Improving Efficiency and Reducing Emissions

EarthCheck

Concern over the potential negative impacts of greenhouse gas (GHG) emissions has led a number of government and businesses to start implementing emission reduction strategies. For many businesses this concern to make a conscious effort to minimise GHG emissions stems from current or proposed regulations, a personal sense of responsibility or customer expectations. By following an eco-efficiency process, strategic decisions can be made about how to go about reducing emissions.

GHG Terminology:

Greenhouse gases (GHG) are gases that trap heat in the atmosphere, similar to the way a greenhouse works, and are claimed to be major contributors to climate change. There are numerous GHG's, however, the three main gases of concern to tourism businesses include carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The main activities in tourism operations that generate GHG emissions are the use of energy and generation of organic wastes and wastewater. Tourism operations also indirectly contribute to the generation of GHG emissions from the manufacturing of products they consume and the services they outsource.

Carbon Dioxide Equivalents (CO_2-e): Greenhouse gases are commonly referred to collectively as 'carbon emissions' and calculated in terms of CO_2 equivalents (CO_2-e). CO_2 provides a reference gas to allow comparisons between the relative global warming potential (GWP) of the different greenhouse gases. See Table 1 for the relative GWP's of the three main greenhouse gases.

Table 1: Global warming potential of greenhouse gases

Greenhouse gas	Chemical formula	Global Warming Potential
Carbon dioxide	CO_2	1
Methane	CH_4	21
Nitrous Oxide	N_2O	310

Carbon footprint: The carbon footprint of a business refers to the total quantity of greenhouse gas emissions attributed to the businesses activities. This typically includes:

- *Scope 1 emissions:* direct emissions from the combustion of fuels such as diesel, petrol, natural or liquefied petroleum gas (LPG), wood or from onsite wastewater treatment
- *Scope 2 emissions:* indirect emissions generally from the use of electricity generated off-site
- *Scope 3 emissions:* indirect emissions from goods and services such as emissions from disposal of organic wastes or emissions from the production of goods and services consumed by the business

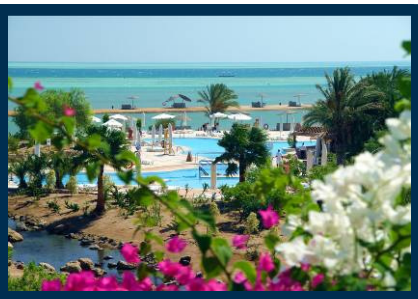
Carbon offsets: are a means for companies or individuals to reduce their net carbon emissions by investing in energy efficiency, GHG sequestration (capture) or low emission technologies (such as renewable energies) with the aim of reducing overall GHG emissions.

Carbon neutral: When a business becomes carbon neutral it means they have generally offset all their emissions and the balance of carbon emissions to carbon credits is equal.

Managing your emissions

The first and most effective way to reduce GHG emissions is to avoid generating them in the first place. The next options available involve reducing emissions through improving energy efficiency, reducing demand or switching to low GHG emitting energy sources. Carbon offset strategies should be the final option investigated for reducing GHG emissions. Use the following as a guide to managing energy consumption and emissions:

1. *Measure:* How much and what type of energy are you consuming? What are your total emissions? Where is energy being consumed and why? What equipment is involved?
2. *Set objectives:* What do you want to achieve? Financial savings? Energy reduction? Emissions reduction?
3. *Avoid:* Can you avoid using energy and generating emissions?
4. *Reduce:* Can you change your activities to reduce energy consumption and emissions?
5. *Switch:* Can you switch to less greenhouse intensive energy sources?
6. *Sequester:* What options are available to sequester GHG emissions?
7. *Assess:* What are your residual GHG emissions?
8. *Offset:* Can you offset your residual GHG emissions?[1]



Case Study:

El Gouna Movenpick, El Gouna, Egypt

El Gouna Movenpick in El Gouna, Egypt recently upgraded its building management system (BMS) to improve the monitoring and scheduling of its air-conditioning system. The BMS automatically operates the air-conditioning system based on the real-time cooling demand to achieve greater energy efficiency. Improved monitoring also alerts staff to abnormalities in the system's operation saving both time and resources that would have been spent had the problem gone unnoticed.

Energy Management - Measuring and monitoring

Actively monitoring and managing energy use will help with understanding energy use, ensuring that energy saving initiatives are effective and GHG emissions are minimised. Conduct a site survey to identify energy consuming equipment and fixtures and install sub-meters on large energy consuming equipment (such as boilers) or areas (such as conference rooms or kitchens). Establish an energy management system including standard procedures for monitoring energy consumption and appoint an energy manager to oversee the energy management system and coordinate energy reduction strategies.

