Task C: GECOL Institutional dev. and perform. improvement

Deliverable 3:
- Tariff framework review
- Tariff structure set-up and reform pathway
- Tools (excel model) development and trainings
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This document has been prepared only for the International Bank of Reconstruction and Development ("IBRD") and solely for the purpose and on the terms agreed with the IBRD in our agreement dated 21 March 2017 relating to Task A.

The scope of our work was limited to a review of documentary evidence made available to us. We have not independently verified any information given to us relating to the services.

We accept no liability (including for negligence) to anyone else in connection with this document. We have agreed with you that the report will be provided by you to GECOL for their consideration. We would ask that it not be provided to anyone else unless otherwise agreed in writing by us.

This is a draft prepared for discussion purposes only and should not be relied upon; the contents are subject to amendment or withdrawal and our final conclusions and findings will be set out in our final deliverable.
The focus of this report is the phase 3 of Task C, focused on the financial performance assessment and financial models.

Focus of this report

1. Project set-up / Inception report
   1.1 Data collection
   1.2 Methodology, team and approach validation

2. Institutional Development
   2.1 Strategy for institutional development
   2.2 Process mapping & identification of gaps in staff, skills, perform.
   2.3 Manpower / org. rationalization review
   2.4 ERP System review

3. Financial performance assessment & financial models
   3.1 Tariff framework review
   3.2 Tariff structure set-up and reform pathway
   3.3 Tools (excel model) and trainings

4. Improving financial performance
   4.1 Improving financial performance of customer service
   4.2 Improving technical performance

5. Review and final report
   5.1 Findings review and final report

6. Workshop & Training

7. PMO (progress reporting)

Source: Task C inception report
The deliverables have been combined in a comprehensive presentation and an excel-based toolkit for tariff design

Approach for new tariff structure set-up

3.1 Tariff framework review
- Cost to serve
- Current tariff framework

3.2 Tariff structure set-up and reform pathway
- New tariff design process and decisions required
- Multi-stage tariff reform roadmap

3.3 Tools (excel model) and trainings
- Training material and user guide
- Excel-based tariff design toolkit

Focus of current presentation

Task C Phase 3 – Financial performance assessment and financial models

End of July

Final deliverable

Source: Strategy& analysis
Report objective is to share cost-tariff analyses & new tariff design approach, and present how to use the excel toolkit

Report objectives

<table>
<thead>
<tr>
<th>Area</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost to serve</td>
<td>• Present an analysis of electricity cost for GECOL and full cost to serve for Libya, including subsidies on fuel</td>
</tr>
<tr>
<td>Current tariff framework</td>
<td>• Present an external view on current tariff framework, implicated issues and recommendations for transitioning economies</td>
</tr>
<tr>
<td>New tariff design process and decisions required</td>
<td>• Present new tariff structure set-up and calculation methodology, and discuss on the key required decisions enabling the design process</td>
</tr>
<tr>
<td>Multi-stage tariff reform roadmap</td>
<td>• Share current approach for the identification of tariff implementation roadmap and discuss reform pathway</td>
</tr>
<tr>
<td>Training material and user guide</td>
<td>• Present yearly tariff design process and share the training material guiding the use of excel-based toolkit for tariff calculation and design</td>
</tr>
</tbody>
</table>

Source: Strategy& analysis
Cost to serve

Current tariff framework

New tariff design process and decisions required

Multi-stage tariff reform roadmap

Excel toolkit user guide
Over the last 6 years, the cost of supply for GECOL has remained within the range of 65 and 79 Dirhams / kWh

Average electricity cost for GECOL\(^{(1)}\)

1) Based on GECOL P&L costs (subsidized fuel prices); 2) 2014 costs contributed by a peak in power purchases (focus on next slide)

Source: GECOL data collection ID2 and ID13, Strategy\& analysis
Salaries contribution to electricity cost has grown with +19% CAGR, while Generation has decreased with -9% CAGR

GECOL costs breakdown (Dhs/ kWh, 2010-15)

1) Includes cost of power purchases

Source: GECOL data collection ID2 and ID13, Strategy& analysis
Fuel incidence on total cost has dropped from 39% to 23%, while Salaries in Distribution have increased from 9% to 24%.

GECOL costs by function and item (Dhs/kWh, 2010-2015)

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>100%</td>
<td>67</td>
<td>65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gen.</td>
<td>39%</td>
<td>53%</td>
<td>35%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transm.</td>
<td>9%</td>
<td>9%</td>
<td>10%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distr.</td>
<td>21%</td>
<td>24%</td>
<td>31%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply</td>
<td>6%</td>
<td>6%</td>
<td>6%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Support</td>
<td>11%</td>
<td>3%</td>
<td>9%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>El. cost</td>
<td>100%</td>
<td>6%</td>
<td>11%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% = Percentage of GECOL electricity cost

Source: GECOL data collection ID2 and ID13, Strategy& analysis

Strategy& | PwC
Including the cost paid by government to subsidize fuel, full cost to serve on average is 3 times the cost paid by GECOL.

Cost to serve (Dhs/ kWh, 2010-2015)

- Costs on government (subsidies on fuel)
- Costs on GECOL P&L

Fuel costs (Bn LD) based on actual fuel volumes and mix

Theoretical cost from international market prices
- Cost paid out by NOC
- Costs invoiced to GECOL

Source: GECOL data collection ID2, ID13, ID20 and ID24, Strategy& analysis
**Based on GECOL data, most of the cost to serve is in Generation, even though decreased from 82% to 75%**

**Cost to serve** (Dhs/ kWh, 2010-2015)

<table>
<thead>
<tr>
<th>Year</th>
<th>Generation (82%)</th>
<th>T&amp;D Network (11%)</th>
<th>Support (2%)</th>
<th>El. cost (100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>61%</td>
<td>8%</td>
<td>3%</td>
<td>21%</td>
</tr>
<tr>
<td>2015</td>
<td>61%</td>
<td>12%</td>
<td>4%</td>
<td>14%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Generation (75%)</th>
<th>T&amp;D Network (16%)</th>
<th>Support (4%)</th>
<th>El. cost (100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>61%</td>
<td>12%</td>
<td>4%</td>
<td>14%</td>
</tr>
<tr>
<td>2015</td>
<td>61%</td>
<td>16%</td>
<td>4%</td>
<td>12%</td>
</tr>
</tbody>
</table>

Source: GECOL data collection ID2, ID13, ID20 and ID24, Strategy& analysis
Cost to serve

Current tariff framework

New tariff design process and decisions required

Multi-stage tariff reform roadmap

Excel toolkit user guide
Four key principles are generally regarded as the fundamental dimensions regulating tariff design

Regulatory principles in tariff design

<table>
<thead>
<tr>
<th>Regulatory principles</th>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SUSTAINABILITY</strong></td>
<td>Ensuring sector <strong>financial health</strong>, by entirely covering allowed costs and effectively yielding revenue requirements and cash flow stability from year to year</td>
</tr>
<tr>
<td><strong>EQUITY / non-discrimination</strong></td>
<td>Promoting <strong>accountability for the use</strong> of electricity, avoiding undue discrimination in allocating costs to the different cost drivers, customer classes, time periods</td>
</tr>
<tr>
<td><strong>ECONOMIC EFFICIENCY</strong></td>
<td>Maximizing short- and long-term social welfare, promoting efficient <strong>use of energy, assets</strong> and competing products and services</td>
</tr>
<tr>
<td><strong>TRANSPARENCY</strong></td>
<td>Being transparent to customers and ensuring scheme <strong>simplicity, understandability</strong> and stability, to facilitate public acceptability / application feasibility</td>
</tr>
</tbody>
</table>

1) Rates are regarded as non-discriminatory if consumers are charged the same amount for using the same good or service, regardless of the purpose for which it is used.

