Energy Efficiency Networks – a new policy instrument to improve Energy efficiency in various countries

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Overview

- Present economic efficiency potentials – a snap-shot of present technology and energy price levels

- Major obstacles and unused constructive factors (within the energy using company)
  - the focus on risk, “robust” management rules (80/20%), procurement by insufficiently specified tenders; motivation and responsibilities of machine/plant operators or apprentices

- Energy efficiency networks as one answer for SMEs and larger companies

- the diffusion of the energy efficiency networks as a policy instrument in different policy frameworks
Profitable energy efficiency potentials of industry and services until 2020

The case - Germany:

- Economic potential 2014 to 2020: 500 PJ (-2.2% per year)
- Reduced energy cost: 11 Billion € in 2020 (-12%)
- Reduction of CO2 emissions: around 45 Mill. Tonnes (-5% of Germany's GHG)
- Additional net 45,000 new jobs (0.1%, induced by a 30 Billion € investment)
- Slight net increase in gross domestic product (+3 Billion € in 2020)
- Smaller capital losses to energy producers by reduced energy imports

Can these potentials be realised?

Source: Jochem u.a. energiewirtschaftliche Tagesfragen, 64(2014)1/2, S.81-85
A selection of existing obstacles – the traditional view

- lack of knowledge and sufficient market survey of energy managers, particularly in SMCs, consulting engineers, architects, installers, bankers

- high transaction cost of the energy manager (for searching solutions, tendering, decision making, installation)

- lack of own capital, fear of lending more capital for investments of off-sites

- technology producers or whole sale often pursue their own interests opposing the possible innovation steps of efficient solutions

- 80% of companies using only risk measures (payback period), but not profitability indicators (e.g. internal interest rate) for their decisions

Why are present profitable efficiency potentials not fully realised?
### Payback time requirement (in years)

<table>
<thead>
<tr>
<th>Useful life of plant (in years)</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>10</th>
<th>12</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>24%</td>
<td>35%</td>
<td>41%</td>
<td>45%</td>
<td>47%</td>
<td>49%</td>
<td>49.5%</td>
<td>50%</td>
</tr>
<tr>
<td>3</td>
<td>0%</td>
<td>13%</td>
<td>20%</td>
<td>25%</td>
<td>27%</td>
<td>31%</td>
<td>32%</td>
<td>33%</td>
</tr>
<tr>
<td>4</td>
<td>0%</td>
<td>8%</td>
<td>13%</td>
<td>17%</td>
<td>22%</td>
<td>23%</td>
<td>24%</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0%</td>
<td>0%</td>
<td>6%</td>
<td>10%</td>
<td>16%</td>
<td>17%</td>
<td>18.5%</td>
<td></td>
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<tr>
<td>6</td>
<td>unf</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4,5%</td>
</tr>
</tbody>
</table>

1) Continuous energy saving is assumed over the whole useful life of the plant

Profitable investment possibilities eliminated by a four-year payback time requirement

One of the major company-internal obstacles of resource efficiency

As long as 80% of technology producers and suppliers do not calculate internal interest rates and life cycle cost, most of the profitable efficiency investments will not be realised – an example how decision routines have to be changed
in addition – often unused supporting factors
consider the motivations of the actors of the innovation system

- Opportunities from the social science perspective: (not just “homo oeconomicus”)
  - first movers well informed, risk taking (as tec producers or tec users)
    - support of first movers (information, training, R&D&D, financially)
  - social prestige of CEOs or companies (green image, member of the Green Dow Jones, leaders who are responsive to societal needs or regional chances)
    - establish efficiency awards, a selected company group of top efficient companies at the national level (e.g. Climate protection companies)
  - professional career of energy managers and acknowledgement of workers by unexpected high savings of energy cost, by motivation, advice to the controller. etc.
    - establish best practice information, local efficiency networks, ask your supplier for carbon foot prints, etc.
LEEN - Local Energy Efficiency Networks – reducing the transaction cost by mutual exchange of experiences

**How do the networks operate with 10 to 15 local companies?**

- **Phase 1.** - energy audit, a report, a list of measures with economic evaluation
  - a joint efficiency and mitigation target

- **Phase 2:** - four meetings per year, professionally prepared and moderated,
  - a site visit included
  - one technology (or organisational measure) each meeting, external expert
  - yearly monitoring, by participant (confidential) and for the network,
  - hot line for the participants,

**Results:**
- many obstacles get reduced, often unused supporting factors are applied
- doubling of efficiency progress compared to average of industry or branch
- average results per participant: 180.000 €/a energy cost savings per site and 10 to 20 €/t CO2 profits

*More in the following paper*
How does it work?

