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PRIME LIKE PROJECTS

Intelligent Energy Europe

Solar power systems as citizen-financed enterprises

Community solar power systems make it possible even for private individuals who do not own a home to take part in solar power projects. Moreover, economies of scale make larger projects attractive. The price per square metre of photovoltaic module tends to drop with each additional kilowatt of output installed (kW_p[1]). The return on larger installations can also be increased by means of more sophisticated technology. It is often possible for community systems to be installed in well-chosen, particularly sunny locations. The owners of these locations must of course make them readily available for this purpose (these could, for instance, be municipal and local authorities). However, participation in a solar power project – as opposed to investment, for example, in savings bonds with a fixed rate of interest –contains a large element of chance and risk, since the shareholder becomes an entrepreneur, thus accepting the risk of making a loss. Three successful examples will now be described. As the installation procedure varied in each case, the different methods can be compared so as to assess the advantages of each particular model.

Example 1: Installation of a citizen-financed solar power system on municipality building rooftops in Zwischenwasser (Austria) 3056 inhabitants

Initiators:

The *Interessengemeinschaft Erneuerbare Energien Zwischenwasser* (Zwischenwasser Renewable Energy Sources Interest Group) organised a series of large-scale events designed to provide information to the public and launched a participatory project with the aim of installing a community solar power system on municipality building rooftops in the village. This also included the region of Vorderland (12 municilalities). The main supporter of this initiative was the mayor, Josef Mathis, who was responsible for having the first community solar power system installed in 1997.

Purposes of the project:

Use of solar energy as an alternative to atomic energy, political awareness and the shift towards citizen-financed participation in renewable energy sources were the main factors in the implementation of this project in the parish of Zwischenwasser.

Description of the project:

In 1997 the first citizen-financed 5.5 kW_p photovoltaic community solar power system was installed, with 364 people taking part. As a result of this initiative, community systems were installed in a further 16 municipalities in Vorarlberg. This put pressure on the regional state government to give financial support to this kind of project. From 1999 onwards, the regional state government provided a subsidy of 30% of investment costs. In October 2001 the Vorarlberg regional government established particularly good rates for feed-in of renewable energy sources (€ 0.72 per kWh of electricity supplied, for a period of 15 years).

The Zwischenwasser Renewable Energy Sources Interest Group put forward a proposal to the local authority with the suggestion that interested individuals whose own roofs were not suited to installation of photovoltaic panels should have public building rooftops made available to them. Furthermore, the municipality should take on the preliminary financing, administration and settling of accounts, and in addition underwrite the risk for any unsold shares. The local authority agreed to this proposal. Panels were installed on the two available rooftops, one system having a 17 kW_p and the other a 13 kW_p output, making a total output of 30 kW_p. One share was defined as 1 kW_p (approximately 8.5 m² of photovoltaic module with an average annual output of approximately 920 kWh of electricity). The smallest share was therefore € 6,800 net. All 30 shares were sold within a short time to keen investors. Income earned by supplying electricity to the national grid is credited to the investors. Investors receive the higher-rate feed-in tariff for 15 years, in accordance with the provisions established, and after this period of time has elapsed, electricity generated and used in municipality buildings will be remunerated in line with the current daily price (purchase price for green electricity from the national grid) and paid to investors by the municipality. The basic idea is that the municipality does not have to buy from the electricity supply company the proportion of its electricity requirement which can be supplied from the solar panels on the municipality building rooftops. Costs saved in this way are credited to the investors. The systems are run for their entire lifespan of

[1] Kilowatt peak (kW_p): Kilowatt peak is the output of a photovoltaic module under standard test conditions: global radiation 1.000 W/m², cell temperature 25 degrees Celsius, insolation levels for central Europe. This roughly corresponds to the maximum output of the solar module at around midday on a very cold sunny day in winter. In summer the cell temperature increases and the cell output therefore decreases.

more than 20 years. Appropriate legal agreements were drawn up between the investors and the municipality. By taking out loans repayable from the income on electricity fed into the national grid, it was possible for individuals with little or no capital of their own to participate in the project.

Further measures:

The "Citizen-Financed Solar Power Project" is one of many schemes devised to reduce CO_2 emissions and to protect the environment. Another example of this kind of venture is the first solar school in Austria, set up in 1990 in Zwischenwasser, which covers 70 % of its heating and its entire hot water requirements, from solar energy. The school became an internationally recognised model of solar architecture as a result of its technologically sophisticated energy scheme. A central biomass heating system was installed in 1994 to supply several public buildings: the primary and secondary schools, *Frödisch* Hall with public house, local administration offices and kindergarten).

Assessment of the project:

Transferability:
There is also enormous potential for the use of solar energy in Europe, where a vast number of municipality building rooftops are available for use. Required are feed-in tariffs, as for example guaranteed in Germany by the Renewable Energy Sources Act[2], favourable conditions for obtaining loans within development programmes or other support mechanisms to make solar power projects economically viable and therefore popular to implement in many towns and municipalities.

