memo

To: IEPR Committee (Chair Weisenmiller and Commissioner Douglas)

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Subject: Memo on Distributed Generation Options on Public Property

KEMA is pleased to submit the attached memo on distributed generation applications on public property in European countries. This memo is an interim deliverable for the European Distributed Generation Infrastructure Study. It is the third memo (3 of 3) of the interim deliverables for this Work Authorization. Eventually, the three memos will be integrated into a Consultant Report.

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INTRODUCTION

This memo addresses the topic of solar power and distributed generation (DG) projects on public property in Germany, Austria, Switzerland, and Spain. Key questions examined in this memo include:

- Do European countries place solar DG on government buildings? Is this a common practice or a new practice?
- Do renewable DG projects on government properties go through the normal permitting process, or are they permitted through an expedited process?
    - How do the European programs for renewable DG address issues such as construction safety issues associated with building along highways, condensation issues on or around waterways, security of equipment, maintenance of equipment and surrounding area, interconnection issues, public experience of equipment being highly visible?
- How are renewable DG projects that are placed on government property in these European countries financed? Are there special or higher incentives or tax credits for renewable DG placed on government property? What are the ownership and revenue structures of the renewable DG projects?

This Memo provides is organized as follows:

Section I: Market Models and Renewable Promotion Schemes

Section II: Germany

Section III: Austria

Section IV: Switzerland

Section V: Spain

Section VI: Summary of Key Lessons Learned

SECTION 1:
Market Structure and Renewable Market Mechanisms

This section provides a brief overview of the market structure and renewable market mechanisms in Germany, Austria, Switzerland, and Spain particularly related to the promotion of renewable energy. While the electricity markets in Germany, Austria, and Switzerland are structured quite similarly, the market in Spain differs significantly.

The electricity wholesale markets of Austria, Germany, and Switzerland are based on the bilateral contracts model with self-scheduling and self-dispatch. This means that market participants are allowed to engage in transactions for the sale and purchase of electricity with other parties, and renewable producers are able to schedule and dispatch their own plants. As a consequence, the bilateral contracts market allows exchanges between any two market participants and in effect allows market participants to act as traders. In other words, a producer may enter into both purchase and sale transactions for energy with any other party in the market.

Each country is organized as a uniform pricing zone and each is operated by a separate Transmission Service Organization (TSO). The markets are mainly characterized by bilateral over-the-counter trading arrangements. Furthermore, the German, Austrian, and Swiss markets are supplemented by a voluntary power exchange, which differs in the contracts and energy products market in that participants may trade. The German power exchange (EEX) provides a two-sided day-ahead market, a same-day spot market and a future market. The Austrian power exchange (EXAA) offers a day-ahead spot market with physical trading of hourly and block products for the following day. Alternatively, market parties may trade energy on the German EEX, since both EEX and EXAA consider Germany and Austria as a common market area within their trading systems. Switzerland also is integrated into the EEX.

As in most Western European countries, there is also a balancing market and a market for ancillary services. In the balancing group model, parties that provide balancing act as counterparties for imbalance settlement with the TSO.

In contrast, the Spanish electricity market operates on a centralized pool. The difference between bilateral and pool markets is illustrated in Figure 1.

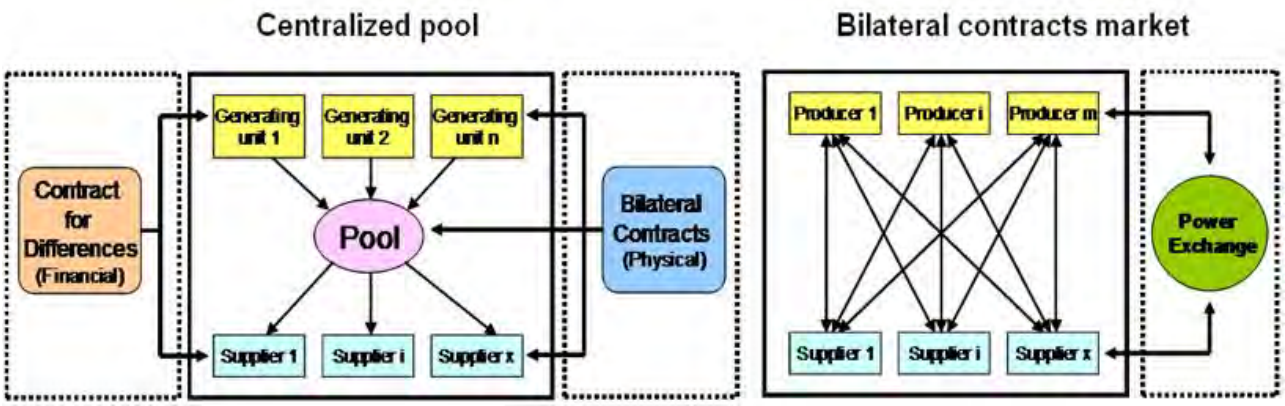

Figure 1: Comparison of Bilateral and Pool Markets

Source: KEMA

In the pool approach, as used in Spain, there is centralized scheduling of all generation dispatch and all energy is bought and sold through the pool. Under Spain's pool, producers must sell to the pool and distribution service providers must purchase from the pool. However, the Spanish pool market is supplemented by physical bilateral contracts and a forward market. Bilateral energy supply contracts between buyers and sellers are incorporated into the overall dispatch once the daily pool market has closed. Finally, the TSO determines regulating reserve requirements based on the daily market results and to cover for any real-time deviations occurring after the daily market closes.

All four of the countries have retail competition in the sense that consumers may freely choose their supplier. However, in Switzerland retail competition has not expanded to the residential sector. Moreover, all these markets are highly fragmented with a large number of local/ municipal utilities and many independent supply and trading companies. Despite the privatization of public utilities, many local government entities have kept majority stakes in the local utility. According to European legislation on unbundling, network operation and energy supply are separated from each other and are provided by different entities, though these may belong to the same utility holding company. Switzerland is again the exception as both functions may be provided by the same entity.

Renewable Promotion Schemes

The EU and four European countries examined have adopted ambitious mid-term and long-term targets on climate change and energy policy. Renewables play a key role for accomplishing these targets.

National energy policies set the legal framework for the establishment of an economic promotion scheme for renewable energy. This is usually based on some form of a renewable electricity law which differs depending on the country examined. Therefore, each nation's energy policy may reflect a different set of promotion schemes. The promotion scheme

introduced in Germany in 2000 has often been used as a benchmark for successful renewable energy policy-making due its effectiveness in boosting development of renewable resource capacity.

The following discussion elaborates on some of the key similarities and differences between the primary renewable promotion schemes used in Germany, Austria, Switzerland, and Spain. The feed-in tariff model is common to all jurisdictions. Eligible producers of electricity from various sources, including solar power have access to the renewable regime. All four countries rely on a feed-in tariff (FIT) scheme, as well as a national renewable electricity law which establishes provisions on:

- Connection and access of renewable power generation assets to transmission and distribution networks
- Ancillary equipment requirements (e.g., remote control and metering, etc.)
- Promotional feed-in tariffs for electricity from eligible sources
- Market access and integration of electricity from renewables sources
- The feed-in tariff provides an energy-related remuneration for the generator's output (in €c/kWh).

