REVIEW OF OVERSEAS INITIATIVES THAT HAVE BEEN TAKEN TO INCREASE THE UPTAKE OF SOLAR WATER HEATING

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1. Introduction

This review of existing literature and other information has been commissioned by EECA and the Solar Industries Association to provide a summary of initiatives that have been undertaken around the world to increase the uptake of solar water heating (SWH).

The review has been undertaken by East Harbour Management Services and the Energy Library & Information Services (*EnergyLibrary*).

Many of the published sources of information that are available relate to the period up until 1999. For the period since then examination of various internet websites has provided information on current government initiatives as many governments use the internet as a means of disseminating information on specific policies to the public. However use of the internet as a source of information has resulted in uneven collection of existing initiatives. To address this problem, emphasis has been put into filling obvious gaps of information, but to be complete, governments would need to be approached directly. This was beyond the scope of this review.

2. Executive Summary

The driving forces for market development for SWH is reduced costs compared to other energy costs, increased use of renewable energy, and the desire to reduce greenhouse gas emissions.

Currently, the most important solar application is for residential water heating, although in Canada the government support is only for industrial facilities.

There are a significant number of market development initiatives being undertaken around the world and these are having beneficial results in assisting the uptake of solar hot water systems. This review reports only on a sample of those appearing most relevant to New Zealand.

There is no single factor that influences the uptake of SWH. Rather it is the cumulative benefits of a series of supportive measures. There are, however, certain essential components which combine to help create an environment in which renewable energy exploitation can succeed.

The successful initiatives appear however to follow an number of key principles which include:

- Significant support from governments
- Fiscal measures are often necessary to stimulate the market
- Improving building regulations to stimulate uptake of SWH.
- Information and promotion programmes

Europe

Solar water heaters have been a success in countries with such different solar irradiance and buying power as Germany, Austria, Greece and Israel. Other countries like metropolitan France hardly install any SWH anymore.

The Soltherm Europe Initiative has set out to realise 15 million m^2 of solar collectors in Europe by 2004. Soltherm Europe has united a number of European key market players and National campaigns will be launched. The Soltherm Europe Initiative aims to increase the awareness of customers as well as to mobilise the complete production and installation chain. In the campaigns, Soltherm Europe will especially involve the installers.

The initiative is based on analysis of the markets of different countries which shows that an effective policy boosts the penetration of solar energy much more than favourable climatic conditions. Guidelines, tools and effective market strategies will be created, so that a comprehensive European approach is developed.

Analysis also shows that the most obvious solar thermal market development strategy is the renovation market of water heaters in single houses and collective water heating systems. A crucial link in the market development is to give potential buyers good information and to guide them to trained and motivated sales and installation organisations.

A European Union DG-TREN study identified that subjective information has a decisive impact on whether a potential client will actually buy a system or not. In other words, the client's decision is based not only on hard facts, but also on the *perception* of these facts.

Fiscal measures may be implemented in the form of environmental taxes, or as a positive form of tax incentive for environmentally beneficial investment, such as a tax exemption or reduction. Both forms of fiscal support measure are increasingly being used by Member States. Member States, including Austria, Denmark, Finland, Italy, the Netherlands and Sweden, have now implemented various forms of environmental tax.

In some cases (including Austria and Italy), some or all of the revenues received from energy taxes are recycled to benefit renewable energy, energy efficiency, or other environmental projects.

Fiscal arrangements can also be used to encourage investment in renewable energy or energy-saving projects. For example, in Ireland, the Netherlands and Spain companies receive tax relief if they invest in SWH projects. In Greece, the installation of SWH water-heating systems has been stimulated by tax exemptions for households buying solar water heaters. In the Netherlands, companies and firms which invest in SWH can benefit from claiming accelerated depreciation of investment in equipment for such projects.

Three Member States (Austria, Germany and Greece) achieved significant increases in exploitation of solar energy for heat through substantial subsidies being provided to households or industry to install SWH.

Solar thermal is often not included in national energy policy targets because it is a heat technology and can most successfully be implemented at the local level.

Financial support to renewable energy schemes is found in almost all the Member State/ technology combinations studied, and is an important factor in influencing the successful implementation of SWH.

Information sources on renewable energies do not differ much between countries. Printed media are mentioned most frequently, followed by TV and radio; Internet comes last: information on SWH still follows a rather classical path.

54% of German users draw information for their system choice from independent tests.

SHW acceptance by the public is generally high. On the other hand, a majority of solar professionals, particularly in France and the UK, think that the public has a low opinion concerning their product and think that SWH are haunted by technical problems. Studies show that this is unfounded: in fact, the public is far more positive than the professionals fear.

SWH often suffers from poor publicity – even in Germany.

In all countries, only a minority of decision-makers feel that building codes are favourable for renewable energies.

The most important finding on technical problems is that SWH have almost twice as many problems in France and in the UK than in Germany and Spain. Installation problems occur in all study countries (most in Germany), problems with maintenance (first in the UK) and durability (high occurrence in France and Spain) have almost disappeared in Germany. Safety problems are rare, except in the UK. The single most important problem in France and Spain is tank durability, but does not occur in Germany and the UK where obviously better quality storage tanks are used.

Cost does not seem to be the decisive success factor for SWH: in Germany, systems are of the highest capacity and cost the most; in France, systems are somewhat smaller and cost half compared to Germany, but French respondents provided a shorter estimate of useful life. Spain and the UK are situated between the two extremes.

The public at large is not aware of incentives, apart from the case of Germany.

Subsidies are often considered to be detrimental to fair competition unless there is an open choice in terms of material and installation – without compromising quality.

Non-users would change their mind if SWH prices would drop or if energy prices would rise, further reasons being government approval, better technology and more information. Government endorsement towards SWH would reassure clients and facilitate their decision to invest in SWH.

The present lack of active influence by promoters and architects shows a potential market opportunity.

Greece provides subsidies of up to 45 %–55 % (depending on location) for the promotion of various investments. Hotels which invested in solar water heaters benefited considerably from this law. Greece also provides tax exemptions to households buying solar water heaters; 75% of the purchase value of a renewable appliance is deducted from a person’s taxable income.

In Austria the high level of financial support available for installing solar collectors has been one of the main reasons for the high uptake of these systems. Feldkirch in western Austria subsidises the installation of solar hot-water collectors by 25 %.

Upper Austria provides targeted support towards promoting the uptake of solar collectors through a wide-ranging programme. Initiatives include:

- Information and training for specialised installers
- Marketing activities
- Demonstration systems to show successful installations

In Germany GRS (Guaranteed Results from Solar Collectors) is an initiative established by several municipal utilities, co-ordinated by municipalities. Its purpose was to ensure that the annual amount of heat supplied by a solar collector was guaranteed by the manufacturer, thus allowing for precise cost–benefit calculations and ensuring that systems met customer needs. Its application has helped to boost consumer confidence in the quality of the new types of heating systems available in Germany, and in particular those produced by German manufacturers.

The UK government has established a sequence of targets to act as a stimulus to industry and to provide milestones against which progress to achieving its national energy policy goals can be monitored. 3% of UK electricity requirements are required to be met from renewables by the end of the year 2003, and 10% by 2010, subject to the cost to consumers being acceptable. The obligations are fulfilled by the sale and purchase of green certificates.

USA

The Million Solar Roofs Initiative announced in June 1997 has the objective of getting businesses and communities to install solar systems on one million rooftops across the United States by 2010. Solar thermal water heating systems for buildings and swimming pools qualify for inclusion in the Initiative.

The Million Solar Roofs Initiative is a federal programme designed to support states and local communities as they develop a strong commitment to the sustained deployment of solar energy technologies. To become a Million Solar Roofs State and Local Partnership, any state or local entity, on behalf of a specific Partnership, must set a goal for a specific number of qualified solar energy systems to be installed on buildings within a specific community. At a minimum, partnerships must commit to installing 500 solar energy systems by 2010.

Examples of activities the Partnerships may undertake as part of their plan include:

- Committing state and local government actions to overcome barriers to solar energy and energy efficiency applications in buildings
- Identifying financial incentives for solar energy installations
- Developing/modifying codes and standards that affect solar energy installations
- Implementing training programmes for building officials, the construction industry, solar energy system installers, and utility personnel
- Providing outreach support for solar energy and energy efficiency
- Taking part in national information sharing, peer-to-peer exchanges, and cooperative research and training projects
- Connecting the Million Solar Roofs Initiative with other sustainable community initiatives

The DOE does not direct, pay and control the activities at the state and community level. Instead, the Million Solar Roofs Initiative brings together the capabilities of the Federal government with key national businesses and organisations and focus them on building a strong market for solar energy applications on buildings.

Examples of partnerships under the initiative:

- The North Carolina Solar Center, established by the North Carolina State University, provides programmes and resources that help people take advantage of solar energy. Services available to the public include a toll-free hotline, a professional referral service, technical assistance and design reviews, free publications, curriculum materials for teachers, training programmes, tours of the NCSU Solar House and a reference and media library.

- In 1999, the North Carolina General Assembly unanimously approved a revised and greatly enhanced set of solar and renewable energy tax credits for the state's citizens, business and industry.

- The California Energy Commission provides grants to California residents to help offset the cost of purchasing and installing new solar energy systems. California residents who are purchasers, sellers, owner-builders, or owner-developers of eligible solar energy systems are eligible to apply. Up to $750 is available for eligible solar energy systems, except swimming pool water heating systems, which are eligible for a maximum of $250 per system. Single domestic water heating systems serving five or more single family dwellings or separate business units (multi-unit systems) that meet the Programme eligibility requirements are eligible for the lesser of (a) 50 percent of the maximum amount available on a per dwelling/unit basis or (b) 25 percent of total eligible system costs.

- Emerald Energy Services offers a cash incentive and a zero-interest loan to its parent electricity supply company customers to purchase a solar water heating system. There is also a state tax credit available.

- Since 1975, the City of Santa Clara has established the nation's first municipal solar utility. Under this programme the City will supply, install and maintain solar water heating systems for residents and businesses within Santa Clara. Solar equipment is offered by the city for the heating of swimming pools, process water, and domestic hot water. The pieces of hardware (solar collectors, controls and storage tanks) are owned and maintained by the city under a rental agreement. The renter pays an initial installation fee and a monthly utility fee. These amounts vary according to the size of the installation.

The U.S. Department of Energy established the National Database of State Incentives for Renewable Energy (DSIRE) through the Interstate Renewable Energy Council. The database is designed to contain all available information on state financial and regulatory incentives (tax credits, grants, special utility rates, etc.) that are designed to promote the application of renewable energy technologies.

There is a proposal in the US House of Representatives to extend the current Production Tax Credits for electricity generated by new wind power plant to cover solar energy. In this proposal there would be a 15% tax credit for home investments in SWH systems.

Australia

To meet the Federal government National Greenhouse Strategy of achieving an additional 9,500GWh of renewable energy by 2010 the States have each introduced initiatives based on Renewable Energy Certificates and / or rebates to encourage SWH. The installation of solar water heaters is included as a source of renewable energy certificates. The government rebate offered in some states, combined with the REC's payment is offset against the purchase price of solar water systems.

- The South Australia state government has announced that from July 2002, all new houses will be required to achieve a minimum energy performance requirement equivalent to a four star energy efficiency rating. SWH can contribute positively to the rating.

- SEDA and EnergyAustralia offer NSW homeowners rebates of up to $900 on the cost of a solar hot water system. Customers also have the option of paying off the system over two years as part of their energy bill.

- The Victorian Solar Hot Water Rebate programme has been designed to provide rebates for solar water heaters that replace conventional systems for a positive environmental effect. The Rebate has been structured so that it is generally a point-of-sale discount available from the manufacturer. Rebates of up to $1500 are available for solar water heaters installed under the Rebate programme. The amount of rebate is based on the performance of a system and the type of water heater that is being replaced.

- The Queensland Government has introduced the Solar Hot Water Rebate Scheme. The Scheme is aimed at Queensland residents who purchase a new solar hot water system or replacement parts for domestic purposes and install them at their principal place of residence. Rebates are available of $750 or $500 (if installed before the 24 May 2000) on the cost of a new solar hot water system with a panel collector area of 3.5 m^2 or greater (nominal two panel system).

- Since January 2002 Brisbane based retailer Energex has been offering an upfront payment of up to $830 for consumers buying a solar hot water system, under a revised Solar Certificates Programme. Acceptance of the rebate is conditional upon the applicant assigning the right to create renewable energy certificates to the State Government. Energex claim that their Solar Certificates Programme has processed more than 70% of RECs created by solar hot water systems. Energex customers can claim the REC's payment at the time of purchase from their solar water heater dealer and immediately realise financial benefits rather than to wait for their RECs to be registered with the Office of the Renewable Energy Regulator.

- The Government of Western Australia offers subsidies of up to $500 off the standard cost of a solar hot water system purchased after the 25th of November 2001 to homeowners installing an accredited gas boosted solar hot water system into a Western Australian residence.

Israel

Israel is the country with the greatest density of installations as it is compulsory to install SWH systems on all buildings under 8 stories high. Because of this compulsion there are no implementation programmes that appear relevant to New Zealand.

Morocco

The Moroccan government has established a programme to increase the use of SWH through a market-based strategy. The overall strategy is to remove the principal market barriers to solar water heaters in Morocco, thus increasing market demand, which in turn will lead to an increase in supply. The Moroccan solar water heater market is underdeveloped, primarily resulting from high prices, poor quality, limited promotion, and insufficient policy. The programme will address each of these issues and many of its components appear directly applicable to New Zealand.

Application to New Zealand

There is a common thread that links all government programmes reviewed. That is that there are mixture of initiatives available and they each need to be included in a well developed broad national programme. In each country where SWH use has increased significantly there has been a partnership between the government and industry to address the issues of quality standards, promotion and public perception. National targets appear very important, and the funding assistance (fiscal and / or financial) from government is very common.

3. Background

Market studies project IEA country market growth rates for SWH of 20-25% per year, and a ten-fold increase in the solar industry by 2010. (Sun in Action, European Solar Industry Federation).

- Current average growth rate for the European market has been 18% since 1989
- The industry is only just beginning to prepare itself for substantial growth
- The expected market growth is based on the technical potential for residential applications alone, which is 0.5-1.0 m² of solar collector/inhabitant

"Solar countries" such as Israel, Greece and Cyprus already have high "solar water heating penetration" (Israel has about 0.95 m² per inhabitant), whereas the best IEA countries Australia and Austria have a penetration of between 0.1 and 0.15 m² per inhabitant. The average solar penetration in IEA countries is roughly 0.02-0.03 m² per inhabitant; this would suggest that a strong growth of solar heating installations can be expected in the future. Driving forces for market development will be reduced costs, market information programmes, and the desire to reduce greenhouse gas emissions.

