



Smart Cities



Building for the Future

Smart buildings are curbing Dubai's energy consumption and carbon footprint

Situated on the edge of the Great Arabian Desert, the fast growing Emirate of Dubai has to make extensive use of energy both for air conditioning and desalination of seawater. But this futuristic city is also a pioneer of smart building technology that is reducing the Emirate's energy bills and its impact on the environment.

Driving the adoption of smart building technology is the Emirates Energy Star (EES) programme, a partnership between mobile operator Etisalat and specialist solution provider Pacific Controls Systems. In the 13 months after it was launched in November 2011, the programme reduced the United Arab Emirates' carbon emissions by more than 35,000 tonnes – the equivalent to planting more than 7,500 trees.

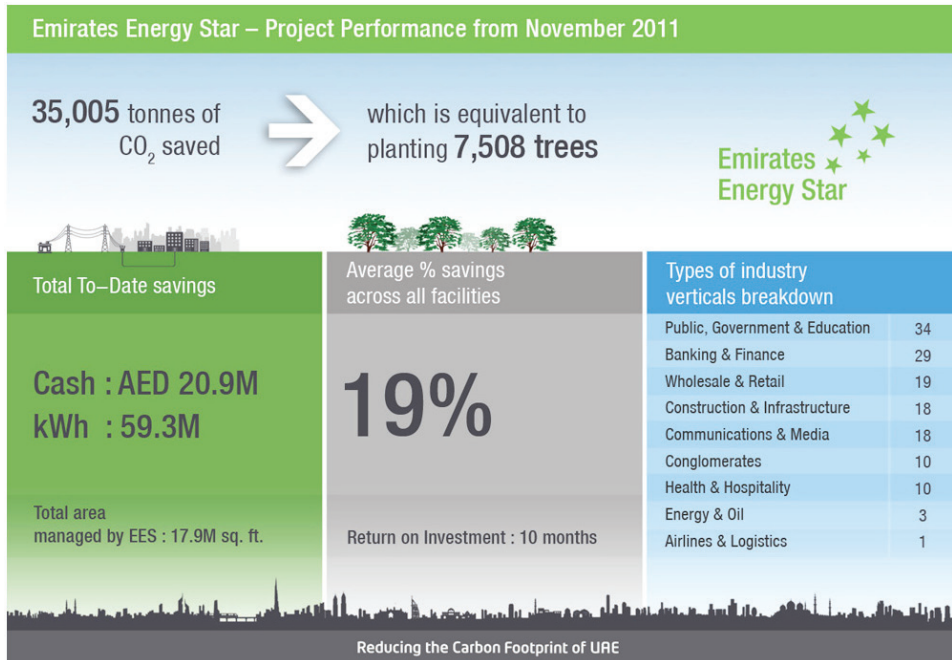
By the end of 2012, the programme has connected more than 140 building developments in Dubai to the Command and Control Centre (CCC), which is staffed by EES engineers, facility managers, IT and communications experts. A monitoring panel installed in each participating building collates data from the equipment and sensors on site and transmits it back to the CCC, enabling the EES to continuously monitor the building's energy usage in real-time.



By actively managing a building's lighting and heating, ventilation and air-conditioning (HVAC) systems 24 hours a day, seven days a week, the EES aims to reduce the building's energy consumption by up to 30%. Using a combination of sensors and connectivity, the CCC can control a building's temperature more precisely than a conventional thermostat can, turning

down, or turning off, equipment and lighting when rooms are unoccupied.

Across the 142 participating sites, which include commercial, retail and residential buildings, the EES programme reduced aggregate energy consumption in its first year by 19%, saving the buildings' owners a total of Dh 20.9 million (4.2 million euros).



Environmental impact of buildings

Buildings use large amounts of electricity and are major emitters of greenhouse gases. In the U.S., for example, buildings account for:

- 36% of total energy use and 65% of electricity consumption
- 30% of greenhouse gas emissions
- 30% of raw materials use
- 30% of waste output
- 12% of potable water consumption

Source: U.S. Green Building Council



By monitoring a building continuously in real time, the EES can compare actual energy use with the forecast base load, and then identify the cause of any variations from the expected consumption. If the building owner sets a target for energy use, the CCC can remotely control the HVAC and lighting systems to keep within the target. To keep energy use within budget, the CCC will adjust HVAC or lighting systems in low-priority areas when consumption exceeds the target level.

The CCC can also vary a building's thermostat settings and outdoor lighting, according to the time of day and the season of the year. The EES estimates that careful control of light levels, using daylighting when possible, and turning off unnecessary lighting, can save up to 50% of lighting energy consumption.

