MODER

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

EU MODER, Linz, Austria

@ Austrian Chamber of Commerce

Sept 29th 2016

Jari Shemeikka, VTT

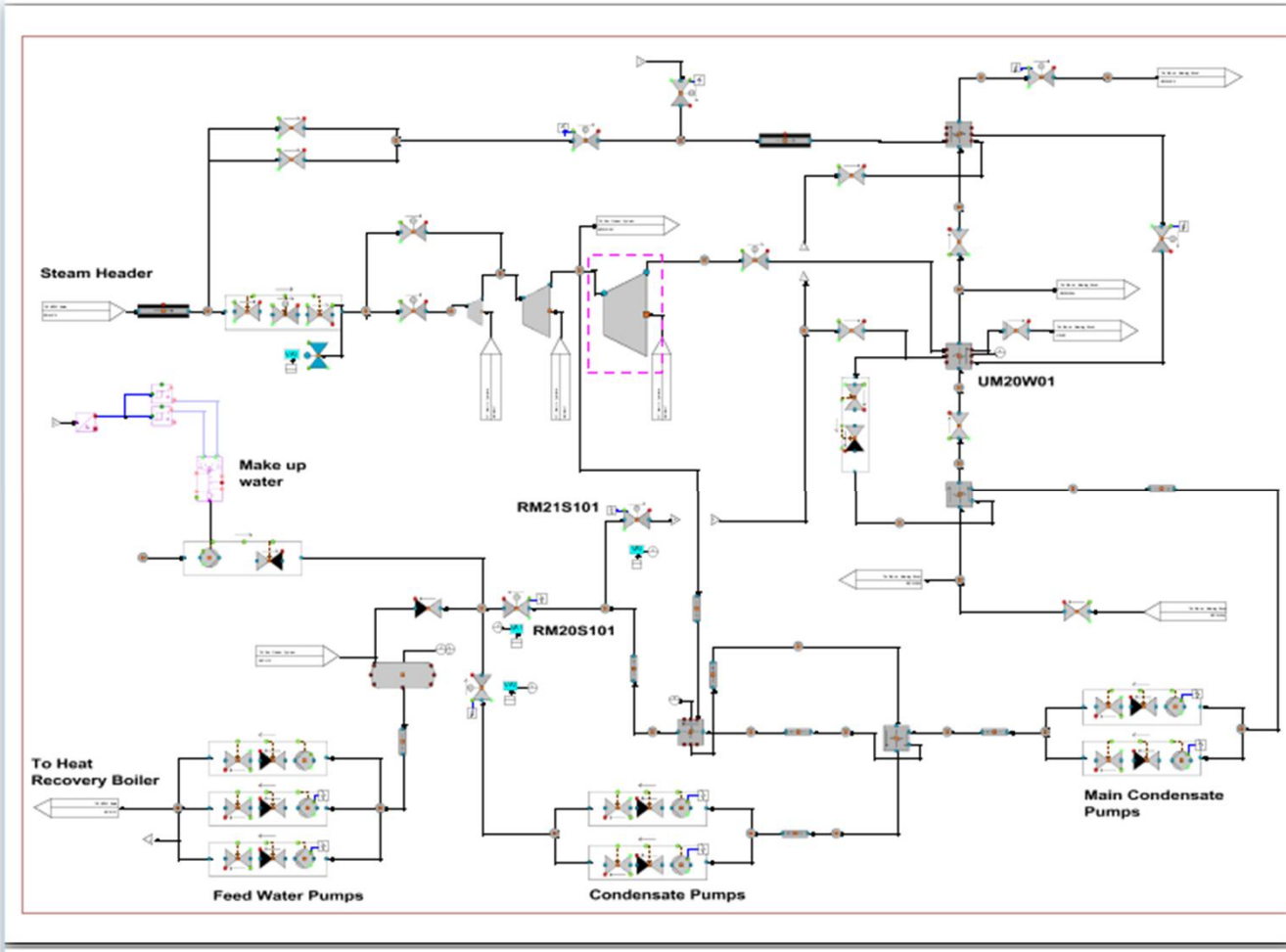
How to capture the value of simulation?

