Bhubaneswar, India

Pioneering renewable energy and energy efficiency application in India's municipal health sector

ICLEI Local Governments for Sustainability

The Bhubaneswar Municipal Hospital (BMH), owned and operated by the Bhubaneswar Municipal Corporation (BMC), mainly serves the low income population of Bhubaneswar. Services were frequently interrupted by an erratic power supply and resources were not available to make improvements. Identifying a unique solution to these issues, the BMH became the first municipal hospital in India to implement renewable energy and energy efficiency measures. This resulted in substantial energy savings while enabling an improved, more efficient delivery of health services.

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Abstract

A solar water heater (SWH) was installed at the Bhubaneswar Municipal Hospital (BMH) as part of the The German Federal Ministry for Economic Cooperation and Development (BMZ/GTZ)-funded Local Renewables Model Communities Network project in 2008. Encouraged by early results from this new power source, the hospital underwent a comprehensive energy audit to identify further potential improvements. This study, and subsequent interventions, were primarily funded by the Wuppertal Institute for Climate, Environment, Energy (WISIONS) initiative.

Solutions addressed two main issues: Efficient fittings were installed to reduce energy demand on-site and renewable energy was introduced to limit dependence on the public power grid.

Hospital staff were trained in the operation and maintenance of the energy efficient and renewable energy equipment after its installation in August 2009. The new equipment reduced the hospital's energy consumption and costs and secured energy availability for vital areas such as the vaccine refrigerator and hot water supply.

The importance of renewable energy and energy efficiency for India's municipal hospitals

Municipal hospitals in India, which are operated by local governments, cater to large low-income populations, are often understaffed, affected by power interruptions and lack in adequate infrastructure.

Frequent and unpredictable power interruptions jeopardize the continuity of critical medical procedures, such as surgeries, and cut off refrigeration to perishable vaccines. This scenario increases a hospital's dependence on diesel power generators which are not only costly, but also increase greenhouse gas emissions. With already straining budgets, municipal healthcare facilities must handle their energy burdens while balancing the needs of large numbers of patients. Bhubaneswar delivers healthcare services from six municipal hospitals to a low-income population of approximately 300,000. The BMH is the most heavily used hospital in the area.

Population / Land area
Approx. 648,032 (2001) / 135 km^2

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

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

Bhubaneswar and Nagpur were, in 2007, the first Indian cities to adopt energy efficiency/ renewable energy policies.This was a key step in their work with the Local Renewables project. The Bhubaneswar Municipal Corporation (BMC) emphasizes awareness-raising activities as part its city energy policy and it has held programs on energy efficiency and conservation for various target groups, including homemakers, school children and teachers.
See box on page seven for more on the Local Renewables project.

Bhubaneswar, the bustling capital of the eastern state of Orissa, is known as the 'Temple City' of India with a history dating over 3,000 years. The city is considered to be an important economic and religious center of eastern India and the state government, Orissa, is keen to further develop the city into an information technology hub. While Bhubaneswar attracts scores of tourists, it is also a top destination for migrants from other parts of Orissa; this has lead to the development of crowded slums, or 'bastis.'

Orissa once enjoyed an energy surplus, but in recent years (2006 - 2009), hydro-electric and thermal power plants have been affected by erratic rainfall, precipitating a crisis-level power shortage in the state - for Bhubaneswar in

Photo: ICLEI South Asia

The Mayor of Bhubaneswar, Mihir Mohanty, inaugurates the first SWH at the BMC Hospital in January 2008.

particular. Growing energy needs have also contributed to a shortfall in the city's energy production.

Leading by example: Pioneering sustainable energy in India's municipal health sector

A practical start: Bhubaneswar Municipal Hospital (BMH) piloted the installation of a 200-liter-per-day (LPD) solar water heater (SWH) in January 2008. The project was funded through carbon-offset fees acrued by the City of Freiburg during the Local Renewables Conference in 2007. Hospital authorities were extremely pleased with the performance of the SWH, which saved over 720 liters of oil and reduced energy consumption by 7700 kilo watt hours (kWh) within 14 months. Subsequent discussions between ICLEI, the BMC, the Ministry of New and Renewable Energy (MNRE) and the Orissa Renewable

Energy Development Agency (OREDA) shaped the project's development. Each of these organizations was invited to be a stakeholder of the project. Under the guidance of the stakeholder committee, BMH authorities organized a comprehensive energy audit, in June 2009, in an effort to determine specific energy-saving opportunities at the hospital. The energy audit and subsequent project activities were overseen by an external consultant.

