INTERNATIONAL ENERGY AGENCY
CO-OPERATIVE PROGRAMME ON
PHOTOVOLTAIC POWER SYSTEMS

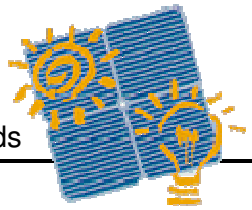
Task 1

Exchange and dissemination of information on PV power systems

National Survey Report of PV Power Applications in the Netherlands 2012

July 2013

NL Agency
Ministry of Economic Affairs



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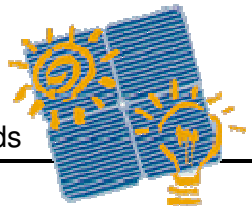
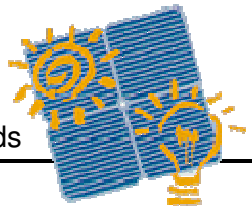




FOREWORD ABOUT IEA

The International Energy Agency (IEA), founded in November 1974, is an autonomous body within the framework of the Organisation for Economic Co-operation and Development (OECD), which carries out a comprehensive programme of energy co-operation among its 23 member countries. The European Commission also participates in the work of the Agency.

The IEA Photovoltaic Power Systems Programme (IEA-PVPS) is one of the collaborative R & D agreements established within the IEA and, since 1993, its participants have been conducting a variety of joint projects in the applications of photovoltaic conversion of solar energy into electricity.

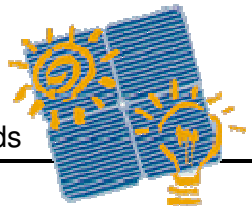
The 21 participating countries are Australia (AUS), Austria (AUT), Canada (CAN), Denmark (DNK), France (FRA), Germany (DEU), Israel (ISR), Italy (ITA), Japan (JPN), Korea (KOR), Malaysia (MYS), Mexico (MEX), the Netherlands (NLD), Norway (NOR), Portugal (PRT), Spain (ESP), Sweden (SWE), Switzerland (CHE), Turkey (TUR), the United Kingdom (GBR), and the United States of America (USA). The European Commission, the European Photovoltaic Industry Association, and the US Solar Electric Power Association are also members.

The overall programme is headed by an Executive Committee composed of one representative from each participating country, while the management of individual Tasks (research projects / activity areas) is the responsibility of Operating Agents. Information about the active and completed tasks can be found on the IEA-PVPS website, www.iea-pvps.org.

INTRODUCTION

The objective of Task 1 of the IEA Photovoltaic Power Systems Programme is to facilitate the exchange and dissemination of information on the technical, economic, environmental, and social aspects of photovoltaic power systems.

An important deliverable of Task 1 is the annual Trends in photovoltaic applications report. In parallel, National Survey Reports are produced annually by each Task 1 participant. This document is the Dutch National Survey Report for the year 2012. Information from this document will be used as input to the annual Trends in photovoltaic applications report. The PVPS website www.iea-pvps.org also plays an important role in disseminating information arising from the programme, including national information.



SUMMARY

1.1 Installed PV capacity

A total of 195 MW PV capacity was installed in the Netherlands in 2012, which resulted in a 135% increase in capacity compared to the level of installed capacity in 2011. The total capacity in 2012 is 340 MW (CBS May 2013). 58 MW of PV were installed in the Netherlands in 2011 and 21 MW in 2010, a 65% and 30% increase, respectively. In 2011, the total installed capacity was 145 MW (CBS).

1.2 Costs & Prices

Typical module and system prices decreased 44 % over 2012compared to October 2011. Average module prices were 1.26 €/Wp (including tax), with a range of 0.64 – 2.63 €/Wp (including tax). Over 10% of the modules were cheaper than 1.10 €/Wp (including tax) [1].

1.3 PV production

In 2012, the Dutch PV industry enhanced its focus on equipment and production machinery for PV production. In particular in the Eindhoven ("Brainport") region equipment manufacturers increased both market position and R & D effort. The High Tech Campus Eindhoven has evolved into 'the place to be' for advanced solar equipment and machinery.

The Netherlands' equipment manufacturers are active in a broad range of solar technologies. Most noteworthy companies are Eurotron, HyET Solar, Roth & Rau BV (formerly OTB), Solar Excel, Smit Ovens, SoLayTec, Rimas, Tempress, and VDL Flow (module production lines). As a result of the global overcapacity in PV production, virtually no new PV production capacity was installed in 2012. In 2012, the focus of almost all PV equipment manufacturers was on the delivery of machinery for the upgrade of existing PV production lines. In addition, new R & D in low-cost, high-efficient cell and module production technologies was initiated.

As in 2011, the production of cells and modules in 2012 suffered severely from the fierce competition from PV producers in Asia. The existing cell and module manufacturers Solland Solar (acquired by an Italian industrial group) and Scheuten Solar (acquired by Chinese investors) closed down their module production in the Netherlands. Solland Solar is the only remaining cell manufacturer with a production capacity of 135 MWp.

1.4 Budgets for PV

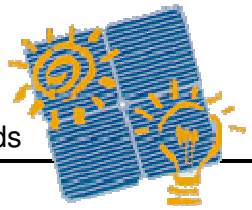
On 2 July 2012, a one-off 52 million euros subsidy deal was negotiated between political parties for individual households to recover some of their investment costs. The amount was divided over 2012 (22 million euros) and 2013 (30 million euros).

The SDE+ commenced in 2012 for PV-installations larger than 15kWp. And 3.3 million euros was awarded to investments in PV-systems throughout 2012.

In December 2011, the contours became clear of the new innovation contract that would replace the subsidy scheme for R & D in the Netherlands. This is a public-private partnership with shared funding that will ensure a closer connection between research, development, market deployment and a more effective use of available funds. Nine top sectors (key areas for innovation) for economic growth have been defined, including the Top

Sector Energy. The public-private partnerships in the Top Sector Energy are organised within 7 Top Consortia for Knowledge and Innovation (*Topconsortium Kennis en Innovatie*, TKI) in order to make optimum use of existing knowledge and expertise. The TKI-Solar is one of these Top Consortia for knowledge and innovation. In the TKI-Solar, entrepreneurs, government officials and scientists collaborate. The innovation contract focuses on three main programme lines: PV systems and applications, wafer-based silicon PV technologies and thin film PV technologies. A total of 19 projects started in 2012 committing 41 million euros in project cost and a contribution of 23.4 million euros in public funding. More than 45 companies, 5 knowledge institutes, and 4 universities collaborate in these projects.

Fig. 1-1: *Office Lidl*



2 THE IMPLEMENTATION OF PV SYSTEMS

2.1 Applications for photovoltaics

In the Netherlands the PV market is divided in 6 segments or sub-segments:

1. Grid-connected systems (division based on the SDE-scheme)
   a. large systems: more than 100 kW
   b. medium-sized systems: less than 100 kW, but more than 15 kW
   c. small systems: less than 15 kW
2. Off-grid:
   a. stand-alone systems (parking meters, sluices and locks, flood gates, emergency telephones, buoys etc.)
   b. mobile systems (caravan's, mobile homes, ships, mobile road marking, etc.)
   c. consumer goods (watches, battery chargers, radio's, garden lights, etc.)

There appears to be little activity in segments 2a stand alone systems and 2b mobile systems. No market information is available for segment 2c, consumer goods, as these are not registered as PV products. Since 2004, the off-grid market stabilized at a level of 5 MW.

2.2 Total photovoltaic power installed

The total cumulative installed PV power in the Netherlands at the end of 2012 was 340 MW (source: CBS May 2013). The growth of the cumulative installed power in 2012 was 195 MW. This is almost a 135% increase in the total amount of installed capacity compared to the level of 2011. The annual growth and the cumulative installed power are given in table 2-1.

Table 2-1

Cumulative installed power	2007*	2008*	2009*	2010**	2011**	2012**/***
Total [MW]	53.1	57.2	67.5	88.2	145	340
Increase compared to level year before [%]		8 %	18 %	31 %	64 %	134 %
Increase [MW]		4.1	10.3	20.7	58	195
Increase compared to increase year before [%]			250 %	200 %	275 %	343 %

** Until 2009, the installed capacity was fairly accurately known. Almost all solar panels were installed with grants and thus registered.*

*** From 2010 the error rate increased. Falling prices and the possibility of net metering (by law since 2004, for grid connections of 3 x 80 A or less) made it also interesting for individuals to install panels without a subsidy.*

**** According to the Association of Energy Network Operators in the Netherlands the total cumulative installed PV power is about 370 MW in 2012 [12].*

