Overview of impact of EnMS in emerging economies and developing countries, including companies examples

Marco Matteini
Industrial Energy Efficiency Division
Department of Energy

IEA Workshop on Energy Management System and Digital Technologies for Industrial Energy Efficiency and Productivity

12-13 December 2017
OECD, Paris
Content

1. UNIDO and Energy Management Systems (EnMS)-ISO 50001
2. Promoting and supporting EnMS-ISO 50001 in developing and emerging economies
3. What EnMS can achieve
   i. Company level
   ii. Programme level
4. Scaling-up EnMS deployment
5. Synergies of EnMS maturity process and digitalization
UNIDO’s EnMS-ISO 50001 journey

**Launch of UNIDO Project on promotion of international EnMS standards**

- **2007**
  - **Mar**
    - UNIDO EGM on EnMS in Industry
  - **May**
    - ANSI-ABNT NWI Proposal to ISO TMB
  - **Jun**
    - UNIDO-DPI EGM on EnMS in Thailand

- **2008**
  - **Feb**
    - ISO TMB establishes ISO PC 242
  - **Sep**
    - UNIDO-SAC EGM on EnMS Standards in Beijing
  - **Oct**
    - UNIDO-ABNT EGM on EnMS Standards in São Paulo

**DEVELOPMENT & IMPLEMENTATION OF UNIDO EnMS PORTFOLIO**

- **2009**
  - ISO PC 242 1st Meeting Washington
  - ISO PC 242 1st CD
  - ISO 50001
  - Ongoing promotion with counterparts of EnMS and engagement in ISO 50001 development

- **2010**
  - Oct
    - ISO PC 242
    - ISO 50001
  - Inception of ISO 50001:2010
  - EnMS projects started/to start in 11 countries

- **2011**
  - Jun
    - Release of ISO 50001:2011
  - Developed in < 3 years!

**Incorporating many of UNIDO Framework for Action findings**

EGM = Expert Group Meeting
UNIDO’s EnMS-ISO 50001 journey

DEVELOPMENT & IMPLEMENTATION OF UNIDO EnMS PORTFOLIO

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>Jun</td>
</tr>
<tr>
<td>2012</td>
<td>Apr</td>
</tr>
<tr>
<td>2013</td>
<td>Apr</td>
</tr>
<tr>
<td>2014</td>
<td>Jun</td>
</tr>
<tr>
<td>2015</td>
<td>Oct</td>
</tr>
<tr>
<td>2016</td>
<td>May</td>
</tr>
<tr>
<td>2017</td>
<td>May</td>
</tr>
</tbody>
</table>

- Development of ISO 50002, ISO 50003, ISO 50004, ISO 50006 and ISO 50015 ……
- Development HLS ISO 50001 ……………..……..
- UNIDO continued participation to experts discussion and standards development
UNIDO Global EnMS-ESO Programme – June 2017

Operational in 18 countries
Planned activities in 10+ countries

Projects ongoing
South Africa
Moldova
Russia
Turkey
Ecuador
Malaysia
Thailand
Viet Nam
Philippines
Indonesia
Egypt
Iran
Ukraine
Colombia
Macedonia
Myanmar
India
Georgia

Other donors
- Swiss State Secretariat for Economic Affairs
- UK Department for International Development
- Government of South Africa
- Government of Italy
- Government of Austria
Success Factors for EnMS-ISO 50001 Deployment

