BASICS ON PV PROJECTS FINANCE

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1. INTRODUCTION

1. Introduction

The contribution of renewable sources to total energy share depends upon na-tional energy policies and local conditions. In some countries, specific renewable energy sources already contribute significantly to the energy supply, e.g. wind en-ergy in Denmark and geothermal energy in Iceland and the Philippines. The rapidly rising supply of electrical energy comes from a range of renewable energy sources: modern biomass technology, wind energy, solar-thermal energy and PV. Some of these renewable sources may contribute to the world energy consumption also in the form of heat or mechanical energy.

The renewable energy sector remains by far the smallest segment of the world's energy industry (World Energy Outlook; 2005). Various finance-related risks and barriers are hindering faster growth. Renewable energy is site specific and most sites are still not cost-competitive with conventional fossil-fuel energy sources in the short to medium term. Most renewable energy projects have high up-front capital costs and low rates of return compared with competing technologies. Addi-tionally, lack of affordable finance services difficult for investors to promote these type of projects, relying on targeted subsidies.

Within the energy sector renewable energies have to compete with the other con-ventional segments of the industry. Generally, the market for renewable energy is improving and is the fastest growing in the energy sector. Though market and in-vestment conditions vary according to technology (size, capacity, on or off grid, energy resource, etc) and region, the market drivers for renewable energy are the same: improved economics (in some cases), energy security, global, regional and local environmental benefits, economic development, and consumer support.

Market growth responds to a number of factors, the most significant of which is cost reductions. Renewable technologies are improving all the time and are be-coming less costly to manufacture and operate. Wind and solar PV are one-tenth of the cost they were in the early 1980s and additional cost reductions of approximately 5% per year are expected in the near term. Major investments are being fi-nanced and moving forward faster than ever, especially when backed by a utility or strong corporate sponsor. Large oil firms and insurance companies are increas-ingly investing in clean energy. Renewable energy's share of the venture capital market for new technology development is growing, although more slowly than other environmental technology areas.

New challenges have come with energy market liberalization. Deregulation is a mixed blessing for the renewables market. Privatization can promote renewables by introducing new sources of capital. And the efficiencies derived from increased competition in energy markets should theoretically improve energy efficiency. In reality, however, privatizing markets has made financing renewable energy more difficult. Due to the higher capital costs and long return timeframes associated with renewable energy financing, private producers with their typically short investment horizons tend to prefer gas and other conventional energy options with lower capital costs.

Without regulatory incentives, competition is likely to steer investments away from renewables. Competitive frameworks based on multiple electricity producers bid-ding into spot markets are unfriendly to non-dispatchable renewables such as so-lar energy which cannot provide power on demand. Unless energy prices are made to reflect environmental costs, retail competition will work against renew-ables, as electricity suppliers favour the (seemingly) cheapest power available over more capital-cost intensive renewable options.

1.1. LEGAL FRAMEWORKS

In the EU, some Member States and regions have developed technology-specific feed-in tariffs to encourage uptake of PV technology, notably Germany where the «Renewable Energy Sources Act» (EEG)[1] sets an ambitious target of 1 GW for 2010. This has resulted in a tenfold market increase in four years (from 13 MW in 1999 to 130 MW in 2003) and a 20% price reduction. Spain has also implemented an incentive feed-in tariff by Royal Decree (RD436/2004)[2], but administrative barriers still prevent uptake. All other EU Member States have very limited market deployment programs. It is becoming increasingly accepted that such support schemes (see Table 1) provide an effective means to achieve rapid market pene-tration and cost reduction for PV. Nevertheless, careful attention needs to be paid to the competitive environment and the specific conditions applied to this type of support scheme. Alternatively, some European countries have opted for a renew-able energy portfolio standard[3]. However, unless technology-specific measures are taken, this will generally not form a sufficient framework for the rapid deployment of photovoltaics.

Table 1. Fundamental Regulatory Framework for PV projects in France, Germany, Portugal, and Spain

Country	Fundamental Regulatory Framework for PV
France	Feed-in tariff: 0.15 €/kWh for systems < 1 MW for 20 years in continental France, 0.30 €/kWh in Overseas Department and Corsica; 5.5% VAT on investments on existing buildings, 15% tax credit for individual tax payers (40% in 2005).
Germany	Feed-in tariff for 20 years with built-in annual decrease of 5% from 2005 onward. For plants (not buildings and sound barriers), the decrease will be 6.5% from 2006 onward. The second REE injection law has been approved by the German Federal Chamber, the Bundesrat: 0.46 €/kWh minimum; on buildings and sound barriers 0.57 €/kWh (< 30 kW), 0.55 €/kWh (> 30 kW) and 0.54 €/kWh (> 100 kW), for façade integration there is an additional bonus of 0.05 €/kWh.
Portugal	Feed-in tariff: 0.41 €/kWh (systems < 5 kW) and 0.224 €/kWh (> 5 kW). Investment subsidies and tax deductions.
Spain	New feed-in law passed in March 2004, which went into ef-fect immediately. 0.396 €/kWh <100 kW (previously limited to 5 kW systems); > 100 kW 0.216 €/kWh. Duration of payment 25 years, with payment on 80% of rated power output beyond that. The decree has also lifted the 50 MW cap, being now 150 MW.

1. Solar Server Magazine; http://solarserver.de/solarmagazin/eeg-e.html#text; http://www.eeg-aktuell.de
2. Noticias Jurídicas; http://noticias.juridicas.com/base_datos/Admin/rd436-2004.html#a1
3. H.J. de Vries, C.J. Roos, L.W.M. Beurskens, A.L. Kooijman, Van Dijk, M.A. Uyterlinde; Renewable electricity policies in Europe, Country fact sheets 2003

While the financial aspects of a regulatory framework are probably the most im-portant ones in terms of their effect on market conditions for different technologies, they are not the only conditions to be met in order to create a favorable market framework. For example, unless the conditions for grid access are clearly defined, a feed-in tariff may remain fairly ineffective[4]. Moreover, while a specific regulatory framework may have positive outcomes for one or several technologies, there may also be negative side effects from a different or macro-economic point of view. It is important to consider the arguments against certain forms of regulatory framework just as much as those in favor. There is probably no single regulatory framework which fulfils all conditions in all circumstances.

Within this framework, this paper aims to show to potential investors in PV systems projects the basic issues to consider when looking for financing mechanisms. This overview paper may be the initial document for a PV solar project developer to understand the main factors that affect a financing decision. It is imperative for the to understand all these issues in order to demonstrate project feasibility and appropriate risk management to potential financiers.

4. The Nordmann, 3rd PV World Conference; Subsidies versus rate based in-cen-tives for technology – economical – and market development of photo-voltaics – the European experience; Osaka, Japan, 2003

2. STATUS OF GLOBAL PV MARKETS

2. Status of Global PV Markets

World electricity generation from renewables is projected to double between 2002 and 2030. Worldwide, 18% of electricity demand was met by renewables, including hydroelectricity. The share of renewables in electricity generation is projected to increase slightly, from 18% in 2002 to 19% in 2030. The share of hydropower will fall, but non-hydro renewables will see their share triple, from 2% in 2002 to 6% in 2030. The largest increase will be in OECD Europe, driven by strong government support and ambitious official targets.

