

SAARC Energy Centre

THE REPORT



**SAARC Dissemination Webinar on “Promotion of Energy Conservation in
Municipalities of SAARC”**



12 March 2019, Islamabad

Organized by
SAARC Energy Centre

March 12, 2019

SAARC Energy Centre
697, Street 43, Sector E-11/4 (NPF),
Islamabad, Pakistan
www.saarcenergy.org



Introduction

SAARC Energy Centre, (SEC) under its approved program activity for the year 2019 successfully conducted a SAARC Webinar “Promotion of Energy Conservation in Municipalities of SAARC” on Tuesday, March 12, 2019. Webinar Agenda is available at Annexure I.

2. The webinar discussed about energy consumption in municipalities & potential areas for energy savings, role of municipalities in energy conservation – International best practices, Smart Cities of the Future, Solar street lighting and Ultra LEDs for buildings. The experts during the course of the webinar suggested solutions and recommendations for effective implementation of energy conservation and efficiency techniques in municipalities.

Participation

3. The Webinar was attended by a total of 56 professionals that included delegates from Member States, representatives of Regional/International organizations, academia and the private sector. The Resource Persons from India, Bangladesh, Pakistan and Europe gave detailed presentations on government policies, existing practices, and international experience in the field of energy conservation in municipalities. The participants list is available at Annexure II.

Opening Remarks

4. Dr. Shoaib Ahmad welcomed all the delegates and participants for attending the webinar and showing keen interest. He also acknowledged the commitment and contribution of experts from the region as well as from UNEP.

5. He started with brief introduction of the Centre and its annual program activities with specific emphasis on Energy conservation and efficiency. The program activities of SEC which includes policy-based research studies, knowledge sharing events i.e., workshops, seminars, webinars, trainings, and pilot projects in all fields of Energy.

6. Dr. Shoaib apprised the participants that SAARC Member States have limited hydrocarbon resources and all of them depends on import of oils. Ever growing energy demand in SAARC Member States has been constantly exerting pressure on the oil dependence and resulting in the environmental externalities. Cities account for nearly two third of global energy use and an even larger share of energy-related carbon-dioxide emissions. In addition to other energy consuming sectors, municipalities in SAARC consumes a large chunk of energy. Thus, holds a huge potential for energy conservation and efficiency. There are many examples of cities which reduced their energy consumptions in efficient manners. Municipalities in SAARC can play an important role in this regard.

7. In the end he thanked the experts and participants for playing key role in realizing the importance of this webinar. He remarked that this webinar is just a first step, and the center shall in future; continue conducting such knowledge sharing webinars.

Technical Proceedings

8. All the presentations delivered during the webinar are available at SEC's website www.saarcenergy.org. The Experts list is available at Annexure III and Presentations at Annexure IV. A brief information on the content of the delivered presentations is as follows:

Presentation 1 – Energy consumption in Municipalities & potential areas for energy savings

Expert: Mr. Rajkiran V Bilolikar, Associate Professor, Energy Area, Administrative Staff College of India.

9. Mr. Rajkiran gave an overview of Energy consumption in Municipalities, energy consuming divisions/ departments within municipalities, potential for energy efficiency in municipalities, Indian experience, benefits and opportunities for implementing energy conservation in municipalities.

10. He mentioned that municipalities are spending large amount of their revenue on purchasing energy for providing local public services like Street lighting, water supply, sewage pumping, municipal buildings and electrical distribution. 25 % of savings can be done through cost effective actions.

11. Rajkiran informed participants that India is plagued by high operating expenses in the supply of water. Around 50% of energy costs arise only from supplying water and an estimated 4,800 million units in electricity is wasted every year due to inefficient water pumps. Whereas out of the building stock, around 66% buildings are energy inefficient. As

per energy bill is concerned, another critical area for every municipality is street lighting. India has set targets for energy efficiency to cut energy consumption by 20% to 40% (Approximately 4,800 MUs of energy savings annually). Hence avoiding the need for an additional capacity of more than 3,300 MW. Reduction of 3.9 million tons of CO₂ emissions per annum, equivalent to a monetary saving of about INR 32,000 million annually.

12. In the end, he listed down some benefits of energy efficiency in municipalities including environmental and economic benefits followed by opportunities and steps towards successful implementation of energy efficiency projects in municipalities.

Presentation 2 – Sustainable SMART Cities of Future

Expert: Mr. Shah Zulfiqar Haider, PEng, CEA, MBA, Bangladesh

13. Mr. Shah Zulfiqar started by defining smart cities in terms of society, quality of life, economy, environment mobility, and role of government. A SMART City is a SMART municipality with efficient delivery of public utilities. SMART Power Management is one of the prime requisites for a SMART City. SMART City should have smart demand management, prevents overload, maintains system serviceability, optimize infrastructure investment, and helps save electricity & benefits environment.

14. In the end he elaborated factors for sustainable development in SMART cities including use of resources and abatement of pollution within carrying capacity of nature, biodiversity & cohabitation of local residents & floating populace to be enhanced and Three “R” Reduce, Reuse & Recycle to minimize wastes and energy consumption.

Presentation 3 – Solar street lighting and Ultra LEDs for buildings - A \$ 1,000's of Millions of electricity savings for all the Municipalities of SAARC

Mr. Bruno Lafitte, United for Efficiency UAE

15. Main focus of Mr. Bruno Lafitte was on street lighting. He started with some basic terminologies and definition of relevant parameters such as luminous flux, illumination, lumens, color temperature, color rendering index, etc. Then he explained various types of street lights available in the market, their respective uses and comparison based on various parameters.

16. He further elaborated on off grid street lighting by explaining about standalone solar street lighting, its utilization, economic analysis, social, technical and economic sustainability. He also suggested some design parameters, battery technology, some assumptions and decision tools.

Wrap up and conclusion

Mr. Ihsanullah Marwat, Research Fellow (Energy Efficiency), SAARC Energy Centre

17. Mr. Marwat thanked everyone for attending the event and hoped that this webinar, will further highlight the importance of saving in energy consumption in municipalities. He

concluded that there are two broader categories, the municipalities have to focus upon, to implement energy conservation and efficiency in their operations and jurisdictions:

18. Firstly, municipalities should target their own operations and install energy efficient technologies and management interventions within municipal operations. Depending on the profile of the municipality, energy efficiency opportunities are easiest to realize in lighting interventions (particularly street and traffic light retrofits). Other major areas could be hot water systems, variable speed drive (VSD) motors for water systems, improved insulation and heat recovery.
19. To achieve these targets some standard steps could be helpful:
 - Develop an overall energy management plan outlining aims, objectives and targets for energy efficiency interventions.
 - Conduct an infrastructure and building assessment to determine which infrastructure has high electricity consumption.
 - Shortlist particular infrastructure for further investigation.
 - Conduct an energy audit on the infrastructure to determine energy efficiency potential (this could include installing a metering system).
 - Develop a business plan for assessing payback periods and potential technology interventions or management approaches.
 - Conduct a procurement process.
 - Monitor energy savings.
 - Ensure adequate stock of the new technologies in stores for maintenance purposes.
20. Second broad area of opportunities for energy efficiency is where the municipality plays a facilitator role in driving energy efficiency, both within municipal operations and the broader community. This could be through a communication focus on energy-efficient interventions, promotion of energy efficiency technology retrofits, such as an incandescent light bulb replacement programme, or a behavior-change programme, such as competitions and games.
21. He stressed that a municipal energy strategy should be developed that outlines where and how key energy saving areas will be achieved in different sectors of the economy. The strategy should also highlight how, when, and by who, these targets will be achieved. Once the strategy is in place, an internal coordinating energy committee should be established to track the implementation of the strategy.

Vote of Thanks and Closing of Webinar

Mr. Ihsanullah Marwat, Research Fellow (Energy Efficiency), SAARC Energy Centre

22. Mr. Ihsanullah Marwat, informed all the participants that the presentations will be available on SAARC Energy Centre's website (www.saarcenergy.org). He requested the participants to submit suggestions and comments to SEC for any further improvement, plus they may suggest and submit any topics of their interest to SEC for arranging future webinars. The webinar was closed with a thank you note to everyone attending the Webinar.

