

Round of introductions of the participants – Expectations and Use Cases

1st Joint SIG 3D and OGC Workshop on the CityGML UtilityNetworkADE
Munich, October 13-14, 2016

AIT & CityGML

- AIT: Largest research centre in Austria, 5 Departments, ca. 1260 people
 - Energy department units
 - Smart cities and regions
 - Smart buildings
 - Smart grids
 - Thermal energy systems
 - Complex energy systems
 - Green processes

- CityGML "introduced" in AIT for the first time in 2014
- Active role in modelling Vienna & Geneva in CityGML (+ Energy ADE)
- Active participation in the development of the Energy ADE
 - 5th Energy ADE workshop held in Vienna, May 2016

Relevant projects for UtilityNetwork ADE 1/2

- **CI-ENERGY: Smart Cities with sustainable energy systems**
 - Marie Curie Action, ITN Project, 2013-2017
 - Cities: **Vienna** and **Geneva**
 - <http://www.ci-energy.eu>

- Goal(s): Decision-support platform for urban energy planning
 - Using (also) geo-referenced city data
 - Variable scale: buildings, district, city
 - Model interaction between energy demand, supply, networks and storage

- Main use cases
 - Buildings' energy demand prediction
 - Dynamic building simulation
 - District heating network (co)-simulation
 - Service-oriented infrastructure



Relevant projects for UtilityNetwork ADE 2/2

- **IntegrCiTy: Multi-energy networks in cities**
 - JPI Urban Europe Era-NET Smart Cities project, 2016-2019
 - Cities: **Geneva, Vevey (CH), Stockholm**
 - <http://integrcity.epfl.ch>

- Goal(s): Decision-support environment for planning and integrating multi-energy networks and low-carbon resources in cities
 - Identify synergies among (utility) networks to increase reliability and robustness of energy supply
 - Planning optimisation of infrastructure investments (forecast of future energy demand, avoid oversizing, ...)

- (Main) use cases
 - Multi-network dynamic (co)-simulation
 - Buildings' energy demand prediction



Expectations from the workshop

- Establishment of an active working group, e.g. like with Energy ADE
 - Publish & share resources, experiences, etc.

- Harmonise/recycle existing (possibly) overlapping topics, e.g.
 - Constructions and Materials module in Energy ADE
 - Schedules & Timeseries / Dynamizer ADE
 - ...

- Use/test the UtilityNetwork ADE actively in running projects
 - Feedback for further development
 - Foster further adoption of CityGML in AIT (...& overall in Austria!)

AIT Austrian Institute of Technology

your ingenious partner

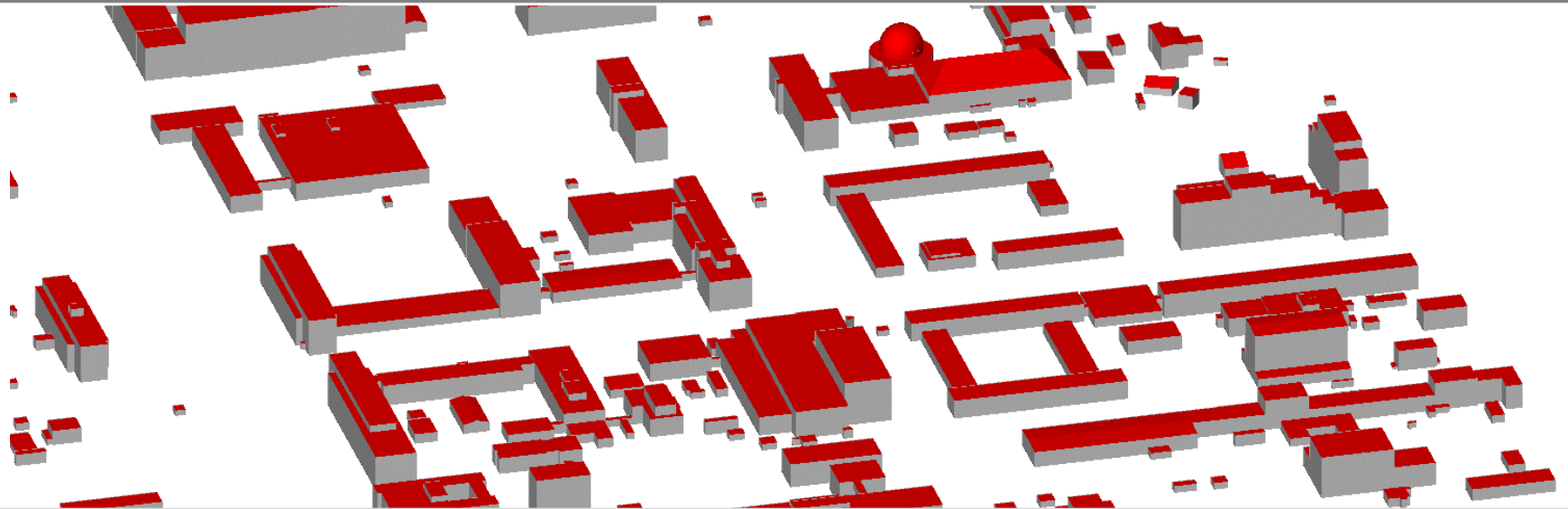
Dr.-Ing. Giorgio Agugiaro
Energy Department
Sustainable Buildings and Cities Unit
AIT - Austrian Institute of Technology GmbH
giorgio.agugiaro@ait.ac.at



UtilityNetworkADE Workshop – KIT perspective

Joachim Benner

Institut für angewandte Informatik

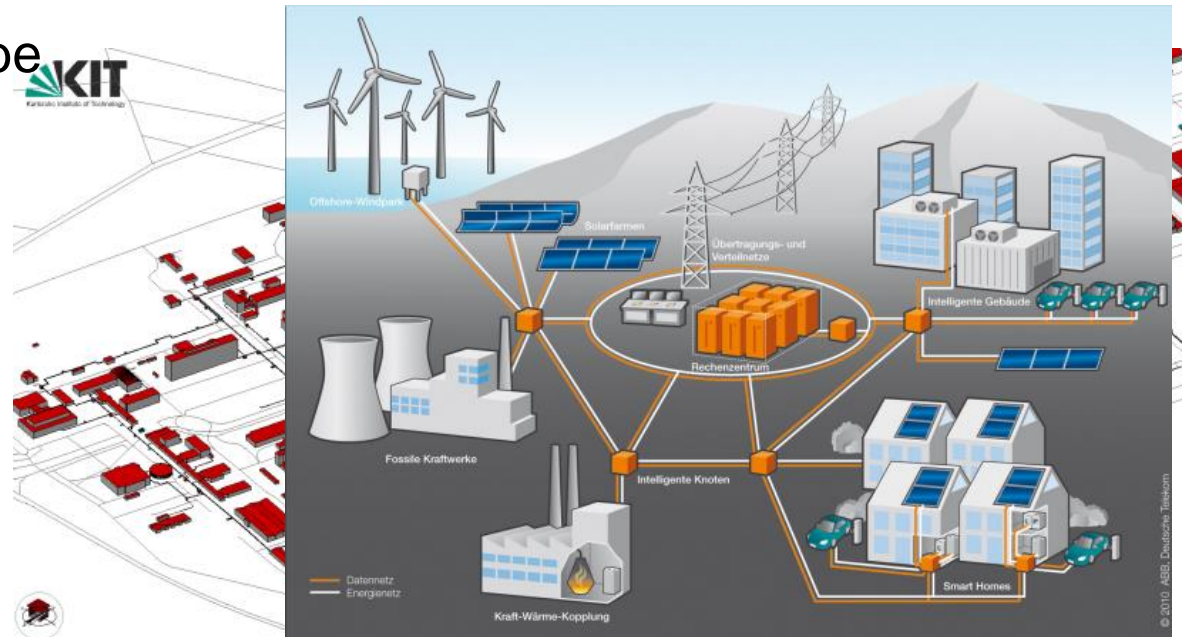


Expectations on workshop results

- Identification of **application areas** and **use-cases**, where a CityGML UtilityNetwork ADE is **needed** or at least seems to be **beneficial**.
- Establishment of a consortium for the further development of the existing UtilityNetwork ADE, consisting of **IT-specialists**, **application domain specialists**, and **software companies**.
 - Testing and evaluation of the data model with **real data** must be integral part of the development
- Identification of those parts of the existing UtilityNetwork ADE which need a technical revision or enhancement.

