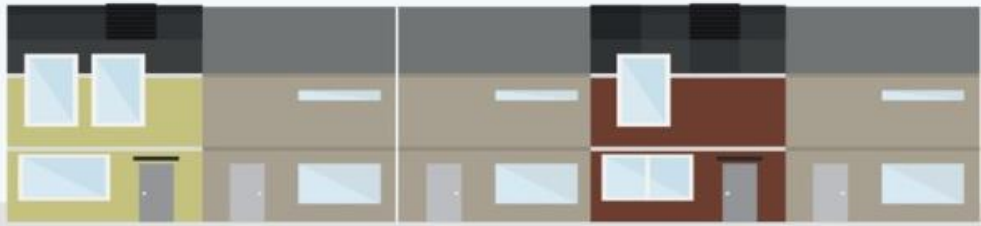
MORE — CONNECT



MORE-CONENCT 1ST TRAINING MODULE

DYNAMIC ENERGY SIMULATION

Duration: 4 hours

Type: class room lectures

Dr.sc.ing. Anatolijs Borodiņecs

M.sc.ing. Renars Millers

INTRODUCTION

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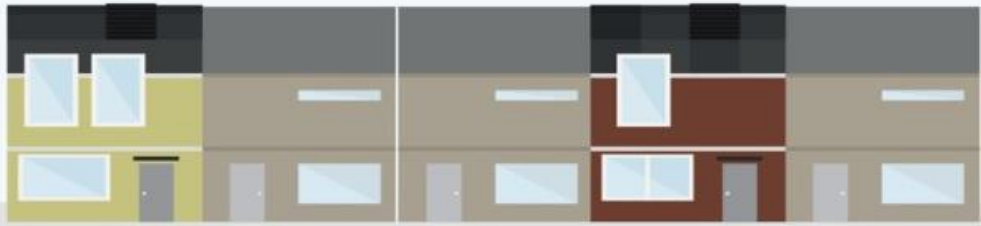


- Precise building energy simulation allows correct evaluation of energy savings and calculation of payback time. Currently widely used steady state energy calculation tools in Latvia don't consider air-tightness, occupant schedule, wind specifics, massivity of building constructions, Floating COP values of heating/cooling equipment etc. For large office buildings and buildings with large windows area and mechanical cooling systems the dynamic energy simulation tools are the most appropriate approach to make precise energy consumption estimation especially for summer time.
- This module is focused on building energy analysis using such dynamic energy simulation software as IDA-ICE, RIUSKA etc. In scope of this module the participants will learn on 3D building model import using IFC format, creation of building 3D model, definition of materials properties and climatic conditions. Each participant will receive IDA-ICE three-months educational license.
- During the lectures the comparison of energy calculation using steady tool and dynamic energy calculation for MORE-CONENCT case building will be analyzed.
- After completing this module individuals will be able to create own building model, to define boundary conditions and to make simplified building dynamic energy simulation.

OVERVIEW

MORE — CONNECT

https://www.buildingenergysoftwaretools.com/

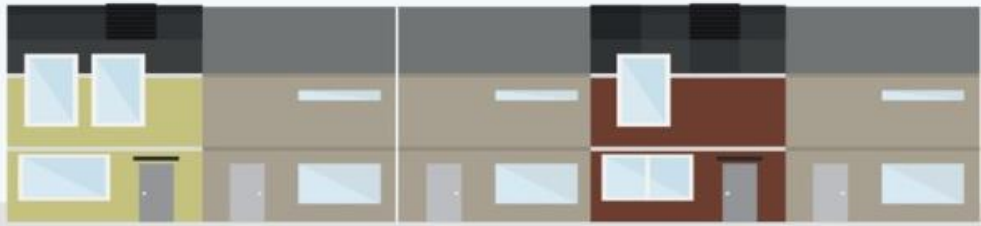
https://www.buildingenergysoftwaretools.com/software-listing?keywords=&field_catagory_tid%5B%5D=201&field_platform_tid=All&field_price_tid=All&field_last_updated_value%5Bvalue%5D%5Byear%5D=2010&field_language_tid=All&keys=&sort_by=field_rating_rating&sort_order=DESC&items_per_page=40

