

## Smart Light LED Conversion and Wind Power

### Executive Summary (Brief Description of Proposal)

Population residing in urban areas in India, according to 1901 census, was 11.4%. This increased to 28.53% by 2001 census, crossed 30% as per 2011 census. By 2030 almost half of the population of India will reside in urban areas. Cities are responsible for 2/3 of global energy consumption and the associated GHG emissions. Therefore, ULBs are now focusing on addressing the high consumption patterns, attempting to provide better lifestyle to its citizens while keeping consumption low.

In recent years, the LED technology has been a revolutionary invention and through this, street light witnessed a paradigm shift. As they are believed to save power by almost 50%, it has changed the energy consumption pattern of street lights and has impacted longevity of the lamps.

AMC has decentralized the street lighting for all zones and the Street light Department co-ordinates all these activities, including provision of new streetlight poles on all roads. Operation & Maintenance of all the street light poles are executed mainly through contracting system.

Light department is looking after the Installation & Comprehensive maintenance of high-mast lighting system provided at various cross-road junctions or at dense public places. Under the PAN-city domain of Smart City initiative, 6000 smart lights have been installed at various location replacing age old Sodium Vapor lamps. These smart lights are equipped with an external controller which can be On/Off/Dim as per the command given and which can log all the critical parameters of the street light fixture Connected to it.

AMC has started the Energy Efficiency Cell (EE Cell) to address energy conservation issues and thereby minimizing the ever-increasing energy consumption by all possible ways with a mission of Continuous upgradation of process with energy efficient and ecofriendly technology to minimize the energy cost without effecting output in services provided by AMC.

This specialized focus on energy efficiency has also birthed projects in tapping solar and wind power for the city. AMC envisaged the benefits of renewable energy, have installed solar and wind power plants at various locations with different capacities such as Nakhatrana (KUTCH), Sardar Patel stadium, Veer Savarkar Complex, AMC offices-halls-UHCs, a step towards green and clean energy.

The Nakhatrana Wind Power projects – two in number, of 4.2MW capacity each – have led to savings of Rs. 18.97 Cr (2.91 Cr units saved) from the first project; and Rs. 10.04 Cr (1.43 Cr units saved) from the second project. The LED and renewable energy has led to cumulative savings of Rs. 75 Cr. (11.74 Cr Units saved) through Energy Efficiency.

The cost of renewables will continue to decrease with greater adoption and acceptance, especially as fossil fuel usage declines. Greater demand and adoption can spur further innovation to make renewables even more efficient, which enhances their effectiveness and the speed at which you can get large amounts of power onto the grid.

### Background and Context – Description of Problem to be addressed

India is a massive country, and as the it modernizes and urbanizes, the one challenge that will continue to concern the nation is the rising demand for power. The key is to not just to address supply and

increase investment and enhance power generation but invest in more efficient power distribution and optimize power consumption through use of efficient technology. An important component of power consumption is street lighting.

In Ahmedabad, like in most cities across the country, street lights were mostly the high-pressure sodium lamps or halide bulbs. The implementation was also unplanned and did not meet area-wise lighting needs. For instance, high traffic areas and low traffic areas have different lighting needs. Areas frequented by pedestrians also require more lighting. The lights were switched on/off at set times, with little study into the needs of the area. Very often, one noticed that the street lights stay on well past sunrise. This is because the lights are switched off based on a pre-decided time rather than lighting needs, which vary based on season and location of the city. There was a need for devising a well thought out way to prevent wastage of electricity.

A one-size-fits-all approach to street lighting resulted in inefficient deployment of power resources and ends up in wasteful use of electricity that could have been better utilized elsewhere. Poor maintenance of street lights is another problem faced by most citizens, leaving large areas without adequate lighting.

