Design a Passive House in 3D!

designPH

***designPH* is a plugin for Trimble Sketchup which allows you to design Passive House projects in 3D and import the model into PHPP**

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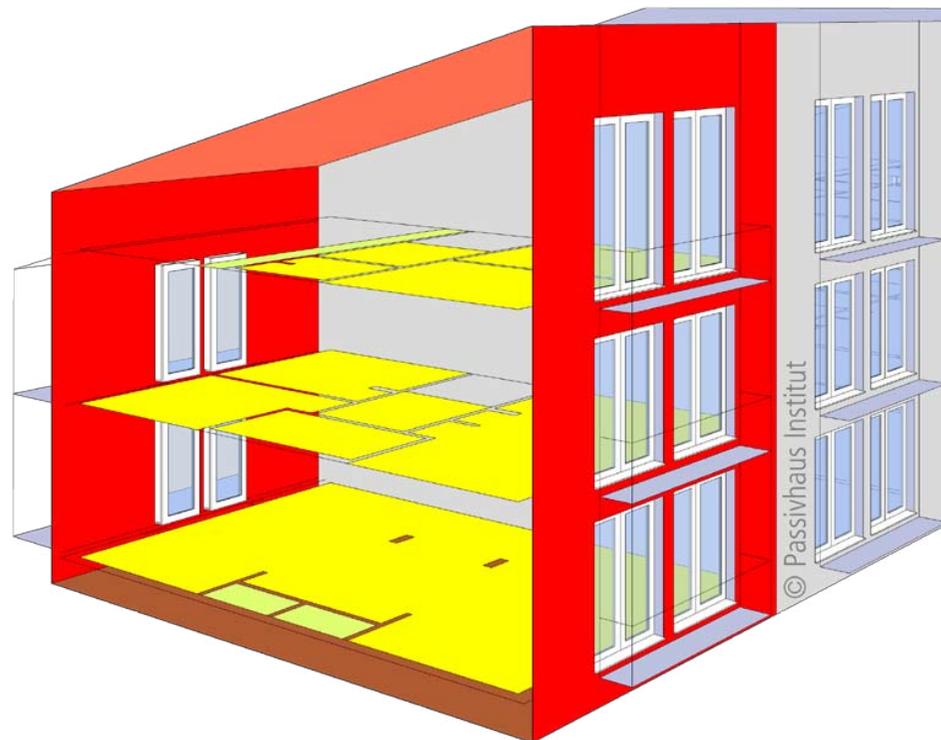
David Edwards, *david.edwards@passiv.de*

Design a Passive House in 3D!

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User interface

Create model

Automatic analysis

Export to PHPP

Refine model

Workflows

Summary
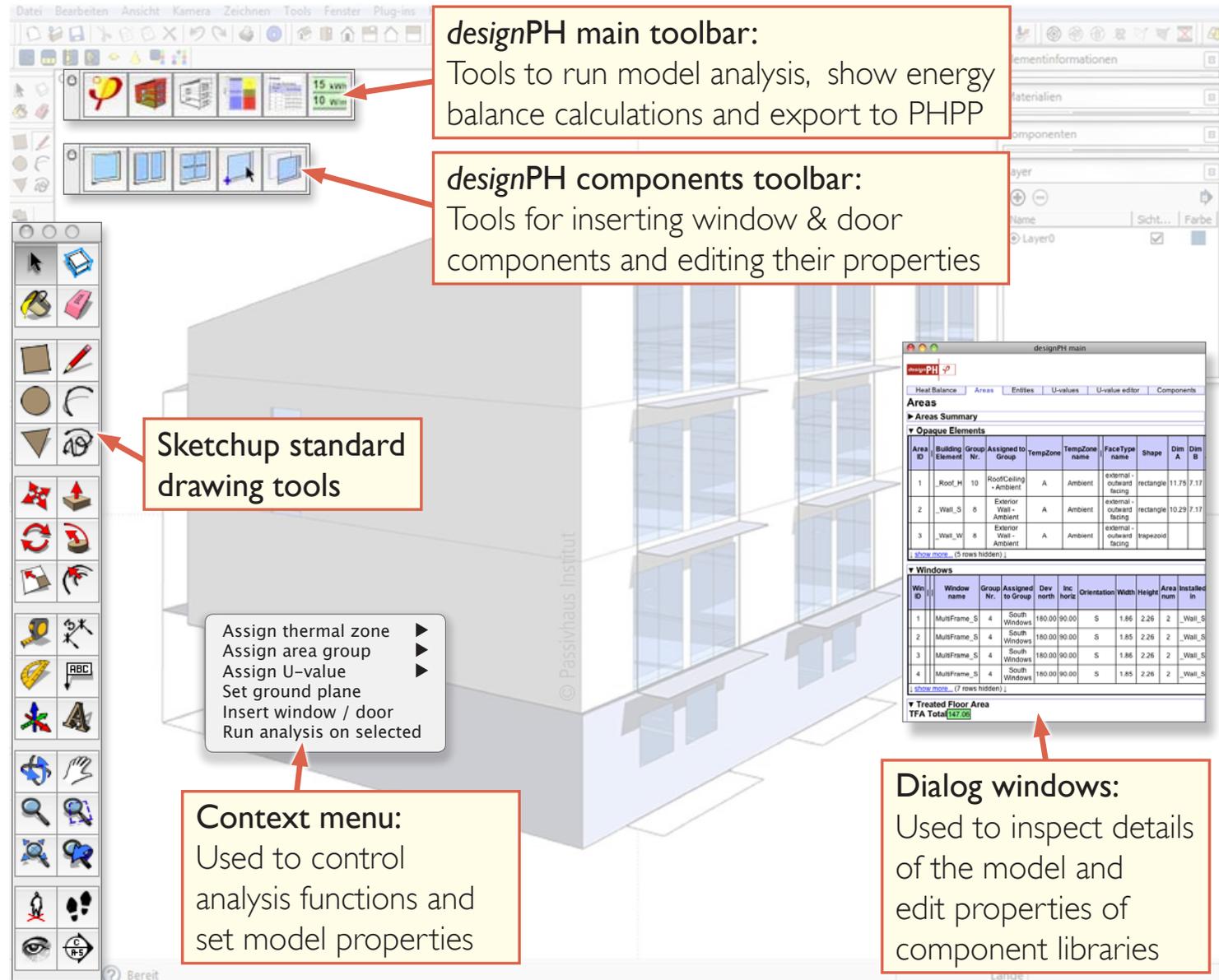
designPH main toolbar:
Tools to run model analysis, show energy balance calculations and export to PHPP

