Idam Infrastructure Advisory Pvt. Ltd.

Presentation on

Innovative Business Model for Refurbishment of Distribution Transformers

8th Annual Conference on

"Power Distribution in India"

Issues & Challenges; Strategies & Solutions

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Agenda

- Indian Power Distribution Sector at a Glance
- Distribution Transformers in India
- Salient features of installed DTs in India
- Increasing Trend of Losses in DTs
- Economic Impact of DT Failure
- Introduction to EE DTs by BEE
- Need for Improvement of Efficiency of Existing Stock of DTs
- Need for Innovative Business Model
- Innovative Business Model for Refurbishment of DT (IBMRDT)

Indian Power Distribution Sector at a Glance ….(1/2)

- Electricity is one of the most vital infrastructure inputs for economic development of country.
- Demand for electricity is enormous and is growing steadily.
- Rapid economic growth, urbanization and growing population leading to substantial energy and peak shortages - consistently remained above 10%.
- Insufficient power generation and its inefficient utilization lead to peak deficit as well as energy shortfall.
- Efficient utilization of generated energy is more economical way to reduce energy and peak demand.
- T&D losses are also very high, in the range of 20-30 percent.
- Primary reason for exceptionally high T&D losses lies at the distribution level.

Indian Power Distribution Sector at a Glance ….(2/2)

- Distribution system suffers from high technical & commercial losses.
- Inadequate investment in system improvement as well as unplanned extensions of distribution system are resulting into high technical losses
- Some of the other reasons for abnormally high level of technical losses are:
  - Use of less efficient assets,
  - Improper operational practices
  - Inadequate maintenance practices
  - Ageing of assets
  - Unavailability of funds for renovations and modernisation
- Poor quality of equipments lead to frequent outages and poor efficiency increases losses in the system.
- Inefficiency of distribution system affecting performance of public sector distribution utilities resulting into deteriorating financial health

Distribution Transformers in India

- Transformer Industry in India has evolved over a period of time and now has matured technology base to manufacture transformers of upto 800 KV class.
- Transformers can be divided in to broadly three types; Power Transformers, Distribution Transformers and Special Transformers.
- India has proven technology and capacity to manufacture a wide range of power transformers, distribution transformers and special type of transformers for various applications.
- Population of installed DTs in India has reached to approx. 4.24 million in numbers and is growing at the compounded annual growth rate of about 10%.

Salient features of installed DTs in India

- Number of aluminium wound DTs are more than that of copper wound DTs.
- Private utilities prefer copper wound DTs while public sector utilities prefer aluminium wound DTs.
- Average rate of failure of aluminium wound DTs is more than copper wound DTs – reason could be related to ownership pattern
- DTs in public sector utilities are repaired around 2-3 times during its life.
- Failure rate of DTs in the private sector utilities is in the range of 1-2% and that of public sector utilities is in the range of 8-16% .
- Substantial difference between DT failure rate of private utilities and public sector utilities could be attributed to various factors such as criterion for purchase of new DTs, maintenance practices, material used for DTs, etc.

Increasing Trend of Losses in DTs

- Huge quantity of distribution transformers operating in public sector utilities are suffering from poor efficiency due improper/imbalance loading conditions.
- More than 80% of existing stock of DT are more than 5 year old and were designed with low efficiency
- Designed efficiency of existing stock of DTs is comparable with present 1 star DT, which is much lower than BEE recommendation of three star DTs
- Every distribution transformer is repaired/refurbished 2 to 3 times during its useful life, which again increases loss levels in DTs
- Distribution utilities are also allowing 10% increase in losses from designed level during repair/refurbishment, which results in poor efficiency of DTs
- In theory, the useful life of a DT is around 25 years, but in public sector utilities in India, transformer is rarely scrapped on completion of useful life

Economic Impact of DT Failure

- Operating conditions like transformer overloading, through faults, etc. often result in transformer failure.
- Extended functioning of the transformer under abnormal conditions such as faults or overloads can compromise the life of the transformer.
- Adequate protection should be provided for quicker isolation of the transformer under such conditions.
- Transformer failure has direct and indirect impact on the economics of the utilities.
  - Direct economic impact is in terms of cost of repairs and/or replacement of failed DT.
  - Indirect economic impact is due to loss of revenue and loss of revenue due to increase in losses

Introduction to EE DTs by BEE

- Realizing need to improve efficiency of distribution transformers, BEE has introduced star labelling of distribution transformers on the basis of their efficiency.
- BEE has categorised DTs on the basis of the efficiency into five categories. The least efficient DT has been awarded one star rating while the most efficient transformer as five star rating.
- BEE has also issued guidelines for the use of 3 star DTs and above for utilities and other users.

