Options to increase the uptake of small-scale solar power by Victorian households

Firecone Ventures Pty Ltd

April 2008

Disclaimer

Firecone Ventures Pty Ltd (including the directors and employees) makes no representation or warranty as to the accuracy or completeness of this report. Nor shall they have any liability (whether arising from negligence or otherwise) for any representations (express or implied) or information contained in, or for any omissions from, the report or any written or oral communications transmitted in the course of the project.

EXECUTIVE SUMMARY

A coherent national policy to support uptake of solar PV is required

The main policy instrument to promote uptake of solar PV in Australia is the grant provided under the Commonwealth Government's PVRP. This policy is in place to 2012. The scale of budget funding and the policy intentions after 2012 are unclear.

Several States are developing feed-in tariffs (FiTs). The subsidy under present proposals will be substantially less than the subsidy provided by the PVRP.

Victoria has introduced a legislative obligation for a net FiT. It is also considering options, discussed in this report, for a FiT at much higher levels than have been considered by other States.

Victoria is also rolling out interval meters. This will establish a basis for rewarding both demand management and solar PV output on a time-of-use basis and is likely to lead to significant innovation in retail tariffs.

A consistent long term policy for the use of these different policy instruments is required to ensure effective policy settings and to give medium term certainty to households and to the supply industry.

A subsidy to solar PV in Victoria should be based on clear objectives

There is no prospect of solar PV reaching financial viability in the next few years. Increased uptake will require higher subsidy.

A significant increase in subsidy to small scale solar PV in Victoria could have high costs. The cost per tonne of abatement of GHG emissions will be several times the cost of alternative abatement measures.

Given the high costs and short term inefficiencies the objectives of subsidy should be clear. These objectives can be used to determine the level of funding and the form of subsidy. If a premium FiT is introduced the objectives can also guide the design of a FiT.

The objectives suggested in this report are achieving a cost effective increase in solar PV uptake; enhancing economic activity in Victoria; minimising greenhouse risks through having multiple options to respond; and minimising power supply costs and ensuring acceptable distributional and equity impacts.

A premium FiT will provide greater certainty for investors

The main options for subsidising solar PV are an upfront grant, a premium FiT or support to RD&D.

The main difference between a premium FiT and a grant program is the certainty for investors. A premium FiT would establish a cross-subsidy through legislation, with a commitment to continue for a defined period or until a certain volume of solar PV was installed. This should give greater certainty to the supply industry over long term growth in uptake.

A premium FiT should also facilitate commercial lending for initial capital costs. However most lending will continue to be based on the credit position of the household.

A budget-funded grant program is likely to provide less long term reassurance to investors. It will retain flexibility to adjust the level or form of the subsidy. It will also leave more scope for retailers to introduce new retail products after the interval meter roll-out.

RD&D can assist with taking disruptive new technologies along the innovation chain. This may assist with achieving a step change in costs. Those technologies could differ in the material used (aluminium or organic cells) and the approach to deployment (such as building integrated PV). This is a significantly different policy objective from the increase to household take-up that could be achieved through a grant program or a premium FiT.

A grant program may facilitate innovation in the retail sector

Victoria is about to roll-out interval meters. It will then be the first jurisdiction in the world with very active retail markets settled on the basis of half-hourly load.

This will lead to substantial innovation in tariff design, including the way that solar PV is rewarded for its time of output, and the way in which air conditioning loads pay for their impact on peak demand.

Establishing a uniform flat tariff for the output of solar PV could reduce innovation. A grant program would retain more scope for innovation, which could in turn assist in making small scale distributed solar PV genuinely commercial.

Increased uptake should have a minor but positive impact on investor interest

The production of silicon feedstock is electricity-intensive, and requires skilled staff and large turnover. Silicon feedstock is not produced domestically.

The production of silicon cells and modules is undertaken in Australia by BP Solar. BP Solar accounts for 3-4% of world production. Around 80-85% of their production in Australia is exported. Increased uptake of solar PV in Victoria will not lead BP Solar to relocate to Victoria.

Three major investments in this area have been considered in recent years. The current uncertainty over the ETS is a significant deterrent. Once that uncertainty is removed, the scale of demand resulting from a premium FiT may be a factor in attracting investor interest.

International experience in Germany and to other European countries suggests that a premium FiT can significantly assist industry development. However, the conceivable scale of demand from a premium FiT in Victoria is small in relation to investment size.

Increased uptake should increase other manufacturing

The supply of other components (such as inverters) and the installation industry itself is served by a large number of small businesses. Economic activity and employment in this sector is likely to increase.

The market for installation is currently small and illiquid. Costs vary widely. Installers cannot realise economies of scale. An increase in uptake will create more liquid markets and lower costs.

Increased uptake will develop new commercial, financial and utility skills

The integration of dispersed small-scale generation into an unbundled, competitive electricity market requires commercial models for funding solar PV, paying for its output, and modifying approaches to network charges and wholesale market settlement. Large scale adoption of solar PV will create new skills in the utility, finance and consultancy industries.

Australia should have a comparative advantage in developing and deploying those skills, due to its very peaky demand, its mature and stable electricity market, and the energy-only design of the market which provides particularly strong signals for peak supply.

The introduction of a premium FiT may reduce innovation in this area. A grant program would retain more scope for retailer innovation after the roll-out of interval meters.

Increased uptake will provide limited protection against future carbon risk

Australia faces risks that future electricity costs are greater than anticipated because carbon capture and storage proves higher cost, gas costs rise to international levels more rapidly than expected, or tougher emissions targets have to be set.

The roll-out of solar PV through an FIT will play little immediate role in mitigating that risk. Under very ambitious targets solar PV would account for 5% of energy in 2020.

Victoria has invested in large scale solar PV, in solar thermal and in subsidies to solar hot water. These technologies are closer to viability and can provide more protection against future carbon risk. A large subsidy to small scale distributed solar PV may reduce the focus on these more prospective solar technologies.

The distributional impacts may be adverse

A premium FiT would be funded through cross-subsidies. The total impact on electricity bills is likely to be minor. However the impact on low income households is likely to be greater than for a tax-funded grant program.

Low income households are likely to be particularly sensitive to upfront capital costs. A grant program will be more successful at reducing up-front costs. Commercial lending can also reduce up-front costs, but is likely to be based on the household's credit strength.

While this analysis suggests differences in distributional impacts, it is not clear that these are material. The main objective of both a grant program and a premium FiT is likely to be industry development rather than distributional impacts.

The design of the feed-in tariff should be uniform across the NEM

Several States are introducing FiTs. A uniform national design of a feed-in tariff will reduce transaction costs for consumers and suppliers. Inconsistencies in design are likely to create high costs for retailer and network billing systems and a significant barrier to entry in the retail market. A structured national process should be established for design of a nationally uniform feed-in tariff.

The level of the FiT does not need to be uniform

There does not need to be a uniform approach to the level of a feed-in tariff. The costs are likely to be high. States may differ in the weighting they attach to the industry development and other benefits of a high tariff, versus the costs.

Differing levels for the FiT are unlikely to create costs for market participants or a barrier to entry provided the form of the FIT is nationally consistent.

A possible design for a Victorian FiT would have the following features

In the absence of that structured process for designing a nationally uniform tariff, we would recommend the following design features:

- *Coverage:* the scheme should cover micro generation in solar PV, wind and biomass consistent with existing Victorian legislation

- *Gross or net:* the decision on net or gross tariff should be designed to ensure national consistency. If other jurisdictions adopt a net tariff Victoria should consider using that form, but applying a much higher FiT if that is required to meet policy objectives

- *Metering:* the metrology procedures should be amended to ensuring metering supports the design of the FiT. If a gross tariff is adopted, Victoria should consider ways of minimising installation costs of the additional metering required

- *Level:* consideration should be given to a net tariff of 40 cents/kWh, and gross tariffs of 40 or 60 cents/kWh. If other jurisdictions adopt a net tariff, Victoria should consider amending these levels to achieve the same subsidy under a net tariff. The equivalent net tariffs will depend on the proportion of output which is exported and would be around $0.80-1.60 and $1.20-2.40 per kWh

- *Term:* the FiT should be paid for 20 years. Payment for solar PV installed in any given year should be constant

- *Adjustment:* the payment for solar PV installed in future years should be adjusted on the basis of a specific index or independent review, rather than a preset figure

- *Duration:* the scheme should remain in place until a defined quantity of solar PV is installed. The quantity target should be 200 MW of installed capacity

- *Payment:* the distributor should be responsible for paying the FiT. Costs should be smeared across all customers through distribution use of system charges

- *Market settlement:* the implications, if any, for the use of the net system load profile for settlement of the retail market should be resolved with the market operator.

Conclusions

A premium FiT may have advantages in being seen to take action on climate change, and enabling households to participate. That decision should be taken by politicians.

A premium FiT would be a high cost and inefficient response. It may reduce innovation following the roll-out of interval meters. It may also reduce attention on technologies such as large scale solar thermal, large scale solar PV and distributed solar hot water heating, all of which are substantially more efficient in greenhouse gas abatement.

A legislated cross-subsidy through a premium FiT is more credible as a long term subsidy than a budget-funded subsidy. It is likely that this would have a minor positive impact on investor interest. An increase in uptake through a premium FiT would also increase turnover and reduce costs in the domestic supply and installation industry.

If the sole or dominant objective is to increase investor certainty, Victoria should adopt a gross tariff of 60 cents/kWh.

