Local Energy Management
Current Developments & New Challenges
EU energy efficiency goals 2012

Energy Efficiency Directive - 2012

- Obligatory energy reduction of the member states between 2014 and 2020 of 1.5% in average per year
- Definition of national energy efficiency goals:
- GER → 2.1% per year until 2020
- Obligatory energy audits on a regular basis for large companies
- CHP: cost-plus-analysis for new or refurbished power plants and industrial complexes
- Implementation in national law until 5th June, 2014

EU green paper goals for 2030 (publication 2014)

- Reduction of GHG-emissions: 40 %
- Share of renewable energies: 27 %
- Increase of energy efficiency: 30%
  (in addition to the 2007 goals)
Energy political goals of the German government

- Reduction of GHG-emissions by 40% until 2020 and by 80% until 2050
- Share of renewable energies on power production: 40-45% until 2025 and 55-60% until 2035
- Reduction of electricity consumption by 10% until 2020 and by 25% until 2050
- Reduction of primary energy consumption by 20% until 2020 and by 50% until 2050 (compared to 2008)
- Increase in energy productivity by 2.1% per year
- Reduction of final energy consumption in the transportation sector by 10% until 2020 and by 40% until 2050
- Reduction of space heat demand by 20% until 2020 and by 80% until 2050
Measures to reach the climate political goals in Germany

Climate political goals in Germany

**National Action Program Climate Protection**

- Clean Development Mechanism, Kyoto (CDM, JI)
- Renewable Energy Act (EEG)
- Accelerated approval procedures for grid extension projects (NABEG)
- Increase of efficiency standards for buildings (EnEV)
- Renewable Energy Heat Act (EEWärmeG)
- Financial support of energy efficiency and emission reduction – National Climate Protection Initiative (NKI)
- Energy-Related-Products Act (EVPG)
- KfW subsidy schemes
- **National Action Plan for Energy Efficiency (NAPE)**
Energy efficiency in the building sector

- Quality control and further development of energy consulting
- Tax subsidies for energy efficiency modernisations
- Enhancement of the KfW subsidy program
- Audits and efficiency labels for central heating systems

Business models for energy savings

- Introduction of a market conform tendering process for energy efficiency subsidies
- Support of performance contracting by state guarantees
- Support of waste heat utilization in industrial processes
- Pilot project „Einsparzähler“ (reduction meter)
National Action Plan for Energy Efficiency (2)

Responsibility for energy efficiency

- Initiative energy efficiency networks
- Lifting of reduction potentials in business parks by „energy efficiency managers“
- EU energy-efficiency-labeling and eco-design
- Sector specific energy consulting
- National Top-Runner-Initiative (NTRI)
- Obligatory energy audits for non-SMEs

Enhancement of measures in transportation sector

- Support of electric vehicles
- Support of rail transportation
- Expansion of truck-toll to vehicles from 7.5 t starting by 2018 on all federal roads
- Support of waterway transportation
- Support of carsharing models
Implementation gap (1)

<table>
<thead>
<tr>
<th>final energy [PJ]</th>
<th>goals EED</th>
<th>creditable early actions</th>
<th>creditabilities</th>
<th>implementation gap</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td>final energy [PJ]</td>
<td>672</td>
<td>168</td>
<td>125</td>
<td>379</td>
</tr>
</tbody>
</table>

See: Ecofys (2012): Ermittlung der Umsetzungslücke zur Erreichung der Zielvorgaben der EU-Energieeffizienzrichtlinie
Implementation gap (2)

EU targets regarding energy consumption

1.5% (based on average final energy consumption between 2010 and 2012)

Possible reduction to 1.125% per year through derogations (crediting of „early actions“)

If there are no other measures the implementation gap in Germany would be 0.8% per year.

Approach to close the implementation gap

- More efficient implementation
- Additional measures
Development of primary energy consumption (PEC)

**Figure 4: Comparison of scenarios up to 2020 according to Forecast Report, climate scenarios, extrapolated trend as well as the resulting shortfall to PEC target for 2020**

PEC non-adjusted (PJ)

![Graph showing development of primary energy consumption](image)

**Shortfall to 2020 target**

-12.8% (-1,867 PJ)
-10.9% (-1,589 PJ)
-9.9% (-1,440 PJ)

**Key Notes**

- **Extrapolated trend**: Based on statistics from 2008 to 2013 (as of 2014)
- **Climate scenarios 2050**
- **Forecast Report 2013**

**Sources:** Fraunhofer ISI/IFAM, Prognos, Ifeu, Ringel, Ziesing, 2014.

Development of greenhouse gas emissions (1)

Figure 1: Greenhouse gas emissions in Germany between 1990 and the 2013 forecast in million tonnes of CO₂ equivalent

Source: Emissions situation according to UBA, 25 February 2014

Development of greenhouse gas emissions (2)

Figure 2: Trends in greenhouse gas emissions in Germany by sector

Source: Federal Environment Agency, 7 January 2014
### Challenges (not yet solutions)

