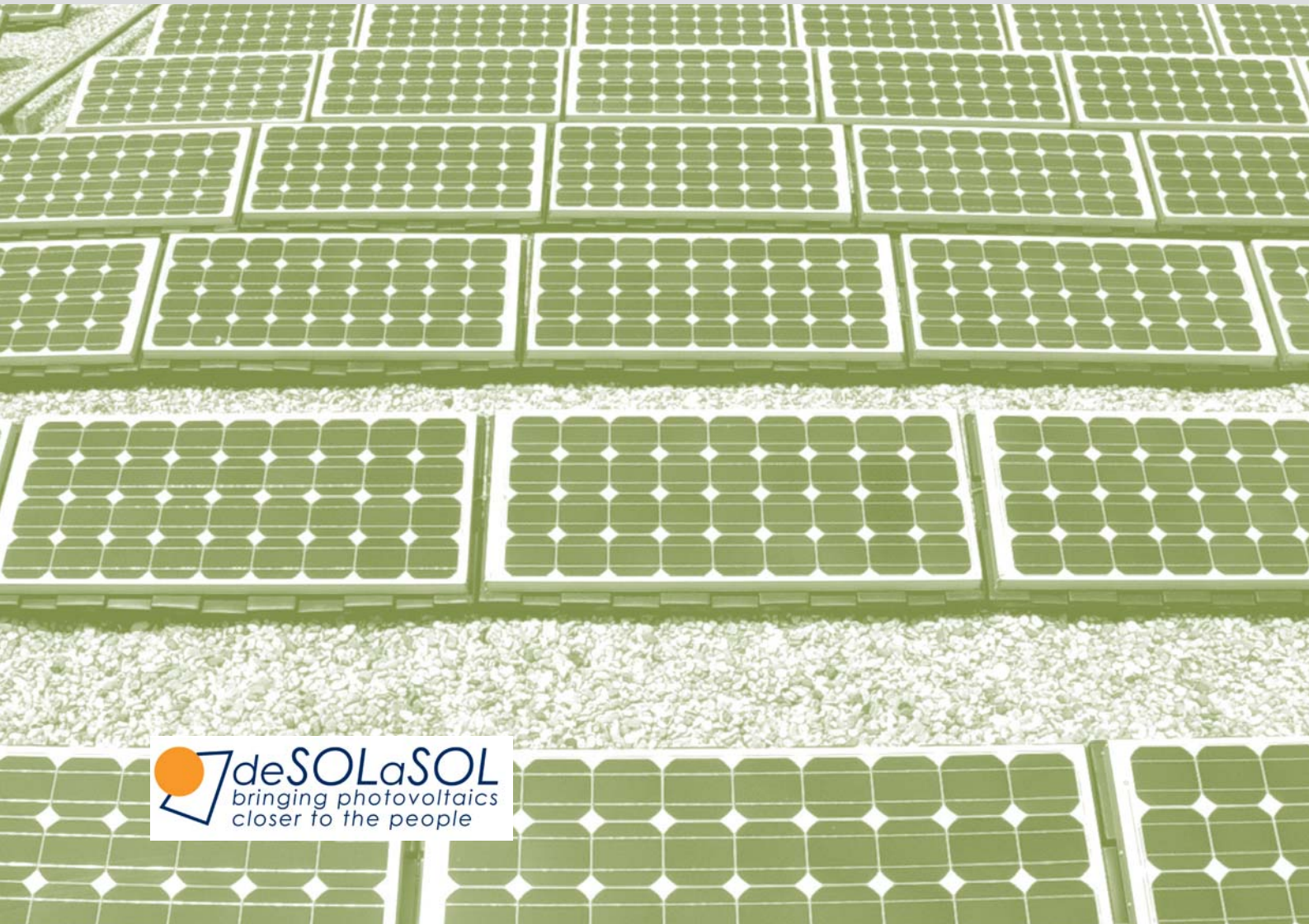
PV PLANTS MARKET ASSESSMENT REPORT CONCERNING GERMANY, SPAIN, FRANCE AND PORTUGAL



This book is a result of the European project deSOLaSOL, in which participate the following entities: Fundación Ecología y Desarrollo (Spain), ecovision GmbH (Germany), Triodos Bank (Spain), Hespul (France), Associação de Productores Florestais (AFLOPS) (Portugal) and La Nef (France).

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1. GERMAN MARKET ASSESSMENT

1. German Market Assessment

1.1. PV NATIONAL MARKET

1.1.1. NATURAL CONDITIONS AND PRODUCTION

In Germany the annual solar radiation global horizontal is between 900 kWh/m^2 in the Northern part and 1,100 kWh/m^2 in Southern Germany.

- *Solar radiation average (kWh/m^2).*

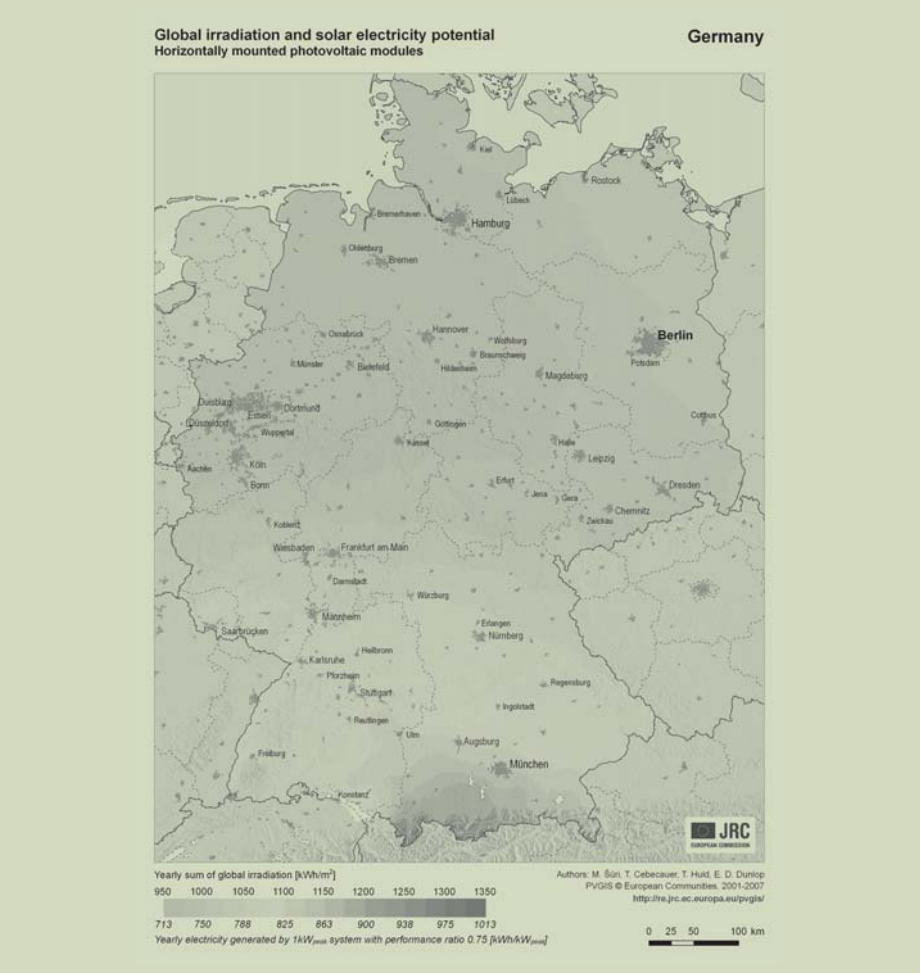

Figure 1. Yearly sum of global irradiation on a horizontal surface.
Source: PVGIS 2001-2007.

- Specific energy yield average (Equivalent Hours) (kWh/kWp)

  The expected annual yield is in Germany today between 820 kWh/kWp in Northern and 970 kWh/kWp in southern Germany.

1.1.2. MARKET BACKGROUND AND HISTORY

- Historic development (power installed evolution 2000-2007).

- Current trends (% growth, % of total electrical production)

  The development goes towards larger ground based PV plants, but house owners are still the largest market group.

  Thin-film modules are gaining market shares as large plants are almost exclusively based on thin-film. For plants smaller 50 kWp crystalline material is more cost-competitive.

- Social PV image or acceptance.

  PV has still the green and best image of all renewable, at least for roof-mounted plants. For ground based plants slowly the same discussion on «landscape mutilation» is coming up as it happens for wind power.

1.1.3. MARKET SIZE AND GROWTH

- Total installed capacity (2000-2007)

  Installed are in Germany approx. 3,700 MWp.

- Annual installed capacity (2000-2007).

  See figure 2.

- Annual growth rate (2000-2007) 55%

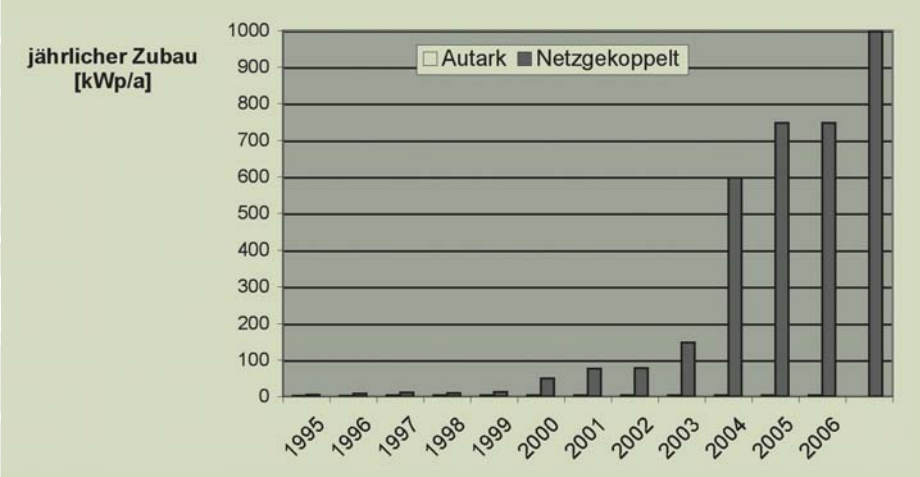

Figure 2. Type of installations
Note: Netzgekoppelt = grid connected, autark = autonomous

- Growth perspective.