Source: Strategy& analysis
**Current Libyan tariff framework is not aligned with three out of such four regulatory principles**

Libya status quo vs. regulatory principles

<table>
<thead>
<tr>
<th>Regulatory principles</th>
<th>Libyan tariff</th>
<th>Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUSTAINABILITY</td>
<td><img src="https://via.placeholder.com/15" alt="Not met" /></td>
<td>• Libyan tariff is set far below cost-recovery levels, causing a huge burden on government &amp; GECOL budget preventing the financial viability of the sector</td>
</tr>
<tr>
<td>EQUITY / non-discrimination&lt;sup&gt;(1)&lt;/sup&gt;</td>
<td><img src="https://via.placeholder.com/15" alt="Not met" /></td>
<td>• Tariffs are also cross-subsidized between customer classes, not reflecting the costs each class is responsible for</td>
</tr>
<tr>
<td>ECONOMIC EFFICIENCY</td>
<td><img src="https://via.placeholder.com/15" alt="Not met" /></td>
<td>• In addition, tariffs are applied to customers with a flat rate, which does not incentivize an efficient use of energy &amp; assets</td>
</tr>
<tr>
<td>TRANSPARENCY</td>
<td><img src="https://via.placeholder.com/15" alt="Met" /></td>
<td>• Customers are charged by means of a basic tariff rate scheme, characterized by the highest level of simplicity and understandability</td>
</tr>
</tbody>
</table>

<sup>(1)</sup> Rates are regarded as non-discriminatory if consumers are charged the same amount for using the same good or service, regardless of the purpose for which it is used.
**Tariff has a key balancing role, enabling consumers to pay for the service they use and to cover the costs they cause...**

**Tariff key balancing role**

<table>
<thead>
<tr>
<th>Generation</th>
<th>Transmission &amp; Distribution</th>
<th>Supply</th>
<th>Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPEX (D&amp;A)</td>
<td>OPEX - Variable O&amp;M</td>
<td>OPEX - Fixed O&amp;M</td>
<td></td>
</tr>
</tbody>
</table>

![Diagram showing the relationship between tariffs, energy usage, and costs](image)

- **Tariff** by customer class, time, volumes, etc.
- **Energy Usage** by customer class, time, etc.

**Revenues**

**Cost to serve**

Source: Strategy& analysis
...however, Libyan tariff is set far below cost-recovery levels, causing a large burden on government & GECOL budget

Libyan cost-tariff unbalance (Dhs/kWh, 2015)

Note: Average tariff weighted by consumption by customer class
Source: Strategy& analysis
**Tariffs are also cross-subsidized between customer classes, not reflecting the costs each class is responsible for**

**Libyan tariff by customer class (2011-2017)**

- **Generation**
  - High-voltage consumers
    - Heavy industrial
    - Large agriculture
    - Light industrial
    - Small agriculture
  - T&D network
    - Commercial, Street lighting, State offices
    - Residential
  - Low-voltage consumers

- **Unit cost (Illustrative)**
  - Lower network & energy costs
  - Responsibility in the cost by customer class
  - Higher network & energy costs

- **GECOL tariff (Dhs/ kWh)**
  - Heavy industrial: 31
  - Large agriculture: 32
  - Light industrial: 42
  - Small agriculture: 30
  - Commercial, Street lighting, State offices: 20
  - Residential: 68

**Cross-subsidization between customer classes**

Residential tariff is lower than industrial, despite the higher costs incurred in the supply, which are driven by:

- **More facilities** needed (e.g. transformers and distribution lines / substations)
- **Higher losses** incurred (supply at lower voltage)

**Source:** Strategy& analysis
In addition, tariffs are applied to customers with a flat rate, not incentivizing an efficient use of energy and assets.

Libyan rate scheme and efficiency indicators (2011-2017)

<table>
<thead>
<tr>
<th>Typology of charge applied to consumers</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD / month (fixed/ customer charge)</td>
</tr>
<tr>
<td>LD / kW (demand charge)</td>
</tr>
<tr>
<td>LD / kWh (energy charge)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Typology of rate applied to consumers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate varying with the TIME of USE (e.g. time of day, day of week, season)</td>
</tr>
<tr>
<td>Progressive rate varying with VOLUMES CONSUMED</td>
</tr>
<tr>
<td>Flat rate, regardless of time of use and volumes consumed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Energy consumed pro-capita (MWh / capita)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Libya</td>
</tr>
<tr>
<td>Jordan</td>
</tr>
<tr>
<td>Egypt</td>
</tr>
<tr>
<td>Algeria</td>
</tr>
<tr>
<td>Tunisia</td>
</tr>
<tr>
<td>Morocco</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Load factor (average load) / (peak load)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Libya</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Source: Strategy& analysis
Only residential class experienced volume-dependent tariffs, even though “lighter” than those applied by regional peers.

Libyan residential rate scheme

<table>
<thead>
<tr>
<th>Tariff</th>
<th>Dhs / kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-05</td>
<td>0-20</td>
</tr>
<tr>
<td>2006-10</td>
<td>20-40</td>
</tr>
<tr>
<td>2011-17</td>
<td>40-60</td>
</tr>
</tbody>
</table>

Source: Strategy& analysis
As a result, current tariff framework has exposed electricity sector to a set of relevant issues and related implications

Major issues driven by current tariff framework

<table>
<thead>
<tr>
<th>Issues</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of required cash/ investment capabilities</td>
<td>Utilities do not have required cash flow/fund to pay suppliers and maintain/ replace retired assets or expand the system to meet growing demand, thus causing a reduction in the reliability and quality of supply</td>
</tr>
<tr>
<td>Unattractiveness for potential investors</td>
<td>Investors and traders are unlikely to make deals with power companies that are in a precarious financial position (unable to pay for the service provided), or will require a significant mark-up, or risk premium</td>
</tr>
<tr>
<td>Non-true cost allocation</td>
<td>Residential class tariff is subsidized by industrial/ commercial customers, while the opposite may occur in developed countries, as these sectors are supposed to create jobs and drive economic growth</td>
</tr>
<tr>
<td>Distortion in pricing signals to customers</td>
<td>When tariff by customer class does not reflect the costs each class is responsible for, customers receive a distorted / non-true pricing signals, and are not aware of the actual cost they are causing</td>
</tr>
<tr>
<td>Inefficient asset and energy utilization</td>
<td>Subsidized and flat prices lead customers to make unwise decisions that result in increased and inefficient load patterns (asset utilization, load factor), and implied higher unit costs of the energy supply</td>
</tr>
<tr>
<td>Distortion in resources allocation</td>
<td>Subsidized sales may be insufficient to meet domestic needs and lead to inefficient resource allocation and higher costs (distorted investment decisions, e.g. over-reliance on gas production due to subsidized price)</td>
</tr>
</tbody>
</table>

Source: Desktop research, Strategy& analysis
**Tariff design process shall lead to the definition of a new framework, guided by some key recommendations**

**Recommendations for transition economies**

<table>
<thead>
<tr>
<th>Regulatory principles</th>
<th>Current tariff framework</th>
<th>New tariff design process</th>
<th>New tariff</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SUSTAINABILITY</strong></td>
<td>![Not met]</td>
<td><img src="#" alt="Recommendations for transition economies" /></td>
<td><img src="#" alt="?" /></td>
</tr>
<tr>
<td>**EQUITY / non-</td>
<td>![Not met]</td>
<td></td>
<td><img src="#" alt="?" /></td>
</tr>
<tr>
<td>discrimination**</td>
<td>![Not met]</td>
<td></td>
<td><img src="#" alt="?" /></td>
</tr>
<tr>
<td>**ECONOMIC</td>
<td>![Not met]</td>
<td></td>
<td><img src="#" alt="?" /></td>
</tr>
<tr>
<td>EFFICIENCY</td>
<td>![Not met]</td>
<td></td>
<td><img src="#" alt="?" /></td>
</tr>
<tr>
<td><strong>TRANSPARENCY</strong></td>
<td>![Met]</td>
<td></td>
<td><img src="#" alt="?" /></td>
</tr>
</tbody>
</table>

**Issues**

- Lack of required cash/investment capabilities
- Unattractiveness for potential investors
- Non-true cost allocation
- Distortion in pricing signals to customers
- Inefficient energy usage and assets utilization
- Distortion in resources allocation

**Recommendations for transition economies**

- Smooth transition from subsidized scheme
- Avoidance of cross-subsidies and application of subsidies for low-income customers rather than generalized to customer classes
- Introduction of time-varying rates on customers ready to react to them
- Avoidance of complex methodologies (controversy, information availability)
- Tradeoff between cost-causation rule and desirable tariff design simplicity

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1) Typically, industrial customers

*Source: Strategy& analysis*
Cost to serve

Current tariff framework

New tariff design process and decisions required

Multi-stage tariff reform roadmap

Excel toolkit user guide
The tariff design process is based on three key steps...

