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the European Union



REEP Plus Policy Dialogue

Using SBEM to implement the EPBD

EECG workshop

Vienna, 20 November 2019

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CONSULTING
ASSOCIATES

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Background

A recap of the background

- ▶ REEP Plus is helping several countries of the Western Balkans to implement the **EPBD**, as adopted by the Energy Community
 - **ECA** is the lead consulting firm and has teamed with other specialist outfits
 - **BRE** is assisting with legislative and IT implementation of the EPBD
- ▶ Three parts of the Directive are **inter-related**
 - National Calculation Methodology (NCM)
 - Minimum Energy Performance Requirements (MEPR)
 - Energy Performance Certificates (EPCs)

DIRECTIVE 2010/31/EU of 19 May 2010 on the energy performance of buildings

Incorporated and adapted by Ministerial Council Decision 2010/02/MC-EnC of 24 September 2010 amending Decision 2009/05/MC-EnC of 18 December 2009 on the implementation of certain Directives on Energy Efficiency.

The adaptations made by Ministerial Council Decision 2010/02/MC-EnC are highlighted in bold and blue.

Whereas:

(1) Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings has been amended. Since further substantive amendments are to be made, it should be recast in the interests of clarity.

(2) An efficient, prudent, rational and sustainable utilisation of energy applies, *inter alia*, to oil products, natural gas and solid fuels, which are essential sources of energy, but also the leading sources of carbon dioxide emissions.

(3) Buildings account for 40% of total energy consumption in the Union. The sector is expanding, which is bound to increase its energy consumption. Therefore, reduction of energy consumption and the use of energy from renewable sources in the buildings sector constitute important measures needed to reduce the Union's energy dependency and greenhouse gas emissions. Together with an increased use of energy from renewable sources, measures taken to reduce energy consumption in the Union would allow the Union to comply with the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC), and to honour both its long term commitment to maintain the global temperature rise below 2 °C, and its commitment to reduce, by 2020, overall greenhouse gas emissions by at least 20% below 1990 levels, and by 30% in the event of an international agreement being reached. Reduced energy consumption and an increased use of energy from renewable sources also have an important part to play in promoting security of energy supply, technological developments and in creating opportunities for employment and regional development, in particular in rural areas.

(4) Management of energy demand is an important tool enabling the Union to influence the global energy market and hence the security of energy supply in the medium and long term.

(5) The European Council of March 2007 emphasised the need to increase energy efficiency in the Union so as to achieve the objective of reducing by 20% the Union's energy consumption by 2020 and called for a thorough and rapid implementation of the priorities established in the Commission Communication entitled "Action plan for energy efficiency: realising the potential". That action plan identified the significant potential for cost-effective energy savings in the buildings sector. The European Parliament, in its resolution of 31 January 2008, called for the strengthening of the provisions of Directive 2002/91/EC, and has called at various times, on the latest occasion in its resolution of 3 February 2009 on the Second Strategic Energy Review, for the 20% energy efficiency target in 2020 to be made binding. Moreover, Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020, sets national binding targets for CO₂ reduction for which energy efficiency in the building sector will be crucial,

NCM, MEPS and EPCs

NCM

Article 3: 'A methodology for calculating the energy performance of buildings..'

To include heating, cooling, ventilation, hot water and lighting

NCM, MEPR and EPCs

NCM



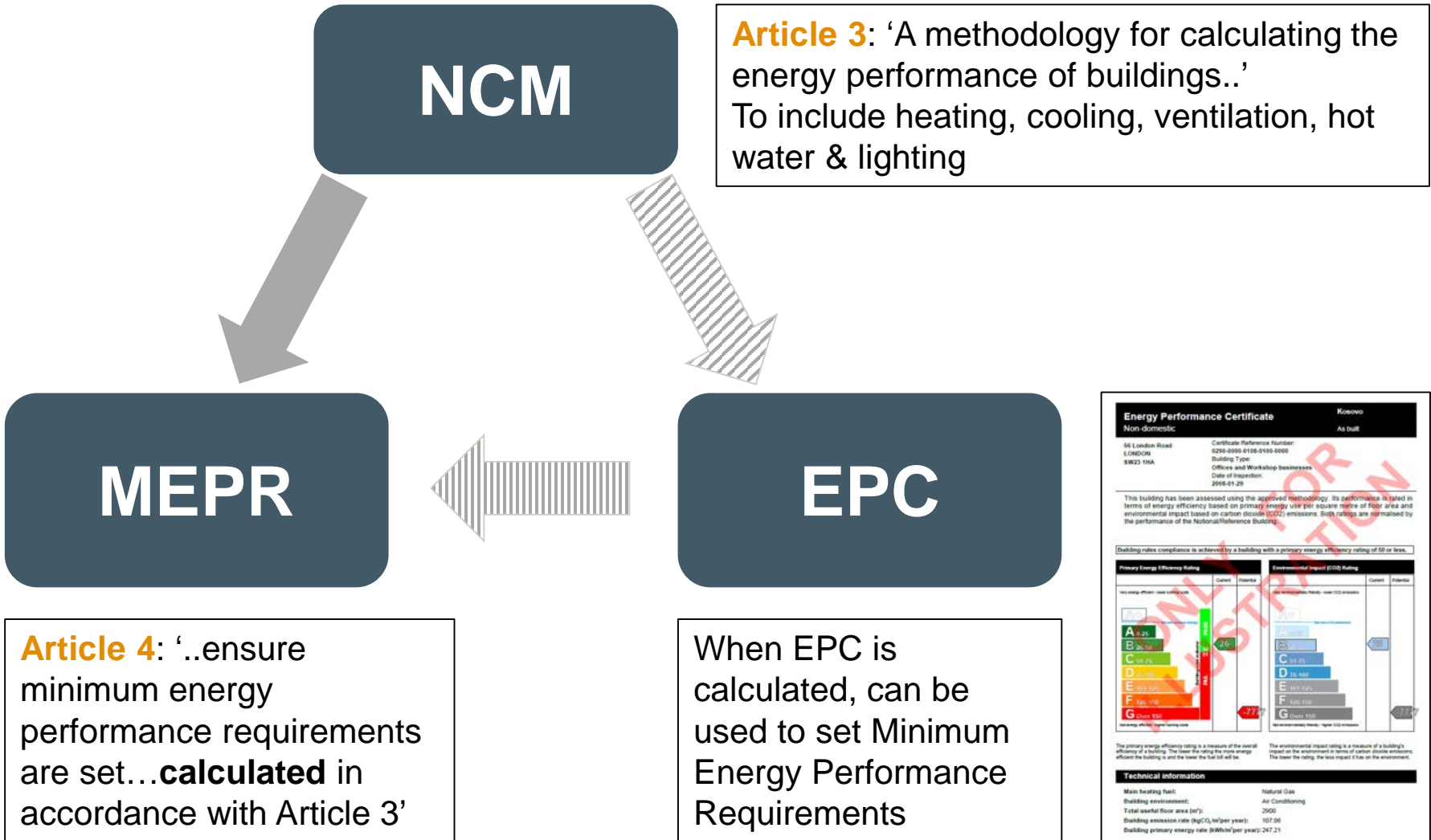
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graph TD; NCM[NCM] --> MEPR[MEPR];
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Article 3: 'A methodology for calculating the energy performance of buildings..' To include heating, cooling, ventilation, hot water & lighting

