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CUTTACK MUNICIPAL CORPORATION

CUTTACK - 753 009

ORDER

The 12th September 2016

No. 10202—VIII(L)-17/2011—As per the provision under Section 657, read with Sections 427 to 429 of Odisha Municipal Corporation Act, 2003 (Act 11 of 2003) as well as, as per the approval of Council of CMC and having been confirmed & approved by the Government, the following Bye-Law/Regulation is hereby notified for publication in the Extraordinary *Odisha Gazette* in the year 2016. It is pertinent to mention here that the year 2015 has already been over. Hence, the following regulation may be called as Regulations, 2016.

1. Cuttack Municipal Corporation Regulations for Lighting of Public Streets and Buildings, 2016.

THE CUTTACK MUNICIPAL CORPORATION

Regulations for Lighting of Public Streets & Buildings, 2011

In exercise of the powers conferred by Section 657, read with Sections 427 to 429 of the Odisha Municipal Corporation Act, 2003 (Act 11 of 2003), the Cuttack Municipal Corporation hereby makes the following regulations having been approved and confirmed by Government for Lighting of Public Streets & Buildings within the City of Cuttack, namely :—

CHAPTER I

PRELIMINARY

1. Short Title, Commencement and Extent.

(1) These regulations may be called the Cuttack Municipal Corporation Regulations for Lighting of Public Streets & Buildings, 2011.

(2) They shall come into force on the date of their publication in the *Odisha Gazette*.

2. Definitions.

(1) In these Bye-Laws/Regulations, unless the context otherwise requires :—

(a) "Act" means the Odisha Municipal Corporation Act, 2003

(b) "Ballasts" are required for all HID and fluorescent lamps. The ballast generally serves three functions. First , it provides the proper open circuit voltage to start the lamp. Second, it keeps the lamp operating within its design parameters. Third, it adapts the lamp to anyone of the line voltages commonly available.

(c) "City" means the City of Cuttack

(d) "Commissioner" means a Commissioner of the Cuttack Municipal Corporation

(e) "Corporation" means Cuttack Municipal Corporation (CMC)

(f) "Electric light source" is a device, which transforms electrical energy, or power (in watts), into visible electromagnetic radiation, or light (Lumens).

(g) "HID" means high intensity discharge lamps normally used in streetlighting installations

(h) "HPSV" means high pressure sodium vapor HID lamp which produce a yellowish light

(i) "Illuminance" means the amount of light or total luminous flux incident on a surface, per unit area—It is easier to measure illuminance than luminance.

(j) Lamp Dimming Systems : There are three types of lamp dimming systems in line voltage, as follows :—

(i) Step-level line voltage dimming circuits work by changing the applied voltage in the streetlighting system. A variable voltage low loss transformer is installed at switching points and has timer control and a power factor correcting mechanism.

(ii) Bi-level dimming electronically modifies the input voltage into low or high near the lamp by employing electronic low or high frequency switching circuits.

CONTENTS

(iii) Continuous dimming systems reduce the line voltage continuously through variable step transformers/variable reactors/wave choppers using electronic circuits.

(k) "LED" means light-emitting diode technology used in masthead LED lighting

(l) "Luminaire" is defined as a complete unit consisting of a lamp together with the parts designed to distribute the light, to position and protect the lamp, and to connect the lamp to the power supply, Components that make up a luminaire include the reflector, the refractor , and the housing. Luminaires are classified into three categories according to the degree of glare (BIS, 1981):—

(i) Cut-off luminaire : A luminaire whose light distribution is characterized by rapid reduction of luminous intensity in the region between about 80^0 and the horizontal. The direction of maximum intensity may vary but should be below 65°. The principal advantage of the cut-off system is the reduction of glare.

(ii) Semi-cut-off luminaire: A luminaire whose light distribution is characterized by a less severe reduction in the intensity in the region of 80° to 90°. The direction of maximum intensity may vary but should be below 75°. The principal advantage of the semi-cut-off system is a greater flexibility in sitting.