Problems:
A possible obstacle to the implementation of this participatory model may lie in concerns on the part of local authorities with regard to two issues in particular: legal problems arising from use of a rooftop, and the financial risk for the municipality arising from liability cover for unsold shares.
Depending on the social structure and size of a village, social exclusion may result when particular households cannot participate in a project of this kind for financial reasons (social controls).
Also, this capital may prove difficult to mobilise during periods of real or perceived financial constraint in the economy as a whole.

Factors leading to success:
A high level of local authority support is provided in this case. Support is high not only for this project but also for the work carried out over a period of years – and thus the preparatory work – of the Zwischenwasser municipality in projects relating to local climate protection. The economic viability of solar projects of this kind is due to the high price offered for feeding in electricity in Vorarlberg, without which only a small group of idealists could or would take part in these projects. Great individual commitment by all participants is also essential, especially that of the initiators.

In brief:
Example counts: at least 10 solar power systems with a total output of more than 50 kW_p have been installed in private households in the municipality as a direct result of citizen-financed community power systems. Renewable energy is rapidly spreading in popularity. Privately and publicly financed solar power systems are being installed in several neighbouring municipalities. The strength of the project lies in the fact that the municipality bears the risks and also provides rooftops. This removes the greatest obstacles to implementation of community solar power projects.

Contact:

The Mayor:

[2] The Renewable Energy Sources Act (*EEG*) came into force in Germany on 01.04.2000 and regulates purchase and payment of electricity generated exclusively from renewable sources of energy by supply companies running networks for general electricity supplies (network operators). The Act specifies payment of at least 48,1 cents per kilowatt hour for electricity from photovoltaic systems over 20 years, including old systems from 2002. Degression in the rates of payment for electricity from solar power, as set out in the Act, will result in newly built systems receiving around 5% less annually from 1 January 2002. For photovoltaic systems installed in 2005 the feed-in tariff is at least 43,4 cents / kWh.

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Example 2: Construction of large-scale citizen-financed solar power systems in Munich (Germany), 1,205,923 inhabitants:

Initiators:

Plans for a community solar power system were developed by the Agenda 21 group of Haidhausen, an area of the city, and also by the firm *Gehrlicher Umweltschonende Energiesysteme* (Gehrlicher Environmentally-Friendly Energy Systems). The latter took the initiative in the early summer of 1998 by suggesting the idea to environmental associations and other interested groups. There followed a period of close collaboration with *Green City e.V*. (Green City registered association), which also took over running the campaign. Other initiators were: *Umweltinstitut München e.V*. (Environmental Institution of Munich, a registered association), *ENERSYS Energiesysteme*, *Wissenschaftsladen e.V*. (an organisation offering advice and practical support for consumers on science-related topics, a registered association) and *Haus der Eigenarbeit e.V*. (a practical, social and cultural centre for do-it-yourself enthusiasts, a registered association)

Purpose:

To enable people who did not have a rooftop at their disposal to take part in solar power projects.

Description of the project:

From 1994-1998 the public utility company in Munich set up a development programme offering payments to cover the costs of solar electricity (payment of 2 DM/kWh over a 10 year term). Initially this development programme was restricted to systems with an output of 5 kW_p. After the public utility company in Munich had installed a larger (approximately 40kW_p) community solar power system on the *Pasinger Fabrik*, a cultural centre, in the spring of 1998, they finally agreed by early summer of that year to the construction of large-scale participatory projects.

It was planned that as many individuals as possible would create an operating company to finance a photovoltaic system. Electricity customers of the public utility company in Munich were able to take advantage of the offer of cost-covering payments for electricity feed-in and they provided the investment total. They will get this sum back within ten years from the increased feed-in tariffs for electricity generated. 136 individuals raised an investment total of 3.5 million DM. This provided the means to install a solar power system with an output of 256 kW_p (kilowatt peak) and more than 2,200 square metres of modules.

Bulk orders lower purchase costs considerably. For example, a 1kW_p system was bought for 13,490 DM instead of between 15,000 and 18,000 DM. The owners of the three rooftops (*Steinbock Boss GmbH Fördertechnik* [materials handling technology], the regional state capital of Munich and the *Deutsche Post AG* [German Post Office]) supported the Solarpark 2000 Project and made their rooftops available either rent free or for a nominal rent. Research showed that the best legal form with regard to taxation and liability issues was a *GmbH & Co KG* (limited partnership with a limited liability company as general partner). With back up from *Gehrlicher Umweltschonende Energiesysteme,* the *Gehrlicher GmbH & Co. Solarpark 2000 KG* was set up.

This project yields a rate of return of around 6% per year. This is calculated before income tax. The degressive deduction means that each partner can receive a loss allocation and thus avoid paying additional income tax. The high tariffs for feed-in of electricity are guaranteed for 10 years by an individual contract with the public utility company. The business is run by the management, with individuals only receiving a statement of account and an invitation to the Annual General Meeting. All partners are co-partners of a Partnership under the Civil Code, i.e.

they are entrepreneurs in an ultra-small business. Limited liability and a comprehensive insurance package ensure that potential problems do not develop.

