Gas- und Wärme-
Institut Essen e.V.

100 KWK-Anlagen
in Bottrop

100 micro-CHP, Bottrop
project, experiences and results

Copenhagen, 18th of September 2014

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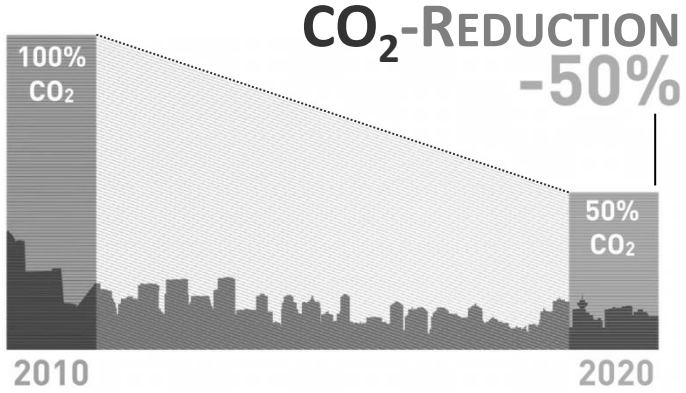
Gas- und Wärme Institut Essen e. V.

- Legal status:
  non-profit association
- Founded 1937 by the gas industry
- 62 members companies
- 63 employees
- Departments
  - Research and Development
    - **Fuel and Appliance Technology**
    - Industrial Combustion Technology
  - Testing Laboratory
  - Training and Consulting Centre

Innovation City Ruhr - Bottrop

InnovationCity Ruhr - Bottrop

- Pilot project
- Representative city within the Ruhrgebiet
- 70.000 inhabitants
- Transferability of results
- Strongly supported by the citizens



Map adapted from
http://www.osnabrueck.de/images_design/Grafiken_Inhalt_Tourismus_Freizeit/Deutschland_karte.gif

From laboratory to implementation

Technology transfer to a monitored demonstration stage

DVGW Die DVGW-Innovationsoffensive. www.dvgw-innovation.de

Laboratory experiments

Application oriented experiments in the GWI demonstration house

TRANSFER

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IMPLEMENTATION

InnovationCity Ruhr Modellstadt Bottrop

INCREASING TECHNOLOGY READINESS

Focus on:

The transferability of results

→ Deduction of recommendations for market access

- In InnovationCity, **buildings with different structure** (size, age, heat demand,…) were selected
- **100 micro CHP units were installed**
- Automatic monitoring of operating parameters via GSM
- Analysis of two heating seasons

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IMPLEMENTATION

InnovationCity Ruhr
Modellstadt Bottrop

Technology | portfolio of CHP units

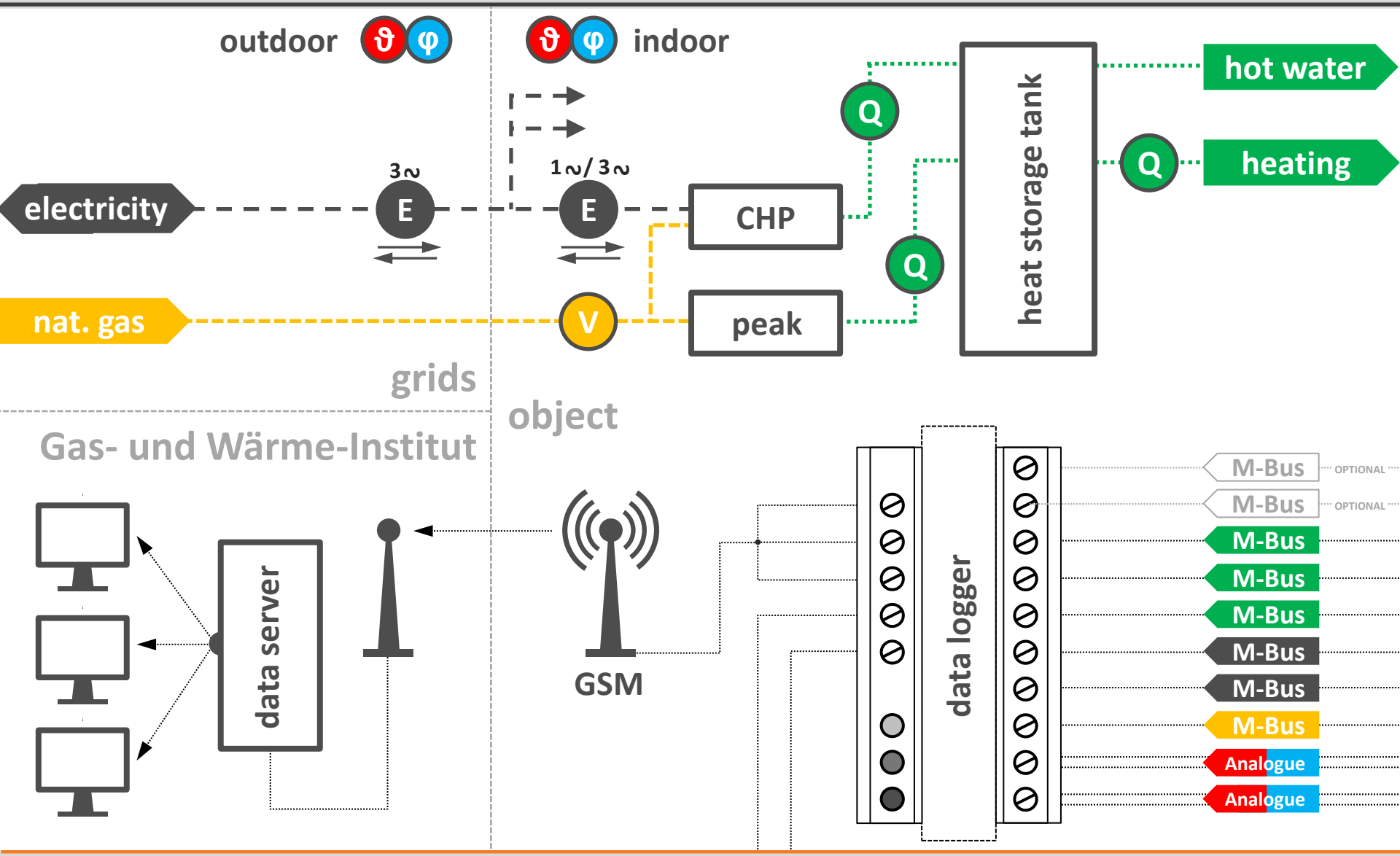
In InnovationCity different micro CHP systems by different manufacturers were installed