(iii) Non-cut-off luminaire : A luminaire where there is no limitation on light distribution at any angle. This luminaire is permissible when a certain amount of glare may be accepted (when daytime appearance of the street is important) and when the luminaires are large and have reduced brightness.

(m) "Luminance" means the intensity of light, or the amount of light per unit area of its source travelling in a particular direction.

(n) "Luminous Efficacy" The rate of converting electrical energy into visible light is called "luminous efficacy" and is measured in lumens per watt.

(o) "MH" means metal halide HID lamp. MH lamps are the most frequently used alternative to HPSV in new installations.

(p) "MV" means mercury vapor HID lamp

(q) "New Installation" means & involves removing existing streetlighting and installing new equipment, or designing and installing a completely new system where streetlighting did not previously exist.

(r) "Outreach'' is the horizontal distance between the center of the column and the center of the luminaire and is usually determined for architectural aesthetic considerations.

(s) "Overhang" is the horizontal distance between the center of a luminaire mounted on a bracket and the adjacent edge of a carriageway.

(t) "Prescribed" means as prescribed in these regulations

(u) ''Retrofitting'' means a change or addition to the existing streetlight pole location generally for efficiency improvements or energy and maintenance savings. For example, sometimes it is necessary to retrofit or replace luminaires or a pole— e.g., in cases where light is not distributed correctly, or where a pole has been damaged.

(v) "Sitting of Luminaires" means and includes fundamental types of site arrangements recognized in streetlighting as per BIS, 1981, as follows :—

(i) Single side arrangement : Where all the luminaires are on one side of the road

(ii) Staggered arrangement : Where the luminaires are placed on either side of the road in a zigzag formation.

(iii) Opposite mounting : Where the luminaires are situated on either side of the road opposite to one another.

(iv) Axial mounting : Where the luminaires are placed along the axis of the road.

(w) "Spacing" is the distance, measured along the center line of the road, between successive luminaries in an installation.

(x) "Schedule" means schedule appended to these regulation.

(2) Words and expressions used in these regulations but not expressly defined herein shall have the meanings as respectively assigned to them in the Act or the Rules made thereunder.

CHAPTER II

Lighting Requirements in Streets

3. BIS Guidelines for lighting: Guidelines for lighting of public streets, roads and highways as provided in the Indian Standard (BIS, 1981) and/or Bureau of Indian Standards (BIS) Code of Practice for lighting of public thoroughfares, as it exists or is updated from time to time shall be followed by the Corporation for an energy efficient streetlighting system.

Explanation: A well-designed. energy-efficient streetlighting system should permit users to travel at night with good visibility, in safety and comfort, while reducing energy use and costs and enhancing the appearance of the neighbourhood.

4. For designing or making changes in streetlighting based on the light requirements of the road, the Corporation shall match the category of road with the streetlighting classification in the Indian Standard (BIS, 1981) based on the traffic density of the road as provided in Schedule 1; and shall then design & provide installation specifications for the concerned streetlighting system. However, it is important to identify the needs and lighting requirements for the particular road since it may have different features.

5. Retrofit or New Installation: Decisions as to whether new design and installation of street lighting is required, or whether project goals can be accomplished by retrofitting the existing lighting system, shall be based on the purpose and lighting requirements of the roadway as well as the age of the existing lighting infrastructure :—

(a) To retrofit existing streetlighting, it shall be determined whether existing poles can be used with replacement of only the luminaires or if the ground needs to be dug up to construct new bases and trenches for laying cables.

(b) If a main street improvement project is planned, new poles and lighting fixtures may be the best option for the most effective energy-efficient design of the streetlighting system.

6. Technical Assessment of Streetlighting Technologies for Energy Efficiency : Lighting components can be grouped based on their functions. They are generally described as the structural systems, electrical systems and optical systems. The items covered include :

Electrical

- Lamps
- Ballasts
- Service Cabinets (fuse box)

Optical

- Luminaires

Structural

- Poles
- Pole Bases (foundations)

All systems for lighting under the Corporation shall be designed to minimize life-cycle cost, while meeting lighting requirements (e.g. minimum illuminance requirements to ensure proper functioning and safety of users). To achieve an effective energy-efficient design, the Corporation shall make proper technical assessment to select the proper lamp/ballast combination (i.e. electrical system) that produces high lumens per watt (i.e. optical system) together with fixtures (i.e. the structural system) that meet design requirements and minimize glare, light trespass and light pollution.

