

**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 Italy
2008**

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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/m², 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 €

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

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.iaepvps.org

This report is related to the status and trends of PV power applications in Italy in 2008 and is intended for the use of IEA Photovoltaic Power System Programme experts. It has been prepared by:

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The authors are greatly indebted with several experts from ENEA, CESI, ENEL and PV Industries, who have supplied information on PV systems and components installed in Italy.

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¹ The previous company's name, CESI RICERCA S.p.A., has been changed into "ENEA - Ricerca sul Sistema Elettrico S.p.A. (in brief ERSE S.p.A.) on 29 April 2009.

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 Italian National Survey Report for the year 2008. 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.

1 EXECUTIVE SUMMARY

The programme "Conto energia" promoting Programme is eventually ensuring a stable situation, providing the basis for the expansion of PV market in Italy. Bureaucratic problems related to the incentive mechanism have been overcome while the ones concerning plant construction and grid connection seem to be enough smoothed. In this context, during 2008 photovoltaic is becoming more and more important as proofed by the following numbers and trends.

1.1 Installed PV power

PV power installed in Italy during 2008 sums to about 338 MWp and then the cumulative installed and operating power has reached 458 MWp, with an increase around 280 % as respect to the previous year.

1.2 Costs & prices

The average system price decreased with a rate of 7%/year, reaching a lower value of 4,2 €/W for large free standing applications while in the case of small rooftop the prices have recoded a wide spread ranging from 4,5 €/W to 6,5 €/W. The average module prices has reached during this year the lowest values of 2,2 €/W for large volume orders while for small orders prices typically range from 3 €/W to 3,6 €/W.

1.3 PV production

The growth of the national PV industry has not been adequate to the installed capacity. By the end of 2008, the production of photovoltaic modules, both single and multi crystal technologies, amounted in fact to only 144 MW with an increase of 70 MW with respect to 2007. The situation is worst in the case of cells and wafers: the cells are mainly imported and only about 30 MW have been produced in Italy; although announced some initiatives, up to now all the wafers are bought from international market.

1.4 Budgets for PV

Public and private budget for research and demonstration initiatives remain essentially flat with respect to the previous years and very small with respect to the budget of about 80 M€ during 2008 allocated for promoting tariffs.

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

In Italy four sectors of PV power system applications are identified:

- Off-grid domestic systems: have reached a saturation value in the late nineties of **5,4 MWp**;
- Off-grid non-domestic applications: slowly, but constantly increasing roughly reach **7,9 MWp**;
- On-grid centralized systems ⁽²⁾: boosted in the nineties and now growing again, this sector is being allowed to benefit feed-in tariffs; at the end of 2008 an amount of **150 MWp** has been counted for this application;
- On-grid distributed systems: growing up to **295 MWp** as cumulative installed power; this sector is dominating with a share of about 65% Italy's cumulative installed power. These systems firstly promoted by the Italian roof-top Programme are continued to be supported by feed-in tariffs.

2.2 Total photovoltaic power installed

The PV power installed in the 4 sub-markets/applications during 2008 is reported in Table 1.

Data of grid connected PV plants have been obtained by means of the database of the Manager of Electric Services (GSE), which manages the feed-in Programme.

Moreover, the following data have been collected by authors among Italian PV operators through direct interviews:

1. Module and cell production data (obtained from the industrial operators).
2. Prices of PV systems and components (declared by the installer of the plant after plant construction)
3. The quantity of imported modules and inverter installed in 2008 (obtained from the industrial operators).

The accuracy of these data is rather high. Uncertainty is around 20% (and not less than 100 kW), associated to the real quantity of installed *off-grid* PV plants, whose installation often is arranged directly by the user.

² In this sector, PV plants with power not greater than 200 kWp are taken into account.

Table 1: PV power installed during calendar year 2008 in 4 sub-markets.

Sub-market/ application	off-grid domestic	off-grid non- domestic	grid-connected distributed	grid-connected centralized	Total
PV power installed in 2008 (kW)	-	200	211 100	126 800	338 100

A summary of the cumulative installed PV Power, from 1992-2008, broken down into four sub-markets is shown in Table 2.

