	45	200
Olie- en gaswinning	2.692	2112	3.000	4.306	3.313	3.000	7.644	5.866	2.800
Zandwinning	33	9	110	57	15	195	69	17	154

Windenergie	0	0	0	0	0	0	23	11	pm
Totaal	*5.453*	*2.812*	*10.610*	*8.163*	*4.313*	*10.495*	*12.437*	*7.147*	*9.154*
Zeehavens	32.793	10.198	126.000	49.211	11.510	123.000	80.159	17.806	121.000
Kustzone	1.810	955	23.000	2.426	1.265	24.000	2.901	1.447	25.000
Totaal op land	*34.603*	*11.152*	*149.000*	*51.637*	*12.775*	*147.000*	*83.060*	*19.253*	*146.000*
Totaal NCP + land	**40.056**	**13.964**	**159.610**	**59.800**	**17.088**	**157.495**	**95.497**	**26.400**	**155.154**

[1]Cijfers mbt zandwinning zijn afkomstig uit Ecorys, 2010.

Kosten van aantasting van het mariene milieu

Er worden momenteel al veel maatregelen getroffen (en kosten gemaakt) ter bescherming van het mariene milieu. Tabel 6 geeft een inschatting van de jaarlijkse kosten die de verschillende sectoren maken om aantasting van het mariene milieu te voorkomen. In totaal wordt er jaarlijks circa €147 miljoen uitgegeven aan maatregelen die op zee worden getroffen om aantasting van het Nederlandse Noordzeemilieu te voorkomen.

Hierbij dient te worden opgemaakt dat het maken van een dergelijk overzicht gepaard gaat met afbakeningsproblemen. Bijvoorbeeld, voor de scheepvaart is aangenomen dat slechts 10 procent van de kosten die de Nederlandse scheepvaart maakt ter bescherming van het mariene milieu moet worden toegerekend aan de bescherming van het Nederlandse deel van de Noordzee, omdat schepen slechts een beperkt deel van de tijd in Nederlandse wateren zijn. Verder is er in de analyse alleen gekeken naar de kosten van huidige maatregelen, en zijn bijvoorbeeld kosten die de visserij zal moeten maken voor Natura2000 maatregelen niet meegenomen in onderstaand overzicht. De gepresenteerde cijfers in tabel 6 moeten dan ook worden beschouwd als een ondergrens van de werkelijk gemaakte kosten.

Naast deze kosten worden er ook veel maatregelen aan landzijde getroffen die een positieve invloed hebben op de waterkwaliteit van de Noordzee. Hoewel deze maatregelen (zoals maatregelen in de landbouw, rioolwaterzuivering, e.d.) in eerste instantie niet worden getroffen voor het verbeteren van de milieukwaliteit van de Noordzee, dragen deze maatregelen hieraan wel in grote mate bij (schoon sediment transport, beperking van eutrofiering, e.d.). De kosten van deze maatregelen zijn een veelvoud van de bedragen in tabel 6.

Tabel 6| Jaarlijkse kosten om aantasting aan het Nederlandse Noordzeemilieu te voorkomen

Kostensoort	**Kosten: Mln. € per jaar**
Scheepvaart - verzekeringskosten - contributies voor het International Oil Pollution Compensation Fund - TBT-vrije anti-fouling verf - ballastwater behandelingsinstallaties - haven ontvangst installaties - schoonmaken van stranden	17
Visserij en aquacultuur - verduurzaming van de visserij (o.a. aanpassingen techniek) - verbod op het introduceren van invasieve exoten in het mariene milieu - sluiten van gebieden op de Noordzee	8
Olie- en gaswinning - maatregelen gerelateerd aan de exploratie van olie en gas, het productieproces en de ontmanteling van platforms, inclusief maatregelen gerelateerd aan productiewater	20
Zand- en schelpenwinning - restricties in de locaties	3
Windenergie	4

- Milieu Effect Rapportages (MER)	
Recreatie - schoonmaken van stranden	9
Defensie - onderzoek naar het effect van onderwatergeluid - technische maatregelen aan boord van schepen	0
Baggeren - opslaan van verontreinigde zoute bagger op land ipv verspreiden op zee	30
Landaanwinning: Maasvlakte II - MER-rapportages - Natuurcompensatie - monitoring van de effecten op het Noordzeemilieu - uitsluiten van visserij in het Maasvlakte II en natuurcompensatiegebied - uitvoeren en handhaven van bovenstaande maatregelen	21
Overheid - beleidsvoorbereiding en coördinatie - beheeractiviteiten - monitoring - kennisontwikkeling	35
Totaal kosten zee-gerelateerde maatregelen	**147**

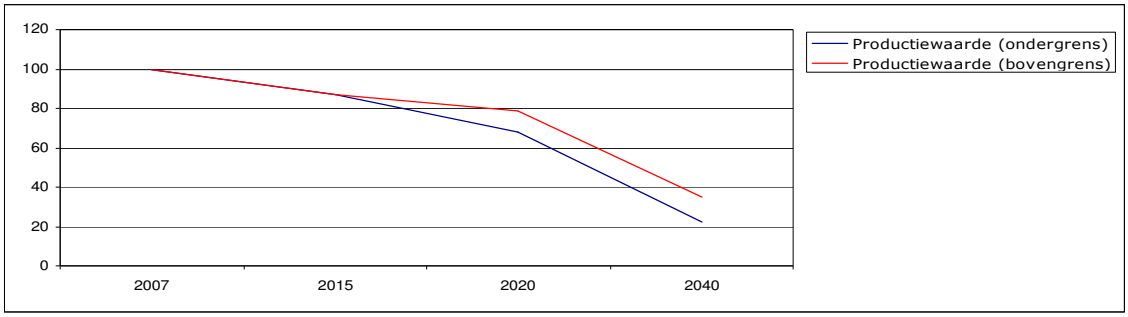
Bron: LEI, 2010

Resultaten per sector

Olie- en gaswinning

Huidig en toekomstig economisch belang

Olie- en gaswinning is van groot economisch belang voor Nederland (zie tabel 3). De economische ontwikkeling van de olie- en gaswinning is grotendeels afhankelijk van de ontwikkelingen van de olie- en gasprijzen. Aardolie- en gaswinning zal in 2015 nog steeds een belangrijke gebruiksfunctie zijn, hoewel deze naar verwachting iets in belang afneemt (zie figuur 3[19]). Na 2015 neemt het belang van de sector verder af door een verwachte daling van de gasreserves en de productie. Na 2040 is er nog wel gas beschikbaar, maar de oliereserves zullen daarentegen na 2020 volledig zijn uitgeput. Ontdekking van nieuwe grote olievoorraden is niet te verwachten. Mogelijk wordt in de toekomst CO_2 opgeslagen in de lege olie- en gasvelden (Ecorys, 2010).



Figuur 3| Toekomstig economisch belang olie- en gaswinning (2007-2040)

[19] Figuur 3 geeft alleen de toekomstige trend van de productiewaarde van de olie- en gassector weer. De trends met betrekking tot de toegevoegde waarde en werkgelegenheid van de sector zijn weggelaten, omdat het figuur anders onoverzichtelijk wordt. Er is gekozen om alleen de productiewaarde weer te geven, omdat emissies/milieubelasting het beste kan worden gekoppeld aan productievolumes. Deze redenering geldt ook voor de andere sectoren (en dus figuren).

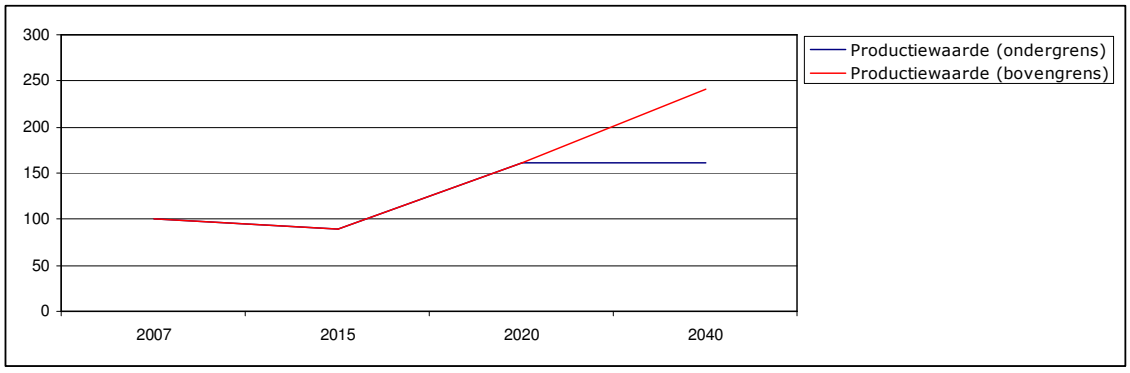
Kosten van aantasting van het mariene milieu
Voor de olie- en gassector hebben de kosten om aantasting van het mariene milieu te voorkomen betrekking op de verschillende fases van het productieproces (exploratie van olie en gas, drillen, productie en ontmanteling van platforms). In de productiefase wordt het water behandeld. Het productiewater bevat namelijk vaak olie, zware metalen en PAH's. Dit water moet eerst worden behandeld voordat het in zee geloosd mag worden. De jaarlijkse kosten (zekere maatregelen + voor-waardelijke maatregelen) voor de olie- en gassector bedragen circa €20 miljoen per jaar (NOGEPA, 2011).

Zandwinning

Huidig en toekomstig economisch belang
Behalve olie- en gaswinning vindt er ook oppervlaktedelfstoffenwinning op de Noordzee plaats. Zandwinning is hiervan het belangrijkst. Tabel 5 geeft het huidige economische belang van deze sector weer. Voor het toekomstig belang spelen drie factoren een rol:

1. Sterke (potentiële) groei in de vraag naar zand voor kustverdediging doeleinden (zandsuppleties);
2. Extra vraag naar zand als gevolg van grote infrastructurele en/of landaanwinning projecten (bouwprojecten);
3. Verschuiving naar (goedkopere of meer milieuvriendelijke) alternatieven voor zand uit het zeegebied, zoals sloopafval, puin en andere gebruikte materialen.

Figuur 4 laat, op basis van de bovenstaande veronderstellingen, het toekomstig belang van zandwinning op de Noordzee zien (in termen van productiewaarde). Voor de jaren 2015 en 2020 wordt één waarde gegeven. Voor het jaar 2040 zijn minimum en maximum schattingen weergegeven. Uit het figuur is op te maken dat het economisch belang van zandwinning in de toekomst fors toeneemt (Ecorys, 2010). Hierbij is er verschil te maken tussen zand dat wordt gebruikt voor kustverdediging en zand dat wordt gebruikt voor commerciële projecten (bouwen van huizen, e.d.). De verwachting is dat de laatste categorie niet sterk zal toenemen, aangezien 2007/2008 een topjaar was voor de zandmarkt.



Figuur 4| toekomstig economisch belang zandwinning (2007-2040)

Kosten van aantasting van het mariene milieu
De maatregelen die de zandwinning industrie moet maken om aantasting van het mariene milieu te voorkomen hebben voornamelijk betrekking op het winnen van zand op minder gunstige locaties en het voorkomen van troebelheid. Deze kosten bedragen jaarlijks gemiddeld €2,5 miljoen. Daarnaast zijn er nog kosten gemoeid

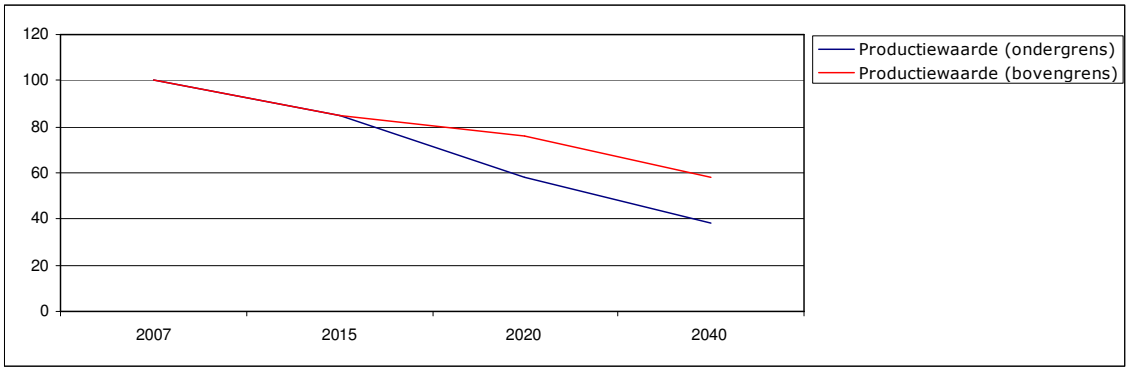
met het uitgeven van licenties aan zand- en schelpwinningsbedrijven. Deze kosten komen voor rekening van de overheid en maken geen deel uit van de € 2,5 miljoen die hierboven wordt genoemd (LEI, 2010).

Visserij

Huidig en toekomstig economisch belang
Op de gehele Noordzee vindt visserij plaats. De visserijsector is een traditionele sector met een groot historisch verleden. De visserijactiviteiten op de Noordzee zijn in vergelijking met aardolie- en gaswinning van minder groot economisch belang (zie tabel 5). Het visserijbeleid wordt voornamelijk bepaald door het Europese Gemeenschappelijke Visserijbeleid (GVB).

Het economisch belang neemt in de toekomst naar verwachting verder af (zie figuur 5). Het verlies van de productie is relatief beperkt als gevolg van de aanhoudende vraag naar Noordzeevis en de stabilisatie van de toekomstige quota als gevolg van een meer duurzame visserij. Echter, als gevolg van hogere kosten (die waarschijnlijk niet volledig kunnen worden afgewenteld op de consument) verslechtert de financiële positie van de sector, wat leidt tot een (verdere) daling van de economische activiteit (Ecorys, 2010).

In tegenstelling tot de hierboven en in figuur 5 gepresenteerde ontwikkeling in de productiewaarden, die gebaseerd zijn op scenario's van het CPB en betrekking hebben op de gehele visserijsector, verwacht de visserijsector dat de productie-waarden van de belangrijkste commerciële vissoorten in de Noordzee (tong en schol, maar ook haring en makreel) als gevolg van het beheer op MSY zullen stijgen (Productschap Vis, pers. Comm. 2011).

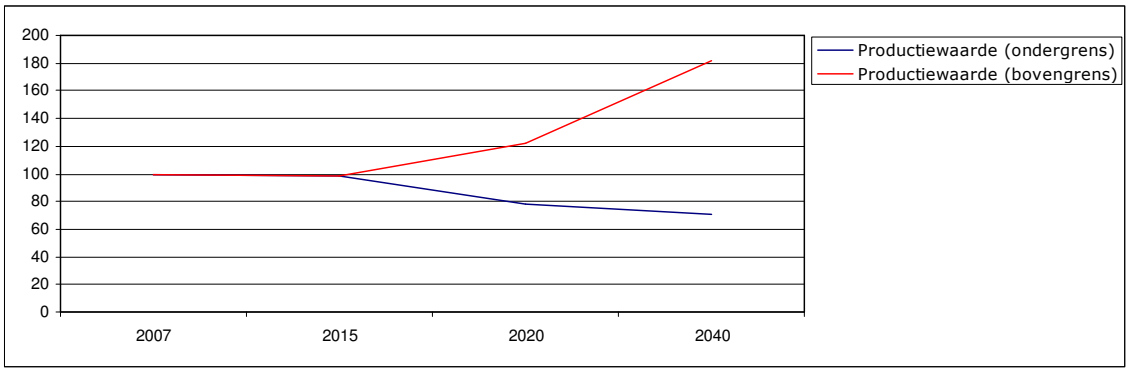


Figuur 5| Toekomstig economisch belang visserij (2007-2040)

Kosten van aantasting van het mariene milieu
De gemiddelde jaarlijkse kosten die de visserij maakt om aantasting van het mariene milieu te voorkomen bedragen circa €8.1 miljoen. Deze kosten bestaan uit maatregelen om de visserijsector duurzamer te maken (o.a. aanpassingen in techniek), het verbod op het introduceren van invasieve exoten in het mariene milieu en het sluiten van gebieden op de Noordzee ter bescherming van het mariene milieu. De kosten worden grotendeels gedragen door de visserijsector zelf, en door de EU en de Nederlandse overheid (LEI, 2010). Kosten van toekomstige Natura2000 maatregelen die de visserijsector in de toekomst zal moeten maken zijn niet meegenomen in de huidige analyse. Volgens Oostenbrugge et al gaat het hierbij om maximaal 11,5 miljoen euro per jaar.

Scheepvaart

Huidig en toekomstig economisch belang
De scheepvaartsector is van groot economisch belang voor Nederland (zie tabel 5). De economische betekenis van de zeescheepvaart is vooral gekoppeld aan de Nederlandse zeehavens. De Nederlandse zeehavens zijn knooppunten voor internationale goederenstromen en een vestigingsplaats voor industrie en dienstverlening. Het toekomstig belang van de scheepvaartsector kan zowel dalen als toenemen, afhankelijk van de verwachte ontwikkelingen van de goederen-overslag in de Nederlandse zeehavens (zie figuur 6). De veronderstelling hierbij is dat de goederenoverslag in de Nederlandse zeehavens gelijke tred houden met de werelddoorvoer, en dat het aandeel van de Nederlandse vaart in het totale volume van de lading over zee verscheept constant blijft (Ecorys, 2010).



Figuur 6| Toekomstig economisch belang scheepvaart (2007-2040)

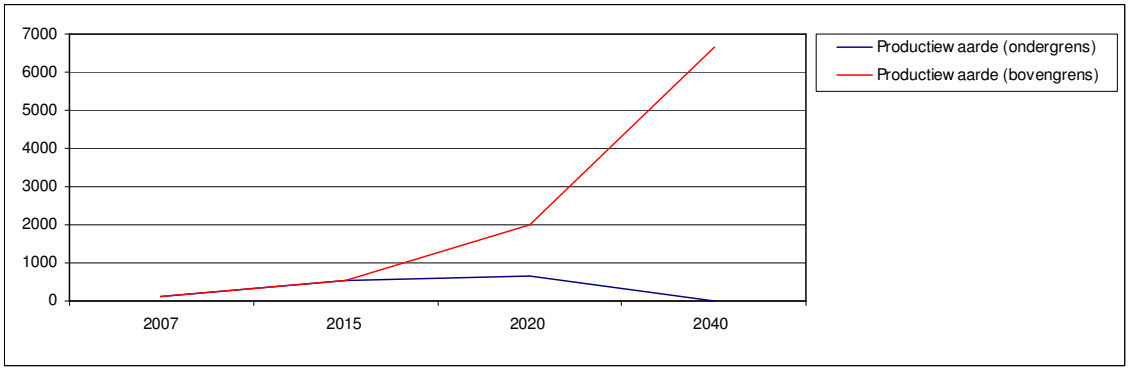
Kosten van aantasting van het mariene milieu
De scheepvaartsector kent vele maatregelen om de aantasting van het mariene milieu te voorkomen. Enkele maatregelen zijn: verzekeringskosten, contributies voor het International Oil Pollution Fund (IOPC), TBT-vrije anti-fouling verf, ballastwater behandelingsinstallaties en havenontvangstinstallaties. De gemiddelde jaarlijkse kosten die hiermee gemoeid gaan zijn circa €17,2 miljoen. Deze kosten worden voornamelijk betaald door private ondernemingen. De Nederlandse overheid draagt ook bij aan het IOPC fonds (LEI, 2010).

Bovengenoemd cijfer moet met voorzichtigheid worden geïnterpreteerd. Voor de scheepvaart is aangenomen dat slechts 10% van de kosten die de Nederlandse scheepvaart maakt ter bescherming van het mariene milieu moet worden toegerekend aan de bescherming van het Nederlandse deel van de Noordzee, omdat schepen slechts een beperkt deel van de tijd in de Nederlandse wateren zijn. De sector zal echter wel het volledige bedrag moeten betalen en zijn dus meer dan 150 miljoen euro kwijt aan huidige maatregelen.

Windenergie

Huidig en toekomstig economisch belang
Op de Noordzee wordt in beperkte mate windenergie opgewekt. In de toekomst kan windenergie op zee enorm toenemen (zie figuur 7). De toekomstige productie wordt voornamelijk bepaald door het Nederlandse energiebeleid en de uitgiften van vergunningen en subsidies. Op korte termijn (2010-2015) is de schatting gebaseerd op de bestaande capaciteit en de aanleg van twee nieuwe parken (600 MW). Voor de periode na 2015 bestaat grote onzekerheid. De overheidsdoelstelling van

6.000MW in 2020 lijkt gezien het huidige tempo niet haalbaar. De capaciteit van windenergie op zee zou kunnen toenemen als gevolg van kostenreducties (kennis spillover effecten) en continue financiële steun van de overheid. Maar als de productiekosten hoog blijven en windenergie niet concurrerend wordt ten opzichte van andere energiebronnen dan kan het zijn dat de productie van windenergie op zee in 2040, na de levensduur van de bestaande windmolenparken, stopt (Ecorys, 2010).



Figuur 7| Toekomstig economisch belang windenergie (2007-2040)

Kosten van aantasting van het mariene milieu
Maatregelen om aantasting van het mariene milieu te voorkomen bij windmolenparken op zee hebben o.a. te maken met het voorkomen/minimaliseren van onderwatergeluid (bubbelschermen) en de locatie van de windparken. Echter hierover is nog geen informatie beschikbaar. De kosten die jaarlijks gemiddeld gepaard gaan met het opstellen van Milieu Effect Rapportages bedragen circa €3,7 miljoen. Deze kosten komen voor rekening van private ondernemingen (LEI, 2010).

Zeehavens

Huidig en toekomstig economisch belang
Sociaal en economisch zijn de Nederlandse zeehavens van groot belang (zie tabel 5). De Nederlandse zeehavens zijn knooppunten voor internationale goederenstromen en een vestigingsplaats voor industrie en dienstverlening. Niet alleen van de industrie die afhankelijk is van de havenactiviteiten zelf (zoals scheepsbouw) maar bijvoorbeeld ook de landbouw heeft profijt van de nabijheid van afzetmogelijkheden (havens, grote steden). Dit is een reden waarom de landbouw in het westen van Nederland een andere oriëntatie kent (eg. glas- en tuinbouw) dan het noordoosten van Nederland (akkerbouw). De economische ontwikkeling van zeehavens is vooral afhankelijk van de wereldhandel. Op lange termijn, verwacht het Havenbedrijf Rotterdam een jaarlijkse overslag van 575-740 miljoen ton in 2030 (Ecorys, 2010).

Kosten van aantasting van het mariene milieu
De activiteiten om aantasting van het mariene milieu te voorkomen, zoals havenontvangstinstallaties, worden door de sectoren gedragen. De kosten worden daarom hier niet weergegeven, maar deze staan bij desbetreffende sector beschreven.

Kustzone
Activiteiten die in de kustzone plaatsvinden hebben vooral betrekking op recreatie en toerisme. Jaarlijks vinden er ongeveer 8,3 miljoen dagtochten plaats langs de

Nederlandse kust en blijven er 4 miljoen toeristen overnachten. Bovendien trekt de Noordzee, vooral in de zomer, windsurfers, sportvissers, zeilers en duikers. De economische betekenis van de sector toerisme en recreatie in het kustgebied (zie tabel 5) is meer dan alleen de economische waarde van de accommodaties, watersport- en strandactiviteiten. Toeleveranciers spelen een belangrijke rol. Het Nederlands Bureau voor Toerisme en Congressen (NBTC) verwacht een stijging in het aantal bezoeken van buitenlandse toeristen in de nabije toekomst. Vanaf 2012 wordt een groei van 2,6 procent per jaar verwacht. Het is echter niet duidelijk hoe dit is verdeeld tussen kusttoerisme en niet-kusttoerisme (Ecorys, 2010).

Kosten van aantasting van het mariene milieu
De kosten om aantasting van het mariene milieu te voorkomen hebben voor wat betreft de recreatie en toerismesector vooral betrekking op het opruimen /schoonmaken van de stranden. Het schoonmaken van de stranden kost de Nederlandse gemeenten gemiddeld €8,84 miljoen per jaar. Daarnaast wordt een groot deel van het afval door vrijwilligersorganisatie opgeruimd. De totale kosten zijn daarom waarschijnlijk een stuk hoger dan het hierboven genoemde bedrag (LEI,2010).

Andere activiteiten
Andere activiteiten die op de Noordzee plaatsvinden zijn baggeren en militaire activiteiten. Om de toegangswegen naar het Rotterdamse en Amsterdamse havengebied op de vereiste diepte te houden, moeten deze geulen worden gebaggerd. Alleen schone baggerstort mag op zee worden verspreid. De rest wordt opgeslagen in een depot.

Defensie heeft een relatief groot gebied ter beschikking op de Noordzee. Circa 7% – ongeveer 4200km^2 – van het Nederlands Continentaal Plat wordt gebruikt als militair oefengebied. Het gaat hierbij om schietgebieden, vlieggebieden, mijnoefengebieden en voormalige munitiedumpgebieden.

Daarnaast bevinden zich op de Noordzee veel pijpleidingen en kabels, die van groot economisch belang zijn. Pijpleidingen worden gebruikt voor het transporteren van olie- en gas, en elektriciteitskabels voor windmolenparken. De economische waarde van deze leidingen en kabels maken onderdeel uit van de waardebepaling van olie- en gaswinning en windenergie.

Kosten van aantasting van het mariene milieu
De kosten om aantasting van het mariene milieu te voorkomen van baggeren hebben vooral betrekking op maatregelen ten aanzien van het opslaan van verontreinigde zoute bagger op land in plaats van het verspreiden op zee. De gemiddelde jaarlijkse kosten hiervan bedragen circa €30 miljoen. De kosten worden grotendeels gedragen door de Haven Autoriteit (LEI, 2010).

De kosten voor defensie hebben voornamelijk betrekking op onderzoek naar onderwatergeluid (€ 222.000 per jaar) en technische maatregelen aan schepen (€190.000 per jaar). Deze kosten bedragen €412.000 per jaar voor de periode 2009-2014 en worden betaald door het Ministerie van Defensie (LEI, 2010).

Summary

Background information

The European Marine Strategy Framework Directive (MSFD) aims to achieve Good Environmental Status (GES) of the European marine waters by 2020. Each Member State is required to develop a socio-economic analysis and a social cost-benefit analysis. More specifically the MSFD has the following obligations:

1. An economic and social analysis of the use of these waters (for the Netherlands the Dutch North Sea) and an analysis of the cost of degradation of the marine environment (Article 8.1);
2. Member States must ensure that the measures (for achieving the MSFD goals) are cost effective and technically feasible and Member States have to prepare an impact assessment including a cost-benefit analysis before implementing a new measure (Article 13.3);
3. Inclusion of exceptions on measures. These exceptions are possible if measures lead to disproportionately high costs (Article 14.4);
4. Economic and social aspects have to be taken into account by establishing goals (Annex IV (9)).

In recent years, in preparation of the Initial Assessment, the socio-economic analysis of the use of the North Sea and the analysis of the cost of degradation of the marine environment has been conducted. The Initial assessment can be considered as the starting point of a cyclical process. The follow-up process consists of identifying possible measures, and review measures on the basis of cost-effectiveness, cost-benefits and disproportionality.

Methods

As part of the socio-economic analysis for the Initial Assessment, three studies have been conducted[20].

1. *Economic description of the use of the North Sea.*
   Based on an internationally agreed approach (Marine water accounts approach, paragraph 2.3 in the European guideline economic analysis MSFD) a description of the production value, value added and employment is given for various sectors which directly or indirectly depend on the presence of the North Sea. The following sectors are described: oil and gas exploration, shipping, fishing, sand and gravel extraction, wind energy, activities in sea ports and coastal recreation. For all these activities, the economic importance is described for the years 1995, 2000 and 2007. In this way, it is possible to get a picture of the developments in the various sectors.