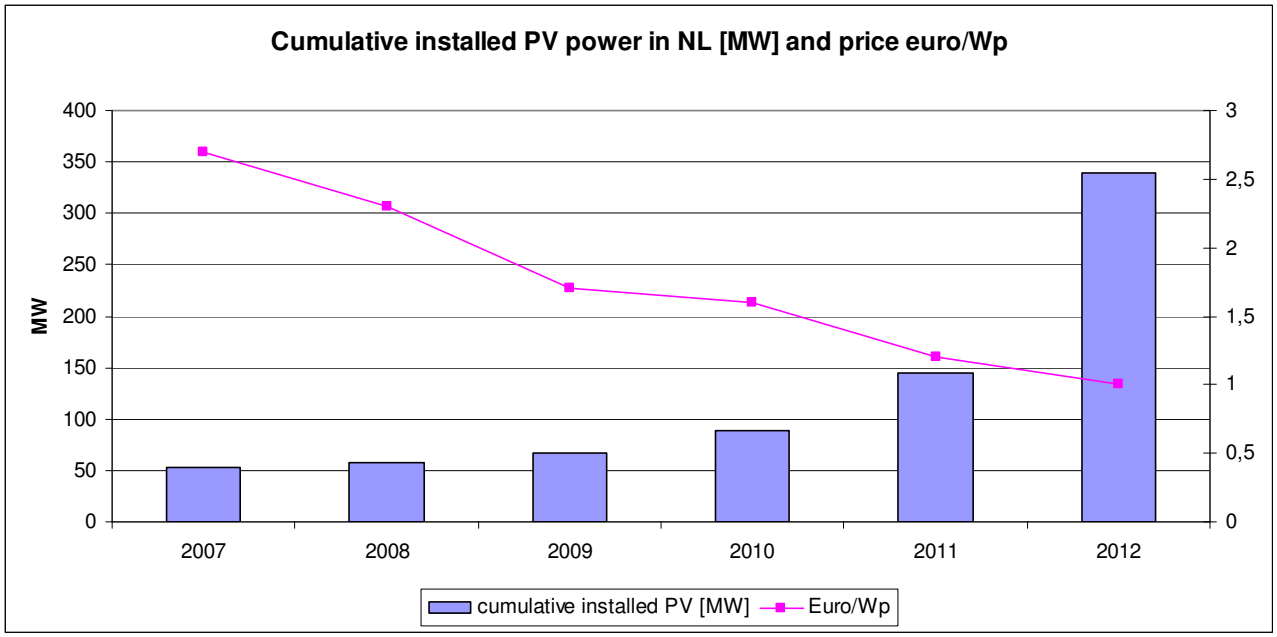


***Fig. 2-1**: Cumulative installed power in MW and price euro/Wp (prices estimated on EPIA data)*

As in previous years the installed power is estimated via surveys by the Central Bureau of Statics (CBS) [7]. The number of surveys sent to companies increased tremendously the last few years as module prices came down and the market picked up. The error margin of the installed capacity in 2012 also increased in this fast expanding market and is estimated to be in the tens of Megawatts.

In a survey [4] done for households each year, the huge increase in installed capacity in 2012 is confirmed.

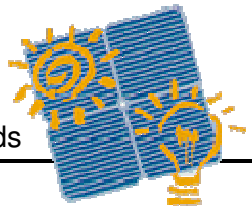
If a household took energy-saving measures in 2012, then PV systems were installed in 10 % of the cases. For 2011 this rate was 2%. Compared to 2011, if measures were taken in 2012, more than three times as many households installed PV-systems.

***Table 2-2**: % PV panels as household energy saving measures*

	Before 2011 [%] *	2011 [%] *	2012 [%] *
rental	1	2	4
owner	3	3	12
total	2	3	10

On average, 19 m^2 of PV panels are installed on the roof in 2012 (households) [4].

2.3 PV implementation highlights, major projects



2.3.1 The renewable energy targets

As a EU Member State, the Netherlands is working towards meeting the EU goal of limiting the rise in temperature to no more than 2°C by 2050. The Netherlands embraces the EU targets to reduce greenhouse gas emissions in 2020 by reducing energy consumption and by using a higher proportion of renewable energy.

For the Netherlands, this emission reduction target set at 16% in 2020 (compared to 2005).

The EU-target for the Netherlands is 14% renewable energy production in 2020. In 2012 elections were held and the new government, installed in November 2012, has in its coalition agreement increased the national target for renewable energy product to 16% in 2020.

2.3.2 Regional and local initiatives

Since the start in 2010, there are a large number of initiatives to promote the purchase of solar panels in short time. With regard to these actions, we conclude that these initiatives have accelerated the home market for PV systems in the Netherlands, by providing an economically attractive alternative and creating a stronger general attention and awareness of the application of PV systems.

The purchasing action Zwolle sun city is a good example of a local initiative with a strong social solidarity (2011-2012, result 0.5 MW installed and price reduction approximately 20 %). The Vereniging Eigen Huis (National House Owners Association) with 1.2.3. Solar Energy has a thoughtful approach and the best results in terms of quality and price when purchasing the PV system and in particular for the use of the system over a period of 10 years (2011-2012, result 10 MW, price reduction approximately 20%) [5].

A number of initiatives by local governments occurred in 2012. A few examples are:

Province of Overijssel

In 2012, dozens of initiatives for residents and businesses in the province of Overijssel have purchased collective solar panels. The province supports the majority of these projects financially. There are about 80 projects completed or planned in which solar panels are placed. At least half of these are projects in which companies and individuals collectively buy solar panels. There are also ideas about the design of large solar parks. These projects are still in the research stage. An example is the solar park in the XL Business Park in Almelo and solar parks on the landfill of Twence.

Province of Limburg
Limburg has the BIHTS program on building integrated high-tech systems. The total public-private investment (including innovation vouchers) for BIHTS over the coming years is 19 million euros. This knowledge centre consists of four parts:

- A research facility for BIPV following the approach of 'open innovation';
- A centre of expertise for knowledge exchange between enterprises, government, and the education sector
- A real life lab especially for students;

- An incubator facility for start-ups in the built environment.

Municipalities

There are a number of municipalities providing subsidies for solar panels. There are large differences in the amount subsidized by towns. For example, in Goirle there was a grant of € 150 (abolished on 2 july 2012, when the federal subsidy came into force) and the Court of Twente had a grant of up to € 2000 per PV-system.

In Almere Poort, applicants can determine how many euros per Watt peak (unit power output of solar panels) they apply for. The private property owner and the company in Almere Poort with the lowest subsidy contribution in euros per Watt peak are considered first.

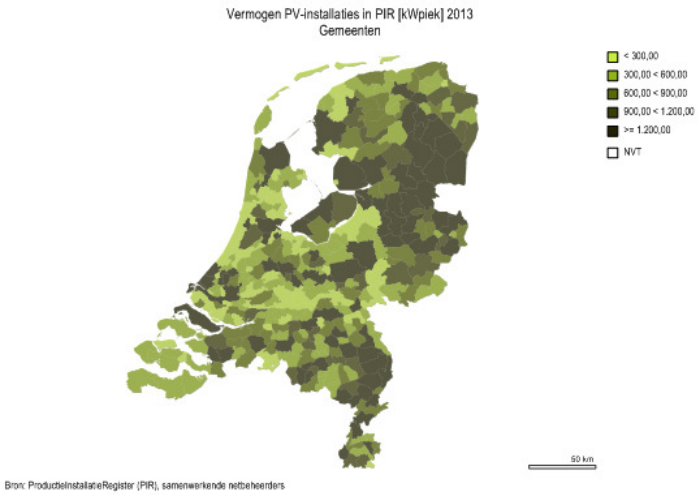


Fig. 2-2: *Distribution of the total granted power of PV-panels [source Productieinstallatieregister (PIR), Association of Energy Network Operators in the Netherlands]*

2.3.3 Building Integrated PV

In Apeldoorn, 113 houses of the 'Woonmensen' organisation received a firm and stimulating improvement package, which provides PV panels on the roof (2450 Wp), floor, roof and cavity wall insulation, HR + + glazing, and mechanical ventilation. All residents were involved in the preparation since the measurements brought along a rent increase.

Fig. 2.3: *Woonmensen, Apeldoorn (source: Van Wijnen Harderwijk BV, O&B vestiging Apeldoorn)*

In office Hurks De Brand, PV is integrated into the building as a sunscreen, with panels consisting of laminated glass separated by solar cells.

2.3.4 Medium Scale PV projects

A major solar applications of 273, 120 kWWp was installed in 2012 at the beach resort of Klepperstee in Ouddorp aan Zee in the province of Zeeland. It is a remarkable initiative on 1,3 hectares by the seaside.

2.3.5 Net metering developments

Since 2004, net metering of electricity has been allowed by law in the Netherlands. For grid connections of 3 x 80A and less, users that generate electricity using renewable energy sources (mainly PV) are able to connect to the electric utility grid and to send electricity back to the grid at times when their generation exceeds their own use. In the past, this was limited to 3,000 kWh annually, while anyone exceeding this limit was not allowed to apply any net metering for that calendar year. The alternative settlement entailed a much lower compensation for all generated PV electricity.

In February 2011, the law was amended to allow for a 5,000 kWh limit on net metering, while the penalty for exceeding this limit was removed. Consumers can now take advantage of the full potential of larger PV systems, without the threat of a cost penalty.

Again, the electricity utilities took a double role with regard to net metering. On the one hand, they were obliged by law to deduct the grid-fed electricity from the purchased electricity before billing (net metering), therewith paying the full grid price, including energy tax and VAT for solar electricity. Many utilities object to this principle. On the other hand, some of them stimulated the realisation of solar energy by offering PV panels to customers or offer unlimited net metering.

2.4 Highlights of RTD

Top sector policy and Top consortia Knowledge and Innovation Solar (TKI-Solar):
In 2011, the Dutch government invited the private sector to influence the direction of innovation in the Netherlands and to show extra financial commitment. This resulted in the new Top Sector policy, which should increase the industry's innovative capacity and competitive strength. Nine Top Sectors (key areas for innovation) for economic growth have been defined, including the Top Sector of Energy. Specialist teams around specific energy topics like solar, wind, and bio-mass, consisting of senior representatives from the industry (multinationals and small to medium-sized enterprises (SMEs)), research organisations, and the government have been appointed to develop and implement the long-term strategy and the sector's Innovation Contract.

