

# **Environmental technologies and socio-political expectations: The case of the wind turbine**

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## **Abstract**

This paper argues that ‘environmental technology’ is not a neutral label; rather it is imbued with a range of socio-political expectations, which shape usage patterns of technologies identified as such. These expectations are analysed using the case of the modern wind turbine for electricity generation. In the 1970s, the alternative technology movement coupled the use of wind power with an emphasis on local benefits. Recently, the political and economic support base for wind power has widened considerably with many governments promoting wind power as part of their greenhouse policies, and some in the corporate world seeking to capitalise on the emerging business opportunities. The rapid increase in the deployment of wind power has led in some cases to a backlash from local affected communities, with opponents constructing an alternative image of the wind turbine as almost anti-environmental.

## **Introduction**

Since the 1970s, wind power has been portrayed by its proponents as a solution to environmental problems – an as ‘environmental technology’ – and it remains popular because of this image. Indeed, because of the distinctive and simple shape of wind machines, they could be regarded as almost the archetypal ‘environmental technology’: many publications about environmental technologies feature the image of a wind turbine or windmill. Yet the environmental issues for which wind power is portrayed as a solution have changed over time. These environmental issues range from resource depletion, to air, water and thermal pollution, to wilderness loss from hydropower, to nuclear power, to acidification, to climate change. Moreover, today’s opponents of wind power also claim to be protecting the environment, particularly scenic landscapes and endangered species of birds.

Ideas about the role of technology in solving environmental problems, and the relationship between technological systems and social arrangements have also evolved. Many early environmentalists called for deindustrialisation and a shift towards smaller and simpler technologies, which could be owned and operated by householders or communities, which could be installed, maintained and perhaps built by the practical layperson, and which enabled greater self-reliance. Wind power, they believed, was such a technology. Yet today's wind machines are large, sophisticated, and typically owned and operated by the electricity utilities. Many environmentalists now see further industrialisation as the key to environmental improvement, and some in the corporate world are promoting greater use of environmental technologies to advance corporate goals rather than environmental goals.

I argue that the label 'environmental technology' is intended to evoke an image of desirability – it is a normative label. Thus the label environmental technology embodies a range of social and political expectations, which shape how technologies are promoted and used. What then are the underlying social and political expectations motivating proponents and opponents of wind power? This paper explores this question by analysing the history of wind power from the 1970s. The focus is on wind power in Australia.

As an aside, it should be noted that deconstructing wind power as an environmental technology in Australia today is problematic, because it may be interpreted by some as undermining the case for wind power. Currently there is a lot at stake. For example, wind power has become a divisive issue in some communities where wind farm projects have been proposed, and this conflict has become politicised. Australia is one of highest *per capita* greenhouse gas emitters; and yet refuses to ratify Kyoto Protocol. Recently the Australian government has reduced its support for renewable energy, and instead has directed funding towards technologies that reduce greenhouse gas emissions from coal, such as 'carbon capture and storage'. By doing this, the government hopes to save Australia's coal industry in a carbon-constrained world. Australia also has vast reserves of uranium. Australia's ban on nuclear power is coming unstuck, with the government currently trying to soften up the public on this issue. Thus wind power is under attack from many different quarters.

## **Overview of wind power**

The power in the wind is harnessed and converted to electricity by machines called wind turbines. These vary enormously in size. Small wind turbines can be used to provide stand-alone power for remote households (in conjunction with battery storage and perhaps solar or diesel generators).

However, most wind turbines installed today are connected to an electricity grid, and therefore large turbines are favoured to achieve economies of scale. A modern wind turbine can generate up to 2 MW, depending on wind speed, representing approximately a 40-fold increase in size over past 20 years. These modern wind turbines are over 100 metres tall and often grouped together in wind farms to reduce grid-connection costs. A wind farm comprising tens or even hundreds of widely spaced wind turbines can occupy large areas, but overall they have a small ‘footprint’. They are typically located in farmland near the coast or on hills, where wind speeds are high. Because of the need to avoid turbulence from obstacles such as buildings and trees, most wind farms are located in agricultural areas. Forests and built up areas are unsuitable. Wind turbines are intermittent generators: their output depends on wind speed. Because electricity supply and demand must be balanced at all times, and because it is much too expensive to store electricity in large-scale systems, wind power can make only a partial contribution to electricity supply.

Globally, wind power is one of fastest growing energy technologies. Today it is promoted mainly as a greenhouse gas-free source of electricity. Supporters of wind power also maintain that manufacture and installation of wind turbines provides employment in regional areas. Most of the recent growth in the deployment of wind power has occurred in only a few countries. Until recently, Australia had only a negligible amount of wind power. In 2000, the government introduced the Mandatory Renewable Energy Target (MRET), leading to a rapid growth in the use of wind power. However, MRET is soon to end, and thus the growth in wind power is starting to stagnate.