CHAPTER III

Design & Procurement of Energy-Efficient Streetlighting Systems

7. The Corporation shall take into account Schedule 2 relating to features & benefits for designing effcetive energy efficient streetlighting systems. In order to properly design new lighting schemes, the Corporation shall consider the appropriateness and effectiveness of the various energy-efficient streetlighting technologies and systems for different situations. Streetlighting technology and design decisions should be based on meeting local lighting requirements while achieving maximum energy efficiency. Decisions about lighting systems also should take into account the relative importance in each situation of such characteristics as lamp efficacy, good colour rendering, and light distribution of different types of lamps.

In addition to these criteria, other considerations may also be taken into account in streetlighting system design decisions as follows :—

(i) Lighting controls such as dimming systems which can result in significant energy savings but are not appropriate for every application;

(ii) operations maintenance and replacement costs; and

(iii) ease of use for each technology option also needs to be considered carefully :

Provided, the design of a streetlighting system must be appropriate for the site and should provide the level of illumination (lux) and uniformity of light specified in the Indian Standard (BIS. 1981 or as updated from time to time).

8. **Specification for determination of design and/or procurement :** In addition to the above, the Corporation shall take account of specifications as follows for determination of the design or procurement of streetlighting system :—

(a) Lamp Technology & Selection : The Corporation shall take account of the commonly used types of lamps for streetlighting as provided in Schedule 3 with their various features to select the required lamp technology for the given situtation. While the luminance on the road surface can vary widely and still provide the required performance, the measurement of illuminance can still be used as a benchmark indicator to signal required lamp replacement or cleaning.

(b) Streeetlight Poles : Swage (insertion) type steel tubular poles are used for street-lighting and the specification for streetlighting poles as explained in Indian Standard (BIS, 1980) shall be adopted by the Corporation with its modifications, if any, from time to time. The present specifications as listed in Schedule 4 shall be taken account of by the Corporation for designing streetlighting system.

(c) Mounting Height of Luminaires : The optimum mounting height shall be chosen by taking into account the light output of the sources, the light distribution of the luminaires and the geometry of installation. The mounting height should be greater for more powerful lamps to avoid excessive glare (BIS, 1981). The Coporation's decision or design of mounting height of luminaires shall be in consonance with Schedule 5, which shows the mounting heights recommended by the Indian Standard.

(d) Spacing : To preserve longitudinal uniformity, the space-height ratio should generally be greater than three.

(e) Outreach : To be determined for architectural aesthetic considerations of the Corporation wherever necessary.

(f) Overhang : In general overhang shall not exceed one-fourth of the mounting height to avoid reduced visibility of curbs obstracles and footpaths.

(g) Luminaires : Lighting energy efficiency is a function of both the light source (the light "bulb" or lamp) and the fixture, including necessary controls power supplies other electronics and optical elements for which, the Corporation shall ensure luminaire efficiency cut-off and glare control to guarantee the right level of lighting while avoiding light pollution. The specification for selection of streetlighting luminaires has been provided in IS 10322 Part I to Part V (BIS, 1981), which shall be adopted by the Corporation, with or without modifications as it stands from time to time.

(h) Siting of Luminaires : Recommended norms or specifications for the four fundamental types of siting arrangements as recognized in streetlighting (BIS, 1981) shall be taken into account by the Corporation, which may be subject to any change in the said standard :—

(a) Single side arrangement : This is recommended only when the width of the road is equal to or less than the mounting height.

(b) Staggered arrangement : This is recommended when the road width is 1 to 1.5 times that of the mounting height.

(c) Opposite mounting : This is advisable for road widths more than 1.5 times that of the mounting height.

(d) Axial mounting : This is recommended for narrow roads the width of which does not exceed the mounting height.

(i) Level of illumination : Recommended levels of illumination for streetlighting related to different roads/streets as enumerated in Schedule 6 shall be adopted by the Corporation subject to any new guidelines for the same by BIS from time to time.

