The Case for a Feed-In Tariff for Solar Micro-Generation

The Alternative Technology Association believes that the introduction of a mandated feed-in tariff for the production and supply of electricity from solar photovoltaic (PV) technology is the most appropriate mechanism for valuing the full benefit of small-scale embedded solar PV systems to the electricity market. A feed-in tariff provides a means for capturing the true economic value and many related benefits of the deployment of renewable energy technologies, in particular small-scale, or 'micro-generation', solar PV.

Feed-In Tariffs

Simply put, a feed-in tariff is a premium tariff paid for electricity fed back into the electricity grid from a designated source of electricity generation, typically renewable energy. At present, feed-in regulations for renewable energy exist in over 40 countries, states or provinces internationally. The scope and implementation of these laws varies across jurisdictions, however all involve the payment of some level of premium for electricity from renewable energy sources.

The first instance of the introduction of feed-in laws was in the United States back in 1978. This remained the sole example of such legislation up until the early 1990s when the concept caught on in Europe whilst simultaneously the USA phased out its laws. Countries such as Denmark, Spain, Italy, Switzerland and Greece implemented feed-in policies between 1990 and 1994, and similar measures were adopted in India, Sri Lanka, Thailand, Latvia and Slovenia towards the end of the decade. More recently we have seen places as diverse as Brazil, Indonesia, Nicaragua, Cyprus and China added to the list.

Rationale for Feed-In Tariff

Solar PV micro-generation is disadvantaged in Australia through market failure which fails to take into account the true value and many benefits to the electricity network which arise from the adoption of renewable energy technologies embedded within the electricity grid. Additionally, solar PV, like other renewable energy sources, provide environmental benefits through reduced atmospheric pollution, and social benefits through industry development and job creation, each with related economic benefit.

A feed-in tariff redresses systemic market failures and rewards micro-generation for its true value to the electricity market and wider society, by providing a financial incentive for the adoption of specified technologies.

Direct Economic Value

Solar PV and other embedded micro-generation technologies (also known as distributed generation or DG) have a true value to the market higher than is currently able to be captured. Peak output of solar PV systems corresponds closely with times of peak demand – sunny summer afternoons, typically times of high air-conditioner use. At these times, the wholesale electricity price frequently rises well above the average NEM price of $35/MWh, reaching the hundreds, even thousands of dollars per MWh. This pushes the overall average higher, and hence increases the cost of power to the consumer.

By generating electricity at these times of peak demand, solar PV effectively acts as a form of consumption abatement, reducing the demand on remote wholesale generators and thus lowering the peak wholesale price of electricity.

Further, by generating electricity close to the point of consumption, embedded generation technologies avoid the need for expensive transmission and distribution network augmentation. It has been calculated that Australian network services providers are committed to spending in the order of $24 billion dollars over the next 5 years on upgrades to networks in order to meet growing peak demand.

A feed-in tariff offers an opportunity to reward embedded generation for its contribution to avoiding this network augmentation, and the associated cost which is ultimately borne by consumers through electricity prices. This is particularly the case with solar PV, as the peak production of electricity is at times of peak demand; the very times the network infrastructure is stretched to its limit.

As the production of electricity from embedded generation is at or near the point of consumption, thus avoiding transmission and distribution requirements and associated charges, it is more accurate to value this electricity at the retail rather than the wholesale rate. As time of production for solar PV corresponds with peak retail prices, a peak time-of-use tariff needs to be applied to capture the network benefits outlined above.

Network Value

At present Australia's electricity generation infrastructure is heavily weighted towards fossil fuels, accounting for 93% of electricity generation, with 77% coming from coal alone. Further, fossil fuel generation comes from a relatively few generation facilities, owned by a small number of increasingly foreign-owned companies. This lack of supply diversity exposes Australia's energy industry to significant risk of potential price spikes and/or supply limitations in the future. As such, it is prudent to invest significantly in lower risk / higher cost generation sources such as solar and wind to ensure security of supply.

In the USA, the application of such a portfolio approach has determined that a minimum of 6% solar and wind generation is required to ensure an adequate level of electricity supply security. At present the Australian market has less than 0.5% from these lower risk sources. As such, the Australian electricity market is exposed to significant energy supply insecurity, with a feed-in tariff a proven mechanism for promoting technology deployment to enhance generation diversity.

Societal Value

When considering an incentive for solar PV it is important to also consider the economy-wide benefits of the development of a solar manufacturing, distribution and installation industry in Australia. Solar PV generates about 40 jobs per MW installed[1], significantly higher than the fossil fuel sector, with all small-scale renewable projects undoubtedly creating more jobs per MWh of electricity produced than conventional energy sources.

Not only would jobs be created immediately, but the development of a high-tech solar industry in Australia, with enormous export potential, would negate the present trend of locally-developed innovations, intellectual property and industry exports heading off-shore in search of markets. Further, the expansion of the solar industry locally will lead to economies of scale and reduced real costs, eventually enabling solar PV to reach parity in the Australian market without the need for financial incentives.

Environmental Value

While debate continues about the economic cost of climate change, the IPCC Fourth Assessment Report and Nicholas Stern's *Review on the Economics of Climate Change* make a strong case for the need to internalise the cost of greenhouse gas pollution. In addition, emissions of sulphur dioxide (SO_2) and nitrous oxides (NO_x) have a significant environmental, social and associated economic cost, and as such are subject to emissions reduction legislation, emissions trading and taxation in many countries internationally.