In general, tariffs are differentiated by type (technology), size (installed capacity) and fuel type (relevant for biomass and biogas) of renewable energy source. They are typically guaranteed for a certain period, e.g., 20 years. A tariff digression factor[1] is applied at the start of each calendar year stemming from cost reductions resulting from technological progress and rewarding early investors. This means that the tariff rate for a particular technology and project size category decreases annually for new installations.

Table 1 summarizes the main aspects of the primary renewable electricity promotion schemes implemented so far in the four countries.

1 Digression means that the FIT rate is adjusted downward annually. In Germany, the percentages by which tariffs decrease are determined by amendments to the Renewable Energy adopted every 3-4 years. This allows each new block of renewable generators coming on line to know—before they actually build—which tariff rate will apply in each future year.

Table 1: Comparison of Feed-in Tariff Schemes

	Austria	Germany	Spain	Switzerland
Promotion model applied	FiT	FiT	Hybrid: FiT and Market Premium	FiT
Purchase obligation by system operator, market operator or network operator?	Yes	Yes: for all renewable electricity, unless producers arrange remuneration via bilateral contracts outside the FiT scheme	Yes	Yes
Tariff (rate) digression (e.g., annually) for new installations?	Yes:	Yes:	Yes	Yes
Are total promotional funds and/or annual capacity increment capped?	Yes	No	Yes	Yes
Is solar power promotion split according to installation type?	Yes	Yes	Yes	Yes
Can grid operator curtail renewable DG resources?	?	Yes, TSOs can curtail any DG 100 kW or larger (PV is exempted)	Yes, the TSO can curtail any DG unit over 10 MW	?

Spain combines its feed-in tariff with a market premium in a hybrid approach. Under the premium scheme the remuneration for electricity from renewable sources has two components; a reference price and a supplemental price. The reference price is often market based and equals the market value of the renewable technology. However, since most renewable sources are not competitive with conventional generation costs, renewables in Spain receive a supplement which covers the difference between the cost of generation and the reference price. Therefore, in Spain a renewable electricity producer may chose between: a) a guaranteed feed-in tariff for the electricity produced or b) a market premium on top of the hourly electricity market price if it decides to sell its output directly on the wholesale market (either through the organized market or a negotiated bilateral sale). Switching between the remuneration models is allowed, with a waiting period of up to one year.

None of the jurisdictions discriminates between private entities and public authorities in accessing the primary feed-in tariff promotion scheme for renewables. However, other promotional funds, provided by federal, state, or municipal administration(s) may be restricted to the private sector, although municipalities may have access to specific funds provided by state or federal programs.

General Role of Public Authorities

Federal and state authorities serve to provide the legal and regulatory foundation to facilitate renewable project development, disseminate information on renewable energy, and provide economic incentives for research, development, and deployment of renewable sources and technologies. Indeed, renewable energy policy heavily promotes activities supportive of technological progress, provides funds for high-technology pioneer projects, and initiates pilot projects for educational purposes. Most importantly, the renewable policy sets the legal framework for increased use of renewable sources and incentivizes new private stakeholders to invest in renewables.

Municipal authorities are increasingly required to check their internal processes for sustainability and energy efficiency and to serve as an example to the private sector. For the most part, municipal authorities usually refrain from taking over a role in the development of renewable sources in their proximity because of economic risks, considerable investment requirements, and other challenges. However, they are keenly aware of the significant economic and social benefits of local renewable resources. Hence, municipal decision makers have been very active in assigning new areas for renewable energy use and assisting individuals and companies with project implementation. In return, municipal authorities incur significant income from land sales, leasing fees and taxes. Furthermore, the voice of citizens can be a driving force behind municipal administration action to promote climate change protection and sustainable energy policy for the public good. This has lead to considerable differences in the intensity of renewable energy use by regions or municipality.

It is important to note that increased activity by the public sector is expected to occur related to solar water, heating and cooling provisions as soon as the EU Directive 2009/28/EC is incorporated into national legislation. This directive stipulates that "Member States shall ensure that new public buildings and existing public buildings that are subject to major renovation, at national, regional and local levels, fulfill an exemplary role in the context of this Directive from 1 January 2012 onwards. Member States may, inter alia, allow that obligation to be fulfilled by complying with standards for zero energy housing, or by providing that the roofs of public or mixed private-public buildings are used by third parties for installations that produce energy from renewable sources." (Article 13.5)

Germany is currently in the legislative process of adopting the directive by amending the Renewable Electricity Act and the Renewable Heat Act. The government estimates that every year some 2,500 buildings used by public authorities (rented or owned) will be required to adapt their heat supply according to the Renewable Heat Act. Solar heating will become the preferred technology at buildings used by public authorities in order to comply with the requirements of the law. An investment cost of €729 to €900 per square meter is estimated for installing this technology.

Activities

There is insufficient information available to determine the level of project development activity that can be directly attributable to municipal authorities within the four jurisdictions examined.

Although renewable projects often have to register with the corresponding network operator and applicable administration, a central registry or database of renewable projects does not exist. Furthermore, public information that is available does not distinguish between municipal activities and privately driven projects.

The involvement of municipal authorities in renewable project development located on publically owned property is limited at this time. Municipal authorities are involved primarily by adjusting local urban development plans and issuing construction approval, where required. Moreover, they sometimes facilitate project development by providing economic incentives, information, and advisory services. For instance, municipal authorities have been very active in assigning public territories to wind power or ground-based solar power use. In the case of small hydropower, long-term water rights have been issued by municipal authorities to licensees. In addition, there are a few examples of electricity generation from gases, biomass, and waste where local legislation has provided economic incentives or stricter environmental provisions that serve to facilitate renewable project development. Nevertheless, municipal resources are often not exploited by the administration itself, but rather by local utilities. In return, municipal authorities incur significant income from land sales and leasing fees as well taxes from entrepreneurial activity.

Procedures

In general the promotion scheme does not discriminate or favor public authorities in their access to the feed-in tariff. However, when it comes to project planning and implementation, some differences may arise between a public property project and a private property project. Based on our experience, small-scale/ building-based projects in the private sector do not require special permits from authorities but have to build in line with industry norms and standards and arrange for network connection with the local network operator in accordance with the technical network connection procedure. These projects can be completed rather quickly. In contrast projects built on municipal property need more lead time due to the approvals required from various departments to solve issues like fire control, construction matters, environmental impact, insurance, or other issues of concern to public authorities. Moreover, public procurement procedures apply, which come into play as soon as solar panels have to be bought or an insurance product has to be selected. Further, public announcement and invitation to bid may be required for finding the contractual partner(s) in a public private partnership. Finally, objections from public and political parties may delay project implementation.

In the case of a public-private partnership for ownership and/or operation, other considerations such as security of equipment and installation maintenance are subject to contract negotiations or the operating service agreement between installation operator and owner.

SECTION 2:
Germany

This section provides a brief overview of the market in Germany particularly as it relates to promotion of renewable distributed generation projects on public property.

