Feed-in Tariffs

Discussion Paper

Department of Infrastructure, Energy and Resources

Tasmania
Explore the possibilities

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Table of Contents

Glossary

DUoS	Distribution use of system
FRC	Full retail competition
MRET	Mandatory Renewable Energy Target scheme, introduced in 2001 to increase the uptake of renewable energy
NEM	National Electricity Market – the interconnected electricity network that includes Queensland, New South Wales, the ACT, Victoria, Tasmania and South Australia.
NEMMCO	National Electricity Market Management Company
NUoS	Network use of system
OTTER	Office of the Tasmanian Energy Regulator
RECs	Renewable Energy Certificates – issued under the MRET scheme
TUoS	Transmission use of system

1. Introduction

In March 2008, as part of the Tasmanian Government's climate change strategy, it was announced that the Government would consider a report on options for providing mandated minimum feed-in tariffs to support householders and small energy consumers that use solar panels and other forms of domestic renewable energy and that contribute surplus energy to the electricity grid.

The purpose of this paper is to outline the possible scope of a feed-in tariff for Tasmanian electricity customers who choose to invest in renewable electricity generation, the implications for all other customers, and on the structure of the Tasmanian electricity market.

A number of questions need to be answered as part of considering the design of a feed-in tariff scheme. These questions are highlighted throughout the discussion paper, and replicated in full in Appendix 3. Submissions may address, but should not be restricted to, answers to these questions.

Submissions should be received by Monday 24 November, 2008, and should be addressed to:

Hard copy	By email
Manager Energy Policy Office of Energy Planning and Conservation, Department of Infrastructure, Energy and Resources 10 Murray Street Hobart Tas 7000	energy@dier.tas.gov.au

1.1 What is a feed-in tariff?

A feed-in tariff is a pricing mechanism whereby an electricity utility pays a customer for electricity that is generated by the customer and exported to the grid.

The objectives behind having a feed-in tariff can include:

- encouraging local, distributed generation, thereby reducing load on the network and reducing distribution losses associated with the transmission of electricity from centralised generators through the distribution network to customers;
- encouraging uptake of, and stimulating innovation in, renewable energy technology (either generally, or a specific type of technology); and
- reducing greenhouse gas emissions by lessening reliance on non-renewable energy sources.

Generally, feed-in tariffs are based on a premium price being paid to the customer that is in excess of the normal wholesale cost of generation, and sometimes in excess of the normal retail price of electricity. Feed-in tariffs are generally available to residential customers, or to those customers below a given consumption threshold, and are not likely to be available to commercial scale electricity generation.

Most Australian states, including Tasmania, presently have small producers with photovoltaic (electricity-producing solar) systems installed, that supply some of the energy they produce back to the grid, and who receive credit for it. Retailers or distributors are then obliged to pay for this electricity, usually at a much higher rate than the wholesale price. These costs are then recovered from other customers, to pay the subsidy to the householder with the photovoltaic cells.

1.2 Background

Climate change is a topic of growing political importance in Australia and abroad. There is strong consensus in the scientific community that climate change is occurring, and that human activities are contributing to it. There is also consensus that the consequences for Australia are likely to be strongly negative. There is broad support for renewable energy in the general community, as it promises an opportunity to source energy without contributing to carbon emissions. Evidence suggests that energy efficiency measures and conservation are the most economically and environmentally sound measures to reduce environmental impact.

With some exceptions, notably hydro-electric generation, most renewable energy sources are at present significantly more expensive than electricity generated from fossil fuels.

Of the other renewable sources, large scale wind generation and biomass plants are currently the most cost effective, as evidenced by their strong growth under the Mandatory Renewable Energy Target (MRET) scheme. Other technologies with good environmental outcomes that have not been taken up to their full extent include photovoltaic solar, small-scale wind, wave and tidal power, and geothermal.

Photovoltaic solar in particular is a long established technology that has developed to serve specific markets. Photovoltaic technology is extensively used for remote area power supply and has served in this role for decades.

The cost of electricity produced by photovoltaic cells is still significantly higher than by conventional generation. However there is a view that the failure to reflect the externalities of carbon emissions has distorted conventional pricing structures and that there are a variety of subsidies attached to generation from fossil fuels.

Consistent with this view, there is a corresponding argument that government should take a more active role in correcting such market failures.

Professor Ross Garnaut has commented that there are some externalities of embedded generation that may not be appropriately included in the price paid for energy exported to the grid. These issues are discussed further in section 1.5 of this Paper.

1.3 The Electricity Market

Consideration of the implications of a feed-in tariff needs to be undertaken within the context of the electricity market.

The electricity supply industry in Tasmania is part of the National Electricity Market (NEM). The NEM includes Queensland, New South Wales, Victoria, the Australian Capital Territory, South Australia and Tasmania. It has operated since 1998, with Tasmania joining the NEM in 2005.

The NEM is divided into four sectors:

- **Generation** – predominantly from coal, but also from gas, hydro and wind.
- **Transmission** – the transport of electricity at high voltage from power stations to distribution networks
- **Distribution** – the transport of electricity at lower voltage to consumers
- **Retail** – the sale of electricity to the consumer.