(j) Dimming Systems : It shall be used with caution by the Corporation although the use of dimming systems yields considerable energy savings and represents a financially justified investment so as not to compromise the visibility & safety of traffic :—

(i) General : The use of dimming systems for streetlighting is recommended when the supply voltage exceeds 220 V. This typically occurs between late night and early morning hours when traffic density is significantly reduced during which period the Corporation may use any of the dimming systems as defined in these regulations as applicable, or any other new energy-efficient dimming system which may be appropriate in the given conditions.

(ii) Dimming High Intensity Discharge Lamps : The exact performance of any HID dimming system or lamp on the system is dependent on the specific dimming circuitry employed with specific ballasts and lamps. As there are few existing standards for the dimming of HID lighting systems it is recommended that the user and lighting designer evaluate any new proposed combination of components as a system and test it in the field to ensure that the combined performance of the system is acceptable.

9. **Procurement :** The Corporation shall stipulate energy efficiency as a requirement in procurement of street lighting equipment and incorporate energy efficiency specifications in the procurement tender or bid document/contract, and specify minimum technical specifications such as lumen output, lumen maintenance and life of lamp for the lamp as mentioned below :

A. Lamp :

(a) Wattage

(b) Luminous flux

(c) Lumen/Watt

(d) Average burning life

B. Luminaires :

(a) Symmetrical light distribution

(b) Cutoff angle

(c) Quality of reflector

(d) Ingress protection

10. The Corporation's streetlighting tender(s) shall give a thorough description of what functional demands should be addressed in a lighting installation to enable selection of the best total solution. In terms of both investment and operation & maintenance (O&M) costs. The life-cycle cost of the products and alternatives must be calculated and presented to provide a holistic view of the project and its future cost.

11. Lamp and Luminaire Depreciation Factors : In determining the light output for a luminaire the lighting system designer of the Corporation must consider the luminaire light loss factor. The luminaire light loss factor is a combination of several factors including the Lamp Lumen Depreciation factor and the Lamp Dirt Depreciation factor. The loss factor is applied to the light output of a new luminaire (initial light output) to determine the light output of the luminaire after a fixed period of time. This shall be considered during procurement to reduce maintenance cost.

12. The Corporation may make use of alternative renewable energy such as solar energy etc. wherever feasible for the purpose of lighting of streets and buildings.

CHAPTER IV

Operation & Maintenance of Streetlight

13. The Corporation shall make every endeavour to reduce energy consumption for street-lighting by incorporating good maintenance practices. The Corporation Engineer shall oversee the following on a regular basis at intervals as may be determined by the Corporation from time to time :

(a) Replacing defective lamps, accessories and wires

(b) Early rectification of cables faults

(c) Making sure that cables are joined properly

(d) Regular maintenance of service cabinet/fuse box to avoid loose connections

(e) Regular cleaning of the luminaire cover to keep it free of dust/dirt and increase light outpput.

Notwithstanding the above, the Corporation may also incorporate practice of substantial amount of energy savings by installing mechanical/electronic timers and/or daylight sensors for turning steetlights on and off, wherever feasible.

CHAPTER V

Metering & Monitoring

14. The Corporation shall undertake proper metering in streetlighting system to properly monitor the performance of the system and energy use, and measure and verify the energy savings in case the system needs to be updated.

15. Defective meters shall be replaced immediately to avoid average billing by Electricity Boards.

16. The Corporation shall, wherever feasible, use advanced technologies like remote monitoring of switching points in streetlights and utilize the same to record information such as :

(a) Instant energy consumption

(b) Trend analysis

(c) Patterns of energy consumption

These can then be used to identify and analyze reasons for increases or decreases in energy consumption, and accordingly the Corporation shall plan and design future installations for equitable distribution of lighting in consonance with need & necessity.

CHAPTER VI

Measurement & Verification (M&V)

17. The Corporation's streetlighting projects shall be energy-efficiency projects covering energy efficiency retrofits, load shifting load shedding, controls and automation, or combinations thereof to achieve reduced energy consumption and result in demand and cost savings.