- Level and quality of policy support, including regulation, for promotion & implementation of EnMS/ISO50001
- Availability of competent EnMS workforce on the “Supply” and the “Demand” sides
- Credible demonstration to organizations and the market of EnMS/ISO50001 tangible benefits
### Typical UNIDO IEE-EnMS Project Structure

| **Policy Support** | Programmatic framework to promote industrial energy efficiency (IEE) and EnMS-ISO50001  
Nationally tailored IEE institutional strengthening |
|-------------------|------------------------------------------------------------------------------------------|
| **IEE Market Development** | National campaign to promote IEE & EnMS-ISO50001  
20+ EnMS & 30+ ESO national experts qualified  
50-100+ enterprises receive training on EnMS & ESO |
| **Implementation in Industry** | 15+ large companies (or SMEs) implement EnMS  
30+ low cost EnMS-ESO projects are implemented  
XYZ GWh of energy & XX,000 tons of CO2eq saved |
| **Investments in IEE BAT** | Mechanisms to enhance mobilization of country’s available financing for IEE-LC BAT investments  
Capacity building of banking sector on IEE investments |
Combining Skills Development and Results
The UNIDO EnMS Capacity Building and Implementation Programme

<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Activity</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2 months</td>
<td>Preparation</td>
<td>Draft Energy Policy, Draft Roles &amp; Responsibility matrix, Initial data collection</td>
</tr>
<tr>
<td>3 days</td>
<td>COMMIT Training</td>
<td>PE team work to implement EnMS</td>
</tr>
<tr>
<td>1.5-2 months</td>
<td>PLANNING Training</td>
<td>Energy Policy, Roles &amp; Responsibility matrix, Significant Energy Uses, Baseline, Energy Performance Indicators, Opportunities list &amp; action plans, Energy savings &amp; …</td>
</tr>
<tr>
<td>4 days</td>
<td>IMPLEM. Training</td>
<td>PE team work to implement EnMS</td>
</tr>
<tr>
<td>4-6 months</td>
<td>CHECKING Training</td>
<td>Energy performance checked, verified and reported, Energy performance reviewed by top management, Decisions for next period based on internal audit, Energy savings &amp; …, Performance impr.</td>
</tr>
<tr>
<td>2-3 months</td>
<td>EXAM</td>
<td>PE team work to implement EnMS</td>
</tr>
<tr>
<td>½ day</td>
<td></td>
<td>Trainee qualified as Energy Management System Expert, EnMS implemented in PE, Energy &amp; cost savings, Performance improvements</td>
</tr>
</tbody>
</table>

**Legend**

**PE team**
A Partner Enterprise (PE) team is formed by the PE’s staff participating in the EXPERT program plus 1-2 national consultants trainees.

Ongoing and periodic communication through webinars, emails and phone calls between international trainers and PE teams to review progress, discuss issues and provide guidance.

Plant visits by national EE consultants trainees.
Example 2: Brewery – Russian Federation

Savings in million Rubles from Sep 2014 to Feb 2015 achieved without investments!

<table>
<thead>
<tr>
<th></th>
<th>Plant 1</th>
<th>Plant 2</th>
<th>Plant 3</th>
<th>Plant 4</th>
<th>Plant 5</th>
<th>Plant 6</th>
<th>Plant 7</th>
<th>Plant 8</th>
<th>Sub-Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>-1,7</td>
<td>-0,8</td>
<td>-0,4</td>
<td>-1,1</td>
<td>-1,2</td>
<td>-0,1</td>
<td>-0,8</td>
<td>-0,1</td>
<td>-6,2</td>
</tr>
<tr>
<td>Electricity</td>
<td>-0,8</td>
<td>-2,2</td>
<td>-4,7</td>
<td>-3,2</td>
<td>0,4</td>
<td>-1,7</td>
<td>-2,2</td>
<td>0,7</td>
<td>-13,6</td>
</tr>
<tr>
<td>Heat</td>
<td>0,0</td>
<td>-0,2</td>
<td>0,0</td>
<td>-2,0</td>
<td>3,0</td>
<td>-5,3</td>
<td>-1,4</td>
<td>1,7</td>
<td>-4,3</td>
</tr>
<tr>
<td>Total (RUB)</td>
<td>-2,6</td>
<td>-3,1</td>
<td>-5,2</td>
<td>-6,3</td>
<td>2,3</td>
<td>-7,2</td>
<td>-4,4</td>
<td>2,3</td>
<td>-24,1</td>
</tr>
</tbody>
</table>
Example 3: Refractory Material – Macedonia

