



TECHNISCHE  
UNIVERSITÄT  
DRESDEN



# IVEL

Integrated Virtual Energy Lab  
Entwicklung einer integrierten Plattform für die  
Gebäudesimulation

**Prof. John Grunewald, TU Dresden**

Gebäude der Zukunft, München 18.-19.01.2011  
FORSCHUNGSSYMPOSIUM & PRÄSENTATION IM RAHMEN DER BAU 2011



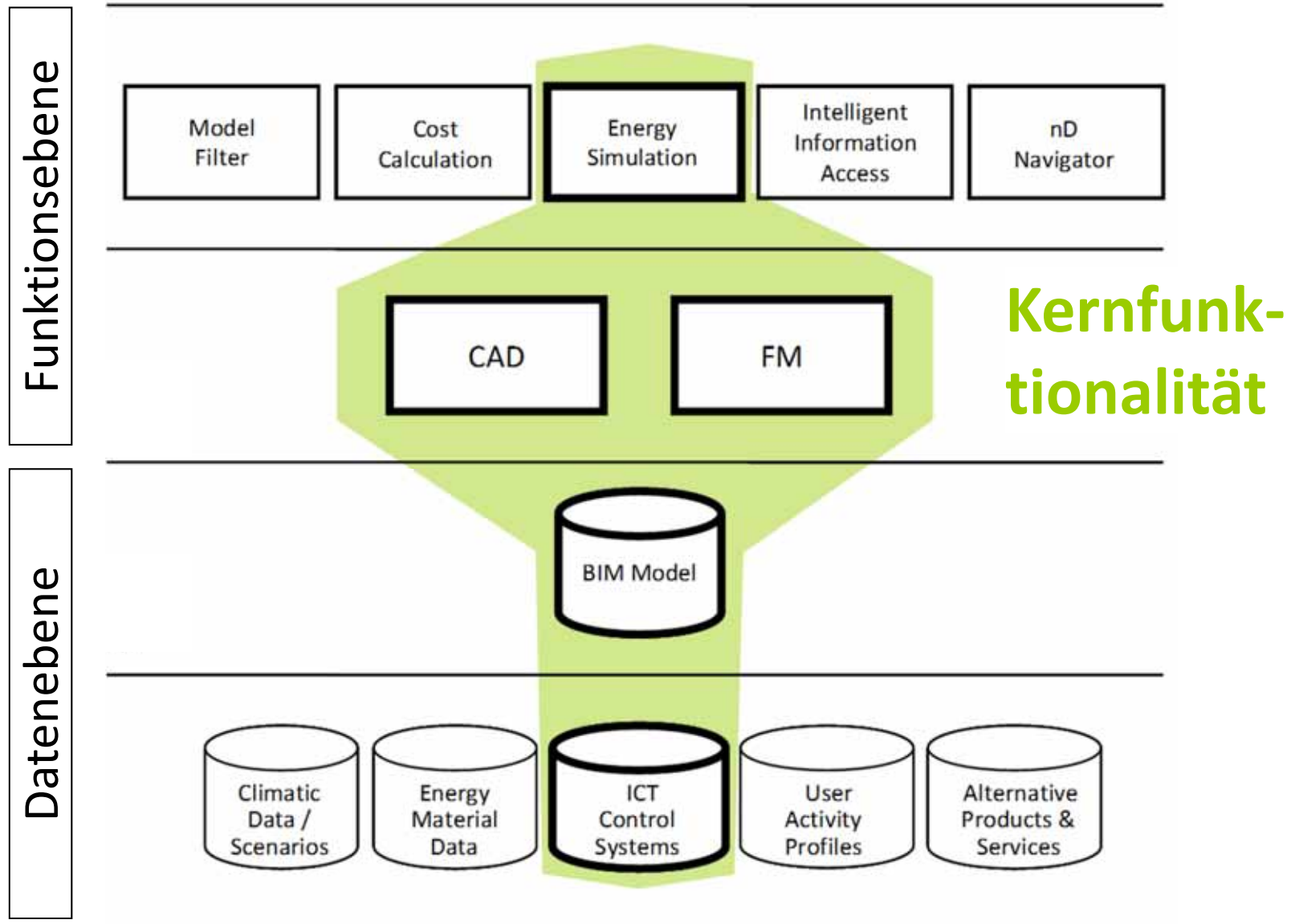
✓ **Laufzeit**      **01/09/2010 – 31/08/2013**

