Seminario de Eficiencia Energetica:
U4E Policy Guide for Distribution Transformers

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Energy-Efficient Transformers Policy Guide
Transformers

Background

- Static devices that transfer electrical power between circuits
  - Losses proportional to current in wire: increase voltage & decrease current
- Huge impact on energy, environment
  - Operate non-stop
  - Lifetimes of 25 years or more
  - Lose nearly 5% of global electricity
  - Stock will nearly double by 2030
# Focus of the Policy Guide

## Main Power Transformers

<table>
<thead>
<tr>
<th>Group</th>
<th>Voltage</th>
<th>Phases</th>
<th>Insulation</th>
<th>Common Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Power</td>
<td>&gt;245 kV</td>
<td>Single &amp; Three</td>
<td>Liquid-filled</td>
<td>Step up or down voltage for transmission over long distances; substation transformers</td>
</tr>
<tr>
<td>Medium Power</td>
<td>&gt;36 kV &amp; ≤230 kV</td>
<td>Single &amp; Three</td>
<td>Liquid-filled or dry-type</td>
<td>Stepping voltages down from a sub-transmission system to a primary distribution system</td>
</tr>
<tr>
<td>Medium Voltage Distribution</td>
<td>≤36 kV</td>
<td>Single &amp; Three</td>
<td>Liquid-filled or dry-type</td>
<td>Step down voltage in a distribution circuit from primary to secondary voltage</td>
</tr>
<tr>
<td>Low Voltage Distribution</td>
<td>≤1 kV</td>
<td>Single &amp; Three</td>
<td>Dry-type</td>
<td>Step down voltage in a building distribution circuit or to supply power to equipment</td>
</tr>
</tbody>
</table>

## Distribution Transformers
Loss and Efficiency Relationship

Transformer efficiency

Maximum efficiency occurs where load loss equals no-load loss

Load (winding) losses

No-load (core) losses
Why Leapfrog to Energy-Efficient Transformers?

13 of the world’s largest economies undergoing a market transformation

- Very attractive when considering the total cost of ownership
- Significant risks of inaction: lock-in decades of electricity waste
- Savings potential: **400 TWh** and **250 million tonnes** of CO$_2$ emissions in 2030

Countries (in red) lacking national mandatory efficiency policies for distribution transformers
Examples of MEPS

Three-Phase Liquid-Filled Transformers

Examples of MEPS

Single-Phase Liquid-Filled Transformers

Sample Recommendations for Policymakers

Standards
✓ Aim to adopt MEPS with test method IEC 60076

Supporting Policies
✓ Labels
✓ Communication campaigns

Monitoring, Verification and Enforcement
✓ Implement MVE in national legal framework in time for the adoption of MEPS

Financial Mechanisms
✓ Encourage the adoption of purchasing practices that are based on the total cost of ownership over a transformer’s lifetime, rather than on the first cost.

Environmentally Sound Management and Health
✓ Follow guidance from the Stockholm Convention on Persistent Organic Pollutants for locating, handling and disposing of PCB contaminated equipment.
ICA’s Contribution in Power Transformer Market Transformation

- Develop technical Standards for MEPS, Test Protocols
- Identify policy tools to promote higher energy performance
- Stake-holder consultations & education
- Help draft regulations, government procurement guidelines
- Develop & implement communication for government

Highlighted countries has policies to promote EE Transformers