

2018

PROJECT MANAGEMENT CONSULTANCY FOR IMPLEMENTATION OF SMART CITY MISSION PROJECTS FOR MANGALURU CITY

DETAILED PROJECT REPORT ON CONVERSION OF ALL LIGHTING IN GOVERNMENT BUILDINGS IN ABD INTO LED LIGHTING

The purpose of the Detailed Project Report is to provide details of various considerations made towards the elements proposed for the project as mentioned in the title above. It aims to give a basic design idea to all the stakeholders before proceeding for final design and estimates.



ISSUE AND REVISION RECORD

Revision	Date	Originator	Checker	Approver	Description	Standard
0	26/03/2018	WTESL/LBI/C DAC	URVI BHATT	URVI BHATT/ KAVITA WAKADE	Detailed Project Report	
1	24/08/2018	WTESL/LBI/CD AC	Dr. Nitin Bhavsar	URVI BHATT/ KAVITA WAKADE	Detailed Project Report	

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CONTENTS

1. INTRODUCTION.....	1
1.1. Mangaluru Smart City Proposal	1
1.2. Conversion of all Lighting into Government Building (In ABD Area) into LED Mangaluru Smart City Project	2
1.2.1. Evolution of LED Technology in India.....	2
1.2.2. Need for Intervention	3
1.2.3. Expected Benefits	3
1.2.4. Stakeholders/ Organizations involved	5
1.3. Objective of the Report	5
1.4. Structure of the Report.....	5
2. EXISTING SITUATION ANALYSIS AND BASELINE ASSESSMENT	6
2.1. Identification of Government Building in ABD Area	6
2.2. Inventory of Existing Fixtures in Identified Government Buildings	7
2.3. Finalization of Government Buildings to be taken up for the project	8
3. PROPOSED INTERVENTIONS	12
3.1. Proposed Equivalent Inventory for Conversion to LED	12
3.2. Estimated Energy Savings	13
3.2.1. Estimated Energy Savings for Option A.....	14
3.2.2. Estimated Energy Savings for Option B.....	15
4. SIMPLE (THEORETICAL) PAYBACK PERIOD	17
5. STANDARDS/NORMS TO BE ADOPTED FOR INDOOR ILLUMINATION	18
6. PROJECT IMPLEMENTATION: ANALYSIS OF OPTIONS AND PROPOSED APPROACH	24
6.1. Existing Trends and Practices.....	24
6.2. Review of Enabling Government Mechanism.....	24
6.3. Assessment of Implementation Mechanism: EPC v/s PPP	26
6.3.1. Technical Consideration	27
6.3.2. Financial Consideration	28
6.3.3. Documentation/Procedural/Legal Consideration.....	30
6.3.4. Obligations for Operation and Maintenance	31

6.4.	Recommended Mode of Project Implementation Mechanism	32
7.	APPLICABLE REGULATORY MECHANISM.....	33
7.1.	E-Waste Management Rules 2016	33
7.1.1.	<i>Applicability of E-Waste (Management) Rules, 2016 to the Project</i>	<i>33</i>
7.1.2.	<i>E- Waste Trade Value Chain</i>	<i>34</i>
7.1.3.	<i>Compliance Measures to be taken.....</i>	<i>34</i>
7.1.4.	<i>List of Approved Dismantler's and Recyclers by Karnataka State Pollution Control Board</i>	<i>35</i>
8.	TIMELINE FOR EXECUTION	36
9.	BILL of QUANTITIES AND COST ESTIMATES.....	37
9.1.	Assumption	37
9.2.	Bill of Quantities	37
9.3.	Estimated project cost and the Budget	37
9.4.	Buy back provision.....	38
	Annexures	39

ABBREVIATIONS

ABD	Area Based Development
BTU	British Thermal Unit
CFL	Compact Fluorescent Lamp
DELP	Domestic Efficient Lighting Programme
EPC	Engineering Procurement and Construction
EESL	Energy Efficiency Services Limited
FTL	Faster Than Light
GO	Government Order
HT	High Tension
HPSV	High Pressure Sodium Vapour
kWh	kilowatt hour
KW	Kilowatt
KUIDFC	Karnataka Urban Infrastructure Development & Finance Corporation Limited
LED	Light Emitting Diode
LT	Low Tension
MESCOM	Mangalore Electric Supply Company Limited
MCC	Mangaluru City Corporation
MSCL	Mangaluru Smart City Limited
MH	Metal Halide
MNRE	Ministry of Natural and Renewable Energy
MoEF	Ministry of Environment and Forest
NTPC	National Thermal Power Corporation
O&M	Operation and Maintenance
PAT	Perform, Achieve and Trade
PPP	Public Private Partnership
SCP	Smart City Proposal
SPV	Special Purpose Vehicle
SPCB	State Pollution Control Board
SNLP	Streetlight National Programme
SLNA	State Level Nodal Agency
UJALA	Unnat Jyoti by Affordable LEDs for All
UPS	Uninterruptible Power Supply

1. INTRODUCTION

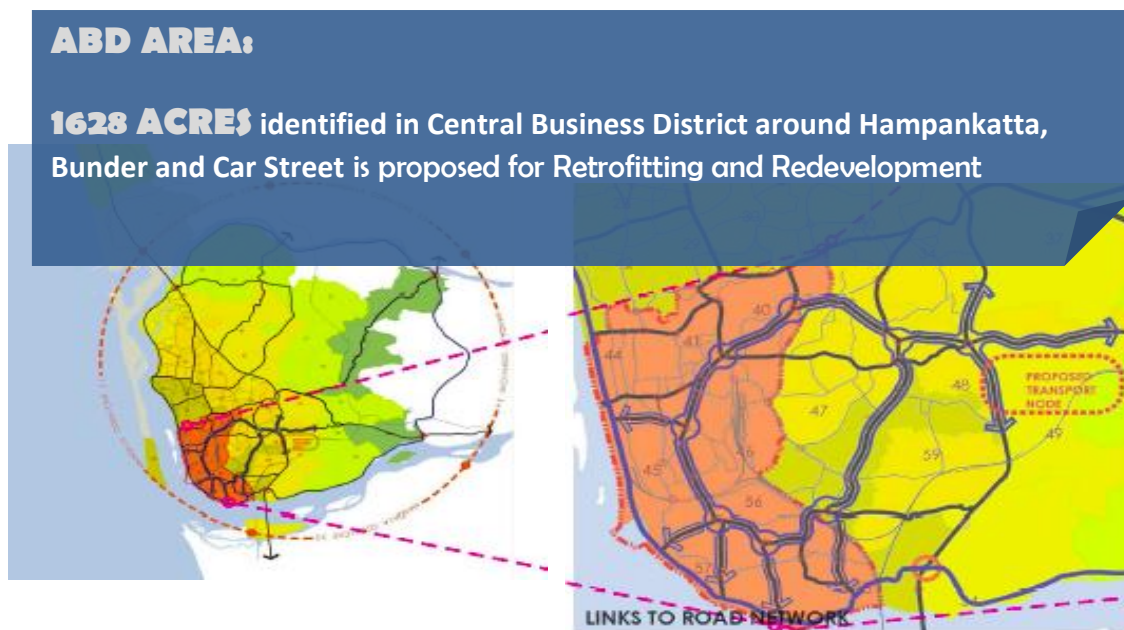
1.1. Mangaluru Smart City Proposal

Karnataka Urban Infrastructure Development & Finance Corporation Limited (KUIDFC) is the State Level Nodal Agency (SLNA) for the Smart Cities Mission in Karnataka. ***Mangaluru was a proud Participant in second round of this Challenge and now aspires to translate the vision i.e. the broad components across both 'area-based' and 'pan-city' heads identified in the Smart City Proposal (SCP) into Reality.***

Mangaluru Smart City Proposals (SCP) is considered as Area Based Development Proposals (ABD) and Pan City Proposals. The SCP has identified 65 projects/sub projects to be taken up under ABD and Pan City Proposal

