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| **Third-Party Assessment Report For EEG Advanced** |

The third-party assessment report shall be conducted by a whitelisted third-party qualified assessor.

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| 1. **Details of Existing System** | | | |
| 1. Specify the details of the equipment in the existing system  |  |  |  |  |  | | --- | --- | --- | --- | --- | | Brand and model of Equipment | Capacity | Qty | Year of Installation | Operating Profile | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | | | | |
| 1. Specify the system demand (e.g. compressed air flow), and the efficiency of the existing system: | | | |
|  | System demand | : |  |
|  | System performance[[1]](#footnote-2) | : |  |
| 1. Please attach a schematic of the existing system and briefly describe how the existing system works. | | | |
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| 1. **Details of Proposed System** | | | | | | | | |
| 1. Specify the details of the proposed equipment in the existing system  |  |  |  |  |  | | --- | --- | --- | --- | --- | | Brand and model of Equipment | Capacity | Qty | Year of Installation | Operating Profile | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | | | | | | | | | |
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| 1. Specify the estimated lifespan of the proposed equipment / system | | | | | | | | |
|  | Lifespan | | | : |  | | |
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| 1. Please attach a schematic of the system and briefly explain how the proposed system works, and why it is more efficient than the existing system. | | | | | | | | |
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| 1. Explain rationale for the equipment sizing selection. | | | | | | | | |
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| 1. Specify the targeted performance[[2]](#footnote-3) of the proposed system, including breakdown of efficiency at component level (if applicable). Please show the step-by-step calculations, including the basis and assumptions. | | | | | | | | |
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| 1. **Annual Committed Energy Savings**   Will the project result in energy efficiency outcomes?  Yes  No | | | | | | | | |
| Please provide the estimated annual committed energy savings associated with the project.  *Note:*   1. *Provide step-by-step calculations on the energy savings and state basis and*   *assumptions (if any)*   1. *Where relevant, provide references on the methodology, guidelines (e.g. IPMVP), standards (e.g. SS 664 – Code of Practice for long term measurement of compressed air) used for the estimation of annual energy savings.*  |  |  | | --- | --- | |  | Committed Energy Savings | | Annual energy savings  (State unit:\_\_\_\_\_\_\_\_) |  | | Annual energy cost savings (S$)  (State tariff rate:\_\_\_\_\_\_\_\_) |  | | | | | | | | | |

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| 1. **Simple Payback Period** | | | | | | |
| Please compute the simple payback period using the following formula:  *Payback = Project costs ÷ annual projected energy cost savings* | | | | | | |
| Simple payback period in years | | : |  | | |
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| |  |  |  |  | | --- | --- | --- | --- | | 1. **Lifetime Carbon Abatement**   Please compute the lifetime carbon abatement based on the energy savings derived from item 3 above.  *Lifetime carbon abatement (tCO2)*  *= Annual committed energy savings × equipment lifespan (years) × carbon emission factor of the fuel used in existing system.*   |  |  |  | | --- | --- | --- | | Lifetime Carbon Abatement (tCO2) | : |  | |  1. **Level of Uncertainty** | | | | | | |
| Please provide the uncertainty analysis.   |  |  | | --- | --- | |  | Details of uncertainty analysis | | Measurement (e.g. instruments) |  | | Others (e.g. modelling, interactive effects) |  | | Uncertainty due to the methodology to estimate energy savings |  | | Total uncertainty |  |   **7. Endorsement**   |  |  |  | | --- | --- | --- | | Qualified Assessor  (Name and Signature) | **:** |  | | | | | | | |

**Instruction on completing the report template**

1. Installation/Purchase of the following would not be supported under EEG Advanced:

* Vehicles[[3]](#footnote-4).
* Key equipment in systems that require Measurement & Verification at system level for legislation compliance[[4]](#footnote-5) or Green Mark Scheme (or equivalent government scheme)
* Blackbox solutions (i.e. software or hardware devices whose functioning cannot be explained by applying mainstream engineering knowledge and theories for EE improvements)
* Non-EE equipment, including monitoring devices and equipment that reduce carbon emission but does not reduce energy consumption (e.g. solar PV Panel, wind turbine)
* International vessels

1. The third-party assessment shall be conducted by a whitelisted third-party qualified assessor and the third-party assessment report shall be signed off by a whitelisted third-party qualified assessor.
2. Applicants should check from GoBusiness portal if their third-party assessors are whitelisted before engaging a third-party assessor and filing their applications. Only applications endorsed by whitelisted third-party qualified assessors would be processed.
3. Third-party qualified assessor shall be responsible to:
4. gather and analysis the data needed to complete the EEG Advanced third-party report template;
5. attach supporting documents that are used for the analysis with the signed EEG Advanced third-party report; and
6. provide step-by-step calculations on the energy savings and state basis and assumptions (if any). Where relevant, provide references on the methodology, guidelines (e.g. IPMVP), standards (e.g. SS 664 – Code of Practice for long term measurement of compressed air) used for the estimation of annual energy savings.
7. Third-party qualified assessor shall always determine efficiency of the existing equipment/system and new equipment/system to determine energy saving, before proceeding into carbon abatement computation.