MEPR

Article 4: '..ensure minimum energy performance requirements are set...**calculated** in accordance with Article 3'

NCM, MEPR and EPCs



The national calculation methodology

▶ EPBD Art 3 (Methodology)

- In accordance with Annex 1
- Based on European standards
- Adopted at national or regional level
- Closely linked to (software) tools which implement the methodology

▶ EPBD Annex 1 (Common framework)

- Calculated or actual annual energy for typical usage
- Energy performance and numeric indicator of primary energy
- Taking account of:
 - Thermal characteristics
 - Building services – heating, cooling, ventilation, lighting, hot water
 - Renewable energy systems
 - Design (including passive measures), position (climate) and orientation
 - Indoor climatic conditions
 - Internal heat loads (from people and equipment)
- For all different types of domestic and non-domestic buildings

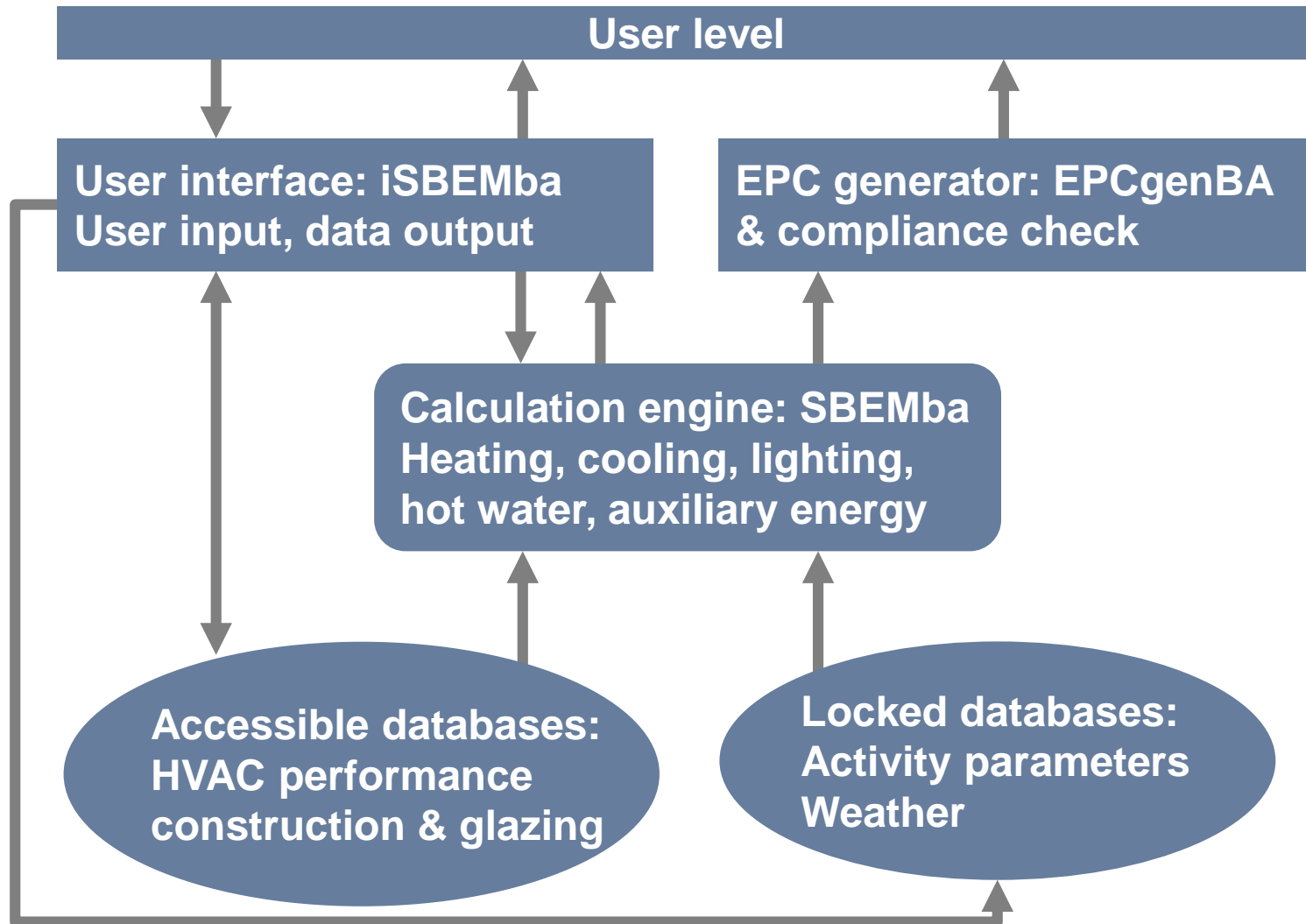
SBEM is one software implementation of this methodology

