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Political aspects of innovation: Examining renewable energy in Australia

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ABSTRACT

Despite possessing a very large potential of renewable energy sources, Australia has lagged behind other developed countries in embracing renewable energy. Various programs and policies have been devised and implemented by Australian governments. Nevertheless, the proportion of renewable energy in electricity generation in Australia has not increased significantly. This paper seeks to explain why Australia has difficulties in adopting renewable energy by using the Political Aspect of Innovation (PAI) framework to examine the causes and barriers that have blocked the taking up of renewable energy. The PAI framework is concerned specifically with public innovation policy in Australia and the way it aims to encourage and support investment in new technology development. The paper finally outlines some future suggestions for charting the progression of the Australian energy system toward a transformative sustainable future.

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1. The problem: political barriers to renewable energy development

Global warming and the threat of climate change caused by large carbon emissions have created interest in Australia in the move to a more sustainable energy mix. Renewable energy is the only viable option to reduce emissions, while at the same time providing Australia's energy needs. There already exist studies with scenarios of Australia's future energy mix predominantly utilizing existing renewable technologies. The Clean Energy Future Group envisions a scenario where solar, wind, hydro and bio-energy can provide as much as 60% of electricity in 2040 [1]. The most optimistic scenario is 100% renewable energy mix in 2020, only with solar and wind energy [2]. While not many people may share these optimistic views, these scenarios in general give a realistic picture of what Australia can achieve with the available technologies.

On the other hand, it is also recognized that the transition to the use of renewable energy faces many barriers. Martin Ferguson, Australia's Federal Minister for Resources and Energy has said, 'The factors limiting the uptake of renewables remain technical, not political. We must have a rational science-based pathway to overcome those hurdles. Faith alone will not get us there' [3]. While this statement is true about the transition barrier in renewable energy, the technical barrier is not the only one [4]. In fact, at the level of the utility and electricity operators, Sovacool [5] finds that inertia comfort makes these operators reluctant to change. It is not about technical difficulties but the way they do their business. The introduction of renewable energy into their system represents large change in procedure, routine and culture in their activity. The other important barrier is economic which is due to market distortion (for example, the presence of subsidy) and externality (for example, the environmental benefits of renewable are not priced). Other barriers include political, financial, social, institutional, cultural and behavioral; for explanation, see [6].

Previous studies have investigated the political side of Australia's renewable energy, such as Jones [7] from a political administration perspective and it is argued that lack of harmonization between federal and state governments create barriers to the renewable energy diffusion. Saddler et al. [1] and Diesendorf [8] have also argued that social and political barriers are very pervasive in Australia. The political barriers come from the clash of interest from incumbent fossil fuel electricity generators who oppose renewable development [9]. This creates impediment in the market by the existence of fossil fuel subsidy [10] and policy biases favoring the fossil fuel industry [11]. It has also contributed to slow process for developing commitment to form a renewable national target [12]. In the implementation aspect, the political barrier creates policy uncertainty through unusually early evaluation on renewable energy program [13] which affects the disruption in the

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finance of the program [14]. All these studies have highlighted the effect of political barriers and institutions in preventing the formation of renewable energy development support. To the best of the authors' knowledge, few studies have attempted to explain the antecedent of these political barriers.

This paper will contribute to the literature on the political economy barrier to renewable energy by specifically proposing sources of the political barriers and the mechanism by which these sources form political structure for capitalists, that in turn inhibits the development of renewable industry. It will examine Australia's recent renewable energy development for electricity generation. The aim is to explain why Australia has been prevented from significantly adopting renewable energy despite having huge potential of renewable sources. The Political Aspect of Innovation (PAI) framework developed by Courvisanos [15] will be adopted to examine the causes and barriers that have blocked the taking up of renewable energy.

The paper is structured as follows. Section 2 describes problems of renewable energy innovation and its state of play in Australia. Section 3 outlines the PAI approach to renewable energy, while in Section 4 the application of PAI to Australia's renewable energy is then described. Section 5 concludes the paper by drawing some policy implications.