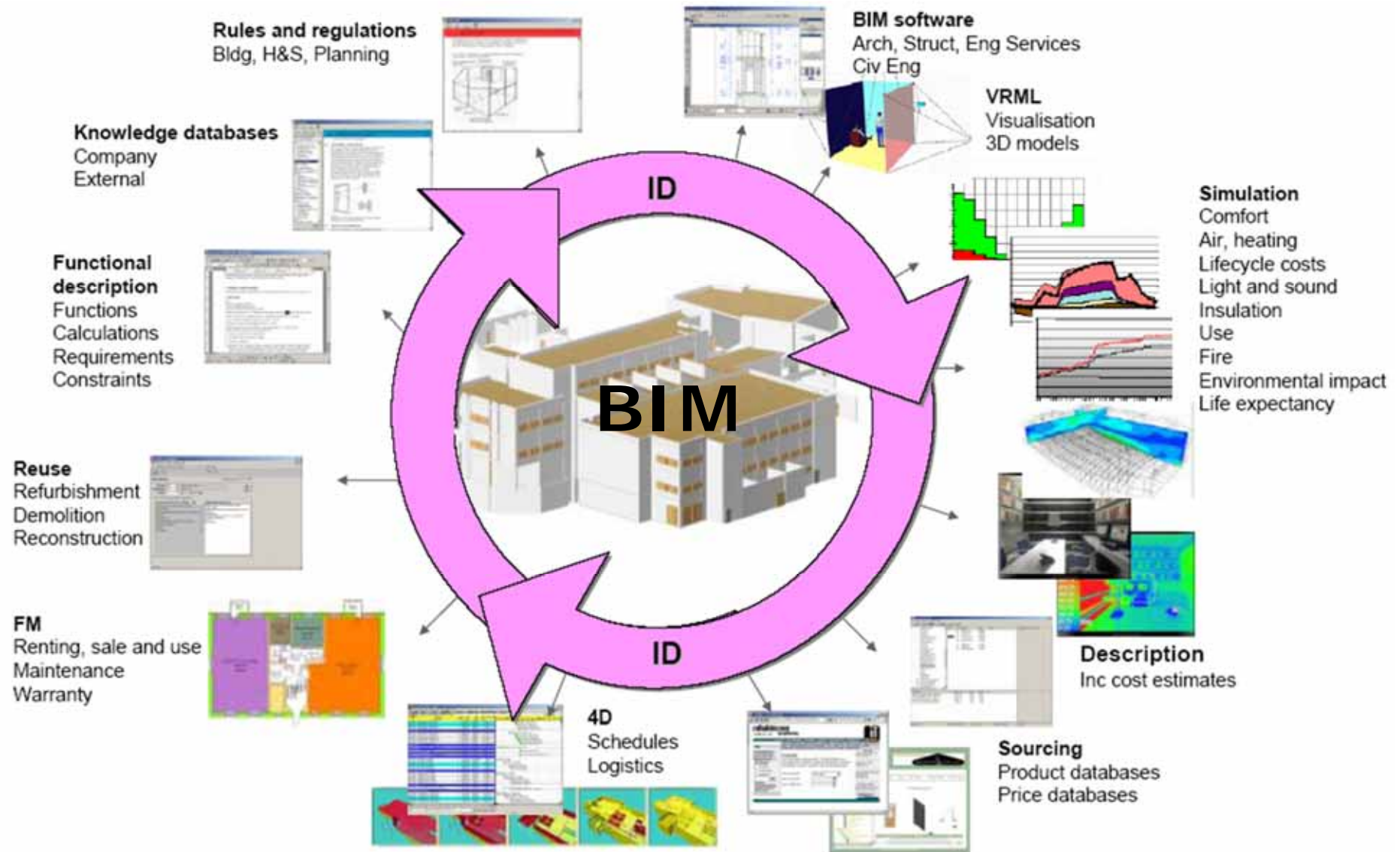
✓ **6 Partner**

<b>Technische Universität Dresden</b>	Germany	
Institut für Bauinformatik (CIB, Prof. Scherer - Koordinator)		
Institut für Bauklimatik (IBK, Prof. Grunewald)		
Institut für Angewandte Informatik (TIS, Prof. Kabitzsch)		
<b>Nemetschek Slovensko, S.R.O.</b>	Slovakia	1064 Mitarbeiter
<b>Insinööritoimisto Olof Granlund Oy</b>	Finland	360
<b>Royal BAM Group NV</b>	Netherlands	8954
BAM Utiliteitsbouw	NL	
BAM Deutschland AG	DE	
BAM Construct	UK	
<b>Obermeyer Planen+Beraten</b>	Germany	1200
<b>AEC3</b>	UK	3

✓ **Ressourcen**

- **Personenmonate** - **420**    (**11,7 Personen x 3 Jahre**)
- **Förderung**                      - **2,7 Mio. €**