The price that a consumer pays includes the wholesale price of electricity; a component for the use of the transmission system (TUoS); a component for the use of the distribution system (DUoS); and a component to cover the costs of the retailer, and a retail profit margin or return on capital.[1]

Transmission and distribution companies are regulated monopolies. The Australian Energy Regulator regulates the prices that transmission companies are allowed to charge for these monopoly prices periodically. Distribution prices in Tasmania have been established by Determinations made by the Tasmanian Electricity Regulator, but on the expiry of the current Determination, future distribution charges (after 2012) will be regulated by the Australian Energy Regulator.

The National Electricity Market Management Company (NEMMCO) manages the wholesale market for electricity centrally, with prices fluctuating depending on the balance between supply (how much electricity can be generated and at what cost) and demand (how much electricity is being used, and what price retailers are able to pay). The wholesale price for electricity changes every 30 minutes and can fluctuate over a very wide range, depending on supply and demand, which in turn fluctuates with the time of day as well as seasonal factors. The assumed wholesale price underpinning retail prices for non-contestable customers in Tasmania is specified in the *Electricity Supply Industry (Price Control) Regulations 2003*, and is $62.50 per megawatt hour for 2008-09, and $63.00 per megawatt hour for 2009-10.[2]

[1] For a detailed explanation of the allowed cost to serve and approved retail margin, see the Regulator's report "Investigation of Prices for Electricity Distribution Services and Retail Tariffs on Mainland Tasmania – Final Report", September 2007.
[2] See Regulation 32(3) and Schedule 2 of the Regulations. This equates to approximately 6 cents per kilowatt hour for the energy component of delivered electricity.

As with generation, the retail sector of the industry is also open to competition in the NEM. With the exception of Tasmania, full retail contestability has been introduced into all NEM jurisdictions. Tasmania began introducing contestability in 2006 for the largest customers, and is gradually extending contestability to other customers. A final decision on the timing of contestability for domestic and small business customers has not yet been made.

There are currently 13 companies licensed to generate electricity in Tasmania, although the scale of generation varies considerably.[3]

Transmission is undertaken by Transend Networks, and Aurora Energy provides distribution services.

Aurora Energy also undertakes electricity retailing in Tasmania, and other licensed retailers include TRUenergy, Country Energy, Integral, and ERM Power Retail.

1.4 Current National Context

On 27 March 2008, the Council of Australian Governments (CoAG) announced a commitment to consider options for a harmonised approach to renewable energy feed-in tariffs. It is anticipated that an options paper will be released later this year.

Any decision on a feed-in tariff for Tasmania will need to be considered in the context of the national approach as it emerges.

1.5 Policy Objectives in the Tasmanian Context

1.5.1 Encouraging local, distributed generation, thereby reducing load on the network and reducing distribution loss factors associated with the flow of electricity through the distribution network.

In his Draft Report, released in July 2008, Professor Garnaut outlined three externalities associated with embedded generation that may not be appropriately included in the price paid for energy exported to the grid. He maintains that, where these externalities provide benefits to the grid, then there should be appropriate feed-in tariffs, at levels commensurate with the associated benefits.

[3] See www.energyregulator.tas.gov.au for a full list of generation licences.

The three externalities are listed below, with additional commentary as to their relevance to the Tasmanian electricity network.

- **Higher value of energy supplied during peak periods**

There is a significant variability in the wholesale price of electricity in Australia. While average prices may be somewhere between $40 and $80 per MWh, there can be price spikes in peak summer periods of several hundred dollars per MWh, up to the bidding cap of $10,000 per MWh. Where distributed generation is available during these summer peaks, generation from grid connected solar photovoltaic systems can alleviate peak demand.

The Tasmanian load is characteristically much “flatter” than in mainland states. Tasmanian peak demand also occurs in winter, with early morning and evening peaks. These times of peak demand do not coincide with high levels of solar generation. Higher levels of solar generation coincide with longer hours of summer, when Tasmanian demand is much lower.

- **Benefits of deferred network augmentation**

Garnaut points out that “during times of peak system demand, the marginal network costs are much higher than the averaged network charges faced by customers, This is because the cost of network augmentation to manage system load is driven solely by the extent of peak demand….Any embedded generation at peak periods helps to avoid or defer the high costs of network augmentation.” (Garnaut, page 436)

The extent to which grid-connected renewables can increase the benefits of deferred network augmentation are again directly related to the extent that peak generation coincides with peak demand. As discussed above, where peak generation in Tasmania coincides with lower demand, embedded solar photovoltaic generation is unlikely to provide any corresponding benefits.

- **Reduced transmission/distribution losses**

Garnaut states that “Embedded generation does not suffer transmission losses to the same extent as generation located far from demand centres”(page 436), and points out that Tasmania has relatively high loss factors. This is therefore a potentially significant benefit.

Loss factors are influenced by a range of issues, including distance from the source of generation, transmission voltage, load density, network load and ambient temperature. The loss factors as determined by NEMMCO, and quoted by Garnaut, are averages that are used for the purposes of adjusting financial settlements. There may be some benefits in terms of reduced distribution losses in Tasmania, however the characteristics of load patterns in Tasmania may also mean that benefits to distribution losses as a result of embedded solar generation will be less than in other states.