Overarching National Renewable Policy

The Renewables Act

Germany has adopted a goal to increase the share of renewable electricity in total electricity supply to 30 percent by 2020. To increase power generation from renewable sources, the German legislature has introduced a set of legal provisions and economic incentives.

The most important legal element is the Renewable Energy Law (EEG). It was first adopted in 2000 and has been amended various times, most recently in 2009 and 2010. The 2004 amendment introduced a (tariff) separation between building-based, ground-based, and other installations. Building-based installations included those built on roofs, building facades and noise protection walls. Ground-based installations were only eligible for payment if they were commissioned for certain legally defined land categories and within the framework of a local development plan and a planning procedure pursuant to the building code.[2] These land categories included:

- Sealed terrains
- Grounds formerly used for military or commercial/ industrial purposes and made usable for other purposes (known as converted grounds)
- Green fields formerly used for agricultural purposes
- Other installations, including those mounted on or added on grounds or at facilities for which the primary purpose is not electricity generation from solar power (e.g., industrial sites, etc.).

The 2009 amendment to the Renewables Act partially corrected for the changes introduced in 2004: Ground-based installations have been additionally allowed on converted areas that were formerly used for transportation (e.g., roads) or housing. Moreover, it allows for solar panels on

4 This argument probably also applies to other jurisdictions but has not been further investigated in this study.

slopes along highways and railways as broad as 110 meters.[3] As of the end of 2010, green fields formerly used as agricultural areas have been excluded.

Furthermore, the 2009 amendment requires a regular adaption scheduled every four years. For solar power the annual digression is set to 9 percent to 11percent (depending on the installation type and size), but is kept variable and the specific digression depends on the increment of total installed capacity of solar power realized in the prior year. Such dependency on actual growth was exacerbated by a July 2010 amendment along with a significant decrease in the nominal feed-in tariff amount. This was due to a strong drop in solar panel prices after 2008 and an increased gap between state subsidy under the EEG promotion scheme and the generation from solar panels.

Other Promotional Schemes

Apart from the Renewables Act there are alternative promotion schemes to foster the growth of renewables sources. The most important is the investment scheme of the state-owned KfW Banking Group providing investment loans or subsidies at appealing credit terms. Moreover, regional or municipal funds created for promoting renewable electricity generation or energy efficiency may provide investment subsidies. These promotion schemes may often be combined with the promotional feed-in tariff scheme under the Renewables Act. Often these funds are only open to private sector activities, while municipalities (cities, towns, and villages) may be exempted from these funds, but have access to different funds (e.g., KfW Communal Fund), mostly for energy efficiency.

General Role of Public Authorities

Until the last few years, it was commonly accepted that municipalities would not play a major role in electricity generation apart from playing a role in facilitating project development. One of the most important arguments behind this assumption has been a German federal law that stipulates that municipalities have to cover their costs primarily from federal funds, i.e. taxes, and fees for public services provided by municipal authorities to its citizens for public good. Ideally, administration(s) should refrain from activities that compete with market forces or do not provide a public good. Moreover, making a profit may not be the sole reason for a municipal activity unless it relates to the provision of a public good according to the former principles.[4]

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4 This argument probably also applies to other jurisdictions but has not been further investigated in this study.

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However, in recent years more and more municipalities have increased their activities in the renewables sector and have become more active in using municipal properties (grounds, infrastructure and buildings) for renewable distributed generation applications. In doing so, they gain additional income from the Renewables Act and the largely unlimited federal funds associated with it.[5] The reason behind this change is the increasingly tight budget constraints both at the municipal and federal levels. Add to this the municipal decision makers' concerns to cover public expenses, efforts to contain debts, and activate new income sources. Moreover, a desire to improve their image in regard to energy education, environmental impacts, and sustainability may encourage local decision makers to become more active in renewable energy development. Municipalities that are more advanced in their approach to these issues have made considerable investments in DG and have reduced dependence on large electricity suppliers for their energy needs.

Activities Related to Solar Power

The following discussion focuses on PV projects on buildings and highways. Little can be said about PV along public waterways, since natural waterways are reserved for shipping, while watersheds and adjoining areas are often environmentally protected areas or used as flood plan buffer zones.

Roof-based Installations

Due to relatively small amounts of funding required and high feed-in tariffs, PV power development has for the most part evolved around small-scale projects. Today, some 90 percent of German PV installations are roof-based modules smaller than 30 kW. They are typically connected to the low-voltage (400 V) network of the local network operator.

Municipalities today are making roofs of public buildings, such as schools and hospitals, more available for PV installations. Typically, they do not adopt a project development function but may engage in some form of public-private partnerships and put the corresponding areas at the disposition of the project. Different models for public-private partnerships have been developed and implemented for this purpose. The various models for private participation enable the municipality to promote civic participation and put forth a progressive image. But economic factors are often a significant market barrier to municipal ownership. For those municipalities that do have an ownership share, they incur significant (and predictable) income from electricity production. Alternatively, they may incur revenue from leasing land or other areas to renewable developers. Moreover, they may have educational goals in sight. For instance,

5 As indicated above, the Renewables Act is the primary source of funding of electricity from eligible renewable sources. It does not discriminate plant operators as, according to the law, "installation operator shall mean anyone, irrespective of the issue of ownership, who uses the installation to generate electricity from renewable energy sources or from mine gas.".

school administrators and students' parents often encourage the use of school rooftops for solar panel installation as this serves to educate school children on the benefits of renewable technology.

Apart from setting appropriate investment conditions in urban development plans or making public property available, municipalities break new ground as well by providing useful information and endorsing new scientific methods to investigate solar potential. For example, new approaches combine flyover data measurements of building covering an entire urban area and structural analysis of individual buildings[6] along with data from local real estate maps. Going even further, there are some examples of what is known as municipal solar maps (cadastre) that provide online information on each building's estimated solar potential.

Public authorities are also more and required to check their internal processes for sustainability and energy efficiency and to serve as an example in the local community. Two relevant examples are:

- The Bonn office location of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety delivers insight into its internal activities in the field of sustainability by means of its *Environmental Statement*. According to the 2010 statement, a roof-based solar power installation is planned for 2011.
- Within the framework of its comprehensive climate initiative the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety has provided funds for building solar panels at schools and installing visualization tools to assist student's education. One program, *Solar Support for Schools – Making Renewables Visible* covers 400 schools. The initiative also provides federal support for investments in energy efficiency and renewable energies by industry, municipalities, and consumers. Up to €400 million will be made available in 2011 from the sale of CO_2 emission allowances.[7]

Installations along Highways and Railways

The 2009 amendment to the Renewables Act adds slopes along highways and railways to the list of approved project categories. In addition, noise protection (abatement) walls along motorways may be used, which fall into the category of "other" facilities. These areas have been admitted by the act due to their large potential for solar power. There are some 12,500 km of highways and some 34,000 km of railways in Germany.[8] There is the additional potential to combine these solar projects with noise abatement structures, requiring limited use of additional land and reducing competition for available land space.

