Market Assessment:
Privately-funded Loss Reduction

April 2020

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The International Finance Corporation (IFC)—a sister organization of the World Bank and member of the World Bank Group—is the largest global development institution focused on the private sector in emerging markets. We work with more than 2,000 businesses worldwide, using our capital, expertise, and influence to create markets and opportunities where they are needed most. In fiscal year 2019, we delivered more than US$19 billion in long-term financing for developing countries, leveraging the power of the private sector to end extreme poverty and boost shared prosperity. For more information, visit www.ifc.org

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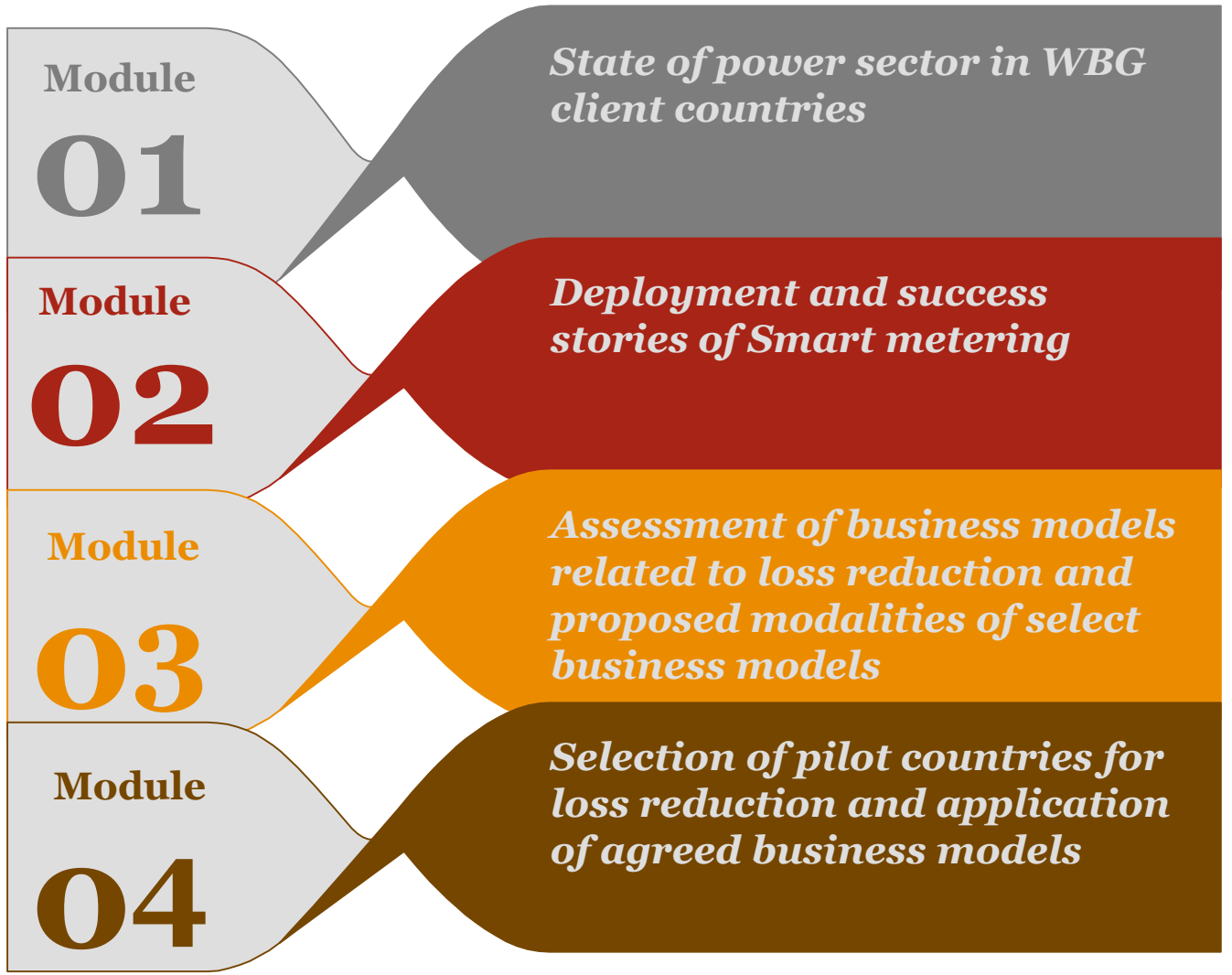
1. SCOPE OF WORK

1. Scope of work

- ***International Finance Corporation*** selected PricewaterhouseCoopers to conduct a market assessment on privately-funded loss reduction.
- Comprehensive market research related to the scope of work was conducted.
- The engagement was divided into four (4) modules aimed at design of modalities of business models for loss reduction.
- The business models will be applied in pilot areas for loss reduction.



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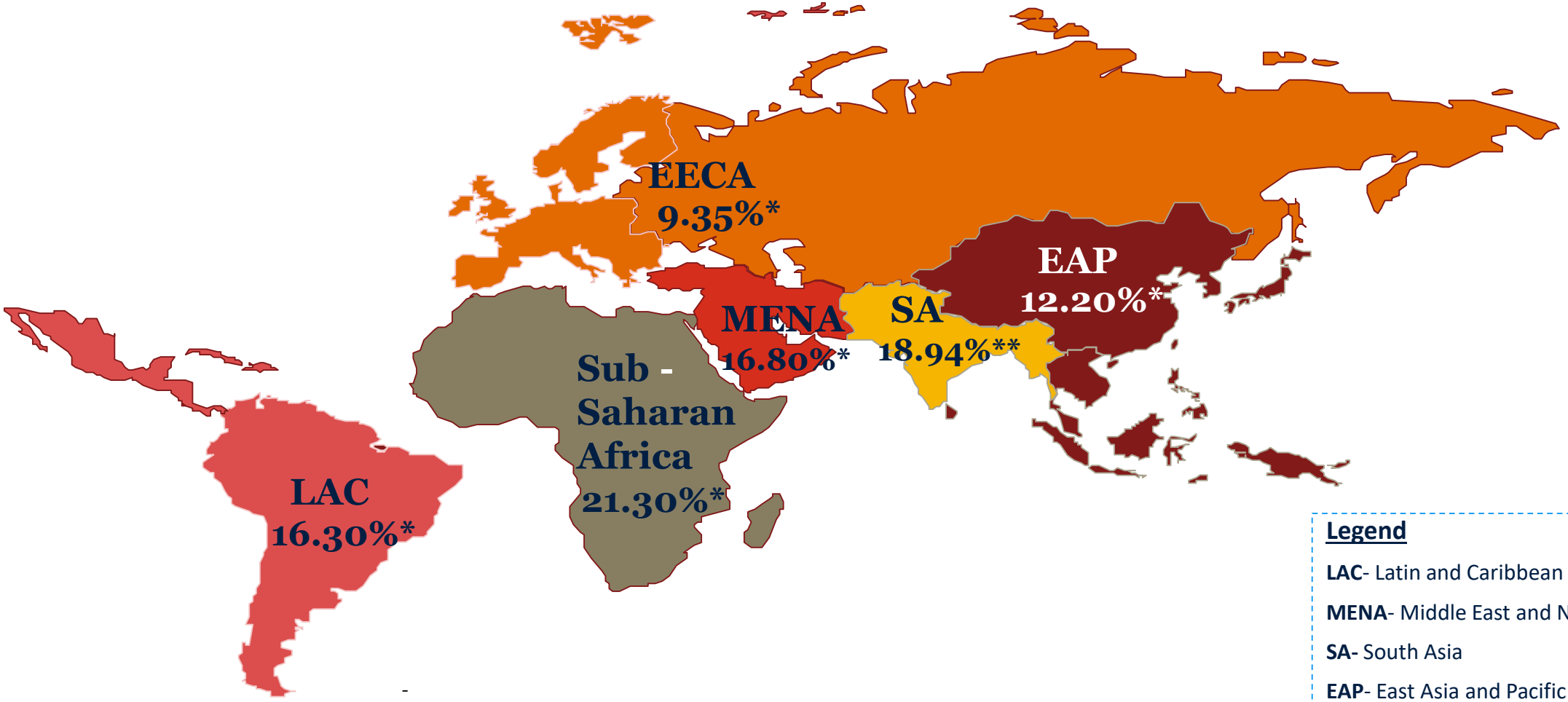
2. Status of power sector in WBG client countries

2. Status of power sector in WBG client countries

Regional Loss Profiles



Legend

LAC- Latin and Caribbean

MENA- Middle East and North Africa

SA- South Asia

EAP- East Asia and Pacific

EECA- Eastern Europe and Central Asia

Source: *-USAID
**-The World Bank

2. Status of power sector in WBG client countries

Parameters considered for regional power sector analysis

1. Country wise loss level profile
2. Access to electricity
3. Region T&D loss level
4. Power consumption (kwh per capita)
5. Utility T&D loss level
6. Income class (number of countries)
7. Private sector participation generation, transmission and distribution

2. Status of power sector in WBG client countries

East Asia and Pacific

Legend	
T&D Loss level range	Colour coding
Upto 15%	
15% - 25%	
25% - 35%	
Above 35%	
PSP in distribution business	P

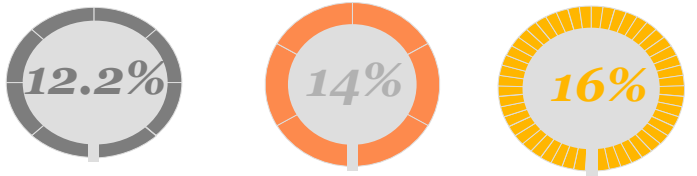
Regional Parametric Analysis

Access to Electricity

Countries> 90% | Region average | World average

Region T&D Loss Level

Region average | World average | Income average

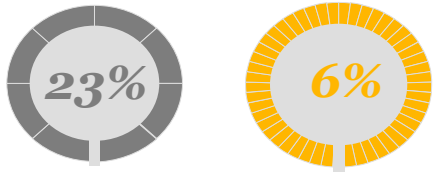


Power Consumption (kWh per capita)

Highest | Region average | World average

Utility T&D Loss Level

Highest | Lowest

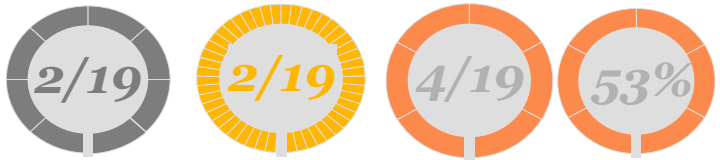


Income Class (Number of Countries)

Upper middle | Lower middle | High

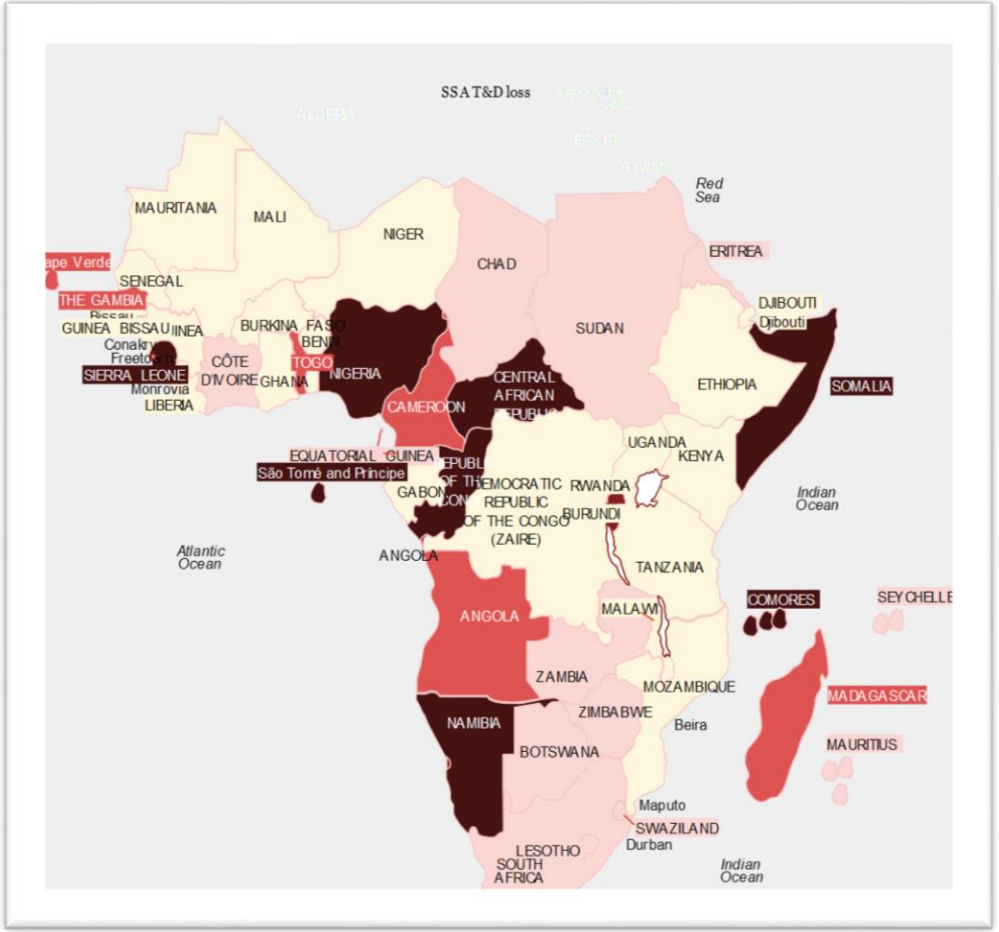
PSP in Power Sector Utilities

Generation | Transmission | Distribution | RA



Source: The World Bank; USAID

2. Status of power sector in WBG client countries



Legend

T&D Loss level range	Colour coding
Upto 15%	
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Above 35%	

Regional Parametric Analysis

Access to Electricity

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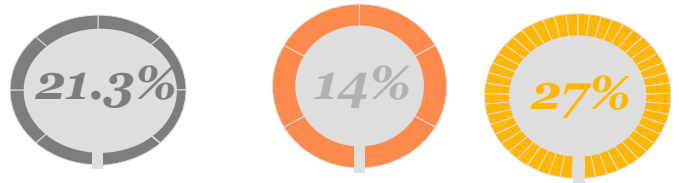
Region T&D Loss Level

Region average | World average | Income average

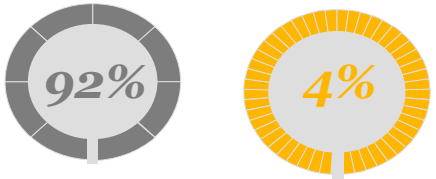


Power Consumption (kWh per capita)

Highest | Region average | World average

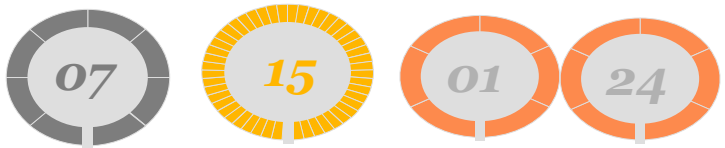
Utility T&D Loss Level

Highest | Lowest



Income Class (Number of Countries)

