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Economic Radar of the Sustainable Energy Sector in the Netherlands, 2008–2011

2013 Edition

Daan Zult
Joram Vuik
Maarten van Rossum

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Explanation of symbols

.	Data not available
*	Provisional figure
**	Revised provisional figure (but not definite)
x	Publication prohibited (confidential figure)
–	Nil
–	(Between two figures) inclusive
0 (0.0)	Less than half of unit concerned
empty cell	Not applicable
2012–2013	2012 to 2013 inclusive
2012/2013	Average for 2011 to 2012 inclusive
2012/'13	Crop year, financial year, school year, etc., beginning in 2012 and ending in 2013
2010/'11–2012/'13	Crop year, financial year, etc., 2010/'11 to 2012/'13 inclusive

Due to rounding, some totals may not correspond to the sum of the separate figures.

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Information
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Daan Zult, Joram Vuik and Maarten van Rossum

For information: Maarten van Rossum (m.vanrossum@cbs.nl)

Remarks: the views expressed in this paper are those of the authors and do not necessarily reflect the policies of Statistics Netherlands.

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Key messages

- The sustainable energy sector (SES) is an international oriented sector that consists of several products and activities with regional clustering, also around universities. It is still a small part of the Dutch economy (0.4 per cent of GDP in 2011), but showed a steady growth over 2008-2011 in most economic indicators. This is remarkable, because during the same period the Dutch economy as a whole was less successful and showed multiple periods of decline.

- Employment in the SES, measured in FTEs, grew by around 13 per cent over the period 2008 – 2011. The employment in the SES as share of the total Dutch employment grew from 0.25 per cent in 2008 to 0.28 per cent in 2011. Employment in the pre-exploitation phase is larger than in the exploitation phase and consists mainly of employment in 'energy saving', 'solar' and 'wind'.

- In the value chain of the pre-exploitation phase, 40 per cent of the employed persons are active in Manufacturing. Other relevant processes in the value chain are 'Installation and maintenance', 'R&D (Scientific research and development)' and 'Consultancy and transport' (e.g. Engineering activities).

- Production in the SES grew by around 22 per cent over the period 2008 – 2011. This large increase is mainly due to a spectacular increase in production of biofuels in both physical and monetary terms. All monetary figures are presented in current prices, so price inflation is included.

- Gross value added in the SES grew by around 7 per cent over the period 2008 – 2011. The value added of the SES as share of total Dutch gross value added grew from 0.38 per cent in 2008 to 0.4 per cent in 2011. Gross value added does contain depreciation costs which are substantial for several SES technologies.

- 'Energy saving' in the pre-exploitation stage is the main contributor to employment, value added and production over the period 2008 – 2011, but this product profile is without much growth (4 800 FTE in 2008 and 4 700 FTE in 2011). Moreover, both production and value added in 'Energy saving' experienced a decrease, which can be partly explained by the general decline in the Dutch construction industry. The demand for insulation materials, part of 'Energy saving' decreased as well.

- 'Solar energy' (production, trade and installation of solar panels (PV)) in the pre-exploitation stage is a large employment creator in the period 2008 and 2011 (2 400 FTE in 2008 and 3 300 FTE in 2011). This development is in line with the development of installed capacity of PV panels in the Netherlands and in the world, which increased substantially in 2011.

- Products related to 'Wind Energy' in the pre-exploitation stage also show a strong growth of employment (2 200 FTE in 2008 and 2 700 FTE in 2011). However, the installed capacity of wind turbines in the Netherlands has grown only slightly and the number of newly installed wind turbines was much smaller in 2011 (65 units) than in 2008 (191 units). Production activities in 'Wind energy' also take place abroad, where wind related services are provided.

- Fixed capital formation in the total SES showed growth (1.65 billion euros in 2008 and 1.74 billion euros in 2011). However, this growth was quite erratic, with 1.01 billion in 2009 and 1.90 billion in 2010.

- Growth in exports of goods has led to an improvement in the trade balance of the sustainable energy sector. In 2008, the Netherlands was a net importer of sustainable energy products while over 2009 – 2011 the Netherlands was a net exporter. Trade in the Port of Rotterdam was important for the sustainable energy sector. A lot of exports were re-exports in the period 2008-2011 (mainly bio fuels).

- Trade balances of product profiles are quite different but stable over the years. The trade balance in 'Solar' is positive, the same holds for 'Biomass(solid) & biofuel'.

- Both the import, export and trade balance of the product profile 'Biomass & biofuels' showed a spectacular increase, which is both the result of a number of biofuel producing factories that were put into use in 2011 and of the national policy of many EU countries for fuel producing companies to blend petrol and diesel with biofuels.

- Based on the number of patent applications, over 2006 – 2010 the SES companies in the pre-exploitation stage are in general more innovative than the average Dutch company.

- The number of Dutch patent applications that are related to SES activities has been gradually increasing over the period 2001 – 2009. However, due to a relatively slow growth, the Dutch annual share in the EU27 number of patents has declined over this period. On the other side, during this period the number of Dutch patent applications per capita has been relatively large compared to the EU27.

- The pre-exploitation phase of the SES constitutes approximately one third of the employment in the Top sector Energy. The Top sector's activities related to natural gas and 'other related activities 'are not included in the P-SES.

- The energy intensity of the Dutch economy has improved in the period 2000-2011. The SES has a role in this 'green economy context'. Other factors, like globalisation and shifts in the structure of the Dutch economy, play also a role in this development.

- While the inclusion of new data sources results in a substantial quality improvement of the figures, it should be noted that the work on the economic figures of sustainable energy sector is still a 'learning process'. On-going interaction and discussions with stakeholders and researchers as well as the international statistical community will result in future improvements and possibly extensions of the figures on the SES.

Management summary

The Economic Radar of the Sustainable Energy Sector has been published by Statistics Netherlands for the third consecutive year. The study has been commissioned by the Ministry of Economic Affairs. Economic figures for the activities in the sustainable energy sector for the period 2008-2011 are published in this report. This is the first CBS report that covers a sufficient long period that allows to draw some conclusions on trends in the SES over time.

This report serves in the evaluation of economic opportunities of the Netherlands in the global transition towards renewable energy supply, demand and energy saving systems. This transition is encouraged by environmental , geopolitical and economic motives. These motives can be described as:

- Energy transformation and economic opportunities: it is envisaged that new markets develop in energy demand and energy production worldwide. According to several recent studies, the Netherlands has a comparative advantage in specific product profiles (Energy report 2011, ministry of economic affairs, modern industry policy, also Ecorys 2010)
- Imports dependence: despite the extraction of natural gas within the Dutch national territory, the Dutch energy consumption is dependent partly on imports.
- Decrease of national gas reserves: Under the 2012 current consumption level, the Dutch natural gas reserve will last for about fifteen more years[1]. (CBS, *Environmental accounts of the Netherlands 2012 (forthcoming).*
- Climate change: there is substantial scientific evidence (IPCC, 2007) that global critical boundaries such as climate change have been exceeded. The consumption of fossil fuels is an important source of carbon emissions and air pollution (e.g. fine dust).
- Energy transition and participation of population: as described by the EU (Energy Roadmap 2050), PBL (Energieke samenleving) and in the Energy agreement negotiated recently (September 2013) by the Social and Economic Council of the Netherlands (SER, 2013). Active participation of and understanding by local communities is considered important in the introduction of new energy systems.

Sustainable energy contributes to securing supplies, diversification of energy supply, reduction of greenhouse gas emissions and creation of green jobs. The sustainable energy sector – which cuts across all industries of the Standard Industrial Classification (NACE) – consists of companies and institutions that physically produce sustainable energy, as well as those active in the value chains that precede this physical production. Apart from sustainable energy, the sustainable energy sector also includes companies and institutions that focus on energy conservation activities.

[1] Potential reserves of shale gas are unknown at this stage.

Concepts and definitions

The sustainable energy sector that is used in this report is defined as described by Ecorys (2010):

"Sustainable energy is the energy we can use indefinitely without compromising the environment and the possibilities for future generations. Sustainable energy, better called pure renewable energy, is not generated by using fossil fuels or chemical minerals, which are all finite. We assume that the sun, water and the air are infinite sources. From an economic perspective and the 'Trias Energetica' we also look at activities with a direct impact on sustainable energy policy in manufacturing. So energy saving will be dealt with(less energy consumption means less energy production) but we also examine activities such as developing the grid, electric transport, hydrogen technology, and capture and storage of CO2 (CCS)." (Ecorys, 2010).

The sustainable energy sector (SES) in this study is broken down into:

The exploitation phase (E-SES): The actual production of renewable energy

The pre-exploitation phase (P-SES): Companies active in value chains preceding the exploitation phase, such as the production of renewable energy systems, R&D focusing on sustainable energy technologies, transport of wind turbines, trade in biomass. Also included are companies and institutions dealing with energy saving in built environment and manufacturing.

For the pre-exploitation phase figures are available for the variables employment, production, gross value added, international trade of goods[2], investments and innovation. No figures are available on innovation and international trade for the entire exploitation phase. The sustainable energy sector is broken down into 16 product profiles and seven process profiles. The various product profiles are 'solar PV', 'solar CSP', 'solar thermal energy', 'biogas', 'biomass (solid) & waste', 'biofuels', 'bio-refining', 'wind on land', 'wind at sea', 'heat & geothermal energy', 'energy from water', 'energy saving', 'electric transport', 'smart grids', 'hydrogen technology' and 'CO2 capture and storage'. The process profiles are 'R&D', 'consultancy', 'transport', 'preparation/raw material production', 'supply, assembly and construction', 'production of energy carriers', 'installation and maintenance'. In this study we calculate economic indicators for these profiles.

In the presentation of the figures for the P-SES a distinction is made between specialised and non-specialised companies. Specialised companies are companies within which all activities are directed at sustainable energy products. Non-specialised companies produce sustainable energy goods or services, but also other products, which are not relevant for this study.

[2] The trade of services, such the transport of construction of offshore wind turbines, is not included. The available data sources do not merge with the approach in pre-exploitation stage so far.

Results

The macro-table below provides a summary of the key figures for the SES over the period 2008 – 2011.

		2008	2009	2010	2011
Indicator	*Sector*	*fte (rounded)*			
Employment	SES	16 900	17 800	18 500	19 100
	E-SES	2 400	2 600	2 600	2 800
	P-SES (specialised)	6 600	7 000	7 400	7 300
	P-SES (non-specialised)	7 900	8 200	8 500	9 000
		euro, mln, rounded			
Production	SES	5 570	5 560	5 900	6 810
	E-SES	1 070	1 180	1 320	1 820
	P-SES (specialised)	1 840	1 820	1 760	1 750
	P-SES (non-specialised)	2 660	2 560	2 820	3 240
Value added	SES	2 250	2 210	2 340	2 400
	E-SES	830	770	760	840
	P-SES (specialised)	580	540	580	570
	P-SES (non-specialised)	840	900	1 000	990
Exports in goods	SES	2 560	2 810	3 300	4 330
Imports in goods	SES	3 020	2 800	2 810	3 900
Capital formation	SES	1 650	1 010	1 900	1 740

Key economic indicators

The general macro picture that evolves from the key indicators is one of a sector that is growing. Almost all key indicators increased between 2008 and 2011. Here it is important to note that all monetary figures are in current prices, which implies that these figures represent both changes in volumes and prices.

Over the period 2008 – 2011 there is a sustained and stable increase in employment across all three SES categories. Despite the relatively bad economic conditions in this period, overall employment increased from 16.9 thousand FTEs in 2008 to 19.1 thousand FTEs in 2011, an increase of nearly 13 per cent in four year. The bulk of employment consists of jobs in the P-SES, where we see an increase in employment in both the specialised and non-specialised P-SES companies.

The gross value added in current prices (includes inflation) over the period 2008 - 2011 shows a more diffuse picture. Overall the value added of the sector increased from 2.25 billion euro in 2008 to 2.40

billion euro in 2011, an increase of around 7 per cent However, where the non-specialised companies in the P-SES showed an increase of around 18 per cent in value added, the value added of both the specialised companies in the P-SES and the companies in the E-SES remained quite stable.

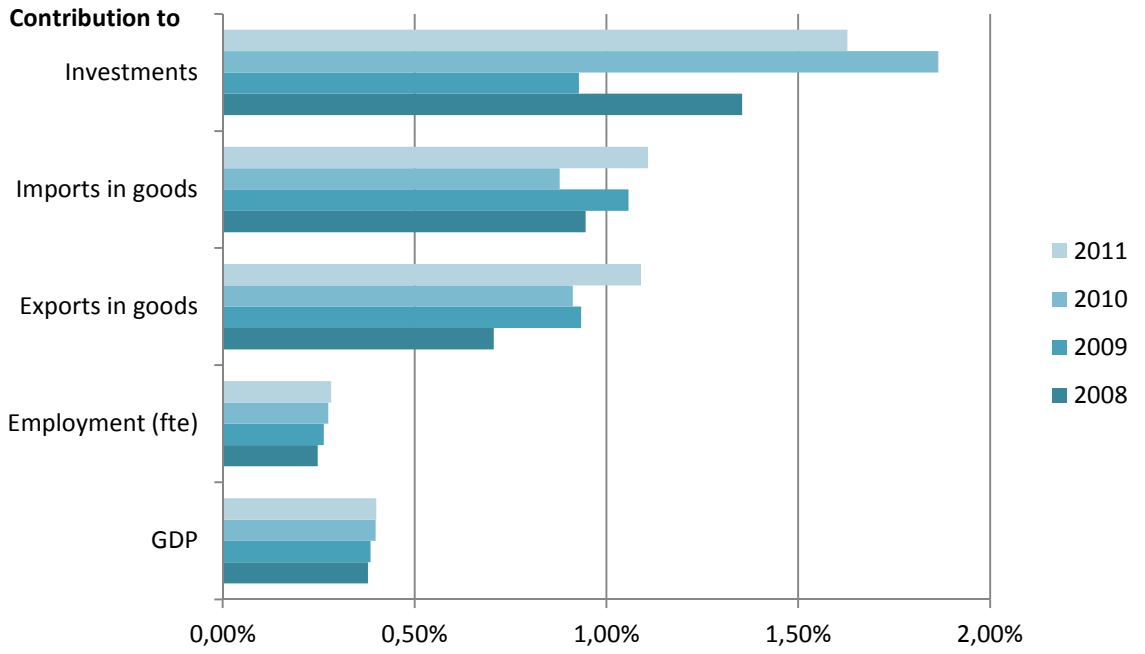
The production in current prices of the SES over the period 2008 – 2011 shows a more complex pattern. Overall it increased from 5.6 billion euro in 2008 to 6.8 billion euro in 2011, an increase of around 22 per cent. However, although overall the trend is positive, it are the E-SES companies (+ 70 per cent) and the non – specialised P-SES (+ 22 per cent) companies that sustain this growth, while the specialised companies in the P-SES have slightly decreased their production (- 5 per cent). The spectacular production growth of E-SES companies is mainly due to a large increase in the production of bio-fuels.

It is interesting to look at the trends of value added per FTE over the period 2008 – 2011. The value added per FTE in the E-SES is substantially higher than in the P-SES as this is a more capital intensive industry. It is interesting to note that the non-specialised companies have on average a higher value added per FTE than the specialised companies. This difference (between specialised and non-specialised) could be either due to relatively low capital intensiveness of specialised P-SES activities compared to the relatively high capital intensiveness of non-specialised P-SES activities. The specialised P-SES consists of relatively a lot of small companies while the non-specialised P-SES consists of relatively a lot of big companies. Big companies are, generally speaking , more capital intensive than small companies. Finally it is interesting to see that overall the SES has a higher value added per FTE than the average in the Dutch economy.

Value added of the E-SES hardly increased in the period 2008 and 2011. Production did increase significantly, especially due to more production of biofuels. The dominating role of 'Biomass & Biofuels' and 'Wind energy' did not change in the period 2008 – 2011. The stability of value added of 'Biomass & biofuels' is quite remarkable compared to the strong increase in production. There are a three main reasons for this notable observation. First, the value added of electricity and heat by biomass combustion is under pressure due to lower electricity prices. Second, the biofuel facilities have not produced on full capacity, which induced higher fixed costs per unit of biofuel. And finally, production of electricity and heat by *biomass combustion* in physical terms has grown over time but not as hard as the production of biofuels. Value added of biofuel production is relatively small compared to the value added of biomass combustion. Production of biofuels has, among other things, grown due to more physical production and price increases. On the other hand, intermediate use of inputs necessary to produce these biofuels has also grown significantly, so the growth in value added has been low.

In physical terms, more renewable electricity was produced in 2010 than in 2009, especially due to more combustion of biomass by electricity producers and more waste incineration. After years of increased production of wind energy, a decline was observed in 2010. This decline can be explained by a very low wind supply. In 2010 the Windex (a measure of wind supply) was at its lowest ever estimated. This lack of wind was not compensated by newly installed wind turbines, which was at a record low since 1990. Prices for electricity did not change very much in between 2011 and 2010. The physical production of renewable energy increased a lot in between 2011 and 2010.

Share of the sustainable energy sector in the Dutch economy



The sustainable energy sector accounted for 0.25 per cent of total employment in 2008, increasing to 0.28 per cent in 2011. The share in gross value added is slightly larger, going from 0.38 per cent in 2008 to 0.4 per cent in 2011. Overall the SES has relatively low employment and value added figures when compared to the other economic indicators like investment and trade. This implies the SES is a relatively capital intensive and internationally oriented sector where investors have positive expectations of the future.

Product profiles in the P-SES

During 2008 – 2011 the main contributor of employment, production and value added in the P-SES is 'Energy saving'. 'Energy saving' employment figures proved to be quite stable during 2008 – 2011 2011 (4 800 FTE in 2008 and 4 700 FTE in 2011), which is remarkable in relation to the crisis in the Dutch construction sector. An important part of 'Energy saving' are the manufacturers of insulation material, which are suppliers to the construction sector. Here it should be noted that the installation of insulation material is not part of the 'energy saving' sector.

In terms of contribution to growth we see a different picture. Here it is 'Solar' that contributes the lion's share, caused by solar installation and trade companies that profit from higher demand for PV panels across Europe. 'Solar energy' (production, trade and installation of solar panels (PV)) in the pre-exploitation stage is a large employment creator in the period 2008 and 2011 (2 400 FTE in 2008 and 3 300 FTE in 2011). This development is in line with the development of installed capacity of PV panels in the Netherlands, which increased substantially in 2011.

Value added and production of solar cell producers have been under pressure, but trade and installation of solar cells were partly stimulated by decreasing market prices of solar cells. Producers of machines designed to produce solar panels profit from extra demand from Asia.

Products related to 'Wind Energy' in the pre-exploitation stage also show a strong growth of employment (2 200 FTE in 2008 and 2 700 FTE in 2011), especially related to offshore activities. However, the installed capacity of wind turbines in the Netherlands has grown only slightly and the number of newly installed wind turbines was much smaller in 2011 (65) than in 2008 (191). This reduction is caused by a temporarily lack (August 2006 – April 2008) of a subsidy scheme for new projects.

Trade balance improvement

Between 2008 – 2011 the trade balance of the SES improved from minus 460 million to plus 430 mln. This substantial increase of almost one billion was already realised over 2008 – 2010 while in 2011 there was a slight decrease. The bulk, both in level and growth, is represented by biofuels. The Port of Rotterdam is important as production, storage and transhipment location of biofuels. In fact between 2008 – 2011 the export in biofuels increased by more than 120 per cent, which is far more than the increase in prices alone. This is both the result of increased production by a number of biofuel producing factories of which the construction was finished in this period and of the national policy of many EU countries for fuel producing companies to blend petrol and diesel with biofuels.

Gross fixed capital formation

The development of gross fixed capital formation is characterised by a dip in 2009, which was already overcome in 2010 when the total gross fixed capital spending exceeded 2008's. This swing was mainly the result of a decline and recovery in energy saving. Furthermore there has been a shift towards 'Wind' and 'Solar'. The backlash in 2009 can simply be explained by the economic crisis of the year, where especially investment on energy saving was under pressure. Especially the capital investment in 'Wind' is interesting, because it is out of sync with the low number of newly installed wind turbines. However, this can be explained by the time lag that takes place, because newly installed capacity takes about three to five years to be operational after the initial investment took place.

Innovation

The progress in research and development (R & D) is indicated by figures in patent applications. These figures are provided by the Patent Office NL Agency and stretch the period 2001 – 2009. Most patent applications concern solar, wind and bio fuel technology applications. During the period 2001 – 2004 the total number of annual patent applications related to renewable energy was quite stable, but between 2004 and 2009 they began to increase. However, the growth in SES related patent applications has been slower than the average growth worldwide and in the EU27. Finally, 162 companies applied for a patent during 2001 – 2009, representing around 15 per cent of the P-SES population. This share is quite high, because in the Dutch economy over the last ten years, only around 1 per cent of the companies applied for a patent.

Regional analysis for the pre-exploitation phase of the sustainable energy sector.

The contribution of the P-SES to the regional economy can be quite different between regions in terms of value added. Interesting are the relative big contributions of the P-SES in the provinces Zuid-Holland, Limburg and Gelderland. In Groot-Rijnmond (part of Zuid-Holland) the proximity of the Port of Rotterdam undoubtedly plays a major role, especially for wholesalers. Also in Zuidoost-Noord-

Brabant there are a substantial number of P-SES companies. The traditionally strong presence of the electrical industry and the presence of the Technical University of Eindhoven may play an important role. The strong presence of P-SES companies in Gelderland is remarkable. Especially the area Arnhem / Nijmegen and the Veluwe seem to present themselves as a cluster. Also the areas around the Technical University of Delft and the Technical University of Twente hosts a substantial number of P-SES companies. South and Central Limburg also accommodate many P-SES companies that provide a substantial amount of employment in the region.

Methodology

The method to construct figures for the sustainable energy sector is designed such that it exploits data sources that are already available within Statistics Netherlands. This has the advantage that no additional data collection took place (no additional administrative burden for companies). The disadvantage is that the information available is not always perfectly designed to create every desired statistic.

P-SES population

The figures for the P-SES is based on a population of companies that was initially compiled from a merger of data sources that are available in organisations such as Statistics Netherlands, ECN, AgentschapNL, Ecorys, the Netherlands Environmental Assessment Agency (PBL) and EZ. The extent in which companies actually produce relevant goods or services ('specialisation factor') is mostly based on estimates from experts. This population of companies is the starting point of the P-SES figures, as it can be merged to economic micro data available at Statistics Netherlands, which allow for the calculation of employment, production and value added figures for the sector.

Revision and update of P-SES population

The P-SES population that is used for this report is a revised and updated version of the population used in the SES Radar 2012. The update involves the search for new companies by the consultation of additional data sources. The data sources used in the update were provided by the energy department of Statistics Netherlands, ECN, the subsidies and patent department of NL Agency, PolderPV and participants in the wind offshore innovation theme of 'Topsector' Energy (Ministry of Economic Affairs) supplemented with some purposeful internet and database search by the authors of this report. The revision implies that the figures for the years 2008 and 2009 differ from the figures presented in the SES Radar 2012 for two reasons. First, the population has changed (more companies/statistical units) and specialisation factors at micro level have been revised/re-evaluated. It should also be noted that in contrast to the SES Radar 2012 the production of biofuels is now included in the figures of the E-SES instead of in the figures of the P-SES.

Specialisation factor and its limitations

The fact that a set of companies is only partially active in sustainable energy related activities deserves special attention. The SES radar deals with this phenomenon by expert guessing a so called 'specialisation factor'. This factor indicates the share in which a company is active in the P-SES, which implies that only this share of a company's is considered part of the P-SES. There are three main methodological problems with this approach.

First, there are not always unambiguous and objective methods available to determine a company's specialisation factor so the specialisation factor is affected by the subjectivity of the expert's opinion.

Second, this share is applied identically and consistently over employment, value added, production and international trade figures, ignoring the fact that it might differ per variable.

Third, the specialisation factor is considered constant, which implies that developments in the specialisation factors are not considered. This implies, for instance, that when a company has a stable number of employees over time and allocates more employees to sustainable energy related activities, this is not observed in the figures presented in this report. Companies can merge, be taken over or split into two or more companies. Also the content of statistical units can change from one year to the other (number of legal units). These changes in units (real and administrative) had to be taken into account in the compilation of comparable data over time. Therefore, the figures presented in this report generally distinguish between specialised and non-specialised companies, because the trends observed in specialised companies might represent the general trends in the SES more accurately.

E-SES

An alternative computation technique has been developed for the E-SES. This approach is not based on company level information (micro data) but on industry level information (meso data). At industry level, Statistics Netherlands has access to high quality data about the physical production of the various renewable energy techniques (CBS, *Hernieuwbare energie in Nederland* , 2013a).

The figures of the E-SES over the years 2008 and 2009 have been updated. This is because in this report the figures of biofuels now belong to the E-SES while in earlier reports this was categorised as a P-SES activity. Finally, also the price-index that is applied has been updated.

Management samenvatting

De economische radar duurzame energiesector van het Centraal Bureau voor de Statistiek (CBS) is in opdracht van het Ministerie van Economische Zaken voor het derde jaar opeenvolgende jaar uitgebracht. Voor de periode 2008-2011 worden economische cijfers over de activiteiten in de duurzame energiesector gepubliceerd. Tevens wordt voor de periode 2008-2011 inzichtelijk gemaakt of er bepaalde trends zijn te ontdekken in deze cijfers.

