

M.Sc. Jean-Marie BAHU



## 2<sup>nd</sup> Workshop on CityGML Energy ADE



*Joint SIG 3D and OGC Workshop on CityGML  
Energy ADE for building energy calculation*

*30.10.2014  
Karlsruhe*





- Presentation of EIFER
- CityGML & Urban Energy Modelling
  - CityGML standard
  - CityGML Application Domain Extension (ADE)
  - Energy Modelling concepts
- Spatial urban modelling in EIFER
- Today's Workshop and objectives



## ENERGY RESOURCES AND DISTRIBUTED GENERATION

- Bio-energy
- Geo-technology
- Distributed Generation Technologies
- Fuel cells and electrolysis

## ENERGY, CITIES AND TERRITORIES

- Energy planning
- Tool development for territories
- Urban systems

- Energy System Analysis and Climate Change
- Externalities

## ECONOMICS OF ENERGY SYSTEMS AND ENVIRONMENT

European Economic Interest  
Grouping between the **KIT** and **EDF**

110 employees  
92 scientists (14 PhDs)



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# CityGML & Urban Energy Modelling



- Ecological and urban **challenges**
- **Sustainable** city development  
Smart City concept & Big Data
- **Complex city context:**
  - Multi-domains
  - Multi-scale
  - Multi-actors



<http://emlakkulisi.com>

➔ **Need of integrative expertise for multi-criteria decision support based on a systemic and multi-scale approach:**

Modelling & simulation VS Observational & data analytics



- **Why CityGML ?**

- Comprehensive urban Data
- Interoperable open standard, “information hub”
- 3D Geo-data Infrastructure
- Management of different levels of aggregation

- **What is CityGML ?**

- OGC-standard spatial data format
- Application independent Geospatial Information Model
- Data exchange & multi-domains
- Multi-purpose
- Multi-resolution



→Urban data issues

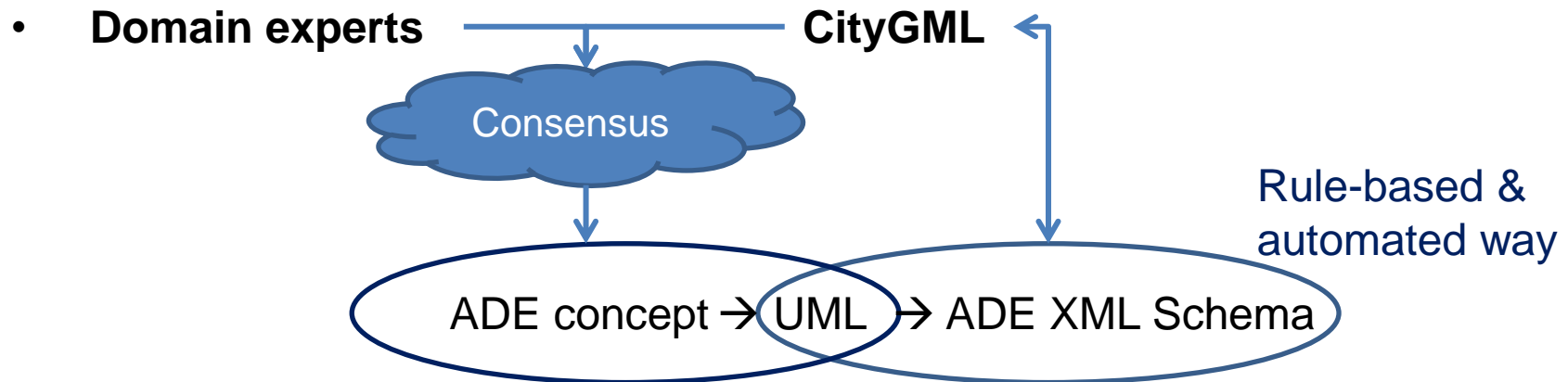


- But, specific applications require specific extra information
- CityGML is **extendable**.  
2 types of extension:
  - Generics – Generic objects and attributes
  - Application Domain Extension (**ADE**)
- **What is an ADE ?**
  - Extension of the CityGML model for specific application domains
  - Formal specification in separate XML schemas referencing the CityGML schemas
- A extension type with **advantages & limits**



- **2 types of ADEs:**

- Extension of existing CityGML feature types
- Definition of new feature types



- CityGML = **ontology** of the urban space

➔ ADE development = Extend this ontology for domain specific data-models

- **Reference document:** *Modeling an application domain extension of CityGML in UML*  
- OGC Best Practice, 2014