Upper middle | Lower middle | High | Low



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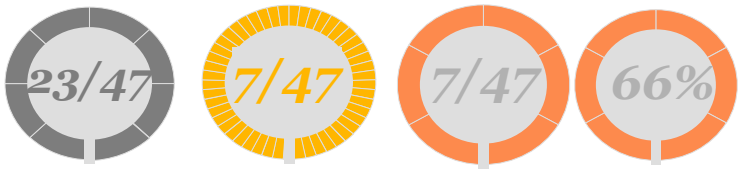
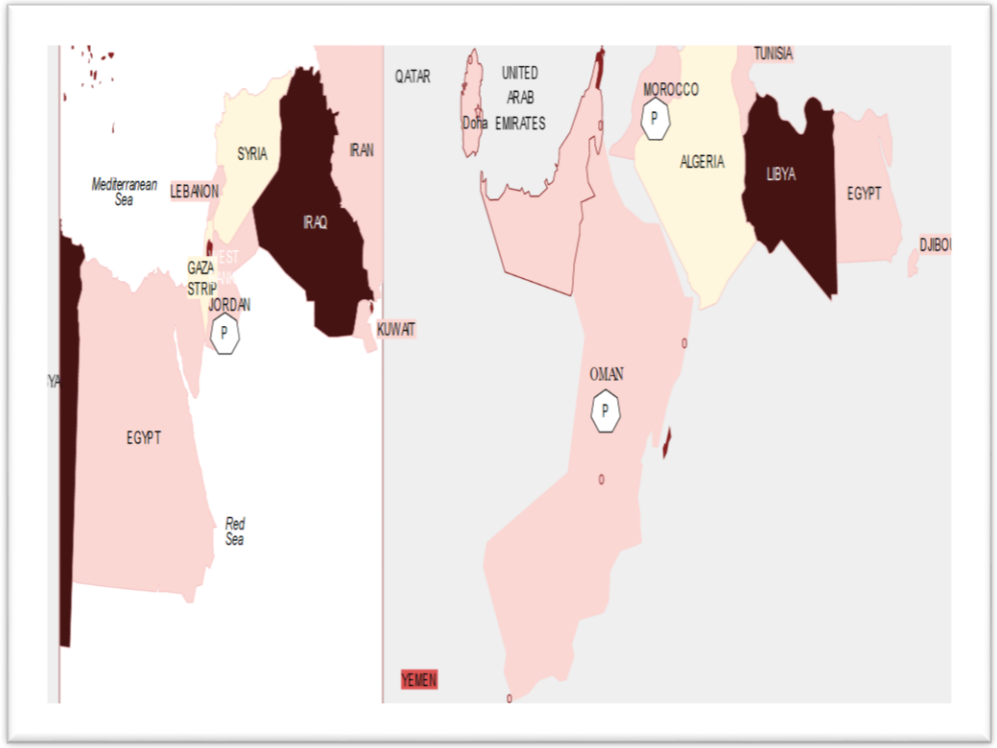


Source: The World Bank; USAID

2. Status of power sector in WBG client countries

MENA (Middle East and North Africa)



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T&D Loss level range	Colour coding
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Regional Parametric Analysis

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Region T&D Loss Level

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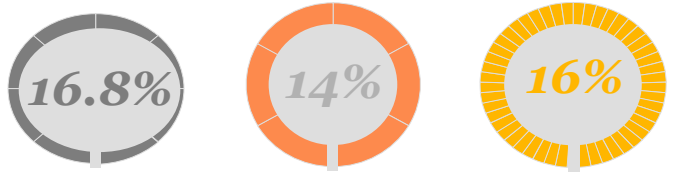
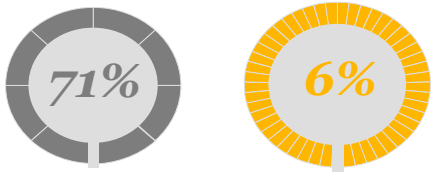


Power Consumption (kWh per capita)

Highest | Region average | World average

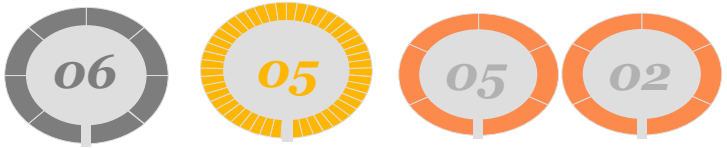
Utility T&D Loss Level

Highest | Lowest



Income Class (Number of Countries)

Upper middle | Lower middle | High | Low



PSP in Power Sector Utilities

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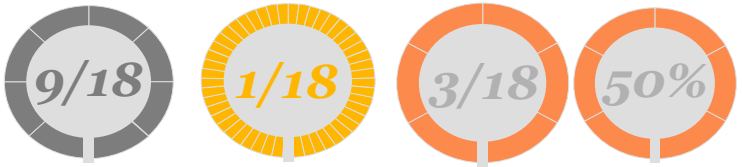

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2. Status of power sector in WBG client countries

Legend	
T&D Loss level range	Colour coding
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Regional Parametric Analysis

Access to Electricity

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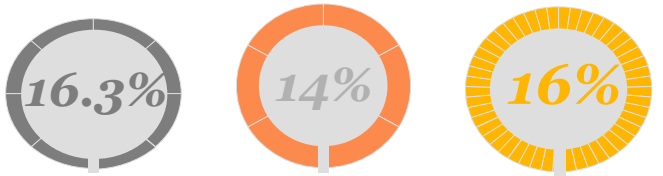
Region T&D Loss Level

Region average | World average | Income average

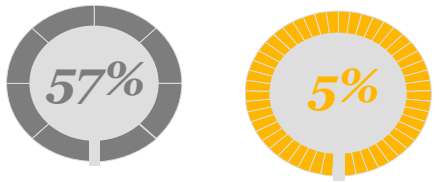


Power Consumption (kWh per capita)

Highest | Region average | World average

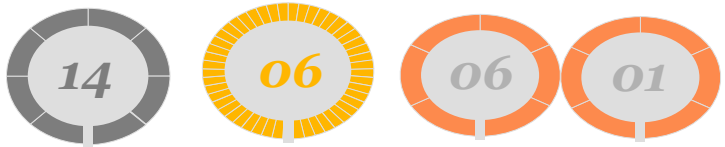
Utility T&D Loss Level

Highest | Lowest



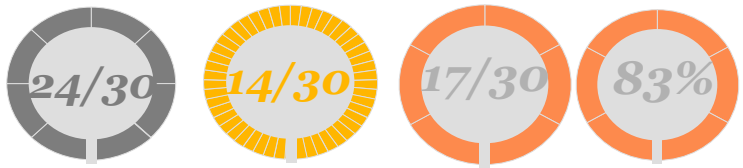
Income Class (Number of Countries)

Upper middle | Lower middle | High | Low



PSP in Power Sector Utilities

Generation | Transmission | Distribution | RA



Source: The World Bank; USAID

2. Status of power sector in WBG client countries

Legend	
T&D Loss level range	Colour coding
Upto 15%	
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Regional Parametric Analysis

Access to Electricity

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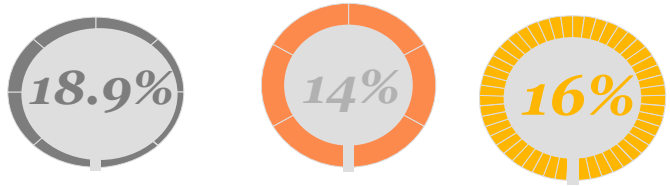
Region average | World average | Income average

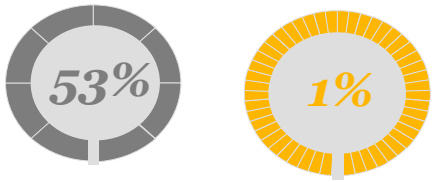


Power Consumption (kWh per capita)

Highest | Region average | World average

Utility T&D Loss Level

Highest | Lowest

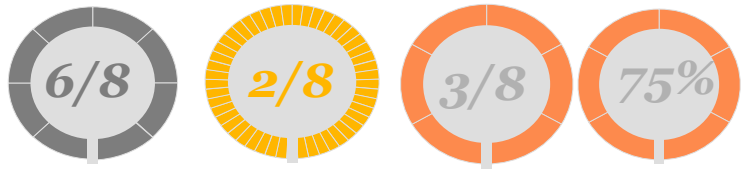


Income Class (Number of Countries)

Upper middle | Lower middle | Lower

PSP in Power Sector Utilities

Generation | Transmission | Distribution | RA



Source: The World Bank; USAID

2. Status of power sector in WBG client countries

Eastern Europe and Central Asia

Legend	
T&D Loss level range	Colour coding
Upto 15%	
15% - 25%	
25% - 35%	
Above 35%	
PSP in distribution business	P

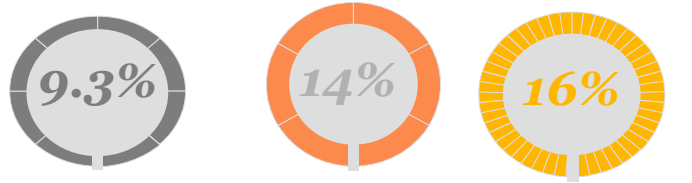
Regional Parametric Analysis

Access to Electricity

Countries> 90% | Region average | World average

Region T&D Loss Level

Region average | World average | Income average

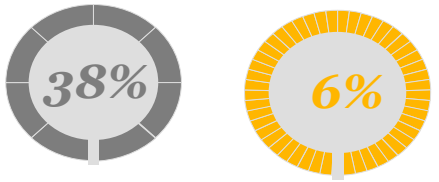


Power Consumption (kWh per capita)

Highest | Region average | World average

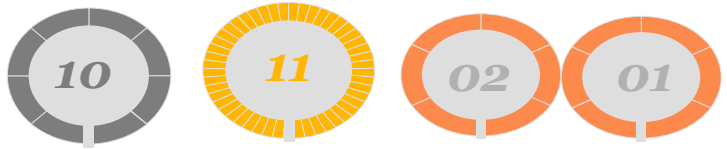
Utility T&D Loss Level

Highest | Lowest



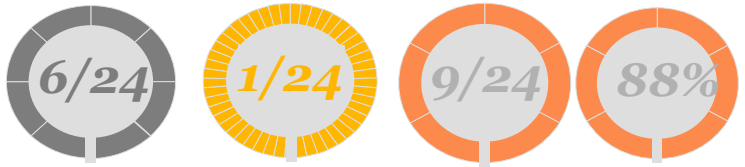
Income Class (Number of Countries)

Upper middle | Lower middle | High | Low



PSP in Power Sector Utilities

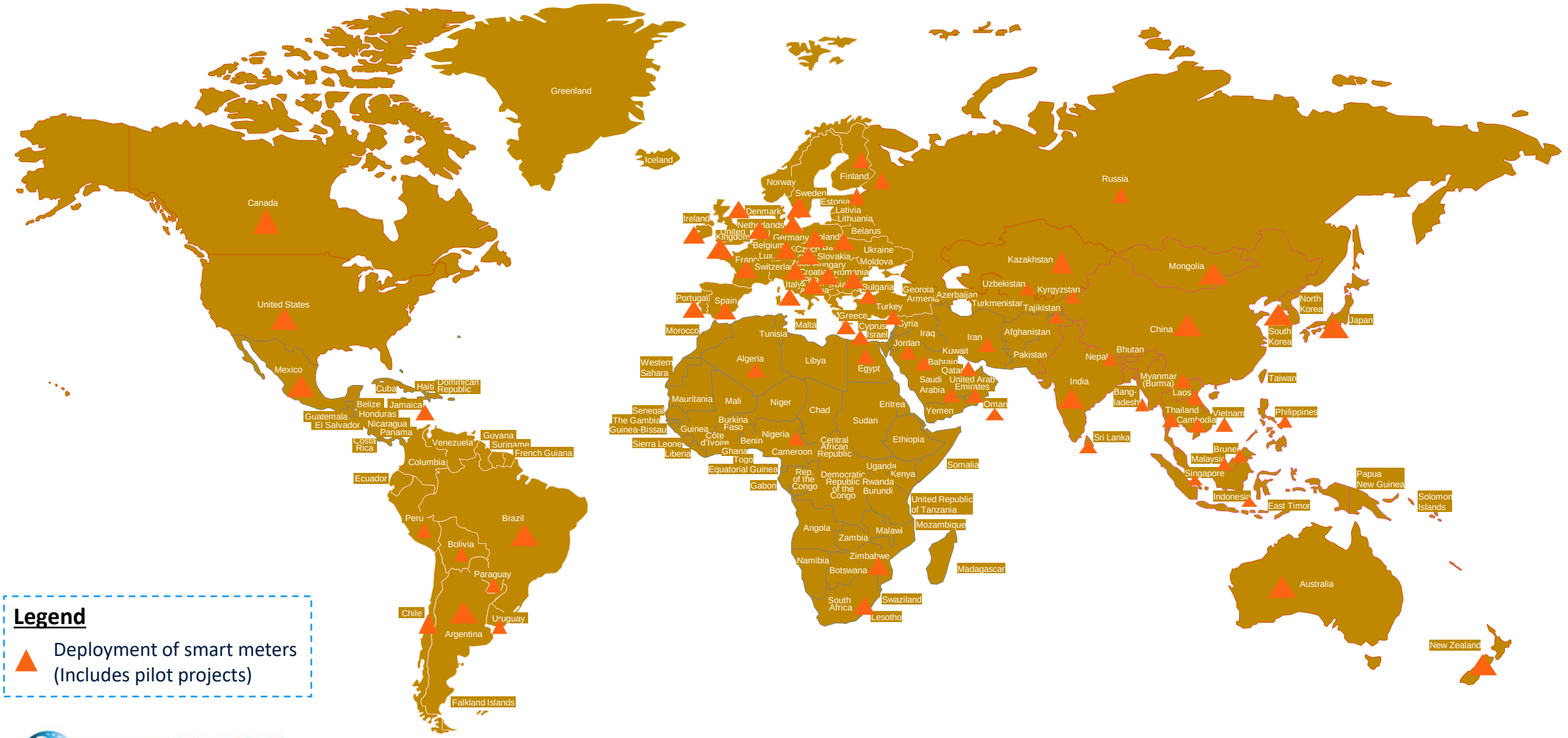
Generation | Transmission | Distribution | RA



Source: The World Bank; USAID

3. Deployment of smart meters

3. Deployment of smart meters



Legend

▲ Deployment of smart meters (Includes pilot projects)

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3. Deployment of smart meters

Key benefits of smart metering

Metering and Billing

Utility saves in O&M costs in terms of manpower involved in meter reading and billing such as labor savings. Utility achieves timely billing and fewer customer disputes.

Remote connection and disconnection

Utilities are able to fulfill remote service connection and disconnection orders in hours instead of days.

Pre-pay billing

Pre-pay billing plans helps customers to manage consumption and costs. Several utilities improved revenue collection and cost recovery by implementing pre-pay billing programs that can help customers avoid defaulting on bills.

Identification of outage areas

AMI enables utilities to isolate outages faster and dispatch repair crews more precisely, reducing outage duration, limiting inconvenience, and reducing labor hours and truck rolls for outage diagnosis and restoration.

Voltage monitoring

Voltage monitoring provides promising benefit stream to include in business case analysis of AMI investments. Utilities can use AMI voltage monitoring capabilities to enhance the effectiveness of automated controls for voltage and reactive power management.

Data analytics

Utility uses data analytics for commercial monitoring of consumers in terms of fraud detection etc.

3. Deployment of smart meters

Key challenges in implementation of smart meters

Data Management

A humungous amount of data is utilized through Smart projects. Data handling is critical for accurate analysis and workflow management.

Regulatory

Meticulous regulations are needed to ensure investment in these technologies, service improvement and return on investment.

Workforce Training

Training of workforce is critical to leverage maximum benefit from technology implementation.

Customer Management

Customers need to be 'bought –in' with the technologies to ensure acceptance and behavioural change.

Communication

Raft of communication technologies exist. Choosing the right mix is important for costs and continuing operations.

Interoperability

Vendors offer a variety of technology options. Interoperability is key to keep the costs low for incremental implementations.

Cyber Security

With increasing data and reliance on smart networks, security is paramount for privacy and for continuity of services.

Stakeholder Management

Various stakeholders like customers, system operators, vendors, policy makers, regulators need to work together for success.