Deze radar is relevant voor de onderbouwing (ex - post) van de kansen voor de Nederlandse economie bij de wereldwijde transitie naar een duurzame energievoorziening en de toenemende aandacht voor energiebesparing. Meerdere geopolitieke en milieu-economische ontwikkelingen vergroten de aandacht voor de energietransitie in het overheidsbeleid. Belangrijke ontwikkelingen zijn:

- De introductie van nieuwe energiesystemen wereldwijd biedt volgens diverse studies economische kansen: Nederland heeft volgens deze studies comparatieve voordelen in bepaalde productprofielen op de Europese markt en kan van daaruit inspelen op nieuwe markten (Energieakkoord voor duurzame groei , 6 september 2013, pijler 10, SER ; Energierapport 2011, ministerie EL&I, modern industriebeleid, Ecorys 2010)
- Importafhankelijkheid: ondanks het aardgas dat in het noorden van Nederland en op het Nederlands Continentaal Plat op de Noordzee wordt gewonnen, is Nederland ook afhankelijk van het buitenland voor de energievoorziening.
- De Nederlandse aardgasreserve krimpt: de bekende gasreserve in Nederland zal bij het huidige extractieniveau over ongeveer 15 jaar uitgeput zijn (CBS, *Environmental accounts of the Netherlands 2012, verschijnt binnenkort*).
- Klimaatverandering: er bestaan wetenschappelijke studies (IPCC, 2007) die aantonen dat het overschrijden van kritische grenzen in het ecosysteem klimaatverandering veroorzaken. Het gebruik van fossiele brandstoffen is een belangrijke bron van CO_2 emissies.
- Energietransitie en draagvlak onder de bevolking: zoals beschreven door de Europese Commissie (Energy Roadmap 2050), PBL (Energieke samenleving) en in het recent ontstane Energie akkoord (Sociaal Economische Raad (SER), september 2013). De actieve deelname en het begrip van de lokale gemeenschap is belangrijk bij de introductie van een nieuw energiesysteem (SER, 2013).

Hernieuwbare energie levert een bijdrage aan de zekerheid en diversificatie van de energievoorziening en mogelijk aan de reductie van de emissies van broeikasgassen. Bovendien kan de Duurzame Energiesector ‘groenere’ banen creëren. De Duurzame Energiesector bestaat uit bedrijven en instellingen die zich bezighouden met de fysieke productie van hernieuwbare energie en uit bedrijven die actief zijn in de waardeketens die hieraan vooraf gaan. Naast hernieuwbare energie bestaat de Duurzame Energiesector ook uit bedrijven en instellingen met activiteiten gericht op energiebesparing (zie box 1 van hoofdstuk 2 voor een toelichting).

Concepten en definities

Voor de duurzame energiesector geldt een afbakening gehanteerd zoals beschreven door Ecorys (2010):

"*Duurzame energie is die energie waarover we voor onbeperkte tijd kunnen beschikken en waarbij het leefmilieu en de mogelijkheden voor toekomstige generaties niet worden benadeeld. Duurzame energie of beter de zuivere hernieuwbare energie wordt dus uiteindelijk niet opgewekt door of samen met fossiele brandstoffen of scheikundige mineralen die allen eindig zijn. We gaan er dus vanuit dat de zon, water en lucht oneindige bronnen zijn. Vanuit een economisch perspectief en de 'Trias Energetica' wordt ook een licht geworpen op die activiteiten die een indirecte impact hebben op het industriële duurzame energiebeleid. Allereerst is dat energiebesparing (hoe minder energie er verbruikt wordt, hoe minder er dient geproduceerd te worden) maar ook de activiteiten zoals netontwikkeling, elektrisch vervoer, waterstoftechnologie en CO2-afvang en -opslag (CCS) worden onder de loep genomen*." (Ecorys, 2010).

De duurzame energiesector wordt in deze studie opgedeeld in:

De exploitatiefase (E-SES): De daadwerkelijke productie van hernieuwbare energie.

De pre-exploitatiefase (P-SES): De bedrijven die actief zijn in waardeketens voorafgaand aan de exploitatiefase, zoals de productie van hernieuwbare energiesystemen, R&D gericht op duurzame energietechnologieën, transport van windmolens, handel in biomassa. Ook bedrijven en instellingen die zich bezighouden met energiebesparing in de gebouwde omgeving en in de industrie worden hierbij meegenomen.

Voor de pre-exploitatiefase geldt dat er cijfers beschikbaar zijn voor de variabelen werkgelegenheid, productie, toegevoegde waarde, internationale handel, investeringen en innovatie. Voor de exploitatiefase zijn (op onderdelen) geen cijfers beschikbaar voor de onderwerpen innovatie en internationale handel. De duurzame energiesector is opgedeeld in 16 productprofielen en 7 procesprofielen. De verschillende productprofielen die worden onderscheiden zijn 'zon-PV', 'zon-CSP', 'zonthermisch', 'biogas', 'biomassa (vast) & afval', 'biobrandstoffen', 'bioraffinage', 'wind op land', 'wind op zee', 'warmte & geothermie', 'energie uit water', 'energiebesparing', 'elektrisch vervoer', 'smart grids', 'waterstoftechnologie' en 'CO2 –afvang en- opslag'. De onderscheiden procesprofielen zijn 'R&D', 'consultancy', 'transport', 'voorbewerking/grondstofproductie', 'toelevering assemblage en constructie', 'productie energiedragers' en 'installatie en onderhoud'. In deze studie zijn voor deze verschillende profielen economische cijfers vastgesteld.

Resultaten

De tabel hieronder presenteert een macrobeeld van de duurzame energiesector voor de periode 2008 – 2011.

		2008	2009	2010	2011
Indicator	*Sector*	*VTE (afgerond)*			
Werkgelegenheid	SES	16 900	17 800	18 500	19 100
	E-SES	2 400	2 600	2 600	2 800
	P-SES (gespecialiseerd)	6 600	7 000	7 400	7 300
	P-SES (niet-gespecialiseerd)	7 900	8 200	8 500	9 000
		euro, mln, afgerond			
Productie	SES	5 570	5 560	5 900	6 810
	E-SES	1 070	1 180	1 320	1 820
	P-SES (gespecialiseerd)	1 840	1 820	1 760	1 750
	P-SES (niet-gespecialiseerd)	2 660	2 560	2 820	3 240
Bruto toegevoegde waarde	SES	2 250	2 210	2 340	2 400
	E-SES	830	770	760	840
	P-SES (gespecialiseerd)	580	540	580	570
	P-SES (niet-gespecialiseerd)	840	900	1 000	990
Export van goederen	SES	2 560	2 810	3 300	4 330
Import van goederen	SES	3 020	2 800	2 810	3 900
Investeringen	SES	1 650	1 010	1 900	1 740

Economische indicatoren

De duurzame energiesector doet het goed in de periode 2008 en 2011. Bijna alle indicatoren zijn gestegen. Hierbij dient wel te worden opgemerkt dat alle monetaire cijfers uitgedrukt zijn in nominale waarden, wat impliceert dat de ontwikkelingen zowel de veranderingen in prijs en volume weergeven.

In de periode 2008 – 2011 is er een gestage en stabiele groei in werkgelegenheid in de SES. Ondanks de economische crisis in deze periode, is het aantal VTE (voltijds equivalent) in de sector toegenomen van 16,9 duizend in 2008 naar 19,1 duizend in 2011, een stijging van bijna 13 procent in vier jaar. Het grootste gedeelte van de werkgelegenheid zit in the P-SES, waar zowel onder de gespecialiseerde als de niet-gespecialiseerde bedrijven een stijging in werkgelegenheid heeft plaatsgevonden.

De bruto toegevoegde waarde in lopende prijzen (inclusief prijsstijging) laat een gevarieerder beeld zien over de periode 2008 – 2011. In totaal is de waarde van de sector gestegen van 2,25 miljard

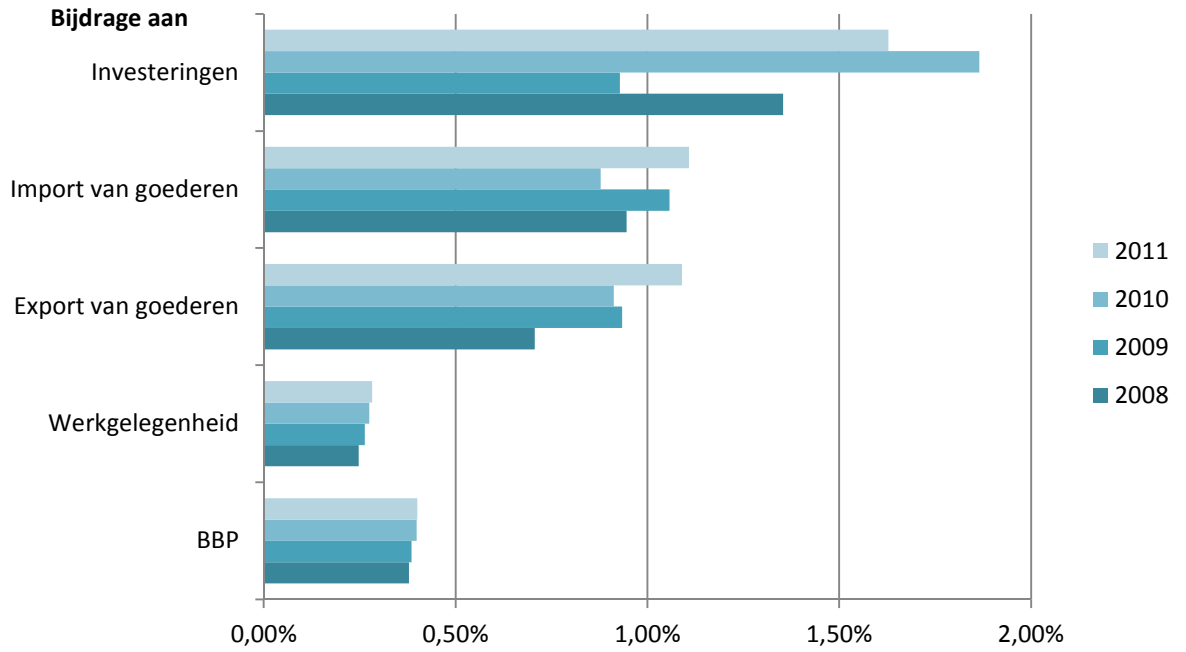
euro in 2008 naar 2,40 miljard euro in 2011, een stijging van zo'n 7 procent. Deze ontwikkeling wordt vooral veroorzaakt door een toename in de bruto toegevoegde waarde die is gegenereerd door de niet-gespecialiseerde bedrijven in de P-SES. Daarentegen was de bruto toegevoegde waarde van de gespecialiseerde bedrijven in de P-SES en de E-SES tamelijk stabiel.

De productie in lopende prijzen van de SES is toegenomen van 5,6 miljard in 2008 naar 6,8 miljard in 2011, een stijging van 22 procent. Deze stijging wordt vooral veroorzaakt door de E-SES (+70 procent) en de niet-gespecialiseerde bedrijven in de P-SES (+22 procent). De groei in de productie van de E-SES is vooral te danken aan een grote stijging in de productie van biobrandstoffen. Dit laatste is echter nauwelijks gepaard gegaan met een groei in bruto toegevoegde waarde. De productie van de gespecialiseerde bedrijven in de P-SES is licht gedaald (- 5 procent).

De bruto toegevoegde waarde per VTE over de periode 2008 – 2011 is in de E-SES een stuk hoger dan in de P-SES, wat met name verklaard wordt door de hoge mate van kapitaal intensiteit van de E-SES. De niet-gespecialiseerde bedrijven in de P-SES hebben gemiddeld een hogere toegevoegde waarde per VTE dan de gespecialiseerde bedrijven in de P-SES. Dit verschil kan komen doordat de gespecialiseerde bedrijven minder kapitaalintensief zijn. Dit vermoeden wordt versterkt doordat de gespecialiseerde bedrijven in de P-SES gemiddeld kleiner zijn dan de niet-gespecialiseerde bedrijven in de P-SES, en een grotere omvang van een bedrijf gaat vaak samen met een hogere mate van kapitaalintensiteit. Ten slotte is het interessant op te merken dat de SES als geheel een hogere bruto toegevoegde waarde per VTE genereert dan gemiddeld in de Nederlandse economie het geval is.

Zoals gezegd is de bruto toegevoegde waarde van de E-SES nauwelijks toegenomen tussen 2008 en 2011. Dit in tegenstelling tot de productie van de E-SES, die enorm is gestegen. Dit is met name veroorzaakt door de stijging in de productie van biobrandstoffen, waarvoor in deze periode een aantal productiefaciliteiten zijn geopend. De grote mate van overcapaciteit zorgt mogelijk voor hoge kosten per eenheid output, waardoor extra productie nauwelijks leidt tot extra toegevoegde waarde. Daarnaast is de toename van de productiewaarde deels een gevolg van stijgende biobrandstofprijzen, waar ook een prijsstijging van de input voor de biobrandstoffen tegenover stond. Ook de toegevoegde waarde van de productie van elektriciteit stond onder druk.

Aandeel van de duurzame energiesector in de Nederlandse economie



Het aandeel in de werkgelegenheid van de SES binnen de Nederlandse economie is gestegen van 0,25 procent in 2008 naar 0,28 procent in 2011. Het aandeel in de toegevoegde waarde lag iets hoger en is gestegen van 0,38 procent in 2008 naar 0,40 procent in 2011. Deze percentages zijn relatief laag als ze worden vergeleken met het aandeel dat de SES heeft in zowel de export, import en investeringen van Nederland. De SES is dus een sector met een internationale oriëntatie en relatief hoge investeringen.

Productprofielen in de P-SES

Tijdens 2008 – 2011 leverde 'Energiebesparing' de grootste bijdrage aan zowel werkgelegenheid, productie en toegevoegde waarde binnen de P-SES. Verder waren de werkgelegenheidscijfers van 'Energiebesparing' redelijk stabiel (4 800 VTE in 2008 en 4 700 VTE in 2011), wat opmerkelijk is aangezien 'Energiebesparing' voor een deel bestaat uit producenten van isolatiemateriaal, die veel aan de bouw leveren. Tussen 2008 en 2011 kende Nederland een periode van economische malaise waarin met name de bouw hard getroffen is. Hierbij moet wel worden opgemerkt dat de installatie van energiebesparingsmaterialen niet wordt meegenomen in de cijfers.

Het productprofiel 'Zon' neemt het leeuwendeel van de groei voor zijn rekening. De werkgelegenheid is in dit profiel gestegen van 2 400 VTE in 2008 naar 3 300 VTE in 2011. Dit is met name veroorzaakt door een toename in de vraag naar installatiewerkzaamheden van zonnepanelen. Ook de handel in zonnepanelen is gestegen. Handelaren in zonnepanelen hebben geprofiteerd van de lagere prijzen en de toename van de vraag naar panelen in Europa. De maakindustrie in 'Zon PV' heeft geprofiteerd van de vraag uit o.a. Azië naar machines die zonnepanelen maken.

De toegevoegde waarde van producenten van zonnepanelen stond onder druk, maar de handel en installatiewerkzaamheden in zonnepanelen kende daarentegen een toename doordat de internationale marktprijzen van de panelen zijn gedaald wat heeft geleid voor extra vraag. Ook de

producenten van machines die zonnepanelen kunnen produceren hebben door extra vraag, vanuit onder meer Azië, meer toegevoegde waarde gegenereerd.

De werkgelegenheid die is gerelateerd aan 'Wind' is ook sterk gestegen (2 200 VTE in 2008 en 2 700 VTE in 2011), met name de offshore activiteiten. Desalniettemin is het geplaatste vermogen van windturbines in Nederland tussen 2008 en 2011 weinig gestegen. Het aantal nieuw bijgeplaatste windturbines lag in 2008 (191) beduidend hoger dan in 2011 (65). Deze afname lijkt vooral het gevolg van het beëindigen van een tijdelijke subsidiemaatregel (augustus 2006 tot april 2008) op nieuwe windturbine projecten.

Verbetering in de handelsbalans

Tussen 2008 en 2011 is de handelsbalans van de SES gestegen van een negatief saldo van 460 miljoen euro naar een positief saldo van 430 miljoen euro. Deze aanzienlijke stijging van bijna 1 miljard is gerealiseerd tussen 2008 en 2010, in 2011 heeft een kleine daling plaatsgevonden. Het grootste deel van de handel, zowel qua totaal als groei is veroorzaakt door biobrandstoffen. Tussen 2008 en 2011 is de export van biobrandstoffen met 120 procent gestegen. Dit is zowel het gevolg van de in gebruik name van een aantal productiefaciliteiten en het beleid van een aantal EU- landen om de bijmengplicht van biobrandstoffen met benzine en diesel te verhogen.

Investeringen

De ontwikkeling van de investeringen in vaste activa wordt gekarakteriseerd door een dip in 2009. Herstel trad op in 2010 toen het totaal aan investeringen reeds hoger lag dan in 2008. De dip werd vooral veroorzaakt door een afname van investeringen door bedrijven actief in 'Energiebesparing'. In 2011 stegen de investeringen in 'Wind' sterk. Deze investeringen zien we nog niet terug in de cijfers over het bijgeplaatste vermogen. Dit komt vooral doordat een investering vaak pas drie tot vijf jaar later tot de ingebruikname van een windmolen leidt.

Innovatie

Cijfers over patentaanvragen (Octrooicentrum NL) geven een indicatie van de onderzoeks- en ontwikkelingsactiviteiten (R&D) binnen de SES. De meeste patentaanvragen zijn gerelateerd aan zon, wind of bio gerelateerde technieken. Gedurende 2001 – 2004 is het aantal patentaanvragen dat gerelateerd is aan de SES nauwelijks gestegen, maar tussen 2004 en 2009 heeft een flinke stijging plaatsgevonden. Deze groei is in lijn met de groei wereldwijd. Ongeveer 15 procent van de P-SES bedrijven heeft een patent aangevraagd. Dit aandeel is hoog vergeleken met het gemiddelde van 1 procent in de Nederlandse economie.

Regionale analyse van de pre-exploitatie fase van de duurzame energie sector

Er zijn grote regionale verschillen wat betreft de toegevoegde waarde en werkgelegenheid in de SES. De bijdrage van de P-SES in de provincie Zuid-Holland, Limburg en Gelderland is relatief groot. In Groot-Rijnmond speelt de aanwezigheid van de Rotterdamse haven ongetwijfeld een belangrijke rol. Ook in Zuidoost-Noord-Brabant is een groot aantal P-SES bedrijven gevestigd. De traditionele aanwezigheid van de electrotechnische industrie en de aanwezigheid van de Technische Universtiteit Eindhoven speelt hier een rol. De sterke aanwezigheid van P-SES bedrijven in Gelderland is opmerkelijk, waar met name in de omgeving van Arnhem/Nijmegen en de Veluwe een cluster aan

bedrijven te zien is. Ook in de gebieden rondom de Technische Universiteit Delft en de Technische Universiteit Twente zijn een substantieel aantal P-SES bedrijven. Ten slotte zijn er ook in Zuid- en Centraal Limburg een aantal P-SES bedrijven die belangrijk zijn voor de werkgelegenheid.

Methodologie

De methode om cijfers voor de duurzame energie sector van Nederland te maken is volledig gebaseerd op databronnen die reeds bij het CBS aanwezig zijn. Dit heeft als voordeel dat er geen extra data door het CBS is verzameld waardoor bedrijven niet te maken hadden met additionele administratieve lasten.

P-SES populatie

De cijfers voor de P-SES zijn gebaseerd op een populatie van bedrijven die ontstaan is vanuit het samenvoegen van databronnen die beschikbaar waren binnen verschillende organisaties, zoals het CBS, ECN, Ecorys, Agentschap NL, Planbureau voor de Leefomgeving (PBL) en het Ministerie van Economische Zaken (EZ). De mate waarin de bedrijven in deze populatie goederen of diensten produceren die onderdeel zijn van de duurzame energie sector is voornamelijk gebaseerd op schattingen van experts. Deze P-SES bedrijvenpopulatie is het startpunt voor de cijfers die betrekking hebben op de P-SES, deze populatie kan namelijk worden gekoppeld aan micro- economische data die beschikbaar is bij het CBS. Dit geeft de mogelijkheid tot de berekening van economische indicatoren voor de sector, zoals werkgelegenheid, productie en bruto toegevoegde waarde.

Revisie en update van de P-SES populatie

De P-SES populatie die voor dit rapport gebruikt is, is een gereviseerde en geüpdate versie van de populatie die is gebruikt voor de SES Radar van 2012. Potentieel ontbrekende bedrijven die wel toebehoren aan de populatie zijn gezocht aan de hand van additionele databronnen. De databronnen die zijn geraadpleegd zijn verkregen vanuit het CBS, ECN, AgentschapNL, PolderPV, de deelnemers aan het innovatiethema 'Wind op zee' en van 'Topsector' energie (Ministerie van Economische zaken (EZ)). Vervolgens is het algemene bedrijven register zoals beschikbaar binnen het CBS en het internet afgespeurd op zoek naar relevante bedrijven die nog ontbraken. Ten slotte zijn ook de specialisatiefactoren voor een deel van de bedrijven die onderdeel waren van de oude populatie opnieuw bekeken.

De revisie heeft als gevolg dat de cijfers voor de jaren 2008 en 2009 in deze Radar gebaseerd zijn op een andere populatie dan de populatie die voor eerdere Radars is gebruikt. De cijfers voor de jaren 2008 en 2009 zijn hierdoor afwijkend van die in de eerdere rapporten. Bedrijven die zich bezighouden met de productie van biobrandstoffen worden in dit rapport tot de E-SES gerekend, in eerdere rapporten werden zij tot de P-SES gerekend.

De specialisatiefactor en haar beperkingen

Niet alle relevante bedrijven zijn uitsluitend actief in duurzame energieactiviteiten. Dit aspect verdient speciale methodologische aandacht. Deze radar gaat in deze gevallen uit van een zogenaamde 'specialisatiefactor', welke aangeeft welk deel van het bedrijf relevant is voor de duurzame energiesector. Deze specialisatiefactor komt tot stand door een schatting van een expert en kent drie methodologische problemen.

Ten eerste, er is niet altijd een ondubbelzinnige en objectieve methode voorhanden om de specialisatiefactor van een bedrijf te bepalen, wat betekent dat de specialisatiefactor niet geheel objectief kan zijn.

Ten tweede wordt dezelfde specialisatiefactor toegepast op de economische indicatoren werkgelegenheid, toegevoegde waarde, productie en handel, terwijl deze verhouding niet voor elk van deze indicatoren dezelfde hoeft te zijn.

Ten derde wordt de specialisatiefactor als een constante beschouwd. Een bedrijf dat een stabiel aantal werknemers heeft, kan in de loop van de tijd meer van deze werknemers toewijzen aan duurzame energie gerelateerde activiteiten. Om deze reden maakt dit rapport onderscheid tussen gespecialiseerde en niet-gespecialiseerde bedrijven, omdat ontwikkelingen in gespecialiseerde bedrijven minder 'last' hebben van niet-geobserveerde ontwikkelingen in de specialisatiefactor en daarom een nauwkeuriger beeld van de SES kunnen geven.

E-SES

Een alternatieve berekeningsmethode is ontwikkeld voor de cijfers in de E-SES. Deze methode is niet gebaseerd op informatie op bedrijfsniveau (micro data), maar op informatie over de fysieke productie van hernieuwbare energie op mesoniveau. (CBS, *Hernieuwbare energie in Nederland* , 2012).

Verder zijn de E-SES cijfers voor 2008 en 2009 aangepast, omdat in dit rapport ook de productie van biobrandstof onder de E-SES valt, terwijl dit in de eerdere rapporten onder de P-SES viel. Ook de prijsindex die is toegepast is herzien.

1. Introduction and background

In this introduction we present both the objective (1.1) of this study and some background information (1.2) on the relevance of the sustainable energy sector for the Dutch economy.

1.1 Motive, purpose and structure of this report

The increasing importance of sustainable energy sources brings economic opportunities both within the Netherlands and abroad (exports). Economic, technological and geopolitical developments have the potential to make the sustainable energy sector (SES) one the fastest growing industries in the Netherlands (Ecorys, 2010). This study aims to monitor whether these opportunities have been realised in the recent past. The SES includes both energy producers and manufacturers of machinery, researchers, transport and storage companies and other companies active in the value chain of sustainable energy goods and services. The SES comprises industries in energy saving, renewable energy systems as well as industry profiles that make fossil energy relatively more sustainable (e.g. carbon capture and storage (CCS)). In the development of the SES there is a prominent role for both the leaders and innovators in the industry itself and the sector's policymakers. It could be said that the outset status of the SES is comparable to the outset status of the Dutch coal and gas industry decades ago. And as those (or any new) sectors, the SES is likely to experience teething problems. Appropriate energy-industry policies (Energy report 2011) can reduce part of these problems and help to make sustainable energy competitive with its conventional competitors more quickly. This is important, as a large part of the sustainable energy market is still an infant industry in development. In order to reduce these teething problems without creating a largely subsidy-driven SES requires intelligent policy that, in turn, requires a comprehensive overview of the energy market. Here we should note that, like all markets, the sustainable energy market has both a deployment/innovation and supply-side.

From an economic policy viewpoint, the economic data on the SES are more valuable when they can be combined with data on physical quantities on energy production and other environmental indicators. Therefore, the Ministry of Economic Affairs (EZ) requested Statistics Netherlands for a supply-side overview of the current Dutch sustainable energy market, providing insight in various types of economic indicators such as the sector's value added, employment, exports, imports, investment and innovation. Finally, the SES plays an important role in the aim for 'Green growth', or sustainable growth, which is high on the Dutch political agenda (Ministerie van EZ, 2013). This subject will be discussed in more detail in section 6.

This report is a continuation of the SES radar 2012 and contains nine sections.

The first section discusses the motive of this study and the relevant policy context.

Section 2 covers the definitions, concepts and methodology used in order to compile the economic figures for the SES in this report.

Section 3 presents figures for the core economic indicators for the SES (2008 – 2011). Core economic indicators like value added, production and employment are presented in this section. Also figures on international trade (exports, imports) and capital formation are presented in section 3 A regional analysis (provinces and COROP) has been conducted for the year 2010.

Section 4 discusses the possibility to compile figures on foreign direct investment in the SES . The companies that are part of the E-SES are often (interconnected with) companies in the conventional energy sector (some electricity producers are both producing renewable based electricity as well as fossil based electricity). The electricity, gas, steam and air conditioning supply corresponds with NACE class 35. On request of Statistics Netherlands, DNB has made an overview of FDI for this NACE class between 2008 and 2011.

Section 5 discusses economic figures for the Topsector Energy. Dutch policymakers have defined nine Topsectors, which represent, for different reasons, important sectors of the Dutch economy. In this section we take a closer look at the Topsector Energy . One important element of the Topsector Energy is the pre-exploitation phase of the SES .