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6 Roof pitch, building orientation, height and so forth

7 http://www.bmu-klimaschutzinitiative.de/en/press?d=100

8 Verges may have different aspects, uses and ownership structures, which might significantly reduce the total length of areas available for solar power.

In practice, there are no standard procedures for solar projects along highways due to a lack of relevant historical experience and established legal provisions. Approval responsibilities are also dispersed among federal, federal-state and municipal administrations, and can be complicated by complex land ownership rights. However, we note increasing engagement of public administrations to promote these types of projects, largely driven by the need to ensure public good and the opportunity to incur economic incentives.[9]

The approval of land use related to noise abatement walls along highways for solar power by the Renewables Act boosted the interest from both municipal authorities and private investors. Numerous planned projects have been made public and municipal activities for exploitation of the corresponding potential is occurring in even greater numbers. Local/municipal development plans are being adjusted to support private investors' desires to use lands purchased or leased from municipalities. They also have economic objectives to achieve by means of public/private partnerships on these lands, as has already been achieved on public buildings. For instance, solar panels attached to noise abatement walls may contribute to covering the costs for building and maintaining the latter. Project plans disclosed so far provide for various types of installations. They refer not only to slopes and noise abatement walls, but also to shelters above highway sections covered entirely by solar panel modules. Some examples of planned or completed projects include:

- The combination of solar power and noise protection on Highway A92 near Freising, commissioned in 2004, was the first of its kind in Germany. Solar panels were built on top of an earth wall separating the motor way from a business park nearby. Now expanded to some 1,200 meters long, it merges the cooperative installation built by a citizen consortium in 2003 with a second installation added later by a local utility. It has a total installed capacity of 717 kW (peak) and produces some 700 MWh per year (with separate metering for the two parts).[10] A similar installation is shown in Figure 2.

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9 However, there are examples where project have not turned out well, especially more complex projects and technologies. For instance, there are cases of citizen opposition to geothermal projects due to security concerns. Moreover, cases have been made public where municipal administration opted for geothermal heat on public properties and where earth movements have produced significant damages to buildings. Furthermore, wind power installations are often affected by objections from citizens living nearby with respect to shadowing and/or noise effects.

10 http://www.sonnenkraft-freising.de/pr_ssw.html

Figure 2: Example of Solar Power Installation at an Earthen Slope Used for Noise Abatement on Highway A96 (similar to the Freising Project)

Source: www.ib-wimmer.de; found in the Photovoltaic Power and Noise Protection at the Motorways A10 concept of the municipality of Michendorf, 2010.

- In 2009, a local utility providing energy and network service to the neighboring municipalities of Goldbach and Hösbach founded a project entity for enclosing a section of a nearby highway for a length of 2,000 meters, as shown in Figure 3. It currently has 8,500 solar panels that produce some 1.5 GWh annually, at an efficiency rate at 950 kWh/kW peak, and generating a revenue of €600,000 per year. The project required an investment of €6 million (10 percent of total investment was in equity - residual funds came from local banks and citizen shareholding). The entity in charge is entirely owned by the utility, which itself is a municipal agency. A highway asset usage contract (with higher administration) was established for a contract term of 20 years (equals the Renewables Act promotion period), and has a potential extension by up to 10 years. Operation is monitored via real-time data provision and analysis at the utility. Total operational costs, including the leasing fee covered by the highway asset usage contract plus maintenance and insurance, amount to €75,000/year. [11]

11 www.a3solar.de

Figure 3: A Pioneering 1.6 MW Project for Enclosure of Transportation Noise on Highway A3 between Goldbach and Hösbach. [12]

Source: www.a3solar.de

- The state-owned German Unity Motorway Planning and Construction Company (DEGES) [13] has responded to the municipality of Michendorf's concept for improving noise reduction and prevention at a section of one of the most heavily used motorways in Eastern Germany. The local concept provides for a combination of reinforcing existing noise reduction walls and privately financed solar panels. DEGES has picked up the concept and expressed interest to gather information about potential investors and whether there are private entities interested in the project. The project envisages raising noise protection walls up to a height of 10 meters over a length of 5.5 km, which will probably be carried out by the

12 Comparable also to Solar Power Serpent Highway project proposed for Santa Monica (U.S.); http://buildaroo.com/news/article/solar-power-serpent-highway-santa-monica/

13 Deutsche Einheit Fernstraßenplanungs- und -bau GmbH (DEGES) is a state-owned institution founded shortly after the reunification of former two separate German countries to support the new member provinces of the Federal Republic of Germany in construction and modernization of motorway infrastructure.

federal transportation office. Moreover, the project stipulates that the investor shall be responsible for constructing solar panels (with potential noise reduction capability) over the same length, operating them for 20 to 30 years and decommissioning them afterwards. It also has to bear the associated costs. The project cost is expected at €25 million based on a planned capacity of 13 MW (peak). A map and photograph of the project area are shown in Figures 4 and 5. According to the project documentation the investor is also liable for the additional cost of adapting the walls to the solar panel construction, as well as a fee equivalent to a percentage of the income from electricity sales (presumably equivalent ownership Model 2 as discussed later in this chapter).

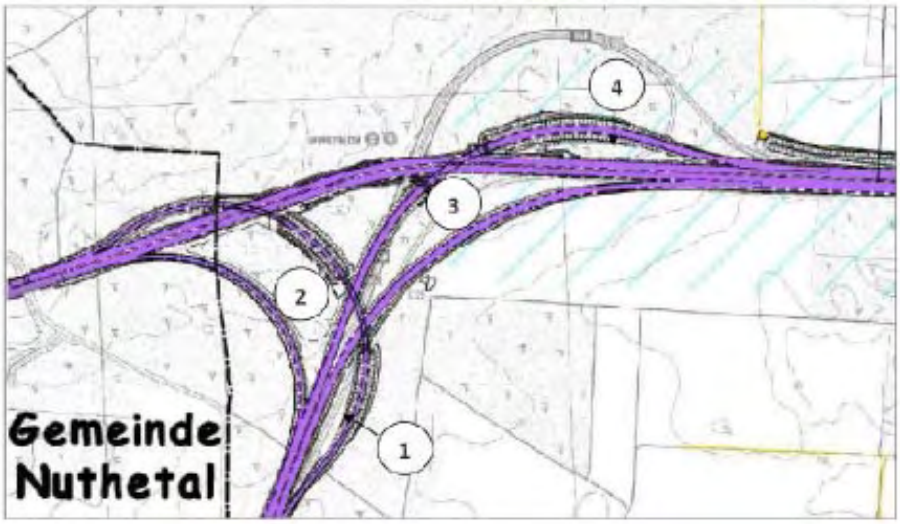

Figure 4: Proposed Areas 1 through 4 for Ground-based Solar Power at the Nuthethal Junction (based on the Michendorf concept)

Source: Photovoltaic Power and Noise Protection at the Motorways A10 concept of the municipality of Michendorf, 2010.

Figure 5: Proposed Area 3 for Ground-based Solar Power at Nuthethal Junction

Source: "Photovoltaic Power and Noise Protection at the Motorways A10" concept of the municipality of Michendorf, 2010.