Apart from all these operational inefficiencies, the technology in use was itself a major concern. Sodium vapour lights are highly energy inefficient, are prone to failures, and have a very short life. The light intensity is also not in user control. Newer lights are more luminescent, and they lose their strength with time, effectively reducing their useful life. Comparatively, the LED offers 50-80% energy saving over Sodium Vapor Lamps, has a life of over 50,000 hours – working 10 hours a day for 13 years which is more than 5-10 times the life of a Sodium Vapour Lamp or mercury lamp and offers far higher luminosity over it. A switchover to LED is not only financially favourable but also environmentally beneficial.

The supply/energy generation side is not forgotten. There is a continuous increase in the demand for energy and associated Greenhouse Gas (GHG) emission in various sectors supporting each of the urban epicenters. With the view to reduce dependence on conventional sources of energy to meet the increasing demand, AMC have taken an initiative to switch to Renewable Energy. The focus of AMC is to reduce the increasing energy demand; and dependence on fossil fuels to meet this demand across different areas in the fast urbanizing city. With an increase in population and economic activity, urban areas face a situation where there are both gross and peak energy deficits. Renewable energy is clean, affordable, domestic, and effectively infinite. Moving beyond solar, AMC has heavily focused on setting up wind power generation capability.

## Implementation Objective – Details of Solution

Energy efficiency is of prime importance as the city embarks on path of modernization. The lack of area-wise study and implementation of street lights – which constitute a large part of the city's electricity consumption – resulted in great inefficiencies which need to be corrected. The technological advantage of LEDs over SVLs is being leveraged.

Photocells in individual lights with automatic scheduling, dimming, controllable intensity, user configurability, result in efficient use of electricity and cater to lighting needs of each area better. The areas are always adequately lit for the benefit of all citizens, and all this is achieved at lesser cost. Moreover, an advanced notification system automatically reports failure of street lights immediately. The problem of non-functional street lights is addressed in this way in a much more efficient way.

Objectives of Street Light National Programme are also aspired to:

- Mitigate climate change by implementing energy efficient LED based street lighting
- Reduce energy consumption in lighting which helps DISCOMs to manage peak demand
- Provide a sustainable service model that obviates the need for upfront capital investment as well as additional revenue expenditure to pay for procurement of LED lights
- Enhance municipal services at no upfront capital cost of municipalities

AMC envisaged the benefits of renewable energy. Two wind power projects of 4.2MW each were commissioned at Nakhatrana, one Hybrid and one Tubular type tower, with a life of 20 years each. The two have saved 2.91 Cr units and 1.43 Cr units of electricity already. The LED and renewable energy has led to cumulative savings of Rs. 75 Cr. (11.74 Cr Units saved) through Energy Efficiency.

## Scope of Implementation – Elaborate work done

AMC intended to convert all existing conventional lights in to LED lights in phase manner under energy efficiency program. West zones area's conventional lights converted into LED under Energy Saving Companies (ESCO) model. Capital Investment done by ESCO and whatever Guaranteed power saving incurred will share in the ratio of ESCO 77% and AMC 23%. AMC opted to outright the purchase of LED streetlights fittings from M/s EESL and till now 105000 nos. 18W/45W/90W/110W LED fittings have been made. New Streetlight pole installation is done as per national lightning code 2010, the lux levels and the corresponding wattages of LED replaced against conventional lights for different categories of roads. 2014 onwards, all New Supply Installations Testing and Commissioning (SITC) use LED lights instead of SVC.

Phase 1: LED installed in slum areas and societies by SITC tendering where it replaced total of 12604 nos. LED with saving of 45 lack units and 2.60 Cr Rupees

Phase 2: Sodium fittings replaced by ESCO project with installation of 9800 nos. LED where 40 lac units were saved with the saving Rs 2.40 Cr.

Moreover, AMC has converted total 1,62,000 street lights to LED lights. Under Smart City initiative, 6000 smart lights have been installed at various location replacing age-old Sodium-Vapor lamps. Further to this, the augmentation of lights with 15000 smart lights is under bid evaluation process.