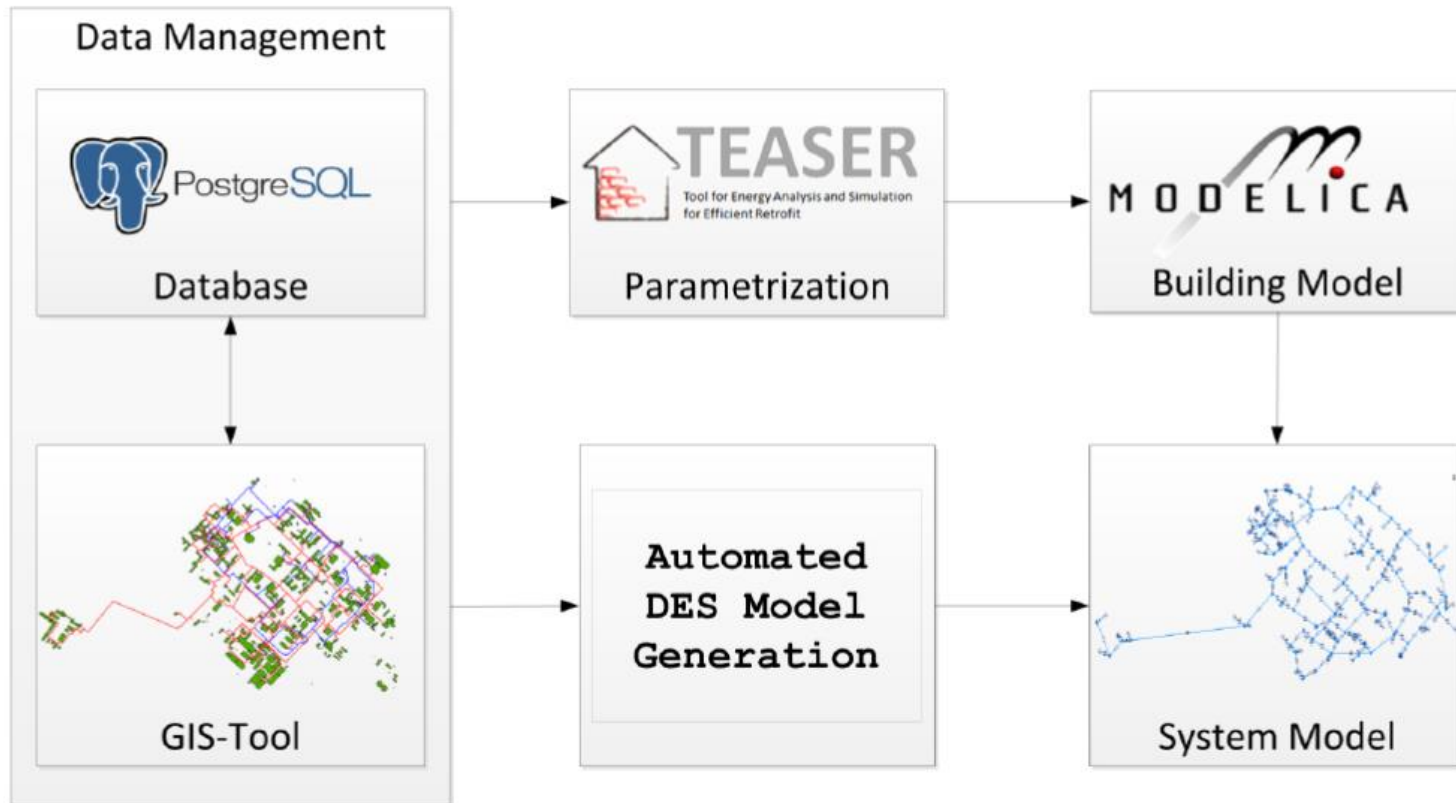
KIT use case: Dynamic simulation of smart energy grids

- Needs detailed data on
 - Energy producers
 - Energy consumers/prosumers
 - Energy storage devices
 - Energy transmission systems (electricity networks, district heating networks)
 - Weather/climate data
- Central test areas will be
 - New KIT Energy Lab
 - KIT Campus North



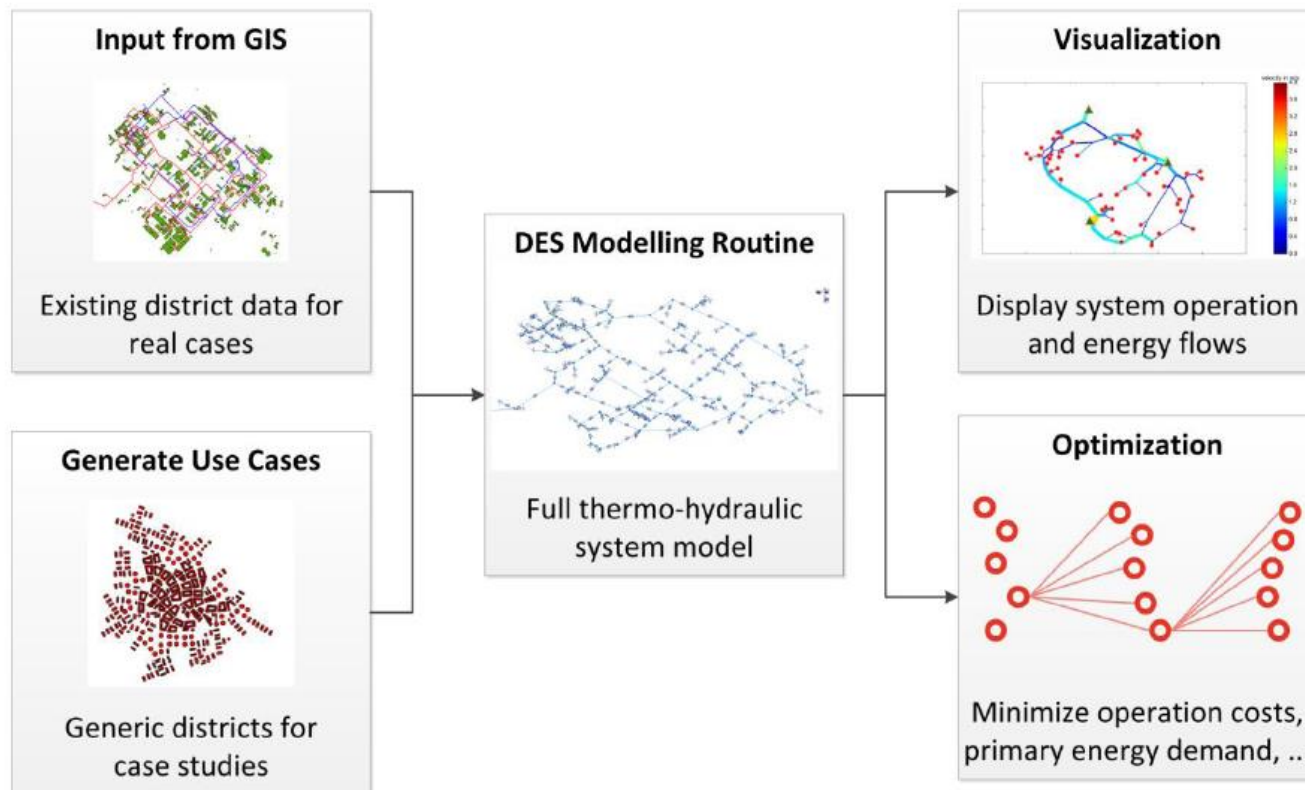
Motivation: Simulation of Urban Energy Systems