Need for Improvement of Efficiency of Existing Stock of DTs ….(1/2)

- Approximately 4 million DTs with capacity in excess of 3 lakhs kVA are in operation with lower efficiency.
- Improper loading, load imbalance, variation in load factor resulting into low "all day efficiency" of DTs
- Useful life of a DT is around 25 years, however transformer is rarely scrapped on completion of useful life again resulting into inefficient operation
- Lack of funds to procure new DTs, utility operates the DTs beyond their useful life by repairing it several times, this inevitably results in lower efficiency of operation.
- All this result into poor efficiency of DTs and high technical losses in distribution system

Need for Improvement of Efficiency of Existing Stock of DTs ….(2/2)

- BEE has not taken any steps in improvement of efficiency of existing stalk of inefficient DT.
- Neither BEE has issued any guidelines for replacement/repair/refurbishment of existing stalk of DT.
- Considering current replacement/procurement rate of DTs (of utilities), it will take around minimum 15 years for complete phasing out inefficient DTs.
- Nation has to bear huge energy/financial loss for at least 10 to 15 year due to these inefficient DTs
- This necessitates effort to improve efficiency of existing stock of distribution transformers.

Need for the Innovative Business Model ....(1/2)

- T&D losses of distribution utilities across india are around to 21% (CEA forecast for FY 2013-14), which are very high compared to distribution utilities operating abroad.
- Financial loss due to high T&D loss had been accumulated to Rs. 82,000 crore between year 2004-05 to 2009-10, and for year 2009 -10 alone about Rs. 27,000 crore (Shunglu Committee report)
- Huge quantity of low efficient equipment including DTs operating in distribution system, increases losses of distribution system
- Utilities are neither in position to replace live inefficient equipment with efficient one, nor regulations permit them to do it.
- Shunglu committee report has shown concern about financial health of utilities and loss of revenue due high T&D losses

Need for the Innovative Business Model ….(2/2)

- Report has also highlighted that losses are primarily on account of poor managerial and operational practices of distribution companies.
- This necessitates the need for improvement of asset management practices of utilities, aim towards reduction in T&D losses
- There is also need for development of innovative business model, which will help distribution utilities in reducing system losses without financial implication on them

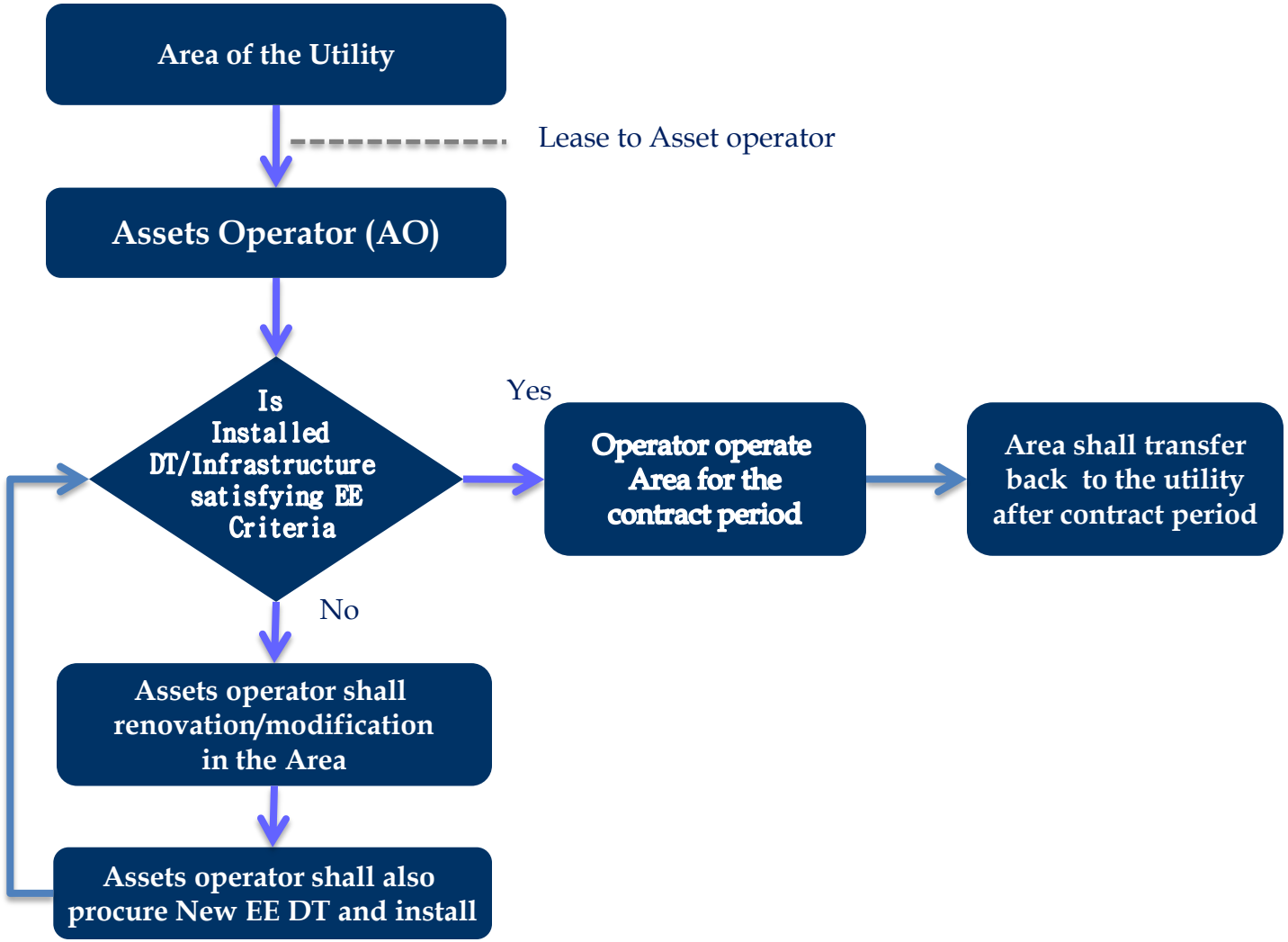
Innovative Business Model for Refurbishment of DTs (IBMRDT)