Monitoring energy use should target large consumers initially and work towards becoming a comprehensive energy monitoring and management system. Smart meters can provide real-time energy information and when integrated with a Building Management System (BMS) can provide effective energy monitoring and management control. It may be worth contracting an energy efficiency specialist to provide advice on energy metering and energy efficiency initiatives. For more information on energy monitoring visit:

Carbon trust:
http://www.carbontrust.co.uk/cut-carbon-reduce-costs/calculate/energy-metering-monitoring/pages/energy-metering-monitoring.aspx, or
United States Department of Energy:
http://www1.eere.energy.gov/femp/pdfs/mbpg.pdf

Developing an action plan

1. Avoiding and reducing energy demand

After establishing an energy monitoring system, benchmarking energy consumption and setting energy reduction targets, the next step to reduce energy consumption and emissions is to identify energy efficiency initiatives and develop an action plan. Eliminating and reducing energy demand from equipment can be achieved through:

- Removing unnecessary equipment and optimising equipment capacity:
  - Correctly size equipment such as boilers, pumps, cooling towers, air conditioners, fans and motors to the load requirement
  - Install multiple smaller pieces of equipment (such as pumps, fans and motors) that can switch on and off depending on demand rather than operating larger equipment at part loads
- Reducing the load on equipment by matching output to demand:
  - Turn air conditioning down during winter and up during summer
  - Reduce the temperature of your hot water system
  - Implement control sequencing of equipment to optimise efficiency and prevent system overload
  - Reduce water or gas pressure where possible
- Replacing or retrofitting old inefficient equipment:
  - Install variable speed drives or multiple speed motors
  - Replace old equipment with new high efficiency equipment
  - Consider cogeneration systems to collect waste heat for reuse
  - Install insulation on hot water pipes and air conditioning ducts

Replacing old inefficient equipment:

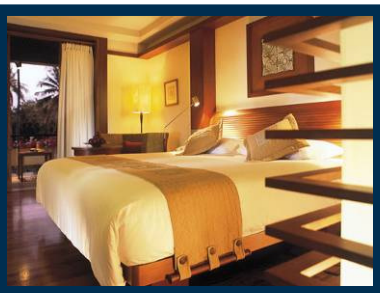
Table 2 shows the relative benefits of replacing old inefficient motors and selecting high efficiency motors over standard efficiency motors.

Table 2 – Relative benefits of replacing inefficient equipment

	Old motor	New motor (Standard)	New motor (High efficiency)
Motor rating (kW)	11	11	11
Efficiency (%)	70	80	90
Hours of operation per day	14	14	14
Cost of electricity ($/MWh)	100	100	100
Annual operating cost	8,030	7,026	6,246
Annual savings ($)	-	1,004	1,784
Purchase price ($)	-	2,000	3,000
Payback period (years)	-	2.0	1.7

Note: Individual circumstances will impact the relative costs, savings and payback periods. Request the above information from suppliers when selecting new equipment and complete a payback period analysis to determine the most viable

- Reducing operational hours of equipment:
  - Switch off lights, televisions, printers and computers when not in use
  - Install sensors or timers on lighting
  - Install electronic room keys that switch off power to guest rooms when removed
  - Reduce the hours of operation of fountains, spas and water features
- Specifying standard equipment operation and procedures:
  - Monitor pressures, temperatures, speeds and flow rates of equipment such as boilers, fans, cooling towers, refrigeration systems, ovens, cookers and pumps to ensure they are within predetermined limits
  - Establish standard procedures and train staff to implement these. For example, food preparation: closing of cool room doors, organisation of functions: air conditioning turned off half an hour before guests leave, pool: duration of filtering
- Maintaining good housekeeping and regular inspection of equipment:
  - Checking for water, air or gas leaks
  - Checking insulation on piping and ducts are not degraded
  - Checking refrigeration seals
  - Regular servicing and maintenance on all equipment according to the manufacturers recommendations
- Reviewing building layout:
  - Remove heat producing equipment from cold storage areas
  - Size rooms (such as cold rooms) according to needs
  - Maintain sufficient air turnover and temperature in utility rooms to prevent inefficient equipment operation
  - Specify building zones according to activities and equipment demand so that metering and monitoring programs can target specific areas



Case Study:
Meliã Bali, Bali, Indonesia

Meliã Bali reviewed equipment use and staff practices and implemented the following initiatives:

- Reduction in the operational hours of the fountain pump, exhaust fans and chiller pump
- Switching off televisions rather than leaving them on standby
- Reducing the capacity of fountain and heat reclaim pump
- Installing a variable speed drive on the cold water and chiller water pump
- Reducing operational hours of the laundry by 4 hours if occupancy rates are less than 70%

Reducing equipment operational hours, switching off televisions and optimising equipment capacity had minimal upfront costs but reduced electricity consumption by 631,146 kWh, resulting in over US$53,500 in savings.

