INTERNATIONAL ENERGY AGENCY
CO-OPERATIVE PROGRAMME ON

PHOTOVOLTAIC POWER SYSTEMS (IEA-PVPS)

National Survey Report of PV Power Applications in Denmark
2008

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TABLE OF CONTENTS

I FOREWORD

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, Mexico (MEX), the Netherlands (NLD), Norway (NOR), Portugal (PRT), Spain (ESP), Sweden (SWE), Switzerland (CHE), Turkey, the United Kingdom (GBR) and the United States of America (USA). The European Commission and the European Photovoltaic Industry 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.

II 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. This report gives information on trends in PV power applications in the PVPS member and other countries and is largely based on the information provided in the National Survey Reports which are produced annually by each Task 1 participant.

The present report is the Danish National Survey Report for 2008.

The public PVPS website also plays an important role in disseminating information arising from the programme, including national information: www.iea-pvps.org.

III DEFINITIONS, SYMBOLS AND ABBREVIATIONS

For the purposes of this and all 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 d.c. current of the modules into a.c. 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 for support of 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 systems 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 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 DKK; by May 2009 1€ = 7,45 DKK and 1 USD = 5,60 DKK

PV support measures:

Enhanced feed-in tariff	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	allows customers to purchase green electricity based on renewable energy from the electricity utility, usually at a premium price
PV-specific green electricity schemes	allows 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 their 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	allows 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	includes 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	includes '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	includes requirements on new building developments (residential and commercial) and also in some cases on properties for sale, where the PV 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

1 EXECUTIVE SUMMARY

Installed PV power

By the end of year 2008 Denmark (including Greenland) had about 3,3 MW installed, an increase of almost 200 kW compared to 2007. The SOL 1000 project originally targeting 1 MW, but finally – following budget reductions – reaching about 600 kW was completed end of 2006, leaving Denmark without any incentives for reducing the investment cost of PV systems. Grid-connected distributed systems constitute at about 90 % the majority of PV systems in Denmark.

Costs & prices

The completed SOL 1000 project demonstrated a turn-key system price for "roof-tops" of around 34 DKK/W. However, high demand world wide for PV modules during 2007 and 2008 has lead to limited supply of modules and slightly increasing module prices, and system cost figures for 2008 vary widely due inter alia to the time of contracting and the size of the actual plant. The individual PV systems implemented during 2008 exhibit turn-key system (BIPV) prices in the range of 35 to 100 DKK per W installed.

PV production

During 2008 the producer of float-zone silicon Topsil continued its commercial activities to supply international PV industry with high purity, low-cost silicon. Modules (brand: Sunpower) using this feedstock have been tested at NREL in the USA exhibiting efficiencies > 20 %. In 2008 the inverter developer and manufacturer Danfoss Solar Inverters also reported ongoing and increasing commercial activities in the multi-million € range.

The module production (Gaia Solar) in 2008 is at about 500 kW, approximately the same as in 2007. The main markets for Gaia Solar are Germany and Sweden. There is no production of PV batteries in Denmark. The building industry is showing a limited, but growing interest in developing PV-building integrated components and systems in particular in connection with highly industrialized building processes.

Late 2008 Danish PV companies took the initiative to establish a national PV association named Dansk Solcelleforening

Public budgets for PV.