The public-private partnerships in the Top sector Energy are organised within 7 Top Consortia for Knowledge and Innovation (TKI), in order to make optimum use of existing knowledge and expertise. The TKI-Solar is one of these Top Consortia for knowledge and innovation. In the TKI-Solar, entrepreneurs, government officials, and scientists collaborate. The TKI gives insight into the knowledge requirements of the industry and advises the Top Sector Energy team about appropriate research themes. The TKI-Solar also advises on the distribution of financial resources, coordinates activities, and keeps in touch with other Top Sectors in the Netherlands."

The figure below visualizes the relationships between the participants and projects within the TKI Solar Energy. The thickness of the line represents the subsidy to the actor. The size of the phere represents the total amount of funding received for the project. The size of a square represents the total subsidy received by an organisation in the TKI Solar Energy.

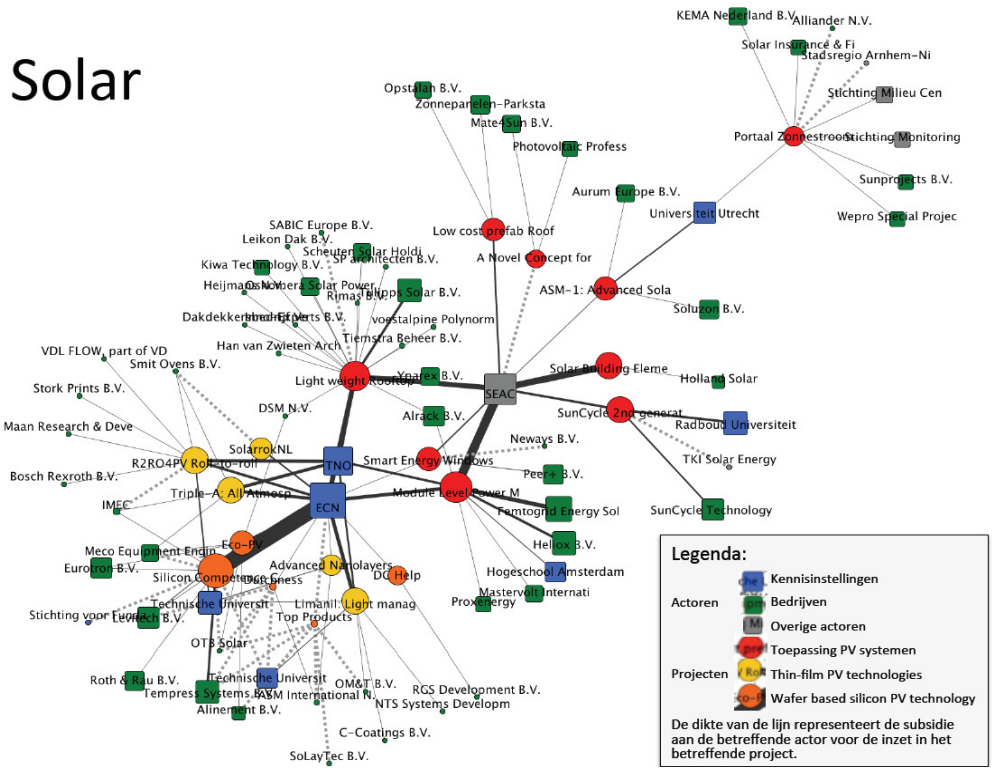


***Fig. 2-4**: TKI network*

The Innovation Contract for solar is *the* roadmap for fundamental and applied science and technology development. For the period 2012-2020, the contract identifies three programme lines:

- Programme line systems and application:
  Stakeholders work together on: BIPV products, integration technologies of solar in the infrastructure, electronic systems and components
- Programme line Thin Film PV technologies:
  This line addresses the following themes: Thin film Si, CIGS, Organic PV, Cross Cutting Technologies, III/IV cells and modules
- Programme line wafer-based silicon PV technologies
  Stakeholders work together successfully in technology development as well as in marketing Dutch technology. A world-class joint infrastructure, the Silicon Competence Centre, is part of this programme line.

A total of 19 projects started in 2012, committing 41 million euros in project cost and a contribution of 23.4 million euros in public funding. More than 45 companies, 5 knowledge institutes, and 4 universities are collaborating in these projects. Bridging the gap between knowledge and implementation, Figure 2-5 points out these projects on technology readiness levels, giving insight in the development stage.

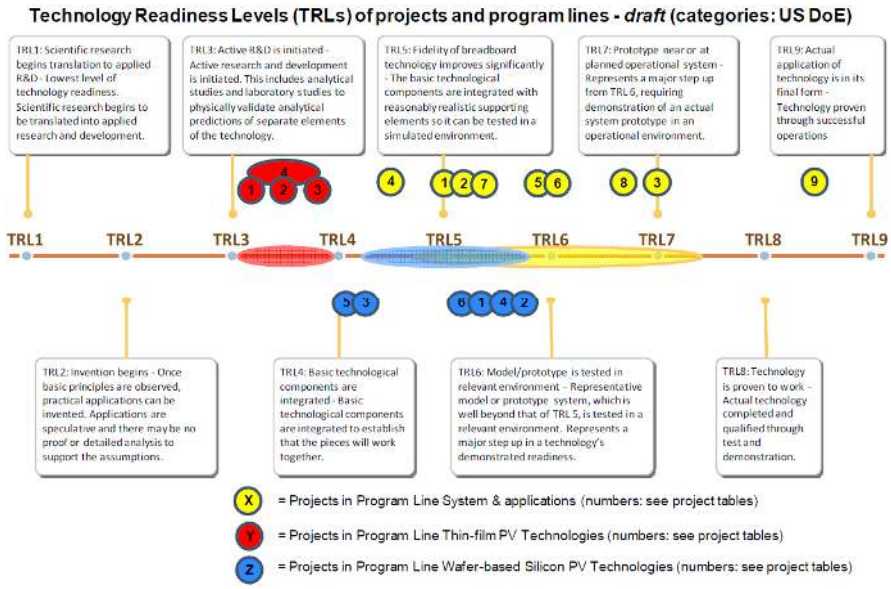


Fig. 2-5

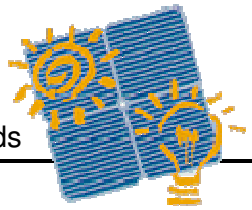
The key research partnerships in these three focus areas are:

- SEAC (Solar Energy Application Centre; an initiative of ECN and TNO) for systems & applications (started in 2012);
- Silicon Competence Centre (ECN, FOM-Amolf, TUD-Dimes) for wafer-based silicon PV technologies;
- Solliance (TNO, ECN, TU/e, Holst Centre, IMEC, and FZ Jülich) for thin-film technologies.

Alongside these national initiatives, there are several active provinces with extensive applied research activities in solar energy, such as Energy Valley (the three Northern provinces) and Limburg with the BIHTS program on building integrated high-tech systems. The total public – private investment (including innovation vouchers) for BIHTS over the coming years amounts to 19 million euros. This knowledge centre consists of four parts:

- A research facility for BIPV following the approach of "open innovation";
- A centre of expertise for knowledge exchange between enterprises, government, and the education sector;
- A real life lab especially for students;
- An incubator facility for start-ups in the built environment.

A number of other existing national research programmes continue or are coming to an end in 2012, such as the Joint Solar Program (JSP) which started in 2004. They include:



- The PV-part of the ADEM (Advanced Dutch Energy Materials Innovation Lab) programme focuses on the materials used in solar cells and modules: the active materials for electricity generation from sunlight and the passive materials used in transport of electricity and the protective packaging of the cells. ADEM collaborates with the many institutes in the Netherlands working on solar cells and aims to facilitate in sharing of equipment and expertise.
- The NanoNextNL program for R & D on nanotechnologies includes a subprogramme on solar energy.
- The FOM institute Amolf has a programme called "Light Management in Photovoltaic Materials" which started in 2011: controlling the collection, guiding, concentration, and conversion of light on the nanometre scale.
- On the first of January 2012, FOM started a new research group called DIFFER for fundamental energy research, which will be based on the high-tech campus in Eindhoven in the years to come.

2.4.1 Dutch Universities and institutes

At the academic level, R & D activities are carried out in a limited number of highly specialised groups. The main players are the Technical Universities of Eindhoven and Delft, the University of Groningen, and the Radboud University of Nijmegen. In addition, the Technical University of Twente, the University of Amsterdam (UvA) and the University of Leiden research PV-related issues, like plasmonic solar cells and artificial photosynthesis.

Furthermore, three Universities of Applied Sciences (UAS) are active in PV RTD: Zuyd UAS (Hogeschool Zuyd te Rijswijk), Hanze UAS (Hanzehogeschool te Groningen), and the NHL UAS (NHL Hogeschool te Leeuwarden). Apart from these, the Netherlands count three institutes active in the field of PV research: ECN, TNO (including the Holst Centre), FOM-Amolf, and KEMA.

2.5 Public budgets for market stimulation, demonstration / field test programmes and RTD

In 2012, the bulk of funding for research was through TKI. In 2012, over 31 million euros was allocated by the TKI Solar Energy, coming from private contributions, innovation budgets, and the general framework for stimulating renewable Energy SDE+. There is separate funding for fundamental research, which goes to the universities and the FOM (Fundamental Research of Matter) institute. These fundamental research funds are not exclusively allocated to the Top Sector Energy but also span the top sectors Chemistry and HTSM (High Tech Systems and Materials).

On 2 July 2012, a one-off 52 million euros subsidy deal was negotiated between political parties for individual households to recover some of their costs. The amount was divided over 2012 (22 million euros) and 2013 (30 million euros). With this subsidy, about 100 MW has been installed in 2012.