Vardar Dolomit

✓ Production of fire resistant materials based on sintered dolomite
✓ 85 employees
✓ 29.3 GWh 2015 consumption of oil & mazut
✓ 3.3 GWh 2015 consumption of electricity

• 19,655 € from electricity savings (7.5%), normalized
• 70,000 € from power purchase contract savings, due to better electricity demand control and forecasting

• In 2017, added oil & mazut to EnMS scope
• 174 MWh of normalized energy savings in first 4 months of 2017 with NO investments

Improvement of Energy Management Practices

<table>
<thead>
<tr>
<th>2016 Electricity Savings Nor. (MWh)</th>
<th>248</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016 GHG Reductions (tons CO₂)</td>
<td>320.7</td>
</tr>
</tbody>
</table>
Example 4: Power Generation – Macedonia

REK BITOLA

- Mining and Energy Combine (REK) Bitola meets over 70% of country’s demand for electricity
- Coal-lignite thermal power plant, total installed generating capacity of 700 MW and annual generation of 4,000 GWh
- Production in 2016 was 2,685 GWh; own consumption was 286.2 GWh
- In 2016, EnMS limited to power generation facilities
  - In 2017, EnMS extended to incl. mining operations
  - 8,700 MWh normalized savings as of 7 Oct 2017
  - EnMS implementation being replicated in all branches of ELEM, the national largest power utility

2.97% of total consumption
Payback time: 22-24 days

Improvement of Energy Management Practices

<table>
<thead>
<tr>
<th>2016 Energy Savings Norm. (MWh)</th>
<th>8,502</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016 GHG Reductions (tons CO₂)</td>
<td>10,528</td>
</tr>
</tbody>
</table>
Example 4: Power Generation – Macedonia

REK BITOLA

Actual savings vs Target & vs Projects - 2016

- Target Savings CUSUM
- Actual Savings CUSUM

Baseline
Savings from projects
EnMS unique
Example 4: Power Generation – Macedonia

REK BITOLA

Actual vs Targeted Energy Savings - 2017

NEW Baseline
EnMS Capacity Building and Implementation Program

Costs and Benefits Analysis - FYR of Macedonia

- 12 Partner enterprises (70% success rate)
- 23 Nat. Consultants/Expert Trainees
- Full cost/value of Nat. Consultants
- Include Progr. develop. and implementation
- No inclusion of UNIDO staff & support costs
- Energy Savings 1 Yr: 13.19 GWh (67% no cost)
- Energy Savings 5 Yr: 165 GWh
- Money savings 1 Yr: 862,700 USD (55% no cost)
- Money savings 5 Yr: 10,792,000 USD
- Without considering non-energy benefits!

### UNIDO Implementation Costs [USD]

<table>
<thead>
<tr>
<th>Category</th>
<th>COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>International Experts</td>
<td>110,000</td>
</tr>
<tr>
<td>National Experts</td>
<td>112,700</td>
</tr>
<tr>
<td>EnMS CBI Programme Management</td>
<td>37,800</td>
</tr>
<tr>
<td>Logistics</td>
<td>30,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>290,500</strong></td>
</tr>
</tbody>
</table>
Scaling-up – Policy Programs

FYR of Macedonia

EU Energy Efficiency Directive – Article 7 & Article 8

Article 7

Legal requirements for large industrial and public sector energy consumers to have a Certified Energy Management Practitioner

Certification Program for Energy Management Practitioner

Financial incentives for ISO 50001 Certification And/Or Financial incentives for EnMS Implementation

Article 8

Energy Management Policy Program for INDUSTRY

IEE Best Practice Information & Dissemination (BPID) Program

EnMS Platform
• Case Studies
• Guidance
• Impl. Tools
• Consultants

Industrial Energy System Platform
• Case Studies
• Guidance
• Tools
• Consultants