SBEM – the basics

Simplified Building Energy Model for the Balkans

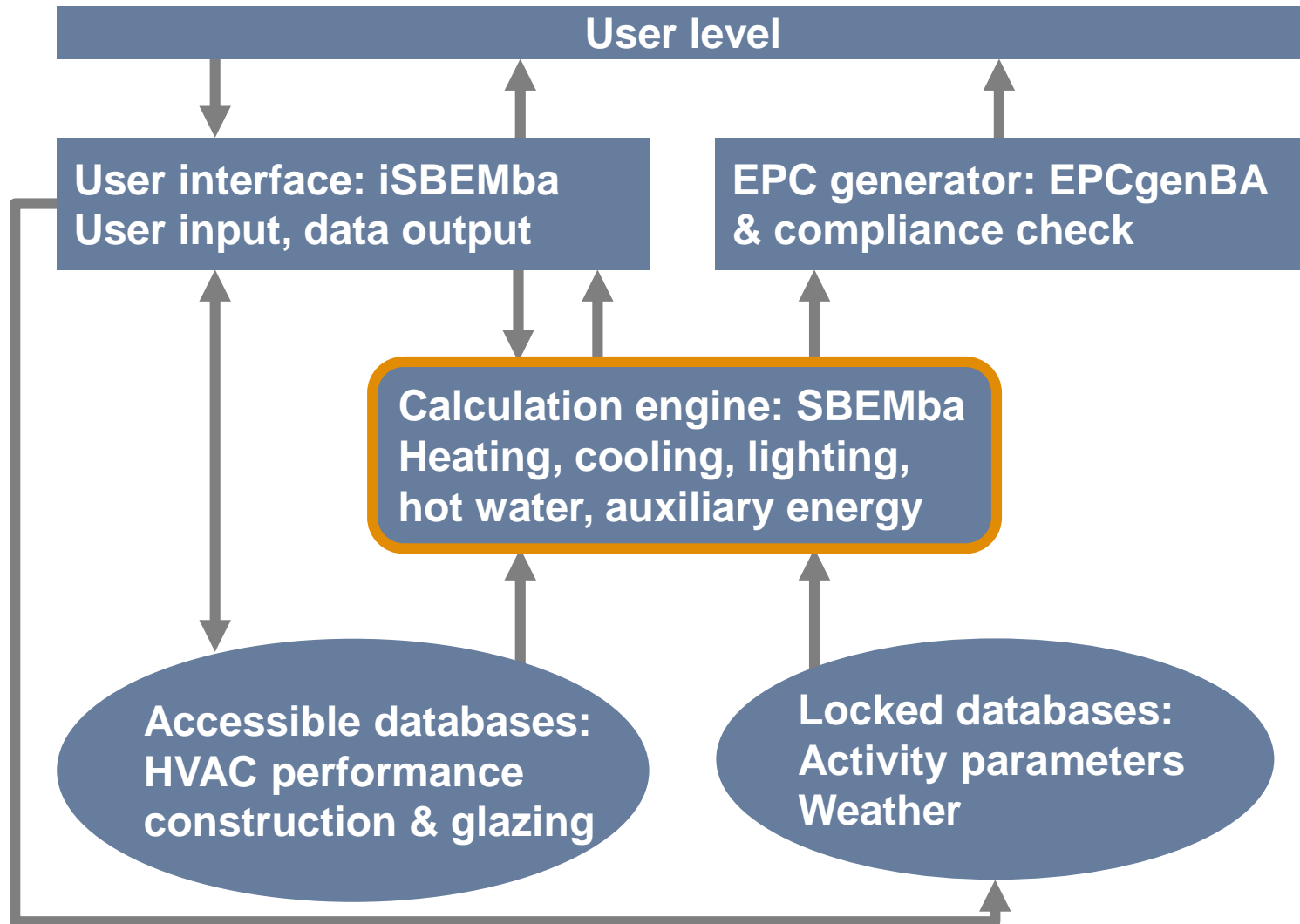
- ▶ **SBEM** (Simplified Building Energy Model) is a simplified software tool developed by BRE for the UK government as the default calculation software for non-residential buildings in the UK
- ▶ **iSBEM** is the user interface to **SBEM**
- ▶ In addition to the four countries of the UK, SBEM is currently used in Ireland, Cyprus, Gibraltar and Malta
- ▶ Under REEP and REEP Plus, BRE has modified and further developed this software to create **tailored versions** for **BA Federation, Croatia, Kosovo** and **North Macedonia**
- ▶ The tools perform the necessary energy calculations for dwellings and non-dwellings, in order to
 - generate EPCs
 - demonstrate compliance with MEPR

Simplified SBEM schematic



Simplified SBEM schematic

The engine



The process inside SBEM

▶ Calculates monthly energy need for

- Space heating
- Space cooling
- Auxiliary energy (pumps and fans)
- Lighting
- Water heating

Based on

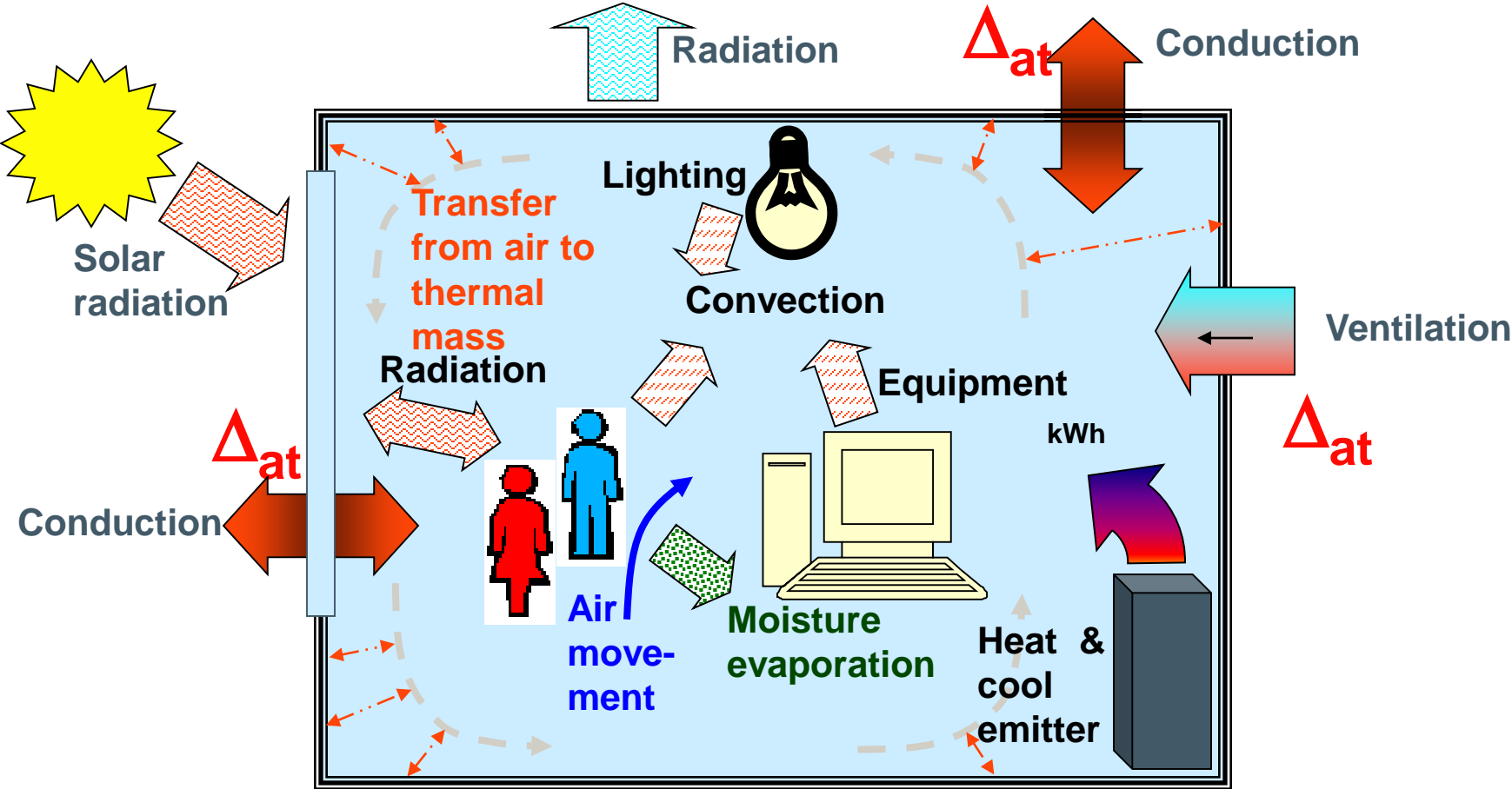
- Geometry
- Construction
- Activity parameters and schedules

