IEA Energy Efficiency In Emerging Economies Training Week

Industry Stream: Indicators, evaluation & scaling up
Patrick Crittenden and Louise Vickery
Jakarta, 16-20 July 2018

#energyefficientworld
Learning outcomes

This session will focus on developing your capabilities to:

- Understand energy efficiency indicators and how they can be used
- Plan, implement and supervise industrial energy efficiency programme evaluations
- Differentiate between different types of programme impacts
- Draw conclusions from evaluations and communicate the results
- Use evaluation to inform options to expand the scale and reach of successful programmes
Data and indicators underpin policy evaluation

- Establish metrics to track progress and evaluate effectiveness
- Allow for objective judgement of policy/programme
- Data required should be established at start of programme
- Structured collection process is necessary
  - Company reporting is essential
- Provides evidence of policy benefits for other countries
Indicators can be developed at different levels

GDP - Gross Domestic Product
GVA – Gross Value Added
Indicators exercise

1. Form a group of 4-5 people

2. Review the data that is provided to you

3. Prepare a brief presentation to describe:
   • What ‘level’ these indicators are on the ‘industry sector indicators pyramid’
   • Which stakeholders will be most interested in these indicators
   • What do the indicators tell you about changes in industrial energy efficiency performance
   • What are the limitations of the data set?
What is an evaluation

• A systematic and **objective** assessment of an ongoing or completed project, programme or policy, its design, implementation and results

• The **aim** is to determine the relevance and fulfilment of **objectives**, **efficiency**, **effectiveness**, **impact** and **sustainability**
Why evaluate?

• Document and report results and benefits
  – Meet requirements
  – Gain support for programme continuation or expansion
  – Get more companies to participate in the programme

• Identify ways to improve current and future policies or programmes

• Support energy demand forecasting and resource planning
Steps in an evaluation

Secure resources (should be done at the outset of the programme)

1. Set the objective and review needs
   - Which audience(s)
   - What are the evaluation questions
   - What do we know
   - What do we need to find out
   - How will we source data

2. Terms of reference

3. Select who will carry out the evaluation

4. Manage the development of the evaluation design
   - Methodologies
   - Scope, boundaries

5. Manage the development of the evaluation work plan

6. Manage the implementation of the work plan, including the production of report(s)
   - Data collection, analysis, synthesis, interpretation

7. Use results, disseminate report and support use of the evaluation
Types of evaluation

- **Impact evaluation** asks the question: "what happened?"
  - Includes direct and indirect benefits, energy and demand savings, multiple benefits

- **Process evaluation** asks the questions: "what was done and how did we do"
  - Includes operations and scope for improvements, satisfaction levels, participation

- **Cost effectiveness evaluation** asks: "what impact did we have relative to our investment?"

- **Market evaluation** asks the question "what happened in the market?"
  - Including how supply of energy efficiency technologies and services has been affected

Typically evaluations combine impact + process + cost effectiveness.
### Programme logic, impacts, causality

<table>
<thead>
<tr>
<th>Logic</th>
<th>What?</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacts</td>
<td>Results beyond programme</td>
<td>Air quality has been improved in the region</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Short, medium term results of the programme</td>
<td>132 energy efficiency projects were implemented resulting in 52 GWh savings/year</td>
</tr>
<tr>
<td>Outputs</td>
<td>Tangible products or services</td>
<td>200 energy efficiency opportunities were identified</td>
</tr>
<tr>
<td>Activities</td>
<td>What was done</td>
<td>32 audits were carried out</td>
</tr>
</tbody>
</table>

**Example**

- **Air quality has been improved in the region**
- **132 energy efficiency projects were implemented resulting in 52 GWh savings/year**
- **200 energy efficiency opportunities were identified**
- **32 audits were carried out**

**Causality? Alternative explanations?**
Data collection for evaluation

- Data to gather - examples
  - Changes in energy use
  - Value of multiple benefits (quantified when possible)
  - Investments in energy efficiency projects
  - Profitability of projects (payback periods)
  - Number of energy efficiency opportunities identified
  - % of projects implemented
  - Case studies

Challenge: cannot directly measure savings and benefits need to compare with counterfactual (situation without the programme) or at least baseline