– Main causes of the market development

  The market growth is continuing in Germany, for end of 2007 more than 1,000 MWp growth are expected. For the future this growth will be reduced due to deteriorating boundary conditions, as the law amendment will bring worse conditions (see below).

– National objectives of development.

  The PV industry is worried about the stronger decrease within the law amendment. From 2009 onwards, the 5% annual decrease for new commissioned plants will go up to 7% from 2009 and up to 8% from 2011 onwards.

1.1.4. MARKET STRUCTURE

- Type of installation (% grid or off grid).

  More than 99% of the installations are grid-connected and less than 0.2% are autonomous systems.

- Project size average.

  20 kWp in the average, minimum from 1 kWp up to – at the moment- 40 MWp (airport of the city of Leipzig)

- Regional development or distribution.

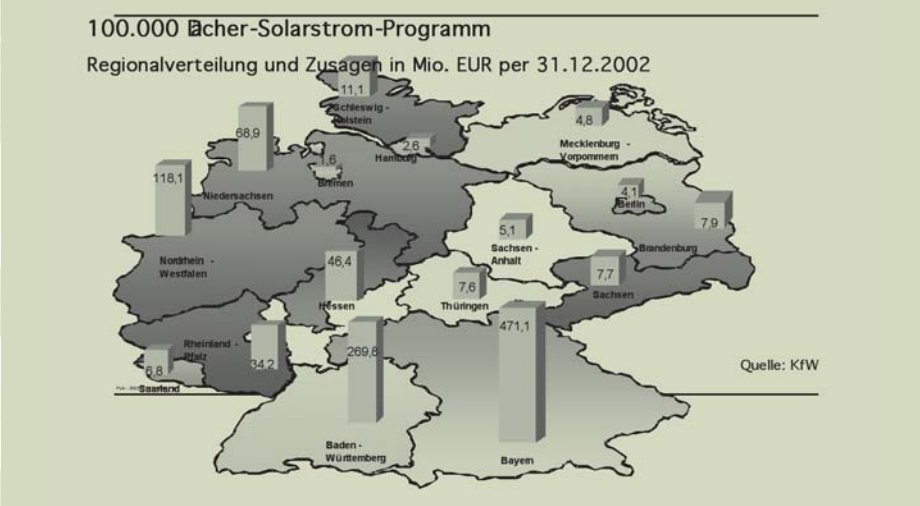

Figure 3. Regional distribution

- Concentration of the property of the installations (ratio kW/owner)

  For joint ownership: approximately 9,000 € / investor. This means that with 30% equity approx.

  30,000 € Investment or 6.5 kWp rated power.

  For plants on the own house roof the equity share is lower as the mortgage is realized not by the project itself exclusively. The typical size should be around 4 kWp.

1.2. PV INDUSTRY

1.2.1. PV INDUSTRY STRUCTURE AND DEVELOPMENT

- Country position in PV market, in Europe and in the world.

  Germany is the leader in the PV-world with a market share of 50%. The employees increased from 3,000 in 2000 up to 40,000 in 2007 by the factor of 13. From the 40,000 around 20,000 (59.0%) are working as crafts men, 7% as wholesalers and 43 % in the industry and suppliers. The export share is around 38%, the import share around 25%

- Silicon / wafer production:
  not published

- Cell and module production: Von 16 MW in 2008 auf 842 MW in 2007.

  No details are known but the market leader SMA, Niestetal, Germany produced about 1,000 MW in 2007.

1.2.2. IMPORTANT DATA

- National main PV equipment production capacity: modules, wafers...)

- Annual sales (MW and €).

  In 2007 estimated 1,100 MWp with 5.4 billion turnover

- Annual investments (MW and

  Approximately 1.6 billion into new production lines.

- PV modules price average.

  2.0 for thin-film modules, 2.8 for crystalline material for wholesalers. Final consumers more 30%.

- PV systems price average

– 3 kWp roof: 4,650 € /kWp

– 100 kWp roof: 4,250 €/kWp

– 2 MW ground based: Thin film 3,900 €/kWp

Profitability average of a solar photovoltaic plant.

– 3 kWp roof: private owned: IRR 5-6.5%

– 100 kWp roof: jointly owned IRR 5%, private owned 6.5%

– 2 MW ground based: jointly owned 5.5-6%

- Main PV Companies.

  Wafer: Solarworld,

  Cells: Q-Cells, Solarworld, Ersol

  Modules: Solon, Aleo, Solarworld,

- Rate of employment

  40,000 employees.

2. SPANISH MARKET ASSESSMENT

2. Spanish Market Assessment

2.1. PV NATIONAL MARKET

2.1.1. NATURAL CONDITIONS AND PRODUCTION.

- Solar radiation average (kWh/m2).

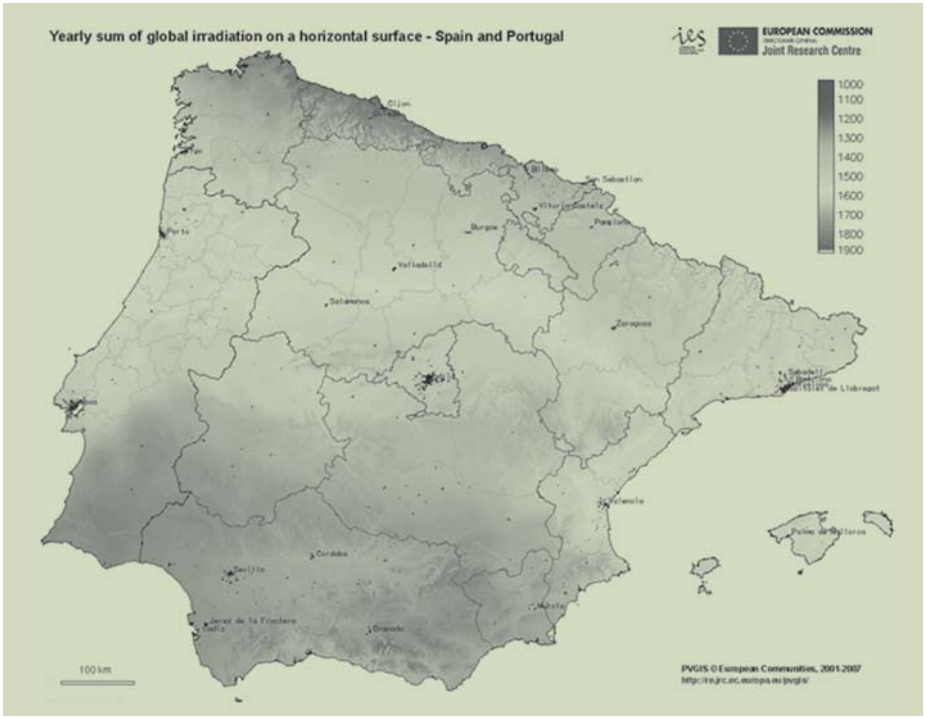

Figure 4. Yearly sum of global irradiation on a horizontal surface.
Sorce:PVGIS 2001-2007

The average daily solar radiation on horizontal surfaces is around 4 kWh/m^2 in the North of Spain and around 5 kWh/m^2 in the South of Spain.

Spain receives many more sun hours per year on average than many surrounding countries (average solar insolation of 1,600 kWh/m2). However, the distribution varies in the different geographic zones and through the year.

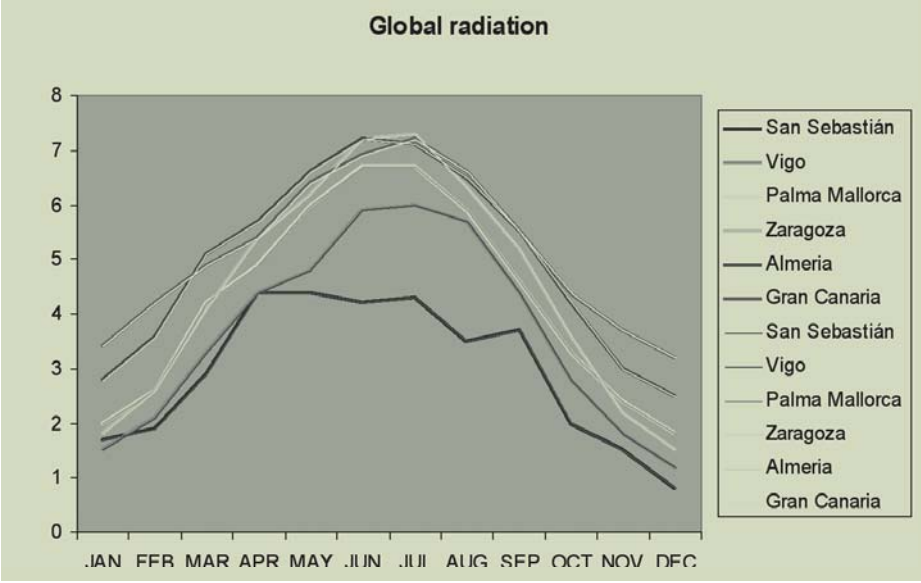

Figure 5. Global radiation.
Source: Ciemat (Energy, Enviromental and Technological Research Agency)

- Specific energy yield average (Equivalent Hours) (kWh/kWp)

  In Spain the average of equivalent hours in fixed installations according to the European Best Practice Report are between 1,000 to 1,500 kWh/KWp. The average energy performance has an average annual value of 1,700 kWh/kWp due to the trackers.