designPH components toolbar:
Tools for inserting window & door components and editing their properties

Sketchup standard drawing tools

Assign thermal zone ▶
Assign area group ▶
Assign U–value ▶
Set ground plane
Insert window / door
Run analysis on selected

Context menu:
Used to control analysis functions and set model properties

Dialog windows:
Used to inspect details of the model and edit properties of component libraries

User interface

Create model

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Workflows

Summary

Draw windows
using Rectangle tool
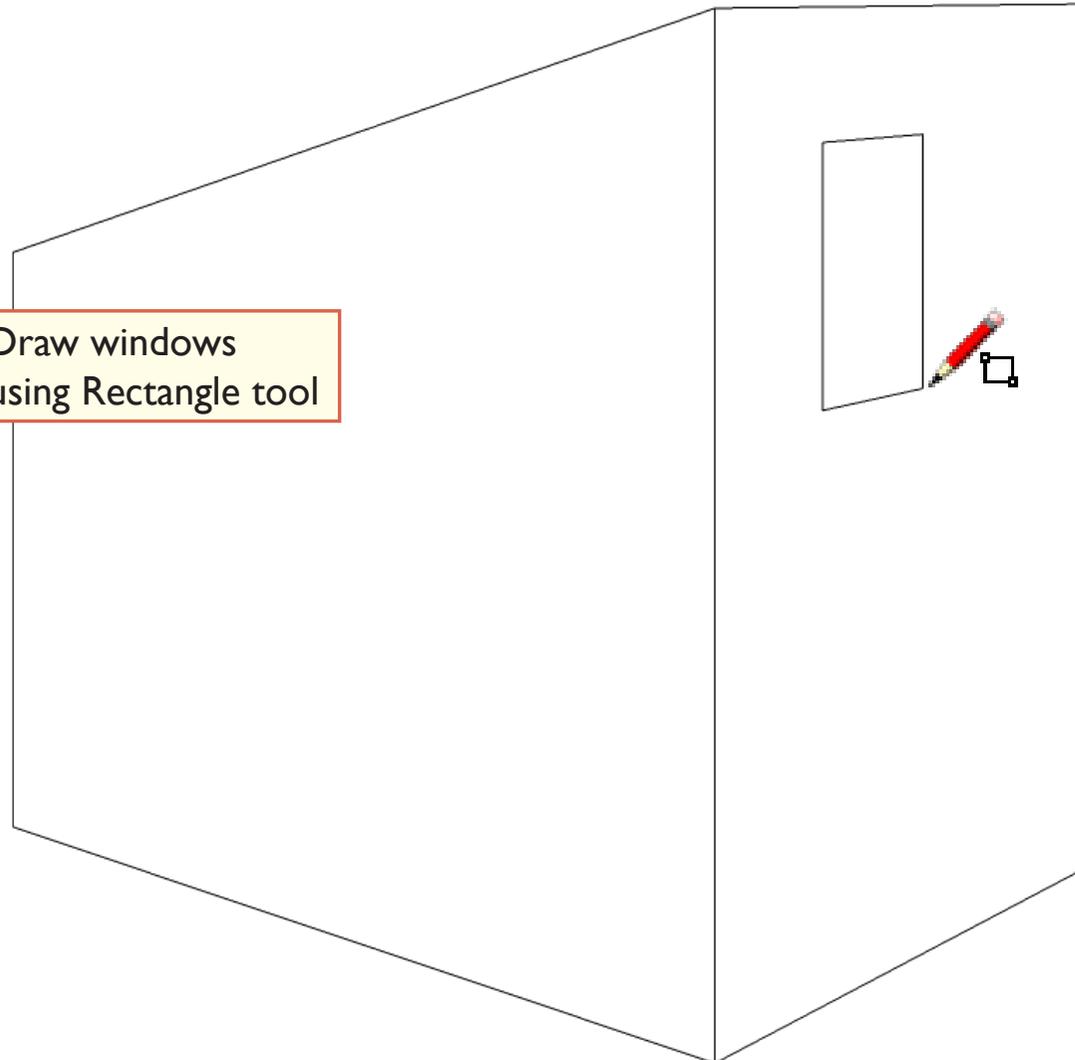
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User interface