- Europe-wide tendering with the goal to achieve a broad technology portfolio
- Selected systems **include heat storage and peak load burner**

Pcs.	System	Technology	kW_{el}	$kW_{th,\ CHP}$	η_{el}
20	Brötje EcoGen WGS 20.1	Stirling	1,0	5,0	17,6
14	Viessmann Vitotwin 300-W	Stirling	1,0	5,3	17,0
6	Viessmann Vitotwin 350-F	Stirling	1,0	5,3	17,0
36	Vaillant ecoPower 1.0	Otto	1,0	2,5	26,3
12	Vaillant ecoPower 4.7	Otto	4,7	12,5	24,6
10	CFCL BlueGen	SOFC	1,5	0,5	60,0
2	CFCL BlueGen Beta 2	SOFC	1,5	0,5	60,0

source: manufacturer specifications

Measurement instrumentation | Data flow *(ecoPower 1.0)*



The system assignment is based on an automated logic as far as possible.
Some exclusion criteria and typical workarounds are listed below

- Insufficient **access** to the installation location
  - ➢ Doors must enable a feasible transport of the buffer storage
  - ✓ In **many** buildings the door widths have been increased by the applicants
- Insufficient **room height** of installation location
  - ➢ Room heights must fit the demands of the heat storage tanks
  - ✓ In **some** buildings the room height has been increased accordingly
- Insufficient **space** for installation
- Insufficient dimensioning of chimney
  - ➢ The exhaust gas routing differs from manufacturer to manufacturer and partly need *well* dimensioned chimney cross-selection areas
- Complicated heat distribution lead to increased installation costs

Selected typical experiences and issues that occurred during installation

- **Rarely**
  - Increased noise emissions due to inaccurate acoustic decoupling
    - ✓ Detection during start-up or by customer feedback
  - CHP control settings incomplete (e.g. CHP system deactivated)
    - ✓ Issues can be detected very fast by analysing the monitored data
- **Very rarely**
  - Challenge to guarantee hot water and heat supply during installation in the heating period (installation between 1 - 5 working days)
    - ✓ Small bridgeable decentralised hot water supply system
- **Common positive feedback**
  - Installers: *The installation of the different micro CHP systems differs partly to conventional heating systems, but presents no problems*
    - ✓ Manufacturer specific trainings had been prerequisite for each installer

The system registration and the corresponding regulatory framework has been identified as one of the main obstacles in Germany

- Delivery of forms for different recipients
  - Notification to the local network operator to provide electricity
  - Electronic notification procedure of the BAFA *(Federal Office of Economics and Export Control)*
  - Notification of decentralised generation of electric energy to receive the proceeds
  - ✓ Customer service: overviews and reminders for required action