Estimates of gross energy (and/or demand) savings
Estimates of net energy (and/or demand) savings – separating out impacts resulting from other factors

Challenge: Production and other factors fluctuate
Data collection for evaluation

**What data to gather?**
- Changes in energy use
- Value of multiple benefits (quantified when possible)
- Investments in energy efficiency projects
- Profitability of projects (payback periods)
- Number of energy efficiency opportunities identified
- % of projects implemented
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**Challenge:** cannot directly measure savings and benefits need to compare with counterfactual (situation without the programme) or at least baseline

**Estimates of gross energy** (and/or demand) savings

**Estimates of net energy** (and/or demand) savings – separating out impacts resulting from other factors

**Challenge:** Production and other factors fluctuate
Baseline or counterfactual

- **Counterfactual** - situation without programme
- Or changes compared to **baseline** (measurements or assessments at outset or before programme)
- but consider changes during the programme period

**Normalisation for:**
- Weather
- Wider economy
- **Production levels**
- Product portfolio changes
- Other key factors?

**For net results consider:**

- **Free riders**: Companies that would have done energy efficiency irrespective of programme

- **Rebound**: Savings from energy are invested in processes that increase energy demand

Rebound can be seen as a **positive effect** (multiple benefits)
Calculating cost effectiveness

Costs:
- Administration costs
- Costs for participating companies

Benefits:
- Benefits for companies
- Benefits for utilities/government
- Benefits for society
- Benefits for energy efficiency market

Issues to consider
- Discount rates - costs upfront, benefits later
- Lifetime of benefits

Think about:
Investment cost vs value of energy savings over lifetime
### Calculating cost effectiveness

<table>
<thead>
<tr>
<th>Method</th>
<th>+</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desktop review e.g. audit reports</td>
<td>Relatively cheap</td>
<td>Depends on quality of documents</td>
</tr>
<tr>
<td>Surveys</td>
<td>Relatively cheap</td>
<td>Low response rates</td>
</tr>
<tr>
<td>Interviews</td>
<td>Deeper insights</td>
<td>Resource intensive, not always representative</td>
</tr>
<tr>
<td>Focus group</td>
<td>More comprehensive discussion</td>
<td>Might be difficult to organise</td>
</tr>
<tr>
<td>Case studies</td>
<td>Deep insights into one company</td>
<td>Bias towards successful cases</td>
</tr>
<tr>
<td>Experimental approaches</td>
<td>Insights into impacts</td>
<td>Expensive, difficult in real world setting</td>
</tr>
</tbody>
</table>

- What combination will provide you with the information you need?
- What can you afford?
## Evaluation examples – assessing net benefits

<table>
<thead>
<tr>
<th>Ireland SME programme 2007 - 2010</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>1470</td>
</tr>
<tr>
<td>Public budget</td>
<td>USD 1.3 million</td>
</tr>
<tr>
<td>Average energy reduction per company</td>
<td>10%</td>
</tr>
<tr>
<td>Cost per kWh saved to 2020</td>
<td>USD 0.020</td>
</tr>
<tr>
<td>Cost per kWh saved to 2030</td>
<td>USD 0.008</td>
</tr>
<tr>
<td>Value emission abatement to 2020</td>
<td>USD 44 million</td>
</tr>
<tr>
<td>Value of emission abatement to 2030</td>
<td>More than USD 88 million</td>
</tr>
<tr>
<td>Emissions abated to 2030</td>
<td>Almost 1800 ktCO₂</td>
</tr>
<tr>
<td>Net benefit to society in 2020</td>
<td>USD 178 million</td>
</tr>
<tr>
<td>Net benefit to society in 2030</td>
<td>USD 425 million</td>
</tr>
<tr>
<td>Net benefit per USD 1 spent by authority to 2020</td>
<td>USD 16.5</td>
</tr>
<tr>
<td>Net benefit per USD 1 spent by authority to 2030</td>
<td>USD 36</td>
</tr>
</tbody>
</table>
## Evaluation examples – Small incentives big results