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Refine model
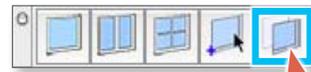
Workflows

Summary

Convert-face-to-window tool
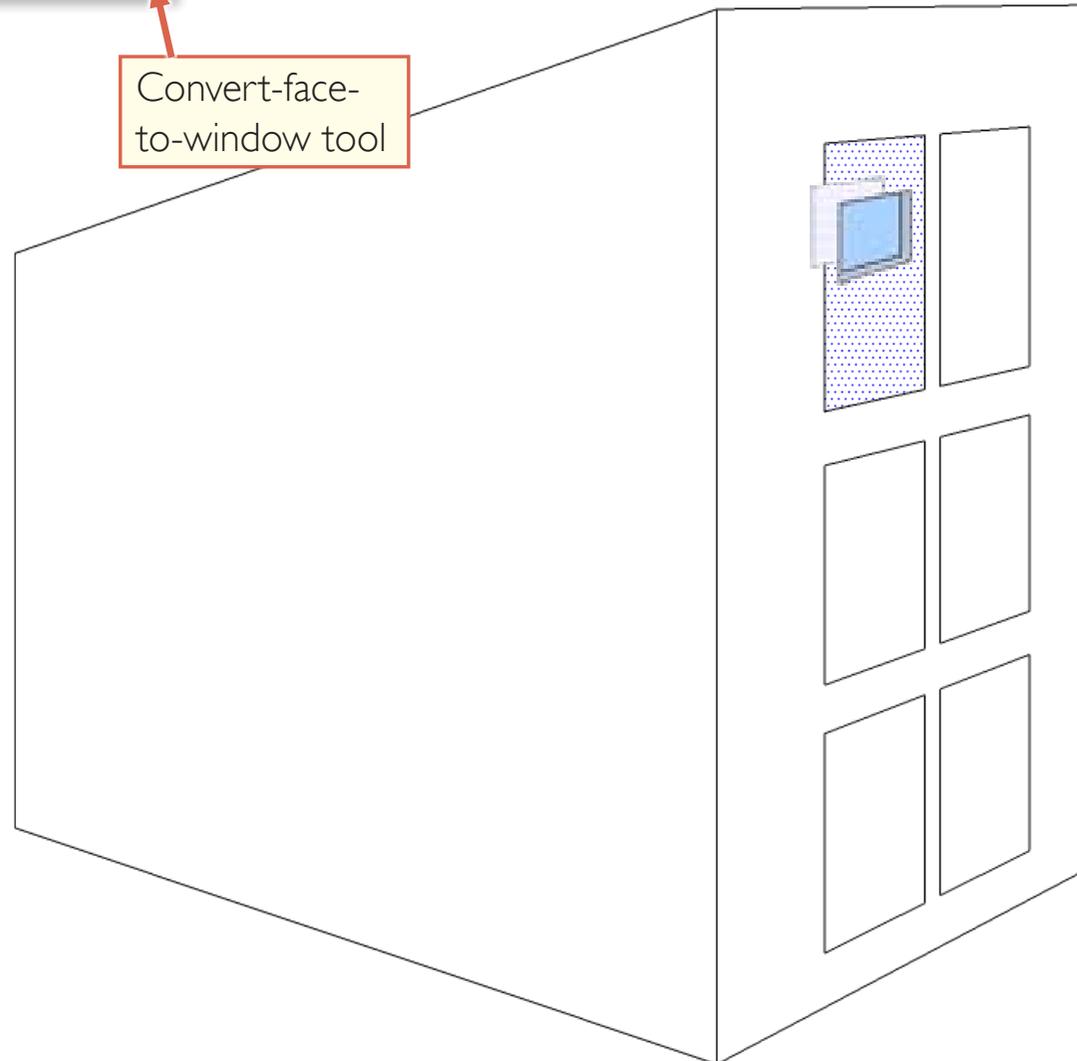
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User interface