4. Success stories of smart meter deployment in the USA

4. Success stories of smart meter deployment

USA

CenterPoint Energy (1/2)

Details of Smart meter deployed

Particulars	Value
Number of Smart meters (no)	
Residential (no)	1,859,008
Commercial (no)	271,729
Total (no)	2,130,737
Number of Smart meters with features enabled	
Remote connect/ disconnect enabled	2,038,499
Outage reporting enabled	2,130,737
Tamper detection enabled	2,130,737
AMI integration with	
Billing system	√
OMS	√
DMS	√
Total cost of AMI implementation (Meter device+Communication+Data management)	$514,519,057

Cost saving details

Particulars	2012	2013	2014
Meter Reading	$17,198,455	$17,946,205	$18,376,912
Route Design Personnel	$0	$150,512	$154,124
Electric Revenue Billing Personnel	$676,468	$1,360,024	$861,346
Injuries, Vehicle, and Other Claims	$300,755	$313,614	$321,141
Avoided Meter Reader Hires	$500,424	$885,808	$1,276,944
Miscellaneous Meter Rereads	$324,709	$338,591	$346,718
Workmen's Comp Insurance Premium	$12,083	$12,603	$12,906
Business Process Personnel	$0	$83,520	$85,524
Total Savings	$19,012,894	$21,090,877	$21,435,615

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Next

4. Success stories of smart meter deployment

USA

CenterPoint Energy (2/2)

Particulars	Duration	Value
AMI cost savings (from cost saving details-previous slide)	Year 2012-2014	$61 million
Reduced service order fees due to automated service orders	Year 2012-2014	$48 million ($24 million per annum)
Additional revenue collection from identification of slow meters, unregistered meters, and electricity theft	Year 2012-2014	$4.5 million
Cumulative fuel savings (950,000 gallons; considering $2.72 U.S. Dollar per US Gallon in Texas)	-	$2.58 million
Reduced customer outage minutes through use of automation	Year 2012	27,111,267 customer outage minutes resulting in an average reliability improvement of 21.9%
Reduction in peak demand	Year 2011	198 participants reduced peak demand by an average of 5 percent, and some participants reduced consumption by as much as 35 percent.

Conclusion: Benefit of smart metering project includes streamlining of commercial processes such as meterization, service orders, commercial monitoring of consumers, increase in revenue collection and reduction of O&M costs. A one-time investment results in benefit in financial terms in consecutive years of operation.

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*Source: CenterPoint's Breakdown of AMI Cost Savings, 2012-2014; Source: Results from the Smart GRID investment Grant program, Sep 2016, U.S. Department of Energy;; https://www.globalpetrolprices.com/USA/Texas/diesel_prices/

4. Success stories of smart meter deployment

USA

Tri-state Electric Membership Corporation

Details of Smart meter deployed

Particulars	Value
Number of Smart meters (no)	
Residential (no)	14,564
Commercial (no)	592
Total (no)	15,156
Number of smart meters with features enabled	
Remote connect/ disconnect enabled	2,064
Tamper detection enabled	15,156
AMI integration with	
Billing system	√
Total cost of AMI implementation (Meter device+Communication)	$2,412,394

Benefit analysis

Particulars	Value
Avoidance of truck rolls in first two years (Due to deployment of 2,000 remote service switches on AMI meters)	13,000
Avoidance of vehicle-miles travelled	51,800
Decrease in annual meter operations costs	From $450,000 per year in 2011, to about $156,000 per year in 2013
Effective Bad debt fell by 97% (Pre-payment program)	From $44,000 in 2011 to just over $1,000 in 2013

Conclusion: Benefit of smart metering project includes streamlining of commercial processes such as meterization, service orders, commercial monitoring of consumers, increase in revenue collection and reduction of O&M costs. A one-time investment results in benefit in financial terms in consecutive years of operation.

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4. Success stories of smart meter deployment

USA

Talquin Electric Cooperative (TEC)

Details of Smart meter deployed

Particulars	Value
Number of Smart meters (no)	
Residential (no)	54,022
Commercial (no)	923
Total (no)	54,945
Number of Smart meters with features enabled	
Remote connect/ disconnect enabled	54,945
Outage reporting enabled	54,945
Tamper detection enabled	54,945
AMI integration with	
Billing system	√
OMS	√
Total cost of AMI implementation	$15,245,056

Benefit analysis

Particulars	Value
Reduction of annual meter operations costs	By more than $568,000
Reduction of Bad debt write-offs from unpaid customer bills (Pre-payment program)	About 65% [Bad debts write-offs: From approx. $700,000 (year 2011) to $250,000 (year 2014)]

Conclusion: Benefit of smart metering project includes streamlining of commercial processes such as meterization, service orders, commercial monitoring of consumers, increase in revenue collection and reduction of O&M costs. A one-time investment results in benefit in financial terms in consecutive years of operation.

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4. Success stories of smart meter deployment

USA

Central Maine Power

Details of Smart meter deployed

Particulars	Value
Number of Smart meters (no)	
Residential (no)	557,269
Commercial (no)	62,546
Industrial (no)	2,565
Total (no)	622,380
Number of Smart meters with features enabled	
Remote Connect/ Disconnect Enabled	576,394
Outage reporting enabled	622,380
Tamper detection enabled	622,380
AMI integration with	
Billing system	√
OMS	√
Total cost of AMI implementation (Meter device+Communication+Data management)	$180,474,628

Benefits realized

Particulars	Value
Saving in meter operation costs in year 2013	More than $7 million
Cash flow savings (in 2011-2013) by reducing the time between reading and billing	$180,000
Avoidance of truck rolls in year 2012	300,000
Avoidance of vehicle miles	1.7 million
Reduction in estimated meter readings	95,441 in year 2010 to 5,833 in year 2012
Decrease in consumer complaints on disputed bills- 29%	From 3,789 in year 2010 to 2,696 in year 2012
Identification of improperly configured meters for the purpose of generating accurate bills to consumers (Using tamper detection analysis)	600

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*Source: CenterPoint's Breakdown of AMI Cost Savings, 2012-2014; Source: Results from the Smart GRID investment Grant program, Sep 2016, U.S. Department of Energy;; https://www.globalpetrolprices.com/USA/Texas/diesel_prices/

5. Need for business models for effective loss reduction

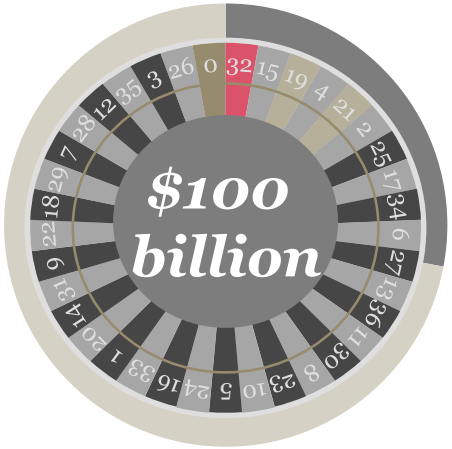
5. Need for business models for effective loss reduction

Power sector scenario

Financial impact of Non-technical loss or commercial losses

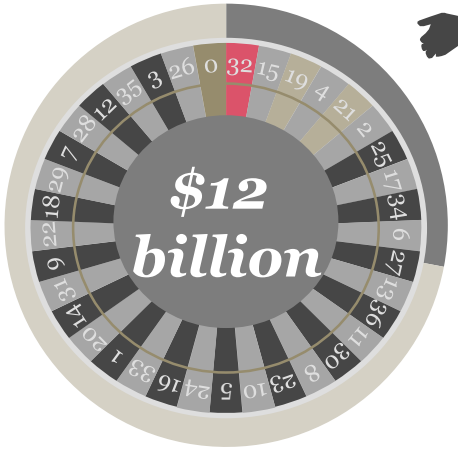
Global level

The annual world-wide costs for utilities due to NTL are estimated to be around USD 100 billion.



India level

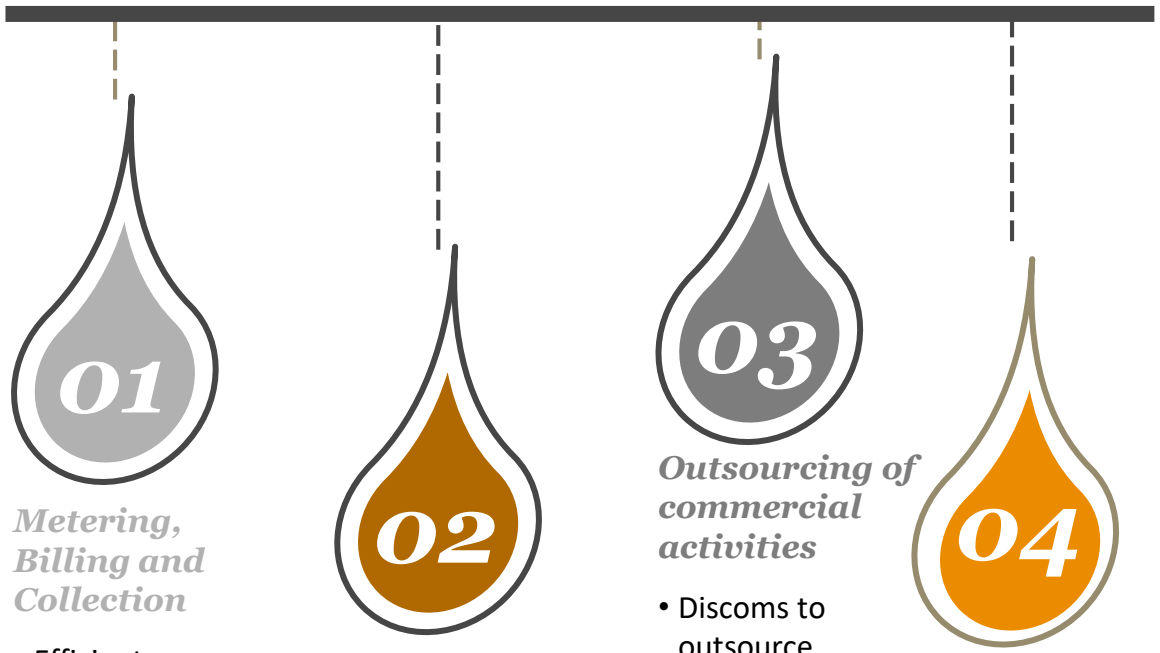
The high commercial losses, estimated at over $12 billion annually for all power utilities in India.



Problem statement

- The distribution and retail supply part of the electricity business has grown extensively in recent years in terms of consumers connected, with better access to rural and semi-rural communities and households.
- Power utilities' systems have not kept pace due to lack of capital, professional management, and lack of an incentive to change. This has resulted in serious deficiency in reliability of the services and high commercial losses, estimated at over **$12 billion annually** for all power utilities in India.

Measures to address Non-technical losses



Metering, Billing and Collection

- Efficient metering, billing as per approved tariff and collection- Pre-paid and Post-paid.

Fraught management

- Commercial monitoring of consumers to prevent revenue leakage

Outsourcing of commercial activities

- Discoms to outsource commercial activities for industry best practices.

Monitoring and Management

- Monitoring and Management of retail supply business

IFC International Finance Corporation WORLD BANK GROUP

5. Need for business models for effective loss reduction

Reasons for high losses in power distribution and retail supply business

- **Energy accounting and audit:**
  - Inaccurate accounting of sales at feeder level due to low level accuracy in updation of billing and energy audit as per field conditions;
  - Inadequate metering at feeder and distribution transformer level leads to inaccurate generation of loss.
- **Technical losses:**
  - Overloaded 11 kV feeders;
  - Overloaded distribution transformers and LT lines;
  - No preventive maintenance and poor workmanship related to distribution infrastructure.
- **Commercial losses:**
  - Inadequate and defective metering at consumer level leading to inaccurate accounting of sales;
  - Electricity theft and poor collection efficiency;
  - Lack of consumer monitoring and vigilance enforcement.
- **Human resource:**
  - Inadequate technical and commercial training to the field staff leading to lack of management skills;
  - Legacy attitude of utility staff for adoption of latest Information technology tools.
- **Inadequate funds:**
  - Lack of funds for capital expenditure for erection of lines, infrastructure etc.

5. Need for business models for effective loss reduction

Rationale for private participation in loss reduction

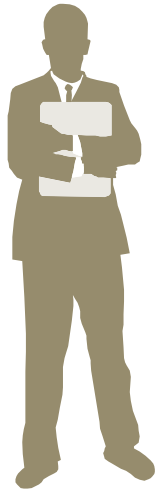
- **Private management of state-owned enterprise (SOE):**
  - Management issues and governance remains an issue with political interference.
  - Corruption is key in the SOE utilities in high losses.
  - A very large number of utilities managed to reduce losses despite continued the support from IFIs, loss reduction studies and investment plans to reduce commercial losses; this is due to adoption of best management practices which private management has developed from past years of experience and innovation.
- **Need for fund for capital expenditure plan:**
  - Investment funds are usually limited on metering and it takes very long time to raise financing from IFIs; Private participation helps to prioritize the efficiency improvement activities such as metering.
- **Need for adoption of latest technology practice:**
  - Utilities have a poor track record of managing meter data and having an effective fraud detection in place;
  - SOE's need to adopt Information technology for commercial monitoring of consumers spread over a large area;
  - Disparate sub-systems within billing make it difficult to integrate systems in the utility under different financing.
- **Change management:**
  - Collusion between staff and customers. Need to adopt commercial mindset for retail supply business.

