

**Appendix A - Measurement & Verification Plan**
**Front PAGE**

<Please demonstrate your artistic talent>

**Instructions:** ESCOs are required to follow the formatting outlined in the following document for the Measurement and Verification Plan. Any information highlighted in yellow must be provided in this report. Sections that are formatted in the red are notes or instructions which should be removed before submission to the client.

Where tables are required, some tables have been provided in the excel file “DFS Excel Template”. However, ESCOs are free to develop their own as long as the order/headings are kept the same.

Examples and templates have been provided in the MVP section as a guide. GGB have approved these methodologies and it is highly recommended that ESCOs use this or apply a similar methodology. However, ESCOs are not strictly required to use these methodologies but will be required to justify and provide detailed explanations if another approach is used.

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# Measurement & Verification Plan

## Overview

This Measurement and Verification Plan (MVP) describes how <ESCO> will prove to <AGENCY>, the savings achieved as a result of implementing the EPC. This MVP has been developed in accordance with the International Performance Measurement and Verification Protocol (IPMVP) which allows for savings to be verified using the options described below in table 4.

**Table 4 – Measurement and Verification options**

|  |  |  |
| --- | --- | --- |
| Option | Title | How does it work? |
| A | Partially measured retrofit isolation | Before and after measurement of some parameters with others stipulated. |
| B | Retrofit isolation | Before and after measurement of all parameters |
| C | Whole facility | Use site level (usually utility) meters to measure the whole site’s usage before and after installation |
| D | Calibrated simulation | A simulated model of the site or system is developed and used to determine the outcome |

##

## Guaranteed savings

*Guaranteed* savings refers to the total project cost savings aggregated from all solutions implemented as part of this project. It is the contractual obligation of the ESCO to prove to the customer that the *guaranteed* savings have been achieved, at a whole of project level, post-implementation.

Note that it is acceptable for individual solutions to not meet their required level of savings, as long as the overall project savings are met or exceeded.

Any shortfalls in guaranteed savings are contractually required to be reimbursed financially by the ESCO to the customer. The financial reimbursement will be based on the total project shortfall in dollar terms, as follows:

**Project shortfall ($) = guaranteed savings ($) - actual savings ($)**

Note that if the result is negative (i.e. a surplus of savings), this surplus is retained by the customer, however it may be reclaimed by the ESCO as compensation for the reimbursement of a shortfall in a previous year

## Formatting

This section provides a separate measurement and verification plan for each solution or site. Each plan is described in the following format:

1. Project savings
2. Utility consumption savings formula
3. Baseline variables
4. Post-implementation variables
5. Baseline adjustment factors
6. Demand reduction savings
7. Maintenance savings
8. Other savings
9. Verification of equipment installation
10. Commissioning/tracking performance
11. Information to be provided by the customer
12. Reporting by the ESCO
13. Extrapolations/calculations

<Note: Include a separate sub-section (2.1, 2.2, etc) for each solution or site to be verified using the format provided in the following pages. There should be a separate sub-section for each row shown in table 1 of this plan.>

## Agreed Utility Rates

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 5 - Agreed Baseline Utility Rates** |  |  |  |  |  |  |  |  |  |  |  |
|  | **Peak Electricity Rate** | **Off-Peak Electricity Rate** | **Gas RateBand 10 - X GJ** | **Gas RateBand 2X - X GJ** | **Gas RateBand 3X - X GJ** | **Water Supply Rate** | **Water Sewerage Rate** | **Water Discharge Factor** | **Variable Demand Charge** | **Max DemandCharge ($ / kVa /month)** | **Max Demand(kVa)** |
| **Site 1** |   |   |   |   |   |   |   |   |   |   |   |
| **Site 2** |   |   |   |   |   |   |   |   |   |   |   |
| **Site 3** |   |   |   |   |   |   |   |   |   |   |   |
| **Site 4** |   |   |   |   |   |   |   |   |   |   |   |
| **Site 5** |  |  |  |  |  |  |  |  |  |  |  |
| **Site 6** |  |  |  |  |  |  |  |  |  |  |  |
| **Site 7** |  |  |  |  |  |  |  |  |  |  |  |
| **Site 8** |  |  |  |  |  |  |  |  |  |  |  |
| **Site 9** |   |   |   |   |   |   |   |   |   |   |   |
| **Site 10** |   |   |   |   |   |   |   |   |   |   |   |
| **Site 11** |   |   |   |   |   |   |   |   |   |   |   |
| **Site 12** |   |   |   |   |   |   |   |   |   |   |   |
| **Site 13** |  |  |  |  |  |  |  |  |  |  |  |
| **Site 14** |  |  |  |  |  |  |  |  |  |  |  |
| **Site 15** |  |  |  |  |  |  |  |  |  |  |  |
| **Site 16** |  |  |  |  |  |  |  |  |  |  |  |
| **Site 17** |  |  |  |  |  |  |  |  |  |  |  |
| **Site 18** |  |  |  |  |  |  |  |  |  |  |  |
| **Site 19** |  |  |  |  |  |  |  |  |  |  |  |
| **Site 20** |  |  |  |  |  |  |  |  |  |  |  |

The utility rates shown below refer to the agreed rates that will be used to determine the project’s cost savings over the term of the contract’s guarantee period. There is no contractual requirement as part of this project for the utility rates shown in table 2 to be escalated or modified over time as actual utility rates change.

###### <Template MVP - insert solution or site name>

**M&V option: (Please state A/B/C/D)**

<Provide a brief overview of the solution, how it will deliver savings and how it will be measured and verified>

### Project savings

<**Removed after noted:** List all utility consumption savings, demand charge savings, maintenance cost savings, and other savings. Note, these listed savings may be based on a mix of measured and stipulated variables, which will be further described in subsequent subsections.>

#### Utility consumption savings:

* Annual electricity peak saving (kWh) = <X>
* Annual electricity off-peak saving (kWh) = <X>
* (Alternatively) Annual electricity saving – total (kWh) = <X>

(note: where complex baseline variations used, this may be the best approach, as opposed to guaranteeing a separate peak and off-peak saving)

* Annual natural gas saving (MJ) = <X>
* Annual water saving (kL) = <X>

#### All other savings:

* Annual demand charge saving (kW) = <X>
(note: this may be best managed under an option C MVP as the cost savings can only be negotiated at a site (billing meter) level)
* Annual maintenance cost saving = <$X>
* Annual (other) cost saving = <$X>

#### Total annual cost saving:

* Annual cost savings = <$X>
<note: must equal the sum of all (utility savings x baseline utility rates) + maintenance and other cost savings>

### Utility consumption savings methodology

<Insert formula or description (or both) explaining how the savings will be calculated from measured or assumed variables for each line above related to utility savings (e.g. energy and water consumption savings). Note: demand charge cost savings, maintenance savings, and other savings should go in the latter subsections rather than here. This subsection is just for utility consumption savings>

**Table <X>: <Electricity / Gas / Water> consumption savings variables**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables** | **Description** | **Baseline** | **Post-implementation** |
| **Measured** | **Stipul-ated** | **Measured** | **Stipul-ated** |
| **Sample** | **Full** | **Sample** | **Full** |
| <Name 1> | <Description of Variable 1> | X |  |  |  | X |  |
| <Name 2> | <Description of Variable 2> |  | X |  |  | X |  |
| <Name 3> | <Description of Variable 3> |  |  | X |  |  | X |

### Baseline variables

#### Already measured (i.e. during DFS)

<Insert details of any baseline variables shown in the savings calculation formula (above), that have already been measured (e.g. as part of the DFS stage). Please also include details of how the variable was measured – i.e. using what sample size and for how long, how regularly, etc.>

* **Variable 1:** <insert value/s and explain how it was measured – i.e. over what sample size and for how long>
* **Variable 2:** <insert value/s and explain how it was measured – i.e. over what sample size and for how long>

#### Stipulated (not measured)

<Insert details of any baseline variables shown in the savings calculation formula (above), that have been stipulated as part of the DFS stage. Please also include justification for the values. E.g. manufacturer’s data, customer advice, etc>

* **Variable 3:** <insert value/s and justification>

#### To be measured after award of EPC

<Insert details of any baseline variables shown in the savings calculation formula (above), that will be measured after award of the EPC. Please include details of how the variables will be measured – i.e. using what sample size and for how long, how regularly, etc>

