Visit of Euroheat & Power
Goals of the city of Aachen

- The City of Aachen is Member of the Convent of the Mayors, the Climate Alliance and awarded with European Energy Award in Gold
- follows the climate protection goals:
  - reduction of CO$_2$-emissions 40 % up to 2020 (base 1990) - 2013 18 % were reached
  - 20 % less energy use up to 2020
  - 40% renewable energies in electricity generation.
Milestones

- Energy supply concept, 1991 (311 million kWh heating requirements were covered by district heating grid supply)
- 1993 wind potential map
- District heating grid, connection municipal buildings since 1995
- Wind potential map 1993, windpark 1997-2001 (9 plants, total 15.5 MW)
- CO₂-reduction concept with concrete calculations of necessary investments (~340 Mio €) to achieve the goals of the Climate Alliance of European Cities, 1998 – 2000
- Solar cadastre 2011
- CHP extension concept 2014
- ...
Distribution of final energy consumption in Aachen

- Heat production: 47% of energy consumption
- Fuels: 30% of energy consumption
- Electricity: 16.5% of energy consumption

Breakdown of energy consumption:
- Fuel wood: 29.7%
- Renewable energies: 35.0%
- Coal: 16.5%
- Other: 4.7%
- District heating: 4.7%
- Natural gas: 4.5%
- Oil: 0.2%
- Electricity (renewable): 0.6%
- Electricity (fossil): 0.2%
CO₂ emissions

* LCA – Life-Cycle-Assessment Method
Overview: trends on grid based energy

- The consumption of natural gas (all sectors) is sinking continuously; since 1994 about 25%.
- The consumption of electricity (all sectors) is sinking continuously about 0.5% a year.
- District heating growing from 230 GWh (1995) to on average of 330 GWh (2012)
Renewable Energy

- the network supply from regenerative energies was 61 million kWh,
- Share of 5% of ~1300 million kWh in total

- in detail
  - 28 million kWh from wind power plants (2.2%)
  - 15.7 million kWh from photovoltaic plants (1%)
  - 18.4 million kWh from biogas CHP (combined heat and power plant) (1.4%)
  - 1.3 million kWh from hydroelectric installations (0.1%)

*Additional 60 GWh STAWAG outside Aachen*
Wind Energy

- Existing Power plants
  - 9 plants (1.5-1.8 Megawatt)
  - 2 plants (500kW + 80kW)
  - Installed capacity 16.7 Megawatt
  - Net supply ≈27 Mio. kWh/a

- In planning process
  11 power plants Münsterwald and Vetschau
  Net supply ≈ 80 Mio. kWh/a

- CO₂-reduction: ≈ 57,000 tons (2% of yearly emissions)
  - ≈30% of electricity needs of houses holds
  - 8% of electricity demand all in all
Solar roof cadaster Aachen

- www.aachen.de/solarkataster
- → to mobilize owners of houses
- Different colours for different suitability levels

<table>
<thead>
<tr>
<th>Potencial for solar energy use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very well suited</td>
</tr>
<tr>
<td>Well-suited</td>
</tr>
<tr>
<td>suitable</td>
</tr>
<tr>
<td>Not suitable</td>
</tr>
</tbody>
</table>

Solarpotenzial Wärmeerzeugung

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Very well suited</td>
</tr>
<tr>
<td>Not suitable</td>
</tr>
</tbody>
</table>
EUropean cities serving as Green Urban Gate towards Leadership in sustainable Energy

7th Research Framework Programme: Demonstration of nearly Zero Carbon Building Renovation for cities and districts

Wien(AT) – Aachen(DE) – Tampere(FI) – Bratislava(SK) – Mailand(IT) – Sestao (ES) + assoc. Gaziantep (TR) und Göteborg(SE)
Project funding 2013 - 2017

Aachen: 400 housings
40,000 square meter of housing space
2,8 Mio. Euro

Energy savings 65%
• Various constructural concepts for energy solutions
• saving goals: heat 25,6 GWh/a and
• electricity 2,5 GWh/a

6 cities: 227,000 square meter
16,8 Mio. Euro

Average Primary energy saving: 45 – 82%
Increasing renewable energy contribution 25% in compared to 2011
Pilot Aachen - smart district Aachen North

A_res_BEST No 2 + 3

A_res_BEST No 6 + 7

A_res_BEST No 4 + 5

A_res_BEST No 1
Pilot Aachen

On 09.09.2013 we started EU-GUGLE with a press conference.