18. The Corporation's objective of M & V shall be to provide a credible, transparent, and replicable process that can be used to quantify and asses the impacts and sustainability of implemented energy-efficiency projects.

19. The basic principle in M & V shall be to compare the measured electricity consumption and demand before and after implementation to determine the electricity savings which is demonstrated in the International Performance Measurement & Verification Protocol (IPMVP)'s equation below.

Electricity Saving=(Pre-implementation electricity use)—(Post-implementation electricity use)=Adjustments.

Explanation : The pre-implementation electricity use conditions are described as the baseline. The baseline represents the electricity use linked to a set of conditions under which the streetlighting system was operating prior to implementation. These baseline details should include baseline period, baseline energy consumption, and demand data, and all independent variables data coinciding with the energy data (e.g., operating hours, agreed burn-out rate, project boundary). If the aforementioned factors remain unchanged the post-implementation electricity use can be directly compared without any adjustment. However, baseline adjustments are necessary to bring the two time periods under the same set of operational conditions (if any of the pre-implementation conditions changed). Therefore, adjustments are made to restate baseline electricity use under post-implementation conditions. In order to determine the savings, it is essential to establish a post-implementation energy usage scenario if the efficiency intervention had not taken place. The baseline documentation typically requires well-documented audits surveys, inspections, and/or short-term metering activities. The extent of this information is determined by the measurement boundary chosen for the projects.

20. The Corporation shall use any of the M & V options (Schedule 7) as and where applicable to determine the savings from the energy conservation measures, which in effect would help effective design and implementation of energy efficiency streetlighting systems.

CHAPTER VII

Energy Conservation in Existing Building/ New Building Construction

21. The following guidelines are given to achieve the efficient, optimal and saving in the electrical energy in all public buildings including those constructed for the Corporation :—

(a) All traffic signal lights, blinkers, should be based on LED only

(b) The power requirement of Signage/Advertisement signage on buildings and road should not exceed 5 Watts/Sq. ft. for internally illuminated signage and 2.5 Watts/ Sq. ft. for externally illuminated signage.

(c) No. of electrical point should be kept minimum as per requirement

(d) Ornamental electrical poles should not be used for campus lighting conventional type tubular poles should be used.

(e) Incandescent lamps and conventional choke should not be used

(f) Defective incandescent lamps and chokes should be replaced by only Compact Fluorescent Lamps (CFL) and electronic chokes which saves 35% energy.

(g) Campus/streetlighting /facade lighting should be linear controlled switch arrangement

(h) All new buildings to be constructed should incorporate energy building design concept, computer energy simulation software like e-QUEST, energy plus etc. including renewable enegy technologies.

(i) Metal halide/Induction lamps should be used in outdoor lighting in place of mercury/ sodium vapor lamp for high illumination level.

(j) Orientation of building should be such that maximum daylight illumination is achieved in place of electric illumination.

(k) Power factor for electric supply should be kept near unity with the use of capacitor bank (APFC Panel).

(l) Interior of building should have light color painted for effective daylighting

(m) Rooftop of building should have roof insulation/reflective tiles to bring down the temperature

(n) All electric points should be switched off when there is nobody in the room

(o) Everyone should avoid lights ON & OFF frequently. This affects the lifespan of the lamps

(p) Meeting Hall/Conference Hall and Staff Rooms should have motion detector or occupancy sensors.

CHAPTER VIII

OFFENCES & PENALTY

22. Without prejudice to any other penalty which may be imposed under the Chapter XXVI & Section 429 of Act for any acts under Sections 428 & 429, any person contravening any provisions of these regulations shall be subject to Section 658 of the Act.