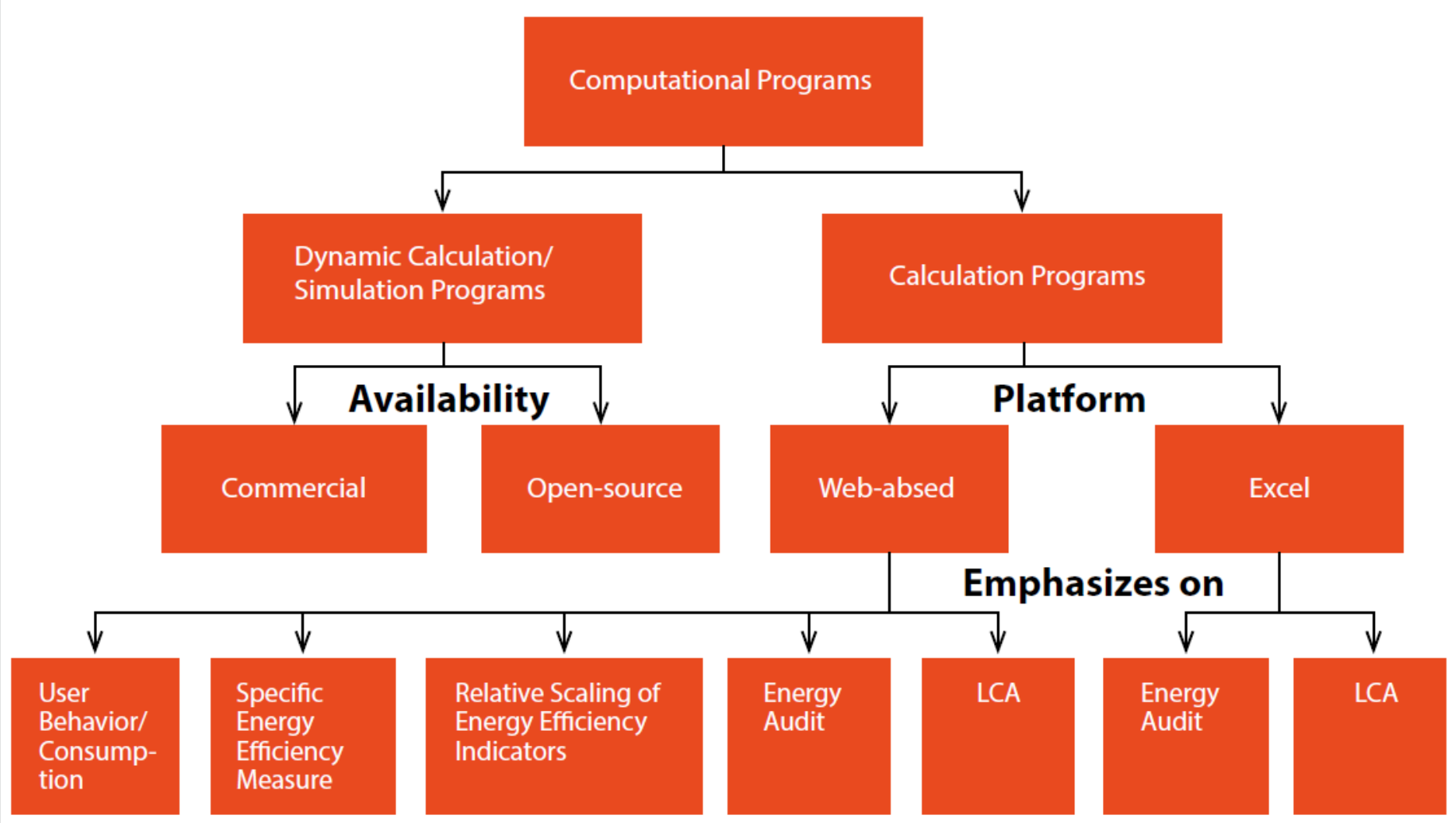
Tool	Applications	Expertize requirement	Load Calculation	Retrofit Analysis	Freely available
BV2	Annual energy use, durational diagram	HVAC systems	yes	yes	
IDA-ICE	Energy performance, thermal comfort, indoor air quality	HVAC systems	yes		
IDA-ESBO	Building design optimization to evaluate energy consumption and comfort	HVAC systems	yes		
RIUSKA	Energy calculation, heat loss calculation, system comparison, dimensioning, 3D modeling	Engineering background	yes	yes	
VIP-Energy	Energy performance, code compliance, economic and environmental calculations	Basic energy flows and building construction			
ParaSol	Energy demand and peak loads for heating / cooling for different glazing and shading devices.	solar radiation, solar shading, windows, energy performance indicators	yes		yes
DEROB-LTH	Influence of solar insolation and shading devices on the energy balance in the building	influence of different design parameters on the thermal behavior of a buildings			
EnergyPlus	EnergyPlus models heating, cooling, lighting, ventilation, other energy flows, and water use.	Engineering background	yes	yes	yes
DOF-Energy	Evaluates energy consumption and heat loss distribution of the buildings	HVAC and building design			
CELLAR	Calculates the heat loss to the ground from a rectangular building with a foundation of the cellar type with constant insulation thickness at the floor and the wall. Both the heat loss variation during the year, including the peak effect and the accumulated heat loss during the heating season, are calculated.	Engineering background helpful for analysis			
HEAT3	HEAT3 can be used for analyses of thermal bridges, heat transfer through corners of a window, heat loss from a house to the ground	Engineering background			
Unorm	UNorm calculates U-values, temperatures, heat flows, and Ψ- or X-values in 2- and 3-dimensional thermal bridges. The program divides the thermal bridge into small cells.	knowledge of thermal transfer, thermal conductivities, and boundary conditions			Yes
ISOVER Energi	Calculates: U-value, for constructions with and without thermal bridges; total heat loss for buildings; and energy demand for buildings.	Building constructions and installations, and of building regulations are necessary.	yes		
BSIM	Building simulation, energy, daylight, thermal and moisture analysis, indoor climate	Building design and how buildings behave thermally in order create the building model	yes		

Borodinecs.A., Rodriguez-Gabriel A., Tatarchenko O., and etc. Handbook on Buildings Renovation in Central Baltic Region – ISBN - 978-9934-507-39-7 – Riga: Riga Technical University

CLASSIFICATION OF COMPUTATIONAL PROGRAMS

MORE — CONNECT





Borodinecs.A., Rodriguez-Gabriel A., Tatarchenko O., and etc. Handbook on Buildings Renovation in Central Baltic Region – ISBN - 978-9934-507-39-7 – Riga: Riga Technical University

PARAMETERS CONSIDERED IN SIMULATION PROGRAMS

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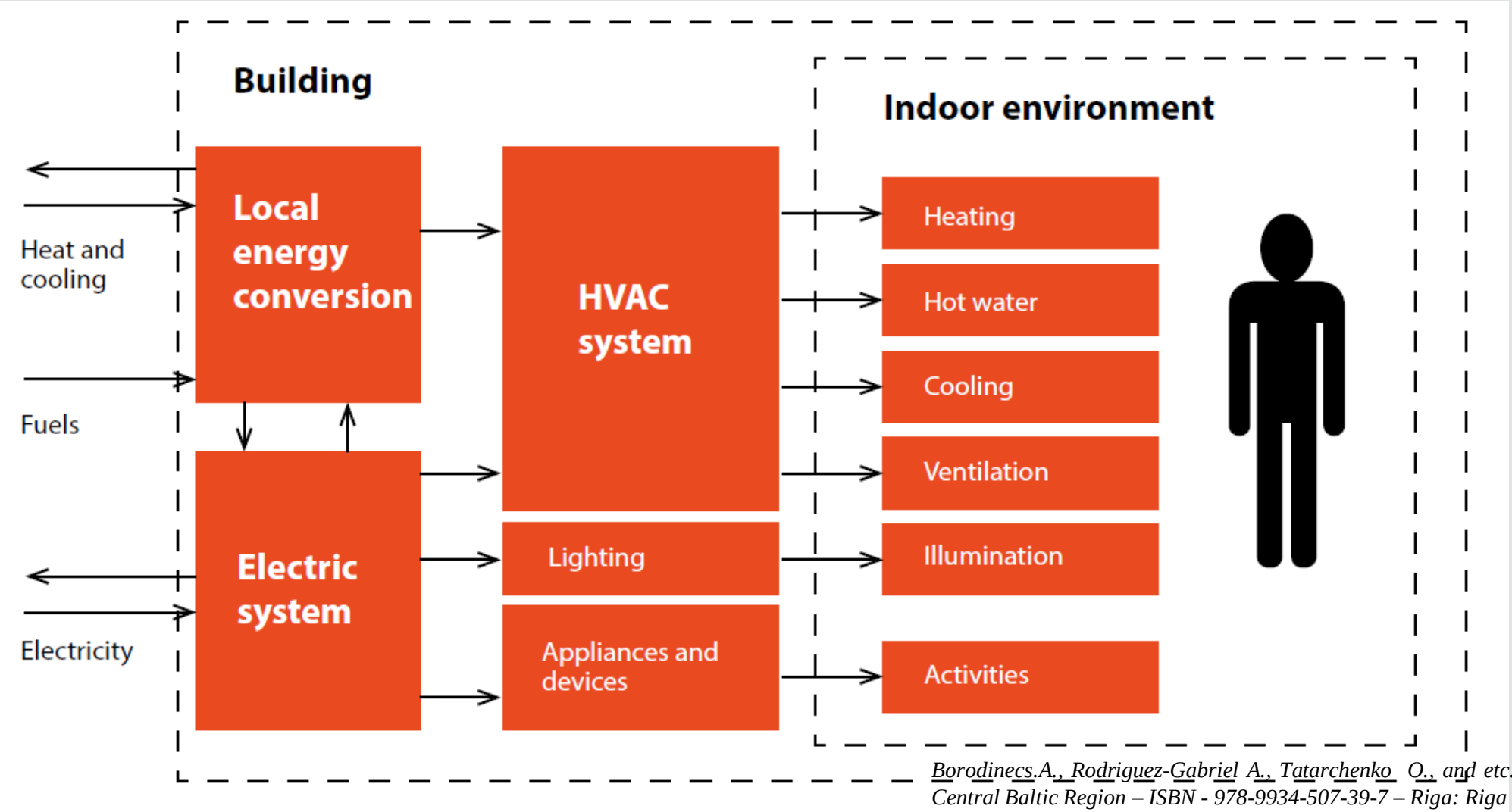