2.1.2. MARKET BACKGROUND AND HISTORY

- Historic development (power installed evolution 2000-2007).

  PV sun energy has undertaken a huge growth in the last years: since 1999 there is an important quantitative leap on annual installed power, coinciding with the introduction of grid-connected applications into the market.

  Spain was in 1999 one of the first European countries in manufacturing PV cells, with 6 MW manufactured by Isofotón and 5 MW by BP Solar, plus the production of Atersa´s modules from imported cells.

  In Spain in recent years there has been an important growth of this type of installations, generally as big PV plants on the ground, especially due to the regulatory framework promoted by the Government.

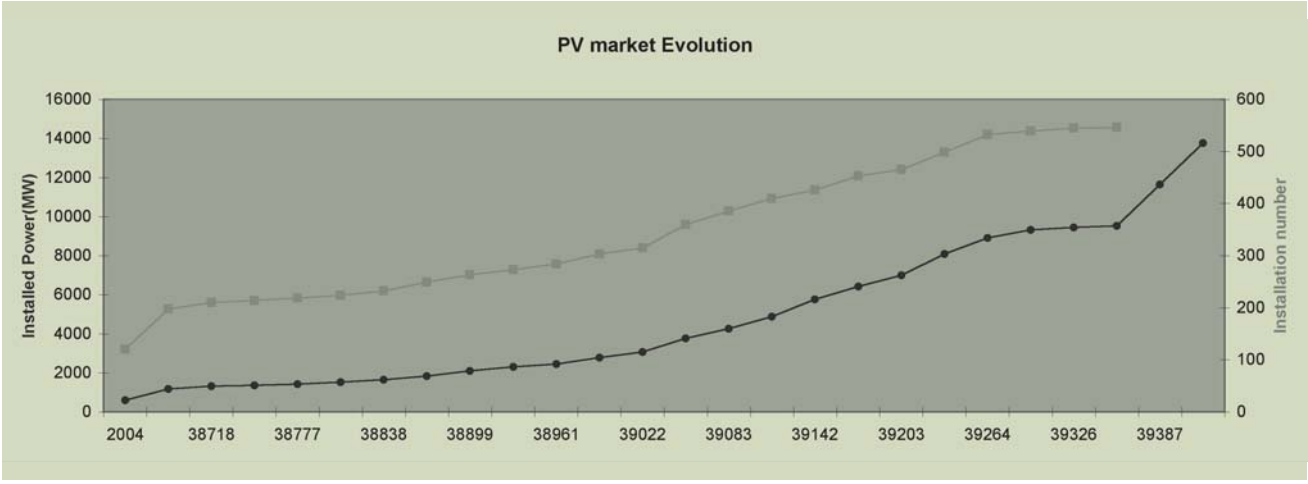

Figure 6. PV Market evolution.
Source: ASIF (Photovoltaic Industry Association), APPA (Renewable Energy Producers Association) and Eurobserv'ER

- Current trends (% growth, % of total electrical production)

  The current trend is of constant growth. Nevertheless, in spite of the spectacular proliferation of grid-connected PV plants in Spain, PV participation on the electricity generation mix is very small, see figure 7.

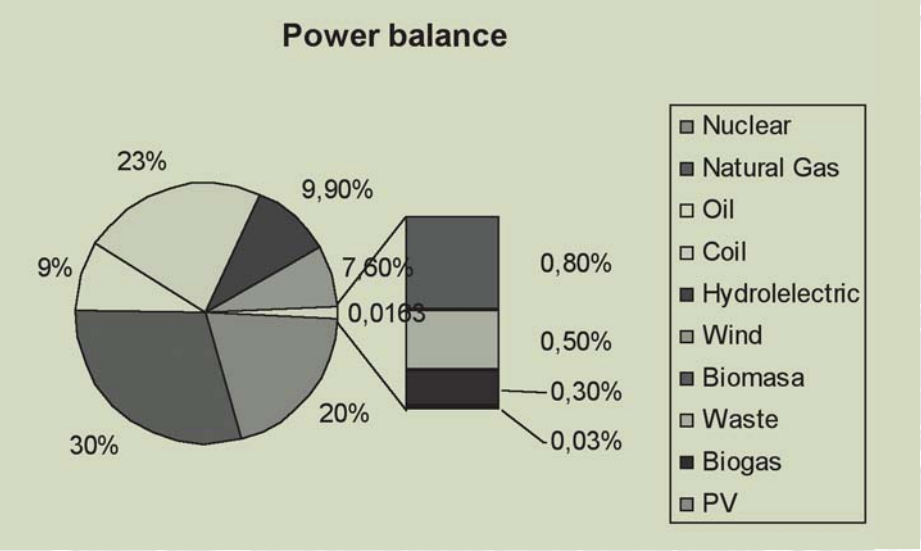

Figure 7. Power balance 2006. Source: I.D.A.E.

- Social PV image or acceptance.

  The growing awareness about climate change caused by human activity is favouring the social image and acceptance of this clean energy, therefore causing a wide social, political and trade union support nowadays.

  According to the Euro Barometer 2006 and 2007, in Spain 70% of the people are "very worried" about climate change, 23% are "worried" and 90% consider that renewable energies should have a minimum share in electricity generation. Furthermore, 50% include the use of the sun's potential among the two main measures to reduce energy dependence.

  On the other hand, according to the Study on Social Attitudes in Spain towards Energy and Water, carried out by the BBVA Foundation in October 2007, 59.5% of the people consider that the energy situation is an important problem in Spain, and there is a clear support for the use of renewable energy sources, specially solar energy (8.6 in a scale from 0 to 10). Moreover, 54.8% would pay a little more if electricity came from renewable sources.

  The main political parties have included, in their programs for the general elections of March 2008, proposals and measures to increment the renewable energy share, and specially PV, in the generation mix.

  However, the proliferation of big PV plans in wide rural areas is starting to affect the perception of this technology. In this sense, it would be more adequate to focus on small installations on roofs.

2.1.3. MARKET SIZE AND GROWTH

- Annual and total installed capacity and annual growth rate (2000-2007)

  According to the Euroserv'ER the first data estimates from I:D.A.E. (Spanish Institute for the Diversification and Saving Energy) confirm the upsurge of the photovoltaic sector in Spain, with a an additional capacity of 340.8 MWp, i.e. growth of nearly 200% with respect to 2006.

- Growth perspective.

– Main causes of the market development

  The main cause of this spectacular growth consists in the regulation established in 2004, together with an abundant solar resource. This development has been allowed the take-off of the solar PV market. Now, the next step needs adequate planning in order to keep a similar growth with a rational distribution of the power installed and balanced profitability.

– National objectives of development.

  Currently, there is uncertainty about which will be the national objectives on grid-connected PV installations, as those established in the legislation in force, which will expire in September 2008, were of 371 MW, but at the end of 2007, 515.815 MW had already been installed, according to Euroserv'ER 2008.

  In 2007 the PV sector has proposed to grow without limits at rates of 20% per year, on a model based on quality installations smaller than 10 MW, promoting the incorporation on buildings and reducing the tariff between 10% and 15% in October 2008 and, from 2010, reducing it 5% per year, with periodic revisions. The different players in the sector are asking for a stable and predictable regulation as soon as possible, considerering that current uncertainty could jeopardise the healthy development of the sector.

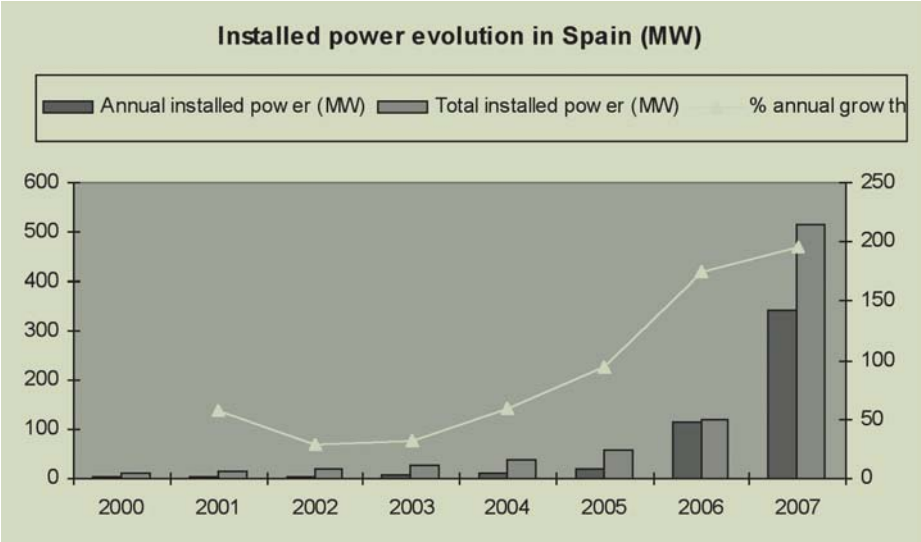

Figure 8 Installed power evolution in Spain (MW).
Source: I.D.A.E and Eurosev'ER.

