Work package 2- Historical and recent attitude of stakeholders

Case 19:
Solar water heaters (SWH)

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*C*ultural Influences on *R*enewable *E*nergy *A*cceptance and *T*ools for the development of communication strategies to promot*E* ACCEPTANCE among key actor groups

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Contents

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1. Introduction

In the developed countries renewable energy (RE) technologies such as solar water heating are most often introduced for environmental reasons - to reduce GHG emissions mandated under the Kyoto Protocol. South Africa signed the Protocol in 2002, but it does not commit non-Annex 1 (developing) countries such as South Africa, to any emission targets in the first commitment period (2008 to 2012), and it creates no external pressure to reduce emissions. Disseminating solar water heaters (SWHs) in South Africa addresses two major concerns: reducing peak load at a time when electricity generation cannot always meet demand, and reducing greenhouse gas (GHG) emissions. And, at the household level, SWHs save electricity cost in the long term.

RE technologies are not as widely disseminated in South Africa as in some European countries, despite high solar radiation making them well suited. The only RE technology which grew steadily in the last 30 years is unglazed solar water heaters used for luxury swimming pools (Cawood, 2002). The general environmental awareness is less advanced than in most European countries, and only recently do media cover environmental issues such as global warming and its impact on South Africa more regularly.

The South African government generally supports RE, and the relevant policy has a voluntary target of 10,000 GWh to be supplied from renewable sources by 2013. This is approximately 10% of the country's electricity demand and at present less than 1% originates from renewable sources (DME, 2004). Different players in projects and the industry account variously for why the market has not responded more positively, often adducing the absence of promotion, high initial capital costs, and the comparatively low electricity tariffs as primary explanations.

The two South African case studies describe solar water heaters (Case study 19 - the present report) and electricity from solar home systems (Case study 18). Both studies include the impact of poverty on the dissemination and acceptance of the technology.

Subsidised solar home systems (SHSs) using photovoltaic panels to generate electricity were expected to light the countryside and bring light and television services to remote rural homes at a much faster rate than they actually did.

SWHs were rapidly distributed in the late 1970s and early 1980s and then their uptake substantially declined (see Figure 3.1). They have been marketed to the general public and made available to poor households in specially targeted projects. The history of the SWH by-law in Cape Town is interesting, because it was inspired by the corresponding ordinance in Barcelona, another one of the case studies in the Create Acceptance project. The technology transfer from north to south began in 2003 when the deputy mayor of Barcelona was invited to speak about the experiences at a workshop in Cape Town.

2. Country overview

South Africa, like other transition countries, faces the dual challenge of pursuing economic growth and environmental protection. Sustainable energy systems, based on RE resources, offer an opportunity to meet both challenges. But their implementation is made more problematical because the electricity generated from abundant local coal is amongst the cheapest in the world. The state-owned electricity utility Eskom has almost a monopoly of electricity generation, while much of it is distributed by municipalities.

South African energy policies have always been linked to the prevailing political situation. Before the democratic elections of 1994, energy policy and planning were characterised by energy security concerns and racially skewed provision of energy. In addressing the inequalities of the past, the new government made electrification of previously disadvantaged people a priority in the National Reconstruction and Development Programme. The highly subsidised National Electrification Programme increased electricity coverage from about 36% in 1994 to over 70% in 2002.

After being connected to the national grid, however, many poor households could not use the electricity because they were not able to afford the monthly bills, and continued to cook with kerosene and wood. The electricity consumption rate among the poor remained extremely low. When government realised that the poor did not fully benefit from the large investment in electrification, the Free Basic Electricity Policy was introduced in 2004, allowing for poor households connected to the grid receive 50 kWh free every month, which is sufficient for lighting, black-and-white television, radio and occasional basic cooking.