Preliminary energy audit of the hospital: The project's external consultant conducted a preliminary energy audit in 2009 to gauge the hospital's consumption patterns and identify areas where an uninterrupted power supply is critical. The BMH determined precise areas requiring energy-saving interventions after an intensive six-week revision of the auditor's asessment.

Identification of equipment and interventions required: Audit results showed that the BMH's actual hot water requirements were roughly 450 LPD to adequately serve its primary areas of use: The operating wing and the gynaecology department. A 200-liter SWH system had been installed prior to the energy assessment, therefore the addition of another 200-liter SWH system was deemed sufficient. Other interventions, such as energy efficient lighting and fans, were to be handled at a later stage.

Procurement and installation of equipment: Cost quotes for the project were solicited from local suppliers in June 2009 and the external consultant oversaw the installation of equipment. The process of identifying the most appropriate equipment was made easier by inviting suppliers to become stakeholders of the project.

Training: Hospital staff were trained to use and maintain the equipment in order to encourage a sense of responsibility and to allow for daily on-site maintenance. In addition, the external project consultant, in cooperation with the Bhubaneswar Resource Center, trained two BMH electrical technicians to operate and maintain the installations. The training program also included a session for nurses, plumbers and some doctors.

Monitoring: Since August 2009, the project's external consultant has been monitoring the installations' performance on an ongoing basis, in quarterly sections, to calculate energy savings Promising results came from the first quarter review. The local hardware suppliers maintain responsibility for ensuring proper functioning of the equipment - a service they agreed to perform for a year, free of charge, from the date of installation.

Information dissemination: The project's post-implementation phase consisted of workshops to raise awareness about - and market - the BMH's installations. The workshops were well-received. Officials from Bhubaneswar's private and public hospitals, as well as local government representatives from cities in eastern India, visited the BMH in September 2009 to study the project's development from inception to post-implementation. This information-sharing will hopefully lead to similar initiatives among other local governments in India.

City energy report to determine Bhubaneswar's energy consumption patterns

Bhubaneswar's recent power crisis prompted local decision-makers to address citywide energy consumption and its resulting carbon emissions. Municipal staff conducted an energy consumption asessment which focussed on street lighting, transportation, water pumping, as well as calculating power usage by the residential, commercial and industrial sectors. Staff used the city's 2005-2006 energy consumption levels (originally compiled by the city for ICLEI's Local Renewable's project) as a point of comparison, thereby allowing them to identify trends and prioritize actions..

The new data was further used for a carbon emissions inventory and also appeared in a status report issued by ICLEI's South Asia Secretariat, *Energy and Carbon Emissions Profiles of 54 South Asian Cities* (2009). The report is part of the 'Roadmap of South Asian Cities and Local Governments for the post-2012 global climate agreement and actions' project which profiles Bhubaneswar and 53 other South Asian cities.

For more information, please contact ICLEI South Asia or the BMC.

The Wuppertal Institute for Climate, Environment, Energy (WISIONS)

is organized with the support of the Swiss-based foundation, ProEvolution, to foster practical sustainable energy projects. WISIONS supported the purchase of renewable energy and energy efficient equipment for the BMC in 2009 through their Sustainable Energy Project Support (SEPS) IV grant. www.wisions.net

Energy efficient and renewable energy equipment was installed by the BMC in mid-2009 following the BMH's energy audit. This municipal package includes:

- one solar photovoltaic power pack (capacity: 1.28 kilo-watt peak);
- two solar water heaters (capacity: each 200 LPD for a total capacity of 400 LPD);
- solar vaccine refrigerator (capacity: 50 litres);
- solar roof light consisting of an 11 watt CFL with solar module;
- solar indoor lighting systems consisting of a 9 watt CFL luminary with solar module at the blood bank and similar lighting in the hospital's common areas;
- energy efficient lighting consisting of 28 watt T5 fluorescent bulbs (190 fittings in total) and 25 watt spiral CFL fittings (50 fittings in total);
- 96 watt EE streetlights; and
- energy efficient fans consisting of 50 watt ceiling fans (45 in total).

