Idam Infrastructure Advisory Pvt. Ltd.

Qualitative Improvements in Manufacturing Practices of DT and Guidelines for Qualitative Improvement of DT Asset Management Practices of Utilities

12th International Conference cum Exhibition

on

"Innovative Quest for Transformer Technology for Efficient and Reliable Power"

Organized by

Indian Transformer Manufacturers Association and Central Power Research Institute

Outline

- Background
- Approach and Methodology
- Assessment of DT Manufacturing Processes
- Assessment of Utility Practices
- Key Recommendations

Background …(1/2)

- Distribution Transformer (DT) is the key
- DTs of 16–3000 kVA common in India
- More than 4 million DTs, more than 300 million kVA, across 62 utilities
- 11 kV/433 V, 22 kV/433 V, 33kV/433 V
- Demand expected to grow at 8%
- 15%–20% of DTs fail every year in India;
  ~ 50% are repaired and put back into service
- Failure rate only 1%–2% in developed countries

Background ...(2/2)

- Repairs lower efficiency and increase system losses
- High failure rates mean financial losses to utilities and to DTM
- Essential to find out root causes and identify solutions
- BEE, ICPCI, and ITMA have decided to come together to
  - find why DTs fail so often
  - measure losses in operating efficiency
  - evolve guidelines for manufacturers and customers (utilities)

Approach and Methodology

Module 1
- Comprehensive assessment of DT manufacturing facilities

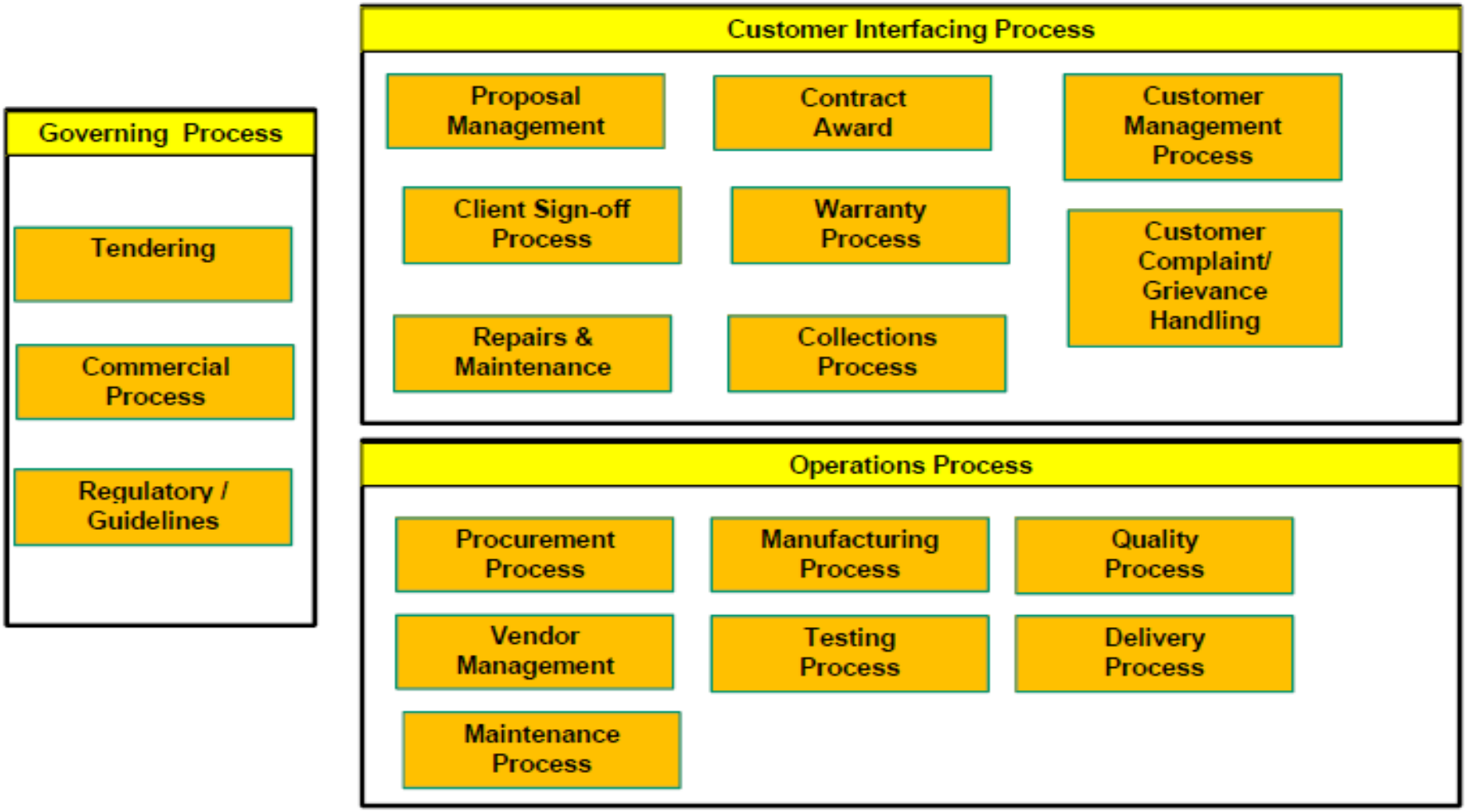
Module 2
- Comprehensive assessment of DT-related operational practices in utilities