Program Agenda**SAARC Webinar on “Promotion of Energy Conservation in Municipalities of SAARC”*****Wednesday, 12th March 2019; 1100–1400 hrs Pakistan Standard time (PKT)***

1100 – 1110	Introduction
1110 – 1120	Opening Remarks <i>Dr. Shoaib Ahmed, Deputy Director, SAARC Energy Centre</i>
1120 – 1150	Energy consumption in Municipalities & potential areas for energy savings <i>Mr. Rajkiran V Bilolikar, Associate Professor, Energy Area, Administrative Staff College of India.</i>
1150 – 1200	Q & A session
1200 – 1230	Sustainable SMART Cities of Future <i>Mr. Shah Zulfiqar Haider, PEng, CEA, MBA, Bangladesh</i>
1230 – 1240	Q & A session
1240 – 1330	Solar street lighting and Ultra LEDs for buildings - A \$ 1,000's of Millions of electricity savings for all the Municipalities of SAARC <i>Mr. Bruno Lafitte, United for Efficiency UAE</i>
1330 – 1340	Q & A session
1340 – 1350	Conclusions and Recommendations
1350 – 1400	Closing of Webinar

Information for the participants:

1. All times mentioned in agenda are according to Pakistan Standard Time (PKT). The participants from other Member States may attend Webinar by following their own national time. The time conversion for all Member States is given below for reference:

Country	Afghanistan	Bangladesh	Bhutan	India	Maldives	Nepal	Sri Lanka
Conversion Time	(PKT-00:30)	(PKT+01:00)	(PKT+01:00)	(PKT+00:30)	PKT	(PKT+00:45)	(PKT+00:30)

2. The participants can ask questions to presenters by typing questions or clicking to the raised hand option into the Attendees pane of the main window of GotoWebinar software. You may send in your questions at any time during the presentations; we will collect these and address them during the Q&A session at the end of each presentation.

List of Participants

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List of Experts

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1.	Rajkiran V Bilolikar	Associate Professor	Energy Area, Administrative Staff College of India, Hyderabad, India.	rajkiran@asci.org.in
2.	Shah Zulfiqar Haider	General Manager	Chittagong Rural Electric Cooperative (Chittagong PBS 3), Bangladesh.	szhaider123@hotmail.com
3.	Dr. Bruno LAFITTE	Lighting and energy efficiency expert	United for Efficiency U4E, Energy, Climate and Technology Branch Economy Division UN Environment	brunolafitte@hotmail.com




Presentations Delivered During the Webinar


Presentation on “Energy consumption in Municipalities & potential areas for energy savings” by Mr. Rajkiran V Bilolikar



Administrative Staff College of India, Hyderabad

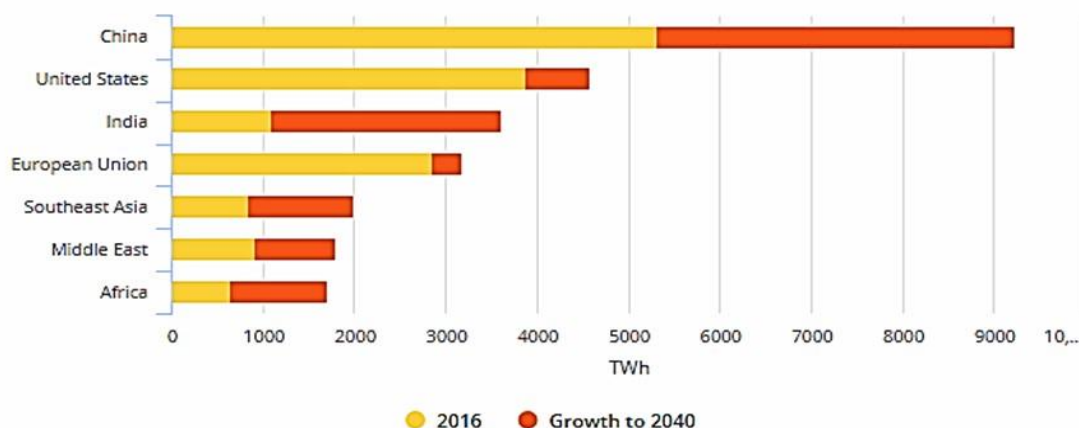
Energy Conservation in Municipalities and Potential Areas for Energy Savings



Electricity Demand across the WORLD

Electricity demand by selected region



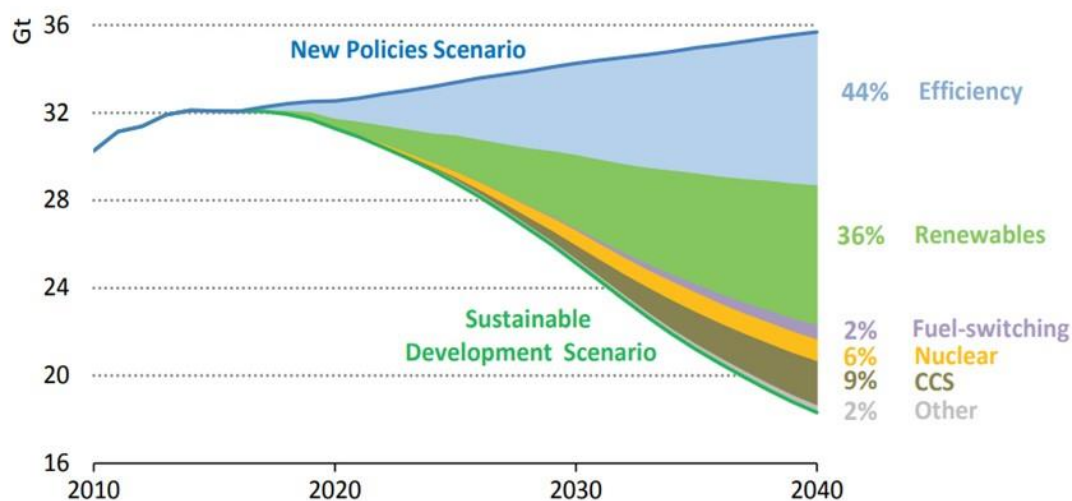
World Energy Outlook 2017, IEA



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Global carbon emissions reductions in WEO 2017 New Policies and Sustainable Development Scenarios

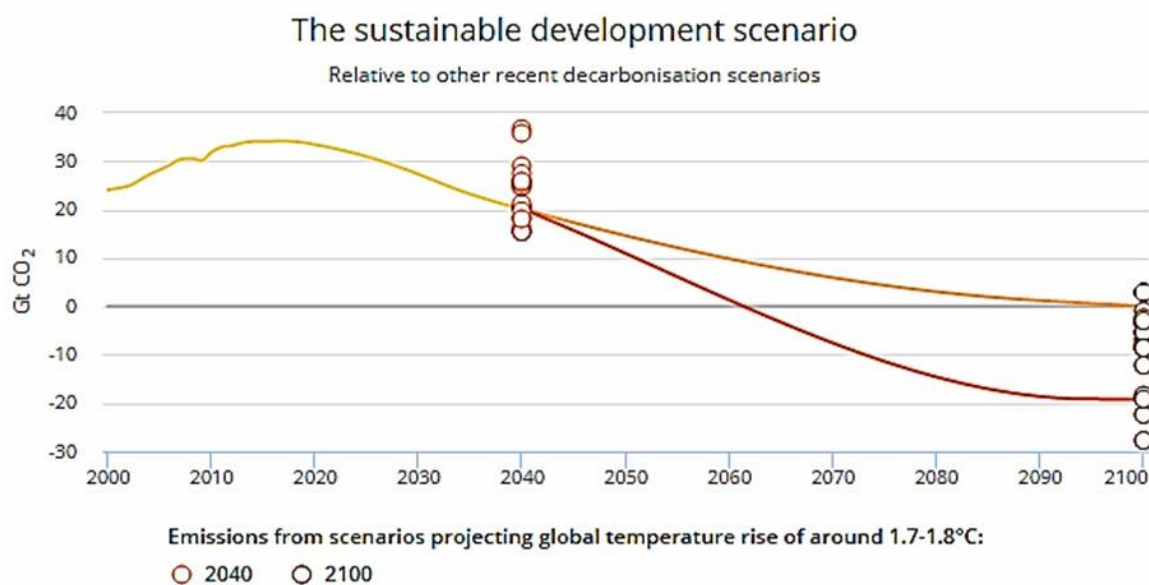


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Emissions projecting global temperature rise