<table>
<thead>
<tr>
<th>Swedish energy management programme 2004-2009</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>100</td>
</tr>
<tr>
<td>Tax exemption value</td>
<td>EUR 15 million/year</td>
</tr>
<tr>
<td>Expected annual electricity savings</td>
<td>0.6 TWh</td>
</tr>
<tr>
<td>Achieved annual electricity savings</td>
<td>1.45 TWh</td>
</tr>
<tr>
<td>Measures implemented</td>
<td>1247</td>
</tr>
<tr>
<td>Private investment</td>
<td>EUR 70 million</td>
</tr>
<tr>
<td>Value of electricity saved per year</td>
<td>EUR 70 million</td>
</tr>
</tbody>
</table>

**Sweden**

CASE STUDY
Communicating and using results

For whom?
- Government
- Funders
- Yourselves
- Partners
- General public
- Media
- Participating companies
- Companies not yet participating
- Others?

Think about
- What is your objective?
- What is the audience interested in?
- Level of technical expertise
- Using appropriate language
- What are the key messages?
After the evaluation – scaling up

Your evaluation shows that your pilot programme is successful and cost effective. You have covered 32 companies and 8% of national industrial energy use.

What will you do next?
Scaling up

What does scaling up mean?

• Same sector more companies
• Same companies more implementation
• Same approach different sector
• Same approach more companies
• Using lessons learned to develop new approach to reach more companies and get more implementation
• New and innovative approaches for bigger coverage & greater efficiency

What is the end goal?

• Mainstreaming industrial energy efficiency - to business as usual – and no need for industrial energy efficiency programmes
Perform, Achieve, Trade (PAT) in India

- During first programme cycle, all sectors over-achieved their targets
  - 400 companies from 8 sectors
  - Energy use reduced by 5.3%, target was 4.1%

- Based on results PAT programme now being expanded for 2nd cycle
  - More companies and sectors (621 corporations from 11 sectors)
  - Financial support to encourage greater implementation
# PAT programme results

## Targets and achievements in the first cycle of the PAT Programme, 2012-15 (BEE, 2017)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Target (million toe)</th>
<th>Achievements (million toe)</th>
<th>% above target</th>
<th>% over achievement</th>
<th>Number of ESCerts (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power (thermal)</td>
<td>3.21</td>
<td>3.06</td>
<td>-5%</td>
<td>-5%</td>
<td>3.8</td>
</tr>
<tr>
<td>Iron and steel</td>
<td>1.49</td>
<td>2.10</td>
<td>29%</td>
<td>41%</td>
<td></td>
</tr>
<tr>
<td>Cement</td>
<td>0.82</td>
<td>1.44</td>
<td>43%</td>
<td>76%</td>
<td></td>
</tr>
<tr>
<td>Aluminium</td>
<td>0.46</td>
<td>0.73</td>
<td>38%</td>
<td>59%</td>
<td></td>
</tr>
<tr>
<td>Fertiliser</td>
<td>0.49</td>
<td>0.83</td>
<td>42%</td>
<td>73%</td>
<td></td>
</tr>
<tr>
<td>Paper and pulp</td>
<td>0.12</td>
<td>0.26</td>
<td>54%</td>
<td>117%</td>
<td></td>
</tr>
<tr>
<td>Textile</td>
<td>0.07</td>
<td>0.12</td>
<td>45%</td>
<td>71%</td>
<td></td>
</tr>
<tr>
<td>Chlor-alkali</td>
<td>0.05</td>
<td>0.13</td>
<td>58%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Total industry</td>
<td>6.68</td>
<td>8.67</td>
<td>23%</td>
<td>30%</td>
<td></td>
</tr>
</tbody>
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Upscaling or new approaches to scale up savings

- Standardised projects and solutions
- Integrated programmes
- Streamline admin.
- Energy management for SMEs
- Energy efficiency networks
- Build on successes and expand
- Regulatory approaches - limits, targets
- Remove regulatory barriers
- Make it mandatory
- Project portfolios for investors
- Risk sharing mechanisms
- Energy service companies
- Innovative finance mechanisms
- New business models
- Services instead of energy
- Long term industry technology roadmaps
- Industrial ecology, eco-industrial parks
- Information Communication Technologies
- Promote structural change
- Energy efficiency networks
- Promote structural change
- Energy management for SMEs
- Energy efficiency networks