Example

- The notification form for the local network operator to feed-in electricity consists of about 20 pages (depending on manufacturer)
  - ✓ Customer service: pre-filled and colour highlighted forms including additional data sheets and specific proofs of manufacturer

example | “from coal to natural gas”

object
Object type: twin house
Living area: 160 m²
Year of construction: 1919
inhabitants: 2
Age heating sytem: 24y
Energy supply: 5-6 t coal/a

Installation
CHP system: *Viessmann Vitotwin 300-W*
Installer: *Smit GmbH*
date: March 07, 2014
Notes:

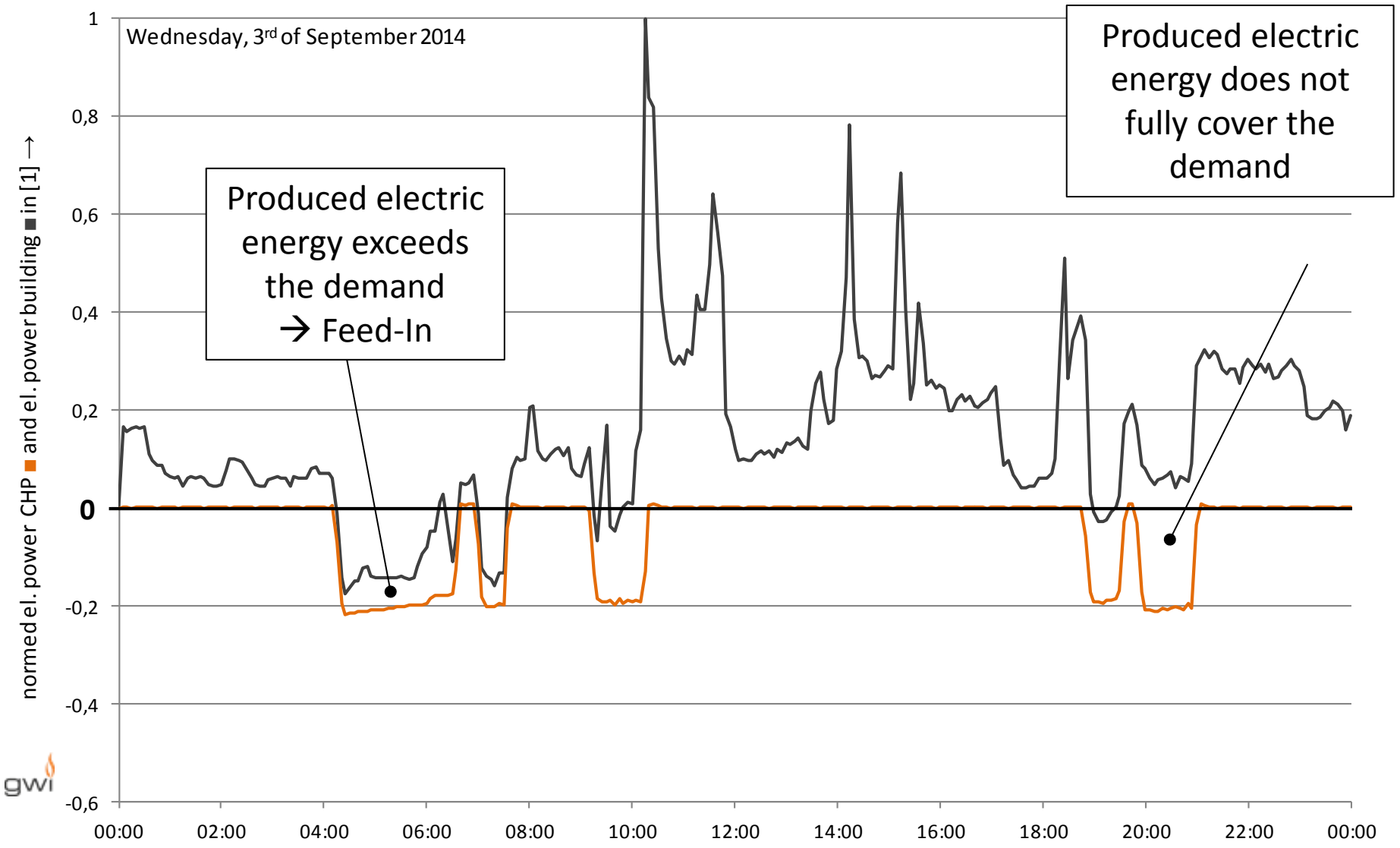
- Usage of the former coal bunker for the installation of the CHP system