- **Urban energy dimensions**

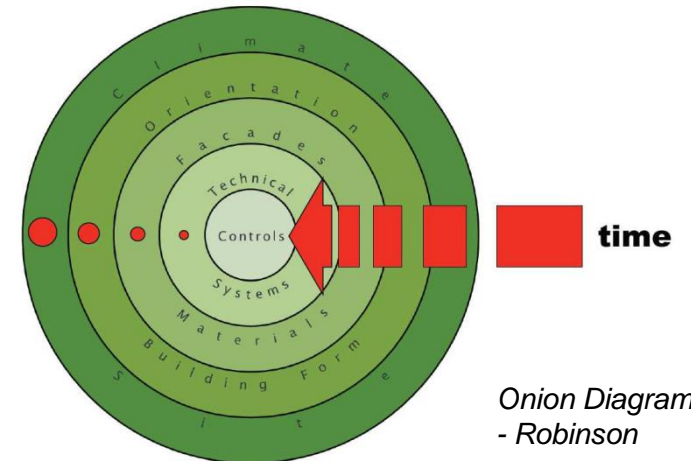
- Energy generation, storage, demand, transport
- Multi-resolution: spatially and temporally
- Different layers

- **What needs?**

- Need for linking urban planning & energy planning at different stages
- Different needs regarding Energy:
  - Diagnosis & prospective,
  - Sizing & optimization of energy systems,
  - Energy management strategies

- **Urban modeling approaches**

- Top-Down and Bottom-up
- Engineering: Static energy balance & Dynamic simulation