If Victoria is also seeking to minimise disruption to industry, it should adopt a net tariff if this is required for national uniformity. A net tariff of roughly 2 - 4 times the gross tariff level will provide similar revenues, although with a little less certainty.

A gross tariff of 40 cents/kWh or net tariff of $0.80 - 1.60/kWh would provide a very major additional subsidy to solar PV, but short of moving to payback periods consistent with normal household requirements.

A net tariff of 40 cents/kWh would be consistent with the approach adopted by other jurisdictions. It would provide a minor additional subsidy to solar PV.

Our preferred approach would be to defer implementation of an FiT until the roll-out of interval meters is complete. The roll-out will lead to a substantial rebalancing of tariffs and innovation in how both demand management and solar PV are rewarded.

This should help advance genuinely commercial approaches to solar PV. Victoria's lead in this area will be much more material for adoption of solar PV than the net tariffs being announced by other jurisdictions.

If earlier action is needed that should be addressed through further funding for RD&D. If earlier and larger subsidy is needed for household take-up, that should be addressed through a budget funded grant program, supplementary to grant funding through the PVRP.

Table of Contents

1 Introduction

1.1 Background

The Victorian Government's policies to address climate change in the stationary energy sector are set out in the Greenhouse Challenge for Energy paper.

The Government has established targets for the share of renewable energy. These targets will mainly be met by large scale renewable energy, in particular wind. The Government also recognises the potential contribution of small-scale generation at household level. The main technology is likely to be solar photo-voltaic cells (solar PV). Other possible technologies are wind, hydro and biomass.

The Government has introduced legislation to ensure that households and small businesses are offered a fair and reasonable price for electricity that they supply to the grid. The Government has also consulted on whether further support is required to encourage households to install renewable energy generators. That consultation suggested that a premium tariff, based on gross metering (that is, on total output of the solar PV) would facilitate a faster roll-out of solar PV at household level.

Sustainability Victoria retained MMA to advise on the costs and benefits of a 'feed-in tariff' (FiT) scheme. That work considered the financial viability of household level solar PV, under different scenarios. The scenarios varied by the level and term of the FiT; the use of gross and net metering; the assumptions on PVRP rebates; and the total number of systems per year which would be covered by an FiT.

This analysis concluded that a significant increase in solar PV could be achieved through a premium feed-in tariff for all generation from newly installed PV systems for 15 years.

Unit abatement costs would be high. Total costs would be modest in relation to the overall costs of electricity supply. The scheme could be funded through a 2% increase in the retail costs of electricity. Costs could be contained by a cap on the total number of systems to be covered under the scheme.

The Department of Premier and Cabinet has now sought further advice on measures to increase the uptake of solar PV by households in Victoria.

1.2 Structure of the report

The report starts by setting out assessment criteria in section 2.

Section 3 sets out the policy options for promoting uptake of solar PV.

Section 4 assesses the options against the criteria.

Section 5 provides our views on detailed design of a feed-in tariff.

Section 6 sets out our conclusions.

2 Assessment criteria

We have assessed the appropriate design of a FiT and the balance of a FiT and other mechanisms to increase uptake of solar PV. These assessments have been done against the following criteria:

- Cost effective support to uptake of solar PV
- Enhancing and supporting industry activity in Victoria
- Ensuring a portfolio of technology options for greenhouse gas response are available
- Minimising power supply costs and associated equity and distributional impacts.
- Ease of implementation

These criteria are briefly described below. Subsequent sections assess how different options to promote solar uptake perform against these criteria.

Cost effective support to uptake of solar PV: options are preferred where they achieve the greatest increase in uptake for a given cost, and also where the cost is shared as part of Public-Private partnerships, or alternative innovative financing options.

Enhancing and supporting industry activity in Victoria: options which lead to a greater level of activity within the solar industry in Victoria are preferred over options which have a low impact.

Ensuring a portfolio of technology options for greenhouse gas response are available: the Government has recognised, in Greenhouse Challenge for Energy and other documents, that an effective greenhouse response will require several policy responses, not a single response. Options which move solar PV along the innovation chain and reduce its costs may provide benefits through making an additional option available as a cost effective portfolio response to greenhouse gas reduction.

Minimising power costs and associated equity and distributional impacts: We assume that the Government will prefer options which minimise the costs of power system supply. Options which deliver a greater share of benefits and/or a lower share of the costs to low income households and to regional areas are preferred.

Ease of implementation: other things being equal, an option which has low administrative and other costs is preferred.

These criteria may conflict. For example, a high and long term FiT would have the greatest impact on the level of take-up and the level of economic activity, but would also have high costs. We have not attempted to weight the criteria However, subsequent sections do assess the trade-offs between criteria, and the implications for preferred policy options.

3 Options

Solar PV is not currently financially viable. In the absence of government subsidy a 1 kW unit does not pay back within the life of the unit and has a substantial negative present value.

Options to increase uptake will require a move to financial viability, or subsidy. Both are discussed in this section.

3.1 Financial viability

Solar PV costs are reducing. The financial benefits of solar PV are increasing:

- Solar PV gets a benefit from 'deemed RECs' under the existing MRET. Typically that benefit is reflected in a discount on the capital cost. The current discount for a 1 kW unit is around $800. This is around 6% of the total cost. The value of deemed RECs and the discount will increase due to the expanded MRET target

- Grid-connected solar PV displaces other generation in the NEM. Generation in the NEM is dominated by coal and gas fired plant. Both coal and gas prices are increasing due to a rise in world energy prices and the increasing linkage of Australian gas and coal into world markets. The cost of coal and gas-fired generation will also increase when an ETS is introduced.

The impact of these changes will not be sufficient to move solar PV to financial viability in the medium term. The options for increasing uptake of solar PV therefore need to consider how to provide a subsidy.

The options for subsidising solar PV are to reduce its costs through grants or soft loans; pay more for its output through a premium FiT; or finance research development and demonstration. These options are briefly summarised below.

3.2 Capital grants

The Commonwealth Government provides support to solar PV under the photovoltaic rebate program (PVRP). The program was introduced in 2000. In 2007 the program was extended to 2012.

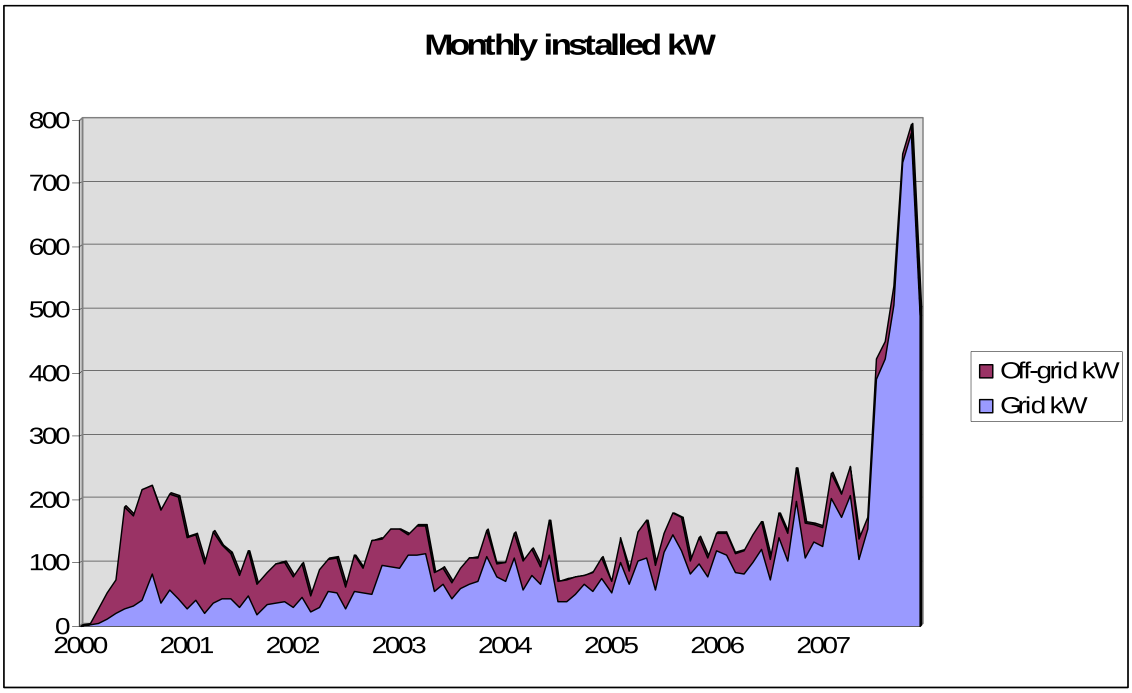
The program provides a rebate of $8/W up to a maximum of 1 kW, or $8,000. At current costs, this covers roughly 50% of the household installation costs. The system must be at the principal place of residence, be at least 450 watts, and be installed by a person accredited by the Clean Energy Council.

Commonwealth Government funding includes a competitive grants program can also cover up to 50% of the cost of installing up to 2 kW solar PV systems at community buildings. The Commonwealth Government is also introducing a $153M National Solar Schools Plan scheme to install $20,000 of solar technology in each school.

In total, 14.7 MW of solar PV capacity has been installed under the PVRP scheme. The average size of the units installed has been 1.3 kW, with a trend towards larger unit size over time.

Installations by month under the scheme are shown in Figure 1. Installations were initially dominated by off-grid PV. In recent years, there has been a rapid growth of grid-connected installations. There was also a very rapid increase in demand under the scheme in the last few months of 2007.