Tariff design process

1. **DETERMINATION of COSTS**
   - Determination of **allowed cost** of service / revenue requirement for each activity
   - Overall service costs are classified by function along the supply chain
   - The allowed part of cost determines the allowed revenues to be recovered by charging tariffs on customers

2. **COST ALLOCATION**
   - **Allocation** of cost components by cost driver and by customer class
   - Cost components are allocated by the driver which caused the cost to be incurred
   - These cost quantitates are then allocated to customer classes according to their responsibility in that cost (allocation weights)

3. **RATE DESIGN**
   - Design of cost-based **rate elements** for tariffs
   - Each customer class is charged for its respective overall contribution to cost along the value chain (by cost driver)
   - Final tariff is computed as a combination of charges by cost driver

---

**ILLUSTRATIVE**

- **N. customers**: Residential, Commercial, Agriculture, Industrial, Public
- **Peak demand**: Residential, Commercial, Agriculture, Industrial, Public
- **Consumption**: Residential, Commercial, Agriculture, Industrial, Public
- **Energy charge**: Dhs / kWh
- **Demand charge**: kWh
...and requires some key decisions to be made

Key decisions required

1.1 Tariff rationale
1.2 Pricing regulation
2.1 Allocation method
2.2 Cross subsidization
3.1 Active charges
3.2 Rate scheme

1.1 and 1.2 are dependent upon tariff design (excel toolkit).
2.1 and 2.2 are approach identified.
3.1 and 3.2 are dependent upon tariff design (excel toolkit).
Design process starts with the determination of the allowed revenues to be recovered by charging tariffs on customers

Determination of the revenue requirements

- Overall service costs are classified by function along the supply chain
- Cost classification is necessary as, in the second step of the design process, each function requires function-specific criteria to allocate cost components

Allowed cost of service (\(=\) revenue requirement) by function

- Based on tariff rationale, and historical and best-practices data, the allowed part of costs is determined
- Allowed costs represent the allowed revenues to be recovered by charging tariffs on customers

Source: Strategy\& analysis
**Libya might either maintain its heavily subsidized pricing framework or move to cost-reflective schemes**

**Tariff rationale**

Libya might either maintain its heavily subsidized pricing framework or move to cost-reflective schemes. This decision hinges on whether Libya decides to maintain its current heavily subsidized pricing framework or transition to a cost-reflective pricing structure. The rationale for this decision is best understood by examining the different tariff scenarios that can be applied in Libya.

### Residential tariff benchmark ($/kWh)

<table>
<thead>
<tr>
<th>Country</th>
<th>Residential Tariff Benchmark ($/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Libya</td>
<td>0.02</td>
</tr>
<tr>
<td>Qatar</td>
<td>0.02</td>
</tr>
<tr>
<td>Lebanon</td>
<td>0.06</td>
</tr>
<tr>
<td>Egypt</td>
<td>0.10</td>
</tr>
<tr>
<td>Algeria</td>
<td>0.15</td>
</tr>
<tr>
<td>Jordan</td>
<td>0.16</td>
</tr>
<tr>
<td>Tunisia</td>
<td>0.21</td>
</tr>
<tr>
<td>Morocco</td>
<td>0.30</td>
</tr>
<tr>
<td>UK</td>
<td>0.22</td>
</tr>
<tr>
<td>Italy</td>
<td>0.24</td>
</tr>
<tr>
<td>USA</td>
<td>0.30</td>
</tr>
</tbody>
</table>

### Tariff rationale scenarios for Libya

<table>
<thead>
<tr>
<th>Year</th>
<th>Invoiced revenues</th>
<th>Costs charged on customers (max theoretical revenues)</th>
<th>GECOL P&amp;L costs</th>
<th>Cost to serve (incl. subsidies on fuel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes**

1) Residential tariff for average consumption of 300 kWh/month and monthly peak demand of 3 kW estimated based on load factor. FX adjusted for differences in PPP.

**Source:** Strategy& analysis, Countries regulatory authorities websites and annual reports, Players websites and annual reports.
Cost-reflective tariffs offer substantial benefits but depend on public acceptability when moving from subsidized schemes

### Tariff rationale options

<table>
<thead>
<tr>
<th>Description</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tariffs reflect the full cost to serve, including the price paid by the government to provide utility subsidized fuel pricing</td>
<td>• Foster complete cost-structure accountability</td>
<td>• May have a relevant impact on vulnerable customers</td>
</tr>
<tr>
<td></td>
<td>• Guarantees sector financial independency from external support</td>
<td>• Requires macro-economic considerations (e.g. cash transfer, salary adjustment)</td>
</tr>
<tr>
<td>Customers are charged with tariffs that reflect utility P&amp;L costs, which benefit from subsidized fuel pricing</td>
<td>• Guarantees independency from government cash injections on utility P&amp;L</td>
<td>• Depends on public acceptability – requires strategies to enhance customer uptake(^{(1)})</td>
</tr>
<tr>
<td></td>
<td>• Foster utility financial health and attraction of investors</td>
<td>• May worsen commercial loss / collection levels</td>
</tr>
<tr>
<td>Tariffs are set below cost-recovery levels: unbalance is covered by government, through partial coverage of fuel costs (subsidies) and direct injections on P&amp;L</td>
<td>• Provides short-term support to national economy by mean of a lighter burden on electricity consumers</td>
<td>• Depends on government funding capabilities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Distort resources allocation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Impact user and non-users regardless of their responsibility in the cost</td>
</tr>
</tbody>
</table>

\(^{(1)}\) Key influencers in the process can be scheme convenience, perceived fairness, mechanism awareness and understanding

Source: Strategy& analysis
Thus, a first decision is required on the desired level of State intervention and the costs to be charged on customers.

### Tariff rationale options

#### Which costs shall be charged on customers?

- Subsidized pricing
- Cost-reflective pricing
- Fully cost-reflective pricing

#### What is the desired level of State intervention in the sector?

- ~60%
- 0%

### Available options

- Cost of fuel subsidies on customers
- GECOL P&L costs on customers

### Interactive session

- 2017: 0%
- 2021: ?
- 2024: ?
- 2027: ?

Source: Strategy & analysis
**Depending on market structure, different pricing regulation formula can apply**

### Pricing regulation options

<table>
<thead>
<tr>
<th>Description</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>In deregulated markets, pricing is set through bilateral contracts under mutually agreeable terms</td>
<td>• Provides strong efficiency incentive (competition)</td>
<td>• Requires mature market levels</td>
</tr>
<tr>
<td>Revenue that can be generated are based on previous-year cap, CPI &amp; required efficiency factors</td>
<td>• Provides efficiency and cost savings incentives</td>
<td>• Limits powerful incentive to increase sales and competition</td>
</tr>
<tr>
<td>Prices have upper limits based on previous-year cap, CPI &amp; required efficiency factors</td>
<td>• Provides efficiency and cost savings incentives</td>
<td>• Can conflict with socially desirable (e.g. DSM(^{(1)}) mandatory) programmes</td>
</tr>
<tr>
<td>Utility is reimbursed for the costs incurred (both operating/ D&amp;A) and guaranteed a return</td>
<td>• Allows utility to cover its operating and capital costs as well as return on capital</td>
<td>• Does not provide efficiency and cost saving incentives (rewards overinvestment)</td>
</tr>
<tr>
<td>Subsidies and pricing are set by govt (rather than calculated) on the basis of political expediency</td>
<td>• Does not require specific analyses and capabilities (ease of implementation)</td>
<td>• Is uniquely applicable with subsidized tariff schemes</td>
</tr>
</tbody>
</table>

1) Demand Side Management  
Source: Strategy& analysis
Among peer countries considered, only Libya has a tariff still set on the basis of political expediency

Pricing regulation benchmark

<table>
<thead>
<tr>
<th>Country</th>
<th>Political expediency</th>
<th>Cost plus</th>
<th>Price cap</th>
<th>Revenue cap</th>
<th>Regulatory period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Libya</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>Discretionary (2004-2006-2011)</td>
</tr>
<tr>
<td>Tunisia</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td>1 year</td>
</tr>
<tr>
<td>Morocco</td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
<td>Discretionary (2004-2008-2014)</td>
</tr>
<tr>
<td>Egypt</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td>1 year</td>
</tr>
<tr>
<td>Algeria</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>Discretionary</td>
</tr>
<tr>
<td>Jordan</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td>Discretionary</td>
</tr>
<tr>
<td>Lebanon</td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
<td>Discretionary</td>
</tr>
<tr>
<td>Qatar</td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
<td>Discretionary</td>
</tr>
<tr>
<td>Italy</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>Discretionary (2017-2020)</td>
</tr>
<tr>
<td>UK(1)</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>USA</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>N/A</td>
</tr>
</tbody>
</table>

1) The price cap is temporary (introduced in 1st April 2017), and is due to expire at the end of 2020 at smart-meter rollout completion.

Source: Strategy& analysis, Countries regulatory authorities websites and annual reports, Players websites and annual reports.
For transitioning countries, Cost Plus is considered the preferred pricing regulation formula in the short term.