- Development of automated model generation for UES from different inputs
- Use of CityGML and Energy ADE for building model generation
- Common data model for district heating and cooling networks would be helpful



Use Case: Automated Model Generation of District Heating Networks

- Use of database/GIS input for model generation
- Python tool to generate Modelica code of district heating and cooling model
- Dynamic system simulation as foundation for visualization and optimization





Integration of industries in the UtilityNetworkADE

AEE INTEC

Wolfgang Glatzl

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Expectations/Interest in CityGML

➤ What we are doing

- ⇒ Energy efficiency and renewable energy in industries and waste water treatment
 - **1st priority: Optimizing within industry entity**
 - **2nd priority: Optimizing wider areas (industrial parks, regions, cities)**



INTERACTION WITH NETWORKS

- **District heat**
- **Gas networks**
- **Electricity grid**
- **Waste water, sewage**

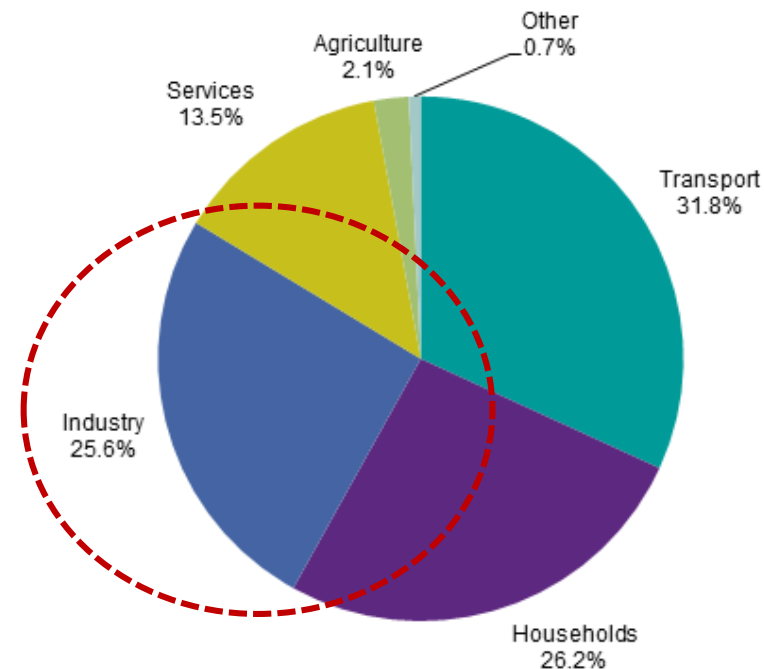
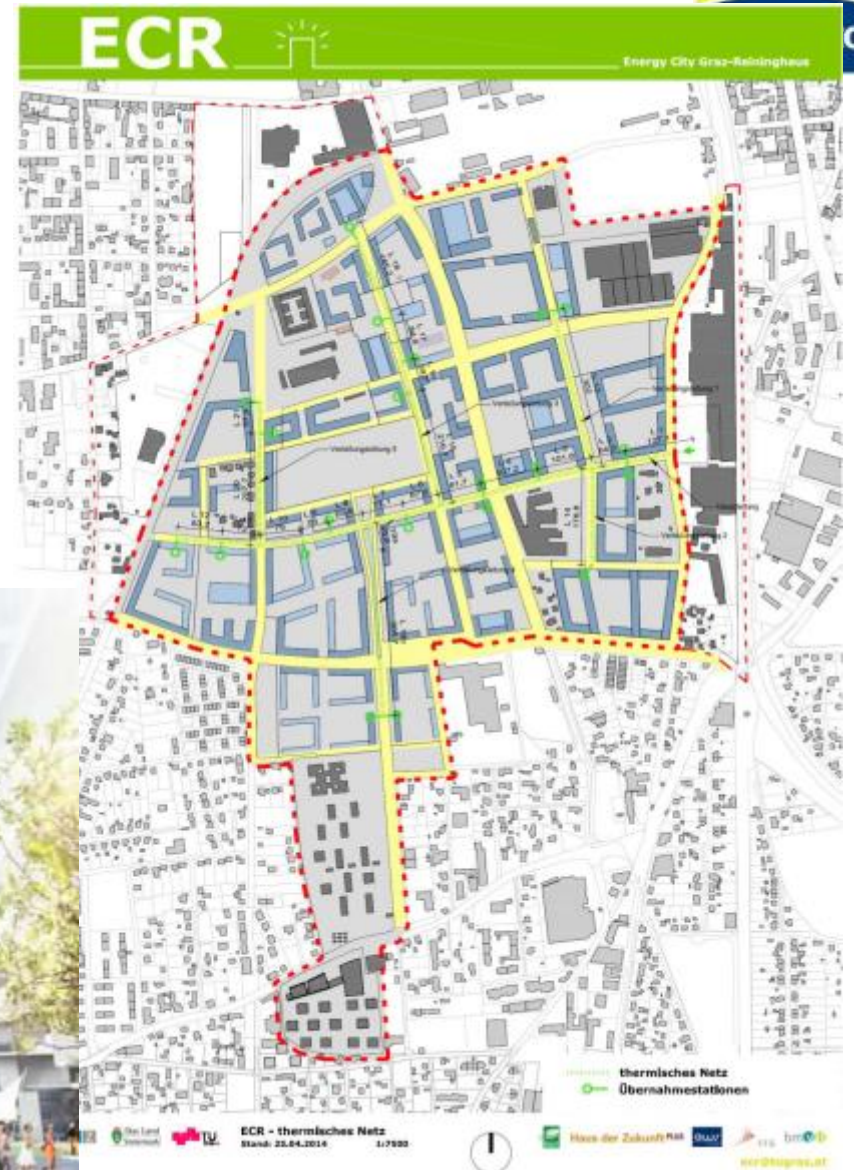


Figure 1: Final energy consumption, EU-28, 2012, Eurostat.