Figure 1: Installations by month under the PVRP



The capital subsidy provide by the PVRP differs in significant respects from the options for a premium FiT which have been analysed in Victoria. The PVRP funding commitment is short term. The total budget is $150M for Australia as a whole. It is unclear what will happen when the policy commitment expires in 2012 or when the budget is spent (which is likely to be earlier).

3.3 Loans

Solar PV has a high capital cost and a low operating cost. The initial high financing requirement may act as a deterrent to households considering installation. Loans can smooth the financing requirement.

Loans can also make payment obligations more closely aligned with cost savings and/or additional revenues attributable to a FiT. However, it should be noted that currently solar PV is a long way from financial viability. The cost savings at household level will be substantially short of the payment obligations unless there is a subsidy through a FiT, or through soft loans.

3.3.1 Soft loans

The Commonwealth Government is committed to introducing low interest green loans of up to $10,000 each to make 200,000 existing homes more energy and water efficient.

3.3.2 Commercial loans

A number of commercial banks provide 'green loans' for investments such as solar PV. These loans are secured on the basis of the lender's capacity to repay the debt, rather than being asset financed against the revenues attributable to the solar PV.

We understand that as part of the Solar Cities project, possible approaches to asset financing of solar PV are being explored by Bendigo Bank. The elements for asset financing would include a high premium feed-in tariff (so that the PV is financially viable) and use of solar parks, with households having rights to the output, rather than of solar PV closely integrated into the household.

We anticipate that most solar PV will either take the form of roof-top units, or be more closely integrated with the house under technologies such as building-integrated PV. This will preclude asset finance, since it will not be possible to secure the asset separate from the house, at any reasonable cost. As a result, bank finance is most likely to be available for owner occupiers, and for high income households who have a good capacity to service debt.

To state the obvious, commercial banks will not <u>fund</u> solar PV. That is, banks will not pay if solar PV is not viable. However, if the Government intervenes to make solar PV financially viable through a premium feed-in tariff then banks are likely to actively seek out households and others to install solar PV.

3.3.3 Public private partnerships

We also considered whether large numbers of solar PV modules could be procured and installed under some form of PPP.

A premium FiT is itself similar to a PPP. Payment is made for services. Risk on capital costs and operating performance is transferred (in this case to households). However payment is made through cross-subsidy rather than under a PPP contract.

A further step would be for the government to aggregate procurement. As described subsequently, most suppliers and installers are too small to realise economies of scale and costs are high. In addition, the market is illiquid and costs are very variable.

A single large scale procurement in place of many smaller procurements could be expected to drive down costs. However, this would have a negative impact on industry development. It would further reduce supplier margins. It is likely to result in one large order followed by a dearth of orders.

We have concluded that a government role in aggregation would not meet the policy objectives and have not explored this option further.

3.4 Feed-in tariffs

In August 2007, the Victorian Parliament passed amendments to the *Electricity Industry Act 2000* to extend the existing FiT provisions beyond wind to included micro generation from solar, hydro and biomass. These amendments also strengthen the current provisions to ensure that retailers offer consumers a fair and reasonable tariff. Our understanding is that this requires a FiT which reflects the opportunity cost of the solar PV (that is, its impact on other generation costs, network losses and network augmentation).

South Australia has recently introduced an obligation to pay an FiT at twice the retail tariff. This will apply to all electricity imported to the grid. This will be measured through separate import and export registers in the household meter. Queensland has announced an FiT at 44 cents/kWh, applying to separately metered household exports to the grid (that is, a net tariff)[1].

The Commonwealth Government has a commitment to develop a nationally consistent approach to feed-in tariffs.

In addition to these policy measures, some retailers offer standard feed-in tariffs for commercial reasons, and to assist with 'green branding'.

The FiT policy under consideration in Victoria would be:

- Established through legislation and funded through cross-subsidy by electricity consumers
- Long term, with a fixed and indexed payment for the output from solar PV installed in a particular year over say a 20 year period (the definition and measurement of output is considered below), and
- Stable, with an agreed number of years that the policy would run (or an indefinite term, but a cap on the total number of solar PV units to be installed).

These characteristics would provide reassurance to potential investors that the scheme would stay in place for a significant period. A further description of the design of a FiT is given in section 5.

The main financial support to solar PV is through the federal Government's grants under the PVRP. If a FiT is introduced the total subsidy to households would be the combination of the PVRP and the FiT.

If the PVRP is maintained a FiT could complement the PVRP and provide an additional incentive to installation of small scale solar PV. If the PVRP is not maintained then the financial incentive to install solar PV is likely to reduce, unless the level of the FiT is substantially above levels discussed to date.

[1] http://statements.cabinet.qld.gov.au/MMS/StatementDisplaySingle.aspx?id=56973

3.5 Funding for research, development and demonstration

The Solar Cities program provides $75M[2] over 7 years to fund trials combining solar thermal, solar PV, interval metering and innovative pricing. The Central Victorian solar cities consortium will include 300 residential PV systems, supported by a subsidised FiT.[3]

The Commonwealth Government provides additional direct funding through the $150M Energy Innovation fund; venture capital support under the $500M Renewable Energy Equity Fund (REEF); and $27M over 2005-9 for small scale low emissions technology. In general these grant and loan schemes cover a wide range of renewable technologies. The Energy Innovation Fund includes $50M specifically for solar PV.

The Victorian Government's Energy Technology Innovation Strategy includes funding for the Sustainable Energy Research and Development Program. Grants announced in 2007 included $6M to a project to increase the efficiency of solar cells as an alternative to silicon based cells.

Funding for RD&D is likely to advance new technologies, and new commercial models for delivery of solar PV. This is a different policy outcome from the large-scale roll-out of current technologies which may be achieved through a premium FiT.

[2] To be increased to $100M under the ALP election commitment to expand the Solar Cities program
[3] http://www.environment.gov.au/settlements/solarcities/centralvictoria/index.html

4 Assessment

The main policy used to support solar PV at present is the capital subsidy under the PVRP. Some use may be made of soft loans under new programs to be established by the Commonwealth Government. As the characteristics of a capital subsidy or a soft loan are similar we have focused on the capital subsidy, as the established policy. We have compared this with a premium feed-in tariff, using the assessment criteria given in section 2.

A capital subsidy or a feed-in tariff could be designed to be equivalent and to have the same present value. The assessment therefore focuses on characteristics other than the level of subsidy. Section 5 covers the level of a feed-in tariff, and other design characteristics.

4.1 Cost effective increase in uptake of solar PV

Both an FiT and a grant program can achieve increased uptake. However they differ in the certainty they provide for investors; the flexibility for government; and the allocation of risk. These characteristics are discussed below.

4.1.1 Investor certainty

The main argument advanced for a premium feed-in tariff is that it creates investor certainty over a sustained and reasonably stable demand for solar PV over the long term. It does this in two ways:

- The scheme establishes rules which determine the price to be paid for the output of any specific solar PV investment for 15 to 20 years. It applies these rules to solar PV investment over a number of years, and

- The scheme finances these costs through a cross-subsidy within the electricity industry. All consumers (or possibly a subset of consumers) pay for the costs of the solar PV FiT. The FiT would be established by legislation, with the detail of the scheme lying in Rules and other instruments subsidiary to legislation.

It would be possible to provide similar subsidy under a capital subsidy scheme. For each year of the scheme, the capital subsidy would be set at a level equivalent to the present value of the FiT for that year.

However, it is much harder to provide long term certainty under a capital subsidy than under a premium FiT. Government budgets are established with a four year outlook.

Commitments beyond the fourth year have a lower level of credibility. Governments have well established processes for annual reconsideration of budget priorities. These processes make it likely that any capital subsidy in year 5 or beyond will be subject to review and may be increased or lowered depending on the overall budgetary priorities.

It appears unlikely that a Government would pass legislation that prevented it reconsidering aspects of the capital budget. Even if it did so, this would be less credible than legislation which established cross-subsidies.