2.1.4. MARKET STRUCTURE

- Type of installation (% grid or off grid).

  5,12% of the installed power is off grid, with the remaining 94,88% feeding the national network.

- Project size average.

  The figure shows the PV installations carried out under the Royal Decree 661/07 up to December 2007, distributed by installation size. However, these data are deceptive as in many cases, installations of several MW are registered as different plants of 100 kW, since these have a higher retribution.

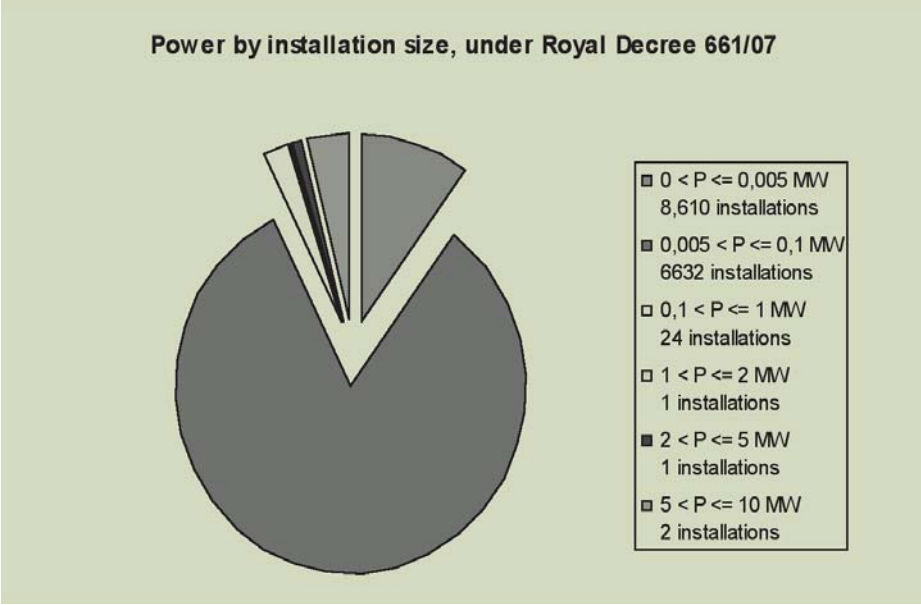

Figure 9. Power by installation size, under Royal Decree 661/07.
Source: CNE (National Energy Commission)

- Regional development or distribution.

  The figure shows the geographic distribution of the installations carried out in 2007.

- Concentration of the property of the installations (ratio kW/owner)

  According to CNE data, more than 15,200 entities are owners of PV installations, which means an average of 36 kWp/owner, distributed in 5,671 installations.

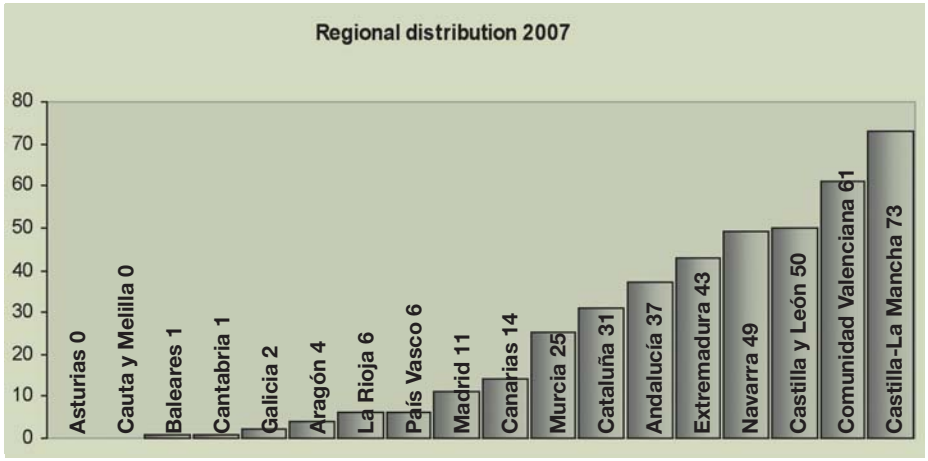

Figure 10 Installed power in MWp regional distribution at year 2007. Source: CNE.

2.2. PV INDUSTRY

2.2.1. PV INDUSTRY STRUCTURE AND DEVELOPMENT

The sector is composed of more than 400 enterprises, the numbers continuing to grow. It is one of the most mature industries with more than 25 years of experience in manufacturing and project development, and an important international presence.

For the first time, in 2008, it is expected that Spain will be able to produce the entire value chain of polysilicon.

- Country position in PV market, in Europe and in the world.

  Moreover Spain surpassed the Japanese and American market in 2007, ranking second in the world only after Germany .

- Silicon / wafer production:

  Currently, there are three polisilicon production projects in Spain: Isofotón together with Endesa, with an expected production of 2,500 tons starting in 2009; Grupo Pevafersa with a forecast of 1,000 tons starting also in 2009 and the investors group Vallombrosa Trust with another project.

  Nowadays there are only two companies that produces wafers at Spain, Silicio Solar and in less quantity, Pevafersa.

  Also there are others projects with companies as DC Wafers in Leon that foresee to start producing not only wafers but also ingots of polysilicon.

  On the other hand, there is a comercial take off of concentration technologies, and the introduction in the market of technologies different from silicon.

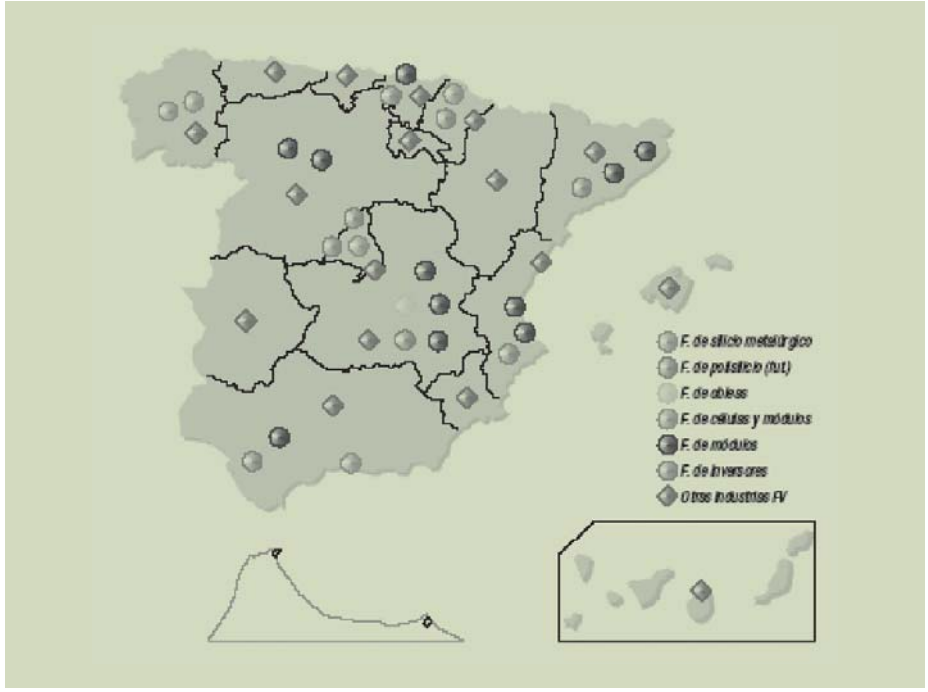

Figure 11. Spanish Industry. Source: ASIF

- Cell and module production:

  The recent development has allowed the national PV industry to be among the more developed countries in the sector, being the second at European level and the sixth at world level in cell manufacturing capacity (10% of the European production in 2005 and 3% of world manufacturing).

- PV components production.

  The inverter manufacturing sector also has high growth index, but concentrated, so far, around four enterprises. The graphic shows the cells, modules and inverters production in 2007.

- Trakers

  Due to the favorable radiation conditions in Spain the trackers' industry is emerging significantly. There are many technologies under development that need of further experience to consolidate.

- R&D

  At this moment in Spain there are some institutions of recognized prestige developing new technologies and making support to PV industry, i.e. I.E.S (Solar Institute).

  Also it is important to take into consideration projects that are currently being financed by both, public and private entities to develop and to test the performance of news technologies as Plataforma Solar de Almeria (CIEMAT)

2.2.2. IMPORTANT DATA

- National main PV equipment production capacity: modules, wafers...)