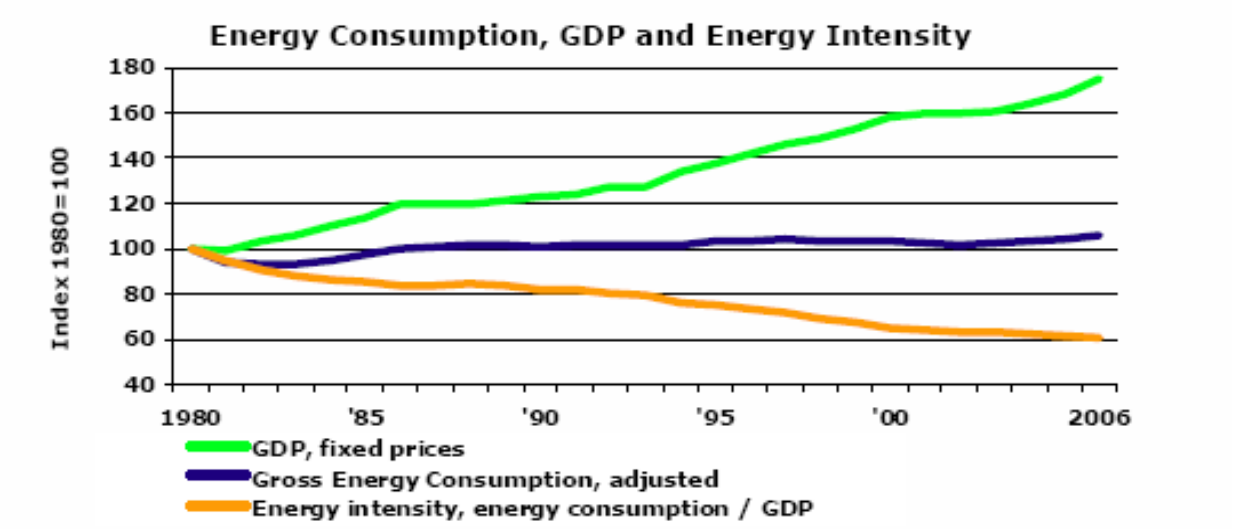
In early 2008 the government confirmed its commitment to support renewables, and a new energy plan "A Visionary Energy Policy" reaching up to 2025 was finally agreed[1] by February 2008. Public funding for R&D into energy is expected to be doubled from about 0,5 billion DKK in 2007 to 1 billion by 2010. Over a 3-5 year period more than 150 mill DKK will be allocated to R&D in renewables; however it is still too early to say to which extend PVs effectively can benefit from these initiatives. In 2008 the Public Service Obligation (PSO) of the Danish transmission system operator, the so called ForskEL programme,

[1] Complex negotiations and a general election prevented the energy plan originally presented early 2007 to be politically accepted until February 28 2008; the February 28 agreement includes a special provision of 100 mill. DKK for PV, wave power and other emerging RE technologies.

funded about 15 mill DKK for applied research projects in PV's, and the other public programmes funded about 6 mill DKK for PV R&D activities[2].

Government Policy & Programmes

As mentioned above the Danish government's new energy plan, "A Visionary Energy Policy" reaching up to 2025, was finally agreed upon in early 2008. The energy plan focus on a fully liberalised energy market supported by a framework, which underpins high consumer and environment protection, energy efficiency, subdued development in energy prices and high security of supply both in the short and long term. The energy plan further focus on the ongoing development of efficient energy technologies both nationally and in the EU, and the government wish to strengthen the research community and the development of new and promising energy solutions. The energy plan also focus on energy conservation and on increasing the penetration of renewables[3] in the total energy supply to 30 % by 2025. The overall objective is not to let the gross energy consumption increase and to decrease the use of fossil fuels by 15 %, this way continuing the trend of the last 25 years as illustrated below. Over the last 25 years Denmark's economy has grown by 75 % with almost constant gross energy consumption effectively de-coupling economic growth from growth in energy consumption.



Note: Energy consumption for international maritime traffic (international bunkering) is not included in the individual country's energy consumption under international rules for energy statistics, but is calculated separately; therefore it does not appear on the figure.

Photovoltaic technology (PV) is for the first time mentioned in the government's energy plan, see footnote 1 on the previous page.

Early 2004 the Danish Energy Authority (EA) in collaboration with the electricity sector, the industry and other key stakeholders finalized a national strategy on PV after a public hearing. Early 2006 a national workshop reviewed the PV strategy and it was consequently revised during 2006 in terms of an addendum to the original strategy. A more comprehensive revision of the PV strategy also including deployment was initiated 2008 and is expected to be completed by mid 2009.

[2] Source: Energy 2008 (Research, Development and Demonstration)

[3] Only technology specific targets for wind energy and for biofuels.

2. THE IMPLEMENTATION OF PV SYSTEMS

The PV power system market is defined as the market of all nationally installed (terrestrial) PV applications with a PV capacity of 40 W or more. A PV system consists of modules, inverters, batteries and all installation and control components for modules, inverters and batteries.

For the purposes of this report, PV installations are included in the 2008 statistics if the PV modules were installed between 1 January and 31 December 2008, although commissioning may have taken place at a later date.