### Post-implementation variables

#### To be measured

<Insert details of any post-implementation variables shown in the savings calculation formula (above), that are proposed to be measured, and have not yet been measured. Please include the guaranteed (minimum) requirement for each variable and details of how the variable will be measured – i.e. using what sample size and for how long, how regularly, etc.>

* **Variable 1:** <insert guaranteed value/s and explain how it was measured – i.e. over what sample size and for how long>

#### Stipulated (not measured or guaranteed)

<Insert details of any post-implementation variables shown in the savings calculation formula (above), that have been stipulated as part of the DFS stage. Please also include justification>

* **Variable 2:** <insert value/s and justification>

### Baseline adjustment factors

<insert details of any adjustment factors that are expected to have a significant impact upon the measured energy performance. It is important to not only describe the adjustment factors here, but to provide details of the degree of adjustment required to the variable based on a stipulated level of change in the adjustment factor.>

### Demand reduction savings

<Insert details of how demand charge savings have been calculated, including justification for any assumptions. Note: this must correspond with the site level max demand and charges negotiated with the electrical retailer, so may be best dealt with under an option C verification (refer to Option C proforma). Any claimed demand reduction cost savings should also include details as to how the change will be negotiated with the retailer and the ongoing cost savings verified.>

### Maintenance savings

<Insert details of how maintenance savings have been calculated, including justification for any assumptions. E.g. For lighting, Include details of improved lamp life, linking to run hours specific to each area and stipulated cost per lamp and unit labour cost to replace it.>

### Other savings

<Insert details of how other savings have been calculated, including justification for any assumptions, and details as to how the cost savings will be verified and maintained>

### Verification of Equipment Installation

<Particularly important for Option A M&V - Insert details of how the installation of the equipment will be verified, i.e. the correct quantity, specification, location, etc. It may be necessary to include or refer to a table/spreadsheet>

### Commissioning/tracking performance

<Particularly important for option A M&V - Insert details of how the ongoing operation (and performance) of the measure will be tracked over time, who will be responsible for tracking it, and how any potential issues will be addressed. Note this is important in cases where the solution is planned to have a once-off MVP, and/or where the MVP is based on a sample measurement. In these cases it may be appropriate to plan a regular check to ensure the measure continues to operate.>

### Information to be provided by the customer

<list the information required to be provided by the customer to the ESCO, including when and how often>

### Reporting by the ESCO

<insert details of when and how often reports will be provided by the ESCO to the customer to verify the performance of this solution>

### Extrapolations/calculations

<insert description of how the measured and stipulated variables will be extrapolated to verify the guaranteed savings. This may require a table to be inserted or refer to an attached table, spreadsheet or document.>

## <L1 proforma – Lighting replacement>

**M&V option: A**

New fluorescent fittings will replace the current fluorescent fittings one for one in the following areas: <list buildings/areas>

These LED lights use less power and will result in electricity savings. The new LED lights also have a longer lifespan and will result in maintenance savings. Energy savings will be verified by measuring the wattage of each different type of light fitting before and after installation of the new lights. Since there will be no impact on the control of the lighting, run hours will be agreed as a stipulated variable. The total savings will be verified by multiplying the measured wattage saving by the agreed run hours for each type of light fitting, and extrapolating across all areas covered by this solution. Maintenance savings will be stipulated based on a per unit cost of lamp replacement.

### Project savings

#### Utility consumption savings:

* Annual electricity peak saving (kWh) = <X>
* Annual electricity off-peak saving (kWh) = <X>

#### All other savings:

* Annual demand charge saving (kW) = <X> <**Removed after noted:** this may be best managed under an option C MVP as the cost savings can only be negotiated at a site (billing meter) level>
* Annual maintenance cost saving = <$X>

#### Total annual cost saving:

* Annual cost savings = <$X> <**Remove after noted:** must = ∑(utility savings x baseline utility rates) + maintenance and other cost savings>

### Utility consumption savings methodology

Annual electricity savings will be verified by measuring the wattage reduction of each replaced light fitting by the stipulated run hours for that fitting. i.e:

**Table x: Electricity consumption savings variables**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables** | **Description** | **Baseline** | **Post-implementation** |
| **Measured** | **Stipul-ated** | **Measured** | **Stipul-ated** |
| **Sample** | **Full** | **Sample** | **Full** |
| Lighting Power | power drawn by existing and new lighting | X |  |  | X |  |  |
| Peak Run Hours | Peak run hours of lighting  | X |  |  |  |  | X |
| Off-Peak Run Hours | Off-peak run hours of lighting | X |  |  |  |  | X |

### Baseline variables

#### Already measured (i.e. during DFS)

**Lighting power (pre-implementation):** each lighting type has already been measured using temporary/instantaneous meters. The electrical demand of each type of light fitting is provided in table <X> (either include below or refer to an attachment).

**Table <X>: Sample measurements of lighting power (pre-implementation)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Type of Lighting** | **Areas affected** | **Number of Measurements (sample)** | **Average Lighting Power (W) (extrapolated)** |
| Lamp A | Open Office, Enclosed Office | 11 | 40 |
| Lamp B | Open Office | 7 | 60 |
| Lamp C | Corridors, Enclosed Office | 12 | 50 |
| Fitting A | Open Office, Enclosed Office | 11 | 30 |
| Fitting B | Open Office | 7 | 35 |
| Fitting C | Corridors, Enclosed Office | 12 | 20 |

<**Option 1** – Use temporary (e.g. HOBO) loggers to determine run hours of sample locations and extrapolate for all other similar areas>

**Peak and off-peak run hours of lighting (pre-implementation):** Run hours to be measured using sample measurements taken from temporary (e.g. HOBO) loggers to determine current operating hours of lighting in certain zones, which are then extrapolated for all other similar areas.

**Table <X>: Sample measurements of lighting run hours (pre-implementation)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Area** | **Sample area/s** | **Measurement time/duration** | **Run hours (sample)** | **Annual run hours (extrapolated)** |
| Open office | Bld A, L2 west open area | 4 weeks (1 Mar 2013 – 31 Mar 2013) | 264 | 3432 |
| Enclosed offices | Bld A, L2, rooms 2.5, 2.6, & 2.7 | 4 weeks (1 Mar 2013 – 31 Mar 2013) | 207 | 2691 |
| Corridors | Bld A corridor | 4 weeks (1 Mar 2013 – 31 Mar 2013) | 327 | 4251 |

#### Stipulated (not measured)

<**Option 2** – Stipulate run hours based on discussion with Agency staff>

**Peak and off-peak run hours of lighting (pre-implementation):** Individual run hours in each area where it is proposed to install this solution are stipulated in the table below. Run hours were determined through discussions with staff in each area.

**Table <X>: Stipulated lighting run hours (pre-implementation)**

|  |  |  |
| --- | --- | --- |
| **Area** | **Stipulated Run hours (per week)** | **Stipulated Annual run hours (extrapolated)** |
| Open office | 66 | 3432 |
| Enclosed offices | 50 | 2600 |
| Corridors | 45 | 2340 |

### Post-implementation variables

#### To be measured

**Lighting Power (post-implementation):** each type of the new light fittings will be measured. The required maximum wattage for each type of fitting is provided in table x (either include below or refer to an attachment).

**Table <X>: Sample measurements of lighting power (post-implementation)**

|  |  |  |
| --- | --- | --- |
| **Type of Lighting** | **Areas affected** | **Guaranteed Lighting Power (W) (extrapolated)** |
| Lamp X | Open Office, Enclosed Office | 15 |
| Lamp Y | Open Office | 20 |
| Lamp Z | Corridors, Enclosed Office | 20 |
| Fitting X | Open Office, Enclosed Office | 10 |
| Fitting Y | Open Office | 15 |
| Fitting Z | Corridors, Enclosed Office | 10 |

#### Stipulated (not measured or guaranteed)

**Peak and off-peak run hours of lighting (post-implementation):** Since there are no lighting control changes proposed as part of this solution, it will be assumed that the post-implementation run hours are identical to the pre-implementation run hours (see above).

### Baseline adjustment factors

Not applicable.

### Demand reduction savings

<Insert details of how demand charge savings have been calculated, including justification for any assumptions. Note: this must correspond with the site level max demand as billed by the electricity retailer, so may be best dealt with under an option C verification (refer to Option C proforma). Any claimed demand reduction cost savings should also include details as to how the change will be negotiated with the electricity retailer and the ongoing cost savings verified (i.e. in writing).>

### Maintenance savings

<Insert details of how maintenance savings have been calculated, including justification for any assumptions.