Further measures:

The solar park installed on the mail-sorting office has a large, four metre square electronic display board showing solar data and the daily output of electricity from the photovoltaic panels. The aim here is to attract people's attention to green electricity from solar power and provide information about how it is generated.

The photovoltaic panels on the south-facing roof of the primary school in Haidhausen are mounted above the school roof at a height of 30 metres and resemble a free-standing glass surface fixed above the main school roof. Information on electricity generation from this solar power system forms part of the environmental sciences curriculum. During physics lessons, current data can be retrieved from the system and the electricity output at any particular moment can be shown on a display board.

Building on the experience of this first large-scale citizen-financed solar power system, *Solarpark 2000 KG*, a further five similar projects were set up in Munich by 2005:

Solarpark 2003 KG
The first citizen-financed solar power system set up by *Green City e.V*. and *Natur Energieanlagen Projekt GmbH* (NEAP) [Natural Energy Systems Project Ltd] was installed on rooftops in Schluderstraße and Zum Künstlerhof, with an output of around 160 kW_p. The buildings belong to the *Gemeinnützigen Wohnungsfürsorge AG* (GEWOFAG) in Munich. GEWOFAG, a company owned by the regional state capital Munich, is one of the largest property owners in Munich and for almost 80 years has devoted itself to providing social housing. As well as its responsibility towards the citizens of Munich to build affordable homes, GEWOFAG is also committed to environmental issues and made the rooftops available free of charge for citizen-financed solar power systems, thus making an important contribution to climate protection.

Solar power system operating company, Arnulfstraße 2004
After preparation and planning by *Green City e.V*., a photovoltaic system of 174 kW_p was likewise installed on the roofs of houses belonging to GEWOFAG in Arnulfstraße 180 – 212 in Munich-Neuhausen. In this case it is a private operating company. The system was constructed by *Dold & Prudlo Solar GbR*. It was installed and is maintained by the firm *Dold Solarenergie*.

The *Solarpark 2004 KG*
The Solar Park 2004 has a capacity of 200 kW_p. The system is installed on several buildings belonging to GEWOFAG and on two old people's homes belonging to the *Münchenstift gGmbH* in Rümannstraße and St. Martin Straße. At least 40 partners participated in financing the seven units.

The *Solarpark Isar 2004 KG*
The Isar Solar Park 2004 consists of photovoltaic modules with an output of 20 kW_p installed on the roofs of the Bavarian Parliament building in mid November 2004. In addition to the rooftops of these well-known buildings, the roofs of two other properties formed part of the solar park. Most of the modules were installed in March and April 2005 on shade-free roofs with the best south-facing aspect on buildings belonging to the municipally-owned *Gemeinnützigen Wohnstätten- und Siedlungsgesellschaft mbH (GWG)* [a social housing company]. The system has a total capacity of around 240 kW_p. In this instance, modules built by the firm *Kyocera* were used.
Another section of the Isar Solar Park 2004 is situated on the roofs of the newly-constructed research centre of General Electric Global Research on the campus of the Technical University of Munich in Garching. GE modules were installed on the flat roof in an elaborate custom-built system. This solar power system has an output of 45 kW_p. More than 80 citizens participated in the Solar Park project thereby contributing towards a total output of 321 kW_p.

The Solarpark 2005
The Solarpark 2005, with a capacity of 252 kW, is due to be completed in 2006. *Solarworld* is installing 2,500 m^2 of solar modules on the roofs of the *Asam Gymnasium* (Asam Grammar School), on houses in Wilramstraße, Grafingerstraße and Reindlstraße and on some other rooftops. Almost all the roofs have a south-facing aspect. This project is also being financed by the participatory model.

Assessment of the project:

Transferability:
Transferability of this project is similar to that of example 1.

Factors leading to success:

In addition to effective campaigning, the funds provided by the participants were an important element in successful implementation of the project. Successful collaboration with other groups involved in Munich was also important. Professional management of legal and financial matters ensures the lasting success of the project. As in the previous example of Zwischenwasser, it was adequate remuneration for solar electricity that made implementation of a participatory project of this kind possible.

Problems:
Lack of time was the main problem with the first project. This was due to the time limit set on cost-covering payments by the public utility company, since this project was only devised shortly before the higher rates of payment came to an end.

In brief:
The high level of interest shown by individual citizens in the community solar power system *Solarpark 2000* exceeded all expectations. The project is in fact part of the Munich *Agenda 21*, which aims to allow people to experience the harmonious collaboration possible between economy and ecology and which offers participation in actual projects contributing to the conversion of the energy industry. One of the local authority's contributions to the project was the provision of rooftops free of charge, which is an important component in the climate protection programme in Munich. The attractive feed-in tariffs for solar electricity in Germany, and the experience gained during the course of the first project led to other large-scale citizen-financed solar power systems being installed in the city, some of them on the roofs of public buildings. It is planned to continue this trend in future.