Table 2: The cumulative installed PV power (kWp) in 4 sub-markets. (as at 31 December)

Sub-market/ application	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
off-grid domestic	3 950	4 350	4 700	4 830	4 962	5 052	5 210	5 220	5 240	5 300	5 300	5 300	5 300	5 300	5 300	5 400	5 400
off-grid non- domestic	3 750	4 150	4 650	4 780	4 792	4 814	5 100	5 640	5 890	6 350	6 365	6 400	6 700	7 000	7 500	7 700	7 900
on-grid distributed	100	100	150	335	404	677	780	905	1 155	1 635	3 620	7 600	12 000	18 500	30 500	83 900	295 000
on-grid centralised	680	3 480	4 590	5 850	5 850	6 166	6 590	6 715	6 715	6 715	6 715	6 700	6 700	6 700	6 700	23 200	150 000
TOTAL	8 480	12 080	14 090	15 795	16 008	16 709	17 680	18 480	19 000	20 000	22 000	26 000	30 700	37 500	50 000	120 200	458 300

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

The main national market stimulation initiative in operation during the year 2008 is the "conto energia" Programme.

The first phase, called "primo conto energia", has been defined through two governmental decrees issued in 2005 and in 2006 and has resulted at the end of 2008 in over 5 000 PV plant's installations (corresponding to about 120 MWp). This first phase is expected to be completed by mid 2009.

The second phase, called "nuovo conto energia", has been defined through a governmental decree issued in February 2007 and resulted in setting in operation about 27 000 plants, corresponding to about 300 MW. The incentivated limit of 1 200 MW, supported in this stimulation initiative, is expected to be reached within 2010.

Moreover, an interesting initiative of the public stakeholder AEEG (National Authority for Electric Energy and Gas) regards the simplification of the procedure for the connection of plants to the grid. It is expected that this scheme will considerably reduce the time for the completion of PV plants.

2.4 Highlights of R&D

Research, development and demonstration activities on photovoltaic devices and systems are mainly conducted by ENEA (the Italian Agency for New Technology, Energy and the Environment) and ERSE Spa (already CESI RICERCA, a research company owned by ENEA and CESI, the Institute for Research and Certification of Electric Components and Systems). Additional contributions have been supplied by some Universities, CNR (the National Council for Scientific Research) and few private Laboratories.

ENEA is the main PV Research organization operating in Italy. Its most significant fields of interest regard: crystalline silicon, Cu_2O solar cells, microcrystalline Si devices, micromorph tandem solar cell as well as concentrators technologies. In this last contest, ENEA is carrying out experimental activities on standard units of 5 kW, in order to assess the technical and economical feasibility of this application.

ERSE is carrying out activities in research and development on high efficiency single and triple junction solar cells (InGaP/InGaAs/Ge) for terrestrial and concentrator applications, in the frame of Italian electric system research programme RdS (Ricerca di Sistema) and in the European project "APOLLON".

Furthermore, ERSE is involved in components' characterization and performance evaluation of PV innovative systems, as well as in research and demonstration activities for electrification of remote communities, again in the frame of the RdS programme.

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

The figures for the year 2008 on budgets from the public authorities for R&D, demonstration/field test programmes and market incentives (public subsidies, fiscal incentives) on the national/federal level, and on the state/regional level are given in Table 3

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

	R & D	Demo/Field test	Market incentives
National/federal	5 M€	0,2 M€	80 M€
State/regional			
Total	85,2M€		

3 INDUSTRY AND GROWTH

3.1 Production of feedstocks, ingots and wafers

Although some initiatives announced, during the year 2008 no production of ingots or wafers has been performed in Italy.

These industrial initiatives (5) foresee the achievement of a total production capacity of 11 000 tons of silicon in the years 2009 and 2010.

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		
	sc-Si ingots.	tonnes	tonnes/year		
	mc-Si ingots	tonnes	tonnes/year		
	sc-Si wafers	MW	MW/year		
	mc-Si wafers	MW	MW/year		

3.2 Production of photovoltaic cells and modules

In the year 2008, three producers of both cells and modules have been active in Italy: the two historical producers of cells and modules, Enipower (ENI group) and Helios Technology (Kerself group), and an emerging manufacturer, Xgroup. Another one (OmniaSolar) produces only cells.

In total, the cells production in Italy sums to 28,4 MW.

Further companies assembling and encapsulating standard or tailor-made and especially designed modules can be found in Italy. During 2008, the module production of such companies sums to about 144 MW with a capacity of 330 MWp.

Information on PV cell and module manufactures production and on production capacity is summarised in Table 5 below.