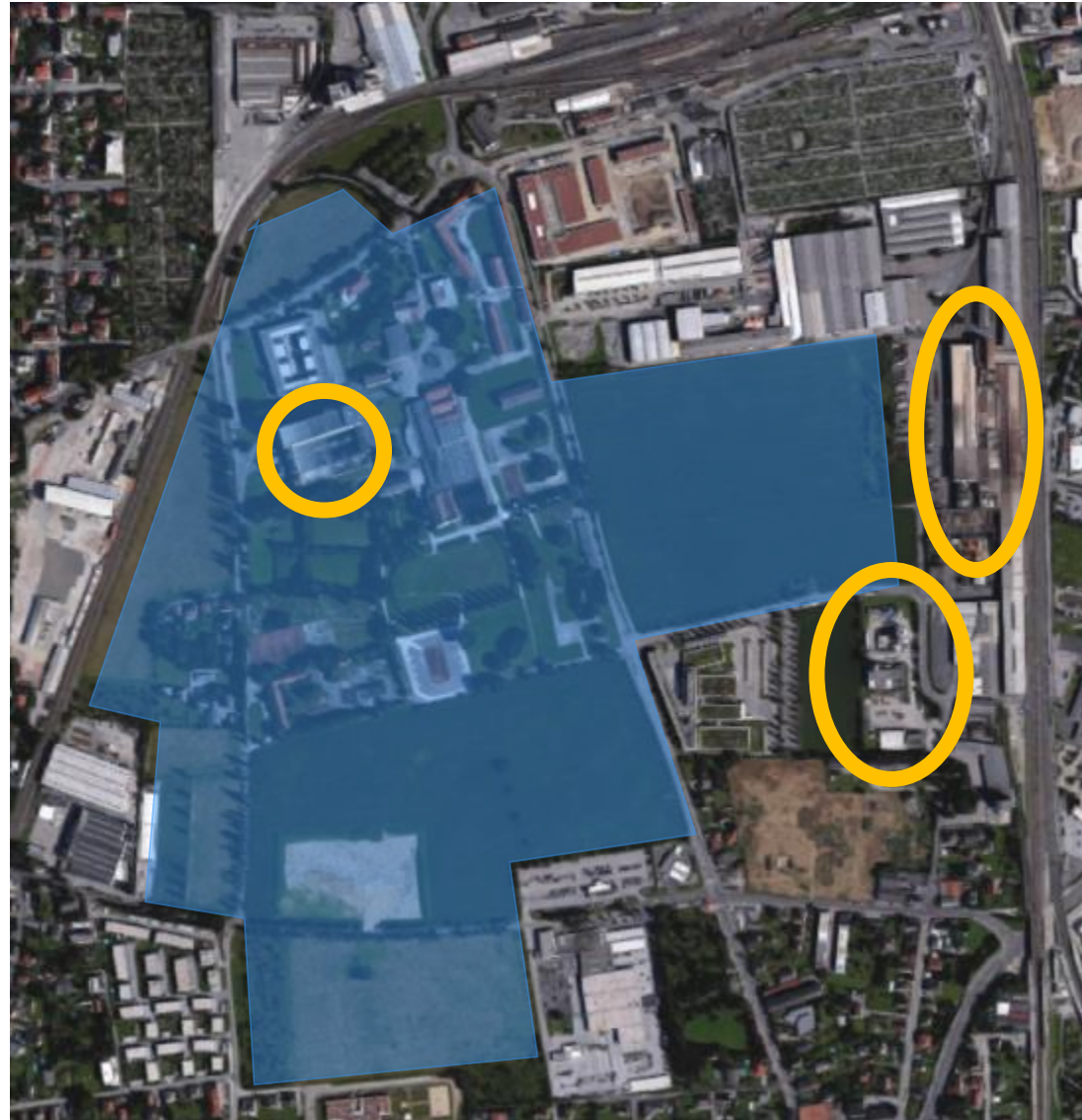
Smart City Reininghaus

- **Graz**
 - ⇒ 2nd biggest city Austria
 - ⇒ 250.000 inhabitants
- **Old industrial area**
- **Residential buildings + 12.000 inhabitants**



Smart City Reininghaus

- **New district heating network**
 - ⇒ Based on industrial waste heat
- **Waste management**
 - ⇒ Solid waste suction (pipelines)
 - ⇒ Biogas reactor for industrial waste water
- **Electricity grid**
 - ⇒ PV integration
 - ⇒ Heat pumps for waste heat

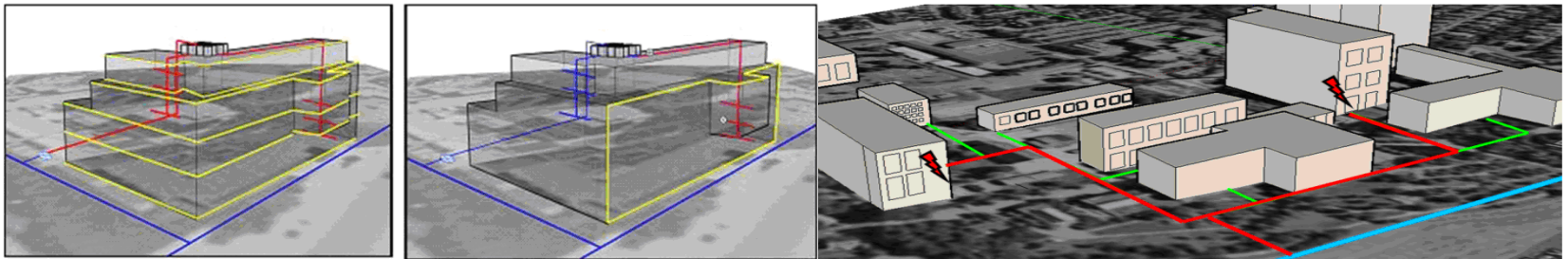


Introduce my self

- ▶ Ihab Hijazi, PhD in Geoinformatics
- ▶ Researcher at Chair of Geoinformatics, at TUM
- ▶ Expectations:
 - One common generic network data model for different use cases
 - Holistic framework link network models to city objects
- ▶ Consider Further issues: Sensors, BIM utilities, and other flows phenomena in the city

Motivation / utilities and built environment

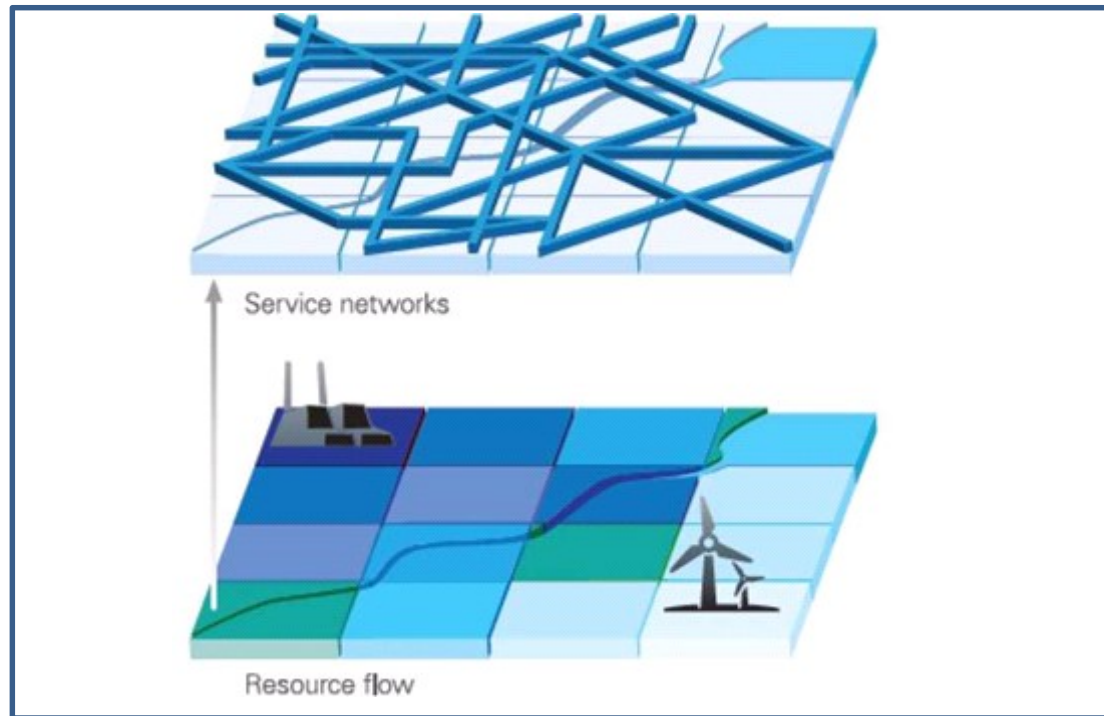
- ▶ Maintenance operations – caused by a failure or planned – in large campus e.g. hospital or University, built environment (train stations, airports).
- ▶ Inspection operation, City regular tests
- ▶ Emergency Operation, Isolate part of utilities in large building.
- ▶ Planning Operations – city scale
- ▶ Currently, facility management make an assumption and generalize the announcement, and some time been unable to provide information to the concerned persons.