Then in section 6 the SES is discussed in the context of Green growth, which is high on the Dutch political agenda (Ministerie van EZ, 2013). The current Dutch government is committed to realizing economic growth while reducing the depletion of natural resources and other environmental impacts. Greening the economy brings opportunities for entrepreneurs to create new jobs and stimulate growth. More on this topic in section 6.

Section 7 discusses recent developments of innovation in the SES by means of an analysis of patent applications. Patents are direct results of innovation and are therefore indicative for the quality of R&D in the SES. Specifically for this report, the patents department of NL Agency collected a number of patent statistics, which we describe in section 7.

Section 8 discusses the plans of Eurostat with respect to monitoring the Environmental Goods and Services Sector (EGSS), which in the future will put the SES radar in an international perspective. It is important to note that in an accounting context, the SES is part of the 'environmental goods and services sector'. The European Commission is right now preparing a legal base for the EGSS.

Finally, section 9 contains the conclusions and some recommendations for further research.

1.2 Policy context

The Dutch economy has a tradition of substantial economic activity in the energy sector. Where the first half of the 20th century was characterised by the extraction of coal in the south of the Netherlands, the second half was characterised by the extraction of natural gas in the north of the country. Furthermore, the port of Rotterdam serves as a gateway for all kinds of fossil fuels to the inlands of Europe, constituting economic activity in both the refinery and distribution of fossil fuels. Although fossil fuels are on a global scale still the main source of energy, there is a growing awareness that there is a need for alternative energy sources. Also in European policy documents robust trends as electrification and the increasing share of new energy systems has been elaborated (Communication by the EC of EU energy roadmap 2050, 15 December 2011). The increasing importance of sustainable energy sources has become self-evident and indicates a new global and European perspective on energy consumption and production. Also the comparative economic advantage of a good functioning energy systems in the creation of a decarbonised, competitive and secure energy sector in both the EU and at the national level. This is reflected by increasing investments in renewable energy worldwide (e.g. Clean Energy Progress Report (OECD/EIA, 2011))

and in the national and international climate and energy goals. The public debate also revolves around public spending on incentives for households and companies.

Recent economic policy in the Netherlands is characterised by the formulation of nine 'topsectors'. The objective of this policy is to further strengthen economic activities where the Netherlands holds a strong worldwide position (www.rijksoverheid.nl). The economic activities discussed in this study are part of the top sector Energy. Economic data have been used by the SER in elaborating the 2013 'Energieakkoord'[3].

More economic data on energy and the SES in particular is important for several energy policy goals at national and European level, which we will discuss here.

Imports dependency

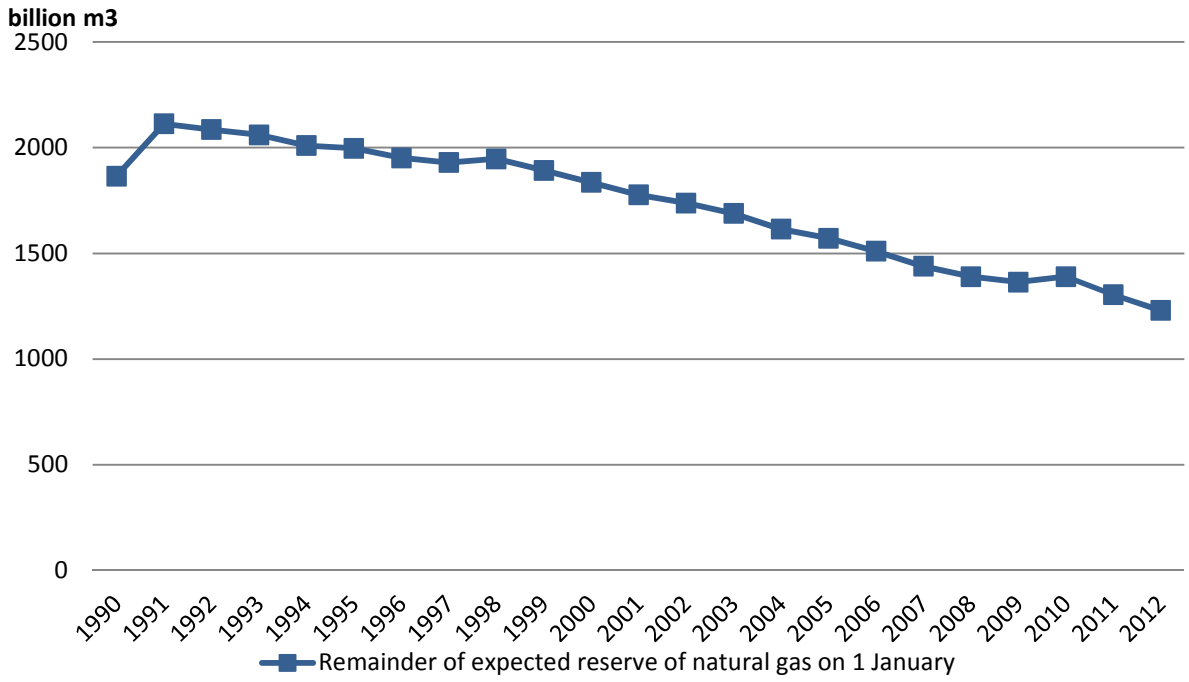
Geopolitical factors are a motive for the development of the SES. Fossil fuels are either extracted from a country's own territory or imported from other countries. If a large amount of resources are imported, an economy dependents highly on other countries and therefore plays an important role in the political debate. However, it is not easy to develop an indicator on import dependency with a clear interpretation.

Limited fossil energy reserves

In this geopolitical context it is also interesting to look at the Dutch gas reserves in more detail. Since the discovery of these natural reserves in the 1950s and 1960s they have been used for the Dutch economy. Revenues from oil and gas extraction contributed around 3 per cent on average to total government revenues in recent years. Although new reserves are discovered occasionally, more than two-thirds of the initial reserves have already been extracted (as far as currently known). At the end of 2012, the remaining expected reserves of natural gas in the Netherlands were estimated at 1 130 billion standard cubic metres (Sm^3). Assuming that net annual production remains constant at its 2012 level, Dutch natural gas reserves will last till 2026. Figure 1.2.1 below presents the decrease of the Dutch gas reserves in the period 1990–2012.

[3] Energy Agreement for Sustainable Growth by over 40 Dutch governmental and non-governmental organisations as well as financial institutions. This agreement aims to promote energy saving and cleaner energy technologies in the Netherlands while creating job opportunities and opportunities for export (SER, 2013)

1.2.1 Remainder of expected reserve of natural gas on 1 January

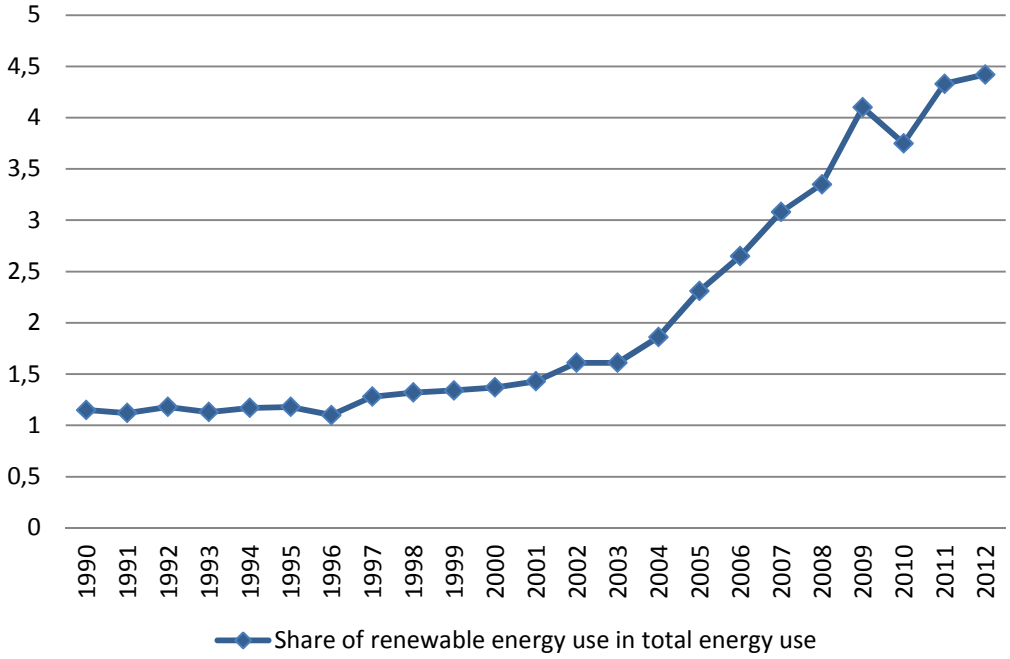


Source: Environmental accounts of the Netherlands, 2012 (forthcoming)

Energy transition

The production and consumption of new energy sources is increasing over time (see figure 1.2.2). Focussing on the use of renewable energy and compared with total energy consumption, there has been a relatively modest increase between 1990 and 2003. After that this share started to rise more rapidly, partly as a result of government support on the production of renewable electricity. A second effective government measure was the obligation for suppliers of petrol and diesel on the Dutch market to blend their products with bio fuel. The obligated share of biofuel increased gradually over time. Therefore between 1990 and 2012 the share of renewable energy in the total energy consumption in the Netherlands grew from 1.2 per cent in 1990 to 4.4 per cent in 2012 (Hernieuwbare Energie in Nederland (in Dutch), 2012 & Statline, Statistics Netherlands, 2013). This is still well below the European target of 14 per cent by 2020. Considering electricity only, the production from renewable techniques is about 10 per cent of the total production in 2011 in the Netherlands (Statline, Statistics Netherlands). At local level, consumers, local governments and new institutions are actively trying to create a better investment climate for new energy systems making grid parity (i.e. electricity from renewable sources is competitive with traditional electricity production) in reach. Imported Asian solar panels have increased market shares. Industries in the Netherlands play an important role in making and developing the technology and services for the complex machinery connected to these new energy systems (Ecorys 2010). The recent introduction of the 2013 'Energieakkoord' as negotiated by more than forty organisations and the SER is meant to give guidance and further impetus to energy savings(buildings and industry), the introduction of new energy systems, innovations and economic performance of the SES and related clean tech sector.

1.2.2 Share of renewable energy sources in total final energy use



Source: Statistics Netherlands, StatLine, 2013

In an international perspective it is interesting to compare the Netherlands to other countries in the European Union. The Eurostat website provides figures for the share of energy consumption that is produced by renewable sources. It shows that the Netherlands is lagging well behind to other countries.

Climate change

Most economies have grown in the past decades. In addition to benefits, economic growth has had some harmful side effects. Fossil fuels, in particular oil, and other natural resources that enable economic growth are becoming increasingly scarce, which might hamper future growth. Also there is substantial scientific evidence (IPCC, 2007) that global critical boundaries such as climate change have been exceeded. Under current conditions, the Netherlands is set to realise its Kyoto targets (PBL, 2010). However, with respect to the year 1990, from a production perspective only relative decoupling for greenhouse gas emissions is taking place. Although the growth rate of greenhouse gas emissions from production processes was lower than GDP growth, the total volume of emissions has not decreased.

2. Concepts, definitions and methodology

This chapter provides a detailed description of the activities included in the sustainable energy sector (scope and boundaries, section 2.1). The methods applied to compile the economic indicators for the SES are presented in section 2.2. Lastly, section 2.3 contains the definitions of the economic variables (e.g. production, value added and export). The economic results of the SES over the years 2008-2011 are presented in chapter 3.

2.1 Delineation and classification of the sustainable energy sector

The present report is not the first study on the Dutch SES. At the request of EZ, Ecorys conducted a study on the SES in 2010, (Ecorys, 2010). That study defined the SES as follows:

"Sustainable energy is the energy we can use indefinitely without compromising the environment and the possibilities for future generations. Sustainable energy, better called pure renewable energy, is not generated by using fossil fuels or chemical minerals, which are all finite. We assume that the sun, water and the air are infinite sources. From an economic perspective and the 'Trias Energetica' we also look at activities with a direct impact on sustainable energy policy in manufacturing. So energy saving will be dealt with (less energy consumption means less energy production) but we also examine activities such as developing the grid, electric transport, hydrogen technology, and capture and storage of CO2 (CCS)." (Ecorys, 2010).

SES contains companies active 16 product profiles as in energy saving, renewable energies and companies making fossil energy more sustainable such as CCS.

Furthermore, the results of the Ecorys pilot study, together with the results and methods of the first 'SES radar' published (in Dutch) by Statistics Netherlands in 2011 (CBS, 2011a) and the subsequent SES radar 2012 (CBS, 2012a) serve as benchmarks for the present study. This study presents and discusses similar but more recent data, thereby constituting a structural monitoring system for the SES. Furthermore, while the SES radar 2012 mainly presented data over 2008 and 2009, which was the most actual data available at the time, this report presents data for the years 2008, 2009, 2010 and 2011.

It should be noted that the above definition does not clearly specify the role of biomass. Iin this report it is considered a relevant part of the sustainable energy sector.

The structure in which the data is presented is designed with the economic value chain in mind. First, the SES is separated into two sub-sectors, the pre-exploitation phase (P-SES) and the exploitation phase (E-SES). Ecorys (2010) defined them as:

Pre-exploitation phase (P-SES): Companies active in value chains preceding the exploitation phase, such as the production of renewable energy systems, R&D focusing on sustainable energy technologies, transport of wind turbines, trade in biomass. Also included are companies and institutions dealing with energy saving (see box I below).

Exploitation phase (E-SES): The actual production of renewable energy (operation and maintenance).

The P-SES mainly concerns companies and institutions involved in activities that precede the physical production of sustainable energy: for example the development and production of solar cells, wind turbines and frugal energy technologies. This is heterogeneous group of companies, active in many different industries. Electric power companies are not included in the P-SES. Most of their activities in renewable energy relate to deployment and these activities are part of the exploitation phase in this study.

In general the E-SES follows after the P-SES and mainly concerns the physical production of energy, e.g. wind turbine operators or the production of energy carriers using solar panels. It is interesting to distinguish the two sectors, as the P-SES is more R&D intensive while the E-SES is much more capital intensive. Furthermore, the P-SES is of particular economic interest due to its high-level employment, while the E-SES indicates the stage of new energy deployment in the Netherlands. Moreover, this distinction allows us to investigate whether investment in technological innovation is reflected in increased use of sustainable technology in the Netherlands.

In contrast to other studies (Ecorys, 2010 and Roland Berger, 2010), this study is limited to quantifying activities that have a direct relation to the SES, while indirect effects (spillover effects) on other sectors are not included. the exploitation phase (E-SES). To give an indication of the indirect effects, Ecorys (2010) considers them to be a factor 2. On the other hand, this study does not consider possible negative effects like loss of jobs in the conventional energy.

This framework distinguishes different processes and products within the SES. More precisely, the sustainable energy sector is broken down into sixteen product profiles (table 2.1.1) and seven process profiles (table 2.1.2).

2.1.1 Overview of product profiles

1. Solar PV
2. Solar - Concentrated Solar Power (CSP)
3. Solar thermal energy
4. Biogas
5. Biomass (solid) & waste
6. Biofuels (including the production of bio fuels)
7. Bio-refining
8. Wind on shore
9. Wind off shore
10. Aerothermal & geo thermal energy
11. Energy from water
12. Energy saving
13. Electric road transport
14. Smart grids
15. Hydrogen technology
16. CO2 capture and storage (CCS)

2.1.2 Process profiles

The value chain of the SES can be outlined in distinguishing 7 processes:

1. R&D
2. Consultancy

3. Transport (of biomass, wind turbines, etc.)
4. Preparation/raw material production
5. Supply, assembly and construction
6. Production of energy carriers
7. Installation and maintenance

Box I Energy saving

The delineation for the product profile 'energy saving' is not straight forward in itself. Energy saving includes activities aiming at the minimisation of the intake of energy sources through in-process modifications as well as the minimisation of heat and energy losses.

The manufacturing of insulation materials holds a major share in the product profile 'Energy saving'. To the contrary, insulation installation activity in houses and other buildings is not included in this profile so far. A preliminary estimate of this installation activity has been calculated based on the share of insulation costs (CBS, 2010 Environmental protection expenditures in the building industry) in total construction costs of houses and other buildings. The result is an estimate of about 6 000 FTE in 2011, a decrease of 9 per cent from 2008. Production and value added are estimated 800 million euros and 400 million euros in 2011, respectively. Like employment, both production and value added decreased 9 per cent since 2008. This estimate is heavily influenced by overall developments in the Dutch construction industry, which is heavily affected by the global financial crises and the on-going European debt crisis. Future improvement of the methodology is desirable as the share of insulation activities of existing houses and other buildings may grow (independently from the overall construction industry) in the future, especially since it is promoted by the 2013 'Energieakkoord'[4]. These figures for the insulation installation phase are not included in the 'Radar' totals so far. These figures can be found in Environmental accounts of the Netherlands, 2012 (CBS, 2013b, forthcoming).

Other activities which are included in the profile 'Energy saving' are consultancy and engineering in the field of energy efficiency. Sustainable architecture is not included as it is difficult to differentiate common practice from high energy efficiency design. Also excluded is the trade (whole- and retail trade) in energy efficient consumer electronics (like washing machines or dish washes) or fuel efficient vehicles. Producers of energy efficient boilers are excluded except for their solar boilers, which are included in the 'Solar' profile.

The delineation of the 'Energy saving' profile is quite narrow in theory and even more so in practice. Only companies that are identified by certain research or branch organisations (e.g. Association of Suppliers of Environmental technologies (VLM), ECN, Ecorys or NL Agency) or Statistics Netherlands are included in the figures. They include companies active in the building materials industry as well as companies working on industrial savings technology. Starting point for the compilation of the figures is always the population database.

[4] Energy Agreement for Sustainable Growth by over 40 Dutch governmental and non-governmental organisations as well as financial institutions. This agreement aims to promote energy saving and cleaner energy technologies in the Netherlands while creating job opportunities and opportunities for export.

International context

Finally, it is important to note that in a national accounting context, the SES is part of the 'environmental goods and services sector', for which Statistics Netherlands has developed a new set of statistics[5]. These statistics are the result of a European (Eurostat) handbook on guidelines to construct European statistics that structurally monitor the Environmental Goods and Services Sector. These statistics are also part of the System of Environmental Economic Accounting (SEEA), which has been formally adopted by the statistical department of the United Nations in 2012. The SEEA describes an international system of harmonised concepts for the compilation of environmental accounts.

2.2 Methodology

The data for both the P-SES and E-SES are compiled in different ways. In this section we discuss the two underlying methodologies for both sectors.

2.2.1 Pre-exploitation phase

In 2011 Statistics Netherlands designed a population of companies from its business register in which all the companies belong to the P-SES (i.e. P-SES 2011 population). The basis for this population were the companies that belong to the environmental goods and services sector, which was already monitored by Statistics Netherlands. Ecorys and Energieonderzoek Centrum Nederland (ECN) supplied additional companies to complete this population of companies. These companies can be linked with the Dutch business register, which allows Statistics Netherlands to derive economic indicators specific to this set of companies. Such an approach is generally referred to as a 'microdata approach'.

This population served as the starting point in this report as well. However, the population has been substantially updated and revised. In order to perform this update, a selection of data sources have been consulted. The department of energy statistics at Statistics Netherlands, ECN , NL Agency (subsidy and patent department) and PolderPV all shared a list of companies that, according to them, might potentially be active in the SES. Furthermore, a set of potential SES companies was collected by looking at start-up companies from Dutch technical universities. Finally, websites of trade associations of the SES were used to identify additional companies. The total collection of new companies were all studied and classified as being part of the SES or not. This procedure led to the updated P-SES 2013 population.

Due to the revision, figures for reporting years 2008 and 2009 are different in this report compared to the figures presented in the SES Radar 2012 for two reasons. First the population has been updated and second specialisation factors at micro level have been revised. It should also be noted that in contrast to the SES Radar 2012 the production of biofuels is now included in the figures of the E-SES instead of in the figures of the P-SES.

[5] http://statline.cbs.nl/StatWeb/publication/?DM=SLEN&PA=81400ENG&D1=a&D2=a&D3=0&D4=14-15&LA=EN&VW=T

The fact that a large set of companies is only partially active in sustainable energy related activities deserves special attention. For instance, a company that installs and maintains solar installations is often also active in traditional construction activities. Or companies that are active in sustainable energy research might also allocate part of their research capacity to environmental related research. The SES radar deals with this phenomenon by expert guessing a so called 'specialisation factor' (a number between zero and one). This factor indicates the share in which a company is active in the P-SES, which implies that only this share of a company's is considered part of the P-SES. There are three main methodological problems with this approach. First, there is no unambiguous and objective method available to determine a company's specialisation factor, so the specialisation factor is affected by the subjectivity of the expert's opinion. Second, this share is applied identically and consistently over employment, value added and production figures, ignoring the fact that it might differ per variable. Third, the specialisation factor is considered constant over time, which implies that developments in the specialisation factors are not considered. This implies, for instance, that when a company has a stable number of employees and allocates more employees to sustainable energy related activities, this is not observed in the figures presented in this report. This second problem applies mainly to companies that are not fully specialised, because it is not unreasonable to assume that these companies switch easier between business activities, in contrast to specialised companies. For this reason, the figures presented in this report generally distinguish between specialised and non-specialised companies, because the trends observed in specialised companies might represent the general trends in the SES more accurately.

The P-SES includes the complete value chain of sustainable energy sector except for the operational activities, which are part of the exploitation phase. The P-SES consists of activities, such as research, transport and manufacturing, which belong to many different NACE classes. This value chain approach demonstrates the contribution of renewable energy products and energy saving to the Dutch economy (*Economische radar duurzame energiesector*, Statistics Netherlands , 2011).

2.2.2 Exploitation phase

An alternative computation technique was developed for the E-SES. This approach is based not on company level information (micro data) but on industry level information (meso statistics). At industry level, Statistics Netherlands has access to high quality data about the physical production of the various sustainable energy techniques (*Hernieuwbare energie in Nederland* , Statistics Netherlands). This data is combined with both price information on energy (source: National Accounts, international trade data and energy statistics) and information on maintenance and operational costs (ECN, 2008 & 2009)). See for more information also the Radar 2011.

All data collected for both the P-SES and E-SES are presented in such a way that they are comparable with the data presented in the SES radar 2011 (van Rossum et al., 2011) and the SES radar 2012 (Vuik et al. 2012). Furthermore, as this report will be publicly available, all data are aggregated and presented in such a way that the results are anonymous with respect to individual companies.

2.2.3 Export and import figures

The export and import figures are, for the most part, compiled by the same method as the employment, value added and production figures of the P-SES figures, using the company level

specialisation factors. The companies in the P-SES are simply linked to the import and export data in goods. However, for biofuels and biomass the figures are compiled directly from the trade in goods database, because they can be directly linked to specific good codes[6]. This is important, because a large part of trade of companies that are involved in trade in biofuels and solid biomass also import and export other conventional energy carriers. Furthermore, it is important to note that the method leaves room for improvement. First because the scope of the GN codes is in particular cases not specific enough, which is a problem because some goods might have multiple purposes. Second, the figures only contain trade in goods and not in services, because appropriate data on the company level (business unit) is not available for trade in services.

2.2.4 Gross capital formation

To monitor gross capital formation developments in the exploitation phase of the sustainable energy sector (E-SES), data of NL agency has been used. Companies can request a subsidy (i.e. tax exemption) if they think their capital formation projects comply with the EIA (Energie Investeringsaftrek regeling) criteria. Every year NL Agency publishes a detailed overview of these requests (see NL Agency (2011, 2010, 2009)). Figures for the E-SES are based on the EIA data. Figures for the P-SES are based on the gross capital formation survey data that is available at Statistics Netherlands (using the company level specialisation factors).

2.3 Definitions of the economic indicators

This study uses the same definitions and concepts as the System of National Accounts (SNA). This system provides a quantitative description of the economic process within a country and its economic relations with other countries. It distinguishes production, accumulation and distribution of income, spending and finance. All these concepts are determined based on the resident-principle. Residents are all persons and companies that belong to the Dutch economy. Any person or company (including companies under foreign control) residing in the Netherlands for longer than one year belongs to this group of residents. We use several key concepts from the SNA to monitor the SES: production, value added and employment (in full- time equivalents (FTEs)). Export, imports and capital formation are part of SNA framework as well. The figures on innovation and R&D are not explicitly part of SNA, all concepts are also defined below.

Production or output (basic prices)

Production covers the value of all goods produced for sale, including unsold goods, and all receipts for services rendered. It also includes the market equivalent of goods and services produced for own use, such as own account capital formation, services of owner-occupied dwellings and agricultural products produced by farmers for own consumption. Production is valued at basic prices, defined as the price received by the producer excluding trade and transport margins and the balance of taxes and subsidies on products. This is the price the producer is ultimately left with.

[6] The following international trade codes (GN) are included: 22071000, 22072000, 29091910, 38249091, 15111010, 15111090, 15119091, 15119099, 44013020, 44013040, 44013080.

Gross value added (basic prices)

Gross value added at basic prices by industry is equal to the difference between output (basic prices) and intermediate consumption (purchasers' prices). Gross means inclusion of consumption of fixed capital. All value added figures in this report are gross value added figures, unless specified otherwise.

Employee (fte)

A person working for a company, an institution or private household located in the Netherlands. Full-time equivalent (fte): a measure of labour volume, calculated by converting all full-time and part-time jobs to full-time jobs

Exports of goods

Exported goods are goods that have been exported by residents from the Dutch economic territory to the rest of the world. Exports of services include services of Dutch transport enterprises abroad, port services, ship repair services and engineering works by Dutch contractors abroad. Also included in exports of services are expenditure by foreign tourists, inhabitants of border areas and diplomats in the Netherlands.

Imports of goods

Imported goods are goods intended for residents that are imported from abroad into the Dutch economic territory. These include raw materials, semi-manufactured products, fuels and final products. They also include imported goods which are re-exported without undergoing any processing. Imports of services include among other things expenditure abroad by Dutch tourists, inhabitants of border areas and diplomats.

Gross fixed capital formation

Expenditure for produced tangible or intangible assets that are used in the production process for more than one year, such as buildings, dwellings, machinery, transport equipment, etc.

