

**MODER**



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

**EU MODER, Tallinn, Estonia**

**SBE16, Sustainable development of districts workshop**

**Oct 6<sup>th</sup> 2016**



## 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 practices
  - Flow sheet tools are not user friendly
- EU 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

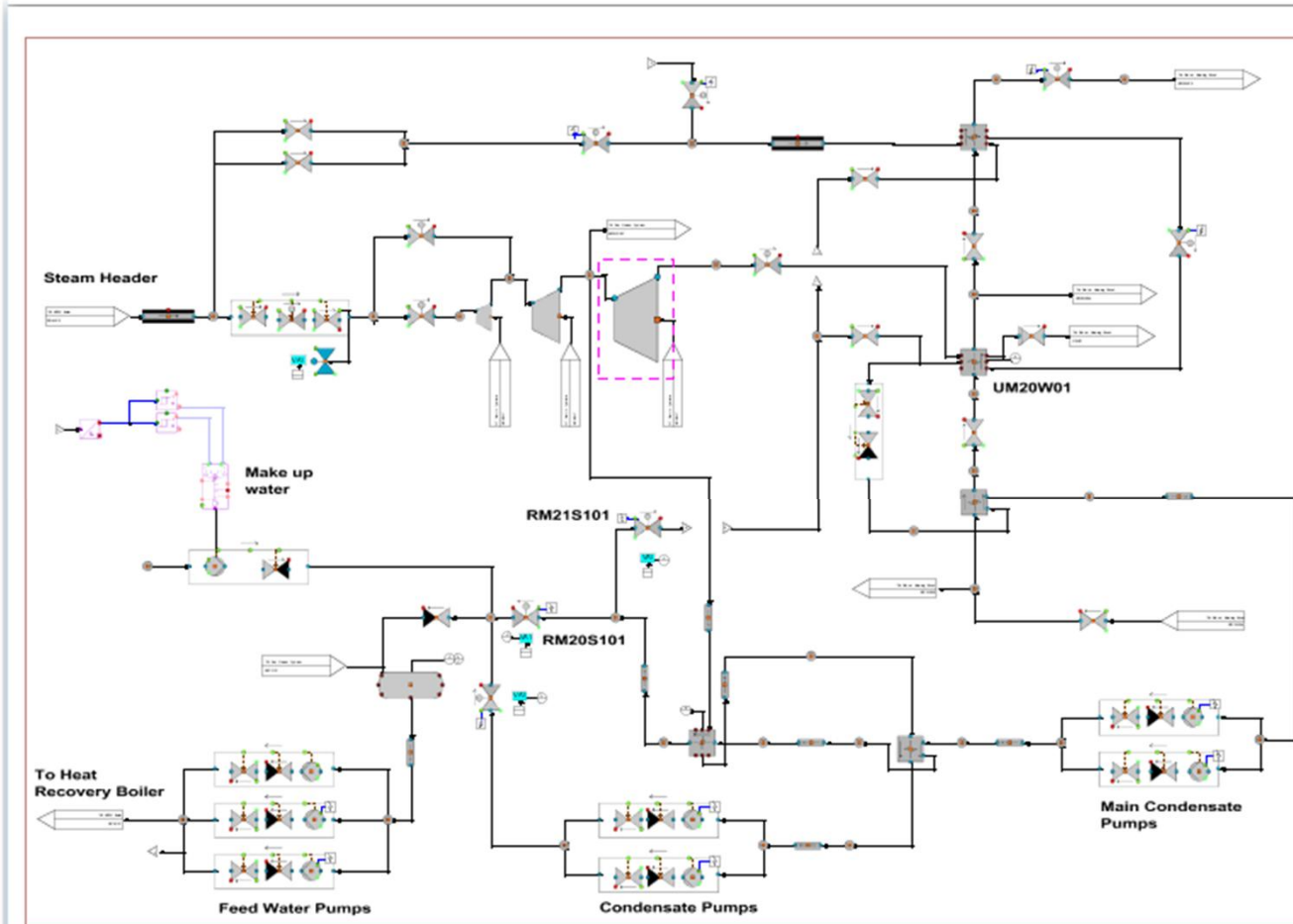




## Apros – high resolution tool in brief

- 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

05/04/2017



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





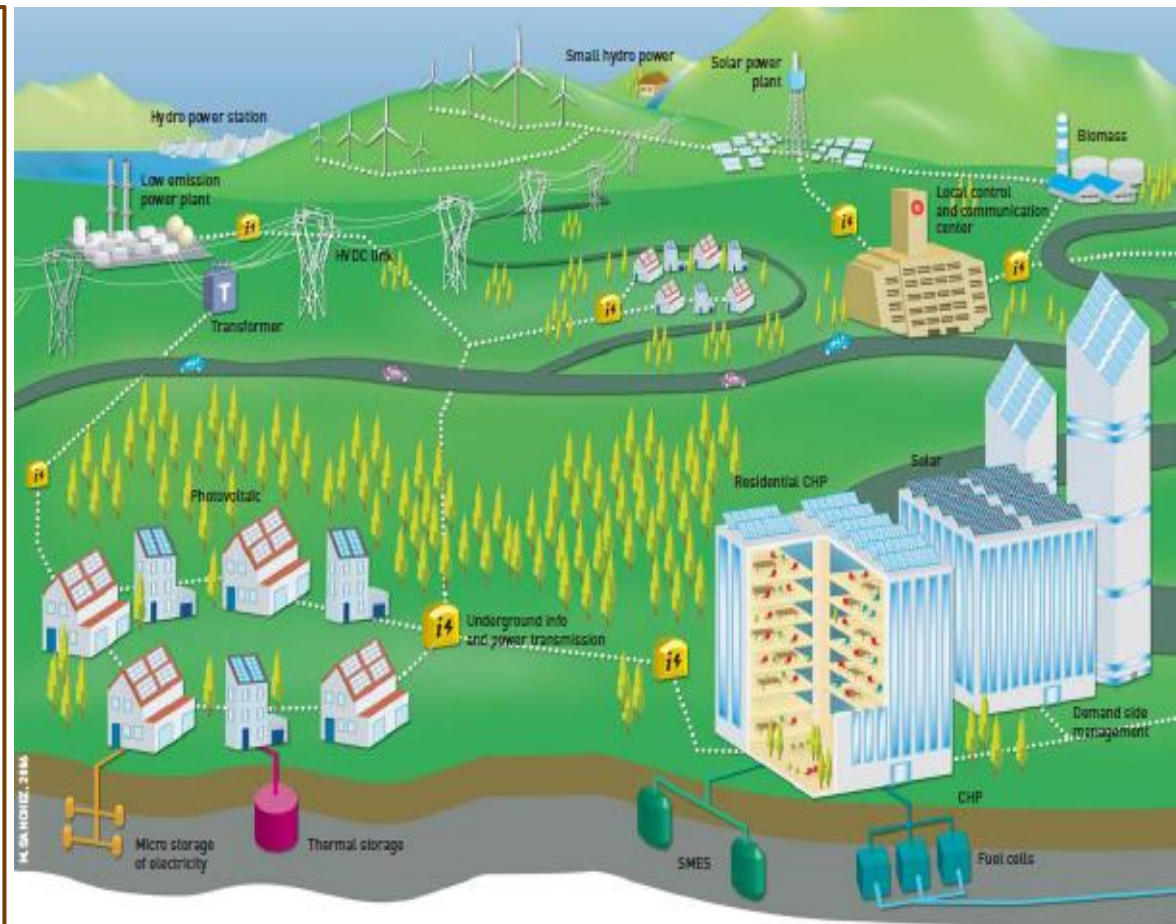
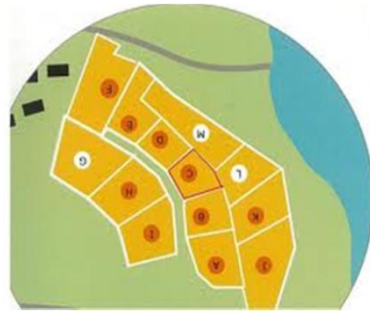
## Energy systems – District level Simulation in Apros

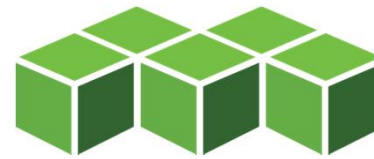