Design challenge of the district level energy system and refurbishment

- Districts contain **lot's of information** by buildings and by energy systems
  - Energy models can be **complex** and contain **interactions** between systems
  - **Large share** of renewables makes hourly fluctuations to the system
- Currently the models are built up **manually**
  - Lot's of work and **time consuming**
  - **Too slow for the** current business practicies
  - Flow sheet tools are not user friendly
- MODER project approach
  - **Apros** simulator handles the complexity
  - **CityGML** integration minimizes the manual work
  - **Visualisation** of results will **ease** the understanding of complex results to the non-technical stakeholder

Apros – high resolution tool in brief

- Apros is a **multifunctional** software for the modeling of the **dynamic** simulation of **processes**, different power plants and district **energy** systems
- Apros has been used **since 1987** to simulate many different kind of conventional **power plant** concepts, **paper mills**, solid oxide fuel cells and **smart energy** concepts, and has users in 26 countries
- In MODER we will make use of and **learn from** the experiences of an industrial energy domain on the refurbishment energy simulation



Typical flow sheet (technical) view of Apros,
the result view of the district energy simulation will be enhanced to the 3D in MODER

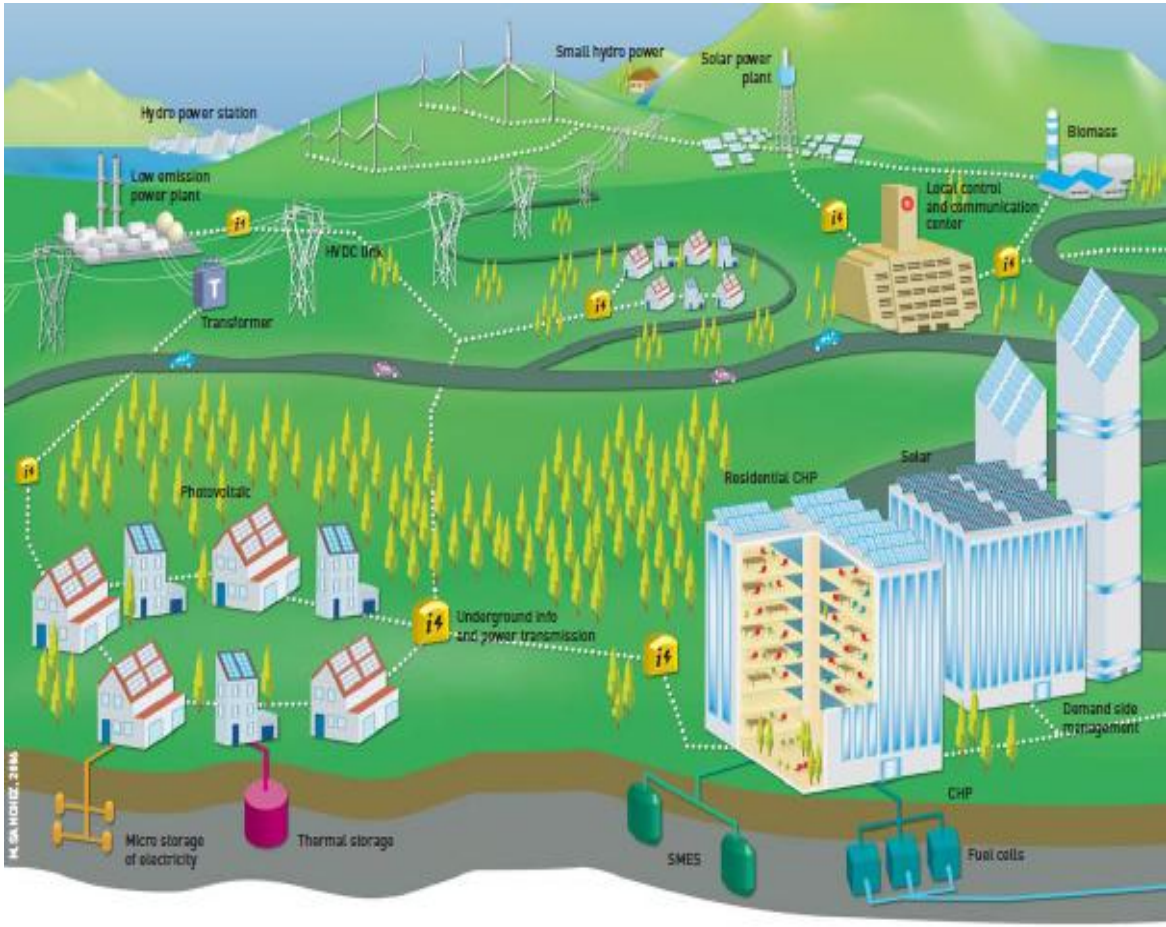
Energy systems – District level Simulation in Apros