RE is one of the areas the government considers in managing energy-related environmental impacts and diversifying energy supplies from a coal-dominated system. As mentioned earlier, there are no external pressures on South Africa to reduce GHG emissions and to disseminate RE technologies. The Government's White Paper on Renewable Energy Policy (2004) supports the establishment of RE technologies, targeting the provision of 10,000 GWh of electricity from renewable resources by 2013. This has the potential to create 35,000 jobs (unemployment rates are about 28%), adding R5 billion to the GDP and R687 million to the incomes of low-income households (DME, 2004). Solar water heating and biodiesel have the greatest potential to contribute to meeting the target and RE is to be utilised for both power generation and non-electric technologies such as solar water heating and biofuels. By late 2005 the Department of Minerals and Energy (DME) completed a Renewable Energy Target Monitoring Framework to ensure that progress towards the 2013 target is effectively monitored (DME, 2005).

3. Case study: Solar water heaters in South Africa

South Africa has abundant sunshine and the average daily solar radiation is between 4.5 kWh and 6.5 kWh per square metre. This resource is relatively predictable and well distributed throughout the country, with some regional variations.

Heating water using SWH technologies has the benefit of saving households money over the long term, mitigating GHG emissions associated with fossil fuel usage, and reducing peak electricity load. It is also the least expensive means of heating water for domestic use on a life cycle cost basis because solar energy is free (Austin & Morris, 2005).

SWHs have been identified as a means whereby RE could significantly contribute towards alleviating poverty, through improving the general welfare of households as well as developing productive activities to generate employment. The country has an established manufacturing infrastructure for SWHs and their manufacture and installation would contribute to job creation and skills development. However, the lack of promotion and the high upfront capital cost of SWHs are two key barriers to the development of a SWH market in South Africa.

There are three types of collectors used for SWH: glazed, unglazed, and evacuated tubes. The glazed collectors are used for domestic solar water heating, the unglazed collectors are generally installed for swimming pools. Evacuated tubes, which are more efficient than either, are more recently being imported into the local market mainly from China.

SWH dissemination in South Africa can be divided into three historical phases.

Phase 1: 1978-1983 Widespread acceptance and installation of SWH

The government supported the promotion of SWHs. The Centre for Scientific and Industrial Research (CSIR) developed effective communication strategies and projects, which motivated home-owners to install them. Home owners would pay, either with a home improvement loan, or paying cash. The SWH market grew, and six major companies manufactured, marketed and/or installed SWHs, focusing on middle- to high-income customers. The average heater cost around R3500 for a 200-litre system, which most houses installed. The industry flourished, and in 1983 about 27,000 m^2 of solar collectors were produced. In that year the SWH communication project came to an end, and following the discontinutation of the CSIR promotion, the market collapsed and has not yet recovered since (see Figure 3.1) although there are encouraging signs of an industry revival more recently.

