Bhubaneswar, India

Installation of energy efficient lighting at the Lord Lingaraj Temple

ICLEI Local Governments for Sustainability

In January 2008, the Bhubaneswar Municipal Corporation (BMC) initiated a project on energy efficient lighting at the Lord Lingaraj Temple. This temple is the most prominent in Bhubaneswar, India's City of Temples. A total replacement of incandescent lights in the main temple with more efficient compact fluorescent lamps (CFLs) and tube lights resulted in energy and monetary savings of more than a third of the temple's monthly energy bills. The intiatives have since been replicated by all the vendors in the large temple complex.

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Abstract

In 2007, as part of a large scale awareness raising program on local adoption of renewable energy and energy efficiency under the BMZ/GTZ funded Local Renewables Model Communities Network project, Bhubaneswar Municipal Corporation (BMC) authorities decided to undertake a pilot demonstration project to increase community interest and involvement in energy efficiency and renewable energy measures.

A comprehensive energy audit of the temple revealed high energy bills, with the major share spent on lighting due to inefficient light fixtures. Based on this audit, the temple authorities undertook a complete retrofit to install energy efficient lighting in March 2008. The costs of interventions were borne by the Local Renewables project, of which Bhubaneswar is one of the Indian model cities.

The temple now consumes 36% less energy and recovered the entire cost of the project after just 13 months of operation with the new fittings.

The importance of setting a good example

Orissa, once an electricity surplus state, has recently (2006-2009) seen a rapid increase in energy demand, resulting in a crisis level power shortage in the state. In 2007 the BMC developed a focus on activities and programs to raise awareness about the efficient use of energy in the local community as an important part of managing and reducing the city's increasing energy demands. The commissioning of energy conservation measures is an excellent way to obtain energy savings through low cost improvements and optimizing building systems so that they operate efficiently and effectively. A high profile pilot demonstration project showcasing energy efficiency was initiated to serve as an inspiration to citizens and visitors.

The Lord Lingaraj Temple is the largest temple of the hundreds that dot the landscape of Bhubaneswar. It is one of the most recognized visual symbols of the city, receiving over one million visitors each year. Due to its prestigious position in the city and the country, this ancient stone walled temple was chosen as the best location to showcase energy efficiency.

Population / Land area
Approx. 648,032 (2001) / 135 km²

Municipal budget
Approx. 2.2 billion INR (2009)
(€ 34.3 million)

Local economy
Information technology, retail, real estate

Role of city in region
State capital city, religious center

LOCAL RENEWABLES
An ICLEI Initiative

ICLEI supports and strengthens local governments which promote the generation and supply of renewable energy and energy efficiency in the urban environment.

Case Study

The Bhubaneswar context

Bhubaneswar, the bustling capital of the eastern state of Orissa, has developed a reputation over the centuries as the 'Temple City' of India. A city with a history going back over 3000 years, it is an important economic and religious center in eastern India.

Photo: Rituraj Borah, ICLEI South Asia

Lord Lingaraj Temple, Bhubaneswar

The last two decades of the twentieth century saw the city grow as an industrial and commercial base in eastern India, and gave a new dimension to the former pilgrimage town. Despite this development, Bhubaneswar remains known as an example of some of India's finest Kalingan temple architecture. It attracts hundreds of thousands of visitors each year, both domestic and international, who come to marvel at the city's ancient stone temples and to pay their respects to the thousands of Hindu deities in the temples.

An energy policy for Bhubaneswar – the first of its kind in India:

Bhubaneswar and Nagpur were the first cities in India to adopt a city wide energy efficiency and renewable energy policy in 2007 as a key step within the Local Renewables project. As part of implementing the city energy policy, the BMC has a strong focus on awareness raising activities. The city has had programs on energy efficiency and conservation for various target groups, ranging from home makers to school children and teachers.
For more information on the Local Renewables project, please see the box on page 3.