2.1 Applications for photovoltaics

The national electric grid covers practically all of Denmark and leaves little room for stand-alone applications besides the traditional low-power niche applications such as signalling, week-end cottages, garden lights, telemetry & telecommunication and urban furniture such as parking meters and information displays. In Greenland stand-alone PV's play a major role as power source for remote signalling and for the telecommunication network extending more than 2 000 km on the western coast line.

Grid connected PV applications are seen as the largest potential in Denmark, in particular building integrated applications on single family houses, apartment buildings, commercial and office buildings. The public interest for building integrated PVs is increasing, and most efforts are focused on developing and demonstrating PVs in the context of existing buildings. The EU directive[4] on energy consumption in buildings has in 2005 been minted into a revised national building code – moved into force early 2006 – which specifically mentions PV and allocates PV electricity a factor 2,5 in the calculation of the "energy foot print" of a building. However, due to the inertia in the construction sector, it is yet too early to see any real impact on PV deployment, although ongoing political discussions indicate an upcoming further tightening of the building codes.

2.2 Total photovoltaic power installed

The PV power installed in 4 sub-markets during 2008 is shown in Table 1.

Table 1 - The PV power installed in 4 sub-markets during 2008.

Sub-market/ application ##	off-grid domestic	off-grid non-domestic	grid-connected distributed	grid-connected centralized	total
PV power installed in 2008 (kW)	25	30	135	0	190

[4] EU directive: Directive 2002/91/EC of 16.12.02

Table 2 - The cumulative installed PV power in 4 sub-markets.

Sub-market/ appli-cation	31 Dec 1993 kW	31 Dec 1994 kW	31 Dec 1995 kW	31 Dec 1996 kW	31 Dec 1997 kW	31 Dec 1998 kW	31 Dec 1999 kW	31 Dec 2000 kW	31 Dec 2001 kW	31 Dec 2002 kW	31 Dec 2003 kW	31 Dec 2004 kW	31 Dec 2005 kW	31 Dec 2006 kW	31 Dec 2007	31 Dec 2008 kW
off-grid domestic	10	10	15	20	25	35	40	50	50	50	55	65	70	80	100	125
off-grid non-domestic	70	75	85	120	125	140	150	155	160	165	170	190	225	255	285	315
grid-conn. distribut.	5	15	40	105	272	330	880	1 255	1 290	1 375	1 675	2 035	2 355	2 565	2 690	2 825
grid-conn. centraliz.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	85	100	140	245	422	505	1 070	1 460	1 500	1 600	1900	2290	2 650	2 900	3 075	3 265

The main Danish PV market sector, grid-connected distributed, exhibited very little progress due to lack of national promotional measuers beyond that of a net-metering scheme with certain constraints.

2.3 PV implementation highlights, major projects, demonstration and field test programmes

During 2008 no national PV promotional activities were found, except for the new ForskVE program with no concrete results in 2008, resulting in a very low progress rate for the otherwise main market sector, the grid-connected distributed, typically roof-top systems. Only the regional distribution utility EnergiMidt provided incentives in their own concessionary area in terms of an investment subsidy of up to 40 % of the investment cost of a grid-connected PV system.

The off-grid professional and private market sectors developed almost as in the previous years.

For a more historical overview or context, please refer to the Danish National Survey Report covering 2006 and previous years (www.iea-pvps.org).

2.4 Highlights of R&D

During 2008 R&D efforts in the fields of organic dye sentizied PV cells (PEC), polymer cells and "PV cells-architecture-lights" continued with steady progress in all fields, attempts to commercialize the R&D results in the field of polymer cells is expected in 2009. R&D efforts into nano-structured PV cells were initiated as well

Basic research into PV cells based on mono-X Si is ongoing at the University of Aarhus in a partnership with industry.

For a more historical overview or context, please refer to the Danish National Survey Report covering 2006 and previous years (www.iea-pvps.org).

2.5 Public budgets for market stimulation, demonstration / field test programmes and R&D

Table 3 - Public budgets for R&D, demonstration/field test programmes and market incentives.