▶ Calculates delivered energy consumption (use) to meet needs, using

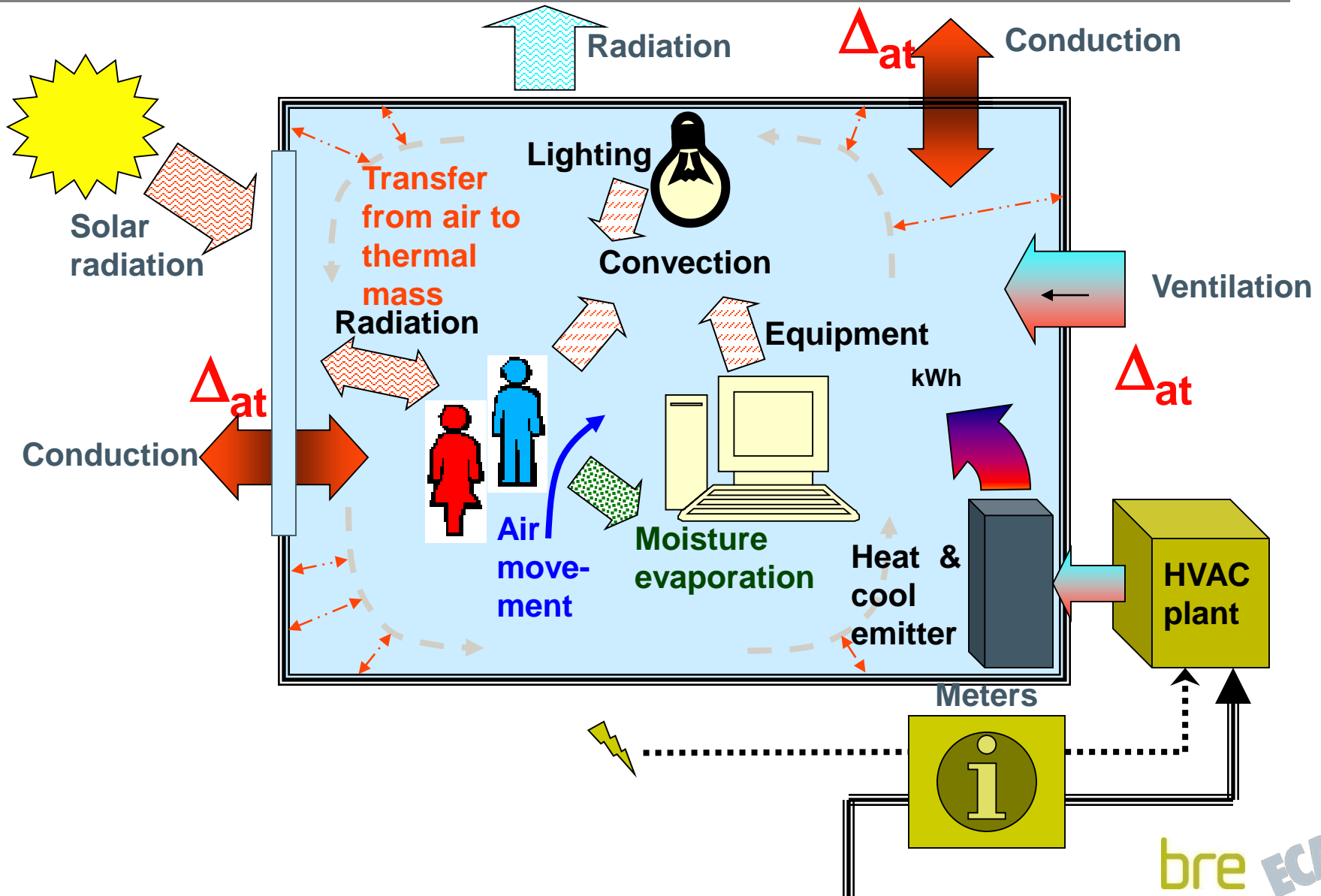
- System types
- System efficiencies

▶ Converts delivered energy use to primary energy and CO₂ emissions using fuel factors