A number of studies carried out by the IEA, the European Commission and in several countries reach a common conclusion: The market for solar water heaters is huge and - taken as a whole - is steadily growing, although the market growth will differ widely from country to country.

Currently, the most important solar application is for residential water heating. Today, systems for hot water production in single-family houses are dominant; although, in the future, solar heating systems will be used in all types of housing. In countries with centralised heating systems, such as district heating, large-scale solar energy systems will feed heat to the distribution network. Such systems have been successfully demonstrated in Scandinavia and Germany. Swimming pool solar systems, common in some countries, also present a large market.

Until the early 1990s the leading markets for solar collectors were in the Eastern Mediterranean area, and there they still have the highest per capita installed collector area.

Since 1990 the fastest growing markets for solar thermal have been in Northern Europe. Since 1993 Germany has been the single largest market in the EU - several factors have encouraged this development. Austria has the largest annual per capita sales. Significant markets also exist in Denmark, the Netherlands and Sweden.

A significant number of market development initiatives are being taken around the world and these are having beneficial results in assisting the uptake of solar hot water systems.

Estimated area of installed Solar Water Heating (1999)

Country	**Area M^2**
Australia	
Austria	1,476,000
Belgium	19,500
Canada	
China	10,000,000
Denmark	282,000
Finland	12,000
France	296,000
Germany	2,290,000
Greece	2,645,000
Ireland	1,200
Italy	244,000
Japan	
Mexico	
Netherlands	146,000
New Zealand	
Norway	5,000
Portugal	219,500
Spain	313,000
Sweden	157,000
Switzerland	241,000
United Kingdom	141,000
United States	

4. IEA Programmes

NZ is an active member country of the IEA Solar Heating and Cooling Programme. Currently there are 8 workstreams underway with 20 member countries. Workstreams are generally technical rather than market focused with an emphasis on passive solar building heating.

Many IEA member countries cite the challenge of climate change as a primary motivation for conducting solar energy research and development.

Task 24 – Solar Procurement

This project is focused on establishing procedures and systems for bulk procurement and installation of SWH systems. Participating countries are Canada, Denmark, Netherlands, Sweden and Switzerland.

National buyer groups have been established, specifications prepared, tenders and procurement undertaken, and systems installed.

Individual country programmes have been supported by information material, brochures, articles and conference papers. Market transformation studies are underway in Canada. Contracts are being pursued with the national plumbers association, house-building associations, and green municipalities in Denmark. The Swiss Solar Energy Society is establishing an internet based virtual buying group with turnkey installation at a fixed price.

5. European Union

At present, about 11 million square meters of solar collectors are installed in Europe, with an annual growth rate of about 1 million square meters per year. The objectives set in the European Commission White Paper on Renewable Energy are to have 100 million square meters of solar collectors installed by 2010.

In the period between 1993 –1999 Austria, Germany and Greece have contributed 80% of new SWH installations within the EU. In these countries the cumulative benefits of a series of supportive measures determine the extent to which a renewable technology is successfully exploited:

- Long established political support
- Obligation on utilities to purchase renewable electricity at guaranteed feed-in tariffs
- Improving building regulations to stimulate uptake of SWH

Substantial subsidies were made available to households or industry in Austria, Germany and Greece.

EEA Case Studies Project

A report 'Renewable Energies: Success Stories' for the European Environmental Agency summarises successful policies undertaken within the European Union that have assisted the uptake of renewable energy. The report has a number of general comments on the successful policies that are relevant to SWH.

This study presents a series of examples of successful renewable energy development in EU Member States. By analysing these cases it seeks to understand the factors that influence the success of renewable energy schemes and to facilitate their widespread penetration in the Member States. The study aims to provide policy-makers and policy implementers with an opportunity to learn from each other's experiences, and thereby to contribute to EU and Member State efforts to meet their renewable energy indicative targets for 2010.

Overall, no single factor is of overwhelming significance in the successful deployment of renewable energy technologies. Instead, it is the cumulative benefits from a series of supporting measures that determine the extent to which renewable energy is successfully exploited in any one Member State. There are, however, certain essential components which combine to help create an environment in which renewable energy exploitation can succeed.

The results of the project are summarised in Annex A with a summary of the mechanisms used in each country listed in Annex B.

Soltherm Europe

The new Soltherm Europe Initiative has set out to realise 15 million square meters of solar collectors in Europe by 2004, which is equivalent to SWH systems for 3 million households. Soltherm Europe has united a number of European key market players. National campaigns will be launched, based on a decade of experience with market development.

Initiated by Ecofys, an international renewable energy consultancy and research company, the Soltherm Europe Initiative consortium currently consists of the following European key partners: the European Active Solar Thermal Industry Group (Astig), the Climate Alliance, AEE and ESV (Austria), 3E (Belgium), DTI (Denmark), Ademe and RAEE (France), DFS and Berliner Energieagentur (Germany), CRES (Greece), Ambiente Italia (Italy), Ecofys and Novem (the Netherlands), ICAEN and Trama (Spain) and BRE (United Kingdom). Other partners will be invited to join the Initiative in due course.

The Soltherm Europe Initiative aims to increase the awareness of customers as well as to mobilise the complete production and installation chain. Based on more than ten years of experience with a number of market introduction projects in several countries, national campaigns will be started to boost the sales. In these campaigns, Soltherm Europe will especially involve the installers as they play an important role in the promotion of solar water heaters. The Soltherm Europe Initiative aims to provide the framework for further expansion of the solar heating market.

The Initiative has started to unfold its activities and has made an application to become a Renewable Energy Partner with the European Commission.

The initiative is based on analysis of the markets of different countries which shows that an effective policy boosts the penetration of solar energy much more than favourable climatic conditions. This indicates that with an effective approach it is possible to quickly expand the market. The Soltherm Europe Initiative is designed to be the central catalyst to exchange the current experiences in the European countries and to use these as a base for national campaigns. Guidelines, tools and effective market strategies will be created, so that a comprehensive European approach is developed.

Analysis of the current market situation and statistics show that the most obvious solar thermal market development strategy is the renovation market of water heaters in single houses and collective water heating systems in all EU countries with solar space and water heating and single solar water heaters as an option. A crucial link in the market development is to give potential buyers good information and to guide them to trained and motivated sales and installation organisations.

The Soltherm Europe Initiative aims to create this in all EU countries by creating a co-operation between sales and installation companies and info centres and information campaigns. Much synergy can be gained by co-operation on European level and by collaboration with existing initiatives.

EU Market Study Project

The European Union DG-TREN has financed a study "Untapped Market Opportunities for Solar Water Heaters in Europe". This study has two particularities:

- The analysis is not limited to objective factors (sales figures, pay-back time, technical characteristics…), but includes especially the *perception* of SWH by professionals and those who decide if there is a market or not – the clients
- The study compares directly the situation in four countries: France, Germany, United Kingdom and Spain

Some of the results (concerning in particular the market image as seen by the public or the lifetime of certain components, etc.) allow targeting actions in a precise manner.

Solar water heaters have been a success in countries with such different solar irradiance and buying power as Germany, Austria, Greece and Israel. Other countries like metropolitan France hardly install any SWH anymore.

The overall objective of this project was to identify the existing barriers to the market penetration of SWH in France, Germany, Spain and the UK and highlight untapped market opportunities for SWH in these countries.

The SWH market in Europe is not only defined by its objective characteristics (such as sales figures and quantities of hardware installed), but also by subjective factors, opinions of professionals, clients, and the public at large. This latter, subjective aspect has a decisive impact on whether a potential client will actually buy a system or not. In other words, the client's decision is based not only on hard facts, but also on the *perception* of these facts.

A summary of the project findings and conclusions is shown in Annex C.

6. Netherlands

The 1997 Netherlands Government White Paper set goals for renewable energy use which were subsequently made more challenging in 1999; they were to meet 5 % of gross inland energy consumption from renewable sources by 2010, and 10 % by 2020. Stimulating the use of thermal solar energy is an essential element in this programme. The major goal for thermal solar energy was to have 40,000 solar domestic hot-water systems in 2010. To reach this, a policy was developed that included market stimulation, technological development, subsidy and co-operation with the utilities. The result was a market growth of over 30% per year since 1990.

7. Greece

Installation of SWH in Greece has been stimulated by tax exemptions for individuals or companies who invest in or use renewable related products or services.

Solar collectors have been widely installed throughout Greece since the 1980s. There are a number of factors that make SWH technologies attractive for providing an increasing proportion of Greece's energy needs, including the country's favourable climate. There is no district heating tradition in Greece, so typical water-heating systems in households are electricity based, and electricity prices are relatively high compared to the Greek household disposable income.

The island of Crete is one area of Greece that has carried out extensive studies and activities to develop its indigenous renewable energy resources. There has been a high take-up of SWH collectors among the population, both for domestic dwellings and in the hotel and tourism sector. To date, about 20 % of Crete households have solar collectors. These are mostly produced and installed by local companies, and supply cost-effective and reliable hot water.

Success Factors

• *Political: Support policies for renewable energy use*
Various policies and legislation to support uptake of renewable energy, including SWH technologies, have been implemented since 1990. The Operational Programme for Energy, which ran from 1994 to 1999, provided a total of EUR 140 million of public, EU and private funds for renewable energy development.

Crete benefited from this programme through targeted support for renewable energy technology development. Crete adopted an energy policy in 1994 that placed a high importance on the use of renewable energy, and the implementation plan was finalised by the regional energy agency in 1999.

Greece's new Operational Programme for Energy, which began in 2000, supports tax exemptions, loans and third party financing for renewable energy and energy efficiency in the building sector.

• *Financial: Grants and loans available*
In the early stages of their development, in the late 1970s and early 1980s, the use of solar water-heating systems was stimulated through subsidies. From 1990, Law 1892 provided subsidies up to 45 %–55 % (depending on location) for the promotion of various investments including in renewable energies. Hotels which invested in solar water heaters benefited considerably from this law.

• *Fiscal: Tax exemptions to individuals for buying renewable appliances*
Since 1995 Law 2364 has provided tax exemptions to households buying renewable appliances, such as solar water heaters; 75% of the purchase value of a renewable appliance is deducted from a person's taxable income.

• *Technological development: Strong domestic manufacturing industry*
The financial support given in the late 1970s and early 1980s to promote the use of solar water heaters created an opportunity, and a market, for the emergence and

establishment of a local industry which developed over the 1980s and reached maturity in the early 1990s. Local industry was an important driving force in SWH expansion in Greece.

Greece has the highest per capita use of SWH technologies in the EU.

In 1993: 92.5 ktoe
In 1999: 124.4 ktoe
Increase 1993–99: 31.9 ktoe, 34 %

8. Austria

One of the most successful regions to encourage SWH uptake is Upper Austria. In 1994, the Upper Austrian Energy Plan established targets to reduce fossil fuel consumption, improve energy efficiency and increase the use of renewable energy in the region. These targets, which were met, included reducing domestic energy use by 20% and increasing the proportion of energy provided from renewable sources to 30% by 2000. The Upper Austrian Energy Agency has been one of the main promoters of actions to achieve these targets, and has been very successful through a combination of support measures from both national and local sources, combined with a high level of information dissemination activities to raise awareness in the region.

More than 500,000 m^2 of thermal solar collectors had been installed in Upper Austria by 2000 as a result of the energy plan, for space heating and producing hot water, mainly in domestic buildings. By 2000 the region had about 0.4 m^2 installed solar collectors per inhabitant — one of the highest densities of solar collectors per inhabitant in Europe. Similar initiatives are now being implemented in other Austrian regions, supported through local or regional energy plans.

Success Factors

• *Political: National and regional support towards development of renewable energy*
The Austrian national government’s energy policy places a strong emphasis on improving the country’s security of energy supply and reducing the amount of energy imports. This, combined with a commitment to environmental protection, has resulted in a long-standing level of political support for renewable energy at the national level and has led to active political support at the regional level. The government also links the benefits of supporting renewable energy to associated socio-economic impacts of job creation and economic benefits to the local economy.

• *Financial: Loans and grants available through national and regional government*
Financial support for installing solar collectors is available through support programmes both at the national level (targeting companies) and at the regional level (targeting households).

This support includes grants to householders and low-interest loans on investments in renewable energy. The high level of financial support available for installing solar collectors has been one of the main reasons for the high uptake of these systems in the Upper Austrian region. Other regions are now following the example of Upper Austria: for example, the town of Feldkirch in western Austria subsidises the installation of solar hot-water collectors by 25 %, while the Municipality of Graz provides EURO 35/m^2 solar hot-water collectors installed.

• *Fiscal: Energy taxes favour renewable energy schemes*
An energy tax was introduced in 1996 on both small-scale and industrial users of gas and electricity. Part of the revenue from this energy tax is recycled to support various environmental protection measures, including support for renewable energy.

• *Administration: Active local and regional support towards the installation of solar collectors*
Many of the regional and local administrations have encouraged the installation of solar collectors through active support measures, for example through installing collectors on their own municipal buildings.

Austria's rapid increase in its use of solar energy for heating purposes demonstrates that SWH can provide an important source of energy even in less sunny regions.

In 1993: 24.9 ktoe
In 1999: 62.1 ktoe
Increase 1993–99: 37.1 ktoe, 150 %

• *Technological development: Support for indigenous solar collector manufacturers and installation industries*
Solar thermal benefited during the 1980s from the establishment of a network of groups throughout the country which provide active support and advice to individuals wishing to install solar water heaters themselves. This initiative encouraged the development of an industry to provide commercial installations. Austria now has a network of companies working in the field of solar collectors, as well as in other renewable energy technologies, which in Upper Austria alone employs more than 1,000 people.

• *Information, education and training: Positive dissemination and support for renewable energy use through the regional energy agencies*
Regional energy agencies provide expert advice, research and targeted initiatives aimed at promoting national and regional energy policies. In Upper Austria, the agency provides targeted support towards promoting the uptake of solar collectors through a wide-ranging programme. Initiatives include:

- Information and training for specialised installers
- Marketing activities
- Demonstration systems to show successful installations

9. Germany

Many German municipalities have seen a rapid increase in the uptake of thermal solar installations. Examples of some successful municipalities in southwest Germany include:

- Freiburg: more than 200 domestic installations (2,500 m^2) achieved by 1996
- Friedrichshafen: nearly 5,000 m^2 of collectors installed to support solar-assisted small-scale district heating and hot-water systems
- Ulm: installation of a central hot-water system for 38 homes and a district heating system (heat and hot water) for 86 residential units, in which heat from solar collectors is used together with a combined heat and power plant fired by biomass and gas

These examples illustrate the variety of innovative ways in which German municipalities are promoting a greater use of solar energy for thermal energy requirements. Both small and larger-scale installations (more than 500 m^2) are being established, and interest in large-scale solar heating opportunities is increasing, with most of these installations supplying heat to residential buildings.