More broadly, the centralised management and reporting provided by the CCC can help facilities managers detect faulty or inefficient equipment and set priorities for upgrades and improvements. As both lights and HVAC systems are more efficient when the units are kept clean, the EES says predictive maintenance, using information from the CCC's Galaxy platform, can reduce a building's energy bills, while optimizing the use of staff time by scheduling cleaning, or the replacement of equipment, in batches.

Implementation and costs

Once a specific project has been agreed with a building owner, Pacific Controls makes any necessary changes to the building's control systems and lighting and HVAC equipment. These modifications might include splitting lighting circuits into separate zones, installing variable speed drives for air-conditioning fans, and adding more sensors, such as room thermostats, CO2 detectors, or light sensors. The Galaxy platform supports a wide range of manufacturer and communications protocols enabling the EES engineers to integrate the equipment on site with a data gathering module that connects to the CCC via the cellular network.

For a large project, this process may be split into phases, so that the benefits of the first phase can be used to justify the additional investment required to generate greater savings.

Once the new equipment is in place, the building owner pays EES a monitoring fee, which is typically a fraction of the reduction in electricity bills resulting from more efficient usage of energy.

EES's project management office handles overall governance of the project, reporting, resource and vendor management. This office also takes responsibility for service operation and for the maintenance of the

devices on site – all events, incidents and problems are handled through the CCC, which ensures that the equipment remains operational, the service level agreement is met, and energy savings are maximised over the lifecycle of the project.

Examples of the EES programme in action

The University of Dubai's Al Masaood Building on Maktoum Street has reduced its carbon emissions by 42 tonnes a month by participating in the EES programme. It is also saving more than Dh 32,000 (6,400 euros) a month through reduced energy usage.

The savings have been achieved by connecting the building's two chillers, three chilled water pumps and two fresh air handling units and pumps to the CCC for real-time monitoring. The CCC adjusts the chillers' settings according to the load, while scheduling the fresh air handling units in line with the building's occupancy.

As a result, the running hours of the systems have been significantly reduced, extending the equipment life, while reducing the total energy consumption of the building. The EES estimates the building will make a return on its investment in the programme within 12 months.

Other buildings have also achieved major savings. Dubai's 21st Century Tower lowered its total greenhouse gas emissions by 764 tonnes between November 2012 and July 2013, while the Ministry of Social Affairs cut its aggregate emissions by 1,078 tonnes between September 2012 and July 2013.

As part of the service, the experts in the CCC use the data collected by the Galaxy platform to identify the potential for a building to make further energy savings through investment in the latest energy-efficient equipment. This information is passed on to the facilities manager who can then decide whether to make the investment. To help building owners finance capital spending, the EES has reached an agreement with commercial banks, which will provide building owners with loans on the basis that the repayments will be lower than the anticipated savings in electricity bills.

This approach enables the building owner to use the energy savings to cover the cost of the monthly installments. And the lower electricity costs, as a result of the reduced consumption, will, of course, continue after the loan has been paid off.

Future targets

The EES programme is aiming to connect 3,000 public buildings and a similar number of private buildings to the CCC with a goal of cutting their cumulative energy usage by at least 20%.



The technology behind EES

As well as promoting the EES programme to its business customers, Etisalat provides the ICT networks that underpin the service. Etisalat uses its existing 3G network to connect participating buildings to the CCC, keeping costs and implementation requirements to a minimum. Pacific Controls delivers the machine-to-machine connectivity solution to the participating buildings.

The EES can provide facilities managers with a web-enabled application that can be accessed via standard web browsers from a wide range of devices, including mobile handsets for some interfaces. Through this web solution, a facilities manager can view the building's performance indicators, such as a list of alarms, direct carbon emissions and other key parameters from a consolidated 'dashboard'.

The UAE Vision 2021

The EES programme fits with the objectives of the Emirates governments' UAE Vision 2021, which calls on the United Arab Emirates to be among the best countries in the world by 2021. The Vision 2021 states: "In a strong and safe union, knowledgeable and innovative Emiratis will confidently build a competitive and resilient economy. They will thrive as a cohesive society bonded to its identity and enjoy the highest standards of living with a nurturing and sustainable environment."

The commitment to a sustainable environment has translated into a drive to lower the carbon footprint of all aspects of the Emirates' economy through the dissemination of information. The goal is to have the lowest per capita greenhouse gas emissions in the region by 2021. The EES says its web portal is demonstrating to businesses in the Emirates how falls in carbon emissions can be achieved without impacting productivity.

The EES is also aiming to benchmark energy efficiency across thousands of buildings in real time, so it can show facilities managers how their buildings' performance compares with that also similar buildings. The EES programme can also be used to assess the performance of emerging renewable technologies, such as solar and wind power.





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