	R & D	Demo/Field test	Market
National/federal	25 mill DKK	-	-
State/regional	-	-	-
Total	25 mill DKK	25 mill DKK	-

Funding is mainly from the PSO Elforsk and the EUDP programmes and there is no funding targets for PV – only RE in general. The figures in table 3 are thus indicative. Funding for more basic research is in principle also available for PV's, but few if any projects are benefitting from this during 2008. As mentioned in footnote 1 p. 8 the government's new energy plan includes an extra 25 mill DKK/year for initially four years starting 2007 for demonstration of emerging RE technologies such as PV and wind power (the ForskVE program). The first alllocation was in 2008 totalling 50 mill DKK (incl. unused funding for

2007), and a major demonstration programme, Photo-Skive, targeting 1 MW of BIPV on the buildings of the Skive municipality in new private-public-partnership received 22 mill DKK in support from this programme. The Photo-Skive project is expected to start in the first half of 2009.

3 INDUSTRY AND GROWTH

3.1 Production of feedstocks, ingots and wafers

Table 4 - Production and production capacity information for the year for silicon feedstock, ingot and wafer producers

Manufacturers	Process & technology	Total Production	Maximum production capacity	Product destination?	Price?
	Silicon feedstock	*tonnes*	*tonnes/year*		
Topsil	sc-Si ingots (float-zone)	**) 10 tonnes*	*10 tonnes/year*	Exports	No data
	mc-Si ingots	*tonnes*	*tonnes/year*		
	sc-Si wafers	*MW*	*MW/year*		
	mc-Si wafers	*MW*	*MW/year*		

*) authors estimate

3.2 Production of photovoltaic cells and modules

Module manufacturing is defined as the industry where in the process of the production of PV modules the encapsulation is done. A company may also be involved in the production of ingots, wafers or the processing of cells, in addition to fabricating the modules with frames, junction boxes etc. The manufacturing of modules may only be counted to a country if the encapsulation takes place in that country.

Table 5 - Production and production capacity information for the year for each manufacturer

Cell/Module manufacturer	**Technology** (sc-Si, mc-Si, a-Si, CdTe)	**Total production (MW)**		**Annual maximum production capacity (MW)**	
		Cell	Module	Cell	Module
Silicon wafer based manufacturers					
Gaia Solar	mc-Si & sc-Si	**-**	**0,5**	**-**	**0,5**
Thin film manufacturers					
Cells for concentration					
TOTALS		-	**0,5**	**-**	**0,5**

Gaia Solar produces modules (laminates) based on imported cells. Modules are of the standard glas-EVA-Tedlar design. Product range is 27-150 Wp with 55-110 W modules being most typical. Normal warranty: 5 years. The company is open to custom design modules. Certification to IEC 61215.

Typical PV module cost range between DKK 30 – 50/W. Most modules are exported to Germany and Sweden.

Some companies have announced plans to establish more large scale PV module proudction, and a few other companies have shown interest in manufacturing window-integrated PVs, but so far the throughput is estimated as negligible.

3.3 Module Prices

Table 6 - Typical module prices in national currency for a number of years

Year (only data since 2000)	2000	2001	2002	2003	2004	2005	2006	2007	2008
Module price(s): Typical	30-50	30-50	21-45	21-45	30-50	30-50	40-60	30-50	30-50
Best price	-	-	-	-	-	-	-	-	-

During 2008 the price of PV modules exhibited a trend towards slightly increasing prices.

3.4 Manufacturers and suppliers of other components

Balance of system component manufacture and supply is an important part of the PV system value chain. For 2008 the situation in Denmark is briefly described below.

The company Danfoss Solar Inverters has reported +25 million € commercial orders for its recently developed inverter system specially designed for large scale OEM customers. However, no detailed information is publicly available on technology, performance, volume and prices.

The company Grundfos produces its special variable frequency inverter system for its water pumping systems. However, no detailed information is publicly available on technology, performance, volume and prices.

No battery producers in Denmark with PV related products.

Three companies produce (on a small scale) charge controllers and PV related electronics for stand-alone PV systems.

One company is looking into development and manufacturing of support structures.

The company Velux Industries has developed and marketed a roof-integration package. However, no detailed information is publicly available on technology, performance, volume and prices.