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Example 3: Invested-in company *solarkomplex* in the Hegau / Bodensee region (Germany), 260,000 inhabitants

Initiators:

In the early summer of 2000 the *Singener Werkstätten*, a group of artists and architects, organised a workshop to which they invited prominent representatives from politics, science and culture to discuss the question of what form a "concrete Utopia" might take and in particular how it could be implemented. This led to the creation of the citizen-financed company, *solarcomplex*, as a *GmbH* (private limited company) in the autumn of 2000. At present there are around 200 partners in *solarcomplex*. In addition there are around 250 individuals and legal experts participating in *solarcomplex* projects through subsidiary companies.

The large-scale project "1 Megawatt of Photovoltaic Power in the Hegau / Bodensee Region in 365 Days", abbreviated to "*2003 1 MW*", was supported by a wide range of environmental groups, including the *Bodensee-Stiftung, BUND, Deutsche Umwelthilfe, FENSOL, Global Nature Fund* and *NABU.*

Purpose:

The motto is: "Don't just talk, act". One of the aims is to create a different kind of investment culture. The idea is to persuade people to take their money out of speculative investments in non-sustainable businesses and to invest it instead in real and manageable projects in the region.

Positively defined aims and successful projects should bridge the gap between theory and practice over a period of 30 years and this will enable a region to convert to a sustainable lifestyle by using

local renewable energy sources. In this process, the long-term aim is divided up into several intermediate stages. At the end of 2005, at least one large photovoltaic system had been installed on the roof of a public and visible building in each municipality. The entire output of all these systems came to around 2 MW. As well as the photovoltaic systems, a biogas plant, two wood-burning plants and a small hydroelectric plant were also being run by *solarcomplex* at the end of 2005.

The proportion of electricity generated by clean sources should reach 5% for private households. After this has been achieved, new intermediate targets will be set for the year 2010. The new plan should be created and implemented by as many people as possible in the Bodensee region.

Description of the project:

During the first few years, several citizen-financed solar power systems were officially set up as subsidiary *GmbH & Co KG* (limited partnership with a limited liability company as general partner) companies. Since 2003, only the extremely successful “6-kW Plan” has been developed. This has two great advantages: firstly, only the most suitable rooftops are used (for example on agricultural, local authority and industrial buildings), to guarantee maximum output; secondly, bulk orders and efficient installation of several systems of similar construction on large roofs ensure low costs. “Output up, costs down”, that is the simple message behind the successful “6-kW Plan”, which achieves a return of around 6 % – the highest level for photovoltaic power nationally. In addition, a tax-efficient loss allocation can also be claimed.

Installation of around 2MW of photovoltaic output clearly demonstrates the success of the *solarcomplex* “6-kW Plan”. This represents an area of around 20,000 m^2 of modules. Around 2 million kWh of solar electricity are generated annually, enough for more than 2000 people or around 700 households. Compared to conventional electricity generation, this saves around 30,000 t of CO_2 emissions over the life of the solar panels. At a time of poor economic performance in the construction industry, the investment total of around 12 million euros to date provides a modest boost to the regional economy. The solar power partnership of the *Volksbank eG* in Konstanz, the *Deutsche Umwelthilfe* and *solarcomplex* aim to continue the construction of one megawatt of new solar power systems per year in the west of the Bodensee region. The *Volksbank* still offers favourable financial conditions, the *Deutsche Umwelthilfe* also supports the project, and *solarcomplex* has the task of finding investors and more rooftops, constructing the solar power systems for a fixed price and offering a comprehensive service package for 20 years.
Solarcomplex draws up the contracts for use of suitable rooftops, finds individuals and companies to be investors, plans and constructs the solar power systems and ensures monitoring and insurance of the systems over the whole life of the feed-in tariff of the EEG (Renewable Energy Sources Act). The entire system is divided into physically separate units each of around 6 kW, which belong to individual investors. The electricity generated is fed into the national grid, and the profits – guaranteed for 20 years through the EEG –are paid directly to the investors by the local electricity supply company.
In the west of the Bodensee region, only the most suitable rooftops are selected for the construction of large solar power systems. There must be at least 150 m² of unobstructed roof surface, an almost perfectly south-facing aspect and no shade. The modules will generate an initial annual power output of around 950 kWh per kW installed.
Solarcomplex recommends taking out loans at favourable rates of interest through each individual’s own bank to finance the 6-kW units, for example with project partner *Volksbank eG* in Konstanz, or *KfW* (the federal reconstruction loan corporation in Germany). Each investor builds his or her own solar power system, but *solarcomplex* offers a comprehensive service package to deal with potential problems. This includes a basic damage and liability insurance for all the solar power systems. The remote monitoring system is directly linked to *solarcomplex*, which means that maintenance work can always be carried out promptly. As part of the service package, *solarcomplex* also carries out all repairs and maintenance work, thus ensuring smooth running of the system over its entire life.
Payment is guaranteed through the EEG for 20 whole calendar years, plus the year in which the system comes into operation. This amounts to 0.518 euros per kilowatt hour fed in (for systems coming into operation in 2006 and up to 30 kW in output). Set against total outlay, total payments on electricity generated give an attractive return of around 6% annually. In addition, tax can be claimed on deficits of around 30 % of the total investment in the first year of investment.