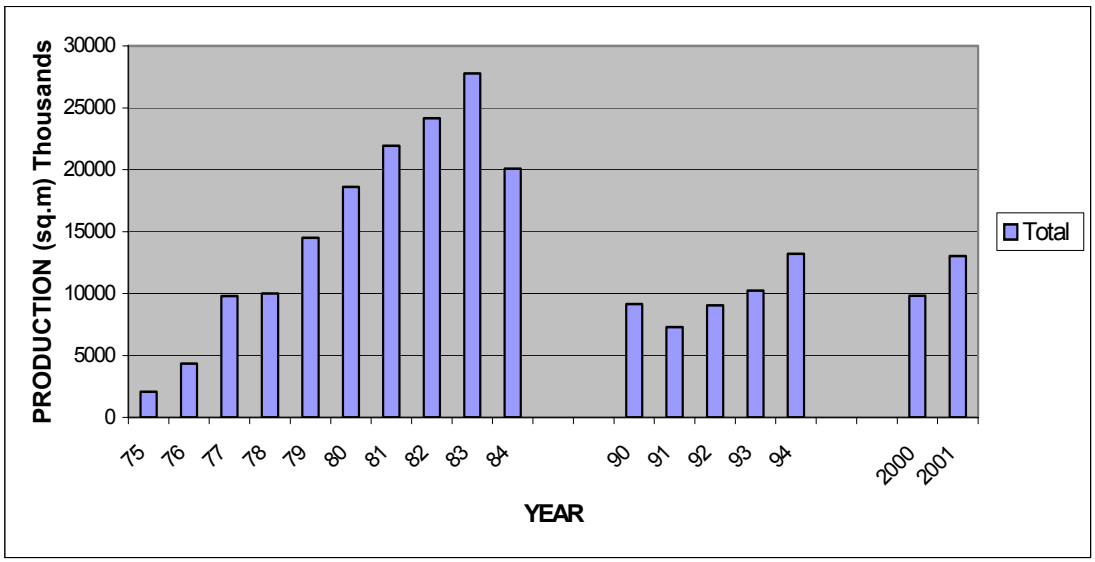

Figure 3.1 *Solar collector production in South Africa 1975-2001*
Source: Cawood, 2007.

Phase 2: 1984-2003 Collapse of the SWH market

In this period, SWH installations dropped and annual glazed collector installations were about half of what they had been in the previous phase. Some solar water heaters were installed in social housing projects, such as that in Lwandle near Cape Town, where a workers' hostel was transformed into family units (Figure 3.2).

Figure 3.2 *Solar water heaters on family units of a social housing complex near Cape Town*

Phase 3: New initiatives starting about 2003/2004 - the SWH by-law for middle- and high-income households and SWH for the poor

The White Paper on Renewable Energy gave a new perspective and created renewed interest in the field. The City of Cape Town has taken the initiative to support RE and is committed to ensuring that 10% of households have SWH systems by 2010, and has initiated a number of activities to promote the technology.

- The City has drafted a by-law (see Appendix) and is currently consulting stakeholders to promote the use of SWHs in middle- and high-income homes to contribute to the RE target.
- Ubushushu Bendalo - meaning 'heat from nature', was founded in August 2004 as a joint initiative by civil society organisations and the City of Cape Town. The Ubushushu Bendalo strategy is to harness the expertise, knowledge and capacity in Cape Town to provide a channel for resources to enable effective and efficient implementation of RE and energy efficiency technologies, in particular SWHs.
- The City plans to retrofit 2300 SWHs in low-income homes in Kuyasa in Khayelitsha township.
- The Central Energy Fund (a government-supported company managing the future energy needs of the country) subsidised 500 SWHs with funding from GEF and UNDP, which were installed in the first half of 2007. In each of the three major cities (Johannesburg, Durban and Cape Town) 165 systems were installed. The project was advertised in the newspapers and it had a positive demonstration effect and renewed customer interest in SWH and encouraged the SWH industry.

The poor cannot afford SWHs and need financial assistance if they are expected to install them. A project to explore the institutional, financial, social and technical feasibility of providing the poor with retrofitted SWHs is being implemented in the township of Kuyasa, Khayelitsha in Cape Town (Figure 3.3). A pilot project has fitted ten houses with SWH. Besides the water heater, a ceiling is added and compact fluorescent lights (CFLs) are distributed, to improve the thermal performance of the houses and the lighting and water heating efficiency. This will result in reduced electricity consumption and avoided CO_2 emissions (from coal-generated electricity). The project developed the methodology and procedures for receiving certified emission credits of the Clean Development Mechanism (CDM) and the CDM credits were approved.

Figure 3.3 *Social housing with subsidised solar water heater*
Source: City of Cape Town, 2007.

Very recent developments
The SWH industry is currently experiencing a revival. The media have included more coverage; notably an advertisement in several local and national newspapers from the CEF and two articles by Eskom encouraged the industry, and sentiment is generally positive. SESSA50 is another project which installed subsidised SWH and collected data for a detailed assessment of the technology.

At the SWH workshop held at the International Conference on the Domestic Use of Energy in Cape Town in April 2007, Eskom presented its new approach to solar water heating and its inclusion into Eskom's Demand Side Management Programme. In June 2007 the Eskom Board approved the investment of R2bn to be made over five years (€ 1 = R9.30 in April 2007). This will have a major positive impact on the SWH industry.

