Energy and Electricity Law, Tariff Policy and Regulation for Clean Energy Mini Grids (CEMG)

Abuja, 17 to 19 July 2017
Chapter 1

Energy and Electricity Law for CEMG (A3)
Energy & Electricity Laws

- Despite the energy reforms being carried out, governments still rely on policies that were developed for centralized grid supply networks which are not appropriate for mini grids or other decentralized electrification options. Decentralized electrification requires a different approach in terms of operation, maintenance, customer service, and billing.

- In the context of CEMG Energy, electricity or renewable energy laws or acts may content:
  - Access **targets**
  - The **institutional framework** for public planning (Rural Electrification Plan)
  - **Enforcement of regulations** for rural electrification in general and mini-grids in particular
Energy & Electricity Laws

• In the context of CEMG Energy, electricity or renewable energy laws or acts may content:
  • The approach for **operator model** (Utility, Private, Community, Hybrid)
  • The approach for **setting**/ monitor/ revise the retail **tariffs**
  • They lay down the **basis** for any specific regulations or **promotion instruments**
  • **Consumers rights and protection**
  • **CEMG operator liabilities**
  • Guidance for **monitoring, inspection, and compliance**
  • Guidance for **dispute settlement**
Energy & Electricity Laws: Principles

• **Stable and long-lived.** A stable policy and regulatory environment is the basis for attracting investment into mini-grids. Mini-grid investors require reassurance that both macro-scale and specific regulatory support mechanisms will remain stable and predictable for the life of the project.

• **Clear and Comprehensive.** An incomplete or unclear mini-grid policy and regulatory framework will hinder rather than foster mini-grid roll-outs. There should be full clarity on permitted tariffs, license and permit requirements, import duties, VAT, company taxes, and other possible incentives and subsidies, as well as the other policy and regulatory issues. The process by which regulatory decisions on these issues are reached should be clear and standardized for all transactions (*Peru, Uganda*)
Energy & Electricity Laws: Principles

- **Accessible Policy** and regulatory frameworks should seek to ensure that the points of contact for permitting, technical and financing support are easily accessible and available. Stakeholders should be able to contact the agencies (and/or individuals) that are key to implementing their project (Ecuador, Nayo-GIZ)

- **Cost-effective and Efficient**. Regulations, procedures, and potentially resulting delays create transaction costs for the project developer, which are particularly critical for smaller developers. It is thus of paramount importance to design a mini-grid policy and regulatory framework that is cost-effective (for all players) and efficient, i.e. that minimizes bureaucratic delays for granting licences and permits, responding to inquiries, or providing other support (Nayo-EIA)
Regulating *too fast, to soon*

- Allowing an **initial grace period** of five years or so, during which private operators of small mini- and micro-grids in rural areas could experiment with different delivery models without obtaining the national regulator’s approval for their retail tariffs or a full license to operate. **Combined with** prespecified **backstop measures** to protect village consumers:
  - Annual reporting
  - Tracking of customer complaints
  - Registration rather than licensing
  - Review after five years
  - *Nayo (provisional license)*
Multi-utilities

- To expand productive uses even if electricity is made available. In those cases, complementary initiatives—such as facilitation for micro-finance and access to water—may be needed to both maximize the benefits of electricity programs and promote long-term sustainability of the CEMG

  http://www.rvesol.com/

- Philippines, “Community Energizer Platform”, it is a modular system in which one container holds a generator while others house electric-powered equipment that can be valuable to the community, such as water purification systems, communications (cell phones, computer, Internet, fax), refrigeration, ice-making, and entertainment
Chapter 2

Tariff Policy and Regulation for CEMG (A4)
Revenues

- Connection fee
- Retail tariff
- Grant and subsidies
Revenues – Connection Fee

- The cost related to connection fee usually **covers the estimated costs of materials, labor, and transport needed to make the connection from the nearest pole of the distribution system, along with the costs of needed inspection and installation at the consumer’s premises**
- Connection fee are **important measure to guarantee commitment** of the electricity customer and cover connection cost
- Initial payments for the connection are **often high for the rural poor**. They may have enough to pay for the regular use of electricity but may not be able to afford the connection fees
- Connection fees should be **as low as possible** for potential mini-grid customers, as the **lower the connection fees, the higher the connection rates**
Revenues – Connection Fee

• Connection fee must be **affordable** (60 – 250 €, usually the cost of connection and in house installation)

• If connection fees cannot be reduced, customer-financing options should be actively sought to make it affordable a percentage (e.g. 50%), **can be spread over a certain time period** using end-users finance of including them in the tariff charge (e.g. Senegal)

• **Could be free of charge** (subsidized) for the very poor, as in South Africa and India

• it is **advisable to subsidize connection fees for consumers or to use results-based rather than operational subsidies** or investment subsidies. This is done by TEDAP in Tanzania, which offers results-based connection subsidies of 380 € for each new connection in a private mini-grid
Revenues – Retail tariff

Tariffs’ main challenge

- Consumers’ ability to pay
- Consumers’ willingness to pay
- Cover O&M costs
- Cover capital costs

