GOVERNMENT OF THE PUNJAB

LOCAL GOVERNMENT & COMMUNITY DEVELOPMENT DEPARTMENT

HIRING OF FIRM/ CONSULTANT FOR ENERGY AUDIT OF LOCAL GOVERNMENTS

PC-II

Cost: PKR 87.445Million

January 2020

GOVERNMENT OF THE PUNJAB

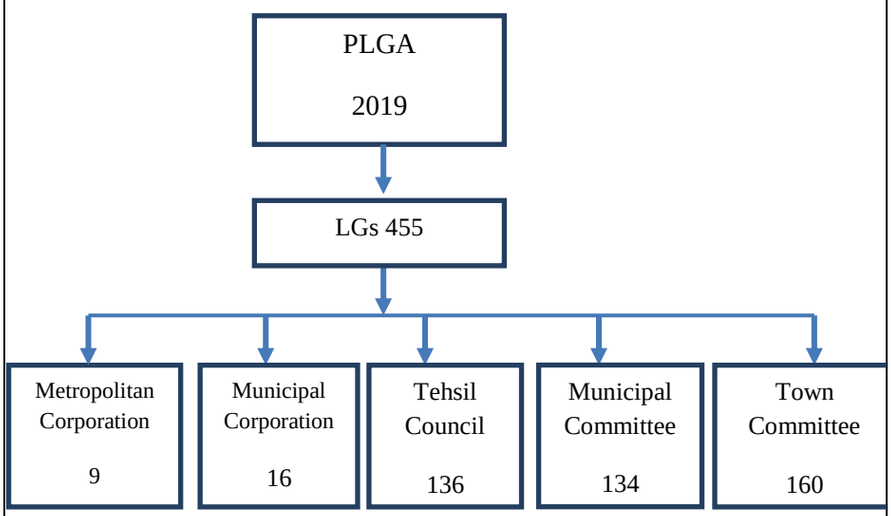
PLANNING COMMISSION
PC-II FORM

1.	**Name of the Project**	Hiring of Firm/Consultant for Energy Audit of Local Governments & Need Assessment of Solarization
2.	**Authority responsible for**	
	i. Sponsoring	Local Government & Community Development Department
	ii. Execution Agency	Punjab Local Government Board (PLGB)
3.	**General Description**	**I. Brief Background** Punjab is the most populous province of Pakistan, and is experiencing rapid urbanization. Cities in Punjab alone are estimated to contribute around 35%to the national GDP. As cities grow, substantial investments in urban governance and service delivery are needed to encourage economic growth and sustainable development.  The efficiency and sustainability of Punjab's urban governance system will be a key factor in achieving green and inclusive growth. Urban local governments in Punjab operate a large array of service delivery infrastructure assets and equipment, Municipal Committees (MCs) are directly responsible for providing services such as water supply, sanitation, solid waste management, and street-lighting, unlike the largest cities where specialized entities have been established to provide some of these services. Expenditures on power of service delivery agencies have increased manifold over time while tariffs for services like water supply and sanitation have largely remained stagnant, with minimal increases approved and notified by the provincial government. The increasing

cost of energy coupled with low tariffs, has made service provision unsustainable. As a result, municipal service delivery agencies are running large deficits against their electricity bills, and are invariably reliant on bail outs by the provincial government for clearing accumulated arrears to continue operation of services. Similarly, rising costs of fuel for backup power generation and vehicle fleet operations by municipalities has added to their difficulties.

Weak Operations and Maintenance (O&M) practices have also led to inefficient energy consumption at the MCs. Energy usage on water supply tube wells, disposal pumps and street lights is sub-optimal. There is an evident need to assess the performance of such equipment, and identify measures to improve energy efficiency. MCs currently lack capacity and tools to undertake energy audits on their own, and have limited O&M budgets that are inadequate to cover required expenditures on repair, maintenance, and replacement of inefficient equipment. Therefore, MCs require critical technical assistance to develop and operationalize effective systems and procedures, and train staff on diagnostic tools.