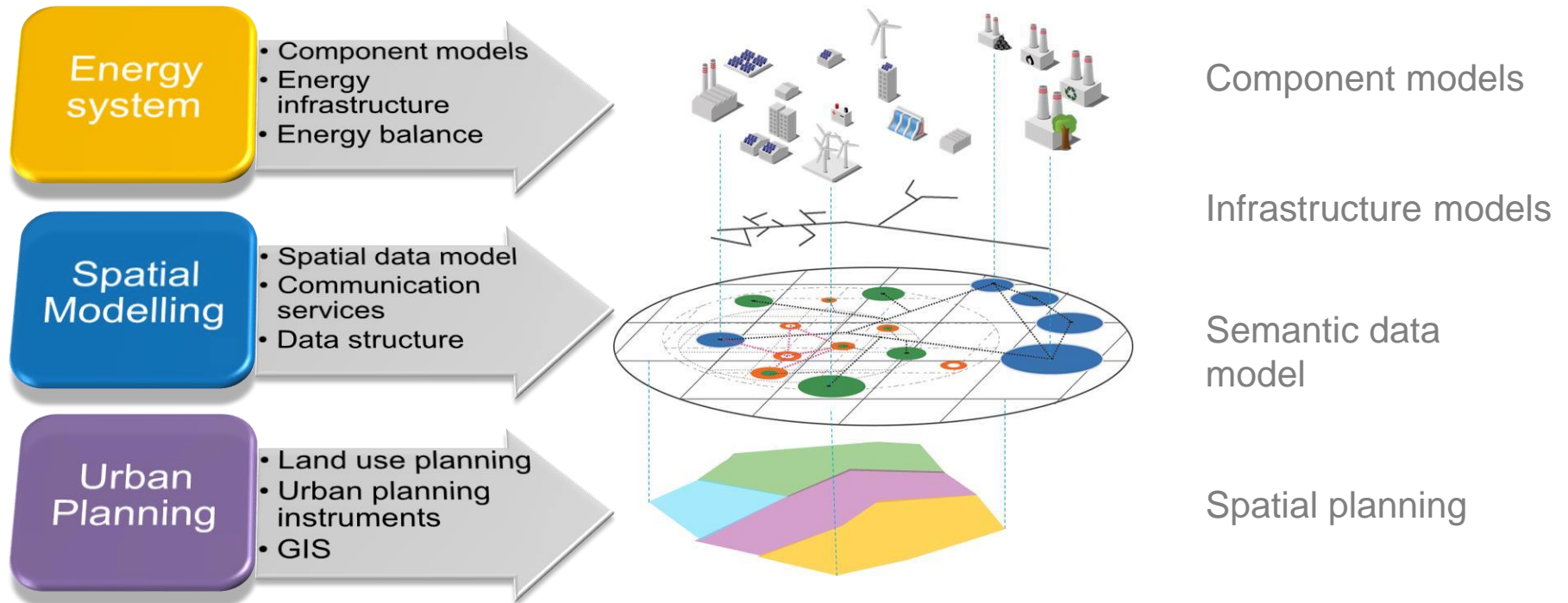


*Onion Diagram  
- Robinson*



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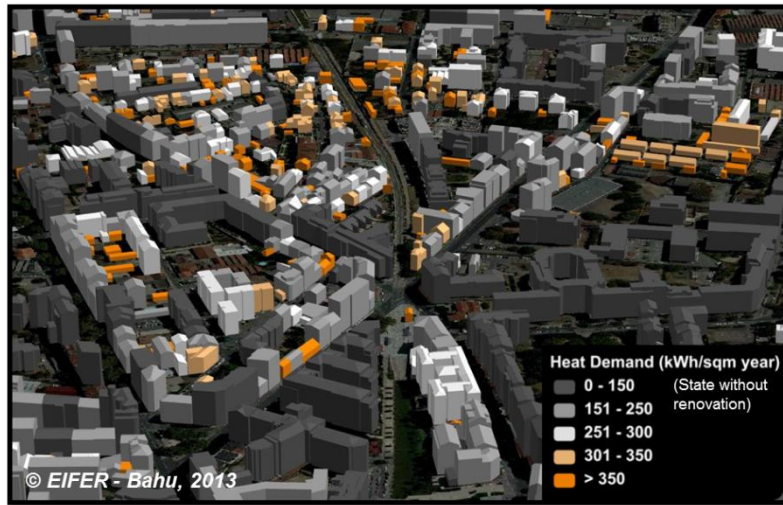
# Spatial Urban Modelling in EIFER



**Spatial assessment of the interaction between energy technologies and spatial development**

**Energy Planning & Geo-simulation:**  
30 emp., (9 Postdocs, 8 PhDs)

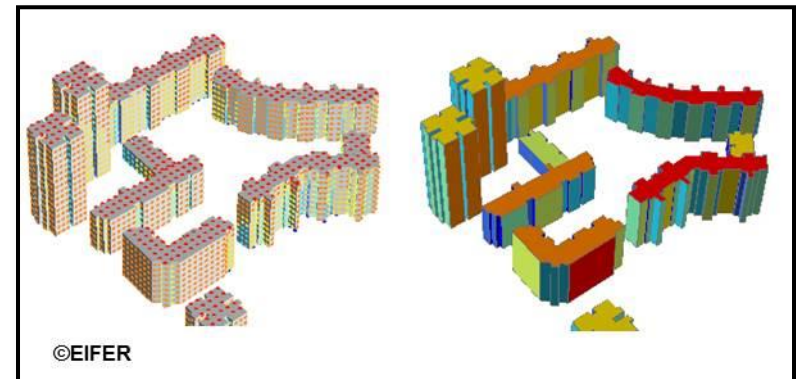
Heat energy demand modelling based on a 3D CM