Installation of the variable speed drive on the cold water pump cost US$17,000 and saved 126,000 kWh of electricity and US$10,397. The payback period was estimated at 1.6 years.

In total, these initiatives have helped Meliã Bali reduce its energy consumption by 757,146 kWh and achieved over US$63,949 in savings with a payback period of less than 1 year.

2. Switching to low emission energy sources

Greenhouse gas emissions from energy consumption are usually highest for non-renewable energy sources such as electricity generated from coal. By utilising alternative energy sources, significant reductions in greenhouse gas emissions can be made. More sustainable energy sources can be integrated into business operations through:

- Utilising alternative energy sources onsite such as renewable power installations (solar, wind, wave, waste or hydro) or fuel switching (using natural gas or biofuels instead of coal)
- Purchasing green power from offsite electricity providers

Onsite alternative energy sources

Renewable power installations: Tourism operators can benefit from installing renewable power systems through operational cost savings, improved health and safety of employees and guests and improved image within markets and the local community. The most common renewable energy systems in tourism operations include:

- Photovoltaic solar panels
- Wind generators
- Solar hot water systems

Fuel switching: Fuel switching can help reduce emissions by substituting high emission energy sources (such as coal) to low emission energy sources such as natural gas or biofuel. Typical fuel switching applications include:

- Substituting coal, oil or electricity for natural gas in boilers and hot water systems
- Substituting petrol and diesel for biodiesel, bioethanol or electricity in transport applications (cars, trucks and boats)
- Substituting diesel, oil or electricity for biodiesel or natural gas in motors and pumps
- Substituting coal or electricity for natural gas in stoves, ovens and cookers.

Some fuel switching applications may require equipment to be retrofitted to cope with the alternate fuel source.

What is a low emission fuel?: Low emission fuels include:

- non-renewable fossil fuels (such as natural gas) which produce lower emissions per unit of energy
- renewable biofuels (such as biodiesel and biogas) made from plant or animal products or generated from the degradation of plant or animal wastes. CO_2 emissions from biofuels are considered part of the natural short term carbon cycle and are not considered in GHG emissions reporting

Table 3 provides a comparison of energy density and emissions from some commonly used energy sources:

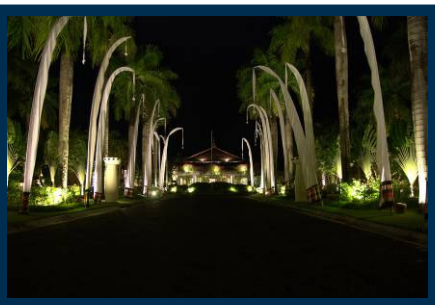
Table 3: Relative emissions of various fuels[2]

Fuel	Energy density	Units	GHG emissions (kg CO_2-e / GJ)
Brown coal	10.2	GJ/t	93.1
Black coal	27.0	GJ/t	88.4
Gasoline	34.2	GJ/kL	67.1
LPG	25.7	GJ/kL	59.9
Natural gas	39.3 x 10-3	GJ/m3	51.3
Biogas*	37.7 x 10-3	GJ/m3	4.8
Bagasse*	9.6	GJ/t	1.5
Dry wood*	16.2	GJ/t	1.3
Biodiesel*	34.6	GJ/kL	0.3

*Biofuels

RETScreen Clean Energy Project Analysis Software

Natural Resources Canada have developed a decision support tool which can be used internationally to evaluate renewable energy production and savings, costs, emission reductions, financial viability and risks for various types of renewable energy and energy efficient technologies[3]. The software is available free-of-charge online at:
http://www.retscreen.net/ang/centre.php



Case Study:
Meliã Bali
Bali, Indonesia

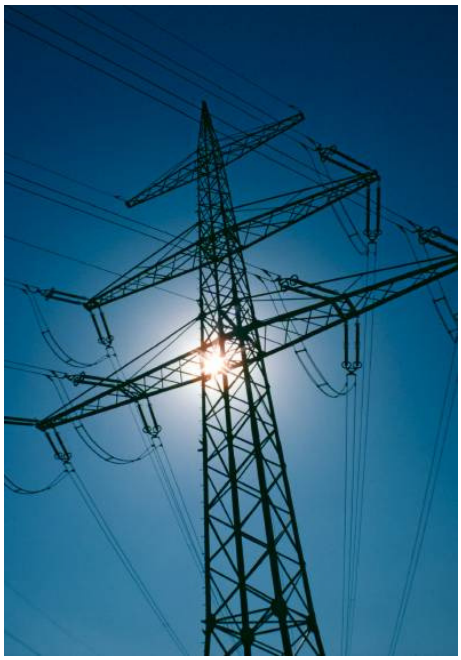
Meliã Bali in Bali, Indonesia installed a dual gas/oil burner on its boiler to improve its energy efficiency and allow for flexibility in fuel use. The burner allows the resort to use gas, a more efficient burning fuel, with the option to also select the most economically appropriate fuel. The dual burner cost US$41,000 and is estimated to save US$101,233.84 with a payback period of 4.5 months.