Borodinecs.A., Rodriguez-Gabriel A., Tatarchenko O., and etc. Handbook on Buildings Renovation in Central Baltic Region – ISBN - 978-9934-507-39-7 – Riga: Riga Technical University

CALCULATION PROGRAMS

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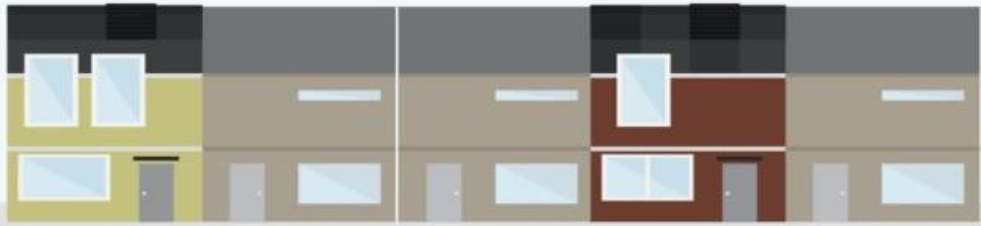
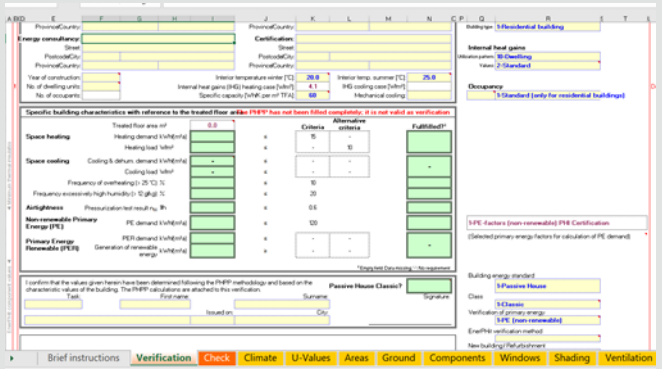
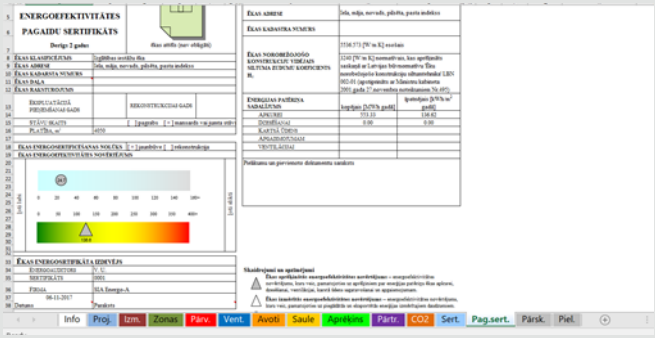


EXCELL based

- Passive House Planning Package, PHPP;
- Latvian energy calculation tool «EFA» ;



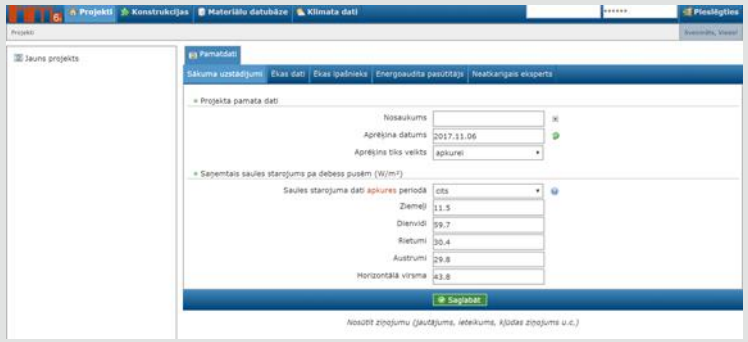
PHPP requires some extra adaptation to prepare final document in accordance to Latvian legislations.



«EFA» is no longer supported by Ministry of Economy. However calculation procedure fulfils major requirements.

WEB-tool

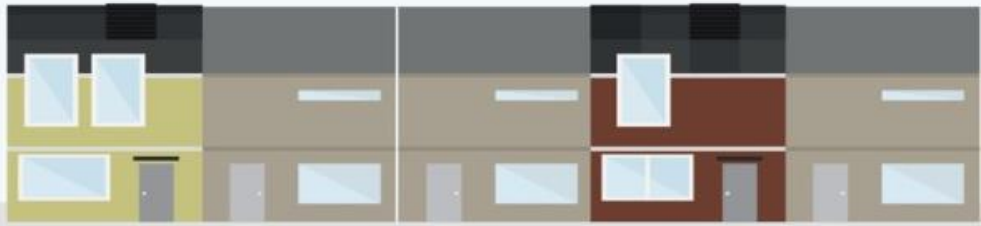
- Heatmod - http://www.heatmod.lv



All tools are based on EN ISO 13790:2009.