Figure 1-1 shows the ABD area considered under Mangaluru Smart City Proposal

Figure 1-1 ABD area considered under Mangaluru Smart City



1.2. Conversion of all Lighting into Government Building (In ABD Area) into LED Mangaluru Smart City Project

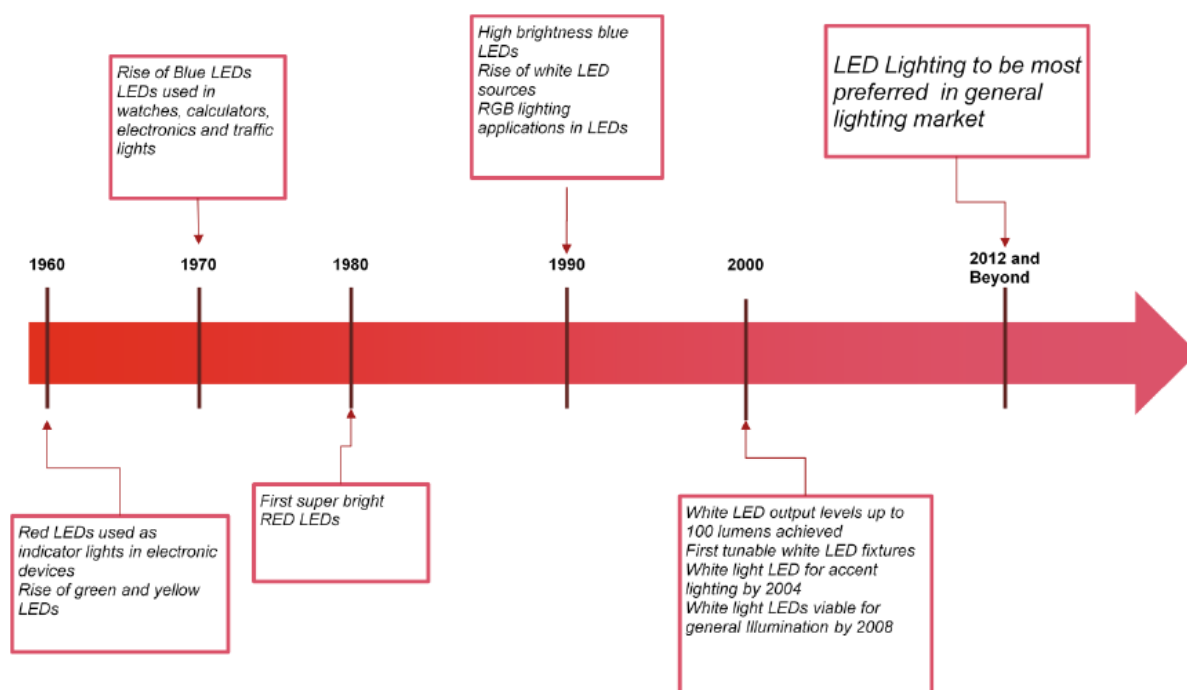
“Conversion of all Lighting in the Government Buildings, in ABD Area, into LED” is one of the projects identified under Mangaluru Smart City Proposal aimed for use of LED luminaires for internal lighting in Government Buildings.

1.2.1. Evolution of LED Technology in India

The invention of LED dates back in 1960's wherein the Red LED's were used as an indicator in electronic devices. Each decade thereafter witnessed advancements in LED Lighting solutions

Figure 1-2 provides a brief of “Evolution of white light LED's in India

Figure 1-2 Evolution of White LED's in India



Technological developments have permitted using LED for traffic lights, remote controls, aviation lighting, etc. LED's usage in general space illumination for residential and commercial buildings has gained pace in recent times and today in LED has become the most preferred and efficient lighting source available in the General Lighting Market. There are about 200 players in the country in the LED Lighting Market.

In near Future, LED's Solutions hold the potential to reach far beyond any competing technology and become the technology of choice for most applications; with energy savings reaching up to 90% compared to the prevailing conventional technologies.

1.2.2. Need for Intervention

Existing internal lighting in the Government Building is in the form of CFL, FTL and Incandescent lamps. Outside area is illuminated by halogen lamps Sodium Vapour lamps and Metal Halide Lamps.

With the advancements in LED Technology, The Ministry of Natural Renewable Energy (MNRE) strongly recommends switching over from the above conventional lighting to LED lighting with overall objective of saving of electricity and low maintenance on account of longer life of LED lamps and environment friendly atmosphere.

Pursuant to success of Hon'able Prime Minister's National LED Programme (UJALA and SNLP) launched in 2015 to facilitate rapid adoption of LED based home and street lighting across country, the Central Government also took a decision for mandatory installation of LED based lighting and Energy Efficient Equipment's in all Government Building. The decision came in view of the fact that Government Buildings are a major source of energy Consumption. Usage of LED Based Lighting and energy efficient equipment's in government building will lead to economy in expenditure and savings in the long run through reduction in energy consumed.

In view of Central Government's initiatives and to enable overall sustainable initiatives under Mangaluru Smart City, it is prudent to adopt the "Transfer of Technology" from Conventional Lights into LED

1.2.3. Expected Benefits

Recent years have seen a trend of switching over to light emitting diode (LED) as compared to the conventional lights. The major advantages cited below demonstrate that LED Street Lights are the right choice for lighting

- **Absence of Mercury coating**
Conventional lamps contain mercury which is toxic to human body as well as to environment. Mercury contain is absent in LED lamps.
- **Less emissions**
Carbon dioxide, sulfur oxide and high level nuclear waste are proportion to electricity consumption. As LED lamps consume less electricity, these emissions

are less. Hence, LED lamps are environmental friendly. LED lamps consume electricity 30 to 50% of conventional lamps.

- **Insensitivity to moisture and temperature**

LED lamps are not sensitive to humidity and low temperatures.

- **No effect of switching operation on the life of lamps**

Life of LED lamps is not affected with switching operation while that of conventional lamps, it reduces the life drastically.

- **Instantaneous switching**

LED lamps switch ON instantly while other lamps need warm up time except incandescent lamps.

- **High burning hours**

Burning hours for different street light lamps are as under -

FTL, CFL	15,000
HPSV lamps	15,000
Metal Halide lamps	10,000 and
LED lamps	40,000 to 50,000 hours

- **High lumen output**

Following are lumen outputs for various lamps

LED lamps	60 to 140 lm/W
HPSV lamps	70 to 110 lm/W
Metal Halide lamps	80 to 105 lm/W
Compact Fluorescent lamps	40 to 70 lm/W
Halogen lamps	15 to 25 lm/W
Incandescent lamps	15 to 25 lm/W

- **No effect of vibration**

LED lamps sustain jarring and bumping while conventional lamps are less durable.

- **Low heat generation**

Following heat generated by various lamps

LED lamps	3.4 BTU/hr
FTL / CFL / MH / HPSV lamps	30.0 BTU/hr
Incandescent lamps	85 BTU/hr

- **Low power consumption**

For a given lumen output conventional lamps consume electricity 1.2 to 2.6 times LED lamps while Incandescent lamps consume 3 to 10 times LED lamps.

- **Reduced Maintenance cost**

1.2.4. Stakeholders/ Organizations involved

- Mangaluru Smart City Limited (MSCL)
- Mangaluru City Corporation (MCC)
- Mangalore Electricity Supply Company Limited (MESCOM)
- Government Departments
- Mangaluru Smart City PMC

1.3. Objective of the Report

The purpose of the Detailed Project Report is to provide details of various considerations and the elements proposed for the Priority Loop Smart Road. It aims to give a basic design idea to all the stakeholders before proceeding for final design and estimates.