Include description of how maintenance savings are calculated (i.e. improved lamp life, linking to run hours specific to each area and stipulated cost per lamp and unit labour cost to replace it). List details relating to:

* Unit cost of lamp (existing lamps vs new lamps)
* Unit cost of labour to replace lamp (should be agreed with customer)
* B50 value of lamp (existing lamps vs new lamps)
* Annual run hours of lighting (corresponding with baseline and future variables above)

It may be necessary to include or refer to a table/spreadsheet listing the details relevant to each area where the lighting has been replaced.>

### Other savings

Not applicable.

### Verification of Equipment Installation

<Particularly important for Option A M&V - Insert details of how the installation of the equipment will be verified, i.e. the correct quantity, specification, location, etc. It may be necessary to include or refer to a table/spreadsheet. >

ESCO will conduct a walking tour of the implementation areas with an Agency representative to verify installation of equipment. A checklist of all equipment installed as part of this ECM has been attached as an Excel spreadsheet.

### Commissioning/tracking performance

<Particularly important for option A M&V - Insert details of how the ongoing operation (and performance) of the measure will be tracked over time, who will be responsible for tracking it, and how any potential issues will be addressed. Note this is important in cases where the solution is planned to have a once-off MVP, and/or where the MVP is based on a sample measurement. In these cases it may be appropriate to plan a regular check to ensure the measure continues to operate.>

### Information to be provided by customer

Not applicable.

### Reporting

A once-only report to be provided to customer on completion of post-installation measurements, no longer than six (6) months after practical completion of installations. The report will describe the results of measurements in section 3.6.4.1, and extrapolation of all variables as described in section 3.6.6 to verify the project savings as detailed in section 3.6.1.

### Extrapolations/Calculations

#### Extrapolations

<Provide extrapolation details for determining the:

* average power per fitting / lamp (number of samples, tools, used, etc)
* average annual run hours per zone (number of samples, tools, used, etc)

#### Calculations

The measured wattage (existing and new lighting) of each type of fitting will be extrapolated across all areas covered by the installation and multiplied by the run hours for each area. The calculations for determining the savings are provided in the attached Excel Spreadsheet.

<**Removed after noted:** ESCO **MUST** provide an Excel Spreadsheet detailing the:

* Relevant area / site affected by the lighting ECM
* The type of lighting installed
* Energy saving calculations which should include:
	+ Number of fittings & lamps (pre/post implementation)
	+ Fitting Power and Lamps (W) (pre/post implementation)
	+ Average Annual Run Hours
* Maintenance saving calculations which should include:
	+ Unit cost of lamp (existing lamps vs new lamps)
	+ Unit cost of labour to replace lamp (should be agreed with customer)
	+ B50 value of lamp (existing lamps vs new lamps)>

## <L2 proforma - Lighting controls>

**M&V option: B**

Lighting controls in the form of occupancy sensors will be installed on all office area lighting to automatically switch lights off when the area is vacant. Savings will be verified by measuring the run hours of the lighting in a represent sample of areas for four weeks after the controls have been installed.

The total savings will be calculated by multiplying the measured run hour reduction by the measured wattage of each type of light fitting, and extrapolating across all areas covered by this solution.

Reducing the annual run hours will also reduce the annual rate of lamp replacements and result in maintenance cost savings. Maintenance cost savings will be stipulated based on a per unit cost of lamp replacement and agreed rate of replacement.

### Project savings

#### Utility consumption savings:

* Annual electricity peak saving (kWh) = <X>
* Annual electricity off-peak saving (kWh) = <X>

#### All other savings:

* Annual maintenance cost saving = <$X>

#### Total annual cost saving:

* Annual cost savings = <$X> <**Remove after noted:** must = ∑(utility savings x baseline utility rates) + maintenance and other cost savings>

### Utility consumption savings methodology

Annual electricity savings will be verified by measuring the difference in run hours post-implementation of the lighting controls and multiplying it by the baseline power of the lamps. i.e:

**Table <X>: Electricity consumption savings variables**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables** | **Description** | **Baseline** | **Post-implementation** |
| **Measured** | **Stipul-ated** | **Measured** | **Stipul-ated** |
| **Sample** | **Full** | **Sample** | **Full** |
| Lighting Power | power drawn by existing lighting | X |  |  |  |  | X |
| Peak run hours | Peak operating hours of lighting | X |  |  | X |  |  |
| Off-peak run hours | Off-peak operating hours of lighting  | X |  |  | X |  |  |

### Baseline variables

#### Already measured (i.e. during DFS)

**Lighting power (pre-implementation):** each lighting type has already been measured using temporary/instantaneous meters. The electrical demand of each type of light fitting is provided in table <X> (either include below or refer to an attachment).

**Table <X>: Sample measurements of lighting run hours (pre-implementation)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Type of Lighting** | **Areas affected** | **Number of Measurements (sample)** | **Average Lighting Power (W) (extrapolated)** |
| Lamp A | Open Office, Enclosed Office | 11 | 40 |
| Lamp B | Open Office | 7 | 60 |
| Lamp C | Corridors, Enclosed Office | 12 | 50 |

<**Option 1** – Use temporary (e.g. HOBO) loggers to determine run hours of sample locations and extrapolate for all other similar areas>

**Peak and off-peak run hours of lighting (pre-implementation):** Run hours to be measured using sample measurements taken from temporary loggers (e.g. HOBOs) to determine current operating hours of lighting in certain area types, which are then extrapolated for all other similar areas.

**Table <X>: Sample measurements of lighting run hours (pre-implementation)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Area** | **Sample area/s** | **Measurement time/duration** | **Run hours (sample)** | **Annual run hours (extrapolated)** |
| Open office | Bld A, L2 west open area | 4 weeks (1 Mar 2013 – 31 Mar 2013) | 264 | 3432 |
| Enclosed offices | Bld A, L2, rooms 2.5, 2.6, & 2.7 | 4 weeks (1 Mar 2013 – 31 Mar 2013) | 207 | 2691 |
| Corridors | Bld A corridor | 4 weeks (1 Mar 2013 – 31 Mar 2013) | 327 | 4251 |

#### Stipulated (not measured)

<**Option 2** – Stipulate run hours based on discussion with Agency staff>

**Peak and off-peak run hours** **of lighting** (pre-implementation): Individual run hours in each area where it is proposed to install this solution are stipulated in the table below. Run hours were determined through discussions with staff in each area.

**Table <X>: Sample measurements of lighting run hours (pre-implementation)**

|  |  |  |
| --- | --- | --- |
| **Area** | **Stipulated Run hours (per week)** | **Stipulated Annual run hours (extrapolated)** |
| Open office | 66 | 3432 |
| Enclosed offices | 50 | 2600 |
| Corridors | 45 | 2340 |

### Post-implementation variables

#### To be measured

**Peak and off-peak run hours of lighting (post-implementation):** Run hours to be measured using sample measurements taken from temporary loggers (e.g. HOBOs) to determine post-implementation operating hours of lighting in certain zones, which will then be extrapolated for all other similar areas.

**Table x: Sample measurements of lighting run hours (post-implementation)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Area** | **Sample area/s** | **Measurement duration** | **Guaranteed Run hours (sample)** | **Guaranteed Annual run hours (extrapolated)** |
| Open office | Bld A, L2 west open area | 4 weeks  | 40 | 2080 |
| Enclosed offices | Bld A, L2, rooms 2.5, 2.6, & 2.7 | 4 weeks  | 30 | 1560 |
| Corridors | Bld A corridor | 4 weeks  | 45 | 1820 |

#### Stipulated (not measured)

**Lighting power (post-implementation):** Since lighting controls do not affect the electrical demand of each lighting, it will be assumed that the post-implementation power of the lighting will be identical to the pre-implementation power values outlined in 3.7.3.1.

### Baseline adjustment factors

Not applicable.

### Demand reduction savings

Not applicable for this solution, as the total potential electrical demand of the lighting has not been reduced by this measure (i.e. if all the sensors happen to be activated at the same time there will be a full load and no reduction in site electrical demand).

### Maintenance savings

<Insert details of how maintenance savings have been calculated, including justification for any assumptions. Include description of how maintenance savings are calculated (i.e. reduced run hours of lighting and a stipulated cost per lamp and unit labour cost to replace it). List details relating to:

* Unit cost of lamps
* Unit cost of labour to replace lamp (should be agreed with customer)
* Rated life of lamps
* Annual run hours of lighting (baseline vs future as per variables section above)

It may be necessary to include or refer to a table listing the details relevant to each area where the lighting has been replaced.>

### Other savings

Not applicable.