Assessment of the project:

Transferability:
See also examples 1 and 2. One of the unusual features of this example is its focus on creating a comprehensive plan for the Hegau region, and not simply on constructing one community solar power system.

Problems:

One real problem is that broad sections of the population lack basic knowledge about possible uses for renewable energy sources and its real potential in the Hegau region. This leads to doubts over the feasibility of accomplishing a shift in regional energy policies.
The “6-kW Plan” requires a relatively large investment total, thus restricting participation to companies or to the well-off.
There is some resistance from local authority institutions, for example energy agencies in which local authorities have a share, as they feel that there might be some overlap in the services provided.

Factors leading to success
A professional approach and professional implementation of the projects are absolutely crucial to long-term success. An attractive return on investment is also essential. Credibility is lent to the whole enterprise by forging a wide network of alliances and also having support from nature conservation agencies and from the advisory board, whose members are Prof. Dr. Hartmut Grassl, Managing Director of the Max Planck Institute for Meteorology in Hamburg, Prof. Peter Hennicke, President of the Wuppertal Institute in Wuppertal and Prof. Dr. Rolf Kreibich, Director of *IZT* (The Institute for Future Studies and Technology Assessment) in Berlin.

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Citizen-Contracting and the Solar & Save Initiative

Citizen-contracting is based on the idea that efficient energy use can be applied profitably to a variety of services. This led to a scheme to combine climate protection measures with an attractive green investment offer which would appeal to the average man in the street. The plan was developed at the time that new support policies for renewable energy sources were being introduced (the Renewable Energy Sources Act [EEG] came into force in April 2000). The plan is financed by private citizens and involves projects using renewable energy sources which at the same time increase energy efficiency.

Citizen-contracting is a kind of energy service. Energy service means in essence that an investment is not implemented by the user, but by a third party, the energy service company (ESCO). The latter undertakes planning, financing, installation and maintenance of the solar power system.

Supply contracting is construction and running of an energy conversion system (heating boiler, small scale cogeneration etc.). Refinancing is effected by the sale of available energy, normally linked with improvements in efficiency during the energy conversion process. Energy performance contracting (EPC) involves investment in technologies which make more efficient use of energy. Investments are made in maintenance, improvement and refurbishment of systems and buildings without putting a strain on the budget of owners or public authorities, thereby also leading to energy saving and a reduction in costs. Refinancing is effected by the savings made in energy costs, and the reduction in CO_2 emissions benefits the environment.

The ECO-Watt Project in Freiburg (Germany), 200,000 inhabitants

Initiators:

This project was based on an idea devised by staff at the Eco-Institute of Freiburg and the Fraunhofer Institute for Solar Energy Systems (ISE). As the Eco-Institute had insufficient funds to finance the project, in June 1998 five private individuals set up *ECO-Watt GmbH*. This company is a general partner of *ECO-Watt GmbH & Co KG*, the company that is implementing the project.

Purpose of the project:

Energy service models such as this one serve to mobilise regionally available capital from private households for the purpose of climate protection. This provides opportunities for investment in projects that would normally not be feasible.

Description of the project:

After investigation and planning phases had been carried out between 1997 and 1998, the project was given the go-ahead in April 1998. June 1998 saw the beginning of the campaign to attract investors. A capital sum of 550,000 DM was required for investment in energy-saving measures for heating, electricity and water supplies and also for solar power. At the same time as complete modernisation of the energy requirements of Stauding Comprehensive School in Freiburg (e.g. changing the lighting to a daylight-sensitive system, improvements in ventilation and room temperature controls, solar powered hot water, water-saving measures, load management), a photovoltaic system was to be installed on the roof of the school building. The aim of the Solar and Save investment was to reduce the school's annual electricity requirements of 120,000 kWh from conventional sources to 30,000 kWh. The investment target was a minimum reduction in electricity consumption of 20 %, in heating consumption of around 30 % and in water consumption of 36 %.

The capital was raised by offering shares as sleeping partners to teaching staff, parents of pupils at the school and other private citizens. The aim was to raise at least 400,000 DM by means of sleeping partners, with the remaining amount financed by a loan from the Eco-Bank. In order to attract partners to the project, an investment brochure was produced promoting climate protection as a capital investment und giving a description of the project. The aims of the project were presented to the parents and pupils of Stauding Comprehensive School at three separate meetings. In order that as many parents and teaching staff would participate in the project, the minimum investment required from local people was set at 1,000 DM. In order to keep administration costs down, the minimum amount for external investors was set at 5,000 DM. Acquisition of funds was carried out by *FESA* (a trustee representing the interests of the investors) and the *ECO-Watt GmbH*. The total amount raised by participants in the scheme came to 478,000 DM.

An energy-saving agreement was drawn up with the city of Freiburg to run for an eight year period. Savings made in energy and water costs over this period are passed on to the ECO-Watt Project. Interest from this source of income is paid on the capital and refunded after eight years. The investors are regularly given information on the progress of the project. On the cautious assumption that the new systems will last on average 18 years, the economic benefit to the city of Freiburg can be calculated at over one million DM.