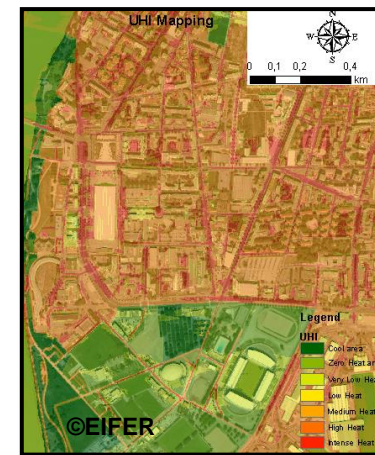
PV cadaster based on a 3D CM



Solar radiation calculation based on a 3D CM

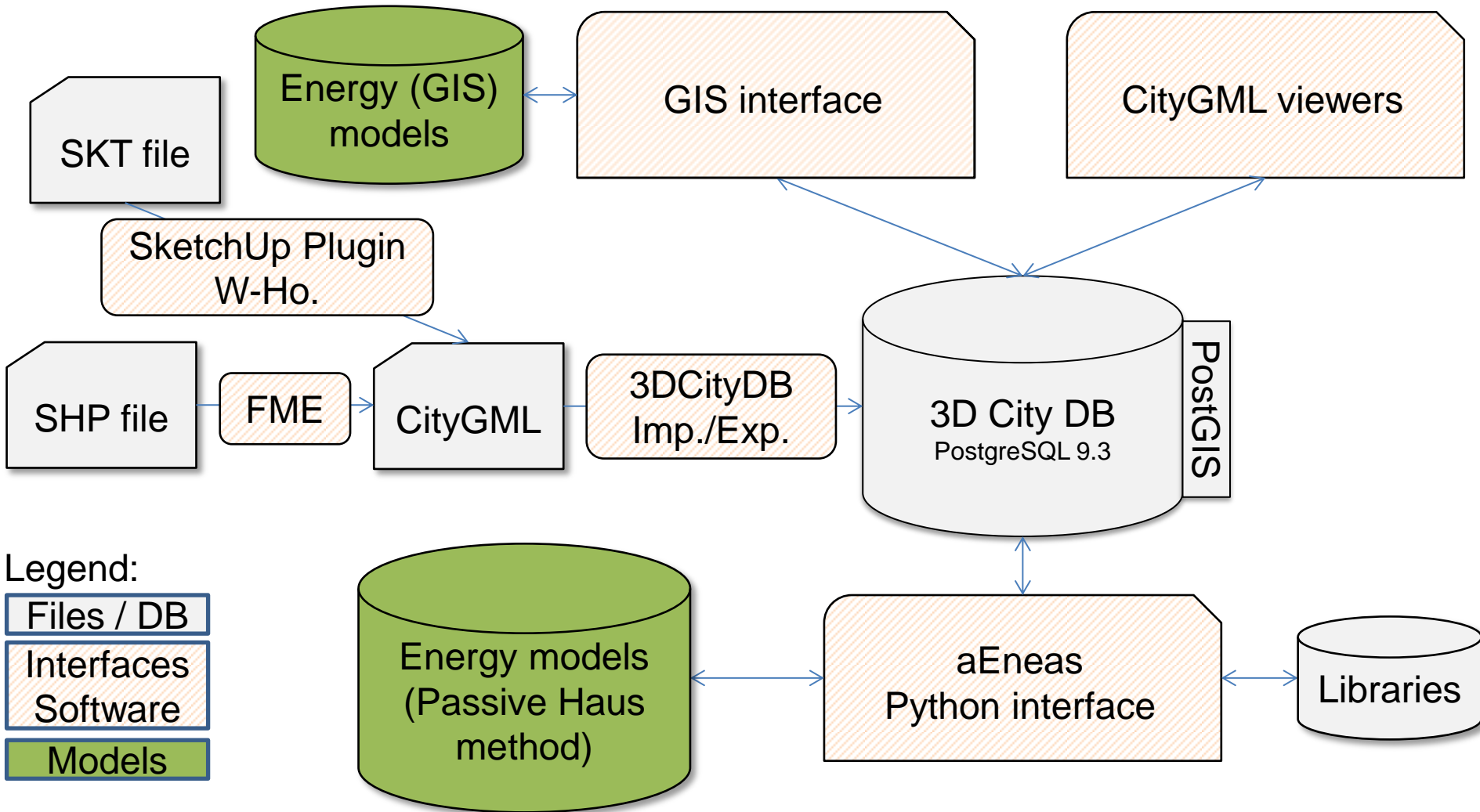


Qualitative Urban Heat Island localisation



# Spatial urban modelling

## 3D Geo-Data Infrastructure & energy modelling



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# Today's objectives





Global objective: Development and harmonization of a CityGML Energy ADE for building energy calculation.

Outputs of the first workshop in the HfT Stuttgart (27.05.2014):

- Agreed on the need for a common CityGML Energy ADE
- Definition of what it should be
- Creation of specific working groups
  - Building Physics and Materials
  - Building Occupant
  - HVAC systems and urban energy infrastructure
  - Metadata and scenarios

## **Objectives of the today's workshop:**

- Present and sum up the working group's outputs
- Finalize a first proposal for a harmonized Energy ADE (UML schema)
- Discuss about perspectives and concrete next steps

Minutes available on the wiki: [http://en.wiki.energy.sig3d.org/index.php/Workshop\\_Stuttgart\\_2014](http://en.wiki.energy.sig3d.org/index.php/Workshop_Stuttgart_2014)



09:30 Opening

10:00-10:20 Introduction – *J.-M. Bahu*

10:20-11:00 INSPIRE, CityGML3.0 – *Pr. Gröger*

11:00-12:20 Presentation of working groups outputs (2x40min)

12:30 Lunch buffet

13:30-14:45 Presentation of working groups outputs (2x40min)

14:45 Coffee break

15:00-17:00 Discussion about the development and harmonization of a CityGML Energy ADE and definition of the next steps.





# Let's start!

## Organising committee:

- |                               |                                                     |
|-------------------------------|-----------------------------------------------------|
| Volker Coors, Romain Nouvel   | - Hochschule für Technik Stuttgart                  |
| Greg Buehler                  | - Open Geospatial Consortium                        |
| Egbert Casper, Gerhard Gröger | - SIG 3D of the Geodata Infrastructure Germany      |
| Jean-Marie Bahu               | - European Institute for Energy Research, Karlsruhe |
| Karl-Heinz Häfele             | - Karlsruhe Institute of Technology                 |

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