6. Business models for effective loss reduction

6. Business models for effective loss reduction

1

Smart metering under BOOT model

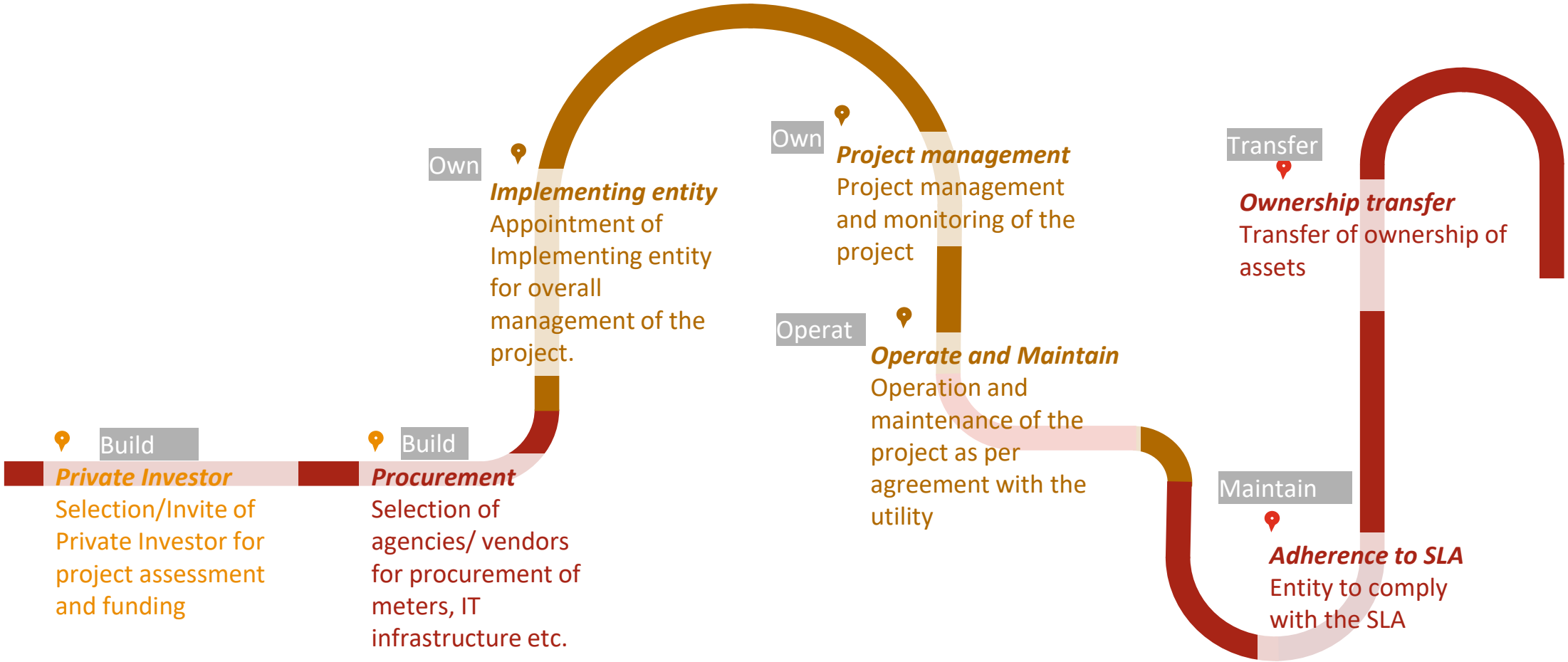


2

Input based Distribution Franchisee model

6. Business models for effective loss reduction

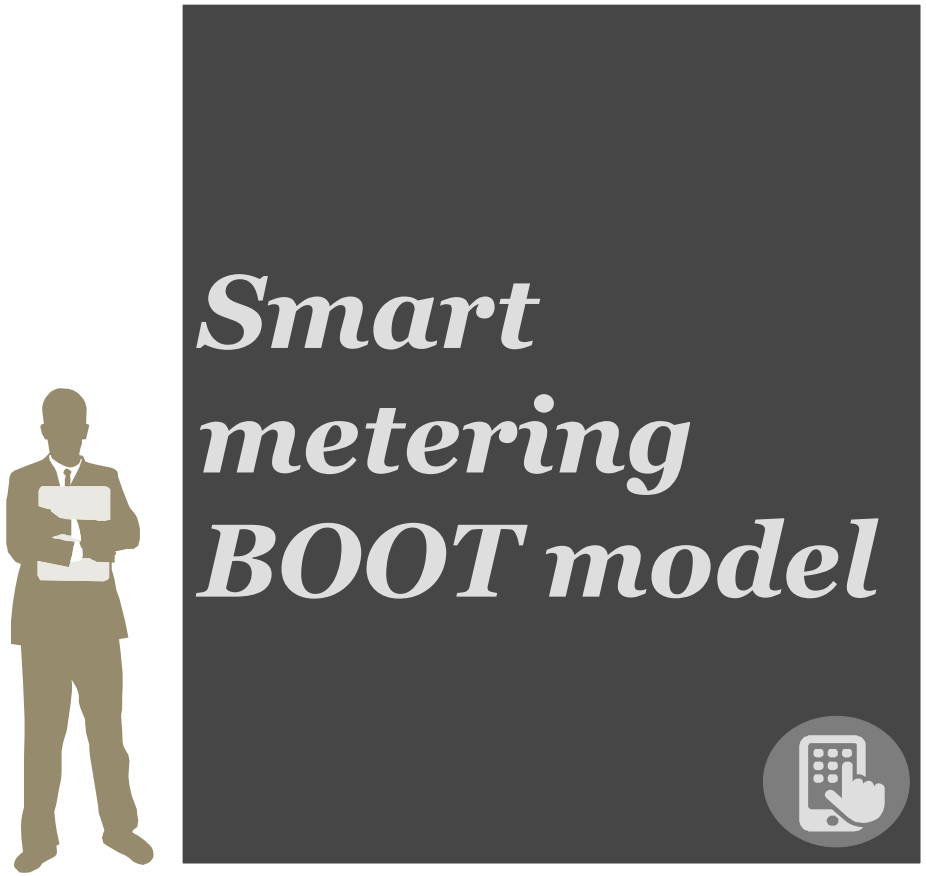
Typical life cycle of a business model



7. Business model #1 for loss reduction: smart metering model

7. Business model #1 for loss reduction

Introduction to smart metering model



Primary objective is improving utility financial viability using off balance sheet financing through:

- Smart metering of all consumers and provision of systems;
- Improve energy management;
- Reduce the overall AT&C loss and plug revenue leakages;
- Reduce the administrative costs (hiring permanent employees) for activities such as metering and operation and maintenance of the infrastructure.

7. Business model #1 for loss reduction

Advantages of smart metering under BOOT model

- Metering and revenue collection is taken out of the utility which could mitigate governance;
- All financing of metering is borne by the private investor, thereby reducing public sector financial debt;
- Metering and revenue collection is the core business of the investor;
- Utility can now concentrate on the distribution infrastructure;
- Take advantage of the sector specific expertise;
- Entire project risks are borne by the private investor;
- Best industry practices for systems, management, innovation, quality delivery and access to skilled resources;
- Focus on effective reduction of losses, reducing power utility burden and responsibility regarding metering;
- State of the art systems for fraud detection and management that work;
- Design of entire system to coordinate with meter data management & Distribution Management Systems;
- Maintain a GIS systems for all consumers and their mapping;
- All consumers metered, comprehensive customer management systems.

7. Business model #1 for loss reduction

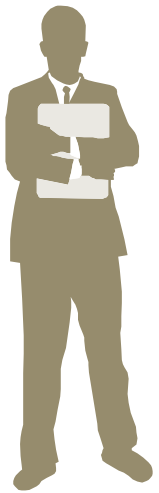
Disadvantages of smart metering under BOOT model

- **Finance**
  - The entire financial risk is borne by the private investor, hence the financing costs may be higher than other models such as EPC, although overall it may be at a lower lifecycle cost especially with reduction of losses.
- **Scalability:**
  - It is more suitable for a) larger scale loss reduction projects preferably above a quarter of a million consumers and
    b) utilities with more than 20% losses to be attractive for private sector, although smaller scale may also be equitable.
- **Discom payback structure:**
  - Loss reduction benefits sharing may be considered depending on commercial agreement.
- **Revenue management- off taker risk:**
  - Question of would the energy sales generate adequate revenue for the investor;
  - If the off taker risk is high project financing costs may be higher;
  - Discom may have to split the benefits with the investor (depending on the commercial agreement).
- **Operational risk:**
  - Power utility transfers control of metering to third party which can be operational risk.
    Energy sales would need to generate adequate revenue for the investor.

7. Business model #1 for loss reduction

Transaction framework

Proposed modalities



Smart metering under BOOT model

7. Business model #1 for loss reduction

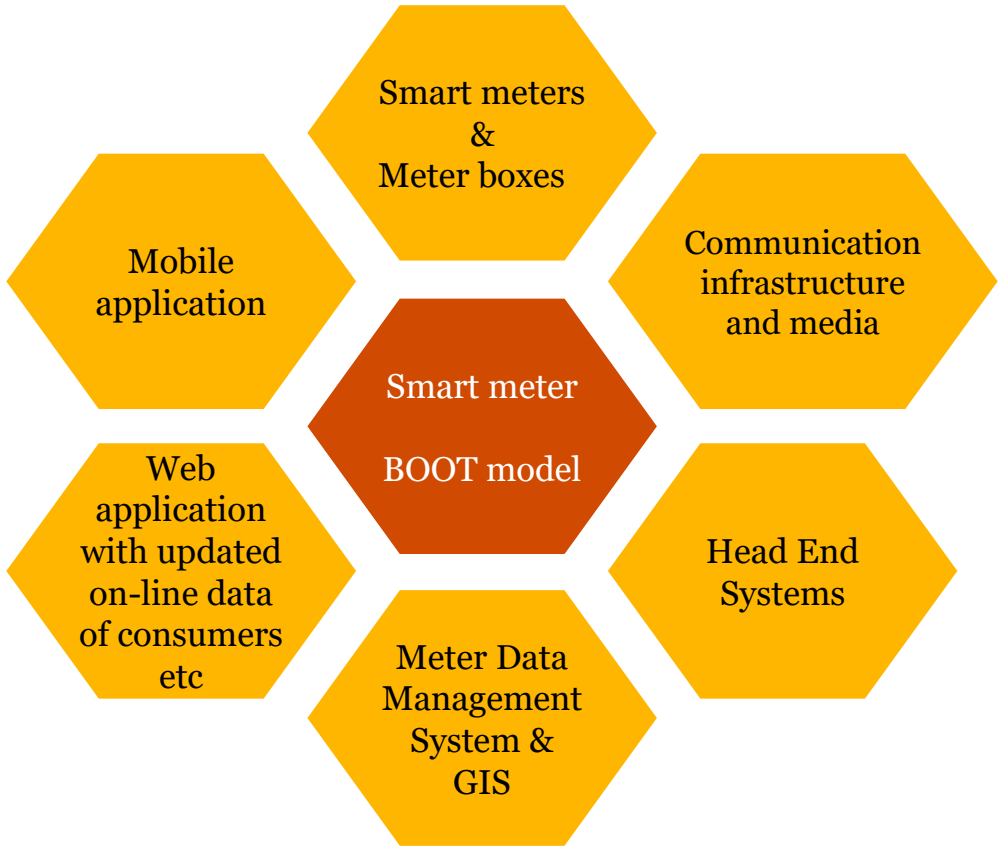
Key features of proposed smart meter BOOT model

Particulars	Description
Metering and Loss reduction Company - MELCO	• A Metering and Loss reduction Company (MELCO) will be set up as the vehicle to take over the metering and loss reduction where the investor will be the main shareholder of the company.
Ownership	• Ownership of assets with MELCO till the end of project tenure.
Design, supply and build	• Scope includes procurement and installation of Smart meter, Head End System (HES), Meter Data management system (MDMS), communications facility, GIS for consumer mapping. The technical specifications and service levels related to each component of the system shall be as per agreement during Build phase and O&M phase.
Operate and maintain	• Operate and maintain infrastructure including meter reading, data analytics, Energy accounting, collections.
Transfer	• Transfer of all assets to the Distribution licensee post end of project tenure.

7. Business model #1 for loss reduction

Key modules of proposed smart meter BOOT model

Modules under scope of work



Primary parameters

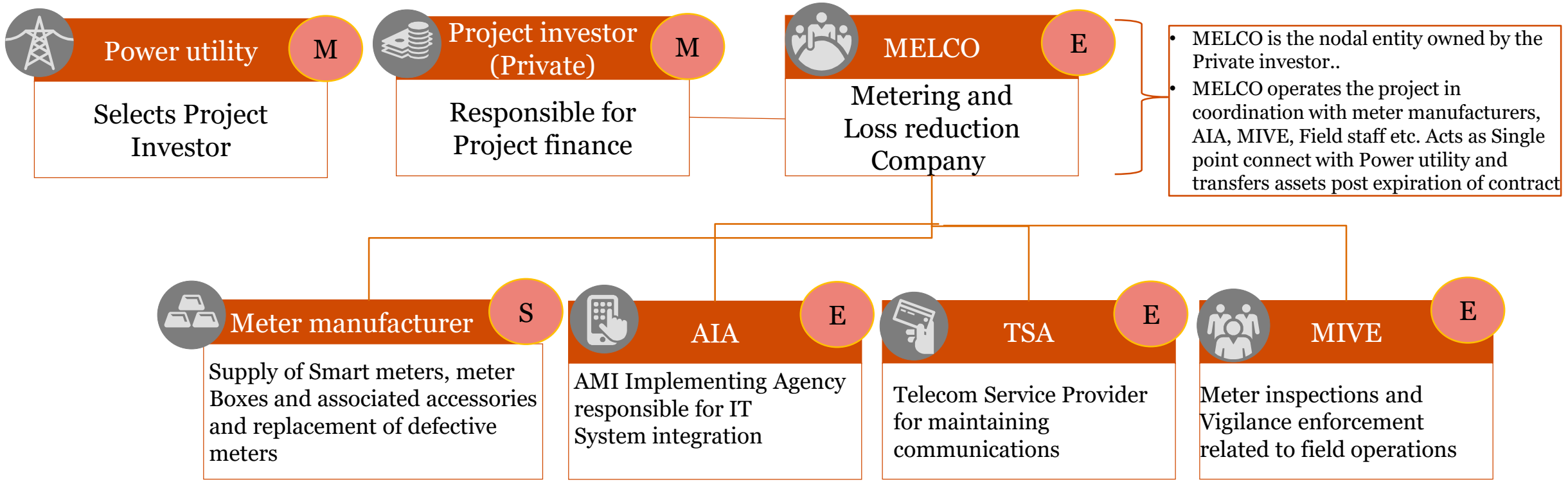
- The primary parameters for selection of area shall be:
  - T&D loss level above 20% and
  - approximate number of consumers to be served shall be preferably more than 0.5 mn to make financial project sense.
- Project period – 4 to 7 years.

- The overall tenure can be divided into two phases, **Build phase (Implementation period) and Operate & Maintain phase**.
  In the Build phase, the meters, HES and associated accessories and IT infrastructure shall be procured and installed.
  In the Operate and maintain phase, meter reading, replacement of defective meters, data analytics etc. shall be executed during the tenure of the project.

- The technical specifications and service levels related to each component of the system shall be as per agreement during Build phase and O&M phase.

7. Business model #1 for loss reduction

Proposed smart metering BOOT framework (1/2)



7. Business model #1 for loss reduction

Proposed Smart metering BOOT framework (2/2)

- Utility designs the modalities for loss reduction through smart metering under BOOT framework;
- Utility floats open tender for selection of agency for execution of contract;
- Private investor intending to participate in the project constitute an agency called MELCO (Metering and Loss Reduction Company);
- MELCO will be the authorised representative for execution of the contract and will sign the agreement with the utility;
- MELCO does the project management of the contract and the contract is supervised by the utility in terms of service level agreements between MELCO and utility;
- Role of Regulator is to ensure the utility meets the statutory timelines in providing services to consumers in terms of meterization, meter reading and other commercial practices.

7. Business model #1 for loss reduction

Proposed project lifecycle

Project finance

- Power utility opts for the concept- Smart metering under BOOT model and selects Private investor for the MELCO
- Private investor arranges for finance on its own.

Advent of MELCO

- MELCO (Metering and Loss reduction Company) produces specs initiates procurement of goods and services from different stakeholders and project management.

Procurement of services

- Procurement of services from meter manufacturers, AMI implementing agency, Telecom service provider, Meter investigation & Vigilance enforcement team and field staff for meterization and replacement of meters, logistics etc.

Execution of project

- Project execution is done in compliance with the Service Level Agreement (SLA).
- Payment is done on Opex model on a monthly basis.

Transfer of ownership

- Transfer of ownership of assets post expiration of contract.

7. Business model #1 for loss reduction

Proposed role of stakeholders in the project

Metering and Loss reduction Company (MELCO) is the nodal agency for project execution.

Meter manufacturers

- Procurement of Smart meters, meter boxes and associated accessories;
- Replacement of meters shall be as per the contract agreement between MELCO and meter manufacturer;

AMI implementing Agency and TSA

- System Integrator responsible for Meter Data Management System (MDMS), integration of HES and MDMS, GIS, design of web application and mobile application, data analytics, prepayment, billing, operation and maintenance of Call centre etc.
- TSA responsible for communication media between smart meters and MDMS.

- Meterization and replacement of burnt/ defective meters;
- Establishment of communication channel and configuration of meters, data concentrators, Head End System (HES) and providing any collaboration with System Integrator

Field staff deployed by MELCO

Note: Existing utility staff (if outsourced by utility) in terms of field staff for meterization, revenue collection, vigilance enforcement can be taken over by MELCO for execution of the contract.

7. Business model #1 for loss reduction

Project finance features

Particulars	Description
Investment ownership	• The financial ownership vests with the Investor and he will finance the project on its own. • Off sheet Balance sheet financing. • Private investor will arrange for finance for procurement from vendors and on-site project execution.
Opening of Escrow account	• An Escrow account shall be opened which shall be maintained between the Utility and MELCO. The purpose of the Escrow account shall be the receipt of revenue on a daily/ monthly basis based on the billing cycle of the utility. • The Escrow account is for the purpose of risk mitigation for ensuring timely transfer of revenue collected where vending stations/ revenue collection centers are managed by MELCO. For the purpose of daily transfer of amount to utility's account, Escrow account is maintained which is also managed by the utility. This arrangement is for safeguarding the risks involved in case MELCO fails to transfer credit amount on a timely basis as agreed in the contract.
Ownership of assets	• The ownership of assets shall be with the MELCO until the end of the duration of the project.
Benefits envisaged and Payback period	• This model is expected to reduce commercial losses of the utility by at least 50% -70% in the first three years of operation, targeting elimination of commercial losses. The straight payback period shall be of the order of 3-4 years of the total value of investment to make it commercially viable.