The three aspects areas of potential benefit offered by small scale embedded generation identified by Garnaut as not being priced accordingly are all predicated on periods of peak demand coinciding with periods of peak solar energy generation. This pattern does occur in mainland jurisdictions, but not in Tasmania, which has a different pattern of electricity peak usage compared with other NEM states. Energy consumption profiles in other jurisdictions exhibit high summer peaks in demand, typically as a consequence of increased air-conditioning penetration. In these jurisdictions, high peak loads for relatively short periods of time place considerable pressure on the capacity of the distribution system to deliver electricity to meet these demand peaks.

In his Final Report, Garnaut focused on only two of these externalities, deferred network augmentation and reduced distribution losses. He reaffirmed the view that the rate of the feed-in tariff should be based on rigorous quantification of the resulting cost savings to the network, and cautioned that this “may result in a lower feed-in tariff than is currently being applied in most schemes” (page 452)

1.5.2 Stimulating uptake of, and innovation in, renewable energy technologies.

The use of feed-in tariffs to stimulate greater innovation in renewable technologies will only be of ongoing benefit if, as a result of the increased interest, new industries and technologies are developed that are likely to provide products that become more cost effective, and that can be adopted more widely in the market without the need for continuing taxpayer or consumer subsidy. This may be due to improvements in design, or to efficiencies of scale due to increased production. This is the “infant industry” argument.

However, solar photovoltaic electricity generation is a mature technology that has been used for a number of decades. Over time there have been advances in photovoltaic technology that have reduced cost and increased efficiency, and photovoltaic cells are mass-produced both in Australia and overseas.

Large-scale wind is a well-developed technology, and also has applications in remote areas. On a smaller scale, it may also have some application in a domestic context. While this has been a less utilised resource in the domestic context, it may gain some additional interest were a feed-in tariff to apply. The extension of a feed-in tariff for small-scale wind may encourage further development of this technology.

1.5.3 Reducing greenhouse gas emissions by lessening reliance on non-renewable energy sources.

Electricity generation in Tasmania has been primarily from renewable resources (hydro-electricity with some wind) supplemented by gas-fired generation at Bell Bay.

Tasmania is currently facing pressure on electricity supply due to reduced storages supporting hydro-electric generation. As at 2 June 2008, storages were at 17.5 per cent of capacity, following several years of drought. As a result of these low storage levels, electricity is currently being imported across Basslink, with 291 gigawatt hours being imported during the month of April, compared with less than a gigawatt hour being exported. During the same month, 106 gigawatt hours were generated by the Bell Bay gas-fired power station[4], hydro-electric generation contributed 487 gigawatt hours, and wind 25 gigawatt hours.

Any additional generation of electricity within Tasmania from renewable resources may reduce the need for imports over Basslink. Even during times of high water inflows, there will be times when electricity is imported over Basslink, depending on time of day pricing. Electricity imported over Basslink is primarily generated from non-renewable resources on mainland Australia, mostly coal. Accordingly, any additional generation of electricity in Tasmania will displace reliance on non-renewable energy resources.

The key issues here however are about **scale**, and **cost of abatement**.

In relation to scale, in order to displace the 291 gigawatt hours imported over Basslink during April 2008, and on the basis of a household installation of 3 kilowatt capacity generating an average of 10.5 kilowatt hours per day, there would need to be over 900,000 household installations. At an average cost in the vicinity of $30,000 per household installation, there would need to be an investment in the order of $27 billion to replace the electricity imported over Basslink for the relevant period. On a more realistic basis, if every household in Tasmania were to have a 3 kilowatt installation, the cost would still be in the order of $4.5 billion, with capability to displace only one sixth of the import capacity over Basslink.

The cost of CO_2 abatement should also be considered. Any generation of electricity from renewable resources displaces the need for generation from non-renewable resources, and consequently reduces the amount of CO_2 emissions. The Australian Government Department of Climate Change has provided National Greenhouse Accounts (NGA) factors for calculating the CO_2 emissions per kilowatt hour of electricity purchased from the grid. These figures vary across jurisdictions and, in the case of the figures for Tasmania, incorporate the operation of Basslink. The emission factor for Tasmania for the full fuel cycle for consumption of purchased electricity from the grid is 0.13

[4] Figures supplied by Hydro Tasmania, media release dated 2 May 2008.

kilograms of CO_2 per kilowatt hour of electricity. This is significantly lower than in other jurisdictions, as indicated in the table below.

Table 1

Jurisdiction	**Full fuel cycle Emission Factor (kg CO_2 emitted per kWh)**
NSW and ACT	1.06
Victoria	1.31
Queensland	1.04
South Australia	0.98
Western Australia	0.98
Tasmania	0.13
Northern Territory	0.79

Source: *National Greenhouse Accounts (NGA) Factors, January 2008*.

With a feed-in rate equivalent to the current retail tariff, the cost of CO_2 abatement is in the order of $1.50 per kilogram, or $1,500 per tonne of CO_2.

Cheaper forms of CO_2 abatement could be realised, at a household level, through other energy efficiency measures, such as improved insulation, more efficient heating (including solar hot water heating), and lighting. All of these measures would also reduce household electricity bills.