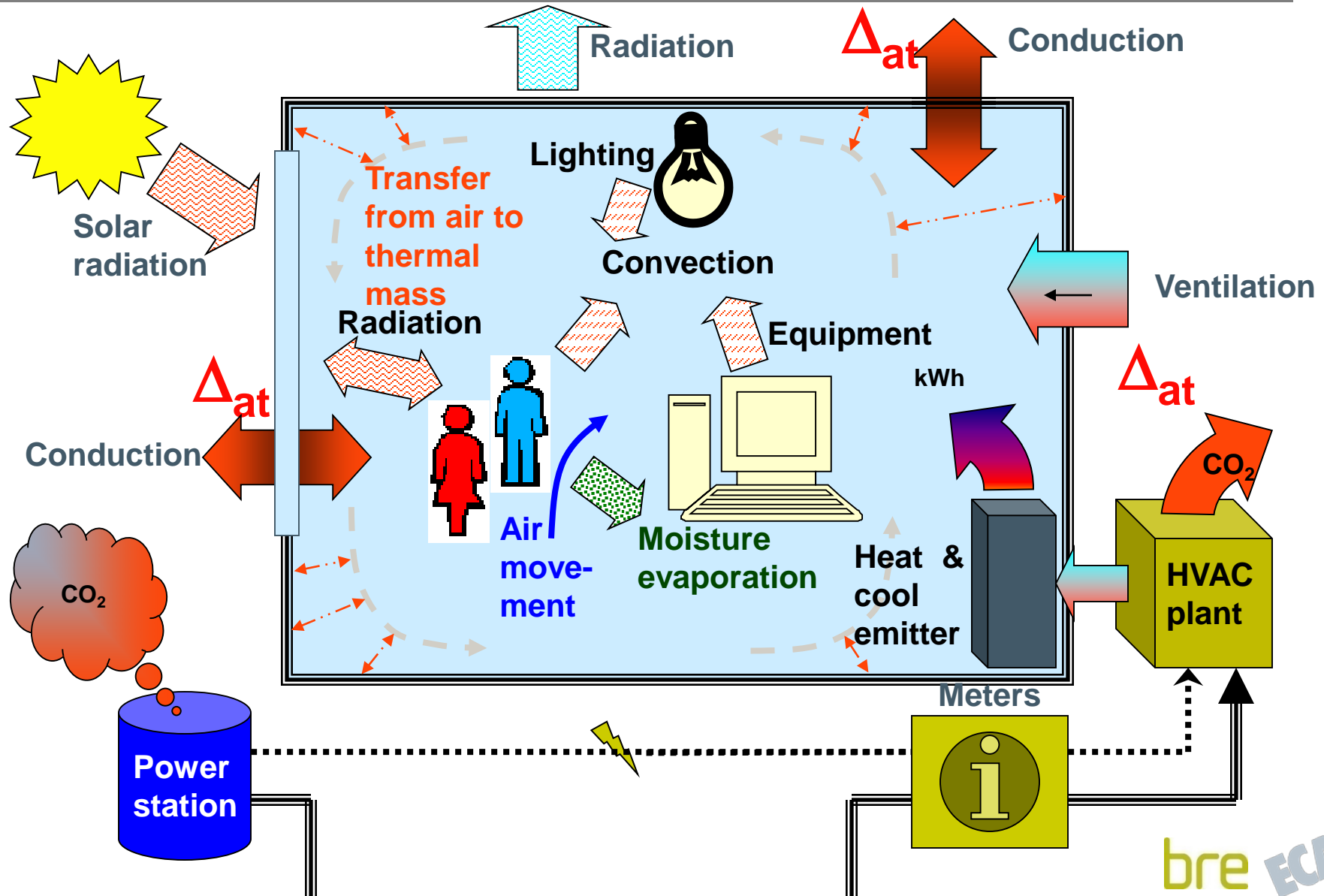
Energy need (kWh) in space for heating/cooling



Delivered energy use (kWh) = need/system efficiency



CO2 emissions = delivered energy x fuel emission factor
 primary energy = delivered energy x primary energy factor