Table 5: Production and production capacity information for 2008 for each manufacturer

Cell/Module manufacturer	Technology (sc-Si, mc-Si, a-Si, CdTe)	Total Production (MW)		Maximum production capacity (MW/yr)	
		Cell	Module	Cell	Module
<i>Wafer-based PV manufactures</i>					
Solon Spa (S.E. Project)	sc-Si, mc-Si		50		110
Helios technology	sc-Si, mc-Si	16	27	30	40
Solarday	mc-Si		20		35
Enipower	sc-Si, mc-Si	1,9	14	10	14
Xgroup	sc-Si, mc-Si	9,5	9,5	25	25
Sorgenia Solar	sc-Si, mc-Si		5		7,5
Renegies Italia			5		30
Elettrosun			3		7
Azimut			1,2		2,5
DG Energy			1		10
Ancora			0,3		2
Brandoni Solare			0		20
Solsonica		n.a.	8	30	30
Omniasolar		1		10	
Total		<i>28,4</i>	<i>144</i>	<i>105</i>	<i>333</i>
<i>Thin film manufacturers</i>					
<i>Cells for concentration</i>					
TOTALS		28,4	144	105	333

- a) The manufacturers, that produce only modules, purchase cells on the international market. As a consequence a total of 115 MW of cells have been imported. The other manufacturers that produce cells and modules from wafer have imported 28,4 MW of wafers.
- b) Taking into account that only 14% of the installed module have been produced by Italian manufactures (corresponding to about 47,3 MW), the other 96,7 MW (144 – 47,3) of modules produced in Italy have been exported from the country.

3.3 Module prices

In Table 6 are shown the typical module prices (excluding VAT/TVA/sales tax) and the best prices achieved. In particular, the typical prices derive from an average on about 10 000

plants (both small and large) while the best price are the lowest ones and regard import products (for Crystalline silicon modules from China and for thin film modules).

Table 6: Typical module prices for a number of years

Year	1993	2000	2003	2005	2006	2007	2008
Standard module price(s): Typical	4,65	4,13	3,5	3,6	3,4	3,8	3,3 (*)
Best price			3,1	3,2	3,2	3	2,2 (**)
PV module price for concentration							

(*) Crystalline silicon modules

(**) Thin film modules

3.4 Manufacturers and suppliers of other components

In Italy, about 10 companies manufacture inverters for on-grid and off-grid applications. The most important of them are Elettronica Santerno, Power One Italy, Siac/Siel, Italcoel and Aros: During 2008, these companies have produced about 600 MW of inverter while their production capacity is around 800 MW. About 45% of the inverters installed in 2008 have been produced in Italy (150 MW). The other 450 MW have been exported. As far as the prices of inverter an average value of 200-300 €/kW has been obtained on a sample large size apparatus. In the case of small size inverter the typical prices range from 400 €/kW to 500 €/kW.

3.5 System prices

Table 7 gives turnkey prices per W (excluding VAT/TVA/sales tax) for the various categories of installation. Prices do not include recurring charges after installation such as battery replacement or operation and maintenance. Additional costs incurred due to the remoteness of the site or special installation requirements have not been included. The prices reported indicate a range of all known prices.

Additional information regarding national trends in the turnkey prices of selected applications are reported in Table 7a

Table 7: Turnkey Prices of Typical Applications

Category/Size	Typical applications and brief details	Current prices per W
OFF-GRID Up to 1 kW	Street light	10 - 13
OFF-GRID >1 kW		
ON-GRID Specific case	For example: 1-3 kW roof-mounted system, if available	5,5 – 6,5
ON-GRID up to 10 kW		
ON-GRID >10 kW	100 kW on industrial building	4,5 – 5,5
GRID – CONNECTED (centralized, if relevant)	>200 kW freestanding	4,2 – 5,0

Table 7a: National trends in system prices (current) for small roof-mounted system (1-3 kW)

YEAR	1998	2000	2002	2004	2005	2006	2007	2008
Price /W:	9,3	7,75	7,5	6,8	7	6,4	6,5	6

3.6 Labour places

Full time labour places in the following activities during the year 2008 are:

- a) Public research and development (not including private companies): 120
- b) Manufacturing of products throughout the PV value chain from feedstock to systems, including company R&D: 2 500
- c) All other, including electricity companies, installation companies etc.: 3 000
- d) Utilities and government: 80

Table 8: Estimated PV-related labour places in 2008

Research and development (not including companies)	120
Manufacturing of products throughout the PV value chain from feedstock to systems, including company R&D	
Distributors of PV products	
System and installation companies	5 500
Utilities and government	80
Other	
Total	5 700