At the generation level, investment in other renewable or low emissions generation, including wind or additional hydro-electric generation, or further research into geothermal, tidal or wave generation, may provide more cost-effective long term benefits for the Tasmanian community. The long run marginal cost of new wind generation, for example, is in the order of $100 per megawatt hour[5]. Upgrading of existing hydro-electric facilities can result in additional generation at a similar cost. Geothermal energy is also very competitive, with estimates of between $70 - $80 per megawatt hour. Geothermal resources in a number of areas across Tasmania are currently being investigated by three different companies.

1. What policy objectives are we seeking to encourage by implementing a feed in tariff?
2. Can you identify any other benefits from stimulating take-up of embedded solar or other renewable energy?

[5] Modelling undertaken by ACIL Tasman for the Energy Supply Association of Australia, June 2008.

2. Tariff Design and Metering

There are **different methods of implementation** for a feed-in tariff. Metering can be either net or gross, and the rate of the tariff is set according to the commitment of the authority instituting it. The effect of the tariff will vary greatly depending on the details of how it is implemented. This makes it problematic to commit to it as a policy until the details of a specific proposal are well understood.

2.1 Tariff rate

Generally a feed-in tariff assumes that there will be a premium paid for electricity generated by a customer and exported to the grid.

It should be borne in mind that any rate that is above the wholesale rate is already a premium rate. A generator selling electricity into the grid could, on the long-term average, expect to receive around $63 per megawatt hour. By contrast, the retail of 19.236 cents per kilowatt hour[6] equates to $192 per megawatt hour, which is about 3 times this wholesale rate.

Comparable feed-in tariff rates in other jurisdictions are included in Appendix 2. All jurisdictions included in the comparison[7] are presently offering a premium rate higher than the retail rate, however the level of tariff needs to be considered in conjunction with the approach to metering.

2.2 Metering – Net or Gross?

The level of tariff necessary to achieve payback on an investment will depend on whether it is payable on net exports or gross exports of electricity to the distribution network.

Most solar electricity systems are connected to the grid through 'import/export' metering. This records the quantity of electricity drawn from the grid separately from the amount the solar electricity system feeds into the grid. When a customer's solar electricity system produces more electricity than the building is using, the metering will record some electricity 'exported' to the grid. The amount of electricity actually exported to the grid will depend not only on the amount being generated, but also on the amount being used. Higher electricity usage during daylight hours will result in lower levels of export to the grid.

2.2.1 Net metering

Net metering is where the feed-in tariff applies only to the export of renewable energy in excess of what is consumed by the user.

[6] Light and power, tariff 31, step 1, as applying from 1 July 2008 until 30 June 2009.
[7] South Australia, Victoria, ACT and Queensland.

For example, let us suppose that the retail rate for electricity is a flat 20 cents per kilowatt hour and that a household consumed around 2000 kilowatt hours of electricity over a quarterly billing period. If that same household generated 1000 kilowatt hours of electricity over the same period via renewable generation[8], then there would be a net import of 1000 kilowatt hours of electricity by that household. While there would be no payment to the household, the use of the solar cells would have saved the cost of 1000 kilowatt hours of electricity, or in the order of $200.00 over that quarterly billing period. This would mean that the quarterly usage charge would be reduced from $400.00 to approximately $200.00.

2.2.2 Gross metering

The gross model applies the feed-in tariff to all renewable energy that is exported to the network, regardless of the electricity consumed by the user. Using the same example as above, the generation of 1000 kWh of electricity over a quarterly period would generate a direct payment for that full amount to the customer. The customer would still be required to pay for all electricity consumed, but would receive a credit for the full amount of the electricity generated.

To continue on this example, under a gross metering arrangement, the customer would be paid $200 for the exported energy, but charged $400 for the energy consumed.

Where the feed-in tariff is the same as the retail rate, there is little difference between the saving to the customer, however if the feed-in tariff were to be greater than the standard retail tariff, then the credit to the customer for the electricity generated could be equivalent to, or possibly even higher, than the cost of the electricity consumed by the household. Let us assume a premium rate of, say, twice the retail rate, applied to the same household. Under net metering, the consumer would still be charged $200 for their net usage of 1000 kWh. Under gross metering, however, the customer would receive $400 for the generation of 1000 kilowatt hours and be charged $400 for the 2000 kilowatt hours consumed. So, although there is a net consumption of 1000 kilowatt hours, the customer would have no payment to make other than the fixed standing charge. This may also mean that the customer has made a lesser contribution to the cost of the infrastructure supplying the premises that allows for electricity to be imported, exported and metered. This could be the case where not all of the network charges are covered by a standing charge, because the unit tariff also includes a component for recovery of fixed costs. Consumption levels, and costs would of course vary during the year, depending on lifestyle patterns, variations of yield from the panels, and the number of panels installed.

[8] Based on an annual average in the vicinity of 3.5 hours of sunlight per day, and a 3 kilowatt system.

3 What rate should apply for a feed-in tariff, and should the metering be based on net consumption or on gross generation?