PHASE 0
(3 to 9 months)

- Acquisition Meetings:
  - LEEN-Concept
  - organization
  - process
  - costs
  - profit

- Letter of Intent / Contract

- Official start of network

PHASE 1
(5 to 10 months)

- Identification of profitable energy savings:
  - data collection sheet
  - site inspection
  - energy review report

- Target agreement
  - energy reduction
  - CO₂ reduction

PHASE 2
(2 to 4 years)

- continuous network meetings (3 to 4 meetings per year)
  - site inspection
  - lecture on an efficiency topic
  - presentation of realized measures
  - general exchange of experiences

- Completion:
  - communication on results
  - decision, if network will be continued

Monitoring of results

Communication on network activities

Timeframe 3 to 4 years
## Measures summary – the same tool: energy audit and yearly monitoring

<table>
<thead>
<tr>
<th>Name of measure</th>
<th>Purchased electricity [MWh/a]</th>
<th>Light fuel oil [MWh/a]</th>
<th>Wood chips [MWh/a]</th>
<th>Time of use [a]</th>
<th>Investment eff. [€]</th>
<th>Additional Investment (eff.) [€]</th>
<th>Net present value (10%) [€]</th>
<th>Internal rate of return [1] [%]</th>
<th>Static amortisation time [a]</th>
<th>Dyn. amortisation time (10%) [a]</th>
</tr>
</thead>
<tbody>
<tr>
<td>E03 Reducing electricity consumption (Base load)</td>
<td>65,0</td>
<td></td>
<td></td>
<td>10</td>
<td>2.000</td>
<td>2.000</td>
<td>41.065</td>
<td>350%</td>
<td>0,3</td>
<td>0,3</td>
</tr>
<tr>
<td>V01 free outflow of waste air via roof during summer</td>
<td>15,0</td>
<td></td>
<td></td>
<td>10</td>
<td>500</td>
<td>500</td>
<td>9.438</td>
<td>323%</td>
<td>0,3</td>
<td>0,3</td>
</tr>
<tr>
<td>L01 Retrofitting: mirror reflector/ clear screen capping</td>
<td>30,0</td>
<td></td>
<td></td>
<td>10</td>
<td>3.000</td>
<td>3.000</td>
<td>16.876</td>
<td>108%</td>
<td>0,9</td>
<td>1,0</td>
</tr>
<tr>
<td>E04 Retrofitting: Eff1-drives</td>
<td>70,0</td>
<td></td>
<td></td>
<td>10</td>
<td>7.300</td>
<td>7.300</td>
<td>39.077</td>
<td>103%</td>
<td>1,0</td>
<td>1,1</td>
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<tr>
<td>H05 Biomass: Reduction the flow temperature in the heating circuit</td>
<td>-500,0</td>
<td>500,0</td>
<td></td>
<td>15</td>
<td>25.000</td>
<td>25.000</td>
<td>126.643</td>
<td>80%</td>
<td>1,3</td>
<td>1,4</td>
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<tr>
<td>CA02 Reduction of the pressure in the compressed air network</td>
<td>38,0</td>
<td></td>
<td></td>
<td>10</td>
<td>7.000</td>
<td>7.000</td>
<td>18.176</td>
<td>58%</td>
<td>1,7</td>
<td>2,0</td>
</tr>
<tr>
<td>E02 Using standby set to reduce peak loads</td>
<td>10</td>
<td>3.000</td>
<td>3.000</td>
<td>10</td>
<td>7.000</td>
<td>7.000</td>
<td>18.176</td>
<td>58%</td>
<td>1,7</td>
<td>2,0</td>
</tr>
<tr>
<td>E01 Reduction of peak load</td>
<td>10</td>
<td>5.000</td>
<td>5.000</td>
<td>10</td>
<td>7.000</td>
<td>7.000</td>
<td>18.176</td>
<td>58%</td>
<td>1,7</td>
<td>2,0</td>
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<tr>
<td>OR01 Installation of an energy management system</td>
<td>50,0</td>
<td>14,0</td>
<td>11,0</td>
<td>15</td>
<td>20.000</td>
<td>20.000</td>
<td>29.618</td>
<td>32%</td>
<td>3,1</td>
<td>3,8</td>
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<tr>
<td>H06 Utilisation of waste heat from the injection moulding</td>
<td>200,0</td>
<td></td>
<td></td>
<td>10</td>
<td>10.000</td>
<td>10.000</td>
<td>9.137</td>
<td>29%</td>
<td>3,2</td>
<td>4,1</td>
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<tr>
<td>CA01 Retrofit heat recovery for compressor AM-37</td>
<td>85,0</td>
<td></td>
<td></td>
<td>10</td>
<td>15.000</td>
<td>15.000</td>
<td>13.158</td>
<td>28%</td>
<td>3,3</td>
<td>3,8</td>
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<tr>
<td>L02 Retrofitting of energy efficient lamps with electronic ballast</td>
<td>20,0</td>
<td></td>
<td></td>
<td>10</td>
<td>12.000</td>
<td>6.000</td>
<td>4.178</td>
<td>25%</td>
<td>3,6</td>
<td>4,7</td>
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<tr>
<td>C01 Insulation of refrigerant pipes and fittings</td>
<td>1,0</td>
<td></td>
<td></td>
<td>10</td>
<td>500</td>
<td>500</td>
<td>163</td>
<td>17%</td>
<td>4,6</td>
<td>6,5</td>
</tr>
<tr>
<td>C02 Utilisation of waste heat from cooling processes</td>
<td>259,0</td>
<td></td>
<td></td>
<td>10</td>
<td>68.000</td>
<td>68.000</td>
<td>17.798</td>
<td>16%</td>
<td>4,9</td>
<td>7,0</td>
</tr>
<tr>
<td>REN01 Installation of a photovoltaic system (PV)</td>
<td>20</td>
<td>120.000</td>
<td>120.000</td>
<td>20</td>
<td>-27.202</td>
<td></td>
<td>-27.202</td>
<td>7%</td>
<td>11,0</td>
<td>-1</td>
</tr>
<tr>
<td>H02 Insulation of burner plate</td>
<td>1,0</td>
<td></td>
<td></td>
<td>10</td>
<td>500</td>
<td>500</td>
<td>-169</td>
<td>1%</td>
<td>9,3</td>
<td>27,5</td>
</tr>
<tr>
<td>BG01 Energy-efficient refurbishment of shed roof</td>
<td>100,0</td>
<td></td>
<td></td>
<td>40</td>
<td>150.000</td>
<td>100.000</td>
<td>-83.882</td>
<td>-1</td>
<td>60,7</td>
<td>-1</td>
</tr>
</tbody>
</table>