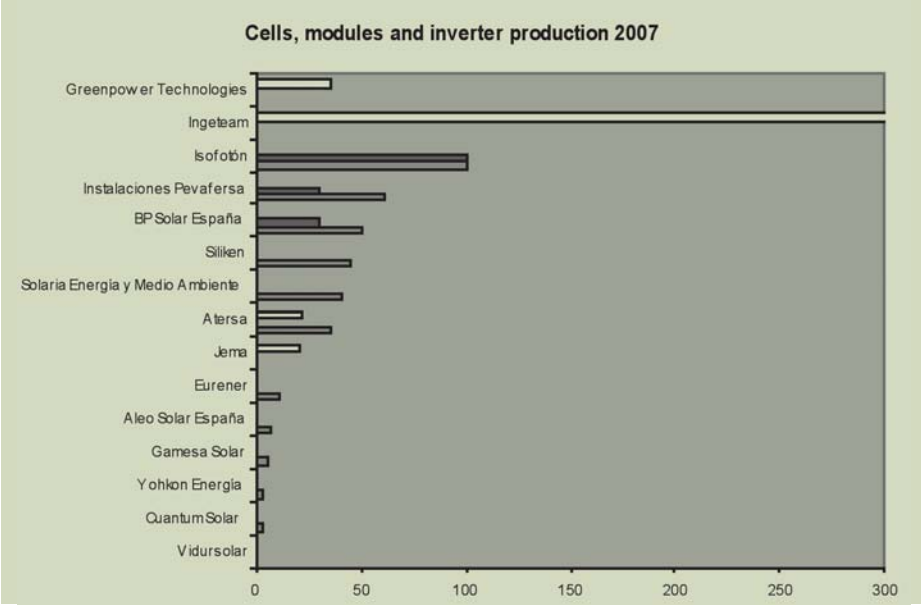

Table 1. Cells, modules and inverter production in Spain, during year 2007. Source: Photon

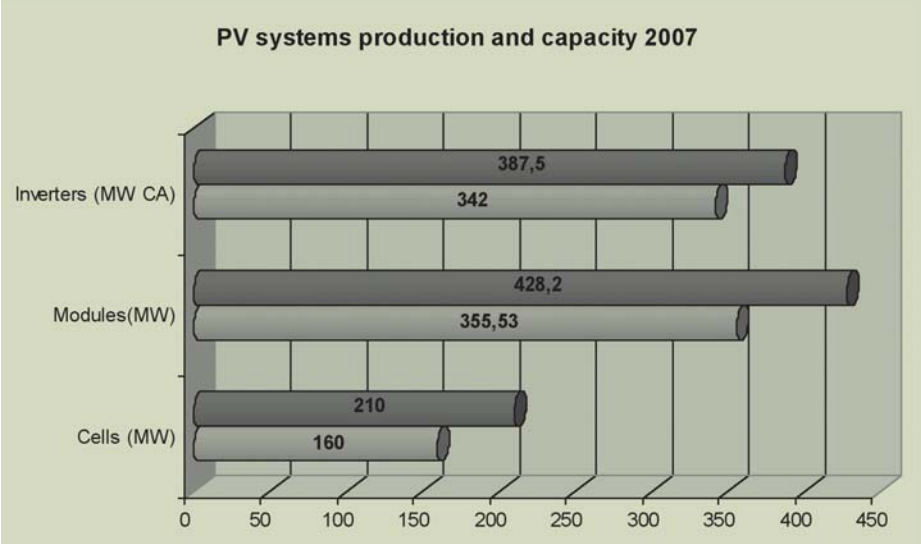

Table 2. PV System production and capacity. Source: Photon

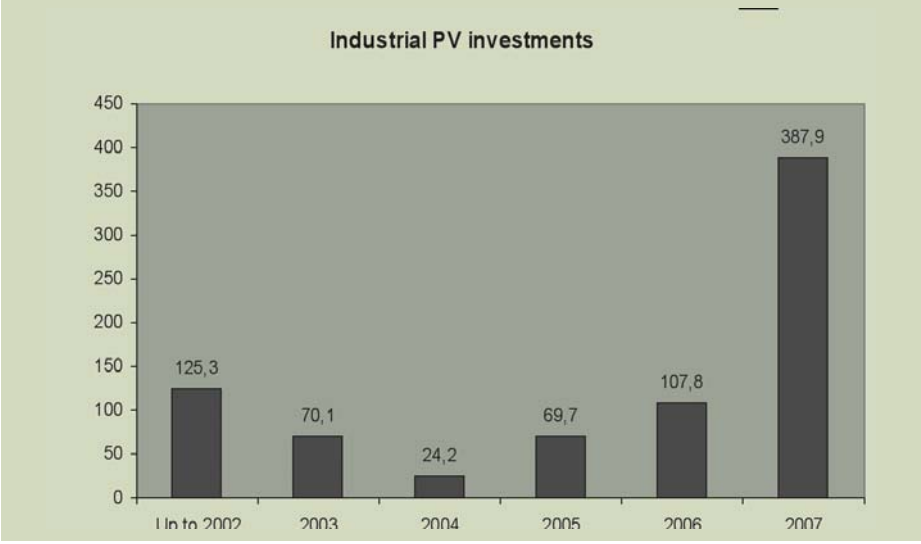

Figure 12. Industrial PV Investment. Source: Solar News

The graphic shows the PV equipment production capacity and the actual production in 2007. It is a fast expansion sector which could double its production in 2008.

- Annual investments (MW and €)

  PV investments have risen at a vertiginous rate, bordering 5.000 million euros in 2007:

- In industrial installations: 400 MM€ (see figure below).
- In PV installations: 2,500 MM€.
- In PV shares: 2,100 MM€.
- PV modules price average.

  The graphic shows the cost and prize of PV modules in 2006.

  More precisely, and according to the European Best Practices Report the prize in Spain in 2004 was between 2,75 to 3,25 €/Wp.

- PV systems price average

  At the moment, the average cost, for fixed ground installations is between 6 and 6,5 €/Wp and for installations with trackers between 7-8 €/Wp.

- Main PV Companies.

  The main PV industries are Isofotón, BP Solar, Atersa, Gamesa Solar, Siliken, Grupo Solar, Guascor, Solaria, Instalaciones Pevafersa, while the main actors in electronics are Atersa, Ingeteam and Enertron.

  It is needed to highlight, that Isofoton is the largest cell and module manufacturer in Spain, and according to the figures of Euroserv'ER 2008, the company is included in the TOP 15 manufactures of PV Cells. The manufacturer is clearly pursuing a strategy of growth, with the increase in 2007 of its module production capacity from 130 to 300 MWp.

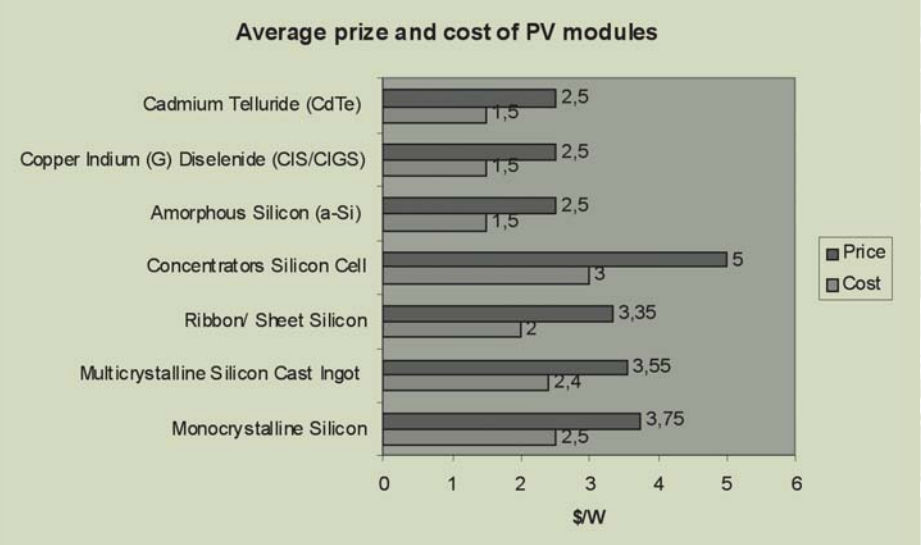

Table 3. Average prize and cost of PV modules. Source: Prometeus

- Rate of employment

  The number of jobs generated by the PV sector grew in an exponential way, reaching 15,200 direct jobs plus 8,503 indirect jobs in 2007.

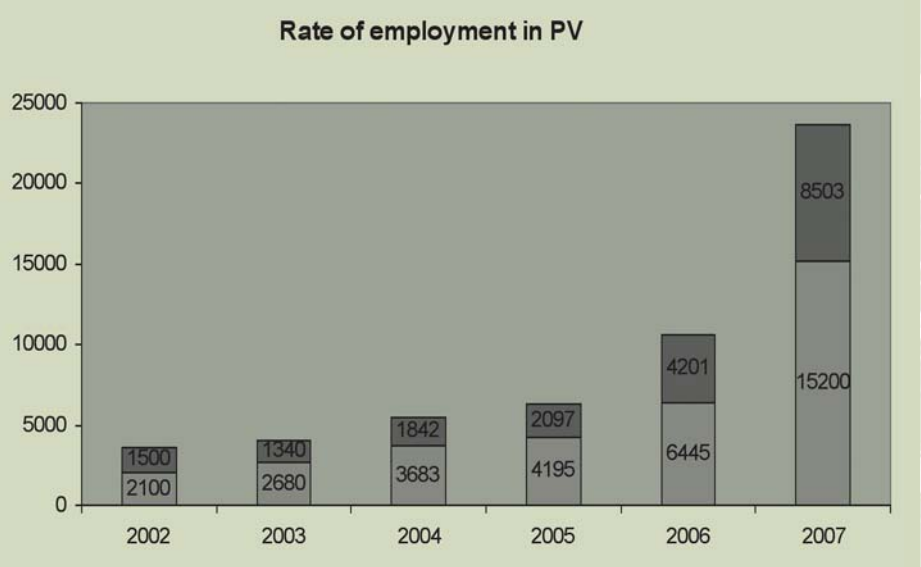

Table 4. Rate of employment in PV. Source: Solar news

- Conclusions

  The Spanish solar PV market has reacted extraordinarily well to the favorable regulation established by Government in 2004.

  From the industrial and economic perspective, growth rate is above 200%, being at the second position of power installed and second industry in Europe an investment around 5.000 MM€.

  From the social and environmental perspective, more than 23,000 employments have been created, and the consolidation of a source of energy responsible with the environment and independent from external dependencies.

  The opportunity is obvious but the market needs a stable regulation to keep such a successful way.