### Pricing regulation options

<table>
<thead>
<tr>
<th>Available options</th>
<th>Liberalized market</th>
<th>Regulated market</th>
</tr>
</thead>
<tbody>
<tr>
<td>No regulation – over the counter</td>
<td>Revenue cap</td>
<td>Price cap</td>
</tr>
<tr>
<td></td>
<td>Cost cap</td>
<td>Cost plus (Rate of Return)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Political expediency</td>
</tr>
</tbody>
</table>

#### Short term: Why Cost plus
- Allows to cover operating costs and possibly make profit
- Provides incentive for investments and quality of service improvement
- Implies low complexity degree:
  - Typically applied as starting point and initial input for price cap or revenue cap
  - Does not require the regulator to have detailed knowledge of utility costs
- Review is usually performed annually

#### Long term: Why Revenue cap
- Performance based measure allows utility to share cost savings
- Provides incentives for efficiency – cost minimization and productivity improvement
- Aligns well with demand side management
- Provides greater certainty and freedom for regulated company as allowed revenues are known in advance
- Review is usually done on multi-year period, so cost of regulation is reduced

Source: Strategy& analysis
The second step of tariff design process is the allocation of costs to customer classes

Cost allocation by cost driver and customer class

<table>
<thead>
<tr>
<th>WHAT</th>
<th>Cost-causation principle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>What caused the cost to be incurred? Which driver?</td>
</tr>
<tr>
<td></td>
<td>e.g. are capacity-addition costs driven by energy consumption or by peak demand requirements?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WHO</th>
<th>Cost-causation principle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Who caused the cost to be incurred? By what extent?</td>
</tr>
<tr>
<td></td>
<td>e.g. what part of capacity-addition costs should be charged to residential customers?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost driver</th>
<th>Class weight</th>
<th>Customer class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Customer allocation factor</td>
<td>Heavy industrial</td>
</tr>
<tr>
<td></td>
<td>Demand allocation factor</td>
<td>Large agriculture</td>
</tr>
<tr>
<td></td>
<td>Energy allocation factor</td>
<td>Light industrial</td>
</tr>
<tr>
<td>N. of customers</td>
<td>Customer-driven costs</td>
<td>Small agriculture</td>
</tr>
<tr>
<td>Peak demand</td>
<td>Demand-driven costs</td>
<td>Commercial</td>
</tr>
<tr>
<td>Energy consumption</td>
<td>Energy-driven costs</td>
<td>Street lighting</td>
</tr>
</tbody>
</table>

Note: Some costs can be identified as not being incurred by particular customers: e.g. distribution lines and substations are not used to serve customers that take power at higher voltages; Source: Strategy& analysis
Allowed costs are firstly classified by the primary driver that caused those costs to be incurred...

Cost allocation by cost driver

**Cost-causation principle**
What caused the cost to be incurred? Which driver? e.g. are capacity-addition costs driven by energy consumption or by peak demand requirements?

**Cost driver**
- **N. of customers**
  - Generation capacity D&A, fixed O&M costs
  - Lines and transformers D&A, fixed O&M costs

- **Peak demand**
  - Fuel, energy purchase, water and lubricants cost
  - (Energy losses cost), quality penalties/incentives

- **Energy consumption**
  - (Metering and billing D&A and service cost (cust. mgmt.))
  - Support

**Possible classification on three drivers**
- Overhead, costs for functioning of system operator, regulatory commission, subsidies to renewable energy, etc.

**Source:** Strategy& analysis
...and resulting quantities are then allocated to customer classes according to class responsibility in that cost driver

Cost allocation by customer class

Some costs can be identified as not being incurred by particular customers. The process is impacted by the allocation factors selection by cost driver and the identified level of detail (e.g. time-block).

Cost-causation principle
What caused the cost to be incurred? Which driver? E.g. are capacity-addition costs driven by energy consumption or by peak demand requirements?

WHO
Who caused the cost to be incurred? By what extent? E.g. what part of capacity-addition costs should be charged to residential customers?

Customer class

1) Customer classes are defined as homogenous categories with similar load profile and responsibility in the costs, e.g. energy consumed, delivery voltage, metering characteristic; 2) e.g. distribution lines and substations are not used to serve customers that take power at higher voltages; Source: Strategy& analysis

1) Customer classes are defined as homogenous categories with similar load profile and responsibility in the costs, e.g. energy consumed, delivery voltage, metering characteristic; 2) e.g. distribution lines and substations are not used to serve customers that take power at higher voltages; Source: Strategy& analysis
Allocation methods are based either on a single driver (energy consumption) or on multiple cost drivers

Three-driver vs. single-driver approach

1) Non-coincident peak demand by customer class; 2) Average of class average demand and class maximum demand, weighted by system Load Factor and (1-LF) respectively

Source: Strategy& analysis
In a three-driver Basic approach, costs are assigned to customer classes in relation to a specific allocation factor...

Three-driver Basic approach

<table>
<thead>
<tr>
<th>Cost components are classified by function and by 3 cost drivers: energy, demand and n. of customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three-driver based</td>
</tr>
<tr>
<td>2.1 Allocation method</td>
</tr>
</tbody>
</table>

Cost allocation

1. Basic approach

Costs are divided by customer classes through cost-driver-specific allocation factors

2. Three-driver based approach

Cost items | Possible allocation factor
---|---
N. customer-driven costs | • Number of customers  
|  | • Weighted number of customers
Demand-driven costs | • Maximum demand\(^{(1)}\)  
|  | • System peak responsibility  
|  | • Average-excess demand\(^{(2)}\)  
Energy-driven costs | • Energy sold (at supply level)  
|  | • Energy sold (at generation level)

Basic option

Weight options:
- Meters costs
- Billing costs
- Service line costs
- Meter-reading costs

Coincident Peak options:
- Annual peak (1-CP)
- Average of four highest monthly peaks (4-CP)
- Average of full-year monthly peaks (12-CP)

---

1) Non-Coincident Peak (NCP9 by customer class); 2) Average of class average demand and class maximum demand, weighted by system Load Factor and (1-LF) respectively.

Source: Strategy& analysis
...while in an Advanced approach – before being allocated to customer classes – costs are firstly divided by time block

Three-driver Advanced approach

Advanced approach steps by cost bucket

1. 1.1 Costs are divided by TIME BLOCK
   1.2 Costs are divided by CUSTOMER CLASS
2. 2.1 Costs are divided by TIME BLOCK
   2.2 Costs are divided by CUSTOMER CLASS
3. 3.1 Costs are classified by VOLTAGE LEVEL
   3.2 Costs are divided by TIME BLOCK
   3.3 Costs are divided by CUSTOMER CLASS
4. 4.1 Optional: costs are divided by TIME BLOCK
   4.2 Costs are divided by CUSTOMER CLASS
5. 5.1 Costs are divided by CUSTOMER CLASS
6. 6.1 Costs are classified by FUNCTION & DRIVER
   6.2 Costs are divided by TIME BLOCK & CLASS

Allocation factor in dividing costs

1. 1.1 Incidence of yearly highest-demand hours
   1.2 Peak demand at generation level by time block
2. 2.1 Average block marginal cost \( (2) \times \) duration
   2.2 Consumption at generation level
3. 3.1 / 3.2 Incidence of yearly highest-demand hours
   3.3 Peak demand by voltage level and time block
4. 4.1 Average block marginal cost \( (2) \times \) duration
   4.2 Consumption at voltage level
5. 5.1 N. of bills issued or n. of phone calls (or other services per year and per customer)
6. 6.1 / 6.2 Current allocation of costs by function

1) Coefficients to allocate T&D costs to demand and energy can be estimated on the basis of other tariff design processes (or, in more advanced approaches, calculated by voltage level through a network-reference model); 2) More advanced approaches are based on the short-term marginal cost (e.g. by hour). However, in developing countries, merit-order dispatch concept may be not fully implemented; Source: Energy Policy, Economics, Strategy& analysis
Time blocks are defined as reference time bands in relation to daily, weekly and seasonal load patterns

Multiple-driver Advanced approach

Example of time-block definition

Average load pattern (GW)

01:00 08:00 16:00 22:00

BASE INTERMEDIATE PEAK

Peak block (8h) Intermediate block (7h + 1h) Base block (8h)

Time blocks are usually defined by using daily, weekly (e.g. weekday-weekend), or seasonal patterns.

Cost allocation on time blocks allows to send customers accurate signals about the cost of the system with time differentiation.

Allocation method

2.1

Three-driver based (consumption, peak demand, customer n.)

Advanced approach

Basic approach

Single-driver based (consumption by customer class)

Source: GECOL, Strategy& analysis
Allocation methods based on three drivers reflect costs more fairly, but require a set of data that might not be available.