Under PLGA 2019, the Local Government Structure is given below:



II. Objectives of Energy Audit

All the Local Governments except sixteen cities being under taken by PMDFC under PCP will be assisted to undertake Energy Audits and identify priority investments and energy saving opportunities to make service delivery more efficient. The project will support analytical and capacity building activities i.e.to undertake Energy Audits of service delivery infrastructure and develop an Energy Management and Investment Plan identifying energy saving measures and Solarization needs for equipment/ infrastructure. These activities are expected to result in the identification of potential savings in energy consumption and costs, better energy management related to

municipal service delivery and identification of priority investments to optimize energy consumption and expenditure.

Energy Audit by an independent professional organization is required to provide the vital information base for overall energy conservation programme covering essentially energy utilization analysis and evaluation of energy conservation measures. The major objectives are:

- Assessing present pattern of energy consumption in different cost centers of operations
- Relating energy inputs and production output
- Highlighting wastage in major areas
- Fixing of energy saving potential targets
- Implementation of measures of energy conservation and realization of savings.
- Need assessment of Solarization where required.
- Propose retrofitting along with preparation of PC-I of each Local Government against retrofitting proposals.

III. Criteria of Selection:

However, the project will cover the following LGs. The selection has been made on the basis of those MCs which are:

(i) Not included in PCP/PICIIP (List given below)

(ii) Not included in PCGIP (List given below)

(iii) Not Tehsil Councils

(iv) District Head Quarter Cities except as above in serial (i) & (ii)

(v) Where District Head Quarter Cities given in Serial (i) & (ii) the second most populated city as per Census 2017 Population. Lahore has been excluded as there are independent Towns.

Basis of Selection of Cities:

Total Allocations for the projects is Rs.400.00 Million. The Energy Audit of 35 Cities will be conducted under this cost. Already Energy Audit for 16 Cities for Punjab Cities Program has been conducted by a

WB outsourced Firm. The estimates based on Energy Audit for these 16 Cities varies from Rs.7.8 Million up to 60.00 Million depending upon the needs and actual requirements of the cities.

Selection of Cities:

By the energy audit completed, it is estimated that about 20 cities will be covered within the allocated cost of Rs. 400.00 Million with an

average cost of Rs.20.00 Million against each project of a selected MC. For balance cities cost may be covered either from some other allocations or re-appropriation from Block Allocations available with the Department. These 20 Cities for investment projects will be selected as per their population in descending order given under the list of following 35 cities (except Metropolitan Lahore):

Table 1: Local Governments in Punjab (35 Cities)

Sr. No	Division	Sr. No.	District	Name of City	Population
1	Rawalpindi	1	Rawalpindi	Municipal Committee, Kahuta	60,557
		2	Jhelum	Municipal Committee, Dina	76,636
		3	Chakwal	Municipal Committee, Chakwal	182,757
		4	Attock	Municipal Committee, Attock	120,700
2	Sargodha	5	Sargodha	Municipal Committee, Bhalwal	685,574
		6	Mandi Bahauddin	Municipal Committee Mandi Bahauddin	246,120
		7	Gujrat	Municipal Corporation Gujrat	513,964
		8	Mianwali	Municipal Committee Mianwali	137,628
		9	Bhakkar	Municipal Committee Bhakkar	109,097
		10	Khushab	Municipal Committee Khushab	119,384
3	Gujranwala	11	Gujranwala	Municipal Committee Qila Dedar Singh	84,302
		12	Hafizabad	Municipal Committee Pindi Bhattian	55,835
		13	Sialkot	Municipal Committee Sambrial	102,063
		14	Narowal	Municipal Committee Narowal	129,456
		15	Gujrat	Municipal Corporation, Gujrat	513964
4	Lahore	16	Lahore	Nil (Excluded)	
		17	Kasur	Municipal Corporation Kasur	407,390
		18	Nankana	Municipal Committee Nankana	79,540
		19	Sheikhupura	Municipal Corporation Sheikhupura	571,251
5	Faisalabad	20	Faisalabad	Municipal Committee Samundari	160,722
		21	Chiniot	Municipal Corporation Chiniot	274,438
		22	Toba Tek Singh	Municipal Corporation TT Singh	103,009
		23	Jhang	Municipal Committee Shorkot	49,956
6	Sahiwal	24	Okara	Municipal Committee	104,595