The SDE+ was continued for solar installations above 15 kWp. Over 31 million euros was eventually allocated for stimulating renewable energy SDE+. The upper limit of 100 kWp has been cancelled, but there are still very few systems this size in the Netherlands. In 2012, the SDE+ subsidy for larger systems shows an increase in the installation size and grants corresponding to 16 MW [6, 7] of installed capacity. This is an increase of almost 150 % over the 6.4 MW in 2011. At the same time, the percentage of the SDE+ scheme of the total amount of installed capacity has declined. Only 8% of the 195 MW installed in 2012 was realised with SDE+.

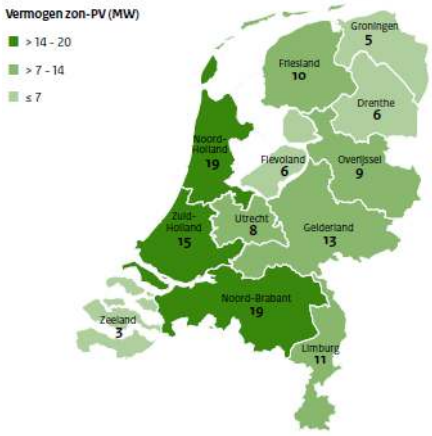


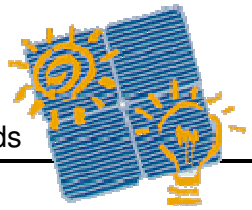
Fig. 2-6: *Granted capacity PV [MW] SDE, SDE+ and MEP per province [6]*

The national discussion on net metering, currently limited to 5000 kWh, above which only 0.07 cents is paid back, also continues.

The phase of demonstration projects of PV modules is all but over in the Netherlands. There is a wide interest for solar PV and the demonstration projects now tend to focus on grid and building integration and on new exploitation models. In that sense, solar energy has arrived and is accepted in the Netherlands but still has some distance to go to scale up. In the 2012 "spring deal", a structural 10 million euros was reserved as from 2014 for net metering experiments with individually owned modules on public roofs. Two experiments in the municipality of Nijmegen have already started with these "solar parks," with easy access to participation for private stakeholders.

Table 2-3*: Overview of Dutch solar PV green certificates (source: CertiQ)*

	2009	2010	2011	2012
Green NL certificates (per MWh solar)	6,567	10,704	22,141	25,615
% PV of total Green NL certificates	0.064%	0.1%	0.2%	0.2%
Solar production sites for certificate scheme	3,817	6,634	9,054	10,544
% PV of total production sites for certificate scheme	75%	84%	87%	89%



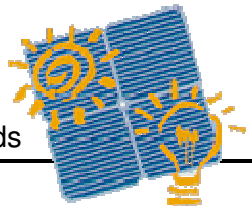
Combined capacity of solar production sites (MW_p)	18.0	31.6	50.9	70.6

2.5.1 Stimulation through subsidies

The main support measures for PV during 2012 are listed in table 2-4.

Table 2-4: *PV support measures*

Support measure	Ongoing measures	Measures that commenced during 2011-2012
Subsidy households		-for a minimum capacity of 0.601 kWp to 3.5 kWp, the subsidy is 15% of the purchase costs actually incurred. -the grant for a PV system with a capacity greater than 3.5 kWp (kilowatt peak) is: 15% of the actual costs is multiplied by 3.5 and divided by the power in kilowatts peak. -The subsidy is limited to 650 euros in all cases.
Feed-in rate	- MEP measure until 2006; 10 year duration - SDE (Promotion of Renewable Energy Production) until 2010: 15 year duration: • Small (1-15 kWp) • Large (15 - 100 kWp)	- SDE+ commenced in 2012 for projects with a capacity over 15kWp.
Direct capital subsidies		Only local or regional schemes, very diverse - max. amounts (up to 2000 euros) to a variant in which applicants may determine how many euros per Watt peak they apply for (unit power output of solar panels) (i.e. Almere-Poort)
Investment funds for PV	"Groen Beleggen" (Green investments) is a 1.3% tax benefit for investments in renewable energy. Any renewable energy system can apply. It was decided to phase out this measure in 3 years, starting in 2011 (a 1% benefit remains for 2011).	In 2012, a 0.7% tax benefit for investments in a green fund or a social-ethical fund.
Tax credits	EIA Energie Investeringsaftrek (Energy Investment Rebate): rebate of 44% of investment in energy-saving technologies or renewable energy from fiscal profit.	Companies can make tax-efficient investing in energy-efficient technologies and renewable energy. Through the Energy Investment Allowance (EIA), there may be the taxable profit, 41.5% of the investment deducted on top of your usual depreciation. As a result, less income tax or corporation tax paid.
Net metering		National law for private grid connections up to 5,000 kWh/yr (balancing). This means that if more electricity is being fed into the system than being used, a utility is then not obliged to balance, which results in a higher income per kWh. Some utilities do not apply any limit.
Net billing		All suppliers are obliged by law to pay a reasonable rate for electricity fed into the grid. This is typically set to 70% of the commodity price. Transport costs are deducted separately from the returns of the solar energy producer.
Commercial bank activities	One of the measures was the energy credit: The government was the guarantor for loans for energy-saving measures in homes. The scheme applies to owner-occupiers. This guarantee amounts to € 35 million available for the benefit of a total amount of	No green mortages. Triodos links the mortgage to the energy of the home (reduction up to 0.6% for low-energy houses).

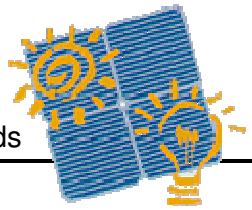


	approximately € 315 million in loans, enough for about 50,000 homes. The end date of this scheme is 31 December 2011. In 2011, several banks provided Green Mortgages (ASN, Triodos, ING, Rabobank, Fortis). These all offered 1-2% discount on market interest rates. The maximum amount of mortgage under these beneficial conditions is €34,034.	
Electricity utility activities	No specific subsidies available through utilities. Some suppliers apply feed-in rate constructions / benefits. Additionally, PV-systems are offered in package deals with energy contracts.	No specific subsidies available through utilities. Some suppliers apply feed-in rate constructions / benefits. Additionally, PV-systems are offered in package deals with energy contracts.
Sustainable building requirements	PV provides points for the required building energy performance coefficient.	PV provides points for the required building energy performance coefficient.

Apart from the regional support schemes, several local communities provide support for implementation.

No specific subsidies are available through utilities. However, they sometimes offer turnkey PV-systems in package deals with an energy contract. Additionally, some utilities offer additional net metering, beyond the mandatory limit of 5,000 kWh annually.
For RTD, several subsidy programmes have been set up, each covering a specific part of the RTD activities:

- The Joint Solar Programme is an Industrial Partnership Programme (IPP) of the Foundation for Fundamental Research on Matter (FOM). IPPs are programmes for basic research, in which FOM staff work closely with researchers from industry. The participating companies bear at least 50 percent of the cost. The total IPP portfolio of FOM is currently around fifty million euros. The first round of the JSP was launched in 2005 and closed in 2011. In 2008, energy company Nuon joined the Joint Solar Programme as a new industrial partner. At that time, a second round of projects was initiated. In 2012, the solar cell activities under the name Helianthos Nuon were transferred to HyET and have since been called HyET Solar. The financial scope of the JSP as at end of 2012: 4 million euros (50% Nuon / HyET Solar, 50 % FOM). The programme aims at fundamental and new research activities, like the application of quantum dots and up-and-down conversion of light.
- NWO – Dutch Organisation for Scientific Research: this programme supports scientific research at universities and institute. The selection of topics is not based on the field of application, but on the scientific quality and challenge.
- STW – Foundation for Applied Science: STW stimulates transition of technology, supporting the transfer of knowledge and results from RTD to application. Subsidies are granted for collaboration projects between universities and/or institutes and industry
- SBIR and IPZ: Small Business Innovation Research and Integration PV are two instruments combined that entered their second phase in 2011. By means of a call for tender in 2011, four parties were selected to continue their research and were granted 2.3 million euros. In 2012, three of the four projects were completed, while the fourth is in the certification phase. For all projects, R & D processes were successfully completed and the commercial phase prepared. Femtogrid has started the production phase.



Ballast Nedam has begun cooperation with a supplier (KingspanUnidek) for its roof-integrated product. To roll out its product PVT, Dimark Solar is cooperating with timber-frame builder de Mar. SunCycle recently developed an innovative CPV concept that can be integrated on top of a roof. In this SunCycle-I system, III/V solar cells mounted to a cooling element with an attachment frame are utilised. The research project is directed at further optimisation of the cell and attachment structure in the focus point. The further integration of cell and cooling element makes for an even higher efficiency and will result in a SunCycle-2 version.

2.5.2 Stimulation through corporate tax incentives

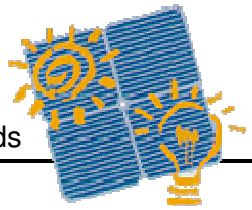
Two other incentives are not provided directly to RTD and employment projects as subsidiary funding, but through tax benefits that companies and institutes can receive for the PV-RTD hours or PV-investments.

In 2012, a new tax scheme started, the Research & Development Allowance (RDA). The RDA scheme encourages innovation and R & D by Dutch business through a tax benefit in the income or corporation tax. The RDA is intended to reduce financial expenses for research and development. For hours of labour, there is the WBSO (Law Promoting Research and Development). For other costs and expenses of R & D projects, there is the RDA. In 2012, there was a budget of 250 million for RDA and 864 million for WBSO.