3. Eligibility

3.1 Which technologies should be included?

The main technology used for small-scale renewable generation is the use of solar photovoltaic cells, however small scale wind generation may also have potential for generation at a domestic level. The Commonwealth rebate for photovoltaic cells, and the feed-in tariff regime in other jurisdictions, with the exception of Victoria, is restricted to solar photovoltaic cells. Victoria's proposal also includes wind, hydro and biomass.

4 If we are seeking to encourage or stimulate innovation in new renewable technologies, should the feed-in tariff apply only to solar photovoltaic cells?

5 Should the feed-in tariff apply equally to generation by small-scale wind, mini-hydro and biomass?

3.2 Which customers should be eligible for a feed-in tariff?

The central premise of most discussions on feed-in tariffs is that they are aimed at householders. The capital cost associated with installation of solar photovoltaic cells will usually mean that they are installed for reasons other than pure financial return, and therefore usually a personal rather than a business decision.

Some customers who operate small businesses, and are charged a business tariff, may also wish to access a feed-in tariff. Many small businesses have electricity consumption that is equivalent to a residential customer. Some small business customers may also feel equally motivated to install renewable generation at their premises. If the policy objective is to encourage small-scale renewable energy, then it could be equally well served by renewable energy generation being installed at business premises.

It also needs to be borne in mind that if the payment regime for feed-in tariffs is to be the retail rate or greater, then the megawatt hour price of the electricity is considerably higher than the regular wholesale price. Accordingly, there needs to be some upper limit placed on the size of systems that could attract this subsidized rate. Consideration also needs to be given to the ability of the distribution network to accept the amount of electricity generated without causing instability in the system. Generation at levels that are too high to fall under the regime for feed-in tariffs, but below the threshold for registration with NEMMCO, may be awkwardly situated.

6 Should a feed-in tariff apply only to residential customers, or should small business customers with equivalent sized systems also be able to receive this subsidised rate?

7 What should be the upper limit for systems that are eligible for this subsidised rate?

4. Interrelationship with other policy tools

A feed-in tariff would need to be considered in conjunction with other policy tools designed to achieve the same objectives.

Encouragement of renewable generation of electricity is encouraged by the use of Renewable Energy Certificates (RECs). Householders are eligible for RECs on the same basis as any generator of renewable electricity. At a household level, many suppliers of solar photovoltaic installations purchase the RECs from the customer at the point of sale, resulting in a discount on the capital cost of the system, which alleviates the householder from the need to engage in the trade of the RECs to receive the benefit. Even where the benefits are included in a discount on the initial cost, the householder still enjoys a direct financial benefit from the scheme in return for their investment in renewable technology.

The Australian Government also offers a rebate of up to $8,000 per household for the installation of solar photovoltaic cells, with a system of 1000 watts (1 kilowatt) qualifying for the maximum payment. While the 2008-09 Federal Budget has introduced a means test to qualify for this payment in the future, existing installations have already received this significant financial benefit.

8 Should all householders with solar photovoltaic systems be eligible for a feed-in tariff at the same rate?

9 Should householders who received a rebate on the installation cost receive a lower feed-in tariff than householders who have not received this rebate?

5. Who would have the obligation to pay

There are two main models, with the obligation being imposed on the retailer or on the distributor.

5.1 Distribution Model

Under this model, the Distributor is required to compensate consumers who export renewable energy into the distribution network. This could take the form of a credit on the DUoS charge, which is passed onto consumers at the billing stage, via the retailer. In the event that the value of export exceeded import, the distributor would be required to pay the consumer the amount owed. The Distributor would then recover costs by passing them on as increased DUoS charges across the entire network. This is the model introduced into South Australia, where it is a condition of a distribution licence that require the crediting of the tariff amount payable against the charges attributable to the supply of electricity to the consumer. There is a corresponding condition of a retail licence that the retailer must reflect this credit in the electricity bill payable by the consumer.

5.2 Retailer Model

This represents an extension of the current, non mandated schemes offered by some retailers prior to the introduction of mandated feed-in tariffs. Aurora Energy offers such a scheme (see section 6, Current Arrangements in Tasmania).

The payment for the exported energy would be credited against charges for electricity consumption and, in situations where exports consistently exceeded imports, the retailer could be required to pay the consumer the relevant amount they are owed for the renewable energy exported.

These additional costs to the retailer would need to be recovered, either through being passed on to all consumers served by that retailer, or across all customers served by all retailers, or a direct subsidy from government.

5.3 Equity Considerations

While there is considerable advocacy from some sectors of the community for feed-in tariffs, not all supporters of renewable energy are advocates of feed-in tariffs as a mechanism to encourage the increased use of renewable energy. In media reports in May 2008, the St Vincent de Paul Society has criticised feed-in tariffs as socially regressive, with the potential to harm the broader retail energy market. The Society has argued that those in a position to benefit from this subsidy are those with the financial resources to own a home and purchase and install photovoltaic solar panels. The energy these units will produce will be subsidised - through increased energy costs - by those not fortunate enough to own their home or with access to sufficient financial resources for the initial capital outlay.[9]

10	Is it fair that all customers pay additional charges to subsidise the feed-in tariff?

6. Current arrangements in Tasmania

There is no mandated scheme in Tasmania, however Aurora Energy currently provides a net metering buy-back scheme. Aurora provides for net metering, at the same rate as the applicable tariff, for photovoltaic systems up to 3 kilowatt capacity. For installations with a larger capacity, customers should seek advice from Aurora. Energy export and import are measured separately, and shown on the customer's bill. Full details can be found on the Aurora Energy website.[10]

7. Consideration of other jurisdictions

The arrangements in Victoria, South Australia, Western Australia, Queensland and the ACT are summarised in Appendix 2. At present, New South Wales is not considering mandating a feed-in tariff, preferring to wait until there is a consistent regime applying across the NEM. The Northern Territory has not publicly announced policies in relation to mandated feed-in tariffs.