Partners in Aachen:

City of Aachen
Gewoge
STAWAG municipal utility
# Overview

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Part of the Model Site</th>
<th>Conditioned Gross Area In m²</th>
<th>Number of Buildings</th>
<th>Number of Dwellings</th>
<th>Goal Primary Energy Saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wiesental</td>
<td>4.584</td>
<td>2</td>
<td>59</td>
<td>77 %</td>
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<tr>
<td>2</td>
<td>Joseph-von-Görres-Straße</td>
<td>20.310</td>
<td>21</td>
<td>197</td>
<td>78 %</td>
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<tr>
<td>3</td>
<td>Burggrafen-/Jülicher Straße</td>
<td>5.366</td>
<td>9</td>
<td>45</td>
<td>85 %</td>
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<tr>
<td>4</td>
<td>Hein-Janssen-/Reimann-/Sigmundstraße</td>
<td>11.428</td>
<td>12</td>
<td>90</td>
<td>85 %</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>41.688</td>
<td>44</td>
<td>391</td>
<td>81 %</td>
</tr>
</tbody>
</table>
Constructural measures

- High thermal insulation of roofs, cellar ceilings, partly facades
- New erected parts of the buildings with highest requirements on energy efficiency and solar energy gains
- Refurbishment of windows
- Innovative heat distribution and demand regulation
- Central water heating systems, with demand site regulation per flat
energy technics and supply

- heat recovery from the sewage network for small district heating with decentralized heat pumps
- District heating systems in an other part
- Air conditioning with heat recovery from the waste air
- Solarthermal plants for tap water heating
- LED-lighting
- Lighting controlled by motion
- PV-plants
organisatorical measures

- Transparency of consumption for tenants
- Controlling energy consumption, smart meters
- Cooperation / involvement of tenants
- Development of an incentive system such as "energy efficiency rent" (device configuration)
- Analysis of user behavior
- Examination of municipal benefit
- Consultation and communication activities
Josef von Görres Straße – 20.310 m²

- Listed buildings (settlement), construction 1923 – challenge for thermal insulation measures
- Presence detectors for house lighting
- Energy control systems to visualize the energy use for the users. Development of “energy efficient rental fees”
- Alternatives have been analysed: heat pumps with heat from the sewage network, district heating combined with solarthermal use or cogeneration plant
- Sensors to regulate the humidity (combined with the air ventilation and heat recovery)
Listed buildings from the 1923
• New windows are partly installed.
• Insulation of the attic floor is partly finished.
• Insulation of the basement ceiling has started.
• New heating system is not yet decided.
New windows are partly installed.
Insulation of the attic floor is partly finished.
Insulation of the basement ceiling has started.
Jülicher- / Burggrafenstraße – 5.366 m²

- Listed buildings, from the 20th no central heating now
- Thermal insulation at the facade (backside) with prefabricated attached glasshouses, expanding dwelling space and improving the energy efficiency
- Suitable insulation measures for the special demand of listed buildings
- Best energy supply system will be chosen
- Energy control systems helping saving energy
Reimann / Sigmund-Straße – 11,428 m²

- Listed buildings from the 30th
- No central heating now
- All measures to improve the energy efficiency performance up to the prescriptive energy efficiency values.
- District heating system.
- Innovative systems for energy use control (smart meter, intelligent heat control thermostat).
- The roofs of the buildings will be checked on their eligibility for photovoltaic installation.
Listed buildings from the 30th
• New windows are installed.
• Insulation under the screed in the ground floor is partly finished.
• Insulation of the attic floor has not yet started.

Connection to district heating system currently being installed:
Work in the flats
Concept **Wiesental** – 4.584 m²

- Buildings from the 70th
- Energetic retrofitting all measure facades, windows, roof, cellar, heating system,
- Heat recovery from the public sewage network, low ex heat network, decentralised heat pumps – monovalent operation, heat recovery from ventilation air,
- Adapted new heat distribution system
- Tap water heating units (just bringing it up to the needed temperature) per flat.
- Energy control systems to visualize the energy use for the users.
- User behaviour will be analysed and motivating concepts developed.
Wiesental 17-23 - A_res_BEST No 1