For PV-investments, companies could also use the EIA (Energy Investment Rebate). SMEs were able to combine this with the KIA (Small-scale Investment Rebate). Both regulations allow a company to deduct either a set percentage or a fixed sum (KIA; depending on the size of the investment) of the PV investment costs from the company's net profit. As a result, less income tax or corporation tax paid (Average yields 10% less tax with the EIA). Combined with the KIA, the subsidy measures can rise to 14%. The KIA is a rebate that is applicable to all investments, not just energy. The KIA is intended for small businesses that invest between € 2,200 and € 300,000.

Table 2-5: *Overview of the public budgets for PV in the Netherlands in million euros*

Instrument	2009 [M€]	2010 [M€]	2011 [M€]	2012 [M€]	Source:
National market stimulation					
SDE 2009-2010 / SDE+ (2011)	143	93	35	3.3	2012 Annual Report SDE+ and MEP
EIA	1.54	3.52	64		Annual Report EIA 2011
KIA	n.a	n.a	n.a	n.a	
Subsidy individual households 2012-2013				22	NL Agency
National RTD subsidies					
JSP	3.80	3.80	2.00	4.0	JSP Ann. Rep.
NWO (FOM)	0.60	3.2	10.6		FOM
STW	1.20	0	5.45		STW
EOS	5.45	3.62	0	0	NL Agency

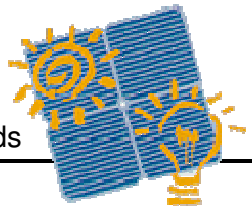


NEO	0.28	0.00	0	0	NL Agency
LT	2.15	3.21	0	0	NL Agency
KTO	3.02	0.00	0	0	NL Agency
DEMO	0.00	0.41	0	0	NL Agency
SBIR	0.00	0.25	2.3	0	NL Agency
PID	3.12	2.23	n.a		NL Agency
TKI				41 (23.4 M€ public funding)	
RTD tax incentives [fte] 1					
WBSO	181 fte	197 fte	170 fte		NL Agency
Direct national RTD funding					
ECN	6.15	6.20	6		NL Agency
TNO	7.90	n.a	n.a		NAER – raw data
AMOLF	n.a	2.4	2.4		FOM
Indirect National market stimulation					
Net-metering	n.a	n.a	n.a		n.a

[2] Net-Metering is an indirect stimulus as kWh produced to the grid can be balanced out with the electricity price and added on this the normal energy-tax and added value tax. There are no publications yet on the exact number of this value.

2.6 Grid integration

With a percentage of 0.2 of the total electricity production in the Netherlands, the penetration of PV is not yet a national problem, but can already be a local problem in the distribution grid. The increase over one year from 0.08 in 2011 to 0.2 in 2012 (CBS statline) points towards a substantial amount and problems with peak load if such a cumulative growth is sustained over the next 5 years and local electricity consumption and production are not balanced.



3 INDUSTRY AND GROWTH

3.1 Production of photovoltaic cells, modules, and equipment

In 2012, the Netherlands' PV industry enhanced its focus on **equipment** and **production machinery** for PV production. In particular in the Eindhoven ("Brainport") region, equipment manufacturers increased both market position and R & D effort. The High Tech Campus Eindhoven has evolved into 'the place to be' for advanced solar equipment and machinery.
The Netherlands' equipment manufacturers are active in a broad range of solar technologies. In 2012, however, virtually no new PV production capacity was installed.

In the field of crystalline solar PV technology, Eurotron, Levitech, Roth & Rau BV (formerly OTB, solar cell production lines), SoLayTec (wafer deposition), Tempress (wafer treatment furnaces), and Rimas (module production lines) took advantage of the current downturn in the solar market to develop and introduce new technologies for the next generation of solar cells.

OTB (automated solar cell production) changed its name into Roth&Rau, following the acquisition by the Swiss/German company of this name. The focus of Roth&Rau in 2012 was on the delivery of machinery for the upgrade of existing PV production lines.
In 2012, the aforementioned companies initiated various research projects on low-cost, high-efficient crystalline solar cells and module production technologies.

Solar Excel (light-trapping foils) has been acquired by DSM, which will continue the development of high-tech foils and coatings for PV modules.

In the field of thin-film solar cells and modules, the Solliance research partnership, located at the High Tech Campus Eindhoven, expanded its field of work with the decision to build a pilot thin-film module production line at the Campus. Solliance, founded by ECN, TNO, TU/e and the Holst Centre, now comprises more than 250 researchers from various institutes in the Eindhoven-Leuven-Aachen region, providing a leading focal point in the development of different thin-film technologies (a-Si, CIGS, organic), with participation from the industry (a.o. HyET Solar, Smit Ovens, VDL Flow). New production line technologies are expected to emerge from Solliance in the years to come.

HyET Solar focuses on the development of production lines for roll-to-roll a-Si modules. In 2012, HyET Solar acquired Nuon Helianthos and continued the development of production lines.

Smit Ovens manufactures furnaces and manufacturing systems for thin-film PV modules (a-Si and CIGS). In 2012, Smit Ovens installed more than 10 production systems worldwide. In total, Smit Ovens has more than 110 production units in operation with a PV-production capacity of more than 4 GWp. Smit Ovens is also a major contributor to R & D on low-cost CIGS production. In 2012, research on roll-to-roll deposition technologies for CIGS was started by Smit, VDL, and others within Solliance at the High Tech Campus Eindhoven.

Fig. 3-1: *Production line of Smit Ovens*

In 2012, the Suncycle solar concentrator entered a new phase by receiving European funding of 7.3 million. The focus will shift from product development to product testing and from there on will move forward to production and marketing of the product. The main goal is the realisation of a mass production line of the Suncycle solar concentrator products.

The production of **cells and modules** suffered severely from the fierce competition from PV producers in Asia. The existing cell and module manufacturers Solland Solar[1] (acquired by an Italian industrial group) and Scheuten Solar (acquired by Chinese investors) closed down their module production in the Netherlands. Solland Solar is the only remaining cell manufacturer, with a production capacity of 135 MWp / year.

In 2012, Alinement (spin-off from Solland Solar) started the development of next-generation PV cells and module production. Production is expected to come online in 2013.
New, lightweight modules are under development at Eindhoven-based Tulipps. Prototypes are expected to come available in the spring of 2013.

The national facts and figures about the actual production of PV cells and modules have not been published for recent years, due to the low number of active companies. These numbers are considered confidential.

[1] In June 2013, the parent company of Solland Solar Cells from Heerlen (Pufin Group) announced it has signed a partnership agreement with the Spanish module manufacturer Eurener.

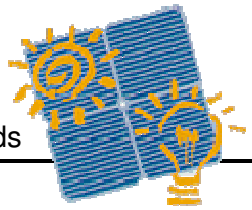


Table 3-1 provides a trend until 2012 of the trade in solar modules in the Netherlands as published by the Dutch Central Bureau for Statistics.

Topics	Trade in solar modules							
	Import	Production	Sales to installers				Export	Trade
			yearly installed power in kWp	autono-mous systems	grid connected systems, utilities	grid connected systems, other		
Periods	kW							
2000			**3 564**	194	180	3 190		
2001			**7 750**	250	2 300	5 200		
2002			**5 817**	302	-	5 515		
2003			**19 845**	300	-	19 545		
2004	13 160	-	**3 604**	434	679	2 491	9 770	4 767
2005	23 677	x	**1 663**	323	-	1 340	20 942	6 500
2006	25 052	x	**1 521**	278	160	1 083	22 148	x
2007	x	x	**1 399**	558	66	775	34 005	x
2008	x	x	**4 444**	239	151	4 054	64 898	x
2009	x	x	**10 669**	91	802	9 776	72 493	x
2010	x	x	**20 682**	291	768	19 623	117 665	x
2011	x	x	**58 473**	86	5 815	52 752	x	x
2012	x	135 000*	**195 000**	600	x	x	135 000*	x

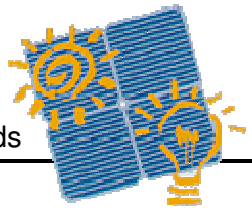
Table 3-1: *Photovoltaic systems trade in solar (Source: CBS, 22-05-2013).*
*: production capacity Solland Solar, cells only

3.2 Module prices

Surveys of module prices often lead to different values as the conditions applied by the surveys may vary. Based on a market analysis conducted in December 2012, commissioned by NL Agency [1], the trend of the module prices is shown in table 3.2. Prices in this table are for modules only. The majority of the systems are installed with mono- or poly-crystalline modules in the low price range.

From October 2011 to the end of 2012, prices have been increasingly under pressure due to fierce competition among many (foreign) suppliers. In total, module prices have dropped with 44% (incl. VAT; 46% excl. VAT) in 2012.

Due to the low PV module prices (combined with friendly net-metering regulations), grid parity was reached in 2012, which increased module sales to unprecedented levels.



Mid-2012, however, the announcement of a new fiscal subsidy scheme led to a consumer strike. Potential consumers waited for final details on the subsidy scheme before making their purchase. The relative low price change in Q3 might very well be attributed to this temporary consumer strike. Given the fact that grid-parity was already reached, the appropriateness of the subsidy scheme was questioned by the PV industry due to the resulting market imbalance it created.