Although reliable PV technology is already available today, it needs further devel-opment, especially to reduce the cost of electricity produced. In addition, even as-suming high market growth figures, it will take a substantial period of time before PV becomes a major global source of energy in absolute terms. This is not due to a lack of vitality of PV, but highlights how long it takes to change patterns in the energy sector. On the other hand, however, the economic benefits of a growing commercial PV sector are already proving a reality and have led to strong global competition. The coming decade is considered decisive in terms of which coun-tries or global regions will dominate the future PV sector. In view of its excellent technology and market starting position, the EU has a unique opportunity to build a large and highly innovative economic sector, while at the same time developing a key building block for a sustainable energy supply.

Currently, the Photovoltaics market recorded an annual growth rate of 25-30% during the last decade. Investment in photovoltaic exceeds €844.4 billion in 2005. Photovoltaic market has also raised €1.520 billion from capital market in 2005. Also, Japan and Germany are the biggest producers as well as consumers in PV[5].

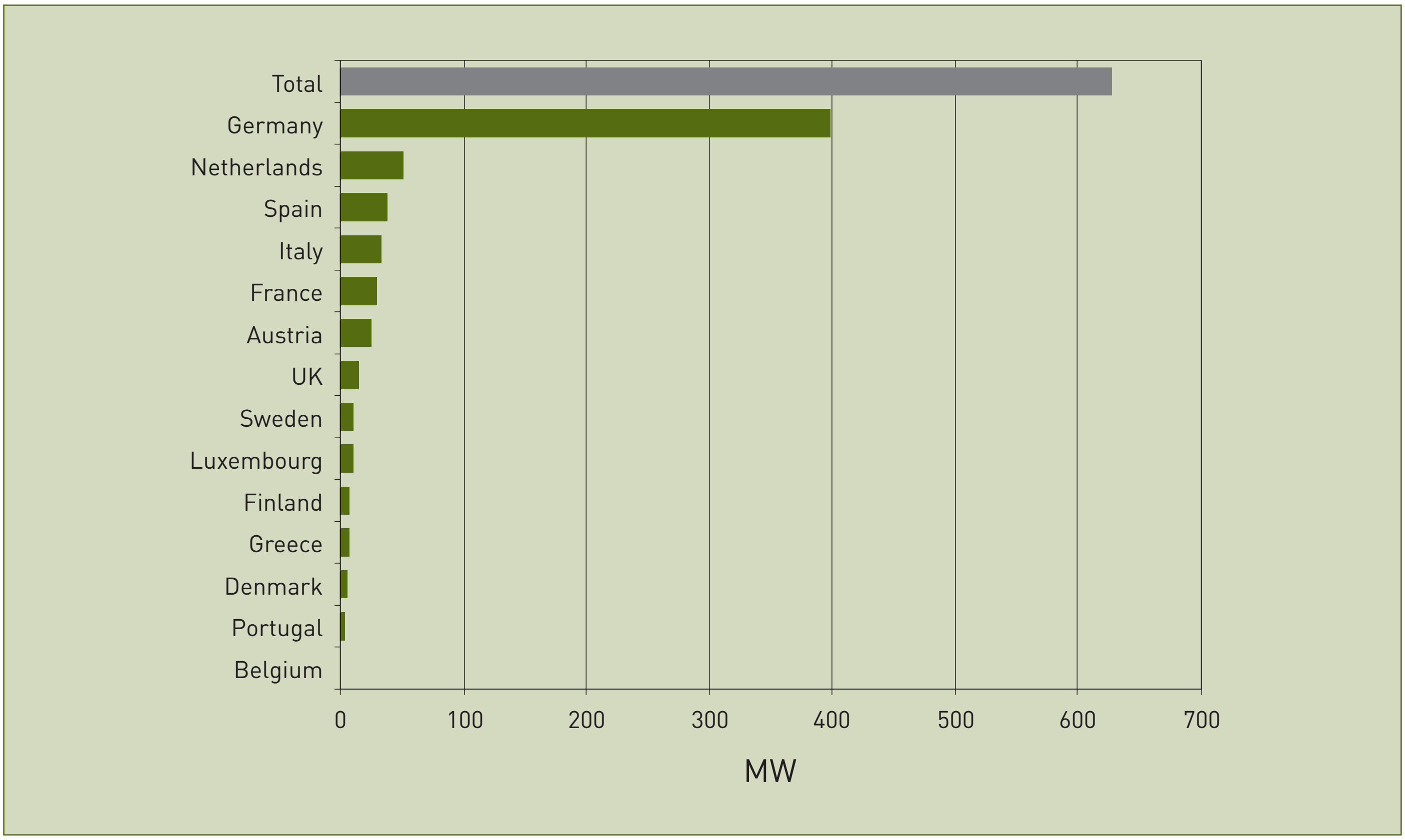
Current electricity generation costs from renewables range from 0.02 to 0.65 €/kWh. The different costs of electricity for each renewable energy source are highly dependent upon local conditions, on the amount of wind or solar radiation available, or the temperature of a geothermal field for example. PV electricity costs of

5. Market Research; Photovoltaics - A High Potential Market Opportunity (2005-2010; marketresearch.com

0.25-0.65 €/kWh are high compared to the current wholesale price of conventional electricity, 0.02-0.035 €/kWh. Even if the added costs to cover the capture and sequestration of CO2 bring the price of conventional electricity to a total of 0.04-0.055 €/kWh, it still remains competitive compared to PV used as a central power source. Though conventional electricity costs are predicted to rise to 0.05-0.06 €/kWh by 2020, there is a need to bring PV costs down by at least a factor of 5 to reach full deployment.

After a slow start, the worldwide PV market has been growing at an average annual rate of approximately 35% (from 150 to 750 MW) over the past 5 years. This success has been generated by a combination of market stimulation and intensive research and development in Japan, the USA and Europe, over the last 10 years. Prices have been reduced by a factor of 3 since 1990. Cumulative worldwide installations are estimated to 2.2 GW by the end of 2003, with Europe standing at 560 MW, as shown in Figure 1.

Figure 1. Total PV installed power in Europe



In 2030, electricity generation from solar power is expected to reach 119 TWh. Over 80% of it will be from photovoltaics (PV), while the rest will be produced in solar thermal power plants. The installation of PV in Europe in 2003 represents 34% of the world PV market, against 38% in Japan. With 49% of the world production far in excess of their domestic market, Japan is a net exporter of PV. The mar-ket has grown in Europe at a consistent rate compared with other large markets (Japan and USA). In contrast, the intensity of technological development efforts and the increase in production capacity are much lower in Europe than in Japan.

3. TYPE OF SYSTEMS

3. Type of Systems

PV technology has the highest investment and generating costs of all commercially deployed renewable energy sources. Average generating costs range between €260 and €460 per MWh, compared to around €35 per MWh or less for gas. The range of costs is wide principally because of differences in the amount of sunshine available in different regions (also known as «insolation»). Consequently, PV will not compete with other technologies for large-scale centralised electricity generation, unless there are dramatic cost decreases achieved through technology improvements.