Success Factors

• *Political: National and regional support towards increasing use of SWH installations*
Political support from national and regional governments is translated into practical implementation measures in the form of targets, grants, research support and other actions aimed at increasing the level of renewable energy use. Many regions or municipalities have targets for increasing their level of renewable energy use, which often place a strong emphasis on renewable energy and energy savings, linked with climate protection objectives. Regions also see solar hot-water systems as important components in implementing Local Agenda 21 (opportunities for carrying out climate protection initiatives at the local level) in their region.

• *Financial: Federal government and private sector financial support to SWH installations*
A wide range of federal, regional and private sector financial support is available for solar installations. These include:

- Federal government support: The federal government's Solarthermie 2000 demonstration programme subsidised the construction of the long-term hot-water storage and the district heating system in Friedrichshafen, contributing 53 % towards total costs
- Regional support: In Friedrichshafen, 9 % of total costs came from regional support measures
- Energy utilities: The role of the local municipal energy company is also important. In Freiburg, for example, the company provided financial support of EUR 230/m^2 (part-financed from EU funds). In Friedrichshafen, the owners and operators of the district heating system have responsibility for overall risk and guarantees of the system

Local people can also benefit from low interest rates provided by local or regional banks for solar installations. A number of financial institutions in Germany have supported both community, and non-community-based renewable energy projects, with favourable financing packages.

• *Administration: Active support provided from municipalities for SWH installations*
One important factor is the role played by both the municipality and the local energy utility in encouraging the uptake of solar heating. The municipality collaborates closely with the utility in establishing and implementing energy planning and municipal energy policy and targets.

Germany is leading the way on SWH energy.
In 1993: 21.0ktoe
In 1999: 75.4 ktoe
Increase 1993-99: 54.4 ktoe, 260%

• *Technological development: Quality standards provided to guarantee results from solar collectors*
GRS (Guaranteed Results from Solar Collectors) is an initiative established by several municipal utilities in 1993, co-ordinated by municipalities. Its purpose was to ensure that the annual amount of heat supplied by a solar collector was guaranteed by the manufacturer, thus allowing for precise cost–benefit calculations and ensuring that systems met customer needs. Its application has helped to boost consumer confidence in the quality of the new types of heating systems available in Germany, and in particular those produced by German manufacturers.

• *Information, education and training: Active promotion of the benefits of SWH installations by municipalities, utilities and local energy agencies*
Close collaboration between municipality and utility has led to a combined effort to both disseminate and improve public relations in order to promote renewable energy uptake.

Specialist advice centres have been established through local energy agencies to provide technical and practical support to local associations for solar installations, but also to support demonstration schemes.

Public awareness of energy and environmental problems, and the opportunities for renewable energy, is strong in Germany.

10. Spain

Spain's 2000 renewables target has now been expanded to a 12% share of renewables in gross inland energy consumption by 2010.

11. Ireland

Ireland established the Alternative Energy Requirement (AER) as a support mechanism for a range of renewable energy technologies, based on the UK Non-Fossil Fuel Obligation (NFFO). Both the AER and the NFFO are competitive bidding systems whereby developers tender to provide electricity from a range of renewable energy sources.

12. United Kingdom

The United Kingdom Government NFFO is being replaced by a Renewables Obligation, the draft of which obliges suppliers to provide an increasing proportion of their supplies from renewable sources. Suppliers will need to purchase new renewable energy capacity, and it is expected that this will stimulate demand for renewables.

The Government has established a sequence of targets particularly in the electricity sector to act as a stimulus to industry and to provide milestones against which progress to achieving its national energy policy goals can be monitored. Initially the Government proposed that 5% of UK electricity requirements should be met from renewables by the end of the year 2003, and 10% by 2010, subject to the cost to consumers being acceptable. The 5% target has now been reduced to 3% with the realisation that because of a number of barriers the target was unlikely to be achievable.

The various UK renewable market sectors and technologies are at different stages in their development cycle. The Government therefore intends to stimulate the market elements in a variety of ways. Key instruments are:

- A new and long term renewable energy obligation on suppliers of electricity together with transition of the existing Non-Fossil Fuel Obligation (NFFO) contracts into the new market to create a growing market in which the industry can invest with confidence
- Exemption from the climate change levy for electricity and heat supplied from renewables energy sources (excluding large hydro) to assist renewables to become competitive with existing and more polluting energy sources
- Demonstrations of new technologies, particularly in the heat and transport markets

NFFO supported electricity from wind, hydro and a range of biomass sources. PV was not included. Under the Renewables Obligation electricity suppliers are legally obliged to provide an increasing proportion of their supplies from renewable sources. A supplier may meet the Obligation in one of three ways (or a combination of these): by supplying all or part of its electricity supplies from renewable sources; by purchasing green certificates to show that another supplier has provided those supplies; or through buying out its Obligation by making a payment to OFGEM.

The involvement of heat within this policy is still being developed.

Another energy-saving initiative in the UK is solar clubs. These were developed by environmental charities in Bristol, southwest England and Leicester in the English Midlands and are now being formed across the country. Householders who join solar clubs pay a certain amount for membership and are then entitled to substantial discounts off solar panels to heat hot water. Finance for the initiative is coming from the DETR and from a number of charitable trusts and foundations.

Solar clubs are based on an idea which has revolutionised the market for solar energy in Austria, increasing demand for solar panels by over 900 per cent in the last ten years.

The solar club in the London Borough of Southwark was set up in 1997, and is run by the Southwark Energy Agency. The club trains householders to install their own solar heating panels. A range of high technology solar water heating panels, which are marketed commercially for as much as 6,000 pounds sterling, are available to householders who join the clubs for between 1,000-1,400 pounds, if they install the panels themselves. It has been estimated that around 1,000 householders in London alone will fit the panels in the next three years. For householders who do not want to install it themselves, the panels can be purchased and installed for around 2,300 pounds sterling. Alternatively, householders can install most of the system themselves and obtain help with anything they cannot do.

There are currently 13 Solar Clubs in Britain and they are likely to grow in number.

13. United States

Restructuring of the US electricity industry has meant that most utilities have cut out energy efficiency measures and have become more focused on just selling electricity. As a result federal and state policy makers have had to take the lead with development of new policies often backed by legislative changes.

Million Solar Roofs Initiative

The Million Solar Roofs Initiative (MSR) announced in June 1997 has the objective of getting businesses and communities to install solar systems on one million rooftops across the United States by 2010.

Solar energy systems that qualify for inclusion in the Initiative are:

- Photovoltaics
- Solar thermal water heating systems for buildings and swimming pools
- Solar thermal systems for space heating

The Million Solar Roofs Initiative is a federal programme designed to support states and local communities as they develop a strong commitment to the sustained deployment of solar energy technologies. The U.S. Department of Energy objective of the programme is to work with partners in the building industry, other federal agencies, local and state governments, utilities, energy service providers, the solar energy industry, financial institutions, and non-governmental organisations to remove market barriers to solar energy use and develop and strengthen local demand for solar energy products and applications.

To ensure positive and productive results, the Million Solar Roofs resources are focused on those areas that have formed strong partnerships and serve as the focal point for solar activity in a specific area. Million Solar Roofs State and Local Partnerships are collaborative ventures that bring together business, government, the energy industry, and community organisations - each individual entity being recognised as a member and partner - with a commitment to install a set number of solar energy systems.

Examples of state and local partners who are participating in these partnerships include the following:

- Builders
- Energy service providers
- Utilities
- Non-governmental organisations
- Local governments
- State governments

To become a Million Solar Roofs State and Local Partnership, any state or local entity, on behalf of a specific Partnership, must express the organisation's commitment to the MSR's objectives, describing the general nature of the partnership and its membership and indicating its goal for the specific number of qualified solar energy systems to be installed on buildings within a specific community. At a minimum, partnerships must commit to installing 500 solar energy systems by 2010.
In addition, Partnerships are asked to develop a draft plan for meeting their installation goals under the Initiative. Partnerships are encouraged to base their plans

for deployment on local values in relation to the technologies' unique applications and operational attributes.

Examples of activities the Partnerships may undertake as part of their plan include:

- Committing state and local government actions to overcome barriers to solar energy and energy efficiency applications in buildings
- Identifying financial incentives for solar energy installations
- Developing/modifying codes and standards that affect solar energy installations
- Implementing training programmes for building officials, the construction industry, solar energy system installers, and utility personnel
- Providing outreach support for solar energy and energy efficiency
- Taking part in national information sharing, peer-to-peer exchanges, and cooperative research and training projects
- Connecting the Million Solar Roofs Initiative with other sustainable community initiatives

A summary of the initiatives available throughout the US is shown in Annex D, and a typical local partner initiative in Arizona is shown in Annex E.

Million Solar Roofs: Benchmarks for Success

	1999	**2000**	**2005**	**2010**
Participating Partners	25	50	200	325
Solar Buildings & Residences	23.5	51	376	1,014
System Size (kW)	1	2	3	4
Annual Capacity (MW)	15	55	270	610
Total Installed Capacity (MW)	25	80	820	3,025
Installed Cost ($/W)	4.9	4.3	2.9	2.0
Energy Cost (¢/kWh)	16.9	14.8	10.6	7.7
Total Annual CO_2 Savings**	39	111	1,037	3,510
Jobs Created*	3.8	11	40	71.5
* in thousands ** thousands of tons				

The Department of Energy (DOE), through its network of regional offices co-ordinate and provide support for the State and Local Partnerships in each region. This might include the following:

- Access to the Million Solar Roofs Small Grants programme for State and Local Partnerships
- Assistance in accessing low-cost loans, buy-down grants, and other financial assistance
- Training, technical assistance, and information from DOE's regional offices; the programme staff of DOE's Offices of Power Technologies and Building Technology, State and community programmes; and the national laboratories
- Recognition and support on a national, regional and local basis

- Assistance to address nation-wide barriers to the widespread application of solar energy technologies, such as financing, restrictive neighbourhood covenants, education, and utility grid interconnection
- Linkage with solar energy businesses, associations, and related industries that can provide assistance to local partnerships and others interested in solar energy applications

The DOE does not direct and control the activities at the state and community level, nor does it typically pay for the installation of solar energy systems. Instead, the Million Solar Roofs Initiative brings together the capabilities of the Federal government with key national businesses and organisations and focus them on building a strong market for solar energy applications on buildings.

To be included in the Million Solar Roofs Initiative, a building's solar energy system must comply with all relevant parts of the National Electrical Code (NEC), Underwriters Laboratories (UL) standards, and the Solar Rating and Certification Corporation (SRCC) standards. The SWH system must also be located on or immediately adjacent to the building and meet the following minimum standards:

- Residential domestic systems must be a minimum of 1.0 kW equivalent or 20 square feet of collector area
- Residential swimming pool heating systems must be a minimum of 100 square feet of collector are
- Commercial domestic systems must be a minimum of 2.0 kW or 40 square feet of collector area
- Commercial swimming pool heating systems must be a minimum of 400 square feet of collector area

The Initiative works "bottom up," attracting partners building by building, community by community, state by state, and business by business. It also works "top down" by developing financing leveraging resources, coordinating Federal agency support, and sharing information.

There are three types of partnerships:

Individual Partnerships: Any person or organisation who installs the minimum size SWH energy system on a residential, commercial, institutional, or government building will be able to register with the Million Solar Roofs Registry. There is no requirement for participation in any other activities for these parties to be a partner in the Initiative.

State and Local Partnerships: Million Solar Roofs state and local partnerships bring together business, government, and community organisations at the regional level with a commitment to install solar energy systems.

National Partnerships: At the national level, partners make a commitment to install a significant number of solar energy systems and provide national support for the Initiative. Examples of potential national partners include the following:

- Any entity that commits to installing more than 5,000 solar roofs by 2010
- Solar energy equipment manufacturers and distributors
- National utility companies and energy service providers
- National financial institutions
- National government associations

- National business associations
- National non-governmental organisations

To help speed the development and use of renewable energy technologies, both the states and the Federal government have established numerous regulatory and financial incentives. Including low-cost loans, buy-down grants, and other financial assistance. Information on the wide range of incentives available is monitored by the DSIRE National Database of Incentives programme.

The anticipated outcomes of the MSR programme are reflected in the following table.

National Database of Incentives

In 1995, the U.S. Department of Energy established the National Database of State Incentives for Renewable Energy (DSIRE) (www.dsireusa.org), through the Interstate Renewable Energy Council. The database is designed to contain all available information on state financial and regulatory incentives (tax credits, grants, special utility rates, etc.) that are designed to promote the application of renewable energy technologies. DSIRE also prepares reports that detail the incentives on a state-by-state basis, and access via the Internet.

The North Carolina Solar Center collected and prepared the information in DSIRE. Each of the financial and regulatory incentives can be identified by state, end-use sector, technology, or incentive type. The details of each financing and regulatory tool are also available, as well as contact information for each state.

Summaries of the State incentives are shown in Annex F.

Production Tax Credits

There is a proposal in the US House of Representatives to extend the current Production Tax Credits for electricity generated by new wind power plant to cover solar energy. The proposal is included in the Inslee/Shays/Udall/Wamp Clean Energy Incentives Act. In this proposal there would be a 15% tax credit for home investments in SWH systems.

SPIRE

Under a grant from the Renewable Energy Programme at the California Energy Commission, the Local Government Council has established a programme for Stimulating Public-sector Implementation of Renewable Energy (SPIRE). SPIRE provides financing and procurement assistance to municipalities for the installation of renewable energy systems. SPIRE combines the State's buy-down rebate (up to 50% of system cost) with low-interest, long-term financing and aggregated procurement to make distributed generation a cost-effective option for the public sector.

North Carolina

North Carolina has established a goal of obtaining 20% of its energy form renewable resources by 2010.

The North Carolina Solar Center, established by the North Carolina State University, provides programmes and resources that help people throughout North Carolina take advantage of solar energy. Services available to the public include a toll-free hotline, a professional referral service, technical assistance and design reviews, free publications, curriculum materials for teachers, training programmes, tours of the NCSU Solar House and a reference and media library.