1.4. Structure of the Report

This report is organized as follows:

- Chapter 1 – Introduction
- Chapter 2 – Existing Situation Analysis and Baseline Assessment
- Chapter 3 – Proposed Intervention
- Chapter 4 – Simple (Theoretical) Payback Period
- Chapter 5 - Standards/Norms To Be Adopted For Indoor Illumination
- Chapter 6 - Proposed Implementation: Analysis of options and proposed Approach
- Chapter 7 – Applicable Regulatory Mechanism
- Chapter 8 – Timeline for Execution
- Chapter 9 – Bill of Quantities and Cost Estimates
- Annexures

2. EXISTING SITUATION ANALYSIS AND BASELINE ASSESSMENT

This section deals with the analysis of existing situation in government Buildings w.r.t to the lighting fixtures and baseline surveys/ inventory carried out

2.1. Identification of Government Building in ABD Area

As per the provision under Smart City Proposal, and discussion with MD, MSCL, it was decided to undertake the “Conversion of all Lighting in the Government Buildings, in ABD Area, into LED”. Accordingly, following 38 Govt premises were identified and necessary survey works were carried out.

1. Police Commissioner’s Office at AB Shetty Circle
2. Asst. Commissioner of Police (Traffic), Pandeshwara South Police Station
3. North Police Station, Bender
4. Govt. Higher Secondary School, Hoigebazar ward-57
5. Govt. Primary School and College of Teachers' Training, Pandeshwar, Ward 46
6. Govt. High School, Urdu, Bunder, Ward 46
7. Govt. Primary and Secondary School and College, Balmatta, Ward-40
8. Govt. High School Kudroli ward-57
9. Govt. Primary School, Bastigarden, Ward-41
10. Gov. Upper Primary School, Neereshwalya, Ward-45
11. Post Office & Logistics Building, Pandeshwar
12. Dakshina Kannada Zilla Prathamikta Hera School, Pandeshwara, Ward-46
13. Primary School, Hoigebazar, Ward-57
14. Karnataka Fishery Dev. Corp.
15. Fire Station, Pandeshwar
16. Telecom Office, Pandeshwar
17. Deputy Conservation of Forest, PWD building and Agriculture, Pandeshwar
18. Commercial Tax Office Building, Pandeshwar
19. Nehru Maidan Cricket Pavilion
20. Taluka Office Building
21. Lady Goshan Hospital

22. RTO Office Building
23. Lady Wenlock Hospital
24. Govt. University College, Mangalore
25. Town Hall Building
26. Deputy commissioner office(DC)
27. BSNL Telephone Exchange Building
28. Govt. Ladies Hostel St.Anns College
29. Central Market, Hampankatta
30. Fisheries Office, Bundar
31. PWD sub-division office
32. Geological Survey of India
33. Old Port Office
34. Block Education Office and Govt High School, Bolar
35. Wet well Compound, Pandeshwar
36. Wet well Compound, Kudroli
37. Urban Primary Health Centre, Jappu
38. IGP Office, Guest House and District Armed Reserve Police Office

2.2. Inventory of Existing Fixtures in Identified Government Buildings

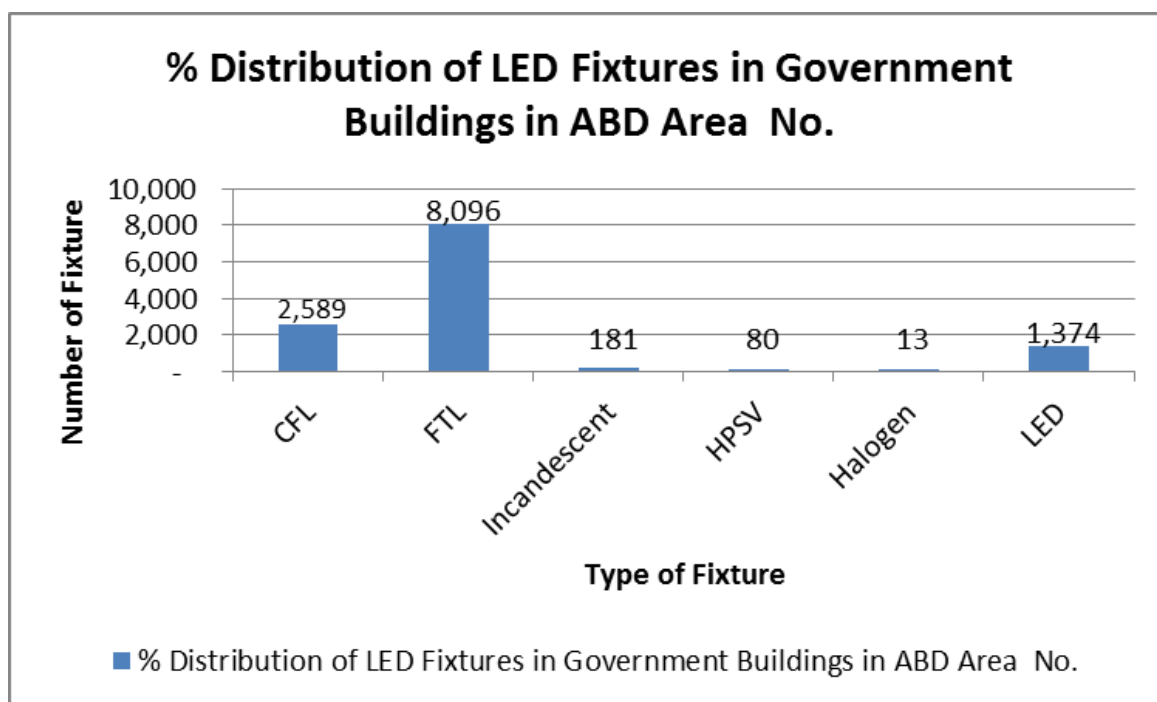
On identification of the premises to be taken up under the project, PMC team undertook a detailed survey for each of the building and prepared an inventory of the existing fixtures in each of the building

A total 12333 fixtures were surveyed across 38 premises Out of the total 12333 fixtures; approx. 11% are already LED fixtures. The inventory assessment was carried out August 2017 and is attached as annexure 1 to the report (excluding the inventory of existing LED fixtures

Figure 2-1 shows the graphical representation of the inventory of existing lighting fixtures in Government Building in ABD Area. ***As is evident, 66% of the lighting fixtures are of FTL type followed by 21% of CFL fixtures.***

In addition, to counting the number of fixture, the inventory assessment also captured information on the ***“wattages of the existing fixtures”*** and whether the fixtures are ***“Surface Mounted” or “Flushed”***.

Figure 2-1 Graphical Representation of the inventory of Existing Lighting Fixtures in Government Building in ABD Area



2.3. Finalization of Government Buildings to be taken up for the project

In addition to carrying out the detailed inventory assessment of identified building, further screening and analysis was carried out for finalization of buildings to be adopted for the project. Table below presents the details of all 38 premises and reason for not selection of Buildings if any. The inventory represented in section 2.2 is towards all 38 premises but considering the buildings finalized for inclusion in DPR

Sr. No	Name of the Premises	Total Number of Buildings	Number of Building finalized for inclusion in DPR	Number of Building Not Considered in DPR	Reason for Non-Consideration of any Building, if any
1	Police Commissioner's Office at AB Shetty Circle	1	1	0	
2	Asst. Commissioner of Police (Traffic), Pandeshwara South Police Station	7	1	6	Residential quarters
3	North Police Station, Bunder	4	4	0	

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IN MANGALURU CITY**

DETAILED PROJECT REPORT – CONVERSION OF ALL LIGHTING IN GOVERNMENT BUILDINGS (IN ABD AREA) INTO LED

4	Secondary School Hoigebazar, Ward 57	4	4	0	
5	Govt. Primary School and College of Teachers' Training, Pandeshwar, Ward 46	6	6	0	
6	Govt. High School, Urdu, Bunder, Ward 44	5	5	0	
7	Govt. Primary and secondary school and College, Balmatta, Ward-40	14	14	0	
8	Govt. High School Kudroli ward-43	7	7	0	
9	Govt. Primary School, Bastigarden, Ward-41	4	4	0	
10	Gov. Upper Primary School, Neereshwalya, Ward-45	2	2	0	
11	Head Post Office & Logistics Building, Pandeshwara	5	5	0	
12	Dakshina Kannada Zilla Prathamikta Hera School, Pandeshwara, Ward-46	5	5	0	
13	Primary School, Hoigebazar, Ward-57	1	1	0	
14	Karnataka Fishery Dev. Corp. (KFDC)	3	3	0	
15	Fire Station, Pandeshwar	7	1	6	Residential quarters
16	Telecom Office, Pandeshwar	4	1	3	Residential quarters
17	Deputy Conservation of Forest, PWD building and Agriculture, Pandeshwar	3	2	1	Being demolished
18	Commercial Tax Office Building, Behind PWD Office, Pandeshwar	4	1	3	Residential quarters