Analysis of resource transport networks in urban energy systems

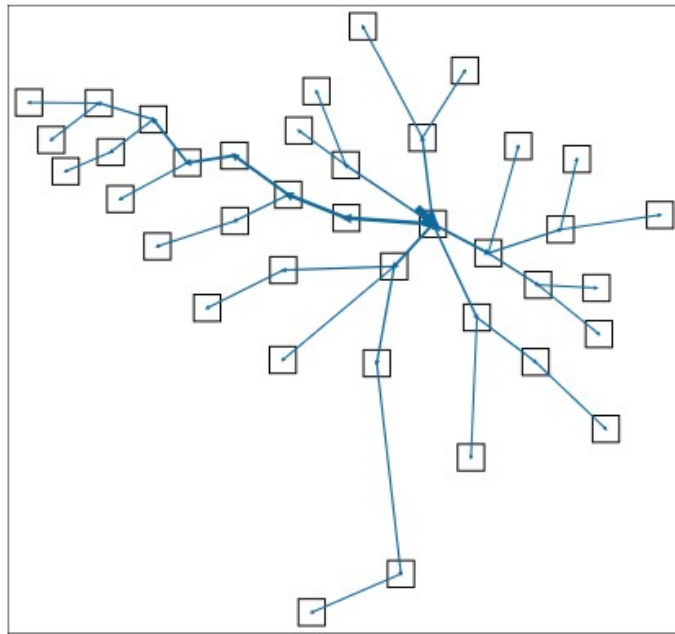
Kamal Kuriyan, UtilityNetworks ADE
workshop, TUM, October 2016

Multi-level analysis of urban energy networks

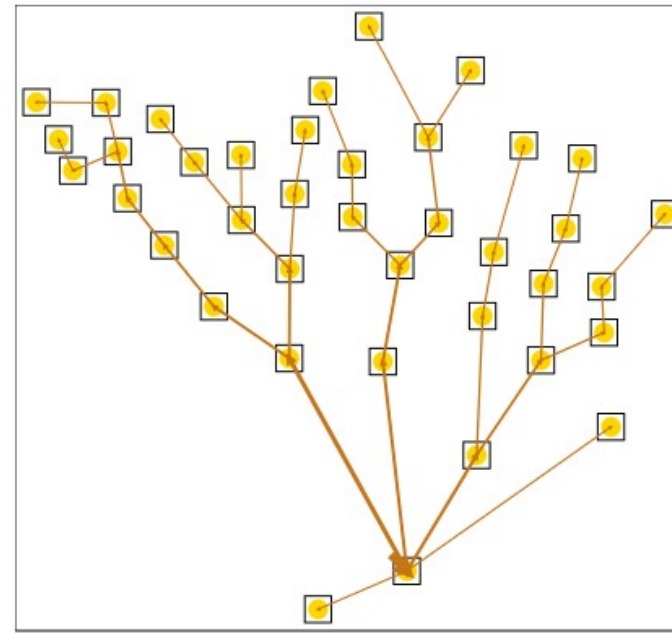


Energy flow analysis

- Without CHP (gas to electricity imports ratio 2:1)
- Boilers installed in all cells



electricity



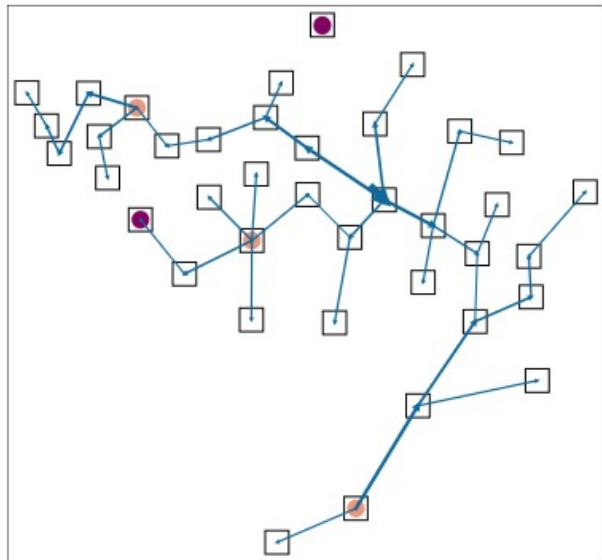
gas

boiler

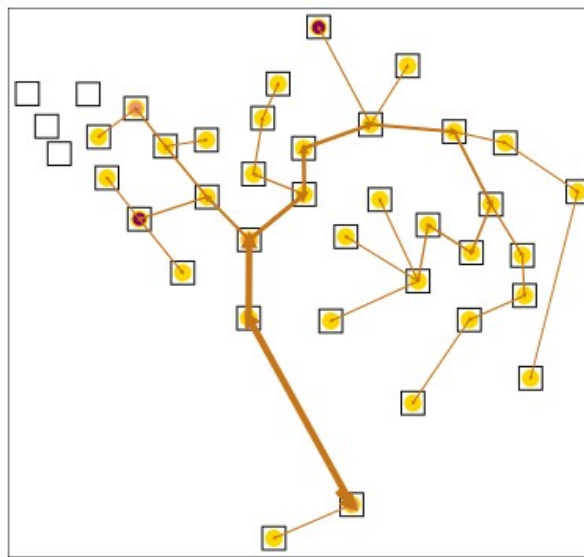
Energy flow analysis

- With CHP (gas to electricity imports ratio 5:1)
- Heat exchangers and boilers (12:1)

