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| **Submission for the Creation of a New Activity or Amendment of an Existing Activity under the ESI Scheme** | |
| **Applicant details** | |
| Date of submission | 11 Dec 2015 |
| Company name  (if applicable) | Easy Warm (Aust) Pty Limited |
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| **Summary of proposal** | |
| **Category of proposed activity** | *Solar PV water heating utilising photovoltaic modules. Current activity is solar thermal water heating utilising rooftop collectors.* |
| **Confidentiality statement:** *No part of this submission is confidential*  In lodging a submission, parties acknowledge the Department's right to engage consultants and contractors to assist in the assessment process, and to disclose information (that might otherwise be identified as confidential by a party) to such persons for those purposes. | |

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| **Briefly describe new or amended activity**  Maximum 100 words. | A solar PV hot water system retrofitable to any electric storage cylinder using new Australian patented technology: a “variable output voltage” (off-grid) inverter to heat water only with power available from the sun.  Key is to adjust element supply voltage continuously, so a 3.6kW element, say, can operate at anywhere from ~100W to 3.6kW, based on amount of solar power available. (Note: elements running at grid voltage must operate at their full rating whenever they turn “on”, so have to make up any shortfall between solar power available and their kW nameplate rating by drawing extra power from the grid.) |

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| **Estimate the average annual energy savings for an average installation of that activity** | Estimate of the annual energy savings for an average Victorian household: | |
|  | **Input Data/Assumptions** | |
|  | Av. number of people per household | 2.41 |
|  | Av. number of showers per day per person | 0.9 |
|  | Av. flow rate of existing shower (L/min) | 12 |
|  | Av. time for shower (mins) | 6.7 |
|  | Cold water temperature – Tc (deg C) | 14.5 |
|  | Hot water temperature - Th (deg C) | 60 |
|  | Average shower temperature - Ts (deg C) | 40 |
|  | Specific heat of water (kJ/kg per deg temperature raised) | 4.186 |
|  | Assumed life of the saving (Yrs) | 10 |
|  | Discount factor (to take into account BAU uptake) | 80% |
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|  | Estimated annual water used for showering  = 2.41 x 0.9 x 365 x 12 x 6.7  = 63,650 Litres/year at 40 deg C  % of water saving which is hot water  = (Ts – Tc)/(Th – Tc) x 100%  = (25.5/45.5) x 100%  = 56%  Number of litres per year at 60 deg C:  = 63,650 x 56%  = 35,644 Litres/year at 60 deg C  Base energy required per annum to provide this volume of water:  = 35,644 x 45.5 x 4.186 / 1000  = 6,790 MJ/Yr = 18.6 MJ/day  **Expected annual energy saved allowing for lower winter output**:  = 75% x 6,790 MJ/Yr  = 5100 MJ/Yr | |
|  | Conversion to number of kWh needed per day to size HotPV array:  = 6790 MJ/Yr  = 18.6 MJ/day  = (18.6 MJ/day) / (3600kJ/kWh) x 1000  = 5.17 kWh per day  Using a design peak sun hour level of average 4 peak sun hours a day in Victoria, this amount of energy can be supplied by a 1.3kW HotPV array. | |

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|  | **Victorian water heating penetrations and performance** | | | | |
|  | Type of water heater | Av. Stock Conversion Efficiency | Unit Energy Saving (MJ/Yr) | Penetration | Weighted Saving (MJ/Yr) |
|  | Electric | 98% | 5204 | 28.9% | 1504 |
|  | Solar electric or heat pump | 230% | 0 | 1.0% | 0 |
|  | Natural gas | 82% | 6219 | 67.9% | 4223 |
|  | LPG/other | 82% | 6219 | 1.5% | 93 |
|  | Solar gas | 215% | 0 | 0.1% | 0 |
|  | Wood | 55% | 9272 | 0.6% | 55 |
|  |  |  |  | Total: | 5875 |
|  | Estimated lifetime savings  = 5875 x 10  = 58,750 MJ  Estimated lifetime saving taking into account the discount factor  = 58750 x 80%  = 47,000 MJ | | | | |

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| **Estimated number of VEET certificates** | | | | |
| To estimate annual greenhouse savings the weighted annual savings for each type of water heater are multiplied by the greenhouse coefficient for the relevant fuel. | | | | |
|  | **Type of water heater** | **Weighted fuel saving (MJ/Yr)** | **Greenhouse Coefficient (kg/MJ)** | **Greenhouse Saving (kg/Yr)** |
|  | Electric | 1504 | 0.2675 | 402 |
|  | Natural gas | 4223 | 0.0573 | 242 |
|  | LPG/other | 93 | 0.065 | 6 |
|  | Wood | 55 | 0.014 | 1 |
|  |  |  | Total: | 651 |
|  | Estimated lifetime greenhouse abatement  = 651 x 10  = 6510 kg = 6.510 Tonnes  Estimated lifetime greenhouse abatement, taking into account the discount factor  = 6.510 x 80%  = 5.21 | | | |