World Energy Outlook 2017, IEA

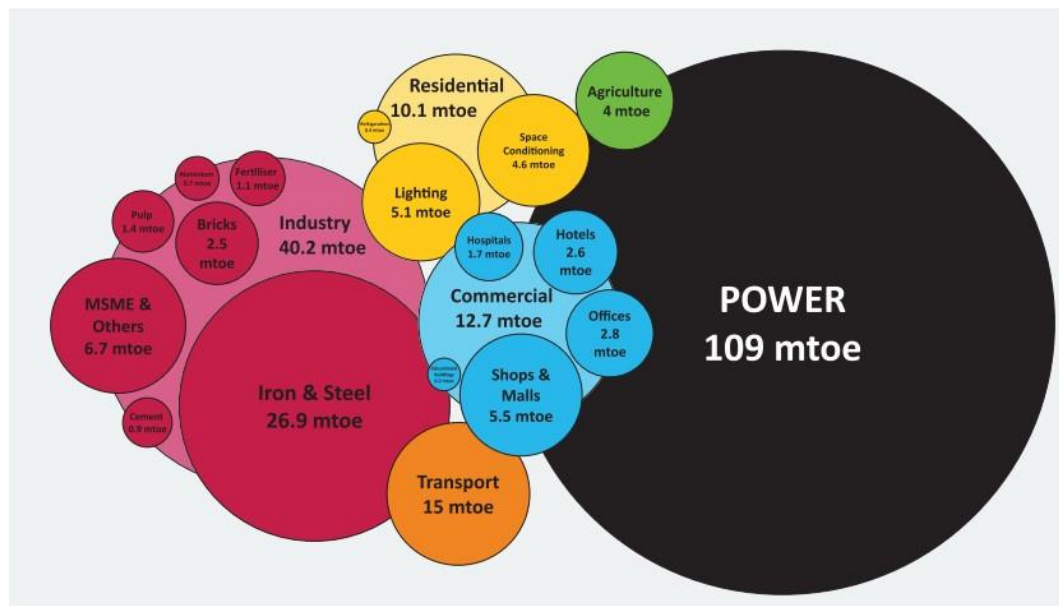


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Energy Saving Potential in India by 2031



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ENERGY EFFICIENCY



● Definition

'Energy Efficiency' means the ratio of output of performance, service, goods or energy, to input of energy

Reasons for Energy efficiency in Municipalities

- Average 4% of total electricity consumption is from Municipal Sector
- Municipalities are spending large amount of their revenue on purchasing energy for providing local public services like Street lighting, water supply, sewage pumping, Municipal buildings and Electrical distribution.
- 25 % of savings can be done through cost effective actions.

Through energy efficiency more than 100 GW additional coal capacity can be avoided until 2047



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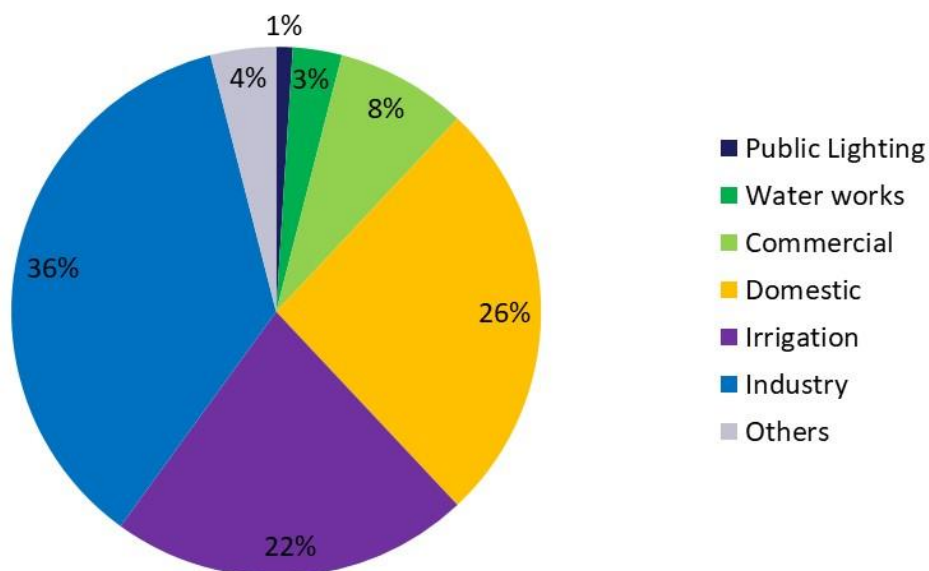
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Electricity Consumption in Different divisions



Electricity Consumption

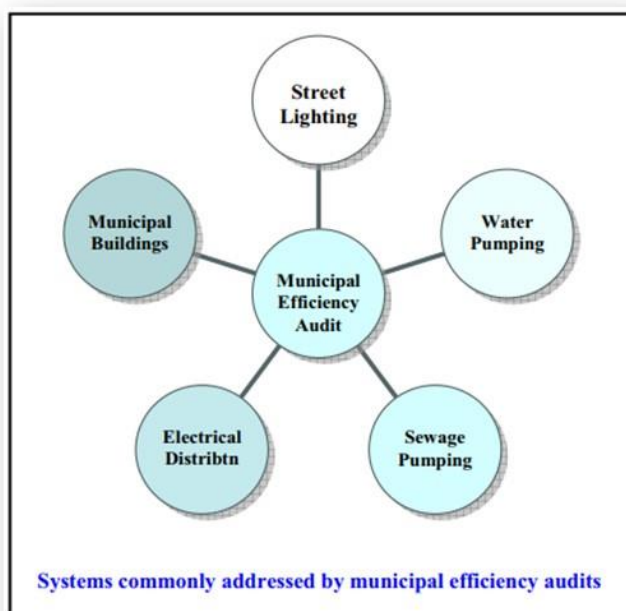


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Municipal Efficiency Opportunities



The major energy loads are typically from the following:

1. Street lighting
2. Water pumping
3. Sewage pumping
4. Electrical distribution
5. Municipal buildings



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Reasons for EE Projects in Municipalities



• Reasons for prioritizing energy efficiency projects

- India is plagued by high operating expenses in the supply of water. Anywhere between 40% to 60 % of energy costs arise only from supplying water, and an estimated 4800 million units in electricity is wasted every year due to inefficient water pumps
- 66% of the building stock in 2030 yet to be constructed according to 2010 data – Most of the buildings are energy inefficient
- Street Lighting – critical area for every municipality as per Energy Bill is concerned



• Major targets for the Energy Efficiency Projects in India

- Energy savings of 20% to 40%
- Approximately 4800 MUs of energy savings per annum
- Avoid the need for an additional capacity of more than 3300 MW
- Reduction of 3.9 million tonnes of CO₂ emissions per annum
- Monetary savings of approximately Rs 3200 Crores per annum



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Energy Efficiency Programs in INDIA



- Standards and Labeling, 2006
- Energy Conservation Building Code, 2008
- Agriculture DSM, 2010
- Municipal DSM (Street Lighting), 2015
- Capacity Building of DISCOMs
- UJALA, 2015
- Strengthening of State Designated Agency (SDAs)
- Contribution to State Energy Conservation Fund (SECF)
- Perform Achieve and Trade (PAT), 2012
- Bachat Lamp Yojana (BLY), 2010
- Super Efficient Equipment Program (SEEP), 2013
- Domestic Efficient Lighting Program (DELP), 2015
- Energy Efficient Financing Platform (EEFP)
- Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE), 2012
- Venture Capital Fund for Energy Efficiency (VCFEE), 2017



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Energy efficiency activities in Municipalities in INDIA – Through Energy Service Company



- The Municipality Demand Side Management (Mu-DSM) scheme of BEE was initiated during XI plan
 - **Objective of the project** was to improve the overall energy efficiency of the ULBs, which could lead to substantial savings in the electricity consumption, thereby resulting in cost reduction/savings for the ULBs.
- Energy Efficient Street Lighting Guidelines were issued
- The **India Energy Efficiency Scale-Up Program** will help Energy Efficiency Service Limited to expand UJALA's deployment of efficient ceiling fans, LED street lights and LED tube lights, along with successful LED bulbs procurement and distribution.
- Under the [Street Lighting National Program \(SLNP\)](#) of EESL has installed over 5.8 million LED street lights in three years across more than 500 municipalities
- EESL enters into long-term annuity agreements with municipalities to retrofit existing streetlights with LED lamps and fixtures, and maintain them for up to seven years.
- The entire investment is made upfront by EESL and recovered from the energy savings of municipalities/cities.

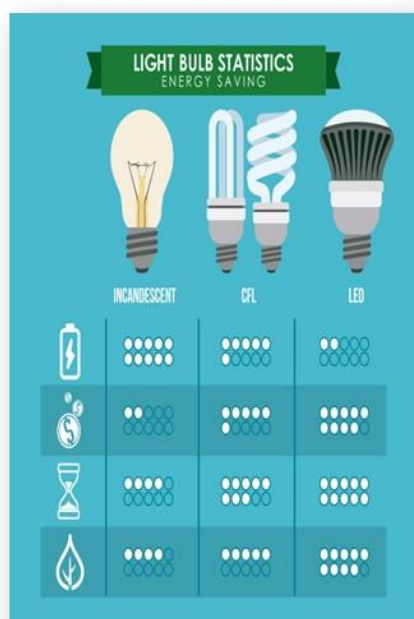


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Street lighting System



LED lighting brings a better quality of light together with over 60% average annual cost savings.