### Verification of Equipment Installation

<Particularly important for Option A M&V - Insert details of how the installation of the equipment will be verified, i.e. the correct quantity, specification, location, etc. It may be necessary to include or refer to a table/spreadsheet. >

ESCO will conduct a walking tour of the implementation areas with an Agency representative to verify installation of equipment. A checklist of all equipment installed as part of this ECM has been attached as an Excel spreadsheet.

### Commissioning/tracking performance

<Particularly important for option A M&V - Insert details of how the ongoing operation (and performance) of the measure will be tracked over time, who will be responsible for tracking it, and how any potential issues will be addressed. Note this is important in cases where the solution is planned to have a once-off MVP, and/or where the MVP is based on a sample measurement. In these cases it may be appropriate to plan a regular check to ensure the measure continues to operate.>

### Information to be provided by customer

Not applicable.

### Reporting

A once-only report to be provided to customer on completion of post-installation measurements, no longer than six (6) months after practical completion of installations. Report will detail the results of measurements in section 3.7.5, and extrapolation of all variables as described in section 3.7.7 to verify the project savings as detailed in section 3.7.1.

### Extrapolations/calculations

#### Extrapolations

<Provide extrapolation details for determining the:

* average power per fitting / lamp (number of samples, tools, used, etc)
* average annual run hours per zone (number of samples, tools, used, etc)

#### Calculations

The run hours (pre and post implementation) of each sample lighting zone will be extrapolated across all areas covered by the lighting controls and multiplied by the agreed power of each type of lamp. The calculations for determining the savings are provided in the attached Excel Spreadsheet.

<**Removed after noted:** ESCO **MUST** provide an Excel Spreadsheet detailing the:

* Relevant area / site affected by the lighting ECM
* The type of lighting installed
* Energy saving calculations which should include:
	+ Number of fittings & lamps (pre/post implementation)
	+ Fitting Power and Lamps (W) (pre/post implementation)
	+ Average Annual Run Hours
* Maintenance saving calculations which should include:
	+ Unit cost of lamp (existing lamps vs new lamps)
	+ Unit cost of labour to replace lamp (should be agreed with customer)
	+ B50 value of lamp (existing lamps vs new lamps)>

## <L3 proforma - Lighting replacement and controls>

**M&V option: B**

New fluorescent fittings will replace the current fluorescent fittings one for one in the following areas: <list buildings/areas>

These LED lights use less power and will result in electricity savings. The new LED lights also have a longer lifespan and will result in maintenance savings. Lighting controls in the form of occupancy sensors will be installed on all office area lighting to automatically switch lights off when the area is vacant. Savings will be verified by measuring the run hours of the lighting in a representative sample of areas for four weeks after the controls have been installed.

The total savings will be calculated by multiplying the measured run hour reduction by the agreed/measured wattage of each type of light fitting, and extrapolating across all areas covered by this solution. Reducing the annual run hours will also reduce the annual rate of lamp replacements and result in maintenance savings. Maintenance savings will be stipulated based on a per unit cost of lamp replacement.

### Project savings

#### Utility consumption savings:

* Annual electricity peak saving (kWh) = <X>
* Annual electricity off-peak saving (kWh) = <X>

#### All other savings:

* Annual maintenance cost saving = <$X>

#### Total annual cost saving:

* Annual cost savings = <$X> <**Removed after noted**: must = ∑(utility savings x baseline utility rates) + maintenance and other cost savings>

### Utility consumption savings methodology

Annual electricity savings will be verified by measuring the difference in run hours post-implementation of the lighting controls and multiplying it by the baseline power of the lamps. i.e:

**Table x: Electricity consumption savings variables**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables** | **Description** | **Baseline** | **Post-implementation** |
| **Measured** | **Stipul-ated** | **Measured** | **Stipul-ated** |
| **Sample** | **Full** | **Sample** | **Full** |
| Lighting Power | power drawn by existing lighting | X |  |  |  |  | X |
| Peak run hours | Peak operating hours of lighting | X |  |  | X |  |  |
| Off-peak run hours | Off-peak operating hours of lighting | X |  |  | X |  |  |

### Baseline variables

#### Already measured (i.e. during DFS)

**Lighting power (pre-implementation):** each lighting type has already been measured using temporary/instantaneous meters. The electrical demand of each type of light fitting is provided in table x (either include below or refer to an attachment).

**Table x: Sample measurements of lighting run hours (pre-implementation)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Type of Lighting** | **Areas affected** | **Number of Measurements (sample)** | **Average Lighting Power (W) (extrapolated)** |
| Lamp A | Open Office, Enclosed Office | 11 | 40 |
| Lamp B | Open Office | 7 | 60 |
| Lamp C | Corridors, Enclosed Office | 12 | 50 |

<**Option 1** – Use temporary (e.g. HOBO) loggers to determine run hours of sample locations and extrapolate for all other similar areas>

**Peak and off-peak run hours of lighting (pre-implementation):** Run hours to be measured using sample measurements taken from temporary loggers (e.g. HOBOs) to determine current operating hours of lighting in certain area types, which are then extrapolated for all other similar areas.

**Table x: Sample measurements of lighting run hours (pre-implementation)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Area** | **Sample area/s** | **Measurement time/duration** | **Run hours (sample)** | **Annual run hours (extrapolated)** |
| Open office | Bld A, L2 west open area | 4 weeks (1 Mar 2013 – 31 Mar 2013) | 264 | 3432 |
| Enclosed offices | Bld A, L2, rooms 2.5, 2.6, & 2.7 | 4 weeks (1 Mar 2013 – 31 Mar 2013) | 207 | 2691 |
| Corridors | Bld A corridor | 4 weeks (1 Mar 2013 – 31 Mar 2013) | 327 | 4251 |

#### Stipulated (not measured)

<**Option 2** – Stipulate run hours based on discussion with Agency staff>

**Peak and off-peak run hours** **of lighting** (pre-implementation): Individual run hours in each area where it is proposed to install this solution are stipulated in the table below. Run hours were determined through discussions with staff in each area.

**Table x: Sample measurements of lighting run hours (pre-implementation)**

|  |  |  |
| --- | --- | --- |
| **Area** | **Stipulated Run hours (per week)** | **Stipulated Annual run hours (extrapolated)** |
| Open office | 66 | 3432 |
| Enclosed offices | 50 | 2600 |
| Corridors | 45 | 2340 |

### Post-implementation variables

#### To be measured

**Peak and off-peak run hours of lighting (post-implementation):** Run hours to be measured using sample measurements taken from temporary loggers (e.g. HOBOs) to determine post-implementation operating hours of lighting in certain zones, which will then be extrapolated for all other similar areas.

**Table x: Sample measurements of lighting run hours (post-implementation)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Area** | **Sample area/s** | **Measurement duration** | **Guaranteed Run hours (sample)** | **Guaranteed Annual run hours (extrapolated)** |
| Open office | Bld A, L2 west open area | 4 weeks  | 40 | 2080 |
| Enclosed offices | Bld A, L2, rooms 2.5, 2.6, & 2.7 | 4 weeks  | 30 | 1560 |
| Corridors | Bld A corridor | 4 weeks  | 45 | 1820 |

#### Stipulated (not measured)

**Lighting power (post-implementation):** Since lighting controls do not affect the electrical demand of each lighting, it will be assumed that the post-implementation power of each lighting will be identical to the pre-implementation power values outlined in 3.8.3.1.

### Baseline adjustment factors

Not applicable.

### Demand reduction savings

<**Removed after noted:** Applicable only to the demand reduced via power reduction from lighting replacement. Not applicable to any sensor related demand savings.>

<Insert details of how demand charge savings have been calculated, including justification for any assumptions. Note: this must correspond with the site level max demand as billed by the electricity retailer, so may be best dealt with under an option C verification (refer to Option C proforma). Any claimed demand reduction cost savings should also include details as to how the change will be negotiated with the electricity retailer and the ongoing cost savings verified (i.e. in writing).>

### Maintenance savings

<Insert details of how maintenance savings have been calculated, including justification for any assumptions. Include description of how maintenance savings are calculated (i.e. reduced run hours of lighting and a stipulated cost per lamp and unit labour cost to replace it). List details relating to:

* Unit cost of lamps
* Unit cost of labour to replace lamp (should be agreed with customer)
* Rated life of lamps
* Annual run hours of lighting (baseline vs future as per variables section above)

It may be necessary to include or refer to a table listing the details relevant to each area where the lighting has been replaced.>

### Other savings

Not applicable.

