AGFW - Who we are

AGFW is the efficient, independent and impartial association promoting energy-efficient district heating, cooling and combined heat and power at national and international levels.

AGFW reunites round about 450 (regional und municipal) district energy suppliers and industrial operators of this industry in Germany and Europe.

AGFW represents over 95% of the heat load connected to German district heating systems – the largest scale in Western Europe.

AGFW means over 40 years of experience in this field.

Welcome to EUSEW

Dipl.-Ing. Dipl.-Wirtsch.-Ing. Harald Rapp

Head of Urban development and KM department

Managing Director of AGFW Project GmbH

Expert in several National and international Committees:

National Expert group for urban development

Project Coordinator for several national and international R&D Projects

University lecturer/Chairman

German Committee on Eastern European Economic Relations Energy group: Romania and Bulgaria

Ecoheat4Cities


Status: at action; 2010 - 30 Month, Partners from Finland, Hungary, Spain, UK

A simple question to start!

What was your private thermal energy consumption (Heating and / or hot water) in the last heating season?

Answer n > 400

80 – 90%

10%

I know I do not know
Energy efficiency through reduction of the energy demand and the increase of energy conversion efficiency in interaction with the components at the same time.

Renewable Energies

Nuclear Phase-out

Eco logical

Social

sustainable

economical

Expected

Building energy factor of DH primary

0.56 - 0.21 - 0.57

0.54 - 0.31 - 0.14

1% to 2%

Renovation rate from 1% to 2% p.a.

rate from renovation

- 80% PEC and RES

2.1%/a

Share Electr. and RES / BMU

27 %

19 %

25 %

20% (city centre)

12%

38%

46%

29%

14 %

Share Heat

Increase to 2.1%/a

Climate

Renewables

Share DH

2020

-40%

35%

14%

18%

25%

-20%

10%

-20%

2030

-55%

50%

30%

2040

-70%

60%

45%

2050

-80-95%

80%

60%

50%

25%

-80% PEC and RES

Energy efficiency

German Energy Policy - Political Targets of the government

» Principle of Sustainability in the Overall Context – Political Objectives – Pillars of the Energy Turnaround

» National Urban Development

» Urban Development Strategy Saxony for 2020

» German Energy Policy - Political Targets of the government

<table>
<thead>
<tr>
<th>Year</th>
<th>Share DH</th>
<th>Share Heat</th>
<th>Share overall PEC</th>
<th>Share Electr.</th>
<th>Primary energy</th>
<th>Electr. energy-productivity</th>
<th>Building renovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>-40%</td>
<td>35%</td>
<td>14%</td>
<td>18%</td>
<td>25%</td>
<td>-20%</td>
<td>-20%</td>
</tr>
<tr>
<td>2030</td>
<td>-55%</td>
<td>50%</td>
<td>30%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2040</td>
<td>-70%</td>
<td>60%</td>
<td>45%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2050</td>
<td>-80-95%</td>
<td>80%</td>
<td>60%</td>
<td>-50%</td>
<td>25%</td>
<td></td>
<td>-80% PEC and RES</td>
</tr>
</tbody>
</table>

Energy efficiency through reduction of the energy demand and the increase of energy conversion efficiency in interaction with the components at the same time.

Guidelines:
- Inner development takes precedence over external development
- Living (and business) in the inner city - for young and old
- Heritage (building conservation) has priority (identity)
- central places
- Innovative energy concepts have priority

GHG carbon equivalents

Fuel specific value today

Quadratic value today

Statistical heating indices today

Reduction of GHG emissions according to the “Energy Scenarios for an Energy Concept of the German Government” (Project 12/10)

The reason for this are different calculation methods.
*A comparison of the results of various computational tools shows deviation by a factor of 2 to 3.