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IN MANGALURU CITY**

DETAILED PROJECT REPORT – CONVERSION OF ALL LIGHTING IN GOVERNMENT BUILDINGS (IN ABD AREA) INTO LED

19	Nehru Maidan Cricket Pavilion	1	1	0	
20	Mini Vidhan Sabha, Taluka Office Building, Pandeshwar	4	3	1	Demolished and new construction was in progress
21	Lady Goshan Hospital	12	7	5	Residential quarters
22	RTO Office Building, Pandeshwar	1	1	0	
23	Wenlock Hospital	32	24	8	6 building - residential quarters and 2 under construction
24	Govt. University College, Hampankatta, Mangalore	10	10	0	
25	Town Hall Building	2	2	0	
26	Deputy commissioner office(DC)	9	3	6	Non-functioning
27	BSNL Telephone Exchange Building, Pandeshwar	2	2		
28	Govt.Ladies Hostel St.Anns College	1	1	0	
29	Central Market, Hampankatta	2	2	0	Proposed for redevelopment
30	Fisheries Office, Bundar	2	2	0	
31	PWD sub-division office near Gateway Taj Hotel	4	4	0	
32	Geological Survey of India, Pandeshwar	14	4	10	Residential quarters
33	Old Port Office	8	8	0	
34	Block Education Office and Govt High School, Bolar	6	6	0	
35	Wet well Compound, Pandeshwar	1	1	0	
36	Wet well Compound,	1	1	0	

	Kudroli				
37	Urban Primary Health Centre, Jappu	9	4	5	Residential quarters
38	IGP Office, Guest House and District Armed Reserve Police Office	13	13	0	

Hence total 38 Premises comprising of total 166 Buildings in which 112 buildings were finalized to be taken up under the project. Total inventory of proposed intervention (in 38 premises) is included as annexure 2.

Based on the above analysis, following 2 options are proposed for executions of works under the current DPR

- ***Option A – Inclusion of School Buildings in Current DPR***

This option includes 38 premises having a total inventory of 10959 fixtures

- ***Option B – Inclusion of School Building in the smart School DPR***

This option includes 26 premises having a total inventory of 9432 fixtures

Option B is recommended option by PMC. However, final decision may be taken up by MSCL (Current DPR incorporates Costing for all 26 premises. Suitable modifications in the DPR as per Option B)

The inventory assessment was carried out August 2017 and is attached as annexure 1 to the report

3. PROPOSED INTERVENTIONS

The proposed intervention includes removal of existing lighting fixtures, Installation of appropriate LED fixtures; carry out necessary changes, if needed, reinstate the site*, carry out necessary touch up of paint*, if required and commission the new LED light fixtures (with assured equivalent or improved illumination) across the 37 identified premises

* While replacing existing concealed / flushed mounted conventional fixtures by LED concealed / flushed mounted fixtures, alterations to the false ceiling cutouts will be required. In Plaster of Paris Ceiling, the existing cut out needs to be altered by replacing the board around the new fixture with necessary finishing as required. For modular false ceiling, the entire ceiling tile needs to be replaced in the grid where new fixture is proposed. It is suggested to replace existing concealed fixtures by bigger dimensions of concealed LED fixtures, wherever feasible, to avoid replacement of false ceiling board or modular tile



3.1. Proposed Equivalent Inventory for Conversion to LED

Based on the inventory of the existing fixtures, the following equivalent fixtures are recommended to be adopted for the finalized premises.

Sr. No.	Type of Conventional Fixtures and wattage	Equivalent Wattage of LED Fixtures	Sr. No.	Type of Conventional Fixtures and wattage	Equivalent Wattage of LED Fixtures
1	CFL, 4 x 3 W, Flushed	6 W	22	CFL, 2 x 18 W, Flushed	18 W
2	CFL, 1 x 5 W, SM	3 W	23	CFL, 1 x 20 W, SM	10 W
3	CFL, 2 x 5 W, Flushed	5 W	24	CFL, 1 x 20 W, Flushed	10 W

4	CFL, 1 x 9 W, SM	4 W	25	CFL, 1 x 25 W	12 W
5	CFL, 1 x 9 W, Flushed	4 W	26	CFL, 2 x 36 W Flushed	36 W
6	CFL, 2 x 9 W, SM	9W	27	CFL, 3 x 36 W	3 x 18 W
7	CFL, 2 x 9 W, Flushed	9 W	28	CFL, 4 x 36 W Flushed	4 x 18 W
8	CFL, 1 x 10 W, SM	5 W	29	CFL, 1 x 40 W	20 W
9	CFL, 1 x 10 W, Flushed	5 W	30	CFL 1 x 85 W	40 W
10	CFL, 2 x 10 W, Flushed	10 W	31	FTL, 1 x 36 W, Surface	20 W
11	CFL, 1 x 11 W, SM	5 W	32	FTL, 1 x 36 W. Flushed	20 W
12	CFL, 1 x 11 W, Flushed	5 W	33	FTL, 2 x 36 W, Surface	40 W
13	CFL, 2 x 11 W	10 W	34	FTL, 2 x 36 W, Flushed	40 W
14	CFL, 1 x 12 W, SM	6 W	35	40 W Incandescent lamp	6 W
15	CFL, 1 x 12 W, Flushed	6 W	36	HPSV, 70 W	35 W
16	CFL, 1 x 15 W	7 W	37	HPSV, 150 W	70 W
17	CFL, 1 x 16 W, SM	8 W	38	HPSV, 250 W	140 W
18	CFL, 1 x 16 W, Flushed	8 W	39	Halogen, 100 W	20 W
19	CFL, 2 x 16 W, Flushed	16 W	40	Halogen, 500 W	140 W
20	CFL, 1 x 18 W	9 W	41	Halogen, 1000 W	210 W
21	CFL, 2 x 18 W, SM	18 W			

3.2. Estimated Energy Savings

The estimated energy savings based on existing fixture and proposed fixture for equivalent LED replacement, in case of option A and B are as described in subsequent paragraphs

3.2.1. Estimated Energy Savings for Option A

Table below shows the estimated Energy Savings for Option A

S.N.7	Type of Conventional Fixtures and wattage	Equivalent Wattage of LED Fixtures	Quantity	Unit saving W	Total W
1	CFL, 4 x 3 W, Flushed	6 W	8	6	48
2	CFL, 1 x 5 W, SM	3 W	2	2	4
3	CFL, 2 x 5 W, Flushed	5 W	2	5	10
4	CFL, 1 x 9 W, SM	4 W	333	5	1,665
5	CFL, 1 x 9 W, Flushed	4 W	235	5	1,175
6	CFL, 2 x 9 W, SM	9W	161	9	1,449
7	CFL, 2 x 9 W, Flushed	9 W	16	9	144
8	CFL, 1 x 10 W, SM	5 W	17	5	85
9	CFL, 1 x 10 W, Flushed	5 W	37	5	185
10	CFL, 2 x 10 W, Flushed	10 W	24	10	240
11	CFL, 1 x 11 W, SM	5 W	9	6	54
12	CFL, 1 x 11 W, Flushed	5 W	278	6	1,668
13	CFL, 2 x 11 W	10 W	17	12	204
14	CFL, 1 x 12 W, SM	6 W	161	6	966
15	CFL, 1 x 12 W, Flushed	6 W	62	6	372
16	CFL, 1 x 15 W	7 W	10	8	80
17	CFL, 1 x 16 W, SM	8 W	66	8	528
18	CFL, 1 x 16 W, Flushed	8 W	71	8	568
19	CFL, 2 x 16 W, Flushed	16 W	22	16	352
20	CFL, 1 x 18 W	9 W	10	9	90
21	CFL, 2 x 18 W, SM	18 W	13	18	234
22	CFL, 2 x 18 W, Flushed	18 W	9	18	162
23	CFL, 1 x 20 W, SM	10 W	86	10	860
24	CFL, 1 x 20 W, Flushed	10 W	24	10	240
25	CFL, 1 x 25 W	12 W	97	13	1,261
26	CFL, 2 x 36 W Flushed	36 W	477	36	17,172
27	CFL, 3 x 36 W	3 x 18 W	47	54	2,538
28	CFL, 4 x 36 W Flushed	4 x 18 W	76	72	5,472
29	CFL, 1 x 40 W	20 W	33	20	660
30	CFL 1 x 85 W	40 W	37	45	1,665