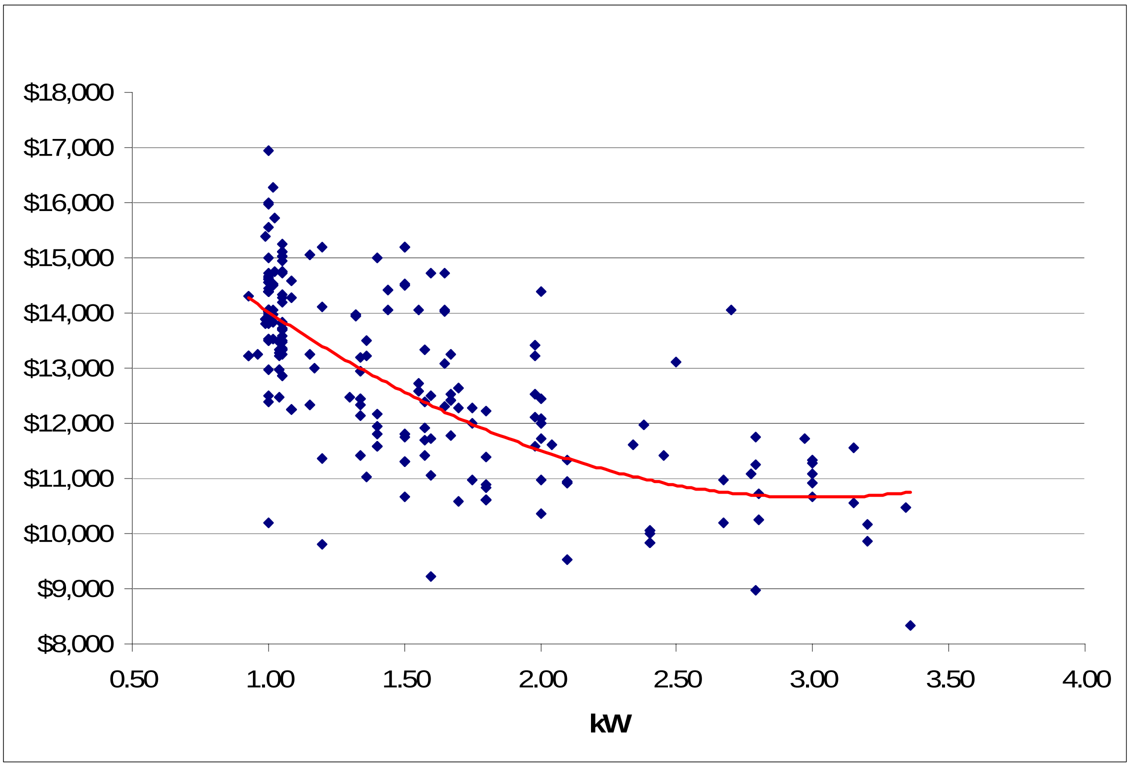
A premium FiT will provide a higher level of long term certainty for investors than a commitment to long term capital subsidies funded from the budget. This will have greatest impact on elements of the supply chain which require major fixed investments, such as supply of silicon feedstock and of cells. It will be less significant for the installation industry.

Assessment: a premium FiT is more likely to provide long term investor certainty than a capital subsidy. This is likely to be most material to the early stages of the supply industry.

4.1.2 Impact of greater investor certainty

Figure 2 provides survey based data on prices for PV systems in Victoria. Prices are highly dispersed. This is normally a sign of an immature or illiquid market. Any scheme which substantially increases funding of solar PV (regardless of the policy mechanism) is likely to reduce dispersion and reduce costs to consumers. It will also achieve economies of scale and reduction of costs for the supply and installation industry.

Figure 2: Dispersion of PV system costs



Source: survey data by Sustainability Victoria

Assessment: any scheme which promotes widespread take-up is likely to increase market liquidity and reduce costs. An FiT may be more effective than a grant program at increasing liquidity

4.1.3 Government and market flexibility

The increased investor certainty under a FiT will be at the cost of reduced flexibility for Government and a loss of adaptive policy making as the situation changes.

The eastern seaboard has a stable and mature electricity market. Victoria has one of the most competitive retail markets in the world.

The retail market is currently settled on the basis of the net system load profile. This assumes that all loads – other than those which are interval metered, or which have a very predictable load shape - have the same distribution over time.

The use of the net system load profile introduces a high degree of averaging. Attachment 1 describes approaches to measuring load and solar PV output in the NEM. Attachment 2 sets out why solar PV does not realise the benefits from time of production (which overlaps with peak demand). In addition, households are not exposed to costs related to time of use (for example, the cost of air conditioning loads which drive system peaks).

Victoria is proposing to roll-out interval meters. This is a major policy initiative. It has been developed over a number of years, in close consultation with the industry and with market institutions, including the AEMC and NEMMCO and with regulators.

Following the roll-out of interval meters the retail market will be settled on a half-hourly basis. Victoria will be the only jurisdiction in the world combining widespread interval metering and a high level of retail competition. This is expected to lead to a high level of dynamism and innovation in the retail market. It may also enable retailers to offer innovative products which reflect the time-of-use value of both household demand management and the output of solar PV.

Assessment: Introducing a flat FiT shortly before the roll-out of interval meters will substantially reduce the ability of retailers to innovate, and the scope for Government to consider new policy measures as this major change is made to the Victorian market. A grant program would not reduce flexibility.

4.1.4 Risk transfer

Solar PV incurs an upfront capital cost followed by benefits from the production of electricity over the life of the PV module. This creates a risk that the value of the output will be lower than anticipated when the capital cost is incurred. Different approaches to financing allocate that risk in different ways:

- Where the cost of solar PV is entirely met by capital subsidy, risk on the volume and value of output is borne by government

- Where the cost of solar PV is entirely met by an FiT over the life of the module, the volume risk is borne by the household (that is, the household earns less if the MWh output of the module is less than anticipated or its life shorter). Price risk is borne electricity consumers through a levy (that is, these parties rather than households bear the risk on changes to the value of solar PV output)

- Where solar PV receives both a capital subsidy (through the PVRP) and an output subsidy (through an FiT) the risk is shared between Government, households and electricity consumers.

Risks should be allocated to the party best able to manage them. Households are well placed to manage risk on the volume of output. This may require periodic maintenance, for example to replace invertors if they fail before the solar PV cells.

However, solar PV costs are dominated by the initial capital and installation cost. The financial incentive for maintenance, and periodic replacement of parts, already exists through the legislated FiT. It seems unlikely that a premium FiT would significantly change this.

Assessment: increased risk/incentive through a premium FiT is unlikely to materially alter the performance of the solar PV.

4.2 Enhancing and supporting industry activity in Victoria

A grant or FiT program will lead to increased uptake. That higher uptake may increase the prospects of new investment in manufacturing. It will also lead to an increased understanding of the integration of solar PV into competitive electricity markets on the part of market participants, market operators and financiers. These three factors – uptake, impact on manufacturing, and impact on market operations – are discussed below.

4.2.1 Impact on uptake

Analysis has been undertaken of the impact of a premium FiT by MMA. This analysis is based on their power system models. The analysis is disaggregated between 22 regions in Victoria. For each region, the model:

- Forecasts peak and energy demand

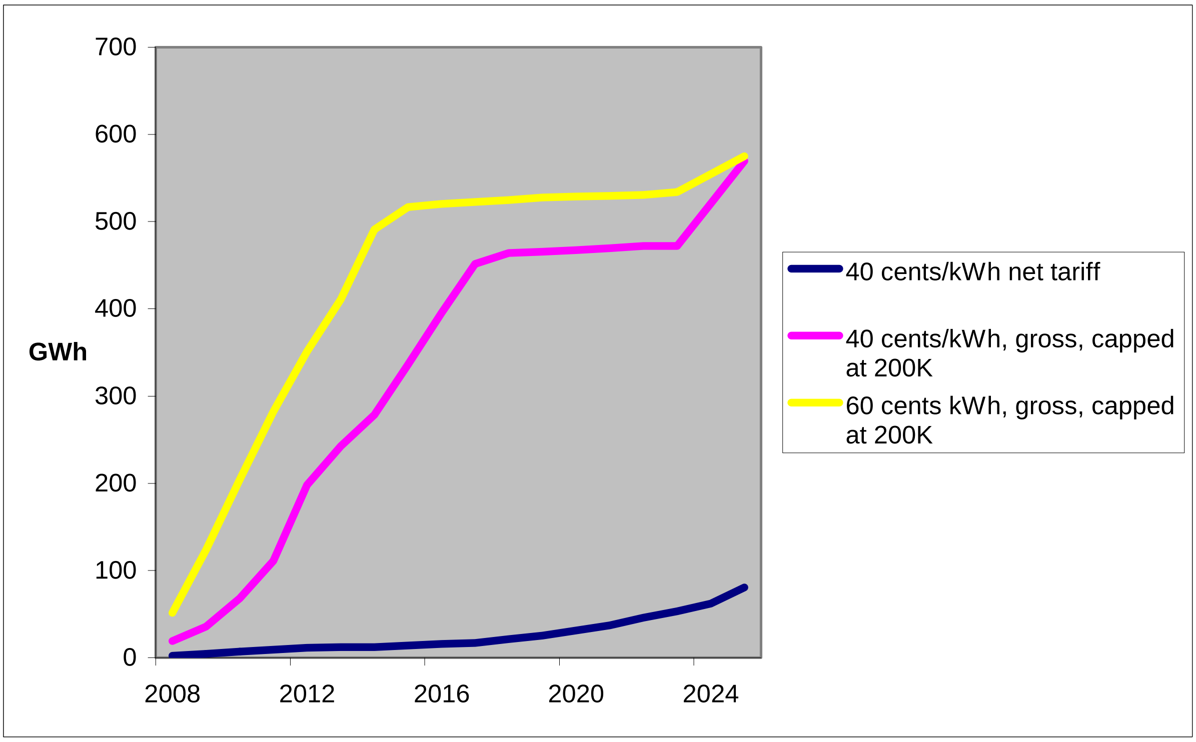
- Forecasts capacity factors for PV systems[4] within each region, allowing for different levels of solar intensity, and

- Forecasts the costs of grid-based supply from other generation, allowing for transmission losses and network charges.

The model then examines the impact of a premium FiT on the costs of solar PV, increasing the premium FiT to the point where solar PV becomes lower cost against other technologies. In two regions, allowance is also made for the benefits of deferred network investments. The impact of different FiT options on the additional energy output by solar PV is shown in Figure 3.

[4] The model is not restricted to solar PV and also forecasts possible output from small-scale hydro and biomass

Figure 3: Impact of FiT on GWh output by solar PV



Source: modelling undertaken by MMA

This is useful analysis, and has substantially advanced the understanding of possible impact of an FiT. However, it is not a model of household choice. Rather, it is a least cost system expansion plan, with modifications to the FiT to alter the level of solar PV (and other small-scale distributed generation).