2.4 Revision impact on previous radar figures.

For the SES Radar 2013, the SES company population that was used for the SES radar 2011 and 2012 has been under scrutiny. This led to a revision in the population of companies that constitute the P-SES figures in earlier reports. Also the E-SES figures have been revised by implementing new insights (production of households in now included (scope) and new data on intermediate consumption and price developments have been utilised). In order to investigate the impact of this revision, table 2.4.1 below compares a set of core economic indicators for the year 2009, for which figures are presented in both reports.

2.4.1 Core indicators for SES for the year 2009 in radar 2012 and 2013

Revision effect	Radar 2012	Radar 2013	% difference
FTE's 2009	16 700	17 800	7%
Production 2009	4 800	5 560	16%
Value added 2009	1 750	2 210	26%

The radar 2013 constitutes higher levels of employment, production and value added. This is easily explained by the increased number of companies in the population. It is interesting to compare the differences in FTE, production and value added. Overall it could be said that the figures of both radars are of the same order of magnitude. The magnitude of the adjustments is different per indicator. The relative small adjustment for employment is solely the result of adjustments in figures for the P-SES (change in the population). The relative large adjustment for value added and to a lesser extent production are the result of a combination of factors. First of all the population of the P-SES has changed (more units in the population). Furthermore, the E-SES figures for value added and production have also been revised for the years 2008-2009. The E-SES is relative labour extensive so the effect of these revisions have relatively little impact on adjustments in employment.

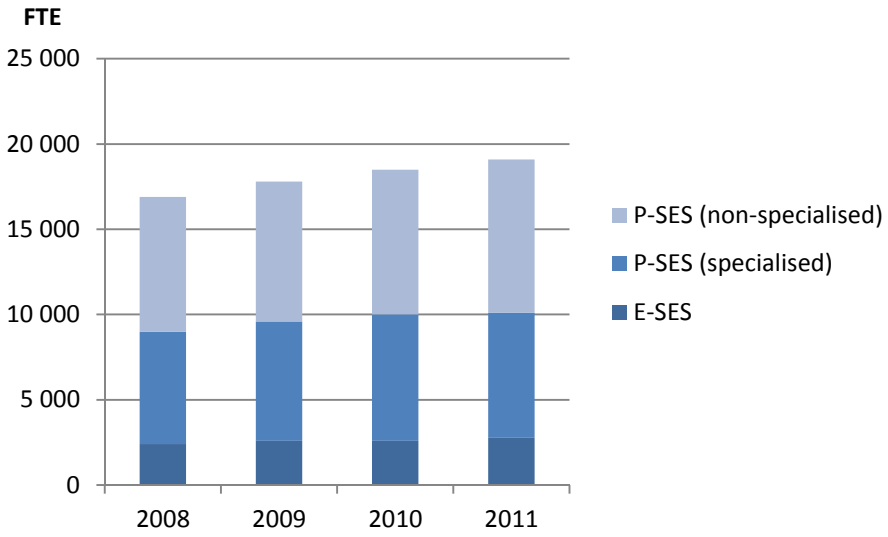
3. Economic data for the sustainable energy sector over the period 2008 - 2011

In the next sections the results are presented for the key-indicators of the SES: employment, production, value added, international trade and capital formation. Currently, the data has the status 'preliminary', which implies figures might be subject to future changes due to the availability of new data sources and/or new insights or classifications.

3.1 SES figures for employment, value added and production

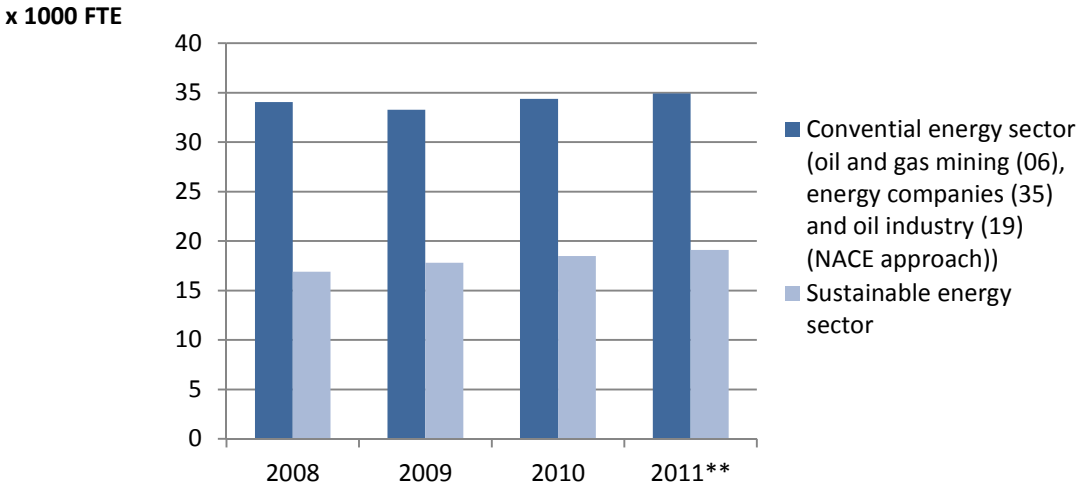
This section presents figures for employment, value added and production for the SES as a whole. The figures concern the period 2008 – 2011 and distinguish between the P-SES (specialised and non-specialised companies) and the E-SES.

3.1.1 Employment (FTEs) in the SES over the period 2008 – 2011



Over the period 2008 – 2011 we see a sustained and stable increase in employment across all three SES categories. Overall employment increased from 16.9 thousand FTEs in 2008 to 19.1 thousand FTEs in 2011, an increase of nearly 13 per cent in four year. The bulk of employment consists of jobs in the P-SES, where we see an increase in employment in both the specialised and non-specialised P-SES companies. This increase is remarkable in the light of the employment developments in the total Dutch economy, where employment decreased with 1.2 per cent in the period 2008 – 2011.

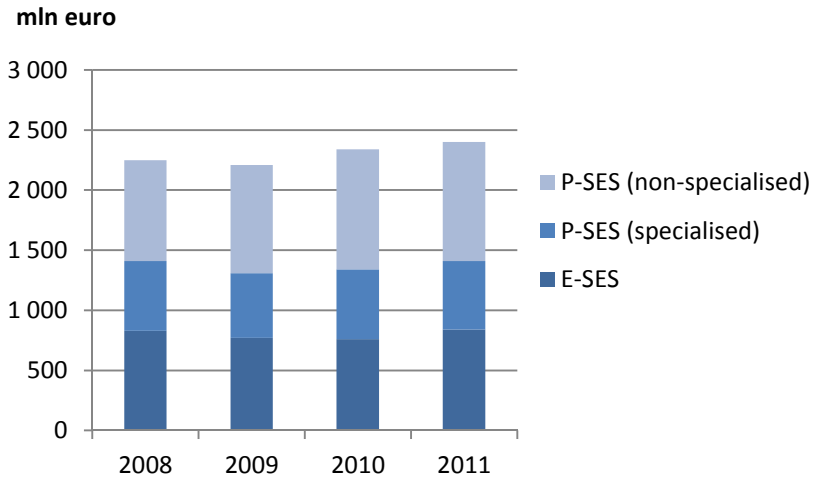
3.1.2 Comparison with conventional energy sector



The sustainable energy sector can be compared to the conventional energy sector. The conventional energy sector can be defined as the sum of the NACE classes: Oil and Gas Mining and Quarrying, Manufacture of coke and refined petroleum products (19) and Electricity, gas, steam and air conditioning supply (35) . In terms of employment, the conventional energy sector is almost twice as large as the sustainable energy sector. It is important to note that the figures for the sustainable energy sector are not directly comparable with those of the conventional energy sector because of some concept differences affecting the figures of both sectors. The sustainable energy sector uses the so called 'value chain approach' while the presented figures for the conventional energy sector are based on the NACE scope concept. The NACE classification system does not use the value chain concept. The conventional energy sector as defined here includes only the exploitation phase (production of energy carriers) and not the pre-exploitation (conventional) activities.

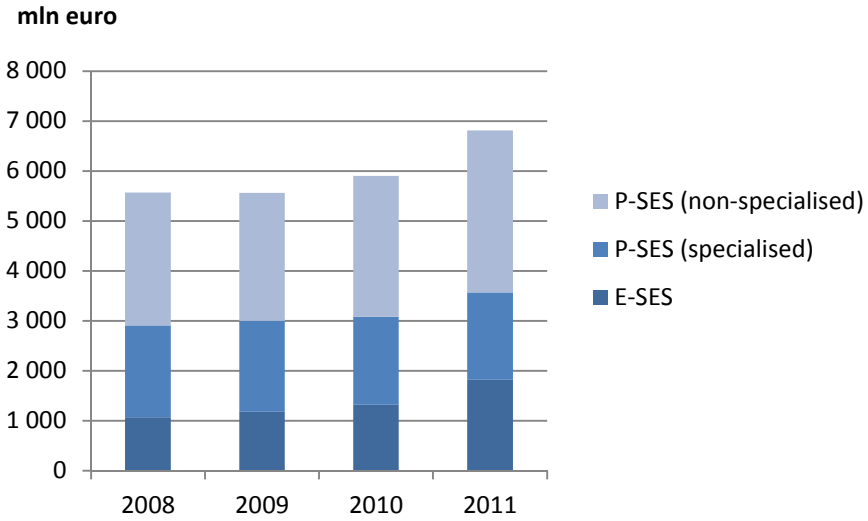
Activities of the sustainable energy sector by companies assigned to NACE classes of the conventional energy sector are excluded from the conventional energy sector.The overlap in figures has been corrected. There is as a consequence no double counting.

3.1.3 Value added (mln euros) in the SES over the period 2008 – 2011



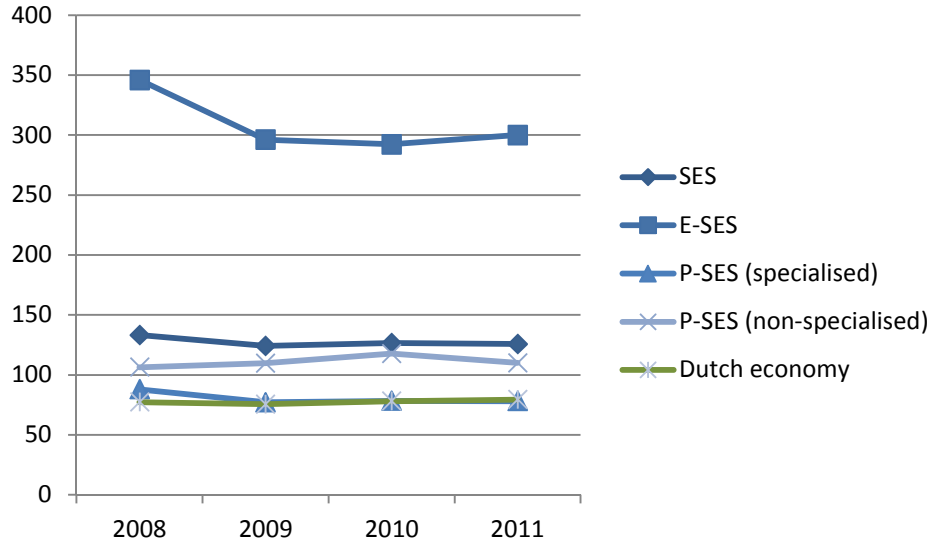
The gross value added in current prices (includes inflation) over the period 2008 - 2011 shows a more diffuse picture. Here it should be noted that there is no inflation correction because inflation is based on a 'basket of various goods' that is not necessarily representative for prices in the SES. However, because part of the growth in value added might still be a price/inflation effect, the employment figures should be considered more representative for the growth in real terms in the SES. Overall the value added of the sector increased from 2.25 billion euro in 2008 to 2.40 billion euro in 2011, an increase of around 7 per cent. Over this whole period (2008 – 2011) the price index of GDP was equal to 2.0 per cent. However, where the non-specialised companies in the P-SES showed an increase of around 18 per cent in value added, the value added of both the specialised companies in the P-SES and the companies in the E-SES remained quite stable.

3.1.4 Production (mln euros) in the SES over the period 2008 – 2011



The production in current prices of the SES over the period 2008 – 2011 increased from 5.6 billion euro in 2008 to 6.8 billion euro in 2011, an increase of around 22 per cent. The E-SES companies (+ 70 per cent) and the non – specialised P-SES (+ 22 per cent) companies that sustain this growth, whereas the specialised companies in the P-SES have slightly decreased their production (- 5 per cent). The spectacular production growth of E-SES companies is mainly due to a large increase in the production of bio-fuels, which is the result of a number of new biofuel production facilities that were put into operation in the period 2008 – 2011.

3.1.5 Value added per FTE (x 1000 euros) in the SES over the period 2008 - 2011



It is interesting to look at the trends of value added per FTE over the period 2008 – 2011. The value added per FTE in the E-SES is substantially higher than in the P-SES as this is a more capital intensive industry. It is interesting to note that the non-specialised companies have on average a higher value added per FTE than the specialised companies. This difference (between specialised and non-specialised) could be due to relatively low capital intensiveness of specialised P-SES activities compared to the relatively high capital intensiveness of non-specialised P-SES activities. The specialised P-SES consists of relatively a lot of small companies while the non-specialised P-SES consists of relatively a lot of big companies. Big companies are, generally speaking , more capital intensive than small companies. Finally it is interesting to see that overall the SES has a higher value added per FTE than the average in the Dutch economy.

In order to put the SES in a macro perspective it is interesting to compare its indicators with its corresponding indicators on the macro level (i.e. the Dutch economy).

3.1.6 SES indicators in relation to the Dutch economy over the period 2008 - 2011

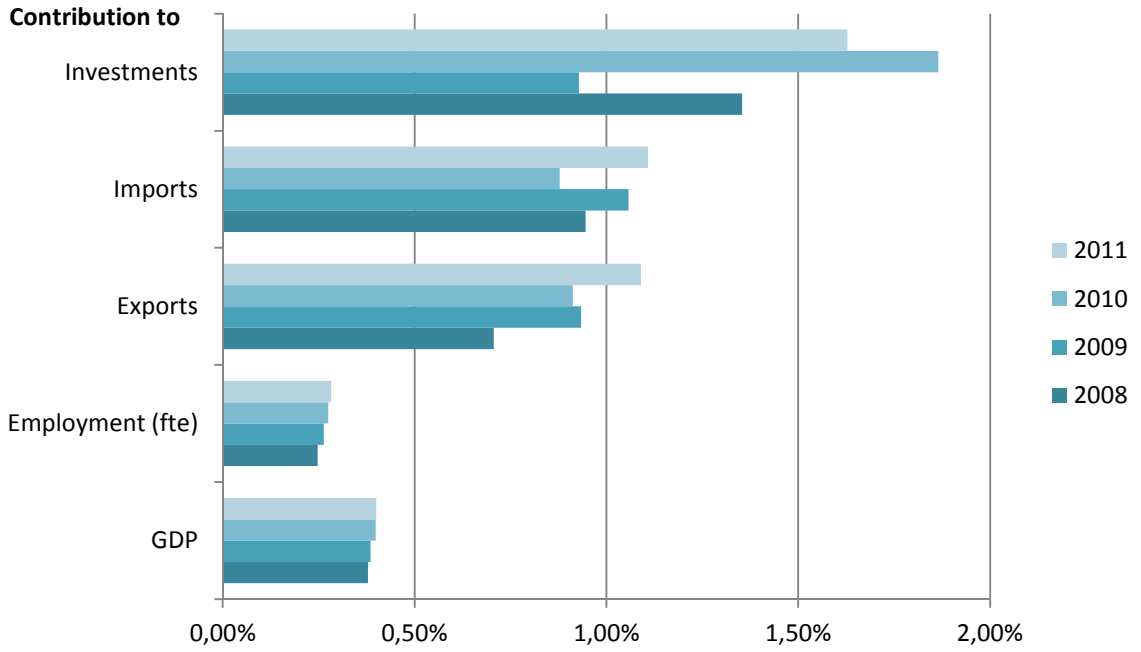


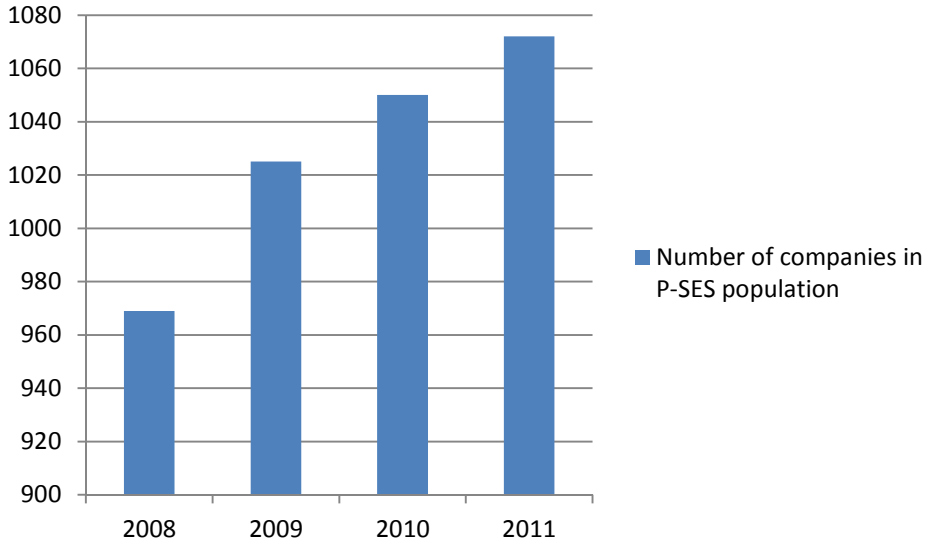
Figure 3.1.6 indicates that the SES is a small sector that is slowly gaining substance in the Dutch economy, as for each indicator its contribution has been increasing over time. In fact, in 2011 all indicators attained their highest share over the past four years. Moreover we see that the SES has a relatively strong representation within the investment, export and import statistics, as compared to its share in employment and GDP. The figures of investment and international trade in the SES show a high volatility. This indicates that the SES is an internationally oriented sector that can attract relatively large sums of investments.

This section discussed the SES from an aggregated perspective. The next section zooms in on the various energy technologies and business activities that constitute the SES. The increased level of detail might shed some further light on the background of the patterns that are observed in this section.

3.2 Economic key figures – pre-exploitation phase

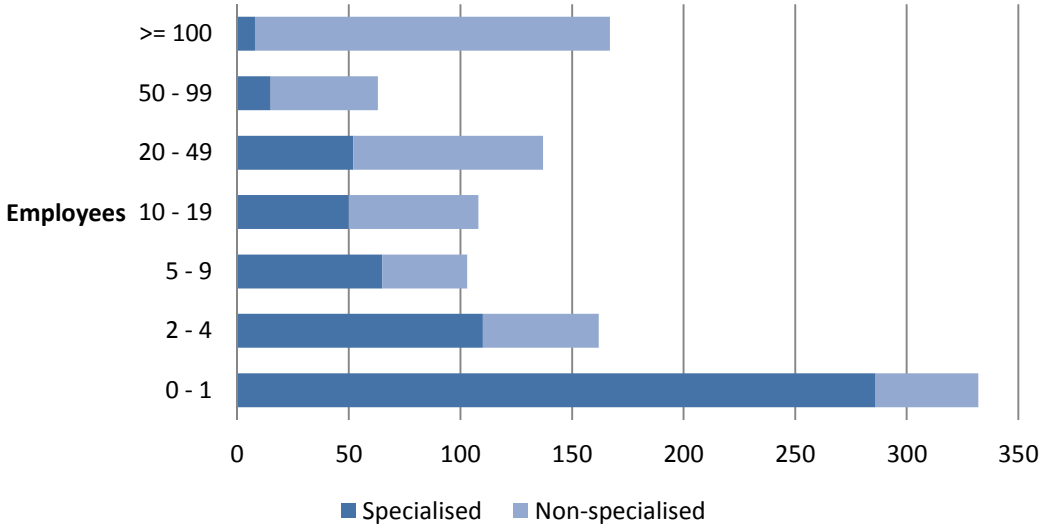
This section first presents figures of the pre-exploitation phase of the sustainable energy sector. It presents some basic figures like the number of units and the distribution of these companies in terms of employment. Next this section presents detailed time series figures on both employment and value added in the P-SES, separated by product profile, process profile activity and specialised/non-specialised. The product and process profiles are presented in a more aggregated order of detail, where the aggregation level is determined by confidentiality regulations and reliability of the figures.

3.2.1 Number of statistical units in P-SES over the period 2008 - 2011



The number of statistical units ('companies') in the P-SES has been steadily increasing over the period 2008 – 2011. The development in this period was + 6 per cent in 2009, + 2 per cent in 2010 and + 2 per cent in 2011. In 2011 the P-SES consists of 1 072 companies. Starting point of the compilation of these numbers is the P-SES population database.

3.2.2 Number of companies by company size, employed persons



The bulk of companies are companies with one employed person, which in fact are one-man businesses. It is also apparent that especially the smaller companies are relatively specialised and the bigger companies are relatively non-specialised.

3.2.3 Employment in 2011 by product profile in the P-SES

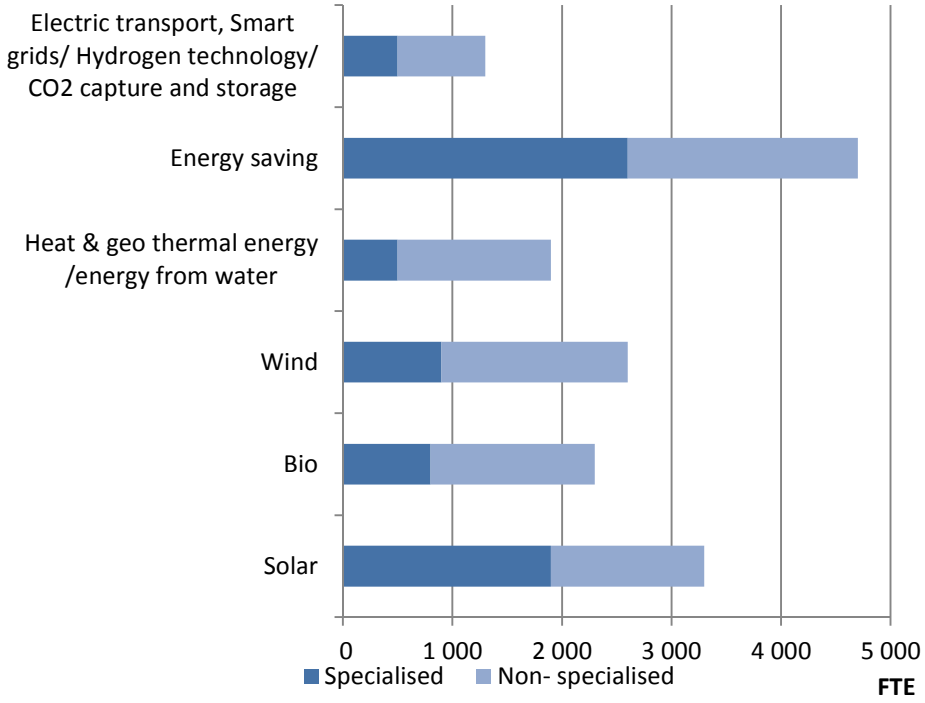
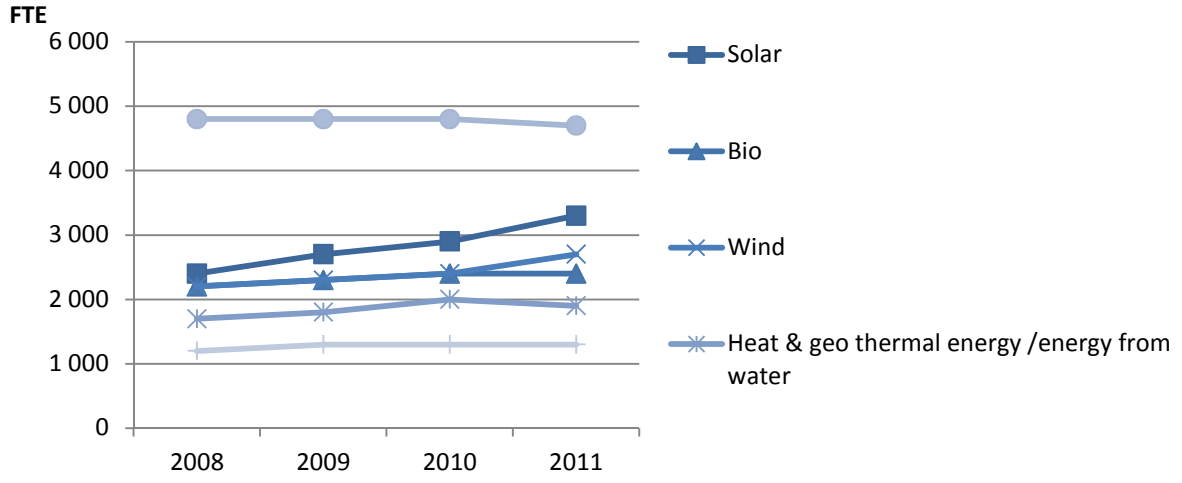


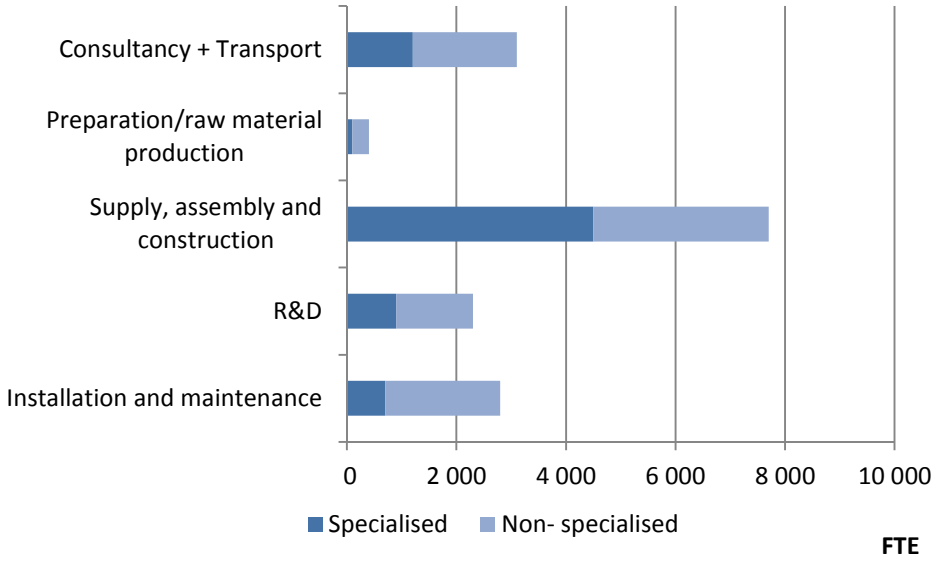
Figure 3.2.3 presents the FTEs by product profile in the P-SES in 2011 for both the specialised and non-specialised companies. It reveals some substantial differences in the levels of employment. For instance, in 2011 'energy saving' makes up for around 30 per cent of employment in the P-SES, which is comparable to the share of FTEs in 'wind' and 'bio' together. Second it shows that the share of specialised companies can differ substantially between energy technologies. For instance, for 'solar' and 'energy saving' more than half of the employment is constituted by specialised companies, while for the other energy technologies the specialised companies contribute only a small share of employment to the total.