### Verification of Equipment Installation

<Particularly important for Option A M&V - Insert details of how the installation of the equipment will be verified, i.e. the correct quantity, specification, location, etc. It may be necessary to include or refer to a table/spreadsheet. >

ESCO will conduct a walking tour of the implementation areas with an Agency representative to verify installation of equipment. A checklist of all equipment installed as part of this ECM has been attached as an Excel spreadsheet.

### Commissioning/tracking performance

<Particularly important for option A M&V - Insert details of how the ongoing operation (and performance) of the measure will be tracked over time, who will be responsible for tracking it, and how any potential issues will be addressed. Note this is important in cases where the solution is planned to have a once-off MVP, and/or where the MVP is based on a sample measurement. In these cases it may be appropriate to plan a regular check to ensure the measure continues to operate.>

### Information to be provided by customer

Not applicable.

### Reporting

A once-only report to be provided to customer on completion of post-installation measurements, no longer than six (6) months after practical completion of installations. Report will detail the results of measurements in section 3.8.5, and extrapolation of all variables as described in section 3.8.7 to verify the guaranteed savings as detailed in section 3.8.1.

### Extrapolations/calculations

#### Extrapolations

<Provide extrapolation details for determining the:

* average power per fitting / lamp (number of samples, tools, used, etc)
* average annual run hours per zone (number of samples, tools, used, etc)

#### Calculations

The run hours (pre and post implementation) of each sample lighting zone will be extrapolated across all areas covered by the lighting controls and multiplied by the agreed power (pre and post implementation) of each type of lamp. The calculations for determining the savings are provided in the attached Excel Spreadsheet.

<**Remove after noted:** ESCO **MUST** provide an Excel Spreadsheet detailing the:

* Relevant area / site affected by the lighting ECM
* The type of lighting installed
* Energy saving calculations which should include:
	+ Number of fittings (pre/post implementation)
	+ Fitting Power (W) (pre/post implementation)
	+ Number of lamps (pre/post implementation)
	+ Lamp Power (W) (pre/post implementation)
	+ Average Annual Run Hours
* Maintenance saving calculations which should include:
	+ Unit cost of lamp (existing lamps vs new lamps)
	+ Unit cost of labour to replace lamp (should be agreed with customer)
	+ B50 value of lamp (existing lamps vs new lamps)>

## <CHP1 proforma - Cogeneration>

**M&V option: B**

A cogeneration plant will be installed on Site A, consisting of a <x> kW natural gas fired reciprocating engine to provide electricity for sites A, B & C, reducing the amount of electricity required to be provided by the grid. This saving will be measured by installing a sub-meter on the electricity output of the generator.

The system will be powered by natural gas, which will be measured using a sub-meter which will be installed on the generator’s natural gas input.

Part of the additional natural gas consumption will be offset by the use of generator waste heat to supplement the existing boilers, thus reducing boiler gas usage. This gas saving will be measured using a sub-meter installed on the gas inputs of the relevant boilers and normalised over the guarantee period using baseline adjustments based on a regression analysis and formula stipulated below.

<**Remove after noted**: this proforma assumes that there are no existing gas meters measuring the usage of the boilers, and thus new meter/s will need to be installed after award of the EPC to measure the boilers’ baseline gas use prior to installation of the cogen system. If there does happen to be existing meters on the gas boilers, this MVP can be simplified, in which case a baseline boiler gas usage should be stipulated below.>

### Project savings

#### Utility consumption savings:

* Annual electricity peak saving (kWh) = <X>
* Annual electricity off-peak saving (kWh) = <X>
* Annual natural gas saving (MJ) = <X>
<**Removed after noted:** i.e. this is the savings on the boilers less the additional usage of the generator – likely to be a negative number>

#### All other savings:

* Annual maintenance cost saving = <$X> <**Removed after noted:** i.e. this is the reduction in maintenance on the boilers (if there is any) less the additional maintenance cost of the generator – likely to be a negative>
* Annual (other) cost saving = <$X>

#### Total annual cost saving:

* Annual cost savings = <$X>
<**Remove after noted**: must = ∑(utility savings/impact x baseline utility rates) + maintenance and other cost savings>

### Utility consumption savings methodology

where

**Table x: Electricity and Gas consumption savings variables**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables** | **Description** | **Baseline** | **Post-implementation** |
| **Measured** | **Stipul-ated** | **Measured** | **Stipul-ated** |
| **Sample** | **Full** | **Sample** | **Full** |
| Electricity Output Peak | Electricity produced by the generator during peak hours | N/A | N/A | N/A |  | X |  |
| Electricity Output Off-peak | Electricity produced by the generator during off-peak hours | N/A | N/A | N/A |  | X |  |
| Boiler Gas Input | Gas consumed by the boilers |  | X\* |  |  | X |  |
| Generator Gas Input | Gas consumed by the generator | N/A | N/A | N/A |  | X |  |

\*Baseline for HHW boiler/s will be installed with a smart meter immediately after signing of EPC to establish baseline usage and adjustment factors prior to cogeneration installation.

### Baseline variables

#### Already measured (i.e. during DFS)

<**Option 1:** A sub-meter can be installed on the existing chiller upon award of the DFS to determine the annual chiller baseline electricity consumption.>

**Boiler Natural Gas Input:** A sub-meter was installed on the boiler(s) to be supplemented by the waste heat from the generator, to measure the natural gas input over <X – must be greater than 6> months. A regression analysis was performed on this data and the result extrapolated to determine the annual boiler gas input, and the relevant baseline adjustment factors. The R2 value for this analysis is <X – must be greater than 0.8>.

* Annual boiler natural gas input: <X> GJ + baseline adjustment factors

#### Stipulated (not measured)

Not Applicable.

#### To be measured after award of EPC

<**Option 2**: A sub-meter can be installed on the existing chiller upon award of the EPC to determine the annual chiller baseline electricity consumption>

**Boiler Gas Input:** A sub-meter will be installed on the boiler(s) to be supplemented by the waste heat from the generator, to measure the gas input for at least 6 months. A regression analysis will be performed on this data and the result extrapolated to determine the annual boiler gas input, and the relevant baseline adjustment factors. The R2 value for this analysis will greater than 0.8. Because the baseline data is yet to be determined, it is only possible at this stage to stipulate the minimum required peak and offpeak electricity savings.

* Guaranteed annual boiler gas input: <X> kWh + baseline adjustment factors

### Post-implementation variables

#### To be measured

**Generator natural gas input:** A sub-meter will be installed on the gas input of the generator. This sub-meter will measure the post-implementation gas consumption of the generator for the full duration of the contract.

* Required maximum annual generator gas input = <X> MJ

**Generator electricity output (peak and off-peak):** A sub-meter will be installed on the electricity output of the generator. This sub-meter will measure the post-implementation electricity produced by the generator for the full duration of the contract. Data gathered from the sub-meter will be analysed to determine the split between peak and off-peak generation.

* Required minimum annual peak electricity output: <X> kWh
* Required minimum annual off-peak electricity output: <X> kWh

**Boiler Gas Input:** The sub-meter used to measure the baseline consumption will be used again to measure the gas consumption of the supplemented boiler for the full duration of the contract. The data will then have the baseline adjustment factors applied to determine the standardised consumption.

<If **Option 1** was selected for gathering baseline data (i.e. already have baseline data)>

* Maximum boiler gas input = <X> GJ +boiler gas input baseline adjustment factors

<If **Option 2** was selected for gathering baseline data (i.e. baseline data has yet to be determined)>

Because the baseline data is yet to be determined, it is only possible at this stage to stipulate the maximum consumption based on the baseline result:

#### Stipulated (not measured or guaranteed)

Not Applicable

### Baseline adjustment factors

<Depending on whether **Option 1 or 2** was selected, the following paragraph will need to be written in the past or future tense respectively>

**Boiler gas Input baseline adjustment factors**

Since the gas baseline consumption of the boiler is affected by a large number of factors, a regression analysis was performed (see 3.9.12 for detailed report) to ensure that any environmental or operational changes in the future, can be correctly applied to the baseline to ensure that the savings are calculated appropriately.