Household behaviour on adopting solar PV may differ from modelling of the volume which becomes least cost under a system expansion plan:

- In practice, some households already invest in solar PV despite the high losses. The main motivations for installing solar PV are reducing environmental/greenhouse impacts, with only 11% of those surveyed saying that cost savings were the principal motivations[5]. Investment which is partly for non-financial reasons should increase if the costs to the household reduce, even if the premium FiT falls short of providing a payback period consistent with normal household requirements

- Households are likely to have high discount rates and to be sensitive to initial capital costs and payback periods. They may also face significant transaction costs in analysing solar PV investments, raising finance, and dealing with suppliers, retailers and distributors. These factors may reduce take up

[5] 2006 survey data on the motivation for households who had installed a PV system under the PVRP program, provided by Sustainability Victoria

There is no quantitative or rigorous basis for weighing up these conflicting pressures. The most useful additional material is survey work commissioned by Sustainability Victoria. This indicates that household decisions on the installation of rooftop solar PV are principally driven by environmental objectives rather than financial. This may encourage faster take-up than modelled above.

However, analysis also shows that the PVRP rebate was very or somewhat important for over 90% of households that installed solar PV, and that more than half of households were seeking paybacks of between 6 and 10 years. This may result in lower take up if the PVRP rebate is budget constrained. It may also result in lower take up as the policy seeks large scale adoption, including by lower income households.

Assessment: the main modelling to date is of least cost system expansion, rather than of household adoption. There are factors which could bring adoption above or below the levels shown in that least cost analysis. In the absence of more substantial analysis of household response, it would appear best to base assumptions on adoption on the least cost modelling undertaken by MMA.

4.2.2 Manufacturing

The supply industry for PV cells is dominated by technologies based on silicon ingots and wafers. Technologies which use thin or ultra thin silicon, organic cells or cells imprinted on other materials are under development but are not yet mainstream[6].

The supply industry can be broken down into three segments:

- Production of purified silicon feedstock in the form of ingots and wafers
- Production of cells and modules, and
- Production of other components, such as inverters, batteries and structures for mounting the modules)

The production of *highly purified silicon feedstock* is partially integrated with the micro-electronic industry: single crystal ingots can be used for microelectronics, while multi-crystalline ingots are only used in solar PV.

The industry faced a surplus in the early 2000s. The supply position is tightening, as production for solar PV exceeds production for the microelectronic industry. This may lead to rising prices, despite the long term downward trend. Production has been dominated by Japan, Germany and the USA. Several plans have been announced for additional production in these and other countries in response to the current tightness.

Feedstock production is very electricity-intensive. It also requires skilled personnel. Germany has successfully developed a large manufacturing capacity, despite higher electricity costs than Victoria. It appears likely that this is mainly due to the large subsidies provided through its FiT.

[6] Polysilicon: Supply, Demand and Implications for the PV Industry, 2006

Over recent years there has been interest from three potential investors. The recent increase in electricity prices in Australia, and uncertainty over medium term prices due to the ETS, are likely to be a deterrent to new investment in Australia. It may however be possible to attract investors once this uncertainty is removed.

Decisions on new investment are unlikely to be affected by the possible scale of demand under a premium FiT[7]. The increased uptake from introduction of a premium FiT will clearly be positive rather than negative for investment in silicon feedstock, but is unlikely to have a major impact.

The production of *cells and modules* is dominated by Japan. Production in Europe as a whole has now exceeded that in Japan, and production in Germany has been growing rapidly based on the large subsidy to solar PV through a premium FiT.

BP Solar is the only producer based in Australia. BP Solar accounts for 4% of world cell production and 3% of world module production, from its production facilities in Australia, Spain and the USA[8]. BP Solar exports around 80 - 85% of its production[9]. It is unlikely that increased demand in Victoria would lead it to relocate production.

The *remaining manufactured requirements* account for around 20% of total supply costs. It is possible that increased solar PV uptake would lead to increased activity in Victoria.

Assessment: the increase in solar PV attributable to a premium FiT is unlikely to materially affect the prospects for investment in feedstock production or cell or module production in Victoria. It might increase industry activity in supporting inputs.

4.2.3 Market operations

In addition to manufacture, increased use of solar PV is likely to require commercial skills on the part of financiers, utilities and the consulting industry to integrate solar PV into competitive energy markets. It is possible that these increased skills could assist with export of know-how rather than manufacturing.

Australia may have a comparative advantage in the incorporation of solar PV systems based on:

- Relatively high capacity factors for solar PV based on sunlight intensity
- Exceptionally peaky demand, driven by air conditioning loads, with a substantial overlap between peak demand and output of solar PV, and

[7] Around 2000 the Government of NSW explored production of silicon at Lithgow, using wood residues for the energy supply. Similar investments were explored in Victoria, with the possible development of a firm called Australian Silicon investing in a silicon smelter at Orbost against based on wood residues. The proposed silicon metal plant project in Orbost was abandoned by Australian Silicon after the Victorian Government declared in November 2002 that native forest timber would not be allowed to be used to produce the charcoal required in a silicon metal plant.
[8] IEA, Trends in Photovoltaic Applications, Survey Report of selected IEA countries between 1992 and 2006
[9] Source: direct communication with BP Solar

- A stable and mature energy market based on an energy-only gross market which provides strong signals for peak power.

As noted above, following the interval meter roll-out Victoria will be the only jurisdiction in the world with a very competitive retail market settled on a half-hour basis. This will enable innovative approaches to rewarding solar PV for its time of output. That innovation will be sharply reduced if a long term flat tariff is established by legislation, and (as discussed below) imposed on the distributor rather than retailers.

Assessment: increased take-up of solar PV, combined with the interval meter roll-out should substantially increase know-how in financing PV and integrating it into energy markets. A mandated FiT prior to the interval meter roll-out is likely to reduce innovation.

4.3 Ensuring a portfolio of options for greenhouse gas response

The Victorian Government has stated that climate change will require multiple policy responses. The availability of solar PV as a proven technology in Victoria might provide an additional policy response, and reduce risks by facilitating a portfolio approach. The availability of solar PV might protect against electricity price shocks if carbon capture and storage proved more expensive than currently forecast, or if gas prices moved rapidly to international levels.

Two factors adversely affect performance against this criterion:

- *Scale:* the maximum scale of solar PV envisaged under a premium FiT is around 5% of total energy. This is likely to provide limited additional protection, and

- *Technology:* Australia is likely to be a technology taker for solar PV production. This is unlikely to be affected by a premium FiT, which will support established technologies rather than 'bleeding edge' technologies in Australia.

The criterion will however be supported by the establishment of greater capacity in the installation and supply of solar PV, and more developed processes for incorporation of solar PV in the electricity market.

Assessment: the increase in uptake of solar PV achievable under a premium FiT is likely to provide positive but modest benefits through diversification and protection against future risks.

4.4 Minimising power supply costs and equity and distributional impacts

4.4.1 Cost impacts

A high level long term premium FiT is likely to be more successful at providing investor certainty. However, overall costs will be high. This will also be an inefficient way of reducing CO_2 emissions.

Table 1 summarises total costs (up to 2030) and average costs for a number of FiT scenarios, and also shows the unit costs per tonne of abatement (that is, the present value of costs divided by the present value of tonnes abated). Present values are calculated using a 6% discount rate. This table excludes the costs of the PVRP.

Table 1: Costs of FiT

Scenario	Total Cost $M	Average cost $M/year	PV of costs, $M	PV of abatement cost, $tonne
40c/kWh Net	66	3	29	414
40c/kWh Gross, capped at 200K	2,120	92	1041	241
60/c kWh Gross, capped at 200K	3,990	173	2194	544

A FiT (or grants or soft loans of a similar scale) would not be cost effective as a (short term) response to climate change. The IEA's 2007 Review of Energy Policies in Germany reached similar conclusions, stating:

> *"The country's feed-in tariff for renewables has resulted in rapid deployment of new electricity capacity, but has done so at a high cost. Estimates show that between 2000 and 2012, the feed-in tariff will cost EUR 68 billion[10] in total. In particular, the subsidies provided to solar photvoltaics are very high in relation to output; they will eat up 20% of the budget but contribute less than 5% of the resulting generation. In comparison, many energy efficiency measures cost multiples less in terms of their reductions in carbon dioxide emissions"[11]*

The costs can be maintained through a cap. This improves performance against a cost criterion. However it weakens performance on other objectives such as industry development by creating a 'stop-go' effect.

Although total costs are high for a number of these scenarios, turnover in the electricity market is also high. A large cross-subsidy to solar PV can be achieved with a small impact on retail tariffs, of at most 2%.

Assessment: the costs of subsidy to solar PV may be high, and unit abatement costs will be well above the alternatives. Given the costs, the objectives from use of an FiT (or other ways of providing major subsidy) need to be clear.

[10] A$113 billion at an exchange rate of A$1=EUR 0.6, and equivalent to per capita expenditure of A$1,400. Per capita expenditure of this level in Victoria would have a total cost of approximately A$7.6B, and is reasonably consistent with the mid-range of MMA's cost estimates

[11] IEA, Energy Policies of IEA Countries: Germany, 2007 review, executive summary. Sustainability Victoria have pointed out that the IEA has also commented more positively on renewables policy in Germany.