IEE Best Practice Award (BPA) Program

EnMS Category
Energy Systems Optimization Category

Other Category
Scaling-up – Utility Programs

FYR of Macedonia

- Partnership UNIDO IEE Project and EVN Macedonia (Power Utility)
- 6+2 new companies implementing EnMS, including EVN Macedonia
- 6 UNIDO Qualified National EnMS Experts
- 7 new EnMS Expert Trainees, 2 from EVN Macedonia
- Cost-sharing of Qualified National EnMS Experts
  - 1/3 UNIDO project; 1/3 EVN Macedonia; 1/3 Beneficiary company
- 75% National Trainers – 25% International Trainers
- EVN Macedonia’s Goals → Start providing EnMS-EE Services to Clients

Estimated (Replication) Cost to UNIDO ~ 10% of Pilot Program (i.e. <30,000 USD)
Scaling-up – Corporate Programs

Ural Mining and Metallurgical Company (UMMC Holding)

9 companies in EnMS Program in 2015

1. AK Serov Metallurgical Plant
2. Coal Mining Company “Kuzbassrazrezugol” (Kedrovsky Open Surface Mine)
3. Branch Of “Ummc-steel” - Electrostan Tyumen Metallurgical Plant
4. Joint Venture Company “Katur-invest”
5. Kirov Non-ferrous Metals Processing Plant
6. Revda Non-ferrous Metals Processing Works
7. "UMMC-Agro" - Teplichnoe
8. Shadrinsky Automobile Units Plant
9. Sukhoi Log Secondary Non-ferrous Metals Plant

Costs of energy resources in 2015 > 17 billion rubles;
Energy resources account for 11.6% in production costs;
Due to tariff increase, energy costs expected to account for 21.5 billion rubles in 2018.

Energy consumption:
- 1054.3 GWh of Electricity (9 companies)
- 269.1 thou. m3 of Natural Gas

2015 Final Energy savings: 78.1 GWh (7.3%)
2015 Cost savings: 86.4 mln. rub.
2015 GHG emissions avoided: 32 361 tons CO2

EnMS implemented in 10 new companies in 2016-2017. UMMC holding counts more than 70 companies.
UNIDO-GEF Global EnMS-ISO 50001 Programme

- Operational in 18 countries (as of Sep 2017)
  - 12 Countries at the end of 2012

- Decision-makers reached
- Enterprises trained in EnMS
- Consultants trained in EnMS
- Enterprises with EnMS
- Cumulative direct final energy savings (GWh)

- 2008:
  - 30 +
  - 250 +

- 2012:
  - 35
  - 200 +
  - 600 +

- 2016:
  - 400 +
  - 600 +
  - 6,000 +
  - 7,000 +

- UNIDO-GEF Global EnMS-ISO 50001 Programme

- ISO 50001 Programme
Impact of UNIDO-GEF EnMS-ISO 50001 Programme

7,000 GWh of final energy savings = Annual energy consumption of 1,150,000 EU households

OR

Annual energy production of 2,000 MW of wind power

OR

CO2 emissions of 1,750,000 middle class cars (running 12,500 km per year)

- Organization-wide energy savings in first 1-2 years range from 4% to 15%, with little or no capital investments
- Annual cost savings of beneficiaries companies in 2015 exceeded USD 100 mio without considering non-energy benefits
- Direct GHG emission reductions of more than 4.3 million tCO2
- Sustainable pipeline of IEE investments generated
Maturity Process of EnMS-ISO50001 & Digitalization

Supply and value chain for EnMS-ISO 50001 and IEE
OBJECTIVE:
- Monitor Energy Performance Indicators (EnPIs) of each SEU on a daily basis
- Automate energy/water consumption data collection & EnPIs calculation

AUTOMATION:
- Medium.
- Automated energy/water consumption data collection
- Manual data collection for relevant variables

SCOPE:
- 10 electricity meters + 2 gas meters + 2 water meters
THANK YOU!

For more information:
Mr. Marco MATTEINI
Industrial Development Officer
E-mail: M.Matteini@unido.org
Industrial Energy Efficiency Division
Department of Energy
UNIDO