3.7 Business value

An estimate of the value of PV business in Italy by the Gross Domestic Product approach is reported in table 9

Table 9: Value of PV business

Sub-market	Capacity installed in 2008 (kW)	Price per W <i>(from table 7)</i>	Value Euro	Totals
Off-grid domestic				
Off-grid non-domestic	200	11,5	<i>2 300 000</i>	
Grid-connected distributed	211 100	6,0	<i>1 266 600 000</i>	
Grid-connected centralized	126 800	4,6	<i>583 280 000</i>	
				<i>1 852 180 000</i>
Export of PV products <i>(including information from Tables 4 & 5)</i>				<i>478 000 000</i>
Change in stocks held <i>(including information from Tables 4 & 5)</i>				
Import of PV products <i>(including information from Tables 4 & 5)</i>				<i>1 228 000 000</i>
<i>Value of PV business</i>				<i>1 102 180 000</i>

4 FRAMEWORK FOR DEPLOYMENT (NON-TECHNICAL FACTORS)

Table 10 lists the main support measures (see definitions at start of guidelines) for PV during 2008.

Table 10: PV support measures

	On-going measures	Measures that commenced during 2008
Enhanced feed-in tariffs	36 - 49 c€/kWh	
Capital subsidies for equipment or total cost	up to 20% and only for BIPV in some regions	
Green electricity schemes	9 c€/kWh added to feed-in	
PV-specific green electricity schemes		
Renewable portfolio standards (RPS)		
PV requirement in RPS		
Investment funds for PV		
Income tax credits		
Net metering	added to feed-in	
Net billing		
Commercial bank activities e.g. green mortgages promoting PV		
Electricity utility activities		
Sustainable building requirements		

4.1 Indirect policy issues

Policy initiatives that may influence the implementation of PV power systems in Italy:

- a) Spring European Council of the action plan "An energy policy for Europe" and the consequent Position Paper of the Italian Government of September 2007 (8 500 MW by 2020);
- b) Programme "Conto energia" of the Italian Government of DM 19.02.2007 (3 000 MW by 2016);
- c) National law (Finanziaria 2008) to promote the use of PV (at least 1 kW) in new buildings.

4.2 Standards and codes

During this year, the Technical Committee 82 of CEI has updated the guide for the design, installation and test of PV plants connected to low and medium voltage grid. This guide includes all the technical regulations for PV plant construction and operation (d.c. working voltage, safety and control devices, supporting structures, connection to the grid, etc.) At international level, Italy has actively participated to the works on new and revised standards carried out within both IEC and CENELEC working groups. In this contest, the Technical Secretariat of CENELEC TC 82, is managed by the Italian Electrotechnical Committee (CEI).

5 HIGHLIGHTS AND PROSPECTS

The last edition of the "conto energia" Programme is ensuring a stable situation, providing the basis for the expansion of PV market in Italy followed by an adequate growth of the national PV industry. Counting on a market growth of 338 MW in 2008 and of about 400-500 MW in the following year, Italian producers of crystalline cells and modules are planning to extend their capacities in the next two years up to 400 MW/years and some initiatives have been announced to realize production lines of polysilicon and thin films modules, as well as production of silicon ingots.

Moreover a recent government call (Industria 2015) foresees the financial support of industrial projects, aimed at creating innovative process and products also for the photovoltaic sector.

ANNEX A: 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, and the reader should do their own research if they require more detailed data.

Source of the information: author's estimate.

- 1) retail electricity prices - household, commercial, public institution
 - a. household (17 c€/kWh)
 - b. commercial, public institution (17.5 c€/kWh)
- 2) typical household electricity consumption (kWh): 2 700 kWh
- 3) typical metering arrangements and tariff structures for electricity customers (for example, interval metering? time-of-use tariff?): tariffs include a fixed charge, a demand charge (€/kW) and an energy charge (cent €/kWh) with several tiers
- 4) typical household income: 36 000 €/year
- 5) typical mortgage interest rate: 5%
- 6) voltage (household, typical electricity distribution network): 220 Vac
- 7) electricity industry structure and ownership: separate generation, transmission, distribution; private owned or municipal
- 8) price of diesel fuel: 110 c€/l
- 9) typical values of kWh / kW for PV systems in parts of your country
 - a. North 1000 -1200 kWh / kWp
 - b. South 1300 -1500 kWh / kWp