2. *Description of expected economic trends (baseline scenario)*
   The Dutch Central Planning Bureau (in Dutch Centraal Planbureau) is the undisputed source of scenario studies. Hence, based on their most recent publication (WLO scenarios) an estimation of the future importance of the

[20] CBS (2011). *Economic description of the North Sea for the Netherlands: an update version 3*, CBS, Voorburg.
http://www.noordzeeloket.nl/krm/Images/Economic%20description%20of%20the%20North%20Sea%20for%20the%20Netherlands%20%28CBS%2c%202011%29_tcm19-4952.pdf
Ecorys (2010) Baseline Scenario Marine Strategy Framework Directive, Ecorys, Rotterdam.
http://www.noordzeeloket.nl/krm/Images/Baseline%20Scenario%20Marine%20Strategy%20Framework%20Directive%20%28Ecorys%2c%202010%29_tcm19-4951.pdf
LEI (2010). *The current cost of avoiding degradation of the Dutch North Sea Environment* LEI, Den Haag.
http://www.noordzeeloket.nl/krm/Images/The%20current%20cost%20of%20avoiding%20degradation%20of%20the%20Dutch%20North%20Sea%20Environment%20(LEI%2C%202010)_tcm19-4950.pdf

various sectors on and along the Dutch part of the North Sea has been made. This information is adjusted based upon interviews with the various sectors to take into account the effects of the economic crisis. Based upon this image of the future importance of the various sectors on and along the Dutch part of the North Sea a link with the environmental pressure on the North Sea for the different sectors can be determined. In this way, it becomes clear what the environmental problems are that have to be solved.

3. *Analysis of the costs of degradation of the marine environment*
   The analysis of the costs of degradation is divided into two parts. First, a description of the present costs that are already taken to avoid the degradation of the marine environment has been made. This can be seen as the lower limit for what the Dutch society is willing to pay for the protection of the marine environment. Despite these efforts there are still environmental problems in the North Sea for which additional measures will be taken. The second part of the analysis gives a global description of the main environmental problems that still exist. The total cost of the degradation of the marine environment is the sum of the cost of current measures and possible additional measures. If, no further measures will be taken than the current situation of the Dutch part of the North Sea can be considered as sustainable.

4. *Social Analysis*
   The economic activities that occur on and along the North Sea not only represent a significant economic value, but they also have an important social value. In the Netherlands, some villages and cities are strongly determined by the presence of certain activities. The Port of Rotterdam, the largest port of Europe, not only determines the appearance of the city, but it is also of great social importance. Many citizens work there, often for generations. Another city with a large social connection with an activity is Zandvoort. Zandvoort is a typical North Sea resort, where in the summer many people from Amsterdam can be found. Zandvoort is strongly dominated by recreation. Scheveningen is also a typical beach resort where many people from The Hague can be found in the summer time. Besides recreation this beach resort has also a strong fishing tradition with the famous Vlaggetjesdag, the celebration of the first catch of herring. A village with an even stronger fishing tradition is Urk. Many citizens of this former island has relatives working in the fishing industry. The island character and the strong ties with and dependence of the whims of the sea provide a very strong sense of social ties within the community of Urk. Den Helder is another example of a village/town that has a strong bond with one particular sector. In Den Helder, the Royal Navy has always been an important client.

   As part of the study 'Experiencing the North sea: a quantitative consultation under Dutch citizens on the North Sea' (TNS NIPO, 2011) a representative survey was conducted among 600 citizens in which their knowledge of and affinity with the North Sea was examined. The general conclusion was that citizens are not aware of potential problems at the North Sea, but when informed, they find it important to do something against it. The majority of the citizens stated that the citizens themselves and the government (Dutch government and European Union) are responsible for solving the presented problems surrounding the North Sea. Fifty percent of the respondents state that they are willing to pay some money to do something against the

environmental problems sketched. However, when given the choice between various measures, they tend to choose the ones that do not lead to additional costs to them. Another result of the study is that citizens are not really aware of the actual economic importance of specific sectors. Respondents believe that fisheries is of significant economic value for the Netherlands. Although in reality the economic significance of fisheries is much smaller compared to other sectors, such as oil and gas exploration and shipping. This shows that the social value of fisheries is very important.

General results

This section describes briefly the results of the various studies. The sections below give a summary of the results for each sector.

Present and future economic importance of the various economic activities on and along the North Sea.

Table 7 shows the economic importance in terms of production value, value added and employment for the sectors on the Dutch Continental Shelf (DCS) and sectors on land that have a direct relationship with the sea. For this analyses, the sectoral division of CBS is used, which makes the figures internationally comparable. Table 7 shows that the oil and gas sector, the shipping sector and the seaports have a great economic importance for the Netherlands.

It is expected that the economic importance of the oil and gas sector and the fishing industry will decrease in the future (see also the next section). Marine aggregate extraction is expected to increase significantly in the future. The future developments in wind energy are very uncertain. The government's target of 6.000MW in 2020 seems not feasible given the current pace of development. The shipping industry and the sea ports will remain of great importance significance for the Netherlands in the future. The economic developments of these sectors depend largely on world trade. The economic importance of the sectors in the coastal zone, tourism and recreation, are expected to increase in the future.

Table 7| Economic importance of the various sectors (CBS, 2011)

	1995			**2000**			**2007**		
	Production value (x mln €)	Value added (x mln €)	Employment (FTE)	Production value (x mln €)	Value added (x mln €)	Employment (FTE)	Production value (x mln €)	Value added (x mln €)	Employment (FTE)
Shipping	2.626	630	7.000	3.689	927	7.000	4.588	1.208	6.000
Fisheries	102	61	500	111	58	300	113	45	200
Oil and gas	2.692	2112	3.000	4.306	3.313	3.000	7.644	5.866	2.800
Sand and gravel extraction	33	9	110	57	15	195	69	17	154
Wind energie	0	0	0	0	0	0	23	11	pm
Total	*5.453*	*2.812*	*10.610*	*8.163*	*4.313*	*10.495*	*12.437*	*7.147*	*9.154*
Sea ports	32.793	10.198	126.000	49.211	11.510	123.000	80.159	17.806	121.000
Coastal zone	1.810	955	23.000	2.426	1.265	24.000	2.901	1.447	25.000
Total on land	*34.603*	*11.152*	*149.000*	*51.637*	*12.775*	*147.000*	*83.060*	*19.253*	*146.000*
Total DCS + land	**40.056**	**13.964**	**159.610**	**59.800**	**17.088**	**157.495**	**95.497**	**26.400**	**155.154**

Note: figures about sand and gravel extraction are based on Ecorys, 2010.

Costs of degradation of the marine environment

Currently, many measures have already be taken (and costs are incurred) to avoid degradation of the marine environment. Table 8 gives an estimation of the annual cost that the various sectors already make to prevent degradation of the marine environment. Approximately €147 million is yearly spent on measures at sea to avoid degradation of the Dutch North Sea environment.

Besides these measures, also many measures on land are taken that have a positive impact on the water quality of the North Sea. Although these measures (such as measures related to agriculture and sanitation, etc) are not initially taken to improve the environmental quality of the North Sea, these measures contribute greatly to a better environmental quality of the North Sea (clean sediment transport, reduction of eutrophication, etc.). The cost of these measures are a multiple of the amounts presented in Table 8.

Note, the analysis on the cost of degradation is based upon several assumptions. For instance, for shipping it is assumed that only 10 percent of the costs that the shipping sector incorporates can be allocated to prevent the degradation of the Dutch marine environment, because ships are only a limited amount of their time present in Dutch waters. Furthermore, the analysis only looks at the costs of current measures. The figures do not include future costs for the fishing industry regarding Natura2000 measures. The figures in table 8 should therefore be seen as a lower limit of the actual costs incurred, and should be interpreted with care.

Table 8| Annual cost of measures of avoiding degradation of the Dutch North Sea environment

Type of measures	**Annual costs Mln €**
Shipping - Insurance costs - Contributions to the International Oil Pollution Compensation Fund - TBT-free anti-fouling materials - Ballast water treatment facilities - Port reception facilities for waste	17
Fisheries and aquaculture - More sustainable fishing methods (i.e. gear change) - Ban on dumping from marine debris from aquaculture - Limitations of cockle fisheries	8
Olie and gas extraction - Measures related to the exploration of oil and gas, the production process and the decommissioning of platforms, including measures related to production water	20
Sand and shell mining - Restrictions on side locations	3
Wind energy - Environmental Impact Assessments (EIA)	4
Recreation - Beach cleaning	9
Ministry of Defence (Royal Dutch navy) - Research into underwater noise - Technical measures on board ships	0
Dredging - Restrictions on sea based dumping of dredged materials	30
Land extention: Maasvlakte II - EIA reporting - Habitat compensation	21

- Monitoring of environmental effects - Restricted fishing areas - Enforcement and management of these measures	
Governance - Policy work - Management - Monitoring of the North Sea environment and economic activities - Improvement of the knowlegde about the North Sea environment	35
Total costs sea related measures	**147**

Source: LEI, 2010

Results per sector

Oil and gas

Current and future economic interests
Oil and gas is of great economic importance for the Netherlands (see Table 7). The economic development of the oil and gas production is largely dependent on the development of the oil and gas prices. Oil and gas production will still be important in 2015, although the economic importance will slightly decline (see Figure 8). After 2015, the importance of the oil and gas industry is expected to decline even further, due to a decline in the gas reserves and production. After 2040 there will be still gas available at the Dutch part of the North Sea; the oil reserves are expected to be depleted after 2020. Discovery of major new oil reserves are not expected. It is possible to use the empty oil and gas fields for the storage of CO2 (Ecorys, 2010).

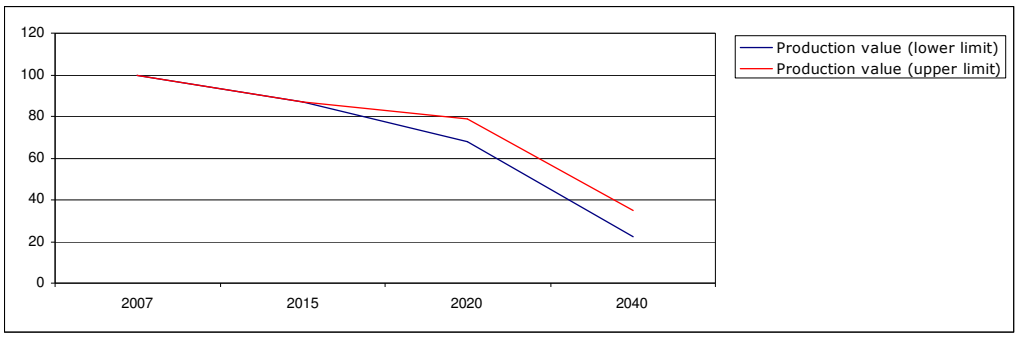


Figure 8| Future economic importance oil and gas

Cost of damage to the marine environment
For the oil and gas sector, the cost of degradation of the marine environment relates to the different phases of the production process (oil and gas exploration, drilling, production and the decommissioning of platforms). In the production phase, the water is treated because the produced water often contains oil, heavy metals and PAHs. The water must first be treated before it can be discharged into the sea. The total annual cost for the oil and gas sector to avoid degradation of the marine environment amounts approximately € 20 million per year, which includes certain and conditional measures (NOGEPA, 2011).

Sand and gravel extraction

Current and future economic interests

At the North Sea marine aggregates are being extracted. Sand extraction is the most important. Table 7 shows the present economic importance of this sector. The future economic development is based upon three factors:

1. Strong (potential) growth in demand for sand for coastal defense purposes (sand replenishment);
2. Additional demand for sand due to major infrastructure and / or land reclamation projects (construction projects);
3. Shift to (cheaper or more environmentally friendly) alternatives, such as demolition, debris and other materials.

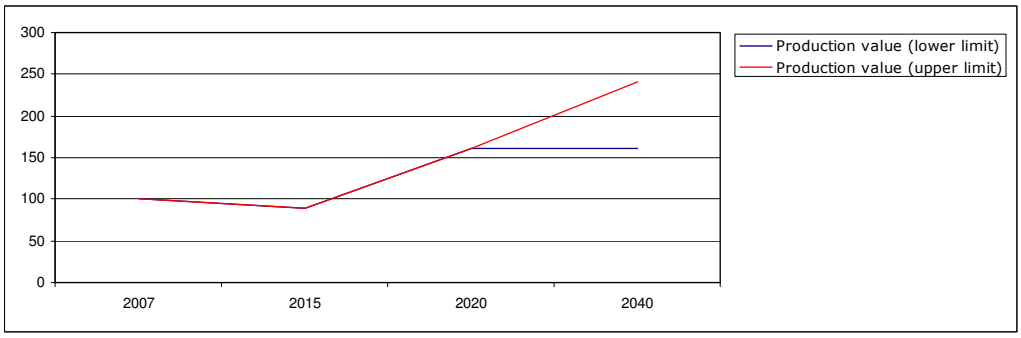


Figure 9| Future economic importance sand and gravel extraction

Figure 9 shows, based on the assumptions above, the future importance of sand extraction in the Dutch part of the North Sea (in terms of production value). For the years 2015 and 2020 only one value is given. For the year 2040 a minimum and maximum estimate is given. The figure shows that the economic importance of sand extraction in the future is expected to increase significantly (Ecorys, 2010). However, a distinction has to be made between sand used for coastal defense and sand used for commercial projects (building houses, etc.). The expectation is that the latter does not significantly increase since 2007/2008 was a record year for the sand market.

Cost of damage to the marine environment
The measures that the sand mining industry currently takes to avoid degradation of the marine environment are extracting sand in less favorable locations and to prevent turbidity. These costs amount to an annual average of € 2.5 million. There are also costs involved in issuing licenses for sand mining and shell companies. These costs are borne by the government and are not part of the € 2.5 million mentioned above (LEI, 2010).

Fisheries

Current and future economic interests
At the entire North Sea fishing takes place. The fishing industry is a traditional sector with a great historical past. The fishing sector is relative less important in terms of production value and employment compared to other sectors, such as the oil and gas sector and the shipping industry (see Table 7). The fisheries policy is mainly determined by the European Common Fisheries Policy (CFP).The economic importance of the fishing sector is expected to further decrease in the future (see figure 10). The loss of production is relatively limited due to the continuing demand for North Sea fish and the stabilization of future quotas due to more sustainable fisheries. However, due to higher costs (which probably cannot be fully passed on to

consumers) the financial positions of the sector will get worse, leading to a (further) decline in economic activity (Ecorys, 2010).

Note: figure 10 presents a future decline in the production value of the fishing sector. These figures are based upon a study of Ecorys (Ecorys, 2010) in which the WLO scenario's of the Dutch Central Planning Bureau are used. However, the Fish Product Board (Productschap Vis; stakeholder organization) expects an increase of the production values of the main commercial fish species in the North Sea (sole, plaice, but also herring and mackerel) due to MSY management.

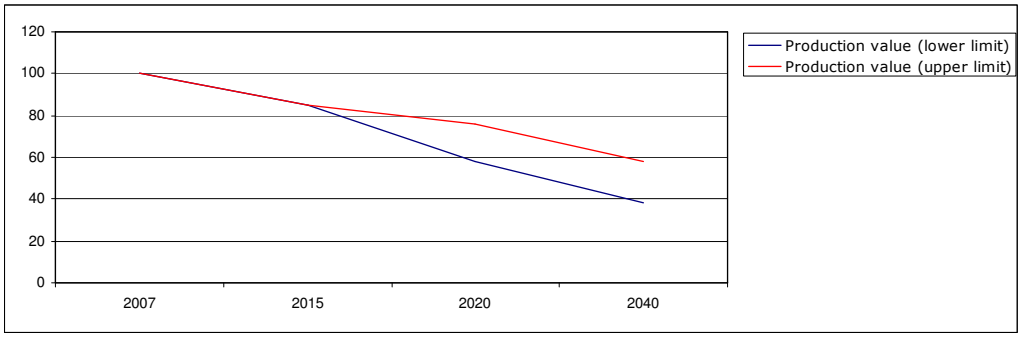


Figure 10| future economic importance fisheries

Cost of damage to the marine environment
The average annual cost that the fishing industry makes in avoiding degradation of the marine environment amounts to approximately € 8.1 million. These costs include measures to get the industry more sustainable (e.g. changes in technology), the prohibition on the introduction of invasive alien species in the marine environment and the closing of areas in the North Sea to protect the marine environment. The costs are largely borne by the fishing industry, and by the EU and the Dutch government (LEI, 2010). Future costs for the fishing industry related to future Natura 2000 measures are not included in the present figures. According to Oostenbrugge et al, these costs will be maximum 11.5 million euros a year.

Shipping

Current and future economic interests
The shipping industry is of great economic importance for the Netherlands (see Table 7). The economic importance of the shipping industry is mainly linked to the Dutch seaports. The Dutch seaports are hubs for international flows of goods and a location for industry and services. The future economic importance of the shipping industry can decrease as well as increase, depending on the expected developments in product throughput in the Dutch ports (see Figure 11). The assumption here is that the transfer of goods in Dutch sea ports will keep pace with the world transit, and that the share of Dutch shipping in the total volume of cargo shipped at sea remains constant (Ecorys, 2010).

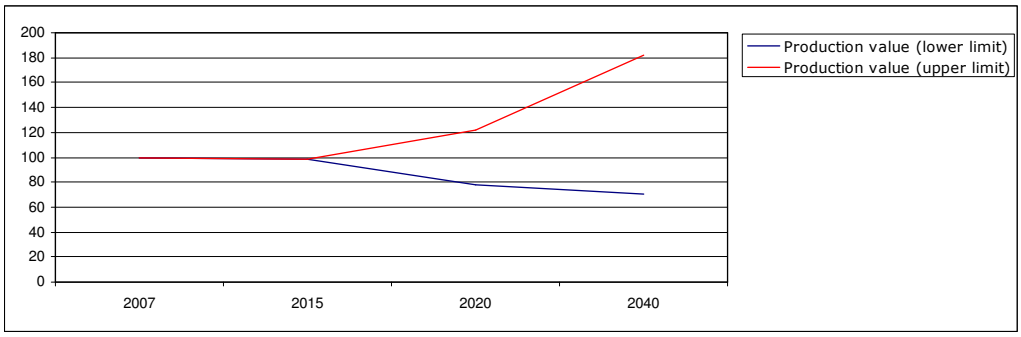


Figure 11| Future economic importance shipping

Cost of damage to the marine environment
The shipping industry takes many different measures to avoid degradation of the marine environment. Some measures are: insurance, contributions to the International Oil Pollution Fund (IOPC), TBT-free anti-fouling paint, ballast water treatment facilities and port reception facilities. The average annual costs involved are approximately 17.2 million euros. These costs are mainly paid by private companies. The Dutch government also contributes to the IOPC Fund (LEI, 2010).

This figure of 17.2 million euro should be interpreted with caution. For the shipping industry it is assumed that only 10 percent of the costs that the shipping sector incorporates can be allocated to prevent the degradation of the Dutch environment, because ships are only a limited amount of their time present in Dutch waters. Note, however that the shipping industry have to pay the full cost on these measures and spend yearly more than 150 million euro.

Wind energy

Current and future economic interests
In the Dutch part of North Sea only a limited amount of energy is generated by wind energy. In the future offshore wind energy is expected to increase significantly (see Figure 12). Future production is mainly determined by the Dutch energy policy, the issuing of permits and the amount of subsidies. For the short-term (2010-2015) the estimation is based on the existing capacity and the constructions of two new parks (600 MW). For the subsequent period (2015-2040) large uncertainty exist. The government's target of 6.000 MW in 2020 seems not feasible given the current pace of developments. The capacity of wind energy could increase as a result of cost reductions (knowledge spillover effects) and continuous financial support from the government. However, if the production costs remain high and wind energy does not become competitive compared to other energy sources, it may be possible that the production of offshore wind by 2040, after the lifespan of the existing wind farms, will stop (Ecorys, 2010).

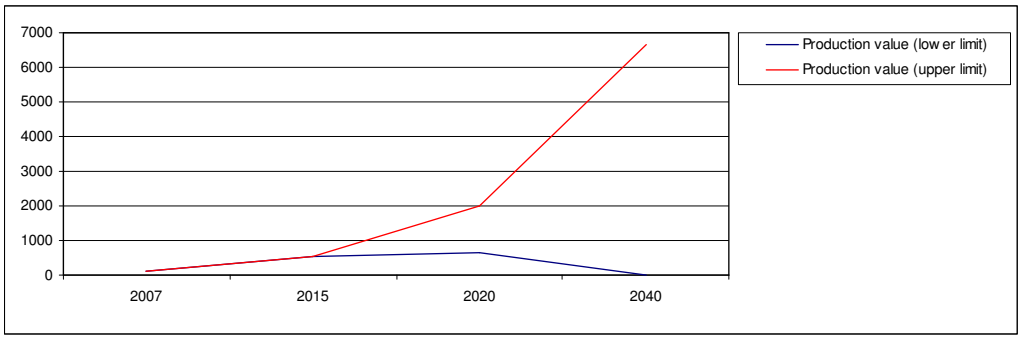


Figure 12| Future economic importance wind energy

Cost of damage to the marine environment
Measures to prevent degradation of the marine environment are based at the prevention / minimization of underwater noise (bubble screens) and the location of wind farms. However, no information is available for these kind of measures. The average annual costs associated with the preparation of Environmental Impact Assessments are approximately € 3.7 million. These costs are borne by private companies (LEI, 2010).

Seaports

Current and future economic interests
The Dutch sea ports are of social and economic importance for the Netherlands (see table 7). The Dutch seaports are hubs for international flows of goods and a location for industry and services. The ports are not only important for the industry that depends on the port activities themselves (such as shipbuilding), but also agriculture has benefited from the proximity of outlets (ports, major cities). This is also a reason why agriculture in the western part of the Netherlands has a different orientation (eg. glass, horticulture) than the northeastern part of the Netherlands (arable farming). The economic development of seaports is mainly dependent on world trade. In the long term, the Port Authority of Rotterdam expects an annual throughput of 575-740 million tonnes in 2030 (Ecorys, 2010).

Cost of damage to the marine environment
The costs of the measures that are taken to prevent the degradation of the marine environment, such as port reception facilities, are borne by the sectors. Hence, these costs are therefore not shown but are described for the specific sector.

Coastal zone

Current and future economic interests
Activities that take place in the coastal zone mainly relate to recreation and tourism. Every year approximately 8.3 million day trips takes place along the Dutch coast and about four million tourists use an accommodation. The North Sea is attractive, especially in summer, for windsurfers, anglers, sailors and divers. The economic significance of tourism and recreation in the coastal area (see Table 7) is more than only the economic value of the accommodation, water sports and beach activities. Suppliers play also an important role. Dutch Bureau for Tourism and Conventions (NBTC) expects an increase of foreign visitors in the near future. From 2012, an increase of 2.6 percent per year is expected. However, it is not clear how this is divided between coastal tourism and non-coastal tourism (Ecorys, 2010).

Cost of damage to the marine environment
Measures, such as cleaning of the beaches, are taken to prevent degradation of the marine environment. The cleaning of the beaches cost the Dutch municipalities on average € 8.84 million per year. However, much of the waste is collected and cleaned by voluntary organization. The total cost is therefore probably a lot higher than the amount mentioned above (LEI, 2010).

Other activities
Besides the activities described above, also other activities, such as dredging and military activities, take place at the North Sea. The access routes to the port of Rotterdam and Amsterdam have to be dredged in order to keep the channels at the required depth. Only clean dredge materials can be spread at the sea, the rest is stored in a depot.

The Ministry of Defence has a relatively large area at their disposal at the North Sea. Approximately 7% - about 4200km^2 - of the Dutch Continental Shelf is used for military activities. These activities include shooting ranges, flying areas, training areas and former ammunition dump areas.

In addition, there are also many pipelines and cables at the bottom of the North Sea, which are of great economic importance. Pipelines are used to transport oil and gas, and electricity cables are used for wind farms. The economic value of these pipelines and cables are part of the valuation of oil and gas exploration and wind energy.

Cost of damage to the marine environment
The dredging measures, to prevent degradation of the marine environment, are primarily related to the storage of contaminated dredged material on land instead of spreading the dredged materials at sea. The average annual cost is approximately € 30 million. These costs are largely borne by the Port Authority (LEI, 2010).

The cost for military measures are mainly related to defense research on underwater noise (€ 222,000 per year) and technical measures to ships (€ 190,000 per year). These costs amount to € 412,000 per annum for the period 2009-2014 and are paid by the Ministry of Defence (LEI, 2010).

1. Introduction

The Marine Strategy Framework Directive (MSFD) requires Member States to develop strategies to achieve good environmental status (GES) in marine waters by 2020. One of the requirements of the MSFD is to perform an economic and social analysis of the use of those waters and of the cost of degradation of the marine environment. The socio-economic analyses for the Initial Assessment are an important first step in the development of the Marine Strategy in 2015, and the overall objective of achievement of sustainable use of the Dutch marine environment.[21]

1.1 Overview socio-economic analyses

The socio-economic analyses that have to be performed as part of the Initial Assessment are:

1. Economic analysis of the North Sea.
   This is a description of the current use of the North Sea in terms of output, value added and employment of the various economic sectors that are active on or alongside the North Sea coast line. This information helps to understand what happens on and around the North Sea; what are the interests of the various stakeholders? This information will be used as a starting point for the baseline scenario (how do economic sectors evolve over time?). But this information will also be important to underpin discussions on disproportionate costs (how much additional costs due to measures for the Marine Strategy could a sector incur?).

2. Baseline scenario
   The WG ESA guidance document defines the baseline scenario as 'the anticipated evolution in the environmental, social, economic and legislative situation in the marine environment over the agreed time horizon in the absence of the policy under consideration (i.e. if the MSFD is not implemented)'. Within this chapter, the focus is on the anticipated evolution in the economic situation, and thus focuses on the determination of autonomous trends; how do economic sectors evolve over time? By linking this economic development of the various economic activities with the environmental pressures for each activity, an estimate can be made of the expected total environmental pressures in the future. By comparing this to the Good Environmental Status (the environmental objectives), it becomes clear what 'gap' or environmental problem remains, for which measures have to be sought.

3. Cost of degradation
   The WG ESA guidance document defines the cost of degradation as 'the welfare foregone, reflecting the reduction in the value of the ecosystem services provided compared to another state'. This can be interpreted and done in various ways. The Dutch have chosen to give an overview of the current costs the various sectors already incur for measures that contribute to an improvement of the marine environment. From this overview it becomes clear what protection of the marine environment for further degradation is apparently currently worth to society (revealed preference). It therefore fits well in with the

[21] Art. 8.1 MSFD states 'In respect of each marine region or subregion, Member States shall make an initial assessment of their marine waters, taking account of existing data where available and comprising the following:
(b) an analysis of the predominant pressures and impacts, including human activity, on the environmental status of those waters which:
(i) is based on the indicative lists of elements set out in Table 2 of Annex III, and covers the qualitative and quantitative mix of the various pressures, ***as well as discernible trends***
(c) an ***economic and social analysis of the use of those waters and of the cost of degradation of the marine environment***

Initial Assessment because the Initial Assessment focuses on the present situation. At the same time, it becomes clear who is paying how much, and how the burden is shared among economic actors. This gives insight in the existing financing structure for the protection of the marine environment, including an overview of existing economic instruments. The information on the financing structure will be useful when the costs of the additional measures become clear, to be able to say who will be paying these costs. And, from the political discussions on the programs of measures for the WFD it has become clear, that exactly this of type of information, on the potential increase in burden due to additional measures played a key role in determining whether costs are disproportionate or not. For the MSFD it is likely that this type of information will again play an important role in the policy process that the economic analysis is trying to support.

4. Social Analysis

The Dutch have not performed a separate social analysis. The European handbook on economic analyses for the MSFD states that 'A socio-economic analysis aims to identify the impact on human welfare of a given policy. This includes economic as well as social aspects, and may include consideration of the distribution of these impacts across stakeholders. In light of this definition, an explicit distinction between 'economic' and 'social' analysis is not necessary' (European Commission, 2010). In other words; the employment data of the use of the marine environment, together with the distribution of the likely impact of the (programmes of) measures cover the social aspects of the analysis of the use of the marine waters (Arcadis, 2010). Annex A to this report gives an overview and describe various studies that have been performed in relation to the socio-economic analysis of the Marine Strategy Framework Directive.