8. Benefits and Disadvantages

It is important to disaggregate the consideration of a feed-in tariff as a policy mechanism from the benefits of renewable technology itself.

There are a number of policy measures that can support the policy objectives of renewable technology, and the choice of the feed-in tariff should be considered on its merits as a policy mechanism. Feed-in tariffs need to be compared with and considered in the context of other mechanisms designed to achieve the desired objective, rather than simply recounting the benefits of renewable generation.

The installation of renewable energy generation at a domestic level is expensive, due to the considerable capital costs involved. Information on costs involved is included in Appendix 1. Without financial incentives that enable the customer to recover some of these costs, the use of photovoltaic cells and other forms of locally generated renewable energy would be

[9] Cited in "*The Age*", 14 May 2008.
[10] www.auroraenergy.com.au

unattractive except to hobbyists, or customers living in remote locations unconnected to the grid.

8.1 Benefits of Feed-in tariffs

Feed-in tariffs are a relatively simple way of providing an incentive for individuals to make a choice that would otherwise be economically unrewarding but that provides public benefit.

Feed-in tariffs can make small-scale renewable generation economically feasible for the beneficiary. When combined with capital subsidies and Renewable Energy Certificates, the rate of return and payback period can become reasonable for the householder.

Feed-in tariffs encourage individuals to invest in infrastructure that can unlock private capital that would otherwise be unavailable for a government to use in pursuit of energy policy objectives. The feed-in tariff provides an incentive for individuals to make a choice that is economically unrewarding but provides public benefit of greenhouse gas abatement and enhanced energy security.

Costs incurred by the utility in paying out feed-in tariffs are transferred to the entire energy consumer base, and so represents an income stream in addition to the investments made by those who become small-scale producers. This is an advantage to consumers with feed-in tariffs, but not to consumers as a whole.

Overseas experience, mainly in Germany, suggests that feed-in tariffs are effective at encouraging the uptake of the targeted technology.

Feed-in tariffs provide a clear and simple basis for potential customers to calculate the returns they can expect from an installation.

8.2 Disadvantages of Feed-in tariffs

Because a feed-in tariff acts as a cross subsidy, they change the structure of the market. Customers are credited for energy at a price higher (and sometimes considerably higher) than the normal wholesale rate. That additional cost needs to be borne elsewhere in the industry. This means that the retail price paid by other customers would increase. The amount by which prices to other customers would increase depends on the rate and design of the tariff structure, and the level of uptake. There may be some difficulty with competition and consumer protection legislation, which generally discourages cross subsidies.

The cost of the tariff to other consumers is a function of the uptake rate. If few people take advantage of the tariff, the cost to the average customer will be negligible. If ten percent of the population were to install photovoltaic cells or another type of renewable energy, then the price of electricity could increase by as much as 2%. The uncertainty of uptake adds considerable uncertainty to the outcome of the policy and the cost implications for the rest of the community.

11	Is a feed-in tariff an equitable, cost effective or efficient mechanism for achieving the desired objectives?

9. Next Steps and Matters Outside Scope

9.1 Next Steps

Following consideration of responses to this Discussion Paper, a detailed evaluation of the options will be undertaken prior to a final decision being made by Government.

9.2 Outside scope

Two issues have not been considered as part of this discussion paper.

The taxation issues, both income tax and goods and services tax (GST) associated with feed-in tariffs are not within scope of this paper. The Australian Taxation Office does not yet have a specific ruling on income derived from a feed-in tariff but it is possible that the income generated from the export of electricity, particularly if the customer is a business customer rather than an individual hobbyist, may be included as taxable income. Further information or private rulings, and advice on GST implications, should be sought from the Australian Taxation Office.

Interrelationship with national electricity market has also not been discussed. As the issue of a nationally consistent regime is also the subject of review as part of the CoAG process, it is assumed that, following the conclusion of that review, there will be clarification as to the appropriate mechanism for any mandated feed-in tariff to be accommodated within the regulated pricing arrangements applying to distribution networks. Accordingly, further discussion of this aspect of tariff design will depend on the outcome of that review.

Appendix 1

Photovoltaic System Overview

Components and a brief explanation of terms.

Components and indicative costs

Photovoltaic Solar cell - The smallest part of a unit that turns sunlight directly into electricity. Cells are assembled into modules, often referred to as “panels”. A group of modules or panels is called an array, and this is the installed generating unit in a system.