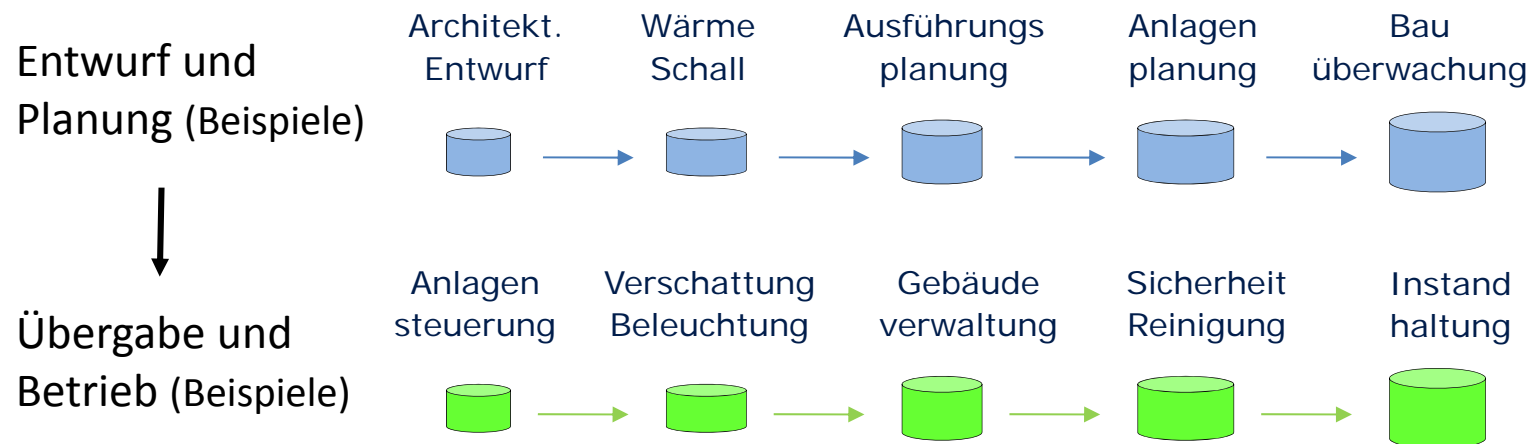






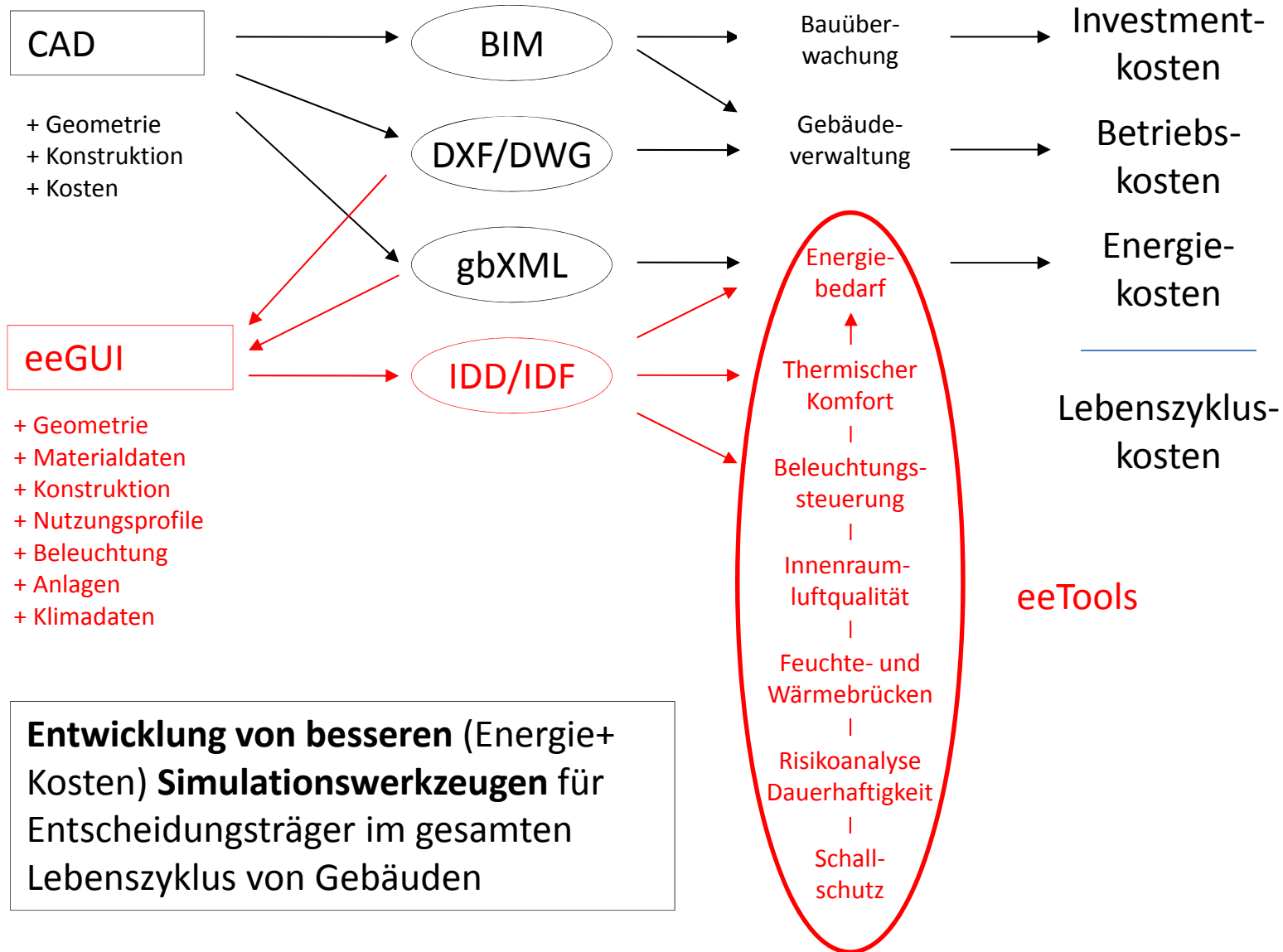
## Building Information Modeling (BIM)