**Step one: Provide details and determine performance of existing system**

1. **A retrofit isolation approach shall be taken.** Only if the equipment or system to be replaced accounts for a significant percentage of a whole facility consumption should third-party qualified assessor consider using facility or sub-facility level measurement (e.g., using energy data from utility meters, whole facility meters, or sub-meters) with appropriate proportioning to the existing equipment/system to be replaced.
2. **Performance of existing system** shall be in terms of:

* efficiency (ɳexisting system) = actual output ÷ actual energy input % where output is typically an energy unit; or
* Specific energy consumption (SECexisting system) = actual energy input ÷ actual output,

where output can be an energy unit or a system demand. For situations where there is more than 1 type of system demand (e.g. hot water and steam from boiler), the output for the above formula should take into account all system demand.

1. **Continuous field metered energy and key related operational data for the associated equipment/system of at least 2 weeks shall be used (where available) to determine the performance of existing system and system demand.** Measurement shall be over a specified period of time representative of normal operation. Take for example, to determine the SEC of compressed air system in kW/Nm3, one would need to minimally measure Nm3 compressed air (system demand) and power consumption.
2. If collection of continuous field metered energy and key related operational data is not feasible, the third-party qualified assessor may consider using the following approaches to estimate efficiency of existing system via one or a combination of the following:

* Continuous field measurement, but over a shorter time period of less than 2 weeks
* Spot measurement
* Validated proxy variables and the related independent variables of the affected system
* Calibrated simulation (e.g., simulation of the energy consumption and demand)
* Measurement results based on testing and commissioning phase
* Design parameters
* Information from past energy audit reports[[5]](#footnote-6) and/or feasibility studies

which combination to use would depend on the availability of field meters, feasibility to install temporary meters, and availability of alternative credible data sources. The third-party qualified assessor shall choose appropriately taking into consideration the overall energy cost savings that could be achieved by the project.

1. For new facility installation, the third-party qualified assessor shall provide justification and supporting documents (e.g. literature study, similar plant adoption) to show how efficiency and system demand is derived. The third-party qualified assessor shall note the following:

* Efficiency that is used to represent the efficiency of existing system shall be based on the **current market norm** technology and performance of the equipment that would have been installed without the EEG Advanced grant.
* System demand shall be based on design at normal operating condition, not maximum operating condition.

**Step two: Provide details and determine targeted performance of proposed system**

1. The third-party qualified assessor shall explain the rationale for the equipment sizing selection. The equipment shall be **right sized** for the purpose of the operation. If the equipment needs to be slightly oversized, in determining the target efficiency of the proposed system, the % loading shall be taken into consideration.
2. **Design specs with appropriate assumptions on % loading shall be used to determine target performance of proposed system.**
3. **Target performance of proposed system shall be in terms of**:

* efficiency (ɳproposed system) = (design output ÷ design energy input) % at target % loading where output is typically an energy unit; or
* Specific energy consumption (SECproposed system) = (design energy input ÷ design output) at target % loading, where output can be an energy unit or a system demand. For situations where there is more than 1 type of system demand (e.g. hot water and steam from boiler), the output for the above formula should take into account all system demand.

1. The boundary for performance determination shall be for all related equipment that are within applicant’s operational control or site/facility boundary. Take for example, if the electricity is generated onsite for a proposed electricity consuming equipment (e.g. electricity used to power a proposed electricity consuming equipment is generated from an on-site diesel generator), the performance of the performance of proposed system shall also include the efficiency of the diesel generator, battery storage system (if any) and charger (if any).

**Step three: Compute annual committed energy savings and energy cost savings**

1. **Actual annual operating hours and actual energy tariff shall be used in energy and cost savings computation.**
2. The following formula shall be used in determining annual committed energy savings:

Annual committed energy savings = -

where output is typically an energy unit

Or

Annual committed energy savings

= (SEC existing system - SEC proposed system) × Annual expected output where output can be an energy unit or a system demand.

Example A

If the EEG Advanced project involves replacing a NG boiler (efficiency 85%) by heat pump of efficiency 250% (COP 2.5), and the expected steam output is 500 kg/hr at a steam enthalpy of 2,762 kJ/kg at 8000 operating hours/year (i.e. an annual expected output of 11 TJthermal), the computed annual committed energy savings will be

(11 TJthermal/85%) - (11 TJthermal/250%) = 8.54 TJ

Example B

If the EEG Advanced project involves replacing an inefficient compressor (SEC of 3.6 kWh/Nm3) with a more efficient compressor (SEC of 3.53 kWh/Nm3), at a compressed air output of 500 Nm3/hr at 8000 operating hours/year, the computed annual committed energy savings will be

500Nm3/hr × 8000hrs \* (3.6 - 3.53) = 0.28 GWh

1. The following formula shall be used in determining annual expected output:

Annual expected output

= actual annual operating hours under proposed system operation × average hourly output under proposed system operation

1. The following formula shall be used in determining annual committed cost savings:

Annual committed energy cost savings (S$)

= **actual** energy tariff × Annual committed energy savings

**Step four: Compute simple payback period**

1. The following formula shall be used in determining payback:

Payback = Project costs ÷ annual committed energy cost savings

**Step five: Compute lifetime carbon abatement**

1. The default equipment lifespan shall be 15 years for direct purchase, unless the project involves installing appliances under the mandatory energy label scheme where the following equipment lifespan shall be used:

* 7 years for MELS air-conditioner; or
* 10 years for MELS refrigerator; or
* numbers of hours stated in design specs ÷ usage per day at facility for lighting.