As has been the experience elsewhere, proposals for wind farms in Australia have led to community conflict. This has been particularly evident in coastal Victoria. Opponents of wind farms have objected to wind farms on the grounds of local environmental concerns, such as degradation of scenic landscapes and bird strike.

## **Energy supply and demand**

Wind power is a supply-side energy technology: that is, it is used to generate electricity. Environmentalists have long argued that there should be greater focus on reducing energy demand (i.e. energy use), through energy conservation and greater energy efficiency. The electricity industry has long had a supply-side focus: that is, it has focussed on building power stations. In the past, the electricity industry actively promoted growth in electricity demand, and indeed was encouraged to do so by governments. Today, it is not so politically acceptable to encourage this growth, but the electricity industry still does little if anything to curtail growth in demand. Electricity supply and

demand are treated as separate spheres: electricity demand is taken as given, and sufficient supply must be made available to meet demand.

Treating supply and demand as separate spheres means that, for example, greenhouse gas emission reduction measures are considered either as supply-side (e.g. using more renewable energy generators or switching from coal to gas-fired generation), or as demand-side (i.e. reducing the demand for electricity such as by increasing efficiency of use). Some supply-side energy technologies, however, may be more compatible with a focus on reducing demand. For a time, wind power and other renewable energy technologies were depicted in this manner. This is discussed further below.

### **The 1970s and 1980s: Social visions associated with wind power**

Many of the earlier social visions associated with wind power came from the alternative technology (AT) movement. AT had its roots in the counterculture including the environment movement which emerged in the 1960s. Also influential was the advocacy of appropriate technology for third world countries, particularly by Fritz Schumacher, whose book *Small is Beautiful* (Schumacher 1973) gave the movement one of its main slogans.

The environment movement of the 1960s was almost anti-technology, painting quite a doomsday scenario. The AT movement represented a shift away from this pessimism, and mapped out an optimistic program for change. For example, John Andrews (an early advocate of AT, wind power and 'solar jobs' in Australia) noted that he was inspired by the idea:

that it was possible to design technologies that served very different goals, that technology doesn't necessarily harm the environment, that you can develop technologies that enhance people and their growth. (Andrews 2000)

Alternative technologies were linked with ideas of creating a better society, though not necessarily in a technological determinist sense. Some advocates of alternative technologies put forward criteria that such technologies should meet. There were a variety of such criteria, but the main ones were as follows (Simon 1991):

- They should have low environmental impact, and make minimal usage of non-renewable resources. (This fitted in with 1970s concerns about resource depletion.)
- They should be labour intensive, and thus alleviate unemployment. (This became a more important issue after the rise of structural employment from the mid 1970s.)

- They should foster decentralisation and self-reliance. For example, they should enable local communities to supply and control own resources. Supporters of alternative technology were particularly opposed to political and technological centralisation, and the planning practices of the electricity industry. They therefore hoped to supply, and thus control, their own energy.
- They should enable freedom from alienation and exploitation. This embodied the idea that forms of renewable energy were more ‘democratic’: renewable energy sources were widely available, and renewable energy technologies required less capital and less technical expertise.

Thus there seemed to be two main motives for those interested in alternative technology. Peter Harper, a prominent UK advocate of AT and analyst of the movement summed it up as follows (1974):

Through all the jumble of goals and assumptions of people tinkering with technological alternatives there are two main blocs:

- those that think the system is bound for physical collapse
- those that think the system is evil.

Of course there’s no reason why you can’t think both. But basically, there are those who worry about *environment and resources*, and those who worry about *alienation and exploitation*. (Harper 1974, n.p.).

Some of these ideas came to be popularised by Amory Lovins in his book *Soft Energy Paths* (1977). Lovins depicted much wider social effects associated with alternative technologies, in particular renewable energy. He referred to these as ‘soft technologies’:

[Soft technologies are] flexible, resilient, sustainable, and benign. They rely on renewable energy flows ... They are diverse, ... flexible and relatively low technology, ... matched in scale and in geographic distribution to end use needs, ... inherently, structurally more participatory ... [and] less coercive. (Lovins 1977, 38-39,151).

In contrast, the hard energy path (using ‘hard’ energy technologies):

Demands strongly interventionist central control ... concentrates political and economic power, ... increases bureaucratization and alienation, ... enhances vulnerability and the paramilitarization of civilian life, ... and nurtures – even requires – elitist technocracy. (Lovins 1977, 148).

Along with these wider social-political visions put forward by Lovins and other AT advocates was a more holistic view of energy. In particular they put forward a view of energy where energy supply and energy demand were integrated, and they linked these with how people should live and with forms of society. Lovins in particular emphasised that energy use should be curtailed, and that how we use energy should be better matched with forms of energy supply.