Lighting up the Lord Lingaraj: installation of energy efficient lighting at the Lord Lingaraj Temple

Background on the Lord Lingaraj Temple: Of the thousands of ancient temples in the region, the Lord Lingaraj Temple is the largest temple in Bhubaneswar. At 55 meters high, built of locally available laterite stone, the temple is over a thousand years old. It is located in the old township of Bhubaneswar city. The temple complex includes a sprawling layout of 108 smaller temples in addition to the main temple. The temple is open everyday between 6:00 and 21:00. The temple averages about 5,000 visits per day which translates to about 1.8 million visits per year.

Project aims to create awareness: Recognizing the importance of the Lord Lingaraj Temple in the city's historical and cultural context, the BMC decided to start an energy efficiency project in the temple in 2008.

City energy report to determine Bhubaneswar's energy consumption patterns

Bhubaneswar's recent power crisis caused local decision makers to address the challenges of citywide energy consumption and resulting carbon emissions. The first step was to conduct an assessment. In 2006, energy consumption data was collected by municipal staff from sectors including street lighting, transportation, water pumping, residential, commercial and industrial sectors. Using the energy consumptions levels of 2005-2006 as a comparison baseline, data from 3-4 years prior to the time of the audit enabled the city to analyze trends and prioritize actions. This data, compiled by the municipality as a city energy report for the Local Renewables project, was updated each year for four years.

This data collected from Bhubaneswar was also used for a Carbon Emission Inventory and a City Energy Status Report, published in the report 'Energy and Carbon Emissions Profiles of 54 South Asian Cities' (2009). The report was compiled by the ICLEI South Asia Secretariat under a project implemented in Bhubaneswar and 53 other South Asian cities within the framework of the 'Roadmap of South Asian Cities and Local Governments for the post-2012 global climate agreement and actions' project.

For more information, please contact ICLEI SA or the BMC

The project was intended to:

- Benefit the temple by achieving energy and financial savings, reducing operation and maintenance costs and increasing occupant comfort in an important religious and cultural monument.
- Create awareness of energy efficiency amongst visitors.

Pre-project energy audit of the temple: In the beginning of 2008, the BMC commissioned an energy audit of the Lord Lingaraj Temple with the assistance of ICLEI's Local Renewables project. Average annual electricity consumption of the temple before the change in equipment (measured in March 2009) amounted to approximately 66,000 kWh of electricity at a cost of 4,615 EUR (300,000 INR) including demand charges and taxes.

One of the major reasons for this high level of energy consumption was the use of incandescent bulbs and inefficient tube lights for lighting. The long working hours of the temple meant that artificial light was being used substantially at the start and end of the day, when natural light is not available.

Installation of energy efficient light fittings: The energy audit revealed that the most effective intervention in the temple would be in the lighting area, while also being the most financially interesting option. Thus, it was proposed to undertake a complete retrofit of the Lord Lingaraj Temple's light fixtures. In April 2008, the existing light fittings of 100 and 200 watt (W) incandescent bulbs were replaced with 20 and 23 W compact fluoroscent (CFL) and 40 W tube lights were replaced with more efficient 28 W tube lights.

Post-installation activities: After the installation of efficient light fittings the energy consumption of the temple was monitored for one year. This enabled a calculation of energy and financial savings achieved.

The energy efficiency initiative in the Lord Lingaraj Temple was covered in local, national and international media. The project was hailed as an innovative initiative.

The Local Renewables project

The Local Renewables Model Communities Network (or Local Renewables project) aims to support and strengthen local governments in promoting sustainable energy and to become model cities in their national and regional contexts. This international project (2005-2010) connects leading cities to cooperate in sharing their expertise and experience in the fields of renewable energy (RE) and energy efficiency (EE). Thus, the project is a key component of ICLEI's Local Renewables Initiative.

Special support for participating model communities in India (Bhubaneswar, Nagpur and Coimbatore) and Brazil (Betim and Porto Alegre) was possible due to generous funding from the German Federal Ministry for Economic Cooperation and Development (BMZ) through the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH.

The European Resource Cities of Bonn, Freiburg, Milan, Växjö and Malmö have highly developed renewable energy and energy efficiency strategies which they were happy to share.