### Allocation method options

<table>
<thead>
<tr>
<th>Allocation method</th>
<th>Description</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three-driver based (consumption, peak demand, customer n.)</td>
<td>Cost allocation is based on three drivers and detailed data at time-block level</td>
<td>• Allows to send customers accurate/fair signals about the cost of the system with time differentiation</td>
<td>• Requires information that might be not available in transition economies (e.g. data by time block &amp; class)</td>
</tr>
<tr>
<td>Basic approach</td>
<td>Cost allocation is based on three drivers and a single allocation factor by each cost driver</td>
<td>• Guarantees a simplified process enhancing fairness in the allocation of costs to the different cost drivers</td>
<td>• Does not provide indication of costs incidence by time block</td>
</tr>
<tr>
<td>Single-driver based (consumption by customer class)</td>
<td>Cost allocation is entirely based on consumption and introduces simplified cost-causality criteria</td>
<td>• Does not require highly-detailed data and complex levels of analysis</td>
<td>• Provides a simplified criteria which only partially reflects customer classes responsibilities in the costs</td>
</tr>
</tbody>
</table>

Source: Strategy& analysis
For Libya, a tailored approach is identified, based on the data available in GECOL

Allocation method options

2.1 Allocation method

- Is any cross-subsidization mechanism required?
- What is the desired level of cross-subsidization by customer class?

Available options

- Three-driver based (consumption, peak demand, customer n.)
  - Advanced approach
  - Tailored approach
- Basic approach
- Single-driver based (consumption by customer class)

Three-driver approach

- N. of customers
- Peak demand
- Energy consumption

Allocation factors

- Customer-driven costs
- Demand-driven costs
- Energy-driven costs
- Weighted n. of customers by customer class
- Maximum demand by voltage level, by customer class, and time block
- Consumption at generation level by customer class and time block

Source: Strategy& analysis
Due to public acceptability reasons, the true allocation of costs might be adjusted by introducing cross-subsidies

Allocation method

1) Illustrative unit cost by customer class
Source: Strategy& analysis

Illustrative
More developed countries have already moved away from cross-subsidized schemes in favor of residential class

Cross-subsidization benchmark

<table>
<thead>
<tr>
<th></th>
<th>Residential</th>
<th>Industrial</th>
<th>Tariff RATIO (res. / ind.)</th>
<th>Costs allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Libya</td>
<td>0.02</td>
<td>0.03</td>
<td>0.6x</td>
<td></td>
</tr>
<tr>
<td>Jordan</td>
<td>0.16</td>
<td>0.42</td>
<td>0.4x</td>
<td></td>
</tr>
<tr>
<td>Lebanon</td>
<td>0.06</td>
<td>0.13</td>
<td>0.4x</td>
<td></td>
</tr>
<tr>
<td>Qatar</td>
<td>0.02</td>
<td>0.04</td>
<td>0.6x</td>
<td></td>
</tr>
<tr>
<td>Egypt</td>
<td>0.10</td>
<td>0.17</td>
<td>0.6x</td>
<td></td>
</tr>
<tr>
<td>Tunisia</td>
<td>0.21</td>
<td>0.24</td>
<td>0.9x</td>
<td></td>
</tr>
<tr>
<td>Morocco</td>
<td>0.30</td>
<td>0.27</td>
<td>1.1x</td>
<td></td>
</tr>
<tr>
<td>Algeria</td>
<td>0.15</td>
<td>0.14</td>
<td>1.1x</td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>0.24</td>
<td>0.19</td>
<td>1.2x</td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>0.22</td>
<td>0.14 (2)</td>
<td>1.6x</td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>0.30</td>
<td>0.13</td>
<td>2.4x</td>
<td></td>
</tr>
</tbody>
</table>

1) Tariff for average consumption of 300 kWh/month (Residential) and 100 GWh/month (Industrial) and peak demand of 3 kW and 20 kW (estimated based on load factor). FX adjusted for differences in PPP; 2) Based on 453 GWh consumption; Source: Countries regulatory authorities, Companies data, Strategy& analysis

Comments

- Residential unit cost is expected to be higher than industrial, as a result of:
  - More facilities needed (e.g. transformers, lines, etc.)
  - Higher losses incurred (supply at lower voltage)
- Thus, the ratio of residential to industrial tariffs may provide an indication of the possible cross-subsidies applied in costs allocation
- A residential-to-industrial ratio lower than 1 is a clear signal of cross-subsidization in favor of the residential class
For Libya, a decision is required on the cross-subsidies to be applied in the short term, and their evolution going forward

Cross-subsidization options

• Is any cross-subsidization mechanism required?
• What is the desired level of cross-subsidization by customer class?

Available options

True allocation

Cross-subsidized allocation

Interactive session

Tariff recovery of class-driven costs

<table>
<thead>
<tr>
<th>Class</th>
<th>2017</th>
<th>2021</th>
<th>2024</th>
<th>2027</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy Ind.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large Agr.</td>
<td>150%</td>
<td>120%</td>
<td>150%</td>
<td>210%</td>
</tr>
<tr>
<td>Light Ind.</td>
<td>150%</td>
<td>80%</td>
<td>210%</td>
<td>140%</td>
</tr>
<tr>
<td>Small Agr.</td>
<td>80%</td>
<td>210%</td>
<td>140%</td>
<td>280%</td>
</tr>
<tr>
<td>Commercial</td>
<td>210%</td>
<td>140%</td>
<td>280%</td>
<td>45%</td>
</tr>
<tr>
<td>Street Lighting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State Offices</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residential</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Strategy& analysis
The last step of the process is rate design, which starts from the identified costs by class to define final tariff rates.

Rate design process and applicable charges

**Costs by customer class**

- **etc.**
- Small industrial customers
- Commercial customers
- Residential customers
  - Customer-driven costs
  - Demand-driven costs
  - Energy-driven costs

**Factor by customer class**

- **etc.**
- Small industrial customers
- Commercial customers
- Residential customers
  - N. customers
  - Avg. monthly peak (1)
  - Consumption (1)

**Unit costs by customer class**

- **etc.**
- Small industrial customers
- Commercial customers
- Residential customers
  - Customer unit cost
  - Demand unit cost
  - Energy unit cost

**Tariff**

- Customer charge
- Demand charge
- Energy charge

1) At supply voltage level
Source: Strategy& analysis

Consumption data by time block allow the calculation of energy unit cost by TIME BLOCK.
**Overall tariff can be obtained as the sum of 3 charges, whose viability is also dependent on the billing variables available**

### Applicable charges

<table>
<thead>
<tr>
<th>Tariff</th>
<th>Energy charge</th>
<th>Demand charge</th>
<th>Customer charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units</td>
<td>LD / kWh</td>
<td>LD / kW</td>
<td>LD / customer</td>
</tr>
<tr>
<td>Pricing</td>
<td>Volumetric-based pricing dependent on energy consumed</td>
<td>Pricing based on the maximum monthly peak(^{(1)}) registered by customer</td>
<td>Fixed monthly fee</td>
</tr>
<tr>
<td>Rationale</td>
<td>Covers energy-driven costs (e.g. supply variable costs)</td>
<td>Covers demand-driven costs (e.g. fixed system costs)</td>
<td>Covers customer-driven costs (e.g. access, metering and billing costs)</td>
</tr>
</tbody>
</table>

**Note:**
- may require variable-rate meters
- requires demand meters\(^{(2)}\)

---

1) e.g. average 1-3-5 highest instances of demand (readings) in peak hours (demand charge may not apply in off-peak hours)
2) Certain types of traditional meters can measure the customer’s non-coincident peak load during the billing period in addition to the customer’s energy consumption

*Source: Strategy& analysis*
Energy, demand and customer charges can then be applied through a various set of different rate schemes

Applicable rate schemes

1. Time-varying rate
   - Dynamic pricing\(^{(1)}\) may vary:
     - By time band (e.g. night-day, base-intermediate-peak)
     - By day (e.g. weekday-weekend)
     - By season (e.g. winter-summer)
   - Note: requires variable-rate meters

2. Progressive rate
   - Pricing grows with the monthly volumes consumed, generally in 3-5 tiers (kWh ranges) with the highest rate between 2 and 5 times baseline rate. May introduce intra-class subsidies
   - Note: requires demand meters

3. Flat rate
   - Price is fixed regardless of time and volumes consumed. Flat rate has persisted due to lack of advanced metering, political expediency or belief that customers are not ready for change

---

1) In addition to Time-of-Use pricing, developed countries may also offer Real Time Tariffs (RTT), with pricing determined by the spot at the power exchange price (30-60 minutes intervals), or additional schemes as Critical peak pricing (CPP), Peak time rebate (PTR), Variable peak pricing (VPP); Source: Strategy& analysis
Energy time-varying rate allows to influence customers’ consumption pattern by using variable-rate meters...