7. Business model #1 for loss reduction

Advanced Metering Infrastructure (AMI) features

Particulars	Description
Technical specifications of meter	• The meters from different suppliers shall adhere to the technical specifications standardized by MELCO. This will guarantee meter interchangeability during the course of contract. Meter calibration and testing to be done by meter supplier under MELCO supervision.
Role of meter manufacturer	• Meter manufacturer- Supply of Smart meters, meter boxes and associated accessories and replacement of defective meters; Complete meter replacement and new meter installation in selected areas is the cost effective solution rather than partial implementation.
Meterization	• The MELCO shall be responsible for meterization of new service connections within the service level defined as per regulatory norms and for replacement of burnt/ defective meters within the project area. The meter calibration and testing shall be done by the meter suppliers under supervision of MELCO designated staff.
Communication with Smart meter	• The Smart meter will communicate with DCU/HES on any one of the technologies as per international standards, in a secure manner, as per the site conditions and as per design requirement of AIA. The communication system shall be RF and PLC- Dual Primary communication as will be determined from field analysis by MELCO. However, GPRS may also be considered in dense populated areas for effective communication.
Cloud based IT infrastructure	• In terms of technical specifications, the IT infrastructure shall be managed on a Cloud basis. This shall result in faster deployment, reduction in CAPEX and rapid scalability.
Deployment of GIS system	• The GIS systems shall form part of the AMI infrastructure and shall accommodate all the consumer and network mapping where consumers are connected. The AIA shall be responsible for maintaining the GIS database. Interfaces shall be determined between existing and potential future systems in the utility through schemes such as data warehousing at the utility.

*DCU/HES- Data Concentrator Unit/ Head End System

7. Business model #1 for loss reduction

Metering installation features (1/2)

Feeder, DTR-LV, Incoming & Outgoing elements at bus bar

Objective
• Provide energy balances at each MV busbar and check continuously accuracy and correct operation of feeder meters and pool data from feeder meter and at DTR meter and generate energy accounting report for MV System and LV consumers around each feeder and transformer.

Activity	Implementer
• Installation of AMR meter at feeder level • Incoming and outgoing elements at the busbar supplying electricity to the distribution consumers	MELCO

DTR level

Objective
• Analyzing the outcomes of the project in terms of loss levels and narrowing down losses to small areas to enable targeting of fraud in conjunction with the facilities from smart meter fraud protection.

Activity	Implementer
• Installation of Smart meter at DTR level	MELCO

7. Business model #1 for loss reduction

Metering installation features (2/2)

Proposed features

Consumer level	Objective	
	• Commercial monitoring at consumer level	
	Activity	**Implementer**
	• Installation of Smart meters (configurable Post-paid/ Pre-paid) as per consumer category and plan at consumer premises.	MELCO

Mode of operation

Smart meter in Pre-paid mode
Smart meters shall operate on pre-paid mode for all LV category consumers. This will eliminate the commercial activities such as meter reading, billing, bill distribution and revenue collection and reduce manpower cost for operations. This will also provide upfront revenue of energy supplies and reduces cash flow risk.

Smart meter in Post-Paid mode
The smart meters shall be configured to operate in post-paid mode for all HV and high value LV consumers. These meters shall come under the category of CT meters and would be three phase meters. Also some of the three phase direct current metering may be under prepaid.

7. Business model #1 for loss reduction

Consumer and energy balances and register

Proposed features

Particulars	Description
Consumer indexing and accounting	• AMI Implementing Agency (AIA) System Integrator shall extract from GIS supplied information from Smart meter via MDM module and maintain consumer accounting, mapped to DTR and feeder. • In case of new service connection, disconnection of existing consumers due to non-payment, transfer of consumers to other infrastructure due to outage, the System Integrator shall update the status in the system.
Energy accounting at Feeder and DTR level	• Preparation and updating of consumer indexing and generation of energy balance reports at feeder and DT level, area, city, region, county etc. to the extent possible. • AMR based reading shall be taken at feeder level for input reading. • DTR level meter reading shall be taken for input reading. • Sales from consumer end shall be consolidated on a monthly basis. • Energy accounting report at feeder and DTR level shall be generated on a monthly basis. • Miscellaneous reports such as supply hours, outages etc. shall also be generated on a monthly basis.

*DCU/HES- Data Concentrator Unit/ Head End System

7. Business model #1 for loss reduction

Meter reading, billing, revenue collection and disconnection features

Proposed features

Particulars	Description
Pre-paid meter	• For pre-paid meters, the commercial activity is on credit basis. The consumer shall recharge their account via mobile app/ webportal. The recharge amount shall be directly credited to the appropriate bank account.
Post paid meter	• For post-paid meters, the meter reading will be done as per meter reading schedule using frozen smart meter readings. Monthly bill shall be generated at centralized billing server which shall be in sync with the Smart meter.
Billing system	• The billing system shall belong to the AIA (System Integrator).
Revenue collection	• The money from monthly revenue collection (pre or post-paid) shall have to be controlled by MELCO through the escrow account with oversight by the utility.
Disconnection of supply	• For Prepayment: In case of running out of balance or running low of credit, the mobile app or SMS based system shall intimate the consumer for recharge of account. In case, there is no credit in the account, disconnection of supply shall be initiated automatically. • For Post Paid. In case the customer does not pay within the prescribed period, according to utility regulations the MELCO agent shall undertake the disconnection (In Smart meter, remote disconnection feature is available)
Meter Relocation	• In case there is a need to relocate consumer meter as per utility or consumer requirement, then MELCO shall execute the activity.
Data management and Back up of data	• In order to ensure data management and back-up of commercial and operational data, the AIA shall execute the activity as per agreed service level in the contract.

7. Business model #1 for loss reduction

Data analytics, fraught management, O&M and cyber security

Proposed features

Particulars	Description
Data analytics	• For commercial monitoring of consumers, the AIA shall generate tamper, consumption details and other parameters such as power factor, recharge transaction history etc. The AIA shall also monitor power system parameters on a daily basis for high value LV consumers. This shall ensure revenue protection and plug any leakage.
Fraught management	• MELCO shall be responsible for fraught management of the project area. MELCO shall conduct regular meter inspections and raids in the suspected consumer premises.
Maintenance of metering infrastructure	• MELCO shall be responsible for maintaining the metering infrastructure and AIA shall be responsible for maintenance of IT system within the timeframe and service level as agreed in the contract.
Cyber security	• In order to prevent the entire IT infrastructure especially at the vending system, the AIA shall provide cyber security to the system and upgrade it on a regular basis based on changing market scenario.
Customer care	• AIA shall establish a customer service center and call center for consumer grievance redressal pertaining to meters. Based on the nature of complaint, the AIA will inform MELCO, TSP etc. for address the complaint.

7. Business model #1 for loss reduction

Service level modalities including incentive/ disincentive

Proposed features

Particulars	Description
Meter supplier	• Delivery of meter and meter boxes at stores maintained by MELCO; AIA will intimate MELCO in case of fault identified in meter. MELCO will inform meter supplier to supply meter under warranty period. • Replacement of faulty meters under warranty. The proposed warranty period shall be 7 years which may be equal to the period of contract in case proposed contract duration is 7 years.
MELCO	• Installation of new meters and replacement of defective meters as per regulatory norms; • Commercial monitoring of consumer meters in terms of regular inspection, raids etc.
AMI Implementing Agency	• Operational Service levels in terms of HES, MDMS, Back-end applications uptime, Integration Services uptime, Database administration services, Asset / Inventory Management, Meter installation performance, Meter replacement, SIM information availability, Management of Distribution utility EMS etc.
Telecom Service Provider	• Networking availability requirements: 24 hours for all locations. • Number of installed devised not communicating within prescribed days.

*HES- Head End System; MDMS- Meter Data Management System

7. Business model #1 for loss reduction

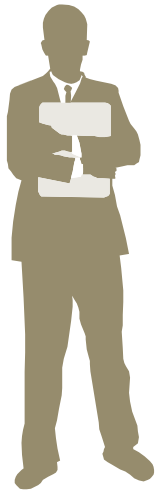
Payment conditions and ownership transfer of assets

Proposed features

Particulars	Description
Project finance	• In this model, there shall be no provision of upfront payment to the Investor. The Investor has to arrange for finance on its own.
Escrow account	• An Escrow account shall be opened which shall be maintained between the Utility and MELCO.
Monthly payment	• The payment shall be in the form of monthly payment to MELCO by the utility. The payment amount can be decided by the number of Smart meters read on a monthly basis. Penalty shall be computed in terms of deviation from desired service levels. The payment amount is fixed for the entire duration of the project.
Incentive mechanism	• An incentives mechanism for payment to MELCO is considered in order to provide better structure for financing and executing the project. A provision for incentives on a revenue sharing basis can be devised on the condition of loss reduction from the agreed base value to be included in the contract agreement. • The detailed mechanism of calculating losses shall be established in the agreement.
Transfer of ownership of assets	• Post expiration of the contract period, MELCO shall transfer the ownership of all assets created during the project life cycle to the Distribution utility. The utility will have to either take over operation of the entire system on its own or conduct tender based bidding for procurement of services from vendors.
Termination of service	• In case of consistent failure of MELCO to adhere to the prescribed service levels, the termination of service shall be handled as per the provisions of the contract.

7. Business model #1 for loss reduction

Case studies – 1/3



Smart metering in India

Primary objective is aimed at effective loss reduction program:

- Accurate metering;
- Correct billing;
- Increase in billing efficiency;
- Operating the entire system by experienced system integrator for successful execution of the project;
- Elimination of collection cycle- in case of pre-paid metering thereby decreasing the manpower cost involved.

7. Business model #1 for loss reduction

Case study #1 – EESL case study: India

EESL is the nodal agency selected for implementation of smart metering project under BOOT model

Meter manufacturers

- Procurement of Smart meters, meter boxes and associated accessories through Open tender;
- Replacement of meters shall be as per the contract agreement between EESL and meter manufacturer.

AMI implementing Agency (AIA) and TSA

- Selection of AIA through contract;
  - AIA responsible for Meter Data Management System (MDMS), integration of HES and MDMS, GIS, design of web application and mobile application, data analytics, prepayment, billing, operation and maintenance of Call centre etc.
  - TSA responsible for communication media between Smart meters and MDMS. Tri-partite agreement between utility, TSA and MELCO will be done.

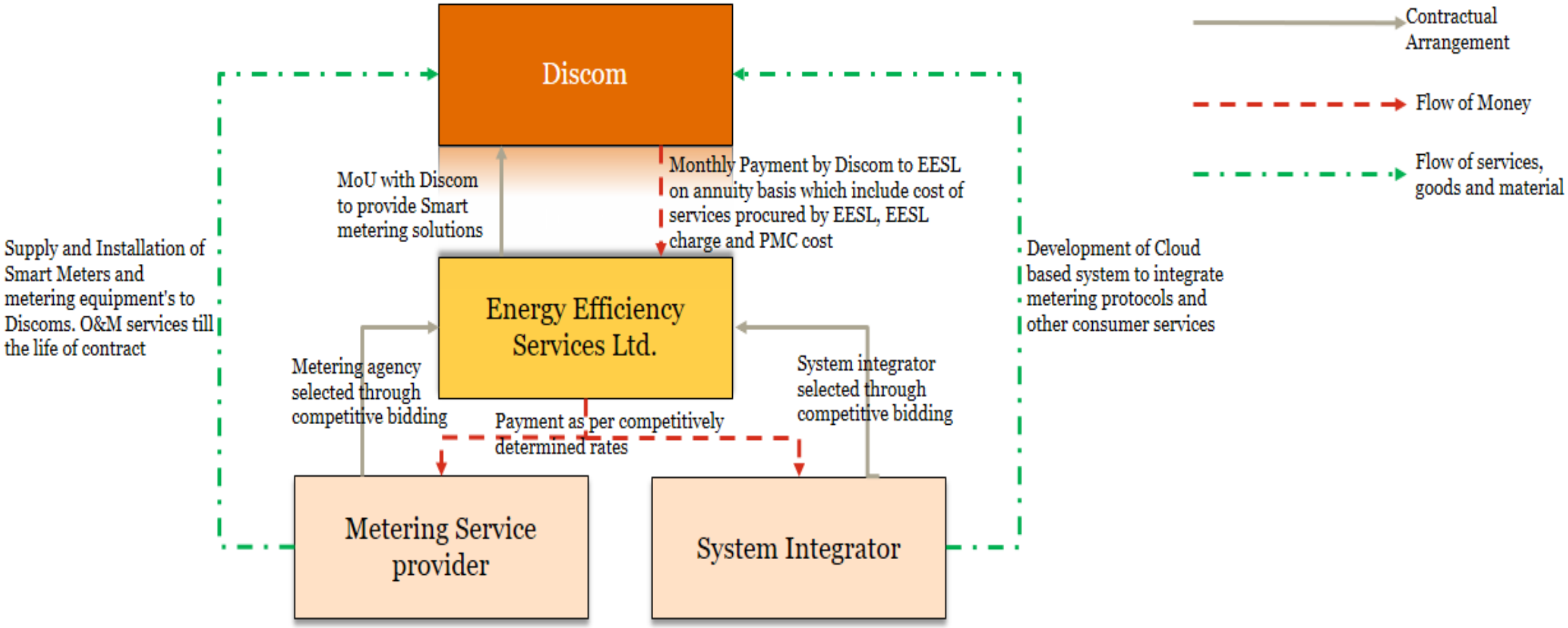
- Meterization and replacement of burnt/ defective meters;
- Establishment of communication channel and configuration of meters, data concentrators, Head End System (HES) and providing any collaboration with system integrator

Field staff deployed by MELCO though local contracts

Note: Existing utility staff in terms of field staff for meterization, revenue collection, vigilance enforcement can be taken over by MELCO for execution of the contract.

7. Business model #1 for loss reduction

Schematic diagram of project implementation



7. Business model #1 for loss reduction

Modalities of the project executed by EESL

Particulars	Description
Energy accounting and meter reading	• AIA is responsible for consumer to feeder/network mapping and generating energy accounting reports. • Meter reading by AIA and performance levels will be measured in terms of daily meter reading coverage. • The AIA will make provisions in the software for tracking of meter status as well as asset location. • AIA is responsible for consumer indexing, DT wise consumer mapping activity and database cleaning.
Interchangeability in mode of operation	• There is a provision for changing in the mode of operation in Smart meter i.e. Post-paid to Pre-paid and vice-versa. AIA will transfer data to the billing system owned and operated by utility.
Recharge of pre-paid meters	• Smart meter MDM is hosted on cloud. Prepaid Consumers can recharge electricity bill through mobile/Web apps and through collection counters of utility. AIA is responsible for consumer data analytics in which AIA will generate exceptions via MDM.
Outage management system	• The AIA via MDM module shall support Smart Grid Outage Management System (OMS) system as per the requirement of the utility.
Cost of ownership	• The cost of ownership, firm upgrade and operation cost is low in terms of RF communication medium as compared to GPRS communication medium. The cost of GPRS communication media is approximately USD 0.14 per meter per month. This cost also covers cost of SIM card and data management.
Service level agreement	• Service level agreement is applicable on Meter manufacturers, AIA, Communication vendor (Telecom Service Provider).

*AIA- AMI Implementing Agency

7. Business model #1 for loss reduction

Project stakeholders (1/2)

Stakeholder	Role
Investor	• Arrangement of finance for project implementation. • Cost –benefit analysis of the project and prepare a bankable DPR • Finalize Scope for the entire project in line with Customer's requirement • Define technical specifications of items and Service levels of Agreement (SLA). • Procurement of Smart meters, meter boxes and associated accessories. • Appointment of AIA and meter manufacturers. • Selection of Telecom Service Provider (TSP) for the entire project. • Identify brought-out items / items directly to be procured and Items in scope of AIA. • Transfer of assets to the utility post end of project tenure.
AMI Implementing Agency (AIA)	• O&M during project period, Web application with updated on-line data of consumers etc., Mobile app, data concentrators etc. • Set up require backend hardware and integration of AMI meters to the AMI system and to the legacy system of the utilities. • Providing services for meterization, installation of replaced burnt/ defective meters (activity is done through registered sub-contractors), data pooling, data analytics etc. • Operation and maintenance of the metering and IT infrastructure. • Data analytics for strategic, tactical and operational decision-making. • Providing Prepaid Billing logic (if required) having facility towards daily billing. • Operation & Maintenance of Smart Meters at site and ensure timely data collection. • Integration with existing ERP solution running in that locality. • Identification of Network strength with each consumer and ensure healthy network for all the consumers.

