POTEnT Study Visit – Renewable District Heating „Musikerviertel“ Ettlingen

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SWE Stadtwerke Ettlingen GmbH

STADTWERKE ETTLINGEN

BUSINESS AREAS

Electricity

Gas

Water

Heating

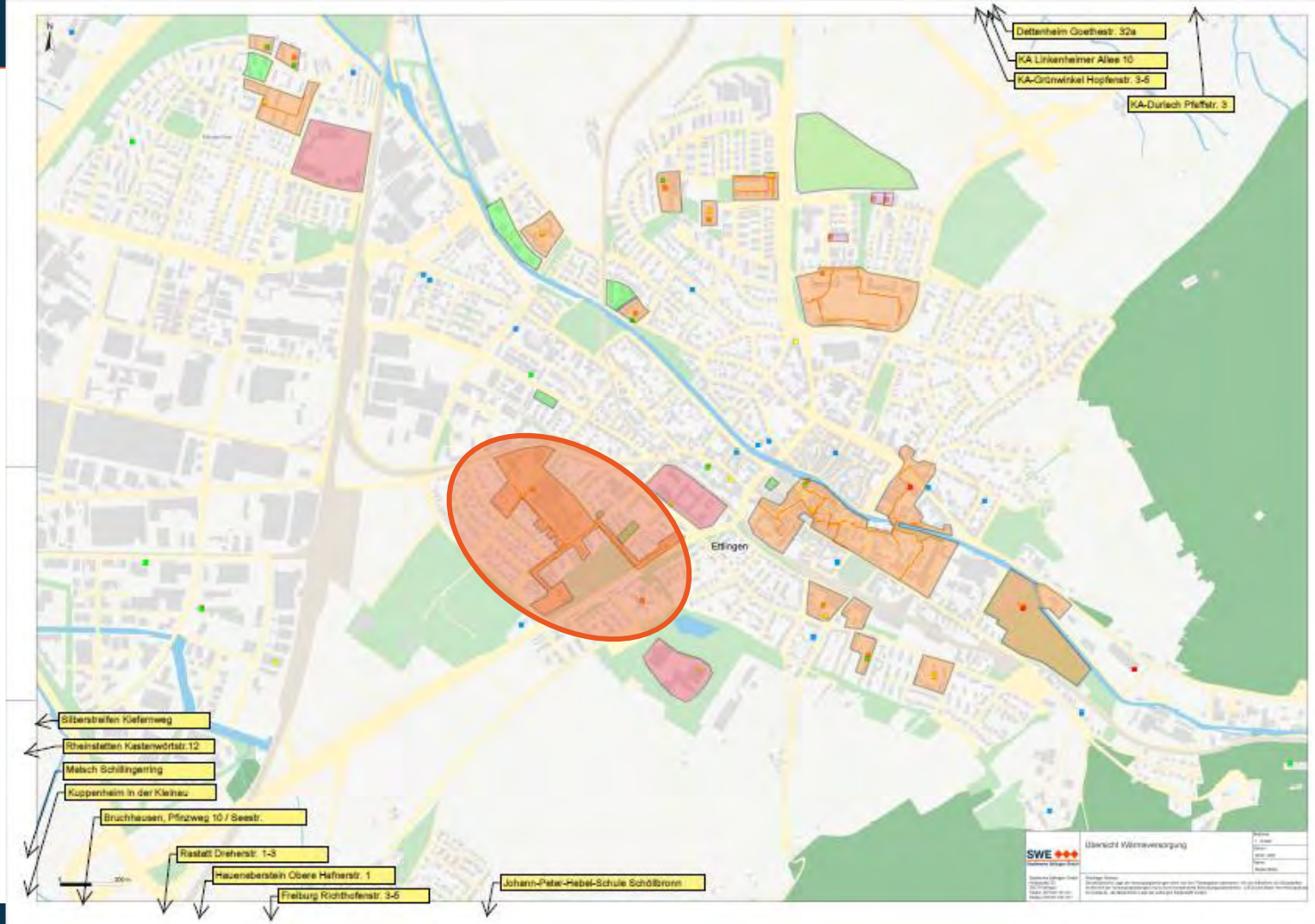
Public Baths

Conference & Event Location

Telecommunication

Energy Services

Heating networks / heat supply areas Ettlingen



RENEWABLE DISTRICT HEATING „MUSIKERVIERTEL“

Project development

INITIAL SITUATION

- **Energetic Building Renovation of „BBZ“ (Karlsruhe County Vocational Education Centre)**
  - BBZ: three vocational schools on a joint campus in the southwest of Ettlingen
  - Nucleus for new DH system; approx. 1/3 of the total heat consumption of the quarter
  - 1 new school building, other buildings to be energetically renovated or rebuilt
- **Other new construction projects in the surrounding area**
  - Stadtbau Ettlingen GmbH, residential multi-family home „Generationenpark“
  - Municipal Kindergarten „Weitblick“
  - ALBA Building Cooperative, new buildings „Rastatter Straße“
- **Existing buildings needing renovation**
  - Familienheim Karlsruhe Building Cooperative: four multifamily residential buidings
  - ALBA Building Cooperative: 8 existing buildings, conversion from individual gas heaters to DH
  - Several multi-family home associations in Schleinkoferstr. are interested to connect to DH when current boiler service life expires

HEAT SUPPLY IN AREA

- **Area developed and built in 1950’s / 60’s**
- **Heating provided largely via existing area-wide natural gas network in the district**

PROJECT DEVELOPMENT

- **→ Conclusion to develop a joint heat energy concept for the area!**
  - Local District Heating system based on renewable energies
- **Stakeholders: customers, concept developers, DH operator …**

Ettlingen · Landkreis Karlsruhe · Stadtbau Ettlingen GmbH · ALBA Baugenossenschaft eG · Familienheim Karlsruhe eG · umwelt- und energieagentur kreis karlsruhe · SWE Stadtwerke Ettlingen GmbH

- **Integration into climate protection plans of city of Ettlingen and Karlsruhe County** eea Klimakonzept Ettlingen
- **Goals:**
  - Heat supply with the highest possible share of renewables => E(E)WärmeG (Renewable Heat Act)
  - Benefits for new and existing buildings
    - Low primary energy factor => easy access to KfW funding
    - Economic alternative to individual heating system, low own investments
  - Contribution to the climate protection targets