Continuation of activities: Inspired by the success of its hospital's initiative, the BMC intends to perform energy audits on several primary buildings with the aim of identifying energy conservation opportunities.

Project results

The post-installation phase of the project involved a month-by-month comparison of pre-project consumption figures in order to assess the average savings achieved. This was cross-checked against the equipment's predicted versus actual performance results. The results achieved in Quarter 1 (September – November 2009) indicate substantial energy savings:

- Energy efficient fittings reduced the hospital's energy demand by 10.23 kW.
- After three months, the new equipment had reduced the hospital's energy consumption by 15%.
- Energy efficient fittings represented 20% of the project's total cost and contributed to 75% of overall energy savings. Remaining

Photo: ICLEI South Asia

Local government representatives of eastern Indian cities visited the BMH in September 2009 to learn about the hospital's initiative.

savings were derived from other renewable energy measures such as the solar power pack, vaccine refrigerator and solar water heater.

- After its first quarter in operation, the project's energy savings amounted to 203 EUR (13,230 INR) in savings.
- Based on first quarter results, monetary savings would be 814 EUR (52,920 INR) per annum.
- The hospital receives a monthly stock of 2500-3000 vaccines. Since the installation of the solar vaccine refrigerator, no vaccine loss has been reported.

While the project's monitoring period is still in its early stages as of June 2010, initial trends indicate valuable savings for the BMH. Hospital staff are pleased with the energy savings, improved healthcare services and preservation of vaccines brought about by the project.

Lessons learned

Win-win scenario: Energy savings and improved delivery of healthcare benefits staff and patients. The main hurdle for hospitals in India, especially municipal health centers, is the large financial commitment involved with improving facilities. The BMH project demonstrates that energy and financial savings follow an initial investment. These valuable savings translate into improved funding for other areas in need of attention.

Energy independence: The installation of solar-powered lighting, a solar photovoltaic power pack in the operating theater and a solar-powered vaccine refrigerator allow the hospital to function independently of the public grid for its critical energy needs.

Specific needs and interventions required need dynamic studies: Thorough revision and analysis throughout the project allowed for optimal troubleshooting. For example, it was initially estimated that the hospital required 1000 LPD of hot water, but further analysis revealed actual requirements to be in the range of 450 LPD. An understanding of local climatic conditions, coupled with data about the hospital's consumption patterns, were key to identifying the reduced energy requirement.

Photo: ICLEI South Asia

Inauguration of RE and EE technologies at the BMC Hospital, the first municipal hospital in India to use renewable energy and energy efficiency technologies.

Combining energy efficiency and renewable energy is crucial: Renewable energy sources are more effective when combined with less energy intensive equipment. Initial energy audits allowed the project implementation team to identify which interventions were required, but detailed analysis of the audit revealed that power was being consumed in large part by inefficient ceiling fans, incandescent lights and high wattage fluorescent

tube-lights. Replacing these with low-wattage bulbs and fans helped to reduce energy use levels.

Stakeholder involvement: The initial idea for the project came up during discussions between the BMC, ICLEI, MNRE, and OREDA at an ICLEI workshop on energy efficient buildings, held in Bhubaneswar in April 2008. Each group became a stakeholder for the project and was involved in all phases of the process.

Replication

The simple and direct approach used in this project - energy assessment, identification of possible interventions, priority setting, procurement, installation, and monitoring - could be easily applied by other local governments in any type of public building.

Uninterrupted healthcare, especially for critical services, is a relevant issue for local governments, especially for those whose healthcare facilities are in remote locations and serve low-income populations.

Photo: ICLEI South Asia

A solar streetlight installed at the BMC Hospital illuminates the entrance and approach.

