ESMAP
Energy Sector Management Assistance Program

Energy Efficient Cities Initiative

GOOD PRACTICES IN CITY ENERGY EFFICIENCY:

Akola Municipal Corporation, India - Performance Contracting for Street Lighting Energy Efficiency

Project title	Energy Efficient Street Lighting
Sector	Public Lighting
Type of project	Performance Contracting
City and country	Akola, India
City population	443,184 (2007)
Capital cost/initial investment	INR5.7 million (US$120,000) (Estimated)
Energy reduction	2.1 million kWh (56% in annual energy savings) and INR6.4 million (US$133,000) in cost savings
Project status	Retrofit completed late 2007

Project Summary

More than 11,500 street lights (standard fluorescent, mercury vapor, sodium vapor) were replaced with efficient, T5 fluorescent tube lamps as part of the energy efficient street lighting project by Akola Municipal Corporation (AMC), an Indian Urban Local Body (ULB) in the state of Maharashtra. The project used an energy savings performance contracting approach under which the contractor, Asia Electronics Limited (AEL), financed all investment costs, implemented the project, maintained the newly-installed lamps, and received a portion of the energy savings to recover its investment. Through the project, AMC was able to improve the service level of street lighting with lower costs and lower electricity bills.

The project resulted in annual energy savings of 2.1 million kWh (56%), representing reduced electric bills for the city totaling INR (Indian Rupee) 6.4 million (US$133,000) per year. Since the total project cost was only about INR5.7 million (US$120,000), the project payback period was less than 11 months. Because the project cost was entirely financed by AEL, acting as an Energy Service Company (ESCO), AMC did not have to make any upfront investment or assume performance risks under the project. Under the energy savings performance contract (ESPC), compensation to AEL was based on a shared savings approach under which AMC paid AEL 95% of the energy bill savings over the contract's 6-year duration. AEL was also paid an annual fixed fee for maintaining the lamps and fixtures.

The project's success has already led to similar projects being implemented in the states of Maharashtra and Madhya Pradesh. AEL, the World Bank, and Government of India are also pursuing options to mobilize carbon financing under the Clean Development Mechanism (CDM) to further enhance benefits to municipalities from such projects (e.g., Pune, Latur).

1. Introduction

Akola Municipal Corporation (AMC) is located in the state of Maharashtra, India. Its population in 2007 was about 450,000. According to the Ministry of Urban Development, AMC is a "Class B" Urban Local Body (ULB)[1] with an annual budget of about INR1.2 billion (US$25 million).

Rising electricity bills for street lighting, water and sewage pumping, and public buildings is a key problem for AMC. As much as 5% of AMC's budget is spent on electricity bills. But, as with most growing cities, investment in roads, health, and education infrastructure take priority over capital expenditures for energy efficiency projects. Using an ESPC to retrofit street lighting was an attractive proposition for AMC, since the city did not need to secure funds upfront to cover the project's investment cost.

2. Project Description and Design

In 2006, AMC called for competitive bids from eligible firms (Energy Service Companies or ESCOs) to implement a street lighting retrofit project within their service territory. Bidding parameters included maintaining luminance levels on the street to 20-30 lux (unit to measure lighting intensity), per Indian Road Congress standards for street lighting.[2] Bidding documents were designed by city officials. Evaluation of bids resulted in the selection of Asia Electronics Limited (AEL), an ESCO that has been implementing a number of energy efficient street lighting projects in India.

Implementation arrangements between AMC and AEL, signed in April 2007, included the following:

1. AEL, in cooperation with AMC, developed and agreed on a measurement and verification (M&V) protocol based on Option A of the International Performance Measurement and Verification Protocol (IPMVP).[3] A definition of the baseline energy consumption was developed by metering 10% of street-lighting circuits in Akola. Metered data was then used to estimate baseline energy consumption for street lighting throughout the city.
2. AEL invested its own funds to replace the entire set of 11,518 street-lighting fittings (high-pressure sodium vapor lamps, mercury vapor lamps, and standard fluorescent tube lights) with energy-efficient, T5 fluorescent tube lamps, within a 3-month period. The number of lamps replaced is shown in Table 1.

[1] Urban Local Bodies (ULBs) of India are the constitutionally provided administrative units that provide basic infrastructure and services in cities and towns.

[2] Under the national Energy Conservation Act of 2001, its implementation agency, the Bureau of Energy Efficiency (BEE), is currently setting up guidelines for the energy efficiency performance contracting process. However, at the time of implementing the project at AMC, these guidelines had not been developed, and officials at the AMC had to develop their own bidding process.