- Distribution utility will select a particular distribution area of its own and give it to the Asset operator on lease
- Distribution utility will set benchmark of energy efficiency for the leased area.
- Asset operator will implement the energy efficiency measures and improve performance of leased distribution area
- Distribution utility will pay the rent to asset operator.
- Asset operator will improve the energy efficiency of the leased area by certain percentage as per the contract within the specified time.
- Overachievement of efficiency will benefit the asset operator and underachievement will be liable for penalty
- At the end of contract period asset operator shall transfer the leased area to the distribution utility.

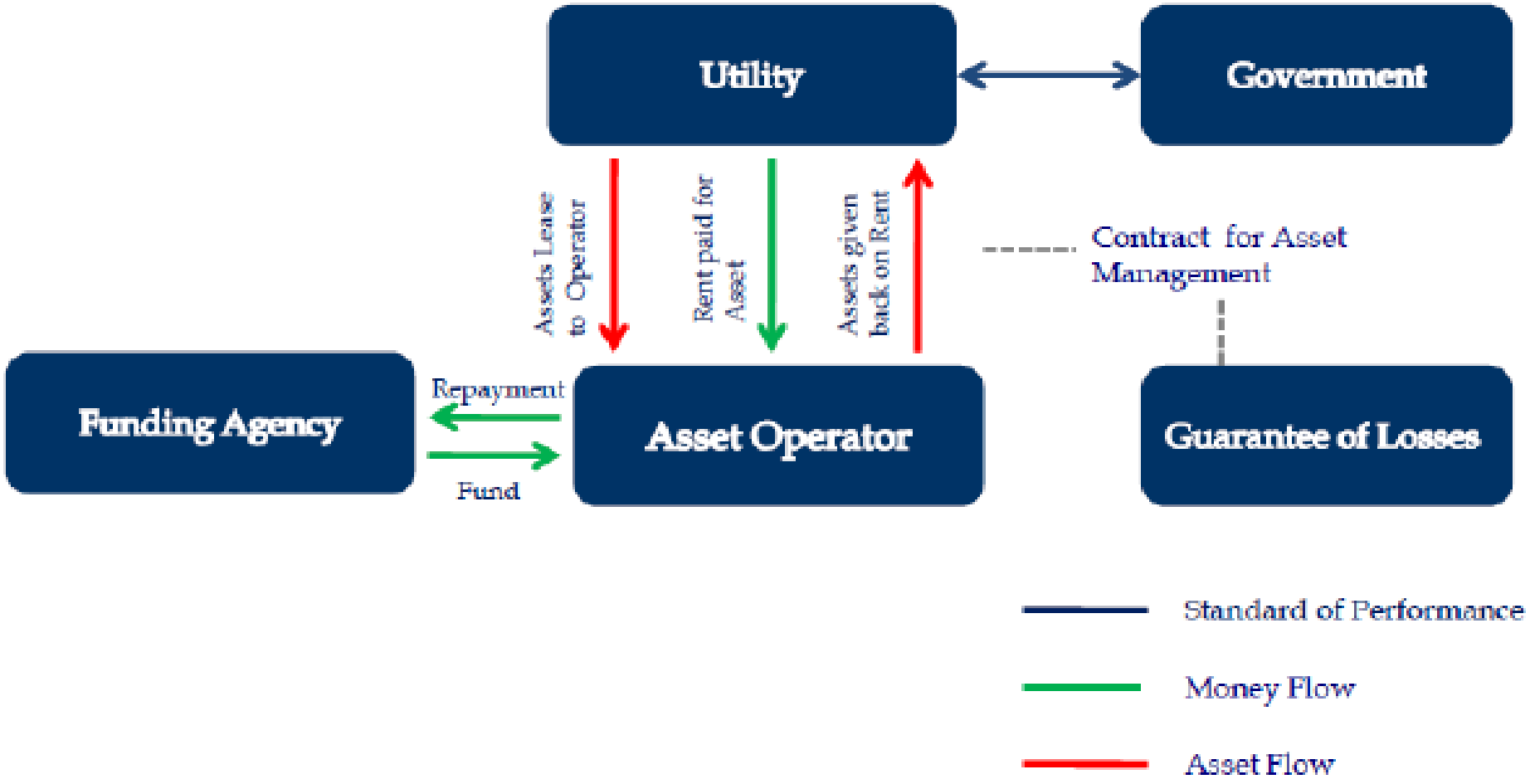
Salient Features of IBMRDT Model

- The asset operator will play key role and will take responsibility for following:
  - Refurbishment of all transformers in the area
  - Maintenance of the transformers during the period of the contract
  - Purchase new transformer as and when need arises
  - Arranging finances for procurement of material/ new transformers