With the increased adoption of LEDs over the next 15 years will also reduce electricity demand from lighting by 62 percent, prevent 258 million metric tons of carbon emissions, and eliminate the need for 133 new power plants

Benefits:

1. The technology reduces energy consumption in comparison to the conventional high-pressure sodium (HPS) lights.
2. It also provides a significant reduction in the pollution level.



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Street lighting System - Issues in Contemporary Street Lighting



- The main reason for the poor and inefficient design of the street lighting system in any municipalities are:
 - Selection of energy inefficient equipment,
 - Poor designing practice of street lights,
 - Poor power quality,
 - Higher O & M costs, and
 - Lack of skilled labor
- Following parameters contribute to low lighting levels on the street:
 - Improper pole to pole spacing and angle of tilt
 - Inadequate or higher mounting height,
 - Interruptions due to road side trees,
 - Improper selection of lamps and fittings, and
 - Poor maintenance of the lamps (continuous dust accumulation, change in orientation, non replacement of burn out lamps, etc.)



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Designed based lighting system – Concept of lightning and non lighting materials



300 % Improvement in Service Delivery
58 % Energy Savings



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Comparison of one Km Road length (Conventional v/s Design based Lighting)



	Conventional	Design based
No.s of Poles	33	22 (33% reduction)
No.s of Luminaries	66	44 + 2 (33% reduction)
Annual KWH	77500 Kwh	51700 Kwh (33% saving)
Saving by staggering	-	(50% from conventional)
Saving by Energy saver	-	(58% from conventional)
Average Illumination	Less than 12 Lux	30/35 Lux with 40% Uniformity



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LED Street lighting and Energy Saving under SLNP



CITY	TOTAL LED STREET LIGHT INSTALLED	TOTAL ANNUAL ENERGY SAVINGS (MUs)	TOTAL PERCENTAGE SAVINGS (%)
Varanasi, Uttar Pradesh	947	1.56	71%
Jhalawar, Rajasthan	2449	0.37	55%
Mount Abu, Rajasthan	1807	0.65	60%
Visakhapatnam, Andhra Pradesh	91775	23.54	60%
Agartala, Tripura	34200	3.90	53%
Total	131178	30.02	

Source: EESL India

STREET LIGHTING NATIONAL PROGRAMME (SLNP)

Launched in 2015, EESL's Street Light National Programme (SLNP) has been instrumental in replacing over **50 lakh street lights** in **over 500 cities in India**, leading to **135 crore kWh** of energy savings and cost saving of **INR 742 crore every year**.

By 2019, SLNP aims to replace all the **1.34 crore** conventional street lights in India. This ambitious goal will make a tremendous difference, enabling peak demand reduction of **500 MW**, annual energy savings of **190 crore kWh**, and reduction in **15 lakh tons of CO₂**.



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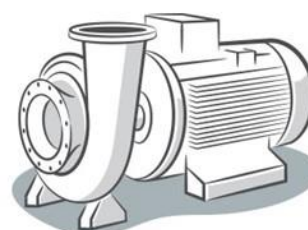


Water and Sewage Pumping



Opportunities of energy efficiency in Pumping system are as follows:

- Energy Consumption by public water works
 - 2.57% relative to total energy consumption by all sectors
 - More than 20000 million units saving potential
- Effective ways
 - Maintenance
 - Monitoring
 - Controls
 - Reduction of demand
 - More efficient pumps
 - Proper pump sizing
 - Multiple pumps for varying loads
 - Impeller trimming (or shaving sheaves)
 - Adjustable speed drives (ASDs)
 - Avoiding throttling valves
 - Proper pipe sizing



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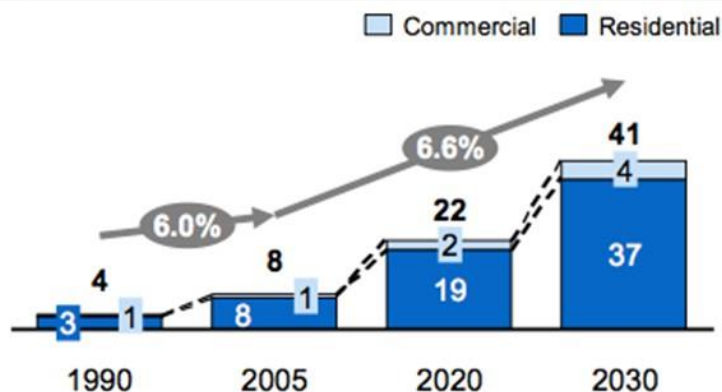


Projected Growth Across Building sector in India



Demand growth up to 2030

Total floor space
Billion square metres



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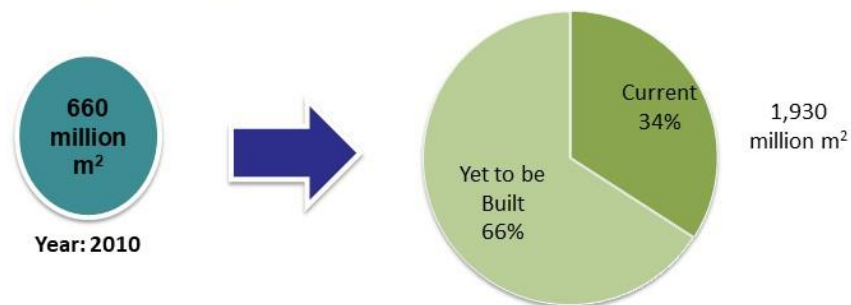


Commercial Buildings Sector in India



- Commercial Buildings Growth Forecast
- Currently, ~ 659 million m² (USAID ECO-III Internal Estimate Using MOSPI, CEA and Benchmarked Energy Use data)
- In 2030, ~ 1,900 million m² (estimated) *

66% building stock is yet to be constructed



* Assuming 5-6% Annual Growth



Source: USAID ECO- III Project, Lawrence Berkeley National Laboratory

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Energy Conservation Building Code (ECBC)



OVERVIEW

1. ECBC sets minimum energy efficiency standards for design and construction of commercial buildings
2. ECBC encourages energy efficient design of new buildings and major renovations
3. Addresses local design conditions and helps improve existing construction practices
4. Emphasis on Integrated Building Design approach
5. First generation code – ease of use and continuous improvement



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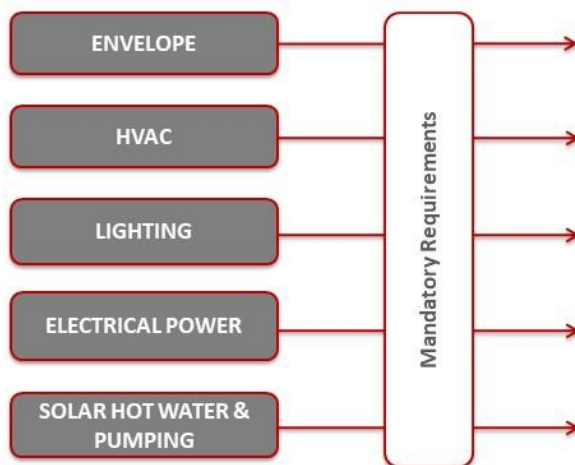
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ECBC Compliance

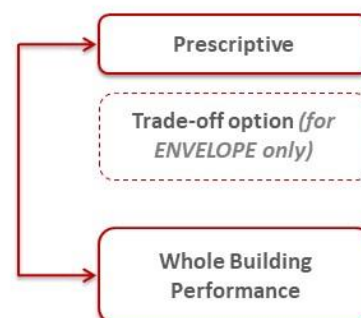


Applicable BUILDING SYSTEMS



Required for ALL
Compliance Approaches

COMPLIANCE APPROACHES

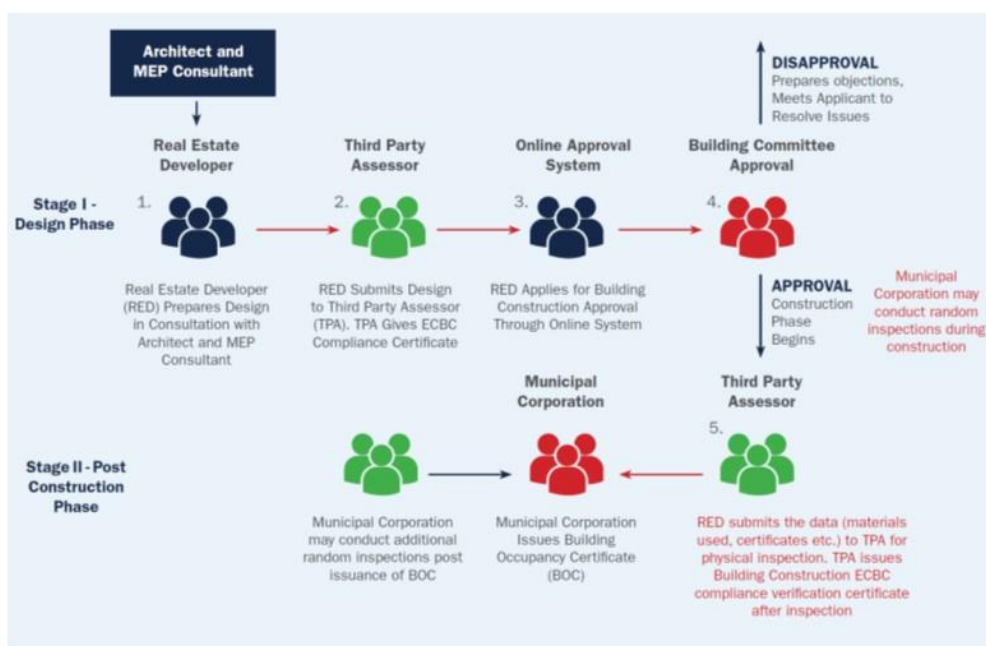


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Building approval process that includes ECBC compliance



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TPA License Format




Every empanelled Third Party Assessor shall possess the following License document.