3.5 System prices

Table 1: **Turnkey Prices of Typical Applications**

Category/Size	Typical applications and brief details	Current prices per W in DKK
OFF-GRID Up to 1 kW	Telemetry, navigational aids, emergency phones, etc.	70-90
OFF-GRID >1 kW	Professional remote: Greenland tele-communication links, etc.	150-200
GRID-CONNECTED Specific case	1-4 kW roof-mounted system (roof-tops)	35-45
GRID-CONNECTED Up to 10 kW	Facades and gables	50-85
GRID-CONNECTED >10 kW	Roofs (typically single projects with high visibility)	50-100

Table 7a: National trends in system prices (current DKK) for roof-tops

YEAR	1998	1999	2000	2001*)	2002	2003	2004	2005	2006	2007	2008
Price /W:	50	40	40	40-80	33-36	33-36	33-36 #)	33-36 #)	35-45 #)	33-40	35-45

*) in between programmes Sol 300 and SOL 1000

#) only for system on long term contract, e.g. SOL 1000. Other (few) systems exhibit price increases, which vary widely.

3.6 Labour places

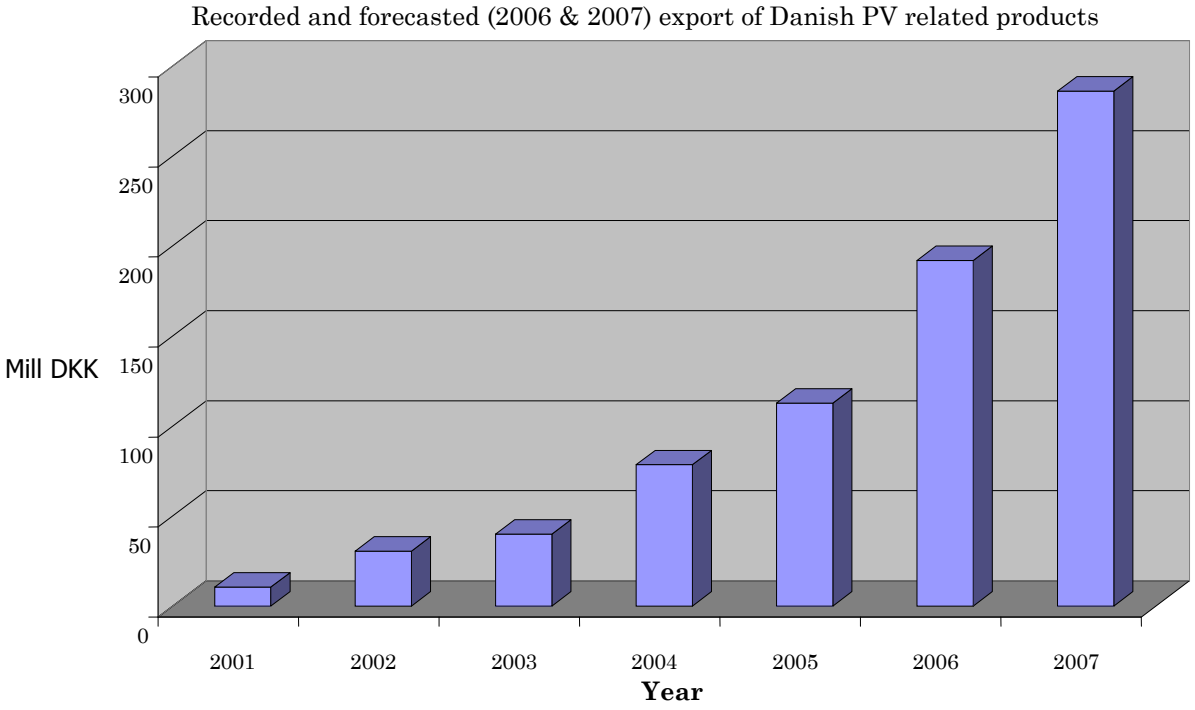
a) Research and development (not including companies): 25
b) Manufacturing of PV system components, including company R&D: 225
c) All other, including within electricity companies, installation companies etc. 25

Information on labour places is based on the author's best estimate – no official statistics available. Table 8 on Labour Places cannot be completed due to lack of data.

3.7 Business value

Total business value is estimated (author's estimate – no way of getting solid data) to about 400 million DKK. Table 9 on Business Value cannot be completed due to lack of data.

Estimate by the Danish Federation of Industries (DI) on PV related export for 2006 points at approx. 200 mill DKK. The trend in PV related exports is illustrated below[5].



[5] Source: The Energy Industry, Danish Federation of Industries.