A study by the European Commission places the cost of SO_2 and NO_x emissions from electricity supply at roughly $25/MWh for black coal and up to $50/MWh for brown coal fired generation[2]. When added to a price for the emission of greenhouse gases, such as carbon dioxide and methane, the economic case for solar PV and other renewable energy technologies is further enhanced. Feed-in tariffs offer a mechanism to economically value the reduced emissions from these technologies and appropriately reward technologies which avoid environmental pollutants in the generation of electricity.

[1] Andrew Birch (BP Solar) in a presentation to the Business Council for Sustainable Energy's Clean Energy Conference 2007, Melbourne, Victoria

[2] Rabl, A & Spadaro, J (2005), *Externalities of Energy: Extension of accounting framework and Policy Applications*, ExternE, European Commission

Collating the Economic Benefit

By combining the many economic benefits of embedded solar PV electricity generation, as outlined above, we can see that the total economic value of solar PV exceeds the installed cost of the technology.

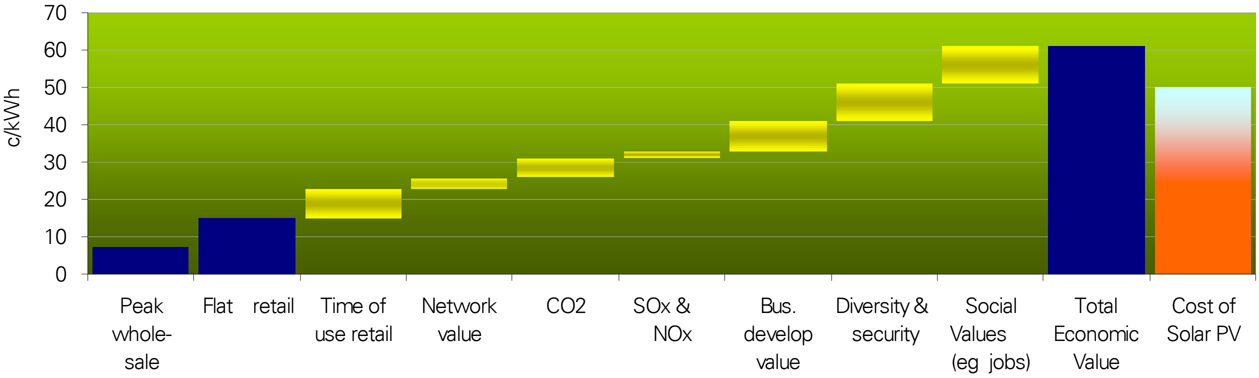

Figure 1: An illustration of the financial case for a feed-in tariff[3]

Over time, as economies of scale and technological advances reduce the installed cost of solar PV, and some form of price on carbon emissions increases the cost of non-renewable generation, it would be expected that the installed cost of solar PV would eventually reach parity with the value of electricity supplied. As such the level of support offered by a feed-in tariff could be gradually reduced, say at 5% per year, as is the case in many international examples, capturing only the deferred network augmentation savings, with solar PV competing squarely with the retail time-of-use electricity price.

The German Experience

Possibly the most famous, comprehensive and successful instance of feed-in laws internationally would be those introduced and modified over the past 15 years in Germany. In 1991 the German government introduced the Electricity Feed Act, legally regulating the feed-in to the grid of electricity generated from renewable resources. This act required utilities to purchase electricity generated from renewable resources at set rates (feed-in tariffs).

This scheme was expanded and enhanced with the adoption of the Renewable Energy Sources Act of 2000, which has been responsible for the dramatic growth in Germany's renewable energy market and the solar photovoltaic industry in particular. In the five years from 2000, the quantity of electricity fed into the grid from eligible sources has more than doubled, with a seven-fold increase in installed solar photovoltaic (PV) capacity to a level of 794MW by the end of 2004. By comparison, at the same time Australia had 6.8MW of grid-connected solar PV, or less than 1% of Germany's capacity.

Costs of a Feed-In Tariff

One of the attractions to government of the feed-in law is that it is cost-neutral, with the costs of paying the tariffs apportioned to electricity consumers. When spread across a broad consumer base, this cost is reduced to a small portion of a customers total electricity bill, and partially off-set by savings resulting from avoided network augmentation and reduced wholesale electricity prices.

In Germany, for all the additional investment and capacity resulting from the feed-in law, the raw cost to consumers is presently around 3% of the total retail cost of electricity, with electricity prices actually falling in real terms in the seven years from 1998 to 2005[4]. It should also be noted that this is in a market where the cost of a feed-in tariff has been applied only to residential and commercial consumers of electricity, with large industry and railways exempt from the levy.

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[3] Graphic courtesy of BP Solar
[4] Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) 2006 *What Electricity from Renewable Energies Costs* BMU, Berlin, Germany

Applying Feed-In Tariffs to Other Technologies

This paper primarily concerns the application of a feed-in tariff to solar PV micro-generation embedded within the distribution network; however feed-in tariffs offer an appropriate incentive mechanism for all forms of renewable energy. With a range of rates available tailored to capture the benefit to the electricity market, environment, economy and society of the particular technology, feed-in tariffs provide a financial incentive for individuals, communities and companies to invest in renewable energy infrastructure.

In particular, embedded generation and small to medium renewable energy projects are particularly disadvantaged in the National Electricity Market on a number of levels. The inability to capture the network benefits of embedded generation, the lack of a carbon price, the poor negotiating position of relatively small electricity generators in securing a fair price for electricity supplied to the grid, and the inability to accurately calculate and capture avoided network use-of-system charges severely disadvantage proponents of these technologies. A feed-in tariff provides an ideal way of reducing these barriers and correctly valuing renewable and embedded electricity generation, providing a financial incentive to stimulate their uptake.