Period	€/Wp		% change since –previous quarter	Average Wp/m²	Modules range €/Wp	Number of unique modules
	excl. VAT	incl. VAT	incl. VAT		incl. VAT	
Q4 – 2011	1.92	2.29	-	140	1.11 – 4.70	166
Q1 - 2012	1.76	2.10	-8%	141	0.95 – 6.69	480
Q2 - 2012	1.34	1.59	-24%	142	0.95 – 6.69	531
Q3 - 2012	1.26	1.52	-4%	143	0.95 – 6.69	583
Q4 - 2012	1.04	1.26	-17%	143	0.64 – 2.63	659

***Table 3-2**: Price trends module - 2012*

3.3 Manufacturers and suppliers of other components

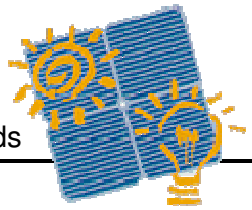
3.3.1 PV inverters

Several companies in the Netherlands sell PV inverters for grid-connected and off-grid applications. One of the largest Dutch companies that supply the Dutch market with PV inverters is Mastervolt B.V. They offer solar inverters in the range of 0-50 kW. Nedap N.V.'s Power Router is able to connect PV to wind and batteries in order to offer independence from the grid status. The SME Femtogrid has started to sell market products for smaller systems that solve the unequal power output of solar panels due to partial shading, a different orientation or module mismatch. In addition to micro-inverters for photovoltaic systems, the company Heliox offers power conversion systems for other applications.

A market analysis commissioned by NL Agency was used to determine the inverter prices in the Netherlands. The average price found for inverters in (December) 2012, ranged from 0.17 €/W for inverters larger than 5 kW to 0.87 €/W for inverters around 1 kW systems [1]. An overview of 2012 inverter prices is shown in table 3-3.

Period	€/W		% change since previous quarter	Average W	Price range €/W	Number of unique inverters
	excl. VAT	incl. VAT	incl. VAT		incl. VAT	
Q4 – 2011	0.38	0.45	-	6,523	0.17 – 0.92	98
Q1 - 2012	0.40	0.48	+7%	5,625	0.16 – 1.09	188
Q2 - 2012	0.39	0.46	-4%	5,614	0.19 – 1.09	229
Q3 - 2012	0.36	0.44	-4%	5,580	0.18 – 1.09	271
Q4 - 2012	0.34	0.41	-7%	5,621	0.17 – 0.87	342

***Table 3-3**: Price trends inverters - 2012*



3.3.2 Power management

A power management system tunes and monitors the incoming and outgoing power of a system, typically being a house or office building. The PowerRouter made by Nedap, the Solar Power Optimizer by Femtogrid, and the Plugwise systems are examples of power management systems. Most of the systems also include the monitoring of photovoltaics.

The aforementioned companies not only offer power management systems, they also participate in research projects.

In the innovation project EVPV-Grid (Power Research Electronics, TU-Delft and ABB), energy is temporally stored in electric car batteries and distributed when needed. Another innovation project is PV Storage integrated Multi agent controlled Smart grid (PV SiMS), lead by SEAC (Solar Energy Application Centre, see section 3.3.6). This project integrates PV systems with a smart grid.

Furthermore, twelve smart grid projects have started within the framework of the Innovatieprogramma Intelligente Netten (IPIN). PV and power management systems are embedded in almost all of the IPIN projects.

3.3.3 Monitoring

Monitoring systems are often offered as an addition to the purchase of solar systems. Utility companies offer universal monitoring devices such as Toon (Eneco) and Energie Monitor (RWE Essent), which include monitoring options for PV systems. Power management manufacturers Mastervolt and Femtogrid both offer an inverter with integrated monitoring facilities. Plugwise and Qurrent offer dedicated monitoring systems. Most systems combine PV monitoring with registration of energy and water usage of households.

3.3.4 Storage batteries

Most companies producing storage batteries focus on the automotive market or maritime applications. However, in 2012, Saft and Nedap presented a commercial photovoltaic energy storage system based on an inverter and lithium-ion batteries, suitable for power balancing of grid connected systems. After running several pilots in 2012, it is expected that the storage system will be commercially available in August 2013. Since 2009, Nedap also offers lead storage batteries for the storage of photovoltaic energy. These lead storage batteries are mostly distributed in Germany.

3.3.5 Battery charge controllers and DC switch gear

The producers of charge controllers are similar to the PV inverter manufacturers. Mastervolt and MG electronics are examples of companies that manufacture battery charge controllers and switch gear.

3.3.6 Support structures

The Dutch companies that offer dedicated support structures have grown and are often affiliated to German or Belgian companies and supply German or Belgian mounting systems.

Leading Dutch mounting systems suppliers are Oskomera, Ubbink Solar, and Van der Valk. These companies provide rooftop systems as well as integrated BIPV solutions. In addition, other Dutch companies that supply construction parts are: Centrosolar, Esdec, Energiebau, Walraven, SolarConstruct NL, SolarNRG, Sunbeam, Icopal, IBC-Solar, and Hafkon.

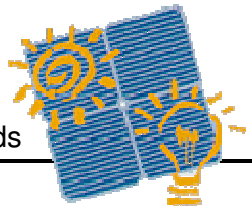
In 2012, SEAC (Solar Energy Application Centre) launched its activities. SEAC is a collaborative effort of Energy ECN, TNO, and Holland Solar. SEAC is located at the High Tech Campus Eindhoven.

SEAC has the ambition to work on the innovation and application of novel PV integration systems. R & D is carried out on the system level, both in the field of integration into the built environment (buildings, ground based, infrastructure), as well was in the field of the integration into the energy system. Several R & D projects involving collaboration with the industry were launched in 2012. Each project focuses on creating "champions" for one specific item related to building integration (aesthetics, size flexibility, weight, etc.). Projects are expected to generate results in the years to come. In addition, various field-testing facilities are available within SEAC.

***Fig. 3-2**: Test roof at SEAC Research Centre*

3.4 System prices

The Central Bureau for Statistics does not mention system prices in which the price per W_p of a PV system is included. Therefore, the results of the market analysis by Stichting Monitoring Zonnestroom [1] were used to determine the system price of PV in the Netherlands. The prices in table 3-4 are excluding VAT, installation and transport cost.



Period	Roofmounted 0-1 kWp		Roofmounted 1-5 kWp		Roofmounted 5-25 kWp		Roof-integrated
	Tilted	Flat	Tilted	Flat	Tited	Flat	
Q2 - 2012	1.8	1.72	1.40	1.43	1.18	1.24	Not available
Q3 - 2012	1.74	1.70	1.34	1.36	1.13	1.17	Not available
Q4 - 2012	1.51	1.60	1.31	1.36	1.15	1.21	Not available

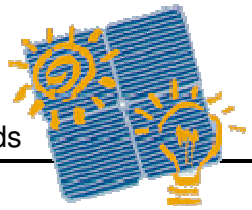
Table 3-4: *Systems prices of typical applications, based on [1].*

An indication of the system cost breakdown is presented in the "National PV-Power Actionplan", lead by DNV KEMA [2].

Component	**System costs**
Installation and implementation	25%
Inverter	15%
PV Modules	40%
Balance of System (BOS)	20%

An example of PV system price developments is shown in the collective purchase action lead by Vereniging Eigen Huis (National House Owners Association). Details are presented in the table below. (Prices incl. VAT.)

Auction date		13-Feb-12	1-Aug-12	15-Jan-13
Number of applicants		1,727	1,958	1,300
System size:number of PV modules	Total Wp	price per Wp	price per Wp	price per Wp
6	1500	€ 2.77	€ 2.39	€ 2.19
9	2250	€ 2.42	€ 2.10	€ 1.79
12	3000	€ 2.22	€ 1.94	€ 1.59
15	3750	€ 2.17	€ 1.90	€ 1.55
18	4500	€ 2.13	€ 1.80	€ 1.47
21	5250	€ 2.07	€ 1.64	€ 1.44
24	6000	€ 1.99	€ 1.58	€ 1.39
Supplier		Oskomera	Oskomera	Oskomera
Modules		Suntech 250 mono	CSUN 250 mono	CSUN 250 poly
Inverter		SMA	SMA/Mastervolt	Growatt
Monitoring		Sunny Explorer	Plugwise	Plugwise



3.5 Labour places

Table 3-5 shows the trend of employment in the PV industry from different sources.

	Statline [2] (25-07-2013) [Fte]	CBS [7] [3] [Fte]	ECN [8] [Employees]	EurObserv'ER [9] [Fte]	Innovation Contract [10] [Fte]
2008	552	1500	800		
2009	545	1500	1180	2200	
2010	622	1400	1240	2300	2100-2500
2011		1300		2500	
2012					

***Table 3-5**: Facts of employment in the PV-sector in the Netherlands, different sources*

Between the employment data CBS/ECN and EurObserv'ER/Innovation Contract is approximately a factor of 2. These data differ because of the different definitions of employment (direct and indirect jobs, including or excluding installation or R&D).

The employment data of 2012 were not available at the time of writing of this report.

In the 2012 fact sheet on employment of PV, EPIA presents job figures for manufacturing and installation, totalling 10-20 fte/MWp (direct jobs) and 32 to 60 fte/MWp (direct and indirect jobs) installed per year [13]. Details are presented in the figure 3-3 below. Module manufacturing is 3-7 fte/MWp (direct) and 12-20 fte/MWp (direct and indirect). Assuming that module manufacturing is minor in the Netherlands, PV employment in 2012 can be estimated at approximately 7-13 fte/MWp (direct jobs)[4], and 17-33 fte (direct and indirect jobs). This would imply a 2012 PV employment figure of direct jobs of about 2000 fte (between 1400 – 2500 fte). For direct and indirect jobs this employment figure is about 5000 fte (between 3300 – 6400 fte). Note that these figures don't include R&D.