- ✓ The license form specifies the name, address, license number and the term of the licensee with an official stamp from the GHMC.
- ✓ Each TPA will be assigned with a unique license number which will also be replicated in the Compliance Certificate.

Significance: The License enables the Third Party Assessor to scrutinize the building documents for ECBC compliance and issue the "ECBC Certificate".

It also enables the GHMC to monitor the TPAs



GREATER HYDERABAD MUNICIPAL CORPORATION

License No. _____ Year: _____

Under Bye-Law No. _____ of municipal corporation Building Bye Law, 1981, made Under section 586 read with section 622 of Hyderabad municipal corporation act, 1955 and sub section (iii) and (iv) of clause c in Rule 15 of AP Building Rules 2012, the commissioner hereby licenses.

Sri / Kum. / Smt. _____

Residing / Office at _____ Hyderabad

to be licensed **Third Party Assessor** for implementation of 'Energy Conservation Building Code' in the state of Telangana for a period of FIVE YEARS from _____ to _____

The License is not transferable to any other person and should be produced by the licensee whenever required to do so by the authority.

The licensee is bound to comply with the Code of Conduct of licensed technical personnel given overleaf.

Any failure on the part of licensee to abide by or comply with the Code of Conduct will entail cancellation of this License for five years. Further He / She will be liable for all the necessary consequences of penal action, if any, instituted against Him / Her including any civil liability.

Photo: _____

Signature of the Licensee: _____

Signature of the Licensing Authority (Office Stamp): _____

Date: _____



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TSECBC Compliance Certificate at Design Stage



Percentage of savings:

- ✓ ECBC certificate highlights the percentage savings of the building.
- ✓ The star rating is awarded based on the percentage of savings obtained from calculating the EPI.

Significance: Increases the marketability of the building.



TSECBC COMPLIANCE CERTIFICATE

LICENSEE NUMBER: 456

SILICON PLAZA, Hyderabad

has successfully achieved following level of certification established by Government of Telangana for Energy Conservation Building Code compliance

★★★★★

OCTOBER, 2017

3 STAR RATING at Design Stage

METHOD OF COMPLIANCE

☐ PRESCRIPTIVE ☒ WHOLE BUILDING PERFORMANCE ☐ BUILDING ENVELOPE TRADEOFF

GENERAL INFORMATION

Applicant Name: Rajkiran V
Address: Rajbhavan Rod, Hyderabad
Project Description: New
Project Category: Shopping Mall
Site Area: 3000 Sq.mts
Built Up Area: 6000 Sq.mts
Conditioned Area: 4000 Sq. mts.
Unconditioned Area: 2000 Sq.mts

TECHNICAL INFORMATION

Project Base case EPI : 100 kWh/m²/year
Project Existing EPI : 88 kWh/m²/year
Star Category Awarded: 3 Star Rating

Percentage of Savings
12%

Name of Licensee/Firm: Satish S Magal

Signature of the Licensee/Firm



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TSECBC Compliance Certificate at Occupancy Stage



Percentage of savings:

- ✓ ECBC certificate highlights the percentage savings of the building.
- ✓ The star rating is awarded based on the percentage of savings obtained from calculating the EPI.

Significance: Increases the marketability of the building.

TSECBC COMPLIANCE CERTIFICATE	
LICENSEE NUMBER: 456	
SILICON PLAZA, Hyderabad has successfully achieved following level of certification established by Government of Telangana for Energy Conservation Building Code compliance  OCTOBER, 2017 3 STAR RATING at Occupancy Stage	
METHOD OF COMPLIANCE	
<input type="radio"/> PRESCRIPTIVE	<input checked="" type="radio"/> WHOLE BUILDING PERFORMANCE
<input type="radio"/> BUILDING ENVELOPE TRADEOFF	
GENERAL INFORMATION	TECHNICAL INFORMATION
Applicant Name: Rajkiran V Address: Rajbhavan Rod, Hyderabad Project Description: New Project Category: Shopping Mall Site Area: 3000 Sq.mts Built Up Area: 6000 Sq.mts Conditioned Area: 4000 Sq. mts. Unconditioned Area: 2000 Sq.mts	Project Base case EPI : 100 kWh/m²/year Project Existing EPI : 88 kWh/m²/year Star Category Awarded: 3 Star Rating Percentage of Savings 12%
Name of Licensee/Firm : Satish Kumar	
Signature of the Licensee/Firm	



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GHMC - Efforts



The screenshot displays the GHMC website with a header for 'The Making of A Global City'. The main content area includes 'ONLINE SERVICES' such as Self Assessment of Property Tax, Trade License, Cell Tower (TET), Residential Welfare Association (RWA), and Fire No Objection Certificate. There are also 'Announcements' regarding Minor Water Logging Places, GHMC Area Of Hydr., Traffic Police Limits, Application Form For RWAs award, and Re-Organization of GHMC circles. A red arrow points from the text 'Expression of Interest for Empanelment of Third Party Assessors for implementation of ECBC in Telangana' to the 'Expression of Interest for Empanelment of Third Party Assessors for implementation of ECBC in Telangana' link on the website.

Expression of Interest for Empanelment of Third Party Assessors for implementation of ECBC in Telangana

FAQs on Online Compliance System for ECBC



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Benefits of Energy Efficiency



- **Environmental**
 - Increased efficiency can lower greenhouse gas (GHG) emissions and other pollutants, as well as decrease water use.
- **Economic**
 - Improving energy efficiency can lower individual utility bills, create jobs, and help stabilize electricity prices and volatility.
- **Utility System Benefits**
 - Energy efficiency can provide long-term benefits by lowering overall electricity demand, thus reducing the need to invest in new electricity generation and transmission infrastructure.
- **Risk Management**
 - Energy efficiency also helps diversify utility resource portfolios and can be a hedge against uncertainty associated with fluctuating fuel prices.



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Opportunities to improve Energy Efficiency(1/3)



- **Local Government Operations and Facilities –**
 - **Energy costs** can be a significant line item in a local government's annual operating budget.
 - By **investing in energy efficiency**, local governments can achieve substantial energy cost savings across their **facilities**, and **demonstrate energy and environmental leadership**.
 - **Improving the efficiency** of existing and new facilities, local governments can incorporate energy efficiency criteria into product procurement decisions.
- **Water and Wastewater Facilities** – Municipal water and wastewater facilities are typically the largest consumers of energy in municipal operations.
 - Improving the energy efficiency of equipment and operations at water and wastewater facilities can **reduce energy costs, GHG emissions**, and increase treatment efficiency.