4.4.2 Distributional impacts

Households tend to have high discount rates, and so be deterred by large upfront payments. Low income households are likely to have higher discount rates than high income households.

A grant program is likely to have more impact on uptake for low income households than a premium FiT. It is possible that commercial banks can smooth initial costs through lending. It appears likely that lending will mainly be based on the credit position of the household, and not asset based.

Grants, soft loans and FiTs all increase costs. The main differences are in the source of funding. Low income households pay relatively little tax, but electricity is a relatively high share of household expenditure. A scheme which is funded through the tax base is likely to have better equity impacts than a scheme which is funded through cross-subsidies within the electricity sector.

Assessment: a grant program may have better distributional impacts than a premium FiT as low income households are likely to be more sensitive to initial capital costs. Tax-funded support to solar PV may have better distributional impacts than schemes funded through cross-subsidies. It is not clear if the difference is material.

4.5 Ease of implementation

The effective use of solar PV requires a basis for its output to be sold back to the grid. An approach which relies on the avoided costs is likely to result in complexity. Households may have to compare several retailers, offering different tariffs with different energy components.

The adoption of a standard FiT will perform well against this criterion.

A premium FiT will require that costs are smeared across electricity bills. This would require an increase of up to 2% depending on the option chosen. Smearing does not affect the costs and benefits of the policy. However, it may well be that this approach to funding is acceptable to the majority of electricity consumers, given the public interest in emissions reduction and so easier to implement than other approaches to funding.

Assessment: a standard FiT will be easier to implement than an avoided cost approach with the potential for multiple tariffs. A premium FiT could be recovered from cross-subsidies within the electricity sector. .

5 Design of a feed-in tariff

Earlier sections focused on the use of FiT against other policy instruments to promote uptake of solar PV, and on the level of an FiT.

Consideration will also be required to the detailed design of an FiT. The key issues are:

- *Coverage:* the requirements for inclusion in the scheme, including technology and size
- *Gross or net:* Whether the tariff is gross (and applies to all output of a solar PV), or net (and applies to export, in periods when output from the solar PV exceeds the household consumption)
- *Metering:* the metering requirements to support the form of tariff
- *Payment:* whether the distributor or retailer is responsible for paying the FiT
- *Funding:* the way in which the costs of the FiT can be recovered through smearing across other customer groups
- *Market settlement:* the implications, if any, for the use of the net system load profile for settlement of the retail market.

It may be very desirable to have national consistency on some but not all of these design characteristics. For example, the use of gross or net tariffs is likely to have a major impact on billing systems and on the use of retailers or distributors to implement an FiT. It would create high compliance costs to have different approaches in the NEM.

However, it may be less material if (for example) some jurisdictions include small scale wind under the scheme while others limit it to solar PV.

5.1 Managing the design task

The major elements in the design of an FiT should be consistent across the NEM. This will reduce costs for retailers and distributors. It should also increase the competition in the market for solar PV, and reduce barriers to entry.

It is also desirable that detailed design meets policy objectives and minimises costs to industry. During the design of the systems to support retail competition in the NEM, a national committee (NEMSAT) was established, with representatives from host and second tier retailers, distributors, NEMMCO and end users. A similar structure would assist with detailed design of a national FiT although the task should be shorter and more straightforward.

The design of systems for retail competition was undertaken within a policy framework set by State Governments. The framework included a decision to use a net system load profiling approach, and for significant elements of the systems for market settlement and transfer to be centralised rather than distributed. It would be desirable to establish the policy parameters applying to a FiT within which industry could take forward its detailed design. Examples of major policy decisions could include whether the FiT is gross or net, and whether the system is implemented by retailers or the distributor.

Initial consultation will be required with market institutions, given the AEMC's role in reviewing competition in retail electricity markets, and the transfer of network regulation to the AER.

Conclusion: design of a feed-in tariff should be based on industry consultation to determine which design characteristics have a material impact on costs for market participants, and a consultative process for detailed design of characteristics with material cost impacts.

5.2 Coverage

A premium FiT could apply only to solar PV. Alternatively, it could apply to micro generation from solar, hydro and biomass, in a similar way to the FiT obligation under current legislation.

It is desirable to have national uniformity on how the output of small, distributed and unregistered generators is measured and rewarded. However, it is unlikely that any difference in the technologies covered will create significant costs for industry. It would therefore be desirable for the coverage under existing legislation in Victoria to be continued.

Conclusion: the premium FiT should apply to micro generation from solar, hydro and biomass.

5.3 Gross or net

A gross FiT would apply to all output by solar PV. The household would also pay for all its consumption at the retail tariff.

A net FiT would only apply to imports to the grid, in periods when the output of the solar PV exceeded household demand. The household would also have lower metered consumption (and lower bills) in periods when it was consuming the solar PV output.

The discussion paper released by South Australia[12] concluded that published papers and industry discussions supported an assumption that on average 25% of solar PV output is imported to the grid and 75% is consumed by the household. Data provided by ETSA Utilities suggested that up to 50% of energy might be imported to the grid, although more detailed market data would be required to determine how far this figure was likely to be an average applicable to a large number of consumers.

The share of solar PV that is imported to the grid may vary in other States due to:

- *Location:* areas with higher levels of insolation will see higher imports to the grid

[12] http://www.climatechange.sa.gov.au/PDFs/Feed-in_Discussion_Paper.pdf

- *Size of solar PV:* the larger the solar PV unit, the greater the share of total output that will be imported to the grid, and

- *Household characteristics:* household size, whether the household is occupied by the day, and appliance ownership (particularly AC) will affect the level of household demand and its distribution during the day.

In the absence of firm data the discussion below assumes that the imports to the grid from small scale distributed solar PV in Victoria would be between 25% and 50% of total energy produced.

Under a gross FiT revenues will be affected by sunlight and the performance of the system. Under a net FiT revenues will also be affected by household demand. A gross FiT will provide greater certainty than a net FiT.

It will also be possible to 'firm up' a net FiT through allowing for diversity. This is routinely done in the supply market. For example, wind generators can sell firm derivative contracts based on expected output. The firm level of output is greater for several wind generators in several different locations and this can be achieved either through ownership, or through use of financial intermediaries.

Consumer behaviour is harder to predict than wind. However, demand side measures are traded in the derivatives market. It should be possible to determine a 'firm' level of revenue under a net FiT. If distributors or retailers do not have sufficient diversity to realise this benefit, it could again be realised through financial intermediaries. It will be easier to achieve this in the short to medium term than over say five to ten years.

For these reasons, it would be incorrect to say that a gross FiT is firm and a net FiT is not. That would be overstating the difference. However, it is reasonable to conclude that a gross tariff is simpler – and does not incur any transaction costs to become firm.

A second issue is the benefit from firmness. A higher subsidy (whether provided through a gross or net FiT) will encourage financiers to seek out households who may be interested in installing solar PV, and who are credit worthy. As a result, the finance sector may act as an effective agent for promoting uptake.

A gross tariff would be more favourable to financing based on the asset, rather than the credit strength of the borrower. However, it appears unlikely that financiers will seek to substantially increase asset financing. Most solar PV is installed on the household roof, and it would be difficult and high cost to reclaim the asset in the event of default. It is also unclear whether the policy objectives would be met by – for example – large amounts of small-scale (and highly inefficient) solar PV separate from households and installed in parks and wasteland.

Conclusion: comparable firm revenues can be achieved under both a gross and a net FiT. A gross FiT will be simpler and 'firmer' but is unlikely to lead to increased asset finance. As the level of subsidy under the two approaches can be made reasonably comparable, the preferred approach may be to ensure consistency with other jurisdictions, to minimise costs for market participants.

5.4 Metering

The decision on the use of a gross or net tariff will have implications for metrology procedures and the metering requirements for households which are participating in the FiT. Attachment 2 discusses the relationship between meter types and the desired approach to measuring and rewarding the output of solar PV.

A gross metering approach would require an additional meter for the solar PV. The costs of installation would be substantially reduced if this could be combined with installation of advanced meters under the interval meter roll-out.

Conclusion: appropriate adjustments should be made to metrology procedures following the decision on the form of the FiT. Consideration should be given to minimising additional metering costs if a gross tariff is adopted.

5.5 Retailer or distributor obligation

The introduction of a premium FIT will require a counter-party to purchase solar PV output from households. This will be required regardless of whether the tariff is a gross one applying to all solar PV output or a net one applying to import to the grid.

Imposing this obligation on retailers would create a strong disincentive for them to introduce solar PV:

- Current approaches to settling the retail tariff, summarised in attachment 1, do not provide second tier retailers with the full benefits when a household they are supplying introduces solar PV, and

- Both host and second tier retailers would face a strong disincentive to sign up households under a premium FiT. The costs of solar PV will exceed their costs of wholesale supply and reduce their profitability.

The alternative would be to put the obligation to enter a premium FiT on the regulated DNSP. The DNSP would be able to recover any net costs in charges for use of the network, so effectively smearing costs across all consumers. We understand that the AER have advised the ACT Government that this could be done within the existing rules, through imposing a requirement on DNSPs, and reflecting this in their regulated revenues during periodic resets.

There may be a transitional issue if this obligation is introduced between resets. If it led to a material increase in costs, the DNSP concerned could seek a pass-through from the regulator. If the impact was below the threshold for materiality, the DNSP would be subject to a reduction in its profitability. This might lead to at best a lack of enthusiasm by DNSPs, and at worst some degree of non-compliance. If so, the Government would have the alternative of directly compensating the DNSP until the next regulatory review.