- Interoperabilität verschiedener Werkzeuge
- Gemeinsames offenes Datenmodell
- Durchgängige Information in Datenbanken



**Energetische Optimierung am Beginn/Ende der Wertschöpfungskette!**  
**BIM ist nicht genug!**

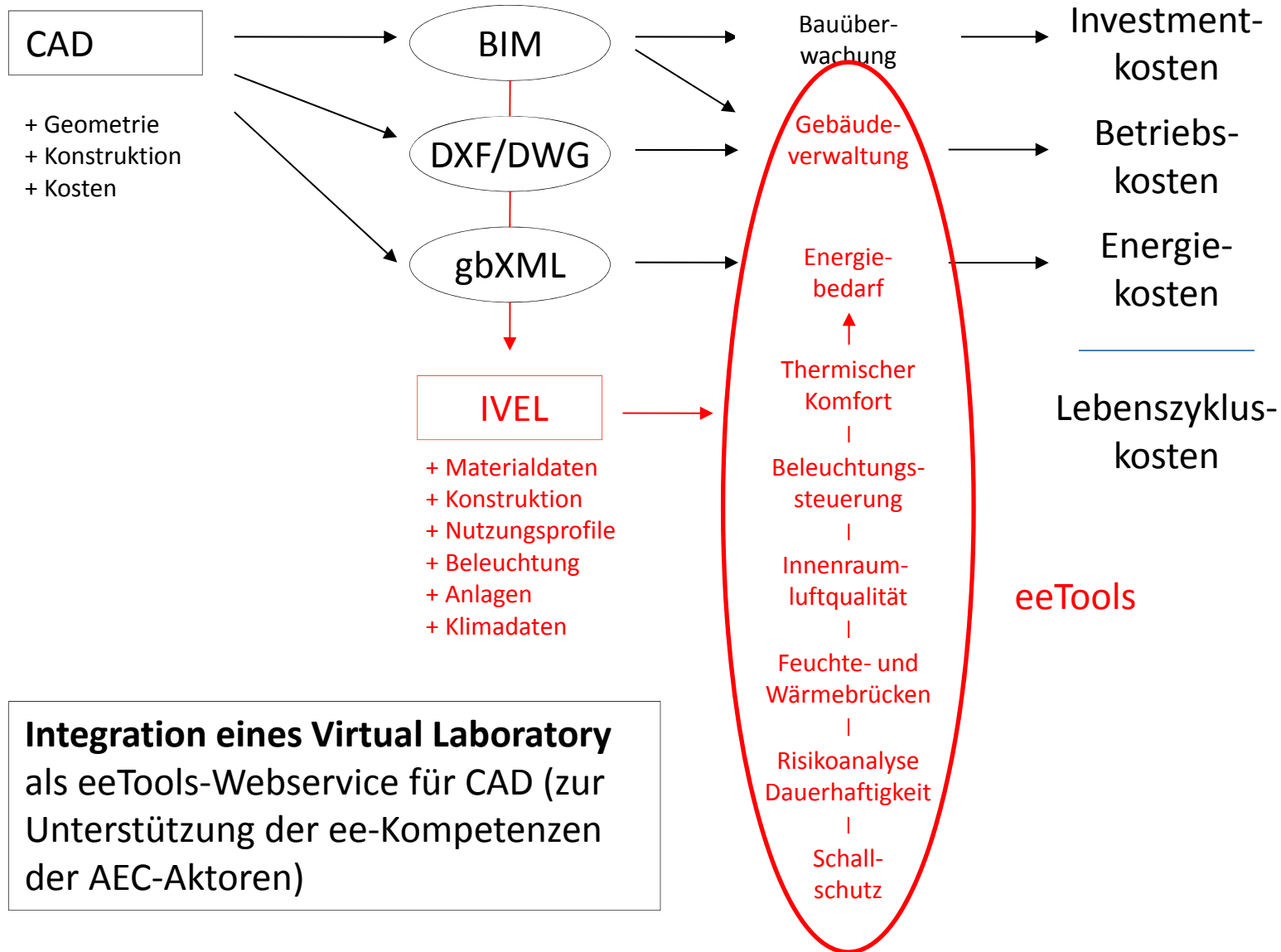
# Was sind eeTools?