[3] See www.evo-world.org.

Table 1. Street Lights Replaced Under Retrofit Project

Existing Lamps	Replacement Lamps	Number
250 W Sodium Vapor	4 x 24 W T5 lamps	1,965
150 W Sodium Vapor	2 x 24 W T5 lamps	97
125 W Mercury vapor	2 x 14 W T5 lamps	183
40 W Standard Fluorescent	1 x 28 W T5 lamps	9,273

3. The retrofit began in April 2007 and was completed within three months.
4. AEL and AMC staff monitored savings based on the metering of a 10% sample of lamps and used the data to estimate savings from all new lamps throughout the city.
5. The M&V process is conducted each year in the first month of the financial year. [4]
6. Per the contract between AEL and AMC, AMC shares 95% of savings with AEL and retains 5% in electricity bills. In addition to shared savings payments, AEL also receives a share in maintenance saving.
7. The ESPC's duration is 6 years.
8. Under the ESPC, AEL must replace any failed lamps and maintain a minimum lux level.

Establishing the baseline was seen as a key issue because, prior to the signing of the ESPC, not all of the existing light fittings were functional. As a result, consumption per lamp prior to the retrofitting was determined based on engineering estimates by AEL and presented to the ULB officials, who then accepted them.

3. Cost, Financing, Benefits, and Effects

Cost and financing:

Capital and Operations & Management (O&M) Costs: AMC incurred no capital investment outlays during implementation, maintaining a positive cash flow. AEL arranged for all investment needed to replace the street lights, which were estimated at about INR5.7 million (US$120,000).[5] AMC pays AEL a share of the energy savings seen from the new lamps, and also a share of savings realized from the maintenance program, amounting to INR8.25 (US$0.17) per lighting fixture per year. Annual O&M expenditures, which were paid to AEL by AMC separately, are INR1.1 million (about US$23,000).

[4] The financial year in India is April 1 to March 31.
[5] AEL did not disclose the actual investment it made.

Cost effectiveness: A project financial analysis shows a positive net present value (NPV) of INR19.4 Million (US$400,000), considering an initial investment of INR500 (US$10.42) per fitting and a discount rate of 10% applied to 6-year savings. The internal rate of return (IRR) for the project is 99%. Since AEL received 95% of the savings, its NPV (INR18 million, US$380,000) and IRR (94%) are also attractive.

Results and benefits:

Meeting project objectives: The project achieved the intended objectives of improving street lighting services while lowering energy costs. Prior to the ESPC, all existing light fittings were not functioning. With the retrofit project, the service level of street lighting was improved with fully functional lamps in place along city streets. AEL is verifying the substantial energy savings that has been achieved. In addition, AEL continues to ensure the installed T5 lamps are in use and is responsible for replacing failed lamps. Most importantly, AMC was able to reduce its electricity bills *and* improve service with no upfront investment or budgetary outlay.

Energy reduction benefits: The project resulted in an annual savings of 2.13 million kWh, representing a 55.7% savings compared to pre-project annual consumption of 3.82 million kWh. The annual electricity bill savings were INR6.4 Million (US$133,000)[6].

GHG emission reductions: The energy savings correspond to GHG reductions of 1,830 metric tons of CO_2 emissions per year[7], or a total of 10,980 metric tons of CO_2 emissions over the 6-year contract period.

Other direct benefits to AMC: The ESPC terms resulted in AMC staff being able to focus on other public priorities. Costs associated with maintaining inventory of old technology lamps (sodium and mercury vapor) have fallen since AEL assumed responsibility for ensuring fully functional lighting fixtures. AMC has also outsourced (lighting) pole maintenance to AEL, which has resulted in improved servicing of lighting fixtures and connections with the electric utility service.

Spillover effects:

The project has resulted in similar ESPCs being replicated in the states of Maharashtra and Madhya Pradesh. AEL has demonstrated its track record to other ULBs and is in the process of registering a bundled carbon finance project, supported through the World Bank Carbon Trust Fund. As a result of the AMC lighting project and other pilot ESCO projects in the state, the Urban Development Department of the Government of Maharashtra is establishing a policy related to ESPCs in efficient street lighting, water and sewage pumping, and public buildings.