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Summary

Add shading
objects

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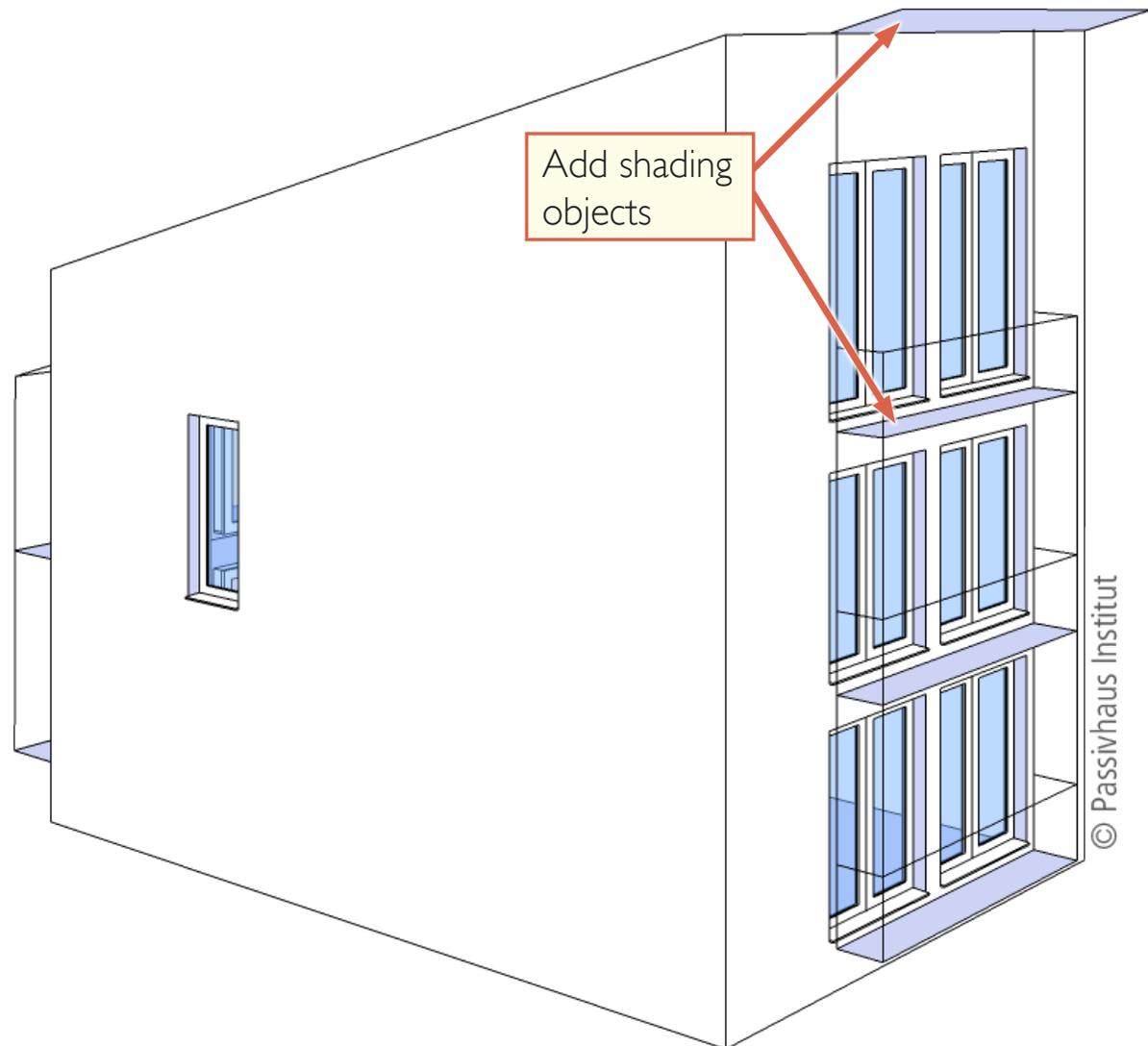
User interface
Create model
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Export to PHPP
Refine model
Workflows
Summary