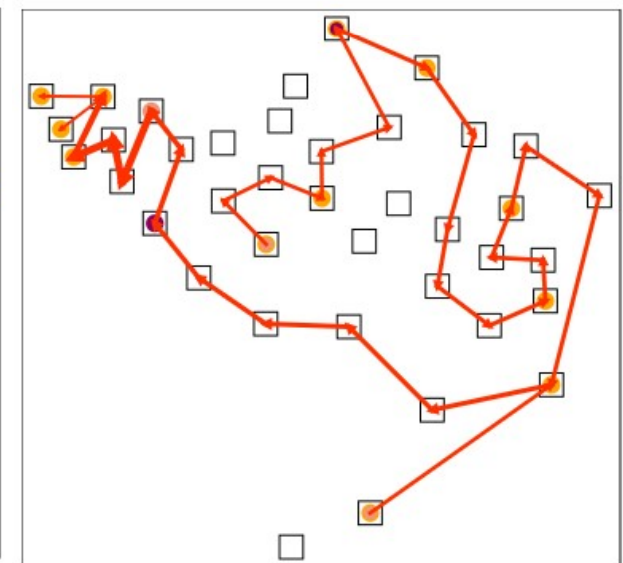
electricity



gas



heat



● boiler

● heatex

● med_chp

● small_chp

Expectations and use cases

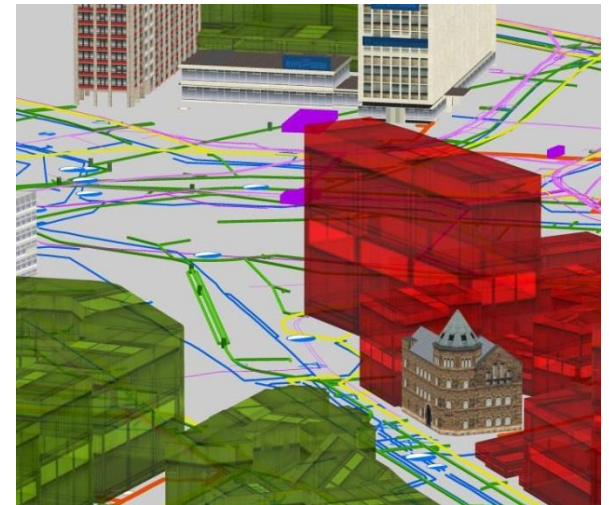
- Understand representation of utility networks with CityGML
- Potential applications
 - Energy flow analysis to determine impact of technology transitions across multiple networks
 - E.g. introduction of CHP, large scale heat pumps
 - Operational analysis of thermal energy networks
 - Determine flows, temperatures, pressures, heat losses for varying demands, climate conditions and process locations

Expectations and Use Cases

Tatjana Kutzner, Thomas H. Kolbe

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Technische Universität München

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1st Joint SIG 3D and OGC Workshop on the CityGML UtilityNetworkADE
Munich, October 13-14, 2016

Expectations from the workshop

- ▶ Learning about interesting and relevant use cases for the UtilityNetworkADE
- ▶ Learning about further requirements which should be included in the ADE to make it usable / useful for different applications
- ▶ Discussing questions we gathered in preparation of this workshop, e.g.
 - What is the scope of the UtilityNetworkADE
- ▶ Determining the current state of development of the ADE as regards its intended integration into CityGML 3.0 as individual module

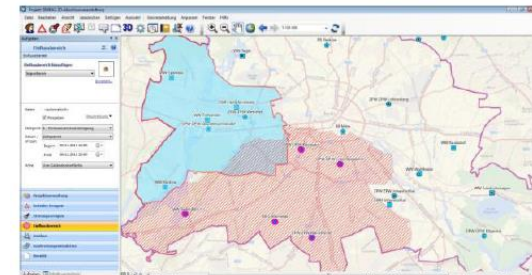
Use Case 1: Disaster Management with SIMKAS 3D

- ▶ Simulation of intersectorial cascading effects caused by a failure of supply infrastructures using the 3D city model of Berlin (2009-2012)



- ▶ Focus on

- simulating interdependent crisis situations
- linking of situation information with the urban space
- implementation of a common situation map which also allows for individual views and analyses by each provider

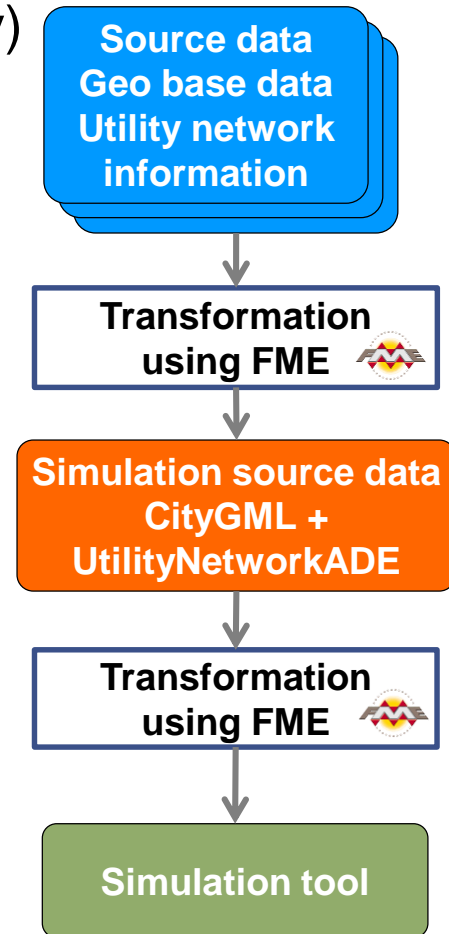


- ▶ Use of the CityGML UtilityNetworkADE

- An ArcGIS geodatabase was implemented based on the UtilityNetworkADE
- The data of the providers (electricity, district heating, gas, fresh water, waste water) were integrated in the geodatabase using FME

Use Case 2: Risk Analysis Supply Infrastructure

- ▶ Cooperation project with the company ESG (Germany) on behalf of the German Armed Forces (2015-2016)
- ▶ Study on the possibilities of utilising supply infrastructures in training simulators
 - for crisis scenarios (e.g. evacuation)
 - for simulating the impact of a failure on the population
 - for simulating the impact on tactical operations
- ▶ Allowing for better execution of simulations by extending the ADE by three additional functional concepts:
 - Supply area
 - Functional roles
 - Suppliability and suppliedness



Use Case 3: VerNet-LEM Project

- ▶ Cooperation project with the companies AED-SICAD and EnBW (2016-2017)
- ▶ The goal of this project is to develop a small-scale, climate-dependent forecasting and simulation system which allows network operators to optimise operation in small-scale distribution networks
- ▶ The system is to forecast the feed-in power and consumption over a period of 24-48 hours and to assess the compatibility of the calculated loads and services with the components and lines installed in the distribution network
- ▶ The system requires
 - detailed information on the network topology
 - detailed weather data
 - Information on past feed-in power and consumption values

Jean-Gil Langlois – LIRIS/ForCity, Lyon (France)

■ Expectations/Interests

Discuss use cases about Utility Networks.

Topics of interests:

- Geometrical and topological representations of networks
- Hierarchies
- Links between utility network elements and existing objects (buildings, transportation).

■ Use case: District Heating Network (DHC) extension

Estimate the cost to link autonomous heating stations to the existing district heating network.

Constraints: follow roads and avoid obstacles like buildings and railroads.

Geometric and topological representation needed.



I am interested in ...

- Current status of the Utility Network ADE
- Bridging the gap in between semantical city models and utility network modelling

My expectations are ...

- Understanding the current status quo of the ADE
- Connecting the ADE to existing industrial standards



- District heating
- Electrical networks (island networks, smart grids)
- Cooling
- Geothermy
- Industrial waste water
- Interoperability (other industrial standards)
- Network navigation
- Visualisation



smartpowerhamburg.de

Current Projects Background

Prof. Dr. Wolfgang Renz

HUAS – Hamburg University of Applied Sciences

Faculty of Engineering and Informatics

MMLab

UtilityNetworkADE - Workshop

TU München - 13. Okt. 2016



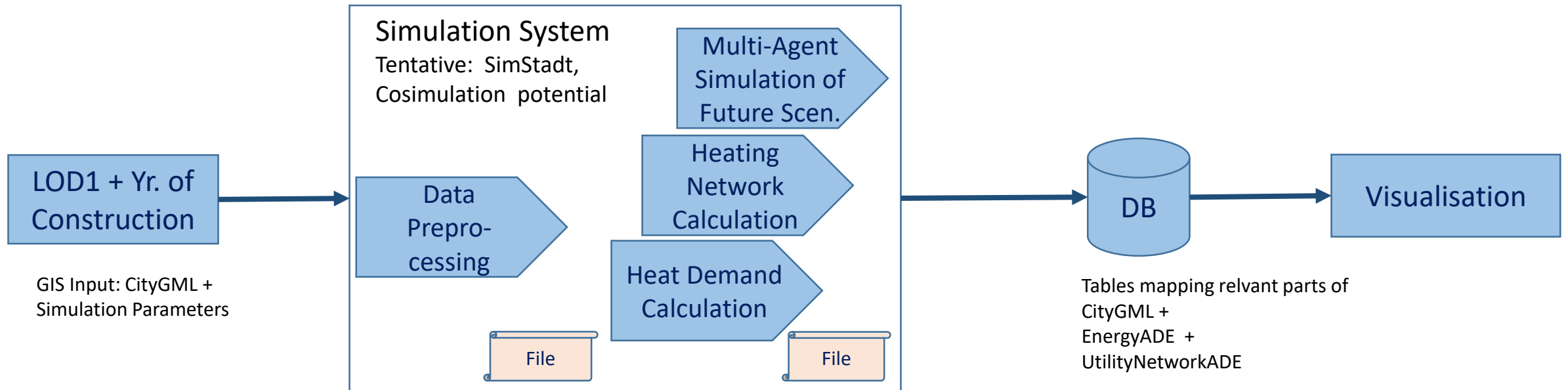
Wolfgang Renz, Thomas Preisler, Tim Dethlefs