The economic activities that occur on and along the North Sea not only represent a significant economic value, but they also have an important social value. In the Netherlands, some villages and cities are strongly determined by the presence of certain activities. The Port of Rotterdam, the largest port of Europe, not only determines the appearance of the city, but it is also of great social importance. Many citizens work there, often for generations. Another city with a large social connection with an activity is Zandvoort. Zandvoort is a typical North Sea resort, where in the summer many people from Amsterdam can be found. Zandvoort is strongly dominated by recreation. Scheveningen is also a typical beach resort where many people from The Hague can be found in the summer time. Besides recreation this beach resort has also a strong fishing tradition with the famous Vlaggetjesdag, the celebration of the first catch of herring. A village with an even stronger fishing tradition is Urk. Many citizens of this former island has relatives working in the fishing industry. The island character and the strong ties with and dependence of the whims of the sea provide a very strong sense of social ties within the community of Urk. Den Helder is another example of a village/town that has a strong bond with one particular sector. In Den Helder, the Royal Navy has always been an important client. Recently, many people may lose their jobs due to significant budget cuts in the military section. This creates a great social unrest. A tension that also occurs each year in Urk and other fishing communities at the time that the European fishing quotas are announced. When considering packages of measures, besides the costs and benefits in monetary terms, these kind of social considerations play also an important role.

As part of the study 'Experiencing the North sea: a quantitative consultation under Dutch citizens on the North Sea' (TNS NIPO, 2011) a representative survey was conducted among 600 citizens in which their knowledge of and affinity with the North Sea was examined. The general conclusion was that citizens are not aware of potential problems at the North Sea, but when informed, they find it important to do something against it. The majority of the citizens stated that the citizens themselves and the government (Dutch government and European Union) are responsible for solving the presented problems surrounding the North Sea. Fifty percent of the respondents state that they are willing to pay some money to do something against the environmental problems sketched. Another result of the study is that citizens are not really aware of the actual economic importance of specific sectors. Respondents believe that the fishing industry is of significant economic value for the Netherlands. Although in reality the economic significance of fisheries is much smaller compared to other sectors, such as oil and gas exploration and shipping. This shows that the social value of fisheries is very important. Another study 'The social importance of the North Sea: Baseline measurement for the Marine Strategy Framework Directive' (LEI, 2010) also concludes that Dutch fishing ports and communities have a special place in the Dutch society.

1.2 Position socio-economic analyses in Initial Assessment and MSFD

This report is part of one in a series of three documents (the Initial Assessment, the determination of GES, and the establishment of Indicators and Environmental Targets) that provide the scientific background for the implementation of the Marine Strategy Framework Directive (MSFD) in the Netherlands. The focus of this report is on Article 8.C of the Marine Strategy Framework Directive (an economic and social analysis of the use of those waters and of the cost of degradation of the marine environment). An analysis of the environmental conditions in the Dutch part of the North Sea, the current human activities and the associated predominant pressures on the ecosystem, which is also part of the Initial Assessment, is carried out by Deltares (Prins e.a., 2011). The other two reports deal with the determination of characteristics of Good Environmental Status (GES), required by Article 9 of the MSFD, and the establishment of indicators and environmental targets as specified by Article 10 of the MSFD.

Figure 13 below tries to bring the various elements of the economic analyses for the Initial Assessment in relation to each other and in relation to the other analyses for the Marine Strategy.[22] The studies discussed in this report are performed for the Initial Assessment (presented in the box on the left hand side in the figure below). The three separate studies[23,24,25] on which this report is based can be found on the following website www.noordzeeloket.nl. The Dutch are also already busy preparing the Strategic Cost Benefit Analysis. Hence, a first database of the costs and effects of measures has been developed. Also potential benefits of measures have been

[22] It is stressed here that this Figure is only meant to be a simplified representation of the various analyses in relation to each other. This Figure is not meant to present the exact place of various types of measures. In the Figure, measures are analysed as part of the Strategic CBA. This also applies to mitigation measures, which are meant to prevent deterioration of the present status (and other environmental problems). If this Figure would represent the place of various measures, mitigation measures would be between human activities and environmental problems. But now they are part of the Strategic CBA.

[23] CBS (2011). *Economic description of the North Sea for the Netherlands: an update version 3*, CBS, Voorburg. http://www.noordzeeloket.nl/krm/Images/Economic%20description%20of%20the%20North%20Sea%20for%20the%20Netherlands%20%28CBS%2c%202011%29_tcm19-4952.pdf

[24] Ecorys (2010) Baseline Scenario Marine Strategy Framework Directive, Ecorys, Rotterdam. http://www.noordzeeloket.nl/krm/Images/Baseline%20Scenario%20Marine%20Strategy%20Framework%20Directive%20%28Ecorys%2c%202010%29_tcm19-4951.pdf

[25] [25] LEI (2010). *The current cost of avoiding degradation of the Dutch North Sea Environment* LEI, Den Haag. http://www.noordzeeloket.nl/krm/Images/The%20current%20cost%20of%20avoiding%20degradation%20of%20the%20Dutch%20North%20Sea%20Environment%20(LEI%2C%202010)_tcm19-4950.pdf

investigated[26]. Both tracks (Initial Assessment and Strategic cost Benefit Analysis) will eventually come together and will result in the Marine Strategy. For more information on other studies

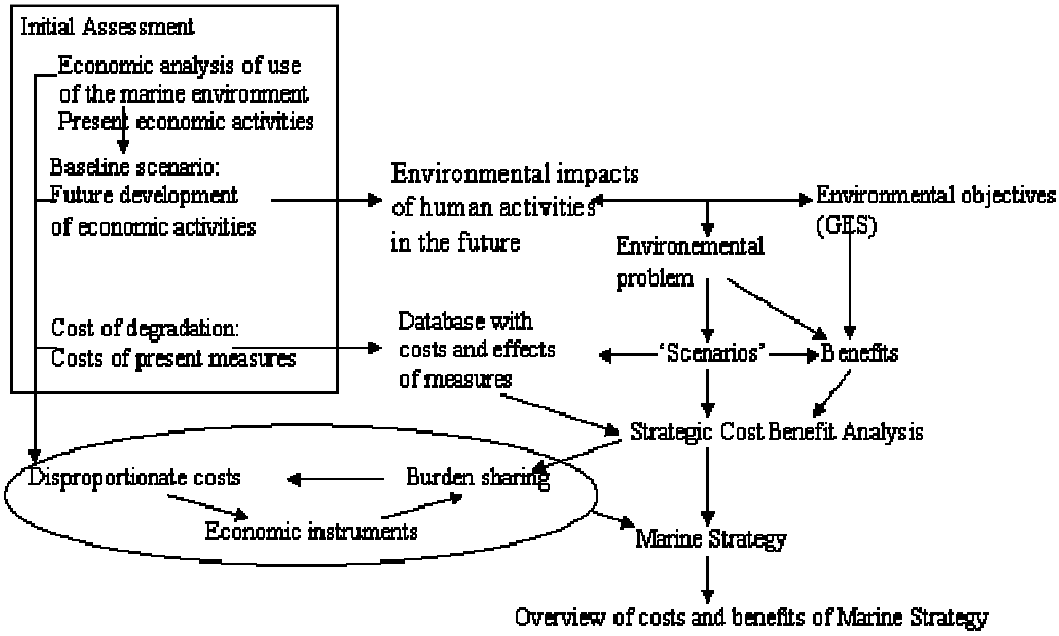


Figure 13| Relation between the various elements of the economic analysis and other analysis the Marine Strategy.

[26] For information on the other studies, such as the cost-effectiveness and cost-benefit analysis for the MSFD, see: http://www.noordzeeloket.nl/krm/stand_van_zaken/nationaal_traject/Economische_analyses_2011/

2. Method

This section describes the methods applied for the various elements of the economic analysis for the Initial Assessment. First, the method to perform the economic analysis of the use of the marine environment is presented. This is the Marine water accounts approach as described in paragraph 2.1 in the WG ESA guidance document. After that, the way the baseline scenario is composed, is briefly explained. It uses the same approaches and data used to support Dutch policies in all other fields. Finally, the analysis of the cost of degradation, is described. Also here, an approach from the WG ESA guidance document is taken; the cost based approach as presented in section 4.3 (in that guidance document).

2.1 Economic analysis of the use of the marine environment: Marine water accounts approach

This approach takes its starting point in economic sectors using marine waters. The idea of the Marine Water Accounts is based on the experiences from using a similar approach called NAMWA (National Accounting Matrix including Water Accounts), which was used to prepare the economic description basins as part of the article 5 reports for the European Water Framework Directive. NAMWA is developed by Statistics Netherlands in close cooperation with the Centre for Water Management. The reason to ask the Statistics Netherlands, is because it is the undisputed national authority in the field of statistics, and it uses international adapted methods, which allows for international comparability. For more details on NAMWA, see Brouwer et al. (2005), Van der Veeren et al. (2004).

The following steps illustrate the marine water accounts approach:

1. Identify and describe the region of interest.
2. Identify and describe the economic sectors using marine waters.
3. Identify and, if possible, quantify the economic benefits derived from the economic sector's use of marine waters in terms of production value, intermediate consumption (goods bought from and sold to other businesses), value added (profits), number of employees (employment) and compensation of employees (salaries etc.).
4. Identify and, if possible, quantify impacts generated by these sectors (e.g. CO2 emissions)

This work was done by CBS (Statistics Netherlands), the national statistics authorities, responsible to provide national accounting figures to national parliament and e.g. EUROSTAT.

Both NAMWA and the Marine Water Accounts have a firm base in the internationally established structure of the System of National Accounts (SNA). These internationally agreed definitions and methods make it is possible to present data that are internationally comparable. The Marine Water Accounts are based on the regional economic accounts. These give a quantitative description of the economic processes in the various regions in the country in such a way that the economic processes can be linked to the national accounts. The economic accounts consist of the following five indicators:

1. Production
2. Use of intermediary products (at purchase prices)
3. Gross value added (at market prices)
4. Employers' wages
5. Labour force

The current version of the Marine Water Accounts presents these data for a large number of economic activities that are directly or indirectly depending on the marine environment (Vuik and Rossum, 2010). For sea-based activities on the Dutch Continental Shelf (e.g. oil and gas extraction on the North Sea), it was relatively easy to present economic data based on regional accounts, because most of these data refer to the region 'Extra territorial'. However, there are also many economic activities that heavily depend on the mere existence of the North Sea. For example economic activities that take place in seaports and recreation in coastal areas. Sea ports and coastal areas are not standard geographical regions in the regional accounts, meaning that the following apportionment method had to be applied:

1. Define the area of interest.
2. Calculate the share of the surface area of interest in the zipcode zones.
3. Allocate the key economic figures per region to the areas of interest.
4. Selection of relevant industries.

In order to be able to calculate the share of the surface area of interest in the zip code zones (step 2), the register of companies was used, which enables the location of companies to be specified within a 4-digit zipcode. To correct for zipcodes being larger than the area of interest the surface areas (percentages) were used. All key figures are allocated using the data on the persons employed per company from the register. For more details, see (Vuik and Rossum, 2010).

2.2 Business as usual scenario

In the Netherlands, there is a long tradition in using scenarios for policy purposes. E.g. projections of consequences of the proposed programs of political parties are often used in election debates to discuss which political party is likely to contribute most to employment, or reductions in state budget deficit, reductions in social inequalities, or other political objectives. The Dutch Central Planning Bureau is the undisputed source of scenario studies for this purpose. Therefore, it was logical to take their scenario analyses as the starting point for the baseline scenario for the MSFD. In the so called WLO four alternative scenarios are described, each consisting of a consistent set of assumptions with respect to possible future developments (see text box below) (CPB, MNP and RPB, 2006).

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.

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.

Based on this description of alternative futures, and combined with an expectation of what the impacts might be of the economic crisis, Ecorys (2010) presents scenario-based projections of the future status of the various economic sectors on and along the Dutch part of the North Sea.

2.3 Cost of degradation: The Cost-based Approach

The method used for the analysis of the cost of degradation is the so-called 'cost-based approach' presented in the handbook prepared by the European working group on Economic and Social Analysis. This approach is based on the assumption that current costs for measures to prevent environmental degradation would only have been made if the value of what is obtained (preventing degradation) is higher than the cost of the measures.[27] In this way, current costs can be seen as a lower bound estimate for costs of degradation. This approach is well-grounded in robust sources of existing data on costs of measures currently implemented to prevent

[27] This is the same kind of reasoning one could follow when trying to estimate the value of a statistical life: if a municipal council decides to install traffic lights, the value attached to prevented casualties should at least be as large as the costs made to install the traffic lights (in addition to congestion costs), otherwise the municipality would not have installed the light.

degradation of the marine environment. This method is similar to the way the Netherlands has conducted the analysis of cost recovery for the Water Framework Directive and is based upon the economic theory of Roefi Heuting (1974)[28].

By providing an overview of the current costs incurred by the various sectors it becomes clear who is currently paying how much, and how the burden is shared among economic actors. This gives insight in the existing financing structure for the protection of the marine environment (in a similar way as the cost recovery issue in Art. 5 of the Water Framework Directive gave insight in the existing financing structures for the WFD-related activities). Information on the financing structure will be useful for the remainder of the MSFD process, when the costs of the additional measures become clear, to be able to analyse who will be paying for these costs and to have an idea about the size of the potential increase in costs.

The steps of the cost-based approach

1. Identify all current legislation that is intended to improve the marine environment
2. Assess the costs of this legislation to the public and private sectors
3. Assess the proportion of this legislation that can be justified on the basis of its effect on the marine environment (as opposed to health or on-shore environmental effects)
4. Add together costs that are attributable to protecting the marine environment from all the different legislation you have assessed.

Note, that also various activities on land affect the marine environment. E.g. nutrient ran of from agricultural land, and emissions from wastewater treatment plants end up in rivers and lakes, which finally end up in the North Sea, where it contributes to eutrophication. The costs of the measures taken on land are not taken into account for this study.

[28] Hueting, R. (1974). *Nieuwe Schaarste en Economische Groei.* Amsterdam/Brussel: Agon Elsevier. English translation: http://www.managementissues.com/media/new_scarcity_and_economic_growth_hueting.pdf.

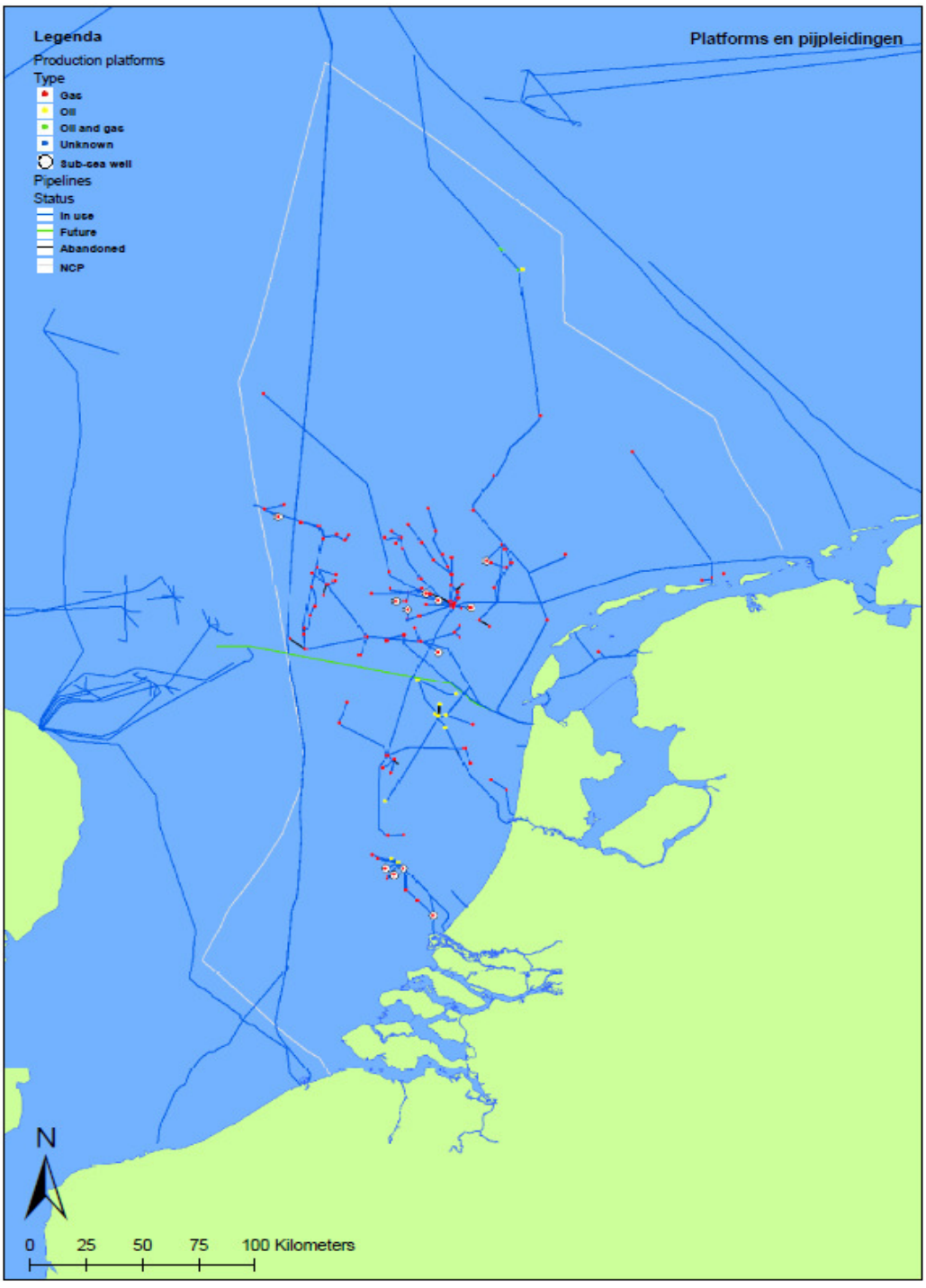
3. Results: Socioeconomic description per sector

In this section the direct economic activities taking place on the Dutch Continental Shelf by resident companies are described[29]. The following economic activities are described: oil and gas extraction, fisheries, sea shipping, marine aggregate extraction, wind energy, piping and cables, other sea-based human activities (e.g. carbon capture and storage, military activities, dredging), seaports and economic activities in the coastal zone. For each of these activities a description is given of past trends and present values, the impact of the economic crisis, factors influencing the future production and the cost of degradation.

[29] This report describes the direct economic value of the activities that take place on the Dutch Continental Shelf. In Annex B and C also figures about the spillover effects (indirect effects) on the Dutch economy are presented. For more information, see the CBS (2011) report 'Economic description of the North Sea for the Netherlands.'

3.1 Oil and gas extraction

This section gives a description of past trends and present economic values (in terms of production value, value added and employment), the impact of the economic crisis, factors influencing the future production and the cost of degradation for the oil and gas sector.



3.1.1. Past trends and present values

The Netherlands has significant subsoil quantities of natural gas as well as some smaller oil deposits. Since the discovery of these stocks in the nineteen fifties and sixties they have been exploited to meet demand of users in the Dutch economy and to facilitate exports to foreign countries. Extraction of natural gas and oil contributes significantly to Gross Domestic Product and to economic growth. Over the last twenty years, the benefits arising from oil and gas extraction, contributed on average 3 percent to total revenue of the Dutch Government. The share in revenues increased from 1.5 percent in 1999 to 3.9 percent in 2009 with a peak of 5.3 percent in 2008 (Environmental accounts of the Netherlands 2009, 2010).

A part of the subsoil energy resources is located beneath the DSC. On January first 2008 the share of the DCS, Wadden Sea exclusive, in the total Dutch gas reserve is 14%, the share in the oil reserve is 35% (Oil and gas in the Netherlands annual report 2007[30], Ministry of Economic Affairs and TNO).

On the DCS one extracts oil but mainly natural gas. The value of production, intermediate consumption and value added of these activities is published annually in the Dutch Regional accounts (Statistics Netherlands). In the regional accounts, an 'extra-territorial region' is defined, which comprises the territorial waters, the Dutch part of the continental shelf in the North Sea and the so-called territorial enclaves situated abroad (Dutch embassies, consulates, military bases, etc.). For oil and gas extraction, only the DCS is relevant. Table 9 shows economic key figures for oil and gas extraction on the DSC. With the exception of the number of employees, the figures are based on the regional module of the national accounts.

In consultation with Netherlands Oil and Gas Exploration and Production Association (NOGEPA) and State Supervision of Mines (SSM) it became clear that the number of employees stated in the regional accounts for this offshore activity were based on a misinterpretation of information supplied by SSM to Statistics Netherlands. The number of employees in table 9 is based on data on offshore exposure hours provided by SSM in response to figures published in the first version of this study in 2010. Two assumptions had to be made to complete table 9. In calculating the number of employees (fte) the assumption was made that one full time employee works 1,600 hours per year on average. Since exposure hours for 1995 are not available, the figure for 1995 has been set equal to that of the year 2000.

Offshore exposure hours of companies and contractors include companies in the industries "Crude petroleum and natural gas production" and "Supporting Crude petroleum and natural gas production" as well as other industries supplying goods and services to the oil and gas industries (caterers, suppliers of installations, etc). In order to make a distinction between the core industry and suppliers the number of employees (fte) in mining and quarrying from national accounts has been used as a starting point. The figures on onshore and offshore exposure hours (SSM) allow a geographical distribution between the DCS and activities on land.

Compensation of employees has been adjusted to the calculated level of employees by multiplying the average compensation per employee of the relevant industry with the new employment level.

[30] Olie en gas in Nederland Jaarverslag Opsporing en Winning 2007

Table 9| Economic key figures of the oil and gas extraction on the Dutch Continental Shelf

		1995	**2000**	**2005**	**2007**
DCS	Number of employees (x 1,000 fte)	3.0	3.0	2.8	2.8
	Compensation of employees (x € 1,000,000)	219	231	248	278
	Production (x €1,000,000)	2692	4306	5673	7644
	Intermediate consumption (x €1,000,000)	580	993	1477	1777
	Value added (x €1,000,000)	2112	3313	4196	5866

Source: CBS, 2011

The number of employees includes only employees on offshore facilities. The State Supervision of Mines provides this figure to Statistics Netherlands. Notice, that in the figures presented above, employees and contractors who are working in offices on land are not included. The reason for this is that it is unclear how many employees and contractors on land are doing work related to offshore mining. Hence, the presented figures may be a significant underestimation of the total number of employees working for the offshore industry. The production figure of the national accounts is allocated geographically in the regional accounts on the basis of the produced quantities on regional scale. The quantities produced are published annually by the Ministry of Economic Affairs and TNO (Oil and gas in the Netherlands).

3.1.2. The impact of the 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.

3.1.3. 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[31].
- *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.

3.1.4. Production prognoses

Gas

Table 10 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 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 10| 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

Figure 14 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).

[31] Source: Annual Report EBN 2009

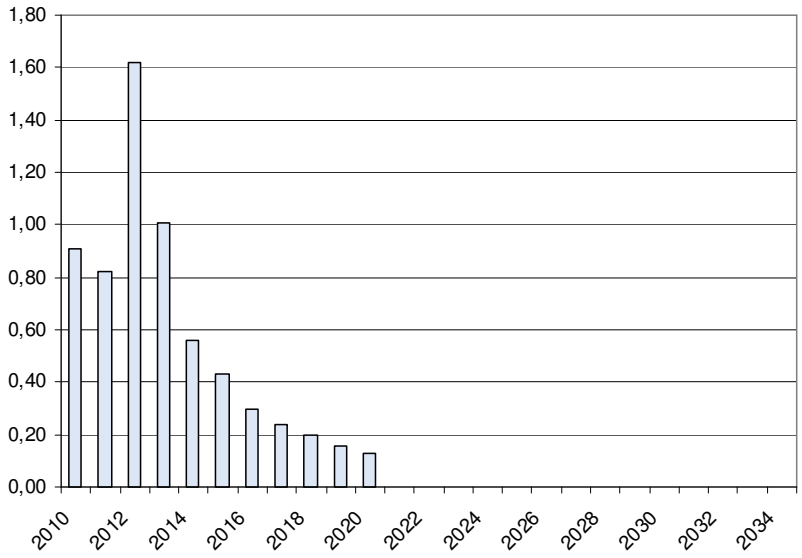


Figure 14| Production from developed and undeveloped oil reserves
Source: TNO – Built Environment and Geosciences (2010).

3.1.5 Baseline projections

Table 11 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 10). Values are expressed in terms of 2007 price level, thus showing changes in output.

Table 11| 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)	7.644	6.062	6.356	6.642	6.642	5.203-6.035	1.665 - 2.705
Added value (million euro)	5.866	4.594	4.817	5.034	5.034	3.943 - 4.574	1.262 - 2.050
Employment (fte)	2.800	531	565	609	624	410 - 534	87 - 150

Source: ECORYS, based on WLO study, 2010;*CBS, 2011

3.1. 6 Analysis of costs of degradation: Costs of current environmental measures

Environmental measures are taken in all phases of E&P activities (exploration, drilling, production and decommissioning). As an example, some measures relating to the drilling and production phases are explained below. It is noted that environmental measures in the offshore industry involves a much wider set of environmental themes, such as energy efficiency, emissions to air, CO2 and NOx emission trading, environmental managements systems etc.

The production phase involves e.g. treatment of produced water. Produced water results from the process of lifting oil and/or gas from water-bearing formations. Water is separated from the oil and/or gas stream in order to reach specifications. The resulting produced water stream is treated before it is discharged into the sea, in order to meet discharge requirements (i.e. dispersed oil content of 30 mg/l).

Other constituents of produced water (e.g. dissolved oil, heavy metal traces, PAH's) are partly removed by the produced water treatment techniques. In the case of produced water re-injection, the produced water stream is injected into the underground, either into the hydrocarbon baring formation with the aim of pressure maintenance, or into dedicated wells.

Chemicals used in the process of drilling or for production shall meet the OSPAR-HMCS criteria. Only chemicals that are registered through the HMCS can be used. This involves the provision of all relevant information, including ecotoxicological information. The HMCS gives provisions on the substitution of chemicals by less harmful chemicals. The Mining regulations in the Netherlands require a systematic substitution process through permitting and plans. More recently, the EU REACH Regulation has entered into force, which is also applicable to the use and discharge of offshore chemicals.

Operators report on environmental measures (1) in 4-yearly company environmental plans and (2) through annual environmental reports. Table 12 gives an overview of the total cost of environmental measures per operator. These costs consist of certain measures and conditional measures. Certain measures are measures that will be implemented. These measures are known and there are no more barriers to proceed the implementation. Conditional measures are measures that will be implemented if one or more explicitly defined conditions are met. These conditions may relate to technical, environmental or economical (international) feasibility. If the measures are conditional than the mining company (operator) will indicate which actions will be taken to meet the requirements (FO Industrie, 2008).