The ICLEI offices for South Asia (Delhi), Brazil (Sao Paulo) and Europe (Freiburg) gave continuous guidance and organized the exchange among the cities.

www.iclei.org/local-renewables

Table 1: Installations at the Lingaraj Temple

Original Fittings	Load (kW)	Efficient Replacement Lighting	New Load (kW)	Reduction in temple's energy demand (kW)
100W Incandescent Bulbs (41 in number)	4.10	20W Compact Fluorescent Lamps (CFL) (40 in number)	0.80	3.30
200W Incandescent Bulbs (11 in number)	2.20	23W CFLs (11 in number)	0.25	1.95
40 W Tubular Fluorescent Lamps (TFL) (50 in number)	2.50	28W TFLs (48 in number)	1.44	1.06
Total	8.80		2.49	6.31

Source: Krishna Engineers, 2008

Results of the project

The average monthly energy consumption at the temple between January and March 2008 decreased from 5,506 kWh to 3,510 kWh per month.

After one month of use, the energy efficient lights resulted in:

- A monthly energy savings of 1,996 kWh (23,952 kWh annually)
- Annual monetary savings of 76,644 INR (1,180 EUR)
- A total reduction in energy demand of the temple by 6.31 kW

The return on investment measured against an initial cost of 1,340 EUR was just over one year. The reduction in energy consumption at the temple also contributed towards a reduction in emissions by 10.29 tons CO_2 equivalent.

Photo: ICLEI South Asia

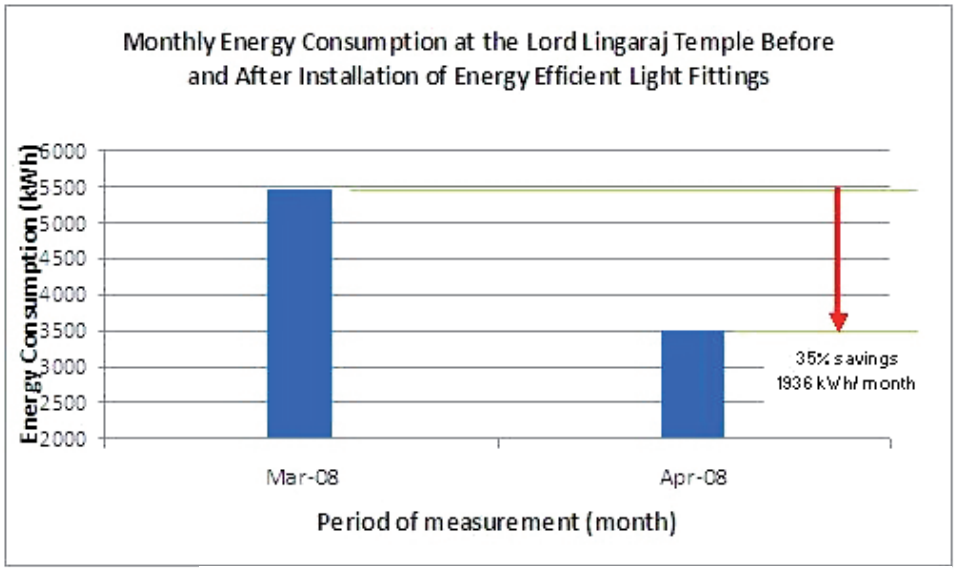
View of the Lord Lingaraj Temple from BMC Hospital

Selection of lighting type: The efficient CFLs have a longer life than the previously used incandescent bulbs and thus require less maintenance. In addition, CFLs provide a better atmosphere. The old stone walls of the temple now glow with the bright light of CFLs instead of the harsh light of incandescent bulbs.

Ripple effect due to raised awareness: Within the premises of the Lingaraj Temple complex are many vendors who have now been inspired by the main temple's experience to make the shift towards energy efficient lighting. Almost all of the vendors now use energy efficient CFLs in place of incandescent bulbs.

The Lord Lingaraj Temple houses approximately twenty vendors just inside of the main entrance that sell various garlands, offerings for the deity within the temple and religious objects. These vendors have all been inspired by the Lord Lingaraj Temple initiatives to make the switch to energy efficiency through CFLs. With energy savings in the range of 93 kWh per annum for each vending stall, the vendors have each saved about INR 280 per year, recovering the cost of their investment in less than one year.