Balance of System - The equipment necessary to make the solar modules functional. This includes mounting equipment such as electrical cables, fuses, an inverter and metering equipment, brackets and frames for securing modules to the roof or structure and so forth. This equipment will generally cost up to 30% of the total.

Inverter - An electrical device that converts Direct Current electricity produced by PV modules to Alternating Current, which is the type of electricity supplied by the grid (mains). A Grid Connect Inverter is an inverter designed to connect to the Grid in order to Export energy as well as receive it. They are also designed to isolate the solar system from the grid if there is an electrical outage. This is to ensure the safety of the crews fixing the faults, as otherwise there could be some areas still energised when the grid is supposed to be “off”. The upshot is that a solar home, grid connected, will still lose power when the rest of the grid is down, even if its solar equipment is generating.

Meter - For grid-connected systems, a separate meter is required to measure electricity exported to the grid. The customer may be required to pay for this additional metering requirement, depending on the policies of the retailer/distributor.

Costs will vary depending on the number of panels, and the costs of installation. As a rough estimate, a 3 kilowatt system could be expected to cost in the order of $30,000.

Other relevant terms

Rated Output - Solar modules have a rated output, which is given in Peak Watts. When someone refers to a “1 kilowatt system” this refers to its nominal rating, which is not the same as its actual production. This ‘Peak’ rating is the output under very specific conditions. The actual output per day will vary depending on daily conditions, including temperature, cloud-cover and the intensity of the sunlight. Tasmania receives an approximate average of 3.5 peak hours equivalent per day throughout the year. Thus, a domestic 1 kilowatt system could be expected to produce 1277.5 kWh per annum, and a 3 kW system could be expected to produce 3832 kWh per annum under Tasmanian conditions.

Orientation and Angle - Ideally, solar panels should face the incoming sunlight as squarely as possible. To achieve this in the winter months, when solar energy is in shortest supply, the panels should face north and be tilted to an angle roughly equal to the latitude of the place where they are installed- in Tasmania this is around the 40 degree mark. If the roof angle is already close to this, say 45 degrees, and facing near due north, they can be attached directly to the roof with very little difficulty. If the angle and orientation are very poor however, it may be necessary to have additional structures built to support the array, either on the roof of otherwise. This will add to the cost of the installation.

Appendix 2

Feed-in tariff schemes in Australia – Jurisdictional comparison table

Design element	SA scheme[i]	Qld "Solar Bonus Scheme"[ii]	Victoria[iii]	ACT scheme[iv]	WA scheme "Renewable Energy Buyback Scheme"	Tasmania
Policy intent	To ensure that households and small business with solar panels will be rewarded for putting power back into the electricity grid.	* Pay consumers for energy exported to the grid from a solar panel system; * Increase uptake of household solar PV; * Ensure that Queenslanders can maximise the benefits of the federal PVRP	To ensure households are paid a fair price for any renewable power that is fed into the electricity grid Premium tariff announced 6 May 2008 to increase the number of private households in VIC with solar PV and to encourage those to be energy efficient	Encourage individuals and businesses to invest in renewable technologies, over time reducing the community's reliance on fossil fuels Compensation to investors for the benefits of embedded generation	* Legislated for government retailer to pay consumers for excess energy exported to the grid from a solar panel system;	* Retail offering only
Tariff level	44 cents / kWh	44 cents / kWh	Retailers legislated to provide "fair and reasonable" (F&R) tariff of not less than the volumetric	3.88 times the highest retail price (currently 52 cents/ kWh) for less than 10 kW generation	Legislation requires fair and reasonable – currently set at retail tariff rate: 12.67c – A1 tariff or	Relevant retail tariff for solar generation units with a capacity of up to 3kW. Larger units would

Design element	SA scheme[i]	Qld "Solar Bonus Scheme"[ii]	Victoria[iii]	ACT scheme[iv]	WA scheme "Renewable Energy Buyback Scheme"	Tasmania
			charge the customer would pay for at that time of day (ie. at least 1:1). Premium Feed-in Tariff Scheme to pay 60 cents / kWh	capacity. 80% of premium rate for 10-30 kW of generation. 75% of premium rate for greater than 30kW generator. Rate to be determined each year by Minister	variable (10.29 – 22.98) on SmartPower tariff.	be negotiated at the relevant wholesale rate.
Generation eligible for tariff	Surplus (net) electricity exported to grid (import/export metered)	Surplus (net) electricity exported to grid (import/export metered)	Surplus (net) electricity exported to grid (import/export metered)	Gross electricity exported to grid	Surplus (net) electricity exported to grid (import/export metered)	Surplus (net) electricity exported to grid (measured over billing period)
Duration of measure	20 yrs – with planned reviews	20yrs (with review after earlier of 10 years or 8 MW eligible capacity)	F&R tariff - Not specified Premium FiT – up to 100MW installed or 15 years	20yrs (from installation of generation, with reviews every 5 years)	On-going	Not specified
Customers eligible	Domestic and small business with systems up to 10 kVA (approx. 10 kW) for a single phase connection or up to	Domestic and small energy up to 10 kVA (approx. 10 kW) for a single phase connection or up to 30 kVA	F&R tariff - Domestic and small business (capacity < 100 kW) on grid Premium tariff –	No restrictions, premium rate payable to any class of electricity consumer up to 10kW of installed	Domestic, educational, business under 50MWh usage and non-profit making organisations.	No restriction, but for units over 3kW capacity, customer to discuss with Retailer.