Schedule 1

Classification of Roads (BIS, 1981)

Group	Description
A1	For very important routes with rapid and dense traffic where the only considerations are the safety and speed of the traffic and the comfort of drivers.
A2	For main roads with considerable mixed traffic like main city streets, arterial roads and thoroughfares.
B1	For secondary roads with considerable traffic such as local traffic routs and shopping streets.
B2	For secondary roads with light traffic
C	For residential and unclassified roads not included in the previous groups
D	For bridges and flyovers
E	For towns and city centers
F	For roads with special requirements such as roads near airports and railways

Schedule 2

Lamp Technology

Type of Lamp	Luminous Efficacy (lm/W)	Color Rendering Properties	Lamp life in Hrs.	REMARKS
(1)	(2)	(3)	(4)	(5)
High Pressure Mercury Vapor (MV)	35-65	Fair	10,000-15,000	High energy use, poor lamp life.
Metal Halide (MH)	70-130	Excellent	8,000-12,000	High luminous efficacy, poor lamp life.
High Pressure Sodium Vapor (HPSV)	50-150	Fair	15,000-24,000	Energy-efficient, poor color rendering.
Low Pressure Sodium Vapor	100-190	Very Poor	18,000-24,000	Energy-efficient, very poor color rendering.
Low Pressure Mercury Fluorescent Tubular Lamp (T12 &T8)	30-90	Good	5,000-10,000	Poor lamp life, medium energy use, only available in low wattages.
Energy-efficient Fluorescent Tubular Lamp (T5)	100-120	Very Good	15,000-20,000	Energy-efficient, long lamp life, only available in low wattages.
Light Emitting Diode (LED)	70-160	Good	40,000-90,000	High energy savings, low maintenance, long life, no mercury. High investment cost, nascent technology.

Schedule 3

Effective Energy-efficient Streetlighting System

Features	Benefits
Proper pole height and spacing	Provides uniform light distribution which improves appearance for safety and security.
	Meets recommended light levels
	Minimizes the number of poles, reducing energy and maintenance costs.

Proper luminaire aesthetics	Blends in with the surroundings
High lamp efficacy and luminaire efficiency	Minimizes energy cost
Life of the luminaire and other components	Reduces lamp replacement costs
Cost effectiveness	Lowers operating cost
High lumen maintenance	Reduces lamp replacement costs
Good color rendering	Helps object appear more natural and pleasing to the public. Allows better recognition of the environment, improves security.
Short lamp restrike	Allows the lamp to quickly come back after a power interruption.
Proper light distribution	Provides required light on the roads and walkways
Proper cut-off	Provides adequate optical control to minimize light pollution.
Minimizing light pollution and glare	Reduces energy use
Automatic shut-off	Saves energy and maintenance costs by turning lamps off when not needed.

Schedule 4

Specifications for Streetlighting Poles (BIS, 1981)

Section	Overall length 11m+25mm (base plate)			Overall length 9.5m+25 mm (base plate)		
	Outside Dia (mm)	Thickness (mm)	Length (mm)	Outside Dia (mm)	Thickness (mm)	Length (mm)
Bottom section	139.7	4.85	5600	165.1	4.85	5000
Middle section	114.3	4.5	2700	139.7	4.5	2250
Top section	88.9	3.25	2700	114.3	3.65	2250
Planting depth	1800mm			1800mm		
Nominal weight of the pole	160kg			147kg		

Tolerance on mean weight for bulk supply is 7.5%

Tolerance for single pole weight is 10%

Schedule 5

Mounting Height of Luminaires (BIS, 1981)

Group	Recommended Mounting Height
A	9 to 10 meters
B	7.5 to 9 meters
Others (roads bordered by trees)	Less than 7.5 meters

Schedule 6

Recommended Levels of Illumination (BIS, 1981)

Type of Road	Road Characteristics	Average Level of Illumination on Road Surface in Lux	Ratio of Minimum/Average Illumination	Type of Luminaire Preferred
(1)	(2)	(3)	(4)	(5)
A-1	Important traffic routes carrying fast traffic.	30	0.4	Cut-off
A-2	Main roads carrying mixed traffic like city main roads/streets, arterial roads, throughways.	15	0.4	Cut-off
B-1	Secondary roads with considerable traffic like local traffic routes, shopping streets.	8	0.3	Cut-off or semi-cut-off
B-2	Secondary roads with light traffic.	4	0.3	Cut-off or semi-cut-off

Schedule 7

M & V Options

M & V of savings can be calculated by following the IPMVP guidelines (Efficiency Valuation Organization, 2007). The IPMVP is the culmination of many years of development of M & V concept and methodolgies through the co-operation of international experts and practitioners. There are two basic methods for calculating savings : the retrofit isolation method and the whole facility method, and each method can be further subdivided into two sub-options (Options A and B for retrofit isolation method and Options C and D for whole facility method). Options A, B and C are outlined below (as Option D—Calibrated Simulation, is not suitable for this application).