Q_H: 21 kWh/m²
TFA: *150* m² (est)
FHLF: 2.51
U-av: 0.15 W/(m²K)

"Dashboard" display:
Shows key results eg: specific space heat demand, TFA, average U-value, form-factor

Roof

External wall - ambient

Shading objects (non-thermal)

Floor slab

External wall - ambient

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User interface
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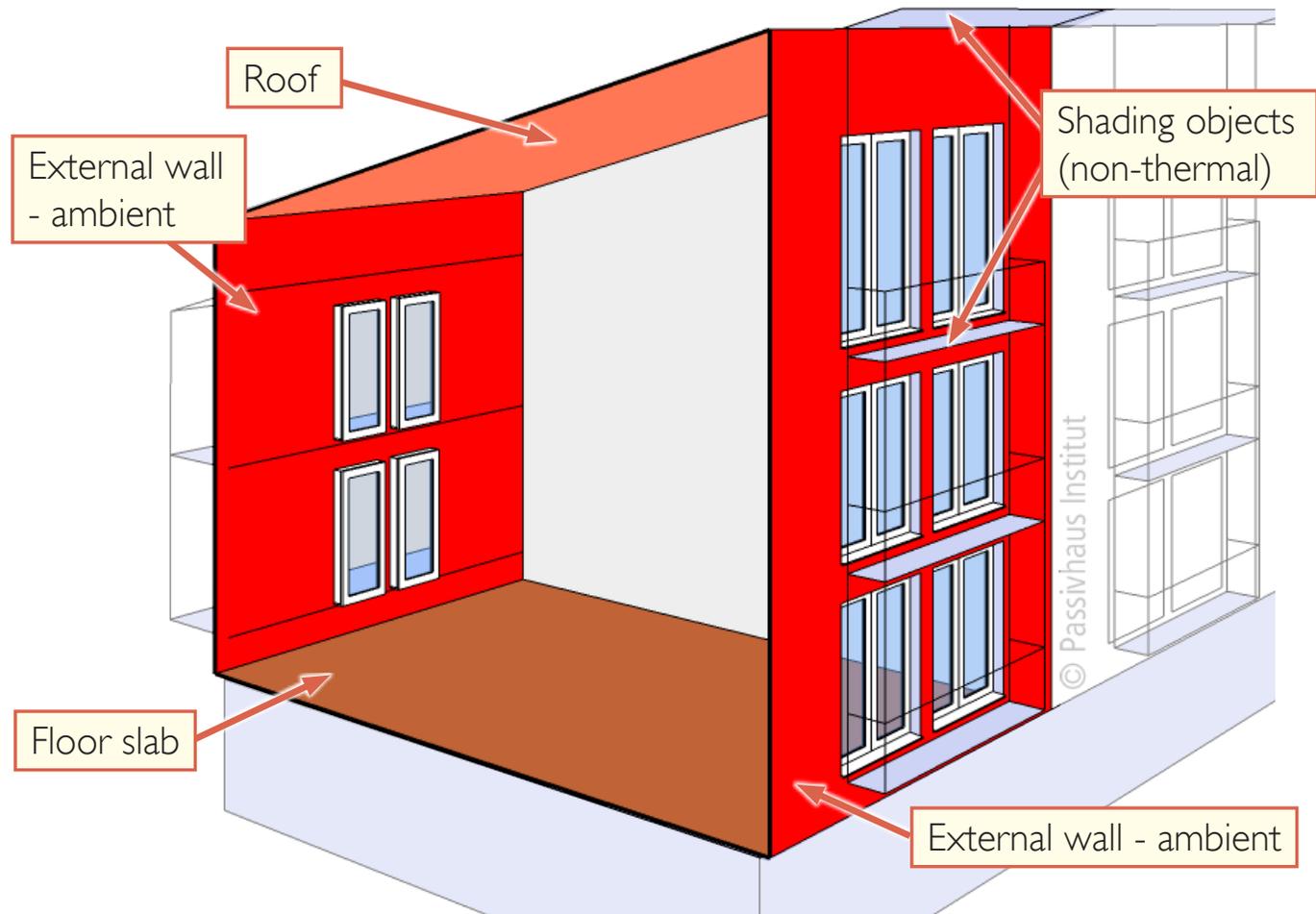
Export to PHPP

Refine model
Workflows
Summary

*design*PH main toolbar: "Export to PHPP" button

The export function allows building geometry, shading and user-defined properties to be imported into a PHPP model.