Design element	SA scheme[i]	Qld "Solar Bonus Scheme"[ii]	Victoria[iii]	ACT scheme[iv]	WA scheme "Renewable Energy Buyback Scheme"	Tasmania
	30 kVA (approx. 30 kW) for a three phase connection on grid	(approx. 30 kW) for a three phase connection on grid. Only applies to domestic and small energy (< 100 MWh consumption per year)	households with systems up to 2kW	capacity, or 50% of premium rate for greater than 10kW capacity	Legislated limit of 5kW. Horizon Power offer extends this to 10kW	
Who pays?	Electricity distributor pays retailer (with > 10,000 domestic customers) who pay consumers	Electricity distributor pays retailer who pay consumers	F&R tariff - Electricity retailer (with > 5,000 domestic customers) Premium FiT - distributor pays retailer who pay consumers	Electricity distributor (TBD)	Government retailers as only they supply residential market	Electricity Retailer
Technologies eligible	Solar PV	Solar PV	F&R tariff - for wind, solar, hydro and biomass Premium FiT - for solar PV only.	Solar, wind and any other renewable energy source prescribed by regulation	Small RE	Solar PV
Status	Legislated	Legislated	F&R tariff - Legislated Premium tarifff - Announced	Legislated	Legislated	Not legislated
Other Comments	* Tariff rate of $0.44 / kWh (approximately 2	* Requires the customer to buy	* F&R rate to be offered by retailers	* tariff to be reviewed each year	Government retailers currently	

Design element	SA scheme[i]	Qld "Solar Bonus Scheme"[ii]	Victoria[iii]	ACT scheme[iv]	WA scheme "Renewable Energy Buyback Scheme"	Tasmania
	times the retail rate) is fixed, but subject to a review to be carried out after 2.5 years of the scheme.	and install a meter to record import and export of electricity * Tariff of 44c/kWh about 3 times the current retail rate of 15.5c/kWh offered to 2028, but tariff to be reassessed in 10 years or when 8 MW of total capacity installed	at least 1:1 * legislation for F&R tariff allows for smart metering, varying rates through the day and retail price increases * Further details of the premium FiT scheme are yet to be made	but tariff is locked in for 20 years when renewable generator is first connected to scheme * no current cap on generation capacity * FiT paid on gross generation	developing proposals to standardise a buyback process for businesses and larger systems. Legislation does not prescribe conditions or level of buyback rate. All schemes must be approved by the Coordinator of Energy.	

New South Wales and the Northern Territory have not announced any proposed legislation for a feed-in tariff. However there are some retailers operating in NSW who offer feed-in rates that are similar to consumption rates for electricity ("1 for 1"), and EnergyAustralia offers NSW customers a "time of use" tiered tariff with a premium level of 25.1 cents for electricity exported between 2pm and 8pm down to 5.1 cents for off-peak times (the comparison standard retail rate is 11.7 cents).

i. Tackling Climate Change in Australia: http://www.climatechange.sa.gov.au/news/news_5_2.htm
ii. Queensland Parliament passed the Clean Energy Act 2008 on 14 May 2008 which legislates the government's Solar Bonus Scheme.
iii. *Energy Legislation Amendment Bill* amending the *Electricity Industry Act 2000* and passed by parliament on 9 August 2007. On 6 May 2008 the Victorian Government announced, as part of their 2008/09 budget package, a premium Feed-in Tariff Scheme. Minimal details have so far been provided on the premium FiT scheme.
iv. Bill introduced to ACT parliament by MLA Mick Gentleman on 9 April 2008 "Electricity Feed-In (Renewable Energy Premium) Bill 2008". It will be debated further at a later date.

Appendix 3

Questions to be answered

1. What policy objectives are we seeking to encourage by implementing a feed in tariff?
2. Can you identify any other benefits from stimulating take-up of embedded solar or other renewable energy?
3. What rate should apply for a feed-in tariff, and should the metering be based on net consumption or on gross generation?
4. If we are seeking to encourage stimulate innovation in new renewable technologies, should the feed-in tariff apply only to solar photovoltaic cells?
5. Should the feed-in tariff apply equally to generation by small-scale wind, mini-hydro and biomass?
6. Should a feed-in tariff apply only to residential customers, or should small business customers with equivalent sized systems also be able to receive this subsidised rate?
7. What should be the upper limit for systems that are eligible for this subsidised rate?
8. Should all householders with solar photovoltaic systems be eligible for a feed-in tariff at the same rate?
9. Should householders who received a rebate on the installation cost receive a lower feed-in tariff than householders who have not received this rebate?
10. Is it fair that all customers pay an additional distribution charge to subsidise the feed-in tariff?
11. Is a feed-in tariff an equitable, cost effective or efficient mechanism for achieving the desired objectives?

CONTACT DETAILS

Office of Energy Planning and Conservation
Department of Infrastructure, Energy and Resources
Level 9, 10 Murray St
HOBART TAS 7000