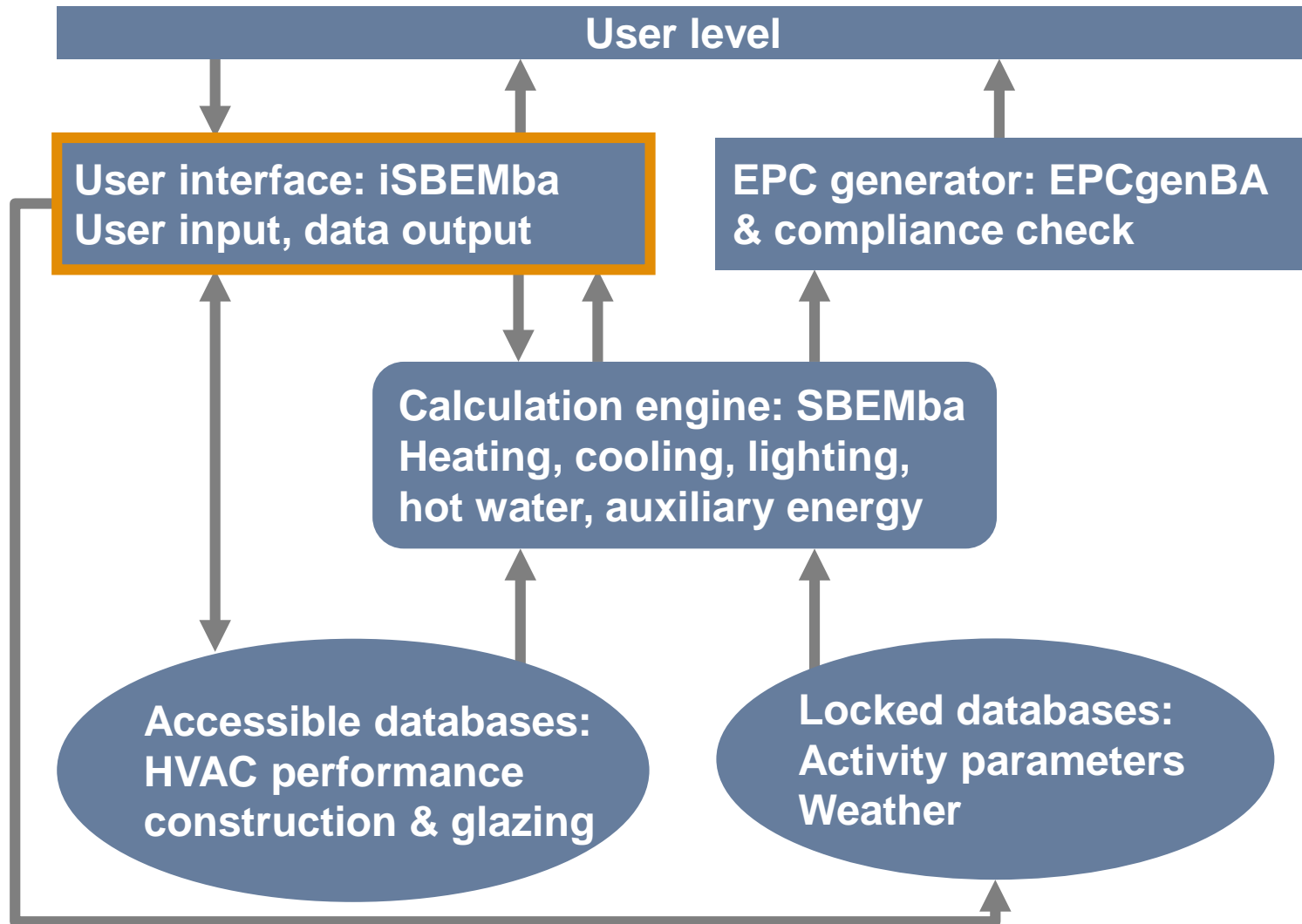
Basis of calculation algorithms

EN/ISO standards, covered by 'umbrella document' **PG-N37**, principally

- ▶ **EN 13790** - Multi-zone monthly calculation without thermal coupling between zones
- ▶ **EN 13789** Thermal transmission
- ▶ **EN 15193-1** Lighting
- ▶ **EN 15316-3** Domestic hot water
- ▶ **EN 15242** Ventilation

Simplified SBEM schematic

The interface



Describing the building - key stages

▶ Geometry

- Overall building layout
- Distribution of activity areas

▶ Construction

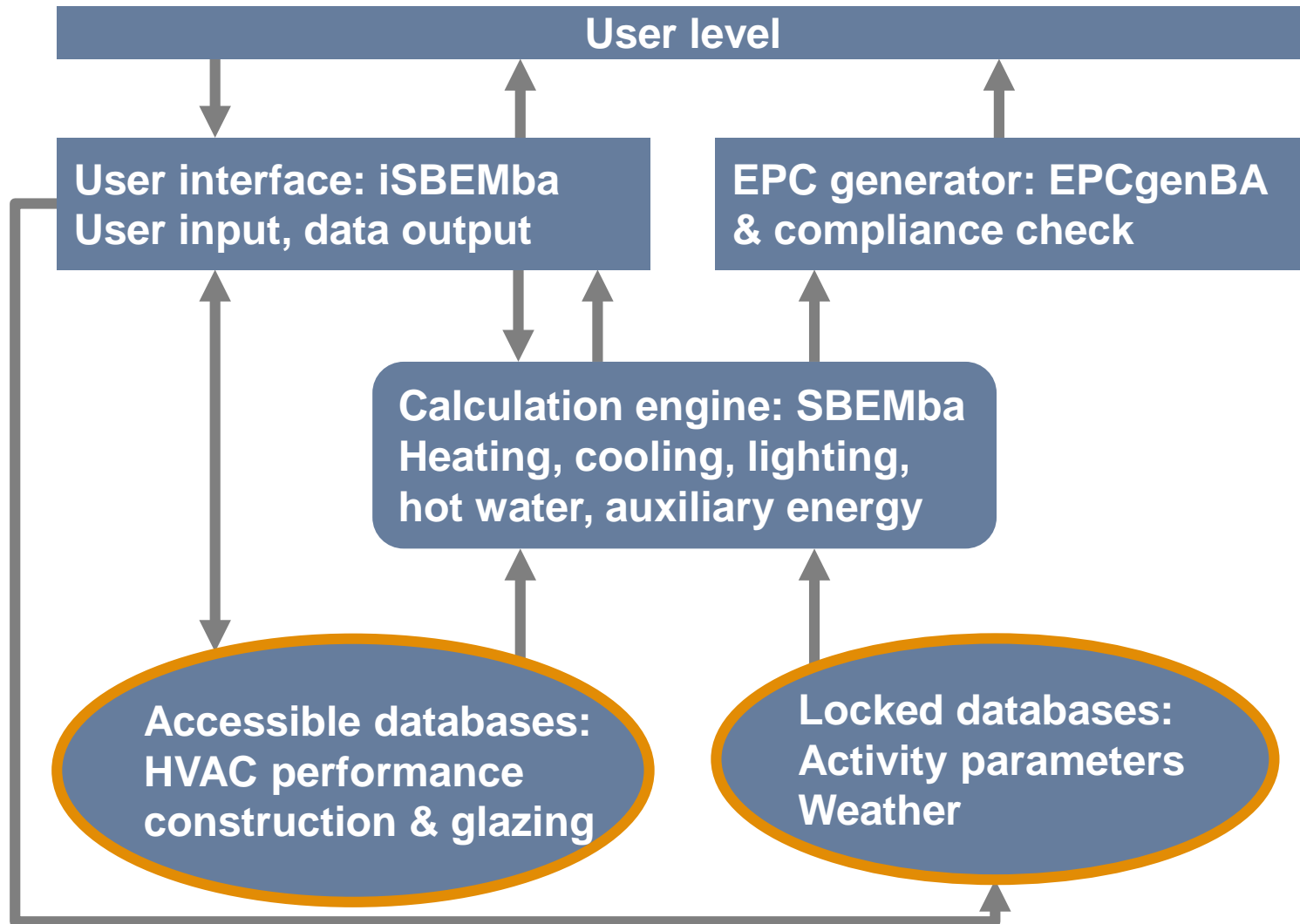
▶ Systems and controls

▶ Two different input routes

- New build – from plans
- Existing buildings – from a survey and other sources (eg log book data), supplemented by inference

Simplified SBEM schematic

The databases



Tailored databases for each country (1/2)

▶ Weather

- Weather data sets for several different locations in each country
- Comprising hourly values of temperature, humidity, solar radiation, etc
- Converted into monthly averages for use with SBEM

▶ Activity Database

- Defining desired standard performance parameters for each type of space in each type of building
- Eg classroom in a school, bedroom in a dwelling, ward in a hospital
- For each, specify
 - Set point temperatures
 - Occupancy hours and density
 - Hot water demand
 - Fresh air rates
 - Lighting levels
 - Etc