Sources: Stadtwerke Herten, Stadt Leipzig, ifeu, eins energie in sachsen, Umweltamt Dresden, Stadt Hamburg, Senatverwaltung Berlin, Stadt München, Stadt Frankfurt, Stadt Köln

» Local Municipal: (started 1973)
- Berlin
- Hamburg
- Munich
- Cologne
- Frankfurt/Main
- Leipzig
- Dresden
- Chemnitz
- Herten

- Grants, laws, assistance

» Principle of Sustainability in the Overall Context – Political Objectives – Pillars of the Energy Turnaround

» German Energy Policy - Political Targets of the government

<table>
<thead>
<tr>
<th>Country</th>
<th>CO2-Equivalent of Selected German Cities – Municipal Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berlin</td>
<td>2.431 t CO2equiv. (2000)</td>
</tr>
<tr>
<td>Hamburg</td>
<td>1.772 t CO2equiv. (2000)</td>
</tr>
<tr>
<td>Munich</td>
<td>1.915 t CO2equiv. (2007)</td>
</tr>
<tr>
<td>Cologne</td>
<td>1.677 t CO2equiv. (2000)</td>
</tr>
<tr>
<td>Frankfurt/Main</td>
<td>706 t CO2equiv. (2000)</td>
</tr>
<tr>
<td>Dresden</td>
<td>912 t CO2equiv. (2000)</td>
</tr>
<tr>
<td>Chemnitz</td>
<td>263 t CO2equiv. (2000)</td>
</tr>
<tr>
<td>Herten</td>
<td>65 t CO2equiv. (2000)</td>
</tr>
<tr>
<td>Germany</td>
<td>72.2 t CO2equiv. (2000)</td>
</tr>
</tbody>
</table>

* A comparison of the results of various computational tools shows deviation by a factor of 2 to 3.

The reason for this are different calculation methods.
Current objectives:
1. Reduction of energy demand
2. Increase of energy efficiency
3. Use of renewable energies
4. Local added value

Fundamental individual concepts:
- Energy concepts (municipal)
- Energy supply concepts (utilities)
- Climate protection concept
- Housing market concepts

» Integration of urban development concepts

Structure integrated urban development concepts
Demography and Conditions of Life

Specialized Concepts
- Housing
- Centers
- Economy and Employment
- Traffic and Technical Infrastructure
- Open Space and Environment

Urban (re)development strategy
Urban (re)development areas

Manager
Project Manager
Specialist
CEOs
Councillors

Manager Utility
Manager Climate

InSEK©

Check of the energetic plausibility in all sub concepts and their repercussion

General principle – (socio-)demography - circumstances – tendency of development - …

» Vision
From idea to concept
From concept to project
From project to the implementation

» Policy

» From concept to project

» Priority

» From project to the implementation

» Actors
The Energy Efficient Urban Development Concept

Municipal actors under increasing pressure to act:
- Budgetary situation - low options for action
- Demographic development - different strategies are essential
- Climate protection/ climate change - adjustment measures are necessary
- Increase of energy efficiency - implementation of objectives and guidelines
- Organisation and prioritisation - change, speed and unidisciplinarity

Same pressure on supply and disposal industry:
- Lower number of customers and lowered consumption
- Increasing costs per unit of product (increasing share of fixed costs, shortened working life of plants)
- Technical problems: utilisation below capacity of infrastructure systems
- Short-term interim solutions instead of investment cycles with 25+ years
- Strongly changing overall context - competition, politics and society

Motivation and Challenges of the Current Urban Development

What is the motivation?
The main challenges for cities and municipalities are among others:
- Demographic development
- Climate adaption strategies
- Reduction of energy demand, increase of energy efficiency and the use of RES
- The tense financial situation

It is valid:
- To use the experiences from the Urban Reconstruction East/West

Fundamentals are:
- Integrated urban development concepts, energy and environmental concepts
- Energy supply concept of the (most public) utility companies
- Concepts of the housing industry

What are the challenges?
- System-compatible analysis of developments
- Networking of all actors with common "language" and goals
- Coordinated and target-oriented actions depending on actual fundamentals of decision-making
- Prioritisation, standardisation and sustainability
- Easy and manageable implementation