Tariffs should aim to

- Attract private parties to invest in MGs
- Make MGs financially viable and sustainable
- Pursue to support economic development and improve living standard in the villages
- Enable understanding of mini-grid operation
- Balance Sustainability vs Affordability

Based on Peterschmidt et al. (2013)
Retail tariff: Energy, Capacity, Service, Device
Retail tariff: Energy

**Characteristics**
- Customer pays per energy consumption [i.e. per kWh]
- Metering required
- Meter Reader required or Electronic readable meter

**(Dis)Advantages**
- No limiters required
- Incentivies energy efficiency
  - Meter reader
  - Electronic readable system
  - Risk of customer’s unpayability

**Metering & Billing**
- Post-paid
  - Meter reading
  - Bill calculation
  - Customer payment
- Pre-paid
  - Customer buys energy before consumption

Example Bangladesh – PVDH mini-grid (100kWp mini-grid)

- Connection fee: 5,000 BDT (46.39€)
- >10 hours/day
- All household appliances allowed
- Max power per household: 2,2 kW
- 10 A limited circuit
- Price: 30 BDT/kWh (~0.28€ /kWh)
- Electricity meter
- Post-paid on a monthly basis
## Retail tariff: Capacity

### Characteristics
- Know as Flat-Rate, subscription tariffs
- Customer pays a maximum power amount
- Overcurrent device required or load limiter
- Theft risk

### (Dis)Advantages
- **Advantages:**
  - No meter required, no bill calculation, no meter reading required
  - Hide charge per kWh
  - No efficiency incentive
  - Difficult demand prediction
  - Discourage productive use

### Metering & Billing
- **Pre-paid**
  - Customer agrees energy price before consumption
  - Cash payment, Mobile phone payment or scratch cards

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Example Nepal – Flat rate tariffs using load limiters

- Combined subscription tariffs with load-limiting devices
- Total wattage subscription below power plant capacity
- No risk of brownout
- Carefully scheduled load by consumers to meet conditions
Retail tariff: Service

**Characteristics**
- Energy is not any more sold per units of energy/power
- Energy priced per units of time, kg, etc
- Adequate for rural areas where costs of solar power electricity would be too high for villagers

**Advantages**
- Required precise and adequate calculation of prices
- Relates energy to other activities
  - Hide price per kWh
  - Customer not aware of energy efficiency

**Metering & Billing**
- Pre or post-paid:
  - Hours of TV/DVD
  - Kg of ground wheat processed
  - Litters of clean water processed

**Example Odisha** – Solar PV based Multy Utility Business Centre (MUBC) in Patapolasahi
- 35 households
- Agriculture as primary livelihood
- Service charged either on kilogram, litre or hourly
- Service charged is capped by an upper limit of the Ability To Pay of customers
- Price considering O&M costs, Logistics Cost, Business Risk, Inflation,
- TV service: 0.9 US$/hour per person – Water purification: 0.036 US$/litre per person
Retail tariff: Per device

Characteristics
- Power tariff adaptation
- Customer pays per number of devices
- Used to reduce initial costs with very low-income populations
- No meter nor current limiter required

(Dis)Advantages
+ No tariff equipment required
+ Reduced grid consumption
  - Hide charge per kWh
  - No efficiency incentive
  - Difficult demand prediction
  - Discourage productive use
  - Unannounced visits required

Metering & Billing
- Pre-paid
  - Customer agrees energy price before consumption
  - Cash payment, Mobile phone payment or scratch cards

Example India – Fixed price model by Husk Power Systems (HPS)

- Each household is allowed to run two fluorescent lights (15W) and charge mobile phones
- 50 rupees (~$1 per month) + connection cost 100 rupees (~$2)
- Further adjustment of the model for two 45W connections and 1,000W package

Based on Tenenbaum et al. (2014)
Retail tariff: Stepped, Time-based, Flexible
Retail tariff: Stepped

**Characteristics**
- Customer class differentiation
- Customer charge increases with consumption
- Represent a cross-subsidy from high to low-consumption customer

**(Dis)Advantages**
- Easy adaptation for low consumers
- Fair system for low income customers
- Wide number of new technologies focusing in this method

**Metering & Billing**
- Post-paid
  - Cash or mobile phone
- Pre-paid
  - Customer buy electricity blocks
  - Cash payment, Mobile phone payment or scratch cards

**Example Nepal**
- 250 kW Micro-Hydro Mini-Grid
  - 4.43 rupees/kWh – domestic use (~0.03€/kWh)
  - 5.84 rupees/kWh – tourist lodges and enterprises (~0.04€/kWh)

**Example Tanzania – Mufindi**
- Lifeline tariff
  - T Sh 60 (4 cents/kWh) < 50 kWh
  - T Sh 234 (15.6 cents/kWh) if consumption is over 50 kWh for more than 3 months a year
Retail tariff: Time Based (Binomial)

**Characteristics**
- Tariff varies by time of day
- Depending on peak/non-peak hours
- Necessity to use batteries and/or diesel is considered
- Aims to reduce use of back-up systems

