MEASUREMENT & Verification

CASE STUDY: Charles Sturt University Wagga Wagga

M&V used to promote energy savings in the community.

The Project

The 'Learning by Doing' project involved an efficiency upgrade within the public facilities at the Wagga Wagga Campus of Charles Sturt University (CSU). The project also had the aim of promoting the benefits of energy and water savings in the Wagga Wagga community.

Ecosave secured funding assistance from the NSW Government's Public Facilities Program to assist CSU to implement energy and water savings measures in 50 buildings on the campus. Without funding assistance, the savings proposed had an aggregate payback of 4.9 years. The financial assistance sought under the application reduced this average payback to 4.1 years which was within the University's commercial expectations.

Costs saved / yr:	**$77,000**
Energy saved / yr:	**1591 GJ**
GHG saved / yr:	**466 tonnes CO2-e**
Payback:	**4.1 yrs**
M&V methodology:	**Option A and B**

Voltage Reduction Units

Power Factor Correction Unit

Photos courtesy of Ecosave

A proposal was developed for the buildings, which listed each Energy Conservation Measure (ECM) and the expected savings, and what measurement and verification (M&V) option would be used. After the efficiency improvements were made, an 'actual' savings report was written detailing the actual savings compared with the proposed savings.

The buildings had similar opportunities for energy savings, which included:

- lighting upgrades
- voltage reduction units
- lighting controls
- optimising air conditioning systems
- installation of power factor correction equipment

M&V in the overview

Ecosaves' philosophy is that it is critical to have an accurate and transparent method of measuring and verifying the savings the project is going to deliver. The International Performance Measurement and Verification Protocol (IPMVP) provides guidelines for this. However, excessive measurement and verification can lead to unnecessary costs. Consequently, as part of the negotiation process, discussions are held with the client on the M&V activities to ensure the client is fully comfortable with the procedures and calculations.

The suitability of the M&V method or protocol applied to each ECM was assessed based upon the following:

- Ability to provide credible results, i.e. accuracy, repeatability,
- Cost effectiveness, and
- Impact on other ECMs.

For example, an ECM with constant load and operating hours, such as refurbishments/ replacements of light fittings, could be relied on to save the same amount year after year and doing the M&V once was adequate. While an

ECM with variable load and/or variable operating hours, such as optimizing air conditioning systems justified M&V over a longer period.

Two different M&V options were used in this project – Option A (for the lighting) and Option B (for the air-conditioning upgrades). The different options were chosen based on the definitions given in the IPMVP.

M&V Methodology in Detail

Each ECM was assessed to determine the most appropriate method of M&V and influencing factors. This included:

- M&V method to be used
- Time period of M&V, both pre and post installation of the ECM
- Equipment to be used
- Assumptions or default factors to be applied, for example operating hours
- External impacts, for example weather, occupancy hours, number of staff / students.

For all the lighting improvements Option A was chosen. The power used by the lighting circuits was measured before and after the improvement and the savings calculated based on the operating hours for the lights specified by CSU. As the operating hours were the same before and after the improvement this was assumed to be a constant.

For all the air conditioning systems Option B was chosen. The power used by a sample of systems was data logged before and after the installation and the savings calculated based on the actual operating hours. The results were normalized for temperature variations and extrapolated to derive the annual savings.

ACTUAL OUTCOMES:

An energy savings of 442 MWh a year and a peak demand reduction of 328kVA were achieved. A detailed (45 pages) Actual Savings Report was developed from the M&V process and submitted to CSU and the NSW government. The extract below summarises the savings achieved on the relevant buildings.

Replaced Light Fitting from 2x36W to 1x37W with reflector and electronic ballast

Energy Saving Module on AC Unit

BENEFITS OF M&V FOR THIS PROJECT

A clear, concise M&V process that was well documented in the Actual Savings Report, enabled all parties to verify that the expected savings had been delivered. CSU was able to promote the positive upgrades to the local community and the NSW government was able to verify that public funds had delivered improvements in energy efficiency.

ACTUAL COST AND SAVINGS SUMMARY - Charles Sturt University Wagga Wagga

Energy Conservation Measure	Area	Annual Energy Saving	Annual Maint. Saving	TOTAL $ ANNUAL SAVINGS	kVA Peak Demand Reduction	MW HOUR ANNUAL SAVINGS	CO2 ANNUAL SAVINGS	Investment Ex - GST	Return on Investment	Pay Back Years
Refurbish and/or Replace Light Fittings	B13-Library, B15-Jack Cross Building, B20-Student Amenities, B404-Cellar Door, B406-NWGIC Laboratories, Gymnasium	$ 21,698	$ 4,293	$ 25,991	59	176	186			
Fluorescent Lighting Voltage Reduction Units	B13-Library, B15-Jack Cross Building, B16-Chemistry Building, B20-Student Amenities, B21-Centre for the Arts, South Campus Conservatorium & Archives Building	$ 24,111	$ 1,760	$ 25,871	70	196	207			
Lighting Controls	B12-Swan Theatres, B16-Chemistry Building, B20-Student Amenities, B21-Centre for the Arts, B404-Cellar Door	$ 2,631	$ 786	$ 3,417	0	21	23			
Energy Savings Modules (ESM 4000)	B13-Library A/C Units	$ 4,320	N/A	$ 4,320	0	38	40			
Power Factor Correction	B11-Lecture Building, B13-Library, B15-Jack Cross Building	$ 17,628	N/A	$ 17,628	200	10	11			
TOTAL ENERGY		$ 70,388	$ 6,840	$ 77,228	328	442	466	$ 317,368	24%	4.1