Heat Balance	Areas	U-values	Components

▼ Areas

Building Element	Assigned to Group	Dim A (m)	Dim B (m)	Total Area (m²)	Window Areas (m²)	Net Area (m²)	Assem. desc.	U-value
Roof	Roof/Ceiling - Ambient	11.75	7.17	84.25	0	84.25	PH Roof	0.1
Wall_S	Exterior Wall - Ambient	10.29	7.17	71.93	25.15	46.78	PH Wall	0.1
Wall_W	Exterior Wall - Ambient			98.96	2.13	96.83	PH Wall	0.1
Wall_N	Exterior Wall - Ambient	7.18	7.17	51.48	8.52	42.96	PH Wall	0.1

▼ Windows

Window name	Orientation	Width	Height	Installed in
WS_01	South	1.86	2.26	Wall_S
WF_01	South	1.86	2.26	Wall_S
WF_03	West	0.94	2.26	Wall_W
WF_04	North	0.94	2.26	Wall_N

▼ Shading

Horiz obj hgt	Horiz obj dist	Reveal depth	Dist to reveal	O/hang depth	O/hang height
0	0	0.2	0.14	1.15	2.3
0	0	0.2	0.14	0.9	0.6
0	0	0.2	0.14	0.2	0.14
0	0	0.2	0.14	1.78	0.14

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- User interface
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- **Refine model**
- Workflows
- Summary

Edit automatic analysis defaults in Dialog window

| Heat Balance | Areas | U-values | Components |

▼ Default U-Values

Grp No.	Area Group	Assembly name	U-Value (W/(m² K))
8	Exterior Wall - Ambient	PH Wall	0.15
9	Exterior Wall - Ground	PH Wall-G	0.15
10	Roof/Ceiling - Ambient	PH Roof	0.15
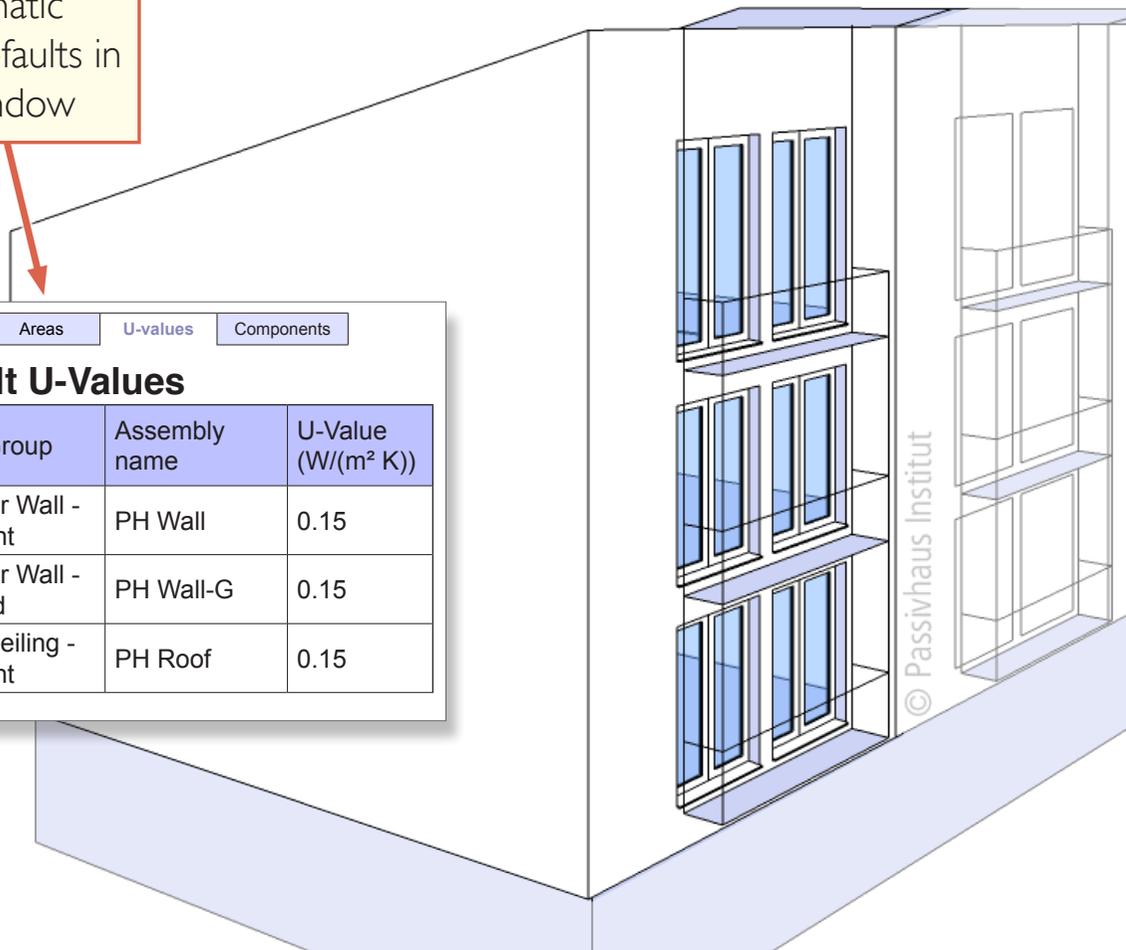
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User interface