Secondary School (WLR)
Heating plant
(Pellets, biogas, storage tank
Ettlingen
Vocational Education
Centre (BBZ)
LANDKREIS
KARLSRUHE
BBZ new building
Solar Thermal Collectors
Multi-family
homes
Multi-family
homes
Multi-family
homes (new built)
ALBA
Baugenossenschaft eG
Private Residences
Renewable
District Heating
„Musikerviertel"
Intergenerational living
home (new built)
Ardensia eG
Wohnen. Zukunft. Wir.
ALBA
Baugenossenschaft eG
Ettlingen
Stadtbau
Ettlingen GmbH
Kindergarten
(new built)
Multi-family
Homes
Supported by:
Federal Ministry
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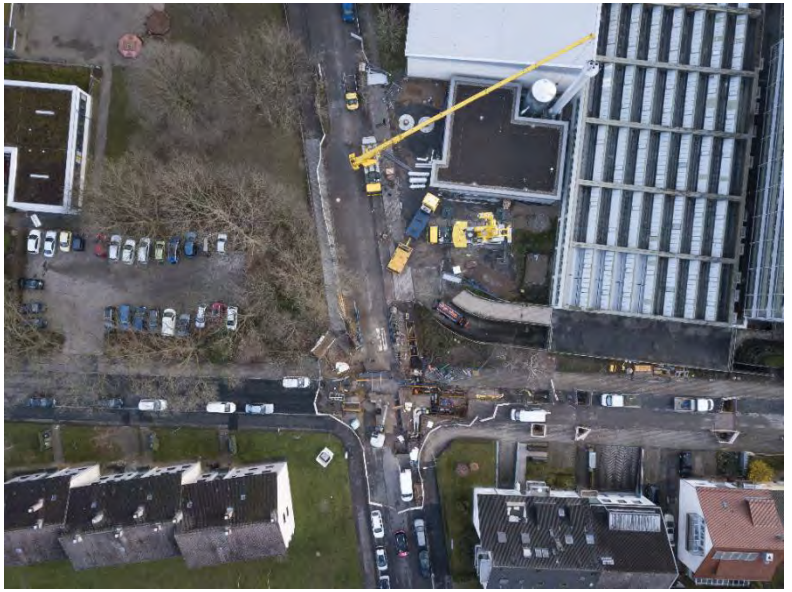
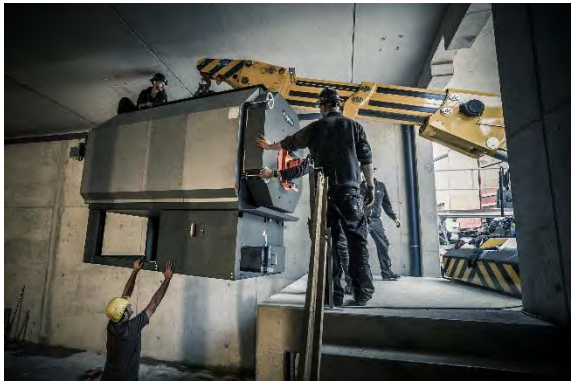
and Nuclear Safety
NATIONAL
CLIMATE
INITIATIVE
based on a decision of the German Bundestag

CONSTRUCTION PROGRESS: HEATING PLANT





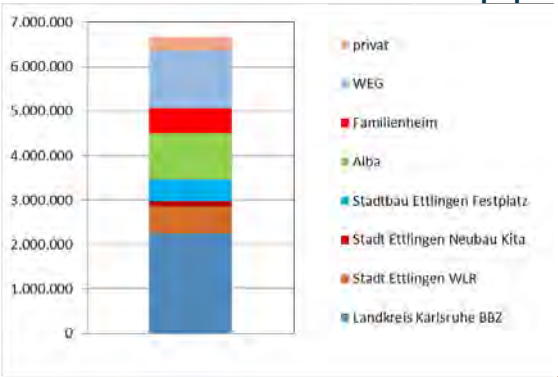
HEAT PRODUCTION: BOILER PLANT, SOLAR THERMAL PLANT

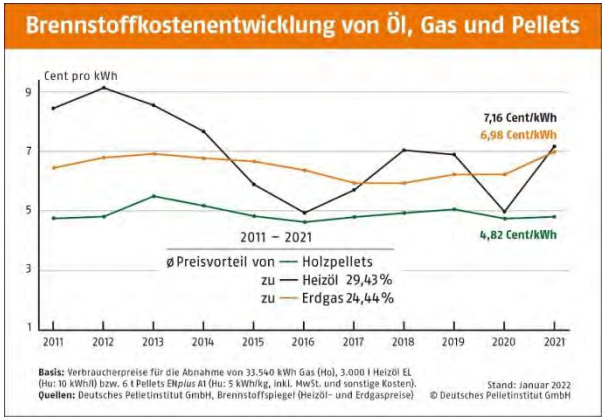
CONSTRUCTION PROGRESS: DH PIPELINES

DISTRICT HEATING SUBSTATIONS

HEAT PRICE – ECONOMIC ASPECTS

- **Three-part heating tariff model:**
  - Energy price (depending on consumption) → fuel cost (wood pellets / biogas)
  - Basic price (depending on heat capacity) → capital and fixed cost
  - Metering price → (metering / billing)
- **Crucial factors for economic operation**
  - Fuel cost → heat price linked to fuel price index
  - Investment cost → public funding
  - **Density** → ratio of heat sales vs. pipeline investment