Module 3
- Review of present policies and regulations

Module 4
- Development of a best-practices guide

Assessment of Manufacturing Practices of DTs (1/2)

Processes Involved in DT Business with Utilities



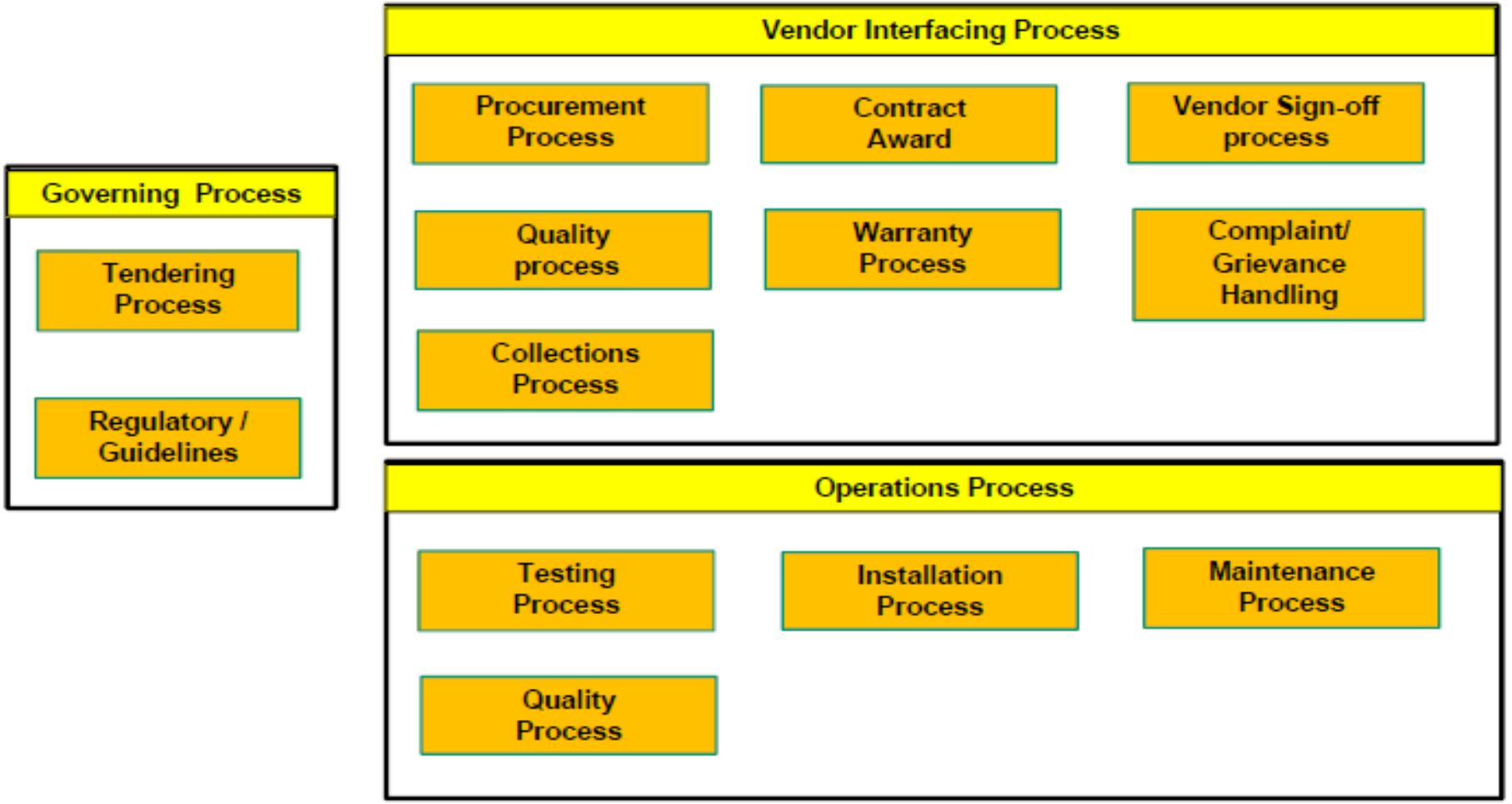
Assessment of Manufacturing Practices of DTs...(2/2)