4. STEP ONE: Visions for solar water heaters in South Africa

The high level of solar radiation in South Africa enables the SWH technology to be the least-cost means of meeting the national target for increased use of RE, and could provide around 25% of the RE target. This represents almost twice the estimated installed collector area of domestic SWHs as at 2002 (DME, 2002).

The residential sector makes up 17% of the national electricity load and electric water heaters generally consume 40-50% of household electricity. A national programme focused on delivering residential SWHs could potentially reduce the overall national energy demand by 4.5% or 9000 GWh/annum, and do this at the critical peak times of the day (Austin & Morris, 2005). This is significant as South Africa faces a growing energy crisis, with Eskom struggling to meet the present demand (in 2006, for example, there were unprecedented blackouts in the Western Cape), and the problem is expected to deepen along with economic growth.

SWH are one means to reduce peak electricity demand, contribute to the national RE target, and reduce GHG emissions. An expanding SWH industry would also create new jobs, addressing the problem of high unemployment.

The introduction of SWHs to mid- and high-income groups in the Cape Town will be regulated by a by-law. SWHs for low-income people would be financed by capital subsidy and Clean Development Mechanism (CDM) credits.

5. STEP TWO: What were the various expectations of the case?

The major actors in the study case are government at national, regional and local level, including municipalities in their role as electricity distributors, Eskom, the Sustainable Energy Society of Southern Africa (SESSA), NGOs, consultants, the SWH industry, and customers. At the national level government has introduced policies and strategies. At the local level the municipality as electricity distributor is faced with the challenges of blackouts and their adverse economic impact. When SWHs are installed in a large number of households the municipality expects to reduce the demand on the grid and avoid blackouts. Eskom expects to reduce its supply constraints and intends to subsidise SWHs as part of its demand-side management programme.

Two different 'publics' are targeted: medium- to high-income households and low-income households. The draft SWH by-law excludes households below the current housing subsidy level (approximately R36,000). The City of Cape Town will be installing 2300 SWH on low-cost houses in Khayelitsha township, as part of socio-political development to improve the living conditions of the poor. Part of the funding for this project is raised from CDM credits.

At the national level the government expects to reduce national GHG emission rates and reduce unemployment.

Cape Town's sustainable energy strategy includes SWHs delivering sustainable and environmentally sound energy to the people of the city. SWH will contribute to the objectives of the strategy. The electricity used in conventional geysers is generated from coal with high emission rates. Increasing the demand for SWHs will create employment in the related industries.

Eskom hopes to ease energy supply constraints and acknowledges the roles of RE, energy efficiency and energy conservation. It recognises SWH as a useful addition to the portfolio of demand-side management measures that would also contribute to the national RE target. Eskom considers this an expensive option. As from June 2007 Eskom will target mid- and high-income housing and will pay subsidies to approved SWH companies and house owners can apply for them.

NGOs, consultants and the SWH industry are expecting to grow their business.

The Sustainable Energy Society of Southern Africa and the professional associations under its umbrella expect to assist its members and to facilitate the roll-out of SWH to the public.

Table 5.1 *Actors and expectations in the solar water heater programme in South Africa*

Actor	Expectation	Speaking for 'publics'
Department of Minerals and Energy	Reduce GHG emissions Create employment	National climate change strategy Unemployed
City of Cape Town	Avoid blackouts Create employment Image of green city	RE energy and climate change strategy
Eskom	Ease electricity supply constraints Use DSM strategy to subsidise SWH	Meeting peak demand Subsidising SWH for domestic users
South African Bureau of Standards	Develop standards for SWH systems	Assuring quality of SWH systems Key customer concerns
SESSA	Demonstrate advantages and promote SWH Assist its professional members	SESSA members and general public
SWH industry	Grow business Gain market share	SWH companies and their employees
NGOs	Advocacy of sustainable energy development Develop professional expertise	Develop sustainable energy strategies SWH for the poor CDM for making SWH affordable
Customers	Save money and avoid GHG emissions	Communities and neighbours

6. STEP THREE: Understanding 'participatory' decision-making: negotiating expectations

How, when and on what basis were the different expectations negotiated?