**<Example only>**

The following regression has an R2 of X **(must be greater than 0.8)**:

Where:

* N = Other agreed adjustment variables are any other variable that may impact the gas usage of the building (e.g. changes to plant and equipment). These variables should all be taken into account but it is not possible to forecast the potential impact. Instead, any significant changes such as these will be assessed (e.g. measured, calculated) at the time the ESCO becomes aware of them, and the customer will be notified of the type and degree of the adjustment factor. If there is disagreement on the extent of the adjustment factor, the standard contract dispute resolution process may take effect.

### Demand reduction savings

Not Applicable

### Maintenance savings

<Include details of the additional maintenance costs for the cogeneration system, and stipulate whether this maintenance will be carried out by the ESCO or by another party. If relevant, also include details of any maintenance savings resulting from the solution, with justifications supporting any assumptions.>

### Other savings

Not applicable.

### Verification of Equipment Installation

<Insert details of how the installation of the equipment will be verified, i.e. the correct quantity, specification, location, etc. It may be necessary to include or refer to a table/spreadsheet. >

### Commissioning/tracking performance

Annual reporting over a seven year period will identify any issues regarding operations and performance.

### Information to be provided by the customer

Customer to provide a quarterly report detailing the sites operations over the previous quarter, including details of:

* Site (and/or area) operating hours
* Room booking hours – all conference rooms
* Vacancy areas and duration of vacancy (if any)
* Electricity and natural gas bills for the period

### Reporting by the ESCO

* A baseline establishment report for the boiler gas usage will be provided to the customer once sufficient metering data has been obtained and a regression analysis with a suitable correlation has been performed. This is likely to be at least 6 months after award of the EPC and installation of the sub-meters.
* Annual reports each year for seven years verifying the actual savings.

### Extrapolations/calculations

<If **Option 1** was selected, please provide regression analysis below, including any assumptions and relevant justifications. If **Option 2** was selected, it is expected that the regression analysis report will be provided upon completion. This report will need to be approved by the agency before proceeding with the installation>

## <PV1 proforma – Solar Photovoltaic System>

**M&V option: B**

A <X> kW Solar Photovoltaic System will be installed on Site A, reducing the amount of electricity required to be provided by the grid. The savings will be directly equal to the electricity generated by the system and will be verified by measuring the electricity output via the meter inside the inverter.

### Project savings

#### Utility consumption savings:

* Annual electricity peak saving (kWh) = <X>
* Annual electricity off-peak saving (kWh) = <X>

#### All other savings:

* Annual maintenance cost saving = <$X><**Removed after noted:** this value may be negative if additional maintenance is required>
* Annual (other) cost saving = <$X>

#### Total annual cost saving:

* Annual (other) cost saving = <$X> <**Removed after noted:** must = ∑(utility savings x baseline utility rates) + maintenance and other cost savings>

### Utility consumption savings methodology

**Table x: Electricity and Gas consumption savings variables**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables** | **Description** | **Baseline** | **Post-implementation** |
| **Measured** | **Stipul-ated** | **Measured** | **Stipul-ated** |
| **Sample** | **Full** | **Sample** | **Full** |
| Electricity Output Peak | Electricity produced by the generator during peak hours | N/A | N/A | N/A |  | X |  |
| Electricity Output Off-peak | Electricity produced by the generator during off-peak hours | N/A | N/A | N/A |  | X |  |

\*Baseline for HHW boiler/s will be installed with a smart meter immediately after signing of EPC to establish baseline usage and adjustment factors prior to cogeneration installation.

### Baseline variables

#### Already measured (i.e. during DFS)

Not applicable.

#### Stipulated (not measured)

Not Applicable.

#### To be measured after award of EPC

Not Applicable.

### Post-implementation variables

#### To be measured

**Generator electricity output (peak and off-peak):** The post-implementation electricity produced by the generator will be measured by the meter within the inverter for the full duration of the contract. Data gathered from the meter within the inverter will be analysed to determine the split between peak and off-peak generation.

* Required minimum annual peak electricity output: <X> kWh
* Required minimum annual off-peak electricity output: <X> kWh

#### Stipulated (not measured or guaranteed)

Not Applicable

### Baseline adjustment factors

<Adjustment factors relating to the hours of sunlight may be applicable>

### Demand reduction savings

Not Applicable

### Maintenance savings

<Include details of any additional maintenance costs for the PV system. If relevant, also include details of any maintenance savings resulting from the solution, with justifications for any assumptions.>

### Other savings

Not applicable.

### Verification of Equipment Installation

<Insert details of how the installation of the equipment will be verified, i.e. the correct quantity, specification, location, etc. It may be necessary to include or refer to a table/spreadsheet.>

### Commissioning/tracking performance

Annual reporting over a seven year period will identify any issues regarding operations and performance.

### Information to be provided by the customer

Not applicable.

### Reporting by the ESCO

Annual reports each year for seven years verifying the actual savings.

### Extrapolations/calculations

Not applicable.

## <CH1 proforma – Chiller Replacement>

**M&V option: B**

A <X> kW <X> Chiller will replace the current <X> kW <X> Chiller on Site A. Savings will be determined by the difference in energy consumption between the newer, more efficient chiller, and the current chiller. Prior to the installation of the new chiller, a meter will be installed on the current chiller for <X> months and the data will be extrapolated to determine the annual baseline consumption. The new chiller will then be installed with the meter and the electricity consumption will be measured to verify savings.

### Project savings

#### Utility consumption savings:

* Annual electricity peak saving (kWh) = <X>
* Annual electricity off-peak saving (kWh) = <X>

#### All other savings:

* Annual demand charge saving (kW) = <X> <**Removed after noted:** this may be best managed under an option C MVP as the cost savings can only be negotiated at a site (billing meter) level)>
* Annual maintenance cost saving = <$X> <**Removed after noted:** this value may be negative if additional maintenance is required>
* Annual (other) cost saving = <$X>

#### Total annual cost saving:

* Annual cost savings = <$X> <**Removed after noted:** must = ∑(utility savings x baseline utility rates) + maintenance and other cost savings>

### Utility consumption savings methodology

**Table x: Electricity and Gas consumption savings variables**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables** | **Description** | **Baseline** | **Post-implementation** |
| **Measured** | **Stipul-ated** | **Measured** | **Stipul-ated** |
| **Sample** | **Full** | **Sample** | **Full** |
| Peak Electricity Consumption | Electricity consumed annually by the chiller during peak hours |  | X |  |  | X |  |
| Offpeak Electricity Consumption | Electricity consumed annually by the chiller during offpeak hours |  | X |  |  | X |  |

### Baseline variables

#### Already measured (i.e. during DFS)

<**Option 1:** A meter can be installed on the existing chiller upon award of the DFS to determine the annual chiller baseline electricity consumption.>

**Electricity Consumption (peak and off-peak):** A sub-meter was installed on the existing chiller to measure the offpeak electricity consumption over <X – must be greater than 6> months. A regression analysis was performed on this data and the result extrapolated to determine the annual peak and offpeak baseline electricity consumption, and the relevant baseline adjustment factors. The R2 value for this analysis is <X – must be greater than 0.8>.

* Annual peak electricity consumption: <X> kWh + baseline adjustment factors
* Annual offpeak electricity consumption: <X> kWh + baseline adjustment factors

#### Stipulated (not measured)

Not Applicable.

#### To be measured after award of EPC

<**Option 2**: A meter can be installed on the existing chiller upon award of the EPC to determine the annual chiller baseline electricity consumption>

**Electricity Consumption (peak and offpeak):** A sub-meter will be installed on the existing chiller to measure the offpeak electricity consumption for at least 6 months. A regression analysis will be performed on this data and the result extrapolated to determine the annual peak and offpeak baseline electricity consumption, and the relevant baseline adjustment factors. The R2 value for this analysis will greater than 0.8. Because the baseline data is yet to be determined, it is only possible at this stage to stipulate the minimum required peak and offpeak electricity savings.

* Guaranteed annual peak electricity savings: <X> kWh + baseline adjustment factors
* Guaranteed annual offpeak electricity savings: <X> kWh + baseline adjustment factors

### Post-implementation variables

#### To be measured

**Electricity Consumption (peak and offpeak):** A sub-meter will be installed on the new chiller to measure the offpeak electricity consumption for full duration of the contract. The data will be then be analysed and broken into its peak and offpeak components, and have the baseline adjustment factors applied accordingly.