31	FTL, 1 x 36 W, Surface	20 W	4,768	20	95,360
32	FTL, 1 x 36 W, Flushed	20 W	151	20	3,020
33	FTL, 2 x 36 W, Surface	40 W	786	40	31,440
34	FTL, 2 x 36 W, Flushed	40 W	1,571	40	62,840
35	40 W Incandescent lamp	6 W	181	34	6,154
36	HPSV, 70 W	35 W	50	42	2,100
37	HPSV, 150 W	70 W	18	110	1,980
38	HPSV, 250 W	140 W	12	140	1,680
39	Halogen, 100 W	20 W	2	80	160
40	Halogen, 500 W	140 W	4	340	1,360
41	Halogen, 1000 W	210 W	7	790	5,530
Total					251,775

3.2.2. Estimated Energy Savings for Option B

Table below shows the estimated Energy Savings for Option B

S.N.	Type of Conventional Fixtures and wattage	Equivalent Wattage of LED Fixtures	Quantity	Unit saving W	Total W
1	CFL, 4 x 3 W, Flushed	6 W	8	6	48
2	CFL, 1 x 5 W, SM	3 W	2	2	4
3	CFL, 2 x 5 W, Flushed	5 W	2	5	10
4	CFL, 1 x 9 W, SM	4 W	289	5	1,445
5	CFL, 1 x 9 W, Flushed	4 W	235	5	1,175
6	CFL, 2 x 9 W, SM	9W	161	9	1,449
7	CFL, 2 x 9 W, Flushed	9 W	16	9	144
8	CFL, 1 x 10 W, SM	5 W	17	5	85
9	CFL, 1 x 10 W, Flushed	5 W	37	5	185
10	CFL, 2 x 10 W, Flushed	10 W	24	10	240
11	CFL, 1 x 11 W, SM	5 W	9	6	54
12	CFL, 1 x 11 W, Flushed	5 W	278	6	1,668
13	CFL, 2 x 11 W	10 W	17	12	204
14	CFL, 1 x 12 W, SM	6 W	90	6	540
15	CFL, 1 x 12 W, Flushed	6 W	62	6	372
16	CFL, 1 x 15 W	7 W	10	8	80
17	CFL, 1 x 16 W, SM	8 W	37	8	296

**APPOINTMENT OF PROJECT MANAGEMENT CONSULTANTS FOR IMPLEMENTATION OF SMART CITY MISSION PROJECTS
IN MANGALURU CITY**

DETAILED PROJECT REPORT – CONVERSION OF ALL LIGHTING IN GOVERNMENT BUILDINGS (IN ABD AREA) INTO LED

18	CFL, 1 x 16 W, Flushed	8 W	71	8	568
19	CFL, 2 x 16 W, Flushed	16 W	22	16	352
20	CFL, 1 x 18 W	9 W	10	9	90
21	CFL, 2 x 18 W, SM	18 W	13	18	234
22	CFL, 2 x 18 W, Flushed	18 W	9	18	162
23	CFL, 1 x 20 W, SM	10 W	82	10	820
24	CFL, 1 x 20 W, Flushed	10 W	24	10	240
25	CFL, 1 x 25 W	12 W	97	13	1,261
26	CFL, 2 x 36 W Flushed	36 W	477	36	17,172
27	CFL, 3 x 36 W	3 x 18 W	47	54	2,538
28	CFL, 4 x 36 W Flushed	4 x 18 W	76	72	5,472
29	CFL, 1 x 40 W	20 W	17	20	340
30	CFL 1 x 85 W	40 W	37	45	1,665
31	FTL, 1 x 36 W, Surface	20 W	4,470	20	89,400
32	FTL, 1 x 36 W. Flushed	20 W	151	20	3,020
33	FTL, 2 x 36 W, Surface	40 W	786	40	31,440
34	FTL, 2 x 36 W, Flushed	40 W	515	40	20,600
35	40 W Incandescent lamp	6 W	96	34	3,264
36	HPSV, 70 W	35 W	50	42	2,100
37	HPSV, 150 W	70 W	18	110	1,980
38	HPSV, 250 W	140 W	-	140	-
39	Halogen, 100 W	20 W	2	80	160
40	Halogen, 500 W	140 W	4	340	1,360
41	Halogen, 1000 W	210 W	7	790	5,530
Total					197,767

4. SIMPLE (THEORETICAL) PAYBACK PERIOD

The payback period has been worked out considering following assumptions -

- a) MESCOM tariff slab for Urban Area, LT-2 (a) (i), is Rs. 7.30'kWh with 5% tariff rise every year
- b) 100% lighting on working days during office hours
- c) 10% lighting on Saturdays, Sundays and during night time

The payback period is

- d) Annual average saving in energy bills is Rs. 57.19 lakh
- e) Estimated project cost is Rs. 200.5 lakh

The simple payback period works out to be 3.5 years (Approx)

5. STANDARDS/NORMS TO BE ADOPTED FOR INDOOR ILLUMINATION

This section covers the provisions laid under IS 3646 (part 1): 1992 (reaffirmed 2003) – Code of Indoor Illumination; Part 1 – General Requirements for interior Illumination. The primary objective of this code is to indicate the factors which should be taken into account to achieve good lighting

The works carried out for the project shall be in line with the illumination/lux levels specified in the IS 3646.

Table below provides the details of the type of Interior of Activity and the corresponding range of Service Illumination to be maintained in Lux

Reference No from IS Code	Type of Interior or Activity	Range of Service Illumination in Lux	Quality Class of Direct Glare Limitation	Remarks
17	Offices			
17.1.1	General Offices	300-500-750	1	
17.1.2	Deep plan general offices	500-750-1000	1	
17.1.3	Computer work stations	300-500-750	1	
17.1.4	Conference rooms, executive offices	300-500-750	1	
17.1.5	Computer and data preparation rooms	300-500-750	1	
17.1.6	Filing rooms	300-500-750	1	
17.2	Drawing Offices			
17.2.1	General	500-750-1000	1	
17.2.2	Drawing boards	500-750-1000	1	
17.2.3	Computer aided design and drafting	--	--	Special lighting is required
17.2.4	Print rooms	200-300-500	1	
17.3	Bank and Building Societies			
17.3.1	Courier, office areas	300-500-750	1	
17.3.2	Public area	200-300-500	1	
20.4	Hospitals			
20.4.1	Anesthetic rooms			
	20.4.1.1 General	200-300-500	--	
	20.4.1.2 Local	750-1000-1500	--	
20.4.2	Consulting areas			
	20.4.2.1 General	200-300-500	--	
	20.4.2.2 Examination	750-1000-1500	--	
20.4.3	Corridors			