Most current PV power is decentralised in buildings and this is expected to remain its main use throughout the projection period. Electricity generation from PV is economically attractive in areas with abundant sunshine and high electricity prices. PV power is most valuable when maximum PV production coincides with peak electricity demand. In remote areas in the OECD and in developing countries, PV can be a cost-effective option.

3.1. GRID-CONNECTED SYSTEMS

When using grid-connected systems solar photovoltaic electricity is fed into the grid. As the electricity generated by a PV module is in the form of direct current (d.c.) the electricity needs to be converted to alternating current (a.c.) for which an inverter is required. Commonly, there are two types of grid-connected PV systems. Small utility interactive PV-systems can be used by private owners for their own consumption. Energy surplus will be fed into the grid, while in times of shortage (e.g. at night) energy will be consumed from the grid. The other option is utility scale, central station PV fields. All d.c.-output of the PV field, which are generally of megawatt range, is converted to a.c. and then fed into the central utility grid after which it is distributed to the customers.

In a grid-connected power system the grid acts like a battery with an unlimited storage capacity. Therefore the total efficiency of a grid-connected PV system will be better than the efficiency of a stand-alone system: as there is virtually no limit to the storage capacity, the generated electricity can always be stored, whereas in stand-alone applications the batteries of the PV system will be sometimes fully loaded, and therefore the generated electricity needs to be "thrown away"[6].

Grid-connected systems in the EU can generate 0.6-1.5 kWh/W.year, depending on the location which is equivalent to 80-200 kWh/m^2.yr for today's most efficient systems. This implies that a system of 20-30 m2 would be able to generate elec-tricity equal to a household's demand on a yearly basis, although intermittency of supply with demand needs will need to be addressed. Future generations of sys-tems may yield 160 to 400 kWh/m2.year or even more.

Turn-key system prices in 2004 are typically 5 €/W (excl. VAT), even if dedicated designs and some applications require higher material, engineering or installation costs. Depending on assumptions concerning economic lifetime, operation and maintenance (O&M) costs, interest rates, electricity generation per watt-peak sys-tem power, etc., the turn-key price can be translated to electricity generation costs. For the best systems available and well chosen sites the figure of 5 €/W roughly corresponds to 0.25-0.65 €/kWh, depending on location (solar irradiation level) in the EU. Detailed analyses of the potential for price reduction have shown that sys-tem prices may be reduced to 3.5 €/W by 2010, 2 €/W by 2020 and less than 1 €/W in the long term (i.e. 2030 and beyond). Studies are being carried out to de-termine the lowest achievable price. This knowledge is important for the com-peti-tiveness of PV in future bulk electricity markets. Since the BOS (balance-of-system, which includes the cabling, battery, charge controller, dc/ac inverter and other components and support systems) accounts for roughly 40% of the turn-key system cost, drastic cost reductions are required in this area along with cost reduction of modules. Two topics require particular attention: inverters and mount-ing/building integration of modules.

The performance of today's grid connected systems is already quite good in ab-solute terms; energy losses on a system level have been effectively reduced to ap-proximately 10-15%, (design) lifetime of components has been increased to 15 years or more and system availability is generally between 95% and 100%. The potential for further improvement lies in an increased overall system lifetime of 25 to 40 years (at reduced cost) and a slight further reduction of losses. The specific system energy yield (electricity delivered to the grid normalized to installed module peak power) is in the range of 0.6-1.5 kWh/W per year for fixed modules, again dependent on location. By applying sun tracking the yield is enhanced by 25% or more, albeit at increased BOS and operating and maintenance cost.

3.2. STAND ALONE SYSTEMS

Stand-alone PV systems are often the preferred option for high-value applications such as rural access to electricity. Although many well-designed, well-engineered and well-maintained systems operate according to expectations most of the time, and significant improvements in system reliability and availability are crucial if PV systems are to become a key technology for off-grid applications. Robustness, ease of repair, availability of replacement parts and low every day maintenance re-quirements are essential, as is the need for a thorough understanding of the inter-action between users and system hardware.

Stand-alone PV systems are already able to compete with alternative sources of electricity such as diesel generators; however, a further decrease of costs will fa-cilitate their use on a much larger scale. Because of the wide range of stand-alone system types, prices (i.e., per W) differ considerably. Compared to grid-connected specific systems, costs are generally higher because of a larger BOS-share, but this comparison does not take into account the different operating environments. A reduction of the life cycle cost (initial investments, replacement costs, O&M costs) is also essential. In particular for systems with batter y storage, the environmental profile is still a matter of concern.

6. International Energy Agency; IEA Photovoltaic Power Systems Programme ; http://iea-pvps.org/pv/gc_syst.htm

4. MARKET TRENDS

4. Market Trends

Market conditions and opportunities vary widely across countries, but several trends currently are evident in many European economies, which tend to increase the demand for energy efficiency:

- Subsidy Removal: Many countries have in recent years begun to decrease or remove energy subsidies. This makes the true cost of energy more ap-parent to end users and increases the incentives for efficiency.

- Privatization: Privatizing formerly state-owned energy utilities and major in-dustries increases pressure on companies to improve efficiency in all as-pects of operation, including energy use.

- International Competition: Increased global trade and competition force companies to minimize input costs. As wages and the costs of local inputs rise with economic development, energy costs become relatively more im-portant, providing further incentive for efficiency.

- Constrained Power Supply: The demand for electricity is growing faster than the expansion of electricity supply, creating incentives and demand for energy-efficient equipment and processes. In fact, recent regular electricity shortfalls threaten industrial expansion and economic growth.

- Environmental Concerns: European countries are under increasing pressure to clean up local pollution from industry and the power sector, and to limit growth in emissions of greenhouse gases that contribute to climate change.

However, persistent barriers inhibit many cost-effective energy efficiency projects in European markets. While each country and market is different, several barriers are common:

- Energy efficiency projects compete for scarce capital with more traditional investments such as power plants and industrial expansion.

- Energy efficiency projects are perceived to be more risky than supply side projects because they are often non-asset based investments, i.e., collateral is difficult to obtain.

- Many energy efficiency projects and ventures are too small to attract the attention of large multilateral financial institutions, a key investor in the en-ergy sector.

- The legal and regulatory frameworks are not compatible with energy effi-ciency investments, particularly performance contracting.

- Few in-country financial institutions have experience financing energy effi-ciency projects or ventures.

In spite of these general barriers, PV projects are making in-roads into some spe-cific markets and sub-sectors. Limited power supply and the price of energy often dictate the use of higher-efficiency equipment wherever possible. If efficient equipment is available and the savings potential is communicated effectively, consumers will buy. According to the German Solar Industry Association, the genera-tion of power from solar energy account for €5.8 billion on annual sales. In recent years, the market has been growing at an average rate of 40% per year. Market analysts with the French bank Crédit Lyonnais are forecasting a market volume of €25 billion by the year 2010. A projection based on the installed PV output capacity in leading EU countries indicates a potential for the extended European Union of 26.4 gigawatts (GWp) installed output capacity, in comparison with the current figure of around 1.0 GWp.