Conclusion: the obligation to enter a premium FiT should be placed on the DNSP, not retailers. Costs should be recovered through charges for use of the transmission

system. There may be a transitional need to address cost recovery until these costs are reflected in the next regulatory determination.

5.6 Tariff level

A premium FiT could be implemented at low, medium or high levels.

A low FiT could consist of a net tariff of 40 cents/kWh. This would roughly double the payment under the current arrangements for a 1:1 FiT. It would be consistent with arrangements in South Australia.

An FiT at this level would provide a modest additional incentive and is likely to have a low but positive impact on take-up.

A medium FiT could consist of a gross tariff of 40 cents/kWh. If other jurisdictions adopt a net tariff, it would be preferable that Victoria also adopted a net tariff. The equivalent payment under a net tariff would be approximately $0.80 - 1.60/kWh. This range could be narrowed by further analysis of expected average imports to the grid.

The take-up is uncertain. Cost exposures could be contained by a cap of 200,000 systems, or around 20% penetration.

A high FiT could consist of a gross tariff of 60 cents/kWh. Again, it would be preferable to adopt a net tariff if this is required for national consistency. The equivalent payment under a net tariff would be in the range $1.20 - $2.40/kWh. Cost exposures could be contained by a cap of 200,000 systems.

For all three options the continuation of the PVRP grant will have a material impact on the subsidy provided and so the likely impact on take-up.

Conclusion: the level of the tariff will significant affect the costs of the premium FiT and its impact on take-up. The preferred level will depend on the weight attached to different objectives. Options for the tariff level are presented in section 6.

5.7 Term and indexation

The term of an FiT needs to be consistent with the asset life. The modelling work to date has assumed a life of 15 years. Recent announcements in South Australia and Queensland have set a term of 20 years. Using the same term in Victoria would enhance national consistency. It would also create incentives to ensure a 20 year life for installed solar PV.

The payment should be indexed to stay constant in real terms. It would be desirable, but not essential, that there is a consistent approach to indexation in the jurisdictions which adopt an FiT.

Conclusion: the FiT should establish fixed real payments over a 20 year period.

5.8 Length of the scheme and adjustment of level

The purpose of the FiT is to establish long term investor certainty. In addition to providing fixed payments for solar PV installed in the current year, it also needs to establish payments for solar PV installed in future years.

It appears unlikely that solar PV costs will stay fixed. There has been a long term reduction in costs. A recent tightening of the market for silicon feedstock has put pressure on costs. However the long term decline is likely to resume and perhaps accelerate given a substantial number of manufacturing investments under way.

This raises the issue of how to provide certainty now on the initial level of the FiT to apply to solar PV installed in future years. One approach is to establish a defined cost adjustment (for example, a real 5% reduction each year).

Any long term pre-defined adjustment will rapidly diverge from actual trends. If it is too high the FiT will be over-paying and imposing an unnecessary cost on electricity consumers. If it is too low the FiT will be unsuccessful in attracting industry investment.

A preferable approach would be to establish a specific index (based for example on the weighted average cost of a number of producers) or to establish an agreed and independent process for review.

The term of the FiT could be addressed in three ways:

- A defined term could be legislated. For example, the FiT scheme might apply to solar PV installed over the next ten years. If the payment has a 20 year term, the last payment would be made in thirty years

- The reduction in costs might remove the need for a premium FiT. For example, a 5% reduction each year combined with increasing retail tariff levels would mean that the level of the premium FiT reached the level of the retail tariff at some point, and the scheme could halt. A similar result may be achieved through a periodic review of the FiT level, although with less certainty

- A quantity cap could be established. This cap would be sufficiently high to meet the objective of encouraging industry investment. The FiT scheme would terminate once the cap was met. Fast take-up would shorten the length of the scheme and slow take-up would extend it.

A quantity cap appears to meet scheme objectives while limiting costs.

Conclusion: the FiT scheme should have an indefinite term, until a cap on total MW installed under the scheme is met. The level of the FiT to apply in future years should be based on a specific index or a process for periodic review, rather than a preset adjustment

5.9 Interaction with market settlement

The approach to small scale, unregistered distributed generation in the NEM is currently under-developed. This reflects the very small amounts of energy currently produced. The approach will need to be clarified if a FiT leads to a rapid increase in uptake of solar PV.

The discussion below reflects consultation with NEMMCO, market participants, and officials in South Australia and Victoria. That consultation has revealed some uncertainty. We cannot guarantee that the description given in this section is correct.

Our understanding of settlement when accumulation meters are used is given in Attachment 2. This concludes that the second tier retailer will not receive the benefit of the energy imported by the grid.

The preferred (but not mandatory) approach is to combine the installation of solar PV with a type 4 meter, that is a remotely read interval meter. The meter would need to be bidirectional and to measure both export from the grid and import to the grid.

All load that is read through an interval meter is excluded from the net system load profile and settled on a half-hourly basis. The same applies to all output of unregistered generation that is measured on an interval basis.

The current approach to unregistered generation is to treat it as 'negative load'. If a 1 kW unit exports 0.5 kWh during a half-hour period, the retailer receives a credit for 0.5 kWh times the half hour price. Our understanding is that this could lead to quite significant price impacts – for example, during recent half-hours in South Australia when the price has hit $10,000/MWh. However, little attention has been paid to this issue due to the very small volume of unregistered generation that is affected.

Conclusion: the Government of Victoria should work with NEMMCO and other jurisdictions to clarify approaches to including small scale unregistered generation in market settlement, and to ensure that these are consistent with the approach adopted to design of a FiT and to metrology procedures for a FiT.

6 Conclusions

6.1 Options for implementing an FiT

There is no single correct answer to the case for a FiT or the detailed design of a FiT. The policy is likely to be relatively high cost and inefficient in the short term. However, it may lead to a significantly greater uptake in solar PV and a greater boost than to the domestic solar PV industry than other policy instruments.

The preferred approach depends on the weight placed on different policy objectives, and on the assessment of likely impact. For example, during our consultation views differed on whether a premium FiT would have a material impact on investment in Victoria in production of silicon feedstock or solar PV cells.

Victoria should adopt a long term premium tariff of 60 cents/kWh, on a gross tariff basis and with a cap of 200 MW, if its dominant or sole objective is to increase investor confidence in long term demand.

This would be an expensive and inefficient response to greenhouse gas abatement. The present value of costs would be $2.2 billion. The cost per ton of CO2 abated would be $544 again in present value terms.

The main rationale for this tariff would be to increase uptake and attract investment. The advice of officials working on inward investment was that investment is unlikely until uncertainty over the ETS is removed. The scale of solar PV uptake achieved under any FiT would be small in relation to likely plant size and would be unlikely to have a major impact on investment.

However, these judgements are necessarily uncertain. A subsidy of this scale must be to some degree a positive factor in attracting investment. The German experience also suggests that a high, long term FiT can be successful in building a domestic industry, although in a much larger economy.

Victoria should adopt a gross tariff of 40 cents/kWh if it is seeking to increase take-up within Victoria, but also seeking to constrain total costs. Alternatively Victoria could adopt an equivalent net tariff of $0.80 - 1.60/kWh. The actual figure would require further work on the average proportion of solar PV output which is imported to the grid. This would assist with national uniformity and minimise costs to industry. It would also create very strong incentives for demand management in households which are receiving the FiT.

A tariff of this scale would be sufficient to significantly improve the financial viability of solar PV. A net tariff would be less welcome to the industry than a gross tariff. Despite this, the very large cross-subsidy to solar PV would be welcomed by the industry.

Victoria should adopt a net tariff of 40 cents/kWh if it is seeking to introduce a modest boost to uptake of solar PV, but also places stress on national uniformity and on containing total costs.

This would be consistent with approaches being adopted in other jurisdictions in both form and level of FiT. It would only provide minor additional support to solar PV. It would leave solar PV with a negative present value and long payback, and is unlikely to have a major impact on take up. If the PVRP subsidy was no longer provided, it is possible there would be a reduction in the take up of solar PV.

Victoria will shortly be implementing the roll-out of interval meters. This will lead to significant innovation in retail tariffs, and major changes in how the output of solar PV is rewarded. If Victoria is seeking to promote dynamic efficiency in the electricity market, and in its greenhouse gas response, it should implement this major reform to the retail market, support continued RD&D in solar PV and consider a supplementary grant program for installation of solar PV with budget funding.

6.2 Preferred option

We were also asked to indicate a preferred approach by Firecone, while recognising this is only one view among many.

A premium FiT may have political advantages in being seen to take action on emissions reduction and may be popular. We leave that judgement to political advisers.

A premium FiT is an expensive and inefficient response to abatement. It is likely to distract attention and funding from more efficient responses. These include larger scale solar thermal and solar PV generation and solar hot water, all of which are considerably more efficient than small scale household PV in greenhouse gas abatement.

A premium FiT would increase take-up. This is likely to increase liquidity in the installation industry, and reduce costs. That would be a positive benefit, but at high cost. It would have little impact in advancing the date at which solar PV technology becomes cost effective against other generation technologies.

Our preferred approach would be to defer implementation of an FiT until the roll-out of interval meters is complete. This will lead to a substantial rebalancing of tariffs and innovation in how both demand management and solar PV are rewarded. This should help advance genuinely commercial approaches to solar PV. This Victorian reform will be considerably more significant for solar PV than the net FiTs being announced in other states.