				Depalpur	
		25	Sahiwal	Municipal Committee Chichawatni	101829
		26	Pakpattan	Municipal Committee	183,486
7	Bahawalpur	27	Bahawalpur	Municipal Committee Ahmad Pur East	178,671
		28	Bahawalnagar	Municipal Committee Chishtian	156,737
		29	Rahim Yar Khan	Municipal Committee Sadiqabad	253,399
8	Multan	30	Khanewal	Municipal Committee Kabir Wala	96,589
		31	Lodhran	Municipal Committee Lodhran	117,851
		32	Multan	Municipal Committee Shujaabad	133,725
9	DG Khan	33	DG Khan	Municipal Committee Taunsa	97,100
		34	Muzaffargarh	Municipal Committee Jatoi	129,703
		35	Rajanpur	Municipal Committee Rajanpur	118,192
		36	Layyah	Municipal Committee Layyah	137,838

There were 5 big cities which were considered under PCGIP i.e.

1. Lahore
2. Faisal Abad
3. Rawalpindi
4. Gujranwala &
5. Multan

The Cities which will be covered under PICIIP are :

1. Sialkot
2. Sahiwal
3. DG Khan
4. Rahim Yar Khan
5. Sahiwal
6. Bahawalpur &
7. Sargodha

While projects for WASA Multan and WASA Rawalpindi will also be taken up under this project.

While on the other hand, 16 cities taken up in Punjab Cities Program have not been including in the Table as given above. The 16 MCs covered under PCP are listed below:

1. Jhelum
2. Wazirabad
3. Komonki
4. Muridkey
5. Hafizabad
6. Daska
7. Jaranwal
8. Jhang
9. Gojra
10. Kamalia

11. Okara
12. Khanewal
13. Burewala
14. Vehari
15. Bahawalnagar &
16. Kot Addu

2. <u>Core Team of the Consultant</u>

The consultant will be bound to provide their detail methodology to carry out an energy audit. The proposition in PC-II has been based upon their proposition of conducting energy audit in 36 MCs in line with scope of work/TORs of energy audit. It has been proposed that a team leader with senior electrical and mechanical engineers will be stationed at Lahore. In all divisions of Punjab, at least one resident electrical engineer with the support of one electrical diploma holder supervisors and one junior electrical engineer will be responsible to carry out the energy audit in each division.

Electrical supervisors and electrical engineers will carry out survey and prepare initial analysis under the supervision of Resident Electrical Engineer and who will send its Division wise distributed and allocated MCs Energy Audit Data after initial analysis to Consultant head office for preparation of Energy Audit Reports. The Team Leader will be responsible to submit these reports to the client i.e. the Project Manager PLGB.

Team structure with allocation of MCs is given below :-

Table 2: Team Distribution in Divisions

S #	Personnel	Based in	No's of Professional
1	Team Leader	Head Office at Lahore	1
2	Senior Electrical Engineer	Head Office at Lahore	3
3	Senior Mechanical Engineer	Head Office at Lahore	1
4	GIS Expert	Head Office at Lahore	1
5	Resident Electrical Engineer	At Divisional Level	9
6	Resident Supervisors	At Division Level	9
7	Junior Electrical Engineer	At Divisional Level	9

Qualification and minimum experience required for required professionals is given below :-

Table 3: Personnel Detail with Qualification

S #	Personnel	No's	Qualification
1	Team Leader	1	M. Sc. in Electrical Engineering with minimum 20-years' Experience, foreign qualification and experience shall be preferred.