5. PV PROJECTS FINANCING

5. PV Projects Financing

5.1. RENEWABLE ENERGY PROJECTS FINANCING CONSIDERATIONS

Renewable energies represent a major step-change innovation as compared with existing energy-supply options. In terms of scale, capacity, energy resource char-acteristics, points of sale for output, status of technology, and a number of other factors, renewable energy technologies are usually markedly different from con-ventional energy systems. The differences are not lost on financiers, as financing a renewable energy plant is different from financing conventional fossil-fuelled power plants and requires new thinking, new risk-management approaches, and new forms of capital.

The differences between renewable energy and conventional energy systems and the risk perceptions they imply can become the most significant barriers to invest-ment, even for renewable energy technologies that are cost-competitive with con-ventional energy-supply options.

Financing renewable energies is relatively new to financiers. Considering investing in the renewable energy sector for the first time is an investment in itself. To become more effective at placing capital in renewable energy markets, financiers must travel up a learning or experience curve. Market failures impede this learning process and create barriers to entry into the market. To operate effectively, markets rely on timely, appropriate, and truthful information. In perfect markets this information is assumed to be available, but the reality is that energy markets are far from perfect, particularly those like the renewable energy market in technological and structural transition. The information that enables a correct assessment of a project's viability is generally lacking, and there is limited economic justification for any single market participant to produce such information. As a result of insufficient information, underlying project risk tends to be overrated and transaction costs can increase.

Compounding this lack of information are the issues of financial structure and scale. Renewable energy projects typically have higher capital costs and lower op-erational costs than conventional fossil-fuel technologies. The external financing requirement is therefore high and must be amortized over the life of the project. This makes exposure to risk a long-term challenge (which also has political-risk implications in terms of changes in government policy). Since renewable energy projects are typically small, as for example solar PV, the transaction costs are dis-proportionately high compared with those of conventional infrastructure projects. Any investment requires initial feasibility and due-diligence work and the costs for this work do not vary significantly with project size. As a result, pre-investment costs, including legal and engineering fees, consultants, and permitting costs have a proportionately higher impact on the transaction costs of renewable energy projects. Furthermore, the generally smaller nature of renewable energy projects results in lower gross returns, even though the rate of return may be well within market standards of what is considered an attractive investment.

Developers of renewable energy projects are often under-financed and have lim-ited track records. Financiers therefore perceive them as being high risk and are reluctant to provide non-recourse project finance. Lenders wish to see experienced construction contractors, suppliers with proven equipment, and experienced operators. Additional development costs imposed by financiers on under-capitalized developers during due diligence can significantly jeopardize a project.

Financiers perceive many renewable energy technologies as being commercially unproven. With the exception of onshore wind, financiers regard the full cost and long-term performance risks of renewable energy technologies as being higher than with conventional technologies. As is the case in most new technologies, fin-anciers and manufacturers are reluctant to invest the capital needed to reduce costs as long as demand is low and uncertain. But unless there is investment, de-mand stays low, because potential economies of scale cannot be realized at low levels of production. Also, fuel supply risk can be a concern for renewable energy projects. Although fuel for renewable energy plants is usually either free or low cost, fuel supply can be a concern for financiers, either in terms of assessing the resource (i.e. wind, solar, geothermal) or contracting the supply (bio-energy).

The risks of conventional power projects are sometimes understated when com-pared with renewable energy, since existing cost-plus regulatory models allow fos-sil-fuel price fluctuations to be passed onto the consumer. In liberalizing markets, where power producers are forced to assume the fossil-fuel pricing risk, their typi-cal approach has been to lock in the fuel supply with futures contracts. A growing body of work, however, is finding that fixed-cost renewable energy can effectively hedge fossil price risk by diversifying a producer's energy portfolio away from fos-sil fuels[7].

But reducing portfolio risk is not the only issue that needs to be reflected in renew-able energy power pricing. A fundamental financing problem is that most renew-able energy investment is still not currently commercially viable if valued using 'conventional' market pricing models. This is because the costs of emitting carbon and other environmental externalities are not yet accurately reflected in market prices. As governments introduce sustainable long-term targets and commitments, as well as reliable legal and regulatory frameworks, this policy intervention will change the financial balance in a structured and sustainable manner. The private sector will then have the incentive and confidence to invest at a scale commensu-rate to meeting government targets.

5.2. SPECIFICS OF PV SYSTEMS FINANCING

PV systems parameters vary from one project to another; thus, thorough calcula-tions should be done before investing. Since the planning process involves vari-ables, different scenarios should be projected to reduce risk exposure.

With the aim of increasing the share of renewable energy in the energy mix, EU governments has set regulatory frameworks, such as the one set by the Federal Government of Germany in its renewable energy law of 1 August 2004 to promote electricity from renewable energy sources. Normally, these targets are planned to be achieved through above-market-price feed-in tariffs for electricity from renew-able energy sources (i.e. solar, wind, geothermal energy, water power and bio-energy). This situation, has led to an increased demand for photovoltaic systems by private homeowners and industrial enterprises. Currently, solar power is booming in Germany on the grounds of a reliable legal framework.

It is important to note that the system price has a relevant impact on the project's investment return. Conside-

7. Shimon Awerbuch; A portfolio approach to electricity planning: Implications for renewables and energy security; August 2003

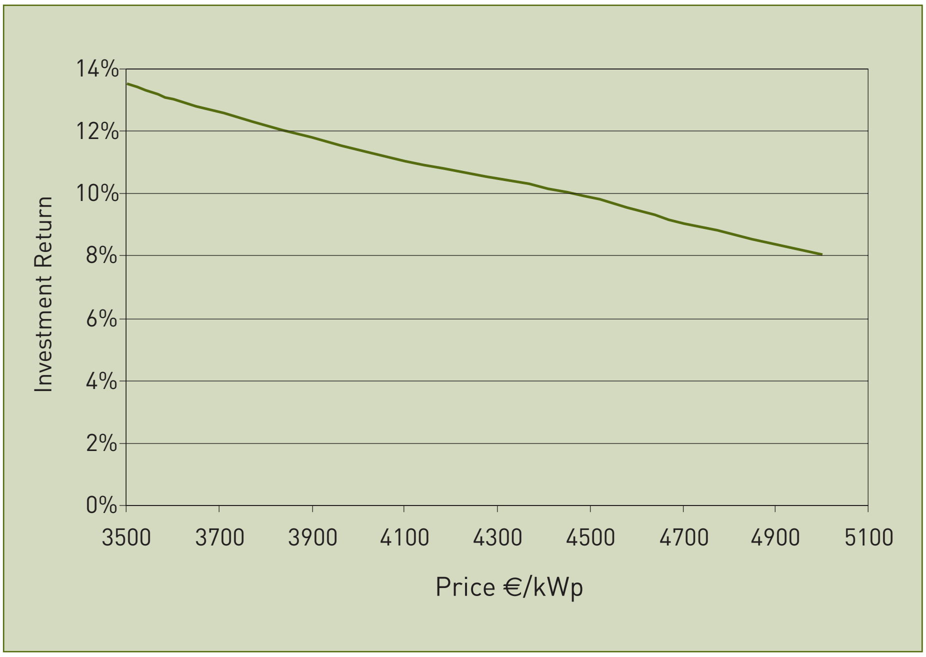
ring the German case, even if the basic conditions re-main promising, two factors should lead investors to do accurate calculations. Firstly, the feed-in tariff as envisaged in the renewable energy law was decreased by a further 5% at the beginning of 2006. Solar power from roof systems with a peak performance of up to 30 kWp is compensated with 0,518 €/kWp instead of the former 0,545 €/kWp. Secondly, the increased demand in photovoltaic modules led to significant price increases. Prices at the beginning of 2006 had increased by approximately 10% compared with 2005. Calculations have shown that a price difference of €200 per Kilowatt installed performance, with all other factors remaining constant, can make a difference of 1% point in returns. It is expected that, as a result of less favourable legal conditions, demand will slightly decrease in Germany. It is also expected that in other EU countries (including Spain and Italy) new regulations will lead to a rise in demand. Consequently, overall EU demand will remain on a high level. A decrease in prices cannot be expected with any certainty in Germany.