3.2.4 Employment in the P-SES over the period 2008 - 2011 by product profile



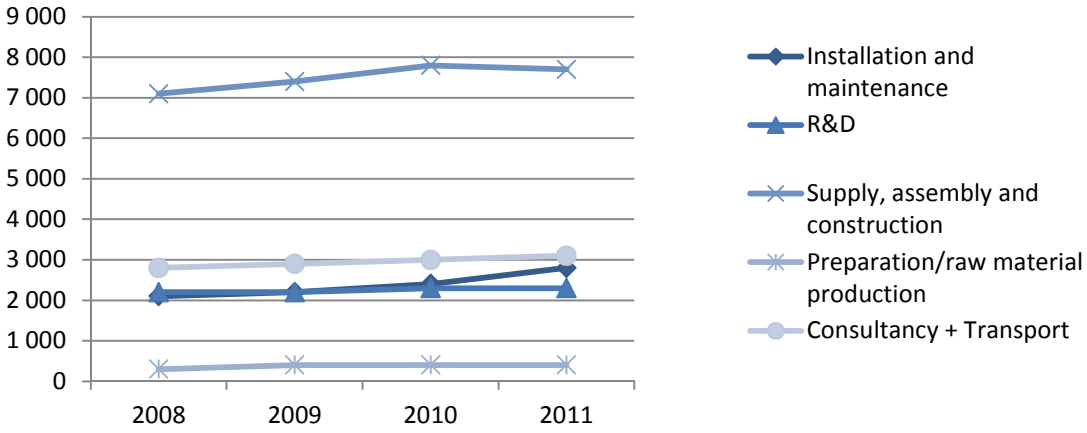
The increasing trend in employment is seen for most product profiles, except for 'energy saving' which employs slightly less FTEs in 2011 than in 2008. Energy saving is closely connected to the activities in the construction industry. The construction industry is heavily affected by the economic crisis. A substantial growth can be seen in the employment within 'solar'. With respect to the general levels, 'Energy saving ' is still the largest employer (29 per cent in 2011), while the other product profiles have smaller shares between 8 to 20 per cent.

3.2.5 Employment in the P-SES in 2011 by process profile



The 2011 employment figures (in FTEs) with respect to their related process profiles show that the largest contributor of employment is 'supply, assembly and construction', which also contains the largest share of specialised companies. In the other categories the specialised companies play only a minor role.

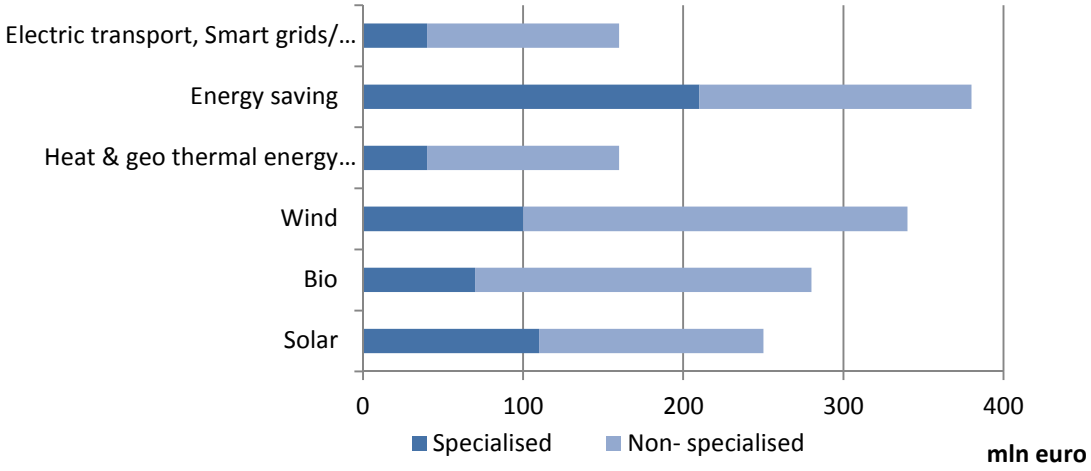
3.2.6 Employment in the P-SES over the period 2008 - 2011 by process profile



With respect to process profiles there have not been major changes during 2008 – 2011. All business categories seem to be steadily growing in terms of employment. One relatively large growth step occurred within 'Installation and maintenance', which grew with 17 per cent over 2010 – 2011. With respect to the general levels, 'Supply, assembly and construction' dominates as an employer,

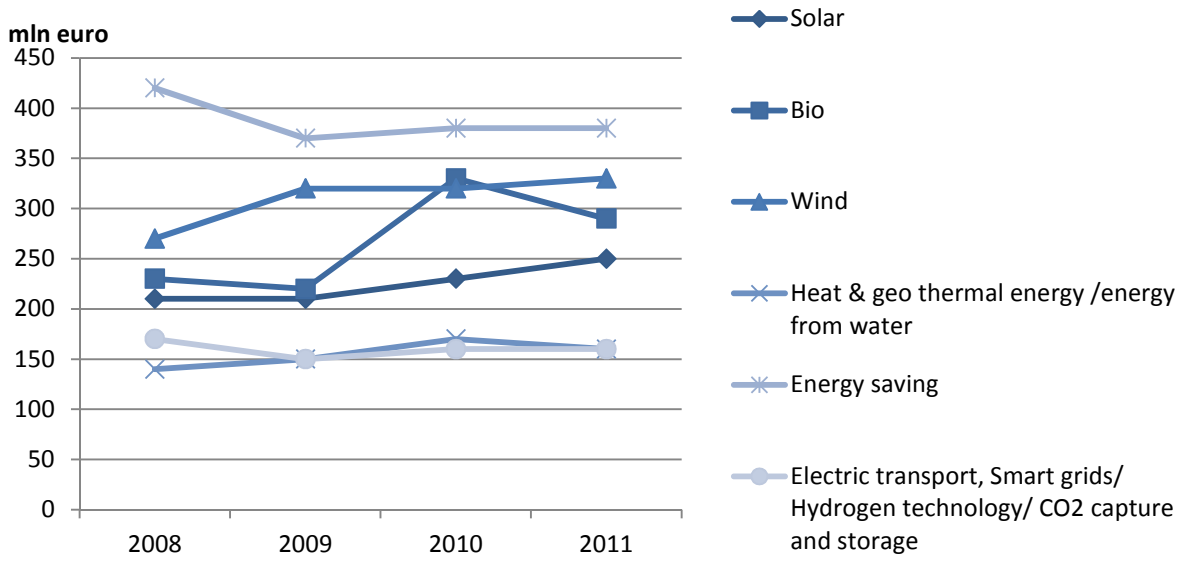
constituting over 47 per cent of total employment in 2011. In contrast, 'Preparation/raw material is by far the smallest employer, constituting only 2 per cent of employment.

3.2.7 Value added in the P-SES in 2011 by product profile



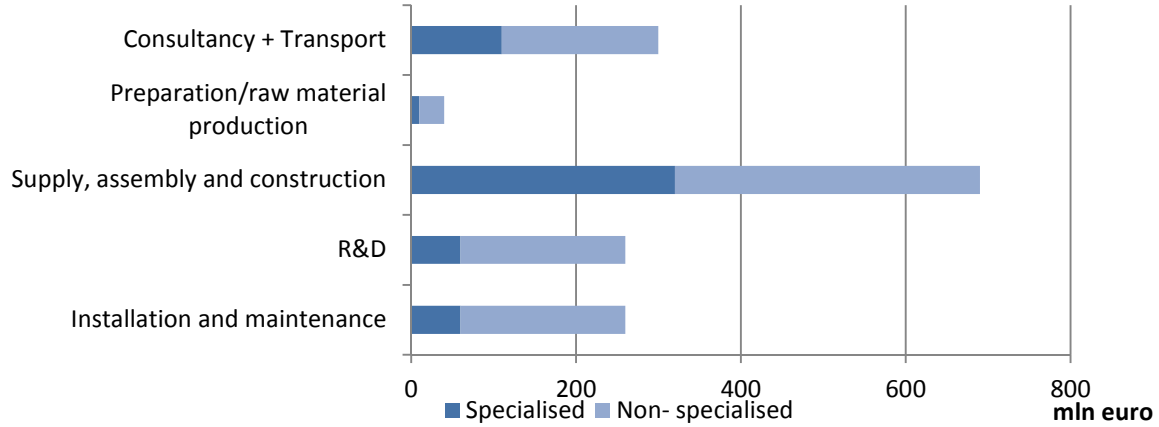
The distribution of gross value added in current prices within the P-SES in 2011 shows a slightly different picture than the picture presenting the distribution of FTEs. Because 'energy saving' is, just like employment, with 24 per cent still the largest contributor to value added, the value added provided by 'wind' (21 per cent) and 'bio' (19 per cent) is nearly comparable, which was hardly the case for employment. Another notable difference with the employment figures, is the distribution of specialised and non-specialised companies within 'solar'. Where in terms of FTE the majority was provided by specialised companies, in terms of value added the majority is provided by the non-specialised companies. This is because the specialised solar companies are usually active in 'Supply, assembly and construction', which is relatively labour intensive, while the non-specialised companies are active in more capital intensive solar energy related activities, resulting in more capital related gross value added.

3.2.8 Value added in the P-SES over the period 2008 - 2011 by product profile



The time series of value added show a slightly different picture than the time series of FTEs. Where in terms of FTEs 'energy saving' was clearly the largest provider, in terms of value added the differences are substantially smaller. However, in terms of development we see a comparable trend as with FTEs. The value added of 'energy saving' has declined since 2008 while the other energy technologies were at least stable or otherwise increasing, although more or less volatile.

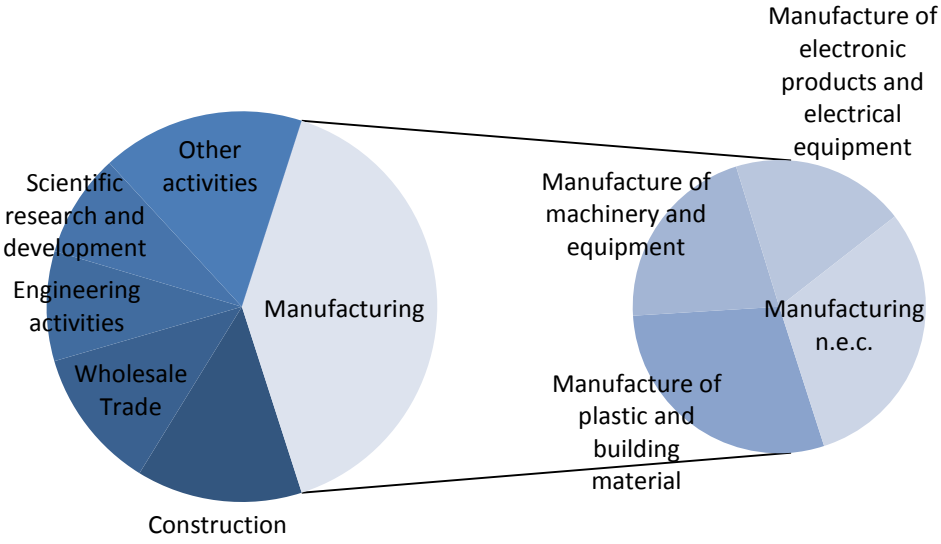
3.2.9 Value added in the P-SES in 2011 by process profile



The value added figures with respect to their related process profiles show a similar picture as the corresponding employment figures. Again it seems that the largest contributor is 'supply, assembly and construction', which also contains the largest share of specialised companies. Also in the other categories the specialised companies play only a minor role.

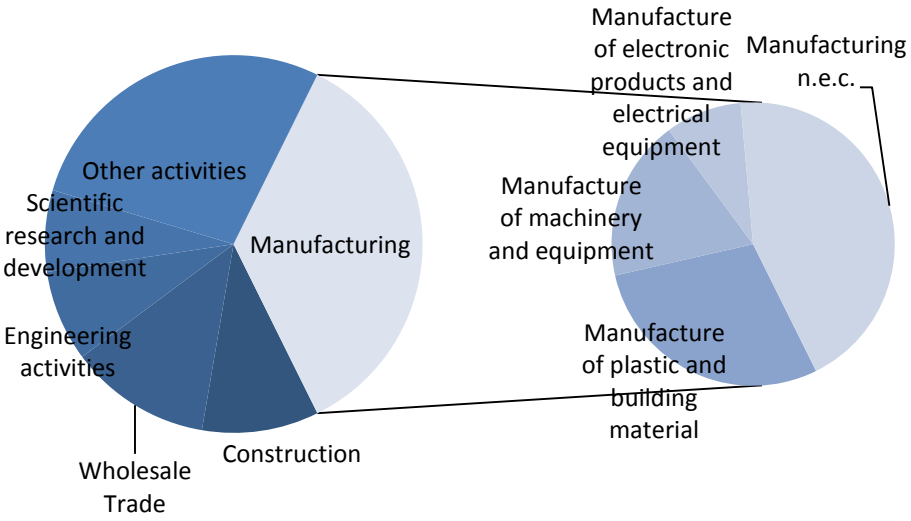
The next section presents P-SES figures with respect to the standard industrial classification of economic activity (NACE Rev 2).This is interesting because it is consistent and thus comparable with the national accounts as well as many other official statistics.

3.2.10 Employment by standard classification of economic activity (NACE Rev 2) in 2011



A large share of the employment in the P-SES consists of FTEs in the SBI 'manufacturing' (40 per cent), while the other SBIs have a similar share of the pie. 'Construction' provides 16 per cent of employment, 'Wholesale trade' 13 per cent, 'Engineering activities' 10 per cent, 'Scientific research and development' 10 per cent and 'Other activities' 19 per cent. Within 'Manufacturing' a relatively large share is contributed by 'Manufacture of plastic and building material' (29 per cent of 'Manufacturing'), such as the manufacturing of insulation materials.

3.2.11 Value added by standard classification of economic activity (NACE Rev 2) in 2011

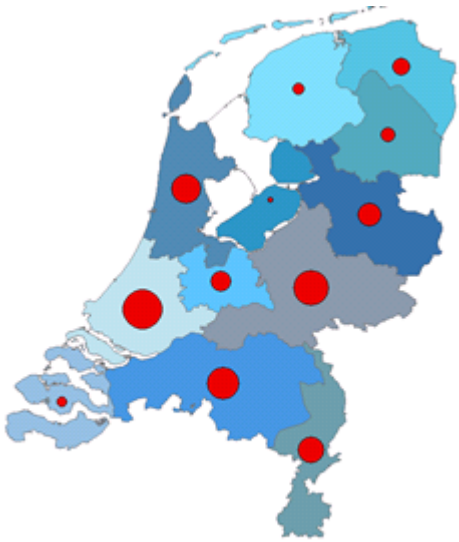


For value added in the P-SES we see a similar picture as with employment in the P-SES. Although 'Manufacturing' also represents a large share (35 per cent) while the other sectors divide the rest of the pie. 'Construction' provides 12 per cent of value added, 'Wholesale trade' 14 per cent, 'Engineering activities' 9 per cent, 'Scientific research and development' 8 per cent and 'Other activities' 33 per cent. Also in 'manufacturing' , just like with employment, 'Manufacture of plastic and building material' (29 per cent of 'Manufacturing') seems to be a main source of value added.

3.3 Regional analysis for value added and employment (P-SES)

In order to investigate whether the sustainable energy sector has a regional component, this section presents both employment and value added figures of the pre-exploitation phase of the sustainable energy sector (P-SES) on the provincial level.

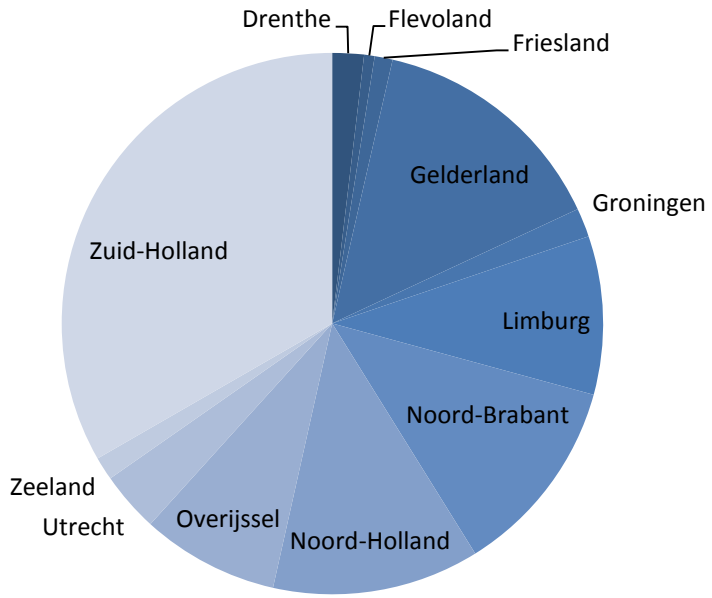
3.3.1 Distribution of employment over provinces in the P-SES in 2010



The size of the red dot reflects the number FTEs employed in the P-SES, a bigger dot means more FTEs employed

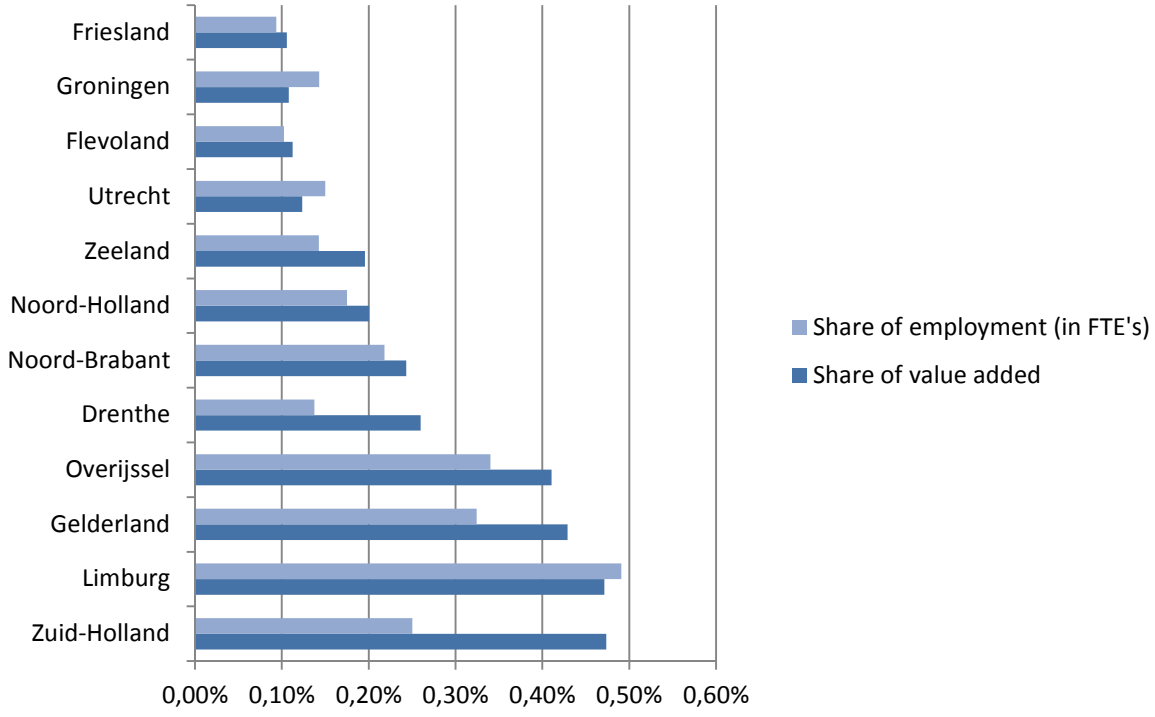
Employment in the P-SES is distributed over a number of provinces in the Netherlands. Most employment is located in the provinces Zuid-Holland (22 per cent), Gelderland (16 per cent), Noord Brabant (14 per cent), Limburg (13 per cent) and Noord-Holland (13 per cent). Utrecht and Overrijsel have a middle position in the share of employment while the provinces Drenthe, Flevoland, Friesland, Groningen and Zeeland have relatively low employment levels. There are although sometimes quite focussed small clusters in certain areas (for example energy from water in Friesland).

3.3.2 Value added distribution over provinces in the P-SES in 2010



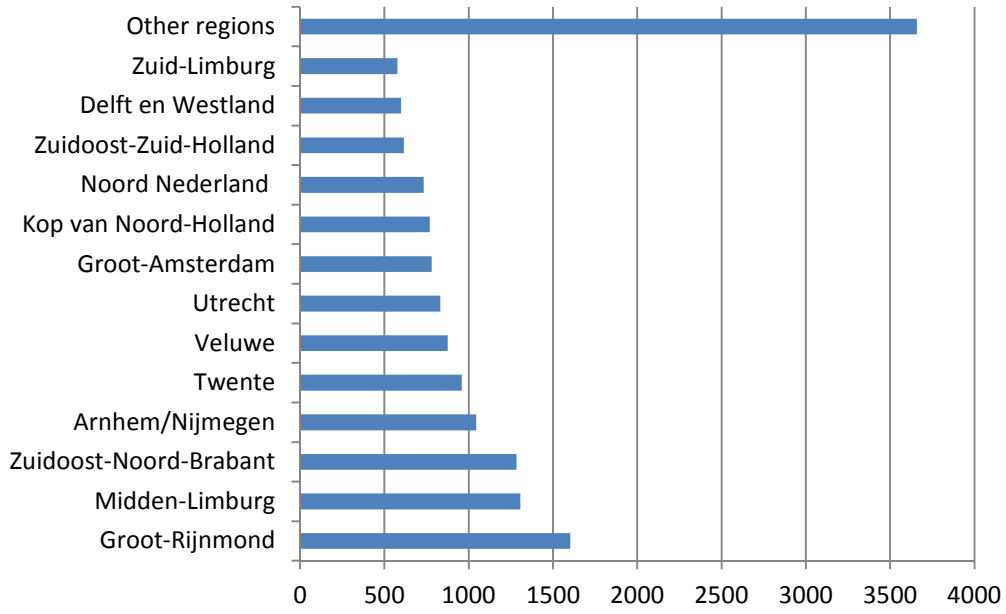
Almost 90 per cent of value added in the P-SES is accumulated in five provinces in the Netherlands. These provinces are the province of Zuid-Holland (33 per cent), Gelderland (15 per cent) , Noord Brabant (12 per cent), Noord-Holland (12 per cent) and Limburg (9 per cent). The other provinces play a modest role with small focused business parks.

3.3.3 Share of employment and value added of the P-SES per province in 2010



The contribution of the P-SES to the regional economy can be quite different between regions in terms of value added. Striking are the relative big contributions of the P-SES in the provinces Zuid-Holland, Limburg and Gelderland. For the provinces of Utrecht, Zeeland, Friesland, Drenthe and Flevoland holds that the contribution of the sustainable energy sector is quite small. In Limburg, the P-SES is best represented in the regional economy in terms of employment. To the contrary, in Zuid Holland, the P-SES is best represented in the regional economy in terms of value added. Also in Overijssel the P-SES provides a significant contribution to the regional economy.

3.3.4 Regional distribution of FTEs by COROP in the P-SES in 2010



The P-SES can also be allocated to so-called COROP areas. COROP areas are smaller (economic) areas than the provinces. The COROP breakdown was designed around 1970 by the Coordination Commission Regional Research Programme. The COROP format is a regional level of the size between municipalities and provinces (source: http://www.cbs.nl/nl-NL/menu/methoden/begrippen).

In Groot-Rijnmond the proximity of the port of Rotterdam undoubtedly plays a major role, especially for wholesalers. Also in Zuidoost-Noord-Brabant there are a substantial number of P-SES companies. The traditionally strong presence of the electrical industry and the presence of a technical university may play an important role. The strong presence of P-SES companies in Gelderland is remarkable. Especially the area Arnhem / Nijmegen and the Veluwe seem to present themselves as a cluster. Also the area of Delft and Twente hosts a substantial number of P-SES companies. Also here the proximity of Technical Universities may play a role here. South and Central Limburg also accommodate many P-SES companies that provide a substantial amount of employment.