  - Handover all transformers back to utility as per agreed conditions
- Distribution utility will:
  - Handover DTs in identified area to repairer at book value
  - Provide access to repairer for monitoring and maintenance
  - Help in installation of appropriate metering system
  - Monitor performance of the system for losses
  - Pay monthly lease rentals to repairer

Operational Structure for IBMRDT Model

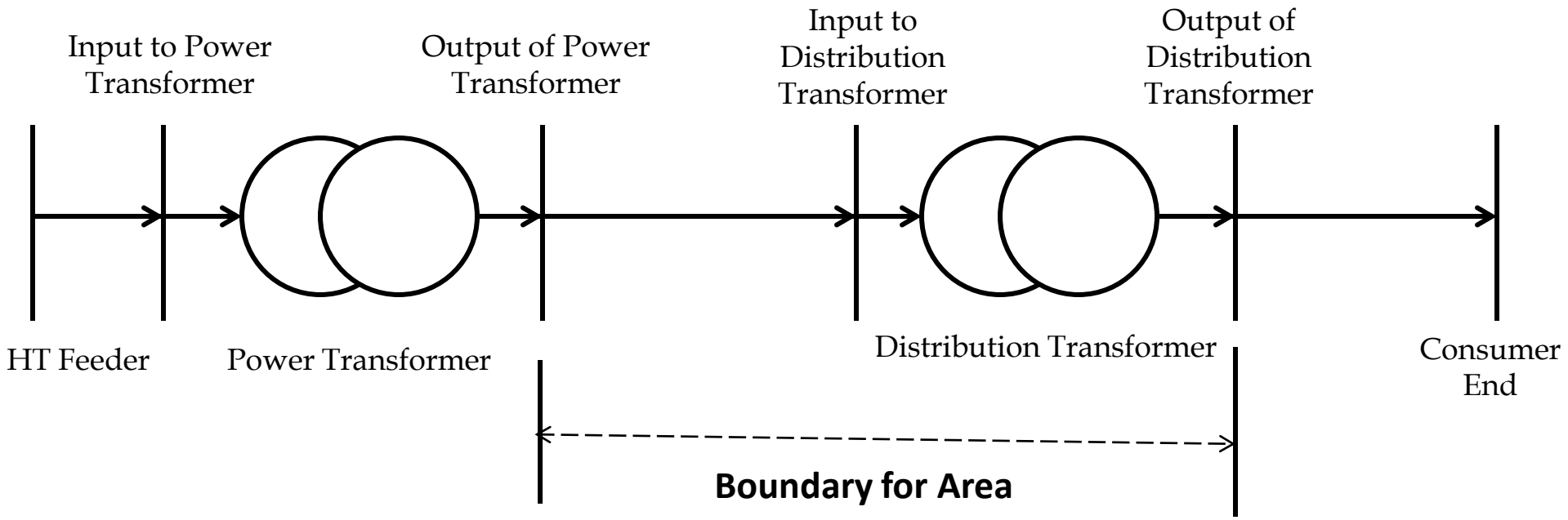


Institutional Structure for IBMRDT Model



Boundary of the Area

- Boundary for Area shall be from output of power transformer to output of DT (i.e. LT side of distribution transformer).



Benefits of Stakeholders

Utility:

- Improvement in efficiency of the distribution area
- Reduction in costly power purchase
- Reduction in failure rate of DTs
- Improvement in asset management practices of utility
- Reduction in O&M expenses thereby improvement in financial health of utility.
- Improvement in financial health

Asset Operator:

- Opportunity to do business and earn profit

Consumers:

- Improvement in power quality and reliability of supply
- Reduction in electricity tariff

Thank You

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