Purchasing green power

If utilising onsite alternative energy sources is not practical due to availability, space or financial limitations, purchasing green power from external electricity providers may be a more feasible option.

You can determine if your green power provider is appropriate by:

- Researching the company: Review websites, request information materials, request to speak with other clients and ask about current infrastructure installations and future proposed developments
- Contacting government agencies to determine whether the provider is registered and licensed as a green power provider
- Looking for accredited ecolabels and review the ecolabel standards to determine if the label is relevant and appropriate
- Shopping around and looking for alternative providers: Compare different providers based on price and the sources of power
- Comparing existing and proposed contractual arrangements: What extra costs will be involved with switching to green power? Will there be different tariffs and peak periods? Can a proportion of your power be sourced from renewable energy and can this be adjusted at any time?



Case Study:

The Alto Hotel
Melbourne, Australia

The Alto Hotel in Melborne, Australia is particularly concerned about the impact of its GHG emissions. To reduce their carbon footprint the hotel firstly purchases 100% of its electricity from renewable energy wind farms via the main grid, which makes up 66% of the site's total energy consumption. Greenpower reduces the Hotel's emissions by approximately 158.6 tonnes CO_2 equivalent. That's equivalent to taking approximately 38 cars off the road[4]. Purchasing Greenpower costs the Hotel 40% more than standard high emissions grid electricity.

To offset the remaining gas and diesel emissions the Alto supports an emissions reduction project in India that burns waste agricultural products such as rice husks to produce power, mitigating potential emissions while also providing a new source of income for the local community.

3. Offsetting emissions

If you have minimised energy consumption and maximised alternative energy sources and are looking to further reduce emissions, carbon offsets is another opportunity. A carbon offset is an investment in a project aimed at reducing or preventing carbon emissions or sequestering carbon from the atmosphere. Carbon offsets involve purchasing 'carbon credits' to offset your carbon emissions. These 'credits' have been generated from a range of greenhouse gas mitigation projects such as:

- Installing renewable energy systems
- Biosequestration through tree planting
- Capturing methane waste emissions
- Improving energy efficiency

Green Power Development Group

The Green Power Development Group (GPDG) have developed a tool for assessing green power opportunities for Europe and the United States. This tool can assist when analysing the costs and benefits of switching to green power. Visit the GPDG for more information and to download the tool:
http://www.thegreenpowergroup.org/

Where to start?

Calculate your residual emissions: After eliminating and reducing your energy use and emissions as much as possible, the next step is to calculate your residual carbon emissions.

- Start with identifying national standards or guidelines for calculating and reporting GHG emissions. Use data collected from your energy metering or bills and the methodologies and emission factors described in these standards to calculate your GHG emissions.
- If national standards are not available, review the IPCC and International Standards – ISO14064 which details carbon footprinting, offsetting and reporting methodologies.
- Decide on what level of assessment you want to complete (i.e. Scope 1,2 or 3).
- Offsetting companies will often undertake a carbon foot print as part of their service. See below for advice on selecting a reputable company.
- Alternatively, Earthcheck provides an international carbon footprinting tool, which can be used to estimate GHG emissions from tourism operations.

Case Study:

Sydney Convention and Exhibition Centre, Darling Harbour, Australia

The Sydney Convention and Exhibition Centre on Darling Harbour, Australia encourage exhibition organisers to take up the offer of carbon offsetting their event. The greenhouse emissions are based on the floor area used. The emissions are offset via Country Energy's Green Power program.

I know my carbon footprint, how do I offset?

A number of companies are available to help offset your emissions. Care must be taken to select a reputable company and offsetting scheme. When selecting a company to use for offsetting, consider:

- Accreditation: Are they accredited at a national or international scale?
- Verification: Is the scheme reviewed and verified by an independent and qualified third party?
- Transparency: Is information provided on how the organisation offsets emissions? Is this in-line with your objectives for carbon offsetting?
- Cost implications: How much will it cost to offset per tonne of CO_2-e emissions? How does this compare to similar offsetting schemes?
- Consider offering carbon offsets as an option to guests or patrons

References

[1] EPA Victoria, 2009, Carbon Management, ***http://www.epa.vic.gov.au/climate-change/carbon-management/default.asp***

[2] Australian Government Department of Climate Change, June 2009, National Greenhouse Accounts (NGA) Factors

[3] Natural Resources Canada, 2009, RETScreen Clean Energy Project Analysis Software

[4] Assuming 4.2 tonnes of GHG emissions per car per year (Source: Greenfleet, 2010, Technical Information, ***http://www.greenfleet.com.au/Global/Researchers/Technical_information/index.aspx***)