AMC has also invested in two Wind Power projects, which will bring Rs. 13.5 Cr/year at full capacity. AMC envisaged the benefits of renewable energy. Two wind power projects of 4.2MW each were commissioned at Nakhatrana, one Hybrid and one Tubular type tower, with a life of 20 years each. The two have already saved 2.91 Cr units and 1.43 Cr units of electricity. The LED and renewable energy has led to cumulative savings of Rs. 75 Cr. (11.74 Cr Units saved) through Energy Efficiency.

## Innovative Characteristics of Proposal

AMC has started the Energy Efficiency Cell (EE Cell) to address energy conservation issues and thereby minimizing the ever-increasing energy consumption by all possible ways with a mission of Continuous upgradation of process with energy efficient and ecofriendly technology to minimize the energy cost without effecting output in services provided by AMC.

Under PAN-city domain of Smart City initiative 6000 smart lights have been installed at various location replacing age-old Sodium-Vapor lamps. Further to this, the augmentation of lights with 15000 smart lights is under bid evaluation process.

- Each light is equipped with a photocell, which allows automatic switch on & off depending on the ambient lighting conditions, thereby eliminating the day time energy consumption which many a times is prevalent in city infrastructure
- Smart lighting Automatically dim and schedule the lights Foreg: For e.g. 100% output from 7 to 11 pm, 80% power output from 11 pm to 1 am, 50% power output from 1 am to 4 am and again 100% output from 4 am to 6 am
- User configurable ON/OFF/DIM schedules programmed on a daily / monthly / special events basis
- Alarm Dashboard- Provide alerts & auto notifications by identifying and understanding each lamp failure immediately along with reason for failure
- The maintenance team knows upfront which parts they need to carry
- Ensures High Burning Ratio- Proactive fault redressal by improving maintenance effectiveness
- Eliminates manual night patrolling for fault finding and thus significant saving on maintenance and repair costs
- Monitor & meter Power Consumption, Burn Hours, Power Factor, Current & several other parameters at an individual light point level and allows to manage the city lighting dynamically, interactively and flexibly
- Voltage & Other Trends to monitor the infrastructure & health of city street lights
- Asset Management with Prioritization of Roads in terms of VVIP & VIP roads and generate alarms with different levels of severity

#### Smart – Monitoring through iCCC

- All Street lights are now connected to CCC and monitored at iCCC.
- In first 30 mins, each field engineer gets an alert and status on his mobile phone to check specific points for breakdown or repair
- CCC gets an alert for breakdown & repair requirement
- Citizens can also lodge complaint via SCADL's Citizen grievance redressal system
- Each complaint is resolved within 48 hours
- Citizens get an update and status of complaint via unique token number

Specifically, in case of streetlights, solar power generation has become more viable with recent developments in efficient **Photovoltaic Modules (PV)**. This has made possible the use of independent street lights that have minimal-to-no dependency on grid-based electric supply. When used with extremely low-power-consuming but high on luminosity LED bulbs, the potential power saved from grid-based supply is significant. With volume production, the per capita cost of both the solar panel and LED bulb will come down further, making the adoption even more viable.

Ahmedabad has implemented an environment friendly system to generate electricity using wind power and has specific focus on using renewable sources as an alternate energy source to cope up with ever rising city's electricity demand. Smart City Ahmedabad has successfully commissioned 4.2 MW wind power plant at Nakhatrana in Kutch (Gujrat). This wind power plant can generate and add upto 100 lakh electricity unit yearly to complement the city electricity requirement.

The Nakhatrana Wind Power projects – two in number, of 4.2MW capacity each – have led to savings of Rs. 18.97 Cr (2.91 Cr units saved) from the first project; and Rs. 10.04 Cr (1.43 Cr units saved) from the second project. Both have life of 20 years each. The LED and renewable energy has led to cumulative savings of Rs. 75 Cr. (11.74 Cr Units saved) through Energy Efficiency.