4. FRAMEWORK FOR DEPLOYMENT (NON-TECHNICAL FACTORS)

4.1 Support measures and new initiatives

Table 2: PV support measures

	On-going measures	Measures that commenced during 2008
Enhanced feed-in tariffs	-	-
Capital subsidies for equipment or total cost	-	-
Green electricity schemes	-	-
PV-specific green electricity schemes	-	-
Renewable portfolio standards (RPS)	-	-
PV requirement in RPS	-	-
Investment funds for PV	-	-
Income tax credits	-	-
Net metering	National scheme	-
Net billing	-	-
Commercial bank activities e.g. green mortgages promoting PV	-	-
Electricity utility activities	Energinet.dk monitoring and metering programme	Forsk VE program for demonstration of PV, wave power etc.
Sustainable building requirements	-	-

4.2 Indirect policy issues

The European Commission has early 2007 established binding targets for RE implementation in the EU as such. This has been followed by binding targets for the member countries, but no technology specific targets have yet been set.

The Danish government has as previously mentioned – also early 2007 – set binding RE targets for the country for 2025. However, few technology specific targets have been set and none for PV. The very new energy-political plan publicised in May 2009 does not mention PV.

The extent to which these overall RE targets may stimulate the deployment of PV's in Denmark is very uncertain.

The EU Directive on energy in buildings has lead to obligatory building codes in the EU member states including Denmark. The new Danish building codes were introduced in 2006, and may in the future promote PV's as PV's enter favorably into the calculation of a buildings energy "foot print". This is expected - with time - to stimulate the use of BIPV in Denmark, but the building sector is quite "conservative".

4.3 Standards and codes

Certification scheme for PV components and systems are established; certification of installers are established and ongoing.

The aforementioned EU Directive on energy consumption in buildings has lead to national building codes in favour of BIPV. The revised Danish building codes has move into force early 2006 and includes a factor of 2,5 for BIPV when calculating the energy "foot print" of a building, see also section 4.2.

5 HIGHLIGHTS AND PROSPECTS

Efforts are ongoing to establish relative large scale deployment/demonstration programmes, which over a 7-8 year period can bridge the gap from the present need of an investment incentive of approx. 30 % to 0 %. The need of an investment incentive is based on consumer polls indicating, that many owners of residential houses can accept a pay-back time for a PV roof-top system of 20-25 years, but not higher.

However, despite a relative small need for public support to get the PV deployment moving, there are no indications in the government's energy plans, that this may happen. PV is not even mentioned in the otherwise ambitious plans for RE deployment.

The national Danish PV strategy will be revised by mid 2009.

ANNEX A: COUNTRY INFORMATION

The following brief description of the Danish scene in which PV activities take place is based on the author's estimates and opinion.

The national electric grid covers practically all of Denmark and leaves little room for stand-alone applications besides the traditional low-power niche applications such as signalling, week-end cottages, garden lights, telemetry & telecommunication and urban furniture such as parking meters and information displays. In Greenland stand-alone PV's play a major role as power source for the telecommunication network extending more than 2 000 km along the west coast.

Grid connected PV applications are seen as the largest potential in Denmark, in particular building integrated applications on single family houses, apartment buildings, commercial and office buildings.

For private households the retail price of electricity is constituted by a number of elements, one example seen from the point of view of a distribution utility is given in table B.1.

Table B.1: Elements of a typical Electricity

• Category:	• Name:	• DKK/100
• Production	• Market price at high voltage level	• 26,31
• Grid, System and Public Service Obligation (PSO)	• Distribution grid	• 14,08
	• Medium voltage grid	• 2,37
	• System	• 3,12
	• PSO	• 12,60
• Taxes (to the state)	• Electricity tax	• 53,60
	• CO2 tax	• 9,00
	• Distribution tax	• 4,00
• Sub-total	•	• 125,08
• VAT	• 25 % VAT	• 31,27
• Price /kWH	• Retail price	• 156,35

Certain industries and commercial operations can get certain taxes refunded.

Average household electricity consumption is estimated to 4 400 kWH/year, and for private households electricity is typically metered at a constant flat rate. Net-metering (allowing the meter to run “backwards”) is permanently set by law for PV systems up to 6 kW and under certain conditions to prevent misuse.

For single family houses PV roof-top systems are seen as an integrated part of the house with regard to taxing, insurance, mortgage etc. Typical mortgage interest is in the range of 4-7 % depending on type of loan.