CLIMATE DATA

MORE — CONNECT

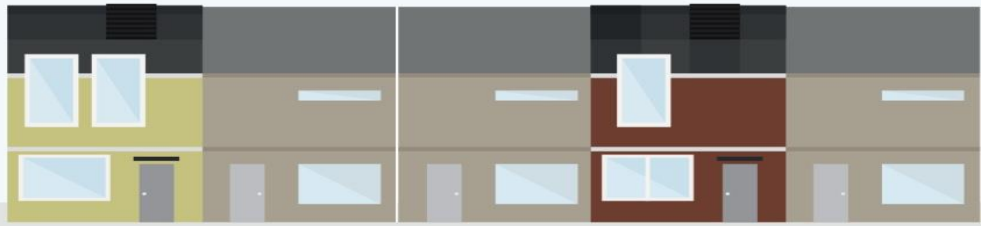


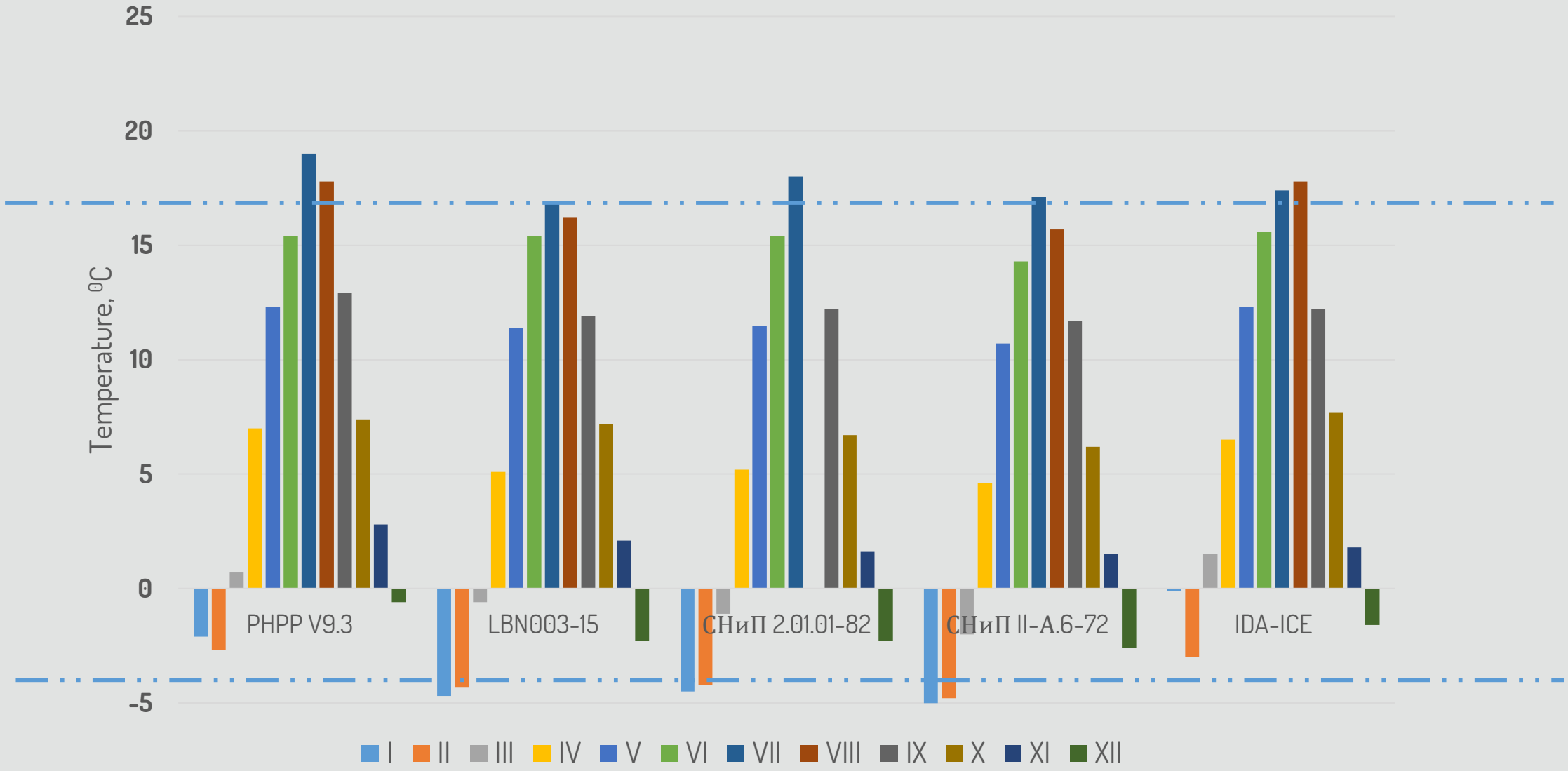
MONTHLY AVERAGE TEMPERATURES

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
PHPP V9.3	-2.1	-2.7	0.7	7.0	12.3	15.4	19.0	17.8	12.9	7.4	2.8	-0.6
LBN003-15	**-4,7**	**-4,3**	**-0,6**	**5,1**	**11,4**	**15,4**	**16,9**	**16,2**	**11,9**	**7,2**	**2,1**	**-2,3**
СНиП 2.01.01-82	-4,5	-4,2	-1,1	5,2	11,5	15,4	18	16,5	12,2	6,7	1,6	-2,3
СНиП II-А.6-72	-5.0	-4.8	-2	4.6	10.7	14.3	17.1	15.7	11.7	6.2	1.5	-2.6
IDA-ICE (ASHARE IWEC2 2011)	-0.1	-3.0	1.5	6.5	12.3	15.6	17.4	17.8	12.2	7.7	1.8	-1.6