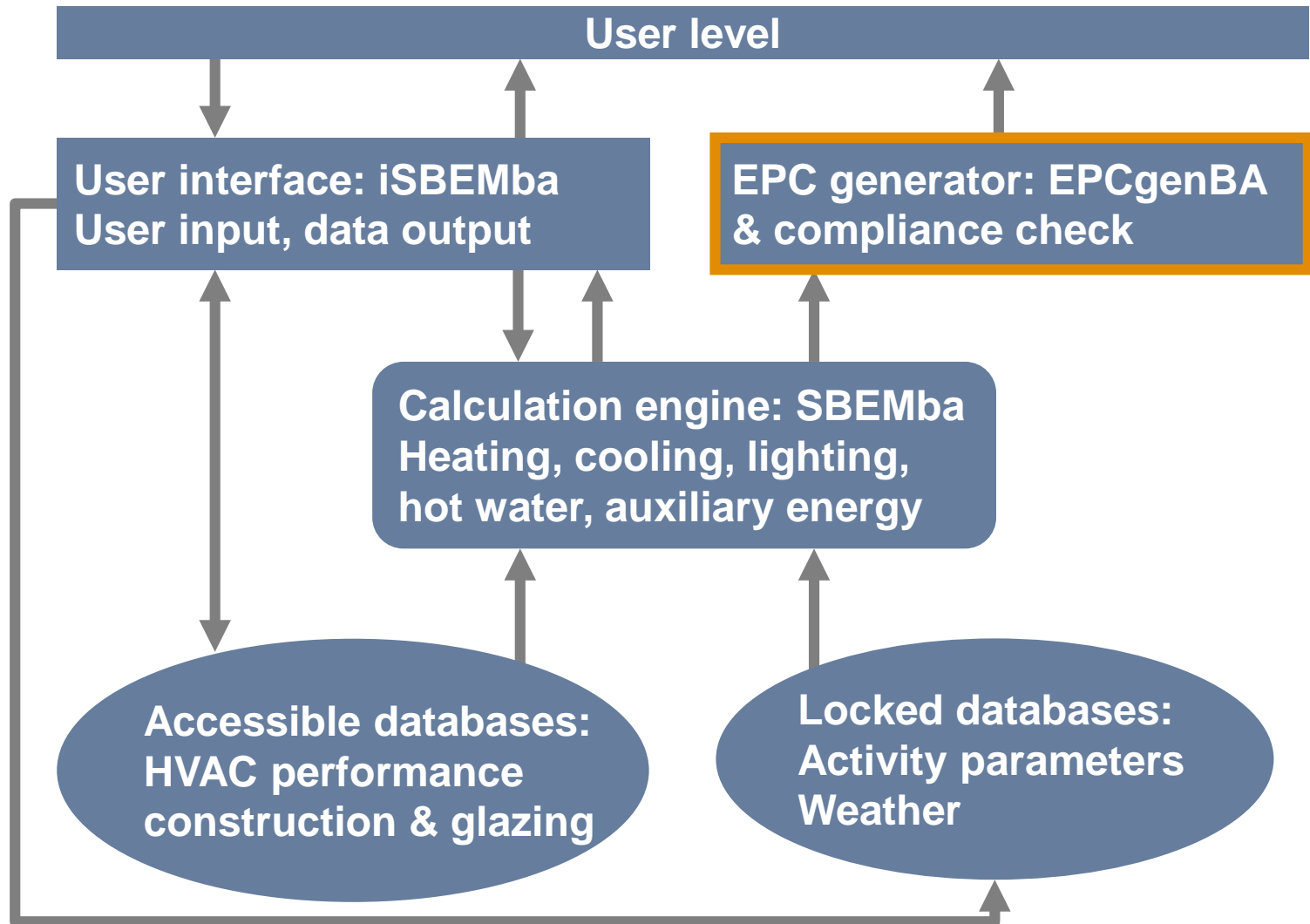
Tailored databases for each country (2/2)

▶ Construction and glazing

- Typical constructions for walls, floors, roofs, glazing
- Specifying U-values and thermal mass parameters for each
- Useful in selecting repeatable parameters for standard construction in existing buildings

Simplified SBEM schematic

EPC generation



Different methods for each country

- ▶ How to calculate EPC classes
- ▶ Benchmarks
- ▶ Minimum performance standards (based on cost-optimality studies)
- ▶ MEPR based on absolute values of primary energy per m² per year
- ▶ Or on comparison with a calculated reference building

Energy Performance Certificate Results

General
Project Database
Geometry
Building Services
Ratings
Building Navigation
About iSBEM

Asset Rating

EPC Bosnia_Herzegovina ?

Building Rating
Graphic rating
Recommendations
EPC Audit
Calculation Logs
Calculation Errors

	Heating	Cooling	Auxiliary	Lighting	Hot Water	Total	
Actual	10.21	12.64	20.67	22.99	17.15	83.67	kWh/m2/yr

kWh/m2/yr	SER	BER	EPC Rating		Total volume [m3]	8700
Band	45.66	34.56	76		Building shape factor [m-1]	0.5
	B-C	B			Average U-value [W/m2/K]	1.46
	Calculate EPC Rating				Building emission rate	51.74
					Building primary energy rate	213.43

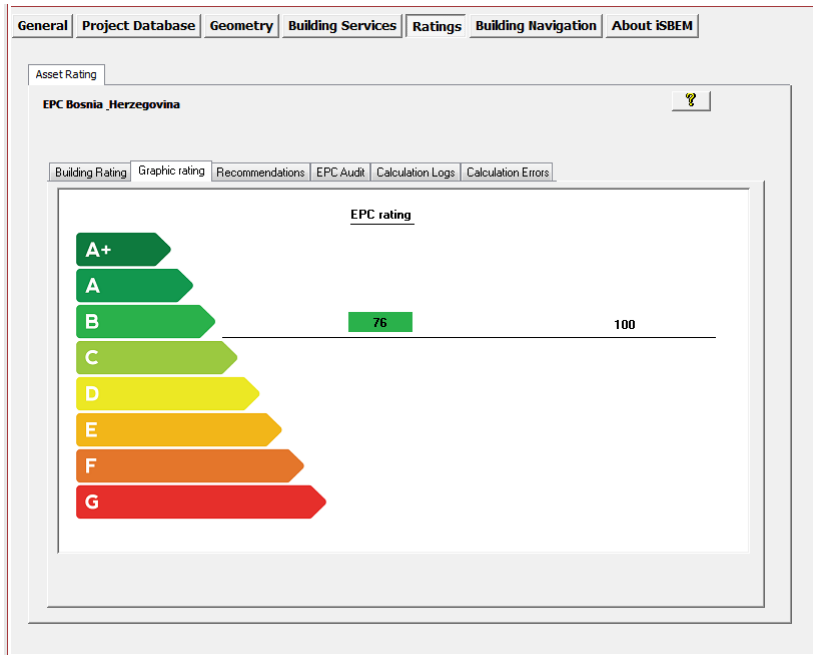
Calculation progress: Asset rating completed