Issues DTM Faces with Utilities

- Utilities encouraging malpractices
- Utilities should give estimated costing
- Money blocked in EMD & Bank Guarantee
- Not sure of Receipt of EMD & Bank Guarantees from the Utilities
- Utilities need to standardize the design-sizes, specification across India
- Labels, RFID as an identification of inspected transformers
- Transformer failure rate is 10-15%
- Star rated transformers will be expensive
- Price Variation clause for raw material price fluctuation needs to strictly implemented
- Transformers are unmanned and not maintained
- Maintenance problems mainly in the rural area
- Transformers fail due to overloading and poor maintenance
- We would be happy to provide AMC contracts for maintenance
- Every utility has their own specifications, we need to store all spares & consumables
- Stores are not well- maintained
- Procurement Practices need to change in the DTM
- Lack of accountability at the Utilities

Assessment of DT Asset Management Practices of Utility…(1/2)

Process Involved in DT Asset Management by Utilities



Assessment of Utility Practices …(2/2)

Issues Utility Faces During the Asset Management Process of DT

- Failure of Insulation is main reason of failure
- Scrap material used during manufacturing process
- Mal-practices followed during type testing
- Indian DTM are not up to the expected standards
- Quality Philosophy needs to change
- Most MNC, TMs have quality products
- Transformer failure rate is 10-15%
- Star rated transformers will be expensive
- Robust Methodology / checklist required for the selection of Vendors
- Requirement of Separate Inspection Team for carrying out inspection
- Need of self protected Transformers
- Transformers maintenance and repairs outsourced to other agencies
- DTMs should avoid manufacturing shortcut
- Confidence in tried and tested vendors..., failure rate <1%
- Life of transformers mostly not more that 10 years
- We need to improve vigilance
- Compulsion for the selection L1 vendor as per CVC guideline
- Need to adopt the IEC Norms
- Testing & Inspection should be carried out at utility store, No need to visit Manufacturer's site (Private Distribution Utility)

Key Recommendations

1. Accreditation of DT Manufacturers
2. Guidelines for Empanelment of DT Manufacturers
3. Vendor Management System
4. Smart Substations
5. Smart Meters for Performance Monitoring
6. Maintenance by Manufacturers
7. Operation and Maintenance Practices for Utilities
8. CVC Guidelines for the Lowest Price

1. Accreditation of DT Manufacturers

Why Accreditation of DTMs

- To limit suppliers of DTs only to credible channel partners
- To improve the quality of DTs
- To encourage best practices in transformer manufacturing
- To monitor and reward superior performance

- Institutional mechanism needed for accreditation
- **Central Apex Committee should be that mechanism**.