[2] Only employment in companies who import or manufacture PV systems and inverters

[3] The CBS estimates that the total uncertainty in their employment figure is equal to 25 percent [7]

[4] Lower level direct jobs: 10 minus 3 = 7 fte/MWp, Upper level: 20 minus 7 = 13 fte/MWp, average 10 fte/MWp
Lower level direct and indirect jobs: 32 minus 3 minus 12 = 17 fte/MWp, Upper level: 60 minus 7 minus 20 = 33 fte/MWp, average 25 fte/MWp.

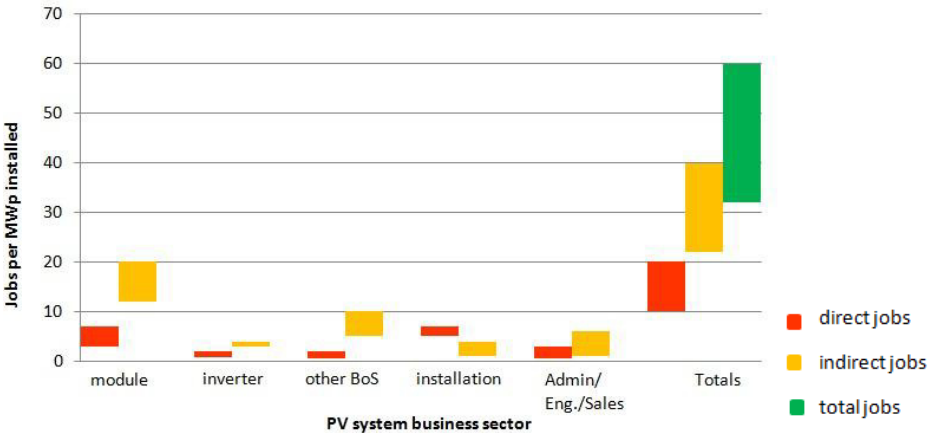
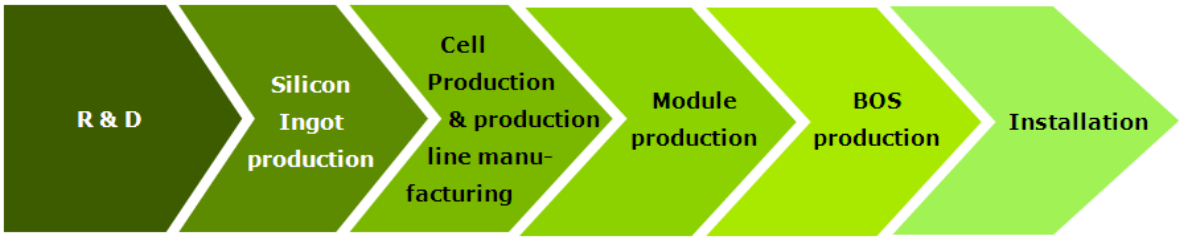


***Fig. 3-3**: Jobs per MWp installed [13]*

3.6 Value chains

Figure 3.2 shows where Dutch companies are active in the PV value chain for both crystalline-based technologies. As is to be expected, a large increase is seen in the installation sector.

***Fig. 3-4:** Crystalline silicon technology value chain*

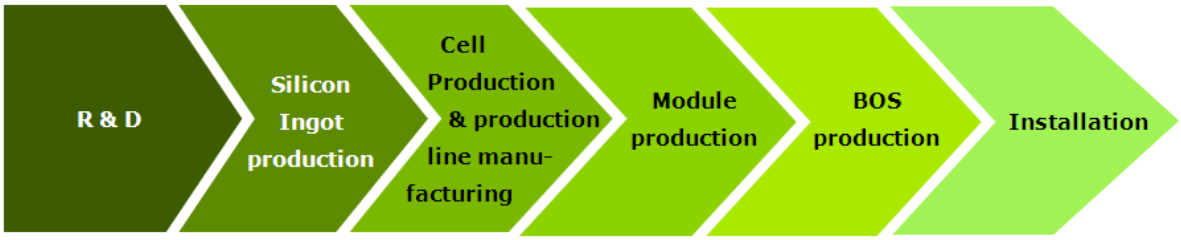


R & D		**Cell prod.**	**Module prod.**	**Inverters**	**BOS**
ECN		Solland Solar		Mastervolt	**Traditional installation companies (300)**
TNO				MG Electronics	
Universities of technology		**Production line manuf.**		Icopal	**Utility companies (10)**
AMOLF		Roth & Rau		Alfen	
Tulips Solar		Tempress			**Wholesalers (32)**
Sabic		Smit Ovens		**Power Management**	
		Rimas		Femtogrid	**Suppliers/Webshop (150)**
		Solar Excel		Heliox	
		Levitech		Plugwise	**Collectives (119)**
		Eurotron		Qurrent	

				Nedap	**Unknown (237)**
				SolarCare	
				GPX	
				Proxenergy	
				Metsens	
				Mounting systems	
				Oskomera	
				Ubbink	
				Van der Valk	
				Tata Steel	
				others	

The Dutch PV value chain is also presented for thin film-based technology. This is shown in Fig. 3-5. Clearly visible are the strong universities and institutes that are at the top in R & D on a global level.

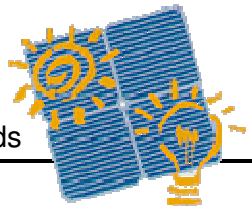
Fig. 3-5: *Thin film technology value chain.*



R & D		**Cell prod.**	**Module prod.**	**Inverters**	**Installation**
Solliance		HyET Solar		See crystalline modules	See crystalline modules
ECN					
TNO		**Production line manuf.**			
Universities of technology		Smit Ovens			
Holst centre					
AMOLF		VDL Flow			
OM&T					

From the illustrations, the conclusion can be drawn that there is currently more focus on thin-film technology with regard to R & D.

The fastest growth is found in the installation sub-sector. Due to the increasing (domestic) demand for PV-systems, the market for contractors installing these systems grew significantly in 2011 and 2012.



It is estimated that a total of more than 700 companies and collectives were active in the solar PV-market at the end of 2012. A breakdown is presented in Table 3-6 below. Several companies are active in more than one class. Therefore, the total percentage exceeds 100%.

Period	Installers	Utility Companies	Wholesalers	Suppliers/ Webshop	Collectives	Unknown
Q4 - 2011	42	4	-	-	-	-
Q4 - 2012	300	10	32	150	119	237

***Table 3-6**: Percentage of active PV installation companies and collectives divided in classes*

3.7 Business value

In 2012 the total business value of the PV systems installed in the Netherlands can be estimated at around 300 M€ (2011: 150 M€) as shown in figure 3-6 below. In the calculation the yearly currently installed PV capacity is converted into a monetary value by multiplying the capacity with the price per Wp (excl. VAT).

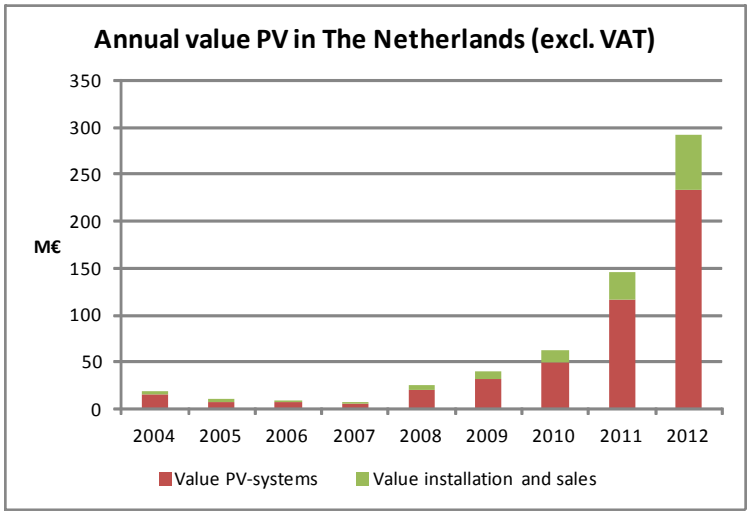


***Fig. 3-6:** Annual business value PV in The Netherlands*

In 2011 the turnover of the PV sector was 1100 M€ [9], in 2010 the turnover was 1000 M€ [8,9].

3.8 Certification

In line with the European directive on renewable energy resources (RES), a technical guideline and certification scheme for the installation of solar systems was set up in 2012. The guideline, "Handboek Zonne-Energie, Bouwkundige en Installatietechnische richtlijnen voor zonne-energiesystemen", was composed by ISSO - Building Services Research Institute and initiated by NL Agency, Holland Solar, UNETO-VNI, OTIB, and ISSO.

Fig. 3-7 *The ISSO guideline for solar energy*

The photovoltaic section of the guideline is divided in three different modules, each with their own certification scheme. The three modules are:

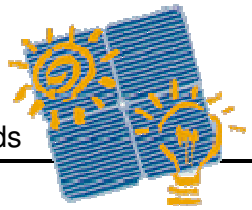
- Expertise of photovoltaic systems (May 2013: 40 certificates)
- Mounting of photovoltaic systems (May 2013: 20 certificates)
- Installation of solar systems (May 2013: 16 certificates)

A certificate can only be obtained by individuals. To obtain such a certificate, an exam must be passed at the CITO institute. At the end of May 2013, 76 certificates had been obtained. All of the obtained certificates are registered on the site **www.qbisnl.nl**. Commercial organisations that offer a course built on the guideline are BDA,BGA,IIR and Switch2Solar, among other organisations.

To ensure the quality level of the certificates and training, Stichting KBI has been appointed by the national government to accredit training institutes offering the courses and exams.