**Entwicklung von besseren (Energie+ Kosten) Simulationswerkzeugen für Entscheidungsträger im gesamten Lebenszyklus von Gebäuden**

eeTools

# Was ist das Virtual Energy Lab?



**Integration eines Virtual Laboratory als eeTools-Webservice für CAD (zur Unterstützung der ee-Kompetenzen der AEC-Aktoren)**

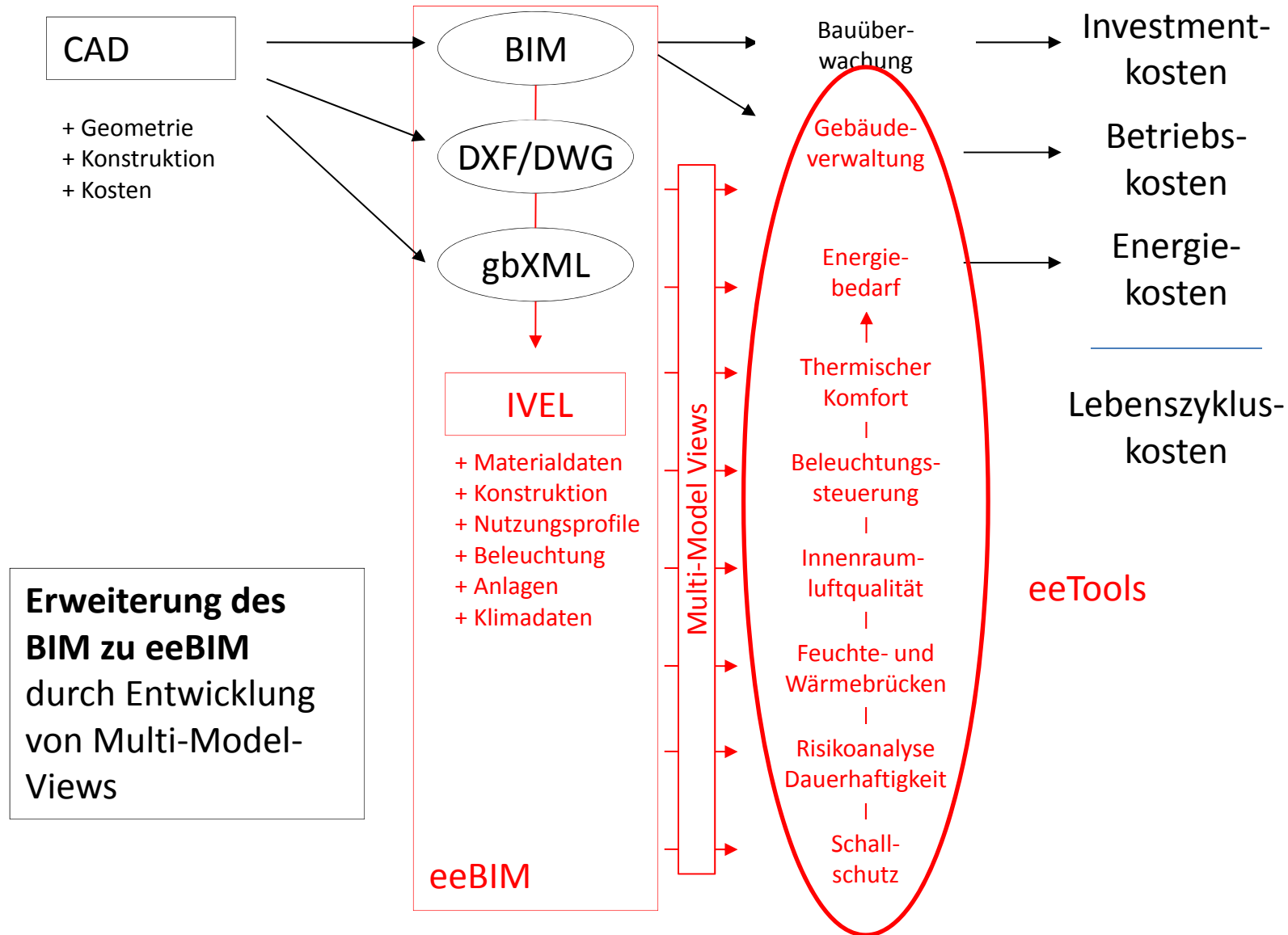


- Werkzeuge müssen auf die Nutzeranforderungen angepasst sein, die “Sprache” der Nutzer sprechen
- Übermenge an Information in BIM macht effizienten Datenaustausch schwierig
- Individuelle Werkzeuge im Lebenszyklus von Gebäuden erfordern ihre eigene Sicht von BIM
  - sind typischerweise Untermengen des gesamten BIM
  - angereichert mit domänen-spezifischen Modelldaten