2	Senior Electrical Engineer	3	B. Sc. in Electrical engineering with minimum 10-years similar kinds of experience particularly energy audit, maintenance of electrical installations and design of electrical projects	
3	Senior Mechanical Engineer	1	B. Sc. in mechanical engineering with minimum 10-years of experience on similar projects along with maintenance and particularly experience of design of electrical and mechanical equipment	
4	GIS Expert	1	MS in GIS with minimum 5-years of experience on GIS based systems with an experience of working on android based applications	
5	Resident Electrical Engineer	9	B. Sc. in electrical engineering with minimum 10-years' experience on similar projects particularly field based assignments	
6	Resident Supervisors	9	Diploma in Associate Engineering in electrical with minimum 10-years' experience with exposure of data collection and field supervisions	
7	Junior Electrical Engineer	9	B. Sc. in electrical engineering with minimum 1-years' experience on electrical engineering assignments	

3. <u>Professional Liability of the Consultant</u>

The consultant shall comply with the PPRA Rule-54 which states

"(1) The consultant selected and awarded a contract shall be liable for consequence of errors or omissions on the part of the consultant.

(2) The extent of liability of the consultant shall form part of the contract and such liability shall not be less than remunerations nor it shall be more than twice the remunerations.

(3) The procuring agency may demand insurance on part of the consultant to cover the liability of the consultant and necessary costs shall be borne by the consultant.

(4) The consultant shall be held liable for all losses or damages suffered by the procuring agency on account of any misconduct by the consultant in performing the consulting services."

4. <u>Hiring Process</u>

The hiring shall be done through competitive bidding based on "<u>Least Cost Selection Method as given in PPRA Rules.</u>

5. Consultant Fee

The Consultant fee will be based upon technical/financial proposal.

The payments to the consultant will be linked with output/deliverables.

All payments made to the Consultant shall be subject to prevalent applicable taxes.

6. Duration of the assignment

(i) Assignment is likely to be completed within Ten (10) months from date of contract agreement.

(ii) The consultant shall furnish Completion Report within a fortnight after completion of assignment.

7. Deliverables and timelines

Table 4: Detail of Deliverables

S. #	Deliverables
1	Inception report
2	Asset inventories (water supply and waste water disposal equipment, municipal buildings, and streetlights)
3	Energy and waste water audit reports developed for water supply and waste water disposal equipment
4	Comprehensive energy consumption inventories developed for equipment, municipal buildings and, street lights, linked to GIS Maps, with each facility as a cost center
5	Energy Management Plans developed, including energy saving opportunities, expected energy savings, investment plans, and PC-Is on the basis of estimated cost.
6	Fuel saving plan with tracker system for vehicles based on working computer applications for each Local Government
7	Energy Audit reports developed for municipal buildings and streetlights
8	Detailed Cost Estimates of Energy Audit Projects (36 MCs)
9	PC-I of Energy Audit Project
10	Bidding Documents

4.	**Justification**	Energy Audit by an independent professional organization is required to provide the vital information base for overall energy conservation program covering essentially energy utilization analysis and evaluation of energy conservation measures.

<table>
<tr><td>5.</td><td>Item wise year wise capital cost estimate</td><td>Capital cost of Energy Audit is PKR 82.71million,the breakup of which is given below;
Table 5: Year wise Cost Break Down
<table>
<tr><th>S #</th><th>Description</th><th>Cost</th><th>Year 2019-20 (30%)</th><th>Year 2020-21 (70%)</th></tr>
<tr><td>A</td><td>Manpower cost</td><td>4,31,00,000</td><td>1,29,30,000</td><td>3,01,70,000</td></tr>
<tr><td>B</td><td>Transportation and Logistics</td><td>1,97,20,000</td><td>59,16,000</td><td>1,38,04,000</td></tr>
<tr><td>C</td><td>Overheads (Utilities, Stationary, TA/DA etc.) 15% of total cost</td><td>94,23,000</td><td>28,26,900</td><td>65,96,100</td></tr>
<tr><td>D</td><td>Office Establishment & other support staff etc @ 5%</td><td>31,41,000</td><td>9,42,300</td><td>21,98,700</td></tr>
<tr><td></td><td>Total</td><td>75,384,000</td><td>2,26,15,200</td><td>5,27,68,800</td></tr>
<tr><td>E</td><td>Govt. Taxes / PRA (16%)</td><td>12,061,440</td><td>36,18,432</td><td>84,43,008</td></tr>
<tr><td colspan="2">Grand Total</td><td>87,445,440</td><td>2,62,33,632</td><td>6,12,11,808</td></tr>
<tr><td colspan="2"></td><td>Say 87.445 Million</td><td>Say 26.233 Million</td><td>Say 61.212 Million</td></tr>
</table>
Detail of cost of project is attached at Annexure-B</td></tr>
<tr><td>6.</td><td>Management structure and manpower requirements including specialized skills during execution and operational phase</td><td><u>Project Manager</u>
Chief Engineer PLGB will be the Project Manager and he will supervise the work of Energy Audit consultants. He will monitor and report the activities of Consultants to Secretary, LG & CD Department
<u>Focal Person</u>
Deputy Secretary (Dev.), LG & CD Department will be the focal person to conduct progress
<u>Core Consultant Team</u>
The Consultant Team will constitute the staff as already described above
<u>Consultant Selection Committee</u>
Consultant Selection Committee shall be notified by the Department within a week of the approval of PC-II
The proposed names of Selection Committee are given as below:
1. Secretary LG & CDD (Chairman)
2. Chief Local Government P&D (Member)
3. Representative of Finance Deptt. (Member)
4. Representative of P&D Department (Member)
5. Chief Engineer(HQ)PLGB (Member)</td></tr>
<tr><td>7.</td><td>Indicate when the cost estimates were prepared and</td><td>The cost estimates have been prepared original in October, 2019 and now revised in January 2020. Market driven rates have accordingly been used for preparation of cost estimate for PC-II.</td></tr>
</table>