2. Innovation in renewable energy

2.1. The general problem of innovation in renewable energy

In terms of generating electricity, renewable sources represent a radical change from electricity that is mainly generated by fossil fuels. The current energy infrastructure and system are built upon the foundation of fossil fuels energy that utilizes centralized transmission systems where fossil fuel plants are concentrated in particular specific places [4]. Fig. 1 depicts that currently the dominant fuel globally for energy generation comes from fossil fuels, namely coal and gas (62.3%).

There are several characteristics that engender problems in renewable energy innovation and development. Firstly, the driver for the change to renewable energy comes from outside the electricity industry. Although some consumers demand green electricity, the genuine driver comes from outside the industry, this being the need to reduce carbon emissions that cause global warming and climate change. This makes transition to renewable energy difficult as the industry is comfortable with fossil fuel already providing cheap to access and very profitable electricity. For example, Table 1 depicts the cost of electricity generation by fuel type in Australia.

Secondly, the nature of renewable sources themselves, apart from biomass, is that they are low density, can not be stored easily, and supply is intermittent. Thirdly, the current renewable energy

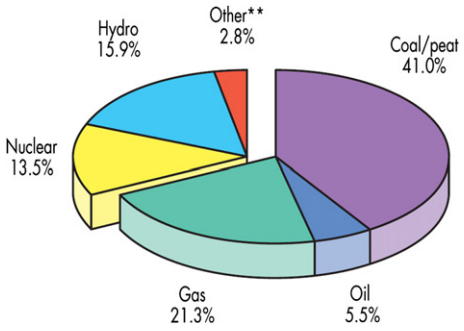

Fig. 1. World electricity generation by fuel type, 2008. Source [16]: page 24.

Table 1
Comparison of electricity generation costs in 2006–2007.

Fuel	Generation cost (Australian $/MWh)
Brown Coal	35–40
Black Coal	30–35
Gas (combined cycle)	38–54
Biomass	46–80
Wind (on-shore)	52–72
Geothermal	70–110
Solar Photovoltaic	120+
Solar Thermal	120–150

Source: [17]

technologies themselves are low efficiency in energy conversion. For example, solar technology can normally convert about 15% of solar energy into electricity while coal and gas with a combined cycle process can achieve around 35% and 50% efficiency respectively [8].

In terms of development, renewable energy technologies are at different stages of commercialization. The most commercially competitive at the moment is wind energy, while solar photovoltaic and thermal energies come after that. While geothermal energy technology utilizing volcanic heat source has reached some level of maturity, geothermal energy that harnesses non-volcanic sources such as hot rock granite and also lower-temperature circulating waters in sedimentary basins is still in developmental stage [18]. Its real commercial cost and viability are still difficult to be determined. The same case also applies to wave and tidal energies since they are currently in the early stage of commercialization [19]. These various different renewable energies and their different commercialization stages mean that renewable energy development still require continuous large funding and need various (and varied) corresponding innovation policies to make them competitively viable *vis-à-vis* fossil fuels.

Another problem facing renewable innovation is the market competition from other types of fossil fuel energy sources such as gas (which has low carbon emissions), clean coal with carbon capture and sequestration, and nuclear energy. Such technologies are highly centralized and can fit into the current transmission system very easily. Yet, in the public agenda, these alternative fossil fuel technologies are positioned as viable alternatives to renewable energy technologies in mitigating the carbon emissions problem [20]. The last problem is that electricity is a huge system represents large inertia that tends to preserve the longevity of fossil fuels [21].

2.2. The state of renewable energy in Australia

Australia has abundant supply of renewable energies such as solar, wind, wave, tidal, biomass and geothermal energy and all of these energies have now being developed in Australia [19,22]. Australia has engaged in research and development (R&D) of solar water heater since early 1950s and became the world leader in this area in the 1960s. Throughout the 1970s Australia developed solar panels for remote area application where there was no electricity available, and in 1985 the first silicon solar cell with 20% efficiency was invented at UNSW [23]. However, since Australian Governments did not provide adequate incentives, this solar technology was taken to China and within a couple of years became one of the largest producers of solar panels in the world [20].

In Australia, the commercialization of renewable energy has not developed in any way close to matching the R&D expertise that has been shown by Australian scientists in solar power. The first serious wave of renewable energy uptake did not start until as late as 1997 when the Howard Government declared Australia's commitment to

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