The Solar House is dedicated to homebuilding professionals and the general public to encourage the efficient use of solar and energy technologies in residential and commercial buildings. The Solar House serves as the headquarters for the North Carolina Solar Center and contains the Center's Reference Library and Media Center, which are open to the public.

To provide a vehicle for North Carolina's communities to develop their programmes, the North Carolina Solar Center has established the Solar Communities Programme. The programme enables cities and counties to organise local steering committees and initiatives to accelerate the use of renewable energy in their area.

In 1999, the North Carolina General Assembly unanimously approved a revised and greatly enhanced set of solar and renewable energy tax credits for the state's citizens, business and industry. The new law includes these provisions:

- 35% Tax Credit for all renewable energy technologies (solar, wind, biomass, small hydro)
- 35% Tax Credit for residential, commercial, and industrial sectors
- Maximum Credit of $10,500 for residential photovoltaic, wind, hydro and biomass systems
- Maximum Credit of $3,500 for residential active and passive solar space heating
- Maximum Credit of $1,400 for residential SWH
- Maximum Credit of $250,000 for commercial and industrial renewable energy applications*

**Federal tax incentives also apply to selected solar and renewable energy technologies in the commercial and industrial sectors.*

System Requirements for water and active space heating are:

- The system must be installed by a contractor appropriately licensed in North Carolina or, in the case of a residential installation by the homeowner, in accordance with the North Carolina State building code and be inspected by a local code official
- The system must provide adequate freeze protection that does not rely on electrical power
- Space heating systems must provide adequate overheating protection during the non-heating season
- The system must remain fully operational for the period during which instalments of the tax credit are claimed
- The system must include an easy to understand way for the owner to determine if the system is operating properly. This may include thermometers and flow indicators
- It is highly recommended that installed solar collectors be OG-100 certified by the Solar Rating and Certification Corporation (SRCC). It is also highly recommended that all stand-alone residential solar hot water systems installed be OG-300 certified by SRCC

California

The California Energy Commission provides grants to California residents to help offset the cost of purchasing and installing new solar energy systems.

California residents who are purchasers, sellers, owner-builders, or owner-developers of eligible solar energy systems are eligible to apply.

For solar energy systems, the following systems are eligible for Programme funding:

- Solar Domestic Water Heating Systems
- Solar Swimming Pool Heating Systems Battery Backup

All solar energy systems must meet the following criteria:

- Owned or leased by a California resident and operated within the State
- Purchased, installed and operating in compliance with the approved Programme guidelines and all applicable laws, including local building permitting and inspection requirements, as of January 1, 2001
- Covered by a three-year system warranty

Up to $750 is available for eligible solar energy systems, except swimming pool water heating systems, which are eligible for a maximum of $250 per system. Single domestic water heating systems serving five or more single family dwellings or separate business units (multi-unit systems) that meet the Programme eligibility requirements are eligible for the lesser of (a) 50 percent of the maximum amount available on a per dwelling/unit basis or (b) 25 percent of total eligible system costs.
Funds may be reserved for one or more eligible solar energy systems before the system is installed. Funding award payments will be approved once the eligible system(s) is installed and operating.

A minimum of $750,000 is available to fund eligible solar energy. Funds are awarded on a first-come, first-served basis until the available funds are exhausted. No more than 20 percent of the total funding available may be used for solar swimming pool water heating systems.

No standards exist at present for SWH systems. In lieu of certification, manufacturers of SWH systems must provide acceptable evidence to the Energy Commission of one year of reliable operation for each model of system they wish to sell under this programme.

Emerald Energy

Emerald Energy Services (EES) offers a cash incentive and a zero-interest loan to its parent electricity supply company customers to purchase a solar water heating system. There is also a state tax credit available.

EES provides customers with a list of approved installers from whom they can obtain bids. EES will also review and approve the installation contract and process a loan application if necessary. EES will inspect the system to ensure the customer has a proper installation. Once they approve the installation, EES will make payment of the incentive and process the loan application.

Incentives range from US$400 to $600, with systems that save more energy qualifying for the higher amount. Qualified customers may also receive an EES zero-interest loan of up to $2,500. Loan repayment terms are up to three years (36 months) for loans of $1,500 or less, and up to five years (60 months) for loans up to $2,500. A state tax credit is also available for qualified systems, for up to $1,500. EES assists the customer obtaining the tax credit.

Santa Clara

Since 1975, the City of Santa Clara has taken a leading role in the development and promotion of the use of solar energy. The City established the nation's first municipal solar utility. Under this programme the City will supply, install and maintain solar water heating systems for residents and businesses within Santa Clara.

The City has also installed solar energy equipment for its own facilities. The Community Recreation Center and the International Swim Center, both in Central Park, use solar heated water.

Solar equipment is offered by the city for the heating of swimming pools, process water, and domestic hot water. The pieces of hardware (solar collectors, controls and storage tanks) are owned and maintained by the city under a rental agreement. The renter pays an initial installation fee and a monthly utility fee. These amounts vary according to the size of the installation:

Installation Charges:

- Solar pool heating system-- installation cost is US$500 plus $30 per panel
- Solar Domestic Hot Water System (Single Family) -- approximate cost is $49
- Solar Domestic Hot Water System (Multi-Family) -- cost must be individually estimated. Typical installation fee for system to serve 10 dwelling units is approximately $2900
- There is a charge to remove and reinstall panels for re-roofing

Monthly Charges:
For all above installations there is a monthly service charge based on the number of panels. Pool systems are billed a monthly service charge for six billing cycles per year (generally from April to September), although the system is available for use all year.

2002 DOE Solar Building Technology Research Budget

The Solar Water and Space Heating research activity develops solar technologies that provide hot water and space heating for residential and commercial buildings, in collaboration with industry partners. The research emphasises low-cost, polymer-based solar water heaters to cut the cost of solar water heating by 50 percent to an equivalent of 4 cents per kilowatt hour by 2004. The initial emphasis is for systems designed for mild climates, gradually shifting to systems for hard-freeze climates. These lower-cost heaters are expected to expand the market by 200 percent. The same polymer-based technology developed for low-cost water heaters can be developed to provide space heating.

*FY 2001***:** Completed design of polymer-based solar water heaters in conjunction with two manufacturers. Continued materials durability research is designed to further develop advanced low-cost polymers and glazing that are able to withstand ultraviolet (UV) and temperature degradation. SBIR Transfer has been reflected in this programme in the amount of $42,000.

FY 2002: Build and field test full-scale, polymer-based solar water heaters in conjunction with industry partners. Continue accelerated testing of glazing, durability testing of polymers, and measurement of scale in heat exchanger tubes. Assist industry in developing manufacturing processes amenable to the new polymer and existing materials used in solar water heaters.

FY 2003: Based on field tests, redesign and modify the low-cost solar water heaters as required. In collaboration with industrial partners the redesign will be evaluated by their potential for reducing the cost of energy to $.04/kWh by 2004. Initiate development of a low-cost solar water heater capable of operation in cold climates with potential sales of 100,000 units per year by 2010. Using the solar collector developed for low-cost water heaters, initiate development of a low-cost active solar system for space heating. Develop and test polymer-based "balance-of-system" components (storage tanks, heat exchangers, pumps) for solar thermal systems.

14. Australia

Federal Programmes

There are 5 major manufacturers in Australia collectively producing about 30,000 systems annually. Sales in Australia are about 20,000 systems annually, with the balance exported. The most common product is a close coupled thermosyphon system.

National Greenhouse Strategy

The National Greenhouse Strategy is the primary mechanism through which Australia's international greenhouse gas commitments will be met.

The National Greenhouse Strategy has been developed by the Commonwealth and all State Governments.

The Government's renewable energy target places a legal liability on wholesale purchasers of electricity to proportionately contribute towards the generation of an additional 9,500GWh of renewable energy per year by 2010. The measure will apply nationally, with all electricity retailers and wholesale electricity buyers on liable grids in all States contributing proportionately to the achievement of the measure.

The Commonwealth Government has recently passed the *Renewable Energy (Electricity) Act 2000* which law requires wholesale electricity buyers to purchase more of the electricity they use or sell from renewable energy sources. This can include householders that have installed a renewable energy generation system.

When a renewable energy generator produces a unit of eligible renewable energy, they will now be able to create a Renewable Energy Certificate to prove the electricity was generated with low net greenhouse gas emissions. The law requires the major electricity companies to purchase these Certificates. If they do not purchase enough Certificates they will be required to pay a penalty.

One Renewable Energy Certificate represents 1 megawatt-hour (or 1000 kilowatt hours) of electricity generated from renewable energy. Renewable Energy Certificates will be only created for whole megawatt hours of electricity.

Under the new Renewable Energy Legislation, owners of eligible small renewable generation units installed on or after 1 April 2001 can earn Renewable Energy Certificates, but this is not automatic. The owner must take certain steps to "create" and register any Renewable Energy Certificates earned. This is referred to as "claiming" them.

However, if the owner does not wish to go through this process, they may transfer their right to "create" the Renewable Energy Certificates to another person, called an Agent.

For a solar water heater to be eligible for renewable energy certificates, the unit must be installed on or after 1 April 2001, and displace non-renewable electricity. The unit must therefore:

- replace an existing electric water heater; or
- replace an electric boosted solar water heater (in this instance, the number of certificates for which the system is eligible for will be the difference between the existing and new solar water heater); or
- be installed in a new house.

Additionally, the particular model of solar water heater must be listed in the *Renewable Energy (Electricity) Regulations 2001.* The ORER regularly updates this list to cover newly eligible solar water heaters. Certificates for solar water heaters may only be claimed once, and are allocated for the life of the system.

National Programmes

The Commonwealth Government has allocated almost $1 billion to a range of greenhouse response actions.

- The Greenhouse Challenge and the Greenhouse Allies programmes are joint voluntary initiatives between the Commonwealth Government and industry to reduce greenhouse gas emissions
- The Greenhouse Gas Abatement Programme (GGAP) is providing grants totalling $400 million over four years for large scale, cost-effective greenhouse gas abatement programmes
- The Photovoltaic Rebate Programme (PVRP) is providing up to $31 million in rebates to householders and community use buildings installing approved grid connected or stand-alone photovoltaic systems
- The Renewable Remote Power Generation Programme (RRPGP) will provide approximately $48 million across the participating states and territories in 2000/01 for the conversion of diesel based remote area electricity supplies to renewable energy technologies. The programme will run for 4 years ending in 2003/04
- The Renewable Energy Commercialisation Programme (RECP) is a five year, $55.6 million competitive grants programme designed to foster the development of a renewable energy industry in Australia
- The Commonwealth's *Renewable Energy (Electricity) Act 2000* (the Renewable Energy Act) provides for the generation of 9,500 GWh of additional renewable electricity in 2010

- Supporting renewable energy industry development activities (RECP SHOWCASE)
- Equity funding for renewable energy (REEF)
- Alternative Fuels to reduce greenhouse gases and other vehicular emissions from Australia's road transport sector

Proponents of renewable electricity generation projects will need to demonstrate that their project will achieve emission reductions above and beyond those associated with the Renewable Energy Act. Activities that are eligible for Renewable Energy Certificates (RECs) fit within the Renewable Energy Act and do not meet the additional criterion under GGAP.

A project that produces heat, as well as renewable electricity, could be assessed for the heat component of the project.

Renewable energy projects that do not earn RECs, such as projects that involve the production of steam or transport biofuels to displace fossil fuels, do not overlap with the requirements of the Renewable Energy Act and may be eligible under GGAP.

The Renewable Remote Power Generation Programme (RRPGP) provides financial support to increase the use of renewable energy generation in remote parts of Australia that presently rely on diesel for electricity generation. The RRPGP will not fund solar hot water systems.

Northern Territory's Renewable Energy Rebate Programme (RERP)

This programme has a budget of $38.2 million in RRPGP funds to provide rebates of 50% of the initial capital costs of renewable energy installations in remote areas of the Northern Territory. Eligible target groups are:

- small communities and households, including outstations and small indigenous communities;
- commercial operations, including pastoral properties and tourist operations;
- large communities, including towns and large indigenous communities; and
- industrial operations, including mine sites.

Indigenous Community Support Programme

This programme has a budget of $8 million in RRPGP funds. Managed by the Aboriginal and Torres Strait Islander Commission (ATSIC), the programme focuses on energy issues in remote, off grid indigenous communities. The programme has two objectives:

1. increase industry capacity to service indigenous communities; and
2. build greater understanding of renewable energy issues within communities.

A leading feature of the project is the creation of mobile service teams designed to assist communities with education, advice, repairs and maintenance of renewable remote area power supply systems.

Renewable Energy Commercialisation Programme (RECP)

RECP supports the demonstration and commercialisation of innovative, substantially Australian renewable energy equipment, technologies, systems and processes. This 5-year, $55.6 million competitive grants programme is designed to foster the development of a renewable energy industry in Australia and to reduce greenhouse gas emissions.

This programme has two separate components: technology commercialisation, and industry development.

Grants, usually between $100,000 and $1 million, have been offered to support competitively selected projects which can demonstrate:

- strong commercialisation potential (or, for feasibility studies and/or prototype development, a clear pathway to commercialisation);
- contribution to the wider development and diversification of Australia's renewable energy industry, domestically and/or internationally; and
- reduction of greenhouse gas emissions.

Applicants fund at least 50% of the project costs, and demonstrate their capacity to raise capital funds to support the ongoing commercial exploitation of the project outcomes.

The industry development component of RECP is expected to be of most interest to industry associations and community organisations, although demonstration of industry support for proposals will be required.

Successful projects will have a clear industry development outcome and could include:

- mechanisms to address barriers to the uptake of renewable energy;
- assessment of renewable energy resources;
- development of standards for the renewable energy industry; and
- promotion of renewable energy use.

Commonwealth Support

The Australian Greenhouse Office is the lead Commonwealth agency on greenhouse matters, and has responsibility for delivering a number of renewable energy programmes, including this site. The Greenhouse Office is implementing the mandatory target for an additional 9,500GWh of electricity to be produced from renewable sources by the year 2010, and a number of financial incentives for the production and use of renewable energy.

Other Commonwealth support for business, including renewable energy businesses, is delivered by the Department of Industry, Science and Resources.

South Australia

The South Australian Government's sustainable energy objectives address the energy-related aspects of sustainable economic development and complement the National Greenhouse Strategy.