There are some cases where investors have not being able to convince municipal decision makers to change urban development plans to incorporate additional areas next to highways into the plan, partially due to public reluctance to do so. This might imply that, particularly in the case of small municipalities, special emphasis has to be given to public concerns and integrating them into the project plan, for example, including the advantages to be gained from noise abatement and recapitalization of municipal bonds.

Projects along railways have not been as prevalent as projects along highways. However, due to lack of data on this specific topic, it is difficult to assess why there is little activity along railways.

Other Aspects Relevant to Solar Power along Highways

Potential investors may face significant challenges when exploring the potential for solar power along highways and railways. First, highways are federal property, but are maintained and operated by specific highway operation offices subordinate to federal and state administration. They are responsible for managing the highways as well as slopes and protection walls, including maintenance and repair activities as needed to ensure traffic safety.

An important element to transportation safety is established by a federal law on highways (Law on Motor Ways). The law empowers the highway office to grant annulments of the legal ban on constructing facilities within the aforementioned distance(s) on a case-by-case basis. The law prohibits installation of structures within 40 meters of the highway.[14] In addition, within a further distance of 60 meters, i.e. up to a total distance of 100 meters from the lane's edge, a construction permit from the federal-state's highway operation office is required in addition to normal construction permits. Ground-based PV installations are only eligible for remuneration if they are commissioned within the framework of a local development plan and a planning procedure pursuant to the building code. This implies the highway office's prior consent for construction, and possibly an annulment of the ban on construction within 40 meters of the lanes.

Apart from safety concerns, land ownership is also an issue for solar panel proliferation next to highways or railways. Other than highway service areas, land space along highways primarily encompasses arable land, forests, residential development, and urban facilities owned by either the private sector (companies and individuals) or local municipalities.

Financing and Ownership

Investment credits are often provided from funds granted by federal, state, or municipal authorities and/or from the state-owned KfW bank, although double funding is often not

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14 This is the primary reason why there are no advertising panels along motorways that might distract drivers and is contrary to other European countries' policies.

allowed. The access to investment credits and foreign capital at preferential conditions is often limited to individuals and private enterprises, while municipalities are excluded. Public-private partnerships, by virtue of the private entity, have access to these investment credits and foreign capital. For fully dedicated municipal projects, financing typically comes from municipal budgets as well as from (local) banks. Local banks also play an important role in financing local public/private partnerships. [15]

In general the following models for financing renewables projects are common practice in Germany:

- **Operational Responsibility and Ownership by Municipal Administration**

  The municipality finances a project from its budgets or by credit for energy self-supply, often to decrease dependency from non-renewable sources and to become more energy efficient.

- **Public Ownership**

  Public administrations hold stakes in the project indirectly via a new project entity or local utility (can be wholly or partly privatized). The project entity is responsible for the operational issues of the project. Often various utilities or administrations from different municipalities cooperate for joint operation, especially when capital requirements cannot be met by a single municipality. This approach may be combined with a public-private partnership approach, e.g. cooperative citizen participation (see below). Municipalities earn income from energy sales and leasing fees, depending upon the specific contractual arrangements for the project.

- **Energy Contracting**

  A contracting service company is responsible for planning, construction and operation of a renewable project built on municipal property. Under the terms of a contract, the service provider incurs income from energy provision to the administration. After a contract period the installation passes into public ownership. For instance, formerly public services often have been outsourced to a semi-privatized local utility that owns or operates the assets and provides services to the public and to the administration. Assets are operated and maintained in a more efficient way and investments are not financed from public budget (e.g. thermal heating for buildings and hot water in public swimming pools.)

- **Cooperative Projects**

  Projects are initiated and financed by neighborhood/ citizen cooperatives. Municipalities may provide public property, initiate the project, or even participate in the cooperative.

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15 Information taken from *Renewable Energy Projects in Municipalities – Success Factors for Planning and Implementation* (translated), Renewable Energies Agency, 2010; available at www.kommunal-erneuerbar.de

Citizens hold shares in the cooperative which kick-starts the project; missing capital may be provided by local banks and cooperative banks.

- **Investor-led Projects**

  The investor (bank, project developer, etc.) develops the project, assuming responsibility for planning, financing, construction, and operation. It sells shares, e.g., via renewables capital investment funds. The role of the municipality is limited to setting appropriate investment conditions in terms of planning law, urban development plans and providing public property (particularly open areas).

Specific Models for Solar Power in Highway Corridors

In late 2010, the scientific service to the German parliament evaluated different ownership models for combining solar panels with noise protection (abatement) facilities on highway corridors. According to its report, [16] an exceptions permit from the federal-state transportation office is required, based on a written agreement between the authority and the investor. The report assumes that investors prefer leaving the ownership of the noise protection (abatement) facilities with the administration (federal or federal-state [17]), while ownership of the solar panel installation is done under one of the three models discussed below:

- Model 1: ownership and operation by the administration
- Model 2: ownership by the administration, but construction and operation of the solar installation by the investor, which is additionally liable to a noise reduction contribution fee
- Model 3: construction, operation and ownership of the solar installation remain with the investor, which is also liable to provide additional noise protection[18]

Apart from ownership, these models also consider the desire for additional noise abatement measures as well as income from electricity generation.

According to the service's analysis, the first two models are difficult to realize and the third model is preferred. This is due to potential budget law restrictions concerning income from the Renewables Act incurred by administration under the first two models. The analysis concluded that there is no experience combining solar panels with noise abatement in terms of the

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16 The report has not been made public and the information provided here is taken from the municipality of Michendorf's concept for improving noise reduction and prevention, DEGES's expression of interest (see above) refers to.

17 The term federal-state refers to a regional administration of the federal German government, similar to the 50 state governments in the U.S.

18 Two alternatives exist: combining solar power with noise reduction facilities, i.e., the physical attachment of solar panels to the latter, alternatively, using multi-functional solar panels with integrated noise protection (though we do not know which is more probable or suitable).

ownership and permitting process. Therefore, an amendment of federal legislation in this regard is recommended.

Permitting Process

Large ground-based installations require permits. They have to be added to the local urban development plan or be registered under municipal construction planning before the project can start. In contrast, most of the smaller PV projects are built on private property and no specific construction permit is required, unless it is a property that is officially listed as a historical or architecturally protected building.

Administrations may exert further influence on private PV projects in different ways. They may establish specific requirements on building orientation or roof structure in the urban development plan and subsequent local construction planning procedures. Differences often arise between the federal/state and municipal levels. The two administrative levels have primary influence on regional and local development plans, taking into account infrastructure projects, urban expansion, environmental protection, and economic development goals.

SECTION 3:
Austria

Overarching National Renewable Policy

Green Power Act

The legal basis for the promotion of electricity from renewable energy in Austria is provided by the Green Power Act and the Green Power Ordinance, which is based on the act. Eligible installations must produce electricity from hydropower (smaller than 10 MW), biomass, biogas, wind, photovoltaic or other sources. In return, they may receive a fixed remuneration during a certain promotion period (i.e., feed-in tariff).