For the downstream PV industry, achieving a certification scheme accepted by all market parties on the national level was an important non-technical milestone for 2012.
Based on the above certifications, among other ones, certain photovoltaic qualifications and quality labels can be obtained by installers. Examples of such qualifications and labels are "SEI", the "Zonnekeur-Installateur", and the KOMO-keurmerk BRL9933.

It is expected that the quality labels will enhance the quality of the total value stream, ranging from components and systems to installation works. Qualified installers assemble certified materials into reliable systems, following certified installation schemes. The availability of quality labels will thus contribute to the further growth of the market. Quality labels will assure potential customers that components and installation works meet specific standards, which can help these consumers to make purchase decisions.
The labels will also indirectly contribute to the overall quality of installed systems, reducing the number of nonfunctioning systems. This will enhance the public support for PV in general.



ANNEX A LITERATURE

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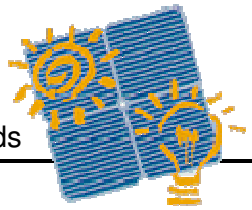


ANNEX B COUNTRY INFORMATION

This information is simply to give the reader some background about the national environment in which PV is being deployed. It is not guaranteed to be 100 % accurate nor intended for analysis. The reader is advised to do their own research for more detailed data.

1) Retail electricity prices:
   Household: ca. € 0.22 depending on the utility
   Small business: ca. € 0.16 depending on the utility
   Large business: by contract
   The difference between the different rate groups is partly caused by the difference in energy tax (REB).

2) Typical household electricity consumption ~ 3,300 kWh per year (source: Nibud, 2012-05-07).

3) Typical metering arrangements and rate structures for electricity customers – choice between single or double metering. Double metering refers to different rates for day and night periods.

4) Average household income – € 32,500 per year (source: CBS, 2012-05-07)

5) Typical mortgage interest rate of 5.6% on average for 20-year mortgages (source: 'Hypotheekshop.nl', 2012-05-07)

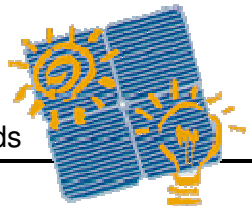
6) Voltage:

Household :	50 Hz, 230 V
Medium Voltage distribution network:	50 Hz, 10 kV (also: 20, 25, and 50 kV)
High Voltage distribution network:	50 Hz, 110, 150, 220, and 380 kV

7) The electricity sector has separate retail, distribution, transmission, and generation businesses. Unbundling has taken place, although distribution company Stedin and utility Eneco are still an integrated company. The Netherlands is one of the most progressive countries regarding unbundling.

8) Price of diesel fuel per litre: € 1.51 depending on company and region (source, United Consumers 2012-04-12)

9) Typical values of kWh / kW for PV systems in the Netherlands: 850 kWh/kW



ANNEX C DEFINITIONS, SYMBOLS AND ABBREVIATIONS

For the purposes of this and all other IEA PVPS National Survey Reports, the following definitions apply:

PV power system market: The market for all nationally installed (terrestrial) PV applications with a PV power capacity of 40 W or more.

Installed PV power: Power delivered by a PV module or a PV array under standard test conditions (STC) – irradiance of 1 000 W/m^2, cell junction temperature of 25°C, AM 1.5 solar spectrum – (also see 'Rated power').

Rated power: Amount of power produced by a PV module or array under STC, written as W.

PV system: Set of interconnected elements such as PV modules, inverters that convert DC current of the modules into AC current, storage batteries and all installation and control components with a PV power capacity of 40 W or more.

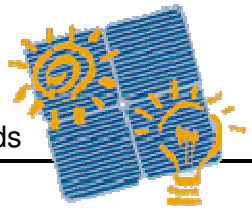
Module manufacturer: An organisation carrying out the encapsulation in the process of the production of PV modules.

Off-grid domestic PV power system: System installed to provide power mainly to a household or village not connected to the (main) utility grid(s). Often a means to store electricity is used (most commonly lead-acid batteries). Also referred to as 'stand-alone PV power system'. Can also provide power to domestic and community users (plus some other applications) via a 'mini grid', often as a hybrid with another source of power.

Off-grid non-domestic PV power system: System used for a variety of industrial and agricultural applications such as water pumping, remote communications, telecommunication relays, safety and protection devices, etc. that are not connected to the utility grid. Usually a means to store electricity is used. Also referred to as 'stand-alone PV power system'.

Grid-connected distributed PV power system: System installed to provide power to a grid-connected customer or directly to the electricity grid (specifically where that part of the electricity grid is configured to supply power to a number of customers rather than to provide a bulk transport function). Such systems may be on or integrated into the customer's premises often on the demand side of the electricity meter, on public and commercial buildings, or simply in the built environment on motorway sound barriers etc. They may be specifically designed to support the utility distribution grid. Size is not a determining feature – while a 1 MW PV system on a rooftop may be large by PV standards, this is not the case for other forms of distributed generation.

Grid-connected centralized PV power system: Power production system performing the function of a centralized power station. The power supplied by such a system is not associated with a particular electricity customer and the system is not located to specifically perform functions on the electricity grid other than the supply of bulk power. Typically ground-mounted and functioning independently of any nearby development.



Turnkey price: Price of an installed PV system excluding VAT/TVA/sales taxes, operation and maintenance costs, but including installation costs. For an off-grid PV system, the prices associated with storage battery maintenance/replacement are excluded. If additional costs are incurred for reasons not directly related to the PV system, these should be excluded. (E.g. If extra costs are incurred fitting PV modules to a factory roof because special precautions are required to avoid disrupting production, these extra costs should not be included. Equally, the additional transport costs of installing a telecommunication system in a remote area are excluded).

Field Test Programme: A programme to test the performance of PV systems/components in real conditions.

Demonstration Programme: A programme to demonstrate the operation of PV systems and their application to potential users/owners.

Market deployment initiative: Initiatives to encourage the market deployment of PV through the use of market instruments such as green pricing, rate-based incentives etc. These may be implemented by the government, the finance industry, utilities etc.

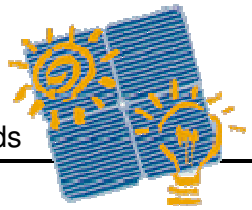
Final annual yield: Total PV energy delivered to the load during the year per kW of power installed.

Performance ratio: Ratio of the final annual (monthly, daily) yield to the reference annual (monthly, daily) yield, where the reference annual (monthly, daily) yield is the theoretical annual (monthly, daily) available energy per kW of installed PV power.

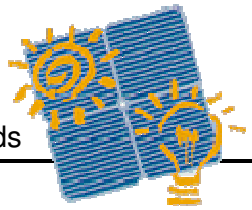
Currency: The currency unit used throughout this report is Euro (€).

PV support measures:

Enhanced feed-in rate	An explicit monetary reward is provided for producing PV electricity; paid (usually by the electricity utility) at a rate per kWh somewhat higher than the retail electricity rates being paid by the customer.
Capital subsidies	Direct financial subsidies aimed at tackling the up-front cost barrier, either for specific equipment or total installed PV system cost.
Green electricity schemes	Schemes allowing customers to purchase green electricity based on renewable energy from the electricity utility, usually at a premium price.
PV-specific green electricity schemes	Schemes allowing customers to purchase green electricity based on PV electricity from the electricity utility, usually at a premium price.
Renewable portfolio standards (RPS)	a mandated requirement that the electricity utility (often the electricity retailer) source a portion of its electricity supplies from renewable energies (usually characterized



	by a broad, least-cost approach favouring hydro, wind, and biomass).
PV requirement in RPS	A mandated requirement that a portion of the RPS be met by PV electricity supplies (often called a set-aside).
Investment funds for PV	Share offerings in private PV investment funds plus other schemes that focus on wealth creation and business success using PV as a vehicle to achieve these ends.
Income tax credits	Credits allowing some or all expenses associated with PV installation to be deducted from taxable income streams.
Net metering	In effect, the system owner receives retail value for any excess electricity fed into the grid, as recorded by a bi-directional electricity meter and netted over the billing period.
Net billing	The electricity taken from the grid and the electricity fed into the grid are tracked separately, and the electricity fed into the grid is valued at a given price.
Commercial bank activities	These include activities such as preferential home mortgage terms for houses including PV systems and preferential green loans for the installation of PV systems.
Electricity utility activities	These include 'green power' schemes allowing customers to purchase green electricity, large scale utility PV plants, various PV ownership and financing options with select customers, and PV electricity power purchase models.
Sustainable building requirements	These include requirements on new building developments (residential and commercial) and also in some cases on properties for sale, where the PV system may be included as one option for reducing the building's energy foot print or may be specifically mandated as an inclusion in the building development.



List of abbreviations:

EIA	Energie Investeringsaftrek (Energy Investment Rebate)
EOS	Energie Onderzoek Subsidie (Energy Research Grant)
FiT	Feed in Rate
fte	Full-time equivalent
FP7	Seventh framework programme
IEA	International Energy Agency
IEE	Intelligent Energy Europe
JSP	Joint Solar Programme
NMP	Nanosciences, materials & production technologies
PV	Photovoltaic
SDE	Stimulering Duurzame Energieproductie (Promotion of Renewable Energy Production)
SME	Small & Medium Enterprise
STW	Stichting Technische Wetenschappen (Foundation for Technological Science)
UKP	Unieke Kansen Programma (Unique Opportunity Programme)
WBSO	Wet Bevordering Speurwerk en Onderzoek (Tax incentive for RTD)
W_p	Watt-Peak