**(Dis)Advantages**
- Supports use of energy during peak production and off-peak demand hours
- Aims for energy efficiency
- Attractive for hybrid MGs
- Sophisticated meter required
- No pre-paid possibility
- Increases unpayment risk

**Metering & Billing**
- **Post-paid**
  - Cash or mobile phone payment according to consumption and tariff
  - Meter must be able to identify the time-based tariff

Example – Tariffs used in the Regulated Contracting Environment in Brazil distributed power generation

- Blue & Green time-of-use tariff
- Both vary according to the time of the year
- Daily periods:
  - Peak-hours
  - Non-peak hours
- Price example: Dry Season: Peak-hour: 32.96€ / MWh
  - Non-peak hour: 23.32€ / MWh

Douglas & Guimarães (2003)
### Retail tariff: Flexible tariff structure (Seasonal)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>(Dis)Advantages</th>
<th>Metering &amp; Billing</th>
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<tbody>
<tr>
<td>• Price differentiation during seasons. E.g. Winter-summer</td>
<td>+ Aims for energy efficiency</td>
<td>• Post-paid</td>
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<td></td>
<td>• PV: lower price → Summer</td>
<td>o Cash or mobile phone payment</td>
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<td></td>
<td>• Based on environmental possibilities depending on season</td>
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#### Example – Tariffs used in the Regulated Contracting Environment in Brazil distributed power generation

- Blue & Green time-of-use tariff
- Both vary according to the time of the year
- Year periods:
  - Dry: May to November
  - Wet: December to April
- Price example: Peak-hour Dry Season: 32.96€ / MWh
  Wet Season: 28.93€ / MWh

Douglas & Guimarães (2003)
Retail tariff revenues: Uniform vs Cost reflective

- **Uniform national tariffs**: with equal tariffs for mini-grid and national grid consumers throughout the country. Sometimes, national tariffs are offered to rural consumers and the utility or operator is provided with cross-subsidies to cover the mini-grid’s higher costs.

- **Cost-reflective - Negotiated tariffs**: when governments (or government-selected concessions) manage mini-grids, prices are determined through negotiations between providers, electricity regulatory commissions, rural energy agencies and consumers.
Retail tariff revenues: Uniform vs Cost reflective

• **Cost-reflective - Approved tariffs**: In cases where the loads are small and there is little chance of connection to the national grid, prices may be negotiated directly between consumers and providers. They are simply approved by regulators (this is often done with micro-grids) or they do not even require approval if the capacity is very small (e.g. below 100 kW like in Tanzania or Cameroon)

• **Cost-reflective - Calculated tariffs**: (a subform of approved tariffs): In other cases, tariffs are calculated using standard formulae that input basic parameters, like fuel costs, operation costs, investment costs, depreciation, etc., and use these inputs to arrive at a fair power price
Retail tariff revenues: Uniform vs Cost reflective

• In order to **successfully** develop and operate mini-grids, utilities need **low cost upfront financing and cost-reflective tariffs**

• From a **private developer’s perspective, tariffs must be cost-reflective.** Otherwise, mini-grids cannot be run profitably. Operational **subsidies on a kWh basis** are not favored by private sector, as they do not want to be dependent on transfers from large utilities or government authorities, which may be delayed

• **With cost-reflective tariffs**, only the people consuming electricity provide the revenues for recovering mini-grid investment and O&M costs. **The equity issue comes into play** here: why should the rural poor pay a higher price for electricity

• **Need a national consensus** to accept different electricity tariffs for mini-grid customers
Retail tariff revenues: Uniform vs Cost reflective

- Utilities usually charge **uniform national tariffs** for their operational mini-grids
- **Lifeline tariffs** for poor customers, which are especially common in Eastern and Southern Africa, or **lower per kWh tariffs for productive-use** customers, like in the Senegalese ERIL programme, add considerable uncertainty to the mini-grid operator’s income stream and are therefore not desired
- With a **uniform national tariff** the main question is: **Who and how** is subsidising mini-grid tariffs?
Retail tariff: Other considerations

- Allowing GEMG to enter into power sales contracts with business customers **without obtaining prior or after-the-fact regulatory approval** of the terms of the contract that will make it easier for an GEMG to obtain bank loans. In the Indian state of Uttar Pradesh, for example, mobile-phone towers are **the initial anchor customers** that make it possible to serve rural villages that would otherwise not be appealing to private operators.

- **Allowing GEMG making loans** to actual and potential customers to allow them to connect and to buy appliances and machinery for productive uses. Rural households and businesses may want to become customers or increase their consumption once they are connected, but they lack access to financing to purchase appliances and machinery.
Retail tariff: Best practice

• Granting CEMG flexibility in deciding on the tariff structures that work best for their technology and business models
Retail tariff: Uniform vs Cost reflective

- http://minigridpolicytoolkit.euei-pdf.org/support-tools
Presentation: Nigeria, Ghana
Intervention from the floor: Senegal, Sierra Leona

- Type of tariff?
- How it is set?
- Challenges?
Thank you for your attention!

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