Photo: ICLEI South Asia



Monthly energy consumption before and after installation of energy efficient lighting in Lord Lingaraj temple

Lessons learned

Pilot demonstration projects need a highly visible location: The BMC chose to undertake a project on energy efficiency at the Lord Lingaraj Temple because the temple is an important historical and cultural landmark in the city. The choice of this site proved to be the key to the success of this project due to its high number of visitors and huge information impact potential, combining energy savings with widespread awareness.

This project was the result of a successful collaboration between the city government and local business: An external consultant, Krishna Engineers, was hired to prepare the energy audit and list possible interventions, along with submitting monitoring reports of the performance. The local supplier of the fittings, Kalinga Kommercials, was responsible for the installation and maintenance of the light fixtures. The importance of the project allowed the businesses to improve their local profiles, helping to generate further demand of energy efficient products.

Photo: Rituraj Borah, ICLEI South Asia

View of Lord Lingaraj Temple complex

Energy issues are not separate from other aspects of development in cities: The Lord Lingaraj Temple's energy savings as a result of the lighting retrofits allowed the temple to improve other services provided to visitors, such as improved visual quality within the temple. Thus, through energy efficiency, the Lord Lingaraj Temple also contributed towards development of the tourism sector, showcasing an example other tourist destinations in the city can emulate.

Financial savings are as important as energy savings: A quick return on investment is crucial. The interventions made at the Lord Lingaraj Temple were relatively minor, with a manageable capital cost. This option made it attractive to the BMC as it allowed a quick return on investment, with large potential impacts through the widespread adoption of energy efficiency in the city. For the temple authorities the benefits were immediate: energy and financial savings were achieved from the moment of installation itself, after a quick installation period.

Replication

The Lord Lingaraj Temple is a successful example of a pilot implementation project that produces energy savings and also serves to create widespread awareness. With an affordable capital investment (of 87,114 INR as compared to 300,000 INR of the temple's annual energy bill), and a quick return on investment (payback period of 1 year and 1 month), the Lord Lingaraj Temple project is an easily replicable project for other institutions.

Selection of a prominent historical and cultural monument to showcase an energy efficiency strategy was the key to the success of the project, as the temple is firmly established in the consciousness of the city and citizens respect it. As a representative of the type of institution and building most typical of Bhubaneswar, the temple's forays into energy conservation served as a ground breaking initiative that the rest of the city's numerous temples and other historical and cultural institutions may easily emulate.

A similar initiative in Freiburg, Germany

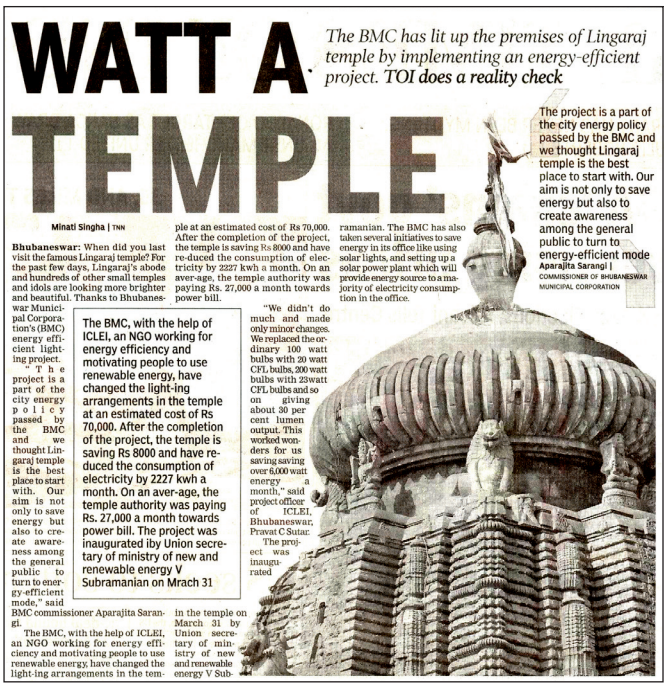
The City of Freiburg in Germany, a European Resource city within the Local Renewables project, won the "Communities in a New Light" competition of the German Ministry for Education and Research (BMBF) in April 2010.