Many of these socio-political visions were watered down as a result of the events of the 1970s. Following the oil shock of 1973-74, policy-makers came to see renewable energy as enhancing security of supply, because it was a local resource. Moreover, with uncertainty about future prices of fossil fuel prices, renewable energy could act as a hedge against price rises. Government funding for renewable energy research and development became available, and hence corporate interests started to move in. The growth in proposals for nuclear power, following the oil shock, also led to the development of an anti-nuclear movement. Many of those opposed to nuclear power advocated renewable energy as an alternative. Some hoped to demonstrate that renewable energy was a viable alternative, and entered the ranks of the AT movement.

The alternative technology movement in Australia was greatly influenced by the anti-nuclear movement, and the desire to develop alternatives to nuclear power, particularly as Australia was home to significant uranium resources and was an exporter of uranium. The AT movement was very focussed on the hardware, rather than energy policy. Many saw wind power and other forms of renewable energy as helping to achieve self-reliance in energy supply. Given their technological focus, advocates of AT were very optimistic about the prospects for renewable energy, barely anticipating the institutional and economic barriers they would face (Ingrouille, 2000).

Australia's electricity utilities had no serious plans for nuclear power during the 1970s (since Australia is rich in fossil fuel and hydro resources); however, the utilities were still the targets of environmental campaigns in Australia. In particular, environmentalists objected to the electricity industry's planning practices where community and environmental concerns were mostly disregarded, their quest for high growth rates and their plans to build new power stations. Plans for large-scale hydro plant in Tasmania, which would flood wilderness areas, sparked off an intense campaign and helped to radicalise a new generation of environmentalists.

These conflicts over electricity planning practices spawned alternative energy experts – people outside the traditional energy sector, who did not necessarily support the AT movement's social visions, but who put forward ideas on how renewable energy could be incorporated into centralised electricity systems, and how the electricity utilities could encourage greater energy conservation and efficiency, while achieving positive social outcomes for energy users. (See for example: White, Sutton, Pears, Mardon, Dick & Crow, 1978.)

Some who had been inspired by the AT movement were also starting to consider how they could get renewable energy, including wind power, into the mainstream. For example, John Andrews (2000) noted:

I was starting to question some of the idealistic aspects of alternative technology with the small-scale self-sufficiency. It was put up as a complete, alternative model of a society and an economy, that we could all have self-sufficiency in food and energy and other produce at quite a small scale, and I was questioning the practicality of that. So I started to be more interested in some of the ways of getting renewable energy into the mainstream system.

In 1980, the first Australian Wind Energy Association (AusWEA) was formed. It comprised alternative energy experts, and those from the alternative technology movement. AusWEA was particularly active during the early 1980s, but lasted only until 1987, when interest in renewable energy was at a low ebb. It was mainly through their participation in the environmental campaign against large-scale hydro power in wilderness areas of Tasmania that AusWEA came to define its social-political vision for wind power. In part AusWEA argued that pursuing wind power in Tasmania would help job creation through development of a wind turbine manufacturing industry. But it also presented a view of wind power as compatible with the curtailment of high growth in energy demand. Large-scale hydro power had a long lead time for construction and comprised a large 'lumpy' addition to supply. AusWEA argued that this locked Tasmania into a high growth path: the electricity utility would need to promote high demand growth or they would face a huge financial loss. Wind power, on the other hand, could be installed quickly and in a modular fashion, sufficient to meet demand if and when it increased (Blakers 1982; 1994). Thus AusWEA argued that a decision to opt for wind power meant that strategies could be employed to reduce growth in energy demand.

Overall, what were the socio-political expectations associated with wind power during the 1970s and 1980s? Wind power was presented as an alternative to conventional generators, and represented a protest against the practices of electricity industry. As in other countries, it was portrayed as alternative to nuclear power – although nuclear power plants were not a likely option in Australia. It was also portrayed as an alternative to hydro power – a very significant issue for Australian environmentalists. The promotion of wind power was also seen as a protest against the supply-side, high-growth focus of the electricity. But the AT movement's 'emancipatory' model of wind power, particularly self-reliance in energy supply, was adopted by very few. Likewise, the idea of integrating energy supply and energy use was not widespread. In any case, wind power technology

did not work very well until around the mid 1980s, and earlier efforts to experiment with wind power often encountered significant technological problems.

## **Wind power and the age of green business**

In the late 1980s, the greenhouse effect emerged on the public policy agenda. This gave a new meaning to wind power as a greenhouse gas-free energy source. This environmental interpretation has become much firmer than previous interpretations of wind power as ‘renewable’ (i.e. non-depleting) or as an ‘alternative’ to nuclear or hydro power. And by this time, wind power had become a mature and reliable technology, and costs were dropping significantly.