3.3.5 Cluster intensity in the pre-exploitation phase of the sustainable energy sector

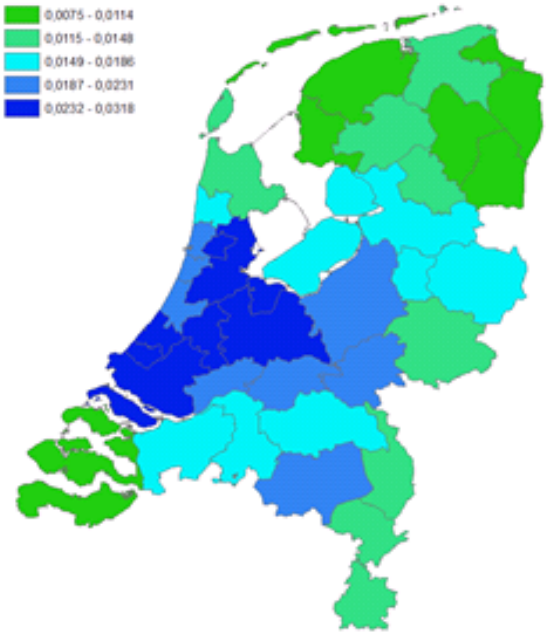


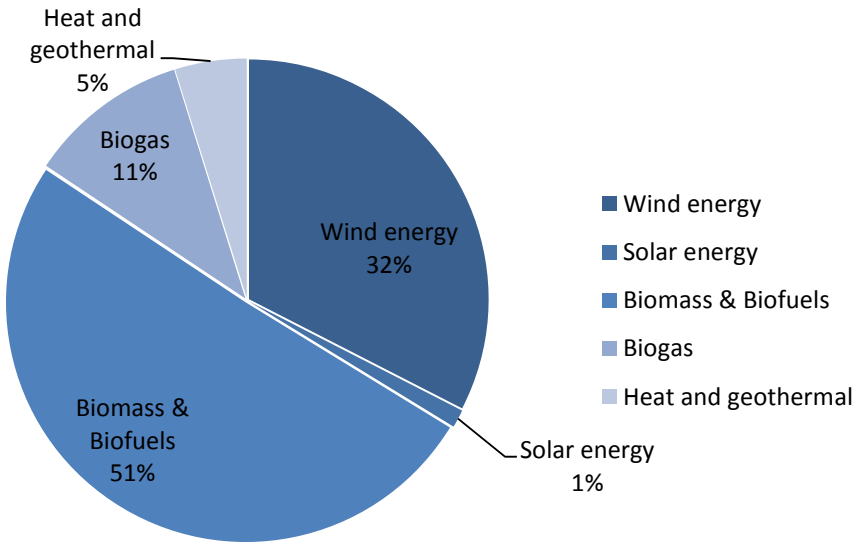
Figure 3.3.5 also presents the clustering intensity in particular COROP regions. The figure presents so called *d*-scores per COROP region. A *d*-score is an indicator for clustering-intensity in a certain region[7]. A high score means that the clustering intensity is high and vice versa. Companies in the P-SES are highly clustered in COROP regions Groot-Rijnmond, Zuidoost-Zuid-Holland, Zuidoost-Noord-Brabant, Arnhem/Nijmegen, Veluwe, Utrecht, Groot-Amsterdam. Less clustering took place in certain parts of the provinces Groningen, Friesland and Drenthe and Zeeland .

3.4 Economic key figures – exploitation phase

For the status of the E-SES, due to its capital intensity, we focus on the status and development of value added. Figures on employment and production can be found in annex A.

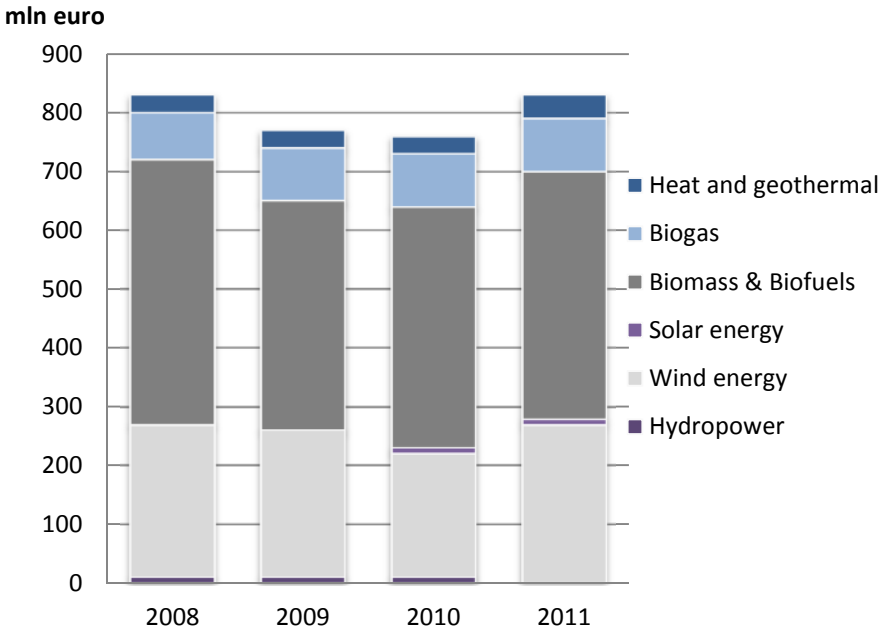
[7] The degree of clustering is determined by measuring the distance from an establishment to all other establishments in the same sector (see for more information: PBL/CBS (2012)-De ratio van ruimtelijk-economisch topsectorenbeleid)

3.4.1 Value added in the E-SES per technology in 2011



The value added in the E-SES represents value created with the actual production of energy. This value added can be appointed to a number of product profiles (energy technologies), as presented in the figure below. Value added of the E-SES was in 2011 equal to 840 million euro. In the E-SES 'Biomass & Biofuels' and 'Wind energy' constitute over 80 per cent of value added, while the other technologies play only a minor role.

3.4.2 Value added in the E-SES per technology over the period 2008 – 2011



Value added of the E-SES hardly increased in the period 2008 and 2011. Production did increase significantly, especially due to more production of biofuels. The dominating role of 'Biomass & Biofuels' and 'Wind energy' did not change in the period 2008 – 2011. The stability of value added of 'Biomass & biofuels' is quite remarkable compared to the strong increase in production. There are a few reasons for this notable observation. First, the value added of electricity and heat by biomass combustion is under pressure due to lower electricity prices. Second, production of electricity and heat by *biomass combustion* in physical terms has grown over time but not as hard as the production of biofuels. Value added of biofuel production is relatively small compared to the value added of biomass combustion. Production of biofuels has, among other things, grown due to more physical production and price increases. On the other hand, intermediate use of inputs necessary to produce these biofuels has also grown significantly, so the growth in value added has been low. Third, the biofuel facilities have not produced on full capacity.

In physical terms, more renewable electricity was produced in 2010 than in 2009, especially due to more combustion of biomass by electricity producers and more waste incineration. After years of increased production of wind energy, a decline is observed in 2010 This decline can be explained by a very low wind supply. In 2010 the Windex (a measure of wind supply) was at its lowest ever estimated. This lack of wind was not compensated by instalments of new wind turbines. Instalments of wind turbines were at a record low since 1990. This reduction is caused by a temporarily lack (August 2006 – April 2008) of a subsidy scheme for new projects. Realisation of a wind turbines project is often a very time consuming business due to planning sessions and legal procedures, financing processes, construction time and delivery time. Price developments for producers of renewable energy were also unfavourable in 2010 compared to 2009. Therefore value added growth for renewable energy production was close to zero in 2010 compared to 2009.

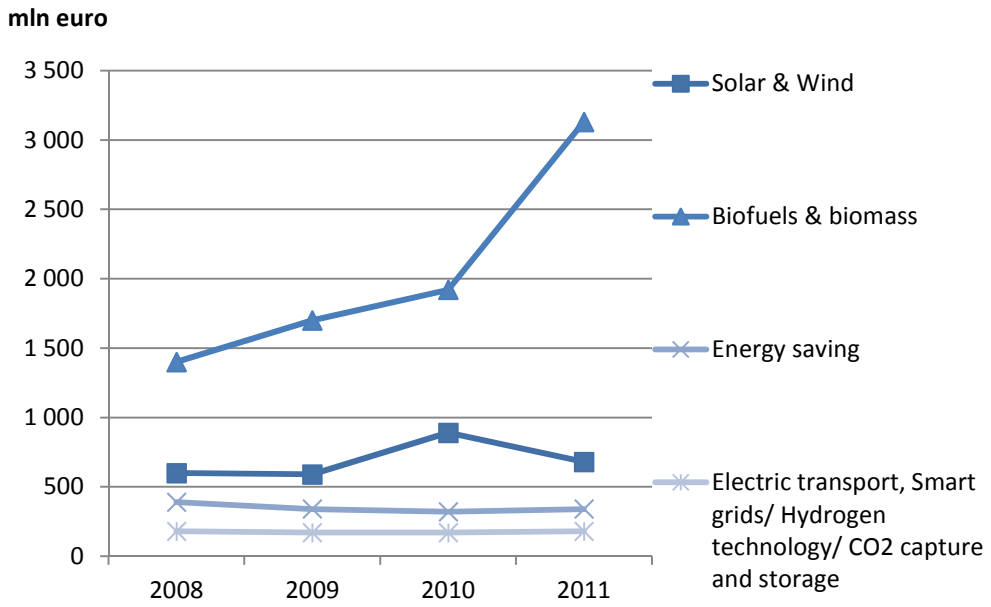
Value added increased in 2011. This increase can be explained by more production of solar and wind energy. The first because of an increase in the installed capacity, the latter because of an increase in wind supply. In 2010 the Windex[8] (a measure of wind supply, Statline CBS) had an index of 77 and was at its lowest point ever estimated. The year 2011 was a more average year in terms of wind supply (Windex: 96).

[8] A windex of 100 means that wind supply was equal to the mean supply of all months in the 1996-2005 period.

3.5 Imports and exports for the pre-exploitation and exploitation phase

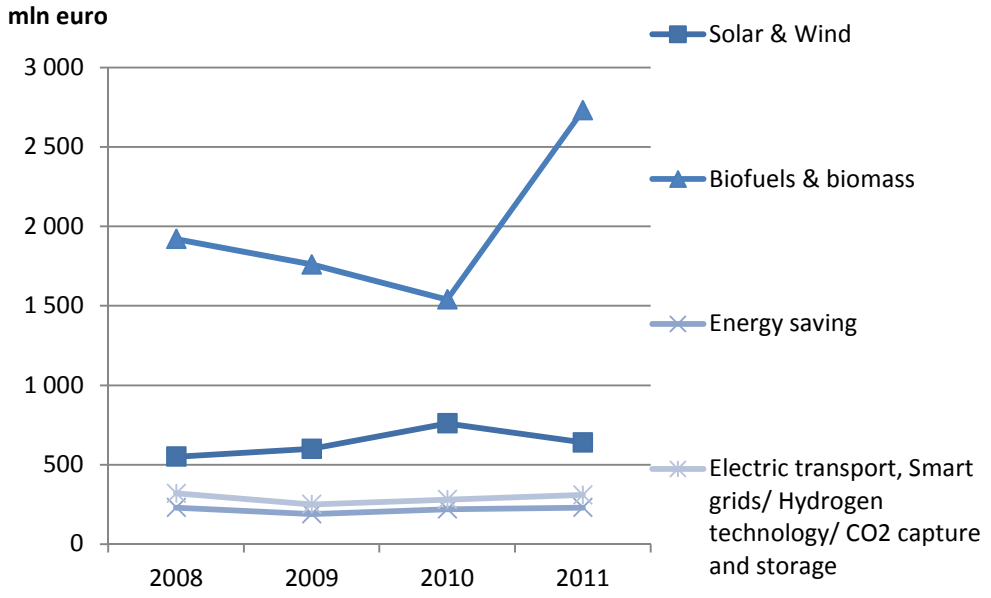
International trade figures present the SES in an international perspective. The graphs below present the export, import and trade balance for different products.

3.5.1 Export in the SES over the period 2008 - 2011 by energy product



The export of most good categories seems to be quite stable. 'Solar & wind' are stable product profiles accounting for positive export performance of SES. 'Biofuels & biomass' showed more than double the 2008 export in 2011. This development can to a large extend be explained by a similar increase in imports, as is shown in the next figure. These are mostly re-exports that are transhipped though the port of Rotterdam.

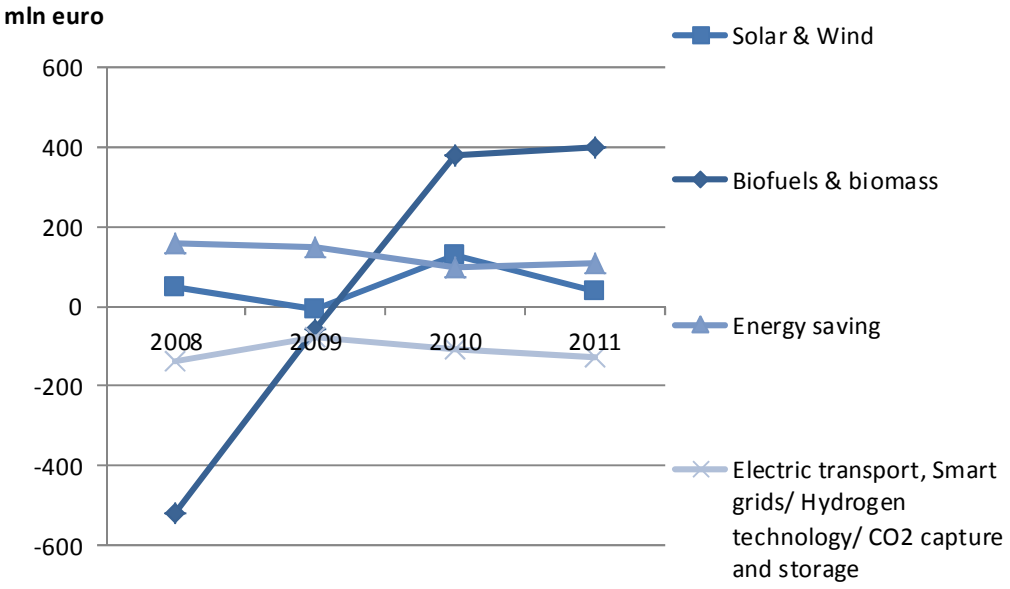
3.5.2 Import in the SES over the period 2008 - 2011 by energy product



The large increase in 'biofuels, biomass and E-SES' in both imports and exports indicates a large increase in re-exports (i.e. import that only serves as exports). The reason for this large increase is

both the result of a number of biofuel producing factories that were put into use in 2011 and of the national policy of many EU countries for fuel producing companies to blend petrol and diesel with biofuels. In the Netherlands this obligatory share of biofuels increased from 2 per cent in 2007 to 4 per cent in 2010. Finally, it is interesting to see whether the Netherlands is net-importer or exporter of the different product profiles. This requires the trade balance per product profile.

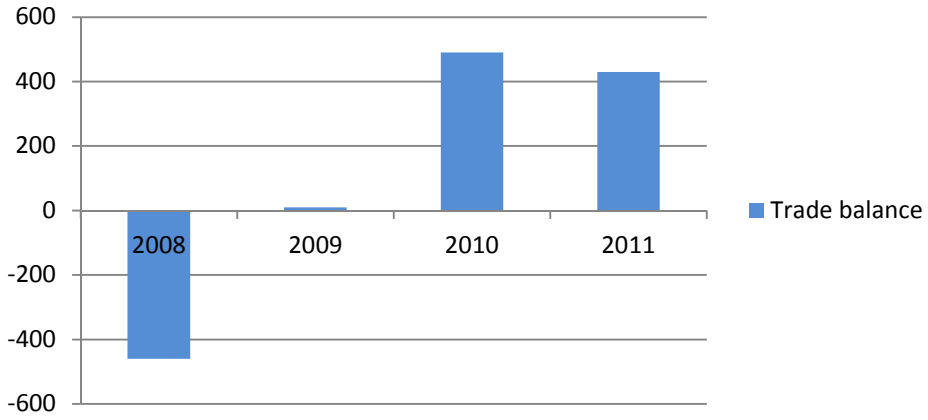
3.5.3 Trade balance of the SES over the period 2008 – 2011 by energy product



The trade balance shows that de SES changed from a net importer in 2008 to a net exporter in 2011. In fact, most categories show quite a stable and positive value on the trade balance, except for 'biofuels, biomass and E-SES' which is the driving force of the shift from net importer to net exporter. This shift in the trade balance is partly due to the a number of biofuel producing installations that were put into operation in 2011. These installations import basic materials and export refined biofuels. Also there has been an increase in international trade, leading to additional re-exports in the Netherlands.

Solar trade and manufacturing are responsible for stable trade surpluses over time. Wind offshore has a strong international position (NL Agency (2011b)). 'Biofuels & biomass' are responsible for recent largest increase in the trade surplus. Certain profiles import more than they export, while other small profiles such as electric transport, still a relatively small infant industry, are still trying to define a position in the value chain of the European and world wide growing electric road transport industry.

3.5.4 Trade balance of the SES over the period 2008 – 2011



3.6 Gross capital formation for pre-exploitation phase and exploitation phase

So far the trend in economic indicators seem to indicate that both the P-SES and E-SES have been stable growing sectors. It is interesting to see whether these developments are further supported by capital formation data, because this may reveal both how investors judge the potential of the sector (given the policy conditions) and how much capital is available for future SES activities. Figure 3.6.1 shows the spending on fixed capital formation for which subsidy (tax exemption)was rewarded by AgentschapNL over the period 2008 – 2011. It should be noted that these figures do not necessarily represent the total spending on capital formation, because the EIA data only contains the spending for which 'subsidy' was awarded. This also implies we should be careful in interpreting these figures, because they might be affected by changes in regulations. Additionally, 'Solar' investments by households (E-SES) as well as the gross capital formation survey data available at Statistics Netherlands for the P-SES are also included.With respect to the development over time, in 2011 the spending on fixed capital formation is back on the 2008 level, overcoming the backlash of 2009.

3.6.1 Capital formation of the SES over the period 2008 – 2011 by product profile

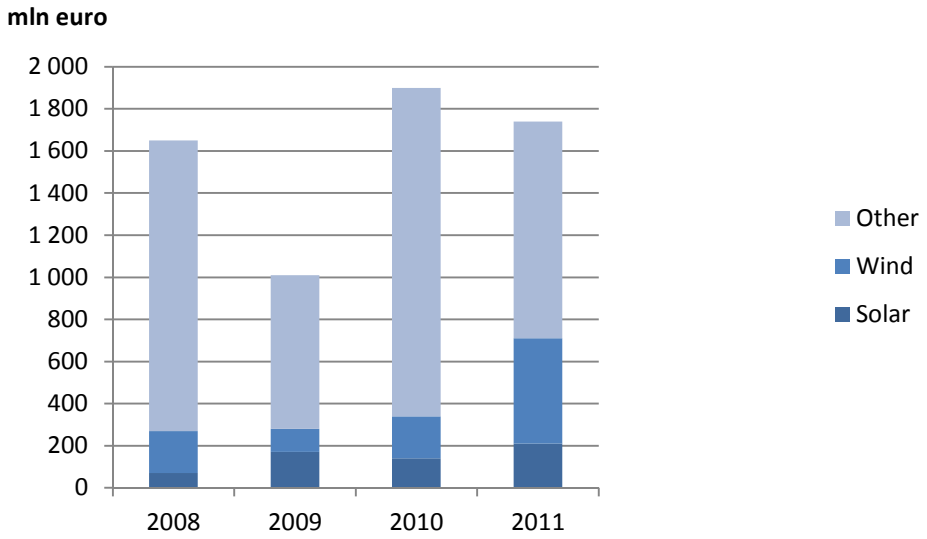


Figure 3.6.1 on capital formation concern the SES as a whole (i.e. both E-SES and P-SES). It further indicates that the structure of the capital spending changed, in particular there has been a shift from 'Other' (which contains e.g. energy saving' and 'Biofuel & (solid) biomass') towards 'Wind' and 'Solar'. This is a similar shift as was seen in the employment and value added time series. However, as said above, these shifts in investments might also be affected by a change in policy regulations. The backlash in 2009 can simply be explained by the economic crisis of the year, where especially investment on energy saving was under pressure.

4. Foreign Direct Investment

This section presents the economic figures for foreign direct investments (FDI) in the sustainable energy sector of the Netherlands. FDI includes transactions relating to the acquisition of equity capital by enterprises in enterprises abroad (by means of establishment, merger or acquisition) with the aim of obtaining a degree of management control. It also includes all other financial transactions between affiliated enterprises (loans, reinvested earnings, changes in intra-group current accounts), as well as purchases and sales of real estate (Source: DNB[9]).

4.1 Definition, concepts and data sources

Data on FDI is collected and published by the Dutch Central Bank (DNB). When considering FDI the distinction between flows and positions is important. 'Flows' comprise transactions that during a given period are entailed by the acquisition of share capital by Dutch residents abroad (*outward*) and vice versa (*inward*) for the purpose of gaining control. FDI further includes all other financial transactions between affiliated companies (loans, retained earnings, current account changes, working capital deposits), as well as real estate purchases and sales. The FDI positions comprise the total value of the external claims and liabilities of Dutch enterprises at a given moment in time. The positions comprise the cumulative transactions, corrected for price, exchange rate and other changes (incl. impairment of goodwill) and concern both capital interests and the other forms of direct investment described above (Source: DNB).

In conformity with the fifth edition of the IMF Balance of Payments Manual, the directional principle is applied for the measurement of Dutch direct investment abroad and foreign direct investment in the Netherlands, meaning that financial flows (and related income flows) from subsidiaries to parent companies are netted out with transactions from parent companies to subsidiaries.

4.2 Compiling FDI data for the SES

In order to calculate FDI figures for the P-SES, first the population of companies in the P-SES needs to be merged with DNB-data on FDI. However, this merging procedure runs into two problems:

1. *Units used in FDI data versus units used in SES population*

The population units in the P-SES population are establishments (subsidiary (company)). For these establishments we have compiled economic data on employment, production and value added. FDI data is collected by DNB on 'group level'. This implies that the FDI figures cover larger entities than the establishments in de P-SES. Therefore, appointing reasonable FDI figures of holdings to the establishments in de P-SES is nearly impossible.

2. *Combination of instability in FDI data and small specialisation factors*

The P-SES consists of companies engaged in the production of relevant good and services in full (specialised) and of companies that are only partly active in the value chains that relate to sustainable energy products (non-specialised). Specialisation factors have been developed for

[9] http://www.statistics.dnb.nl/index.cgi?lang=uk&todo=Balans

establishments. These factors cannot be applied to FDI data which are representative for enterprise units. Another problem is the fact that companies engaged in FDI are very often non-specialised and large companies. Only six companies in the P-SES reporting FDI are more than 20 per cent specialised in sustainable energy products. The small specialisation factors of FDI reporters in the P-SES make it highly uncertain whether this FDI really relates to sustainable energy or energy saving activities or not.

In light of these two problems and in consultation with DNB's experts, Statistics Netherlands concludes that is not feasible to compile useful FDI data for the P-SES based upon register information only. Therefore, a specific questionnaire for companies in P-SES is required to collect the appropriate data that is required to calculate figures on FDI in the P-SES. However, the use of additional questionnaires is beyond the scope of this report.

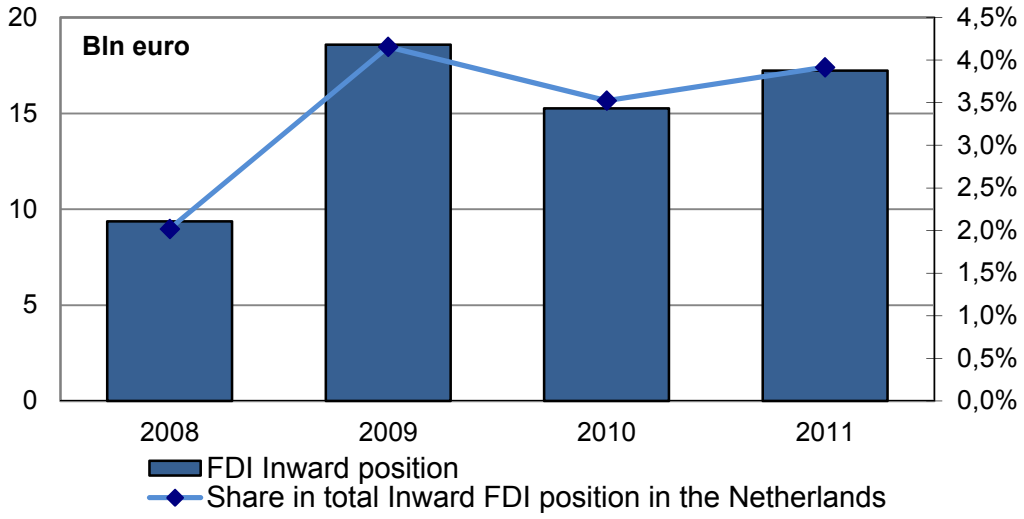
The companies that are part of the E-SES are often interconnected with companies in the conventional energy sector (some electricity producers are both producing renewable based electricity as well as fossil based electricity). The electricity, gas, steam and air conditioning supply corresponds with NACE class 35. On request of Statistics Netherlands, DNB has made an overview of FDI for this NACE classes between 2008 and 2011.

4.3 FDI positions in the Dutch electricity and gas supply industry

The focus of our description of FDI in the Electricity, gas, steam and air conditioning supply is on end of year FDI positions. Figure 4.3.1 presents the development of total inward FDI and total outward FDI positions at the end of the year (2004-2010). The value of the inward FDI position doubled between 2008 and 2009 because foreign European companies bought substantial positions in two Dutch utility companies. The share of inward FDI positions in Energy supply companies in total FDI grew considerably over time from a share of 2.0 per cent in 2008 to 4.2 per cent in 2009.

4.3.1 Share and value of Dutch inward FDI positions, 2008-2011

Value of inward FDI positions in Electricity, gas, steam and air conditioning supply industry in the Netherlands and the share of this industry in the total Dutch inward FDI position , 2008-2011



Source: DNB

Although DNB provided more detailed information of the FDI positions (e.g. geographical dispersion) as well as other relevant NACE classes, confidentiality policies of both DNB and Statistics Netherlands prohibit publication of these figures.

4.4 Conclusions on FDI

Data on FDI of companies in the P-SES is generally not collected by DNB on establishment level. Companies that belong to the same group and that are active in the same sector report jointly their FDI data. The P-SES includes a lot of small and often specialised, dedicated companies but also large non-specialised global companies, which produce sustainable energy products as well as unrelated goods or services. When considering FDI the larger companies are dominant, but as data is available only on 'a group level' it is unfortunately unfeasible to estimate reliable data on FDI specifically for sustainable energy and energy saving.

The electricity, gas, steam and air conditioning supply can be defined using NACE class delineation and calculating FDI for this sector is feasible. Confidentiality issues may prohibit the publication of other relevant NACE classes and more detailed figures (e.g. geographical dispersion). The results show an increase in the value of inward FDI positions between 2008 and 2011. This is a result of Dutch energy companies that are bought by companies located in other European countries in 2009.