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| **BASIS OF CLAIMED SAVINGS** | |
|  | Average installation is a HotPV system with a VOV inverter and solar PV hot water controller, retrofitable onto any electric storage cylinder element. The application is able to be used for both residential and business sectors.  This activity should be rewarded under a “deeming approach”. To simplify verification means, the same calculation for measuring the deemed abatement achievable can be the same as that used for the creation of STCs.  The proposed average savings are likely to be achieved in an average installation because the likely output of PV arrays is well documented.  The main difference between a standard PV array and a HotPV array is that in the latter case, the output of the array is directly connected to the element of a hot water cylinder rather than to the distribution board. This allows the power generated from the array to be used directly to heat water.  A key advantage of this system is the technical feature where any element connected to the HotPV array is provided with electric power from the array only, and does not need (and cannot receive) any grid supplied electricity while the system is in operation. To ensure reliable hot water for no-sun days, a controller allows the cylinder to be boosted by the grid. |
| **Demonstrate that the activity is likely to be additional to business as usual (BAU)** | The HotPV system allows solar power to directly substitute for grid supplied electricity for heating water. The HotPV systems are in competition with night rate, largely coal fired generation.  The renewable electricity supplied by the HotPV systems which heat water faces a market of generally low overnight power prices, which is at a significantly lower cost than power from the grid during the day.  Night rate electricity would be the water heating method of choice in a BAU situation.  With a solar hot water system, behavioural factors heavily influence the outturn result. For example, if householders shower at the end of a hot day, the benefits of a solar hot water system (both PV and solar thermal) are maximised. If householders shower first thing in the morning, then standing losses will mean that the cylinders may need to be grid-boosted (automatically by the controller) just prior to use. These two behaviours cam significantly affect the efficacy of the solar PV hot water service. The inverters have the capability to display power generated on a web portal, so that customers who are interested in maximising the use of solar energy can see when there hot water services are likely to be fully “charged” for use. |
| **List the key variables that should be considered to ensure the activity best represents the delivered energy savings** | With the availability of parallel verification measures such as the STC issued to small scale arrays, it is possible to cheaply with little administrative overhead to verify the likely delivered energy savings. The key variables that should be considered are:   * Good installation practices * Systems sized to meet hot water service required * Reduction in power bills * Customers’ willingness to move from a controlled tariff to a daytime tariff |
| **List all existing product standards which support the claims for energy savings or related matters** | The existing standards and measures that underpin quality assurance and/or performance are:   * AS/NZS 5033 Installation and safety requirements for photovoltaic (PV) arrays * AS 3000 Wiring Regulations * CER calculations for the deeming of STCs for small scale PV systems |
| **Ensuring savings are valid** | The existing requirements administered by the CEC is able to be used to verify that the installation of the activity is to a standard which achieves STCs, by installers certified to do the work, with existing robust compliance regimes in place which do not need to be replicated nor any additional administrative burden. |
| **Protecting health and safety** | The safety and occupational health and safety issues of the HotPV systems are identical to any other rooftop PV array. Existing legislation and regulations cover the proposed activity, and no additional measures need to be put in place. Certification of installers by the CEC and continuous professional development requirements of registered electrical workers are already in place, and no additional oversight is required. |
| **Other benefits and issues** | The proposed activity requires the use of an innovative inverter. Aside from this piece of equipment, the proposed systems are identical in all respects to PV arrays being implemented throughout Victoria. A number of these systems have been installed in field trials with very good results. These field trials have informed the following:   * The estimated cost of implementing the activity (capital and installation costs): these are similar in most respects to any PV array installed in Victoria. There is an additional cost for the controller where grid boost of the solar PV hot water systems may be required. However, the proposed activity utilises as more of the power generated by an array inside the householder’s premises, affording faster payback times which more than cover any additional cost of the solar controller * The estimated total number of installations possible in Victoria annually is dependent only on sales of the systems: all of the infrastructure to deploy the systems in scale quantities are in place * Potential for product or service innovation, or industry development, including likely investment or employment creation:   + the proposed activity effectively allows a household to install a second off-grid array on any dwelling that already has an on-grid PV array, with no limitation by network distributors or any connection limitations, allowing employment creation by potentially doubling the number of PV arrays on each dwelling   + the proposed activity is able to be controlled by network distributors with product of service innovation by developing communication capability in the software of the control systems * The proposed activity is new technology and new business models may need to be developed to fully realise the potential benefits of the proposed activity |