Reference No from IS Code	Type of Interior or Activity	Range of Service Illumination in Lux	Quality Class of Direct Glare Limitation	Remarks
20.4.4	20.4.3.1 General	100-150-200	--	
	Ward corridors			
	20.4.4.1 Day, screened from bays	100-150-200	--	
	20.4.4.2 Day, open to natural light	150-200-300 (total)	--	
20.4.5	20.4.4.3 Morning / evening	100-150-200	--	
	20.4.4.4 Night	5-10	--	
	Cubicles			
	20.4.5.1 General	200-300-500	--	
20.4.6	20.4.5.2 Treatment	750-1000-1500	--	
	Examination			
	20.4.6.1 General	200-300-500	--	
	20.4.5.2 Local inspection	750-1000-1500	--	
20.4.7	Intensive therapy			
	20.4.7.1 Bad head	30-50	--	
	20.4.7.2 Circulation between bed ends	50-100-150	--	
	20.4.7.3 Observation	200-300-500	--	
	20.4.7.4 Local observation	750-1000-1500	--	
	20.4.7.5 Staff base (day)	200-33300-500	--	
	20.4.7.6 Staff base (night)	30	--	
20.4.8	Laboratories			
	20.4.8.1 General	200-300-500	--	
	20.4.8.2 Examination	300-500-700	--	
20.4.9	Nurses stations			

Reference No from IS Code	Type of Interior or Activity	Range of Service Illumination in Lux	Quality Class of Direct Glare Limitation	Remarks
	20.4.9.1 Morning / day / evening	200-300-500	--	
	20.4.9.2 Night desks	30	--	
	20.4.9.3 Night, medical trolleys	50-100-150	--	
20.4.10	Operating theatres			
	20.4.10.1 General	300-500-750	--	
	20.4.10.2 Local	10000 to 50000	--	Special operating lights are used
20.4.11	Pathology departments			
	20.4.11.1 General	200-300-500	--	
	20.4.11.2 Examination	300-500-750	--	
	20.4.11.3 Pharmacies	200-300-500	--	
	20.4.11.4 Reception / enquiry	200-300-500	--	
	20.4.11.5 Recovery room	200-300-500	--	
20.4.12	Ward circulation			
	20.4.12.1 Day	50-100-150	--	
	20.4.12.2 Morning / evening	50-100-150	--	
	20.4.12.3 Night	3-5	--	
20.4.13	Ward-bed head			
	20.4.13.1 Morning / evening	30-50	--	
	20.4.13.2 Reading	100-150-200	--	
20.4.14	Night			
	20.4.14.1 Adult	0.1-1	--	
	20.4.14.2 Paediatric	1	--	
	20.4.14.3 Psychiatric	1-5	--	

Reference No from IS Code	Type of Interior or Activity	Range of Service Illumination in Lux	Quality Class of Direct Glare Limitation	Remarks
	20.4.14.4 Watch	5	--	
20.4.15	X-Ray areas			
	20.4.15.1 General	150-200-300	--	
	20.4.15.2 Diagnostic	150-200-300	--	
	20.4.15.3 Operative	200-300-500	--	
	20-4.15.4 Process dark room	50	--	
20.4.16	Surgeries			
	20.4.16.1 General	200-300-500	--	
	20.4.16.2 Waiting rooms	100-150-200	--	
20.4.17	Dental surgeries			
	20.4.17.1 Chair	Special lighting	--	
	20.4.17.2 Laboratories	300-500-750	--	
20.4.18	Consulting rooms			
	20.4.18.1 General	200-300-500	--	
	20.4.18.2 Desk	100-500-750	--	
	20.4.18.3 Examination couch	300-500-750	--	
	20.4.18.4 Ophthalmic wall and near vision charts	300-500-750	--	
20.8	Sports Facilities			
	Multi-Purpose Sports Halls	300-750	-	This lighting system should be sufficiently flexible to provide lighting suitable for variety of sports and activities that place in sports hall. Higher illumination of

Reference No from IS Code	Type of Interior or Activity	Range of Service Illumination in Lux	Quality Class of Direct Glare Limitation	Remarks
21	Education			
21.1	Assembly Halls			
21.1.1	General	200-300-500	3	
	Special and Stage	-	-	Special lighting to provide emphasis and to facilitate the use of platform/stage is desirable
21.2	Teaching spaces			
	General	200-300-500	1	
21.3	Lecture Halls			
21.3.1	General	200-300-500	1	
21.3.2	Demonstration Benches	300-500-750	1	Localized lighting may be appropriate
21.4	Seminar rooms	300-500-750	1	
21.5	Art Rooms	300-500-750	1	
21.6	Needlework Rooms	300-500-750	1	
21.7	Laboratories	300-500-750	1	
21.8	Libraries	200-300-500	1	
21.9	Music Rooms	200-300-500	1	
21.10	Sports Halls	200-300-500	1	
21.11	Workshops	200-300-500	1	

6. PROJECT IMPLEMENTATION: ANALYSIS OF OPTIONS AND PROPOSED APPROACH

The section deals with current practices of undertaking works pertaining to replacement of electrical lighting fixtures/tubes, recent trends, Various enabling Government policies/ Guidelines/measures, Evaluation/Assessment of Technical and Financial implications while implementing the current project (under Mangalore Smart City Proposal) under EPC vis-à-vis PPP Mode and the proposed mode of implementation for the current project under of “Conversion of all Lighting in Government Building in ABD area into LED” under Mangaluru Smart City Proposal

6.1. Existing Trends and Practices

The traditional practice of undertaking the changes/additions/ alternations in the Lighting Fixtures for various government departments is through the own sanctioned fund in the annual budget prepared by respective department

In recent past, various initiatives are by taken by Energy Efficiency Services Limited (EESL). EESL is a joint venture of four National Public Sector Undertakings – NTPC Limited, Power Finance Corporation Limited, Rural Electrification Corporation Limited and POWERGRID Corporation of India Limited, set up under Ministry of Power, Government of India. EESL has taken up implementation of various energy efficiency measures through various schemes and payback mechanism.

Subsequent sub-sections provides analysis of various options for project implementation and the proposed approach under Mangaluru Smart City Project

6.2. Review of Enabling Government Mechanism

For the success of any initiative at wider scale and ensure implementation of the initiatives, the support of Government Policy and necessary enabling mechanism play an important and critical role. In view of increased urbanization trends and technology enabled solutions, Government has led emphasis on various sustainability aspects and measures. The section provides glimpse of various measures taken by the Government in promoting and implementing LED solutions in India and State of Karnataka.

The section deals with the various government initiatives to encourage moving from traditional lighting solutions to the LED solutions and thereby ensure sustainable solutions

A. Government policy on energy conservation and specific activities for commercial facilities

In the National Action Plan on Climate Change, focus is placed on the industrial sector in particular; including, for example, a Perform, Achieve and Trade (PAT) certification scheme for energy-savings achievement. The Energy Conservation Building Code has been established for newly constructed commercial buildings, and energy conservation measures are promoted

B. Positioning of LED lighting in energy conservation policy

As a part of Jawaharlal Nehru National Solar Mission, which derives from the National Action Plan on Climate Change, the Ministry of New and Renewable Energy, in 2011, announced the development of "solar cities" in 60 cities nationwide. Installing LED lights is encouraged as a part of this mission.

The aim of the programme is to reduce minimum of 10% of the projected demand of conventional energy of the city through renewable energy installations and energy efficiency measures.

C. Various Schemes promoting use of LED in Street lights, Domestic lighting

Unnat Jeevan by Affordable LEDs and Appliances for All (UJALA) – Launched in 2015, the main objective of scheme is to promote efficient lighting, enhance awareness on using efficient equipment which reduce electricity bills and preserve environment. It is LED based Domestic Efficient Lighting Programme (DELP). Under it, LED Bulbs are distributed

Street Light National Programme is an initiative of the Government to promote energy efficiency in the country. The National Programme has been launched on 5th January 2015 to convert conventional street and domestic lights with energy efficient LED lights.