Projected savings of roughly 814 EUR per annum (52,920 INR) are substantial and valuable savings for inadequately funded municipal hospitals. Adopting renewable energy is a sustainable and realistic option in healthcare; the equipment requires very little maintenance and is easily monitored by hospital staff.

While inaugurating the new installations at the hospital on 31 August 2009, Ananta Narayan Jena, Mayor of Bhubaneswar, said he would recommend the BMH example in government circles to encourage its use by other primary and community health centers in the region.

The BMH project's simple structure can be easily applied in different contexts and supported by pre-existing manufacturing networks. The project's success is likely to attract the interest of local governments in a region where power shortages affect all municipally-run hospitals.

With high initial costs and a long payback period of close to 20 years, this project is easily replicated in design, but less so from a financial perspective; external financial support would be required for municipal and other public hospitals to undertake such an initiative.

Hospital made energy-efficient

The potential savings can touch Rs.1 lakh per year, says project officer

Staff Reporter

- New solar panel system installed, besides pursuance of energy-saving tips
- The expected energy saving is about 30 per cent to 35 per cent

BHUBANESWAR: Building of municipality hospital has been made energy-efficient with pursuance of several energy saving tips and installation of new solar panel system.

"The expected energy saving can be achieved at about 30 per cent to 35 per cent and the potential savings in terms of energy could touch a figure Rs.1,00,000 per year for the Bhubaneswar Municipal Corporation hospital building," said Pravat Sutar, project officer of ICLEI-South Asia, which had given solution.

In addition, the solar photovoltaic systems would ensure round the clock power backup in the common areas in case of a power failure, Mr. Sutar said. The new system was recently inaugurated.

According to a preliminary energy survey for the period January 2007 to May 2008 conducted by ICLEI, BMC hospital consumed 79703 kWh of electrical energy, which translated to an expenditure of Rs. 20.91 per square feet area and specific energy consumption of 905.71 kWh/KW.

However, the benchmark for electricity consumption per square foot per year in similar hospital buildings should be between Rs.16 to Rs.18 and the specific energy consumption should be 800 kWh/KW, he said.

Energy efficient retrofits like replacing incandescent bulbs with T5-28W FTLs and 25 W CFLs, 75W ceiling fans with 50W energy efficient ceiling fans and by installing renewable energy devices would surely bring down consumption level, Mr. Sutar said.

The project, which was supported by WISIONS, an initiative of the Wuppertal Institute for Climate, Environment and Energy (Germany), would help low-income communities avail improved municipal health services with decrease in energy costs.

Article: The Hindu, Orissa edition 3 September 2009

This article appeared shortly after the inauguration of the new equipment in the BMC Hospital.

Budgeting and finance

Of the total project cost, 17,700 EUR (1.16 million INR), 15,790 EUR (1.03 million INR) was funded by WISIONS through their SEPS (IV) grant while 1,910 EUR (125,125 INR) came from the GTZ-BMZ Local Renewables project. The total cost of the renewable energy installations amounted to 13,800 EUR, while the energy efficient fittings amounted to approximately 3,800 EUR. The energy efficient fittings were jointly funded by WISIONS and GTZ-BMZ. The hospital avoided having to hire additional personnel by training its own staff in the maintenance and operation of the equipment.

Photo: ICLEI South Asia

View of the solar panels belonging to the hospital power back up system

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

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Sources

- 'Energy Audit Report of BMC Hospital' Krishna Engineers, 2008
- 'Monitoring of the BMC Hospital: Quarter 1' Krishna Engineers, 2010
- Bhubaneswar City Energy Report 2008-09, Bhubaneswar Municipal Corporation and ICLEI SA, 2009
- Energy and Carbon Emissions Profiles of 54 South Asian Cities, ICLEI South Asia Secretariat November 2009
- 'Application of RE and EE in India's Urban Health Sector: a Case of Bhubaneswar City Health Services: First (2008), Second (2009) and Final (2010) Progress Reports' ICLEI SA, 2008
- 11th Five Year Plan: National Urban Health Mission (NUHM), Planning Commission of India, 2006

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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

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