3. FRENCH MARKET ASSESSMENT

3. French Market Assessment

3.1. PV NATIONAL MARKET

3.1.1. NATURAL CONDITIONS AND PRODUCTION.

- Solar radiation average (kWh/m2).

  In average, the solar radiation in Lyon is 3,925 Wh/m^2/day, for a panel with a 25° inclination

- Specific energy yield average (Equivalent Hours) (kWh/kWp)

  In average: 1,000 kWh/kWp.

  – In Paris: 900 kWh/kWp

  – In Marseille: 1,350 kWh/kWp

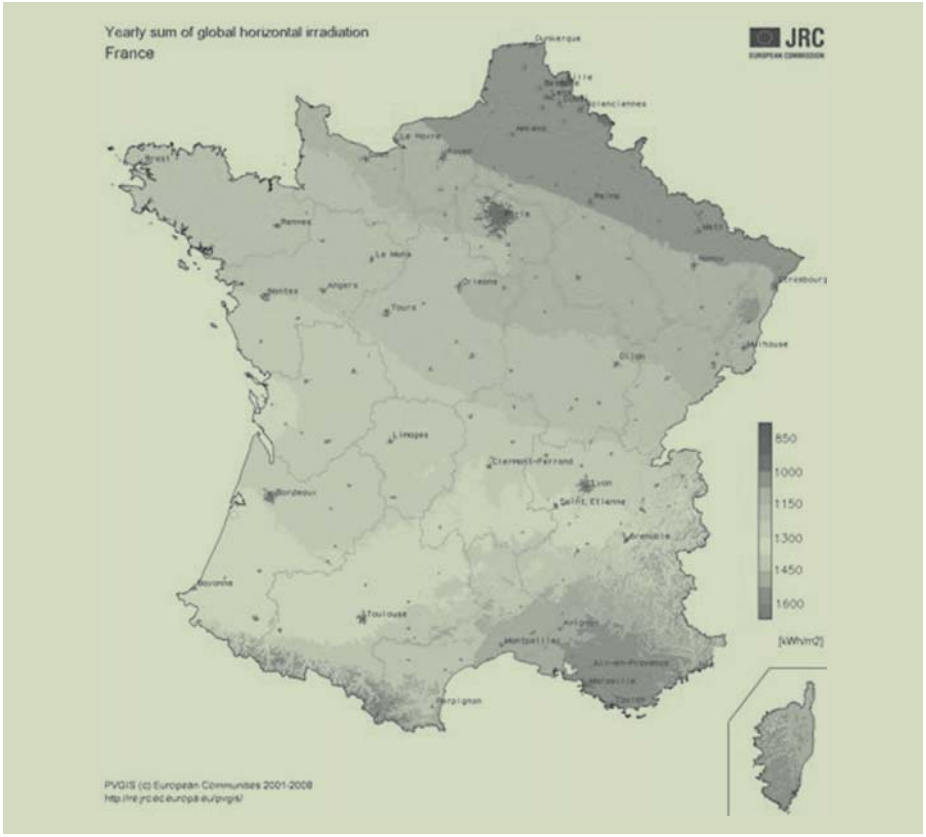

Figure 13. Yearly sum of global irradiation on a horizontal surface.
Source: PVGIS 2001-2007.

3.1.2. MARKET BACKGROUND AND HISTORY

- Historic development (power installed evolution 2000-2007).

The first grid connected PV system in France showed up on 1992, in a village named Lhuis, in the Ain department. At this period, there was no legal framework defining clearly the connection and production rules for this kind of system.

Willing to develop this field, the association HESPUL (which name was Phebus) worked on several European projects co-financed by the European commission, and installed nearly 300 PV systems all around France. These projects were the first step towards the integration of PV as one more electrical production system equivalent to any other usual one. With the inexistence of a legal procedure to connect the installation to the grid, the system owner used to send a letter to the utility, informing of a new grid connection and giving all the technical details. The measuring systems consisted on an old counter with a reversing mode.

In the year 2000, the first legal texts on this purpose were published and introduced the feed-in tariff as a remuneration model for the PV systems and other specific points concerning the connection to the grid: the law n°2000-108, published the 10th of February 2000.

In 2,002, the first feed in tariff value is fixed to 0.15 €/kWh in France Mainland, and 0.30 €/kWh in the overseas departments (DOM).

However, despite this evolution, the feed-in tariff is too low in France mainland (3 times less than in Germany) to be able to afford an economical profitability to the system. Few systems are done and the owners are usually motivated by a militancy cause. In the end of 2005, 8.5 MW are installed in France, of which 2 MW in France Mainland. In this same year, the grid connected PV systems reach a higher power installed than the stand alone systems.

In 2006, the new feed in tariffs are introduced and distinguish two kinds of systems:

– The traditional PV systems: 0.30 €/kWh in France Mainland and 0.40 €/kWh in the overseas departments and in Corsica.

– A bonus for the building integrated systems: 0.25 €/kWh in France Mainland and 0.15€/kWh in Corsica and the overseas departments, which allows a better profitability for these kinds of systems.

- Current trends (% growth, % of total electrical production)

– 2.006 - 2007: 200%

– 2.005 – 2006: 122% growth

– 2.006 - 2007: estimated to 150%

% of total electrical production: 0.014% is PV production

- Social PV image or acceptance.

Few years ago, the development of the wind energy in France was faced to a hard refusal from the population. Today, the photovoltaic energy is much more accepted and this is due to several reasons:

– The size of the systems usually installed is closer to the scale of the consumers. In average 4.4 kW.

– The production site can be nearby the consumption site.

– The systems are fixed and silent, which is inconspicuous and can be easily introduced in an urban area.

– Due to its easy use and maintenance, its economical profitability (different subsidies are offered and an interesting feed-in tariff), and the availability of the source of energy (sun) in a major part of the territory, PV is an energy accessible to general public and consumers.

– The global context is favourable for the development of the renewable energies; tackle climate change is a priority for a majority of the European countries.

3.1.3. MARKET SIZE AND GROWTH

- Total installed capacity (2000-2007)

The total power of the systems installed in France during the year 2007, is estimated to approximately 12 MW. The total capacity installed until today is nearly 46,659 MW.

- Annual installed capacity (2000-2007).

No public data informing on the power installed every year in France is available. To be able to get some visibility on the market, HESPUL analyzed the data published by the ministry of industry. The information is extracted from previews demands every future PV producer have to send to the administration. This demand "declaration d'exploiter" does not confirm if the system has been installed and connected, but can give a general overview on the market size.

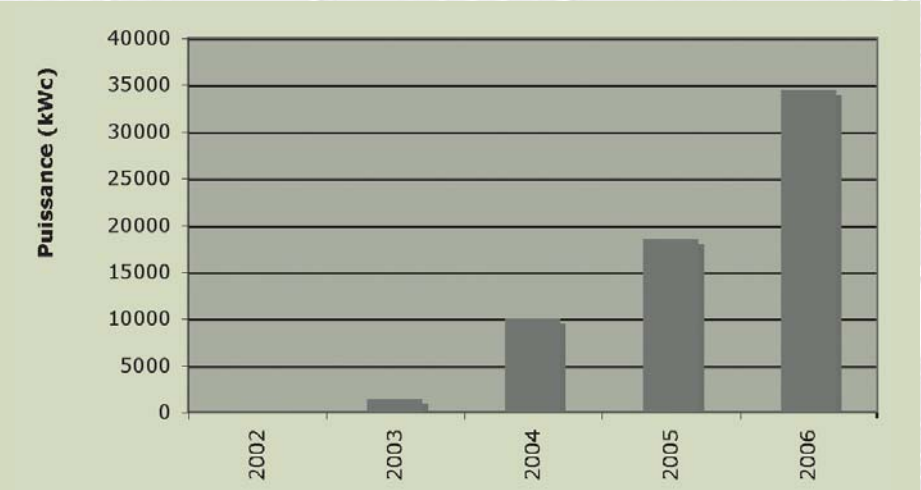

Figure 14. Accumulated power installed every year

From another hand, a market growth study published by ADEME estimated these data until 2004. The information was extracted from the subsidies ADEME gave to the projects. Before 2006 and the introduction of the feed in tariff, mainly all projects got subsidies from ADEME, which is no longer the case today.

Estimation of annually installed power in France:

	Grid connected PV systems		
kW	DOM - TOM - Corsica	France Mainland	Total
1992		1	1
1993		5	5
1994		32	32
1995		2	2
1996		26	26
1997		16	16
1998		116	116
1999		55	55
2000		130	130
2001		181	181
2002	130	485	615
2003	1.221	1.485	2.706
2004	2.902	2.212	5.114
2005	4.875	1.625	6.500
2006	8.400	6.000	14.400

Table 5. Annually installed power in France

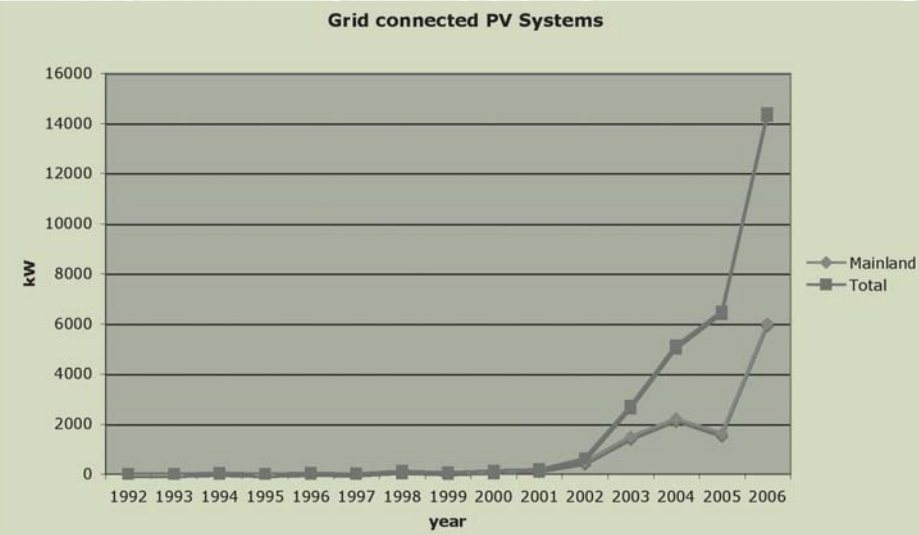

Figure 15. Distributed connected PV System

Since it is becoming difficult to count this growth ADEME together with its partners such as the Renewable Energies Federation (SER) and EDF are trying to rationalize the collection of information

- Annual growth rate (2000-2007) 55%

Considering the estimations below, we can calculate an annual growth:
– 2000: 135%
– 2001: 40%
– 2002: 240 %
– 2003: 340%
– 2004: 90%
– 2005: 27%
– 2006: 122%

- Growth perspective.