After a public consultation process the government issued the White Paper on Renewable Energy in 2003 setting a framework for implementing RE in South Africa. The City of Cape Town's by-law makes the installation of SWH compulsory for new houses and additions to houses such as bathrooms and kitchens of the mid- and high-income group, and public stakeholder consultation by-law is scheduled for May 2007.

Table 6.1 *Forms of participation in the solar water heater programme in South Africa*

Type	Organisers	Involvement	Purpose
Workshops (see details in Table 6.2)			
Summits and presentation of strategies	Province of the Western Cape, City of Cape Town	Government, NGOs, stakeholders	To disseminate and gain support for government programmes To initiate partnerships
Exhibitions at summits, conferences and workshops	Conference initiators and event organisers	SWH companies	Promotion of SWH products and services
Participation in CEF500 and SESSA 50	CEF and SESSA	SWH companies, customers	Installing subsidised SWH Testing SWH (SESSA50) Promoting SWH
Market	SWH industry, customers	SWH industry, customers	Grow business, promote the industry
Community pilot project	Project team, Kuyasa community members and leaders	Customers, neighbours, friends, community leaders and local government	To install SWH and to demonstrate the technology in the community

In Kuyasa, Khayalitsha a number of consultative community meetings were held, where the project was explained, clarifications could be sought and objections raised. Community representatives were also included in the project team. There was a pilot and demonstration project in which 10 houses were fitted with SWH. Funding for SWH in low-income houses is expected to come from government grants and already approved CDM funding. The City is presently negotiating with the national government for the additional finance required to start the project.

What mechanisms (formal and informal) were used?

The professionals concerned with SWH generally know each other and many informal meetings and information exchanges occur. From January to April 2007 three SWH workshops were organised addressing different aspects and interest groups (Table 6.2).

Table 6.2 *SWH workshops in 2007*

Date	Organizers	Target participants	Content
Jan 2007	Eskom	SWH suppliers	DSM funding for SWH
29 March	REEEP/CEF	Local authorities	How much of hot water can come from solar and how can it be supplied in Southern Africa?
12 April	Domestic Use of Energy Conference DUE 2007 SWH Workshop	DUE participants with largely technical/academic background	The status quo of SWH in SA and the way forward, solving outstanding problems. Output: A research agenda for SWH

Who controlled them?

Eskom has included SWH in its DSM programme. In a workshop in January 2007 it discussed the issue with SWH suppliers who are expected to roll out the programme.

SWHs for the low-income households were targeted at the subsidised housing sector. Dedicated consultants and NGOs approached donor organisations for project funding. They were generally

motivated by social and or environmental concerns (Holm, 2004). The community participates in most project activities.

Manufacturers and companies are the suppliers of the SWH and the services.

How were the interests of various actors aligned?
At the three SWH workshops (Table 5.1) stakeholders presented their projects and discussed the way to implement them.

The City of Cape Town sought the opinion of different stakeholders on the SWH by-law in a public consultation process. The last stage of this consultation process in which the general public will be consulted will take place in May 2007. After this process the by-law will be passed into law.

Community members and leaders in the low-income housing areas are included in the planning phase and play an active part in the project. This enhances the acceptability of the technology in the community.

7. STEP FOUR: From visions to actualities

How was the vision translated into action?
The SWH by-law will translate the vision of the City of Cape Town into reality. It is expected that other cities will follow with similar by-laws.

CDM funding was used to leverage grants at city, provincial and national level.

As a demonstration project ten low-income houses were fitted with a SWH and are a showcase project. They are in the area where the additional 2300 SWH are to be installed.

Did this result in adapting the initial objectives of the vision?
The subsidized SWH of the CEF 500 project were quickly taken up. The SWH industry was encouraged and more customers wanted subsidized systems. The Eskom project has not yet rolled out any SWHs and it is too early to say if the subsidy for mid- and high-income groups is sufficient incentive to install SWHs on a large scale. Electricity prices have risen by 5.6% and similar annual increases are approved for the next two years. If electricity becomes more expensive it is expected that more people will switch from grid electricity to combined solar/electricity for water heating and invest in SWHs.