CLIMATE DATA

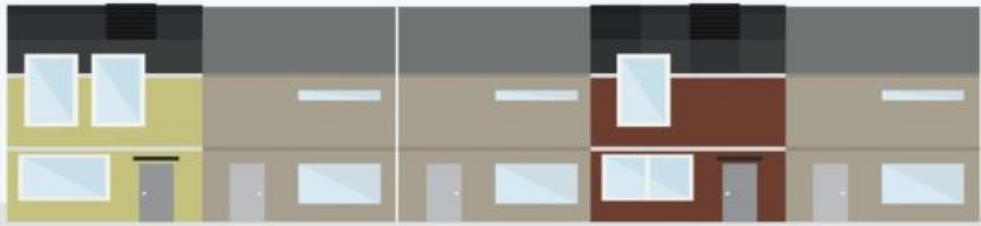
MORE — CONNECT

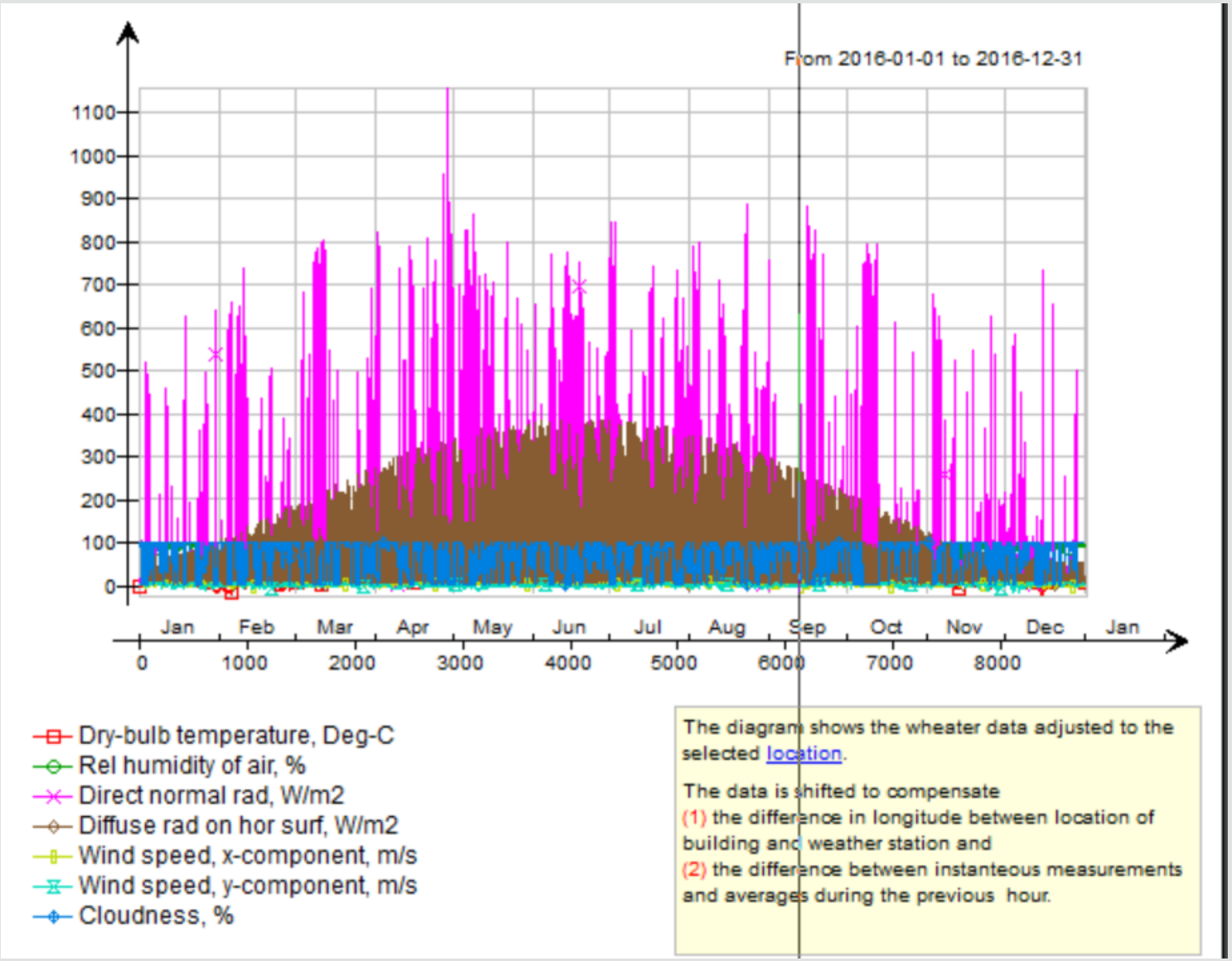




HOURLY DATA

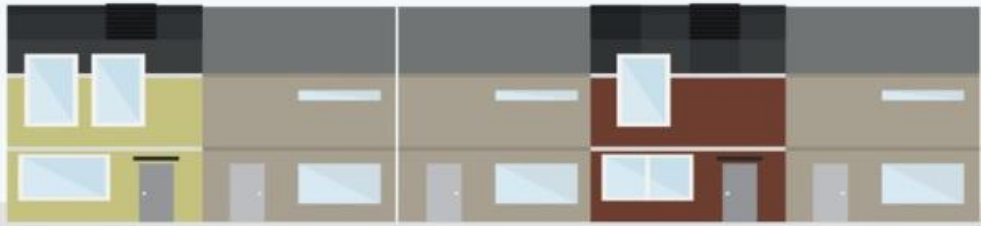
MORE — CONNECT





INTERNAL HEAT GAINS

MORE — CONNECT



CONSTANT

TABLE F.3 Approximate Summer Heat Gains from Occupants, Equipment, Lighting, and Envelope

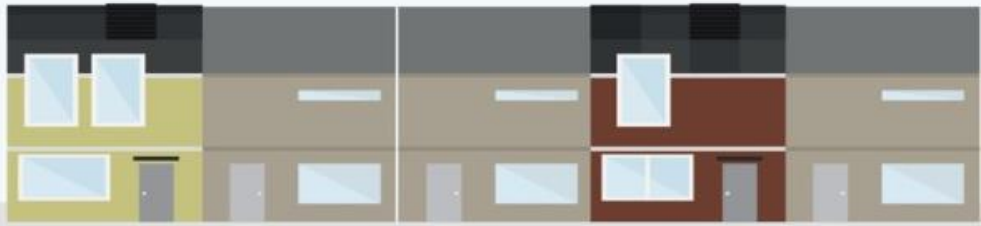
Part A. Internal Heat Sources—People and Equipment

Function	Area per Person[a] ft²	Area per Person[a] m²	Sensible Heat Gain (Btu/h ft² of Floor Area) People[b]	Sensible Heat Gain (Btu/h ft² of Floor Area) Equipment[c]	Sensible Heat Gain (Btu/h ft² of Floor Area) Total	Sensible Heat Gain (W/m² of Floor Area) People[b]	Sensible Heat Gain (W/m² of Floor Area) Equipment[c]	Sensible Heat Gain (W/m² of Floor Area) Total
Office, U.S.[c]	180–100	16.7–9.3	1.3–2.3	0.4–1.1	1.7–3.4	4.1–7.3	1.2–3.4	5.3–10.7
Office, Europe[e]			1–1.6	2.2–4.2	3.2–5.8	3–5	7–13.1	10–18.1
School: elementary, U.S.	100–20	9.3–1.9	2.3–11.5	0–0.6	2.3–12.1	7.3–36.3	0–2.0	7.3–38.3
Schools, Europe[e]			3.8–8.0	0–0.6	3.8–8.6	12–25.2	0–2.0	12.0–27.2
School: secondary, college	150–100	13.9–9.3	1.7–2.6	0–0.6	1.7–3.2	5.4–8.2	0–2.0	5.4–10.2
Health care								
Sleeping (hospital)	240	22.3	0.9	0.6[e]	1.5	2.8	2.0[e]	4.8
In-patient (clinic)	120	11.1	1.9	Varies	1.9+	6.0	Varies	6.0+
Assembly: fixed seats	15	1.4	14.0	—	14.0	44.2	—	44.2
standing space, concentrated use	15–7	1.4–0.7	21.0–45.0	0–0.5	21.0–45.5	66.3–142.0	0–1.6	66.3–143.6
Restaurant:[f]								
Fast food: dining area	15	1.4	17	3.4	20.4	53.6	10.7	64.3
Kitchen, refrigeration				17.1	17.1		54.0	54.0
Sit-down: dining area	25	2.3	10.2	5.1	15.3	32.2	16.1	48.3
Kitchen, refrigeration				7.2	7.2		22.7	22.7
Mercantile: street floor	50–30	4.7–2.8	6.3–10.5	3.4	9.7–13.9	19.9–33.1	10.7	30.6–43.8
Other sales floors	60–50	5.6–4.7	5.3–6.3	3.4	8.7–9.7	16.7–19.9	10.7	27.4–30.6
Shopping center, Europe[e]			3.2	0.3–1.3	3.5–4.5	10	1.0–4.0	11.0–14.0
Warehouse	1000–300	92.9–27.9	0.4–1.2	—	0.4–1.2	1.3–3.8	—	1.3–3.8
Hotels, nursing homes	300–200	27.9–18.6	0.8–1.2	3.4	4.2–4.6	2.5–3.8	10.7	13.2–14.5
Apartments[g]	300–200	27.9–18.6	0.8–1.2	See note g	See note g	2.5–3.8	See note g	See note g