Central Apex Committee (CAC)

Composition

- Ministry of Power
- Central Electricity Authority
- Bureau of Energy Efficiency
- Representative of Utilities
- ITMA members

Key Activities

- Developing criteria for grading of manufacturers
- Registering and certifying manufacturers
- Monitoring performance of manufacturers across utilities
- Carrying out annual due diligence on manufacturers
- Inspecting manufacturers through a third party to assess manufacturing facilities
- Blacklisting the DTMs who exceed a stipulated failure rate

2. Guidelines for Empanelment of DTM

- DTM to apply to CAC for empanelment
- Attach grading certificate by an authorized accreditation agency
- Fresh empanelment: certificate + report by authorized agency
- CAC to collect data on product performance from DTM and utilities
- TMA to assist CAC in collecting data from utilities
- CAC to issue certificate based on agency rating and performance data
- Certificate to rate DTM on transformer quality & production capability
- Certificate mandatory in bidding for utility tenders
- Empanelment to be valid for only 2 years

Methodology for Grading of DTM (1/2)

- Accreditation voluntary but, if sought, grading to be mandatory
- Accreditation by CAC expected to be a must for eligibility to supply DTs to any utility
- Assessment of DTM on criteria finalized in consultation with CAC to be a key part of grading process
- Weighting for criteria
  - Performance capability 60%
  - Business risk factors 10%
  - Organizational risks 10%
  - Financial risks 20%

Methodology for Grading of DTM (2/2)

- Data from DTMs the primary source of information.
- Regular feedback to be sought from utilities
- Grading agency may visit applicant's premises
- Supplying data or allowing visits not mandatory. But, non-provision of data or refusing visits could weaken the case resulting in a lower grade.
- Grading agency may seek feedback from customers as well as bankers on the performance of DTM.
- Extensive interaction with key functionaries of the companies, raw material suppliers, bankers, customers

Grading Scale for Accreditation of DTM

Proposed grading scale

Grade	Interpretation
1	Very high
2	High
3	Good
4	Below average
5	Poor

Proposed methodology for Grading

Tender quantity divided into two:

85% for graded DTM; 15% for new or ungraded DTM

Award of tender contract

- Price variation with reference to the grade of DTM for 85% of tender order
- Lowest cost as criterion for new DTM and ungraded DTM for 15% tender order

Proposed Methodology for the use of Grading System (1/2)

Price Variation w.r.t. Grade of DTM for 85% of Tender Order

- Price quoted by DTM considered based on CAC grade
- Base price with reference to grade of DTM determined as follows.

Grade	*Offered price by DTM (X)*	*% price base allotted based on grade*	*Base price (B)*
1	X_1	90%	$\mathbf{B_1 = 0.9 \times X_1}$
2	X_2	95%	$\mathbf{B_2 = 0.95 \times X_2}$
3	X_3	100%	$\mathbf{B_3 = 1.0 \times X_3}$

- 50% of tender quantity awarded to the lowest base price DTM and 35% to the second lowest base price DTM.
- Remaining quantity to be awarded to

Proposed Methodology for the use of Grading System (2/2)

Lowest price criterion for new DTM and ungraded DTM for 15% of tender order

- ~15% tender order reserved for new or ungraded DTM
- Only new or ungraded DTMs to be considered provided they have applied for registration to CAC
- DTMs whose grading is under process also to be considered
- New or ungraded DTMs considered only if they fulfil the basic criteria defined in tender document
- Tender awarded to the lowest-price DTM, which should be lower than the price offered by Grade 3 DTM in previous process
- Based on lowest-price criterion, 10% of tender order awarded to the lowest price DTM and 5% to the next lowest DTM in this group.