<table>
<tr><td></td><td>basis of these estimates</td><td></td></tr>
<tr><td>8.</td><td>Source of financing of the capital cost</td><td>The provision of the Project already approved under ADP General Serial No. 2792. The provision of this project in ADP is Rs 500.00 million, in three financial years i.e. 2019-2020, 2020-2021, 2021-2022.
Table 6: Year Wise Allocations<table><tr><td>Years</td><td>2019-2020</td><td>2020-2021</td><td>2021-2022</td><td>Total</td></tr><tr><td>Allocations (Rs. Million)</td><td>100</td><td>200</td><td>200</td><td>500</td></tr></table></td></tr>
<tr><td>9.</td><td>Implementation Schedule</td><td>The implementation schedule is given in Annexure-D.</td></tr>
<tr><td>10</td><td>Expected outcomes of the survey and feasibility studies and details of the projects likely to be submitted after the surveys</td><td>• Energy Audit will help to find out deficiency in performance of Machinery of MCs and to find out the ways to increase it.
• The study will help to save energy by finding out more energy consuming items and suggestion of converting into less energy consuming items.
• The Energy Audit firm will suggest the Solarization of elements wherever required.
• The estimates of each item for energy saving will be framed by the Energy Audit Firm
• PC-I of the whole project will be framed based upon the detailed cost estimates mentioned in the Final Energy Audit Report</td></tr>
<tr><td colspan="2">Prepared by:</td><td>Chief Engineer, Punjab Local Govt. Board</td></tr>
<tr><td colspan="2">Checked & Recommended by:</td><td>Additional Secretary (Dev.)
Local Govt & Community Development Department</td></tr>
<tr><td colspan="2">Forwarded by:</td><td>The Secretary
Local Govt. & Community Development Department</td></tr>
</table>

Annexure-B

Terms of Reference (TORs) of Energy Audit Consultant:

1. Duties & responsibilities

ThedutiesandresponsibilitiesofConsultantshallincludebutnotlimitedto the following:-

- Analyze energy consumption and costs: Collect, organize, and analyze past energy bills.
- Compare energy performance: Determine the energy use and resources that can help compare them internally from one period to another, from one facility to a similar one, or from one system to another.
- Profile energy use patterns: Determine the time and relationships of energy use such as the electricity demand profile.
- Inventories energy use: Prepare a list of all energy-consuming loads/efficiencies in the audit area and measure their consumption and demand.
- Identify Energy Management Opportunities that include operational and technological measures to reduce energy usage.
- Measure the potential energy and cost savings, along with any other benefits.
- Check the efficiency of existing vehicles.
- Recommend condemnation of inefficient vehicles.