Table 12| Cost of certain and conditional measures related to oil and gas (€)

Company	**Cost certain measures (4-year period in €)[1]**	**Yearly cost certain measures (in €)**	**Cost conditional measures (4-year period in €)[1]**	**Yearly cost conditional measures (in €)**	**Total costs certain and conditional measures (4 year period in €)[1]**	**Yearly total costs of measures (certain and conditional) (in €)**
CENTRICA	89.000	22.250	2.000.000	500.000	2.089.000	522.250
CHEVRON	1.315.000	328.750	5.085.000	1.271.250	6.400.000	1.600.000
DANA	990.000	247.500	515.000	128.750	1.505.000	376.250
GDF SUEZ	1.010.000	252.500	0	0	1.010.000	252.500
NAM	11.140.395	2.785.099	34.105.000	8.526.250	45.245.395	11.311.349
TAQA	260.000	65.000	2.462.000	615.500	2.722.000	680.500
TOTAL	6.565.000	1.641.250	7.330.000	1.832.500	13.895.000	3.473.750
WINTERSHALL	317.000	79.250	6.912.000	1.728.000	7.229.000	1.807.250
Total	**21.686.395**	**5.421.599**	**58.409.000**	**14.602.250**	**80.095.395**	**20.023.849**

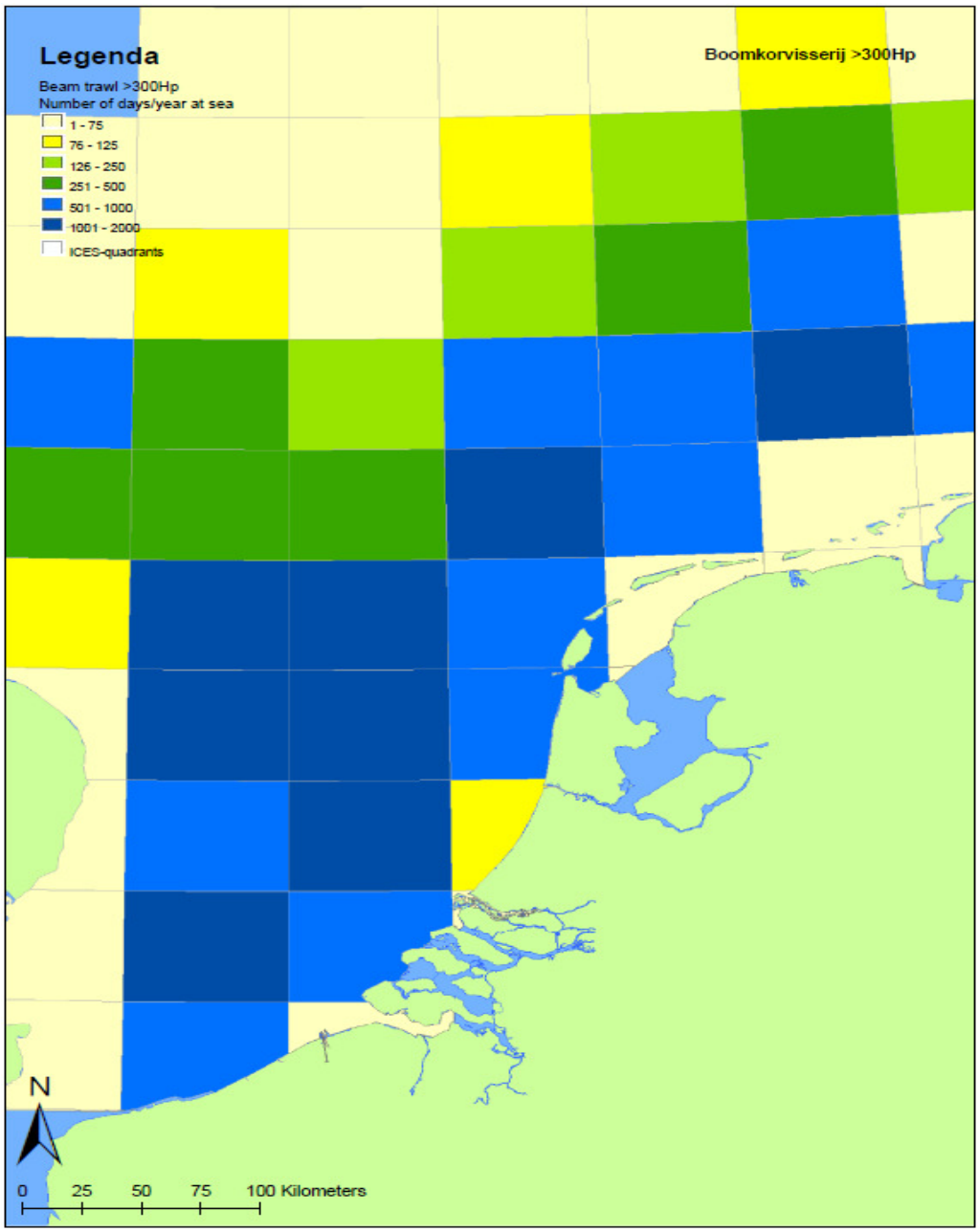
Source: [1]NOGEPA, 2011. Note: the figures received from NOGEPA are based upon the 4-yearly company environmental plans. For reasons of convenience, we also presented the average annual cost. Hence, we made the assumption that the total cost is spread evenly over the years.

3.1.7. Who bears the cost?

These costs represent the effect on profit for the oil producers. As such, they bear the burden of the regulation.

3.2 Fisheries

This section describes the economic development of the fishing industry. This section is based on studies of CBS (2011), Ecorys (2010) and LEI (2010). Due to the scope of the project, the economic development is described for the sector as a whole and not for each sub sector separately. This can be considered as a limitation of the report. Hence, the figures presented in this section should therefore be interpreted with care. More information about the fishing industry can also be found in paragraph 3.10 in Prins, e.d., 2011.



3.2.1. Past trends and present values

The Dutch Continental Shelf is intensively fished. The fishing intensities in the North Sea vary by location and season, but the Dutch fishing fleet operates mainly in the southern and eastern parts of the North Sea. However, unlike the extraction of oil and gas, the Dutch Regional accounts do not provide figures for other relevant activities on the DCS. In the regional accounts economic activities are generally allocated to the registered address of the companies on land (oil and gas extraction is an exception). For fisheries, economic activities are allocated to the harbours where the fishing vessels are registered.

Macro economic figures for the fishing industry[32] are obtained from the Dutch national accounts. The fishing industry in the Netherlands consists of Cutter fisheries, Palegic Fisheries, mussel farming and aquaculture. The last two activities do not take place on the DSC. For mussel farming, there is a relationship with the North Sea since the sea provides salt water. Mussels are generally harvested from either the Wadden Sea or the Oosterschelde, thus outside the geographical boundaries of this study.

Textbox fishing quota and development of prices

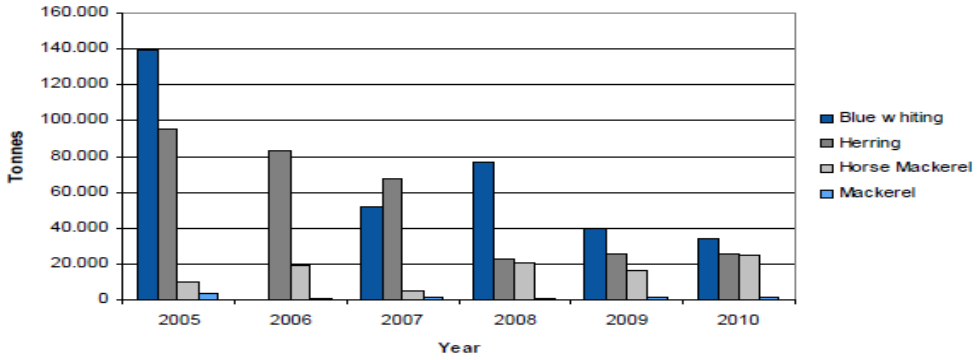
The fishery sector is a highly regulated sector. Coastal and marine fisheries are mainly regulated from the EU, through the Common Fisheries Policy, which is aiming for sustainable fisheries. Special attention is given to the discussion of Maximum Sustainable Yield (MSY). MSY is the maximum yield that 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 below).

[32] An industry refers to a group of companies or organisations that produce similar goods or services.

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



* For 2006 no information about the blue whiting was collected

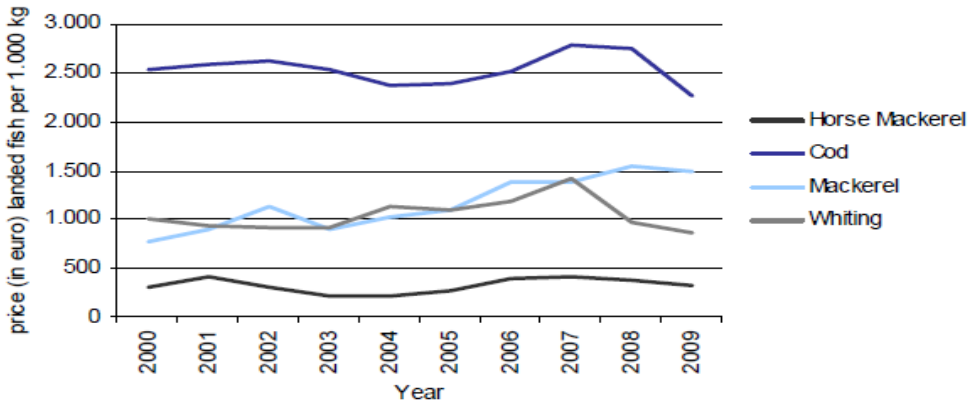
Source: PVIS

Although the fishing quota declined over recent years, the prices of landed fish did not 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 (see figure below). 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.

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



Bron: CBS, 2010

Source textbox: ECORYS, 2010

The Agricultural Economics Research Institute (LEI, Compendium voor de leefomgeving, 2006) has published figures for the Dutch fishing industry indicating

yields on the DCS for 2001, 2002 and 2003. In current prices for these years, the share of turnover generated on the DSC in the total national turnover is on average 21.6%. This average share of 21.6% is used to allocate the macro-economic figures of the Dutch fishing industry to the DCS. This results in the economic figures in Table 13 representing the relevance of the DSC for Dutch Fisheries.

Table 13| Economic key figures of the (Dutch) fisheries on the Dutch Continental Shelf

		1995	**2000**	**2005**	**2007***
Total NL	Number of employees (x 1,000 fte)	2.2	1.5	1.1	1.0
	Compensation of employees (x €1,000,000)	93	84	63	64
	Production (x €1,000,000)	471	511	472	524
	Intermediate consumption (x €1,000,000)	191	245	277	317
	Value added (x €1,000,000)	280	266	195	207
DCS	Number of employees (x 1,000 fte)	0.5	0.3	0.2	0.2
	Compensation of employees (x €1,000,000)	20	18	14	14
	Production (x €1,000,000)	102	111	102	113
	Intermediate consumption (x €1,000,000)	41	53	60	69
	Value added (x €1,000,000)	61	58	42	45

Source: CBS, 2011

3.2.2. The impact of the economic crisis

For fisheries, fuel costs have an important impact on the performance of the sector. As a result of the high oil price due to the economic crisis fishing activities were more concentrated nearby the coast instead at fishing grounds further away. However, this does not mean that these places further away are not interesting for 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. 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[33], 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).

3.2.3. Factors influencing future use

The future fish production depends on the following influence factors:

- **The development of fish quota allocated to the Netherlands;**

[3333] Not all fresh fish can be considered as a luxury good. For example, plaice is a bulk product.

The main limiting factor for fisheries is the European quota for fish. Every year the quotas 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.

The quota has also a significant effect on the price of fish. For instance, a couple of years ago the quota for plaice decreased, because a model showed that the fish stocks decreased. However, the demand for plaice did not change, and the gap between demand and supply was filled with Pacific dab. Pacific dab is also sold as plaice in the Netherlands, but at a lower price. After a few years, when the quota for plaice was increased again, the market was overloaded with plaice (and substitutes of plaice, like Pacific dab) which resulted in a lower price for plaice. Hence, an increase of the quota to the old level does not mean that also the price of the fish and profitability of the sector returns to the old level.

- **Changing (fish)consumption patterns;**
  For those types of fish that can be considered as 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. Import is especially important for the Dutch market. Approximately 80 percent of the fish that is consumed in the Netherlands is import, while 80 percent of the catch of the Dutch fleet is exported (pers. comment de Visser).

- **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, except for shrimp fishery (especially as part of N2000 measures). 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 distortion.

  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[34]. 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

[34] 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.

fishery will start. It is expected that by the end of 2012 the plaice-sole fleet will be completely certified.

3.2.4. Baseline projections

Table 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 (Ecorys, 2010).

Note: table 14 presents a future decline in the production value of the fishing sector. However, the Fish Product Board (Productschap Vis: stakeholder organization) expects an increase of the production values of the main commercial fish species in the North Sea (sole, plaice, but also herring and mackerel) due to MSY management.

Table 14| prognoses for production value, added value and employment fisheries DCS (nominal values)

	2007[8]	**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[1]	442	480	495	507	399 - 478	263 - 377

Source: ECORYS, based on WLO study (CPB, PBL, 2006);[1]this includes coastal fisheries

3.2.5. Analysis of costs of degradation: Costs of current environmental measures

In this section, the costs involved in Dutch fisheries management, research, innovation and restrictions because of Natura 2000 are discussed.

Within the last 150 years, the fisheries sector underwent an enormous change. Advancements in technology made it possible to find and catch fish in circumstances and quantities that were unthinkable of more than one hundred years ago. The sector underwent the most significant change after the Second World War, with the advent of beam trawling. Since then, fisheries gradually went from small-scale to large-scale. Over the years, concerns about overfishing and the ecological impact of fisheries resulted in management restrictions such as quota and coming restriction fishing areas under Natura 2000. Next to that, the fisheries sector is currently supported by The Netherlands and the EU in the form of subsidies to stimulate innovation in more sustainable fisheries techniques (gear change, etc).

In the current situation, the fisheries sector is legally restricted by and is (partly) subsidized through the EU and The Netherlands. The main management tool in the field of subsidies is the EFF (European Fisheries Fund). Several of the subsidies can be classed as being spent to prevent degradation of the marine environment. The Dutch government uses the subsidies to initiate and to stimulate sustainability. For instance, the subsidy is used for demonstration projects. An example of an innovation is the Sumwing. In 2007, trial runs started with the Sumwing, a suspended wing with nets. The fishing gear is much lighter than the beam trawl,

which result in tremendous savings on fuel costs. Another advantage is that the bottom is not churned up as much.

All of the relevant subsidies require funding from the private sector. In some cases these costs can be counted as real costs to society. In some cases they cannot. This is because the costs can be considered as an investment which the private sector makes in order to increase its revenues. The private sector will only make this investment if the revenues are greater than the costs. In this way, the costs are not "real costs" (Taal, 2010). When the private sector can be assumed to be able to offset increases in costs with increases in revenues, these costs are "not counted" in the final column of table 15[35]. In one case (subsidy 2: collective actions in the fisheries chain) a proportion of the costs to the sector are real costs because it is not expected that the private sector will be able to recover all of its costs through increases in revenues. In this case expert opinion (Taal, 2010) was used to decide that 30% of the costs were "real".

Table 15| Average annual subsidy and related private sector costs for fisheries in the Dutch North Sea for the period 2008-2013 (€,000)

Name	**Description**	**Treatment of private sector costs**	**Average annual cost (€,000)**
Certification of the fisheries chain	Certification of fisheries	Counted	€ 1,250
Collective action in the fisheries chain	Improving management of fish stocks, sustainable techniques, cooperation within the sector	30% of costs counted	€ 3,760
Investing in fishing vessels - alternatives for trawling	Reducing impact on benthos by beam trawling, stimulating selective fishing methods	Not counted	€ 2,000
Investing in fishing vessels	Stimulating use of pulse fishing, reducing impact on benthos by beam trawling	Not counted	€ 880
Investing in ex round fish vessels	Recovery of cod stocks, selective fishing methods	Not counted	€ 480
Innovation in the fisheries chain	Selective fishing methods, environmental management plans, introduction of MPAs, reducing discards & environmental impact	Not counted	€ 3,500
Average total			**€ 11,870**

Source: Ministry of Economic Affairs, Agriculture and Innovation (2010)

Table 15 shows the relevant subsidies and their magnitudes. The figures are mean costs per subsidy over the 6 year period of the subsidies (2008 to 2013).The final step related to subsidies is to adjust for the fact that the benefits of subsidies will not just be felt in the Dutch North Sea but also in any area of where the Dutch fishing vessels operate. The percentage of sea days that Dutch fishing vessels fished in the Dutch North Sea has been calculated using official log book databases for 2009. This is equal to 62% (Bartelings, 2010). Sea days are considered to be the most relevant figure because they relate more closely to the environ-mental effects

[35] Contrary to economic theory as explained above, according to the fisheries stakeholder organisation, the Dutch fisherman see investments in Sum Wing and other environmental measures that can be beneficial for them, since it reduces costs in the long run, still as an additional burden for environmental purposes and would like to see it presented as such.

of fishing than the value of the catch. As such the final value is € 7,361 (see also Table 16).

When considering this data it is important to bear in mind that not all available finance will not necessarily be utilized. This is because of failed projects. Subsidies are paid on a per project basis and the private sector must finance the initial expenditure. If the project is a success then the organizations involved qualify to have the money reimbursed through the subsidy. The risk that some projects will fail has not been accounted for. This is because it does not matter, for the purpose of this report, whether a project fails. Failure or success does not change the fact that society is willing to incur the cost of preventing degradation of the marine environment. This in turn provides insights into the lower bound for the cost of degradation.

Within the following years, due to the implementation of Natura 2000 areas within the North Sea itself, fisheries will be further affected (i.e. beam trawlers might have to avoid those areas). The yearly future costs to the fisheries sector (due to loss in benefit) are estimated to be less than €11,500,000 (Oostenbrugge et al, 2010). However, these are future costs and as such are not included in the costs of current measures.

Within the Dutch North Sea, some fisheries are not allowed in certain areas due to environmental protection. An example of such a fishery is the cockle fishery, which is not allowed in the Voordelta. The yearly loss in profit to cockle fishery is estimated to be around €0.5 mln. (Holstein, 2010). Unavailability of data precludes the inclusion of other fisheries, thus it is best to consider this cost as an underestimate. Furthermore, some fisheries (i.e. cockle fisheries) are obliged to apply for permits (Nature Conservation Act/Natuurbeschermingswet). These costs are not included in the calculations because the overall figure was negligible.

To prevent the introduction of non-indigenous species in the North Sea waters, the aquaculture sector is obliged to take measures when importing shellfish from abroad. Originally, these shells were imported, cleaned of marine debris and sold. The marine debris was then dumped into the Oosterschelde, along with the debris from the Dutch shells. Since some of the debris from imported shellfish includes non-indigenous species which posed a hazard to the marine environment, it was decided by (Natura 2000) law to forbid it. The total costs related to measures to prevent the introduction of non-indigenous marine plants and animals from entering the Oosterschelde and North Sea are estimated to be around €260,000 a year. These costs include monitoring, legal advice, permit application and quarantine measures (Holstein, 2010).

Table 16| Average annual costs related to fisheries and aquaculture (€,000)

Type of cost	**Average annual cost**
EFF Subsidies	7361[a]
Private investments	In te vullen door sector
Marine debris	260[b]
Cockle fisheries	500[c]
Total	8,121
Natura 2000[*]	11,500

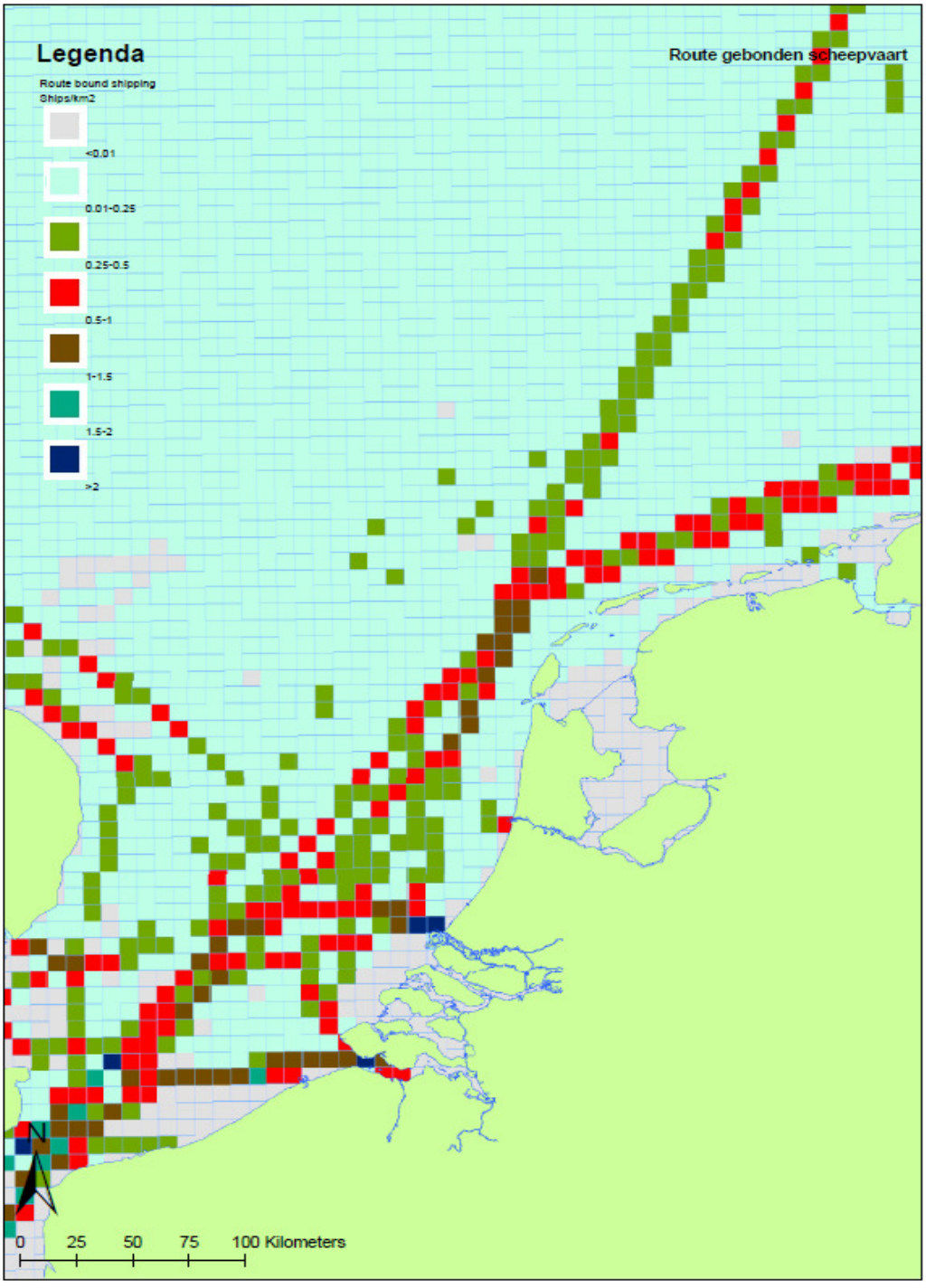
Source: a) Ministry of Economic Affairs, Agriculture and Innovation (2010), b) Oostenbrugge et al (2010), c) Holstein (2010). *This is not a current cost and therefore it is not counted in the total.

3.2.6. Who bears the cost?

EFF subsidies are funded by the EU and the Dutch Government. Natura 2000 costs, as calculated in this report, are borne by the fisheries industry through limitations on the areas which they can fish. The costs of alternative disposal of marine debris and of restrictions on cockle fisheries will be borne by the aquaculture sector.

3.3 Sea shipping

This section gives a description of past trends and present economic values (in terms of production value, value added and employment), the impact of the economic crisis, factors influencing the future production and the cost of degradation for the shipping sector.



3.3.1. Past trends and present values

The North Sea is important for marine traffic and its shipping lanes are among the busiest in the world. International shipping companies navigate the Dutch Continental Shelf intensively. The National Accounts provide macro-economic figures for the Dutch sea shipping industry. Though inland vessels may sometimes use the DCS, sea shipping is the most relevant industry. Macro-economic data for the industry sea shipping represent all international and national activities of Dutch sea shipping companies (residents). Sea shipping includes the transport of both cargo and passengers. The residence principle refers to the centre of economic interest of the operators of vessels[36]. The vessels of the Dutch operators may carry a flag of another territory. The ownership of the vessels operated by Dutch residents can be with a foreign company.

Table 17| Economic key figures of the (Dutch) sea shipping industry on the Dutch Continental Shelf [37]

		1995	**2000**	**2005**	**2007***
DCS	Number of employees (x 1,000 fte)	7	7	6	6
	Compensation of employees (x €1,000,000)	274	303	326	357
	Production (x €1,000,000)	2626	3689	4913	4588
	Intermediate consumption (x €1,000,000)	1996	2762	3576	3380
	Value added (x €1,000,000)	630	927	1337	1208

Source: CBS, 2011

The total national figure is used for the valuation of the DCS. Considering the DCS exclusively may be considered irrelevant, because the international accessibility matters and not so much the DCS itself.

3.3.2. The impact of the economic crisis

After several good years, there was a decrease in the cargo volume and price 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, but prices are still very low. 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

[36] In the particular case of ships flying flags of convenience, it is often difficult to determine the residence of the operating unit, because of complex arrangements involving the ownership, mode of operation and chartering of such ships, and the fact that the country of registry in most instances is different than the country of residence of the operator (or owner). Nonetheless, in principle, the shipping activity is to be attributed to the country of residence of the operating unit. If that unit establishes a branch (direct investment) in another country to manage the operation, for tax or other considerations, the operation is to be attributed to the resident (branch) of that country. (SNA 1993, UN)

[37] The industry of sea shipping is also included in the analysis of seaports in chapter 3.8.2. This results partly in an overlap in figures. Since, this overlap is less than 10 percent this overlap is not considered significant.

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, caused by a mismatch of supply and demand. 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 (Ecorys,2010). Note: for the shipping sector, in contrary to ports, the economic viability is measured in tonnes and prices of transported cargo and not only the amount of transported cargo.

3.3.3. Factors influencing future use

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 CO2-emissions, secondly how to comply to the stringent sulphur standards in 2015. A potential issue is sub aquatic noise. Currently more studies and knowledge is developed regarding the issue of under water sound from marine activities including shipping.
- NOx-Emissions
  From 2016 onwards, vessels in NOx Emission Control Areas (NECAs) have to comply with more stringent NOx emission standards. Currently, the Baltic area has been proposed as NECA and research is ongoing for the North Sea.
- Ballastwater
  Most likely the Ballastwater convention will be approved in the coming years, resulting in obligations to install treatment systems for the shipping sector from 2014 onwards.
- *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). Although other studies draw a different conclusion regarding the effect on modal shifts. EC decision is taken. Dutch government and ports should think of implementation of LNG as shipping fuel or stimulate the use of scrubbers or promote the use of clean fuels (Pim de Wit, 2011).
- *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.

3.3.4. Production prognoses

Table 18 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[38], 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 18| 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

3.3.5. Baseline projections

Table 19 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 16). 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 19| 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

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

3.3.6. Analysis of costs of degradation: Costs of current environmental measures
In 2009, approximately 840 of ships were under a Dutch flag (KVNR, 2010). Regarding the measures in the Dutch shipping industry to avoid degradation to the North Sea environment, five types of measures are classified; insurance, anti-fouling, emissions to air, ballast water treatment and marine litter. In the following section each type of measure and their costs are discussed. The Dutch shipping sector is also investing in other measures such as research regarding underwater noise, operational measures like education of crew and weather routing, fuel efficiency measures, environmental friendly tube oil, optimalization of lube oil systems, transport chain optimalization, testing and collecting of data and dual fuel systems, disposal of sludge and black and grey water (Altena, 2010). Due to the limited scope of this research, data on these measures are unavailable and as such, are not taken into account. This section uses the Ecorys (2007) assumption that 10% of Dutch shipping occurs in the North Sea. Note, that this is an assumption and that the actual number may be significantly higher.

Insurance
Insurance measures refer to both the insurance costs to cover the impact of disasters at sea (i.e. oil spills due to collisions) and the costs of contributing to the International Oil Pollution Compensation Funds (IOPC Funds). The insurance costs of an average Dutch ship are between €125,000 and €150,000 for a 10,000 GT (gross tonnage) ship (Ecorys, 2007). This figure is used because 10,000 GT is approximately the average size of a ship under a Dutch flag. It is important to note that only a proportion of the total insurance amount can be attributed to avoiding degradation of the marine environment. It is assumed, based on expert opinion, that this proportion is 25% (Ecorys, 2007). Based on the number of ships in 2009, the figure is €26-32 mln. This figure must then be adjusted to account for the fact that the fund covers all oceans not just the North Sea. In order to do this, the 10% assumption is used. As such the final yearly average is between €2.6-3.2 mln.