For selecting PV panels, pricing is a relevant issue for selection but it is not the only factor to consider in order to improve success opportunities of the project. Is-sues such as panel's degradation (loss of efficiency) during the course of its operating time have a significant impact on the long-term returns of a PV system. All decision for or against an investment should be based on a thorough calculation considering all relevant return and cost items. In order to begin negotiations with a bank, the construction worker or investor is required to prove the feasibility of the investment. An integrated return and liquidity planning is required for the entire lifespan of the system. The planning of profits must be complemented with a li-quidity planning to prove that future interest and redemption payments (capital service) can be achieved using current income. The basis for turnover calculations is the feed-in tariff and the expected average solar power return. In the case of Germany, the German renewable energy law (EEG) assures feed-in tariffs for 20 years so that no price fluctuations need to be considered in the planning process.

Solar power returns depend on the average yield of electricity. With the help of a global radiation map, the long-term average solar radiation at the required invest-ment location can be established. Accurate electricity yield at a specific location is affected by a mix of various factors, including the location, panels orientation, the slope of the PV system base, the efficiency of the technical elements (i.e. inverter), and the temperature.

Since the actually generated annual solar power can deviate from the long-term average because of the above factors, various scenarios with different electricity yields per installed module should be calculated. This will show the connection between the return of a system and the electricity yield. This in turn will lead to safe planning and risk reduction in the investment decision. Besides the once-off in-vestment costs, operational costs should also be considered in profitability and li-quidity calculations. These include insurance premiums, maintenance costs, gen-eral administrative costs, and interest payments. If the system is installed on a let property and must be disassembled upon expiry of the contract, these costs should be included in the calculation.

Figure 2. Correlation between Solar Power System Price and projects' Return on Investment



Financing costs, especially in very large systems, are a significant share of the total cost of the project. Generally, financing should be done with sufficient own capital; the rest can then be financed through a bank loan. Since interest rates vary significantly from one bank to the next, a comparison of the various financing options may be worthwhile. Planning should be done at least for the period of guaranteed feed-in tariffs. All planning should also include projections of annual cost developments and the inflation rate over the entire investment period. Additionally, it is necessary a liquidity forecast considering repayment instalments and private withdrawals. The liquidity surplus generated through the production of solar power should be used first for loan repayments. If the loans are structured to allow for years without repayments, reserves should be built up during this period to make provision for costs that may be higher than calculated, e.g. possible repairs.

Summarizing, the developer of a potential PV project must consider the following issues to determine whether the venture is worth pursuing:

- Resource assessments
- Technology analysis
- Economic analysis
- Sitting studies
- Transmission interconnection studies (for power projects)
- Legal and regulatory considerations

Project developers and consulting firms can provide guidance in conducting the preliminary analysis. Feasibility studies require an investment, but it may be worth spending money in the beginning to avoid costly mistakes later.

- Resource Assessment: This is a relevant first step to determine how much «fuel» is available and how much power it can be produced by the potential solar installation. This is essential to justify the investment costs.

- Technology Analysis: This involves matching the appropriate technology to the energy use and the availability of resources. Other considerations in-clude operational and maintenance concerns, resources required to operate the equipment, the availability of vendor support, etc.

- Economic Analysis: Through this analysis, the following questions need to be addressed: Are the revenues significant enough to justify the costs? Can the energy be sold at a high enough price to pay for the equipment and other expenses?

- Sitting Studies: The physical location has an impact on the efficiency of PV generation projects. Also, local policies and land use rules have an impact on sitting. It is important to contact the government representative office dealing with zone planning to determine if a specific location can be zoned for energy generation.

- Transmission Interconnection Studies: An assessment needs to be done to determine whether the grid can absorb the additional energy generated and where. Issues such as interconnection policies, opportunities, costs and load need to be considered.

- Legal and Regulatory Considerations: In addition to zoning, developers need to be able to obtain the necessary permits. In some cases, environ-mental impact reviews and statements will be required. Also, legal experts prior to signing should review all contracts. Everything from lease agreements to power purchase agreements with electric utilities should be dis-cussed with an attorney. Lenders will require copies of all documentation prior to issuing a loan.

6. DRAFTING A FINANCIAL PROPOSAL

6. Drafting a Financial Proposal

In the course of attracting investors and partners, a financing proposal is the pri-mary vehicle for communicating the opportunities and profitability of the project. The purpose of the financing proposal is to describe the potential of the proposed venture in terms of the fundamentals of the business and its risks and returns to owners and investors. The completed financing proposal and its projected financial statements will provide a baseline against which the actual performance of the venture can be measured. A good financing proposal takes considerable time and effort to compile, but it is essential for attracting financing.

In addition to providing pro forma financial statements, profitability calculations and cash flow projections, the financing proposal should anticipate and address financier's risk and return criteria. In general, assume the potential investor knows little about the technology, customer, market, service, risk and potential growth and profit of the business. It is in the developer's interest to address all potential questions and to disclose the full range of risks associated with the investment. Information on how the risks will be managed is also essential. It is particularly important to anticipate and address these questions and concerns for PV projects or any other energy efficiency projects, which are a new area of investment for financiers. In general, the financing proposal is a tool for selling the commitment, experience and capability of the project developers and partners, as well as the viability of the project itself.

While private financial institutions and investors are generally looking to answer questions of risk and return in a financing proposal, specialized financial or devel-opment institutions may have additional priorities. The closer you can tailor the proposal to their requirements and format, the easier it will be for them to evaluate it. For example, environmentally interested financing sources will take environ-mental and climate change benefits into consideration and sometimes provide ad-ditional resources to finance projects meeting that specific criteria. The financial organization may be willing to assist you in identifying these additional areas of concern and priority. The following are the main issues that should be addressed in any financing proposal:

Introduction to company and partners: Provide information on your company and the length of time you have been in business or have worked in this field, annual sales for at least three years, financial capitalization, number of employees and production capacity. Provide all contact information.

- Management Team and Structure: List all management team members and their areas of expertise, and describe how the management of the project or venture will be structured. Clearly state the specific areas of responsibility and provide background information on each person's experience and credentials.