**BIM + Multi-Model Views = eeBIM**



# Was ist eeBIM?



**Erweiterung des BIM zu eeBIM**  
 durch Entwicklung  
 von Multi-Model-  
 Views



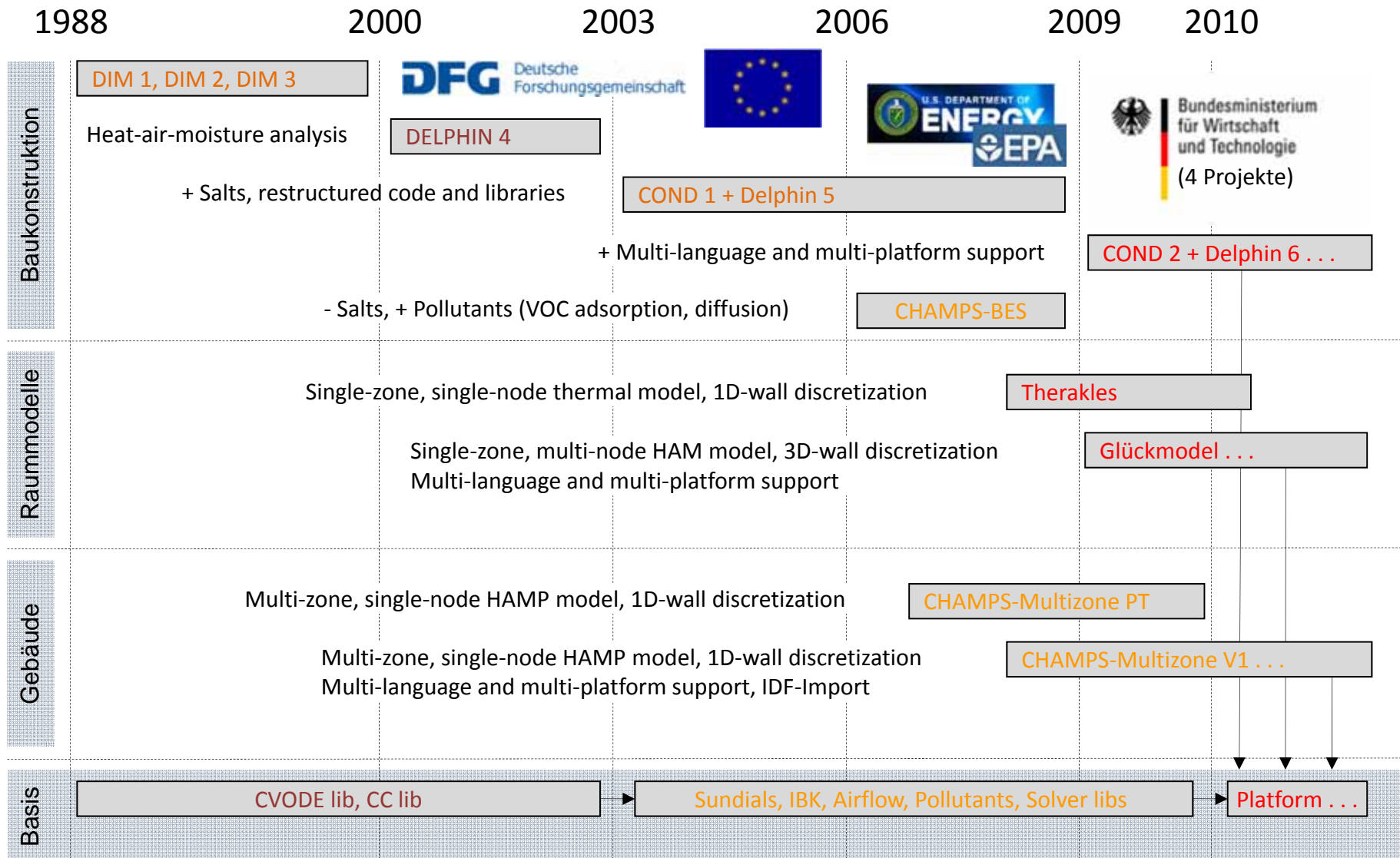
- 1. Entwicklung von besseren (Energie+ Kosten) Simulationswerkzeugen** für Entscheidungsträger im gesamten Lebenszyklus von Gebäuden
- 2. Integration eines Virtual Laboratory als eeTools-Webservice** für CAD (zur Unterstützung der ee-Kompetenzen der AEC-Aktoren)
- 3. Erweiterung des BIM zu eeBIM** durch Entwicklung von **Multi-Model-Views**
- 4. Schnittstellen zwischen Building Information Modelling (BIM) und Building Automation Systems (BAS)** für die Betriebsoptimierung

## **HESMOS Produkt:**

***Integrated Virtual Energy Laboratory (IVEL)***



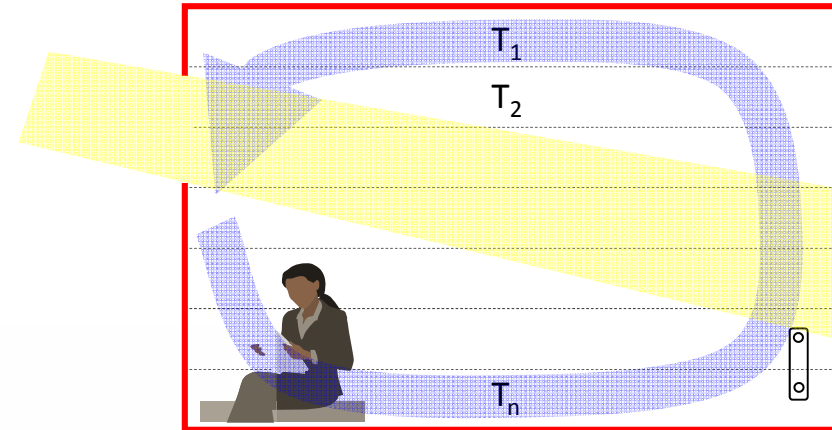
# Beispiele eeTools (IBK-Entwicklung)