Create model

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Refine model

Workflows

Summary

Assign U-values directly using context menu

Assign thermal zone ▶
Assign area group ▶
Assign U-value ▶
Set ground plane
Insert window / door
Run analysis on selected

PH Wall   [U=0.10]
PH Roof   [U=0.10]
PH Floor   [U=0.15]
─────────────
HLZ24–ALtb [U=1.44]
Vollziegel38– [U=1.64]
...

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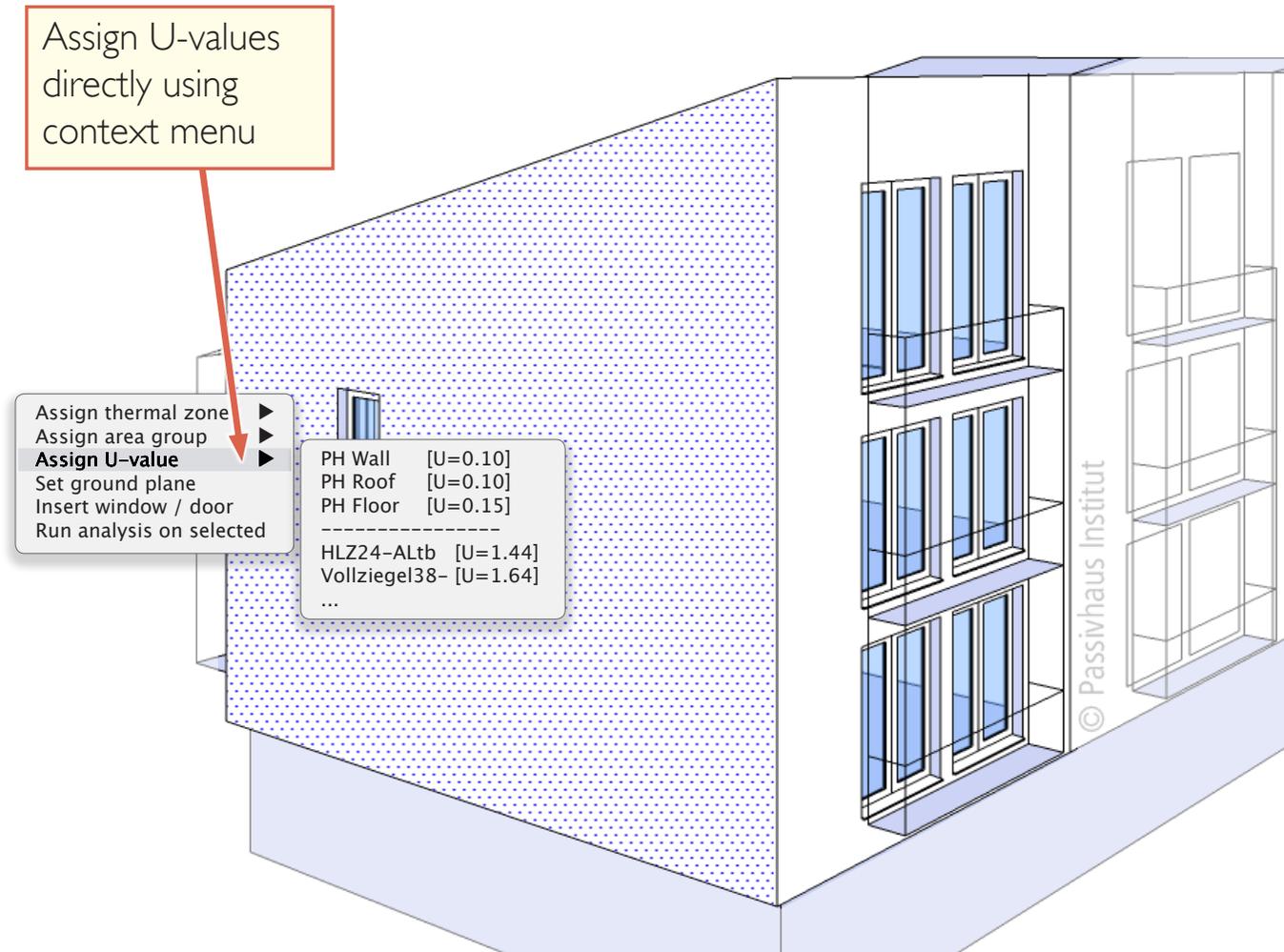
User interface