Further measures:

In conjunction with the investment programme carried out as part of the ECO-Watt Project, a range of educational activities were run, providing information for pupils, parents and teaching staff. A series of project days and project weeks covering energy-related topics were organised, and the topic of climate protection in all its many aspects became a central theme of other teaching subjects.

In this school, it is now normal practice for the older pupils to give the new pupils of Class 5 background information on the ECO-Watt Project and to explain how they can contribute to energy saving by correct use of the ventilation system and light switches. Energy-saving competitions are organised for all classes of Stauding Comprehensive School, with the aim of inculcating energy-saving patterns of behaviour into all pupils. Once the solar power system was running successfully, one member of the teaching staff started training her own team of "Energy Detectives". This involved showing pupils of one Class 6 in the lower school how to find ways of saving energy at home and how to act on their findings.

The Solar & Save Initiative in North Rhine-Westphalia (Germany) as follow-up action

When the **"**100 000 Watt Solar Initiative for Schools in North Rhine-Westphalia – Energy School 2000+" was launched in 2000, this new ECO-Watt approach was also introduced in another region of Germany. The Solar & Save Project combines installation of solar power systems (up to an output of 50 kW) with measures to modernise lighting and introduce other energy-saving procedures. In specially selected schools, about 50 watts of solar energy per pupil are generated. A further 50 watts per pupil are saved by other energy-efficiency measures (e.g. energy-efficient lighting, heating and ventilation systems). This leads to savings of 100 000 watts in an average school with 1,000 pupils.
Between November 2000 and March 2002, the first project was successfully completed at Aggertal Secondary School in Engelskirchen. A four hundred square metre solar power system was installed on the roof of the Aggertal Secondary School, and the lighting system was refurbished. This is the largest solar power system in operation in the region up to the present date.
At the same time, three more projects were set up as part of the "100 000 Watts Solar Initiative". For example, at the Willibrord Secondary School in Emmerich/Rhine, a project was set up in co-operation with the municipal authorities, the Emmerich public utility company and the school. This involved installation of the largest solar power system in the Lower Rhine region financed by individual citizens (50 kW_p), modernisation of the lighting system, refurbishment of the heating and ventilation systems, and the installation of a small natural gas-fired cogeneration system.
The other two projects are being implemented at the Berger Feld Comprehensive School in Gelsenkirchen and at the European School in Cologne.
What makes these projects so different is the fact that they were realised through private citizens' participation. The investors took out shares as sleeping partners in the *Solar & Save Contract GmbH & Co. KG*. The company then invested the money in a solar power system and other energy-saving measures (as described above). In return, the company receives the return on the energy which the solar power system feeds in to the local energy supply company. The company also receives the energy costs saved by the municipality. After taking into account the running costs of servicing loans and business operating expenses, the surplus will be paid to all participants over a period of 20 years.

Assessment of the project:

Transferability:
In Europe there is great potential for saving energy in schools in which the right conditions prevail. The annual costs for electricity and heating must be more than 100.000 Euros. For the installation of photovoltaic systems good supporting mechanisms like the Renewable Energy Sources Act (EEG) in Germany are required.

Problems:

One major problem is that the ESCO has a great deal of preparatory work to carry out before the agreement is concluded (choose suitable building, devise energy plan, find investors etc.). Most ESCOs are put off by the economic risk involved, as well as by the high cost of transactions resulting from the large number of small investors.

The following reservations expressed by local government may cause a problem:

Outsiders are given access to internal local government affairs.

The impression might be given that outsiders – and ESCOs *are* outsiders – are better at devising energy and cost-saving measures than local government staff.

With respect to costs, the ESCO has to be co-financed. This means that not all cost savings are passed on to the municipality, because a proportion has to be used to pay for the ESCO's services.

Factors leading to success:
Small private ESCOs are often satisfied with a lower return than large investors would be. Moreover, financing of project by individual citizens increases the ESCOs' equity capital, making it easier for them to be offered loan capital by the banks. This makes it possible to carry out projects with a low profit margin. All participants in this kind of project are highly committed and closely involved with the energy-saving measures being introduced on each building.

This project combines behaviour-related and technology-based savings potential, thus improving overall cost reduction outcomes and making energy into a real topic of interest for all users. A further helpful factor is that the investors in energy-saving schemes and the actors are often the very same people.

In brief:
The project offers an opportunity for innovative participation and is easily transferable to other municipalities. As a result people can more easily identify with the aims of climate protection, and energy efficiency measures and use of solar power become more widespread.

The project also demonstrates that climate protection at local level is good for local business. All the schemes were implemented by small and medium-sized firms. More than half of the investment sum is allocated to wages. In this way, electricity and oil imports are replaced by innovative technology and labour locally. This increases employment, strengthens buying power and stimulates the local economy.

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1.3 Conjointly use of renewable energy sources in rural municipalities

In small rural municipalities dependent on agriculture and forestry, biomass is of great (economic) importance. Farmers and forestry managers are increasingly realising that it is possible to earn additional income and save money by using biomass as an energy source. This makes them more receptive to all types of renewable energy. As there is usually a strong sense of community in these rural areas, recent years have seen an increase in the number of community energy projects which use biomass as the main form of energy.