7. Business model #1 for loss reduction

Project stakeholders (2/2)

Stakeholder	Role
Meter manufacturers	• Supply of Smart meters, meter boxes and associated accessories and ensure adequate no's of Smart Meters, Modem and Meter Box available for the project • Replacement of defective meters found within the guarantee period and ensure timely service of defective meter.
Telecom Service Provider (TSP)	• Providing communication service for the operational area.
Sub-contractors	• Meterization and replacement of Smart meters and associated accessories.
Utility	• Appointment of Investor for providing services related to Smart metering under BOOT model.

7. Business model #1 for loss reduction

Case analysis of smart meter project in India

Benefit realised

- Effective meterization of consumers which ensures including all consumers in the service area of the utility;
- Increase in billing efficiency and reduction of AT&C loss;
- Commercial monitoring of consumers in terms of load survey, tamper analysis, consumption analysis etc;
- Proactive replacement and maintenance of metering infrastructure;
- Remote meter reading generates more timely, accurate bills, eliminating the need for manual labor to read meters, connect/disconnect service, and diagnose many meter issues. Large-scale deployments and utilities with low customer densities or geographically dispersed territories had the greatest savings potential;
- Remote service connection and disconnection orders in hours instead of days;
- Reduced customer complaints using AMI data to resolve billing disputes faster;
- Pre-pay billing plans helped customers to manage consumption and costs.

7. Business model #1 for loss reduction

Case analysis of smart meter project in India

Key challenges faced by Agency

- Smart metering project is a costly solution as compared to deployment of electronic meters which is a key concern for public loss making utilities who have to depend on government funds or external agencies (private investors) for funding the project; Public utilities have to depend on timely availability of funds for complete roll out of the project;
- In rural and distant areas, the utilities face communication issues between Smart meter and Data concentrator unit (DCU); this is with reference to option of RF communication media between Smart meter and DCU.
- Awareness among consumers is needed as consumer may be apprehensive about replacement of electronic meters with smart meters in terms of recording high consumption.
- Lack of baseline data including wrong consumer mapping, it was difficult for implementing agency to identify consumers for meter installation based on data provided by the utility.

7. Business model #1 for loss reduction

Case studies 2/3

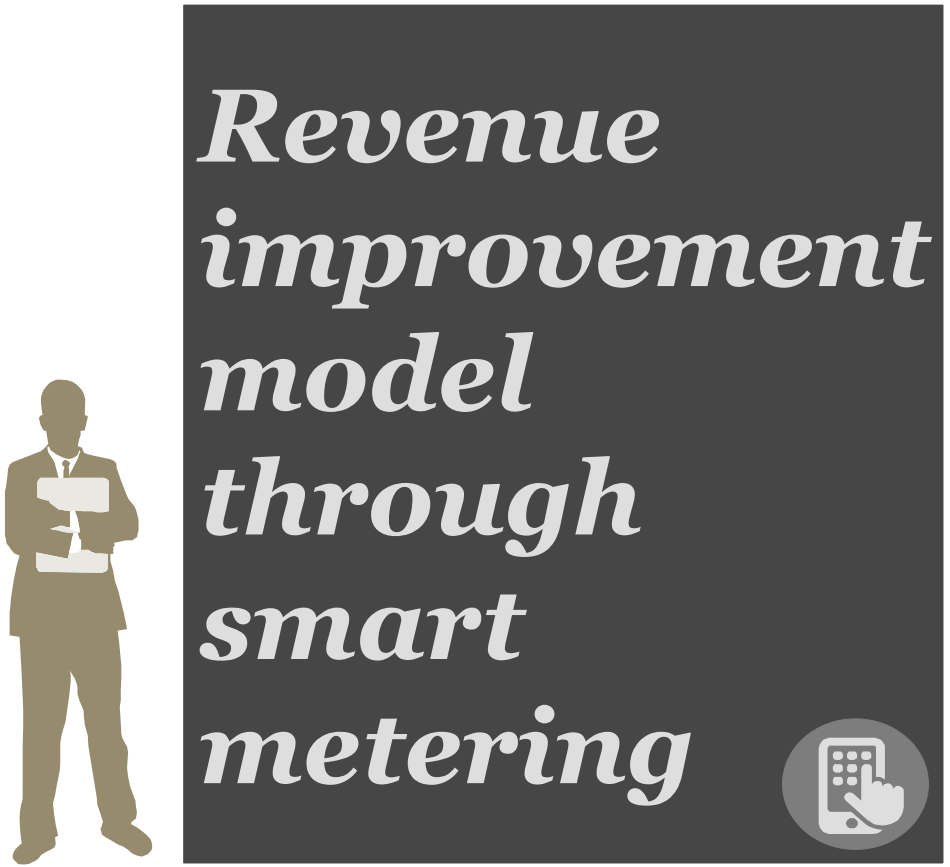
7. Business model #1 for loss reduction

Case study#2 – Nigeria Meter Asset Provider (MAP)

Particulars	Description
Legal ownership of assets	• MAP has legal ownership of the meter asset until fully amortized through payment of a metering service charge by beneficiary customers.
Commercial activities	• Access to customer premises to enable it carry out its operations in compliance with the Metering Code, Meter Reading, Billing and Collection Regulations.
Periodic inspection	• Periodic inspection of meters to ensure integrity and reading accuracy. The MAP would repair or replace faulty meters within two (2) working days. The MAP Would perform its obligation to customers according to service standards set out in a Service Level Agreement (SLA) with the Distribution Licensee.
Payment by consumer	• Upfront payment by customer would be the efficient cost of the meter asset and its installation cost as determined by the procurement process for the MAP conducted by the Distribution Licensee.
Cost structure	• The cost structure of Metering Service Charge covers the cost of providing the meter asset and the ongoing costs of operating and maintaining the meter.
Metering Service agreement	• The Distribution Licensee and the MAP Would enter into Metering service agreement. Distribution Licensees would within thirty (30) days of the execution of the MSA issue a payment security.
Service level agreement	• The Distribution Licensee and the MAP Would enter into Service Level Agreements pertaining to timeframe, maintenance, installation standards, meter replacements etc.

7. Business model #1 for loss reduction

Case studies 3/3



7. Business model #1 for loss reduction

Other models for smart meter deployment - Investor: PowerCom

Particulars	Description
Project finance	• The Investor (Primary lead entity responsible for the project) arranges for project finance and provides services related to manufacturing of meter, communication infrastructure such as MDM module, Data Concentrator etc., metering of consumers and providing services across the revenue cycle from meter reading, collection from consumers to vigilance enforcement.
Payment model	• The payment model depends on the agreement between the Purchaser and service provider for e.g. retaining certain revenue amount and rest is submitted to the Purchaser.
Management of project	• The investor has signed Joint Venture (JV) agreement with a firm having local presence in host country. It appoints a sub-contractor for execution of the project. The overall management of the project is done by the Investor for implementation of best industry practices and control of entire revenue cycle.
Role of Investor in design of technology and management of revenue cycle	• Design of technology, manufacturing and installation of meters, meter data communication etc.; • Management of entire revenue cycle from metering, meter reading to revenue collection (management of cash cycle).
Data analytics and disconnection of service	• Commercial data analysis; • Identification of tampers and suspected theft cases; • Conduct field visits and establishment of theft cases with evidence and impose penalties; • Remote disconnection is done through Smart meters and in case, the meter is by-passed, the physical disconnection is done and applicable law enforcement measures are conducted once the case is established.

8. Business model #2 for loss reduction: Distribution franchisee model

8. Business model #2 for loss reduction

Input based Distribution Franchisee (DF) model

Input based Distribution Franchisee model

Primary objective for appointing Input based DF:

- To minimize Aggregate Distribution and Commercial losses;
- To bring improvement in Metering, Billing and Revenue Collection;
- To minimize Current Assets on account of arrears;
- To enhance customer satisfaction level by improving quality of service.

8. Business model #2 for loss reduction

Advantages and disadvantages of DF model

Advantages

01 DF model can be implanted without any fundamental ownership changes within the current legal structure.

02 It is a deployed quickly for involving private sector participation in loss reduction and consumer service.

03 The model is now an established model with over 10 years of track record, and has also been appraised by lenders for funding in India

04 The model has seen significant interest from established players in distribution business

Disadvantages

01 Finance

The level of Capital expenditure required to reduce losses in an area and maintain the SLAs is cannot be defined for the entire 20 years which is the tenure period of the DF contract.

02 Service level

The current model does not takes into consideration the quality of supply aspects

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8. Business model #2 for loss reduction

Proposed project lifecycle

- Power utility defines the project. Power utility opts for the concept- Operate, Maintain and Transfer and selects Private investor.
- Private investor arranges for finance for Capex and Opex.

Project execution is done by specialised team and field staff with industry best managerial and technical practices.

Distribution Franchisee executes mandatory capital investment plan and operational expenditure plan for increasing the technical and operational efficiency of the power system.

DF transfers the ownership of assets as per agreement with the power utility.

8. Business model #2 for loss reduction

Input-based Distribution Franchisee - proposed modalities

Model

- Utility operational and commercial performance improvement program
- Private investor acts as Distribution franchisee for loss reduction etc.

Financing

- Financing is done by the Private investor (Distribution Franchisee) responsible for Capex and opex plan and related financing.

Modules

- Energy accounting, Metering, Meter reading, Billing, Revenue collection, Fraught management, O&M, Capital expenditure, Customer care etc.

SLA & Payment

- SLA pertains to compliance with quality and timelines of service related to commercial and operational parameters.
- Payment is done based on monthly invoice.

Incentive

- Incentive related to recovery of arrears.

Project stakeholders

- Private investor, SPV, Power utility, Field staff, IT staff, Operations staff, Vigilance enforcement staff.

Project operations

- DF is the nodal agency for carrying out licensee operations in terms of new service connections, metering, vigilance enforcement, meter reading to revenue collection cycle, customer care, capex execution.

Distribution franchisee model

- The project is for a period of 15-20 years to allow for adequate time for payback. The licensee, is responsible for supply of input energy in the Franchisee area ensuring cash flows at quoted input rates for the energy supplied from the DF.

Asset ownership

- Licensee remains the owner of the assets.
- DF obligated to use and maintain such assets at its own cost. However, DF would be entitled to a terminal payment for any investment made by him in the area.

8. Business model #2 for loss reduction

Proposed features of the DF Model

Particulars	Description
Operating model	• An area within the distribution utility License area is carved out to be given to private operator for a number of years. Model: Operate, Maintain and Transfer.
Terms of agreement	• At present, the tenure of Distribution Franchisee is generally between 15 to 20 years.
Ownership of assets	• Distribution licensee remains the owner of the assets. DF obligated to use and maintain such assets at its own cost. DF would be entitled to a terminal payment for the balance of any relevant investment made in the area.
Responsibility of DF	• DF shall not be required to obtain any separate license from the concerned authority and shall be responsible for distribution of electricity in licensee's area of supply.
Bidding parameter	• The bidding parameter in this model is the price of input power being supplied to Distribution Franchisee for the selected area. Applicability of tariff would be same to the entire distribution license area.
Minimum capital investment	• The minimum capital investment would ensure that objective of private capital for efficiency improvement is fulfilled. • Maintaining the existing distribution network including replacing failed distribution transformers and defective meters within the time frame as prescribed in Regulations/ Orders/ Directives of Regulatory Commission including repair of the same.

*DF- Distribution franchisee

8. Business model #2 for loss reduction

Proposed activities of a Distribution Franchisee

Particulars	Description
Meterization	• Replace defective meters with new meters. Provide supply of electricity to applicants within the Franchisee area as per Distribution code issued by Regulatory Commission.
Energy accounting and audit	• Maintain consumer database and billing records. DF will be responsible for energy audit on a monthly basis.
Capital investment plan	• DF will be responsible for incurring capital expenditure in order to provide new connections within the franchisee area. The commercial conditions as per Distribution licensee will also be executed by the DF such as collection of security deposit etc.
Demand estimation	• DF will carry out demand estimation/ load forecast of the Franchisee area.
Deployment of manpower	• The existing employees in discom will be given an option to join the Distribution Franchisee on deputation. The cost of employees on deputation would be borne by Distribution Franchisee.
Commercial activities	• Conduct meter reading and billing to the consumers; collection from consumers from time to time; collection of arrears.
Minimum capital investment plan	• The minimum capital expenditure to be carried out by the DF will be over a period of 5 years; • Operation and maintenance of sub-stations and transformers; repair, maintain and replace failed DTR as per statutory regulations.

8. Business model #2 for loss reduction

Schematic diagram of Distribution Franchisee model

Responsibility of Power distribution utility

Distribution Utility to supply power at EHV substations to private player (Distribution Franchisee)

