

## Worksheet 3.1C

# Sustainability project payback – worked example

This is a worked example of the cost benefit of upgrading a new lighting system.

Use this as a guide to evaluate the payback on sustainability projects. This is an example only – adapt this worksheet to suit your organisation's requirements.

|                                                                                                                                                                                     |                                       |                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------|
| <b>Project name:</b>                                                                                                                                                                | <b>Upgrade to new lighting system</b> |                           |
|                                                                                                                                                                                     | <b>Existing fixture</b>               | <b>New fixture</b>        |
| Lamp type                                                                                                                                                                           | Standard fluorescent                  | Triphosphor fluorescent   |
| <b>1. Power input</b>                                                                                                                                                               |                                       |                           |
| Number of fittings                                                                                                                                                                  | 20                                    | 21                        |
| Number of lamps per fitting                                                                                                                                                         | 2                                     | 1                         |
| Total number of lamps                                                                                                                                                               | 40                                    | 21                        |
| Power input for each lamp                                                                                                                                                           | 36 watts                              | 36 watts                  |
| Power input for each ballast*                                                                                                                                                       | 9 watts                               | 4 watts                   |
| <b>Total power input</b>                                                                                                                                                            | 1800 watts                            | 756* watts                |
| = total number of lamps x power input of (lamp + ballast)                                                                                                                           | = 40 x (36+9)                         | = 21 x (36+4-4)           |
| *Note: an electronic ballast will run a lamp at a lower wattage (i.e. 32 W) but there is still a ballast loss of 4 W. Therefore the power input for one lamp and the ballast = 36 W |                                       |                           |
| <b>2. Annual energy consumption by converting power input to kilowatt hours (kWh)</b>                                                                                               |                                       |                           |
| Operating hours per year                                                                                                                                                            | 3000 hours                            | 3000 hours                |
| <b>Total annual energy consumption</b>                                                                                                                                              | 5400 kWh                              | 2268 kWh                  |
| = total power input/1000 x operating hours per year                                                                                                                                 | = 1800 watts x 3000hr/1000            | = 756 watts x 3000hr/1000 |
| <b>3. Annual lighting energy costs</b>                                                                                                                                              |                                       |                           |
| Average electricity price (\$ per kWh)                                                                                                                                              | \$0.10                                | \$0.10                    |
| <b>Total annual lighting energy costs</b>                                                                                                                                           | \$540 kWh                             | \$227 kWh                 |
| = energy cost x total energy consumption                                                                                                                                            | = \$0.10 x 5400                       | = \$0.10 x 2268           |
| <b>4. Annual savings</b>                                                                                                                                                            |                                       |                           |
| Energy saved                                                                                                                                                                        | 3132 kWh                              |                           |
| = total energy consumption of (existing lights – new lights)                                                                                                                        | = 5400-2268                           |                           |
| Any additional hidden savings?                                                                                                                                                      |                                       |                           |

|                                                                                                                                           |                                                                                  |                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Project name:</b>                                                                                                                      | <b>Upgrade to new lighting system</b>                                            |                                                                                                                                               |
|                                                                                                                                           | <b>Existing fixture</b>                                                          | <b>New fixture</b>                                                                                                                            |
| Lamp type                                                                                                                                 | Standard fluorescent                                                             | Triphosphor fluorescent                                                                                                                       |
| Is the space air conditioned?<br>If yes, 25% more energy savings can be made.<br><br>If no, use initial energy savings calculated.        | 3915 kWh<br>= 3132 x 1.25                                                        |                                                                                                                                               |
| <b>Total energy to be saved per year</b>                                                                                                  | 3915 kWh                                                                         |                                                                                                                                               |
| Dollar savings per year<br>= energy cost x total energy savings per year<br><br>Annual maintenance cost saved                             | \$391.50<br><br>\$50                                                             | = \$0.10 x 3915                                                                                                                               |
| <b>Total dollar savings per year</b>                                                                                                      | \$441.50 kWh                                                                     |                                                                                                                                               |
| Estimated conversion cost (parts and labour)                                                                                              | \$1500.00                                                                        |                                                                                                                                               |
| <b>5. Simple payback</b>                                                                                                                  |                                                                                  |                                                                                                                                               |
| = conversion cost/total annual savings<br><br><b>Annual rate of return (ROR)</b><br>= total dollar savings per year/conversion cost x 100 | 3.4 years<br>= \$1500/\$441.50<br><br>29%<br>= \$441.5/\$1500 x 100              | A 100% ROR means that the energy savings will pay back the conversion cost within one year. In this case it will be paid back in under a year |
| <b>6. Greenhouse gas reduction</b>                                                                                                        | 1 kWh = 1.06 kg CO <sub>2</sub> ,<br>1 MWh = 1.06 t CO <sub>2</sub> <sup>1</sup> |                                                                                                                                               |
| = total energy savings/1000 x 1.06<br>= tonnes of CO <sub>2</sub> abated                                                                  | 4.2 tonnes<br>= 3915 kWh/1000 x 1.08                                             |                                                                                                                                               |
| On average, 1 car produces 4.5 tonnes of CO <sub>2</sub> in a year                                                                        | Almost 1 car tonnes<br>= 4.2/4.5                                                 |                                                                                                                                               |

<sup>1</sup> NSW emission factor (full fuel cycle) for electricity purchased by end users, 'National Greenhouse Accounts (NGA) Factors', Australian Government Department of Climate Change 2008 ([www.climatechange.gov.au/workbook/index.html](http://www.climatechange.gov.au/workbook/index.html))