<If **Option 1** was selected for gathering baseline data (i.e. already have baseline data)>

* Maximum peak electricity consumption = <X> kWh + baseline adjustment factors
* Maximum offpeak electricity consumption = <X> kWh + baseline adjustment factors

<If **Option 2** was selected for gathering baseline data (i.e. baseline data has yet to be determined)>

Because the baseline data is yet to be determined, it is only possible at this stage to stipulate the maximum consumption based on the baseline result:

*
*

#### Stipulated (not measured or guaranteed)

Not Applicable

### Baseline adjustment factors

<Depending on whether **Option 1 or 2** was selected, the following paragraph will need to be written in the past or future tense respectively>

**Electricity Consumption Baseline Adjustment Factors**

Since the baseline consumption of the chiller is affected by a large number of factors, a regression analysis was performed (see 2.7.12 for detailed report) to ensure that any environmental or operational changes in the future, can be correctly applied to the baseline to ensure that the savings are calculated appropriately.

**<Example only>**

The following regression has an R2 of X **(must be greater than 0.8)**:

Where:

* N = Other agreed adjustment variables are any other variable that may impact the electricity consumed by the chiller (e.g. changes to plant and equipment). These variables should all be taken into account but it is not possible to forecast the potential impact. Instead, any significant changes such as these will be assessed (e.g. measured, calculated) at the time the ESCO becomes aware of them, and the customer will be notified of the type and degree of the adjustment factor. If there is disagreement on the extent of the adjustment factor, the standard contract dispute resolution process may take effect.

### Demand reduction savings

<Insert details of how demand charge savings have been calculated, including justification for any assumptions. Note: this must correspond with the site level max demand as billed by the electricity the retailer, so may be best dealt with under an option C verification (refer to Option C proforma). Any claimed demand reduction cost savings should also include details as to how the change will be negotiated with the electricity retailer and the ongoing cost savings verified (i.e. in writing).>

### Maintenance savings

<Include details of the additional maintenance costs for the chiller, and stipulate whether this maintenance will be carried out by the ESCO or by another party. If relevant, also include details of any maintenance savings resulting from the solution, with justifications supporting any assumptions.> Include description of how maintenance savings are calculated (i.e. less routine maintenance, extended life, etc). List details relating to:

* Frequency of routine maintenance
* Expected Life of Chiller
* Cost of labour
* Etc>

### Other savings

<Insert details of how other savings have been calculated, including justification for any assumptions, and details as to how the cost savings will be verified and maintained>

### Verification of Equipment Installation

<Insert details of how the installation of the equipment will be verified, i.e. the correct quantity, specification, location, etc. It may be necessary to include or refer to a table/spreadsheet. >

### Commissioning/tracking performance

Annual reporting over a seven year period will identify any issues regarding operations and performance.

### Information to be provided by the customer

Not applicable.

### Reporting by the ESCO

Annual reports each year for seven years verifying the actual savings.

### Extrapolations/calculations

<If **Option 1** was selected, please provide regression analysis below, including any assumptions and relevant justifications. If **Option 2** was selected, it is expected that the regression analysis report will be provided upon completion. This report will need to be approved by the agency before proceeding with the installation>

## <Option C proforma – site level verification>

**M&V option: C**

Multiple solutions are to be implemented at the site, including lighting and HVAC upgrades controls, and water conservation measures. As these solutions are expected to deliver a substantial proportional saving across the building, the savings will be verified at a whole of building level using building utility meters. Additionally, the works are expected to deliver a reduction in the maximum electrical demand for the site. Note all savings and baseline figures below refer to site totals.

### Project savings

#### Utility consumption savings:

* Annual electricity saving – total (kWh) = <X> <**Removed after noted**: this is a blended saving including peak and off-peak savings used when regression analysis is being undertaken on whole site usage. Assumptions regarding the split of peak to off-peak usage are explained in the ‘extrapolations/calculations’ section below>
* Annual natural gas saving (MJ) = <X>
* Annual water saving (kL) = <X>

#### All other savings:

* Annual demand charge saving (kW) = <X>
* Annual demand charge cost saving = <$X>
* Annual maintenance cost saving = <$X>
* Annual (other) cost saving = <$X>

#### Total annual cost saving:

* Annual cost savings = <$X> <**Removed after noted:** must = ∑(utility savings x baseline utility rates) + maintenance and other cost savings>

### Utility consumption savings methodology

**Table x: Utility consumption savings variables**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables** | **Description** | **Baseline** | **Post-implementation** |
| **Measured** | **Stipul-ated** | **Measured** | **Stipul-ated** |
| **Sample** | **Full** | **Sample** | **Full** |
| 1 | Annual site electricity use |  | X |  |  | X |  |
| 2 | Annual site natural gas use |  | X |  |  | X |  |
| 3 | Annual site water use |  | X |  |  | X |  |

### Baseline variables

#### Already measured (i.e. during DFS)

**Annual site electricity use (pre-implementation):** This was based on the past 12 months of site electricity usage (xxx date to xxx date) measured from the site meter <insert NMI number/s>, validated by its consistency with electricity usage in the previous 24 months, and confirmed by staff operators that there were no significant unusual events in this year that would lead to a non-representative baseline.

* Annual Site Electricity Consumption (kWh) = <X>

**Annual site natural gas use (pre-implementation):** This was based on the past 12 months of site gas usage (xxx date to xxx date) measured from the site meter <insert MIRN number/s>, validated by its consistency with gas usage in the previous 24 months, and confirmed by staff operators that there were no significant unusual events in this year that would lead to a non-representative baseline.

* Annual Site Natural Gas Consumption (GJ) = <X>

**Annual site water use (pre-implementation):** This was based on the past 12 months of site water usage (xxx date to xxx date) measured from the site meter <insert meter number/s>, validated by its consistency with water usage in the previous 24 months, and confirmed by staff operators that there were no significant unusual events in this year that would lead to a non-representative baseline.

* Annual Site Water Consumption (kL) = <X>

#### Stipulated (not measured)

Not applicable.

### Post-implementation variables

#### To be measured

**Annual site electricity use (post-implementation):** Data from the site meter <insert NMI number/s> will be measured annually for seven years and compared to the baseline usage adjusted based on the adjustment factors.

* Guaranteed Maximum Annual Site Electricity Consumption (kWh) = <X>

**Post -installation annual site natural gas use (post-implementation):** Data from the site meter <insert MIRN number/s> will be measured annually for seven years and compared to the baseline usage adjusted based on the adjustment factors.

* Guaranteed Maximum Annual Site Natural Gas Consumption (GJ) = <X>

**Post -installation annual site water use (post-implementation):** Data from the site meter <insert meter number/s> will be measured annually for seven years and compared to the baseline usage adjusted based on the adjustment factors.

* Guaranteed Maximum Annual Site Water Consumption (kL) = <X>

#### Measured and guaranteed

Not applicable.

### Baseline adjustment factors

**Electricity baseline adjustment factors**

Since there are a large number of factors which can affect the site electricity consumption, a regression analysis was performed (see 2.7.12 for detailed report) to ensure that any environmental or operational changes in the future, can be correctly applied to the baseline to ensure that the savings are calculated appropriately.

**<Example only>**

The following regression has an R2 of X **(must be greater than 0.8)**:

Where:

* N = Other agreed adjustment variables are any other variable that may impact the electricity usage of the building and should be taken into account. This may include changes to plant and equipment, and changes in office equipment (e.g. more computers, monitors, fridges, etc). For these variables it is not possible to forecast the potential impact. Instead, any significant changes such as these will be assessed (e.g. measured, calculated) at the time the ESCO becomes aware of them, and the customer will be notified of the type and degree of the adjustment factor. If there is disagreement on the extent of the adjustment factor, the standard contract dispute resolution process may take effect.

**Natural gas baseline adjustment factors**

Similar to the electricity consumption, a regression analysis was also performed for the gas consumption (see 2.7.12 for detailed report) to ensure that any environmental or operational changes in the future, can be correctly applied to the baseline to ensure that the savings are calculated appropriately.

**Example only>**

The following regression has an R2 of X **(must be greater than 0.8)**:

Where:

* N = Other agreed adjustment variables are any other variable that may impact the gas usage of the building and should be taken into account (e.g. changes to plant and equipment). For these variables it is not possible to forecast the potential impact. Instead, any significant changes such as these will be assessed (e.g. measured, calculated) at the time the ESCO becomes aware of them, and the customer will be notified of the type and degree of the adjustment factor. If there is disagreement on the extent of the adjustment factor, the standard contract dispute resolution process may take effect.

**Water baseline adjustment factors**

Similar to the above utility consumptions, a regression analysis was also performed for the water consumption (see 2.7.12 for detailed report) to ensure that any environmental or operational changes in the future, can be correctly applied to the baseline to ensure that the savings are calculated appropriately.

