Transforming Markets for Lighting, Appliances and Equipment: Proven Solutions for Developing and Emerging Economies

November 15, 2017 – COP23 Bonn Germany

Motors and Transformers: energy efficiency and emissions potential, policies and programme development

IEA 4E Electric Motor Systems Annex EMSA
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Content

1. Electric Motors
2. Transformers
3. Mandatory and Supporting Policies
4. U4E Policy Guides
Motor & Motor System

Motor Driven Unit

\[ \eta_{\text{system}} = \eta_{\text{power equipment}} \times \eta_{\text{controls}} \times \eta_{\text{motor}} \times \eta_{\text{transmission}} \times \eta_{\text{driven equipment}} \times \eta_{\text{components and controls}} \]
Motors - Global electricity use account for more than half

Source: IEA WEO 2016

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Motor market will grow significantly

- Energy use will almost double by 2040
  - Largest contribution China & ‘ROW’ (rest of world)
  - Systems efficiency increases slowly

![Electricity demand for motor systems](chart)

Source: IEA WEO 2016; EMSA

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Savings in electric motor systems

- Through regulations (MEPS) and supporting policies
- Savings in 2040

<table>
<thead>
<tr>
<th>Sectors</th>
<th>New Policies</th>
<th>2°C (450)</th>
<th>(*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>7%</td>
<td>14%</td>
<td>1 700 TWh/a</td>
</tr>
<tr>
<td>All, excl. Transport</td>
<td>8%</td>
<td>24%</td>
<td>4 900 TWh/a</td>
</tr>
</tbody>
</table>

Electricity demand for motor systems (TWh/a) from Current to New Policies Scenario (CPS-NPS)

Source: IEA WEO 2016, EMSA

(*) IEA New Policies and 2°C (450) vs. Current Policies Scenario

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Efficiency Standard Motor

IEC 60034-30-1: ed.1 (2014)

Electric motors: 4 pole, 50 Hz

IE5 - Ultra Premium Efficiency
IE4 - Super Premium Efficiency 50 Hz
IE3 - Premium Efficiency 50 Hz
IE2 - High Efficiency 50 Hz
IE1 - Standard Efficiency 50 Hz

Motor output power [kW] log scale

Efficiency [%]

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Status of Minimum Energy Performance Standards (MEPS) for Electric Motors

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Electricity distribution - transformers

- Static devices that transfer electrical power between circuits
  - Operate non-stop
  - Lose nearly 5% of global electricity
  - Lifetimes of 25 years or more

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Transformers market follows electricity demand

- Electricity use steady at 5% of total electricity demand
- Savings up to 20% feasible by 2040 (global MEPS)

Source: U4E 2017
MEPS Transformers

example Three-Phase Liquid-Filled Transformers


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Status of MEPS for Transformers

Countries **without** MEPS for distribution transformers (in red)

Note: Brazil and India refer to a label program for transformers only

Source: U4E 2017
Mandatory and Supporting Policies

**Electric Motors/VFD**

- **0.75 – 375 kW**

  - MEPS, including
    - IEC classification, nameplates
      - IE2 or IE3 + timetable
    - Implement MV&E

  - Supporting Policies
    - Communication Campaign
    - Professional repairs per ANSI/EASA AR100
    - Financial Mechanisms
    - Environmentally Sound Management and Health

**Transformers**

- **Low and Medium Voltage**

  - MEPS, including
    - IEC test method (no class. yet)
    - Efficiency metric
    - Implement MV&E

  - Supporting Policies
    - Communication Campaign
    - Financial Mechanisms
    - Utility purchasing practices on TCO
    - Environmentally Sound Management and Health
      - PCB handling and disposal

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See U4E Policy Guides for More Information

http://united4efficiency.org/resources/

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Thank you

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