*Integration of new energy production or regeneration concepts, network concepts, energy storage concepts, behaviour patterns, peak handling, control concepts, testing of local market concepts...*

### 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, Solar thermal, Photovoltaics
- **Energy Storages:**  
Various Thermal, Gas, Electric, Electric car integration
- **Grids:**  
Electrical, Gas, Steam, Heating and Cooling networks





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## 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

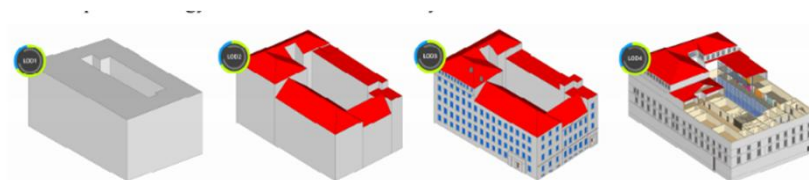
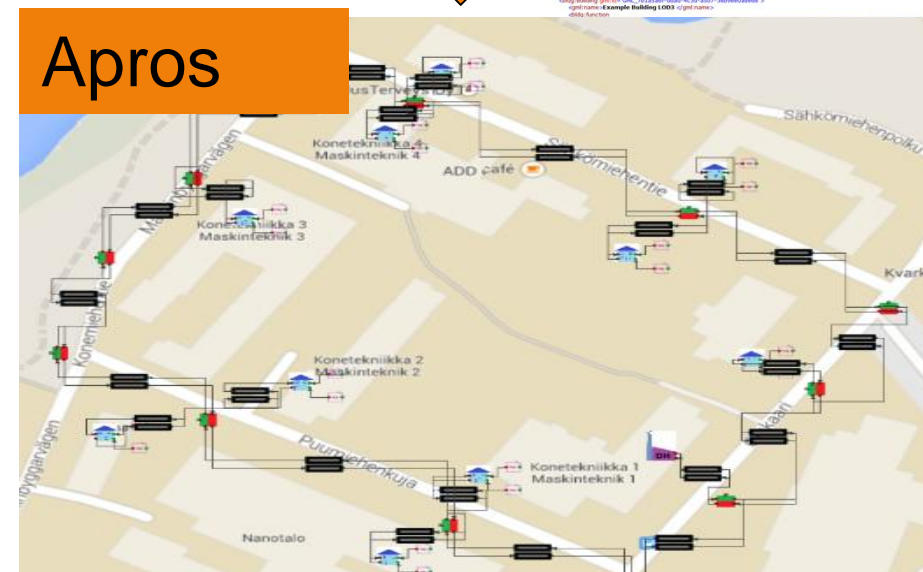


Figure 1 Building 2 of HFT Stuttgart, represented in the four Levels of Detail (LoD) of the OGC standard CityGML (source: HFT Stuttgart)





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## 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