– Main causes of the market development

The French government has implemented in 2006 measures to promote the use of solar photovoltaic (PV) energy systems. These measures are designed for boosting the market and create a French industry able to propose an added value to the world PV market. This added value is the development of new systems designed to be integrated to the building.

The main measures causing the PV development are:

– The feed-in tariffs set up in 2006.

– The tax credit deductible from the private individuals' income is set at 50 % of the costs of the equipment with a ceiling at 8,000 EUR per fiscal home.

In parallel, since 2005, the government has extended the national sources for funding research and technological development (RTD) in the photovoltaic field. The agencies sharing these sources and working or research interventions are ADEME, the National Research Agency (ANR) and the Agency for Industrial Innovation associated to OSEO Agency. Moreover, the year 2007 has seen two important initiatives:

The European objectives: reaching 20% of renewable energies in the energy package by 2020.

The «Grenelle de l'Environnement», which is a series of meeting gathering different actors concerned directly or indirectly by ecological matters. Each meeting proposed a series of conclusions and recommendations to set in the French policy. One of the discussion group debated on energy matters and the integration of renewable energies in the primary energy sources. In October, during a speech presenting the conclusions of the discussion groups, the President of the Republic has stressed his willingness to promote the development of renewable energies. Another phase of the "Grenelle de l'environnement" is undertaken, whose objective is to propose practical recommendations to be transformed in legal texts.

– National objectives of development.

The national objectives for the development of renewable energies are in a phase of reconstruction. When the conclusions of the Grenelle are ready, the government will propose a new national policy. Today, the Multiannual Investments Programs (PPI) propose:

- 160 MW PV power for 2010

- 500 MW PV power for 2015

3.1.4. MARKET STRUCTURE

- Type of installation (% grid or off grid).

– 22,178% off grid (Eurobserv'ER)

– 80% Building integrated systems in France Mainland, while most of the systems are installed on large surface areas of roofing as building added-on applications (the basic PV feed-in tariff is higher).

- Project size average.

  There is a big difference in the size of applications between France Mainland and overseas departments. In France Mainland, most of the projects are small ones, installed on consumers' roofs. The systems installed in 2006, had an average of 4.5 kWp. While in the overseas department, the average is about 30 kWp.

  France Mainland:
  – 2002: 2,8 kWp
  – 2003: 3 kWp
  – 2004: 3,4 kWp
  – 2005: 3,6 kWp
  – 2006: 4,5 kWp

  Overseas department:
  – 2002: 2,5 kWp
  – 2003: 20 kWp
  – 2004: 18,5 kWp
  – 2005: 31 kWp
  – 2006: 38 kWp

- Regional development or distribution.

  Due to the lack of specific data, the estimations below are extracted from the previews demands sent to the administration: the "declaration d'exploiter". As explained before, the information do not confirm if the system has been installed and connected, but can give a general overview on the market size.

  The "declaration d'exploiter" informs on the power and address of PV systems to install for the period going from 2002 until august 2007.

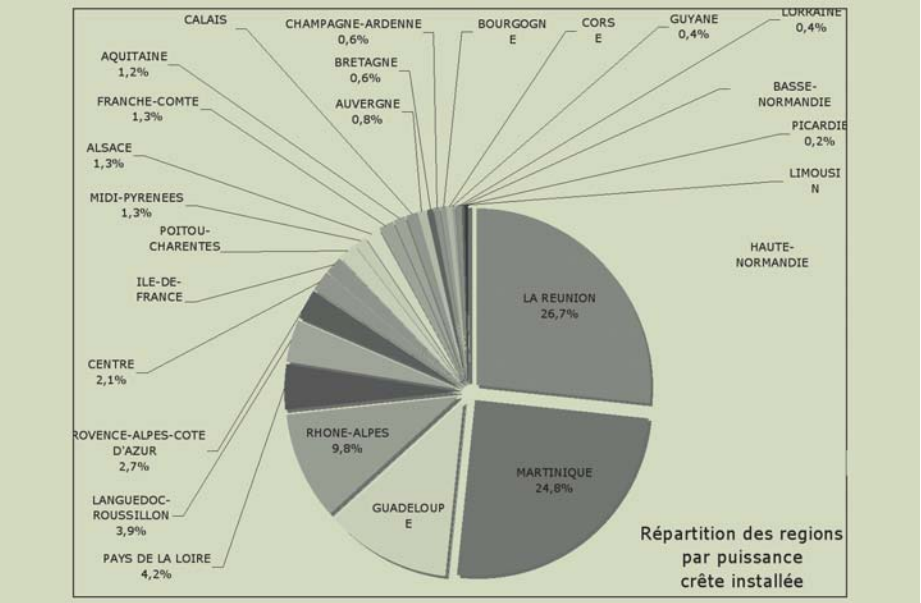

Figure 16. Regional distribution

Region	Number	Power	Size systems Average
RHONE-ALPES	1.231	3.861	3,1
PAYS DE LA LOIRE	497	1.702	3,4
LANGUEDOC-ROUSSILLON	315	1.509	4,8
PROVENCE-ALPES-COTE D'AZUR	344	1.071	3,1
CENTRE	174	844	4,8
ILE-DE-FRANCE	57	696	12,2
POITOU-CHARENTES	147	635	4,3
MIDI-PYRENEES	130	526	4,0
ALSACE	63	525	8,3
FRANCHE-COMTE	154	512	3,3
AQUITAINE	125	492	3,9
NORD-PAS-DE-CALAIS	98	462	4,7
AUVERGNE	37	341	9,2
BRETAGNE	101	240	2,4
CHAMPAGNE-ARDENNE	57	233	4,1

Table 6. Regional distribution

3.2. PV INDUSTRY

3.2.1. PV INDUSTRY STRUCTURE AND DEVELOPMENT

- Country position in PV market, in Europe and in the world.

  End of 2006: France occupies the 4th position in Europe, after Germany, Spain and Italy, and occupies the 7th position in the world.

- Silicon / wafer production:
  Silpro: silicon production
  Emix: wafer production
  Photosil: silicon production

- Cell and module production: Von 16 MW in 2008 auf 842 MW in 2007.

  The company Tenesol produces multicrystalline modules. It is located at Toulouse.

  The company Photowat produces multicrystalline silicon ingots, wafers, cells and modules. It is located at Bourguin-Jallieu.

- PV components production

  Clipsol: produce a building integration instrument that can be fixed on roofs, with a PV panel. The company is located at Aix Les Bains.

3.2.2. IMPORTANT DATA

- National main PV equipment production capacity: modules, wafers...)

  Photowatt: the annual capacity stands at 60 MW

  Tenesol: 18 MW and have a project of increasing this production until 50 MW.

- PV systems price average

  Non-integrated systems:

  P < 10 kW: 6€/Wc

  P < 100 kW : 5 €/Wc

  P > 100 kW : 4 €/Wc

  BIPV systems

  Depending on the system integration, the price is different: 7 € ‡ 13 €/Wc

- Main PV Companies.
  – Tenesol – Photowatt
  – Silpro – Photosil
  – Emix

4. PORTUGUESE MARKET ASSESSMENT

4. Portuguese Market Assessment

4.1. PV NATIONAL MARKET

4.1.1. NATURAL CONDITIONS AND PRODUCTION.

- Solar radiation average (kWh/m2).

  In Portugal the average solar radiation is 1,700 kWh/m2 (Source: EPIA).

- Specific energy yield average (Equivalent Hours) (kWh/kWp)

  In Portugal the average of the energy yield is 1,400 kWh/kWp (Source: EPIA).

4.1.2. MARKET BACKGROUND AND HISTORY

- Historic development (power installed evolution 2000-2007).

	2000	2001	2002	2003	2004	2005	2006	2007
Installed power [MW]	1,2	1,3	1,5	2,1	2,7	2,9	3,4	14,5

Table 7. Evolution of power installation. Source: DGEG)

- Current trends (% growth, % of total electrical production) (Source: DGEG)

  – Growth rate of the PV installed 19%

  – PV Production share 0.1%

- Social PV image or acceptance.