These outputs will be used to develop an Energy Management Plan for each MC, which will include short-, medium-, and long-term measures to optimize energy consumption in municipal service delivery. The Plans will recommend measures such as:

- Rehabilitation of pumps, including power factor correction, impeller adjustment, replacement of components etc.
- Review of operational schedules for pumps, particularly in terms of reducing operation during peak hours, and recommending whether investment in such elements as Over Head Reservoirs (OHRs) may be viable at certain sites to rationalize operating hours.
- Recommend where it may be viable to replace existing equipment models in the medium to long term with more energy efficient ones.
- Replace existing streetlight bulbs with Light Emitting Diode (LED) bulbs.
- Assess and recommend Solarization wherever required and viable.

Methodology

1. The Consultancy Firm shall develop a detailed work program for carrying out the work immediately after mobilizing. It shall then prepare an inventory of relevant assets owned/operated by the MC, including municipal buildings, streetlights, and water-supply/wastewater disposal pumps. Vehicles and machinery operated by concerned Local Government. In doing so, it can be guided by information already available within MCs, but this information will need to be verified. The Consultants shall also collect relevant information on energy expenditure (bills etc.) for each asset for at least the last 12 months.

2. Collection of additional information on location (where applicable), performance, and energy consumption and expenditure incurred, as specified in the following sub-section of this TOR shall commence next. The outputs should be provided in a format with detailed information records for each asset, and an overall inventory and analytical report discussing key performance indicators.

3. The Consultants shall then identify energy saving opportunities, and provide saving potential (in energy and monetary terms) for each opportunity, estimated investment costs and returns on investments, engineering plans, and Bill of Quantities, as needed.

4. Recommended information fields for each category of assets are listed below. The consultants may suggest additional information fields, or revision of any data field suggested below, with the submission of the detailed work program.

Water Supply and Wastewater Disposal

a) Develop inventories of all water supply &disposal pumps installed and operated by the MCs, and record details given below:

- Unique Identification Number
- GPS Location/geo-tag
- Primary function (distinguish between water and wastewater pumps)
- Name Plate Data of each pump-motor set (year of installation, capacity, power etc)
- Record Design parameters for each pump-motor set, including inter alia:
  - Pump efficiency at design flow and head
  - Pump performance curve
  - Motor rated power
  - Motor efficiency at design load
  - Motor power factor at full load
- Perform field performance tests for each pump-motor set, including inter alia:
  - Measurement of discharge
  - Measurement of static water level
  - Measurement of pumping water level
  - Computation of draw down
  - Computation of system head
  - Computation of frictional losses
  - Motor power factor at duty point
  - Measurement of power inputs (Volts, Power Factor, Amperes and Kilowatts)
  - Measurement of motor winding and bearing temperature
  - Computation of Motor, Pump and hydraulic efficiency at current head & flow
  - Measurement of Motor & Bearing Vibrations

- Study the site loads and compare with capacities of installed pumps.
- Determine system resistance and calculate the duty point.

b) Determine energy efficiency and identify energy saving opportunities:

- Measure actual energy consumed and water produced by each pump installed, taking account of performance and the time for which the pump is operated on a typical day.
- Compare actual energy consumption with the designed energy requirements of the pump installed and the basis on which energy charges are currently levied by the electricity supply company
- Assess the need of motor-power and compare it with the motor installed.
- In case the pump is operating at some distance below its rated characteristic curve, assess the reason.
- Give recommendations for modification, repair and replacement of specific components.
- Set the performance objective for modification, repair and replacement activity.
- Prepare and cost detailed proposals for an investment program.
- Prepare a rank-ordered list of appropriate modifications.
- Produce full contract drawings, documents and costings.

c) Based on the asset inventory, calculated KPIs are given below:

- Energy Density of Potable Water Production (kWh/m^3)
- Energy Density of Wastewater Disposal (kWh/m^3)
- Energy Density of Wastewater Treatment (kWh/m^3) – if applicable
- Expenditure on Potable Water Production (PKR/m^3)
- Expenditure on Wastewater Disposal (PKR/m^3)
- Expenditure on Wastewater Treatment (PKR/m^3) – if applicable

Street Lights

a) Develop inventories of all street lights installed and operated by the MCs, and record details given below:

- Unique Identification number
- GPS location
- Operational status: Functional (satisfactory, unsatisfactory); Non-functional (Missing light equipment, repairable/non-repairable); etc.
- Dates of installation for pole/fixture and lighting equipment respectively. Use estimated dates in case actual dates are not available.
- Costs of (i) purchase and (ii) installation, for pole/fixture and lighting equipment respectively. Use estimated costs in case actual dates are not available.
- Lighting technology used (high-pressure sodium vapor, low-pressure sodium, metal halide, LED, etc.)