### Investment today eff. (profitable measures)

- **Sum profitable measures**: 370,000 €
- **Net present value (10%)**: 330,000 €
- **Internal rate of return**: 54,0%
- **Static amortisation time**: 1,8 a
- **Dyn. amortisation time (10%)**: 2,1 a

- **Sum all measures**: 340,000 €
- **Net present value (10%)**: 330,000 €
- **Internal rate of return**: 23,0%
- **Static amortisation time**: 4,3 a
- **Dyn. amortisation time (10%)**: 6,0 a
Energy Efficiency Networks – from an idea of an engineer to an accepted policy instrument

➢ Switzerland

1987: First network in Switzerland (Zurich), invented by Thomas Bürki, a Swiss consulting engineer

the 1990s: replication and improvement of the Modell Zürich as EnergieModell Switzerland, funded by the Fed. Office of Energy

2002: The Law on the CO2 surcharge: companies with target obligations, confirmed by the EnAW, are exempted from the surcharge

surcharge: 2008: 12,- CHF to 2016: 72,- CHF per tonne of CO2

2015: 90 networks and in addition 900 small and medium sized companies, totalling to 3500 production sites
Energy Efficiency Networks – from an idea of an engineer to an accepted policy instrument

- Switzerland
  - 1987: First network in Switzerland (Zurich), invented by Thomas Bürki, a Swiss consulting engineer
  - The 1990s: replication and improvement of the Modell Zürich as EnergieModell Switzerland, funded by the Fed. Office of Energy

- 90 networks a la „Zürich“ with 900 participating companies
- 900 SMEs in the SME-Model
- Total: 3,500 production sites
- Benchmark Model was stopped in 2013 in favour of SME-Model
- Transport networks were labelled as normal networks in 2015
Energy Efficiency Networks – from an idea of an engineer to an accepted policy instrument

Germany

2002: first energy efficiency network in the region of Hohenlohe

2006 – 2008: 5 pilot efficiency networks in five regions of Germany


2014: foundation of the association of energy efficiency networks in Germany (AGEEN) www.ageen.org


2015: about 80 energy efficiency networks operating or already finished, involving about 850 production sites
Energy Efficiency Networks – from an idea of an engineer to an accepted policy instrument

Austria

2012: first energy efficiency network (LEEN) in Vorarlberg
April 2014: 2nd LEEN network in Austria operating (ENAMO)
July 2014: legislation passed the Austrian Parliament demanding a “measure-based” prove that the customers of energy suppliers have reduced specific energy demand by 1 % per year
August 2015: five energy efficiency networks operating

Easy diffusion of the policy instrument (all supporting elements of the network management in German, high pressure on the energy suppliers)
**Energy Efficiency Networks – the case of China 2011 to 2015**

- **China:**
  - Chinese delegations visited the Fraunhofer Institute and EnAW in 2011 and 2012.
  - Invitation for training 50 consulting engineers and 50 moderators in 2012 and 2013.
  - All trainee courses in China over three weeks were professionally shoted.

- Chinese efficiency legislation: of 2012 the State Grid Company has to prove an energy efficiency improvement of their customers of at least 1% per year.

- The State Grid Company decided to generate some 500 energy efficiency networks within 3 years.

- In 2014, 525 networks were in operation.

- However, little competence and poor performance.
Energy Efficiency Networks –
- an accepted policy instrument

➢ **Outlook**

- 2015: interest in the energy efficiency networks in
  - Sweden (Energy Agency)
  - Belgium (regional institution)
  - Mexico (regional institution)
  - Brasil (consulting engineering company)

➢ EU-Proposal pending (Poland, UK, Belgium, Spain, etc.)

➢ Target groups for network operators in the case of market situation:
  - large utilities; energy agencies,
  - but also: city governments, Chambers of Commerce, consulting engineers,
  - applied research institutes
Thanks for contributing to a sustainable development in the global context!

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