# Project Report

## IOT/GSM based Smart Energy Meter

## 1 Background

Although electric power was introduced to India by British in the colonial period in 1879, it was in 1910 that the Electricity Act of India was framed. Electrification process took long enough and it was only recently that 100 % households got access to electricity in most of the states. Traditionally, electricity meters were analog and electro-mechanical watt-hour meters relying on the concept of Eddy currents to measure the power. These were replaced by the electronic meters which are in use today. These rely on using transducers like voltage and current transformers from which power rating is obtained.

## 2 Market Survey and SWOT Analysis

The total installed capacity of power stations in India stood at 346.62 Gigawatt (GW) as of November 2018. The power sector in India is continuously developing and the power consumption is estimated to reach around 1894 TWh by 2022. Currently, an estimated number of 230 million meters are installed in households across India. Most of these meters are conventional and electronic in nature. That is, they lack the facility of remote and real-time access/control.

To overcome this issue, in the last few years, government of India along with some private shareholders, start-ups have come up with the aim of installing smart meters in households across India. Some of these include : Tata Power Delhi Distribution Ltd (TPDDL), a joint venture of the Delhi government and Tata Power, EESLs (Energy Efficiency Services Ltd.) Smart Meter National Programme (SMNP) etc. However, the effects of successful implementation of these schemes and services are yet to be seen. Performing a SWOT analysis for this product gives us a clear idea about the strength and opportunities involved in launching a smart electricity meter. The market analysis, described above gives us an idea about the current market share and potential. The challenge involved in launching this product is ensuring that the developed solution is economical and scalable for Indian markets. So, to this end, we propose to develop a novel smart electricity meter with advanced functionalities whose production and deployment is economical in nature.

## 3 Smart Meter - Motivation and Advantages

Most of Indias power distribution companies, or discoms, lose money on every unit of power sold due, in part to theft, inadequate billing and selling below cost to poor and agricultural consumers. State-run distributors in India held combined debt of 4.3 trillion rupees ($67 billion) as of September 2015. There are several reasons why these energy meters need to be re-designed to cater to the standards of today's increasingly digitizing economies. Some are:

- Admin side benefits :
    1. Remote meter reading - It saves the cost of a human meter reader and the resulting mistakes and it also allows more measurements, and remote provisioning.
    2. Provide remote access for switching off or on the power supply of its users. Thereby, providing a better mechanism to check for bill-defaulting users.
    3. Identify anomalies and thefts of electricity by analyzing the consumption data of its users.
    4. Providing real-time data useful for balancing electric loads and reducing power outages (black-outs). Thereby, also saving electricity wastage by surplus production.
    5. Enabling dynamic pricing or Time-of-use Tariffs (raising or lowering the cost of electricity based on demand).

- Client (User) side benefits :

    1. Consumers can be informed remotely (historical data) or locally (real-time data) on energy costs. Also, they can reduce costs by increasing energy consumption during off-peak cheaper tariff periods.
    2. Notifications can be sent to users on this application whenever the admin(s) find the possibilities of anomalies or thefts by analyzing the power consumption.
    3. Machine learning algorithms (For example : ARIMA) can be leveraged to estimate the power consumption of users on a monthly/yearly basis.

# 4 Prototype costing

The costing of the components utilized for developing the prototype of the wireless smart energy meter are listed in the table below :

Table 1: Costing of components

| **Components** | **Pricing (In Rs.)** |
|---|---|
| Arduino Uno | 400 |
| GSM 900A Module | 750 |
| LCD Display | 80 |
| SMPS | 80 |
| Triac BT136 | 16 |
| Optocoupler MOC3021 | 18 |
| Transformer | 40 |
| Resistors, Capacitors | 20 |
| Wires and accessories | 20 |
| Miscellaneous | 76 |
| **Total** | **Rs. 1500** |

# 5 Production Unit Costing

The entire circuit of the developed prototype can be integrated to design a System on Chip (SOC) which can further be integrated with the current electronic meters to transform them into smart electricity meters with all the additional features.
We estimate the costing of this custom chip to be around **Rs. 450 - 550** [1].
Estimate number of smart meters required for Indian market - **130 million**.
Thereby, **Projected Revenue Potential : Rs. 65 Billion.** [2]
**This further strengthens our claim, that the developed product (electricity meter) is smart, economical and scalable, and hence can be launched for the Indian market.**

[1] Industry experts were consulted before arriving this estimate cost.
[2] A very crude projection, needs to be properly analyzed.