The state government has announced that from July 2002, all new houses will be required to achieve a minimum energy performance requirement equivalent to a four star energy efficiency rating. Major extensions will be required to achieve this rating from Jan 2003.

The Greenhouse Challenge is a programme of cooperative agreements between industry and government whereby companies undertake action to abate their greenhouse gas emissions through energy efficiency and other measures. The programme is being extended to engage smaller businesses through the Greenhouse Allies programme. The State Government has completed a successful Allies programme with the Motor Trades Association and is currently involved in a further programme with the SA Wine and Brandy Industry Association.

New South Wales

SEDA is an agency created by the New South Wales Government to reduce the level of greenhouse gas emissions in NSW. SEDA accomplishes this by promoting investment in the commercialisation and use of sustainable energy technologies.

The PowerSaver Home Pack is a bundle of energy-efficient products that significantly improves the energy-efficiency of new homes The PowerSaver™ Home Pack includes; glasswool insulation, solar control glass, SWH, energy-efficient demisting mirrors, and a Free DishDrawer dishwasher.

For those building or renovating a home in an Energy Smart Council area, they may be eligible for $500 off a solar hot water system.

SEDA and EnergyAustralia offered NSW homeowners rebates of up to $900 on the cost of a solar hot water system. The programme targets Sydney, Newcastle, the Hunter, Central Coast, Illawarra and the Blue Mountains. SEDA pay $100 for the first 1,000 customers, on top of $800 rebate. Customers also have the option of paying off the system over two years as part of their energy bill.

Victoria

The Sustainable Energy Authority is a Victorian Government agency established to contribute to the reduction of greenhouse gases, and support and facilitate the development and use of sustainable energy options to achieve environmental and economic benefits for the Victorian community.

The Sustainable Energy Authority has introduced the Solar Hot Water Rebate programme as part of the Victorian State Government's commitment to reducing greenhouse gas emissions. The Government has provided up to $15 million for funding this programme to June 2003.

The Solar Hot Water Rebate programme has been designed to provide rebates for solar water heaters that replace conventional systems for a positive environmental effect. The Rebate has been structured so that it is generally a point-of-sale discount available from the manufacturer.

Rebates of up to $1500 are available for solar water heaters installed under the Rebate programme. The amount of rebate is based on the performance of a system (as assessed by Australian Standard 4234) and the type of water heater that is being replaced. The better performing systems, or the ones that make the most effective use of the sun's energy, attract a higher rebate. There is a list of accredited systems and the rebate they attract.

To be accredited, a solar water heater system must fulfil several criteria:

- Greater than 50% solar fraction in Northern Victoria as tested under AS4234
- A warranty on major components of no less than 5 years including frost protection
- The system must be new and not second-hand (pre-heaters can be attached to an existing tank but the pre-heater system must be new)

Solar water heaters installed for the following purposes will be eligible for a rebate:

- Residential use (this includes holiday homes, motels, caravan parks, hostels, boarding schools etc.)
- Community facilities (this includes non-profit organisations, churches, local government buildings, sporting clubs etc.)
- Use in farms
- Domestic hot water purposes

Only system installations that result in reduced greenhouse gas emissions are eligible for a rebate. As a result the replacement of an existing natural gas water heater with an electric-boosted solar water heater will not attract a rebate. Only gas-boosted solar systems will attract a rebate.

An existing electric water heater can be replaced with a solar-electric system in a home with a natural gas connection, provided that there is off-peak electric water heating at the residence. The applicant will be required to sign a declaration giving information about current gas connections to the house or the availability of a gas connection for new homes. The installer will also be required to sign a declaration regarding the existence of a gas connection to the house.

A solar water heater (including collectors and tank) can be attached to an existing conventional water heater and will still qualify for a rebate. When a system is configured in this way it acts as a preheater.

A solar water heater that is generally designed for electric boosting can be connected to an existing gas water heater provided that an electric element is not fitted. Where the existing water heater is gas-fuelled then an attached solar preheater will only be eligible for a rebate if the existing water heater is expected to last for 3 years.

Solar water heater retrofit kits are now available on the list of accredited systems. It is up to the manufacturer to approach SEAV with retrofit kit details in order to have them included in the rebate programme.

Locations that require large amounts of hot water (such as dairy farms or apartment buildings) can also benefit from the Rebate programme. Rebates for larger systems are calculated based on the area of collectors, and the performance of the collector as tested to AS2535.1.

A solar system using solid fuel boosting or installing a system as a preheater to a solid fuel water heater can be installed in any situation and will attract the specified rebate.

Summary of Rebates

Situation	Rebate availability
Existing homes with no natural gas connection	Rebates available for any accredited solar water heater.
House with a natural gas connection, replacing an electric water heater	Rebates available for gas-boosted solar water heaters. Rebates will also be available for electric-boosted solar water heaters provided that a copy of an off-peak Y6, Y8 or J6 electricity bill accompanies the application form.
House with a natural gas connection, replacing a gas water heater	Only gas-boosted solar water heaters, or preheaters with the electric element removed will be eligible for a rebate.
New homes with natural gas reticulated down the street	Only gas-boosted solar water heaters, or preheaters with the electric element removed will be eligible for a rebate.
New homes with no natural gas reticulated down the street	Rebates available for any accredited solar water heater.
Adding panels to complete an accredited system (boost fuel criteria must be met)	Will attract a rebate provided the manufacturer is prepared to warrant the system (including the original tank) for 5 years from the installation of the panels.
Adding panels to an existing off-peak electric water heater either with a pump or by thermosiphon	These are defined as retrofit kits in the accredited systems list.

Homeowners using their own plumber, or purchase their solar water heater from a plumbing merchant may not receive the rebate as a point-of-sale discount unless separately claimed for.

The installation of solar water heaters is included as a source of renewable energy certificates. Acceptance of the rebate is conditional upon the applicant assigning the right to create renewable energy certificates to the State Government.

Queensland

The Queensland Government has introduced the Solar Hot Water Rebate Scheme (SHWRS). The Scheme is aimed at Queensland residents who purchase a new solar hot water system or replacement parts for domestic purposes and install them at their principal place of residence.

The rebates do not apply to solar hot water systems installed:

- At rental properties, commercial, industrial or business locations, public housing and holiday homes
- For non-domestic purposes such as heating a swimming pool
- To replace an existing solar hot water system damaged as a consequence of an insurable event, and subject to a current or future insurance claim

The rebates are available upon receipt of evidence that purchase and installation has occurred on or after 23 May 1998 on a new solar hot water system, as either a first hot water system or a replacement for an existing hot water system (electric, gas or solar):

- $750 or $500 (if installed before the 24 May 2000) on the cost of a new solar hot water system with a panel collector area of 3.5 square metres or greater (nominal two panel system); or
- $450 or $300 (if installed before the 24 May 2000) on the cost of a new solar hot water system with a panel collector area of 1.75 square metres or greater - up to 3.49 square metres (nominal one panel system).
- Rebates are available for the cost of replacing component parts (tanks and panels only) of existing solar hot water systems:
  - $150 or $100 (if purchased and installed before the 24 May 2000) on the cost of replacing a panel and $150 or $100 (if purchased and installed before the 24 May 2000) on the cost of replacing a tank of an existing solar hot water system, with the rebate limited to $300 or $200 (if purchased and installed before the 24 May 2000) per household (i.e. 1 x tank and 1 x panel).

All solar hot water systems and components rebated under the Scheme must be certified by the manufacturer as satisfying one or more of the following standards:

- AS 2712;
- Watermark; or
- manufactured in accordance with AS/NZS ISO 9001.

All systems must be installed by a qualified electrician/plumber.

Energex
Since January 2002 Brisbane based retailer Energex has been offering an upfront payment of up to $830 for consumers buying a solar hot water system, under a revised Solar Certificates Programme. The Energex Solar Certificates Programme was introduced as a result of the Federal Government's 2 percent renewables target. Energex claim that their Solar Certificates Programme has processed more than 70% of RECs created by solar hot water systems.

Energex customers can claim the RECs payment at the time of purchase from their solar water heater dealer and immediately realise financial benefits rather than to wait for their RECs to be registered with the Office of the Renewable Energy Regulator.

The government rebate offered in some states, combined with the RECs payment is offset against the purchase price of solar water systems.

Programme partners are - Solahart, Edwards Hot Water and Beasley Water Systems.

Western Australia

The Government of Western Australia offers subsidies of up to $500 off the standard cost of a solar hot water system purchased after the 25th of November 2001 to:

- homeowners installing an accredited gas boosted solar hot water system into a Western Australian residence or
- first homeowners installing an accredited electric boosted solar hot water system with a boosting timer into a newly constructed residence

A subsidy of $500 is available for systems with a 300 litre capacity or above and with a solar panel space of at least 3.5m^2 (family size) unless otherwise approved. For systems below 300 litres in capacity and a solar panel space between 1.72 and 3.49m^2 (1 or 2 person household), a subsidy of $300 is available.

Note: Commercial or government premises, and replacement parts are not eligible for the subsidy.

The Alternative Energy Development Board (AEDB) provides grants (usually in the range of $10,000 - $50,000) for research, demonstration and education projects which:

- Promote the use of renewable energy sources in Western Australia
- Promote the more efficient end use of energy in Western Australia
- Improve the understanding of renewable energy resources and the importance of energy management and efficient energy use.

The annual budget for the AEDB is around $500,000. Support for individual grants depends on the availability of funds and the quality of applications. Projects which entail significant expenditure outside Western Australia are eligible for funding, however they must be of benefit to the State.

15. Canada

REDI (Renewable Energy Development Initiative) developed by Natural Resources Canada (NRCan) was announced in December 1997 and came into effect on 1 April 1998. REDI is a 6 year, $24 million programme designed to stimulate the demand for renewable energy systems for space and water heating and cooling. These systems include active solar hot water systems.

Under REDI, NRCan undertakes market development activities, in cooperation with renewable energy industry associations and other partners, and provides an incentive for specific renewable energy systems. To encourage the private sector to gain experience with active solar businesses are eligible for a refund of 25 percent of the purchase and installation costs of a qualifying system, up to a maximum refund of $50,000. NRCan provides a similar incentive to federal departments and to public institutions.

The principle focus of the programme is on commercial, industrial and agricultural business purposes, not residential. Some incentives are however provided to the residential sector for pilot projects delivered by partners.

NRCan undertakes in cooperation with the renewable energy industry, market strategies and assessments, and promotional, advertising and information campaigns. NRCan also helps the industry develop and deliver training programmes, produce design tools, update and develop standards for renewable energy systems, and create a nationwide network of renewable energy technology specialists.

In the first two years of the programme REDI approved 40 applications ($4.4 million) of which 34% were for SWH (8% of expenditure).

Several pilot projects to promote the installation of SHW systems in residential markets have been initiated.

- The SunWater project has identified homeowner candidates for solar energy installation. Monitoring equipment has been installed in a sample of homes
- The Peterborough Green-up project is installing 9 systems from different manufacturers that were selected through a tender process.30 systems will be included in the second phase of the project

16. China

The UN Department of Economic and Social Affairs (DESA) is funding a US$1,832,400 three year to expand the solar heating market in China.

China has a well-established commercial SWH industry that manufactures and sells solar hot water systems. However, poor quality and the fragmented nature of the solar industry in China frequently limit overall market penetration and long-term market growth. In addition, many communities in China do not like the appearance of current solar technology and resist large dissemination efforts.

This DESA project will help develop standards and codes for integration of solar water heaters into building construction. The project will strengthen capacity within the building industry for integration of high quality SWH technology into new residential construction. In addition, the project will disseminate information to consumers on the benefits of solar technology.

The project will also disseminate information to consumers on the benefits of solar technology and explore opportunities for creating financial incentives for real estate developers and home buyers to use solar systems.

17. Israel

In Israel, it is compulsory to have solar water heating in all dwellings in buildings up to eight storeys high.

The law, which came into force in 1974, has culminated in 1.5 million households being equipped with solar water heating. Israel's population is 6 million. At present, more than 80% of all apartments in Israel are fitted with SWH systems, and each year some 100,000 new residential units are constructed and fitted with these systems.

The law has encouraged the growth of a domestic solar water heating industry. The size of the domestic market has enabled high-volume manufacture and economies of scale.

One of the effects of compulsory solar water heating was that it became part of the building process, and was subject to price attack by construction companies. In spite of the existence of standards and a requirement for a five-year guarantee, building contractors trying to cut costs pushed for low-cost, low-quality systems.

After 25 years, the market in Israel was mature and consisted mainly of replacement systems.

18. Morocco

The United Nations Development Programme (UNDP) has been working with the Moroccan government to increase the use of SWH through a market-based strategy. The overall strategy is to remove the principal market barriers to solar water heaters in Morocco, thus increasing market demand, which in turn will lead to an increase in supply.

While in Morocco SWH is considered a commercially mature technology the solar water heater market is underdeveloped, primarily resulting from high prices, poor quality, limited promotion, and insufficient policy. Hence, the project is intended to increase the market demand by addressing four principal market factors: product quality, product price, promotion/marketing, and financial incentive policies. The underlying assumption is that the increased market demand of solar water heaters will bring down the price. In addition, the local assembly and manufacturing capacity will develop once the sufficient market volume can justify the investment, leading to further decrease in prices.

To ensure sustainability of the project, only good quality products will be promoted through a preferential financing mechanism. However, the *end-user pays* principle will be applied. This stems from the fact that long-term costs of using solar water heaters are equal to, or lower than other alternatives currently in use (mainly electric water heaters). This will contribute to the development of a least cost development strategy, both in financial and economic terms, for the provision of hot water for various end-uses.

The project is designed to improve the financial incentive policies for renewable energy, particularly related to solar water heaters in Morocco, such as import tariff and tax incentives, thus providing incentives for dealers to promote solar water heaters, and for consumers to purchase them. The goal is to increase market demand for solar water heaters by levelling the playing field between renewable energy and conventional energy.

The project will help develop an aggressive product promotion and marketing campaign for decision-makers and professionals, a national marketing plan targeting different consumer groups, and a bundling programme targeting large groups of consumers. In addition, the rehabilitation programme to retrofit existing solar water heater installations with poor quality will increase consumer confidence in the product, and improve local technical capability of installation and maintenance of high quality solar water heating systems through a hands-on training programme.

This project will also develop financing mechanisms for the consumers, dealers, and investors, as well as prepare a business plan and a pipeline of 10-12 bankable proposals. It will also have increased access to information on internationally available systems for dealers, and improved dialogue between suppliers and installers, with a goal of reducing prices and mark-up fees. In addition, this project will put in place an incentive-based Quality Guarantee Fund mechanism, which will provide favourable financial arrangements for the good quality products. Thus, the market price for good quality solar water heaters is expected to drop with the increased market volume.