Current Projects



- OS4ES – EU-FP7-ICT Smart Grid: R&D-Project with 8 Partners → os4es.eu
 - Open System for Energy Services → Distributed Registry System
 - Extension of the IEC61850 Data models, CIM-Mapping
- GEWISS – BMWI EnEff:Wärme: R&D-Project with 9 Partners → next slide
 - Geographic Heat Information and Simulation System
 - Future Heat production, distribution and consumption scenarios
- NEW4.0 – Northern German Energy Transition with ~35 Partners
 - Work Package 4 - ICT for the Electricity Grid (Smart Grid Perspective)
 - Work Package 8 – System Simulations based on measured data to analyse the
 - 6 Use Case Scenarios: Intraday Market, Smart Balancing, Reactive Power etc.

GEWISS Data Flow: Simulation based, Prosumers and Heating Network



- OGC standards as an alternative to Alkis
- Simulation Deployed on our Multi-Core Servers and Cloud Infrastructure

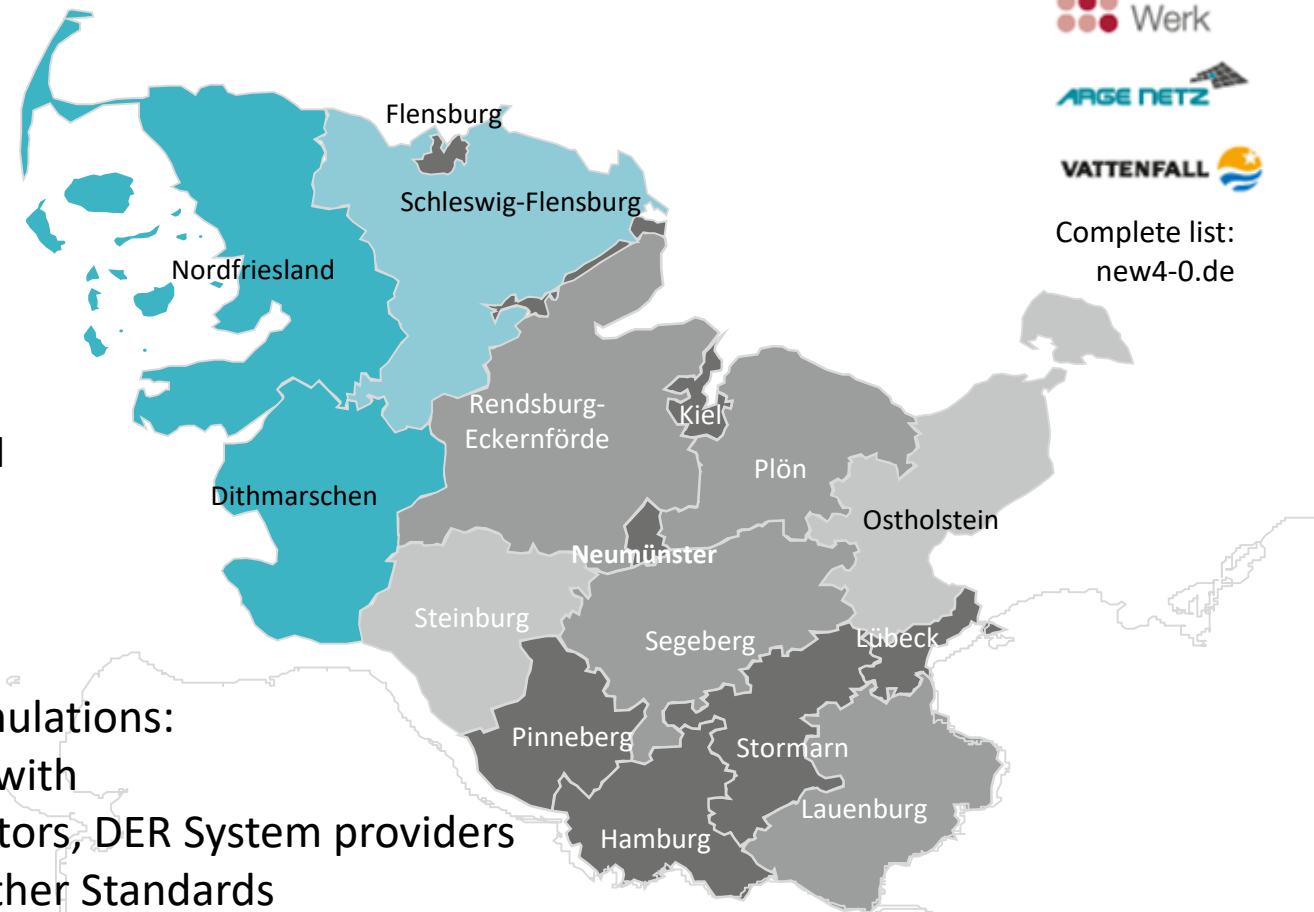
Percentage Renewables in Brutto Electricity Consumption



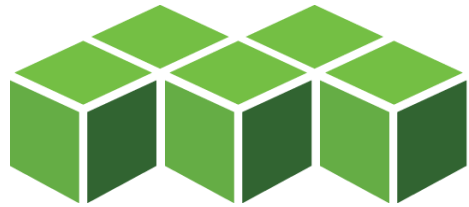
Production Region SH and Consumption Region HH
Wind and PV, Power2Gas, Power2Heat, DSM etc.
Sector Coupling: Electricity, Gas, Heat ...