Focus on energy dynamic rate

- Utility system costs vary according to time of day, day of week and season, in relation to assets and variable costs required to serve
- Peak periods account for a large proportion of overall cost of power generation and supply
- Dynamic pricing permits to charge customers more fairly for the costs incurred and influence their consumption pattern

Rationale

- Incentivize consumers to modify energy usage towards more efficient patterns (e.g. energy saving, load shifting) and improve social welfare
- Enhance equity in cost recovery
- Gain savings in peak-period high generation costs and foster optimal level of investments, and limit capacity additions for the peak period load
- Secure a reliable supply

Purpose

- Measuring electricity use in peak, off-peak necessarily entails that special meters are installed
- Variable-rate meters permit 2 to 3 tariffs via simple electromechanical time switch; Time-of-use meters have multiple registers and switch through radio-signal / ripple-control
- Given associated costs, rates are typically levied on large businesses with energy use exceeding a consumption monthly limit

1) In addition to smart meters, associated technologies usually offered to support Time-of-Use / Peak-demand pricing are: in-home displays, direct load control devices and interactive web portals where consumers could access real-time data and manipulate their own consumption history; Source: Desktop research, Strategy& analysis
...while demand charges aims to limit customers’ monthly peak, but necessitate advanced demand meters

Focus on demand rate

![Load pattern graph]

**Rationale**
- Generation and T&D facilities are designed to cope with extreme cases of peak power demand, which are of very rare occurrence.
- Dimensioning the grid and keeping power reserve plants for the purpose of meeting temporary high loads is vastly expensive.
- Demand charge permits to equally share the burden of satisfying / reducing peak demand among the consumers causing its occurrence.

**Purpose**
- Strongly incentivize customer to level out their demand profile (e.g. peak reduction, load shifting) to improve inefficient average-load to peak-load ratio (Load Factor).
- Foster equity in cost recovery, levying higher costs on consumers with spikier-loads, passing savings on those with consistent loads.
- Limit capacity additions, promote wiser asset utilization and improve security of supply.

**Requirements**
- Demand response programs require at least hourly meter readings, and require electronic Automatic Meter Reading systems or smar meters.
- Measurement intervals are dictated by metering / billing constraints, and typically register highest 15-minute-interval average demand.
- Demand charges are initially offered exclusively to large commercial and industrial customers exceeding a minimum demand requirement.

---

1) Certain types of traditional meters can measure the customer’s non-coincident peak load during the billing period in addition to the customer’s energy consumption.

Source: Desktop research, Strategy& analysis

Strategy& | PwC

Prepared for The World Bank
The application of both energy and customer charges is an easy option not necessarily requiring metering upgrades

### Active charges options

<table>
<thead>
<tr>
<th></th>
<th>Energy</th>
<th>Demand</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy, demand and customer charge</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Energy and customer charge</td>
<td>✔️</td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td>Energy charge</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Pros
- Strongly incentivize to shift load and level out demand profile: fosters load factor / efficiency improvement (thus, security of supply, savings)
- Fosters equity in cost recovery
- Addresses cost-shift issue (1)
- Does not require advanced metering technology

#### Cons
- Requires peak-demand meters / smart meter
- Require strategies to enhance appropriate demand response (peak pricing can be perceived as unfair and unacceptable)
- Provides not-optimal equity in cost recovery
- Provides no incentive to shift usage to non-peak periods
- Provides a simplified cost allocation and limited equity in cost recovery
- Provides no incentive to shift usage to non-peak periods

---

1) Some costs such as metering and billing are clearly fixed and vary with the number of customers, not with the amount of electricity consumed

Source: Strategy& analysis
Peer countries do not typically apply demand charges on residential class, but they do it on industrial consumers

Active charges benchmark

<table>
<thead>
<tr>
<th></th>
<th>Residential</th>
<th>Industrial</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Energy charge</td>
<td>Demand charge</td>
</tr>
<tr>
<td>Libya</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Tunisia</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Morocco</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Egypt</td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Algeria</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Jordan</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Lebanon</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Qatar</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>UK (1)</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>

Comments

- Majority of peer countries apply a customer charge, not requiring meters upgrade and reflecting fixed costs such as metering & billing that vary with the n. of customers rather than the amount of electricity consumed
- Demand charges require advanced and more expensive customer connections / metering technology
- Developed countries usually start activating demand charges on selected high-consuming customers (e.g. industrial class), as they can influence a relevant share of total load acting on a limited n. of consumers

1) No direct info was found on industrial tariffs, since the terms are usually negotiated in private

Source: Strategy& analysis, Countries regulatory authorities websites and annual reports, Players websites and annual reports
Thus, GECOL has the opportunity to decide the combination of charges that shall be activated by each customer class

Active charges and rate scheme options

3.1 Active charges

- What is the identified technology to measure electricity usage?
- What are the charges that shall be applied to customers?

Available options

- Energy charge (E)
- Energy and customer charge (E+C)
- Energy, demand and customer charge (E+D+C)

Interactive session

Heavy Ind.
Large Agr.
Light Ind.
Small Agr.
Commercial
Street Lighting
State Offices
Residential

2017 2021 2024 2027

Source: Strategy& analysis
**Flat or progressive rate schemes do not require metering upgrades, but do also not provide any load-shift incentive**

**Rate scheme options**

<table>
<thead>
<tr>
<th>Rate scheme</th>
<th>Description</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
</table>
| Time-varying         | Tariffs are higher during periods of higher usage (peak pricing) | • Provides an incentive to limit consumption on peak periods: fosters load shifting & efficiency, enhancing security of supply and savings  
• Fosters equity in cost recovery | • Requires smart meters  
• Require strategies to enhance appropriate demand response (peak pricing can be perceived as unfair and unacceptable) |
| Progressive rate     | Pricing grows with the monthly volumes consumed  | • Offers a simplified intra-class cross-subsidy between low- and high-income consumers (usage generally increases with income)  
• Does not require advanced metering technology | • Provides no incentive to shift usage to non-peak periods  
• Provides limited equity in cost recovery and introduces intra-class cross subsidizes |
| Flat rate            | Rate is fixed regardless of time and volumes consumed | • Provides the simplest and most understandable pricing scheme  
• Does not require advanced metering technology | • Provides no incentive to shift usage to non-peak periods  
• Provides limited equity in cost recovery: customers consuming less in peak periods subsidize those who consume more |

*Source: Strategy& analysis*
Peer countries typically charge progressive rates to residential consumers, and time-varying rates to industrial consumers.

### Rate schemes benchmark

<table>
<thead>
<tr>
<th>Residential</th>
<th>Industrial</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy charge</strong></td>
<td><strong>Energy charge</strong></td>
</tr>
<tr>
<td>Flat</td>
<td>Progressive</td>
</tr>
<tr>
<td>Libya</td>
<td>✔</td>
</tr>
<tr>
<td>Tunisia</td>
<td>✔</td>
</tr>
<tr>
<td>Morocco</td>
<td>✔</td>
</tr>
<tr>
<td>Egypt</td>
<td>✔</td>
</tr>
<tr>
<td>Algeria</td>
<td>✔</td>
</tr>
<tr>
<td>Jordan</td>
<td>✔</td>
</tr>
<tr>
<td>Lebanon</td>
<td>✔</td>
</tr>
<tr>
<td>Qatar</td>
<td>✔</td>
</tr>
<tr>
<td>Italy</td>
<td>✔</td>
</tr>
<tr>
<td>UK</td>
<td>✔</td>
</tr>
<tr>
<td>USA</td>
<td>✔</td>
</tr>
</tbody>
</table>

**Total** 2 8 3 2 6 1 1 9 7 6

1) Varies exclusively by time of day unless additional variability is indicated (e.g. weekly: weekday-weekend differentiation); 2) Fixed monthly tariff unless indicated differently; 3) Applies on peak time only; Source: Countries regulatory authorities websites and annual reports, Players websites and annual reports; Strategy& analysis
Egypt combines a progressive energy rate with a customer rate, and applies a demand charge only on industrial class.