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Opportunities to improve Energy Efficiency (2/3)



- **Non-Governmental Buildings –**
 - Government buildings typically account for a relatively small percentage of the total GHG emissions.
 - **Strategies** to improve the **energy efficiency** of commercial, industrial, and other non-governmental buildings allow local governments to achieve much greater benefits than by focusing on their buildings alone.
- **Residential –**
 - Helping homeowners improve energy efficiency in their homes can be an effective strategy for local governments
 - To reduce energy demand
 - To Reduce greenhouse gas emissions
 - To Increase the households savings
 - To Improve comfort



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Opportunities to improve Energy Efficiency (3/3)



- **Utilities and Energy Efficiency Program Sponsors –**
 - By working with **electric and gas utilities**, regional energy efficiency alliances, and other organizations dedicated to improving energy efficiency
 - **local governments** can leverage resources and capitalize on the expertise and unique abilities of utilities and alliances to improve energy efficiency among **end users**



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Steps for developing municipal energy efficiency projects



1. Self assessment to choose the best fit option for undertaking Energy Efficiency (EE) program
2. Collect energy usage data by carrying out a preliminary (walk-through) audit
3. Develop and issue a request for Expressions of Interest (EOI)
4. Issue of Request for Proposal (RFP)
5. Evaluate the proposals
6. Finalize ESCO selection
7. Award the Investment Grade Audit (IGA) contract
8. Package the documentation for third party financing
9. Enter into the performance contract
10. Monitoring and Verification (M&V)



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THANK YOU

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Presentation on “Sustainable SMART Cities of Future” by Mr. Shah Zulfiqar Haider

Sustainable SMART Cities of Future

SAARC Energy Center

12 March 2019

Author: Shah Zulfiqar Haider, PEng, CEA, MBA
GM, Chattogram Rural Electric Cooperative 3

Co-Authors:

Saddaf Haider

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Fahad Haider

Researcher (RE/EE), EMI Consultants, Australia



SMART City

S Specific
M Measurable
A Achievable
R Realistic
T Time related

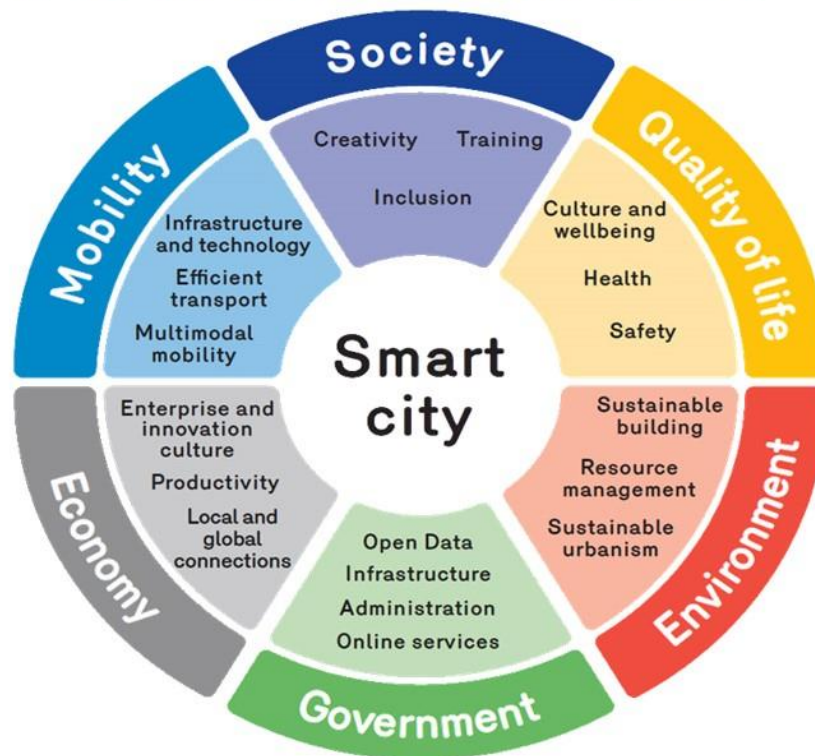
SMART – EFFICIENT TO HIGHEST LEVEL

SMART Sustainable City

**11 SUSTAINABLE CITIES
AND COMMUNITIES**



WHAT IS SMART CITY



SMART CITY

SMART City is a SMART Municipality

Efficient delivery of public utilities:

- Water
- Electricity
- Solid waste
- Sanitation & Sewerage

Mechanism for supply-demand matching:

- Surface transport services
- Congestion free roads
- Minimal waiting time

Elements of SMART City

- **Very High Speed Reliable Internet connectivity**
- **5G –Wireless Next Generation**
- **Continuous Electricity**
- **Future is SMART**
- **Future is Electric**
- **Sensor Technology**



SMART Power Management for SMART City

SMART Demand Management

Prevents Overload

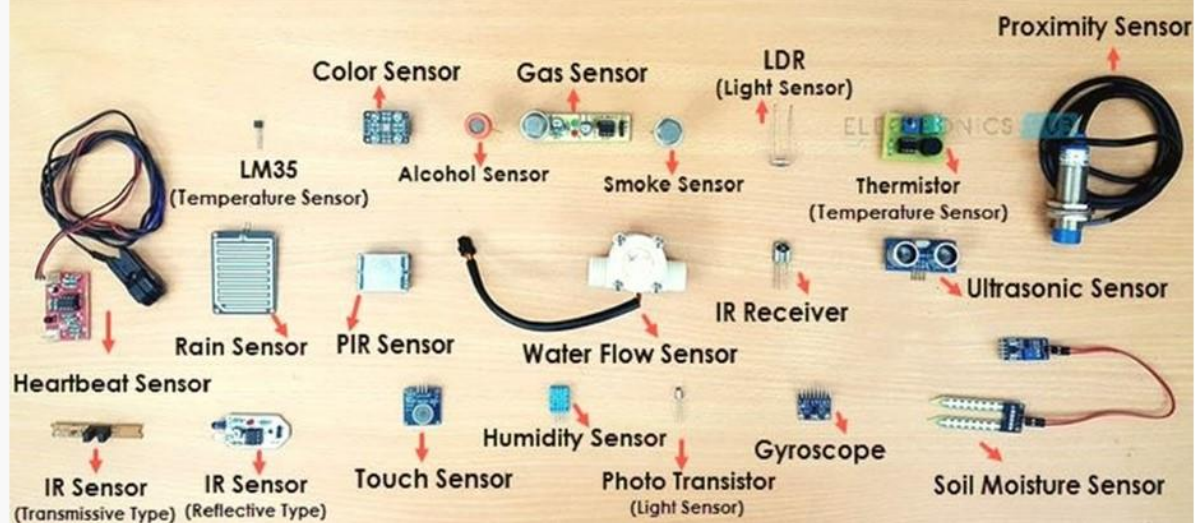
Maintains System Serviceability

Optimize Infrastructure Investment

Helps Save Electricity & benefits environment

SMART Electricity System

DIFFERENT TYPES OF SENSORS



- **SENSORS POWER SMART CITIES-HACKER'S DREAM**
- **CYBER SECURITY**
- **PRIVACY CONCERN**

SMART Shopping Malls

- **China – SMART Shopping Mall**
- **No Payment hassle – Card Identification**
- **No Theft worry by Store**
- **Further SMART Store will identify Customer & Payment through Retina Scanner**





IoT for SMART City Structure



Sustainable SMART Cities

Sustainable & Reliable Infrastructure

SMART City should be financially viable & sustainable

Develop SMART city agenda around the environmental resilience of the region.

Citizen & Government machinery positive Participation

Country's Economy & Education

**11 SUSTAINABLE CITIES
AND COMMUNITIES**



Factors for Sustainable Development in SMART Cities

Ecologically ethical utilization of natural resources

Use of resources and abatement of pollution within carrying capacity of nature

Biodiversity & Cohabitation of Local Residents & Floating Populace to be enhanced

Three “R” Reduce, Reuse & Recycle to minimize wastes and energy consumption



Our Team



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**THANK
YOU**

Presentation on “Solar street lighting and Ultra LEDs for buildings - A \$ 1,000's of Millions of electricity savings for all the Municipalities of SAARC” by Mr. Bruno Lafitte



City Street lighting

Bruno LAFITTE
United for Efficiency



2

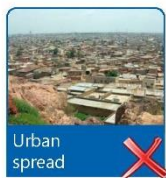
- 01 - Benefits and Warning**
- 02- Light sources**
- 03 - Luminaires and control**
- 04 - Off grid street lighting**
- 05 - A comprehensive approach**



01

Generalities

Public lighting

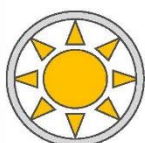


02

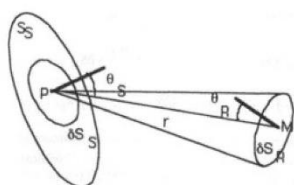
Light sources

Luminous flux

Flow of photons



Total flux
= quantity of light



lumen

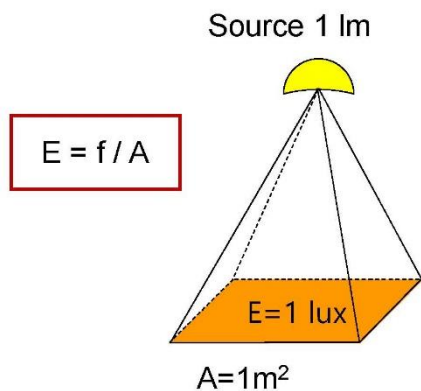
luminous flux of light produced by a light source of intensity one candela over a solid angle of one steradian