Example 1: The Environmental Mix Project in Greußenheim (Germany), 1,600 inhabitants

Introduction to the project:

When Agenda 21 was signed in 1992 in Rio de Janeiro, a global partnership of 179 countries thereby committed themselves to maintaining the integrity of life-support systems for future generations. Within Agenda 21, Article 28 is devoted to local authorities. They are described as having a vital role to play in shaping international development, as towns and villages have to address environmental issues directly. They need and use natural resources and this affects living conditions in other parts of the world. Political decisions taken in municipalities affect all of mankind directly, but people can also participate directly in shaping their local environment. That is why, in Article 28 of Agenda 21, all local authorities throughout the world are called upon to adopt their own Agenda 21 locally, based on their own particular local conditions. Those people involved in the process should seek consensus on future development locally and all participants should agree on any decisions taken during the consultation process.

Initiators:

The initiators of the Environmental Mix Project were the mayor, Bruno Scheiner, and Agenda 21 representative Raimund Fischer of Greußenheim.

Purpose:

The main purpose of this project was to get citizens involved in sustainable development in the municipality. This can only happen through collaboration *with* the local inhabitants and not *without* them. Awareness of environmental issues must be strengthened and increased and volunteers need to be encouraged. The true purpose becomes clear in this version of the original African verse, now adapted to fit Greußenheim:

Many little people
In many little places,
Doing many little things,
Will change the face of
Greußenheim.

Description of the project:

The Agenda 21 process in Greußenheim uses the slogan: “Join in – think, talk, act!” Over a period of two years, at least 30 private individuals devised guidelines and development targets based on the principles of sustainability through a series of workshops, events, citizens’ forums and publications aimed at the municipality of Greußenheim. In the last four years, citizens have been very active, and the level of participation is high. This has led to agreement on the need for sustainable development in the municipality, including plans to slow down the greenhouse effect by using alternative sources of energy in Greußenheim. The projects were planned and developed by the municipality, in accordance with Agenda 21 objectives, and some of them were also conjointly implemented. An inventory was drawn up, listing the existing available municipality resources and energy use, and guidelines and strategies for future development were agreed. The projects and strategies described below were assessed and implemented by citizens on the basis of their environmental compatibility. The various projects involving energy use in Greußenheim, in particular the use of biomass, employed a variety of participation models, but all were designed to fit in with Agenda 21 objectives. A brief description of a selection of the projects now follows:

Heating and electricity from alternative energy sources –vegetable oil-fired small scale cogeneration power station
Since 1998, a central small scale cogeneration power station has provided heating and electricity from cold-pressed vegetable oil to around 30 households in the new housing development of Eselsweg in Greußenheim, thereby replacing all the individual oil-fired heating systems. The house owners have formed an operating company. Some other older properties nearby are now also connected to this local heating network.

Heating provided by a wood chip heating system
In the old part of the town, there are nine public buildings situated in close proximity to each other (church, rectory, parish hall, town hall, kindergarten, voluntary fire fighters' depot, building depot, school and community hall). These buildings are also adjacent to private housing. Ten local people have formed an operating company and since 2000 have been running a wood chip heating system which provides these public buildings with heating and hot water.

Solar cells operate a fountain in the town hall square
At least ten private citizens have participated in individual schemes to install photovoltaic systems, thus contributing to the use of alternative energy sources and putting into practice the guidelines set out by the municipality of Greußenheim. When simple improvements were made to the village, a fountain was also installed in the church square in order to enhance its appearance. The water is pumped through a closed system, with a photovoltaic panel on the town hall roof providing the power. The pride felt by the locals in this achievement is evident in this short rhyme: "The sun on the roof it shines away, giving power to the fountain all through the day."

Cold-pressed vegetable oil to drive diesel-powered cars
At least ten households are saving resources by running their vehicles on cold-pressed vegetable oil instead of diesel, and at the same time avoiding using the energy which would be required for transporting crude oil over long distances.

Other measures:

- Purchase and sale by the municipality of industrial sites, including an obligation to take measures towards sustainable development. It has also bought up land ear-marked for development and made building plots available to families with children at favourable rates
- Sinking of a new well, including a water protection area of around 70 hectares, converted from intensive arable use to extensive grassland use
- Holding an annual eco-fair
- Development of strategies for creating and marketing alternative farming methods

Assessment of the project:

Transferability of biomass and solar power plans:
There is great potential for using biomass and solar power as energy sources in the vast majority of rural areas. Locally available energy sources can be used and their use can be adapted to suit local requirements. Therefore integration into a local Agenda 21 project is likely to make better use of this potential.

Problems:
The main problem is keeping the Agenda 21 process going over a long-term project and involving all the relevant groups. This also applies to combining and coordinating the activities, which is of particular importance in view of the variety of projects.

Factors leading to success:
Support by the municipality and the initiators for the entire Agenda 21 process is vital for successful implementation of biomass and solar power projects. Cooperation with other institutions, for example the University of Würzburg, is also a factor in contributing to success.