- Average daily hours of operation (for example, 5 p.m.–7 a.m.) for each month
- Overall annual electricity consumption by streetlight
- Current electricity rates for street lighting (PKR/kWh)
- Annual maintenance costs

b) Based on the asset inventory, calculate KPIs given below:

- Average electricity consumed per kilometer of lit roads(kWh/km)
- Average electricity consumed per light pole/fixture (kWh)
- Average cost of purchase of (i) pole/fixture and (ii) lighting equipment
- Average cost of installation of (i) pole/fixture and (ii) lighting equipment
- Average annual maintenance costs
- Average daily duration of operation
- Average energy costs per kilometer of lit roads(PKR)
- Average energy costs per light pole/fixture (PKR)
- Number and percentage of failed public lights

c) Based on energy consumption and associated costs to MC, provide recommendations for:

- Reducing energy use and expenditure incurred (on installation, operation and maintenance)
- Technology replacement or up gradation (including proposed BOQs, estimated installation/retrofitting and maintenance costs, and financial analysis)
- Technical solutions for managing lighting timing and intensity (dimming)
- Cost Estimates of interventions design for the purpose

Municipal Buildings

a) Develop inventories of all municipal building owned/operated by the MCs, and record details given below:

- Unique Identification number
- Ownership of the building (MC-Owned, other?)
- Operator of building (MC, commercial tenants, etc.)
- Type of building (residence, office, commercial)
- Age of the building
- Condition of the building, Functional (satisfactory, unsatisfactory), Non-functional (repairable/non-repairable); Need for repairs, etc.
- Total floor area
- Total number of floors
- Type and number of heating unit(s), Central heating; individual heating units -

stoves/gas heaters, electric heaters, etc.

- Type and number of cooling unit(s), fans, desert/air coolers; air conditioning systems (centralized AC), air conditioning systems, split etc.
- Type and number of water heating units (including energy source).
- Type and number of lighting unit(s), input with power rating, conventional light bulbs, tube lamp, energy saver bulbs, compact fluorescent lamps (CFLs), LED bulbs, etc.
- Are buildings insulated? Type of insulation.
- Energy consumption during previous year (segregated by function heating, cooling, water heating, lighting, etc.)

  Expenditure on energy over previous year.

b) Based on energy consumption and associated costs to MC, provide recommendations for:

- Reducing energy use and expenditure incurred (on installation, operation and maintenance)
- Technology replacement or up gradation (including proposed BOQs, estimated installation/retrofitting and maintenance costs, and financial analysis)

c) Based on the asset inventory, calculate KPIs given below:

- Municipal Buildings Electricity Consumption (kWh/m^2)
- Municipal Buildings Heat Consumption (kWh/m^2)
- Residential Buildings Electricity Consumption (kWh/m^2)
- Residential Buildings Heat Consumption (kWh/m^2)
- Commercial Buildings Electricity Consumption (kWh/m^2)
- Commercial Buildings Heat Consumption (kWh/m^2)
- Average Cost of heating (PKR/m^2)
- Average Cost of cooling (PKR/m^2)
- Average Cost of lighting (PKR/m^2)