Finally, this project will have a quality control component to establish standards and codes of practice, develop testing procedures and capacities, develop certification and labelling, train manufacturers and inform consumers of the improved standards and certification, and design the performance contracting enforcement mechanism.

One of the main goals of this project will be to demonstrate the win/win nature of good quality solar water heaters investment to manufacturers, dealers and consumers so as to ensure private sector sustainability beyond the period of the project.

19. Application to New Zealand

There is a common thread that links all government programmes reviewed. That is that there are mixture of initiatives available and they each need to be included in a well developed broad national programme. In each country where SWH use has increased significantly there has been a partnership between the government and industry to address the issues of quality standards, promotion and public perception. National targets appear very important, and the funding assistance (fiscal and / or financial) from government is very common.

The majority of national programmes are a mixture of strong government leadership, government assistance, and market development through promotion. The involvement of government is usually to meet national environmental and energy policies specifically related to least cost energy, movement from fossil fuel base energy to renewable energy, and greenhouse gas reduction.

There is a common view that the technology is commercially mature but the SWH markets are under developed.

The national benefits of greater use of SWH are considered high but there are a number of barriers that limit individual investment contributing to acquisition of this national benefit.

Specific initiatives that appear to warrant further investigation include:

- European Soltherm Europe project
- UNDP Moroccan project
- German, Austrian and Greek programmes
- Individual US promotion programmes
- Use of Australian Renewable Energy Certificates and the United Kingdom Green Certificates
- US and Australian fiscal and financial incentives

Annex A

Summary of Best Practice Information Contained in the Report "Renewable Energies: Success Stories" Produced for the European Environment Agency

This study presents a series of examples of successful renewable energy development in EU Member States. By analysing these cases it seeks to understand the factors that influence the success of renewable energy schemes and to facilitate their widespread penetration in the Member States. The study aims to provide policy-makers and policy implementers with an opportunity to learn from each other's experiences, and thereby to contribute to EU and Member State efforts to meet their renewable energy indicative targets for 2010.

The study drew on the considerable amount of previous work carried out at EU and Member State level on the barriers that hinder the implementation of renewable energies. It identifies a number of potential success factors likely to have a positive influence on the development of renewable energy technologies.

The following conclusions summarise the results of the analysis carried out, based on the case studies.

- The successful policies demonstrate that strong political support at national, regional or local level is a consistent component in successful penetration of renewable energy. The support is either of renewable energies in general or of a particular renewable energy. Most governments had implemented energy plans that supported the development of renewable energy and/or had identified national or regional targets for increased renewable energy use and associated policies and measures to support renewable energy uptake.

- Fiscal measures may be implemented in the form of environmental taxes, which penalise the use of fossil fuel (and hence benefit renewable energy use) or as a positive form of tax incentive for environmentally beneficial investment, such as a tax exemption or reduction. Both forms of fiscal support measure are increasingly being used by Member States to encourage renewable energy and other environmentally beneficial activities, or for penalising fossil generation or other environmentally damaging activities.

- Denmark was one of the first countries to implement an environmental tax. Energy consumers were charged a CO_2 tax from 1992, with some of the revenue given to generators of electricity from renewable sources.

- Member States, including Austria, Denmark, Finland, Italy, the Netherlands and Sweden, have now implemented various forms of environmental tax. They have introduced energy or environmental taxes as part of their overall energy policy to more accurately reflect the total costs (including costs to the environment) of generating heat or power from fossil or non-fossil sources.

- The types of environmental taxes implemented vary widely; they may be levied on energy use (both heat and electricity), power or heat generation, CO_2, or SO_2.

- In some cases (including Austria and Italy), some or all of the revenues received from energy taxes are recycled to benefit renewable energy, energy efficiency, or other environmental projects.

- Fiscal arrangements can also be used to encourage investment in renewable energy or energy-saving projects.

- Tax exemptions or reductions can encourage private individuals and companies to consider investing in renewable energy projects as an attractive financial option. For example, in Germany and Sweden, investment in wind schemes can be offset against tax for individuals, while in Ireland, the Netherlands and Spain companies receive tax relief if they invest in renewable energy projects. In Greece, the installation of SWH water-heating systems has been stimulated by tax exemptions for households buying renewable energy appliances such as solar water heaters. In the Netherlands, companies and firms which invest in energy-saving projects (including renewable energy projects) can benefit from claiming accelerated depreciation of investment in equipment for such projects.

- Financial support for the development of renewable energy schemes at the commercial or near-commercial stage is found in almost all the Member State/technology combinations studied. This kind of support is generally through grants or loans towards capital or operational costs. It is clearly an important factor in influencing the successful implementation of renewable energy technologies, both for power and for heat technologies.

- Three Member States (Austria, Germany and Greece) achieved significant increases in exploitation of solar energy for heat. In all three, substantial subsidies are being or have been provided to households or industry to install SWH. This support is still required because the payback period for SWH installations is long. In Austria and Germany, many of the subsidies for SWH installations are provided from regional government funds, and are implemented at the local level. Solar thermal is often not included in national energy policy targets because it is a heat technology and can most successfully be implemented at the local level.

- Fiscal measures act in favour of renewable energy in two ways: as part of wider environmental tax initiatives and/or as fiscal arrangements to encourage investment in renewable energy.

- Environmental tax initiatives are inter alia implemented as part of Member States' environmental policies, particularly to reduce greenhouse gas emissions. These taxes recognise and reward the environmental benefits from renewable energy, and are increasingly seen as a way of internalising the environmental costs and benefits of energy systems. The case studies demonstrate that environmental taxation is becoming increasingly common in many Member States (Austria, Denmark, Finland, Italy, the Netherlands, Sweden). Taxes are mainly focused on the carbon dioxide or energy content of the fuel, but also on emissions from pollutants (SO_2, NOx). Renewable energy benefits either through exemptions or refunds from the taxes, or by being subsidised from revenue raised from the taxes.

- Many Member States also allow tax exemptions/reductions or tax incentives for individuals or companies to invest in renewable energy projects. Again, this approach rewards investment in clean technologies, and can also encourage a greater level of awareness of and investment in renewable energy by business or the public.

- Financial support to renewable energy schemes is found in almost all the Member State/ technology combinations studied, and is clearly an important factor in influencing the successful implementation of renewable energy technologies, for both power and heat.

- In some Member States citizens have a high level of environmental awareness and a desire to reduce dependence on fossil or nuclear energy sources, and understand the role that renewable energy can play. As the case studies emphasise, they are sometimes also well aware of a specific renewable energy, because it is already used extensively (e.g. biomass). However, in some other Member States education and information campaigns are essential to generate interest and informed debate amongst the general public.

- The success of a renewable energy project, and its subsequent replication, ultimately resides with its public acceptability at local level. At the local level, emphasising non-energy benefits is an important component in the acceptability of renewable energy, especially its role in providing an income stream and local jobs. Cooperative participation in a project can be a successful way of involving the local population in a new renewable energy development.

- Cooperative financing of renewable energy projects is common in a number of Member States, particularly Denmark, Germany and Sweden. The role of the developer could also be important to the public acceptance of a new renewable project and requires that developers work with the local community to provide information about the nature of the new developments and their potential benefits. In Spain, the example of wind energy included a strong element of information dissemination to the local community before the project was fully accepted.

Annex B

Summary of the Principal Support Mechanisms Identified in the Case Studies for Renewable Energy Power Developments (1993 –99)

From European Environment Agency report "Renewable Energies: Success Stories"

Member State	Legislative support	Fiscal initiatives	Financial support
Austria	Guaranteed prices	Energy taxes on gas and electricity; revenue partly recycled to support renewable energy	Public grants, subsidies and loans
Denmark	Purchase obligation + premium guaranteed prices	Energy/carbon dioxide taxes on fossil fuel; revenue partly 'recycled ' to support renewable energy	Subsidies provided historically for research, development and demonstration (R,D&D), especially in wind Subsidies (capital grants — biomass)
Finland	Transmission costs are fixed; grid access is open to all producers	Energy/carbon dioxide taxes on fossil fuel; revenue partly 'recycled ' to support renewable energy	Subsidies on investments and equipment (capital grants)
France	Competitive tendering (Eole 2005)	–	Subsidies (capital grants — biomass)
Germany	Purchase obligation + premium guaranteed prices	Tax benefits for investing in renewable energy	Subsidies and low-interest loans for all renewable energy projects provided by local banks. Direct financial support: PV roofs programme; subsidies for biomass installations
Greece	Purchase obligation + premium guaranteed prices	Tax benefits for investing in renewable energy	Subsidies (capital grants — SWH)
Ireland	Competitive tendering (Alternative Energy Requirement, AER)	Tax benefits for investing in renewable energy	Subsidies (capital grants)

Italy	Purchase obligation + premium guaranteed prices	Energy/carbon dioxide taxes on fossil fuel; revenue recycled to support renewable energy	–
Netherlands	Purchase obligation	Energy/carbon dioxide taxation favourable towards renewable energy. Tax benefits for investing in renewable energy	Government subsidies. Obligation for utilities to invest in renewable energy projects
Portugal	Purchase obligation + premium guaranteed prices	–	Interest-free loans. Support for grid connection
Spain	Purchase obligation + premium guaranteed prices	Tax benefits for investing in renewable energy	Capital grants (biomass)
Sweden	Purchase obligation	Renewable energy pays lower or no energy tax or nitrous oxide levy Tax benefits for investing in renewable energy	Investment grants

Annex C

Summary of Results and Conclusions from the Report "Untapped Market Opportunities for Solar water Heating in Europe" Produced for the European Commission DG TREN

A market survey was carried out which collected data on the market players in four countries, gathered information on policy incentives and subsidies in place, identified levels of public awareness of SWH, and looked at the social, economic and environmental characteristics of each country. The SWH market structure was analysed in each country as were the opinions of the market players and the level of market penetration of SWH systems.

The project included an analysis of the SWH markets in France, Germany, Spain and the UK, which identified the barriers to SWH deployment as well as successes in each country.

A strategy handbook has been developed for the British, French and Spanish markets which addresses the barriers and identifies technical, financial, political and social recommendations.

The results of the questionnaire-based enquiry show how SWH and the different aspects of the SWH market are perceived by different categories of the public (including clients, professionals and decision-makers) in the four study countries.

SWH in the Eye of the Public: Information, Awareness, Acceptance and Publicity

Information sources on renewable energies do not differ much between the study countries. Printed media are mentioned most frequently, followed by TV and radio; Internet comes last: information on SWH still follows a rather classical path.

An important difference between countries concerns independent tests. 54% of German users draw information for their system choice from tests. For the other study countries, this figure is less than 20%, indicating the need for independent test publications there.

Public awareness is still low: in all countries except Germany, only a minority of respondents considers that the public is aware of SWH.

SHW acceptance is high: a large majority of respondents in the four countries approves renewable energy technologies in general and SWH in particular.

On the other hand, not everybody is aware of this high acceptance: a majority of solar professionals, particularly in France and the UK, think that the public has a low opinion concerning their product and thinks that SWH are haunted by technical problems. The enquiry results show that this is unfounded: in fact, the public is far more positive than the professionals fear.

Everybody agrees that SWH suffer from poor publicity – even in Germany.

- **Information on SWH still relies mostly on print media**
- **Independent test results have an impact on SWH choice only in Germany**
- **Public awareness is low except in Germany**
- **SWH acceptance is high**
- **SWH professionals in France and the UK have the unfounded fear that the public has a low opinion on their products**
- **SWH publicity is seen to be poor everywhere**

Political and Regulatory Environment

Respondents consider that renewables and particularly SWH presently find themselves in a rather hostile political environment, except for Germany where renewables met market success against an initial resistance from utilities. When asked to rate the main conditions for a market success of SWH, solar professionals consider a favourable policy towards renewable energies a priority.

In all countries, only a minority of decision-makers such as planning departments feel that building codes are favourable for renewable energies.

- **Respondents feel that SWH face a hostile political environment**
- **Building codes are seen by decision-makers to be unfavourable towards renewable energies**

Technology and Cost

When asked about their opinion on whether the SWH available on the market are adapted to users needs, a majority in France, Germany and Spain agreed that SWH are adapted. In the UK, potential solar professionals don't agree.

Solar energy professionals in Germany, but also to a lesser degree in Spain and the UK, do not believe that simpler SWH (integrated or mono-block type systems) are adapted to users' needs: freezing is mentioned most, followed by low performance, installation and integration problems, and the observation that costs are still high. Professionals in France don't share this scepticism.

The most important finding on technical problems is that SWH have almost twice as many problems in France and in the UK than in Germany and Spain.

As for the nature of technical problems: installation problems occur in all study countries (most in Germany), problems with maintenance (first in the UK) and durability (high occurrence in France and Spain) have almost disappeared in Germany. Safety problems are rare, except in the UK.

Single most important problem in France and Spain is tank durability, but does not occur in Germany and the UK where obviously better quality storage tanks are used.

Cost does not seem to be the decisive success factor for SWH: in Germany, systems are of the highest capacity and cost the most; in France, systems are somewhat smaller and cost half compared to Germany, but French respondents provided a shorter estimate of useful life. Spain and the UK are situated between the two extremes.

- **SWH are seen as adapted to users needs, except in the UK where potential solar professionals don't agree**
- **Simple SWH are seen to have market potential in France**
- **Technical problems are twice as frequent in France and UK than in Germany and Spain, tank durability is the most reported problem (France and Spain)**
- **Highest average SWH cost is reported in Germany**

Incentives

The public at large is not aware of incentives, apart from the case of Germany.

Subsidies as operated at present are seen to have a number of negative side effects, particularly in France. Part of the professionals are worried about quality standards and defend the necessity of restrictive labels, and excluding non-labelled hardware and installers. Other professionals provided a number of harsh comments describing subsidies as detrimental to fair competition. Fact or fiction, this kind of antagonism can pollute the business atmosphere. One of the most important prerequisites for the SWH market success is thought to be the provision of efficient incentives without stifling competition, without creating a negative atmosphere amongst clients and professionals – and without compromising quality.

- **Incentives are not well known by the public, except for Germany**
- **Subsidies can be detrimental to fair competition and should leave an open choice in terms of materiel and installation – without compromising quality**

The Client's Decision to Acquire a SWH

SWH users in all study countries attach high priority to energy savings and environmental consciousness. On the other hand, non-users would change their mind if SWH prices would drop or if energy prices would rise, further reasons being government approval, better technology and more information. Government endorsement towards SWH would reassure clients and facilitate their decision to invest in SWH.