In addition to the costs related to insurance, the Dutch oil industry contributes to the International Oil Pollution Compensation Funds (IOPC Funds). These funds are part of an international regime for liability and compensation for oil pollution damage caused by oil spills from tankers. Under the regime, the owner of a tanker is liable to pay compensation up to a certain limit for oil pollution damage following a leak. If that amount does not cover all the admissible claims, further compensation is available from the 1992 Fund if the damage occurs in a state which is a member of that fund. Additional compensation may also be available from the Supplementary Fund if the state is a member of that fund as well. The IOPC Funds are financed by levies on certain types of oil carried by sea. The Dutch contribute 7% of the value of the 1992 fund and 15% of the supplementary fund (IOPC, 2009).

The contributions of the IOPC members varies depending on the amount which the fund needs to pay out. Accordingly the average of the costs for the Netherlands is taken over 3 years - 2007 and 2008 data from the IOPC report (2009) and the data from the Ecorys (2007) which was calculated for 2006. In these years, 7% of the 1992 fund plus 15% of the supplementary fund is approximately €440,000 for 2007 and €3,670,000 for 2008. The 2006 figure is €8,000,000. The average over the 3 years are adjusted to account for the fact that the fund covers all oceans not just the North Sea. Again, the 10% assumption is used and as such the final yearly average is €403,830.

Anti-fouling
In order to minimize the impacts of marine species attaching themselves to ships, many ships are protected by antifouling coatings. Many types of coatings, however, have been found to be toxic to marine organisms. For example, extremely low concentrations of tributyltin moiety (TBT), which was the most commonly used anti-fouling agent, caused defective shell growth and development of male characteristics in female dog whelks. Concerns about the environmental and health effects of these paints have led to the ban of these compounds in marine coatings by the International Maritime Organization (IMO). The International Convention on the Control of Harmful Anti-fouling Systems on Ships was adopted in 2001 and came into force in 2008 (IMO, 2010). The yearly costs of measures related to TBT free anti-fouling material taken by the Dutch shipping industry are €59 mln. (CBS, 2010). The 10% assumption is used and as such the final yearly average is €5.9 mln.

Reduction of SOx and NOx emissions
A further measure relates to SOx and NOx emissions from ship exhausts. A reduction in shipping emissions may result in reductions in sulphur and nitrogen deposition and reductions in acidification and eutrophication. This relates to the revision of the MARPOL Annex VI Regulations which took place in 2008. These regulations require a reduction in emissions through changing fuel use or installation of scrubbers or any other technical measure. Accordingly, the costs of these measures will be the increase in costs to the shipping industry. Due to the recent nature of these regulations, it is not possible to present data on the costs. This is partly due to a lack of knowledge about whether ships will adopt more expensive fuels or choose to adopt scrubbers or any other technical measure. Uncertainties about the future cost of low sulphur fuels also complicates the analysis. However, the obligation for shipowners to use low-sulphur fuels has resulted in increased bunkering costs. Bunkerfuel containing 1% sulphur is about 300 US Dollar per ton more expensive. Besides, the use of technical measures to comply with the 0.1% sulphur rule per 2015 in ECA's could lead to acidification and eutrophication of seawater, especially in estuary-like areas such as harbors and the Baltic Sea. Legislation to avoid this still needs to be developed. Further information on this topic can be found in ENTEC (2010).

Marine Litter
Marine litter poses numerous threats to the marine environment and economy. The economic effects of marine litter are impacts on habitat destruction and effects on wildlife as well as aesthetics and tourism, human health and safety (UNEP, 2005). Besides fisheries, input from other (sea) areas, beaches and rivers, shipping is one of the sources of marine litter. Within the 12 mile zone ships are not permitted to dispose of any kind of litter at sea. Outside of the 12 mile zone it is only permitted to dispose of degradable domestic and human waste. The revised Marpol Annex 5 will from 2012 onwards prohibit the disposal of all garbage at sea in general. All Dutch ports have reception facilities where ships can dispose of their litter. Based on the year 2009, the costs to the Dutch shipping industry to use these facilities are €17.3 mln. a year (Prinssen, 2010). Using the assumption that 10% of these costs are accountable to the Dutch North Sea, the final yearly average is €1.73 mln. Since litter is a local problem, the assumption of 10 percent might be an underestimation.

Ballast water
Ballast water treatment facilities are required under IMO legislation. In 2016 all large ships are obliged to have ballast water treatment systems on board. The costs of these facilities are estimated to be around €0,5-3,0 mln. for an average Dutch

ship (€1,5 mln. for a large ship) (Altena, 2010). The total yearly costs of these facilities for all ships under Dutch flag are €42-84 mln. per year. A central estimate is therefore taken of €63mln. Of these costs, 10% can be allocated to the North Sea. As such the final yearly average is €6.3 mln[39].

Table 20 gives an overview of the average annual costs for the shipping industry with respect to environmental measures to prevent degradation of the marine environment. Note, that the cost presented below are based upon the assumption that 10% of Dutch shipping occurs in the North Sea. However, the sector will have to pay the full amount and therefore has to pay more than €150 million on current measures.

The shipping sector has indicated that they spend more money on measures to prevent degradation of the marine environment, which are not fully reflected in this report due to the limited scope of this project (pers. comment Paul Altena, KVNR). In addition, measures taken in the Dutch shipping sector might have indirect consequences for other industries as well. Hence, the figures presented below should be seen as an indication of the total annual cost.

Table 20| Average annual costs for the shipping industry (€,000,000)

Measure	**Sub-Measures**	**Lower Estimate per sub-measure** [a]	**Central Estimate per sub-measure**	**Upper Estimate per sub-measure** [a]	**Total per measure**
Insurance	Insurance [b]	2.6	2.9	3.2	3.304
	IOPC [c]	0.404	0.404	0.404	
Anti-fouling [d]		5.9	5.9	5.9	5.9
Marine Litter [e]		1.73	1.73	1.73	2.99
Ballast Water [f]		4.2	6.3	8.4	6.3
Totals		**14.834**	**17.234**	**19.634**	**17.234**

a) where available. Where not, the central estimate is used;
Sources: b) Ecorys,2007; c) IOPC,2009; d) CBS,2010; e) Prinssen,2010; f) Altena, 2010

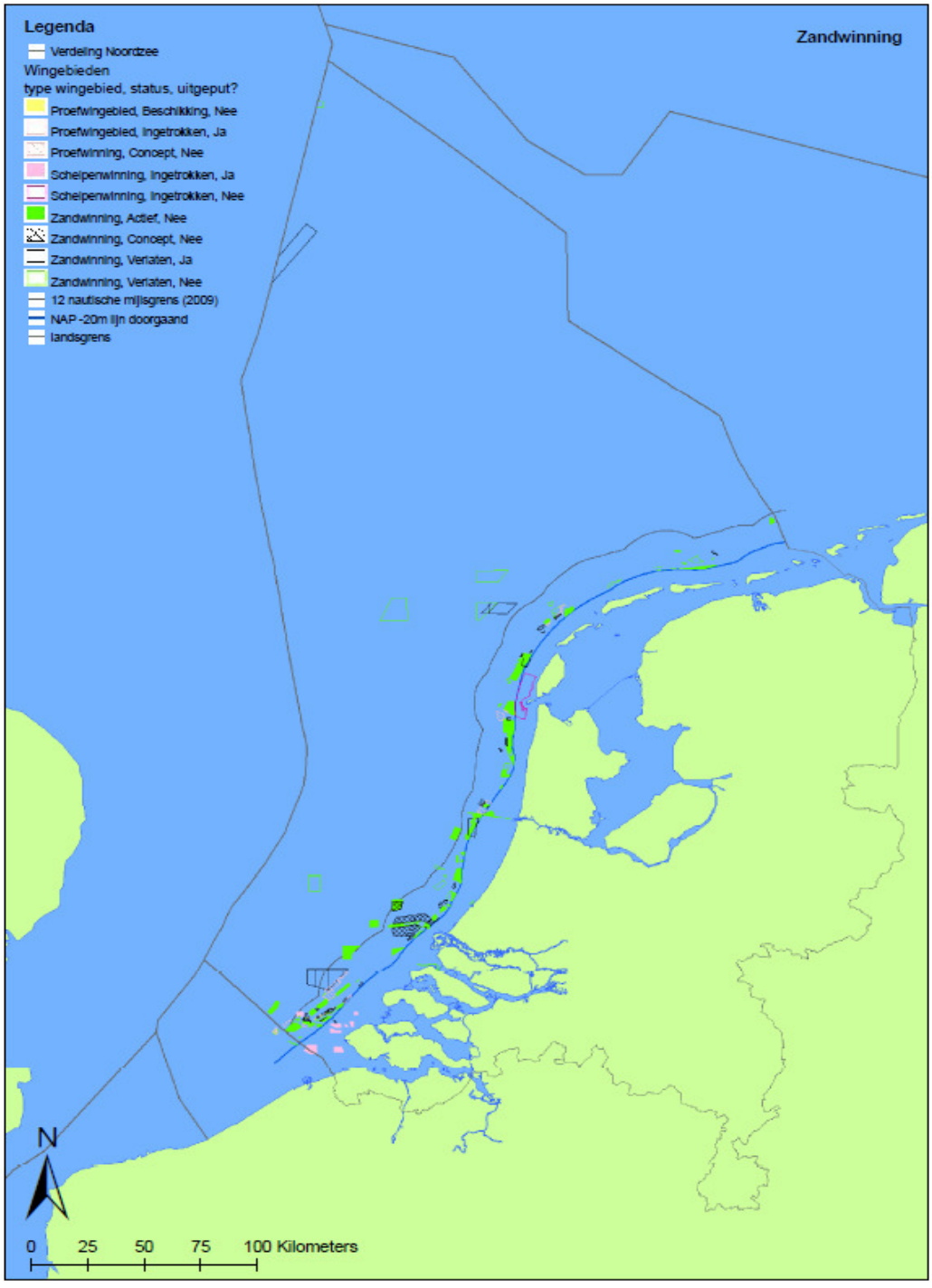
3.3.7. Who bears the cost?

All the costs of the measures in this section are borne by private industry. There are two exceptions. Beach cleaning is paid for by municipalities and the Dutch government also pays a contribution to the IOPC fund. The ratio of the IOPC fund which is paid for by the Dutch government is not available from the IOPC.

[39] These cost figures depends on a large number of assumptions. For example, the deprecation period of the shipping fleet. According to Paul Altena (KVNR) a lower estimate would be more plausible, because of the average age of the Dutch shipping fleet.

3.4 Marine aggregate extraction

This section gives a description of past trends and present economic values (in terms of production value, value added and employment), the impact of the economic crisis, factors influencing the future production and the cost of degradation for the marine aggregate sector.



3.4.1. Past trends and present values

Besides oil and gas extraction also surface mineral extraction takes place at the Dutch Continental Shelf. Sand extraction is the most important. Gravel extraction is of relatively minor importance and shell mining is mainly extracted in the Wadden Sea[40]. The sand that is collected from the sea floor is used for the protection of the coast as well as for fill sand for (infrastructural) projects. These activities can be defined as dredging activities. Also maintaining shipping channels on the DCS is a purpose of this activity. Dredging activities on the DCS are included in the industry 'construction', more specifically 'hydraulic engineering'. Besides dredging, this industry includes for example construction of bridges and dams. Data on hydraulic engineering are rare, in the Dutch national accounts this industry is included in the much broader industry 'civil engineering'.

In order to specify dredging on the DCS requires multiple steps. Firstly, hydraulic engineering needs to be specified. The next step requires the allocation of a part of hydraulic engineering to dredging. Finally, figures for dredging activities need to be allocated geographically to the DCS. Dutch dredging companies are very active in different geographical areas, both nationally and internationally.

Financial statistics on both hydraulic engineering and civil engineering are available for 2006, 2007 and 2008 (Statline, Statistics Netherlands). For these years the share of hydraulic engineering in the net revenue of civil engineering industry is 5.4 percent. This percentage is used to allocate figures for civil engineering in the National Accounts to hydraulic engineering (see table 21; data for value added and production). For all figures presented the share of hydraulic engineering is assumed to be equal to the share in production. Since only three years are available, a constant share is assumed over time.

Table 21| Economic key figures of hydraulic engineering by Dutch companies

		1995	**2000**	**2005**	**2007***
Hydraulic engineering (NL)	Number of employees (x 1,000 fte)	3	3	3	3
	Compensation of employees (x €1,000,000)	91	124	140	151
	Production (x €1,000,000)	353	530	560	627
	Intermediate consumption (x €1,000,000)	230	358	389	441
	Value added (x €1,000,000)	123	172	171	186

Source: CBS, 2011

The second step requires isolating dredging activities from the industry hydraulic engineering. No suitable indicators for this specification have been found so far. In addition, no suitable indicators for the geographical specification have been found. Sand extraction from the DCS is thereby only included Pro Memoria (P.M.) in this study. The lack of detailed information of dredging activities and the difficulty of isolating dredging activities from other hydraulic engineering activities and the geographical location of these activities motivate this decision.

[40] 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 volumes of top sand, under the condition that this sand is suitable for coastal defence measures or land filling (Ecorys, 2010).

In an earlier study (Voet, L. (Royal Haskoning), B. Budding (Rebel Group), 2008) of economic activities on the DCS, the extraction of sand was estimated based on financial statistics (Statistics Netherlands) of the industry 'sand and gravel extraction'. Figures on the quantities of sand produced/extracted on the North Sea and prices estimated by experts are used for the geographically allocation of the national figures. The main argument for abandoning this approach is that the dredging companies active on the DCS are not included in the industry 'sand and gravel extraction', but rather in 'hydraulic engineering'.

3.4.2. The impact of the economic crisis

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 increase again after 2013. However, it is not expected that the volume of fill sand will return to the level of 2007/2008.

3.4.3. Factors influencing future use

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.

Ad1) 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 22) 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 approximately 40 - 80 million m3 will be required for beach nourishment[41].

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 22| 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)**

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

Source: RON2, RWS Noordzee (2004)

Ad2) 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 23), based on economic growth and other factors.

Large infrastructural projects like e.g. WCT Vlissingen[42] and the Sand Engine (in Dutch: Zandmotor) 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 2, 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 area.

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 23| 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)

Ad3) 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.

3.4.5. Baseline projections
Table 24 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.

According to the Dutch Association of Sand Extractors (NVZ) the numbers presented in table 24 are relatively high. As stated before, there is a difference between the extraction of sand for suppletion purposes and the extraction of sand for commercial purposes. Not only with respect to the expected developments (sand extraction for coastal defence is expected to increase significantly in the future due to the Delta

[42] The construction work for the WTC is scheduled to start in 2012. However, in order to start the construction government authorities still have to make some decisions.

program, whereas sand extraction for commercial project is not expected to increase significantly), but also with respect to value added. The added value of fill sand is relatively higher, because the production chain is longer. The production chain of suppletion sand mainly consist of transportation, while for fill sand also building companies and contractors are part of the production chain. Therefore, value added for the entire sector as presented below might be overestimated.

Table 24| 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

3.4.6. Analysis of costs of degradation: Costs of current environmental measures

Mining of sand, gravel and shells are the only two kinds of surface mining occurring in the Dutch area of the North Sea. Sand extraction is the most important. In 2005, around 26 mln. m3 of sand was extracted from several specified mining locations. Due to environmental concerns, the government only issues permits to certain specified locations. Since these are not all located at the economically most optimal locations there is a cost involved. The sector estimates that it spends approximately 5% more than in an 'ideal' situation where it is allowed to mine for sand and shells in every suitable location. In 2005, the total turnover was €48.7 mln. Therefore, the extra costs of avoiding degradation is estimated to be around €2.5mln (Ecorys, 2007).

Another measure which relates to sand and shell mining relates to avoiding turbidity. Turbidity refers to the suspension of material from the sea bed in the water due to the process of mining. Higher levels of suspended material interfere with aquatic species metabolism and can interfere with spawning. Certain types of dredging equipment reduce the turbidity but may be more costly. Unfortunately, this report was unable to identify these costs.

In evaluating this result, care must be taken about basing the estimate on turnover. Ideally, the 5% figure would be applied to profit and not to turnover. Turnover was used because it was the only data available. Since turnover should be greater than cost, the results are, in this respect an overestimate. However, given that sand and shell mining has a small impact on the final result, this is not a significant problem, especially given that the result is an underestimate due to the turbidity measures.

3.4.7. Who bears the cost?

For these measures (both less than ideal locations and reductions in turbidity), the costs are borne for through increased costs to the sand and shell mining businesses. The costs of licensing sand and shell mining are borne by the Ministry of Infrastructure and Environment. These are counted under 'government'.

3.5 Wind energy

This section gives a description of past trends and present economic values (in terms of production value, value added and employment), the impact of the economic crisis, factors influencing the future production and the cost of degradation for the wind energy sector.

3.5.1. Past trends and present values

Due to the strong prevailing winds, countries surrounding the North Sea, particularly Germany and Denmark, have used these windy areas near the coast for the generation of wind power since the 1990s. In the Netherlands, wind power is harvested on the DCS since 2006. Statistics Netherlands have calculated production, intermediate consumption and value added. This calculation is based on the quantities of electricity produced by wind turbines on the DCS. In 2007 330 million KW h of electricity was produced by off shore wind farms (Statistics Netherlands, Statline, September 2010). This equals 9.5% of the national total production of wind energy. To calculate monetary figures from the quantities produced the relevant producer prices were used. The methodology used to calculate the economic variables for wind energy production is based upon a study of van Rossum and Kulig (2008).

Table 25| economic key figures of the production of wind power on the Dutch Continental Shelf

		2007
Total NL	Production (x €1,000,000)	218
	Intermediate consumption (x €1,000,000)	100
	Value added (x €1,000,000)	118
DCS	Production (x €1,000,000)	23
	Intermediate consumption (x €1,000,000)	13
	Value added (x €1,000,000)	11

Source: CBS, 2011

No figures for the number employees or the compensation of employees are available. Wind energy production is labour extensive. Both the small size of this activity and the capital intensive nature of the activity explain why this activity will not contribute much to employment once off- shore wind farms are operational. However, maintenance platforms is a growing industry for the (Dutch) shipping sector.

3.5.2. The impact of the 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.

3.5.3. Factors influencing future use

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[43]. 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.

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.

3.5.4. Production prognoses

Table 26 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 26 only the range for capacity for the period 2020-2040 is presented.

Table 26| 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

[43] Stimulering Duurzame Energieproductie (SDE).

3.5.5. Baseline projections

The future economic significance depends on the installed capacity as discussed above. Table 27 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. The figures below should be interpreted with care due to the large uncertainties regarding to wind energy for the period 2015-2040.

Table 27| 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)	23[1]	127				153 - 458	0 - 1.528
Added value (million euro)	11[1]	36				43 - 130	0 - 433
Employment (fte)	36	273				330 - 990	0 - 3.300

Source: ECORYS, based on WLO study; [1]CBS, 2011

3.5.6. Analysis of costs of degradation: Costs of current environmental measures

Currently, two offshore wind farms are in operation in the Dutch area of the North Sea: Noordzeewind (108 megawatt, located in front of Egmond aan Zee) and the Princess Amaliawindpark (120 megawatt, located in front of IJmuiden). In the near future, several others will be constructed. Wind farms may be required to be positioned in less than optimal locations due to environmental concerns. This could involve significant costs to the high costs of high voltage power cables (greater distance implies higher costs of expensive cables), but no data on this was available. Another potential measure involves using bubble curtains to limit the noise pollution from hammering monopole foundations into the seabed. These are not currently a measure in the Dutch North Sea because waters are too deep at current sites for bubble curtains to work. As such, the only source of data available for this report relates to the production of EIAs (Environmental Impact Assessments).

It can take between 5 and 7 years to get through the process of getting permission to build a wind farm in the North Sea. As such the costs of EIAs can be considered as being spread across this period. Currently there are 12 wind farms which are going through the planning process. These are shown in Table 8.

In order to calculate the costs of EIAs several assumptions are made. The first is that the cost of turbines at the Prinses Amalia Park are representative of the costs of wind turbines in the Dutch North Sea. This allows the total costs of the wind farms to be calculated according to how many turbines are going to be or are being built. Since no information was available on the cost of EIA, another assumption involves the percentage of costs which can be allocated to the EIA. Percentages were available from The Ministry of Infrastructure and Environment (2010). These referred to the percentage of total costs attributable to EIAs for land based wind turbines. These range from 0.001% to 1% of total costs depending on the size of the wind farm. These land based figures they can only be used as a very rough guide. Given that EIAs require substantial effort to produce and also given the indications of costs of land based wind farms, 0.5% was decided upon. This percentage fits within the range of land based percentages. It also produces results which seem to be reasonable given the demands of EIAs. Table 8 shows the final result of approximately €3.7 mln. per year.

Table 28| Average annual EIA costs of turbines in the Dutch North Sea over a 7 year period (€,000)

Wind Park Name	**Number of turbines**	**Cost per turbine [a]**	**Total cost**	**Costs of EIA [b]**
Q4-WP	26	€ 6,383	€ 166,000	€ 830
Q10	51	€ 6,383	€ 326,000	€ 1,628
EP Offshore NL1	55	€ 6,383	€ 351,000	€ 1,755
Tromp Binnen	59	€ 6,383	€ 377,000	€ 1,883
Schevingen Buiten	59	€ 6,383	€ 377,000	€ 1,883
BARD Offshore NL1	60	€ 6,383	€ 383,000	€ 1,915
GWS Offshore NL1	60	€ 6,383	€ 383,000	€ 1,915
West Rijn	72	€ 6,383	€ 460,000	€ 2,298
Den Helder I	78	€ 6,383	€ 498,000	€ 2,489
Beaufort	93	€ 6,383	€ 594,000	€ 2,968
Brown Ridge Oost	94	€ 6,383	€ 600,000	€ 3,000
Breeveertien II	97	€ 6,383	€ 619,000	€ 3,096
Average Total [c]				**€ 3,666**

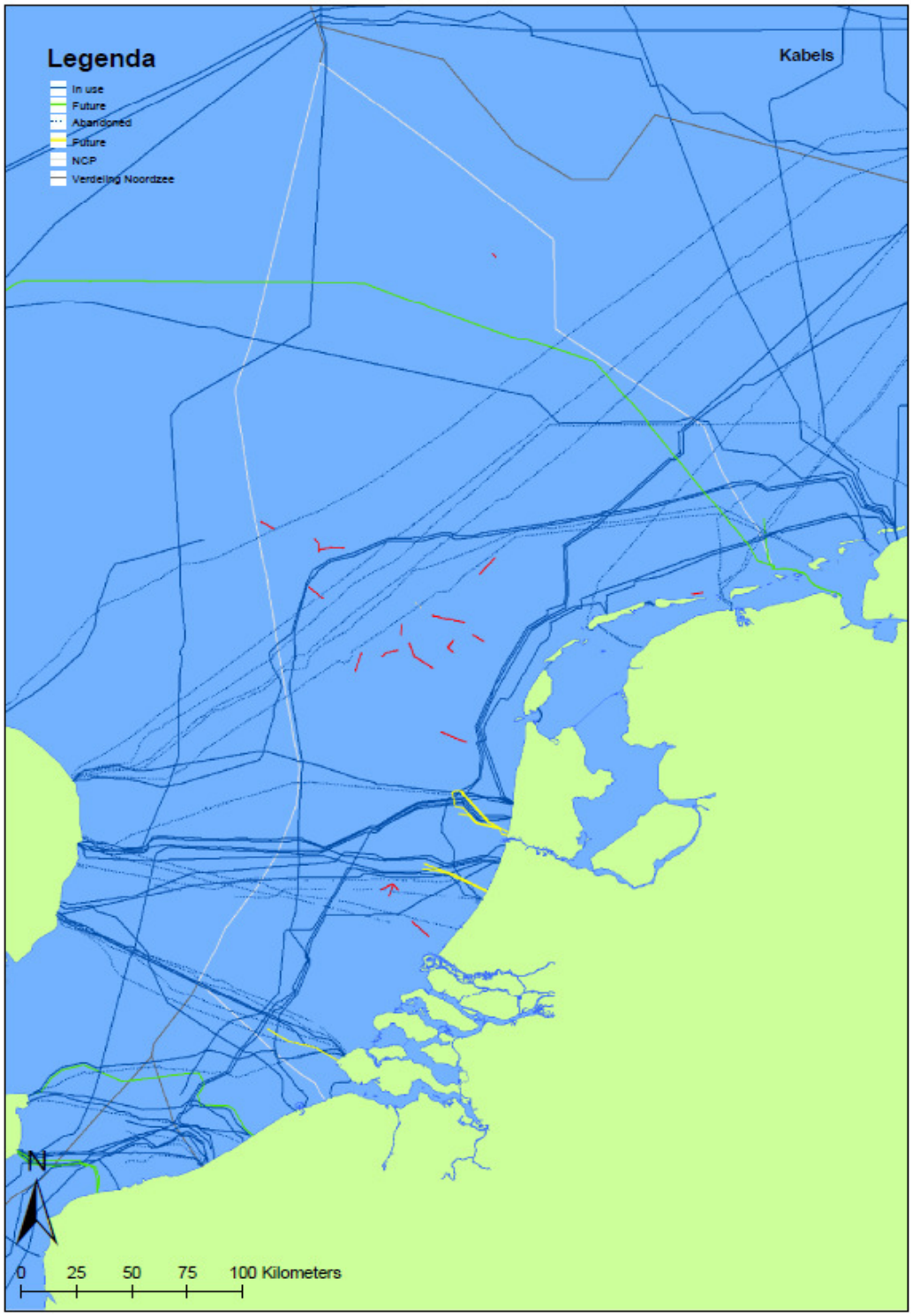
Source: Rijkswaterstaat (2010)(for wind park names and turbine numbers)
a) average cost of a turbine based on Prinses Amalia Park; b) Assuming 0,5% of total cost is spent on EER; c) averaged over 7 years.

3.5.7. Who bears the cost?

In this case, all the costs of producing EIAs are borne by the private companies who are running the wind farm projects.

3.6 Piping and cables

This section gives a description of the current economic significance, the impact of the economic crisis, and factors influencing the future production related to piping and cables.



3.6.1 Current economic significance
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. 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 BritNedcable 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.

3.6.2 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.

3.6.3. Factors influencing future use

- *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 internet11. 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.

- *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.