Focus on tariff framework in Egypt

**CASE STUDY**

Rate design

3.2 Rate schemes

---

1) Refers to heavy industries with high voltage (i.e. 66.33 KV); 2) EgyptEra does not specify time intervals;

Source: EgyptEra website, Strategy& analysis
Algeria displays an advanced tariff framework composed of energy, demand and customer charges

Focus on tariff framework in Algeria

### Residential

<table>
<thead>
<tr>
<th>Time block</th>
<th>Energy charge ($/kW/month)</th>
<th>Demand charge</th>
<th>Customer charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off-peak (21-17h)</td>
<td>0.00</td>
<td>Flat</td>
<td>Flat</td>
</tr>
<tr>
<td>Base (21-06h)</td>
<td>0.00</td>
<td>Flat</td>
<td>1.0 $/month</td>
</tr>
<tr>
<td>Mid-peak (06-17h)</td>
<td>0.30</td>
<td>Flat</td>
<td>1.0 $/month</td>
</tr>
<tr>
<td>Peak (17-21h)</td>
<td>0.35</td>
<td>Flat</td>
<td>1.0 $/month</td>
</tr>
</tbody>
</table>

### Industrial (1)

<table>
<thead>
<tr>
<th>Time block</th>
<th>Energy charge ($/kW/month)</th>
<th>Demand charge</th>
<th>Customer charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off-peak (21-17h)</td>
<td>0.00</td>
<td>Flat</td>
<td>Flat</td>
</tr>
<tr>
<td>Base (21-06h)</td>
<td>0.00</td>
<td>Flat</td>
<td>6.3 $/month</td>
</tr>
<tr>
<td>Mid-peak (06-17h)</td>
<td>0.15</td>
<td>Flat</td>
<td>18.1 $/month</td>
</tr>
<tr>
<td>Peak (17-21h)</td>
<td>0.35</td>
<td>Flat</td>
<td>18.1 $/month</td>
</tr>
</tbody>
</table>

1) Refers to heavy industries with high voltage (i.e. voltage between 40 kVA and 15000 Kva)
Source: CREG website, Strategy& analysis

---

**Focus on tariff framework in Algeria**

Algeria displays an advanced tariff framework composed of energy, demand and customer charges. The focus is on the rate schemes, which include:

- **Residential**:
  - Energy charge: Time-varying, Progressive
  - Demand charge: Flat
  - Customer charge: $/month

- **Industrial (1)**:
  - Energy charge: Time-varying, Progressive
  - Demand charge: Flat
  - Customer charge: $/month

1) Refers to heavy industries with high voltage (i.e. voltage between 40 kVA and 15000 Kva)

Source: CREG website, Strategy& analysis
Italy applies energy, demand and customer charges for both residential and industrial segments

Focus on tariff framework in Italy

1) 08-19h on Mon-Fri
2) 19-08h on Mon-Fri, and 24h on weekends & holidays

Source: AEEGSI website, Strategy& analysis
For Libya, a final decision is required on the rate schemes to be applied by customer class in the short & in the long term

Rate scheme options

- What is the identified technology to measure electricity usage?
- What are the rate schemes that shall be applied to customers?

Available options

1. Time-varying rate
2. Progressive rate
3. Flat rate

Rate schemes

Interactive session

Source: Strategy& analysis
Cost to serve

Current tariff framework

New tariff design process and decisions required

Multi-stage tariff reform roadmap

Excel toolkit user guide
Current tariff framework in Libya is defined by a set of traditional solutions, and has never varied across 2011-17

Libyan current tariff framework

1.1 Tariff rationale
- Fully cost-reflective pricing
- Cost-reflective pricing
- Subsidized pricing

1.2 Pricing regulation
- Liberalized market - OTC
- Revenue cap
- Price cap
- Cost plus
- Political expediency

2.1 Allocation method
- Three-driver advanced approach
- Three-driver basic approach
- Single-driver basic (consumption)

2.2 Cross subsidization
- True allocation
- Cross-subsidized allocation

3.1 Active charges
- Energy, demand, customer charge
- Energy and customer charge

3.2 Rate scheme
- Time-varying rate
- Progressive rate
- Flat rate

Note: No allocation method identified, as current tariff is set on the basis of political expediency rather than calculated
Source: GECOL, Strategy& analysis

Developed solutions
Complexity
Traditional solutions
Target milestones help define a tariff reform roadmap, which is leveraged as input guideline in tariff design excel toolkit.

Tariff reform roadmap

1.1 Tariff rationale
   - GECOL P&L costs on customers
   - Wave I: 60%
   - Wave II: 90%
   - Wave III: 100%

2.2 Cross subsidiization
   - Coverage of residential-driven costs
   - Wave I: 45%
   - Wave II: 75%
   - Wave III: 90%

3.1 Active charges
   - Demand charge
   - Residential offices
   - State offices
   - Street light
   - Commercial
   - Small Agr.
   - Light Ind.
   - Large Agr.
   - Heavy Ind.
   - Wave I: Reviewed
   - Wave II: Reviewed
   - Wave III: Reviewed

3.2 Rate schemes
   - Time-varying energy charge
   - Residential offices
   - State offices
   - Street light
   - Commercial
   - Small Agr.
   - Light Ind.
   - Large Agr.
   - Heavy Ind.
   - Wave I: Reviewed
   - Wave II: Reviewed
   - Wave III: Reviewed

Source: Strategy& analysis
For instance, tariffs might increasingly cover GECOL P&L costs and start reflecting part of the cost of fuel subsidies.

Tariff rationale roadmap

<table>
<thead>
<tr>
<th>Wave I</th>
<th>Wave II</th>
<th>Wave III</th>
<th>ILLUSTRATIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>2021</td>
<td>2024</td>
<td>2027</td>
</tr>
</tbody>
</table>

- Cost of fuel subsidies on customers:
  - Wave I: 0%
  - Wave II: 0%
  - Wave III: 20%

- GECOL P&L costs on customers:
  - Wave I: 60%
  - Wave II: 90%
  - Wave III: 100%

Source: Strategy& analysis
Cross-subsidies between customer classes might be gradually decreased...

Cross subsidization roadmap

<table>
<thead>
<tr>
<th>Coverage of class-driven costs&lt;sup&gt;(1)&lt;/sup&gt;</th>
<th>2017</th>
<th>2021</th>
<th>2026</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>State offices</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy Industrial</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light Industrial</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Street Lighting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large Agriculture</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small Agriculture</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residential</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Based on allowed costs by customer class (which benefit from subsidies); thus, values higher than 100% do not necessarily imply full coverage of overall class-related costs

Source: Strategy& analysis
...and more advanced charges and rate schemes applied, enabled by metering technology deployment and upgrade

### Charges and rates roadmap

<table>
<thead>
<tr>
<th>Year</th>
<th>Wave I</th>
<th>Wave II</th>
<th>Wave III</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2024</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2027</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Active charges

- **Customer charge**
  - Heavy Ind.
  - Large Agr.
  - Light Ind.
  - Small Agr.
  - Commercial
  - Street light.
  - State offices
  - Residential

- **Demand charge**
  - Energy charge

- **Energy charge**

#### Rate schemes

- **Customer charge**
  - Flat rate
  - Time-varying rate

- **Demand charge**
  - Flat rate

- **Energy charge**
  - [all cust. classes]
  - Heavy Ind.
  - Large Agr.
  - Light Ind.
  - Small Agr.
  - Commercial
  - Street light.
  - State offices
  - Residential

- **Energy charge**

---

**Source:** Strategy& analysis

---

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Guided by a gradual and tailored improvement pathway, tariff framework would thus experience a smooth transition

**Average tariff evolution**

<table>
<thead>
<tr>
<th>Customer charge</th>
<th>Energy charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD / month</td>
<td>Dhs / kWh</td>
</tr>
</tbody>
</table>

**2017**
- Heavy Industrial: 31
- Large Agriculture: 32
- Light Industrial: 42
- Small Agriculture: 30
- Commercial: 68
- Street Lighting: 68
- State offices: 68
- Residential: 20

**2021**
- Heavy Industrial: 187, 5, 14
- Large Agriculture: 118, 5, 12
- Light Industrial: 21, 44
- Small Agriculture: 15, 36
- Commercial: 24, 63
- Street Lighting: 22, 75
- State offices: 60, 59
- Residential: 10, 39

**2024**
- Heavy Industrial: 160, 4, 31
- Large Agriculture: 120, 4, 32
- Light Industrial: 18, 34
- Small Agriculture: 19, 34
- Commercial: 21, 45
- Street Lighting: 21, 79
- State offices: 45, 68
- Residential: 13, 64

**2027**
- Heavy Industrial: 160, 3, 59
- Large Agriculture: 120, 3, 61
- Light Industrial: 18, 4, 63
- Small Agriculture: 19, 3, 65
- Commercial: 16, 4, 63
- Street Lighting: 21, 103
- State offices: 34, 78
- Residential: 14, 98

**Focus on Residential - Energy charge (Dhs / kWh)**

1) True tariff calculation and design process is enabled by year-by-year financial and technical performance data projection; Source: Strategy& analysis
Cost to serve

Current tariff framework

New tariff design process and decisions required

Multi-stage tariff reform roadmap

Excel toolkit user guide
On the basis of a specific set of input data, excel-based Tariff Design Toolkit enables tariff calculation and setting...

Tariff Design Toolkit introduction

**Description**
- Tariff Design Toolkit has been developed to support tariff calculation activity in Libya and enable a full design process, with visibility of the financial impact on the sector.
- The tool is built so to provide results on annual basis (typically, from one year to the following) according to a specific set of input data (mainly one-year projections), and is set-up to design tariff rates for up to 10 distinct customer classes.