Responsibility of Distribution Franchisee

O&M

Fault Restoration

Loss Reduction

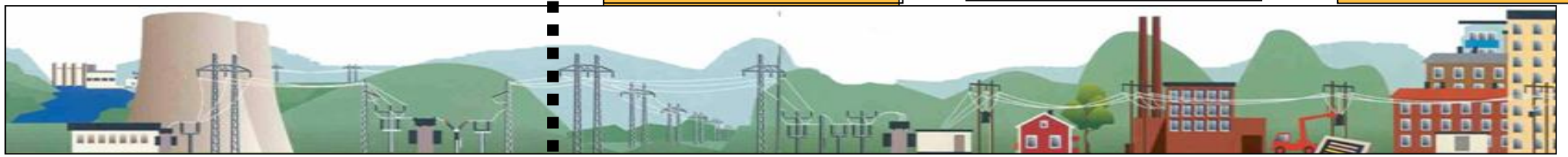
Revenue collection

Meter Reading, bill Distribution

Customer Care

Capital investment

Energy Input Metering



Generation

Transmission

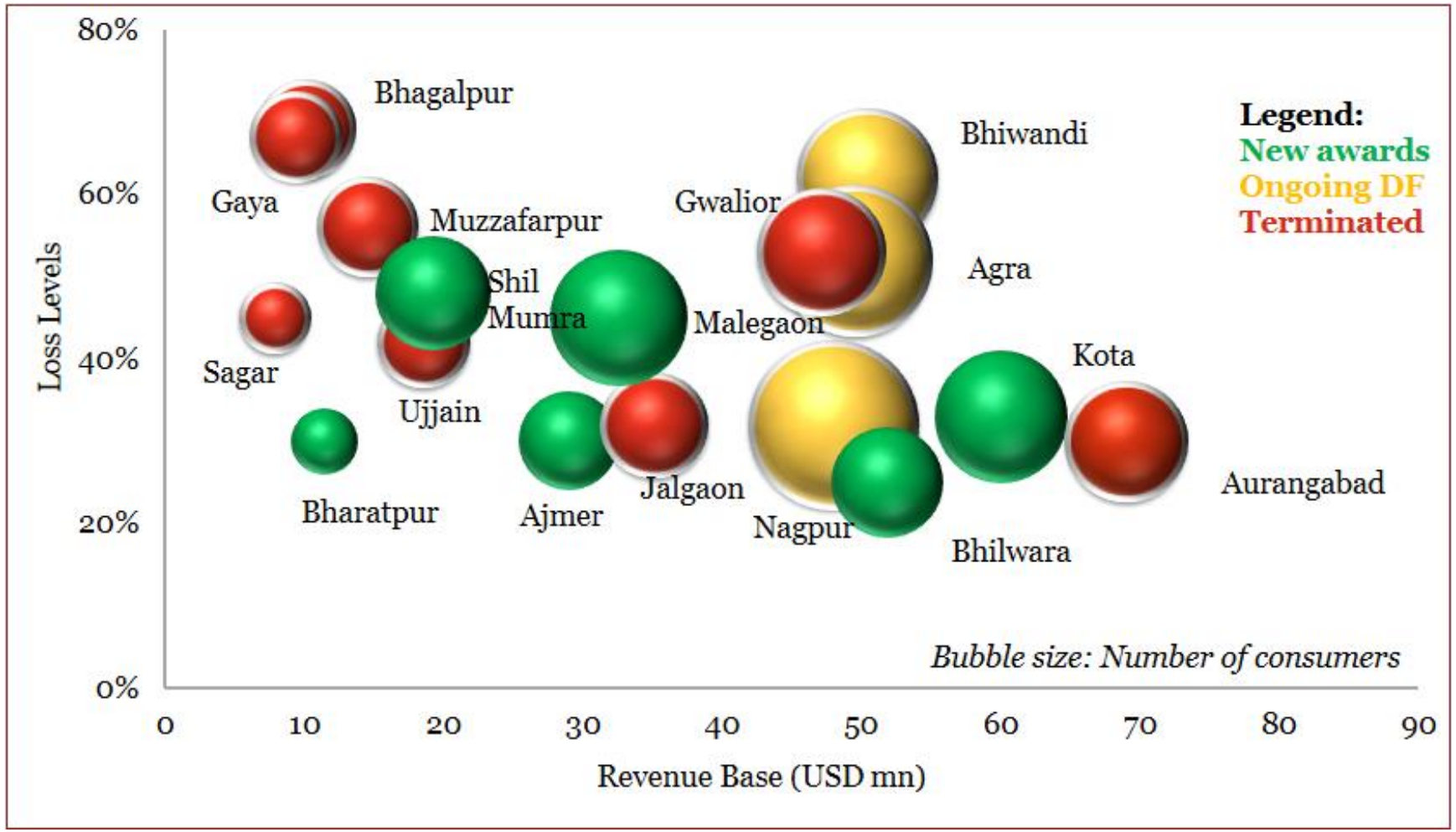
Distribution

8. Business model #2 for loss reduction

Case study

8. Business model #2 for loss reduction

DF model – The Indian Experience



- The experience of Distribution Franchisee model has been mixed, the adjacent graphics shows the bids which have been undertaken by Indian states till now.
- The model has evolved over a period, after a brief period when several DF were terminated
- Most recently in 2019 state of Maharashtra tendered out two of its circles viz. Shil, Mumbra, Kalwa and Maleagon to Distribution Franchisee whereas earlier in 2016 the state of Rajasthan had tendered out 4 areas.

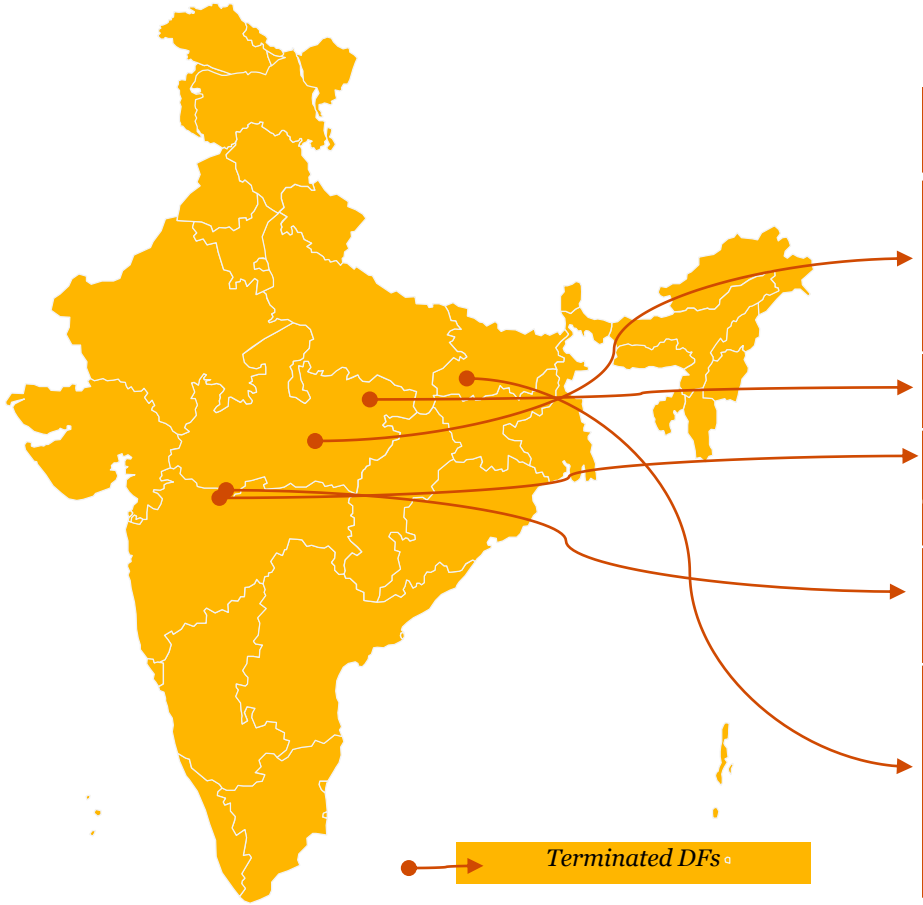
8. Business model #2 for loss reduction

Key Successes of DF model

- **Operational parameters:**
  - In various locations in India, it has been observed that the DF was able to increase reliability of power system in terms of reduction of 33 kV/ 11 kV tripping;
  - A reduction of DT failure rate was observed due to proactive maintenance activities by the DF.
- **Commercial parameters:**
  - Number of new connections has been increased resulting in increasing the consumer base of the franchisee area.
- **Customer care:**
  - Opening of Customer care centres for increasing customer satisfaction.
- **Loss reduction:**
  - The Distribution franchisee is able to achieve AT&C loss reduction in its area.

8. Business model #2 for loss reduction

Key reasons for failure of some of the Distribution Franchisees



Area	Pvt. Player and reason for failure
Ujjain (2015)	Essel Infra; Inadequate maintenance, poor complaint redressal, lack of adequate technical manpower
Gwalior (2015)	Essel Infra; Public protest during takeover
Jalgaon (2015)	Crompton Greaves; Non-payment of dues and violent protest by farmer association
Aurangabad (2017)	GTL; Non-payment of dues and unable to meet loss trajectory
Bhagalpur (2017)	BEDCPL; Unauthorized diversion of revenue from customers and default of Escrow account, failure to perform operational duties, Misappropriation of facts

8. Business model #2 for loss reduction

Case study: Rajasthan-India

Input based Distribution Franchisee model

Rajasthan-India

8. Business model #2 for loss reduction

Case study: Rajasthan-India

Key issues being faced by the Licensee

- As the network is mainly overhead system, there is a large number of transient tripping of 33 or 11 kV feeder
- Very high AT&C losses
- Almost non-existent consumer services
- Billing and other customer related processes are largely manual with minimum IT supported services
- Cash counters suffer from long queues of angry customers
- Overall infrastructure of subdivision offices is in a poor and dilapidated condition
- Offices frequently suffer from lack of connectivity and IT system downtime

Understanding the need for improvement, Rajasthan Discom rolled out 4 of its distribution areas on **Input plus Investment based DF Model:**

DF Area	DF (SPV)	Parent Company	Effective Date
Kota City	M/s. KEDL	M/s. CESC Limited, Kolkata	01st Sep 2016
Bharatpur City	M/s. BESL	M/s. CESC Limited, Kolkata	01st Dec 2016
Bikaner City Circle	M/s. BkESL	M/s. CESC Limited, Kolkata	16th May 2017
Ajmer City	M/s. TPADL	M/s. Tata Power, Mumbai	1st July 2017

Capital Expenditure to be done by DF:

- DF to invest minimum capital expenditure in first 5 years of the operation period and maintain a separate record for the asset purchased by it
- All the Capital expenditure to be made by DF 16th year onwards other than for load growth will require prior approval from Regulatory Commission.
- Capital invested by all DF till Dec-18 has been given below:

DF Area	Capital Expenditure (USD mn)
Kota City	21.67
Bharatpur City	4.32
Bikaner City Circle	7.94
Ajmer City	4.98

Source: Discom review reports

8. Business model #2 for loss reduction

Rajasthan DF – Performance of Distribution Franchisees

Sr. No.	Parameter	Ajmer	Kota	Bharatpur	Bikaner
1	Revenue (USD mn)	35	69	11.5	65
2	Energy Sales (in MUs)	446	870	212	582
3	No. of Consumers ('000)	135	176	50	142
4	Net Operating Profit (USD mn)	5.33	31.04	3.13	4.93
5	Reduction of AT&C Losses	from 17.83% (in Base Year 2015-16) to 11.46% (12 Month Average till Dec-2018)	From 29.71% (in Base Year 2014-15) to 23.13% (12 Month Average till Nov-2018)	from 27.40% (Base year 2014-15) to 17.7% (12 Month Average till Nov-2018)	19.31% (Opening level) to 18.86% (May 17 to Apr 18)
6	Reduction of 33 kV / 11 kV tripping	43.4% YOY against previous year	23.4% YOY against previous year	23.4% YOY against previous year	23.4% YOY against previous year
7	Addition in DT Installed Capacity	9.2 MVA (increased from 315 MVA to 324 MVA)	233.11 MVA (increased from 338.01 MVA to 551.12 MVA)	24.43 MVA (increased from 88.63 MVA to 113.06 MVA)	7.6 MVA (increased from 472.7 MVA to 480.3 MVA)
8	Reduction in DT Failure Rate	from 3.33% (Base Year) to 0.32% (FY 19 till Nov-2018)	from 3.36% (Sep'15-Aug-16) to 0.29 % (FY 19 till Nov-2018)	from 8.9% (Base Year) to 0.54 % (FY 19 till Nov-2018)	2.1% (FY 17-18) to 0.6% (FY 18-19 till Nov-2018)
9	Substations with SCADA and Remote Operations	19	28	9	34
10	Avg. time to replace failed DT	~ 4:00 hrs	~ 3:00 hrs	~ 4:00 hrs	~ 1:45 hrs
11	New Connections	8834 50% of new connections released within one day of deposition of demand payment	20000 75% of new connections released within one day of deposition of demand payment	8000 75% of new connections released within one day of deposition of demand payment	11000 88% of new connections released within one day of deposition of demand payment

8. Business model #2 for loss reduction

Key issues observed in this case study

Particulars	Description
Regulatory gap	• Jurisdiction of Regulatory entity does not extend to the franchisee. • Distribution utility will be able to regulate the franchisee only to the extent of its contract and it would have to bear the remaining regulatory burdens and risks.
Treatment of existing employees	• Distribution utility would be left with the burden of their employees and it needs to be determined whether they can bear this burden in perpetuity. In practice, the Distribution utility will pass on this burden to the State Government or the consumers.
Baseline parameters (losses, sales, input etc.)	• In most cases, the data is not audited and thus risks a flawed assessment by the bidder to base their assumptions for Capex and loss reduction.
Capital investment	• Currently the bid documents only specify a minimum capital (which is generally a % of the revenue of that area) which is to be incurred by a Distribution Franchisee in an area. Such metric will not be consonant with system augmentation, renovation and modernization required to improve distribution operations.
Benchmark rates	• The bidders are provided a year-on-year benchmarks rates, on which they have to quote a premium. This does not provide bidders the flexibility of adjusting their financial models according to the trajectory of efficiency improvements considered in their business plan.

8. Business model #2 for loss reduction

Recommendations on improving the Distribution Franchisee model

Particulars	Description
Franchisee area	Priority area: • Area with distribution loss level higher than 20%. • Compact area (Urban area) with sufficient load and input energy of >1000 MU per year.
Contract period **Capital Investment**	• Contract period: 15 – 20 years • Minimum investment equivalent to percentage of revenue (can be decided by the issuing utility) of the base year over the period of first five years.
Pre-qualification **Bid variable**	• A strong pre-qualification criteria focusing on past experience in handling large consumer base, strong financial and positive net worth. • Bid variable: input rate per unit of energy input and to be decided on the basis of NPV with provision of Minimum Benchmark Rates.
Security against performance	• Provision for bid bond, performance guarantee, payment security and escrow account. Franchisees are required to execute a Default Escrow Agreement as payment security in addition to furnishing LC.
Quality & reliability of supply	• Utility shall not discriminate in the supply of power between the franchisee area and its other distribution divisions. • To ensure 24X7 quality supply to all consumers in the area, KPIs related to quality and reliability of supply such as SAIFI, SAIDI, CAIFI should be prescribed by the utility in the DFA with stringent penalties in case of non-compliance by the DF. • Responsibility of the licensee to provide reliable and quality supply of electricity to the consumer based on pre-determined performance parameters. For this purpose, the licensee may procure additional power by entering into new PPAs.

*LC- Letter of Credit

9. Pilot areas for loss reduction

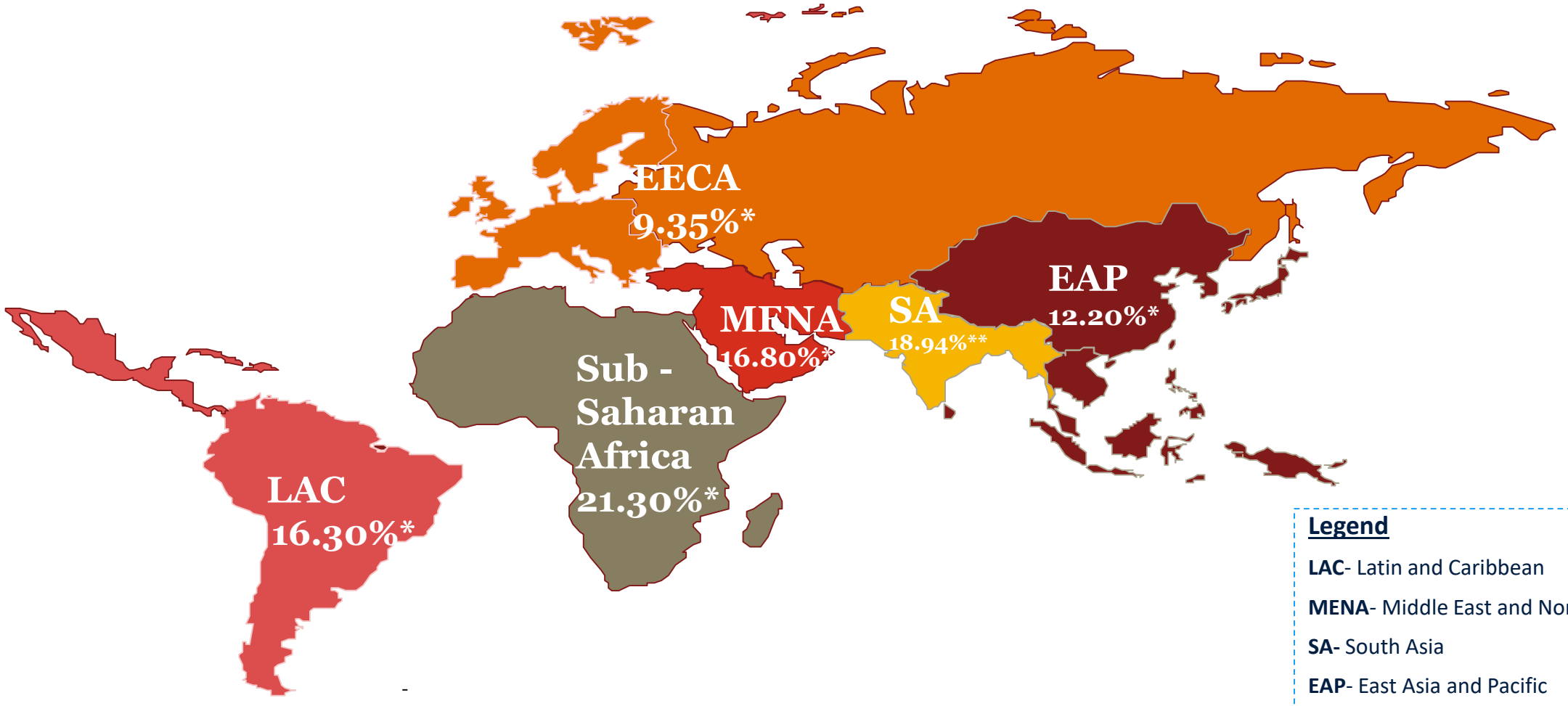
9. Pilot areas for loss reduction

Parameters for selection of countries

*Except South Africa

9. Pilot areas for loss reduction

Regional Loss Profiles



Legend

LAC- Latin and Caribbean

MENA- Middle East and North Africa

SA- South Asia

EAP- East Asia and Pacific

EECA- Eastern Europe and Central Asia

Source: *-USAID
**-The World Bank

9. Pilot areas for loss reduction

Methodology for selection of pilot area

Selection of Region

- Selection parameter: Based of the highest T&D loss level
- List of Regions:
  - East Asia & Pacific
  - Eastern Europe & Central Asia
  - Middle East & North Africa
  - Latin American & Caribbean
  - South Asia
  - Sub-Saharan Africa excl South Africa

Selection of Country

- Selection parameter:
  - Political stability
  - Private Sector Participation (PSP)
  - T&D loss

Region wise T&D loss

- East Asia & Pacific: 12.20%
- Eastern Europe & Central Asia: 9.35%
- Middle East & North Africa: 16.80%
- Latin American & Caribbean: 16.30%
- South Asia: 18.94%
- Sub-Saharan Africa: 21.30%

- Based on the highest T&D loss level, Sub-Saharan Africa and South Asia region can be selected for pilot area for loss reduction.