Since this time, the idea of an ‘environmental technology’ has also been transformed. Some businesses are now embracing environmental technologies, seeing that it makes good business sense. However, this view has been slow to catch on in Australia due to dominance of the minerals and resources sector and their influence on government policy. Renewable energy support mechanisms have also seen many companies enter the wind industry to capitalise on business opportunities. A second Australian Wind Energy Association (AusWEA) was formed in 1999. Unlike the earlier association, the new AusWEA comprised mainly the wind power industry – wind farm developers, project managers, consultants, and manufacturers of wind turbines and associated equipment.

Wind power, however, is a lot more problematic than conventional power sources. In particular, because it is an intermittent and highly variable power source, it doesn’t fit well with the existing electricity system. There are less problematic and perhaps cheaper ways of achieving greenhouse gas reductions. Because of this, the associated socio-political expectations are also important in understanding why and how wind power is deployed. In particular, wind power remains popular due to the strong image of being associated with environmental issues, but also in part due to social-political visions from an earlier period.

The popularity of wind power (and other forms of renewable energy) has shaped the type of support mechanisms used. (In Australia, these are the Mandatory Renewable Energy Targe, and voluntary Green Power schemes.) Governments have tended to favour renewable energy support mechanisms as part of their greenhouse policies, since other greenhouse gas reduction measures are not so well understood by public.



In the past couple of years, this public support for wind power has started to diminish a little due to conflicts over wind farms proposals. The wind industry and environmentalists believe that it is essential to maintain high levels of public support for wind power if it is to have a future. Thus much of the industry's current efforts are about maintaining the robustness of wind power's image as an environmental technology, in order to keep high levels of public support. For example, wind industry associations are now promoting the idea of "appropriate development" of wind power. The AusWEA president recently stated:

AusWEA recognises that the long-term sustainability of the wind industry depends on appropriately sited and sensitively developed wind farms (AusWEA, 2005).

### **Wind power into the 'mainstream'?**

Today, most proponents of wind power promote it as just another form of power generation, albeit with extra benefits, such as no greenhouse gas emissions, no pollution and the promise of regional jobs. Although wind power is now depicted as a *sustainable energy* technology – a notion which incorporates renewable energy and energy efficiency technologies – wind power by itself is seen almost exclusively as a supply-side option. That is, wind power represents just another power station, another development opportunity. Meanwhile electricity demand continues to grow, and power stations continue to be built, with only a small fraction of them being wind power plants. Moreover, although wind power may be 'just another power station', it is judged differently, because it is regarded as an environmental technology. The growth in the use of wind power has led to opposition, and hence increased difficulties in gaining planning permission for wind farms. Is wind power being asked to meet higher social and environmental standards than other power generators, because it is regarded as an environmental technology?

As noted above, wind power is not like other forms of power generation, because it is intermittent, and because there exist other technologies that have low greenhouse gas emission and which are not as problematic as wind power. Earlier advocates of wind power envisioned integration of energy supply and demand, and the curtailment of energy demand. How then can we recapture this vision with wind power?

### **References:**

Andrews, John (2000), Personal Communication, August 15.

Australian Wind Energy Association (2005), 'Minister Campbell releases wind energy landscape report', Media Release, June 16.

- Blakers, Andrew (1982), Submission to Senate Select Committee on South West Tasmania, *Hansard*, Australian Parliament, April 1.
- Blakers, Andrew (1994), 'Hydro-electricity in Tasmania revisited', *Australian Journal of Environmental Management*, 1: 110–120.
- Harper, Peter (1974), 'What future for alternative technology?', in Herring, Horace (Ed.), *Alternative Technology*, Vol. 1, Brighton (UK): Smoothie Publications.
- Ingrouille, Stephen (Founder of Alternative Technology Cooperative) (2000), Personal Communication, November 22.
- Lovins, Amory B. (1977), *Soft Energy Paths: Towards a Durable Peace*, San Francisco: Friends of the Earth, and Cambridge (Mass.): Ballinger.
- Schumacher, E. F. (1973), *Small is Beautiful: A Study of Economics as if People Mattered*, London: Blond & Briggs.
- Simon, Thomas (1991), 'Appropriate technology and inappropriate politics', in Thompson, William B. (Ed.), *Controlling Technology: Contemporary Issues*, Buffalo (NY): Prometheus Books.
- White, Deborah, Philip Sutton, Alan Pears, Chris Mardon, John Dick and Maurie Crow (1978) *Seeds for Change: Creatively Confronting the Energy Crisis*, North Melbourne: Patchwork Press.