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International policy issues regarding solar water heating, with a focus on New Zealand

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Abstract

Like many countries New Zealand is moving towards renewable energy targets and has recently (November 2006) announced a revised solar hot water heating subsidy program that is being implemented through the Energy Efficiency and Conservation Authority (EECA). This paper describes the new program and reviews international policies regarding solar water heating to see which aspects have been effective in gaining an increased penetration of solar systems for water heating. In addition, the factors leading to successful policy implementation and the possible downsides of the 2006 New Zealand policy are discussed with regard to international experience.

Keywords: Solar water heating; Policy; Financial incentives

1. Introduction

Anthropogenic global warming and resource depletion has led many countries in the world to try to mitigate their fossil fuel use and CO_2 emissions, by switching to renewable energy (RE) sources. In 2004, the share of RE (hydro plus combustible renewables, plus waste) as a proportion of global energy consumption was still low at 12.8% of total primary energy supply in 2004, and at only 5.4% in OECD countries (IEA, 2007). This percentage must rise as fossil fuel resources deplete and if emissions are to be reduced (IPCC, 2005). Experience has shown, however, that in many cases it is unlikely that the free market will provide sufficient uptake of renewable resources without the assistance of directed government policies. One of the reasons for this is that renewable energies are entering an existing market dominated by fossil fuels which are competing without the external costs being fully taken into account. Existing fossil fuel energies are currently cheaper than RE in most instances. In addition, RE technologies often incur a significant initial capital cost, which is a barrier for both commercial and residential applications. As long as production of RE is small scale price will remain high, and as long as price will remain high the demand will remain small. To be really effective, RE policies must avoid numerous pitfalls as explained by Mallon (2006) in his recent book Renewable Energy Policy. In this paper, we will focus on policy issues regarding solar water heating around the world, and particularly on the New Zealand program. First, the new policy instigated in 2006 in New Zealand will be described. Then a review of international policies aimed to promote energy-efficient domestic hot water heating will be undertaken to identify those likely to succeed. Finally, a comparison will be conducted between the New Zealand case and the international experiences.

2. Background

New Zealand is an isolated island in the South Pacific, and so must be self-sufficient for its electricity production. Almost two-thirds of its electricity supply comes from renewable sources (either hydro or geothermal). Due to a steadily increasing population, a history of cheap electricity and a reform of the market in the mid

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to late 1990s, the demand for electricity has been increasing while supply options are facing constraints. Since the Clyde Dam was commissioned in 1991, most new electricity supply has been gas fired, although increasingly wind generation is being installed with several large wind farms now consented. As NZ signed the Kyoto Protocol, the current government has announced that New Zealand should not build new thermal power stations and will take a more sustainable path (MED, 2007). The 2007 NZ Government Energy Strategy has now effectively banned additional thermal generation plant for the next decade, except when essential for security of supply. The domestic energy demand for New Zealand's residential households comprised 12.6% of the total consumer energy demand in 2006 (EDF, 2007) and households typically use one-third of their electricity consumption for water heating (BRANZ, 2004). One well-proven way to achieve significant reductions in electricity demand is through the use of energy-efficient water heaters. Typically the options here involve the use of either individual solar or heat-pump technologies. The NZ climate is relatively favorable for the implementation of both of these technologies.

By the end of 2006, it was estimated that some 33,600 solar hot water heaters were installed on New Zealand homes (Energy Efficiency and Conservation Authority (EECA), 2007)—equivalent to 0.81 systems per 100 people. In comparison, Germany, with between 900 and 1200 $kWh\,m^{-2}\,yr^{-1}$, has similar or poorer insolation levels to New Zealand, with between 1000 and 1400 $kWh\,m^{-2}\,yr^{-1}$, and yet the penetration of solar water heating in that country is much higher, at approximately 8.75 systems per 100 people (Weiss et al., 2005), and this high penetration in Germany is predicted to continue increasing over the next years. A large opportunity therefore exists to increase the penetration of solar hot water systems within the New Zealand residential sector. The NZ Government is attempting to capitalize on this opportunity by introducing a range of policies to support solar energy applications.

A previous review of international initiatives in this regard was conducted for EECA in 2002 (East Harbour Management Services Ltd and Energy Library Information Services Ltd., 2002). The countries investigated included The Netherlands, Greece, Austria, Germany, Spain, Ireland, United Kingdom, Canada, United States, Australia, China, Morocco and Israel. The report concluded by giving general advice about policies concerning solar water heating. In particular it emphasized the necessity of a "partnership between the government and industry to address the issues of quality standards, promotion and public perception". It was admitted that although the technology was mature the SWH markets in NZ have been fragmented and underdeveloped. In particular they suggested that government policy initiatives would be needed to overcome barriers that have restrained the historical uptake of SWH.

2.1. International experience with the promotion of solar water heaters

Solar water heating penetration varies widely internationally. China has the largest thermal capacity of glazed collectors, with 52,500 MWth installed as at the end of 2005. Turkey is a long way behind, with a total capacity of 6300 MWth (Weiss et al., 2007). The total installed capacity (thermal) per inhabitant gives a slightly different ranking. Cyprus is first, followed by Israel, with, respectively, 657 kWth per 1000 inhabitants and 498 kWth per 1000 inhabitants of glazed collector total capacity. New Zealand had a total capacity of 64 kWth at the end of 2005, or 93,950 m^2 of solar collector and an installed capacity of 15.9 kWth per 1000 inhabitants. Because of the recent improvement in this situation, it was estimated that 33,600 m^2 of solar collector had been installed in 2006 (Table 1).

2.1.1. Policy types

Throughout the world a wide range of policy types have been used to increase the uptake of solar water heating, including:

- collector-area-based subsidies,
- performance-based subsidies,
- tax credits,
- tax deduction,
- mandatory policies

These policy types will be discussed in terms of the success or failure for a selection of countries.

2.1.2. Subsidies

Direct subsidy is the most common type of policy to promote renewable energies. Solar Water Heaters have been subsidized in many regions and countries such as

Table 1
Total capacity of glazed flat-plate and evacuated tube collectors at the end of 2005 (Weiss et al., 2007)

Rank	Country	Total capacity (MWth)	Rank	Country	Total capacity per 1000 inhabitants (kWth)
1	China	52,500	1	Cyprus	657.0
2	Turkey	6300	2	Israel	498.0
3	Japan	4900	3	Austria	205.4
4	Germany	4656	4	Barbados	200.5
5	Israel	3346	5	Greece	191.8
6	Greece	2133	6	Turkey	86.1
7	Brazil	1890	7	Australia	59.2
8	Austria	1691	8	Germany	56.3
9	United States	1554	9	Denmark	42.3
10	Australia	1192	10	Taiwan	41.6
28	New Zealand	64	19	New Zealand	15.9