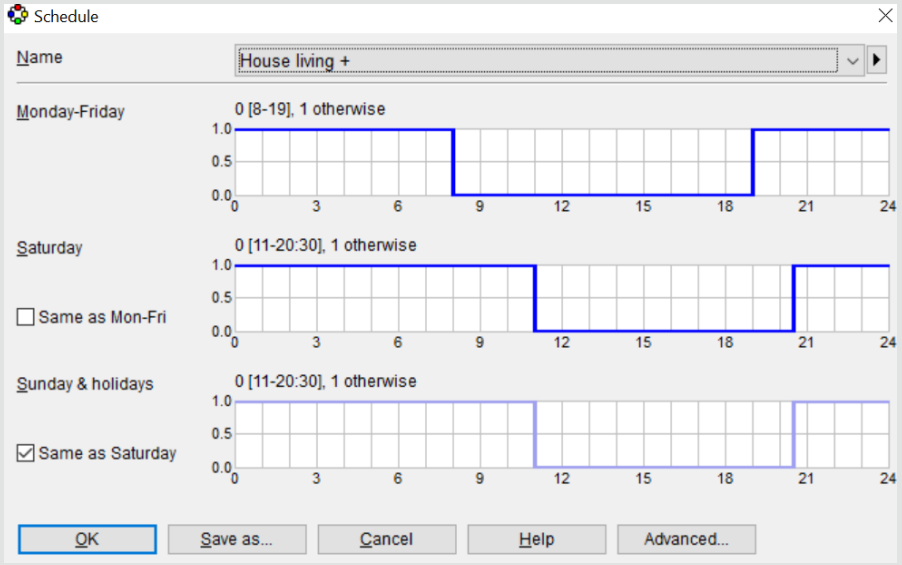
Day	Time	Living room and kitchen	Other room
Monday - Friday	07.00 – 17.00	8.0	1.0
	17.00 – 23.00	20.0	1.0
	23.00 – 07.00	2.0	6
	average	9.0	2.67
Saturday - Sunday	07.00 – 17.00	8.0	2.0
	17.00 – 23.00	20.0	4.0
	23.00 – 07.00	2.0	6.0
	average	9.0	3.83
average		9.0	3.0