Publicising success stories locally encourages people to persevere with a project. Recognition from outside, for example by conferment of the Energy Globe Award or the Climate Alliance's Climate Star, can also help towards a productive outcome. Small projects, whose successful results can be seen relatively quickly, are particularly useful in this respect. It is also useful to produce figures showing tangible success in climate protection, for example by providing a CO_2 emissions balance sheet.

In brief:

The municipality of Greußenheim is well on the way to becoming a model municipality in its use of renewable energy sources. This is due to the variety of measures it has introduced and successful implementation of individual projects. Above all, the key to success can be found in the close interlinking of municipality and private initiatives and in the variety of ways to participate.

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Example 2: Three kinds of renewable energy within one community in Antiesenhofen (Austria), 1,100 inhabitants

Initiators:
At the beginning of the 1990s, a group of local people began to develop an interest in the use of renewable energy sources for a wide variety of reasons.

Purpose of the project:
It started when a sawmill owner, whose small hydroelectric plant no longer had enough capacity to supply all the power needed for the business, started looking for ways to make use of the by-products of his business (wood chips, wood shavings etc.). At around the same time, the twenty year old oil-fired boiler which supplied power to the local school and kindergarten centre had to be replaced. In addition, local farmers had been suffering the after-effects of the severe gales which had swept across the region in 1990. They had not found a way of using all the fallen timber resulting from the storm damage.

Description of the project:
At the beginning of the 1990s, a group of interested citizens – with the support of the mayor at that time –set up the *Nahwärme Antiesenhofen GmbH* (Antiesenhofen local heating company) with the aim of using local renewable energy sources. A local heating network running on biomass came into operation in 1993. The boiler, which is called EDUARD, is run on wood chips and has an output of 1 MW. The local heating system currently provides environmentally-friendly heating from biomass to 60 individual homes, 3 multiple-occupancy homes and 14 industrial premises. Moreover, a range of municipality buildings are also connected to the local heating network: kindergarten, school, local authority offices, cultural centre and local authority building depot. Since 1999, the hot water supplied by the local heating network has been provided by a cogeneration system run on landfill gas during the summer, which means that the boiler only has to be run during the period in which it is also needed for heating purposes. The 8 cylinder gas-fired engine has a heat output of 340 kW and a power output of 190 kW. Electricity produced is fed into the regional electricity supplier's network. The landfill gas is transported by a 3.8 km long gas pipeline from a landfill site to the gas-fired engine. Since 2002 there has also been a biogas system, which runs mainly on liquid manure and silage from local farms. The biogas produced is also used in the cogeneration system. The ratio of biogas to landfill gas is about 2:1.

These biomass systems are of great economic importance. Three local farmers are employed part-time to carry out maintenance of the heating systems, heating sales and administration of the local heating network. Since the *Nahwärme Antiesenhofen GmbH* was set up, around 3 million euros has been invested in the biomass systems and the local heating network. Around half of the return on this investment has benefited local firms. Every effort

has also been made to use the remaining investments for providing contracts to firms in Upper Austria. Sales of firewood to the *Nahwärme Antiesenhofen GmbH* provide local farmers with guaranteed additional income.
At present, 70% of the heating requirement and 65% of the electricity requirement in Antiesenhofen are supplied by renewable energy sources.

Other measures:
In addition to the large-scale projects described above, there are other small-scale renewable energy systems in operation in the municipality of Antiesenhofen. It is worth mentioning the two small hydroelectric systems of Hinternberg and Bruckmühle with a power output of 200 kW and 120 kW respectively. Biomass heating systems have also been installed in some buildings which are situated too far away from the village to be connected to the local heating network. Additionally, solar power in Antiesenhofen is generated by a number of solar power systems.
The municipality of Antiesenhofen provides a range of advice and support services to encourage the use of renewable primary products.

Assessment of the project

Transferability:
Conditions such as those in Antiesenhofen are to be found in many European rural settlements. If individual citizens recognise the advantages of renewable energy sources as a means of improving their lives, and if they are prepared to commit themselves to making use of them, with support from the local mayor and local government, then it will be possible to set up similar projects across Europe wherever there are sufficient financial and technical resources.

Problems:
There needs to be an awareness of the pitfalls and potential problems in initiating any project of this kind. There may also be a shortage of funds to invest in new energy technologies. The established energy supply structure and vested economic interests may also continue to hinder change of this kind.

Factors leading to success:
Widespread awareness of local potential amongst the population, individuals' willingness to become entrepreneurs, and open-minded local government policies are all required if a decentralised energy supply system based on renewable energy sources is to flourish in rural areas.

Summary:
Communal use of renewable primary products and agricultural waste is now common in small rural cmunicipalities in Austria. This trend is also on the increase in Germany. Public buildings are not in every instance supplied with heating and power by the new systems, but in some places public buildings were, and still are, the first to use renewable energy sources. People in smaller municipalities are particularly keen to invest in community heating systems if their own homes can also be supplied by heating from these systems.

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