Freiburg will use energy efficient LED lighting solutions for the illumination of the city's historical center. Through the use of advanced LED light sources in combination with intelligent control systems, savings of up to 65 percent compared to earlier lighting could be achieved. The "Solar City Freiburg" will receive 2 million EUR for retrofitting selected street lights and public places, most prominent of which is its famous cathedral and marketplace. The cathedral is visited by hundreds of thousands of visitors each year, which makes it the perfect place to raise energy efficiency awareness.

www.freiburg-greencity.de

Budget and finances

Total investment for the execution of the project amounted to 87,114 INR (1,340 EUR). Funding for this intervention project was provided entirely by the BMZ/GTZ funded Local Renewables project. The project was executed with the administrative and technical support of the Bhubaneswar Municipal Corporation.



WATT A TEMPLE

The BMC has lit up the premises of Lingaraj temple by implementing an energy-efficient project. TOI does a reality check

Minati Singha | TNN

Bhubaneswar: When did you last visit the famous Lingaraj temple? For the past few days, Lingaraj's abode and hundreds of other small temples and idols are looking more brighter and beautiful. Thanks to Bhubaneswar Municipal Corporation's (BMC) energy efficient lighting project.

"The project is a part of the city energy policy passed by the BMC and we thought Lingaraj temple is the best place to start with. Our aim is not only to save energy but also to create awareness among the general public to turn to energy-efficient mode," said BMC commissioner Aparajita Sarangi.

The BMC, with the help of ICLEI, an NGO working for energy efficiency and motivating people to use renewable energy, have changed the light-ing arrangements in the temple at an estimated cost of Rs 70,000. After the completion of the project, the temple is saving Rs 8000 and have re-duced the consumption of electricity by 2227 kwh a month. On an aver-age, the temple authority was paying Rs. 27,000 a month towards power bill.

"We didn't do much and made only minor changes. We replaced the ordinary 100 watt bulbs with 20 watt CFL bulbs, 200 watt bulbs with 23watt CFL bulbs and so on giving about 30 per cent lumen output. This worked wonders for us saving saving over 6,000 watt energy a month," said project officer of ICLEI, Bhubaneswar, Pravat C Sutar.

The project was inaugurated in the temple on March 31 by Union secretary of ministry of new and renewable energy V Subramanian. The BMC has also taken several initiatives to save energy in its office like using solar lights, and setting up a solar power plant which will provide energy source to a majority of electricity consumption in the office.

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Aparajita Sarangi | COMMISSIONER OF BHUBANESWAR MUNICIPAL CORPORATION

Photo: Times of India, Bhubaneswar edition

Energy efficient lighting in the Lord Lingaraj Temple was covered in local print media.

Photo: ICLEI South Asia

EE tubelight as seen from outside the temple

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- 'Monitoring of the Lord Lingaraj Temple' Krishna Engineers, 2008-09
- Bhubaneswar City Energy Report 2007-08, Bhubaneswar Municipal Corporation and ICLEI SA, 2008
- Energy and Carbon Emissions Profiles of 54 South Asian Cities, November 2009

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Local Renewables project materials from India

- Bhubaneswar, Nagpur and Coimbatore City Completion Reports
- Case Study # 108: Pioneering renewable energy and energy efficiency application in India's municipal health sector in Bhubaneswar
- Case Study #109: Installation of energy efficient lighting at the Lord Lingaraj Temple in Bhubaneswar
- Case Study # 110: Water sector audit enables efficient use of water and energy resources in Napgur
- Case Study # 111: Reducing carbon emissions while improving Coimbatore's municipal public services

Further case studies about energy efficiency and renewable energy in India, Brazil and the European Resource Cities, as well as city completion reports for the Local Renewables project are available on the project website.

www.iclei.org/local-renewables

Federal Ministry for Economic Cooperation and Development

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