Integration of new energy production or regeneration concepts, network concepts, energy storage concepts, behaviour patterns, peak handling, control concepts, testing of local market concepts…

District level energy systems with Apros

Detailed district energy planning, integrating

- **End use** Building types, new & retrofit, near zero
- **Customer** behaviour models,
  using smart meter data
- **Generation** units:
  Heat, Power, Combined (CHP)**,** HeatPumps, Solarthermal, Photovoltaics
- Energy **Storages**:
  Various Thermal,
  Gas, Electric,
  Electric car integration
- **Grids**:
  Electrical, Gas, Steam,
  Heating and Cooling networks

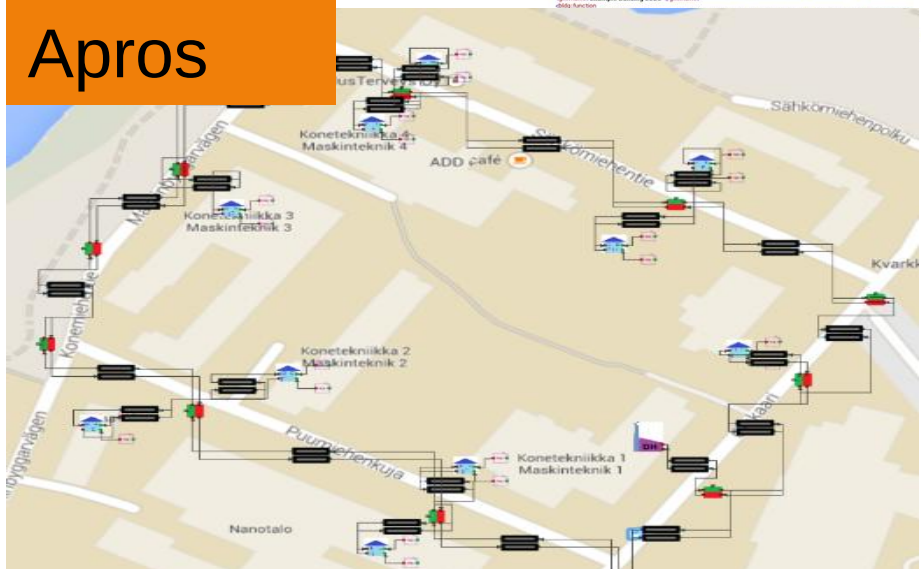


CityGML as a district energy data source

1. CityGML is a standardised **data exchange format**, which enables the *modeling*, *saving*, *transferring* and *updating* of the **spatial** city data
2. **Interoperability** between tools is enabled
3. CityGML will **speed up** the district level energy refurbishment simulation by **easing** the initial build-up phase of the simulation model

CityGML semantic model

Apros



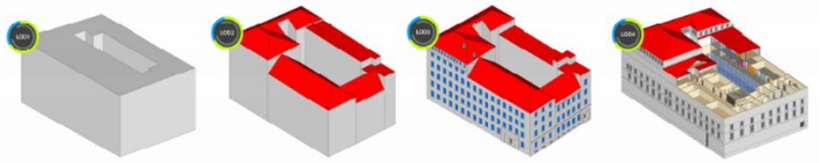


Figure 1 Building 2 of HFT Stuttgart, represented in the four Levels of Detail (LoD) of the OGC standard CityGML (source: HFT Stuttgart)

Communication with the non-technical people in the context of district level refurbishment

- 3D Visualisation is a good tool to get the **common understanding** of the complex design challenge

- It's easy to comment **3D** by the human nature – we all have eyes and we are **used to handle spatial data**

Source: Hospitool project

MODER 3D application - Cesium Sandcastle

- Cesium 3D tiles brings the 3D geospatial information to the web (https://cesiumjs.org/index.html)
  - Web-browser access (phones, tabs, computers all OK)
  - Optimized for the online use
  - Open - an open specification with an open-source implementation in Cesium available on GitHub.

Business benefits of the simulation assisted district refurbishment - Conclusion

- **Time savings** – science made simple
  - The use of **scientific** simulation techniques to predict the real-world behavior of energy refurbishment solutions is essential
  - **Complex energy** system problems need **efficient solutions in daily business**
- Good information management with **common information model**
  - CityGML as an **information platform** creates the basis for district data management
  - **Less typos** and **errors** in data flow, automated build up of models
- Good **communication** with the stakeholders
  - Visualisation of the complex world in an **understandable way** maximizes the **acceptance** of the refurbishment solutions