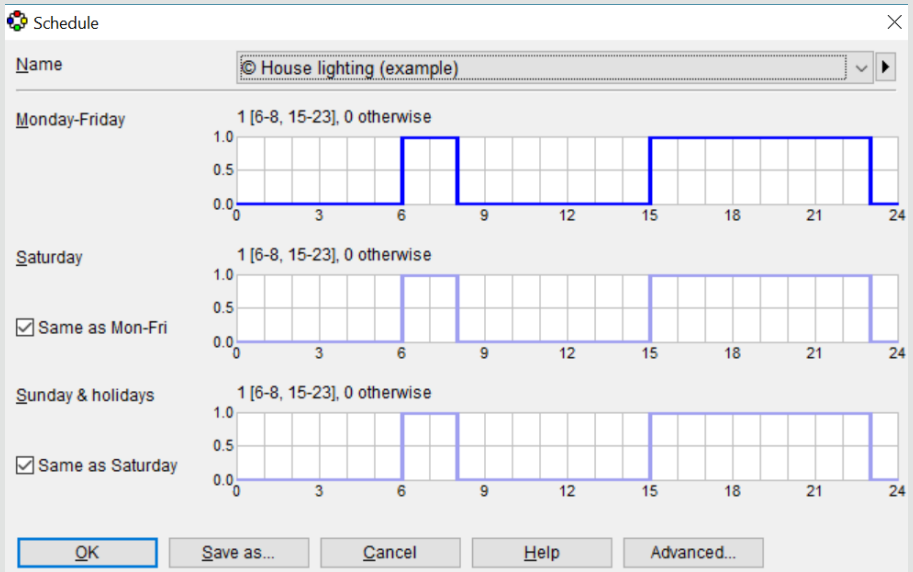
INTERNAL HEAT GAINS

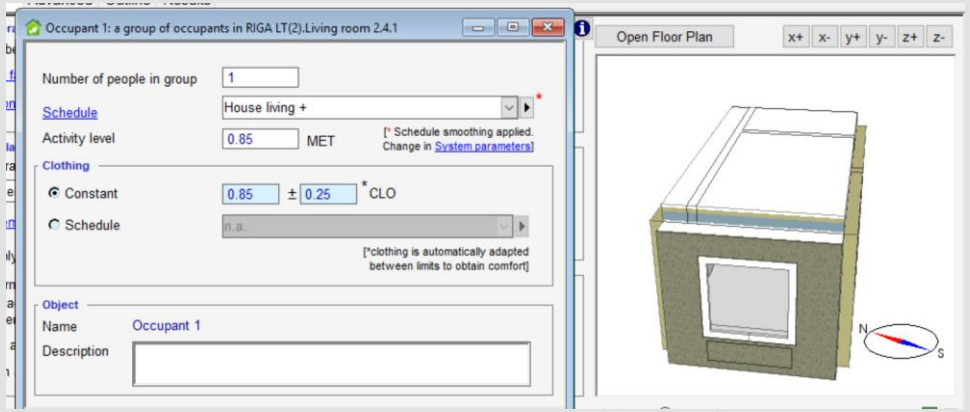
MORE — CONNECT

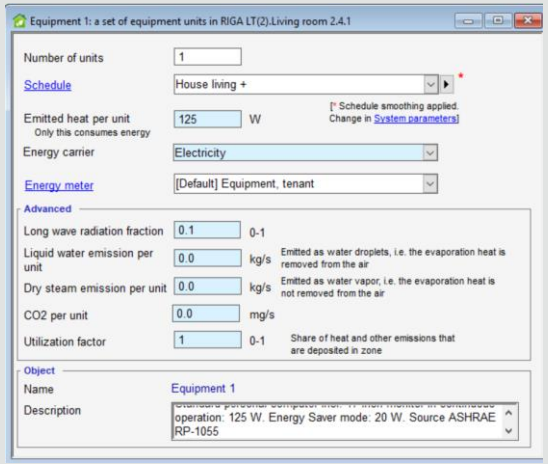


VARIABLE



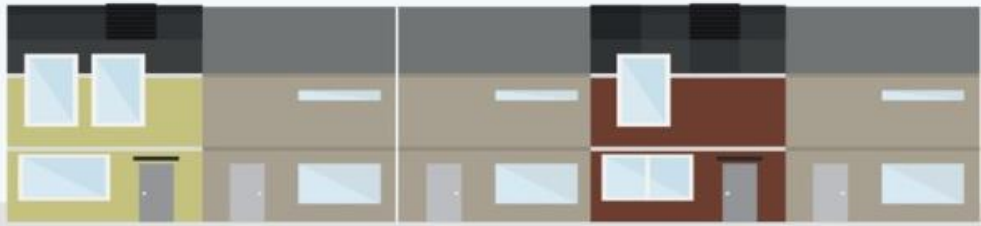






USED IN LATVIA DYNAMIC ENERGY SIMULATIONS

MORE — CONNECT



- ArchiCAD EcoDesigner STAR add
- MagiCAD Comfort & Energy

Embedded tools

- IDA- ICE;
- IESVE;
- RIUSKA

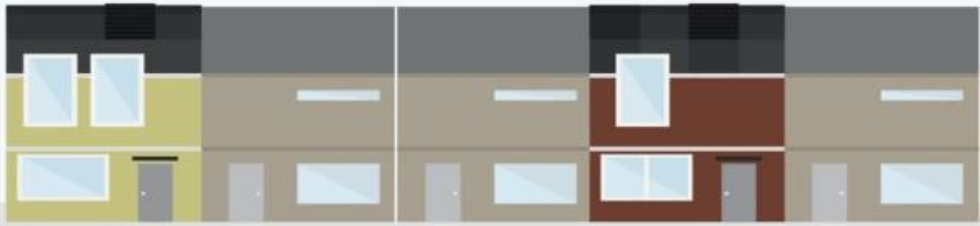
Stand alone software

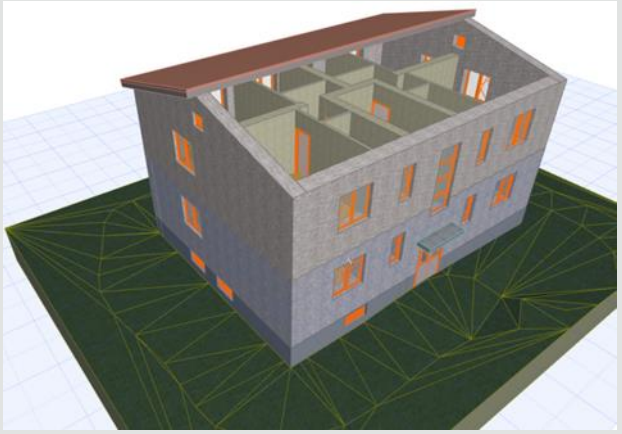
MORE-CONNECT BUILDING

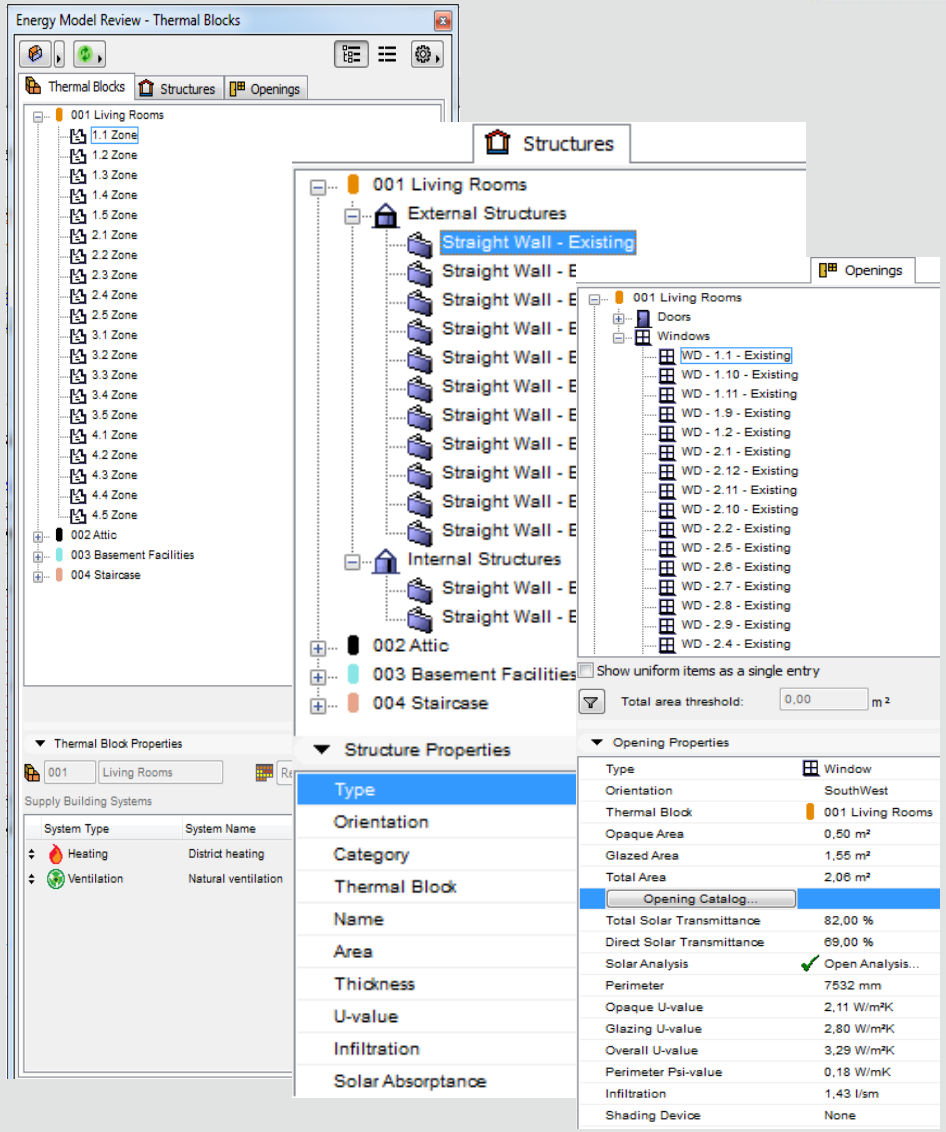
MORE — CONNECT

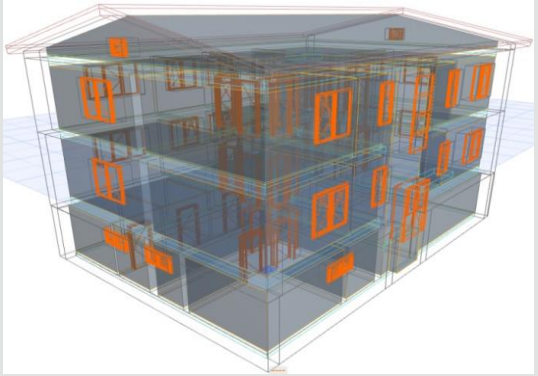