Establish ICT Infrastructure, Data based System Simulations:

- IT Specialists and Software Companies together with
- Market Participants: TSO, DSO, Utilities, Aggregators, DER System providers
- Usage of Data Models related to IEC, OGC and other Standards



Complete list:
new4-0.de



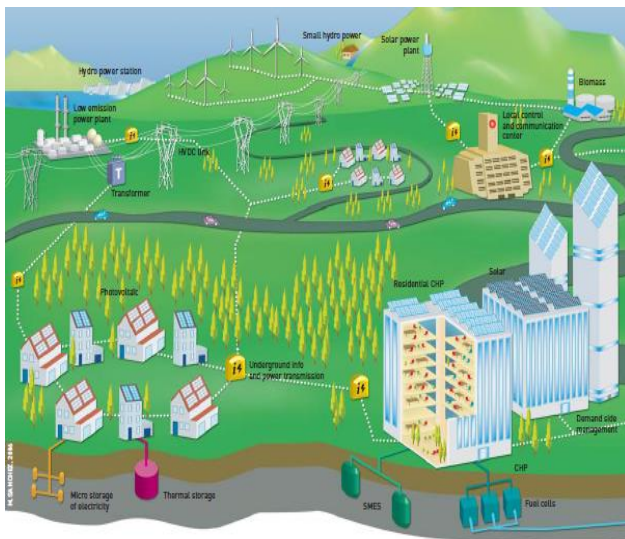
MODER



Apros – Tool for analysis and scenario comparison for complex energy systems at district level

CityGML UtilityNetworkADE workshop, Munich

Jari Shemeikka, Technical Research Centre of Finland, VTT Ltd
Oct 13th – 14th 2016



Expectations or interest in this workshop

- We have an ongoing **EU MODER** project applying:
 - **Apros** simulator to model the **complex** energy systems
 - **CityGML** integration that minimize the manual work
 - **Visualization** of results that will ease the understanding of complex results to the non-technical stakeholder
- Expectations
 - To see and hear **other experiences** of the detail (sub-hourly) energy simulation using CityGML as data source
 - To find out the **current status of the applicability** of the UtilityNetworkADE
 - To hear experiences **how to map existing network data** (mainly district heating, cooling and electricity) from utility information systems to CityGML, are there any converters available



MODER



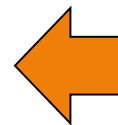
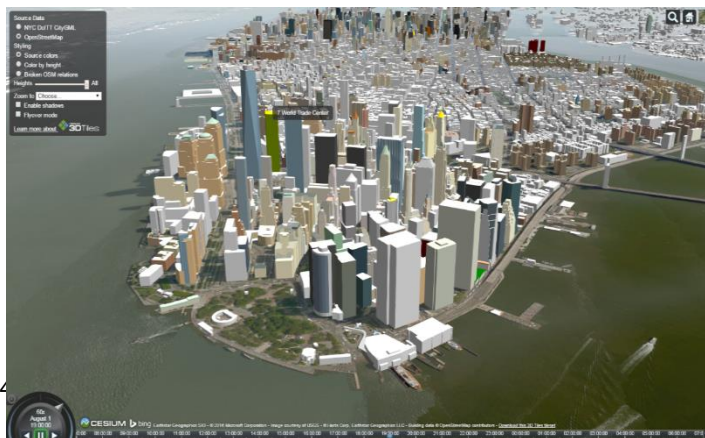
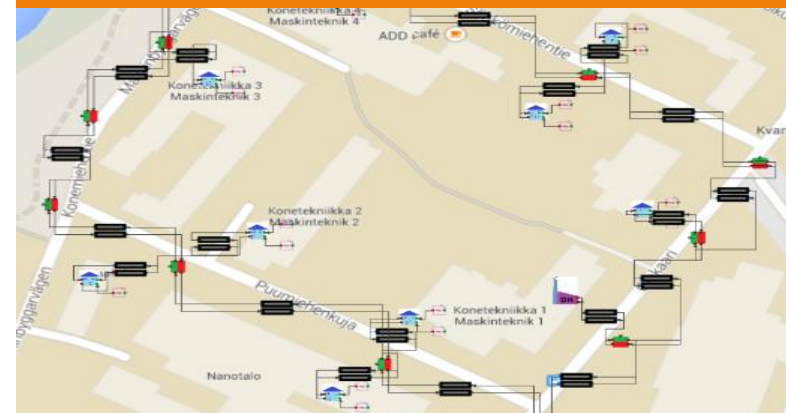
EU MODER Use cases of the UtilityNetworkADE

1. CityGML will **speed up** the district level energy **refurbishment** simulation by **easing** the initial build-up phase of the simulation model
2. The data source of the 3D **visualization** of the simulation results and the refurbishment scenarios in **Cesium sandcastle**

CityGML semantic model



Apros thermohydraulic simulator





I am interested in ...

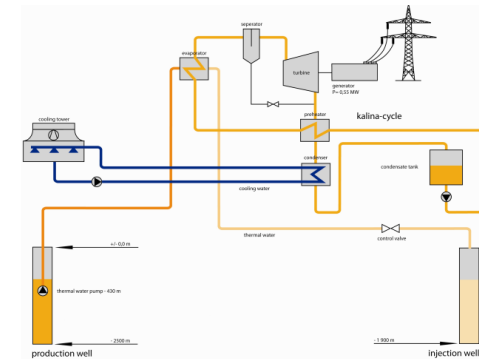
- Current status of the Utility Network ADE
- Current Applications
- Future development

My expectations are ...

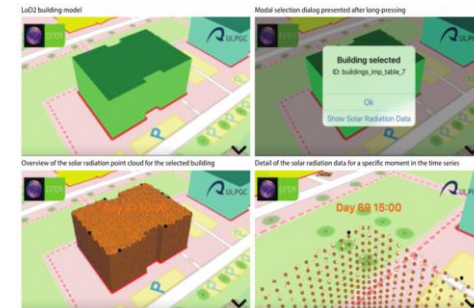
- Finding interesting use cases for application and testing of the ADE
- Extending the ADE



- Modelling of district heating network
- Distributed energy systems
- Geothermal applications
 - Geothermal energy components (ground heat exchanger, heat pumps)
- Waste water/water pipes
- Interoperability with other CityGML ADEs (e.g. Energy ADE)
- Semantic information visualization
 - Inventory mapping (mobile applications)
 - Semantic editing (mobile applications)



Zorn (EIFER)



Wendel (EIFER)

CityGML UtilityNetworkADE

Zentrum für nachhaltige Energietechnik (zafh.net)

M. Sc. Maryam Zirak

Stuttgart, den 13.10.2016

Expectations or interest in this workshop/UtilityNetworkADE

- So far have been dealing with Demand side → interested in getting contact with research groups who are working on Supply-side
- Getting familiar with Utility-network's simulation methods or tools

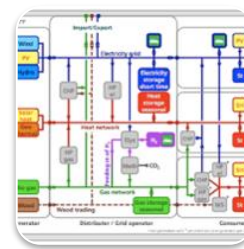
use cases the UtilityNetworkADE would be required for

- Providing required input data for Tools which analyse the utility Network like Energy-load management (Lastmanagement) tools or Energiesysteme Optimierung
- Making Energy AND-Demand side more comprehend with Utility Network

Application of UtilityNetworkADE in Energy system optimization



idname	Y-Coord	Area	Summe	
[m]	[A²]	[m²]	[W/m²]	
14698.5	5285105	200	48	23.6
14698.4	5285112	200	0	85.6
14706.4	5285104	380	0	38.5
524070	5285135	250	28	97.5
524070	5285135	75	44	88.9
14819.7	5285143	380	0	2082
14825.4	5285074	200	27	88.8
14825.4	5285074	12	26	95
525147	5285251	380	0	65.4
14839.7	5285181	384	24	135.6
14839.7	5285181	4	24	390
14821.9	5285194	524	12	5.4
14821.9	5285194	122	22	4.8
14771.8	5285199	280	0	887.1
14861.8	5285199	340	47	17.3
14818	5285231	329	38	89



UtilityNetworkADE

- Heat Demand of buildings (Minute or hourly resolution.)
- Electricity demand of buildings
- Photovoltaic potential of buildings
- Energy carrier of building (type, cost, etc.)
- Energy system of building (yearly global efficiency, etc.)

Probable Pre-processing of data (?)

- Aggregated energy load-profile ?

Energy System Optimization/ energy-load management system

- hourly/ minutely optimized heat and electricity supply system
- Optimization-Criteria:
 - Minimum total energy cost per year
 - Minimum CO2-emission
 - Maximum decentralized current consumption

(Sustainable) Energy System

- Sustainability criteria (Environmental, Social, Economic)