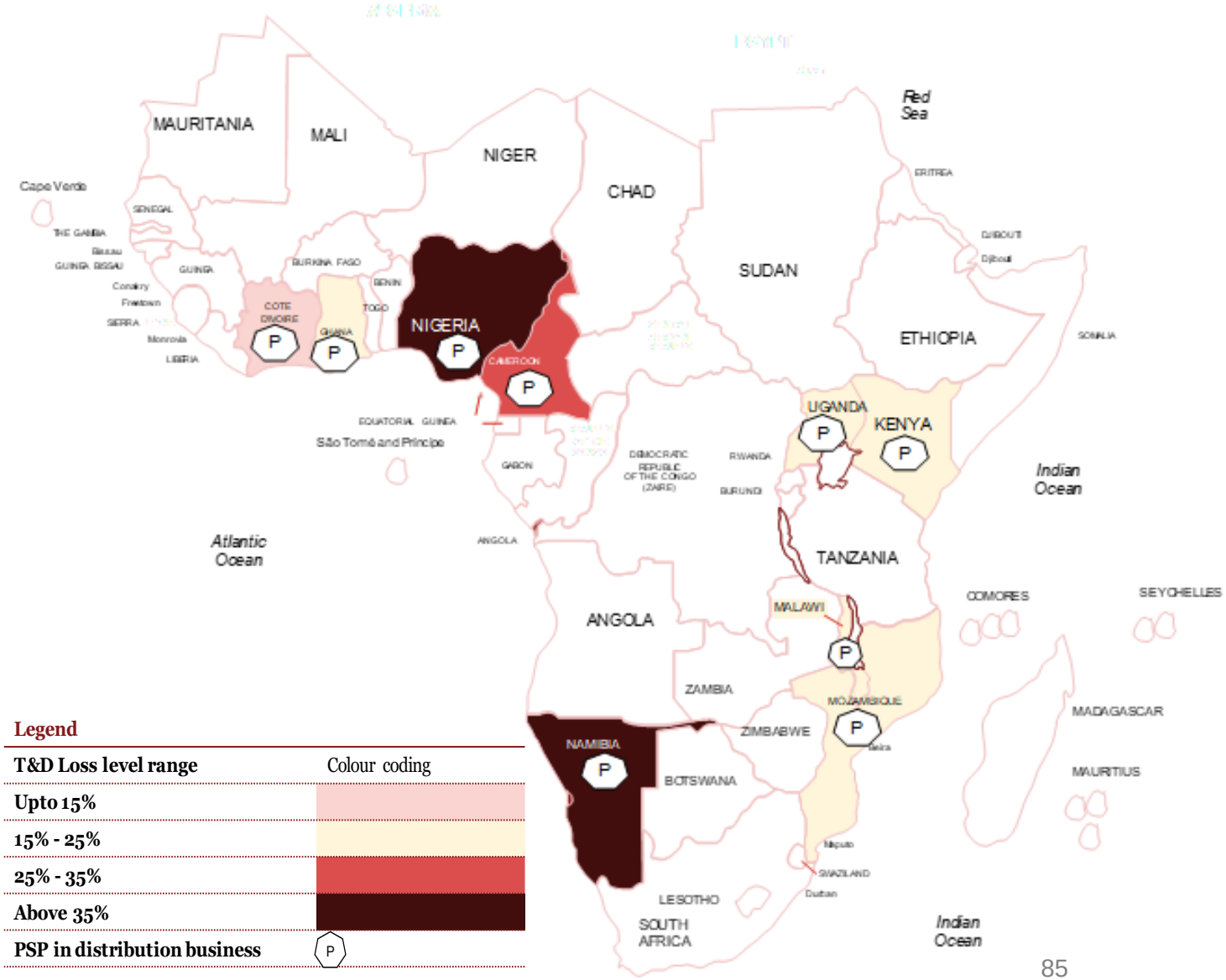
- SSA region: 10 no. countries are selected
- South Asia region: India can be selected for pilot loss reduction.

9. Pilot areas for loss reduction

Selection of countries in Sub-Saharan region for pilot loss reduction

Selection of countries

- Selection parameters:
  - High T&D loss
  - Political stability
  - Private sector participation (PSP)
- Countries, which should be considered for pilot loss reduction in Sub-Saharan Africa region based on the selection parameters based on the priority:
  - Nigeria
  - Cameroon
  - Namibia
  - Uganda
  - Malawi
  - Kenya
  - Ivory Coast
  - Mozambique
  - Ghana
  - Gabon



Legend	
T&D Loss level range	Colour coding
Upto 15%	
15% - 25%	
25% - 35%	
Above 35%	
PSP in distribution business	P

9. Pilot areas for loss reduction

Selection of countries in Sub-Saharan region for pilot loss reduction

- In SSA, we recommend, smart metering through BOOT as the business model for selected countries in Sub-Saharan Africa region.
- The modalities of the business model may be as per recommendations mentioned in the above section.
- Distribution Franchisee model can also be considered to be implemented in select territories in SSA where conditions are favourable.

9. Pilot areas for loss reduction

Selection of countries in South Asia region for pilot loss reduction

Selection of countries

- Selection parameters:
  - High T&D loss
  - Political stability
  - Private sector participation (PSP)
- Countries, which are eligible for pilot loss reduction in Sub-Saharan Africa region based on the selection parameters based on the priority:
  - India

Legend

T&D Loss level range	Colour coding
Upto 15%	
15% - 25%	
25% - 35%	
Above 35%	
PSP in distribution business	P

- In India, we are already observing implementation of BOOT model (through EESL) in some states like UP, Bihar and Haryana. However, states like Madhya Pradesh, Rajasthan and Chhattisgarh are keen to implement smart metering through a Private Investor and the proposed model could be suggested to these states for implementation.
- On Distribution Franchisees, Maharashtra and Rajasthan have already taken lead, with several areas tendered out in last 2 years. States such as Madhya Pradesh and Uttar Pradesh are pursuing DF and have shown their keenness to adopt this model and should be considered as candidates for implementation of the suggested model on DF.

10. Way forward

10. Way forward

Selection of pilot country for loss reduction

- Sub-Saharan Africa region;
- South Asia region;
- Countries highlighted in SSA region in **Section-9;**
- Country highlighted in SA region in **Section-9**

Selection of business model for loss reduction in pilot area

- Smart metering under BOOT model;
- Input based Distribution Franchisee model

Project management support for pilot projects

- Support in discussion of model with utility management;
- Support in preparation of tenders for procurement of services;
- Bid process management;
- Support in project management during project execution;
- Assessment of key learnings for scalability of business model in other areas.

11. Appendices

Appendix 01: Selection parameters for countries - SSA region

Name of the country	Political Stability	Political Stability#	PSP	T&D loss	T&D Loss>8.26% (World Average)
Nigeria	L	-1.94	Y	39%*	Y
Cameroon	L	-1.08	Y	28%*	Y
Namibia	H	0.65	Y	36.25%**	Y
Uganda	M	-0.56	Y	21%*	Y
Malawi	M	-0.27	Y	24%*	Y
Kenya	L	-1.08	Y	23%*	Y
Ivory Coast	L	-1.09	Y	14.32%****	Y
Mozambique	M	-0.98	Y	22%*	Y
Ghana	H	0.09	Y	23%*	Y
Angola	M	-0.29	Y	35.00%	Y
Benin	H	0.05	Y	21%*	Y
Botswana	H	1.03	Y	10.79%'	Y
Burkina Faso	M	-0.92	N	17%*	Y

Appendix 01: Selection parameters for countries - SSA region

Name of the country	Political Stability	Political Stability#	PSP	T&D loss	T&D Loss>8.26% (World Average)
Burundi	L	-1.97	N	19%*	Y
Cape Verde	H	0.90	Y	32%*	Y
Central AfR	L	-2.7	N	48%*	Y
Chad	L	-1.34	N	7.00%	N
Comores	H	0.03	N	40.1%*	Y
Congo, Democratic Republic of	L	-2.30	Y	21.44%**	Y
Congo, Republic of	M	-0.53	N	46%*	Y
Djibouti	M	-0.71	NA	16.00%	Y
Equatorial Guinea	M	-0.15	N	9.18%	Y
Eritrea	M	-0.66	N	12.89%**	Y
Ethiopia	L	-1.69	N	25%*	Y
Gabon	M	-0.09	Y	24%*	Y
Gambia	M	-0.21	Y	27%*	Y

Appendix 01: Selection parameters for countries - SSA region

Name of the country	Political Stability	Political Stability#	PSP	T&D loss	T&D Loss>8.26% (World Average)
Guinea	M	-0.61	Y	24%*	Y
Guinea-Bissau	M	-0.60	N	24%*	Y
Lesotho	M	-0.25	N	12.87%'	Y
Liberia	M	-0.41	Y	25%*	Y
Madagascar	M	-0.33	Y	33%*	Y
Mali	L	-1.91	Y	23%*	Y
Mauritania	M	-0.62	N	23%*	Y
Mauritius	H	0.99	Y	9%*	Y
Niger	L	-1.30	N	19%*	Y
Rwanda	H	0.04	Y	25%*	Y
São Tomé and Príncipe	H	0.22	Y	43%*	Y
Senegal	M	-0.04	Y	17%*	Y
Seychelles	H	0.68	N	12%*	Y

Appendix 01: Selection parameters for countries - SSA region

Name of the country	Political Stability	Political Stability#	PSP	T&D loss	T&D Loss>8.26% (World Average)
Sierra Leone	H	0.03	Y	39%*	Y
Somalia	L	-2.33	N	50%'	Y
South Africa	M	-0.27	Y	9%*	Y
Sudan	L	-2.01	N	15%*	Y
Sudan, South	NA	NA	N	15%***	Y
Swaziland	M	-0.30	Y	11%*	Y
Tanzania	M	-0.58	Y	18%*	Y
Togo	M	-0.74	Y	28%*	Y
Zambia	H	0.11	Y	12%*	Y
Zimbabwe	M	-0.77	Y	15%*	Y

Sources:

1. *- World Bank staff calculations based on utility annual reports and other sources; Note: T&D loss- Total combined Transmission and Distribution losses
2. **- World Bank data- 2014
3. ***- U.S. Energy Information Administration; and Exim Bank Analysis- 2014- (Sudan-South includes Sudan)
4. ****-https://web.stanford.edu/group/efmh/jacobson/Articles/I/TransmisDistrib.pdf.

Somalia- Federal Government of Somalia and African Development Bank

5. '- https://tradingeconomics.com; Lesotho Electricity Company (P) Ltd, Annual report

Abbreviations

12. Abbreviations (1/2)

Acronym	Description
ABR	Average billing rate
ADB	Asian Development Bank
AIA	AMI Implementing Agency
AMI	Advanced Metering Infrastructure
AMR	Automatic Meter Reading
AT&C	Aggregate Technical and Commercial
BIS	Bureau of Indian Standards
BOOT	Build, Own, Operate and Transfer
BSEB	Bihar State Electricity Board
CAIFI	Consumer Average Interruption Frequency Index
Capex	Capital investment
CEA	Central Electricity Authority
Cr	Crore
CT	Current Transformer
DBFO	Design, Build, Finance and Operate
DC	Data Concentrator
DCU	Data Concentrator Unit
DF	Distribution Franchisee
DFA	Distribution Franchisee Agreement
DFI	Development Finance Institution
DPR	Detailed Project Report
DT/ DTR	Distribution transformer

Acronym	Description
DSM	Demand Side Management
EECA	Eastern Europe and Central Asia
EESL	Energy Efficiency Services Limited
EHV	Extra High Voltage
EMS	Energy Management System
EPC	Engineering, Procurement and Contract
ERP	Enterprise Resource Planning
FMS	Facility Management Services
FIR	First Information Report
FSA	Fuel Surcharge Adjustment
GDP	Gross Domestic Product
GIS	Geographic Information System
GPRS	General Packet Radio Services
GW	Giga-watt
HES	Head End System

Acronym	Description
HV	High Voltage
HT	High Tension
IFC	International Finance Corporation
IPP	Independent Power Producer
IT	Information Technology
INR	Indian Rupees
JV	Joint Venture
kWh	kilo-Watt hour
LC	Letter of Credit
LT	Low Tension
LT-CT	Low Tension Current Transformer
LV	Low Voltage
MAP	Meter Asset Provider
MDM	Meter Data Management
MENA	Middle East and North Africa
MELCO	MEtering and Loss reduction Company
MFD	Maximize finance for development

12. Abbreviations (2/2)

Acronym	Description
MIS	Management Information System
MoP	Ministry of Power
M.P.	Madhya Pradesh
mn	Million
MSA	Meter Service Agreement
MU	Million Unit
MV	Medium Voltage
MIVE	Meter Inspection and Vigilance Enforcement
NESI	Nigeria Electricity Supply Industry
NPV	Net Present Value
O&M	Operate and Maintain
OMS	Outage Management System
OMT	Operate, Maintain and Transfer
OPEX	Operational expenditure
PMC	Project Management Consultant
PPA	Power Purchase Agreement

Acronym	Description
PPIAF	Public-Private Infrastructure Advisory Facility
PPP	Public Private Partnership
PSP	Private Sector Participation as per PPIAF
PSU	Public Sector Unit
PwC	PricewaterhouseCoopers (P) Ltd
RAPDRP	Restructured Accelerated Power Development and Reforms Program
RF	Radio Frequency
RFP	Request for Proposal
SAIFI	System Average Interruption Frequency Index
SAIDI	System Average Interruption Duration Index
SCADA	Supervisory Control and Data Acquisition
SERC	State Electricity Regulatory Commission
SI	System Integrator
SIM	Subscriber Identification Module
SLA	Service Levels of Agreement
SOE	State Owned Enterprise

Acronym	Description
SMNP	Smart Meter National Programme
SSA	Sub-Saharan Africa
T&D	Transmission and Distribution
TSP	Telecom Service Provider
TV	Television
TWh	TeraWatt Hour(s)
UK	United Kingdom
USA	United States of America
Utility	Distribution company/ Purchaser
UP	Uttar Pradesh
VPN	Virtual Private Network
WBG	World Bank Group
WFM	WorkForce Management

Thank you