The appropriate method is selected based on the needs of the utility. If an assessment of a particular retrofit is to be done, then the retrofit isolation method should be used. On the other hand, if the total energy use is to be determined, the whole facility method should be selected. The following section describes the methods and options.

Retrofit Isolation Method

Option A—Key Parameter Measurement

This option only measures the key parameter/s used in the energy computation. It is most applicable when operation conditions are either constant (operating hours can be estimated based on historical patterns of use) or variable (where measurement of operating hours will have to be done on site) and it is possible to assume parameters with a level of certainty that is acceptable to all parties. Savings are typically determined by field measurement of the key performance parameter(s) which define the energy use of the system affected by the Energy Conservation Measure (ECM). The frequency of measurement ranges from short-term to continuous, depending on the expected variations in the measured parameter, and the length of the reporting period.

Example : The type of lamp fitting in a lighting installation is changed to a more efficient type while maintaining the same quality of lighting. Energy savings are determined by measuring the energy used by the old and new lighting systems. However the numbers of hours of use may have to be stipulated if the lights are controlled manually. In this case only performance (power drawn by the lighting circuit which was upgraded and in some cases lighting level measurements before and after the project implementation) is measured while operation is stipulated.

kWh (savings)= (kWpre—kWpost) x hours. In this case, the energy savings are achieved by reducing the installed lighting demand.

Option B—All Parameter Measurement

This option is used for a single ECM whereall factors governing energy used are included. Here, both the performance and the operation should be monitored and measured. Savings are determined by field measurement of the energy use of the system under consideration. The savings are verified by engineering calculations using short-term or continuous measurements, depending on the expected variations in the savings and the length of the reporting period.

Example : In the example above, if automatic lighting controls are included there is no point in stipulating hours of operation, as that would not allow measurement of the impact of the controls. Therefore, total consumption before and after the ECM should be measured and compared.

Examples for routine adjustments include agreed burn-out and switching ON and OFF time. Non-routine adjustments include an increase in the agreed burn-out, additional load, change of wattage, non-functioning of timers or controls and unauthorized tapping of power.

Option C-Whole Facility Method

This option is used for either a single ECM or multiple ECMs within a whole facility or complete streetlighting installation. Savings are determined by measuring energy use at the whole facility or sub-facility level. Continuous measurements of the entire facility's energy use are taken throughout the reporting period. Both baseline and reporting period data are needed for the calculation using this option. Energy use should be measured by utility meters for 12 months of the base year and continuously throughout the post-retrofit period. The actual measured consumption in the post-retrofit period is compared with an estimate of what the consumption would have been, in the post retrofit period, without the ECM. The post -retrofit savings are the difference between the estimated "baseline energy use" in the post-retrofit period and the actual energy measured in the post-retrofit period.

In general Option C should be used with complex equipment replacement and controls projects where projected savings are relatively large (e.g., at least 20% of the total energy use). It is suggested that Option C be applied in cases where there is a high degree of interaction between installed ECMs or between ECMs and the rest of the facility, or when the isolation and metering of individual ECMs is difficult and costly.

Example : An entire streetlighting system is retrofitted with various ECMs including lighting retrofits (replacements of lights and fixtures), a power conditioning unit, a dimming mechanism, and Supervisory Control And Data Acquision (SCADA) systems. In this case, the ECMs may have individual contributions to the total savings and may also interact with other ECMs (e.g., reducing lighting impacts due to controlled voltage supply); the overall effect may thefore be difficult to determine if only individual measures are taken.

By order of the Cuttack Municipal Corporation

GYANA RANJAN DAS

Municipal Commissioner

Cuttack Municipal Corporation

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