Municipal Machinery

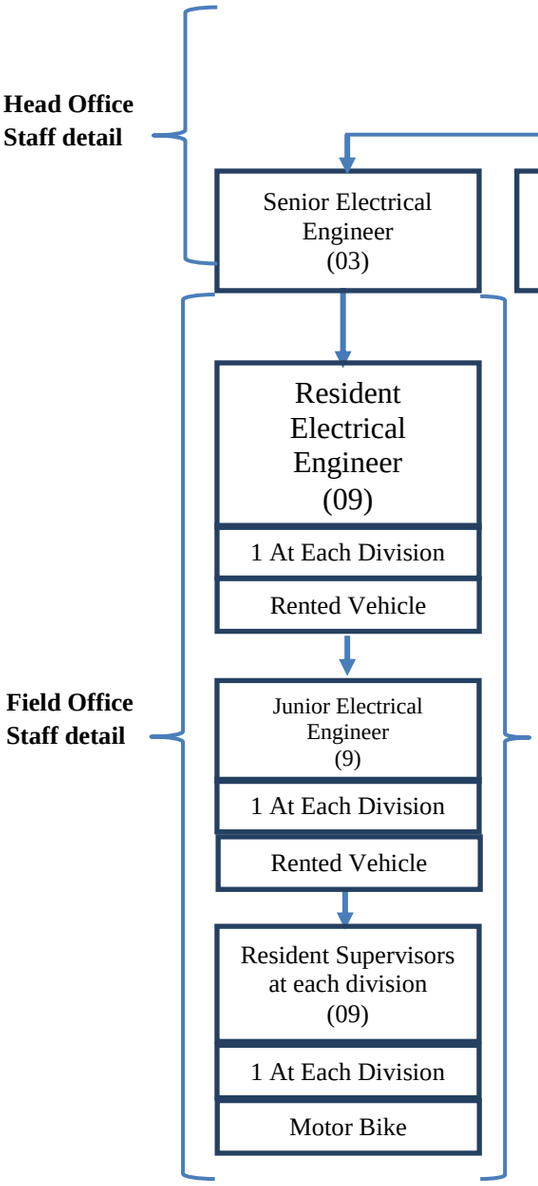
- Based on asset inventory.
- Collect data about all machinery when it was purchase.
- Whether the machinery has complete it use full life.
- Whether the machinery is condemnable.
- Average fuel Consumption
- Average mileage covered daily.

Note:

Cost Estimates required for the purpose will also be prepared by the Consultants along with PC-Is based on the recommendations after completion of the Energy Audit and approval of the Client

						Annexure-C
Cost estimates for Energy Audit of Local Governments						
A	**Manpower cost**					
	Designation	**No of slots**	**Man months each**	**Total man months**	**Cost per month**	**Total cost Rs.**
1	Team Leader	1	10	10	300,000	3,000,000
2	Senior Electrical Engineer	3	10	30	200,000	6,000,000
3	Senior Mechanical Engineer	1	10	10	200,000	2,000,000
4	GIS & IT Experts	1+1=2	5	10	150,000	1,500,000
5	Resident Electrical Engineer	9	10	90	200,000	18,000,000
6	Resident Supervisors	9	10	90	75,000	6,750,000
7	Junior Electrical Engineer	9	10	90	65,000	5,850,000
					Total	**43,100,000**
B	**Transportation & Logistics**					**19,720,000**
					Total	**62,820,000**
C	**Overheads (Utilities, Stationary, TA/DA etc.) @15% of Total Cost**					**9,423,000**
D	**Office Establishment & other support staff etc. @ 5%**					**3,141,000**
					Total	**75,384,000**
E	**Govt. Taxes/PRA @ 16%**					**12,061,440**
				Grand Total (2)		**87,445,440**
				Say Rs.	**Million**	**87.445**

TEAM ORGANOGRAM FOR ENERGY AUDIT OF LOCAL GOVERNMENTS



Supported By:

- One site office at each division
- Proper Logistics
- Utilities
- Computer Operator
- Security Guard
- Stationary
- Furniture
- Internet Access
- Android Mobile Devices*(To run Android Application)*

IMPLEMENTATION SCHEDULE

ENERGY AUDIT OF LG & CD DEPARTMENTS

Annex-D

Sr. No	Activities	Financial Year 2019-20						Financial Year 2020-21						
		Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan
1	PC-II Preparation													
2	PC-II Approval													
3	Preparation of RFP													
4	Issuance of RFP													
5	Submission of proposals by Consultants													
6	Evaluation of Proposals													
7	Award of Contract													
8	Contract Agreement													
9	Implementation													
10	Months				**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**