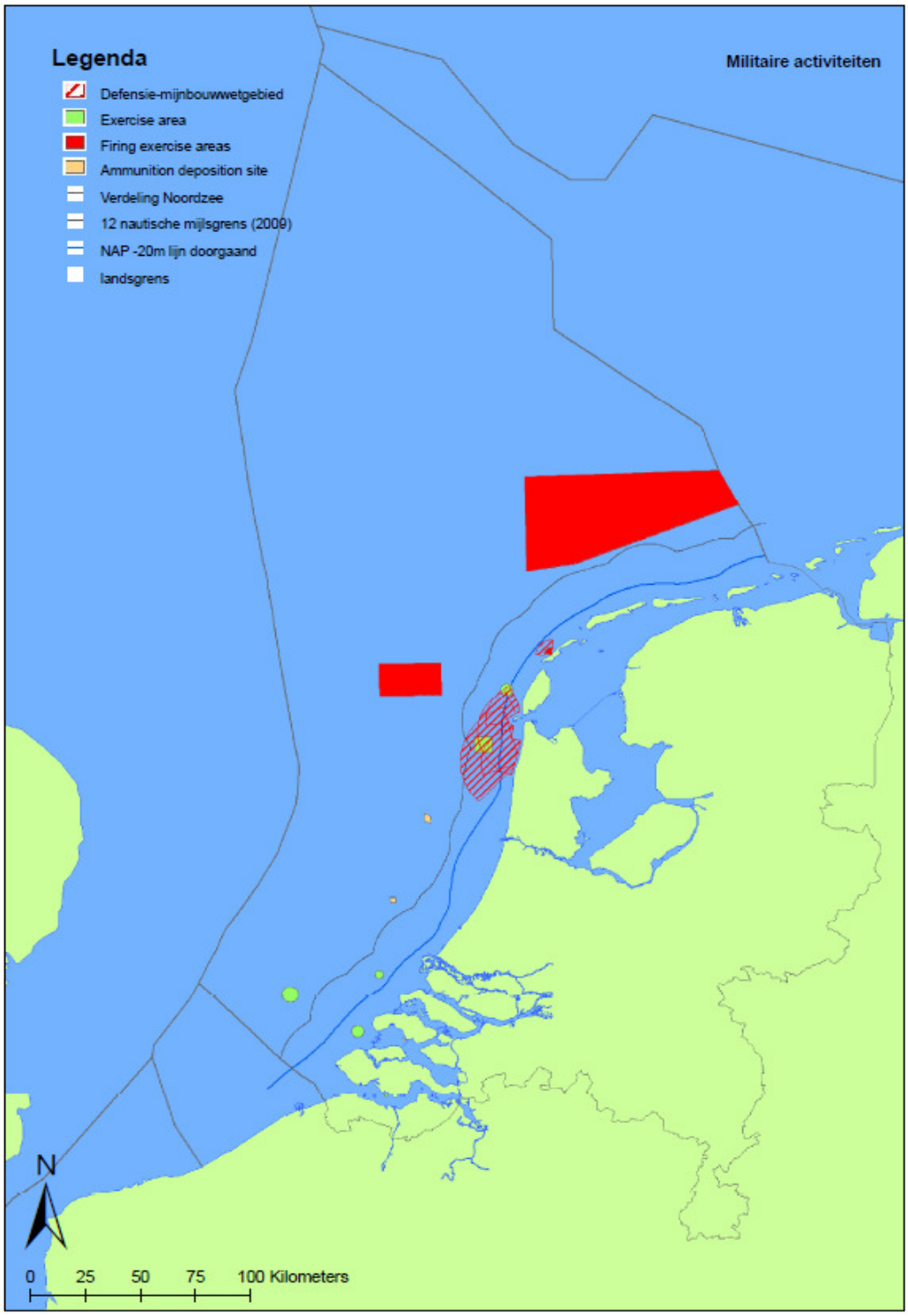
  The information about the telecom sector on the North Sea is limited. Because of the small number of businesses in the sector and the strong competition between them, information about economic performance and employment is sensitive. Also, contracts regulating the use of the cable capacity are complex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

3.7 Other sea-based human activities

This paragraph describes the remaining human activities in the Dutch part of the North Sea (c.q. carbon capture and storage and military activities), not mentioned earlier in this chapter.



3.7.1. 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 particular site for large-scale storage. Locations of certain underground water-retentive soil strata (aquifers) might also be used for CO_2 storage. However, use at large scale is not expected before 2020[44].

3.7.2 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.

Analysis of costs of degradation: costs of current environmental measures
The Royal Netherlands Navy accounts for an appreciable amount of ship movements in the Dutch North Sea and takes measures to limit its impact on the marine environment. The Royal Netherlands Navy is currently engaged in a 6-year (2009 up to and including 2014) €114m program of investing in ship building. Of this ship building program, expert opinion (De Rooij, 2010) estimates that 1% of the costs of this program are related to avoiding degradation of the marine environment through technical measures built into the ships. As such, the costs are €1.14m, which averaged over the 6 years equals €190,000.

In addition to the extra costs involved in ship building, the Ministry of Defence also carries out research into, and the mitigation of, underwater noise. This is part of an 8 year program (2006 up to and including 2014) which costs approximately €2m. The average over this period equals €222,000. The total is calculated in table 29 and show a final result of approximately €412,000 per year.

The Hydrographical Services (which is part of the ministry of Defence) is not counted here, but is counted under the governance section 3.10.

Table 29| Annual cost related to defence for the period 2009-2014 (€,000)

Type of cost	Annual cost
Ship building [a]	190
Research [a]	222
Total	412

Source: a) De Rooij, 2010.

Who bears the cost?
The Ministry of Defence is funded by the Dutch Government. As such they bear the costs of avoiding degradation in the marine environment in this case.

[44] Some parties, such as the oil and gas industry, the energy sector and the Port of Rotterdam, are very interesting in this development. This could give a boost to this innovation.

3.8 Sea-dependant activities on land

This paragraph describes the economic importance of seaports and tourism and recreation in the coastal area.

Both seaports and coastal areas have a strong economic link to the North Sea. Economic activities in these areas depend on access or proximity to the sea. Therefore, also the economic key figures of ports and in coastal areas are presented. The coastal area has been defined as a one kilometer wide strip of land after the Dutch North Sea coastline and includes the entire Dutch Frisian Islands. The coastal strip was put not directly behind the shoreline but behind the beach and sand dunes, since this area includes little or no economic activity. The beach and sand dunes were located using a land use map; all dry natural terrain bordering the North Sea has been defined as beach and sand dunes. The figure on page 80 shows a map of the Netherlands illustrating the location of the beach and sand dunes as well as the coastal strip including the Dutch Frisian Islands. Narrowing down the industries of a coastal economy is a necessity for a fair estimate of the coastal economy. This selection is to some extent a subjective matter. The difficulty in selecting relevant industry is illustrated by the example in the text box below.

Real estate in the coastal zone (Example)
For real estate activities, the argument can be made that this industry is big in the coastal area because the coast is an attractive residential and business location. In this case, one could argument to include the real estate industry in the selection of the coastal economy. Analysis of the results for this industry clarifies that again the Hague area is important in the figure for the coastal zone. The proximity to the sea is not the only factor defining this area as an attractive location so are employment opportunities and urban facilities such as shops, restaurant and theatres. Therefore, it is sensible to exclude the real estate industry from the coastal economy.

Industries, for which proximity to the coastline is an important location factor, that are concentrated on the coast include: hotels and restaurants, retail trade, recreational, cultural and sporting activities and fisheries. Next to this, the presence of the harbor is also very important for economic activities such as the Dutch agricultural sector, e.g. for the import of animal feeds stuff. However these activities are not presented in the tables below.

Table 30 provides estimates for the available key indicators for the coastal zone. 'Retail trade and repair' and 'Hotels and restaurants' are the most important industries. It is important to note that these industries are seasonal and the results partly depend on the weather in a specific year. The industry 'Fisheries' is the smallest of the selected industries. Part of the production in this industry overlaps with the production of fisheries in the chapter on activities on the sea (DCS). This overlap concerns only the activities on the DCS of fishing companies located in the selected coastal area.

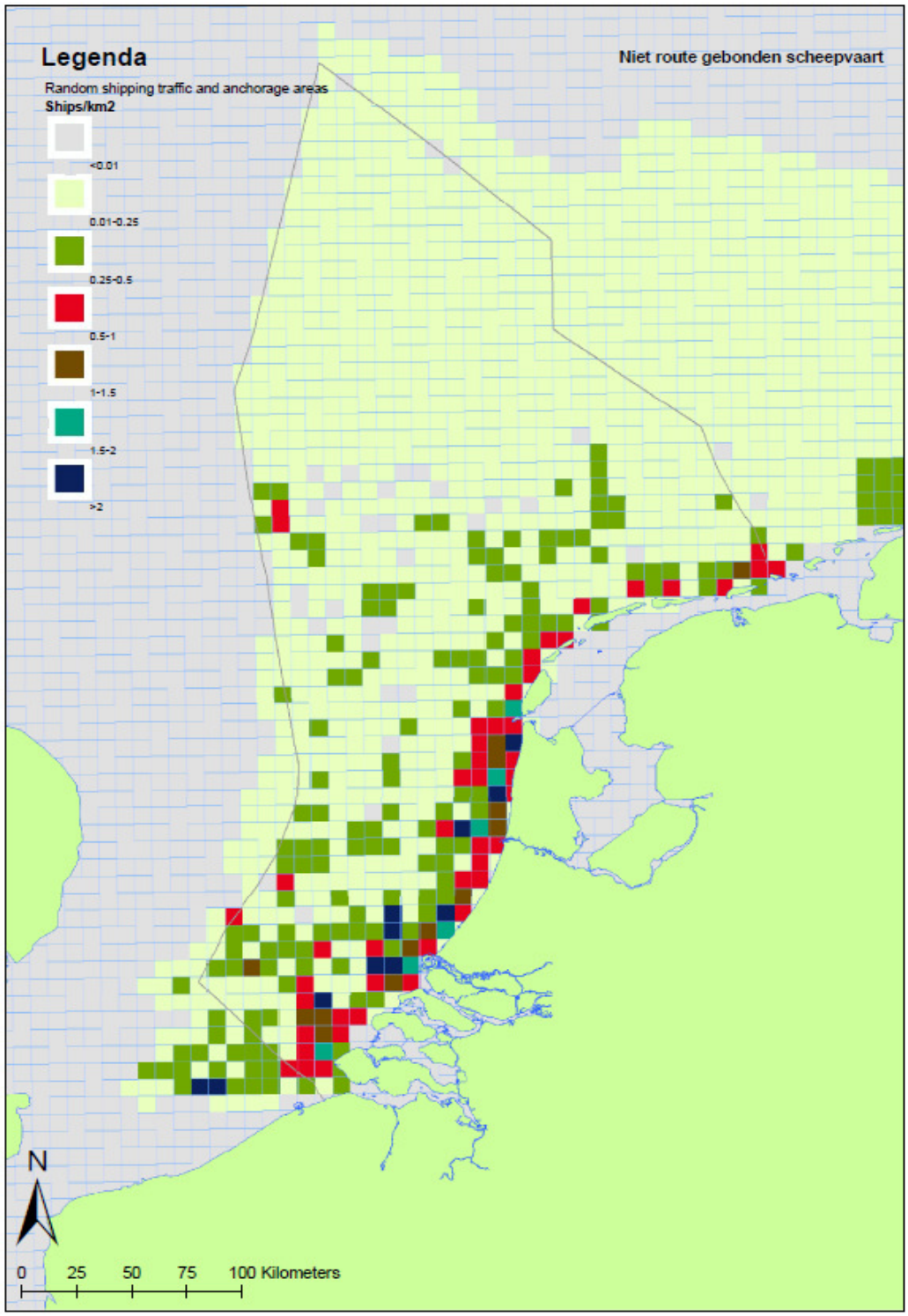
Table 30| Key indicators for selected industries in the coastal zone

Year	Industry	Number of employees (x 1,000 fte)	Compensation of employees (x €1,000,000)	Production (x €1,000,000)	Intermediate consumption (x €1,000,000)	Value added (x €1,000,000)
1995	Fishing	1	29	220	89	131
	Hotels and restaurants	9.0	168	658	344	313
	Recreational, cultural and sporting activities	3	87	343	202	141
	Retail trade and repair (excl. motor vehicles/cycles)	11.0	212	590	220	370
Total 1995		23	495	1.810	856	955
2000	Fishing	1	31	264	127	138
	Hotels and restaurants	10	237	959	485	474
	Recreational, cultural and sporting activities	3	113	479	271	208
	Retail trade and repair (excl. motor vehicles/cycles)	11	261	723	277	445
Total 2000		24	642	2.426	1.160	1.265
2007*	Fishing	0	22	264	159	104
	Hotels and restaurants	10	306	1.268	637	631
	Recreational, cultural and sporting activities	3	120	523	312	212
	Retail trade and repair (excl. motor vehicles/cycles)	12.0	338	846	346	500
Total 2007*		25	787	2.901	1.453	1.447

Source: CBS, 2011

3.8.1. Tourism and recreation in the coastal area

This section gives a description of the current and future economic significance and the cost of degradation for the tourism and recreation sector 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, 2011).

Furthermore, the North Sea attracts, especially in summer, wind surfers, recreational anglers[45], sailors and divers. The recreational sector is important for the Dutch economy. For instance, the Netherlands counts about 650.000 recreational anglers and the total economic value of the sector is approximately 165 million euro (TNS-NIPO, 2007). 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).

Expectation for the future

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 recreational anglers and beach visits are limited. Due to the economic crisis people decided to recreate closer to home. 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) in territorial waters is expected to increase. Also the number of boats of recreational anglers is expected to increase. However, this increase mainly depends on the growth of the fish stocks and the economic developments. An increase in number of divers is expected as well.

Analysis of costs of degradation: Costs of current environmental measures

Beach litter comes from many sources including fisheries, shipping and inland sources, but the most significant source of litter is the recreational use of beaches. As such the costs could be split between other sections of this report, however, data on the proportion of litter coming from different sources is unavailable. As such municipalities throughout the North-east Atlantic region face relatively high costs

[45] Recreational angling can be done all year long. In the winter, recreational anglers fish on different species than in the summer time. E.g. in the winter, they fish on whiting, and in the summer they fish on mackerel The number of spots (e.g. pier, jetty) for recreational anglers is decreasing due to competition with other activities, such as kiters, divers and fisheries.

associated with the removal of beach litter. Removing beach litter costs municipalities in the Netherlands approximately €8.84 million per year. For most municipalities, the potential economic impact of marine litter on tourism provides the principal motivation for removing beach litter. The city of The Hague, for example, spends around €1.266.000 annually on its beach cleansing program (Mouat et al., 2010). Volunteer organizations also remove a significant amount of litter from beaches, which suggests that the total cost of voluntary action to remove marine litter could add a considerable number to the cost of beach cleans.

3.8.2 Seaports

This section gives a description of past trends and present economic values (in terms of production value, value added and employment), expectations for the future and the cost of degradation related to the seaports.

3.8.2.1.Past trends and present values

The Dutch seaports are of great social and economic importance. The seaports are hubs for international goods and an important place for business. This study includes in total 11 ports: Rotterdam, Amsterdam, Ijmuiden (clustered with Velsen and Beverwijk), Drechtsteden, Terneuzen, Vlissingen, Moerdijk, Den Helder, Harlingen, Eemshaven and Delfzijl. The port of Rotterdam is Europe's largest port for (trans) shipment of goods. It is located between the North Sea coast and the city centre of Rotterdam along the Nieuwe Waterweg[46].

Table 31 shows the results of key figures of activities in ports and coastal zones. The total number of employees (full time equivalent) for the activities in the predefined areas shows a minimal decrease. The industries selected for seaports are not labour intensive and the decline in the number of employees can potentially be explained by technological developments (automation and mechanization). The number of employees in the selected industries along the coastal area is rather stable. The value added in current prices for the selected industries in the areas of interest is equal to 4.0% of the Dutch total value added in 1995. In 2000 this figure is equal to 3.4% and in 2007 it was equal to 3.8%. The share of production of the selected activities in the total production figure is larger. For 1995, 2000 and 2007 the share in production is equal to 6.0%, 6.4% and 7.7% respectively.

Textbox: Differences to the Port Monitor

Since 2004 the Port Monitor is published annually. The Port Monitor includes economic figures on seaports. The objective of that the Port Monitor overlaps partially with the objective of this study on seaports in the Netherlands. Both studies present figures on employment and value added in the seaports, but results differ substantially. In this textbox a brief explanation of the differences between the Port Monitor 2007 (RebelGroup Advisory et al., 2009) and the figures presented for seaports in 2007 in this study is provided.

The estimate of total (direct) value added for all seaports in this study is 35% lower than the value added estimated in the Port Monitor for 2007. The largest part of the difference is explained by different geographical boundaries. In this study seaports are limited to industrial areas surrounding these ports only. In many cases maps provided by port authorities have been used in designing the boundaries. The Port Monitor in multiple cases, e.g. Rotterdam and Amsterdam, includes complete municipalities in setting their boundaries. The geographical boundaries set in the Port Monitor are much broader than the boundaries set in this study.

Another difference are the industries selected. Some examples are given: Fisheries are included in the figures of the Port Monitor. In this study this industry is not labeled relevant in the sea ports (already covered by activities on sea. The figures of this study include more different construction industry classes than the Port Monitor does. Waste processing activities in seaports are included in the Port Monitor while these activities are not included in this study. Furthermore, Scheveningen is also

[46] Analysis of the results shows that, although production is located in the defined area of the port, the employees are in some cases registered on office locations in the centre of Rotterdam. Since production (and other variables) is allocated based upon zip codes of the companies where employment is registered, production is also virtually shifted to the centre of Rotterdam. This statistical problem exists for all ports and in the coastal zone, but is most prominent for the Port of Rotterdam. The industries in this port are concentrated in a few large companies. Missing a couple of these companies, because the registered location differs from the production site, results in a substantial error. To correct this the total figure for the COROP region is taken for some major industries. The larger region that includes the port of Rotterdam is called the 'Rijnmond' region.

included as a seaport in the Port Monitor. The economic activities in Scheveningen are included in the coastal in zone in this study.

A third difference is the calculation of direct transport activities. In this study direct transport activities are estimated like all other industries based on location. The Port Monitor makes use of data on transport performances, just like the estimate in this study for the spillover effect of the seaport's industries on the transport industry. In this study these transport activities are partly labeled as indirect activities.

A comparison for direct employment is difficult to make. The Port Monitor provides figures on the number of employed persons which includes self-employed persons. In this study self-employed persons are excluded.

Source: CBS, 2011

Table 31| Key figures for activities in ports and coastal zones

Area of interest	Year	Number of employees (x 1,000)	Compensation of employees (x €1,000,000)	Production (x €1,000,000)	Intermediate consumption (x €1,000,000)	Value added (x €1,000,000)
Rotterdam	1995	57	2.244	19.219	14.303	4.916
	2000	55	2.470	31.126	25.378	5.748
	2007	55	3.262	50.594	41.435	9.159
Amsterdam	1995	11	431	1.988	1.151	837
	2000	10	440	2.142	1.314	828
	2007	10	551	3.212	1.971	1.241
Ijmuiden cluster	1995	15	594	2.631	1.367	1.264
	2000	14	648	3.009	1.761	1.248
	2007	13	875	4.589	2.871	1.718
Drechtsteden	1995	15	503	1.885	1.157	728
	2000	16	608	2.372	1.396	976
	2007	16	810	3.471	2.049	1.422
Vlissingen	1995	4	127	726	500	226
	2000	3	151	1.099	828	270
	2007	3	183	1.594	1.205	389
Terneuzen	1995	10	384	3.624	2.434	1.190
	2000	9	419	5.471	4.321	1.150
	2007	9	511	9.795	7.931	1.865
Other seaports	1995	14	527	2.710	1.683	1.036
	2000	15	643	3.992	2.702	1.290
	2007	15	819	6.904	4.891	2.013
Total seaports	1995	126	4.810	32.793	22.595	10.198
	2000	123	5.379	49.211	37.702	11.510
	2007	121	7.011	80.159	62.353	17.806
Coastal zone	1995	23	495	1.810	856	955
	2000	24	642	2.426	1.160	1.265
	2007	25	787	2.901	1.453	1.447
Total on land	1995	149	5.306	34.603	23.451	11.152
	2000	147	6.021	51.637	38.863	12.775
	2007	146	7.799	83.060	63.806	19.253

Source: CBS, 2011

Table 29 only describes the economic value of the direct activities in the ports and coastal zone. However, there are also many indirect activities that are related to the

ports, such as inland shipping. In annex C the indirect effects on other industries of relevant industries in seaports (excluding effect on transport) are described. The seaports have a relatively large spillover effect on the rest of the economy. In 2007 the total indirect value added is equal to 6.7 billion euros. Both the effect on supply companies as well as on the transport activities are relatively big (CBS, 2011).

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. 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 to show substantial growth (Ecorys, 2010). The expansion of the harbour of Rotterdam will also lead to extra activities in the harbour area.

Analysis of costs of degradation: Costs of current environmental measures
Dutch ports invest in different measures to avoid degradation of the marine environment. The most important measure is dredging. Other measures/initiatives are Environmental Ship Index and Port Reception Facilities.

Dredging
Most of the larger Dutch ports are situated on the North Sea and the Rhine and Meuse estuaries. Deposition of marine and fluvial sediment occurs at these locations. This is most apparent in the port of Rotterdam. Marine sediments accumulate through tidal action mainly in the western port areas, whereas the eastern port areas are mainly influenced by fluvial sediments, transported by the Rhine (Vellinga and Eisma, 2005).

These sediments, if left undisturbed, pose a hazard to sea traffic and the accessibility of the ports. Therefore, about 30mln. m^3 of material is dredged every year from all Dutch seaports and seaways. In the port of Rotterdam alone, some 20 mln. m^3 of sediment is dredged each year (Vellinga and Eisma, 2005). Most of the sediments to be dredged derive from the marine environment and only around half of the river sediment settles in the port. Heavy metals such as zinc and copper are commonly found in port sediments as well as Polycyclic Aromatic Hydrocarbons (PAHs) and Tributyltin (the toxic part of anti-fouling paints which was previously applied to ship hulls).

The relocation of this dredged material in the North Sea, the preferred disposal option, is regulated by a set of chemical criteria. About 2m m^3 of dredged material exceeding certain chemical criteria has to be disposed of in confined (land-based) sites (in the case of Rotterdam: the Slufter). However, most of the dredged material (about 28mln. m^3) is returned to the North Sea. The costs of processing the contaminated dredged material is estimated to be around €20 per m^3. The costs of relocating dredged material at sea are estimated to be around €5 per m^3 (Eisma, 2010). The extra costs for the 2mln. m^3 are therefore around €30mln. a year.

Environmental Ship Index (ESI)

The Environmental Ship Index is an indication of the environmental performance of ships. The ESI measures a ship's emissions based on the amount of nitrogen oxide (NOx), sulphur oxide (SOx), particulate matter (PM) and greenhouse gas it releases. Some ports, such as the port of Rotterdam, reward ships when they comply or meet lower than current International Maritime Organization (IMO) emission standards. Those ships receive a discount on the port dues. Although this is a completely voluntary program, ports hope the incentives motivate the global port community to assume its role in improving the environment (WPCI, 2011).

Port Reception Facilities (PRF)
All Dutch ports have port reception facilities where ships can dispose their litter and sewage. Some ports also have facilities for receiving remnants of cargos from chemical tankers. All ships which lay berth in Dutch ports are required to comply with the legislation and when obliged, dispose their wastes at a PRF, which reduces the discharges in the North Sea (see also §3.3.6).

Who bears the cost?
The dredging is commissioned by the parties responsible for managing the port area and the river: The Port Authorities and the Ministry of Infrastructure and Environment. The sediments in the river system are mainly clean, which can be relocated at sea. The contaminated dredged material is mostly dredged by port Authorities in port areas. As such, they bear the burden of this regulation.

3.8.3. Harbour expansion: Maasvlakte II
With the creation of Maasvlakte 2, the Port of Rotterdam is adding 1000 hectares of new business premises on newly re-claimed land in the North Sea, next to the present Maasvlakte. Nature will be lost with the construction of Maasvlakte 2. In order to limit the impact on the environment as much as possible, compensatory measures are and will be taken. This will be done in accordance with Dutch and European provisions. The Birds and Habitats Directive is paramount here. In this directive, the European Union states which areas must be protected so that the habitats of specific flora and fauna are conserved.

The current phase in the Maasvlakte 2 project runs over 2006-2013. This encompasses several elements of the project including planning and construction of the port extension itself as well as the EIA reporting and the implementation of associated environmental projects. Not all of these activities were carried out for every year in 2006-2013. Some have already been carried out (before 2010) and some will be carried out in the future (after 2010). Yearly costs are calculated over this 8 year period.

As part of the Maasvlakte 2 project, a number of studies and reports were carried out to analyze the natural values that will be lost. Two EIAs were carried out to evaluate the environmental impact. The costs of these studies are estimated to be around €30 mln., paid for by the Port of Rotterdam (Vellinga, 2010). Over the 8-year period, this equals, €3.75 mln.

To compensate for the loss in (North Sea and coastal) nature, a nature compensation scheme was setup. The compensation for nature consists of the creation of a sea bed protection area and the extension of the dunes. The sea bed protection area used to be called a marine reserve. The focus of this area is on protecting the sea bed and providing rest areas for protected bird species. The sea bed protection area will cover an area of 31,250 hectares at the most. A maximum of 100 hectares will be earmarked for extra dunes near Delfland and there will be a

further 23 hectares at the most for the fore-dune at the Brouwersdam and/or on the reclaimed land. The costs of these compensation measures are estimated to be around €90 mln. and are borne by the Dutch government (Vellinga, 2010). Over the 8 year period, this equals, €11.25 mln.

The total monitoring program to measure the environmental effects during the construction of Maasvlakte 2 carries a price tag of approximately €10 million, paid for by the Port of Rotterdam. Next to that, the effectiveness of the nature compensation scheme will be monitored. The cost estimate of this effectiveness study is around €30 mln. (Vellinga, 2010). As such the total costs of monitoring are approximately €40mln. Over 8 years, this is equal to €5mln

At the Port of Rotterdam, approximately 5 FTE are working on the topics mentioned above, which adds another €0,5 mln. (Vellinga, 2010) if the assumption of one FTE (Full Time Employee) costing €100,000 per year is followed.

Oostenbrugge et al (2008) produced estimates of the losses that will result from the closing of the areas for beam, shrimp and otter trawling fishing. Losses are estimated under 2 scenarios; termination of operations and relocation of operations. It is considerably more likely that fishing operations will move to other areas rather than stopping entirely. As such, the second scenario is used. The effect is measured as change in gross value added. This is defined as the return from invested capital and labour (I.e. profit) and this is considered as a good measures of the losses suffered by the entrepreneur (Oostenbrugge et al, 2008). The loss in yearly gross value from relocating fisheries for beam trawling is estimated to be €29,000 and €66,000 to shrimp and otter trawling. Ergo, the total yearly cost to the industry is €95,000 per year.

The total environmental costs of the Maasvlakte 2 to be around €165,5 mln. This is then averaged over the 8 year period (2006 to 2013) and as such the final value is €20,595,000. The costs to the Port of Rotterdam (EIA, FTEs and compensation measures) may financed through loans. This suggests that the costs may be higher because of interest payments. In-formation on whether the relevant environmental aspects of the Maasvlakte 2 were funded through loans was not available. If the costs were in fact, funded through loans, interest is a costs of borrowing money, not a cost of avoiding environmental degradation. This is an argument not to include the cost of loans.

Table 32| Average annual costs related to the Maasvlakte II for the period 2006-2013[c] (€,000)

Type of cost	Average annual cost
EIA [a]	3,750
Compensation Measures [a]	11,250
Monitoring [a]	5,000
FTEs [a]	500
Fishing losses [b]	95
Total	**20,595**

Source: a) Vellinga, 2010: b) Oostenbrugge et al, 2008.
c) Averages over this period are not used for fishing losses or FTEs

Who bears the cost?
The Port of Rotterdam has financed the EIAs, FTEs and the monitoring program. As such, their current yearly costs are €9.25mn. The compensation measures are funded by the Dutch Government and the fishing industry will bear the losses resulting from the closed areas.

3.9 Government

This section gives a description of the governance costs according to the number of FTEs (full time employees) who are involved with MSFD related topics.

The Dutch government is directly involved in policy work, management, monitoring of the North Sea environment and economic activities, improvement of the knowledge about- and further understanding of the North Sea environment. The costs involved in these include policy preparation and coordination, subsidies to research institutes and NGO's, permit licensing, coastguard and inspection.

Ecorys (2007) estimate the governance costs according to the number of FTEs (full time employees) who are involved with MSFD related topics. This was estimated for 2005 and is shown in table 33.

Table 33| Number of FTEs involved in MSFD related work

Government Body (total FTEs)	**Sub-body**	**FTEs**
Ministry of Infrastructure and Environment (160)	Directorate-General Transport	7
	Directorate-General Water	5
	Inspectorate for Transport, Public Works and Water Management	3
	North Sea Agency (RWS North Sea Directorate)	72
	Specialist Services (i.e. RWS Waterdienst Centre for Water Management)	66
	Other Services	7
Ministry of Economic Affairs, Agriculture and Innovation (15)	Directorate Fisheries	6
	Directorate Nature	2
	Directorate Energy production	1
	State supervision of mines	6
Research institutes related to Ministry of Economic Affairs, Agriculture and Innovation (112)	LEI	12
	IMARES	90
	Deltares	10
Ministry of Education, Culture and Science (39)	Netherlands Geological Survey	12
	Netherlands Institute for Ocean Research	25
	Netherlands Institute for Cultural Heritage	2
Ministry of Defence	Hydrographical service	10
Coast Guard		18
Total		354

Source: updated from Ecorys 2007.