For new solar power installations being commissioned in 2011 the feed-in tariff differs depending on whether it is facility-based (erected at or on top of a building), or a noise protection facility, or ground-based. They also differ according to the size of the installations category: a) between 5 kW and 20 kW peak and b) above 20 kW peak. Facility-based installations have a higher remuneration than ground-based ones of the same size category. Smaller installations have a higher tariff than larger ones. Remuneration for solar power is limited to 13 years. The tariff is reset by the Green Power Ordinance every year.

Installations up to 5 kW peak are not eligible for the feed-in tariff, but may have an investment subsidy provided from a different fund, known as federal climate and energy fund, which has means of €35 million for new solar power.

Notably, the Green Electricity Law stipulates a maximum fund size for promotion of electricity from new installations, i.e. the entire set of renewable electricity increment eligible for the tariff in a specific year. For 2011 the fund available to the electricity increment is capped at €21 million, while in former years fewer funds were available. Moreover, it caps the share of solar power in these funds to €2.1 million, out of which remuneration for ground-based installations may not exceed €5 million according to the corresponding ordinance.

The act stipulates the creation of an Austrian green electricity settlement office, which is responsible for organizing remuneration streams and managing promotion funds. It acquires green electricity from producers at the administrative tariff and provides it to electricity suppliers and traders subject to specific provisions. Any renewable electricity generator has to apply with its local federal-state administration to be recognized as green power producer and to receive the feed-in tariff from the green electricity settlement office.

Currently, the promotion scheme is overrun with requests. Therefore, applications for the feed-in tariff are queuing up and will be admitted according to the date of receipt by the green electricity settlement office. New installations are expected to be admitted in coming years.[19]

General Role of Public Authorities

Traditionally, large hydro renewable power has been fundamental element of electricity supply and load following in Austria. But development of distributed generation sources, such as small-scale hydropower and other renewable sources, has not been advanced by energy policy to the same extent as in Germany. For instance, total solar power installations in Austria amounts to roughly 40 MW. Such development is limited by the amount of state funding and growth restrictions. [20]

There are individual cases of municipal engagement in fostering solar power. They provide access to surfaces on municipal buildings for solar power panel installation, like schools. Sometimes, they coordinate themselves for joint project implementation. Most projects involve strong participation of citizenship in financing. The activity of these municipalities is by far not representative for other administrations.

19 www.oem-ag.at/

20 See http://www.solarbundesliga.at

SECTION 4: Switzerland

This section provides an overview of the market in Switzerland, particularly as it relates to the promotion of solar projects on public property.

Overarching National Renewable Policy

Swiss Energy Law and Energy Ordinance

According to the Energy Law and the Energy Ordinance, electricity from renewable energy, including solar power, may be eligible for promotion via cost-effective remuneration.

Rules for access to the cost-reflective remuneration regime are established in the *Energy Decree* and the *Guideline on the Cost-Reflective Remuneration*. There are no exceptions from the default procedure for renewables projects launched by public administration.

Under this policy, the cost-effective feed-in tariff has replaced economic support programs and tax exemptions at the federal-state level. This means granting economic support equal to reference installations' electricity generation costs, which vary by year, installation size, technology, and other parameters. Moreover, an annual tariff digression applies and the legislator reserves the right to periodically analyze market environment and reset feed-in tariffs and digression accordingly.

Market for Renewable Electricity Products

Renewables have limited access to the legal promotion scheme that would otherwise grant them a stable, cost-covering price for their electricity production. Due to the maximum size of the fund providing the cost-reflective remuneration, a significant amount of renewable electricity may not be able to profit from the current promotion scheme. Moreover, size restrictions or other factors may impede the access to the scheme. These installations have to find income sources outside of the promotion scheme. In doing so, they may be supported by federal-state or municipal investment subsidies and the Swiss Energy Law. The latter obliges network operators to connect installations for renewable electricity generation to their network and acquire the electricity produced.

Installations commissioned before 2006, i.e., prior to the Energy Decree's approval, had to agree upon remuneration in bilateral agreements with local utilities (network operator and energy provider). Such agreements used to pay for electricity at a price equivalent to actual generation cost instead of market prices. The utility, then, would pass the resulting excess cost to the TSO. These agreements stay valid for a certain transition period. Installations commissioned as of 2006 and not accredited to the promotion scheme are remunerated either upon market prices or upon specific renewable electricity trades between network utilities.

This explains why renewable electricity, and in particular solar power, is still a niche product in Switzerland. It is often traded on trading platforms with local or regional focus, some of them dealing with specific sources like solar power. Often utilities enable trades taking over the role of a market operator. They provide the platform, bring together offer and demand for renewable electricity and settle it at a common price. Alternatively, utilities buy renewable electricity from generators and provide specific energy products to customers ready to pay a higher price.

Promotion of Solar Power

Up to now, solar power has played a negligible role in power generation and energy supply in Switzerland due to the relatively high cost of this technology. Some change has taken place in 2009 and 2010 as the cost-reflective remuneration sets new incentives. Nonetheless, promotion funds are limited and applications are being queued. Specific to solar power, the feed-in tariff guarantees constant remuneration for 25 years. Moreover, an 8 percent annual digression applies each fiscal year. Eligible projects are not only new but also refurbished or amplified installations.

Feed-in tariffs are differentiated per installation type and size. As a rule, the tariff is higher the smaller the installation is (generation capacity). The promotion scheme considers three different types of installations:

- Ground-based installations
- Installations added or attached to other facilities, such as buildings meant solely for electricity generation
- Integrated installations with solar panels serving multiple purposes apart from electricity generation[21]

To receive the feed-in tariff, project developers have to apply for it and register with the transmission system operator in charge of implementing the support program. The TSO also organizes remuneration of eligible installations and provides the funds. However, unlike in Germany, the fund for promotion is limited both in terms of total amount as well as amount per technology. It is loaded by an additional consumption-related fee on top of the electricity price and is, hence, provided by all consumers. According to the Energy Law, this fee is reset by the legislature annually. The TSO levies the fee as add-on to transmission tariffs, and the fee is passed through by tiers of network users to final consumers. Currently, the add-on to final consumer energy prices may not exceed 0.01 Swiss Francs (CHF) per kWh. Moreover, the share of solar power promotion in total funds may exceed:

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21 Additional purposes may be weather protection shadowing, noise protection, and fall protection. Examples are solar panels replacing/ reinforcing the effect of noise protection walls, or roof-based structure replacing tiles.

- Five percent, if the difference between a market price index and average generation cost exceeds 0.50 CHF/kWh
- Ten percent, if the difference between a market price index and average generation cost is in the range 0.40-0.50 CHF/kWh
- Twenty percent, if the difference between a market price index and average generation cost is in the range 0.30-0.40 CHF/kWh
- Thirty percent, if the difference between a market price index and average generation cost is less than 0.30 CHF/kWh.

The maximum potential energy produced by solar power under this scheme is based on the amount of the cost-reflective remuneration, the above thresholds, and market prices. The legislature estimates the annual maximum capacity increment eligible for the feed-in tariff and which the transmission system operator is instructed to control. Solar power projects have been queuing up and further access to the promotion scheme has been put on hold since applications are exceeding maximum funding to date.