Energy Consumption in private households - Structure

Basic points:
- Networking of main actors (Know-How) in the INSEK
- Process of coordination
- Common prioritisation and process oriented thinking
- Achievement of objectives and sustainability
- Standardised assessment criteria
- C\text{\textsuperscript{2}}O\text{\textsubscript{2}}
- Efficiency oriented thinking in implementation measures
- Hydraulic compensation
- Consideration of the demographic change
- Age-appropriate housing
- Adjustment measures
- Cooling and extreme weather conditions
- Increasing acceptance
- Participation processes and architecture

Energy Consumption in residential buildings by type of service

Heating water and hot water consumption (only heating approx. 15 – 30 kWh/m² p.a., across all classes of buildings; years under review 2006 - 2009, data basis > 6 million residential units (double counting possible))

Energy Efficient City – Process of Municipal Planning and Implementation

Basic points:
- Networking of main actors (Know-How) in the INSEK
- Process of coordination
- Common prioritisation and process oriented thinking
- Achievement of objectives and sustainability
- Standardised assessment criteria
- C\text{\textsuperscript{2}}O\text{\textsubscript{2}}
- Efficiency oriented thinking in implementation measures
- Hydraulic compensation
- Consideration of the demographic change
- Age-appropriate housing
- Adjustment measures
- Cooling and extreme weather conditions
- Increasing acceptance
- Participation processes and architecture
Most efficient climate protection measure within existing buildings

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Consumption/Saving per m²/a</th>
<th>Abatement costs per t CO₂ approx.</th>
<th>Equivalent energy price per kWh approx.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unrenovated old building - basis</td>
<td>166 kWh</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Boiler replacement</td>
<td>- 5 kWh</td>
<td>200 €</td>
<td>0,33 €</td>
</tr>
<tr>
<td>Low temperature boiler</td>
<td>- 18 kWh</td>
<td>- 20 €</td>
<td>0,11 €</td>
</tr>
<tr>
<td>Condensing boiler</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydraulic balance</td>
<td>- 10 kWh</td>
<td>200 €</td>
<td>0,32 €</td>
</tr>
<tr>
<td>Insulation</td>
<td>- 19 kWh</td>
<td>270 €</td>
<td>0,40 €</td>
</tr>
<tr>
<td>of facade</td>
<td>- 9 kWh</td>
<td>310 €</td>
<td>0,48 €</td>
</tr>
<tr>
<td>of roof</td>
<td>- 9 kWh</td>
<td>20 €</td>
<td>0,13 €</td>
</tr>
<tr>
<td>of top ceiling</td>
<td>- 8 kWh</td>
<td>70 €</td>
<td>0,26 €</td>
</tr>
<tr>
<td>of cellar ceiling</td>
<td>- 1 kWh</td>
<td>400 €</td>
<td>4,70 €</td>
</tr>
<tr>
<td>Replacement of windows</td>
<td>- 19 kWh</td>
<td>- 35 €</td>
<td>0,09 €</td>
</tr>
<tr>
<td>Solar thermal installation</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Examples of savings – Hydraulic balance, percentage of buildings

Impact of climate change on the urban climate to moderate IPCC scenario

Impact on the city of Frankfurt 2050:
- The average annual number of summer days per year will increase from 44 days to 5-31 days.
- The summer half-year will be warmer every second to fourth day in Frankfurt as 25 °C. Simultaneously, the average annual number of "Summer Nights" is that there are evenings where a 22 °C clock at least 20 °C warm, increase by 5 to 33 days.
- The number of "hot days" with a maximum temperature of 30 °C and the tropical nights with air temperatures fall below 20 °C, will increase significantly.

The changes do not differ significantly between tightly and loosely built-up districts. The heat load will increase so much alike, and in future there will be highest where it is today.
- The differences between the city and surrounding area will not get worse.
- The probability that the summer heat - such as in 2003 - will become more frequent, increases until the middle of the century.