In addition to above, there are various other schemes targeting Energy efficiency measures, including

- National Energy Efficient Agriculture Pumps Programme
- Standards and Labeling programme
- National Energy Efficient Fan Programme
- Unnat Chulha Abhiyan
- Indian Seasonal Energy Efficiency Ratio (star rating methodology for ACs.)
- National Mission for Enhanced Energy Efficiency
- Municipal Energy Efficiency Programme

D. Directions of Ministry of Finance, Department of Expenditure for “Mandatory Installation of LED based lighting in all Government Buildings

Pursuant to the various LED based schemes launched under the National LED Programme (2015), the Central Government has taken decision for ***mandatory installation of LED based lighting and energy efficient equipment's (Fan's and AC's) in all Government Buildings.***

Government buildings are a major source of energy consumption. Usage of LED based lightings and energy efficient equipment's in Government Buildings will lead to economy in expenditure and savings in the long run through reduction in energy consumed. Keeping in view the economy in expenditure and savings that will entail, the Ministry of Finance, vide office memorandum F.NO. 25(24)/E. Coord /2017 dated 4th August 2017 requested all Ministries/Departments to converted the existing lighting/equipment's into LED based lighting and energy efficient equipment's on priority

Refer Office Circular Attached as annexure 3 to the report, regarding directions of Ministry of Finance, Department of Expenditure for “Mandatory Installation of LED based lighting in all Government Building

6.3. Assessment of Implementation Mechanism: EPC v/s PPP

This sections deals with evaluation/assessment of various aspects while implementing the project on EPC v/s PPP mode. The overall objective is to derive at the feasible mode of implementation of the project whilst taking into consideration various Technical, Financial, Operation and Maintenance considerations and also scale of the project

6.3.1. Technical Consideration

Description	EPC Mode	PPP Mode
<p><i>Need for recording the energy savings and related difficulties in bifurcating the energy consumptions based on various electrical equipment's/uses</i></p> <p>Any government premises/departments, there are either all or some of the following type of electrical equipment</p> <ul style="list-style-type: none"> ▪ Lighting fixtures ▪ Fans ▪ Air-conditioners ▪ Computers and printers ▪ Televisions ▪ UPS ▪ Water coolers ▪ Refrigerators ▪ Service water pumps ▪ Special diagnostic machines in hospitals <p>Each of the above equipment will consume electricity and operates at different time and for different duration. This poses a problem to assess the energy consumptions by non-lighting equipment. Further, The billing meter records the total energy bill for the premises and it is practically difficult to separate out energy consumed by lighting fixtures. Hence, energy saving achieved by the conversion of only lighting fixture into LED cannot be measured.</p>	<p>The recording of energy saving is not critical while implementing the project on EPC mode. Since the project is being implemented by the government body/ULB, the savings in energy can be directly availed benefit w/o mandating measurement of benefit availed out of replacement of lighting fixtures</p>	<p>While executing the project on PPP, recording/measurement of saving in electrical bills on account of conversion of lighting fixture into LED becomes essential and is mandatory.</p> <p>The concessionaire is paid an Annuity based on savings in Electricity bills on account of conversion of lighting fixture into LED</p> <p>However, as described, the energy savings due to LED conversion can practically neither be measured at the energy meter nor can be computed after carrying out necessary measurements in a laboratory</p> <p>Hence, executing this project on PPP becomes technically challenging and non-feasible</p>

Difficulties in assuring the same lumen output from LED lamps and risk of quality of lamp selection by the bidder/concessionaire/contractor

As can be seen from illumination standards described in codal provisions (chapter 5), the illumination standards/norms have wider range in Lux levels to be maintained and similarly also for lighting distribution
Hence it is difficult to ensure installing same lumen output from LED Lamps

The payment to the bidder/contractor is not linked to savings in energy bills and hence there is no risk of contractor choosing lower wattage lamps or compromising on quality of work

Maintaining the same lumen output while replacing conventional lighting into LED, is one of the key considerations while implementing the project on PPP.

As described, it is difficult to ensure installation of same lumen output from LED lamps. This poses a risk of the concessionaire taking advantage by selecting a lower wattage LED lamp to ensure/claim higher savings.

6.3.2. Financial Consideration

Description	EPC Mode	PPP Mode
<i>Components of the project cost</i>	The Project cost includes the cost towards, removal of existing fixtures, installation of new fixture, Making good the old cut out when size of new fixture is smaller than existing fixture	In addition to the cost components mentioned while implementing the project on EPC mode, the financial costs incurred by the bidder also gets added to the project cost, thereby increasing the project cost
<i>Availability of funds for execution of project and Availing the benefits of</i>	Since the Funding is available under the Smart City Mission,	The project will be funded by the private player/

<p>savings in energy bills by respective Government Departments/ULB's/ESCOM'S</p>	<p>the respective ULB/Government departments are not required to fund the project execution</p>	<p>concessionaire. However, the cost incurred by the Concessionaire is to be paid back in form of annual annuity based on savings in energy bills. Since the financial cost is added in the overall project cost (resulting into more project cost), the relative benefit to government is less (as compared to project being executed on EPC mode)</p>
<p>Scale of Project and interest of bidder/contractor/concessionaire <i>The project involves replacement of 11000 fixtures (quantity is rounded off) towards cost of 3-4 Cr</i></p>	<p>Scale of project may not influence/alter the interest of bidder/contractor</p> <p>There are various small/medium scale contractors available in market to undertake such project. Hence, there are changes of bidder's/contractors willing up to take the project</p>	<p>Scale of the project may influence/alter the interest of Concessionaire</p> <p>Since the project cost is minuscule, there is risk that the private bidder may not be interested in taking up the project.</p> <p>Further, there is risk that on account of involvement of 11000 fixtures across 38 premises and related documentation/legal complexities, the bidder may leave the project mid away (the O&M cost is also miniscual</p>

and hence can be easily built in by private player while quoting for the project)

6.3.3. Documentation/Procedural/Legal Consideration

Description	EPC Mode	PPP Mode
<i>Signing of various legal documents including MOU's , Tripartite agreements Opening of ESCROW account</i>	<p>Since the project will be undertaken by Government entity (here, MSCL) on behalf of various government departments and in view of direction received from Ministry of Finance, department of Expenditure there is no formal documentation/MOU/agreements required.</p> <p>Also there is no need for opening of ESCROW account</p>	<p>For execution of this project on PPP mode and through private concessionaire, there is need for signing of formal MOU's, Tripartite Agreements, and Opening of ESCROW account for paying annuity to the concessionaire. Further, this particular project involves 38 premises across ABD area and hence need for signing 38 MOU's/Tripartite agreements/PPA in addition which is too cumbersome. Also, these MOU's/Tripartite agreements/PPA/ESCROW Account will be in place until the end of concession period</p>

6.3.4. Obligations for Operation and Maintenance

Description	EPC Mode	PPP Mode
Accountability of Concessionaire/Contractor towards the quality of work and O&M of installed fixtures	The quality of work can be ensured through proper monitoring during execution phase.	The quality of work can be ensured through proper monitoring during execution phase. Further, O&M is concessionaire scope
	Further, In order to ensure proper quality of work, the payment terms shall be derived to release the payment progressively over 4 years..	However, there is risk that on account of involvement of 11000 fixtures across 38 premises and related documentation/legal complexities, the bidder may leave the project mid away (the O&M cost is miniscual and hence can be easily built in by private player while quoting for the project)
	Also, it is proposed to implement this project as Item Rate Contract (instead of lumpsum contract)	

6.4. Recommended Mode of Project Implementation Mechanism

Taking into consideration assessment/evaluations of various aspects above and considering the issues/risks as summarized below, **IT IS PROPOSED TO TAKE THIS PROJECT ON EPC MODE AS ITEM RATE CONTRACT.**

IN ORDER TO ENSURE PROPER QUALITY OF WORK, THE PAYMENT TERMS SHALL BE DERIVED TO RELEASE THE PAYMENT PROGRESSIVELY OVER 4 YEARS.

- Technical impracticalities in recording the savings in energy bills on account of conversion of convention lighting fixtures into LED light fixtures
- ***Difficulties in assuring the same lumen output from LED lamps and risk of quality of lamp selection by the bidder/concessionaire/contractor***
- Increased Project Cost
- Scale of Project limiting **concessionaire** interest and accountability
- Cumbersome documentation process of MOU/Agreements etc with 38 premises/govt departments

7. APPLICABLE REGULATORY MECHANISM

This section deals with the applicable Regulatory Mechanism applicable to the project

7.1. E-Waste Management Rules 2016

The Government of India, in exercise of its powers conferred by section 6,8, and 25 of the Environment (Protection) Act, 1986 (29 of 1986) has made rule (hereafter refereed as E-Waste (Management) Rules, 2016 as notified on 23.3.2016.