5. Topsector Energy

Dutch policymakers have defined nine Topsectors, which represent, for different reasons, important sectors of the Dutch economy. In this section we take a closer look at the Topsector Energy. Statistics Netherlands executed a benchmark study (reporting year 2010) in 2012 quantifying the economic contribution of the Topsector Energy to the Dutch economy (for more information the website of Statistics Netherlands[10], CBS (2012c). Intention is to monitor Topsector Energy over time. The Topsector Energy consists of two groups. The first group contains companies that are mainly involved in the production of energy from conventional, non-renewable sources They employ activities such as extraction, production, transport and trade of energy. In the Monitor Topsectors[11] these companies are categorised as subsectors under 'Natural gas' and 'Related activities'. It should be noted that this first group of companies ('Natural gas' and 'Related activities') mainly contains companies that produce energy from conventional energy sources. The second group of companies that belong to the Topsector Energy are the companies in the pre-exploitation phase of the sustainable energy sector (P-SES) companies as they are defined in the Economic Radar of the sustainable energy sector. In this section we treat 'Natural gas' and 'Related activities' as one group, therefore the Topsector Energy is equal to companies involved in 'Natural Gas & Related activities' and the P-SES. The exploitation phase of the E-SES is not included in the figures of the Topsector Energy. In section 5.1 we present some core indicators for the Topsector Energy.

The comparison of the P-SES figures with the other activities in the Topsector is rather complicated, because the applied approaches differ. For the P-SES, the value chain approach has been applied. The so called NACE approach is implemented for the Topsector activities other than P-SES, so these activities are more narrowly delineated to, roughly speaking, the extraction of oil and gas (and exploration services) and the production, distribution and transport of electricity, steam and warm water.

5.1 Economic figures for Topsector Energy

In terms of the number of companies and FTEs, the Topsector Energy is a relatively small sector. With 49 thousand FTE and 1 580 companies (statistical units) (0.73 per cent of total FTE in the Netherlands) it concerns, beside the Topsector Life sciences & health, the smallest number of FTEs of all Topsectors. On the other hand, this topsector creates 5 per cent of the total production and value added of the Netherlands. The sector as a whole is relatively capital intensive, in particular the subsectors 'Natural gas and Related activities'. The labour productivity of the P-SES is, with around 84 thousand euro per FTE, comparable with the average productivity in the Dutch economy.

[10] http://www.cbs.nl/NR/rdonlyres/FA8F2205-3054-41D9-A206-BC9D13F7ECBF/0/monitorentopsectorenresultatenweb.pdf

[11] See for more information: http://www.cbs.nl/NR/rdonlyres/46E17CAF-48DD-4D64-9BFB-C6C871493139/0/monitortopsectorenmethodeentabellenweb.pdf

5.1.1 Core indicators for Topsector Energy in 2010

	Number of companies	Production	Value added	Export of goods	Employed persons
	absolute	*mln euro*			*x 1 000 fte*
Natural gas and related activities	530	50 984	25 474	12 905	33
P-SES	1 050	4 580	1 580	3 300	16
Total	1 580	55 564	27 054	16 205	49

*Source: Monitor Topsectoren (*Statistics Netherlands, *2012), revision P-SES*

Topsector Energy employs around 49 thousand FTE and in the Dutch economy as a whole it constitutes around 0.73 per cent of total employment. The P-SES constitutes approximately one third of the employment in the total Topsector Energy. The capital intensity of the sector is further demonstrated by its spending on fixed capital formation. This spending in capital formation is relatively high compared to the value added of the sector, with nearly 20 per cent this is the highest share of all Topsectors and roundabout 2.5 times higher than the average in the Netherlands.

5.2 Innovation themes in the Topsector Energy

Finally, in order to shed some light on the size and distribution of innovation activities that occur within the Topsector Energy, seven themes are formulated. The selection of these themes is mainly based on 'energysector experts' expectations regarding export and employment growth opportunities. Six of the seven themes are fully included in the SES. The theme 'Gas' is only partly included in the P-SES, new gas (bio gas product profile) is included while natural gas is not. The themes 'built environment' and 'manufacturing' together constitute the theme 'energy saving'. Only the pre-exploitation phase activities are included here. Energy from water, electric transport, hydrogen technology, wind onshore, solar CSP, solar thermal energy and carbon capture and storage are part of the P-SES but are not part of the seven 'innovation themes' within the top sector Energy.

5.2.1 Core indicators for innovation themes (TKI) in the Topsector Energy

	2008		
Themes Topsector Energy	Employment (fte)	Production (mln euro)	Value added (mln euro)
Energy saving plus Aerothermal & geothermal energy*	6 400	1 530	550
3. Gas (natural gas excluded)	400	110	30
4. Smart grids	500	130	50
5. Wind offshore	1 500	610	200
6. Solar Energy	1 600	510	120
7. Bio-energy	1 700	770	200
Other P-SES not in top sector themes	2 500	830	280
Total pre-exploitation SES	**14 500**	**4 500**	**1 420**

	2010		
Themes Topsector Energy	Employment (fte)	Production (mln euro)	Value added (mln euro)
Energy saving plus Aerothermal & geothermal energy*	6 700	1 450	540
3. Gas (natural gas excluded)	400	100	40
4. Smart grids	500	130	50
5. Wind offshore	1 500	730	250
6. Solar Energy	2 100	610	140
7. Bio-energy	2 000	770	280
Other P-SES not in top sector themes	2 800	800	290
Total pre-exploitation SES	**15 900**	**4 590**	**1 580**

	2011		
Themes Topsector Energy	Employment (fte)	Production (mln euro)	Value added (mln euro)
Energy saving plus Aerothermal & geothermal energy*	6 500	1 530	530
3. Gas (natural gas excluded)	400	120	40
4. Smart grids	500	130	40
5. Wind offshore	1 800	760	240
6. Solar Energy	2 500	630	160
7. Bio-energy	2 000	980	240
Other P-SES not in top sector themes	2 800	840	310
Total pre-exploitation SES	**16 300**	**4 990**	**1 560**

* 1. Built environment and 2. manufacturing, including 'Aerothermal & geo thermal energy'. In Annex B there is a table that connects the product profiles of the P-SES with the TKIs of Topsector Energy.

As already stated, Topsector Energy employs around 49 thousand FTE and in the Dutch economy as a whole it constitutes around 0.73 per cent of total employment. The P-SES constitutes approximately one third of this employment in the total Topsector Energy. Approximately 80 per cent of employment in the P-SES is relevant for *the innovation themes* of the top sector Energy.

Some product profiles of the Radar belong to other topsectors. For instance, 'Electric Transport' belongs to topsector 'High Tech Systems and Materials'. See for more info on electric transport the box below. Table 5.2.1 shows that the growth in the P-SES can be mainly attributed to the themes 'Wind offshore', 'Solar energy' and 'Bio-energy'. In particular solar energy, which employed around 56 per cent more FTEs in 2011 compared to 2008. It is also interesting to note that despite the economic conditions, none of the themes experienced a serious downfall in any of the economic indicators.

Electric Road Transport

Source: AgentschapNL 2013
Verdienpotentieel Elektrisch Vervoer in Nederland
Jaarrapportage stand van zaken medio 2013

An important objective of the Plan of Action 'Electric Driving in the Acceleration 2011-2015 'is to strengthen the economic position of the Netherlands in the field of electric transport. To this end, the Formula E-Team (FET) adopted in September 2012 an approach with 12 promising product / service /market combinations, the so-called spearheads. In July 2013 the FET approved the annual report by NL Agency on innovation and electric transport.

Data in WBSO[12] and patents show an increase in activity in the field of electric transport compared to previous years. This positive trend is recognized by Syntens (innovation centre), where a difference is seen between the providers of transport solutions (2, 3 or 4-wheelers) and infrastructure providers (in particular, charging stations). The charging stations sector already creates value both at home and abroad. Based on research of AgNL there is relatively much activity taking place around the following spearheads:

- New (custom) vehicles;
- Charging infrastructure;
- Transmission;
- Smart grids and metering;
- (Existing) Mobility Services.

In 2013, AgentschapNL-in collaboration with EV business association DOET- executed a survey among DOET-members on the development of the earning potential of electric vehicles. Questions were asked about the financial scope of activities, measured in the development of employment, turnover and exports. The response rate of the survey was equal to 31 per cent. In the study, 22 EV companies responded. The sample represents 243 FTEs, € 31 million and € 2.8 million export sales (reference date2012).The sample provides insight into the relative growth of the EV sector in the period 2010 to 2012. Conclusions about the absolute size and growth of the EV industry cannot be drawn based on this survey. However, the survey among DOET-members shows some positive trends regarding employment, sales and exports. Respondents reported:

- a tripling of employment from 2010 to 2012.
- a doubling of sales from 2010 to 2012.
- a fourfold increase in exports from 2010 to 2012.

Electric transport is also one of the product profiles of the Radar. It is from a statistical point of view a challenge to quantify the absolute economic contribution of electric transport because the Electric Transport sector is still quite small and has a low specialization level. Production is estimated at approximately € 120 million in 2011. The number of FTEs is estimated at approximately 400 FTEs in

[12] Research and Development (R&D) tax credit

2011. Value added of electric transport is estimated at 40 million euro. Growth in between 2008 and 2011 was negligible.

Plans have been made by Statistics Netherlands, NL Agency and DOET to share experiences and data in order to improve the reliability and user potential of the data on electric transport. This cooperation will lead to more and better insights in the future. In 2014 NL Agency will present these results in its second annual report on innovation in electric transport to the Formula E-Team.

6. Green growth and the sustainable energy sector

In the Netherlands green growth is high on the political agenda. The current Dutch government is committed to realizing economic growth which does not deplete nature's resources. Greening the economy is not considered as a threat but as an opportunity for entrepreneurs to create new jobs and stimulate growth. By implementing sustainable solutions, Dutch companies may increase human well-being as well as strengthen their competitive position. In order to monitor and evaluate its policies, the Dutch government has asked Statistics Netherlands to develop monitoring frameworks for sustainability and green growth. The first Green growth report is published in May 2011 (Statistics Netherlands, 2011b), an update of this report is foreseen in November 2013. It may be noted that one variable of the economic radar for the sustainable energy sector, namely the share of employment of the SES, has been included in the 33 indicators to assess the status of green growth in the Netherlands. This is one of the indicators because the status of the SES is indicative for the economy behind renewable energy and energy saving in the Netherlands, which is an important aspect of Green Growth.

The green growth framework and 'the sustainability monitor for the Netherlands'[13] contains a lot of energy related indicators. In this chapter we zoom into the green growth framework by focusing entirely on energy aspects which are directly or indirectly of interest for the Economic Radar of the Sustainable Energy Sector in the Netherlands. This chapter is based upon chapter two of the publication *Environmental accounts of the Netherlands 2011 (CBS, 2012)*. See for more actual information on Green Growth and a visualisation on the subject the link below[14]. Section 6.1 first discusses the basic concepts of the green growth framework. Section 6.2 presents the state of green growth in the Netherlands with a clear focus on energy.

6.1 What is green growth?

The performance of an economy is usually measured in terms of changes in its gross domestic product (GDP). Economic growth, i.e. the increase of GDP, offers benefits such as welfare, but it also has some negative side effects. In this respect, there are multiple reasons to look at the nexus of the environment and economy. Non-renewable resources such as fossil fuels and some metals are becoming scarce, and renewable stocks, such as fish, are vulnerable to over-exploitation. In turn, these developments can hamper future growth. In addition, there is substantial scientific evidence that the quality of our environment is degrading to a critical level. For instance, global boundaries such as the concentration of greenhouse gasses in the atmosphere, water extraction and biodiversity losses have exceeded their tipping points (Rockström et al. 2009; IPCC 2007). There is international consensus that more action is required (e.g. OECD, 2008; UNEP, 2009; UN, 2012).

As a result of these concerns, the notion of 'greening the economy' is receiving more attention from policy and decision makers. Green economy was one of the central themes on the Rio+20 Earth Summit in June 2012. According to the declaration of Rio+20, "a green economy in the context of sustainable development and poverty eradication is considered as one of the important tools

[13] http://www.cbs.nl/en-GB/menu/themas/dossiers/duurzaamheid/cijfers/extra/duurzame-ontwikkeling.htm?Languageswitch=on
[14] http://www.cbs.nl/nl-NL/menu/themas/dossiers/duurzaamheid/cijfers/extra/2012-groene-groei-visualisatie.htm

available for obtaining sustainable development" (UN 2012, par. 56). Consequently, a sound measurement framework is required to guide and evaluate policy decisions and to evaluate current policies with respect to greening growth.

The concept of "greening the economy" is still relatively new. Recently, there have been two important initiatives that focus on the economic and ecological aspects of sustainability, namely the green growth strategy of the OECD and the green economy of UNEP. Although both initiatives broadly encompass the same topics, there are some conceptual differences. According to the definition formulated by the OECD (OECD, 2011a), green growth is about "*fostering economic growth and development while ensuring that the quality and quantity of natural assets can continue to provide the environmental services on which our well-being relies*. *It is also about fostering investment, competition and innovation which will underpin sustained growth and give rise to new economic opportunities"*. UNEP defines a green economy as one that results in *"improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities"* (UNEP, 2011). Statistics Netherlands has chosen to apply the OECD framework to measure green growth as this currently provides the most elaborate measurement framework.

According to the OECD measurement framework for green growth, the indicators are broken down into four themes (OECD, 2011b):

1) Environmental and resource productivity of the economy
2) The natural asset base
3) The environmental quality of life
4) Policy responses and economic opportunities

These groups of indicators interrelate. Economic production requires natural resources from the environment, such as energy, water, biomass, ores and other resources. The environment is also used as a sink to absorb emissions and waste. Therefore, environmental efficiency (for instance greenhouse gas emissions / economic growth) and its development are central measures of green growth. Due to globalizing supply chains, 'footprint' type indicators are essential to capture the worldwide environmental pressure resulting from national consumption requirements.

Furthermore, it is important to monitor whether an increasing environmental pressure does not turn into irreversible environmental damage This is measured in the natural asset base, preferably in terms of quantity and quality of the stocks. The natural asset base is monitored by evaluating the stocks of the natural resources that are directly used for economic activities, including renewable assets, like timber, and non-renewable assets such as fossil energy reserves. Ecosystem related indicators are included as well. Due to the complexity of measuring the services that eco-systems provide to the economy, only indirect parameters are measured, such as land use changes and changes in biodiversity. The link between the environment and the population's quality of life is captured in the third set of indicators, and deals primarily on local environmental issues such as population exposure to pollution.

The shift to green growth requires different policy responses depending on the specific country's circumstances. In general, governments can choose between several policy instruments such as taxes, subsidies and regulations. The transition towards green growth also creates new opportunities

for economic activities that may generate new jobs and stimulate economic growth. These last two aspects are measured by indicators for policy responses and economic opportunities.

Environmental accounting and green growth

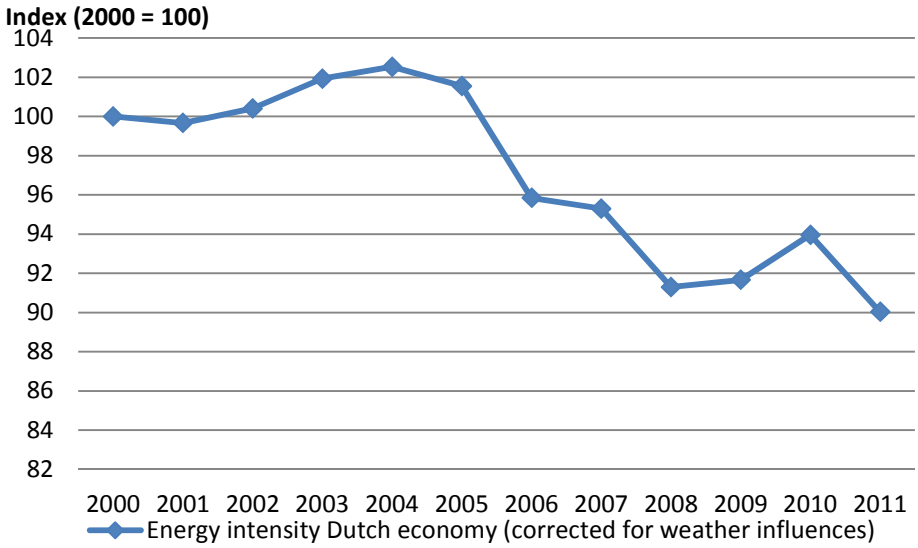
The System of Environmental-Economic Accounting (SEEA) provides a consistent and comprehensive measurement framework for green growth, as it integrates economic and environmental statistics. Both UNEP and the OECD advocate that environmental accounting is used as the underlying framework for deriving indicators. The OECD explicitly advocates that measurement efforts should, where possible, be directly obtained from the SEEA framework (OECD, 2011). A large number of the indicators from the OECD green growth monitoring framework can be directly obtained from the accounts of the SEEA central framework. Indicators for environmental efficiency and resource use can be derived from the physical flow accounts. Combining physical information with monetary indicators from the SNA provides information on the degree of decoupling between environmental pressure and economic growth. The asset accounts provide the basis for indicators related to the natural asset base. Environmental activity accounts offer useful information on the application and efficiency of various policy instruments, such as environmental taxes and subsidies. Finally, data from the environmental goods and service sector (EGSS) provides indicators for evaluation of economic opportunities that may be initiated by green growth.

6.2 The state of green growth in the Netherlands: a focus on energy and efficiency

Environmental and resource efficiency

Greenhouse gas emissions caused by production activities have been reduced since 2000. The levels of other harmful emissions to air, such as fine dust and smog forming substances are also steadily decreasing. On the whole, indicators for resource use show that fewer resources are required to generate an equal amount of output. Energy use for economic production is still rising, but less than the GDP growth rate.

6.2.1 Energy intensity Dutch economy (corrected for weather influences)



Energy intensity, defined as energy use per unit of value added (fixed price level), is an indicator for the energy efficiency of the economy or different industries. A decrease in energy intensity can be caused by more efficient energy use in production processes, for example by energy conservation, or by systematic changes in the economy. Variation in temperature also effects the year-on-year changes of the energy intensity, particularly for the service industries and agriculture. Figure 6.2.1 shows the energy intensities of industries adjusted for this temperature effect. The energy intensity of the Dutch economy has decreased by 10 per cent since 2000. The 2013 'Energieakkoord' aims to give a further impetus to structurally improve the energy productivity and intensity of the Dutch economy or industries

The percentage of renewable energy production is increasing steadily, but it is still low compared to fossil energy carriers. One of the major challenges in the transition to green growth is to ensure that materials are used efficiently.

Natural asset base

Although environmental efficiency is gaining ground, it does not mean that the economic growth is not causing irreversible damage to the environment. This is measured by indicators for the natural asset base. The group of indicators for the natural asset base still shows a rather negative picture. The natural asset base is measured for both renewable and non-renewable stocks and indicators on eco-systems. The Dutch natural gas reserves, the most economically relevant non-renewable resource, are rapidly being depleted. A declining total stock is perceived as an indicator of unsustainable performance, as the stocks are likely to run out in a couple of decades given the current extraction rates and the absence of significant discoveries and revaluations. Increasing the share of renewable energy in the total energy use- the 2013 'Energieakkoord' holds an objective of 16% by 2023- may reduce the rate of extraction and postpone depletion.

Policy responses and economic opportunities

There are several policy instruments that can be used to stimulate green growth. Environmental taxes and subsidies provide key policy instruments that can create incentives to reduce environmental externalities. This is also reflected in the policy recommendations on Green Growth (2013) the Dutch cabinet that outlines several approaches.

The share of environmental taxes in total tax revenues has been constant for several years. The average burden of taxes on energy use is up. A shift in taxation from labour to energy consumption may foster initiatives to improve energy efficiency. Environmental expenditure, all measures aimed to prevent the damaging consequences of human activities or acts on the environment, as a share of GDP has decreased in recent years (CBS (2012b).

Another way to grow green is by innovation and creating economic opportunities. The Topsector Energy is working on promoting innovation and economic opportunities in the field of sustainable energy. Also the cross-sectoral innovations as between energy, water and waste treatment are taken into account by innovating companies. Several indicators show that there are more economic opportunities that arise from greening the economy. The share, but also the absolute number of green patent applications has grown since 2000, indicating an upward trend in the inventiveness and knowledge-intensification of the country in the field of green technologies. Cleaner technologies make production processes more environmentally benign. In addition, the production of environmental technologies by specialised producers may contribute to economic growth. Their share of employment in the environmental goods and services sector (EGSS) in total employment is up, whereas its share in value added in GDP started to increase since 2005. With its contribution to innovation and job creation, the SES and the environmental goods and services sector in general are important drivers of a green economy.

7. Patent applications in the sustainable energy sector

This section presents figures on patent applications in the sustainable energy sector, which show part of the innovative status of the sector. The figures in this section were provided by the Netherlands Patent Office which is part of NL Agency. Main finding is that the share of SES in patent applications is quite high compared to the average for the Dutch economy.

Patents are direct results of innovation and are therefore indicative for the quality of R&D in the SES. Specifically for this report, the patents department of NL Agency collected a number of patent statistics, which we describe here. One advantage of patents is that they are classified in accordance with the International Patent Classification (IPC). They can therefore be linked directly to energy technologies, making it possible to pinpoint more precise relevant innovation activities. This section presents several statistics based on patent applications by companies in the P-SES population in 2006 - 2010.

First, to get an indication of the innovative nature of the P-SES, this section presents the total share of companies in the P-SES that submitted one or more patent applications. The patent office of NL Agency matched the 2011 P-SES companies to their patent database, and found 162 companies in the P-SES that had applied for one or more patents in 2006-2010, i.e. 15 per cent of the total P-SES. This share is quite high compared to the average for the Dutch economy, where approximately 1 per cent of companies applied for one or more patent applications in the last ten years. This is also because the P-SES contains a relatively large sum of relatively large companies, which in general do more patent applications.

Next, we present the distribution of patent applications that according to the IPC are related to sustainable energy technology. If we zoom in further on the companies that did a patent application, we can classify them into different content types. Table 7.1 below presents the number of companies that did a patent application into at least one of the four content types (i.e. sustainable energy and other content categories).

7.1 Types of patent applications by P-SES companies over 2006 – 2010

Content type	Number of companies
No relation with sustainable energy or environment	107
Indirect relation with sustainable energy or environment	40
Relation with environment	21
Relation with sustainable energy	76

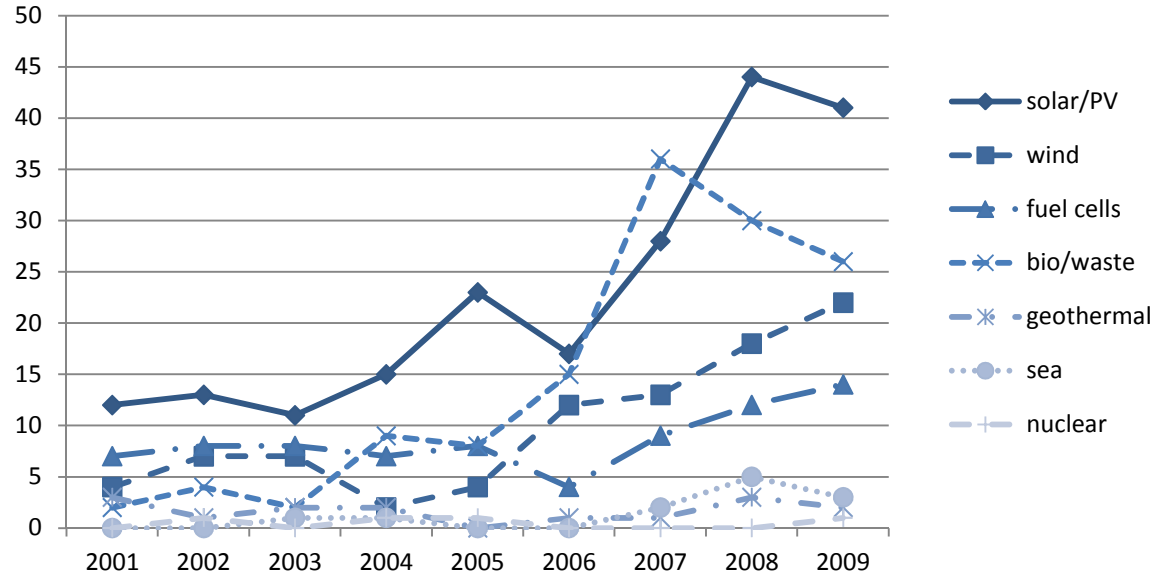
Source: Patent Office NL Agency

Table 7.1 shows that about one third of the companies that filed one or more patents, applied for at least one patent that is directly related to sustainable energy technology, while around 60 per cent has no relation to either sustainable energy or the environment. This large share is not surprising, considering the fact that many companies in the 2011 P-SES have activities both within and outside the scope of P-SES (i.e. non-specialised companies). Innovation activity (in terms of patent applications) is still more intensive in the P-SES than the average innovation activity in the Dutch

economy. Patent applications do not necessarily lead to more economic growth, employment or profits.

Finally it is interesting to look at patent developments over time. Here the patent office of NL Agency provided data for the period 2001-2009. Figure 7.2 presents the development of patent applications by different categories of sustainable energy technology.

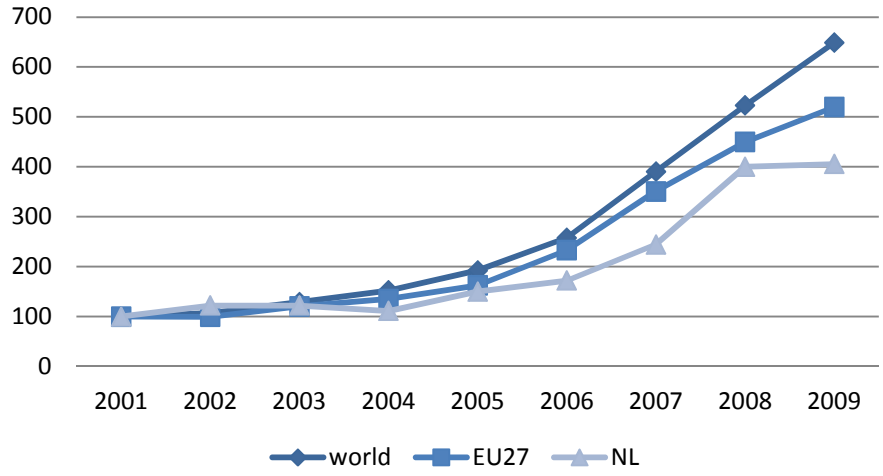
7.2 Patents in sustainable and nuclear energy technology by Dutch companies



Source: Patent Office NL Agency

Figure 7.2 indicates that over the years solar, bio/waste and wind energy technology are the most prominent technology categories in which patents have been applied for, while nuclear, ocean and geothermal technologies are less prominent. Moreover, we see that in 2006–2008 both solar, wind and fuel cells energy patent applications show a substantial increase.