FUNDING PROGRAMME

- **Funding Programme „Klimaschutz Modellprojekte“**
  - **National Climate Initiative** Funds, provided by Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
  - Funding application filed June 2016, granted April 2017
- **Total investment (*) ~ 5 M EUR**
- **Funding ratio 80% => ~ 4 M EUR**
  - Funding capped to 4 M EUR
  - Own funds contribution of SWE re-financed via heat price
  - Substations included in funding => additional stimulus for heat customers

Supported by:

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and Nuclear Safety

NATIONAL
CLIMATE
INITIATIVE

based on a decision of the German Bundestag

RESULTS

- **Heat production facilities**
  - Solar heating system: Feeding into the grid / heat storage tank; ca. 150 kW
  - 2 x wood pellet boiler 1‘250 kW and 540 kW
  - natural gas peak load boiler 2‘000 kW
- **Heat distribution network**
  - Pipeline route length: approx. 1‘600 m (incl. building connection lines
- **15 building connections and heat substations**
  - all heat substations in operation, including:
    - BBZ (new and existing buildings), Wilhelm Lorenz Secondary School
    - large apartment buildings / housing cooperatives, approx. 210 residential units
    - smaller private multi-family houses, approx. 10 residential units
  - a total of approx. 4’000 kW heat capacity already connected (approx. 65 % of the planned capacity)
  - high customer interest in additional connections => densification, network expansion

CHALLENGES & LESSONS LEARNT

- **Project Development, project funding, cost increase**
  - Managing various (diverging) interests of different stakeholders can be challenging
  - Important to develop a suitable project structure / define roles of parties involved
  - Political support is very important => acquire resolutions in committees (supervisory board, municipal council, county)
  - Fixing of heat price in early stage is risky – helps in customer acquisition, but makes price adjustments difficult in case of unexpected cost increase
- **Planning, permits, procurement procedure**
  - necessity of rescheduling due to cost increases caused by unforeseen difficulties
  - Construction permit took longer than expected => project delay!
  - No bids on first tender for solar thermal plant => project delay!

CHALLENGES & LESSONS LEARNT

- **Construction Phase**
  - difficult ground conditions (contaminated soils, geology, confined space for construction due to many pre-existing pipelines…)
  - other construction projects in the same period require detailed scheduling
  - Avoid/minimise disturbances for residents already troubled by parallel construction projects in the area (road closures, construction noise…)
  - construction delays, esp. pipeline construction, subsoil, joint laying with other pipelines, Corona
- **Investment grant**
  - high funding rate (80%) was great for economic feasibility, but capped grant (max. 4M EUR) resulted in doubled own funding share in case of cost increase
  - high level of planning detail desirable before application