Compared to the typical default digression value of 8 percent, the digression value in both 2010 and 2011 has been set to an exceptionally high value of 18 percent. In return, the total promotion fund is being raised from 5 percent in 2010 to 10 percent in 2011. Both items have to be understood in the context of significant drop in solar panel prices which has taken place in the last two to three years.

General Role of Public Authorities

Responsibility for energy policy lies with the Federal Energy Office. The main instruments it has at hand to promote solar power are coordination with market players and authorities, information dissemination, and economic support for pilot projects.[22] According to the Swiss Energy Law, the federal-state administration is the main partner for design and application of federal legislation to promote solar power. They assume similar responsibility as the Federal Energy Office, including support to the education and investigation sector, information dissemination via federal-state energy advisory offices and support of pilot and demonstration projects.

Municipalities play a key role for local development of solar power due to their tight relationships to local business and their social responsibility towards their citizens. They boost the use of solar power installations both for network connection as well as autonomous operation by:

- Exemplary installation of at municipal buildings

22 Previous and subsequent information taken from http://www.solarch.ch/

- Use for infrastructural purposes (lighting, parking meter)
- Complementary services and products by associated/ local utilities (electricity products based on renewable electricity or solar power only)
- Information and education campaigns
- Moreover, the label *Energy City* may be granted to municipalities based on their sustainable municipal energy policy (see below).

Activities Related to Solar Power

Up to now, solar power has played a negligible role in power generation for energy supply in Switzerland due to the considerable generation cost of this technology and insignificant state funding. Consequently, private investors as well as municipalities have been reluctant to launch solar power projects. Even progressive municipalities have mainly focused on energy efficiency, energy savings, and strategy adaptation towards increased sustainability of municipal life. Such measures – often in close cooperation with local utilities—include improvements in mobility/ transportation, urban/spatial development, administrative organization, communication and education as well as energy supply and disposal. Electricity generation, energy self supply or initialization of solar power projects has not been the focus of the initiatives carried out so far.[23] There also is no centralized database for such projects due to the significant autonomy of federal-state administrations from federal policy.

In spite of limited incentives, there are some exceptional examples of progressive solar power projects in Switzerland, including:

- Private pilot project Alpha A1

  A community association named IG Solar Safenwil, founded in 1998, implemented a 80 kW peak solar panel project (see Figure 8). The structure was mounted on top of noise protection walls on Highway A1 between Swiss cities of Zürich and Bern next to the municipality of Safenwil. Alpha A1 has a total length of 368 meters and a solar panel surface of 543 square meters, and produces some 70 MWh per year. The panels were installed by the association in the course of planned replacement of old noise protection walls on the highway, which was already planned by the federal-state transportation administration. Operation was handed over to a new company specifically founded for this purpose. The project was partially funded by the Federal Energy Office; other financing capital was provided by a bank. [24]

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23 This is the spectrum of options considered by the Energy City label as well as the options mostly used by municipal decision makers when designing and implementing sustainable energy strategies.

Figure 6: Swiss Alpha A1 Highway PV Project

Source: Solar Panel Installation on A1 in Safenwil (translated), Ruedi Hottiger-Reck/Alan C. Hawkins/ IG SOLAR Safenwil, 2003.

- Geneva

  The city of Geneva, called the Energy City, has developed an own solar power strategy for exploitation of the solar power potential inherent in its building assets at some 800 locations.[25] The strategy builds upon two project development and ownership models. In the first model, city administration takes over the responsibility for construction and operation of solar panels at new or renovated buildings. The electricity produced is sold to the local utility, Services Industriels de Geneva, which integrates it into its renewable energy product portfolio. The income goes to a specific solar panel construction fund. Since the program start in 1999 more than 800 square meters of building roofs have been covered in this way. In the second model, put into practice in 2004, the administration puts the public buildings at the disposition of private partners at no charge. The partnership is formalized in an agreement which gives the private partner the right and duty for constructing and operating of the installation and enables it to incur sales revenues from electricity production.

- Basel

  The real estate office of the local administration of the city of Basel recently disclosed a concept for optimal use of solar power and solar heat on federal-state buildings, totaling

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olarch.ch/"http://www.solarch.ch/

25 This is the spectrum of

some 1,250 assets. As a rule, the concept gives priority to thermal heat over solar power and defines exceptions from compulsory installation of either technology. By 2012 all assets need to be evaluated for aptitude. Moreover, solar installations constructed on buildings that are classified as appropriate for such projects will remain in federal-state administration hands, instead of leasing the corresponding surfaces to other parties. To do so, there will be either singular or joint call for bids for construction of all installations considered feasible. Operation and maintenance will be outsourced to various or a single service provider. Financing will be provided by the federal-state's own sustainability fund or investment budgets. [26]

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options considered by the Energy City label as well as the options mostly used by municipal decision makers when designing and implementing sustainable energy strategies.

26 Solar Panel Installation on A1 in Safenwil (translated), authors: Ruedi Hottiger-Reck/Al

SECTION 5:
Spain

This section provides an overview of the market in Spain, particularly as it relates to the promotion of solar projects on public property.

Overarching National Renewable Policy

Spanish Renewable Energy Plan (REP)

The Spanish Renewable Energy Plan (REP) 2005-2010 sets up the Spanish objectives in renewable energy generation, defines the global strategy for its achievement, and describes the framework by identifying regulatory aspects, market actors, market barriers, and R&D activities.

The Spanish Energy Policy is established by the Ministry of Industry, Tourism and Commerce (MITYC). The Ministry of Industry is advised by the IDAE (Institute for the Diversification and Energy Saving), an institute which is independent of the ministry. The IDAE is a public, business-structured organization reporting to the ministry through the General Secretariat for Energy. Its strategic goal is to promote energy efficiency and the rational use of energy in Spain, to support the diversification of sources of supply and promote the use of renewable sources of energy. IDAE is the organization in charge of the elaboration and follow-up of the Renewable Energy Plan (Plan de Energías Renovables) for Spain, 2011-2020 (PER 2011-2020), currently in draft format.

Royal Decrees (RDs) have been established mainly to achieve the political goals established in the REPs. For instance, according to RD 2818/1998, renewable electricity (RES-E) producers in Spain with a capacity below 50 MW were provided the option to choose between two different payment schemes:

- Fixed regulated feed-in tariff
- Market option (electricity market price plus a fixed premium).

More recently, in 2008 the Boletín Oficial del Estado published a new RD 1578/2008 regarding the feed-in tariff for PV plants. This decree established provisions that are in line with the REP 2005-2010 and update tariffs that were previously governed by RD 661/2007. The publication of the RD 1578/2008 was motivated by the following main factors:

- The growth of the installed solar PV capacity far exceeded the goals of the REP 2005-2010 after the publication of the RD 661/2007. For instance, the goal for the solar PV sector defined in the REP 2005-2010 was achieved far ahead of schedule in 2007.