An FTE is assumed to cost €100,000 per year. This number includes salary and other costs such as overhead, housing, etc. As a result the final cost is €35,400,000. This is based on data which could now be updated to provide a better result. It would also be wise to vary the FTE cost per department. It is currently still a reasonable estimate.

This table has been updated in terms of the names and organization of the relevant ministries but the content remains the same. As such, it may not be wise to put too much emphasis on the rows of the table. The total figure however, is still expected to represent the number of FTEs in government concerned with marine environmental degradation. It is reasonable to assume that over the last 5 years, while allocation may have changed, the total number has remained reasonably similar.

3.10.1. Who bears the cost?

Clearly, in this case, the costs of running the government with respect to avoiding degradation of the marine environment are borne by the government themselves.

4. Spillover effects on the national economy

Activities in seaports, coastal zones and on sea have spillover effects in the rest of the economy of the Netherlands and vice versa. Without hinterland large ports would not be there. Only taking into account direct employment, production and value added would lead to serious underestimation of the importance/relevance of activities in related to the North Sea, more specifically the Dutch Continental Shelf (DCS). The growing interconnectedness of economic activities leads to significant indirect or spillover effects in the rest of the economy. These indirect effects can be determined by calculating multiplier effects derived from input-output (IO) analysis (e.g. Miller and Blair, 2009). Multipliers can be useful instruments in economic analyses despite their limitations. In this chapter the results of a variety of economic multipliers for different seaports, for the coastal zone and activities on sea for the Dutch economy are described. For more information about the methodology and limitations of the multipliers see CBS (2011) report 'Economic description of the North Sea for the Netherlands, an update version 3.'

4.1 Results for spillover effects, the intermediate consumption effect

Total indirect value added (excluding transport) triggered by activities on sea and on land (except transport, which is discussed in chapter 4.2) are equal to 8.2 billion in 2007. In 1995 total value added triggered by North Sea activities was equal to 4.9 billion euro, so value added of indirect activities has grown by 67 percent. Indirect value added triggered by seaports has the largest share in total indirect value added. Seaport relevant industries indirectly generated 6.7 billion euro value added elsewhere in the economy. Coast relevant industries generate indirectly just 0.9 billion euro value added. Production in the relevant industries and areas under consideration has grown significantly in between 1995 and 2007. This extra production has gone along with extra intermediate consumption triggering more value added in other industries in other areas of the economy. See annex C, annex D and annex F for a complete data overview for the intermediate consumption effect.

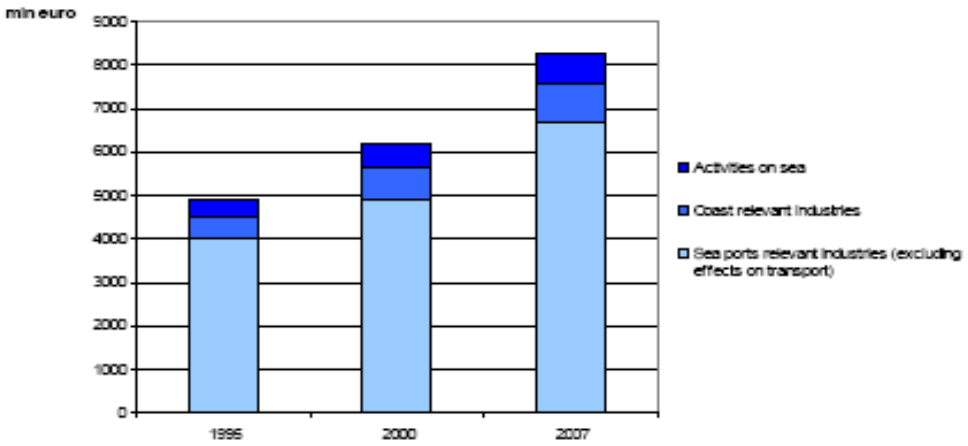


Figure 15 Indirect effects (spill-overs) on value added of North Sea activities

Total indirect employment (excluding transport) triggered by North Sea activities is equal to 73 thousand employees (fte's) in 2007. In 1995 total employment as a result of North Sea activities was equal to 76 thousand employed persons (fte's), so employment of indirect activities has decreased by 4 percent. The production multiplier for a few important industries has declined over time. This is due to relatively more import of these industries. Their intermediate use is more and more produced abroad and therefore the spillovers of these industries have become

relatively smaller. Secondly, 'intermediate goods and services' supplied by domestic producers can be produced by less employees due to increased labour productivity. However caution is required in interpreting these time series because regional differences are not specified in the model used.

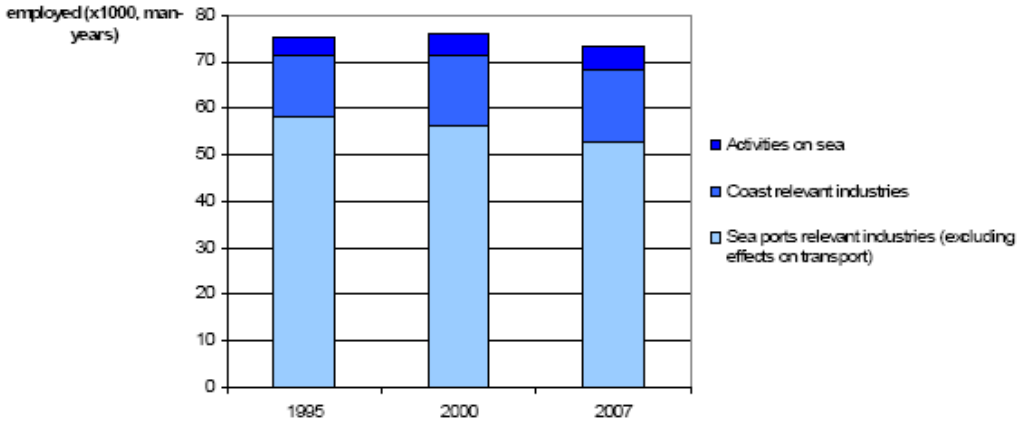


Figure 16 Indirect effects (spill-overs) on employment of North Sea activities

Indirect employment triggered by seaports has the largest share in total indirect employment (53 thousand employed persons in 2007). Coast relevant industries generate indirectly just 15 thousand jobs (measured in fte's, employed persons). Also here counts that production in the relevant industries and areas under consideration has grown significantly in between 1995 and 2007. This extra production increased intermediate consumption. Production per employee has also grown in the period 1995-2007. Growth in labour-productivity has compensated for this increase in intermediate consumption leading to a nearly stable employment level for the indirect activities.

4.2 Results for spillover effects of seaports on transport activities

The total effects of the seaports in the Netherlands to the rest of the economy are very prominent for transport activities in the Netherlands. Approximately 31.3 thousand fte's (excluding self employed people) are involved in transporting goods from and to the Dutch seaports in 2007 (see annex H). This number of employment has only increased slightly in the period 1995-2007. Total value added related to the spillover effects on transport is equal to 2.3 billion euro in 2007 (see annex H). Total production value related to the spillover effects on transport is equal to 4.6 billion euro in the year 2007 (see annex H). These figures are all based upon cargo tonnekm statistics compiled by the 'Transport Statistics department' at Statistics Netherlands (see annex G, (CBS, 2011))

Approximately 25.4 thousand fte's are involved in transporting goods by the road and railway from and to the Dutch seaports in 2007. Value added and production of these activities are equal to respectively 1.7 billion and 3.3 billion euro. Roundabout 5.9 thousand fte's are involved in transporting goods by inland shipping from and to the Dutch seaports in 2007. Total transport related employment triggered by Dutch seaports has only grown very slowly in the period 1995-2007 from 30.1 thousand fte's to 31.3 thousand fte's. Value added of these transport activities has grown from 1.6 billion to 2.3 in the period 1995-2007 while production has grown from 2.9 billion to 4.6 billion euro.

The total transport industry related to the combined seaports grew over time for all transport modules. Looking at individual seaports the level of employment is not always increasing over time. The number of employees in road and railway transport related to the Rotterdam seaport diminished between 1995 and 2007. The same holds for inland shipping. It seems that Dutch transporters have been less involved in transport activities from and to the port of Rotterdam. This may have a few causes. Firstly, competition has increased due to new entries in the market for transport activities (for example foreign road transporters are engaged in transport activities from and to Rotterdam). Dutch transporters possibly have lost market share of physical flows of goods. International transport by road is more and more dominated by foreign transporters. It seems that the spillover effects of the Rotterdam mainport have diminished for Dutch transporters while it has increased for foreign transporters (import leakage).

The total effect for employment for total transport activities have grown for the seaports Delfzijl/Eemshaven, Harlingen, Amsterdam, Dordrecht, Terneuzen/Axel, Vlissingen and the Moerdijk area. Especially the transport activities from and to the seaport Amsterdam have grown over time. Inland shipping has been triggered the most. The spillover effects on the transport industry in real terms (here employment) for total transport activities have decreased for the seaports IJmuiden/Velsen and Rotterdam.

In annex H the economic figures for total transport activities triggered by seaports have been presented. Some of these total transport activities are already included as direct economic activities. In order to avoid double counting these direct activities should be subtracted from total activities in order to calculate indirect transport activities. Economic figures for indirect transport activities only are presented in annex I and annex E.

4.3 Conclusions on spillover effects of North Sea activities

Multiplier effects, the additional effect
The spillover effects (additional effects) of the areas under consideration on other industries in the economy can be summed (effects on both supply companies and transport companies). Total indirect employment is equal to 96 thousand employees (fte) that result in 4.6 billion euro of compensation of employees. Indirect value added is equal to 9.7 billion euros while indirect production is equal to 32.5 billion euro. The seaports have a relatively large spillover effect to the rest of the economy. Both the effect on supply companies as well as on the transport activities are relatively big.

Table 34 Overview spillover effects North Sea activities, 2007

2007	Employees (x1000 Fte)	Compensation of employees (mln euro)	Intermediate consumption (mln euro)	Production (mln euro)	Value added (mln euro)
Sea ports relevant industries (excluding effects on transport)	53	2.841	18.968	25.664	6.696
Coast relevant industries	15	491	907	1.794	887
Activities on sea	5	255	1.274	1.929	655
Transport activities by sea ports	23	994	1.577	3.111	1.535
Total	**96**	**4.581**	**22.726**	**32.498**	**9.773**

Source: CBS, 2011

Multipliers

The employment multiplier is largest for the coastal zone. For every 10 employees active in the coastal zone trigger approximately 6.4 persons working elsewhere in the economy. For the seaports holds that for every 10 employee's active approximately 6.2 persons are working elsewhere in the economy. The activities on sea have the smallest employment-multiplier. For every 10 employees active on sea, approximately 3.2 persons are active elsewhere in the economy.

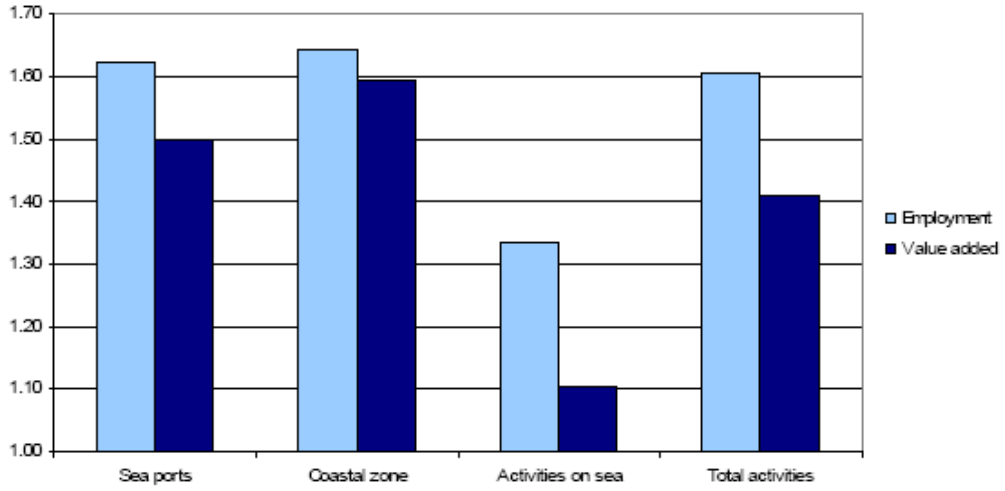


Figure 17: Employment- and value added-multiplier, average 1995-2000-2007

The Dutch Continental Shelf has on average, taking into account all relevant activities, an employment multiplier of 1.6. This is significantly lower than the Dutch average (1.9 in 2008, Environmental Accounts of the Netherlands 2009 (CBS, 2010)). This is due to the fact that the activities on sea have little interactions with other industries because they are located on sea. Activities on sea are relatively capital intensive and do not consume much input of goods and services for their production. So production on sea does not trigger other production that much. Activities in seaports are located there because the relevant companies have strong relationships with foreign economies (for example import of crude oil or import of iron ore). Intermediate consumption consists of many imports cause these specific materials are not available in the Netherlands. Extra production of companies in the seaport does not lead to large spillover effects in the rest of the Dutch economy due to these import-leakages.

The value added multiplier is equal to 1.4 on average for the years 1995, 2000 and 2007. This means that for every 10 euro value added created by North Sea activities approximately 4 euros are created elsewhere in the economy. Like the employment multiplier, the value added multiplier of the selected activities is significantly lower than the Dutch average (1.6 in 2008 Environmental Accounts of the Netherlands 2009 (CBS, 2010)). The value added multiplier for activities on sea (1.1) is significantly smaller. Oil and gas production is responsible for this small multiplier. Oil and gas production does not consume much goods and services in order to produce gas and oil. Small intermediate consumption leads to small spillover effects.

5. North Sea prices in fixed prices

Economic growth is defined as the volume growth of gross domestic product (GDP). The analysis of the activities related to the DCS so far (see chapter 3) included only economic figures on value added in current prices, compensation of employees in current prices, intermediate use in current prices and production value in current prices. Growth in value added of the North Sea economy in current prices cannot be compared with the economic growth of the total Dutch economy. Price fluctuations are imbedded in the current price approach. Economic growth is defined as volume growth of the economy (growth in real terms instead of growth in nominal terms). Value added in current prices therefore should be deflated with relevant price indices in order to compile statistics on value added in constant prices (constant price level). Value added in constant prices of the North Sea can be compared with macro economic growth.

Correcting the North Sea figures for price changes serves two objectives:

- If one wants to compare real developments in the North Sea economy with the overall economic growth of the Dutch economy one has to adjust the monetary variables for price changes over time.
- Production is often used in environmental-economic analysis as a cause of environmental pressure. If growth in production value in current prices is used as indicator for growth in environmental pressure, one overestimates the growth in environmental pressure (in the case of price increases) or one underestimates the growth in environmental pressure (in the case of price decreases). Compiling production figures in constant prices is done by correcting for price changes over time.

5.1 Results in fixed prices

Production value created by the North Sea economy equalled 54.9 billion euro in 1995, measured in current prices. Expressed in 2007 prices, production in 1995 was equal to 93.6 billion euro (for details annexes J, K and L). Production value in 2007 was equal to 124.0 billion euro. Production growth in real terms of the North Sea economy equals 32.5 percent over the period 1995-2007. This is significantly less than the 126 percent growth in production value in current prices. This result means that if growth in production value is used as indicator for growth in environmental pressure, and production value in current prices is used, growth in environmental pressure would be overestimated by approximately factor four. If growth in production value is used as indicator for growth in environmental pressure, it is recommended to use production value in fixed prices in stead of production value in current prices.

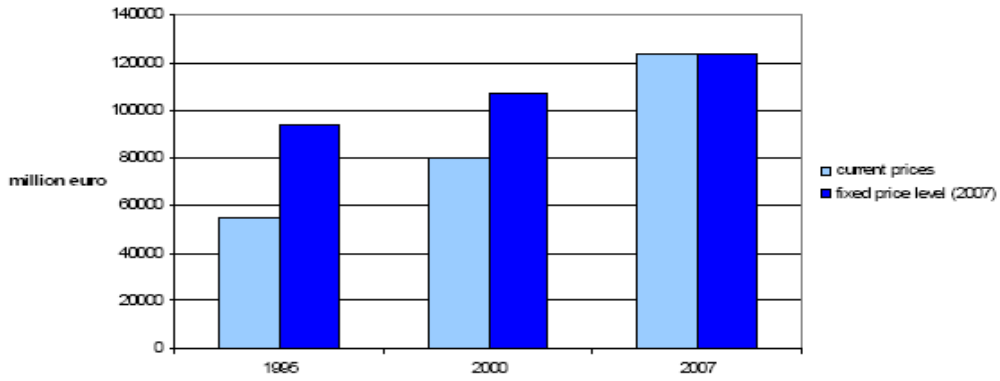


Figure 18: Production North Sea economy in current prices and fixed price level (2007=100), including spill over effects

Value added created by the North Sea economy equalled 19.5 billion euro in 1995, measured in current prices. Expressed in 2007 prices, value added in 1995 was equal to 26.7 billion euro. Value added in 2007 was equal to 35.2 billion euro. Growth in real terms of the North Sea economy equals 32 percent over the period 1995-2007.

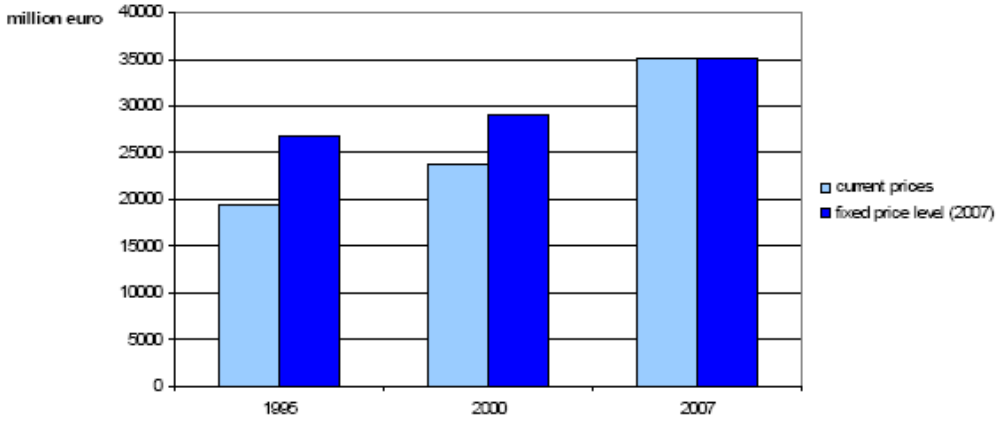


Figure 19 Value added North Sea economy in current prices and fixed price level (2007=100), including spill over effects

Growth of value added in nominal terms equals more than 80 percent. Growth in real terms was equal to 32 percent. As a consequence, on average the price increase in value added for the North Sea economy equalled 36 percent. (1.32x1.36= 1.80; see for details annex L). The Dutch economy as a whole grew with 40 percent in this reference period. The North Sea economy thus grew less fast than the Dutch economy as a whole.

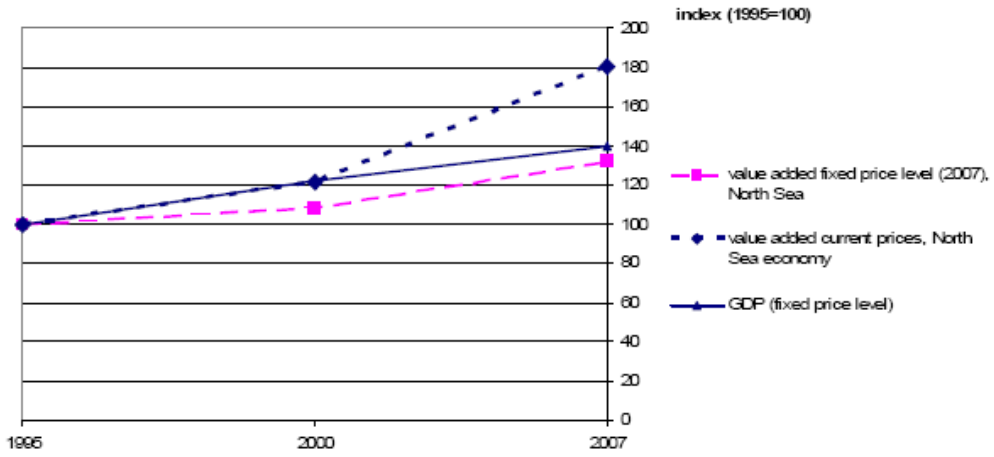


Figure 20 Growth in value added North Sea economy versus GDP growth, including spill over effects

This difference in growth is explained by several factors. Firstly manufacturing is very prominent in the North Sea economy. Manufacturing has grown less hard in the reference period than the economy as a whole. The service industries are not prominent in the North Sea economy. These services industries have grown above average. Oil and gas extraction has not grown spectacular in the reference period. Growth in oil and gas extraction is very much dependent upon long term extraction strategies and the weather. Growth in real terms (value added, fixed prices) of the oil and gas industry is equal to 14 percent. Growth in nominal terms (value added, current prices) of the oil and gas industry is equal to 180 percent. The relevant activities in the coastal zone have grown with 24 percent. Fishery showed a decline in value added in real terms in the reference period. Growth in nominal terms (value added, current prices) of fishery is equal to 180 percent. Sea shipping is as an exemption, this industry has grown very fast in the reference period, and value added has more than doubled in real terms.

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Source images: Noordzeeatlas, except Annex B and image about sea ports. These images are from CBS.

Annex A| Social Analysis

The European handbook on economic analyses for the MSFD states that 'A socio-economic analysis aims to identify the impact on human welfare of a given policy. This includes economic as well as social aspects, and may include consideration of the distribution of these impacts across stakeholders. In light of this definition, an explicit distinction between 'economic' and 'social' analysis is not necessary.' (European Commission, 2010). In other words; the employment data of the use of the marine environment, together with the distribution of the likely impact of the (programmes of) measures cover the social aspects of the analysis of the use of the marine waters (Arcadis, 2010). Although a separate social analysis is not strictly necessary, the Dutch have carried out a number of studies to get information on the social importance of the North Sea. The results of these studies will briefly be discussed.

Study of Social Analysis methods for the Marine Strategy Framework Directive (MSFD)(Witteveen + Bos, 2009)

This study shows that a social analysis can be carried out in different ways varying from minimal to maximal information provision. An absolute minimum is to limit the social information provision to the impacts of the marine strategy that are included in the socio-economic cost benefit analysis. A maximal scenario is to carry out a separate social analysis that provides the largest amount of information in the most detailed way and with the largest research effort information in all three phases of the marine strategy: in the initial assessment, the establishment of environmental targets and the program of measures.

In order to investigate the strengths, weaknesses, opportunities and threats of the different social analysis scenario's a SWOT evaluation has been performed. This evaluation showed that the reference scenario of not providing any additional information to the socio-economic analysis has the advantages of a limited research effort and information transparency due to one single analysis. It has the disadvantage of possible incomplete information provision and it entails the risk of being held accountable for not following the letter of the directive text. The maximal scenario has the advantage of providing optimal information. It has the disadvantage of a large research effort. One runs the risk of setting up large social data collection programmes that, in the end, may turn out not generate crucial information on the marine strategy since it is not known in advance which social impacts are relevant.

Media analyse (Rijkswaterstaat/Trendlight, 2009)

To understand the social importance of the North Sea a media analysis has been conducted. The purpose of the media analysis is to gain insight into how the media has informed the Dutch public in recent years about the status and importance of the North Sea and the role of the Ministry of Infrastructure & Environment when it comes to managing the North Sea. In total an extensive query of nearly 5.000 articles was selected, of which 2.370 articles are used after deleting all irrelevant entries.

The regional newspapers provide the most attention to the North Sea with 1.375 articles (58%), followed by the national newspapers (904 items – 38%) and journals (91 items – 4%). In one third of all articles, more than one stakeholder group (users of the sea (economic or ecological use), local residents, and the rest of the Dutch citizens) is mentioned. In two thirds of all items, the item is about the users of the sea (67%) followed by the society in general (56%). Local residents play a minor role in the media (only 13% of all articles).

In all media types, the economic use of the North Sea is by far the main subject of all articles. Other topics that were mentioned are environment and climate, the state of the North Sea, sustainability and safety. The articles about the North Sea deal with a significant proportion of positive and negative tone. The positive tone is mainly due to the business opportunities in the North Sea (e.g. possibilities for wind energy and reclamation of land) and sustainability (e.g. possibilities for green energy). The negative tone is mainly due to the declining fish population and business opportunities (e.g. drying up of the energy sources of the North Sea).

The social importance of the North Sea: Baseline measurement for the Marine Strategy Framework Directive (LEI, 2010).
This report describes a baseline measurement of the social importance of the North Sea for coastal residents, fishermen and recreational users in the Netherlands. The social importance of the North Sea refers to the relationship or connection between these users on the one hand and the North Sea and the marine environment on the other hand. Based on the scores of roughly twenty indicators, the current social importance of the North Sea can be marked as 'average' on the measurement scale applied.

The North Sea is of major social importance if the North Sea and its beaches remain relatively accessible for groups of users now and in the future. If the accessibility, environmental quality, safety and experience of the North Sea were to deteriorate or decrease, this would have a negative effect on its social importance. Any measures taken under the EU Marine Strategy Framework Directive (MSFD) to change the environmental state of the North Sea would also affect its social importance.

Perception of the North Sea; a quantitative consultation among Dutch citizens (Beleving over de Noordzee (Bemer and Steenhuisen/TNS NIPO, 2011))
As part of the public consultation process, a representative survey was performed among 600 average citizens on their use to the North Sea, their knowledge of the state of the North Sea, and their preferences for potential measures that could be implemented to reduce potential environmental problems. In this study, four potential environmental problems were sketched; plastic debris, extinction of fish species, soil integrity, and algae blooms. These environmental problems were presented more dramatically (exaggerated) than the actual situation, so as to make the potential problems more vivid.

The general conclusion of this study is that citizens are not aware of potential problems at the North Sea, but when informed, they find it important to do something against it. Half of the respondents state that they are willing to pay some money to do something against the environmental problems sketched, but when given a choice between various measures, they tend to choose the ones that do not lead to additional costs to them. For example, in order to reduce plastic discharges, a price increase for plastic containing products is accepted by less people than to no longer have the opportunity to get plastic bags at grocery stores for free. Similarly, a reduction in choice of different types of meat is accepted by more people than an increase in wastewater treatment levy to finance measures aimed at reducing eutrophication problems.
Another result of the study is that citizens are not really aware of the actual economic importance of specific sectors. Respondents believe that fisheries is of significant economic value for the Netherlands. Although in reality the economic significance of fisheries is much smaller compared to other sectors, such as oil and

gas exploration and shipping. This shows that the social value of fisheries is very important.