#### Table 1: Central measures in NAPE

<table>
<thead>
<tr>
<th>Measure</th>
<th>PEC in PJ</th>
<th>Greenhouse gases in million tonnes of CO₂-equivalent</th>
<th>Forecast savings by 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short-term NAPE measures</strong></td>
<td></td>
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<tr>
<td>Quality assurance and optimising existing energy consulting</td>
<td>4.0</td>
<td>0.2</td>
<td></td>
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<tr>
<td>Granting tax incentives for energy efficiency renovations</td>
<td>40.0</td>
<td>2.1</td>
<td></td>
</tr>
<tr>
<td>Upgrading the CO₂ Building Renovation Programme</td>
<td>12.5</td>
<td>0.7</td>
<td></td>
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<tr>
<td>Introduction of a competitive tendering scheme</td>
<td>26–51.5</td>
<td>1.5–3.1</td>
<td></td>
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<tr>
<td>Funding for energy performance contracting (including default guarantees)</td>
<td>5.5–10</td>
<td>0.3–0.5</td>
<td></td>
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<tr>
<td>Upgrading KfW energy efficiency programmes</td>
<td>29.5</td>
<td>2.0</td>
<td></td>
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<tr>
<td>Energy Efficiency Networks Initiative</td>
<td>74.5</td>
<td>5.0</td>
<td></td>
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<tr>
<td>Top Runner Strategy – at national and EU level</td>
<td>85.0</td>
<td>5.1</td>
<td></td>
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<tr>
<td>Energy audit obligation for non-SMEs</td>
<td>50.5</td>
<td>3.4</td>
<td></td>
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<tr>
<td>National energy efficiency label for old heating installations</td>
<td>10.0</td>
<td>0.7</td>
<td></td>
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<tr>
<td><strong>Additional short-term measures in NAPE</strong></td>
<td></td>
<td></td>
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<tr>
<td>Total for short-term measures</td>
<td>350–380</td>
<td>21.5–23.3</td>
<td></td>
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<tr>
<td><strong>Other measures</strong></td>
<td></td>
<td></td>
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<tr>
<td>Measures as of October 2012</td>
<td>43.0</td>
<td>2.5</td>
<td></td>
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<tr>
<td>Provisional estimate of effects of long-term work processes</td>
<td>up to 40</td>
<td>up to 4</td>
<td></td>
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<tr>
<td><strong>Total</strong></td>
<td>390–460</td>
<td>approx. 25–30</td>
<td></td>
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<tr>
<td><strong>Transport measures</strong></td>
<td></td>
<td></td>
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<tr>
<td>(see Climate Action Programme 2020)</td>
<td>110–162</td>
<td>7–10</td>
<td></td>
</tr>
</tbody>
</table>

Sources: Fraunhofer ISI/IFAM, Prognos, Ifeu, Ringel, 2014.
How to assess energy efficiency goals?

- There is a certain level of economic energy efficiency potential.

\[
\text{Costs for reduction of resource consumption (} C_{\text{red}} \text{)} \\
\text{Costs for resource consumption (} C_{\text{con}} \text{)} \\
\]

Constant level of service from resource input

Cost optimum: All cost elements to be taken into account!
What barriers to overcome?

- **Risk**
  
  *short payback time required, because relatively higher technical / financial risks*
  
  *uncertain energy price development / high volatility*

- **Imperfect information**
  
  *Lack of information on energy efficiency technologies*

- **Hidden costs**
  
  *overhead costs / transaction costs, staff training, …*

- **Access to capital**
  
  *energy efficiency investments need to compete against other investments*
  
  *debt ratio*

- **Split incentives**
  
  *benefits outside the own organizational unit / system*
  
  *positive external effects*

- **Bounded rationality**
What costs to calculate (and when) – and to reduce?

Saved transaction costs due to Information exchange in energy efficiency networks

- initiation
- decision
- implementation
- adjustment

- feasibility study
- on-site inspection
- information procurement, technologies, prices, supplier
- tender procedure
- cost planning, investment request
- supplier negotiations
- consultations
- evaluation
- commissioning
- consultations
- installation supervision
- measurements, acceptance
- renegotiations
- employee trainings

Learning from the past – Least-Cost-Planning (LCP)?

LCP examines the total costs and benefits for all alternatives to cover a defined supply task (e.g. higher energy efficiency vs. new capacities).

LCP approach applied mainly for integrated utilities

Today’s structure is much more complex
LCP application for integrated utilities in regulated markets

higher energy efficiency at customer level

→ energy savings

→ drop in turnover from energy sales in first place

→ **BUT** adjustments at regulated price to compensate the utility
LCP application in a liberalised energy market

Open questions

- How to define the system?
- Who is responsible for energy efficiency support actions?
- How to compensate companies for lower turnover?
- Definition of interfaces and organization of markets
Local Energy Management – local utilities

Energy efficiency as a business model

Advantages of local utilities
- close customer relation
- detailed information about energy demand
- trend of distributed generation technologies
- know-how in long term energy related investments
- ...

Contracting
- performance contracting
- plant management
- provision of leasing models
- ...

Requirements for planning and evaluation
- Long range planning
- **Demand forecast**
- Energy price forecast
- Technical innovation management
Forecast of local energy demand development

- Power
- Natural gas
- Heat

→ Development of forecast database with detailed temporal and spatial resolution

**user selection**
- *time horizon*
- *region*
- *energy source*
- *sector*

**Database**
- *forecast models*
- *regional differentiation*
- *stochastic parameters*

**output**
demand time series
Geographical information system model
Structure and quantity of consumption (natural gas)

Natural gas & biomethane consumption
Germany 2011
811 TWh (H₂) / 79.77 Mrd. Nm³

- Households: 236 TWh (29.0%)
- Industry + other: 251 TWh (31.0%)
- Commerce, trade, services: 109 TWh (13.4%)
- (heating-)power plant: 185 TWh (22.8%)
- District heating plant: 28 TWh (3.4%)
- Transportation: 3 TWh (0.3%)

Households
- 0–80
- 80–130
- 130–200
- 200–300
- 300–420
- 420–630
- 630–1000
- 1000–1500
- 1500–2500
- 2500–4000

Industry

Commerce, trade, services
Modeling of regional energy demand @ E&R

- Increasing granularity of data

- Under development