## Results – Output/Outcomes & Impacts derived from Project

- LED lights are 40-60% more energy efficient than traditional lighting technologies
- With implementation of 1,62,000 LEDs, AMC have saved 6.24 Cr units of energy (cost saving Rs 39 Cr), with more than 2000 societies and slums benefited.
- LEDs Provided better quality lighting, lower energy consumption, and reduced 29884 tons of CO2 emissions
- Brighter Roads for increased public safety and new smart look by decorative brackets. Lux Levels increased by 25% and that too with significant decrease in power consumption.
- Adjusting light brightness level in areas where more accidents or criminal activities observed
- Long Lifespan: Burned out street lights are a nuisance when driving or walking at night. Due to LED streetlighting's long lifespan, city won't have to worry about changing out bad bulbs.
- Recent studies have shown that due to the installation of bright, white LED streetlighting, crime rates have lowered. With less dark, un-illuminated pockets, people feel, and are, safer walking home late at night in comparison to when walking under traditional streetlighting.
- Other streetlight types produce light pollution in the surrounding area, but the way LED street lights work means less of pollution
- Implementation of solar and wind power projects reduced dependence on DISCOM provided electricity. Eventually, on large-scale adoption, benefits of lesser pollution, lesser depletion, cheaper energy, better public health, and so on will also be realized.
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## Replicability/Scalability of Proposal

The biggest advantage of using LED lights is it can be used anywhere in the city:

- Entire city's sodium Vapour lamps can be converted into LED lightings
- Many industries which operates 24\*7 uses high amount of electricity, LED lights lights can help such industries in reducing their electricity bills
- All the bus stations and in future metro stations can be converted into LED lightings

- Public Gardens and Libraries
- Municipal Schools and Colleges
- Stadiums, Gyms, Swimming pools and Grounds

Therefore, the utility of these new lights can be realized everywhere, and the process of putting them into place is also straightforward. The phases can be replicated and readapted to regions across the city. The feasibility of implementation is also unproblematic, for the incurred costs are offset by long term operational savings. LED lights can be used in the entire city. LED can be sized precisely to the needs, at the small and bigger scale. The costs have declined dramatically, more and more households, industries are installing LED which and they will save money over the long term.

AMC has targeted to achieve more than 50% of its entire energy requirement to be fulfilled through renewal energy by 2022.

The cost of renewables will likely continue to decrease with greater adoption and acceptance, especially as fossil fuel usage declines. Greater demand and adoption can spur further innovation to make renewables even more efficient, which enhances their effectiveness and the speed at which you can get large amounts of power onto the grid. With renewables, it is possible to have a virtuous cycle which drives increasing affordability and performance, whereas with fossil fuels we have a vicious cycle of climate change emissions, air pollution that harms and kills humans, rising seas, more severe weather, massive coral die-offs, and the contamination of air, soil, water, and food.

- Renewables are scalable is their portability and ability to fit the scale needed, no matter how small or how large.
- The renewable projects can be sized precisely to the needs, whether at the small scale where people might use diesel generators or at the gigawatt scale.
- Renewable energy costs have declined dramatically, more and more homeowners are going solar, and they will save money over the long term.
- Installing a solar power farm has very little setup time, with even the larger ones taking at most a year. The same is true of wind farms.
- Electricity produced from sunlight and wind are scalable because these sources are abundantly available and will never run out.
- Renewable energy can be employed by just about anyone at any time if they have the means to do so. Sunlight and wind are free.
- Installing solar and wind power is not nearly as dangerous as building a nuclear or coal power plant. Installing solar power and wind power farms almost never results in fatalities
- Renewable energy is more scalable and a better fit to address global warming as it doesn't carry the burden of potentially causing catastrophic damage — which also comes with sophisticated safety guards that take much time to implement, monitor, and keep up to date.