Buildings from the 70th
- Retrofitting facade started.
- On the front, balconies were removed.
- Windows are changed currently.
- Installation of the heating system in the street has started.
- Change of heating system in the house will start in october.
- Insulation of the attic floor and the basement ceiling will start later.
Wiesental 25-29 - A_res_BEST No 1

- On the front, balconies were removed.
- Windows are already changed.
- Insulation of the facade has started.
- Insulation of the attic floor and the basement ceiling will start later.
- Change of heating system in the house will start in October.
Heat recovery from sewage network

Site plan of the Low ex network
First version and refined concept
Heat pumps Site plan of the Lowex network

Some technical data

Heights and width of the sewage channel: 3200 mm / 2550 mm

Average (year) temperature of sewage water: 14 °C

Heat capacity of the heat source sewage water: 380 kW

Additional: heat recovery from the ventilation system

Heat pumps (all): 530 kW

Monovalent
Thank you for your attention!
Energy recovery renovation of old buildings

- Advisory centre “altbau plus”
- Initial advice: Basic advice on constructional and heating possibilities,
- cost-saving possibilities
- Financial support programmes
- Events, promotions
- Contributions to regional events
- Professional events

www.altbauplus.de

In english:
http://www.aachen.de/de/stadt_buerger/planen_bauen/themen/altbauplus/7service/altbauplus_englisch.pdf

78 % of the buildings are over 25 years old
Municipal buildings

- Use district heating
- Monitoring [www.eview-aachen.de](http://www.eview-aachen.de)
- High energetic standard (Passivhaus)
- Renewables
  - 55 PV-systems, 1682 kWp, 6% of energy use
Monitoring of municipal buildings

- www.eview-aachen.de
- consumption of energy, water, waste
- CO₂ emissions

166 buildings, 1006 meters
Sonnenenergie-Nutzung

Anlagenbestand

- Über 1100 registrierte PV-Anlagen (2013)
- Installierte Leistung 17595kWp
- Netzeinspeisung ca. 15,66 Mio. kWh
- ca. 1600 solarthermische Anlagen, 6 GWh

Ausbau-Potenzial lt. Solarkataster

- Dachflächen für 833 GWh Strom
- Davon ein Drittel erschließbar → 160.000 Tonnen CO₂-Red. möglich
- Ziel bis 2020: 20.000 Tonnen mobilisieren mittels PV + 3100 t mittels Solarthermie
City of Aachen – solar electricity

- more than 1000 plants (2012)
- installed capacity about 16.500 kWp
- 13.5 million kWh network supply
- local potential 350 GWh
- about 20% of local electricity requirement!
### Pilot Meetings, tenants involvement

<table>
<thead>
<tr>
<th>Working Group tenants participation</th>
<th>Events</th>
<th>Date</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-12-13</td>
<td>Tenants meeting (Best sheet 6)</td>
<td>04-06-13</td>
<td>25</td>
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<tr>
<td>29-01-13</td>
<td>Meeting Stakeholder: Lessons learnt from Neighbours</td>
<td>07-11-14</td>
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<td>06-03-14</td>
<td>Tenants meeting (Best sheet 2)</td>
<td>06-02-14</td>
<td>100-120</td>
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<td>08-04-14</td>
<td>Steering Group Aachen-Nord Consultation Smart Meter</td>
<td>11-02-14</td>
<td>20</td>
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<tr>
<td>04-06-14</td>
<td>(Workshop WP 1.4.2)</td>
<td>02-04-14</td>
<td>25</td>
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<td>09-07-14</td>
<td>Stakeholder information Rehmviertel</td>
<td>10-06-14</td>
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<td>Tenants meeting (Best sheet 1)</td>
<td>10-07-14</td>
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<td>Tenants event</td>
<td>23-08-14</td>
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<td></td>
<td>Press conference</td>
<td>09-09-13/21-08-14</td>
<td>12</td>
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</tbody>
</table>
About gewoge

- gewoge AG, established in 1891 by private citizens, since 1941 main stockholder the city of Aachen, is the largest residential property management company in Aachen.
- This tradition leads to a special commitment to providing residential accommodation for low income tenants.
- Own about 4,700 flats and manage with full-services 2,700 flats of municipal housing stock.
- gewoge AG is aiming on energy efficiency, social subsidy programs for parts of Aachen, is involved in the City of Aachen's residential action plan and apartments for senior citizens, students and multi-generational living.

Person involved in EU-GUGLE:

Frank Adolphs, CTO
Ulrike Greiner-Lövenich