**<Example only>**

The following regression has an R2 of X **(must be greater than 0.8)**:

Where:

* N = Other agreed water adjustment variables are any other variable that may impact the water usage of the building and should be taken into account (e.g changes to plant and equipment). For these variables it is not possible to forecast the potential impact. Instead, any significant changes will be assessed (e.g. measured, calculated) at the time the ESCO becomes aware of them, and the customer will be notified of the type and degree of the adjustment factor. If there is disagreement on the extent of the adjustment factor, the standard contract dispute resolution process may take effect.

### Demand reduction savings

Annual electricity demand charge savings will be negotiated with the electricity retailer by the ESCO on behalf of the customer. The bases for the changes to be negotiated are listed below.

#### Current conditions:

* Negotiated max demand (site name) = <X>kW
* Negotiated max demand charge (site name) = <$X>/kW/month
* Historical actual annual max demand (site name) = <X> kVA (state over which years this was valid)

#### Post-installation conditions:

* actual annual max demand =<X> kW
* proposed new negotiated max demand = <X> kW
* negotiated demand reduction =<X> kW
* annual demand charge cost savings = <$X>

#### Actions to verify the demand charge saving:

* Practical completion of this solution (and start of period of reduced demand charges) will be demonstrated through a written agreement from the retailer and subsequent reduction visible in future invoices.
* The ESCO will annually verify that the demand does not exceed the agreed maximum demand for the site.

### Maintenance savings

<Insert details of how maintenance savings have been calculated, including justification for any assumptions. E.g. For lighting, Include details of improved lamp life, linking to run hours specific to each area and stipulated cost per lamp and unit labour cost to replace it.>

### Other savings

<Insert details of how other savings have been calculated, including justification for any assumptions, and details as to how the cost savings will be verified and maintained.>

### Verification of Equipment Installation

<Insert details of how the installation of the equipment will be verified, i.e. the correct quantity, specification, location, etc. It may be necessary to include or refer to a table/spreadsheet.>

### Commissioning/tracking performance

Annual reporting over a seven year period will identify any issues regarding operations and performance.

### Information to be provided by customer

Customer to provide a quarterly report detailing the sites operations over the previous quarter, including details of:

* Electricity, natural gas and water bills for the period
* Site (and/or area) operating hours
* Room booking hours – all conference rooms
* Vacancy areas and duration of vacancy (if any)

ESCO will also be provided with access to interval electricity data directly from the customer’s electricity retailer.

### Reporting by the ESCO

* Annual reports each year for seven years verifying the guaranteed savings
* Once-off report verifying that the maximum demand rate has been negotiated with the electricity retailer. This will be provided within 3 months of works being completed.

### Extrapolations/calculations

<insert details of the regression analysis that was performed to determine the degree of adjustment for each baseline adjustment variable mentioned in the section above. Include a chart plotting the correlation and details of the R2 value, etc. Also insert details of assumptions relating to the split of peak versus off-peak electricity usage (and savings), including justifications.>

## <W1 proforma> – Water fittings flow control

**M&V option: A**

Flow restrictors will be placed on all taps and shower-heads to reduce the flow of water when turned on. This will be verified by measuring the flow of all taps before and after installation using a calibrated water flow measurement device (i.e. the cup where you twist the base to maintain a constant level – whatever that’s called).

### Project savings

#### Utility consumption savings:

* Annual water saving (kL) = <X>

#### All other savings:

Not applicable.

#### Total annual cost saving:

* Annual cost savings = <$X> <**Removed after noted:** must = ∑(utility savings x baseline utility rates) + maintenance and other cost savings>

### Utility consumption savings methodology

**Table x: Water consumption savings variables**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables** | **Description** | **Baseline** | **Post-implementation** |
| **Measured** | **Stipul-ated** | **Measured** | **Stipul-ated** |
| **Sample** | **Full** | **Sample** | **Full** |
| Water flow rate  | Flow rate of each existing fitting in litres per minute | X | X |  | X | X |  |
| Annual run hours | Hours per annum that each fitting is running |  |  | X |  |  | X |

### Baseline variables

#### Already measured (i.e. during DFS)

**Water flow rate (pre-implementation):** The flow rate of every fitting where it is proposed to install a flow restrictor has been measured during the DFS. The process was to hold a calibrated water flow measurement device (i.e. the cup thing) under each fitting and turn it on, then adjust the device until the water level was maintained in the cup and a reading could be taken. The results for all fittings is shown in the table below (or attached). To make certain that this measurement process was understood, a customer representative was present while a sample of fittings were measured. These same fittings are identified in the table below (or attached).

**Table <X>: Sample measurements of lighting power (pre-implementation)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Type of Fitting** | **Areas affected** | **Number of Measurements (sample)** | **Average Water Flow (L/min) (extrapolated)** |
| Fitting A | Staff Kitchens | 2 | 8 |
| Fitting B | Staff Toilets, First Aid Room | 7 | 9 |
| Fitting C | Student Toilets | 8 | 8 |

#### Stipulated (not measured)

**Annual Run Hours (pre-implementation):** The run hours of each fitting were estimated based on discussions and agreement with the following customer representatives:

* <List names of customer representatives>

The methodology for estimating was based on the number of uses per person per day and the number of staff, and the assumption that each staff will work an average of 45 weeks of the year. The estimated assumptions (i.e. uses per person, # of staff, etc) and the stipulated run hours for each fitting/area as agreed by the staff listed above are shown in the table below (or attached).

### Post-implementation variables

#### To be measured

**Water flow rate (post-implementation):** The flow rates of every fitting installed with a flow restrictor is required to not exceed <X>L/minute. This is the manufacturer rating for the restrictor, however the performance will be measured immediately after installation of the flow restrictor by the installer. The process will be the same as with the base flow rate measurements. As with the baseline measurements, it will be requested that a customer representative be present while a sample of fittings are measured (the same sample used during the baseline measurements).

* Required maximum water flow rate (L/min) = <X>

#### Stipulated (not measured or guaranteed)

**Annual Run Hours (post-implementation):** Since this solution will have no impact upon the control of the fittings, the annual run hours of the baseline will be assumed to hold post installation – refer to the agreed run hours as per table x above (or attached).

### Baseline adjustment factors

Not applicable.

### Demand reduction savings

Not applicable.

### Maintenance savings

Not applicable.

### Other savings

Not applicable.

### Verification of Equipment Installation

<Insert details of how the installation of the equipment will be verified, i.e. the correct quantity, specification, location, etc. It may be necessary to include or refer to a table/spreadsheet.>

ESCO will conduct a walking tour with an Agency representative to prove that the flow restrictors do not exceed XL/minute using the appropriate tool (i.e. cup-thing) across various sample locations.

### Commissioning/tracking performance

Not applicable.

### Information to be provided by the customer

Not applicable.

### Reporting by the ESCO

A one-off report will be provided by the ESCO to the customer within 3 months of the completed installation of this solution. The report will verify the post installation flow rates for each fitting.

### Extrapolations/calculations

#### Extrapolations

<Provide extrapolation details for determining the:

* average water flow per fitting (number of samples, tools, used, etc)
* average annual run hours per zone (number of samples, tools, used, etc)

#### Calculations

The water flow (pre-implementation) of each sample fitting zone will be extrapolated across all areas covered by the lighting controls and multiplied by the agreed run hours of each zone. This will be provided in a table as part of the M&V report for this solution.

<**Remove after noted:** ESCO **MUST** provide an Excel Spreadsheet or table detailing the:

* Relevant area / site affected by the water solution
* The type of fittings installed
* Water saving calculations which should include:
	+ Number of fittings (pre/post implementation)
	+ Fitting flow rates (L/min) (pre/post implementation)
	+ Number of fitting samples taken
	+ Average Annual Run Hours

## Provision of information (consolidated)

<provide a consolidated list of information required to be provided by the customer to the ESCO. I.e. take all the separate information from section 2.x.11 (solution M&V plans) and consolidate it into one list here. Make sure it includes details of timing and regularity.>

## Reporting by ESCO (consolidated)

<provide a consolidated list of reports required to be provided by the ESCO to the Customer. i.e. take all the separate reporting requirements from section 2.x.12 (solution M&V plans) and consolidate it into one list here. Make sure it includes details of timing and regularity.

It may be appropriate to include a post-Installation report which documents any deviations from the specified equipment and, if necessary, make recommendations for approval of any adjustments to M&V plans.>