3. Vendor Management System

Need for Vendor Management System

- Quality of raw material affects the quality and performance of DT.
- Raw material bought from independent vendors by DTM.
- Utilities neither participate in raw material procurement nor define suppliers.

Vendor Management System

- Raw material suppliers must approach a utility and register themselves as approved vendors.
- Utilities must sample raw material submitted by vendor at their premises or through the third-party testing.
- Utility must list names of registered vendors in tender document and insist that raw material be procured through them.
- CRGO material, insulating material, and transformer oil to be procured through vendor management system.

4. Smart Substations

- Smart substation, an advanced version of a self-protected transformer
- Increases reliability of power supply and reduces system losses
- Important features
  1. Sensors to monitor temperature of internal parts and transformer oil
  2. Displays voltage, current, load condition, temperature of internal parts & oil, oil level, and operational condition of protection devices
  3. GPRS or GPS-based remote monitoring and operation
  4. Devices to protect transformer from abnormal conditions like overload, over voltage, short circuit, and internal short circuit
  5. Energy metering for energy audit and automatic theft detection

5. Smart Meters for Performance Monitoring

- Transformers vital to a power distribution system. Regular monitoring of transformers prevents potential faults.
- A utility owns several thousand transformers: impossible to physically monitor each
- Systems for remote monitoring of transformers needed
- Smart meters: a GPRS- or GPS-based metering system to be installed on each transformer
- Transformer monitored continuously: any abnormal behaviour signalled to a central control automatically
- Record of different system parameters: help in failure analysis
- Causes of transformer failure easily identified and analysed

6. Maintenance by Manufacturer

- Why distribution transformers fail too often
  - Poor operational practices and poor culture of asset maintenance
  - Poor maintenance and lack of credibility in utility people towards maintenance.
- Manufacturer to provide maintenance for the warranty period
- Maintenance by manufacturer will ensure single-point responsibility for manufacturing and maintenance
- Charges for annual maintenance to be part of initial cost of transformer
- Responsibility of maintenance for the warranty period to be part of tendering

7. Operation and Maintenance Practices for Utilities

- Regularly checking oil level, BDV, and pH; fixing leakages
- Insulation resistance to be checked every 6 months
- Deposition of dust and dirt, salt or other chemicals, cement, and acid fumes on bushings to be carefully noted and ~~rectified~~ removed.
- Regularly checking any loose terminals on HV and LV sides
- Breather examination; dehydration by silica gel if necessary
- Examination of explosion-vent diaphragm
- Cleaning conservator from inside every 3 years
- Regular inspection of oil and winding temperature meter readings
- Cleanliness in substation yard: all nets, vines, shrubs to be removed
- Every transformer to be reconditioned after 15–20 years

8. CVC Guidelines for the Lowest Price

- Utilities sometimes demand a price lower than that quoted by the lowest bidder.
- This price is fixed arbitrarily without any regard to the cost of material required to manufacture the transformer.
- CVC guidelines insist that the contract be awarded to the lowest bidder who meets the specifications.
- Demanding a price lower than the lowest price offered **is illegal**. The practice must be stopped immediately because it forces a manufacturer to cut corners.

Thank You

Idam Infrastructure Advisory Pvt. Ltd.

Mumbai (Regd. Office):
801, Crystal Plaza,
158, CST Road,
Kalina, Santacruz (E),
Mumbai – 400 098
Tel: +(91) 22 4057 0200

Delhi:
704, Bhikaji Cama Bhawan,
Bhikaji Cama Place,
New Delhi - 110066
Tel: +(91) 11 2616 5220

Contact:
Balawant Joshi +(91) 98214 21630
Ajit Pandit +(91) 98211 08222

Email:
contact@idaminfra.com