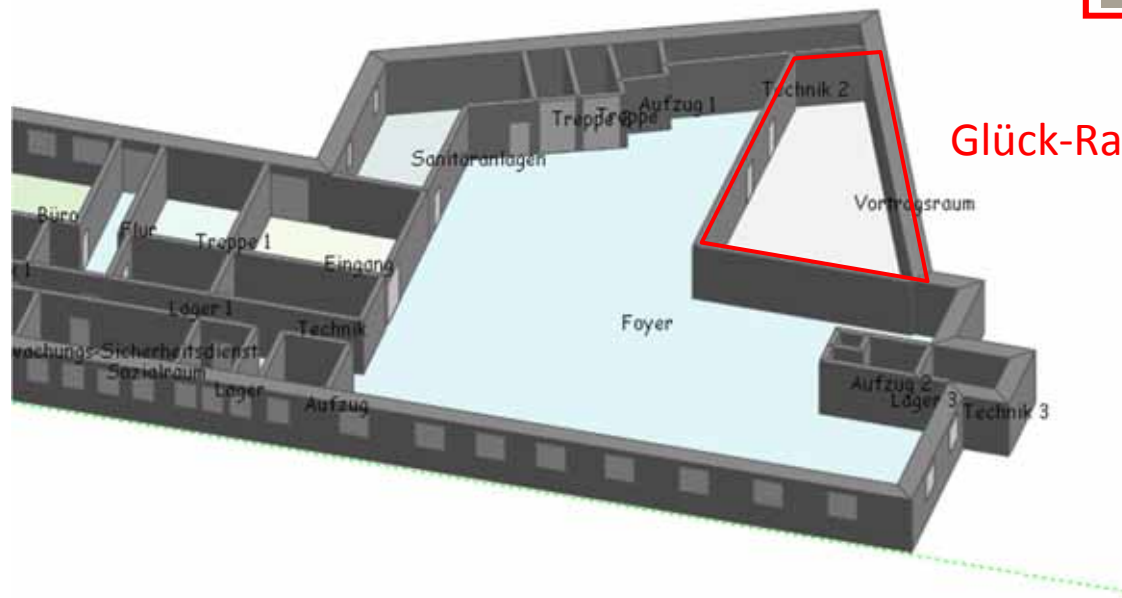


## Gebäudesimulationsplattform + Glückmodell

- Eingabe der Geometrie, Wandaufbauten
- Einteilung des Gebäudes in Zonen
- Zuweisung der Nutzung in Zonen
- Spezifikation der Beleuchtung
- Spezifikation der Anlagentechnik



Vertikalschnitt



Glück-Raum

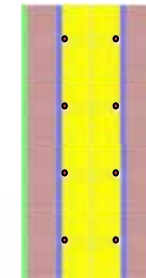
- Einstrahlzahlen
- Strahlungstemperaturasymm.
- Temperaturschichtung
- Raumluftströmungen
- Behaglichkeit



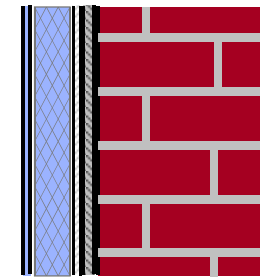
## Gebäudesimulationsplattform + Delphinmodell

- Eingabe der Geometrie, Wandaufbauten
- Einteilung des Gebäudes in Zonen
- Zuweisung der Nutzung in Zonen
- Spezifikation der Beleuchtung
- Spezifikation der Anlagentechnik