The main influences on the decision to have a SWH installed: except for Germany, other users are a decisive influence, as well as installers who are first in Spain and without influence in France. The present lack of active influence by promoters and architects shows a potential market opportunity.

The reasons why potential users do not purchase a SWH system are mainly related to price: "cannot afford" and "other systems are cheaper", followed by "architectural constraints" and "no competent professional found". A market segment, which should be relatively easy to conquer, consists of the 10% of potential users who could not find a competent professional.

Price is important to potential users and potential solar professionals, while it is not a central issue for users and solar energy professionals who are more concerned about whether future energy costs and energy policy justify the acquisition of a SWH.

- **Government endorsement towards SWH would reassure clients and facilitate their decision to invest in SWH**
- **The present lack of active influence by promoters and architects shows a potential market opportunity**
- **A promising market segment consists of the 10% of potential users who could not find a competent professional.**

Annex D

Summary Of State Incentives Available For Solar Water Heating Throughout The United States

Financial Incentives

Corporate Tax Incentives

Corporate tax incentives allow corporations to receive credits or deductions ranging from 10% to 35% against the cost of equipment or installation to promote renewable energy equipment. In some cases, the incentive decreases over time. Some states allow the tax credit only if a corporation has invested a certain dollar amount into a given renewable energy project. In most cases, there is no maximum limit imposed on the amount of the deductible or credit.

Direct Equipment Sales

A few utilities sell renewable energy equipment to their customers as part of a buy-down, low-income assistance, lease, or remote power programme.

Grant Programmes

States offer a variety of grant programmes to encourage the use and development of renewable energy technologies. Most programmes offer support for a broad range of renewable energy technologies, while some states focus on promoting one particular type of renewable energy such as wind technology or alternative fuels.
Grants are available primarily to the commercial, industrial, utility, education, and government sectors. Some grant programmes focus on research and development, while others are designed to help a project achieve commercialisation. Programmes vary in the amount offered--from $500 to $1,000,000--with some states not setting a limit.

Industrial Recruitment Incentives

This category focuses on special efforts and programmes designed to attract renewable energy equipment manufacturers to locate within a state or city. Renewable energy industrial recruitment usually consists of financial incentives like tax credits, grants, or a commitment to purchase a specific amount of the product for use by a government agency.

The recruitment incentives are designed to attract industries that will benefit the environment and create jobs. In most cases, the financial incentives are temporary measures that will help support the industries in their early years but include a sunset provision to encourage the industries to become self-sufficient within a number of years.

Leasing/Lease Purchase Programmes

Utility leasing programmes target remote power customers for which line extension would be very costly. The customers can lease the technology from the utility, and in some cases, the customer can opt to purchase the system after a specified number of years.

Loan Programmes

Loan programmes offer financing for the purchase of renewable energy equipment. Low-interest or no-interest loans for energy efficiency are a very common strategy for demand-side management by utilities. State governments also offer loans to assist in the purchase of renewable energy equipment. A broad range of renewable energy technologies are eligible. In many states, loans are available to residential, commercial, industrial, transportation, public, and nonprofits sectors. Repayment schedules vary; while most are determined on an individual project basis, some offer a 7-10 year loan term.

Personal Income Tax Incentives

Many states offer personal income tax credits or deductions to cover the expense of purchasing and installing renewable energy equipment. Some states offer personal income tax credits up to a certain percentage or predetermined dollar amount for the cost or installation or renewable energy equipment. Allowable credit may be limited to a certain number of years following the purchase or installation or renewable energy equipment.

Property Tax Incentives

Property tax incentives typically follow one of three basic structures: exemptions, exclusions, and credits. The majority of the property tax provisions for renewable energy follow a simple model that provides the added value of the renewable device is not included in the valuation of the property for taxation purposes. That is, if a renewable energy heating system costs $1,500 to install versus $1000 for a conventional heating system, then the renewable energy system is assessed at $1000.

Property taxes are collected locally, so some states allow the local authorities the option of providing a property tax incentive for renewable energy devices. Six states have such provisions: Connecticut, Iowa, Maryland, New Hampshire, Vermont, and Virginia.

Rebate Programmes

Rebate programmes are offered at the state, local, and utility levels to promote the installation of renewable energy equipment. The majority of the programmes are available from state agencies and municipally owned utilities and support SWH and/or photovoltaic systems. Eligible sectors usually include residents and businesses, although some programmes are available to industry, institutions, and government agencies as well. Rebates typically range from $150 to $4000. In some cases, rebate programmes are combined with low or no-interest loans.

Sales Tax Incentives

Sales tax incentives typically provide an exemption from the state sales tax for the cost of renewable energy equipment.

Rules, Regulations & Policies

Construction and Design Policies

Construction and design policies include state construction policies, green building programmes, and energy codes. State construction policies are typically legislative mandates requiring an evaluation of the cost and performance benefits of incorporating renewable energy technologies into state construction projects such as schools and office buildings. Many cities are developing "Green Building" guidelines that require or encourage consideration of renewable energy technologies.

Some guidelines are voluntary measures for all building types, while others are requirements for municipal building projects or residential construction. Local energy codes are used to achieve energy efficiency in new construction and renovations by requiring that certain building projects surpass state requirements for resource conservation. Incorporating renewables is one way to meet code requirements.

Contractor Licensing

Many states have rules regarding the licensing of renewable energy contractors. These requirements--where they do exist--are designed to ensure that contractors have the necessary experience and knowledge to properly install systems.

Equipment Certifications

Statutes requiring renewable energy equipment to meet certain standards are generally seen as a tool for reducing the chance that consumers will be sold inferior equipment. Beyond being a consumer protecting measure, equipment certification benefits renewables by reducing the number of problem systems and the resulting bad publicity.

Public Benefit Funds

Public Benefit Funds (PBF) are typically state-level programmes developed through the electric utility restructuring process as a measure to assure continued support for renewable energy resources, energy efficiency initiatives, and low-income support programmes. (These funds are also frequently referred to as a system benefits charge, or SBC). Such a fund is most commonly supported through a charge to all customers on electricity consumption, e.g., 0.2 cents/kWh. Examples of how the funds are used include: rebates on renewable energy systems; funding for renewable energy R&D; and development of renewable energy education programmes.

Renewables Portfolio Standards/Set Asides

Renewables Portfolio Standards (RPS) require that a certain percentage of a utilities overall or new generating capacity or energy sales must be derived from renewable resources, i.e., 1% of electric sales must be from renewable energy in the year 200x. Portfolio Standards most commonly refer to electric sales measured in megawatt-hours (MWh), as opposed to electric capacity measured in megawatts(MW). The term "set asides" is frequently used to refer to programmes where a utility is required to include a certain amount of renewables capacity in new installations.

Solar Access Laws

These statutes provide for solar easements or access rights. Easements allow for the rights to existing access to a renewable resource on the part of one property owner to be secured from an owner whose property could be developed in such a way as to restrict that resource. This easement is transferred with the property title. Access rights, conversely, automatically provide for the right to continued access to a renewable resource. Solar easements are the most common type of state solar access rule. Furthermore, some states prohibit neighbourhood covenants that preclude the use of renewables.

At the local level, communities use many different mechanisms to protect solar access, including solar access ordinances, development guidelines requiring proper street orientation, zoning ordinances that contain building height restrictions, and solar permits.

Annex E

Solar in Arizona - The Arizona Solar Initiative

The Mission of the Arizona Solar Initiative is to encourage individual, local, and statewide action that capitalises on the national Million Solar Roof Initiative and the region's explosive growth. This Initiative will help enable Arizona to become a national leader in solar energy utilisation, manufacturing, and exports.

Goal 1
Establish an Arizona Solar Initiative sub-committee of the Arizona Solar Energy Advisory Council. The sub-committee will be comprised of invited parties and a representative from the Energy Office.

Objective:
a. To serve as Arizona's clearinghouse for the MSR Initiative.

Goal 2
Install 100,000 new thermal and photovoltaic systems in Arizona by 2010.

Objectives:
a. Encourage the Community of Civano L.L.C. and other current and future solar projects around the state to utilise active and passive solar systems.
b. Assist ARISEIA and others in the industry in promoting consumer confidence in Arizona's solar industry and in developing the infrastructure necessary to complete Goal #2.
c. Support the grassroots efforts of ASEA, CFS, and others in educating the population on the benefits of solar.
d. Hold up the Scottsdale Green Builders Programme and the Tucson Sustainability Code, which are solar friendly, as models for residential building programmes statewide.
e. Work with the state Energy Office to develop a series of workshops that provide instruction in the areas of photovoltaic and solar water heating system design, installation, maintenance and service.
f. Push for the adoption of minimum level requirements to qualify a PV system or component for general public buy-down or tax rebate.

Goal 3
Establish technical capabilities to utilise solar in government and non-government application.

Objectives:
a. Promote the development of photovoltaic certification programmes for technicians and installers.
b. Encourage the development of solar technician training courses at the community college level or equivalent.
c. Support the continued operation of a thermal technician certification programme run by the industry association.
d. Encourage government personnel to attend solar training workshops.
e. Encourage the testing and evaluation of solar system components by in-state organisations.

Goal 4
Educate consumers about the benefits of using passive and active solar systems.

Objectives:

a. Support the efforts of the Arizona Solar Energy Advisory Council in the establishment of a virtual solar centre on the Internet that will contain all pertinent information relating to solar energy and its use.

b. Identify and promote financial tax incentives and low interest rate loan programmes for new solar systems.

c. Support the continuation of the state Energy Office's solar education programmes, which include school programmes, seminars, workshops, and high profile demonstration projects.

d. Encourage the state Energy Office to develop and distribute informational materials (pamphlets, radio PSAs, and videos) that educate and inform Arizonans about the benefits of using solar.

Goal 5

Coordinate industry and government efforts to overcome institutional barriers.

Objectives:

a. Promote changes to deed restriction policies that will allow full utilisation of solar in residential settings.

b. Work with the Corporation Commission to establish an equitable net metering policy for electricity generated from solar.

c. Establish an effective solar access policy for the state and overcome obstacles to its implementation.

d. Advocate creation of a buy-down programme for solar systems. Some options may include a fund established by electric service providers.

e. Work with other state agencies (and JLBC) to have government set an example of what can be accomplished.

f. Encourage and assist local governments to adopt appropriate sustainable energy codes such as the Tucson Sustainable Energy Code as an option to their established codes.

Goal 6

Develop and support solar manufacturing capacity in the state.

Objectives:

a. Work with the appropriate political subdivision to establish tax policies favourable to renewable manufacturers.

b. Support the efforts of the Greater Flagstaff Economic Council in locating new solar manufacturers to the state.

c. Encourage the state legislature and other governmental agencies to establish a procurement policy that encourages the purchase of solar products from local manufacturers.

d. Promote the export of renewable energy products manufactured in Arizona.

e. Propose the development of "Solar Enterprise Zones", "Solar Industrial Parks", or other programmes within Arizona as a means of attracting new businesses and expanding those businesses already established within the state.

f. Support efforts to attract trade fairs and solar related conferences to Arizona.

Annex F

Solar Water Heating Incentives in the USA

Type of Incentive	Number of States with Incentive	Description	States
Personal Income Tax Credits	8	Eight states offer tax credits that can be used for residential solar hot water systems. Seven of the eight are based on a percentage of what you pay for the system (and installation). These range from 5% in North Dakota to 40% in Idaho and North Carolina. All indicate a maximum amount. This is usually based on the assumption that the installed system will cost $4000 or less. The eighth state, Oregon, has a performance-based standard. Interestingly, the performance of the system is determined by an estimate of the solar incidence in your area and the assumption that each household uses 75 gallons of 125 F water per day. Thus, the credit is not really performance-based since your system doesn't necessarily have to be working to qualify for the credits. It should also be noted that only Hawaii has a special stipulation for multi-unit dwellings ($350 per unit). Note that states like Florida and Tennessee can't offer tax credits because they do not have state income taxes.	Arizona, Hawaii, Idaho, Massachusetts, North Carolina, North Dakota, Oregon, Utah
Sales Tax Exemption	4	Four states allow solar hot water equipment to be fully exempt from their state sales tax, which range from 5% to 7%. (Arizona is the only state that indicates a maximum exemption amount of $5000.) Researchers from North Carolina note that this incentive tends to be "of more philosophical and public relations import than economic significance. While the incentive shows the states support for solar energy, it is expected that sales increases as a direct result of this incentive will be modest".	Arizona, Florida, Massachusetts, New Jersey
Property Tax Exclusion	13	This incentive states that the added value from the installation of a solar hot water heater will not be included in the assessment of the property's value for tax purposes. Thirteen states have some form of property tax exclusion. Several states allow the city or town to offer the exemption. Some limit the time of this exclusion to 3 to 10 years. Some give an exemption for systems provided that they are valued at no more than the value of a conventional system—thus they are not exempted altogether. This incentive removes barriers, but the effects on sales are also believed to be modest.	Connecticut, Illinois, Indiana, Massachusetts, Montana, Nevada, New Hampshire, North Dakota, Oregon, South Dakota, Texas, Virginia, Wisconsin
Rebates	7	Seven states are known to have at least one utility programme that offers rebates to homeowners who install solar hot water heaters. These rebates range from $150- $1000. (This wide range is due to the wide range and cost of systems required given variations in climate.) On one extreme, SMUD has installed over 3,000 systems under this programme. Hawaii has also been very successful at installing solar hot water heaters through this and other programmes; more than 4000 systems were installed in Hawaii in 1998 through their combination of programmes. At the other end of the spectrum, Wisconsin's rebate programme is believed to have installed only 1 system since 1993.	California (SMUD), Florida (Gainsville), Hawaii, Nevada, Oregon (Emerald and Eugene), Texas (Austin) Wisconsin (MG&E)