☰ Click to check object assignments, there are NO CRITICAL un-assignments in the project

Energy Performance Certificate

For official output

EPC Rating

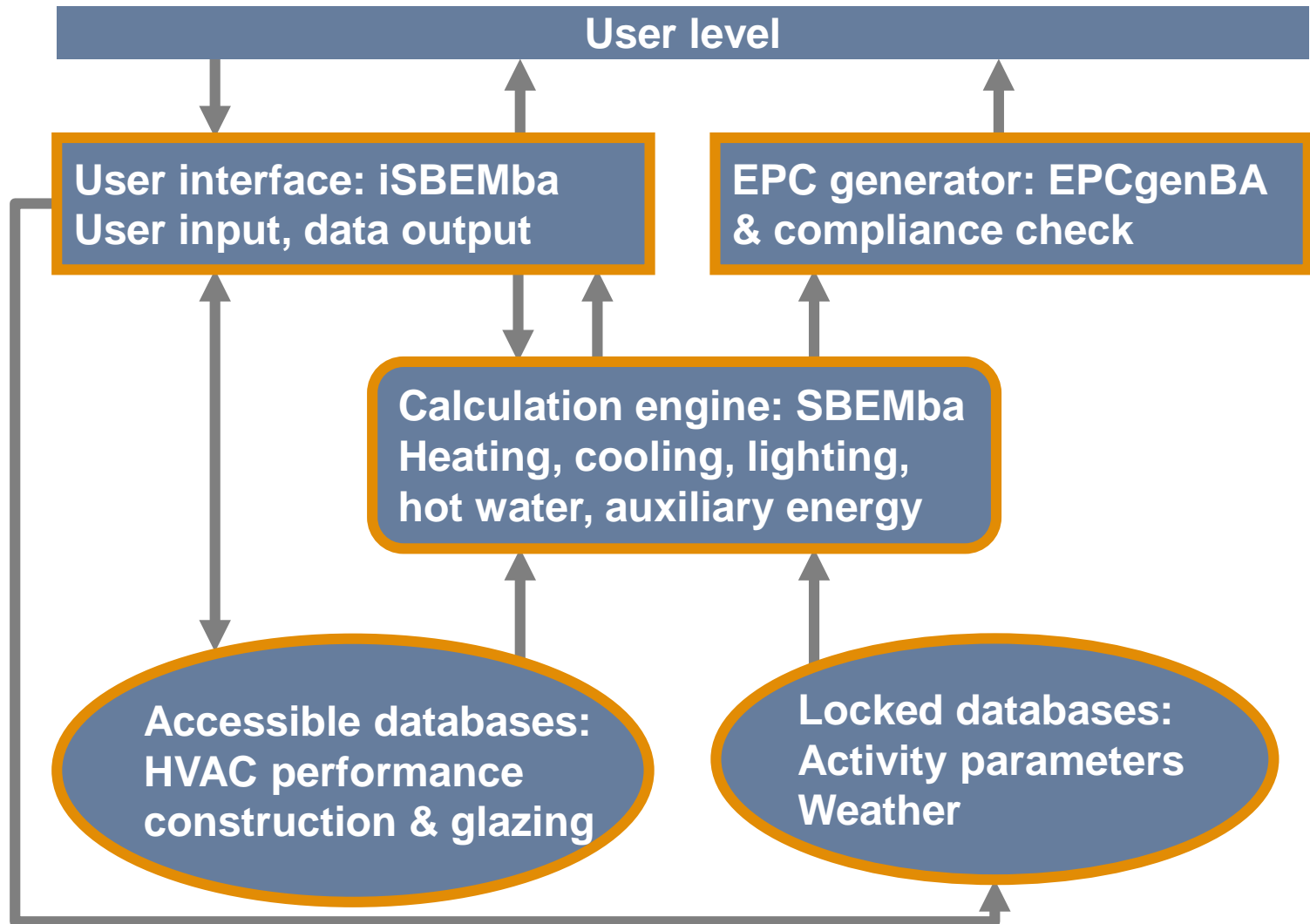


Recommendations

The screenshot shows the 'Recommendations' section of the software. It displays a detailed view of a recommendation for lighting fixtures. The recommendation is titled 'Introduce HF (high frequency) ballasts for fluorescent tubes: Reduced number of fittings required'. The category is 'LIGHTING' and the code is 'EPC-L7'. The interface includes a navigation menu at the top with 'Recommendations' selected, and a sub-menu below with 'Recommendations' selected. The recommendation details include 'Energy impact' (LOW), 'CO2 impact' (LOW), 'CO2 saved per KM spent' (GOOD), and 'Payback' (UNKNOWN). The applicable to is 'BUILDING' and the pay back is '-5556' years. The interface also includes a 'Show Recommendations' section with filters for 'All NCM', 'All USER', 'All', and 'Only from Report'.

Simplified SBEM schematic

The complete tool



What SBEM does and does NOT do

- ▶ Generates EPC rating and additional metrics
- ▶ Shows whether or not a building meets the minimum energy requirements for new buildings
- ▶ Allows you to check the effect of different design decisions

BUT

- ▶ It is NOT a design tool
- ▶ It is NOT a cost effectiveness calculation tool
- ▶ It does not prove that a design will work in practice
- ▶ It is not a tool for sizing equipment
- ▶ It does not predict the actual operational performance of the building

Live demonstration of tools

- ▶ iSBEMxk – for Kosovo
- ▶ iSBEMba for BA Federation

- ▶ In English and local languages

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