- Technology or Service: Many energy-efficient technologies are new to in-vestors. It is necessary to substantiate the reliability of the technology, and clearly explain its function and benefits. Keep this section clear, to the point, and understandable to non-engineers. Provide documentation of the effec-tiveness and safety of your technology, such as Underwriters Laboratory certification and the results of any pilot tests or demonstration projects, par-ticularly under developing country power conditions.

- Market Description: Provide evidence of the market for your product in the target country, including the basis for projected demand and sales. Identify policies or market conditions driving demand for the technology used or service, as well as factors that could adversely affect the market.

- Project or Venture Structure: Describe clearly how the project or venture will function. A diagram may be helpful to illustrate the flow of products/services and payments among the supplier, customer, financial institutions and any intermediaries. The soundness of the project or venture depends on the soundness of each transaction involved.

- Risk Assessment: Many financial institutions perceive energy efficiency projects to be riskier than other types of projects, often due to a lack of un-derstanding of the business. Therefore, a thorough assessment and discus-sion of the risks is even more critical for an energy efficiency project than for others such as traditional power supply projects (e.g., coal or oil-fired power plants) where the risks are generally better understood. An energy efficiency financing proposal that includes a comprehensive risk assessment has a higher likelihood of attracting appropriate financing.

It is recommended to receive input from a financial advisor in order to clarify, miti-gate and allocate risks among stakeholders. Potential financiers can do this proc-ess during the development of the business plan or in the advanced stages of a proposal's evaluation.

6.1. OVERVIEW ON FINANCIAL CALCULATIONS

The financing proposal must also calculate the value and the potential perform-ance of the proposed venture. Investors expect to see number estimates in a busi-ness proposal, including a clear description of all the assumptions behind the projected financial results. Generating savings through energy efficiency improvements looks fundamentally different from the revenue generation that financiers are used to evaluating. It is necessary to define a revenue stream, net income and cash flow from the energy savings produced. Above all, it is required to demon-strate how the energy savings will generate cash flow to repay financing or gener-ate the required return to investors.

In assessing the potential profitability of the PV system initiative, it is necessary to calculate some basic financial information and present both historical and five-year (at least) projected results. This financial information should be based on conservative estimates of revenues, costs, production, energy savings, and other elements of a cost/ benefit analysis. The estimates should clearly show how the project will be able to generate sufficient cash flow to fund operations and repay debts. It is also useful to provide two scenarios if possible; such as best and worst case projections for the project's performance. Make sure that the project works even in the worst-case scenario.

Financiers will expect a set of pro forma or projected income statements and bal-ance sheets, particularly when seeking debt financing. A sensitivity analysis will demonstrate the range of conditions under which the venture will be profitable, and will demonstrate the extent to which the projections are dependent on uncontrollable conditions.

6.2. NET PRESENT VALUE AND INTERNAL RATE OF RETURN

The net present value (NPV) and internal rate of return (IRR) calculations are key indicators of the potential profitability of the project or venture. NPV amortizes all of the expected expenses and revenues of the initiative over a certain period of time. It provides a single value for the project in terms of today's currency, factoring in investment costs, future expenses and future revenues. The calculation methodol-ogy is available in all guides to developing a business plan. The IRR is the interest rate that will make the NPV of the project equal to zero. IRR is a widely used con-vention to assess the rate of return that the investor will receive on his or her in-vestment. It provides a means of comparing the perfor-mance of competing in-vestments. It does not include any valuation of risk to the investor. A separate risk assessment will still be needed.

6.3. PPAS AND RECS

Power Purchase Agreements (PPAs) create a revenue stream based on the pro-jected energy sales from the pro-ject. Lenders will evaluate the dura-tion of the con-tract, the creditwort-hiness of the utility or developer and the penalties for breaching the con-tract. It is prudent to specify the ownership of the green power attri-butes in PPAs and capture the green power premium up front if possible. «Green power» often sells at a higher price than traditional fossil fuel power due to various policies and incentives.

It is also important to consider the recent green power market growth, with trading taking the form of either the renewable generation itself or renewable energy cer-tificates (RECs) that are based on that power. RECs represent the non-electricity attributes (particularly the environ-mental benefits) of renewable energy generation. On the voluntary market, RECs are sold to people and organi-zations with an interest in supporting the development of new renewable capacity. On the compliance market, RECs are used as a means for utilities to comply with Renewable Portfolio Standards.

RECs are a highly flexible tool for financing, since they can be sold on the volun-tary market (not just enti-ties connected to the local grid). It is worth noting, how-ever, that prices for RECs on the voluntary market have been falling steadily since there is currently more supply than demand. Depending on how the eligi-bility rules are developed, the rene-wable power or the RECs based on renewable power, may be sold to uti-lities to help them meet new regula-tory requirements.

6.4. TYPES OF FINANCING

The question of how to recover costs and make a profit is determined by project financing. In order to make a project viable, flexibility may be required when mak-ing decisions about the project siting, configura-tion, financing, and ownership struc-tures. Outside expertise in finance, engineering and contract law can be helpful in making the best decisions.

Sources of financing for PV projects range from commercial banks to spe-cialized energy efficiency funds to socially responsible investors. Finan-cing through com-mercial banks remains difficult in many cases because energy efficiency invest-ments often do not meet the standard investment criteria, such as collate-ral re-quirements. However, a gro-wing number of specialized financing sources for en-ergy efficiency are increasingly coming available thro-gouht the continent.

Developing a financing structure con-sists of designing a credit-worthy project and selecting the types, amounts and likely sources of finan-cing. Choosing financing is more than just allocating risks and selecting between debt (taking on a loan) and equity (selling ownership stakes). There are other mechanisms and structures as well. For example, lea-sing or vendor financing are viable financing options for many energy efficiency projects and ventures. Similarly, letters of credit or bank guarantees can be arranged to facili-tate financing. Funders will someti-mes provide assistance for develo-ping an effective financing design if presented with a creditworthy project that clearly demonstrates how the financing will be repaid.

Manufacturing and licensing ventu-res, energy utilities, existing organi-zations and start-ups can all be financed with debt or equity. For a creditworthy company with signifi-cant assets and cash flow, designing a financing structure is a matter of choosing the lowest cost debt or equity options that meet the financing needs of the project. However, the use of both debt and equity entails tradeoffs, and riskier ventures in new industries. A start-up company, for example, will have significantly less flexibility in selecting between debt and equity financing and will typically face a higher risk adjusted cost of capital.

6.4.1. DEBT

Debt options include corporate or project loans under recourse or limi-ted recourse structures, leasing arrangements, and full or limited guarantees. Many funders specify minimum cash flow generation pro-jections, debt coverage, leverage and other financial ratios for projects to qualify for loans. Stronger credit sup-port can sometimes be structured into a transaction by obtaining additional collateral, cash flow, or parent company or third party guarantees for a loan. Debt financing can include options whereby loans convert to some amount of equity ownership if the project is successful, to increase the lender's rate of return.

6.4.2. RECOURSE DEBT

Financing with recourse is sometimes structured as corporate or balance sheet fi-nancing, whereby the debt holder is obligated to the primary sponsor of the pro-ject, and the loan must be reported on a company's balance sheet as a liability. In essence, the company stands behind the project or venture and the related debt, and financiers have recourse to the company's assets in the event of default. Re-course financing usually has a lower cost than project finance or limited-recourse debt because of its generally lower credit risk. In addition, warranties, guarantees and insurance can provide various forms of recourse to add to the creditworthiness of a transaction. Most energy efficiency projects (including PV projects) require some degree of recourse to a creditworthy entity.