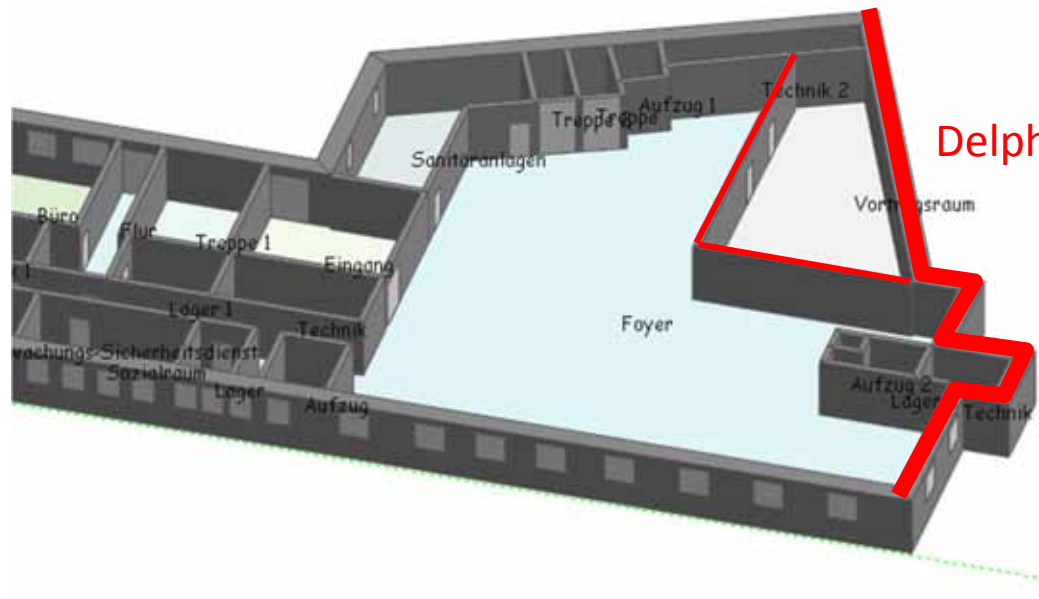
z.B.  
thermoaktives  
Bauteil



z.B.  
kapillaraktive  
Innendämmung



Vertikalschnitte



Delphin-Wände (1D, 2D, 3D)

- Thermische Speicherung
- Wandheizungen
- Hygrothermische Prozesse
- Mikroklima
- Dauerhaftigkeit
- Emissionen



# Demonstrationsgebäude (Auswahl)



## West Dunbartonshire Schools

PFI contract involving BAM PPP (finance & investment), BAM Construction (D&C) and BAM FM (O&M)

Location: near Glasgow, UK



The project encompasses 3 secondary schools (completed Aug. 2009) as well as 1 primary school (due late 2010). The schools are built to latest UK building standards (fit to purpose Community Learning Centres). Heating and cooling are provided via ground source heat pumps.

Capacity: over 4500 pupils

Investor: BAM PPP (100%) – responsible for the day-to-day management of the facilities, with BAM FM providing operational and maintenance services such as janitorial services, security, energy and utilities management, waste management.

Concession period: 30 years

All influencing variables must be recorded and documented to inspect and evaluate the calculated values for the heating and cooling system.

BAM FM (UK) will be able to provide data and information on energy consumption, while BAM Construction (UK) will be able to provide information on design and specification, as well as building standards, regulations and other relevant data for HESMO analysis and simulation tools.





## Solihull Schools

PFI contract involving BAM PPP (finance & investment), BAM Construction (D&C) and BAM FM (O&M)

Location: near Birmingham, UK



The project comprises 3 secondary schools and 1 special education needs facility. The three schools provide replacements for 1,400 pupils each, the special-needs facility is a new purpose-built building for 50 pupils, a 40 place PRU and a sports hall. Integrated services include places of worship and multi-purpose social spaces. All facilities are operational since 2009.

Investor: BAM PPP (100%)

FM contractor: BAM FM (100%)

Concession period: 25 years

The project includes a number of different facility types that can be very useful to test and validate HESMOS products.

These include, beside the mentioned school buildings a new theatre and chapel, a sports hall and a reconstructed swimming pool and sports complex.

As above, BAM FM and BAM Construction (UK) will be able to provide the needed data for HESMOS analysis and simulation tools.



## New Construction of the Landtag Brandenburg

PPP project; Public contracting body: Ministry of Finance of the State of Brandenburg, Germany

Location: Potsdam, Germany



The new construction of the Landtag of Brandenburg is being developed in the historical centre of the regional capital Potsdam. Behind the historical 3 part façade, a total of 4 modern office floors are installed. The preservation of monuments requires strong cooperation and coordination with the customer and the authorities.

In particular, to be able to adhere to the guidelines of the ENEC (energy saving regulation), the installation is as follows: constructive damping on inner concrete walls and the historical facades in front.

### Key figures:

Gross volume	150,632 m <sup>3</sup>
Gross floor area	34,525 m <sup>2</sup>
Building costs:	ca. € 120 mill.
FM contractor:	BAM (100%)
Concession period:	30 years

Similar to the presented UK projects the influencing variables must be recorded and documented to inspect and evaluate the calculated values for the heating / cooling system. This includes the recording of the energy consumption from the use of the IT systems to just the same extent as the heating up of the building through insulation. In addition options must be created that enable the inspection of energy storage and energy retrieval.

BAM will provide energy-related and other necessary data from FM and construction in their capacity of both contractor and operator of the facility.



## Rudolf-Harbig Stadium Dresden

PPP project: Landeshauptstadt Dresden, Dresden Stadium Projektges. mbH, BAM AG

Location: Dresden, Germany



The new Dresden stadium has a capacity for ca. 32,000 spectators (incl. a VIP area for 1,343 persons). A particular focus provides the use of a large number of pre-fabricated elements.

### Key figures:

Gross area	78,870 m <sup>2</sup>
Field area	22,603 m <sup>2</sup>
Building costs: ca.	€ 47 mill.
FM contractor:	BAM (100%)
Concession period:	30 years

The operation of the stadium is characterised by a multiple use concept: (1) football arena, (2) staging of musical events for 100 up to 32,000 people, (3) exhibitions/meetings in the business area, and (4) entertainment events (PPP contract duties).

HESMOS should enable greater energy efficiency by (1) simulation of usage scenarios, (2) reducing peak electricity loads, (3) simulation of work performance to aid decision-making and (4) integrated reduction of emissions while taking the operating situation into account.



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# Vielen Dank

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