QUESTIONS & ANSWERS

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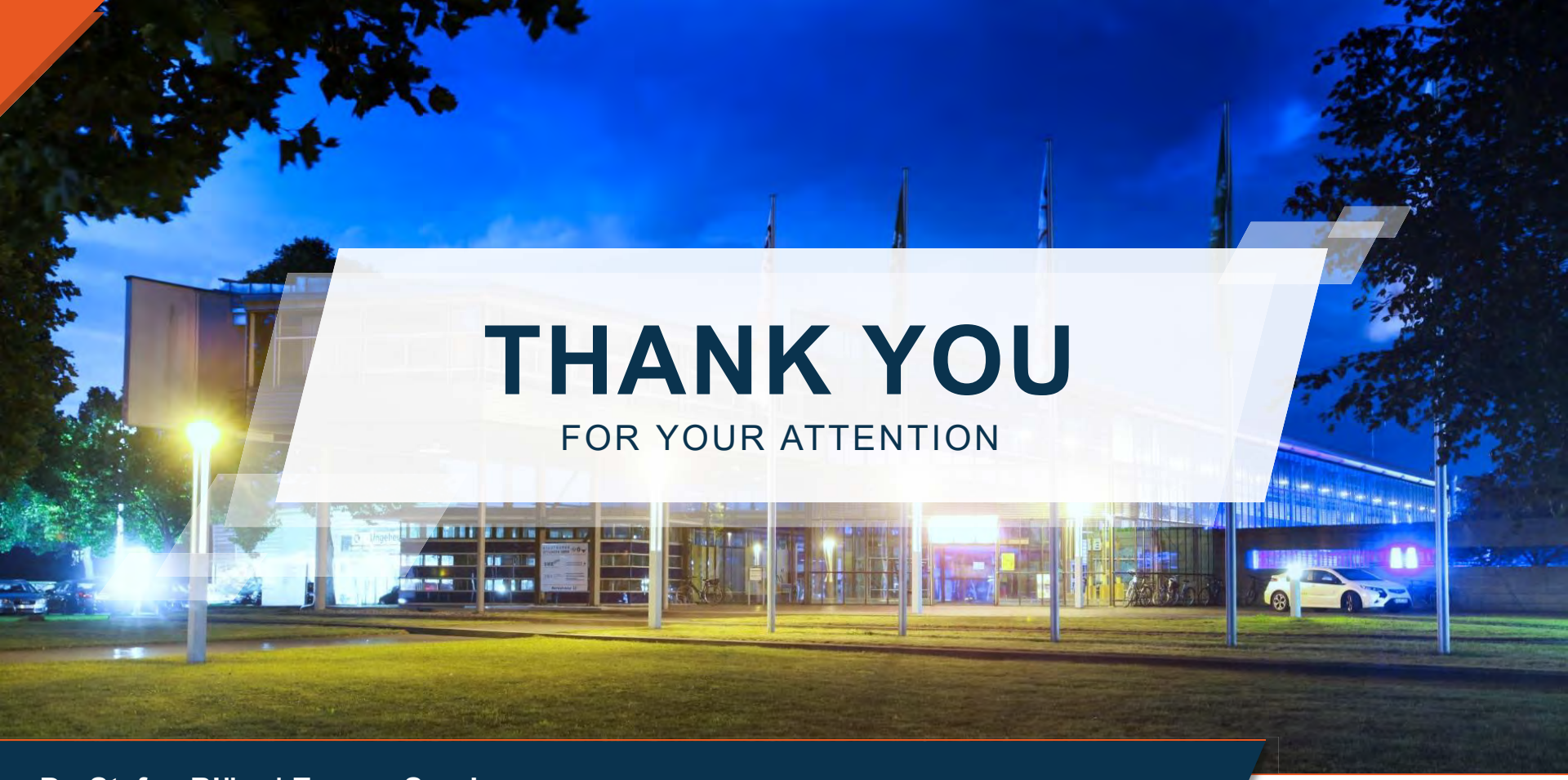
- **Commissioning / start of heat supply**
  - March 2020
- **Compliance with building code (EnEV, EWärmeG) regarding energy efficiency and required renewable heat energy share**
  - Primary Energy Factor approx. 0,4 → high primary energy efficiency standard is easily achievable (→ allows for KfW funding !)
  - Building Energy Law (GEG) requires 15 % share of heat from renewable energies; Musikerviertel DH is 100 % renewable → fulfilled
- **CO_2 emission reduction**
  - reduction of approx. 1’750 tons/year
  - approx. 85 % of pre-project emissions avoided

QUESTIONS & ANSWERS

- **Safety of supply**
  - heat base load in summer by solar thermal system
  - approx. 70 % of the year, one boiler alone is sufficient to cover total heat demand
  - 20 % of the time two boilers are needed (usually the two pellet boilers)
  - approx. 10 % of the time third boiler is required
  - heat distribution with several redundant mains pumps ("N-1" principle)
  - technical life expectancy of pipes approx. 40 years
- **Pipeline heat loss**
  - approx. 10 % of the annual heat production
- **Pellet Consumption / Logistics**
  - Under design load conditions: approx. 1’500 t/a pellet consumption → approx. 60 trucks per year



THANK YOU

FOR YOUR ATTENTION

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