The E-Waste (Management) Rules came into effect from 1st October 2016 and applies to every manufacturer, producer, Consumer, bulk Consumer, collection centres, dealers, e-retailers, refurbisher, dismantler and recycler involved in manufacture, sale, transfer, purchase, collection, storage and processing of e-waste or electrical and electronics equipment listed in Schedule 1 of the rule. “The E-Waste (Management) Rules, 2016” issued by MoEF and the “Guidelines on Implementation of E-Waste (Management) Rules, 2016” issued by CPCB are annexed as Annexure 4 and Annexure 5 to the report

7.1.1. Applicability of E-Waste (Management) Rules, 2016 to the Project

As per the Section 3(c) of the E-Waste (Management) Rules, the **Central Government or State Government Departments, publics sector undertakings, banks, educational institutions, Multi National Organizations, International agencies partnership and public/private sector companies registered under Factories Act 1948, and Companies Act,2013 and health care facilities which have turnover of more than one Crore or have more than twenty employees, are considered as bulk users of Electrical and Electronic Equipment and defined as “Bulk User” in the said rules**

Hence, the project under the consideration of the DPR attracts the provisions laid under the E-Waste (Management) Rules, 2016

In view of the provisions of the Section 9 (1) and procedures mandated under the E - Waste (Management) Rules, 2016 and the subsequent circular No. PCB/WMC/2164/E-Waste/CIRCULAR/2017/7015 dated 18 March 2017 (attached has Annexure 6 to the report) issued by the Karnataka State Pollution Control Board, mandates the **Bulk Users to ensure that the E-waste generated by them is channelized to authorized collection centers or dealer of authorized producer or dismantlers or recyclers or is returned to pick up or take back services provided by the producers to authorized dismantlers or recyclers.**

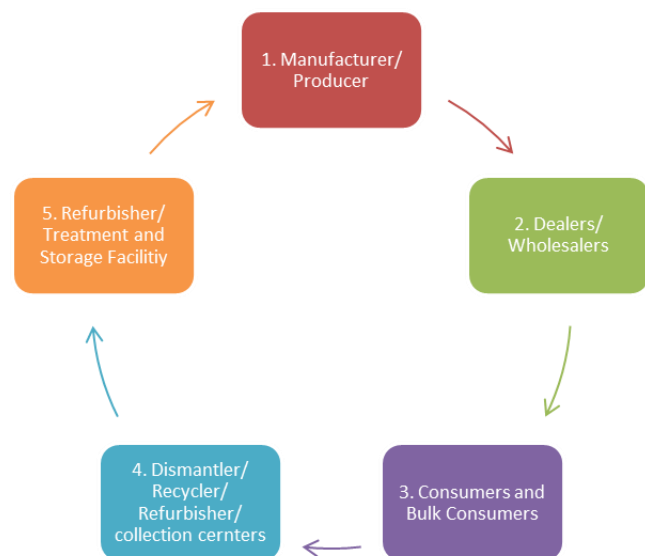
Further, as per the provisions of section 9 (2) of the rules, the bulk Consumers are mandated to

- Maintain records of the E-Waste Generated by them as per Form 2 of the rules and make the same available for the scrutiny by the concerned State Pollution Control Board (SPCB),
- File annual return as per Form 3 of the rules, to the Concerned Pollution Control Board on or before 30th June following the financial year to which that return relates

7.1.2. E- Waste Trade Value Chain

Adjacent Figure shows various stakeholders' involved in the E-Trade Value Chain

Since the project involves "Conversion of all Lighting in Government Building in ABD into LED", the applicable E-Waste Trade Value Chain involves stakeholders from 3, 4 and 5 from the adjacent figure



7.1.3. Compliance Measures to be taken

In view of various provisions laid under the E -Waste (Management) Rules, 2016, MSCL while executing of the project intends to ensure compliance to the statutory/regulatory requirements and will facilitate the concerned stakeholder's to successful implementation of the project

The scope of the contractor/agency appointed for execution of the project includes removal of existing lighting fixtures, Installation of appropriate LED fixtures; carry out necessary changes, if needed, reinstate the site*, carry out necessary touch up of paint*, if required and commission the new LED light fixtures (with assured equivalent or improved illumination) across the 37 identified premises. **Hence, the contractor is mandated to ensure compliance to the "E-waste (Management) Rules, 2016 and will have to be part of approved vendors/E-Waste Value Chain and shall have facilities defined for each role as per the guidelines of the Central Pollution**

Control Board and having authorization from concerned State Pollution Control Board. Accordingly, the provision laid in the DPR incorporates the “Buy-back” Provision in the project.

The Contractor/Implementing Agency will essentially take up “Extended Producer Responsibility” i.e Responsibility of any producer of electrical or electronic equipment, for channelization of e-waste to ensure environmentally sound management of such waste. Extended Producer Responsibility may comprise of implementing take back system or setting up of collection centers or both and having agreed arrangements with authorized dismantler or recycler either individually or collectively through a Producer Responsibility Organization recognized by producer or producers in their Extended Producer Responsibility – Authorization.

7.1.4. List of Approved Dismantler’s and Recyclers by Karnataka State Pollution Control Board

The list of Karnataka Pollution Control Board dismantler/recycler and list of collection center in Karnataka has been attached as annexure 7 and Annexure 8 of the report

The Contractor/Implementing Agency shall ensure execution of works as per its Extended Producer Responsibility – Authorization and in necessary arrangements with authorized dismantler or recycler

8. TIMELINE FOR EXECUTION

The proposed timeline for execution of project is 6 Months, including installation and Commissioning

9. BILL of QUANTITIES AND COST ESTIMATES

9.1. Assumption

- Existing FTL / CFL / HPSL lamps will be replaced by LED lamps with appropriate lumen output.
- In case, the existing illumination is poor, higher lumen LED lamps will be installed.

9.2. Bill of Quantities

The detailed BOQ for the project is as given in Annexure 9 of the report

9.3. Estimated project cost and the Budget

As per Smart City Proposal, the project is envisages to be taken up at an estimated cost of INR 4.46 Cr with 50% contribution from GOI's EESL Scheme and 50% from Beneficiary (here individual premises owners)

Based on the proposals considered under DPR, The total estimated cost of the Project is INR 1.95 Cr. Detailed cost estimated have been annexed as Annexure 10 to the report

Table below provides summary of the Cost Estimates

Sr. No	Description	Amount (INR)
1	Removal of existing Compact Fluorescent Tube Lights (CFL) fixtures, supply, installation, testing & commissioning of new LED light fixture and commissioning	7109187
2	Removal of existing Fluorescent Tube Lights fixtures (FTL) , supply, installation, testing & commissioning of new LED light fixture and commissioning	8666424.4
3	Removal of existing Incandescent Lights fixtures , supply, installation, testing & commissioning of new LED light fixture and commissioning	57615.36
4	Removal of existing Lights fixtures, supply, installation, testing & commissioning of new LED light fixture and commissioning (HPSV and Halogens)	555565.3
5	Making good the old cut out when size of new fixture is smaller than existing fixture.	324462
6	Misc. wiring and casing capping in case of light fixture shifting	276149
	Total Cost (1-6) above	16989403.2
	Contingency @ 3%	509682.09
	Buy Back Amount @ 10%	1698940
	Tender Premium @ 5%	849470.16
	Total Cost of the project	20047495.5

Misc. & Round off	2504.48
Grand Total	20050000

9.4. Buy back provision

As mentioned above, the DPR provisions the “Buy Back” Quote and the RFP required that the contractor should quote for buyback offer.

For estimation purposes, it is assumed as 10% of total project cost will be the Buy-Back cost quoted by the bidder's. However, final Buy Back Cost as quoted by the successful bidder

Annexures