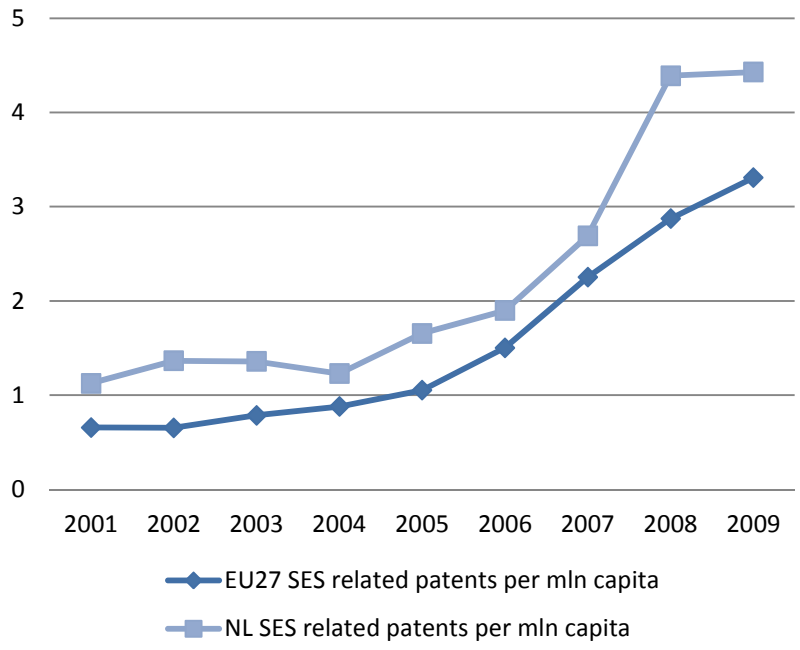
7.3 Growth of international patent applications in renewable energy



Source: Patent Office NL Agency

In the period 2001 – 2009 the number of patent applications in the Netherlands was increasing. However, growth in the number of applications in the Netherlands was on average slower than in other countries. The number of annual patent applications related to renewable energy was quite stable in the Netherlands over 2001 to 2005, while after 2005 it increased every year until 2009 (figure 7.3).

7.4 Growth of international patent applications in renewable energy



On the positive side, over the complete period 2001 – 2009, the number of patents per capita in the Netherlands is still quite large compared to the EU27. In fact, between 2007 and 2009 this difference has actually been further increasing.

8. International cooperation and harmonisation

From the Dutch perspective there are both international as bilateral efforts to increase international cooperation and harmonisation with respect to the SES. It is important to note that in a national accounting context, the SES is part of the 'environmental goods and services sector', for which Statistics Netherlands has recently developed a new set of statistics. These statistics are the result of a European (Eurostat) handbook on guidelines to construct European statistics that structurally monitor the Environmental Goods and Services Sector. These statistics are also part of the System of Environmental Economic Accounting (SEEA), which has been formally adopted by the statistical department of the United Nations in 2012. The SEEA describes an international system of harmonised concepts for the compilation of environmental accounts.

The international cooperation and harmonisation is constituted by the 'Regulation on European Environmental Economic Accounts' (REEEA), which is governed by both Eurostat and the European Commission. REEEA came into place in concordance with the recent adoption of the System of Environmental Accounting (SEEA) by the United Nations and is fully in line with it. The SEEA formulates a classification of resource management activities (CreMa). Three subcategories of resource management of this internationally recognised framework represent Sustainable Energy Sector (SES) activities. These are 'Production of energy from renewable resources' (i.e. CreMa 13A), Heat/energy saving and management (CReMA 13B), and Minimization of the use of fossil energy as raw materials (CReMA 13C).

The European Commission is right now preparing a legal base for the EGSS. The main key elements of the 'provisional' legal base which is still under construction are the following (July 2013). Statistics shall be compiled and transmitted on a yearly basis and shall be transmitted within 24 months of the end of the reference year. In order to meet user needs for complete and timely datasets, the Commission (Eurostat) shall produce, as soon as sufficient country data becomes available, estimates for the EU-27 totals for the main aggregates of this module. The Commission (Eurostat) shall, wherever possible, produce and publish estimates for data that have not been transmitted by Member States within the deadline The first reference year is the year in which this Regulation enters into force. In the first data transmission, Member States shall include annual data from 2013 to the first reference year. In each subsequent data transmission to the Commission, Member States shall provide annual data for the years n-3, n-2, n-1 and n, where n is the reference year. It is not clear yet if and when the Regulation enters into force. The Regulation is an important step for international harmonization of statistics on the SES.

Beside the effort of Eurostat en the European Commission, Statistics Netherlands also invests in improving cooperation and harmonisation on the bilateral level. There have been close contacts with researchers from DESTATIS, the German statistical bureau, in order to harmonise the Dutch and German SES definitions and classifications. Recently this led to the conclusion that there are a lot of differences that need to be resolved in order to increase comparability between the SES statistics of both bureaus. In order to overcome such differences Statistics Netherlands aims to harmonise the environmental goods and services sector at the Eurostat level. A study visit of the UK Statistical Bureau to the Netherlands is scheduled in autumn 2013.

9. Conclusions and recommendations

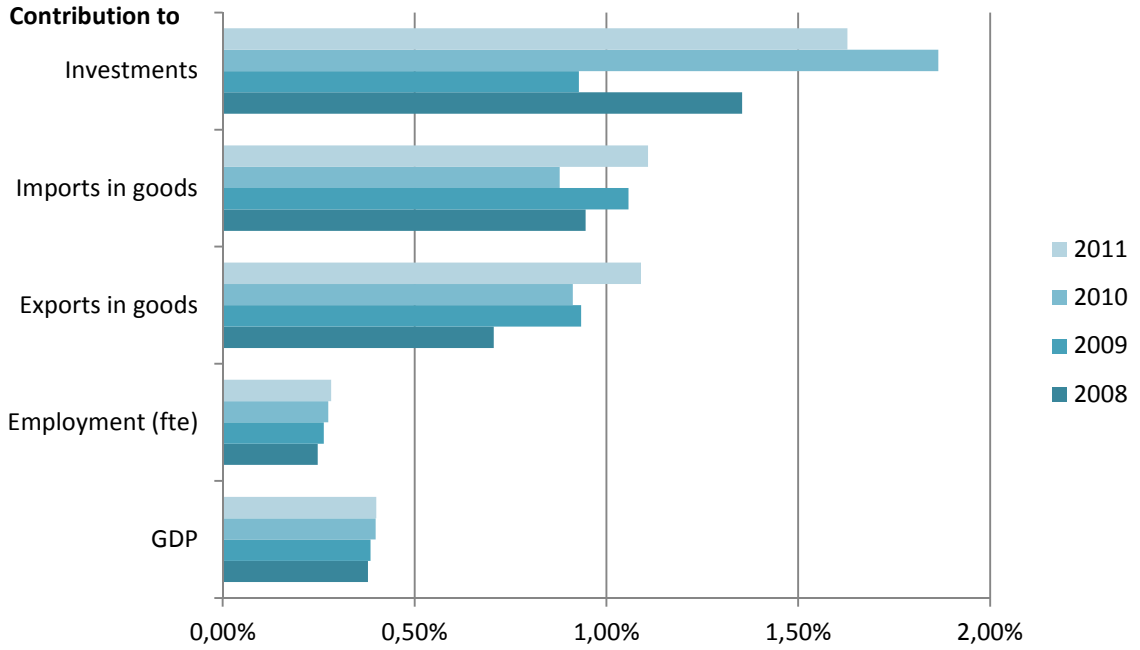
This report presents economic figures for the years 2008 – 2011 on the sustainable energy sector (SES). The general trend in these figures is that the sector is growing. Employment in both the exploitation phase of the SES (E-SES), the specialised companies in the pre-exploitation phase of the SES (P-SES) and the non-specialised companies in the P-SES increased. The total increase in employment over the total SES is 13 per cent during 2008 – 2011.

9.1 Overview of key economic indicators

		2008	2009	2010	2011
Indicator	*Sector*	*fte (rounded)*			
Employment	SES	16 900	17 800	18 500	19 100
	E-SES	2 400	2 600	2 600	2 800
	P-SES (specialised)	6 600	7 000	7 400	7 300
	P-SES (non-specialised)	7 900	8 200	8 500	9 000
		euro, mln, rounded			
Production	SES	5 570	5 560	5 900	6 810
	E-SES	1 070	1 180	1 320	1 820
	P-SES (specialised)	1 840	1 820	1 760	1 750
	P-SES (non-specialised)	2 660	2 560	2 820	3 240
Value added	SES	2 250	2 210	2 340	2 400
	E-SES	830	770	760	840
	P-SES (specialised)	580	540	580	570
	P-SES (non-specialised)	840	900	1 000	990
Exports in goods	SES	2 560	2 810	3 300	4 330
Imports in goods	SES	3 020	2 800	2 810	3 900
Capital formation	SES	1 650	1 010	1 900	1 740

This increase also led to an increase in the employment share of the SES in the total Dutch employment, which grew from 0.25 per cent in 2008 to 0.28 per cent in 2011. This increasing trend is also observed in production, trade, investment and innovation figures.

9.2 Contribution of the SES to core economic indicators



The only exception is value added, which although it shows an overall growth of 7 per cent, this is mainly due to an increase in the non-specialised companies of the P-SES, while the specialised companies in the P-SES and the E-SES show a more stable pattern. This overall increase in value added should therefore be interpreted with some more caution, because it might also be the result of an increase in value added of activities that are unrelated to renewable energy or energy saving services or goods by non-specialised P-SES companies.

Products/Technologies in the P-SES.

In the P-SES the main source of employment, value added and production over the period 2008 – 2011 are activities related to energy saving, solar, heat & geothermal and wind offshore products . Energy saving related indicators show a stable pattern over time, 4 800 FTE in 2008 and 4 700 FTE in 2011. Approximately 40 percent of employed persons in the P-SES are active in manufacturing industries.

From a growth perspective, the main contributors are solar and wind energy related activities. The employment in solar energy increased from 2 400 FTE in 2008 to 3 300 FTE in 2011, an increase of 38 per cent while the number of FTE in wind energy increased from 2 200 FTE in 2008 to 2 700 FTE in 2011, an increase of 23 per cent. These increasing trends are observed in both the specialised and non-specialised solar and wind energy related companies. This growth in solar and wind also reflects in the growth of 'Installation and maintenance' figures, where FTEs increased with 33 per cent (2 100 FTE in 2008 and 2 800 FTE in 2011) and value added increased with 37 per cent (190 million euro in 2008 and 260 million euro in 2011).

Patent applications in the P-SES

The number of SES related patent applications grew from 28 in 2001 to 109 in 2009, in increase of nearly 300 per cent. However, this growth may seem substantial, it is below both the average growth in the rest of the world and the EU27. However, within the EU27, the number of Dutch annual patent applications per capita is still quite large compared to other countries

International trade

The P-SES in the Netherlands was a net importer of goods in 2008, as of 2009 the Netherlands became a net exporter of SES related goods . This development is largely the result of increased exports of biofuels.

Capital formation

With respect to the development over time, in 2011 the spending on fixed capital formation is back on the 2008 level, overcoming the backlash of 2009. The structure of the capital spending changed, in particular there has been a shift from 'energy saving, heat and geo' to 'wind'. This is a similar shift pattern as was seen in the employment and value added time series.

Recommendations and future developments

- This is third consecutive year the SES radar has been published by Statistics Netherlands. The annual calculation of the economic key figures (employment, value added, production, trade and investment) as well as publishing a detailed radar (e.g.. with data on innovation and more incidental efforts like a regional analysis and rebase) once every two or three years is useful in evaluation of the Dutch SES.
- The rebase of the P-SES population that was performed for this report has proven to be fruitful. Taking into account both its labour intensiveness and impact, it is recommended to repeat the rebase every three year.
- Part of the economic potential of the SES lies in the export of services as transport and installation of offshore wind facilities abroad. So far, the export and import of services are not included in the radar. The data collection of the international trade in services by Statistics Netherlands is executed on a more aggregated level, not on the level of individual company units but on the level of a group of companies that are part of the same holding. It will be a challenge to makes estimates for these flows.
- Monetary economic values are currently only available in current prices. It is desirable to measure these developments also in terms of volume. However, this would require proper deflation of the figures, which would be a major challenge.
- More international coordination and harmonisation would be very useful because it is interesting for policymakers to see how the Dutch SES performs compared to the SES in other (European) countries such as as Germany, Denmark and the UK. Economic relations between countries have an important effect on the Dutch SES. Increasing international comparability of the SES figures will add both to their significance and interpretation.
- The P-SES is based on a 'micro approach', which identifies individual companies. This proves to be a useful approach as it allows for detailed in depth research, such as spatial cluster

analysis (section 3.3) or analysis or the merge with the patent register (section 7). The quality of the approach can potentially be improved by further confrontation with other relevant figures, such as the newly installed capacity for solar and wind technologies. Local, decentralised energy production is promoted by the 2013 'Energieakkoord'. These developments should be well monitored over time.

- Other ways in improving of the quality of the figures lie in strengthening the cooperation with other organisations in the field of 'the economy of renewable energy and energy saving'. In recent this has been increasingly implemented by organising a radar feedback group and actively participating in other feedback groups.
- While the inclusion of new data sources in 2013 results in a substantial quality improvement of the figures, it should be noted that the work on the economic figures of the sustainable energy sector is still a 'learning process'. On-going interaction and discussions with stakeholders, such as the organisation that signed the 2013 'Energieakkoord', and researchers as well as the international statistical community will result in future improvements and possibly extensions of the figures on the SES.

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Annex A: Tables on key figures for product-profiles and process profiles

Table I - Employment in the pre-exploitation stage of the SES, 2008-2011

Pre-exploitation stage of the Sustainable Energy Sector in the Netherlands

Employment (fte, rounded)

	Specialised				Non- specialised				Total P-SES			
Product	**2008**	**2009**	**2010**	**2011**	**2008**	**2009**	**2010**	**2011**	**2008**	**2009**	**2010**	**2011**
Solar	1 400	1 600	1 800	1 900	1 000	1 100	1 200	1 400	2 400	2 700	2 900	3 300
Bio gas	100	200	100	100	200	200	300	300	400	400	400	400
Bio mass (solid) & waste	300	400	500	400	300	300	400	400	700	700	900	800
Bio fuels (fuel production excluded)	100	200	200	100	500	500	500	600	600	700	700	700
Bio refining	200	200	200	200	200	200	200	200	500	500	400	500
Wind onshore	500	500	600	600	300	300	300	300	700	800	900	900
Wind offshore	200	200	300	300	1 200	1 300	1 200	1 400	1 500	1 500	1 500	1 800
Heat & geo thermal energy /energy from water	400	400	500	500	1 400	1 400	1 500	1 400	1 700	1 800	2 000	1 900
Energy saving	2 800	2 700	2 700	2 600	2 000	2 100	2 200	2 100	4 800	4 800	4 800	4 700
Electric transport	200	200	200	200	200	200	200	200	400	400	400	400
Smart grids/ Hydrogen technology/ CO2 capture and storage	300	300	400	300	600	600	500	600	800	900	900	900
Total	**6 600**	**7 000**	**7 400**	**7 300**	**7 900**	**8 200**	**8 500**	**9 000**	**14 500**	**15 200**	**15 900**	**16 300**

Pre-exploitation stage of the Sustainable Energy Sector in the Netherlands

Employment (fte, rounded)

	Specialised				Non- specialised				Total P-SES			
Process	**2008**	**2009**	**2010**	**2011**	**2008**	**2009**	**2010**	**2011**	**2008**	**2009**	**2010**	**2011**
Installation and maintenance	600	600	700	700	1 500	1 600	1 700	2 100	2 100	2 200	2 400	2 800
R&D	900	900	1 000	900	1 300	1 300	1 400	1 400	2 200	2 200	2 300	2 300
Supply, assembly and construction	4 000	4 200	4 500	4 500	3 100	3 200	3 300	3 200	7 100	7 400	7 800	7 700
Preparation/raw material production	100	100	100	100	300	300	300	300	300	400	400	400
Consultancy + Transport	1 000	1 100	1 100	1 200	1 800	1 800	1 800	1 900	2 800	2 900	3 000	3 100
Total	**6 600**	**7 000**	**7 400**	**7 300**	**7 900**	**8 200**	**8 500**	**9 000**	**14 500**	**15 200**	**15 900**	**16 300**

Table II - Value added in the pre-exploitation stage of the SES, 2008-2011

Pre-exploitation stage of the Sustainable Energy Sector in the Netherlands

Value added (euro, mln, rounded)

	Specialised				Non- specialised				Total P-SES			
Product	**2008**	**2009**	**2010**	**2011**	**2008**	**2009**	**2010**	**2011**	**2008**	**2009**	**2010**	**2011**
Solar	110	100	100	110	100	110	130	140	210	210	230	250
Bio gas	10	10	10	10	20	20	30	30	30	30	40	40
Bio mass (solid) & waste	30	40	40	40	30	30	30	40	60	70	80	80
Bio fuels (fuel production excluded)	10	30	50	10	70	70	120	120	90	90	170	130
Bio refining	20	10	10	10	30	30	30	20	50	30	40	40
Wind onshore	40	50	30	60	30	30	30	30	70	70	70	90
Wind offshore	20	20	20	40	170	230	220	210	200	250	250	240
Heat & geo thermal energy /energy from water	30	30	50	40	110	120	130	120	140	150	170	160
Energy saving	270	210	210	210	150	160	170	170	420	370	380	380
Electric transport	20	20	20	20	20	20	30	30	40	40	40	40
Smart grids/ Hydrogen technology/ CO2 capture and storage	20	20	30	20	100	90	90	90	130	110	120	120
Total	**580**	**540**	**580**	**570**	**840**	**900**	**1 000**	**990**	**1 420**	**1 440**	**1 580**	**1 560**

Pre-exploitation stage of the Sustainable Energy Sector in the Netherlands

Value added (euro, mln, rounded)

	Specialised				Non- specialised				Total P-SES			
Process	**2008**	**2009**	**2010**	**2011**	**2008**	**2009**	**2010**	**2011**	**2008**	**2009**	**2010**	**2011**
Installation and maintenance	50	50	50	60	150	170	180	200	190	220	240	260
R&D	70	70	70	60	170	180	200	200	250	250	270	260
Supply, assembly and construction	360	320	340	320	330	340	390	370	690	660	740	690
Preparation/raw material production	10	10	10	10	20	30	30	30	30	40	30	40
Consultancy + Transport	90	90	100	110	170	190	210	190	260	280	310	310
Total	**580**	**540**	**580**	**570**	**840**	**900**	**1 000**	**990**	**1 420**	**1 440**	**1 580**	**1 560**

Table III - Production in the pre-exploitation stage of the SES, 2008-2011

Pre-exploitation stage of the Sustainable Energy Sector in the Netherlands

Production (euro, mln, rounded)

	Specialised				Non- specialised				Total			
Product	**2008**	**2009**	**2010**	**2011**	**2008**	**2009**	**2010**	**2011**	**2008**	**2009**	**2010**	**2011**
Solar	460	500	500	450	300	330	380	440	760	830	880	890
Bio gas	30	40	20	20	70	90	80	100	110	130	100	120
Bio mass (solid) & waste	70	80	110	100	90	70	90	100	160	150	200	200
Bio fuels (fuel production excluded)	30	60	80	20	440	320	380	640	470	380	460	660
Bio refining	60	20	30	30	90	70	80	80	140	90	100	120
Wind onshore	200	220	170	180	90	70	90	100	290	290	260	280
Wind offshore	70	50	60	100	540	630	670	660	610	680	730	760
Heat & geo thermal energy /energy from water	80	80	100	100	310	300	340	350	390	380	440	450
Energy saving	740	680	590	650	430	410	450	470	1 180	1 090	1 040	1 120
Electric transport	50	40	40	50	60	60	60	70	110	110	100	120
Smart grids/ Hydrogen technology/ CO2 capture and storage	50	50	60	50	230	210	190	220	280	260	260	280
Total	**1 840**	**1 820**	**1 760**	**1 750**	**2 660**	**2 560**	**2 820**	**3 240**	**4 500**	**4 380**	**4 590**	**4 990**

Pre-exploitation stage of the Sustainable Energy Sector in the Netherlands

Production (euro, mln, rounded)

	Specialised				Non- specialised				Total			
Process	**2008**	**2009**	**2010**	**2011**	**2008**	**2009**	**2010**	**2011**	**2008**	**2009**	**2010**	**2011**
Installation and maintenance	230	230	210	210	490	480	520	630	720	710	730	850
R&D	160	160	190	150	470	440	480	570	640	600	660	720
Supply, assembly and construction	1 160	1 110	1 120	1 110	1 180	1 130	1 220	1 440	2 340	2 240	2 340	2 550
Preparation/raw material production	80	100	40	30	80	70	80	90	160	170	120	120
Consultancy + Transport	210	230	210	250	430	440	520	510	640	660	730	760
Total	**1 840**	**1 820**	**1 760**	**1 750**	**2 660**	**2 560**	**2 820**	**3 240**	**4 500**	**4 380**	**4 590**	**4 990**

Table IV - Economic indicators for the exploitation stage of the SES, 2008-2011

Exploitation Stage of the Sustainable Energy Sector in the Netherlands								
		Hydropower	Wind energy	Solar energy	Biomass & Biofuels	Biogas	Heat and geothermal	**Total E-SES**
Employment	**2008**	0	900	0	800	700	0	**2 400**
(fte, rounded)	**2009**	0	900	0	900	700	0	**2 600**
	2010	0	800	0	1 000	800	0	**2 600**
	2011	0	1 000	100	1 000	700	0	**2 800**
Production	**2008**	10	390	0	560	80	30	**1 070**
(euro, mln, rounded)	**2009**	10	380	0	670	90	30	**1 180**
	2010	10	320	10	860	90	30	**1 320**
	2011	0	420	10	1 250	90	40	**1 820**
Value added	**2008**	10	260	0	450	80	30	**830**
(euro, mln, rounded)	**2009**	10	250	0	390	90	30	**770**
	2010	10	210	10	410	90	30	**760**
	2011	0	270	10	420	90	40	**840**

Table V - International Trade in the SES, 2008-2011

Export (mln, euro, rounded)

	Specialised				Non-specialised				SES			
Product	**2008**	**2009**	**2010**	**2011**	**2008**	**2009**	**2010**	**2011**	**2008**	**2009**	**2010**	**2011**
Solar & Wind	320	320	590	390	280	260	300	290	600	590	890	680
Biofuels & biomass	x	x	x	x	x	x	x	x	1 400	1 700	1 920	3 130
Energy saving	300	260	240	240	90	80	90	100	390	340	320	340
Electric transport, Smart grids/ Hydrogen technology/ CO2 capture and storage	30	40	50	40	150	130	130	140	180	170	170	180
Total	**650**	**620**	**870**	**670**	**520**	**480**	**510**	**540**	**2 560**	**2 810**	**3 300**	**4 330**

** Includes E-SES*

Import (mln, euro, rounded)

	Specialised				Non-specialised				SES			
Product	**2008**	**2009**	**2010**	**2011**	**2008**	**2009**	**2010**	**2011**	**2008**	**2009**	**2010**	**2011**
Solar & Wind	360	410	560	420	200	190	210	220	550	600	760	640
Biofuels & biomass	x	x	x	x	x	x	x	x	1 920	1 760	1 540	2 730
Energy saving	170	140	150	140	70	60	70	80	230	190	220	230
Electric transport, Smart grids/ Hydrogen technology/ CO2 capture and storage	90	80	80	110	240	170	200	200	320	250	280	310
Total	**610**	**620**	**790**	**680**	**500**	**420**	**480**	**500**	**3 020**	**2 800**	**2 810**	**3 900**

** Includes E-SES*

Table VI - Capital formation in the SES, 2008-2011

Capital formation in the Sustainable Energy Sector		**2008**	**2009**	**2010**	**2011**
Indicator	*Profile*	*euro, mln, rounded*			
Capital formation	Solar	70	170	140	210
	Wind	200	110	200	500
	Other	1 380	730	1 560	1 030
		1 650	**1 010**	**1 900**	**1 740**

Annex B: Topsector Energy themes and product profiles of the P-SES

Table I - Topsector Energy themes (TKIs) and the relation to the P-SES product profiles.

Product profile P-SES	Topsector Energy's Innovationtheme
1. Solar PV	6. Solar Energy
2. Solar - Concentrated Solar Power (CSP)	Other pre-exploitation SES not in top sector themes
3. Solar thermal energy	Other pre-exploitation SES not in top sector themes
4. Biogas	3. Gas (natural gas excluded)
5. Biomass (solid) & waste	7. Bio-energy
6. Biofuels (including the production of bio fuels)	7. Bio-energy
7. Bio-refining	7. Bio-energy
8. Wind on shore	Other pre-exploitation SES not in top sector themes
9. Wind off shore	5. Wind offshore
10. Aerothermal & geo thermal energy	Energy saving 1.Built environment and 2. Manufacturing
11. Energy from water	Other pre-exploitation SES not in top sector themes
12. Energy saving	Energy saving 1.Built environment and 2. Manufacturing
13. Electric road transport	Other pre-exploitation SES not in top sector themes
14. Smart grids	4. Smart grids
15. Hydrogen technology	Other pre-exploitation SES not in top sector themes
16. CO2 capture and storage (CCS)	Other pre-exploitation SES not in top sector themes