6.4.3. LIMITED RECOURSE DEBT OR PROJECT FINANCE

Limited recourse financing is sometimes known as project finance. Under these transaction structures the project is financed largely based on its own merits, and payments are made by the project's cash flows. Financiers have recourse primarily to the project's cash flow and assets or additional collateral. Compared to recourse financing, structuring financing with limited-recourse is a time-intensive process. It involves a full clarification, mitigation, and allocation of all risks that could have a negative impact on the cash flows from the project or venture. The financing structure allocates risks among the parties in a transaction through contracts and financing agreements. Under these contracts different parties accept varying amounts of responsibility to repay the debt in the event that a project fails and the loan is not repaid. The debt issuer has different degrees of recourse to other parties to enforce the project's payment obligations if a financing contract is broken.

6.4.4. SECURED DEBT

Secured financing refers to when additional assets are pledged to the bank or fin-ancier as loan collateral. The assets can be cash, physical equipment or property, or sometimes a bank letter of credit. In the event of a default on the promise to re-pay the project debt when due, the bank has the right to seize and sell these as-sets and utilize the proceeds to repay the loan. Collateral liquidation is an expen-sive and time consuming process and the financier rarely collects close to the full collateral value, even on cash, after legal and other fees. Thus, collateral is never a substitute for a well conceived project with solid cash flows. Guarantees and other types of credit support can provide other assurance or security for debt repayment but are not collateral per se.

6.4.5. LEASING

Leasing can be used to finance the sale of energy efficiency equipment and serv-ices. It is commonly used in vendor financing and electric utilities projects and as part of utility programs. Lease financing can also be applied to energy efficiency manufacturing ventures. Leasing works best with simple equipment and large quantities of sales or installations. Large numbers of similar transactions facilitate a statistical approach to managing end-user credit risk. Lease financing is available in countries having fairly well developed capital markets and amenable laws.

6.4.6. GUARANTEES

Guarantees can be provided by parent companies or third parties, and are essen-tially promises to pay a project's debt under certain conditions. Guarantees can be used to partially mitigate financial and performance (technological and operating) risks. These instruments can provide additional credit support for a basically sound transaction, thereby facilitating conventional financing at market rates. Guarantees can be made on part of a loan, debt service or to assure an investor's return on equity. Most commercial banks will issue or accept guarantees, which can be collateralized to provide additional credit support.

6.4.7. EQUITY

Equity financing involves the ownership of a company or project, and can take a variety of forms. Equity can come from the project sponsor, or in the form of a pri-vate placement or preferred or common stock. Equity usually provides longer term financing for a higher expected rate of return than debt. Usually a minimum of be-tween 20% and 30% equity in a project is required to obtain debt financing, de-pending on the company or customer's credit-worthiness. Funders providing eq-uity may provide more stable financing but also require significant control of the initiative. Types of equity partners include:

- Strategic investors (such as utility-related companies)

- Institutional investors (banks, insurance companies) – usually for commer-cial developers
- Corporate investors (large compa-nies) – to offset tax liabilities

6.4.8. VENDOR FINANCING

Vendor financing occurs when a financier provides a vendor with capi-tal to enable them to offer «point of sale» financing for their equipment. Vendor financing works well with high-volume sales of small products to customers in the residential and small commeial/industrial sectors. It is similar to leasing in that vendor financing lends itself to a statistical or portfolio risk management appro-ach to end-user credit risk. Indeed, leasing is the most common form of vendor financing. Under a vendor finance scheme there are two types of agreements: one between the vendor and the financier; and the other bet-ween the vendor and the customer. The ven-dor/financier agreement defines the terms that can be offered to the customer such as rates, length of term and necessary documenta-tion. A simplified and streamlined credit analysis process reduces tran-saction costs[8].

Finally, it is worth remembering the iformation typically required when applying for a loan for a PV project:

- A resource assessment
- A project feasibility study (techni-cal and economic evaluation) by a credible consultant
- Proven expertise in managing the type of project to be financed or an agreement with a qualified third party project manager
- Zoning and site permitting appro-val, including environmental impact studies
- Equipment performance data
- Equipment warranties and an ope-rations and maintenance agree-ment
- A completed interconnection study
- A long-term power purchase agre-ement with a creditworthy utility that will purchase the electricity at specified prices
- Commitments for all required equity
- A business, financial and risk management plan for the project including complete pro-forma financial statements

6.5. TYPES OF OWNERSHIP STRUCTURES

Small-scale or community-based projects can face several barriers: lack of access to capital, limited eco-nomies of scale, and the inability to take advantage of tax breaks. Selec-ting the right ownership structure can help overcome these obsta-cles. The following are the main types of ownership structure that have proven helpful in the EU.

- Municipal: Public entities have access to lower-cost public finan-cing (such as issuing bonds) and lower financial return require-ments. Municipal utilities also have tax benefits in some countries. Like other utilities, these ones can sell green power at a premium to their customers or sell RECs.
- Rural Electric Cooperatives: Rural electric cooperatives invest in renewable energy projects to supply green power to their mem-bers' customers. These projects can benefit from low financing costs through the green power spe-cific programs or RECs. Anot-her options is for coops to lease PV and wind systems to customers. Rural electric coops can be good partners or valu-able sources of information.
- Sole Ownership (LLC): If the busi-ness or individual can produce the re-quired equity, it is possible to be the sole owner of a utility-scale project. In-dividuals should esta-blish one or more limited liability corporations (LLCs) in order to avoid personal financial liability for the project.
- Local Investor Groups: Individuals can purchase shares in projects. The projects are formed as an LLC to shield against liability, but pro-fits and losses flow through to investors. Any tax credits linked to production and project losses apply only to the extent that each passive investor has in-come to offset against these tax benefits.
- LLC/C-Corporation Joint Owners-hip: Local investor groups can join forces with outside corporate investors. The local group does the pre-development work and mar-kets the project to corporate inves-tors who are interested in the local tax shelters offered and accelera-ted depreciation. Debt financing is obtained along with a commitment from the corporate investor to acquire an interest in the project when it begins operation. After the corporate investor has realized its

8. US Agency for International Development; Business Focus Series, Strate-gies for Financing Energy Efficiency; Washington, DC, July 1995

financial return objectives, it may grant the local investors the right to purchase its interest at fair market value. After the end of ten years (may be the end period of a power purchase agreement) the cost of buying the interest in the project is significantly lower since depreciation has been taken on taxes over this period. A variation on this model is for the local group to lease the project to the corporate investor, share revenues from the energy sales, and for the local group to receive royalties based on rights and a value assigned to the pre-development expenses. The local owners would have the option of purchasing the project at the end of the power purchase agreement. Note that investment projects may consist of several separate projects bundled together since investors generally seek a minimum project size. Moreover, royalties and other terms are negotiable.