ARCHICAD ECODESIGNER

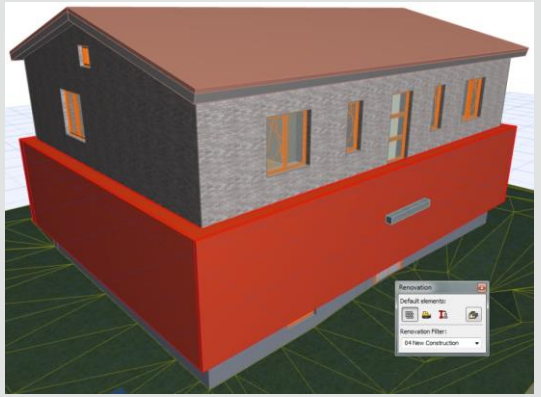
STAR ADD

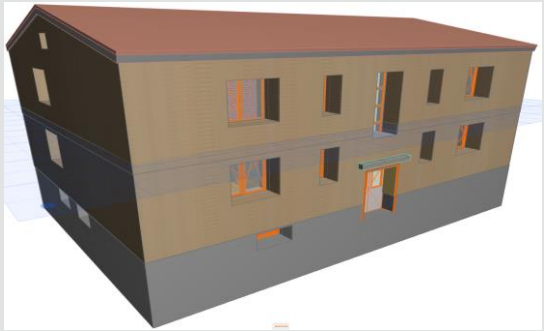






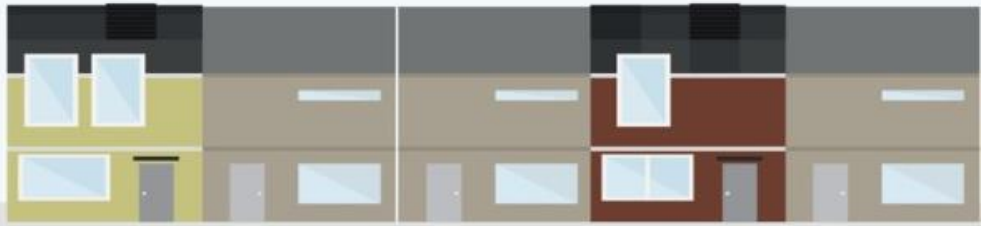


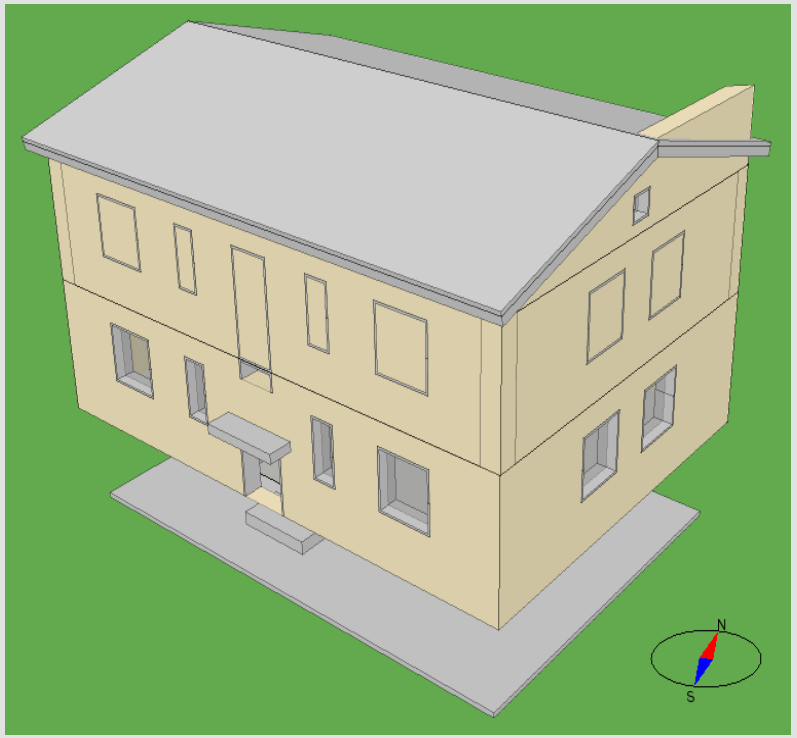




.IFC IMPORT FOR IDA-ICE

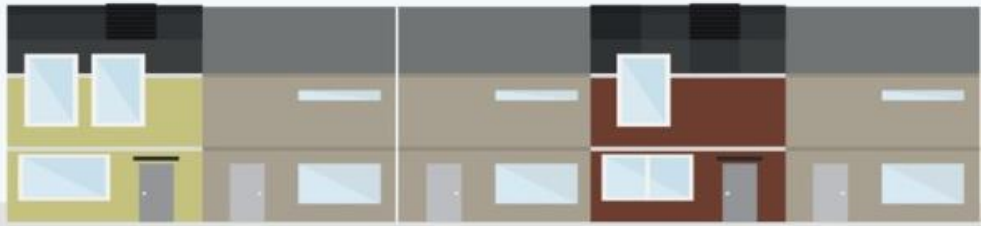
MORE — CONNECT





PRACTICAL EXERCISE

MORE — CONNECT



To choose renovation package which insure:

- 60% thermal energy reduction;
- 80% thermal energy reduction;

- Initial data:
  - Building. IFC model;
  - U values:
    - Wall – 0.9'W/(m2K);
    - Roof – 0.75;
    - Floor – 0.8;
    - Windows/door – 1.9