Integrating sphere

Illumination

A flux ϕ of 1 lumen arriving on a surface of surface
 $A = 1\text{m}^2$ produces an illumination of 1 lux :

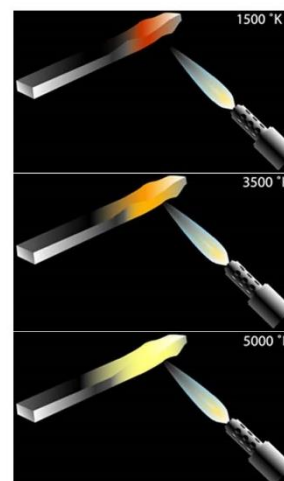
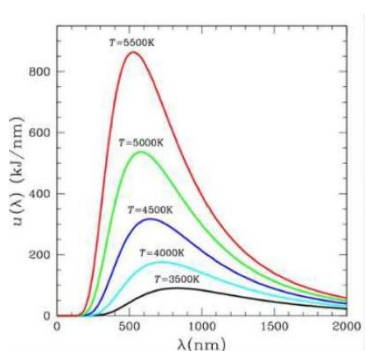


Luxmeter



Colour temperature

The colour temperature of a source is the heat of a blackbody that produce a light of a similar appearance



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Colour rendering index

Ability of a light source to keep their “real” colour to objects. Its values goes from 0 (no colour) to 100



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Low pressure sodium

Power: 18 - 180 W

Efficacy: 98 - 200 lm/W

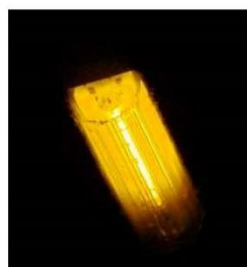
Energy efficiency: 40%

Lifetime: 12 000 - 18 000 h

CRI: N/A

Tcp: 1 700 - 1 800 K

Time to full light: 15 min



10

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High pressure sodium (HPS)

Power: 50 – 1 000 W

Efficacy: 58 - 131 lm/W

CRI: 20 - 65

Tcp: 2 000 – 2 150 K

Lifetime: 9 000 - 24 000 h

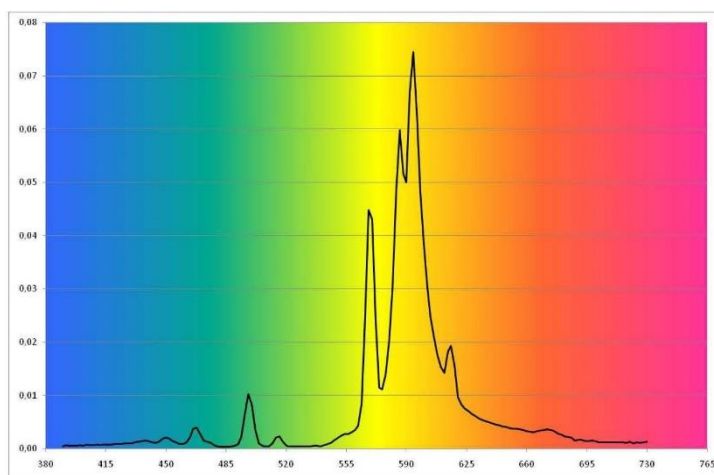


THORN



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Spectrum of HPS



Ceramic metal halides lamps (CMHL)

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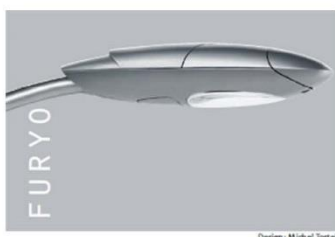
Power: 20 - 400 W

Efficacy: 70 - 115 lm/W

CRI: 86 - 95

T_{cp}: 3 000 – 4 500 K

Lifetime: 7 000 - 18 000 h



High pressure mercury lamps

14

Power : 50 - 400 W

Efficacy: 25 - 50 lm/W

CRI: 15 - 60

T_{cp}: 3 000 – 5 500 K

Lifetime: 7 000 - 20 000 h



Mixed lamps (mercury vapor)

Power: 10 - 500 W
 Efficacy: 15 - 25 lm/W
 CRI: 15 - 60
 T_{cp} : 3 000 – 5 500 K
 Lifetime: 4 000 - 5 000 h
 No control gear or starter



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Induction lamps

Without electrodes
 Power: 55, 85 et 165 W
 Efficacy: 65 - 74 lm/W
 CRI: > 80
 T_{cp} : 2 700, 3 000 et 4 000 K
 Lifetime: 60 000 h



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LED module luminaire

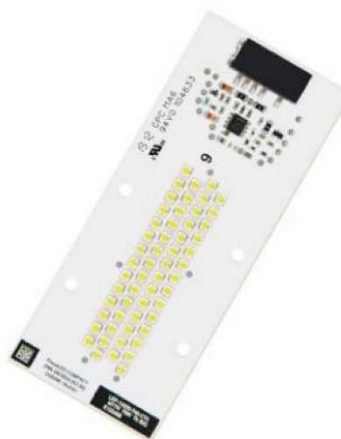
Puissance: 20 - 100 W

Efficacité: 58 - 150 lm/W

IRC: 70

Tcp: 3 000 – 5 000 K

Durée de vie: 20 000 – 100 000 h



Comparison

Technology	Efficacy max.	Lifetime max.
Low pressure sodium	200 lm/W	18 000 h
High pressure sodium	131 lm/W	24 000 h
Metal halides	115 lm/W	18 000 h
High pressure mercury	51 lm/W	20 000 h
Mixt	25 lm/W	5 000 h
Induction	74 lm/W	60 000 h
LED luminaire	150 lm/W	100 000 h



The best technology depends on flux, average

LPS : 200 lm/W for **32 000 lumens**, lifetime 18 000 h (> 4 years)

Deep
Yellow



Tunnel, industrial platforms



HPS : 130 lm/W for **33 000 lumens**, lifetime 25 000 h (> 6 years)

Clear
Yellow



Roadway lighting, higher than 8 meters



MH : 115 lm/W for **10 000 lumens**, lifetime 18 000 h (> 4 years)

White
Light



Town center, commercial areas, not higher than 6 m

LED : 120 lm/W **for every flux**, 80 000 à 100 000 h (> 20 years !)

All
colors



Everywhere !



Mercury

25 mg

HPS



60 mg

Hg HID



Mercury is dangerous, needs a dedicated recycling system.

LEDs have nor mercury and must be recycled as a WEEE.



Dark Sky Association

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Protecting the night sky starts with **YOU!**

<p>1 Light only what you need</p> 	<p>2 Use energy efficient bulbs and only as bright as you need</p> 	<p>3 Shield lights and direct them down</p> 
<p>4 Only use light when you need it</p> 	<p>5 Choose warm white light bulbs</p> 	<p>6 Join IDA!</p> <p>We need your help to continue the fight against light pollution.</p> 



03

Luminaires and control

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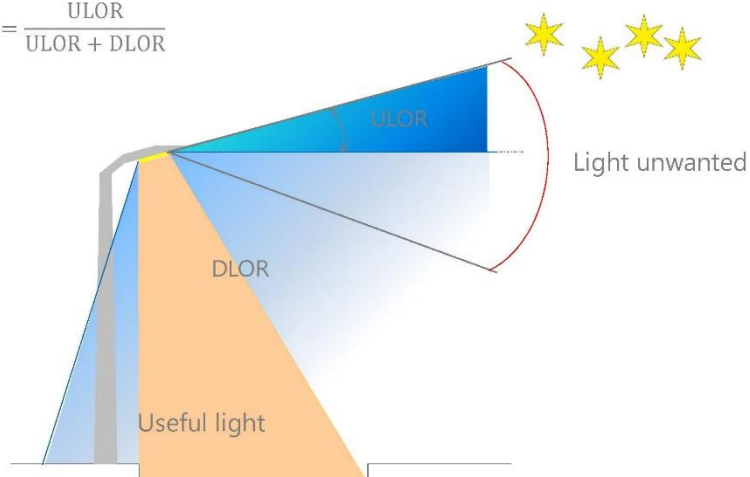
The luminaire