Energy Consumption - Structure

Influencing factor:
- Building characteristics
- Energy systems
- Season
- Climate development
- Demographic trends
- Social trends
- Economic trends
- Number of households
- Household size
- Age of the household
- Income
- Education
- Region
- Habits
- Social values
- Motives / conviction
- Ventilation
- "comfortable temperature"
- Environmental awareness
- Altitude

Influence quantity:
- Building type
- Year of construction
- State of refurbishment
- Thermal insulation
- Heating system
- Energy source
- Mean annual temperature
- Days of frost in annual average
- Summer days
- Number of households
- Household size
- Age of the household
- Income
- Education
- Region
- Ventilation
- "comfortable temperature"
- Environmental awareness
- Altitude

Examples of savings - Hydraulic balance, percentage of buildings

Energy Consumption - Structure

Private household

Influence quantity:
- Building type
- Year of construction
- State of refurbishment
- Thermal insulation
- Heating system
- Energy source
- Mean annual temperature
- Days of frost in annual average
- Summer days
- Number of households
- Household size
- Age of the household
- Income
- Education
- Region
- Ventilation
- "comfortable temperature"
- Environmental awareness
- Altitude

Examples of savings - Hydraulic balance, percentage of buildings

Impact of climate change – climate adaption

- Loss of power by river cooled power plants in the summer months
- Electricity consumption is shifting in the summer months
- Air cooling demand increases strongly
- Extreme weather events will increase (rainfall, drought, wind, ...)
- Provide of biomass-based renewable energy can change

Parameters: cooling and heat market

- Risk of exceeding max. 0.2%
- Design according to DIN 4710, in terms of absolute values, remain valid (DH-Connecting load)
- The annual output will change (+, cooling, - heating)
- Smoothing of the annual load duration curve is expected at a lower level
- Reduction of heat demand by about 1 - 1.5% /a (depending on region)
- Air cooling demand increases strongly
- Minor effects on the interpretation of data on heating and cooling load

Examples of savings - Hydraulic balance, percentage of buildings

Energy Consumption - Structure

Private household

Influence quantity:
- Building type
- Year of construction
- State of refurbishment
- Thermal insulation
- Heating system
- Energy source
- Mean annual temperature
- Days of frost in annual average
- Summer days
- Number of households
- Household size
- Age of the household
- Income
- Education
- Region
- Ventilation
- "comfortable temperature"
- Environmental awareness
- Altitude

Examples of savings - Hydraulic balance, percentage of buildings

Impact of climate change – climate adaption

- Loss of power by river cooled power plants in the summer months
- Electricity consumption is shifting in the summer months
- Air cooling demand increases strongly
- Extreme weather events will increase (rainfall, drought, wind, ...)
- Provide of biomass-based renewable energy can change

Parameters: cooling and heat market

- Risk of exceeding max. 0.2%
- Design according to DIN 4710, in terms of absolute values, remain valid (DH-Connecting load)
- The annual output will change (+, cooling, - heating)
- Smoothing of the annual load duration curve is expected at a lower level
- Reduction of heat demand by about 1 - 1.5% /a (depending on region)
- Air cooling demand increases strongly
- Minor effects on the interpretation of data on heating and cooling load
Storage characteristics – Example: Hot water

Storage: Gravel-water
Storage volume: 8,000 m³
Start of operation: 2000

Supplement system parameters:
Solar absorber surface
540 m² total heat demand from vacuum tube heating system:
- First Phase: 573 MWh / a
Useful heat delivery solar system:
- First Phase: 169 MWh / a
Solar fraction: 1 Phase: 30% /
Cost solar system: 1./2. + Construction Phase: 1.4 million €
Solar thermal costs: 1./ 2. + Construction Phase: € 24-cents / kWh

Quelle: AGFW/IER/M.Blesl

Thank you for your attention
Dipl.-Ing. Dipl.-Wirtsch.-Ing. Harald Rapp
You will find the presentation:
http://www.agfw.de/stadtentwicklung/vortraege/
For more information please contact:
AGFW | Der Energieeffizienzverband für Wärme, Kälte und KWK e. V.
Stresemannallee 28
60596 Frankfurt/Main
Tel.: +49 69 6304-418
Fax: +49 69 6304-391
E-Mail: h.rapp@agfw.de
Internet: http://www.agfw.de