  According to the study "Energy Technologies – Knowledge Perception Measures", developed in 2006 with the support of the European Commission, 77% of the Portuguese are in favour of the utilization of the solar energy, 9% does not know, 2% is against and 12% does not have an opinion

4.1.3. MARKET SIZE AND GROWTH

- Total installed capacity (2000-2007)

	2000	2001	2002	2003	2004	2005	2006	2007
Installed power [MW]	1,2	1,3	1,5	2,1	2,7	2,9	3,4	14,5
Installed capacity [MW]	0,1	0,1	0,2	0,6	0,6	0,2	0,5	11,1
Yearly growth rate	9%	8%	15%	40%	29%	7%	17%	326%

Table 8. Total installed capacity. Source DGEG

- Annual installed capacity (2000-2007). See table 8.

- Annual growth rate (2000-2007). See table 8.

- Growth perspective.

  Portugal has exceptional conditions for the production of PV electrical energy.

  In Portugal, every time there are legal conditions adequate for this economical activity, the market reacts almost explosively, and therefore its contention is determined above all by legal impositions that establish production shares for the big producers and, more recently for the micro producers. Besides the shares, it was established a set of restrictions that condition the raising of this kind of energy production

  On the other hand, the recent legislation concerning the micro producer statute is a strong contributes for the appearance of this new actor in the energy market, by the simplicity of the processes that it is introducing in the licensing process of the installation.

  The Portuguese government established, for 2010, the objective of 150 MW in solar PV energy. In 2005, 128 MW were already contracted, since then the attribution of more power for grid connection is "frozen" due to the huge number of requests registered meanwhile.

  With the new micro producer statute, they were kept 50 MW to give to PV microgeneration installations to implementing in households, commercial, services or industrial buildings.

4.1.4. MARKET STRUCTURE

- Type of installation (% grid or off grid).

  There is no information, in Portugal, available concerning installed PV systems with no connection to the grid; however, this is a very small part, represented mainly by the solar panels used for signalization/communication systems. Presently there is a project that may assume relevance at the isolated PV systems that goes through the installation of panels in the motor-way payment cabins of Brisa, making them autonomous in energetic terms.

- Project size average.

  In Portugal, the market is dominated by the big production structures. The example is the 14.5 MW installed in Portugal, 11 MW attributed to the PV plant in Serpa (76% of total).

- Regional development or distribution.

  Although in Portugal, from the North to the South, there are optimal conditions for the implementation of PV installations, the regions on the inside of the country are privileged by the slightly induced clouding that happens in the coastal regions because of the sea. The southern inner regions (inner Alentejo), are the best places for the installation of big PV investments, because of their climatic characteristics, very similar to the ones of the desert regions.

- Concentration of the property of the installations (ratio kW/owner)

  Due to the market structure dominated by the big installations, also the property is highly concentrated, as an example, the society that owns de PV Plant in Serpa (composed by GE Energy Financial Services, PowerLight Corporation and Catavento Lda) owns 76% of the

market in Portugal with 11 MW installed.

4.2. PV INDUSTRY

4.2.1. PV INDUSTRY STRUCTURE AND DEVELOPMENT

- Country position in PV market, in Europe and in the world.

  At the end of 2.007, Portugal occupies the 8th position in the photovoltaic European market

- Silicon / wafer production:

  Non so far.

- Cell and module production.

  1 module production site from Shell Solar with a capacity of 17 MWp.

4.2.2. IMPORTANT DATA

- National main PV equipment production capacity: (modules, wafers...)

  Portugal has a national module production capacity of 10.8 MWp in 2002. A dozen companies are supplying and installing PV modules. A few of them produce power electronics for stand-alone PV applications.

- Annual sales (MW and €).

  Estimated to 22.5 Mio € in 2005 with 410% increased compared to 2004.

- PV modules price average.

  According to the figures of European Best Practices in the year 2004 the price was 3.5 €/Wp.

- PV systems price average

  According to the figures of European Best Practices in the year 2004 the price was is 6-8.5 €/Wp.

- Rate of employment

  175 employments were created in 2004.

5. COMPARATIVE SUMMARY OF THE SOLAR PV MARKETS

5. Comparative Summary of the Solar Markets

	Germany	Spain	France	Portugal
Installed Power 2007 (MW)	1.000	341	45	11
Installed power accumulated 2007 (MW)	3.700	515	75	15
2007 Growth Rate	37%	196%	150%	326%
Wp installed/inhabitant	46,50	11,74	0,77	1,68
Equivalente hours	895	1.250	1.000	1.400
Country Ranking in EU per installed power	1	2	5	8
Installed power forecast 2010 (MW)[1]	8.575	1.815	615	102
Average size per project (kWp)[2]	20	36	30	One project 11MW
Investment (€/Wp)[3]	4-4,5	6-8	5-6	6-8,5
Expected profitability[4]	5-6,5%	8-10%		
Total Investment in 2007 (M€)[5]	5.400	2.387	248	78
Industry development[6]	4	3	2	1
Employment	40.000	23.700	570 in 2004	175 in 2004
CO2 emissions saved[7]	3.311.500	643.750	75.000	20.300

1. EPIA
2. Estimations of deSOLaSOL based on the available figures
3. Estimations of deSOLaSOL according to the market knowledge
4. Estimations of deSOLaSOL according to the market knowledge
5. Estimations of deSOLaSOL: installed capacity in 2007 x €/kWp
6. Ranking from 1 to 4
7. Estimations of deSOLaSOL: installed power x equivalent hour x 1 kg of CO_2/kwh

Table 11. Comparative summary of the solar PV market

From these data it can be concluded that:

- There are big differences in the development of the PV market ranging from 3.846 MW in Germany to 18 MW in Portugal.
- Despite the fact, that Spain and Portugal have more favourable climate conditions, the regulation plays a higher role in the development of the solar PV market.

NOTE: In the report « Comparative analysis of legal, fiscal and technical norms» further conclusions are included.

ANNEX 1: MARKET ASSESSMENT BIBLIOGRAPHY

Annex 1: Market Assessment Bibliography

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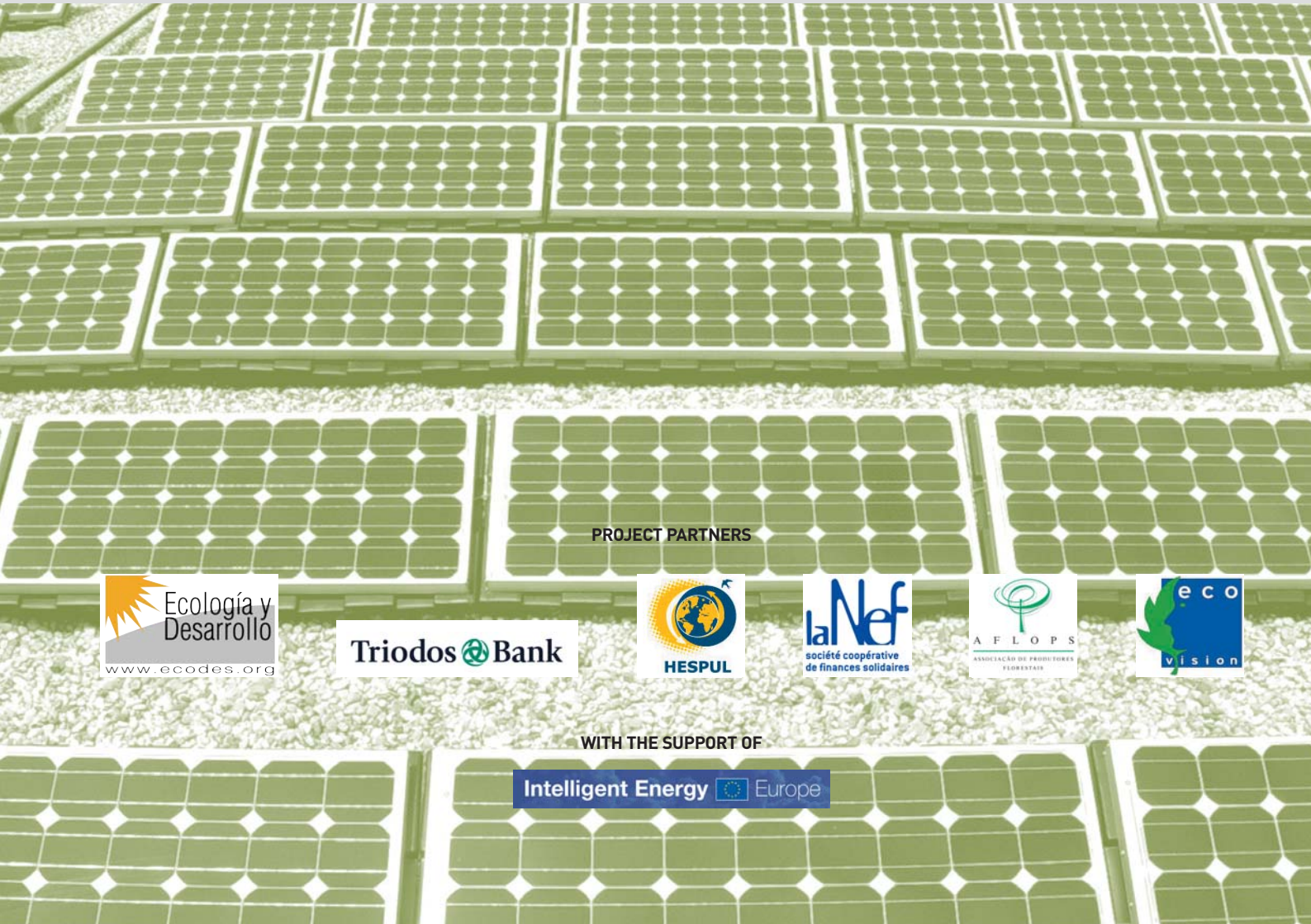

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