Object

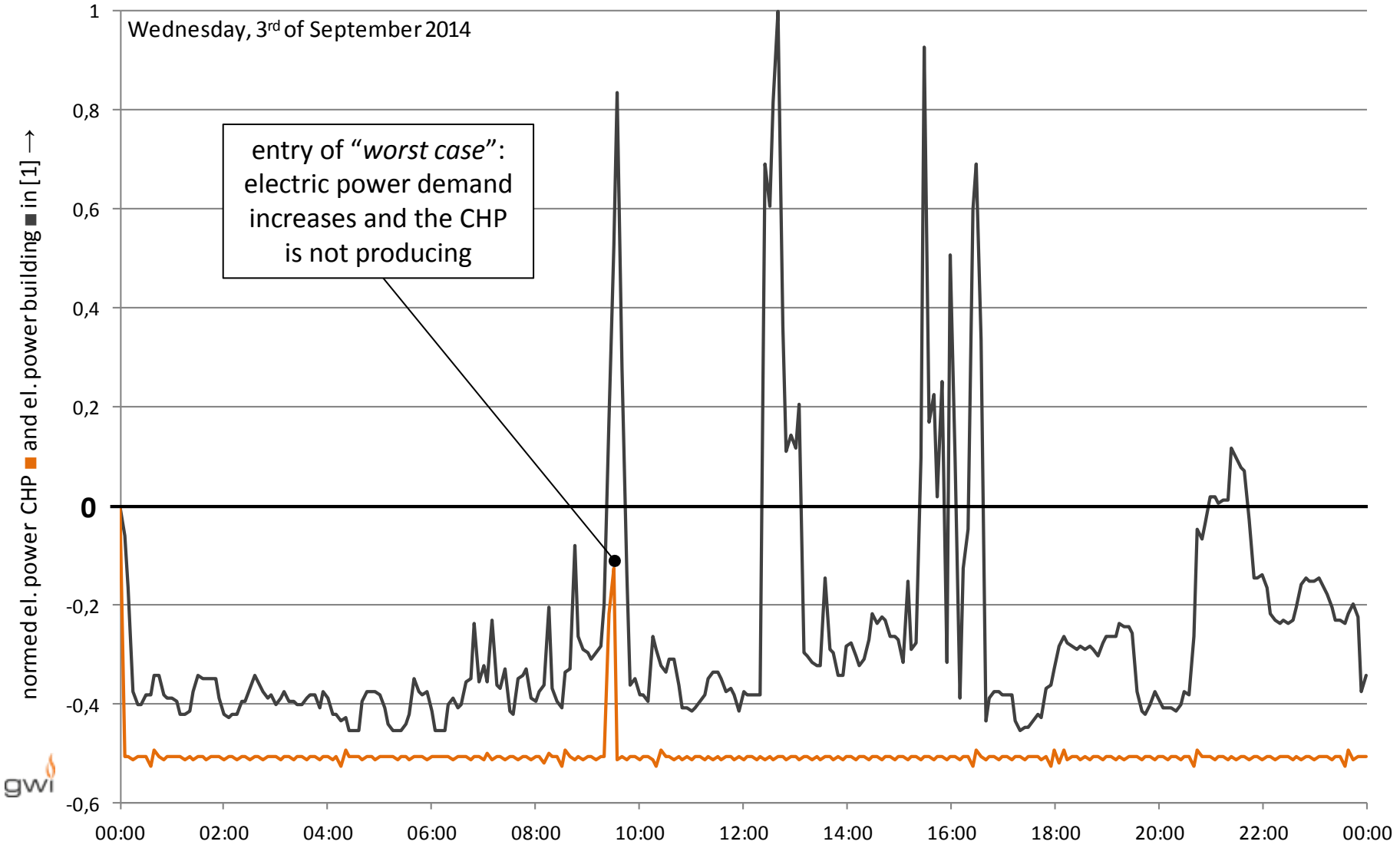
before

after

results | electric power balance | example I



results | electric power balance | example II



Goals and Outlook

The project is ongoing and will be completed in September 2015

Current tasks are

- Capturing a complete heating period as a basis for analysis
- Collect realistic utilisation rates (deduce e.g. CO2 savings)
- System comparisons (Otto, Stirling, Fuel Cell)
- Extension of theoretical models using Modelica
  - Transient simulations of residential areas regarding potentials of CO_2-emission reduction by CHP systems integrated in smart grids

Outcomes

- Energy demand and unit characteristic database
- Optimise the system “CHP + Periphery”
- General statements regarding the potentials of micro CHP units
- Identification of optimisation potentials regarding technical interaction of systems parts on the one hand and non-technical influences (framework) on the other hand
- Economic and ecologic evaluation

➢ For more information please visit: www.100kwk.de

Thank you very much
for your kind attention

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