U.L.O.R = Upward Lumen Output Ratio
U.L.R = Upward Lumen Ratio

$$ULR = \frac{ULOR}{ULOR + DLOR}$$

Loss of energy

Light pollution



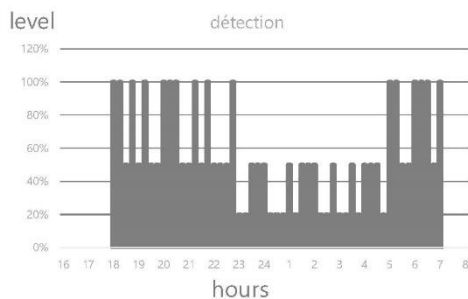
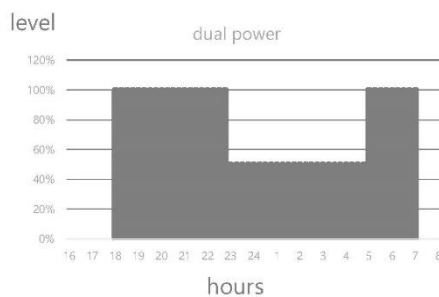
24

Dimming and presence detector

Dimming

18 h to 23 h : 100 % of flux
23 h to 5 h : 50 % of flux
5 h to 7 h : 100 %

23 % savings



+ presence sensor :

If presence 100 % or 50 % depending on time
either standby at 50 % or 20 % depending on time

42 % savings



04

Off grid Street lighting

Guide



SUMMARY	Society, financing & quality issues background
	Quality Charter for Solar Standalone Streetlights
PRELIMINARY DESIGN	Need assessment: what tools for on-site identification?
	Economic analysis: why opting for a solar streetlight project ?
FINANCIAL SETUP	Mobilization of financing: towards a mapping of stakeholders ?
	Contracts & business models: ensuring long-term investment ?
DESIGN	Writing tenders: how to guarantee organizational quality ?
	Decrypting bids : how to guarantee technical quality ?
IMPLEMENTATION	Installation : How to sustain service quality over time?
	Maintenance : how to train maintenance technicians?
	Recycling channels
EVALUATION	project evaluation: how to assess social, technical and economic sustainability ?
	Impact measurement: how to measure socio-economic impacts in face of initial objectives ?



Preliminary design

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	Main road	Passing through villages ; local roads (width 7m)	Public places
Illuminance (lux)	15 to 20	10 to 15	5 to 10
Uniformity	0,4	0,4	0,4
Duration of light at full power	5 h minimum	4 h minimum	4 h minimum
Minimum level of light when dimming	60 %	50%	30%
Light control	All luminaires together	Presence detector / extinction	Presence detector
Height of luminaire	8	6	4
Colour temperature	3 000 to 5 000 Kelvin		



Quality criteria of system, easy to check

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Criterion 1: Power of Modules in Wpeak / Luminaire Power in W :



Criterion 2: Module Power / Daily Reference Consumption :

In equatorial zone

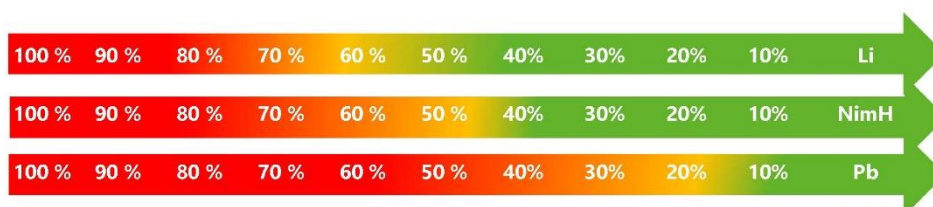


In tropical zone



Battery technology – to keep in mind !

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The only way to run a lead-acid battery is to limit the rate of cycling to 15%, which de facto condemns its economic interest



Assumption

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PV cells efficiency	15 %
Loading efficiency	90 %
Battery efficiency	95 %
% of capacity loss before maintenance	20 %
% of useful battery	90 %
Utilization factor of the PV pannel (surface / use surface)	90 %

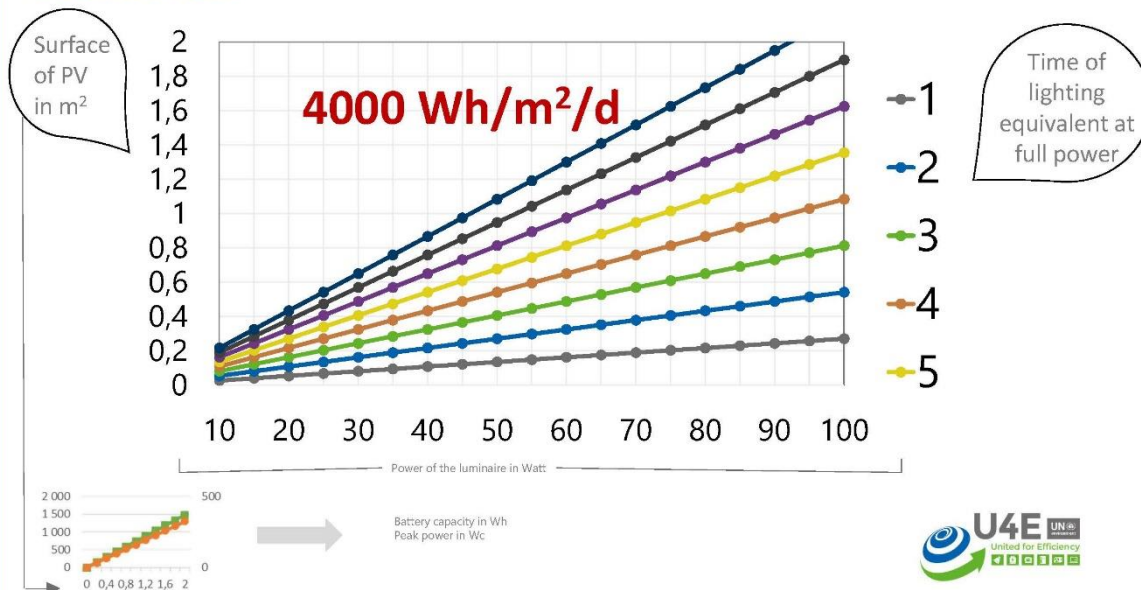
Autonomy of 3 days without loading



Decision tool

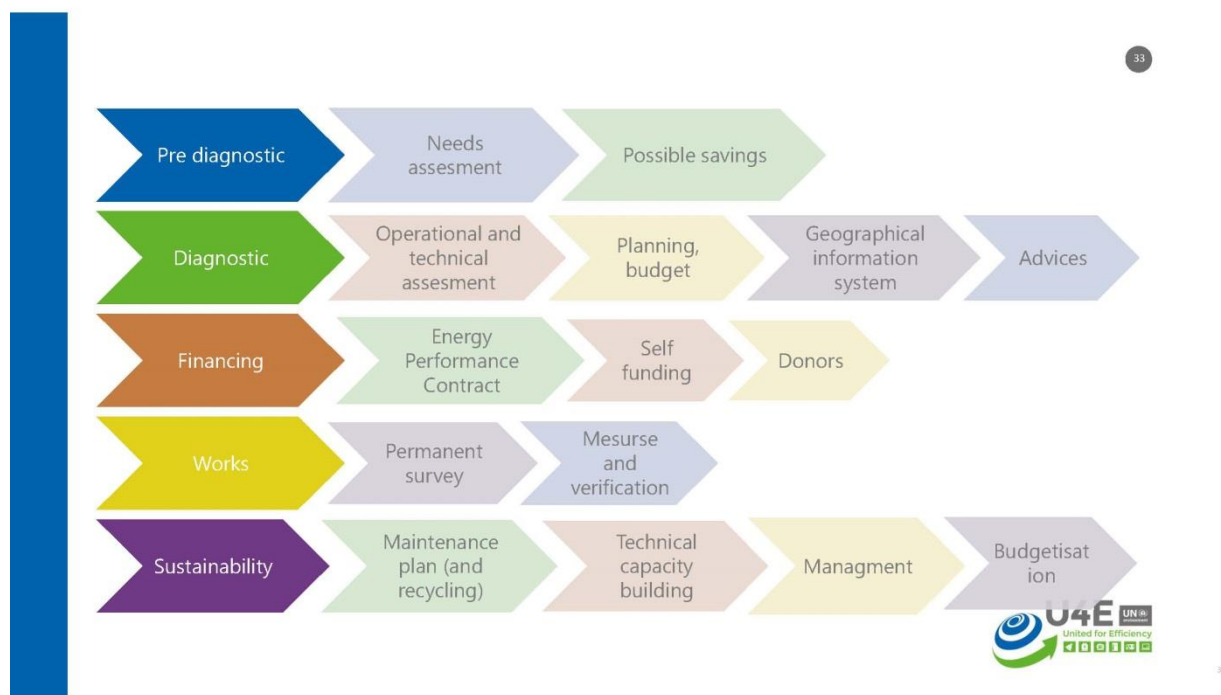
[time, power of LED] = battery capacity, peak power and surface of PV

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05

A comprehensive approach



Contact
TRANSFORMING MARKETS TO ENERGY-EFFICIENT PRODUCTS

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