If earlier action is needed that should be addressed through further funding for RD&D. If earlier and larger subsidy is needed for household take-up, that should be addressed through a budget funded grant program, supplementary to grant funding through the PVRP.

Attachment 1: Measuring solar PV output

A feed-in tariff would pay for the output of solar PV at household level. The rewards to solar PV will depend on the level of the tariff and on how the output of solar PV is measured and rewarded.

Household electricity consumption is measured through meters at household level. Historically, the standard has been an accumulation meter. This measures total electricity consumption over the period between two meter readings.

A simple accumulation meter will measure consumption of electricity exported from the grid. When the use of solar PV reduces supply from the grid that will be reflected in lower consumption over the period. The impact of lower consumption will depend on the structure of the household tariff and the balance between fixed and variable charges.

It is also possible for the meter to measure the flow when production of solar PV exceeds household demand and the grid imports electricity from the household. This can be done in two ways:

- A bidirectional accumulation meter is able to run in two directions, and will net off any import by the grid. The result will be that at the next meter reading the meter will show either net import from or (more probably) reduced export to the household. This would be the minimum requirement under metrology procedures if there is potential for two-way flows.

- An accumulation meter with import and export registers can separately record imports to the grid and exports to the household over the period between meter readings. This allows greater rewards where households are being paid a premium for import to the grid. Our understanding is that this is the metering technology being adopted in Australian States which are introducing FiTs.

Wholesale energy costs are very volatile. High prices often coincide with periods of high demand, typically driven by high temperatures and high air-conditioning loads. The benefits of solar PV will be greater if their output leads to a reduction in demand (or a net import to the grid) during these high price periods.

Accumulation meters do not provide information on the time of use (unless separate meters or registers are used for say peak and off-peak consumption). Interval meters will provide information on consumption for every half hour. The proposed specification for the interval meter roll-out in Victoria will also provide information on net import to the grid for each half-hour period. It will therefore allow greater sophistication in measuring and rewarding the impact of solar PV.

Accumulation or interval meters with separate import and export registers measure the net production of solar PV (that is, any import to the grid after household demand is met). It is also possible for the gross output of solar PV to be metered. This requires the installation of a production meter specifically for the solar PV module.

Victoria's roll-out of interval meters will not measure the gross output of solar PV. Additional investment in metering would be required by all States to move to a gross tariff that rewards all solar PV output, rather than just net import to the grid.

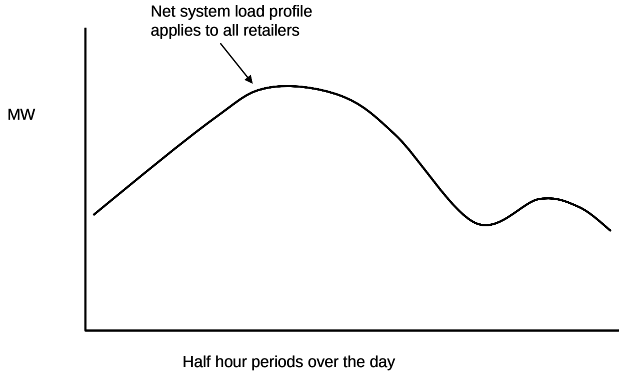
The implications for measuring and paying for solar PV output are summarised in Table 2.

Table 2: Impact of meter type on energy receiving a premium feed-in tariff (FIT)

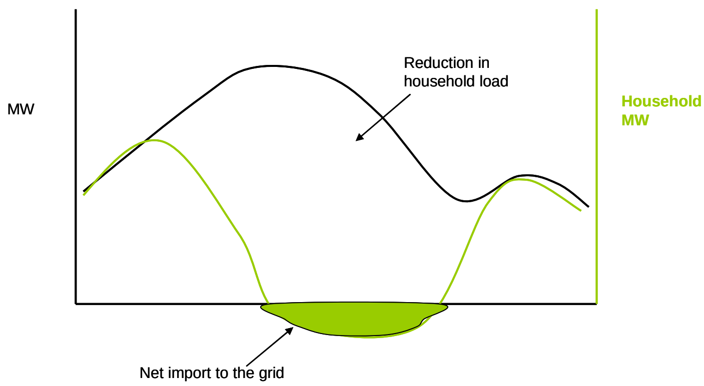
Meter type:	*Impact on metered consumption*	*Impact on household revenues from a premium feed-in tariff*
Simple accumulation meter	Reduced demand for grid supply, value depends on retail tariff	No benefit – import to the grid is not measured. Not acceptable under current metrology procedures
Bidirectional accumulation meter	Reduced demand for grid supply, including 'netting off' of any imports to the grid. Value depends on retail tariff.	No output is paid FiT unless output over 3 months exceeds household demand over the same period
Accumulation meter with separate import and export registers	Reduced demand for grid supply, value depends on retail tariff. Imports to the grid are not netted off household consumption.	All imports to the grid can be paid FiT.
Bidirectional interval meter	Exports from the grid and imports to the grid can be measured for each half-hour.	All imports to the grid can be paid the FiT. There is also potential to provide differential rewards for time of import.
Separate meters for production and consumption	All household consumption can be charged retail tariff.	All PV output can be paid at FiT

Attachment 2: Impact of solar PV on market settlement

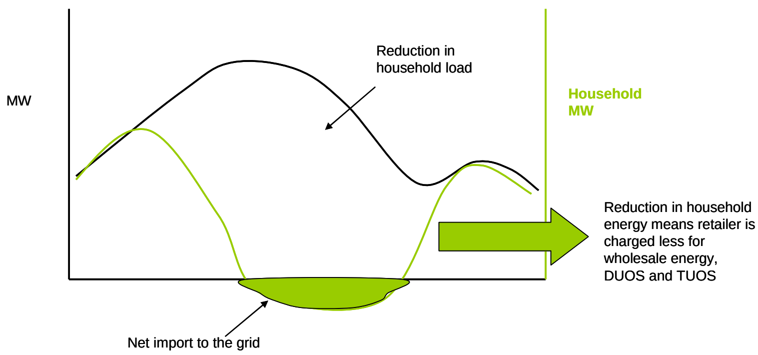
Wholesale prices vary by half hour. However, retail load may only be measured a few times a year giving information on total consumption but not time of consumption. All retailers within the area served by a transmission node are assumed to have the same half-hourly load shape (the net system load profile). This forms the basis of wholesale energy and network charges for second tier retailers.



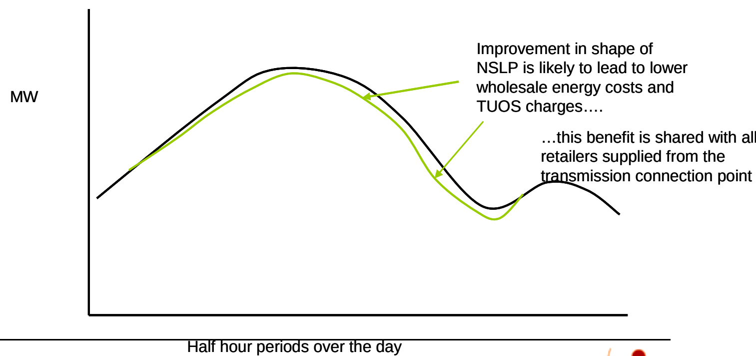
When a household contracting with a second tier retailer installs solar PV then their load shape – shown against the right hand axis – improves substantially. For simplicity, the load shape before solar PV is assumed to be the same as the NSLP. The solar PV reduces demand during peak afternoon hours. It may also lead to import to the grid when output exceeds household demand.



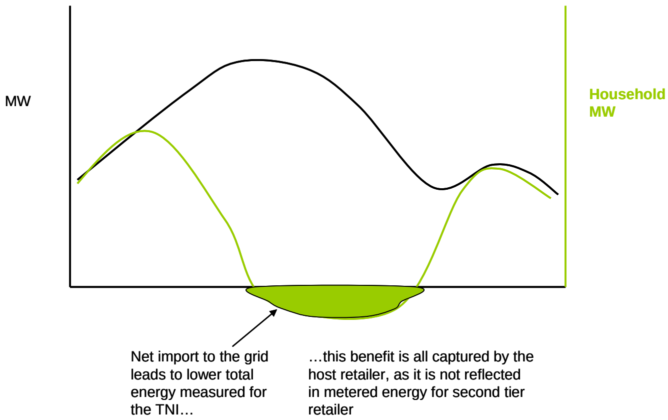
One impact of the solar PV is to reduce total metered consumption by the household. This means that the second tier retailer bills the household less. It also means that the second tier retailer pays less for wholesale energy and for use of the transmission and distribution network. The impact will depend on the structure of TUOS and DUOS charges.



A second impact of the solar PV is to improve the shape of the net system load profile, by reducing the share of peak energy. This benefit is shared with all retailers, since all retailers are charged on the basis of the net system load profile.



A third impact of the solar PV is to reduce total energy supplied to the transmission connection point, through the import of solar PV output to the grid. That benefit is not capture by the second tier supplier, as their payment depends on the household's metered consumption. The output will therefore lead to a reduction in the costs of the host retailer.



If the solar PV is combined with a remote read interval meter, household load is charged (to the retailer) on a half-hour basis, and excluded from the NSLP. Output of the solar PV is treated as negative load. It is measured on a half-hour basis, valued on the half-hour price, and treated as a credit for the retailer.