Utility Metered Programmes	1	Lakeland Electric in Florida offers residential customers a pilot programme that replaces electric water heaters with metered solar water heaters at no cost. The utility owns the equipment, and charges the customer for its use. A meter on the equipment determines the fee. An electric water heater is kept in the house as a backup. After a certain number of years, Lakeland Electric will offer the customer the option to buy the solar water heater. There are about 35 test cases currently in operation. This incentive programme is similar to a municipal solar utility although much smaller in scale.	Florida (Lakeland)
Financing Loans	7	This incentive programme makes low interest loans available for technologies like solar hot water heaters that reduce the homeowners dependence on conventional energy sources. Under the Nebraska and Iowa programmes, homeowners seeking a loan approach their own financial institution, which must first approve the project on financial terms. The State Energy Office then buys half of the loan at 0% interest so that the total interest on the loan—from the borrower's perspective—will be half the market rate obtained through their private lending institution. The principles of this programme are also being incorporated into a proposed programme in California. Other programmes offer loans for the cost of the system at 4% to 7.25%. The Idaho Energy Division's brochure states, "For existing homes or businesses, the savings from reduced usage of conventional fuel must be sufficient to pay for the project's installation cost (e.g. simple payback of 10 years or less). For new projects, use of a renewable energy resource must be the least cost alternative." The drawback is that renewables have not yet benefited greatly from the programme.	California (SMUD), Idaho, Iowa, Nebraska, Oregon, Virginia, Texas
Certifying Equipment	11	The Solar Rating and Certification Corporation (SRCC) have established national standards for solar equipment. Several states require certification of all solar equipment sold in the state by either SRCC or a state group. Guaranteeing proper installation, however, is much more difficult.	Arkansas, California, Florida, Idaho, Louisiana, Maine, Minnesota, New Jersey, Oregon, Texas, Utah
Licensing Installers	11	Several states offer the equivalent of a solar contractor license. This usually requires four years experience, a fee, and often an exam. In order for individual in Oregon to be eligible to claim income tax credits for their solar energy systems, they must have the system certified by the state Office of Energy or installed by a contractor certified by the Office of Energy under their certified dealer/installer programme. In most of the states, however, you don't have to use a certified installer, so this programme is not used. In Arkansas, for example, very few solar mechanic licenses have been issued since the rules were put into place in 1984 as part of Arkansas's plumbing code.	Arizona, California, Connecticut, Florida, Hawaii, Maine, Michigan, Nevada, Rhode Island, Utah, Oregon
Demand-Side Management	4	Three states require utilities to manage electricity demand by promoting the use of renewables. Hawaii has a very successful programme that uses an IRP surcharge to fund a rebate programme for solar hot water heaters.	Florida, Indiana, Wisconsin, Hawaii
System Benefit Charge	4	Several states are collecting funds for the installation of renewable energy systems. While solar hot water systems are eligible for these funds in many states, it is unlikely that this money will be used to fund solar hot water programmes.	California, Illinois, Montana, Rhode Island

Requirements for State Buildings, Schools, State Housing Projects	6	Several states have passed laws requiring state agencies to evaluate and encourage the use of active and passive solar energy systems in state buildings when life cycle costs indicate they are economically feasible. Florida's law also mandates that schools with hot water demands exceeding 1,000 gallons per day must include a SWH system to provide at least 65% of hot water needs whenever economically feasible. These statutes, however, have not had a large impact on the installation of solar hot water systems.	Arizona, Colorado, Florida, Hawaii, Maryland, Montana
Solar Access Laws	14	State statutes usually include both covenant restrictions and solar easement provisions. The state's covenant restrictions prevent planning and zoning authorities from prohibiting or unreasonably restricting the use of solar energy. They generally do not create an automatic right to sunlight. Rather, they allow parties to voluntarily enter into solar easement contracts, which are enforceable by law. Most were enacted in 1978 and are seldom invoked. New Mexico's Energy Conservation and Management Division reports that three to five solar easements are granted each year. Wyoming's law is the most specific. It allows unobstructed direct sunlight from 9:00 AM to 3:00 PM on the winter solstice (the day with the least sunlight). "While the statute outlines the basic provisions of solar access rights, it leaves implementation to municipalities and counties."	California, Colorado, Hawaii, Indiana, Massachusetts, Minnesota, Montana, Nebraska, Nevada, New Mexico, New York, Utah, Wisconsin, Wyoming

Annex G

Contacts and Sources of Information

Consultants

Alternative Energy (Power Supplies) Ltd		Consultant, supply and installation, solar (water heating and photovoltaic), mini hydro, wind, power systems
IT Power	http://www.itpower.co.uk	IT Power's expertise covers the range of renewable technologies, solar architecture and energy efficiency.
PCM Solectric Co Ltd	http://www.pcmsolectric.co.nz	Energy Consultants, solar & wind generators, water heating, supply and installation
Rainbow Power Company Ltd	http://www.rpc.com.au	Design, manufacture, sell and install renewable energy equipment
Renewable Energy Policy Project (REPP)	http://www.repp.org/	REPP supports the advancement of renewable energy technology through policy research, including our Reports, and Initiatives. We seek to define growth strategies for renewables that respond to competitive energy markets and environmental needs.
Solar Energy Research Pages (ANU)	http://engn.anu.edu.au/solar/	R&D activities in the area of Photovoltaics and Concentrating Solar Thermal systems
Solar Rating and Certification Corporation (SRCC) (USA)	http://www.solar-rating.org	Non-profit organization whose primary purpose is the development and implementation of certification programs and national rating standards for solar energy equipment.
Sunpower Co	http://www.cope.org.nz/sunpower	Consultant, Solar laminates/modules custom made, batteries
Thermocell Limited	http://www.thermocell.co.nz	Thermodynamics research, development and production solar energy
University of New South Wales Photovoltaics Special Research Centre	http://www.pv.unsw.edu.au/	

Educators and Trainers

Florida solar energy center (FSEC)	http://www.fsec.ucf.edu/	An institute of the University of Central Florida (UCF), FSEC functions as the state's energy research, training and certification center.
North Carolina Solar Center	http://www.ncsc.ncsu.edu	Provides programs and resources that help people throughout North Carolina take advantage of solar energy.
RENEWABLE AND APPROPRIATE ENERGY LABORATORY (RAEL)	http://socrates.berkeley.edu	The Renewable and Appropriate Energy Laboratory (RAEL) is a unique new research, development, project implementation, and community outreach facility based at the University of California, Berkeley
Solar Energy and Building Physics Lab	http://lesowww.epfl.ch/	

Installers and Contractors

Alternative Energy (Power Supplies) Ltd		Consultant, supply and installation, solar (water heating and photovoltaic), mini hydro, wind, power systems
PCM Solectric Co Ltd	http://www.pcmsolectric.co.nz	Energy Consultants, solar & wind generators, water heating, supply and installation

Manufacturers and Suppliers

Able Solar	http://www.ablesolar.co.nz/	renewable energy systems utilising Solar and wind powered generating equipment, storage batteries and control equipment.
Alternative Energy (Power Supplies) Ltd		Consultant, supply and installation, solar (water heating and photovoltaic), mini hydro, wind, power systems
Alternative Power NZ Ltd		Specialist in solar, hydro, wind, alternative power systems for remote homes etc. Solahart solar water heating. Manufacturer of Mainland micro hydro units
BP Solar	http://www.bpsolar.com/	high efficiency crystalline and thin film photovoltaic modules
Free Power New Zealand	http://www.freepower.co.nz	consultants and national distributors of Canon® Solar Products and Chromagen® Solar Hot Water Systems
Pacific Solar	http://www.pacificsolar.com.au	Rooftop solar photovoltaic systems
PCM Solectric Co Ltd	http://www.pcmsolectric.co.nz	Energy Consultants, solar & wind generators, water heating, supply and installation
Peacock Technologies Ltd	http://www.ptech.co.nz	solar power modules, panels, wind power generators, regulators, chargers and kits
Power Options (NZ) Ltd	http://www.power-options.co.nz	Solar, wind & micro hydro power equipment
Power Protection Solutions Pty Ltd	http://www.powersolutions.com.au	Energy Specialists for Marine, Vehicle, Industrial, Solar Applications
Precision Technology Ltd	http://www.pretech.co.nz	Solar Panels & Controllers
Rainbow Power Company Ltd	http://www.rpc.com.au	Design, manufacture, sell and install renewable energy equipment
Shell Renewables	http://www2.shell.com/home/Framework?siteId=rw-br	developing commercial opportunities in Solar and Wind energy
Sola 60 NZ Ltd	http://www.sola60.co.nz	Solar hot water systems
Solahart Solar Water Heating (Australia)	http://www.solahart.com.au	Solar hot water systems
Solwind Ltd	http://www.solwind.co.nz	Solar, Wind and Hydro systems designed to suit your needs
Sunpower Co	http://www.cope.org.nz/sunpower	Consultant, Solar laminates/modules custom made, batteries

Synergex Systems NZ Ltd	http://www.synergex.co.nz	Solar hot water, Solar Pool Heating, Skylights
Thermo Dynamics	http://www.thermodynamics.co.nz	Domestic solar power management & mobile solar power systems, water heating
Thermocell Limited	http://www.thermocell.co.nz	Thermodynamics research, development and production solar energy
Wellwind Energy Ltd	http://www.wellwindenergy.co.nz	small solar, wind energy systems and accessories
Zane NZ Ltd	http://www.zane.co.nz	Solar strip absorber system, solar pool heating systems

Government

California Buydown Program (The California Energy Commission)	http://www.consumerenergycenter.org/buydown/	Offering cash rebates on eligible renewable energy electric-generating systems
California Energy Commission Renewable	http://www.energy.ca.gov/renewables/	Renewables Program
California Energy Commission Solar Energy & DG	http://www.consumerenergycenter.org/solaranddg/index.html	solar energy and distributed generation grant program
California's Renewable Energy Programs	http://www.energy.ca.gov/reports/500-99-008.PDF	Buying a Photovoltaic Solar Electric System: A Consumers Guide,
Database of State Incentives for Renewable Energy (DSIRE) USA	http://www.dsireusa.org	Comprehensive source of information on state, local, and utility incentives that promote renewable energy.
Distributed Energy Resources (DER)	http://www.eren.doe.gov/der/	DER-related programs of the Office of Power Technologies (OPT), within the Office of Energy Efficiency and Renewable Energy (EERE).
DOE EREN (Energy Efficiency and Renewable Energy Network)	http://www.eren.doe.gov/	
Energy Efficiency and Renewable Network (EREN), US Department of Energy Solar	http://www.eren.doe.gov/RE/solar.html	information on solar energy
Energy Efficiency and Renewable Network (EREN), US Department of Energy Solar Basics	http://www.eren.doe.gov/RE/solar_basics.html	information on solar energy (solar basics)
Energy SA (South Australian Government)	http://www.energy.sa.gov.au/	Government's focal point for policies, programs, advice & regulation
Environmental Protection Agency (Queensland Australia)	http://www.env.qld.gov.au/sustainable_energy/	We will give you free, independent information and advice on energy efficiency and renewable power

International Centre for Application of Solar Energy (CASE)	http://www.case.gov.au	promote the application of renewable energy technology in developing countries
Local Government Commission (California USA)	http://www.lgc.org/energy/renewable.html	LGC has developed resource guides for renewable energy including Energy Conservation Under the Sun: A Resource Book for Local Governments
National Renewable Energy Lab	http://www.nrel.gov/	
Natural Resources Canada (NRCan)	http://www.nrcan.gc.ca/es/renewable_e.htm	NRCan delivers several initiatives to encourage the development and use of emerging renewable energy sources and technologies
scientific research in Israel	http://www.israel.org/mfa/go.asp?MFAH00l30	
Sustainable Energy Development Authority (SEDA) (NSW Australia)	http://www.seda.nsw.gov.au	SEDA is an agency created by the New South Wales Government to reduce the level of greenhouse gas emissions in this state. SEDA accomplishes this by promoting investment in the commercialisation and use of sustainable energy technologies
The Australian Greenhouse Office (AGO) Renewable energy	http://www.greenhouse.gov.au/renewable/	
US Department of Energy's Alternative Fuels Data Center	http://www.afdc.nrel.gov/	U.S. Department of Energy classifies the following fuels as "alternatives" to gasoline: biodiesel, electric fuel, ethanol, hydrogen, methanol, natural gas, propane, p-series, and solar fuel.
US Energy Information Administration	http://www.eia.doe.gov/cabs/	US Energy Information Administration Database of energy use internationally

Associations

Australian and New Zealand Solar Energy Society	http://www.converge.org.nz/solaraction	
Consumer Energy Council of America	http://www.cecarf.org	U.S. focusing on the energy, telecommunications and other network industries that provide essential services to consumers.
Energy and Environment Sampler	http://www.weea.org/sampler/	
Institute for Solar Living	http://www.solarliving.org	Dedicated to the belief that education will help bring about the changes in consciousness and behavior necessary to create an environmentally sustainable future.
International Solar Energy Society (ISES)	http://www.ises.org/ises.nsf	
Solar Energy Industries Association (SEIA)	http://www.seia.org/	
Solar Energy Society of Canada Inc. (SESCI)	http://www.solarenergysociety.ca	

Solar Industries Association	http://www.irl.cri.nz/msl/solarin.htm	
Solstice	http://solstice.crest.org/	Renewable Energy Policy Project
World Bank (Solar site)	http://www.worldbank.org/html/fpd/energy/subenergy/solar/solar_pv.htm	

Database/Information

AGORES	http://www.agores.org/	European Web Site for Renewable Energy Sources
CADDET Energy Efficiency	http://caddet-ee.org/	
CEERT - The Center for Energy Efficiency and Renewable Technologies	http://www.cleanpower.org/aboutpower/solar.html	CEERT is a nonprofit public-benefit organization founded in 1990 in Sacramento to bring together concerned scientists, environmentalists, public interest advocates and innovative energy technology companies – all of whom share a vision to benefit the environment with sustainable solutions to California's growing appetite for energy.
CERN Virtual Library		
Crest	http://www.crest.org/	
Energy Efficiency Technical Library		
EUREC Agency	http://www.eurec.be	European Economic Interest Grouping to strengthen and rationalise the European RD&D efforts in renewable energy technologies.
GEM, the Global Energy Marketplace	http://www.crest.org/gem.html	Welcome to the GEM database! GEM is a gateway to sustainable energy information on the web
International Energy Agency Solar Heating and Cooling Programme	http://www.iea-shc.org/	
MySolar	http://www.mysolar.com	Site for all interested in solar energy. What is it, do you need it, how to get it and where
Refocus magazine (previously Sun World Magazine)	http://www.re-focus.net/	Contacts
Solarbuzz Inc	http://www.solarbuzz.com	The mission of Solarbuzz Inc. is to be a premier source of Solar Energy information on the Internet
Source for Renewable Energy	http://energy.sourceguides.com/	Comprehensive buyers guide and business directory to more than 5000 renewable energy businesses and organizations around the world.
World Wide Virtual Library section on the Environment	http://earthsystems.org/Environment.shtml	index of useful and informative web sites on environmental topics