Annex B| Overview total direct and indirect

Table 33| Summery of the economic key figures for activities on sea and on land and their spillover effect on the national economy (indirect)

		DIRECT			INDIRECT			TOTAL		
		1995	2000	2007	1995	2000	2007	1995	2000	2007
Total on land	Number of employees (x 1,000 fte)	144	142	141	94	94	91	238	236	232
	Compensation of employees (x €1,000,000)	5073	5764	7501	2954	3528	4326	8027	9292	11827
	Production (x €1,000,000)	32294	48477	79124	16118	22058	30569	48412	70535	109694
	Intermediate consumption (x €1,000,000)	21657	36451	60849	10404	15188	21452	32061	51639	82301
	Value added (x €1,000,000)	10637	12026	18276	5714	6870	9117	16351	18896	27393
Total on sea	Number of employees (x 1,000 fte)	10	10	9	4	5	5	14	15	14
	Compensation of employees (x €1,000,000)	513	552	649	152	193	255	665	745	903
	Production (x €1,000,000)	5420	8106	12368	1114	1646	1929	6534	9752	14284
	Intermediate consumption (x €1,000,000)	2617	3808	5239	746	1097	1274	3363	4905	6505
	Value added (x €1,000,000)	2803	4298	7130	368	549	655	3171	4847	7781
Total	Number of employees (x 1,000 fte)	154	152	150	98	99	96	252	251	246
	Compensation of employees (x €1,000,000)	5586	6315	8150	3106	3721	4581	8692	10037	12731
	Production (x €1,000,000)	37714	56583	91492	17232	23704	32498	54946	80287	123978
	Intermediate consumption (x €1,000,000)	24274	40259	66088	11150	16286	22726	35424	56544	88805
	Value added (x €1,000,000)	13440	16324	25406	6082	7419	9773	19522	23743	35174

Source: CBS, 2011

Annex C| Spillover effects seaports

Table 34| Indirect effects on other industries of relevant industries in seaports (excluding effect on transport)

Area of interest	1995				
	Employees (x1000 fte)	Compensation of employees (x €1,000,000)	Intermediate Consumption (x €1,000,000)	Production (x €1,000,000)	Value added (x €1,000,000)
Total Amsterdam	5.4	182.6	599.1	941.8	342.6
Total Drechtsteden	7.1	225	656	1017	362
Total IJmuiden cluster	6.3	219	754	1165	411
Total Moerdijk	2.8	99	335	533	199
Total Rotterdam	26.3	868	4928	6761	1833
Total Terneuzen	5.5	213	1142	1662	520
Total Vlissingen	1.3	47	201	299	98
Total Delfzijl	1.9	72	320	478	158
Total Den Helder	0.4	14	43	71	28
Total Eemshaven	0.1	4	10	17	7
Total Harlingen	0.7	22	82	119	37
Total	58	1966	9069	13064	3995
	2000				
	Employees (x1000 fte)	Compensation of employees (x €1,000,000)	Intermediate Consumption (x €1,000,000)	Production (x €1,000,000)	Value added (x €1,000,000)
Total Amsterdam	5.3	205	661	1044	383
Total Drechtsteden	7.8	292	883	1372	490
Total IJmuiden cluster	6.5	268	1005	1499	494
Total Moerdijk	3.6	150	771	1084	313
Total Rotterdam	22.3	942	7182	9332	2150
Total Terneuzen	5.7	267	2013	2670	657
Total Vlissingen	1.6	67	352	488	135
Total Delfzijl	2.0	83	400	569	169
Total Den Helder	0.5	19	56	95	39
Total Eemshaven	0.2	9	18	31	14
Total Harlingen	0.7	28	116	169	53
Total	56	2329	13458	18354	4896
	2007				
	Employees (x1000 fte)	Compensation of employees (x €1,000,000)	Intermediate Consumption (x €1,000,000)	Production (x €1,000,000)	Value added (x €1,000,000)
Total Amsterdam	5.9	295	996	1581	585
Total Drechtsteden	7.2	351	1212	1846	635
Total IJmuiden cluster	5.7	330	1510	2170	660
Total Moerdijk	3.8	206	1253	1738	486
Total Rotterdam	21.1	1134	9851	12755	2904
Total Terneuzen	4.8	291	2888	3800	911
Total Vlissingen	1.3	73	440	603	163
Total Delfzijl	1.8	102	620	854	234
Total Den Helder	0.5	24	72	125	53
Total Eemshaven	0.2	10	23	40	16
Total Harlingen	0.5	26	103	152	49
Total	53	2841	18968	25664	6696

Source: CBS, 2011

Annex D| Spillover effects coastal zone

Table 35| Indirect effects on other industries of relevant industries in the coastal zone (excluding effect on transport)

	1995				
	Employees (x1000 fte)	Compensation of employees (x €1,000,000)	Intermediate Consumption (x €1,000,000)	Production (x €1,000,000)	Value added (x €1,000,000)
Fishing	0.4	18	37	90	54
Recreational, cultural and sporting activities	1.7	55	136	214	78
Hotels and restaurants	6.1	123	250	481	230
Retail trade and repair (excl. motor vehicles/cycles)	5.3	107	109	296	187
Total Coastal zone	13.5	303	532	1081	549
	2000				
	Employees (x1000 fte)	Compensation of employees (x €1,000,000)	Intermediate Consumption (x €1,000,000)	Production (x €1,000,000)	Value added (x €1,000,000)
Fishing	0.4	20	60	125	65
Recreational, cultural and sporting activities	2.1	74	185	303	118
Hotels and restaurants	6.7	169	340	672	332
Retail trade and repair (excl. motor vehicles/cycles)	5.9	141	145	385	240
Total Coastal zone	15.1	404	730	1485	755
	2007				
	Employees (x1000 fte)	Compensation of employees (x €1,000,000)	Intermediate Consumption (x €1,000,000)	Production (x €1,000,000)	Value added (x €1,000,000)
Fishing	0.3	20	97	161	64
Recreational, cultural and sporting activities	1.7	76	201	328	127
Hotels and restaurants	6.8	207	411	830	419
Retail trade and repair (excl. motor vehicles/cycles)	6.5	189	197	475	278
Total Coastal zone	15.3	491	907	1794	887

Source: CBS, 2011

Annex E| Spillover effects

Table 36: Spillover effects

Indirect effects	1995				
	Employees (x1000 fte)	Compensation of employees (x €1,000,000)	Intermediate Consumption (x €1,000,000)	Production (x €1,000,000)	Added Value (x €1,000,000)
Sea ports relevant industries (excluding effects on transport)	58	1966	9069	13064	3995
Coast relevant industries	13	303	532	1081	549
Activities on sea	4	152	746	1114	368
Transport activities by sea ports	22	685	804	1973	1169
	98	3106	11150	17232	6082
Indirect effects	2000				
	Employees (x1000 fte)	Compensation of employees (x €1,000,000)	Intermediate Consumption (x €1,000,000)	Production (x €1,000,000)	Added Value (x €1,000,000)
Sea ports relevant industries (excluding effects on transport)	56	2329	13458	18354	4896
Coast relevant industries	15	404	730	1485	755
Activities on sea	5	193	1097	1646	549
Transport activities by sea ports	23	795	1001	2220	1219
	99	3721	16286	23704	7419
Indirect effects	2007				
	Employees (x1000 fte)	Compensation of employees (x €1,000,000)	Intermediate Consumption (x €1,000,000)	Production (x €1,000,000)	Added Value (x €1,000,000)
Sea ports relevant industries (excluding effects on transport)	53	2841	18968	25664	6696
Coast relevant industries	15	491	907	1794	887
Activities on sea	5	255	1274	1929	655
Transport activities by sea ports	23	994	1577	3111	1535
	96	4581	22726	32498	9773

Source: CBS, 2011

Annex F| Indirect effects on other industries

Table 37| Indirect effects on other industries of relevant industries on sea

		DUTCH CONTINENTAL SHELF (DCS)			
		1995	2000	2005	2007
Sea shipping (overlaps partially with seaports)	Number of employees (x 1,000 fte)	3	4		3
	Compensation of employees (x €1,000,000)	132	170		174
	Production (x €1,000,000)	1034	1546		1591
	Intermediate consumption (x €1,000,000)	707	1046		1084
	Value added (x €1,000,000)	326	501		506
Fisheries(overlaps partially with seaports)	Number of employees (x 1,000 fte)	0	0		0
	Compensation of employees (x €1,000,000)	8	9		8
	Production (x €1,000,000)	42	52		69
	Intermediate consumption (x €1,000,000)	17	25		42
	Value added (x €1,000,000)	25	27		27
Oil and Gas extraction (overlaps partially with seaports)	Number of employees (x 1,000 fte)[a]	0	0		2
	Compensation of employees (x €1,000,000)	12	14		72
	Production (x €1,000,000)	39	48		257
	Intermediate consumption (x €1,000,000)	22	26		140
	Value added (x €1,000,000)	17	21		117
Sand extraction	Number of employees (x 1,000 fte)	P.M.	P.M.		P.M.
	Compensation of employees (x €1,000,000)	P.M.	P.M.		P.M.
	Production (x €1,000,000)	P.M.	P.M.		P.M.
	Intermediate consumption (x €1,000,000)	P.M.	P.M.		P.M.
	Value added (x €1,000,000)	P.M.	P.M.		P.M.
Wind energy	Number of employees (x 1,000 fte)				0
	Compensation of employees (x €1,000,000)				1
	Production (x €1,000,000)				13
	Intermediate consumption (x €1,000,000)				8
	Value added (x €1,000,000)				5
Total	Number of employees (x 1,000 fte)	4	5	0	5
	Compensation of employees (x €1,000,000)	152	193	0	255
	Production (x €1,000,000)	1114	1646	0	1929
	Intermediate consumption (x €1,000,000)	746	1097	0	1274
	Value added (x €1,000,000)	368	549	0	655

a) employment spillover for 1995 set equal to 2000

Source: CBS, 2011

Annex G| Time series cargo tonne/km transport activities Dutch residents.

Table 38| Time series for cargo tonne/km, transport activities by Dutch residents

road transport and railway transport (tonnekm)	1995	2000	2007
Delfzijl & Eemshaven	1051	1086	917
Harlingen	183	181	199
IJmuiden/Velsen	865	813	675
Amsterdam	2520	2709	2756
Rotterdam	11497	11660	12627
Dordrecht	593	582	725
Terneuzen/Axel	424	556	776
Vlissingen	730	680	831
Moerdijkgebied	1121	1298	1781
subtotal road transport and railway transport	18984	19565	21287
inland shipping (tonnekm)	**1995**	**2000**	**2007**
Delfzijl & Eemshaven	844	1019	1590
Harlingen	349	274	270
IJmuiden/Velsen	1250	1657	1764
Amsterdam	7124	9699	11852
Rotterdam	43816	35005	36145
Dordrecht	672	712	827
Terneuzen/Axel	1937	2234	2141
Vlissingen	2479	2385	2132
Moerdijkgebied	114	982	1886
subtotal inland shipping	58585	53967	58607
total transport (tonnekm)	**1995**	**2000**	**2007**
Delfzijl & Eemshaven	1895	2105	2507
Harlingen	532	455	469
IJmuiden/Velsen	2115	2470	2439
Amsterdam	9644	12408	14608
Rotterdam	55313	46665	48772
Dordrecht	1265	1294	1552
Terneuzen/Axel	2361	2790	2917
Vlissingen	3209	3065	2963
Moerdijkgebied	1235	2280	3667
total transport (tonnekm)	77569	73532	79894

Source: CBS, 2011

Annex H| Time series transport activities, total effects seaports

Table 39| Time series transport activities, total effects seaports

	Number of employees (fte)			Compensation of employees (x €1,000,000)			Production (x €1,000,000)			Value added (x €1,000,000)		
	1995	2000	2007	1995	2000	2007	1995	2000	2007	1995	2000	2007
road and railway transport												
Delfzijl & Eemshaven	1271	1365	1283	38	51	58	96	126	166	58	72	86
Harlingen	182	276	284	6	10	13	14	25	37	9	15	19
IJmuiden/Velsen	1296	1240	954	41	46	44	100	112	124	62	66	64
Amsterdam	3433	3890	3727	107	145	168	263	354	483	161	207	248
Rotterdam	14847	13983	13959	450	517	616	1126	1294	1806	679	738	915
Dordrecht	833	852	869	26	32	39	64	77	113	39	45	58
Terneuzen/Axel	568	834	1062	18	31	48	44	76	138	27	45	71
Vlissingen	952	893	1048	29	33	47	72	82	136	44	47	69
Moerdijk	1531	1905	2183	48	71	99	117	173	283	72	102	146
subtotal road and railway	*24913*	*25239*	*25368*	*761*	*937*	*1132*	*1895*	*2319*	*3286*	*1150*	*1337*	*1675*
inland shipping												
Delfzijl & Eemshaven	73	95	167	3	3	8	14	17	36	7	8	16
Harlingen	21	25	27	1	1	1	4	5	6	2	2	3
IJmuiden/Velsen	112	154	173	4	5	8	21	28	37	11	13	17
Amsterdam	607	900	1235	22	28	56	114	165	267	60	79	120
Rotterdam	3940	3249	3649	141	101	165	740	596	789	388	284	355
Dordrecht	59	66	71	2	2	3	11	12	15	6	6	7
Terneuzen/Axel	160	207	217	6	6	10	30	38	47	16	18	21
Vlissingen	223	221	241	8	7	11	42	41	52	22	19	23
Moerdijk	10	91	168	0	3	8	2	17	36	1	8	16
subtotal inland shipping	*5205*	*5010*	*5947*	*186*	*155*	*269*	*978*	*920*	*1286*	*512*	*438*	*579*
total transport												
Delfzijl & Eemshaven	1344	1459	1449	41	54	66	110	143	202	65	80	102
Harlingen	203	301	311	6	11	14	18	30	43	11	17	22
IJmuiden/Velsen	1408	1393	1126	45	51	51	121	140	161	73	80	81
Amsterdam	4040	4790	4962	129	173	224	377	519	750	221	286	368
Rotterdam	18787	17233	17608	591	618	782	1866	1890	2596	1066	1022	1270
Dordrecht	892	918	940	28	34	43	75	90	128	45	51	65
Terneuzen/Axel	728	1042	1279	23	38	58	74	114	185	43	63	92
Vlissingen	1175	1115	1289	37	40	57	114	123	188	66	67	92
Moerdijk	1541	1996	2351	48	74	107	119	190	320	73	110	162
total transport	30117	30248	31315	948	1093	1402	2873	3239	4572	1662	1775	2254

Source: CBS, 2011

Annex I: Indirect effects of sea ports on transport activities

Table 40| Indirect effects of sea ports on transport activities

Indirect effect of sea ports on transport activities	1995				
	Employees (x1000 fte)	Compensation of employees (x €1,000,000)	Intermediate Consumption (x €1,000,000)	Production (x €1,000,000)	Value added (x €1,000,000)
road transport and railway transport (mln euro)					
Delfzijl & Eemshaven, Harlingen, Dordrecht, Terneuzen/Axel, Vlissingen, Moerdijkgebied	2.7	75.7	54.6	158.7	104.1
IJmuiden/Velsen	0.9	28.9	26.5	71.0	44.6
Amsterdam	2.4	77.5	71.9	189.2	117.4
Rotterdam	13.1	394.4	380.0	971.7	591.7
subtotal road transport and railway transport	19.1	576.6	533.0	1390.7	857.7
inland shipping (mln euro)					
Delfzijl & Eemshaven, Harlingen, Dordrecht, Terneuzen/Axel, Vlissingen, Moerdijkgebied	0.2	7.3	17.0	31.5	14.5
IJmuiden/Velsen	0.1	2.4	5.7	12.0	6.3
Amsterdam	0.6	20.5	51.2	107.2	56.0
Rotterdam	2.6	78.1	196.9	431.8	234.9
subtotal inland shipping	3.4	108.2	270.7	582.4	311.8
total transport (mln euro)					
Delfzijl & Eemshaven, Harlingen, Dordrecht, Terneuzen/Axel, Vlissingen, Moerdijkgebied	2.8	83.0	71.6	190.2	118.6
IJmuiden/Velsen	1.0	31.3	32.1	83.0	50.9
Amsterdam	3.0	98.0	123.0	296.4	173.4
Rotterdam	15.7	472.5	576.9	1403.5	826.6
total transport (mln euro)	22	685	804	1973	1169
	2000				
	Employees (x1000 fte)	Compensation of employees (x €1,000,000)	Intermediate Consumption (x €1,000,000)	Production (x €1,000,000)	Value added (x €1,000,000)
road transport and railway transport (mln euro)					
Delfzijl & Eemshaven, Harlingen, Dordrecht, Terneuzen	4	143	122	312	190
IJmuiden/Velsen	1	32	31	75	44
Amsterdam	3	119	119	287	168
Rotterdam	12	442	458	1075	618
subtotal road transport and railway transport	20	736	731	1750	1020
inland shipping (mln euro)					
Delfzijl & Eemshaven, Harlingen, Dordrecht, Terneuzen/Axel, Vlissingen, Moerdijkgebied	0	-3	9	-3	-12
IJmuiden/Velsen	0	5	14	28	13
Amsterdam	1	27	84	160	76
Rotterdam	2	30	163	286	122
subtotal inland shipping	3	59	270	470	199
total transport (mln euro)					
Delfzijl & Eemshaven, Harlingen, Dordrecht, Terneuzen/Axel, Vlissingen, Moerdijkgebied	4	140	131	309	178
IJmuiden/Velsen	1	37	46	103	57
Amsterdam	4	146	203	447	244
Rotterdam	14	472	621	1361	740
total transport (mln euro)	23	795	1001	2220	1219
	2007				
	Employees (x1000 fte)	Compensation of employees (x €1,000,000)	Intermediate Consumption (x €1,000,000)	Production (x €1,000,000)	Value added (x €1,000,000)
road transport and railway transport (mln euro)					
Delfzijl & Eemshaven, Harlingen, Dordrecht, Terneuzen/Axel, Vlissingen, Moerdijkgebied	4	193	262	537	275
IJmuiden/Velsen	1	25	38	74	36
Amsterdam	3	134	160	351	191
Rotterdam	11	487	692	1397	704
subtotal road transport and railway transport	19	840	1152	2359	1207
inland shipping (mln euro)					
Delfzijl & Eemshaven, Harlingen, Dordrecht, Terneuzen/Axel, Vlissingen, Moerdijkgebied	0	19	52	88	36
IJmuiden/Velsen	0	8	20	36	16
Amsterdam	1	52	138	252	113
Rotterdam	2	76	214	376	162
subtotal inland shipping	4	155	425	752	328
total transport (mln euro)					
Delfzijl & Eemshaven, Harlingen, Dordrecht, Terneuzen/Axel, Vlissingen, Moerdijkgebied	5	212	314	625	311
IJmuiden/Velsen	1	33	58	110	52
Amsterdam	4	187	298	603	305
Rotterdam	13	563	906	1773	867
total transport (mln euro)	23	994	1577	3111	1535

Source: CBS, 2011

Annex J | Summary results activities DCS, sea ports and coastal zone (current prices)

Table 41 Summary of the results for selected activities on the DSC, in sea ports and in the coastal zone (current prices)

		DUTCH CONTINENTAL SHELF (DCS)			INDIRECT (SPILLOVER EFFECT)			TOTAL		
		1995	2000	2007	1995	2000	2007	1995	2000	2007
Seaports (-/- Seashipping in seaports)	Number of employees (x 1,000 fte)	121	117	116	81	79	76	202	196	192
	Compensation of employees (x €1,000,000)	4577	5122	6714	2651	3124	3835	7228	8246	10549
	Production (x €1,000,000)	30484	46051	76224	15037	20573	28775	45520	66625	104999
	Intermediate consumption (x €1,000,000)	20801	35290	59395	9872	14458	20545	30674	49749	79940
	Value added (x €1,000,000)	9682	10761	16828	5164	6115	8230	14847	16876	25058
Coastal Zone	Number of employees (x 1,000 fte)	23	24	25	13	15	15	36	40	40
	Compensation of employees (x €1,000,000)	495	642	787	303	404	491	798	1046	1278
	Production (x €1,000,000)	1810	2426	2901	1081	1485	1794	2892	3910	4695
	Intermediate consumption (x €1,000,000)	856	1160	1453	532	730	907	1388	1891	2361
	Value added (x €1,000,000)	955	1265	1447	549	755	887	1504	2020	2334
Sea shipping	Number of employees (x 1,000 fte)	7	7	6	3	4	3	10	11	10
	Compensation of employees (x €1,000,000)	274	303	357	132	170	174	406	473	531
	Production (x €1,000,000)	2626	3689	4588	1034	1546	1591	3660	5235	6179
	Intermediate consumption (x €1,000,000)	1996	2762	3380	707	1046	1084	2703	3808	4464
	Value added (x €1,000,000)	630	927	1208	326	501	506	956	1428	1714
Fisheries	Number of employees (x 1,000 fte)	0.5	0.3	0.2	0.2	0.2	0.1	0.7	0.5	0.3
	Compensation of employees (x €1,000,000)	20	18	14	8	9	8	28	27	22
	Production (x €1,000,000)	102	111	113	42	52	69	144	163	182
	Intermediate consumption (x €1,000,000)	41	53	69	17	25	42	58	78	111
	Value added (x €1,000,000)	61	58	45	25	27	27	86	85	72
Oil and Gas extraction	Number of employees (x 1,000 fte)	3.0	3.0	2.8	0.4	0.4	1.7	3.4	3.4	4.5
	Compensation of employees (x €1,000,000)	219	231	278	12	14	72	231	245	350
	Production (x €1,000,000)	2692	4306	7644	39	48	257	2731	4354	7901
	Intermediate consumption (x €1,000,000)	580	993	1777	22	26	140	602	1019	1917
	Value added (x €1,000,000)	2112	3313	5866	17	21	117	2129	3334	5983
Sand extraction	Number of employees (x 1,000 fte)	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.
	Compensation of employees (x €1,000,000)	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.
	Production (x €1,000,000)	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.
	Intermediate consumption (x €1,000,000)	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.
	Value added (x €1,000,000)	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.
Wind energy	Number of employees (x 1,000 fte)						0			0
	Compensation of employees (x €1,000,000)						1			1
	Production (x €1,000,000)			23			13			36
	Intermediate consumption (x €1,000,000)			13			8			21
	Value added (x €1,000,000)			11			5			16
Total	Number of employees (x 1,000 fte)	154	152	150	98	99	96	252	251	246
	Compensation of employees (x €1,000,000)	5586	6315	8150	3106	3721	4581	8692	10037	12732
	Production (x €1,000,000)	37714	56583	91492	17232	23704	32498	54946	80287	123991
	Intermediate consumption (x €1,000,000)	24274	40259	66088	11150	16286	22726	35424	56544	88813
	Value added (x €1,000,000)	13440	16324	25406	6082	7419	9773	19522	23743	35178

Annex K | Summary results activities DCS, sea ports and coastal zone (fixed prices, price level 2007)

Table 42| Summary of the results for selected activities on the DSC, in sea ports and in the coastal zone (fixed prices, price level 2007)

		DUTCH CONTINENTAL SHELF (DCS)			INDIRECT (SPILLOVER EFFECT)			TOTAL		
		Pricelevel 2007			Pricelevel 2007			Pricelevel 2007		
		1995	2000	2007	1995	2000	2007	1995	2000	2007
Seaports (-/- Seashipping in seaports)	Compensation of employees (x €1,000,000)	6388	6209	6714	3704	3783	3835	10092	9993	10549
	Production (x €1,000,000)	58213	63632	76224	20917	25408	28775	79129	89039	104999
	Intermediate consumption (x €1,000,000)	46696	51980	59395	13760	17792	20545	60456	69772	79940
	Value added (x €1,000,000)	11517	11652	16828	7157	7615	8230	18674	19267	25058
Coastal Zone	Compensation of employees (x €1,000,000)	673	755	787	423	489	491	1097	1244	1278
	Production (x €1,000,000)	2392	2805	2901	1366	1735	1794	3758	4540	4695
	Intermediate consumption (x €1,000,000)	1189	1405	1453	691	871	907	1881	2276	2361
	Value added (x €1,000,000)	1202	1400	1447	674	864	887	1877	2264	2334
Sea shipping	Compensation of employees (x €1,000,000)	370	366	357	187	207	174	557	573	531
	Production (x €1,000,000)	2921	3787	4588	1418	1869	1591	4340	5656	6179
	Intermediate consumption (x €1,000,000)	2599	3169	3380	934	1244	1084	3533	4412	4464
	Value added (x €1,000,000)	322	618	1208	485	625	506	807	1243	1714
Fisheries	Compensation of employees (x €1,000,000)	27	21	14	12	10	8	38	32	22
	Production (x €1,000,000)	130	115	113	57	63	69	188	178	182
	Intermediate consumption (x €1,000,000)	75	72	69	22	30	42	98	102	111
	Value added (x €1,000,000)	55	43	45	35	33	27	90	77	72
Oil and Gas extraction	Compensation of employees (x €1,000,000)	323	294	278	17	18	72	340	312	350
	Production (x €1,000,000)	6119	7341	7644	53	58	257	6172	7398	7901
	Intermediate consumption (x €1,000,000)	902	1262	1777	29	32	140	930	1294	1917
	Value added (x €1,000,000)	5217	6079	5866	25	26	117	5242	6105	5983
Sand extraction	Compensation of employees (x €1,000,000)	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.
	Production (x €1,000,000)	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.
	Intermediate consumption (x €1,000,000)	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.
	Value added (x €1,000,000)	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.
Wind energy	Compensation of employees (x €1,000,000)						1			1
	Production (x €1,000,000)			23			13			36
	Intermediate consumption (x €1,000,000)			13			8			21
	Value added (x €1,000,000)			11			5			16
Total	Compensation of employees (x €1,000,000)	7782	7646	8150	4343	4508	4581	12124	12154	12732
	Production (x €1,000,000)	69775	77680	91492	23811	29132	32498	93587	106812	123991
	Intermediate consumption (x €1,000,000)	51462	57888	66088	15436	19968	22726	66897	77856	88813
	Value added (x €1,000,000)	18314	19792	25406	8376	9164	9773	26690	28956	35178

Annex L| Summary of price indices of selected activities DSC, sea ports and coastal zone (price indices 2007=100)

Table 43| Summary of the price indices for selected activities on the DCS, in sea ports and in the coastal zone (price indices 2007=100)

		DUTCH CONTINENTAL SHELF (DCS)			INDIRECT (SPILLOVER EFFECT)			TOTAL		
		1995	2000	2007	1995	2000	2007	1995	2000	2007
Seaports (+/- Seashipping in seaports)	Compensation of employees price index (2007=100)	72	82	100	72	83	100	72	83	100
	Production price index (2007=100)	52	72	100	72	81	100	58	75	100
	Intermediate consumption price index (2007=100)	45	68	100	72	81	100	51	71	100
	Value added price index (2007=100)	84	92	100	72	80	100	80	88	100
Coastal Zone	Compensation of employees price index (2007=100)	74	85	100	72	83	100	73	84	100
	Production price index (2007=100)	76	86	100	79	86	100	77	86	100
	Intermediate consumption price index (2007=100)	72	83	100	77	84	100	74	83	100
	Value added price index (2007=100)	79	90	100	81	87	100	80	89	100
Sea shipping	Compensation of employees price index (2007=100)	74	83	100	71	82	100	73	83	100
	Production price index (2007=100)	90	97	100	73	83	100	84	93	100
	Intermediate consumption price index (2007=100)	77	87	100	76	84	100	77	86	100
	Value added price index (2007=100)	196	150	100	67	80	100	118	115	100
Fisheries	Compensation of employees price index (2007=100)	75	84	100	71	82	100	74	84	100
	Production price index (2007=100)	78	96	100	73	83	100	77	92	100
	Intermediate consumption price index (2007=100)	54	74	100	76	84	100	59	77	100
	Value added price index (2007=100)	111	134	100	71	82	100	96	111	100
Oil and Gas extraction	Compensation of employees price index (2007=100)	68	78	100	71	82	100	68	79	100
	Production price index (2007=100)	44	59	100	73	83	100	44	59	100
	Intermediate consumption price index (2007=100)	64	79	100	76	84	100	65	79	100
	Value added price index (2007=100)	40	55	100	70	81	100	41	55	100
Sand extraction	Compensation of employees price index (2007=100)	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.
	Production price index (2007=100)	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.
	Intermediate consumption price index (2007=100)	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.
	Value added price index (2007=100)	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.	P.M.
Wind energy	Compensation of employees price index (2007=100)			100			100			100
	Production price index (2007=100)			100			100			100
	Intermediate consumption price index (2007=100)			100			100			100
	Value added price index (2007=100)			100			100			100
Total	Compensation of employees price index (2007=100)	72	83	100	72	83	100	72	83	100
	Production price index (2007=100)	54	73	100	72	81	100	59	75	100
	Intermediate consumption price index (2007=100)	47	70	100	72	82	100	53	73	100
	Value added price index (2007=100)	73	82	100	73	81	100	73	82	100