4. Project Innovation

The use of the ESPC approach for street lighting retrofits represents a true innovation by AMC. While AMC and other neighboring ULBs have implemented road projects using build-own-operate (BOO) and build-own-operate-transfer (BOOT) contracts, they have

[6] Based on a tariff of INR3/kWh (US$0.0625/kWh) and an exchange rate of 1 US$ = 48 INR.
[7] Using an emissions factor of 0.8g kg of CO_2e/kWh of energy savings.

not in the past used these approaches for street lighting or other energy efficiency retrofits. The contractual innovation implemented by AMC in the street lighting contract is exemplary. Based on the success of the AMC contract in the state of Maharashtra alone, at least five more contracts have been signed by ULBs in the cities of Aurangabad, Latur and Pune, and at least three more projects in Maharashtra are at the design stage. In addition to these projects, several other states including Karnataka, Gujarat and Tamil Nadu have initiated ESPC projects in the street lighting sector.

5. Lessons Learned

Leadership shown by AMC officials taking the initiative to implement the ESPC approach was an important factor in the project's success. City officials developed the project concept, prepared and issued the bidding documents, and selected AEL as the highest ranked firm. The process and tools utilized in this project, particularly the tender and final contract, are likely to be of value to other ULBs in Maharashtra and other Indian states.

The availability of locally manufactured energy efficient T5 fluorescent tube lamps and existence of local ESCOs were also factors in the project's success. AEL is a major manufacturer of T5 lamps and showed its capacity and interest in taking on projects on a performance contracting basis. Further, AEL's ability to serve as an ESCO – that is, mobilize financing, provide turn-key services, and guarantee project performance – also made the project succeed for all parties involved.

Issues during contract negotiations included defining baseline energy consumption and the methodology used for verifying energy savings. A sampling approach using metered data from 10% of street lighting circuits was agreed and successfully implemented by AMC and AEL. Baseline development was an issue because prior to project initiation not all existing street lighting fixtures were working. To simplify the contract, AEL made additional investments to install old technology lamps in selected circuits where existing lamps were inoperative.

In other street lighting ESPCs in India, the absence of a credible and independent M&V agency had resulted in contractual disputes between some ESCOs and ULBs.[8] Since national guidelines being developed by India's Bureau of Energy Efficiency (BEE) were not yet available, AMC agreed with AEL to use measured data from a sample of 10% of street lights as the basis for calculating energy savings from all street lights.

6. Financial Sustainability, Transferability, and Scalability

From the perspective of the city government, the project is financially sustainable because it was not required to make any upfront investment in the project yet received

[8] In order to support the performance contracting in India, the BEE is currently setting up national standards for M&V and short-listing ESCOs to perform M&V services. Another program promoted in the state of Gujarat, the local implementing agency is tendering the M&V services supporting performance-based contracting in energy efficient street lighting and water pumping projects.

5% of energy savings (or about INR320,000 or US$6,700) over the 6-year life of the contract. The contractor also assumed responsibility for retrofitting and maintaining the street lights as well as replacing failed lamps.

The project was financially sustainable for the ESCO because it was able to get 95% of the energy savings as payment for its services, yielding a high positive NPV and IRR. Additional financial benefits are likely to be seen through CDM by bundling this project with several other similar projects for carbon financing.

The successful ESPC approach for municipal street lighting has led to several other projects using a similar implementation model. This model is particularly well suited for cities with inefficient street lighting equipment, high maintenance costs, low service levels, restricted budgetary resources for equipment upgrading, and a desire to lower energy costs. However, credible local or international ESCOs willing and able to perform such functions are critical, as is the public sector's willingness to try a new approach to contracting--using an ESPC.

REFERENCES

Interview with Mr. Madhav Dandavate, Assistant General Manager of Asian Electronics Limited, conducted in July 2009.

World Bank, 2009. "India Energy Efficient Street Lighting Carbon Offset Project Information Document." World Bank, April 29, 2009.

ANNEX: CITY AND PROJECT PROFILE

CITY PROFILE

1. Name of the City	**Akola**
2. Area	**India**
3. Population	**443,184**
4. Population Growth Rate	**N/A**
5. GDP of the City	**N/A**
6. GDP Growth Rate	**N/A**
7. GDP per Capita	**N/A**

PROJECT PROFILE

1. Project Title	**Energy-Efficient Street Lighting Project**
2. Sector	**Public Lighting**
3. Project Type	**Street Lighting**
4. Total Project Capital Cost	**US$ 120,000**
5. Energy/Cost Savings	**56%**
6. Internal Rate of Return	**104%**
7. Project Start Date	**April 2007**
8. Project End Date	**Ongoing energy performance contract**
9. % of Project Completed	**100%, Performance contract for 4 more years**

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