1. The following formula shall be used in determining lifetime carbon abatement. This formula is structured for EEG Advanced grant:

Lifetime carbon abatement (tCO2)

= Annual committed energy savings × equipment lifespan (years) × carbon emission factor of the fuel used in existing system.

Where Carbon emission factor for NG = 56.114 tCO2/TJ,

Carbon emission factor for diesel = 74.1 tCO2/TJ,

Grid emission factor = 408 tCO2/GWh

The above factors may change on an annual basis and the figures would be updated whenever necessary. The third-party qualified assessor can propose other emission factor where applicable.

For the same example in clause 16), Example A

If the EEG Advanced project involves replacing an NG boiler (efficiency 85%) by heat pump, the lifetime carbon abatement (tCO2) will be

8.54 TJ × 15 years × 56.114 tCO2/TJ = 7188 tCO2

where 56.114 tCO2/TJ is the default NG emission factor.

For the same example in clause 16), Example B

If the EEG Advanced project involves replacing an inefficient compressor with an efficient compressor, the lifetime carbon abatement (tCO2) will be

0.280 GWh × 15 years × 408 tCO2/GWh = 1713.6 tCO2

where 408 tCO2/GWh is the current grid emission factor

1. As EEG focuses on energy efficiency improvement, not decarbonization, for fuel switch measures (i.e. the existing equipment using fossil fuel combustion and the proposed equipment uses non-fossil fuel (e.g. electricity, biomass), the third-party qualified assessor shall only compute carbon abatement for EEG Advanced project based on the above committed energy savings computation computed in Step 3 using Step 5. Carbon abatement due to fuel switch **shall not be** included in carbon abatement for EEG Advanced projects.

1. *Performance of existing system shall be in terms of :*

   * *efficiency (ɳexisting system) = actual output ÷ actual energy input % where output is typically an energy unit; or*
   * *Specific energy consumption (SECexisting system) = actual energy input ÷ actual output, where output can be an energy unit or a system demand.*

   [↑](#footnote-ref-2)
2. *Target performance of proposed system shall be in terms of either*

   * *efficiency (ɳproposed system) = (design output ÷ design energy input) % at target % loading where output is typically an energy unit; or*
   * *Specific energy consumption (SECproposed system) = (design energy input ÷ design output) at target % loading, where output can be an energy unit or a system demand.*

   [↑](#footnote-ref-3)
3. *This includes Goods vehicles (e.g., cement mixers, concrete pump, mobile cranes) that are registered under LTA’s ‘Normal’ Vehicle Scheme (i.e. subject to relevant vehicle taxes/fees), but excludes off-road engineering plants (e.g., excavator, wheel loader, and dump trucks) that are registered under LTA’s ‘Engineering Plant’ Vehicle Scheme (i.e. subject to only Registration Fee with relevant vehicle taxes exempted)*  [↑](#footnote-ref-4)
4. *For clarity, for chilled water system that do not need to comply with NEA’s Minimum Energy Efficiency Standards (MEES), replacement of standalone key equipment of chilled water plant (e.g. chiller, cooling towers) can be supported under EEG Advanced. For chilled water system that shall comply with NEA’s MEES, EEG Advanced can support chilled water system replacement/new installation that*

   *(1a) can meet or exceed MEES performance standard* ***before*** *MEES comes into effect, or*

   *(1b) exceed MEES performance standard* ***after*** *MEES comes into effect, whichever applies at the point of the first EEG Advanced submission; and*

   *(2) is installed with M&V sensors/meters to facilitate post retrofit system efficiency determination for compliance with MEES. The cost of M&V sensors/meters would not be funded under EEG Advanced.*

   *It is the responsibility of the assessor to show to the grant administrator that the new chilled water system can meet (1a) or (1b) using simulation of expected hourly operating load and efficiency at each hour loading based on chiller, pumps and cooling towers performance curve. For chilled water system that is installed after MEES comes into effect at the point of the first EEG Advanced submission, assessor shall ensure that the performance of the existing system stated in the application shall be no lower than the NEA’s MEES performance standard (i.e. Grant is only applicable to savings/abatement exceeding MEES for (1b)).* [↑](#footnote-ref-5)
5. *The energy audit referenced should be representative of the energy consumption system(s) and pattern(s) of the facility at the point of application (i.e. no major change in demand and/or retrofits implemented at the facility).* [↑](#footnote-ref-6)