7. CONCLUSIONS

7. Conclusions

Renewable energy markets have been positively and rapidly developing in the EU area, demonstrating high potential to compete with current economic environment conditions. However, financing this type of projects requires an in-depht assessment that demonstrates feasibility and capacity to manage risk. Such risks are, sometimes, new issues for the financing industry. Thus, it is important for project developers to understand all the elements that are part of an economic feasibility analysis of a renewable energy project, specifically a PV project. It is also essential to know the regulatory environment under which the project will be developed and how it affects the financing process.

Assuming that the feasibility study and preliminary analyses have identified a viable opportunity, the developer should be prepared to start investing in the project itself. The next steps entail: initiating the interconnection process with the local utility; developing the plant layout and design; beginning the permitting application process updating financial projections; initiating power purchase negotiations and contacting funding sources to obtain financing.

In some cases, strategic partners will also be equity investors, which may expedite project implementation. The entire process – from conducting the resource as-sessment to the start-up of operations – may take two years or longer, depending on the scale and complexity of the project.

The following bullets comprise a list of main financial institutions in Germany, France, Spain, and Portugal that have experience in PV projects financing. This is not a full list and will be supplemented in the next report.

SPAIN:

- Bancaja
- Banesto
- BBVA
- Bilbao Bizkaia Kutxa
- BSCH
- Caixa Cataluña
- Caixa Galicia
- Caixa Nova

- Caja de Ahorro del Mediterráneo (CAM)
- Caja de Ahorros de Madrid
- La Caixa
- Triodos Bank

GERMANY:

- Umweltbank AG, Abteilung Solar-kredit,
- GLS Gemeinschaftsbank eG,
- Sparkasse Staufen-Breisach
- Sparkasse Freiburg
- Sparkasse Tauberfranken
- Sachsen LB
- Raiffeisenbank Neu-Ulm / Weißen-horn eG
- Wolfgang Schachtner, Sparkasse
- Volksbank Hochrhein eG
- HypoVereinsbank, Credit Risk Management
- Commerzbank AG
- DEG German Investment and Development Company (only manages public funds. Just began to work in the PV area)
- Bayerische Hypo- und Vereinsbank AG (only manages public funds)

FRANCE:

Concerning the French market, the point is that banks are just beginning to think about renewable energies and that until now PV has often come last. As a conse-quence, information is poor and banks yet officially involved are very few, although many of them are now building a strategy on this matter.

There is today no French association that can provide information about PV fi-nancing entities. Specifically because a few months ago there was no bank to list. A French solar Institu-te was created in September 2006 and will be able to provide in-depth country PV market information within a few months.

Some of the few banks providing especial financial services to PV pro-jects are:

- Crédit Agricole
- La Nef
- Crédit Coopératif
- Caisse des Dépots (only finances local governmental projects)
- Fideme (created by the French energy agency, ADEME, and CIB and has mostly been financing wind projects until now)
- Banque Populaire du Haut-Rhin (woks through ALTERNER)

PORTUGAL:

Currenlty, most of the banks offer personal credit options for PV pro-jects financing. The only exception is Caixa Geral de Depósitos, which has the incentive PROENERGIA. This ini-tiative is only offered in the Azores islands focusing on PV projects for self-consumption.

Next report will address specifics on financial entities' PV financing details. Addi-tionally, it will address the question "why banks are reluc-tant to finance PV pro-jects?" This information will suppelement the present report.

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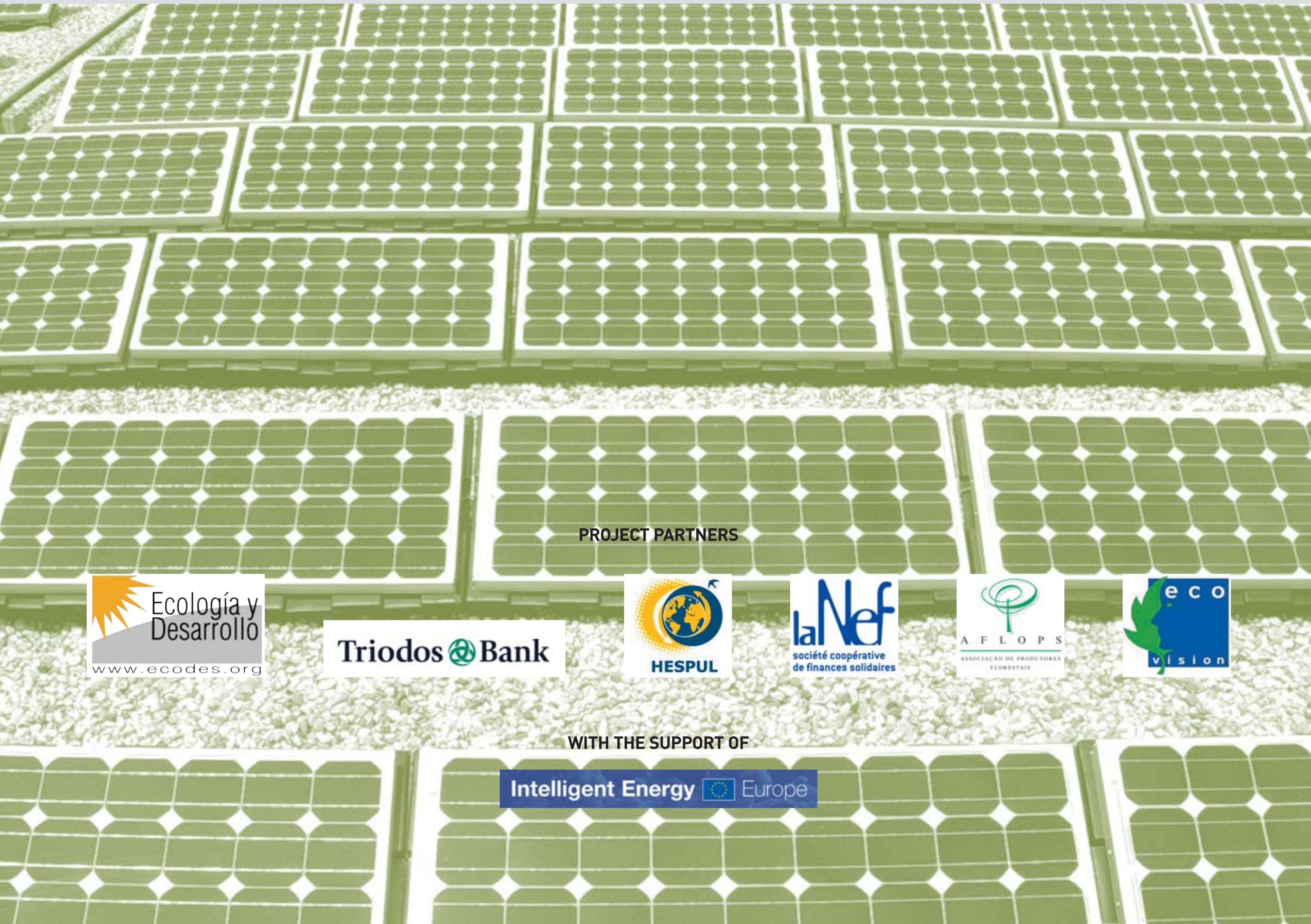

PROJECT PARTNERS

WITH THE SUPPORT OF