**General directions**
- The recommended way to utilize the model is to start by completing the “Input” section, making sure to provide all the required inputs.
- The user-friendly “Control Panel” section then allows to adjust several parameters and quickly run simulations, without the need to work on “Input” and “Calculation” sheets.

**Warnings**
- The model requires a set of specific inputs in order to deliver accurate results (e.g. projection of P&L costs, consumption by time block, demand by voltage level, etc.)
- The user is responsible for inputting all the required data (explored in the following slides), and remains responsible for their accuracy.

*Source: Strategy& analysis*
...supporting whole design and review process, which shall be developed on annual basis by GECOL and the regulator

### Tariff design and review process

<table>
<thead>
<tr>
<th>Year n-1</th>
<th>Year n</th>
<th>Year n+1</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g. 2018</td>
<td>e.g. 2019</td>
<td>e.g. 2020</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
</tr>
</thead>
</table>

#### Activities

- Data collection related to year n-1
- Data projections for year n+1
- Preliminary rate design for year n+1
- Preliminary-tariff submit to the regulator
- Review of projections (regulator)
- Review of tariff rates (regulator)
- Launch of new tariff framework
- Application of new tariff

**Source:** Strategy& analysis

**Color code:**
- Yellow: details on next slides

---

Prepared for The World Bank
Excel toolkit is built on three major sheets, two of which support the user in the design process

Tariff Design Toolkit sheets

**Input sheet**

**FORECAST**
Year n+1 e.g. 2020

**ACTUAL**
Historical data e.g. 2008-2017

**Year n-1**

368 368 361
312 312 306
295 295 289
137 137 134
351 351 344
262 262 257
223 223 219
331 331 325
317 317 311

**FORECAST**
To be filled in with projections for year n+1

**ACTUAL**
To be filled in with actual data for year n-1

**Calculation sheet**

Receives data and rate-design parameters from Input and Control Panel sheets

Elaborates data (e.g. cost allocation) and performs calculations (e.g. unit cost by customer class)

Returns output values leveraged as reference data in the Control Panel / dashboard

No need to work on Calculation sheet

**Control Panel sheet**

**DECISION REQUIRED and RATE DESIGN**

RATE DESIGN
To be filled in with desired parameters defining final rates by customer class

**DASHBOARD**

Source: Strategy& analysis
Input sheet is organized in 4 main chapters, each divided in two main sections, “Forecast” and “Actual”

Input sheet structure

Source: Strategy& analysis
On annual basis, Forecast and Actual shall be filled in with following-year projections and historical data respectively.

Input sheet data

**FORECAST section**

- **Tariff for Year n+1** (“reference year”)

**ACTUAL section**

To be filled in with historical data up to year n-1, which represent a reference for the calculation and the review of year n+1 projections in the “Forecast” section.

**Color code**

- Red: Projections
- Green: Calculated cells (shall not be edited)
- Yellow: Actual historical data
- Light Green: Illustrative historical data (actual data to be filled in)
- Gray: To be filled in with actual data up to year n-1 (on annual basis)

**Source:** Strategy& analysis

---

**Table:**

<table>
<thead>
<tr>
<th>Year</th>
<th>Year n+1</th>
<th>Year n-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>2021</td>
<td>2019</td>
</tr>
<tr>
<td>2021</td>
<td>2022</td>
<td>2020</td>
</tr>
<tr>
<td>2022</td>
<td>2023</td>
<td>2021</td>
</tr>
</tbody>
</table>

---

**Strategy& | PwC**

Prepared for The World Bank 69
According to the identified tariff design methodology, data are automatically elaborated in the Calculation sheet.

Calculation sheet structure:

1. **DETERMINATION of COSTS**
   - Input: Receives data from Input sheet and rate-design parameters from Control Panel sheet.
   - Elaboration: Elaborates data and performs calculation.
   - Output: Returns output values leveraged as reference data in the Control Panel / dashboard.

2. **COST ALLOCATION**
   - Input: Receives data from Input sheet and rate-design parameters from Control Panel sheet.
   - Elaboration: Elaborates data and performs calculation.
   - Output: Returns output values leveraged as reference data in the Control Panel / dashboard.

3. **RATE DESIGN**
   - Input: Receives data from Input sheet and rate-design parameters from Control Panel sheet.
   - Elaboration: Elaborates data and performs calculation.
   - Output: Returns output values leveraged as reference data in the Control Panel / dashboard.

Source: Strategy& analysis
**Control Panel sheet** interactively supports the core rate-design activity, and displays results within a dashboard.

Control Panel sheet structure

1. **Decisions required on TARIFF RATIONALE and CROSS-SUBSIDIZATION**
   - 1.1 Tariff rationale
   - 2.2 Cross subsidization

2. **Decisions required on ACTIVE CHARGES and RATE SCHEMES**
   - 3.1 Active charges
   - 3.2 Rate scheme

3. **Final RATE DESIGN**

4. **DASHBOARD**

Source: Strategy& analysis
The sheet is organized in 4 distinct panels, and allows to adjust a set of design parameters, highlighted as blue cells.

Control Panel sheet structure

I

Decisions required on TARIFF RATIONALE and CROSS-SUBSIDIZATION

II

Decisions required on ACTIVE CHARGES and RATE SCHEMES

III

Final RATE DESIGN

IV

DASHBOARD

Color code

- Input parameters for rate design

Note: cells formatted with colors different than blue are calculated cells and shall not be edited

Focus on next slides

Source: Strategy& analysis
The first panel allows to set the costs charged on customers, as well as the possible set of cross-subsidies between classes.

Decisions required 1.1 and 2.2

**DECISIONS REQUIRED (1.1 and 2.2)**

1.1 TARIFF RATIONALE

- **Cost of fuel subsidies on customers**
  - 0%
  - 100%: NO SUBSIDIES ON FUEL
  - tariff covers full fuel cost, including the cost of fuel subsidies

- **GECOL P&L costs on customers**
  - 90%
  - Share of P&L cost reflected on tariff

2.2 CROSS SUBSIDIZATION

<table>
<thead>
<tr>
<th>CUSTOMER CLASS</th>
<th>Coverage of class-driven cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Constraints</td>
</tr>
<tr>
<td>Heavy Industrial</td>
<td>100%</td>
</tr>
<tr>
<td>Large Agriculture</td>
<td>120%</td>
</tr>
<tr>
<td>Light Industrial</td>
<td>138%</td>
</tr>
<tr>
<td>Small Agriculture</td>
<td>138%</td>
</tr>
<tr>
<td>Commercial</td>
<td>138%</td>
</tr>
<tr>
<td>Street Lighting</td>
<td>138%</td>
</tr>
<tr>
<td>State Offices</td>
<td>138%</td>
</tr>
<tr>
<td>Residential</td>
<td>75%</td>
</tr>
<tr>
<td>Additional 1 (Non-R)</td>
<td>0%</td>
</tr>
<tr>
<td>Additional 2 (Resid)</td>
<td>0%</td>
</tr>
</tbody>
</table>

Customer classes with no constraints (empty cells) may be charged for the discounts accorded to subsidized classes.

Source: Strategy& analysis
The second panel allows to choose the charges to be activated and the rate schemes to be applied by customer class

Decisions required 3.1 and 3.2

Source: Strategy& analysis
The third panel displays resulting rates, and allows further manual adjustments to define ultimate Designed rate

Final rate design

The panel provides an indication of the incidence of the Costs related to each charge on Total allowed costs.

The rates resulting from the applied set parameters can be used as reference in ultimate rate design (blue column).

Coverage of allowed costs resulting from Designed rates is an additional reference guiding ultimate rate design.

Further manual adjustments allows to define the ultimate Designed rate (to maximize political / public acceptability).

Rate schemes different than Flat are displayed in a chart.

Source: Strategy& analysis
**On residential class, available parameters also allow to set Progressive-rate intervals and possible lifeline discounts**

**Final rate design – Focus on Residential class**

**On residential class Flat rates, the user can either decide to apply a lifeline discounted tariff or not**

**On residential class Progressive rates, the user is allowed to set first-consumption tier rate, while following tiers (black cells) are automatically calculated to cover allowed class costs**

**Focus on Residential class**

Source: Strategy& analysis
The dashboard exhibits tariff impact on revenue/cost and resulting contribution required from government

Dashboard – Results

Source: Strategy& analysis
The dashboard also provides a snapshot of the designed rates, including achieved level of coverage of allowed costs.

Dashboard – Designed rates

Source: Strategy& analysis

Ultimate Designed rate may have altered coverage of allowed costs by customer class (and overall)
In addition, the forth panel displays the impact of commercial performance, with different scenario options.

Impact of commercial performance

Scenario selection (as per scenarios defined in Input sheet)

Expected deficit in GECOL P&L due to commercial losses

Expected non collection

Source: Strategy& analysis