The blackouts in the Western Cape in 2006 were major turning points both for local government and Eskom to actively persuade households to go solar for water heating.

What were the key lessons of the transition process at different points in time?
Insufficient information, high upfront cost and low electricity prices have been the major barriers to the dissemination of SWHs. The CEF 500 project installed 500 subsidised SWH in the three major cities of South Africa and this had a very positive promotional impact. The electricity company Eskom is introducing subsidies for the purchase of SWH because it cannot meet peak demand. Media have recently reported more than before on SWH as a means to avoid GHG emissions. In order to finance new power stations and to meet future electricity demand electricity tariffs will have to be raised in the coming years. The question remains as to whether the relatively modest tariff increase of 5.6% annually together with expected higher tariff increases over the next three years will motivate people to install SWHs.

Solar Water Heaters - City of Cape Town (after City of Cape Town 2007)
The core business of local government including the City of Cape Town is the distribution of electricity and the City derives substantial income from it. Demand side management and the diversification of supply were not the responsibilities of the City. The City also finds itself constraint in engaging with the market-based nature of CDM projects. The public sector lacks the flexibility, technical and market experience and the swiftness of decision making to successfully manage CDM projects.

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Appendix A City of Cape Town draft by-law

CITY OF CAPE TOWN
SOLAR WATER HEATER BY-LAW
Draft 10
12 March 2007

To regulate the incorporation of solar water heaters for the production of sanitary hot water in buildings in the City of Cape Town; and to provide for matters connected therewith.
BE IT RESOLVED by the Municipal Council of the City of Cape Town, as follows:-

OBJECTIVES

a. To improve energy security and improve energy risk management;
b. To reduce the use of electricity;
c. To reduce the national contribution to environmental impacts associated with the burning of fossil fuels, such as carbon dioxide (C02), sulphur dioxide (S02) and nitrous oxide emissions (N03);
d. To improve the quality of life through the provision of hot water;
e. To create jobs in the solar water heater industry.

SCOPE

a. This By-law applies to all new buildings in the City other than those exempted in subsection (c.).
b. This By-law applies to all additions to existing buildings, which will require the use of hot water (e.g. bathroom, bedroom with en-suite bathroom and kitchen extensions) other than those exempted in subsection (c.).
c. This By-law does not apply to the following cases:
    i. Water used only for industrial purposes in buildings where hot water requirements exceed that which can be reasonably obtained through solar water heating;
    ii. Any privately funded residential building of which the extent is less than 75 m^2 (including garage space)
d. The City shall be authorised to exempt buildings or parts of buildings from the obligations of this bylaw if there are valid reasons for such an exemption, such as :-
    i. Historical Buildings;
    ii. Buildings in areas, which, due to permanent shading, are not able to have solar water heating.
e. Multi-storey buildings are required to have as much solar water heating as can be technically and economically accommodated by the structure and may apply for a Notice of Exemption for the hot water requirements not able to be served.
f. No Notice of Exemption will be valid unless given in writing over the signature of an authorised official.

REQUIREMENTS FOR BUILDING PLAN APPROVAL

a. An application for building plan permission must disclose a description of the solar water heating system, showing compliance with this bylaw.

b. The description shall, as a minimum, contain the following information:

    a. aperture area; where an aperture area of 0.7m2 per 50l of usage is deemed the minimum acceptable;

    b. size of the water storage tank to be installed

    c. whether the SWH is freeze resistant or not freeze resistant;

    d. for domestic solar water heating, a signed declaration on compliance of the SWH with SANS 1307 in terms of section 4(2)(e) from manufacturer or distributor;

    e. a declaration including the rated daily output according to SANS 6211-1 or SANS 6211-2 which should equal 80% unless exemption has been given as per Clause **3** (**d.**) or (**e.**). In the absence of SABS standards, international standards should be adhered to;

    f. the name of the installer and the installing company.