- The need to promote the development of rooftop PV plants, according to the general policy of supporting distributed small plants and following the example of other countries such as Germany.
- The need to enhance the competitiveness of PV technology, putting pressure on market prices of solar modules to achieve convergence with the cost of conventional generation technologies within a reasonable timeframe.
- The desire to avoid the fragmentation of single plants to benefit from more favorable feed-in tariff (many parks have been divided into 100 kW plants, formally owned by different companies but managed centrally).

The new tariffs established by RD 1578/2008 distinguish between two types of PV installations, as shown in Table 2.

Table 2: PV Installation Categories under Spain's RD 1578/2008

Type	Description	Introductory feed-in tariff (€/kWh)
I	Installations located on the roofs or the façades of immovable, closed constructions, made of resistant materials, that are used for residential, service, commercial or industrial purposes, including agricultural uses. This type also includes installations located on immovable support structures used to provide shade or cover parking lots. These installations are further divided into two installation subtypes, depending on the capacity involved.	
I.1	Plants with capacity less than or equal to 20 kW	0.34
I.2	Plants with capacity greater than 20 kW and less than 2 MW	0.32
II	All other plants not included in type I (i.e., ground photovoltaic plants) Plants with capacity less than 10 MW	0.32

The total annual capacity quota is 500 MW and two thirds of it will be reserved for rooftop PV plants. Furthermore, there is no division of free-range plants into 100 kW sized projects and the tariff will only be paid for 25 years. It is also now mandatory for PV plants to deposit a guarantee of €500/kW for Type I.2 and €50/kW for Type I.1.

In 2012, it is expected that a decree will be issued regarding a new compensation structure.

General Role of Public Authorities

The role of the State General Administration and other public authorities is to take exemplary actions on the removal of technical, administrative, and market barriers for renewable energy development and promotion of energy efficiency and the rational use of energy.

Activities Related to Solar

The autonomous communities have established their own measures to promote renewable energies through their Energy Plans, based on the National Renewable Energy Plan (REP) 2005-2010. Spanish municipalities have been adopting this measure to promote the implementation of RES-E technologies in new as well as in old highly refurbished buildings.

Many municipalities have taken initiatives to improve the sustainability of their cities through solar initiatives on public properties. In general, there are no expedited permitting processes or special incentives for renewable generation placed on government property and/or along highways or waterways.

Listed below are some examples of municipal solar initiatives:

- Barcelona

  A 1.3 MW solar PV plant in the Forum Barcelona area (Figure 7).

Figure 7: Photovoltaic Pergola in Barcelona

- Castilla-la Mancha

  Under Law 1/2007 to promote renewable energies, energy saving, and efficiency, all the buildings owned by the autonomous body, public companies, and other entities comprising the regional public sector as well as the public buildings to be constructed or acquired in future shall be compliant with the Technical Building Code, regarding

energy efficiency and renewable energies. This includes a minimum solar-thermal contribution for water heating and photovoltaic contribution for electricity production.

- Andalucia

  Under Law 2/2007 to promote renewable energies, energy saving, and efficiency in the community of Andalucia, regional public buildings shall incorporate solar energy installations that can be replaced or be complemented with other energy sources as cogeneration or residual heating.

- Island of Grand Canary

  There is about 100 kW of solar power installed on the roof of every public school, adding up to a total 3 MW.

SECTION 6:
Summary of Key Findings

This section summarizes key findings from examining the regulations and developments in Germany, Austria, Switzerland, and Spain, with respect to renewable project development on public property.

Key findings include:

- Until the last few years, it was commonly accepted that municipalities in these four jurisdictions should not play a major role in electricity generation apart from establishing local conditions favorable to the permitting of and private investment in renewable facilities. In recent years, the municipal role has expanded to include facilitating project development on public lands and buildings, but again these projects are almost always owned and operated by private investors.
- Germany and Spain are clearly the most proactive countries to use public buildings and lands for renewable project development. However, municipal resources are often not exploited by the administration itself, but rather by local utilities or private developers. In return, municipal authorities incur income from land sales, leasing fees and taxes.
- For the most part, lack of public ownership of renewable projects is attributable to considerable investment requirements, economic risks, and other institutional barriers.
- A wide range of ownership and operating models for projects on public lands and buildings have been demonstrated in the jurisdictions examined. The various models for private participation enable the municipality to promote civic participation and put forth a progressive image to the public. Public-private partnerships are becoming increasingly more common and several different models for these partnerships have been developed.
- In all jurisdictions examined, there has been minimal or no development of small wind projects on public transportation corridors or PV project development along railways or waterways. The use of such corridors for distributed generation projects may be limited in large part by environmental constraints, safety concerns and opposition from the public.
- The local public, largely motivated by climate change protection and sustainable energy policy, can serve as a driving force behind municipal administration action to promote local renewable project development on public property. This has lead to considerable differences in the intensity of renewable energy use by regions or municipality.
- Increased activity by the public sector is expected to occur throughout Europe stemming from the solar water, heating and cooling provisions of the EU Directive 2009/28/EC. This directive stipulates that "Member States shall ensure that new public buildings and existing public buildings that are subject to major renovation, at national, regional and local levels, fulfill an exemplary role in the context of this Directive from 1 January 2012 onwards. Member States may, inter alia, allow that obligation to be fulfilled by complying with standards for zero energy housing, or by providing that the roofs of

public or mixed private-public buildings are used by third parties for installations that produce energy from renewable sources." (Article 13.5)

- In Germany, recent amendments to the Renewables Act pave the way for project development on slopes along highways and railways and noise protection (abatement) walls along motorways. These areas have been added due to their large potential for solar power development and the significant economic savings and conservation of land that results from project development in these categories. For instance, solar panels attached to noise abatement walls may contribute to covering the costs for building and maintaining the walls.
- The approval of land use related to noise abatement walls along highways for solar power boosted the interest from both municipal authorities and private investors. Numerous planned projects have been announced in public and municipal activities for exploitation of the corresponding potential is occurring in even greater numbers. Local/municipal development plans are being adjusted to support private investors' desires to use lands purchased or leased from municipalities. They also have economic objectives to utilize public-private partnerships on these lands, as has already been achieved on public buildings.
- In Germany, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety has provided funds for building solar panels at schools and installing visualization tools to assist student's education. One program, Solar Support for Schools – Making Renewables Visible covers 400 schools. The initiative also provides federal support for investments in energy efficiency and renewable energy by industry, municipalities, and consumers. Up to €400 million will be made available in 2011 from the sale of CO2 emission allowances.
- Solar projects built on municipal property tend to take more lead time than projects on private land. Typically there is a more lengthy and complex approval process, particularly if public safety, health, environmental impact, insurance, or other issues are of concern to public authorities. Moreover, public procurement procedures may apply, which tend to be more cumbersome than those found in the private sector. For instance, public announcement and invitation to bid may be required for finding the contractual partner(s) in a public-private partnership. Finally, objections from public and political parties may delay project implementation.
- We found no expedited permitting processes or special incentives for renewable generation placed on government property and/or along highways or waterways.
- Municipal authorities are increasingly required to check their internal processes for sustainability and energy efficiency and to serve as an example to the private sector.