Create model

Automatic analysis

Export to PHPP

Refine model

Workflows

Summary

Add or edit properties of user-defined assemblies library in Dialog window

Heat Balance	Areas	U-values	**Components**

▼**User-defined assemblies**

Assembly name	Total thick-ness (m)	U-value (W/(m² K))	
PH Wall	0.5	0.1	
PH Roof	0.5	0.1	
PH Floor	0.5	0.15	
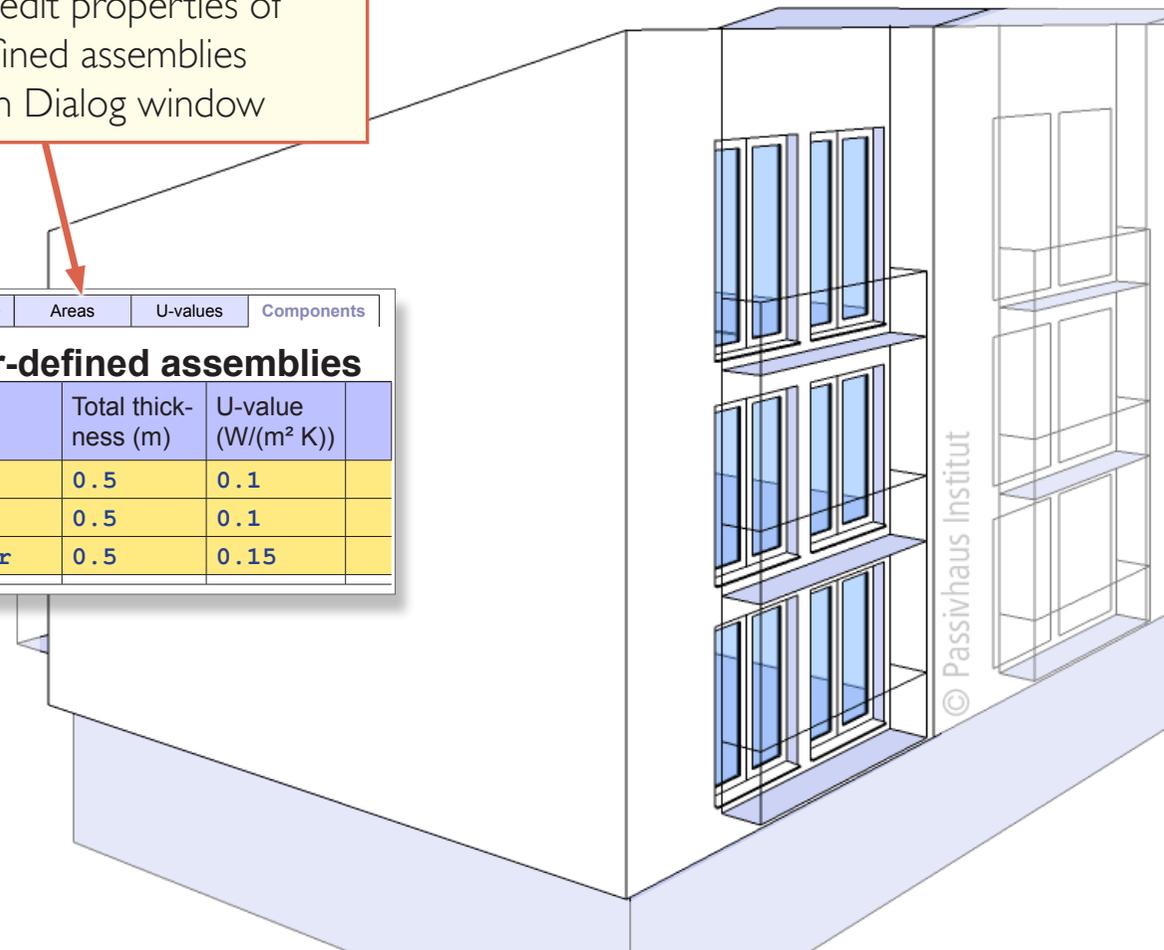
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Draw user-defined
Treated Floor Area
and assign using
context menu

| Assign thermal zone ▶ |
| Assign area group ▶ |
| Assign U–value ▶ |
| Set ground plane |
| Insert window / door |
| Run analysis on selected |

1	Treated Floor Area
10	Roof/ceiling ambient
11	Floor slab
18	Partition to neighbour
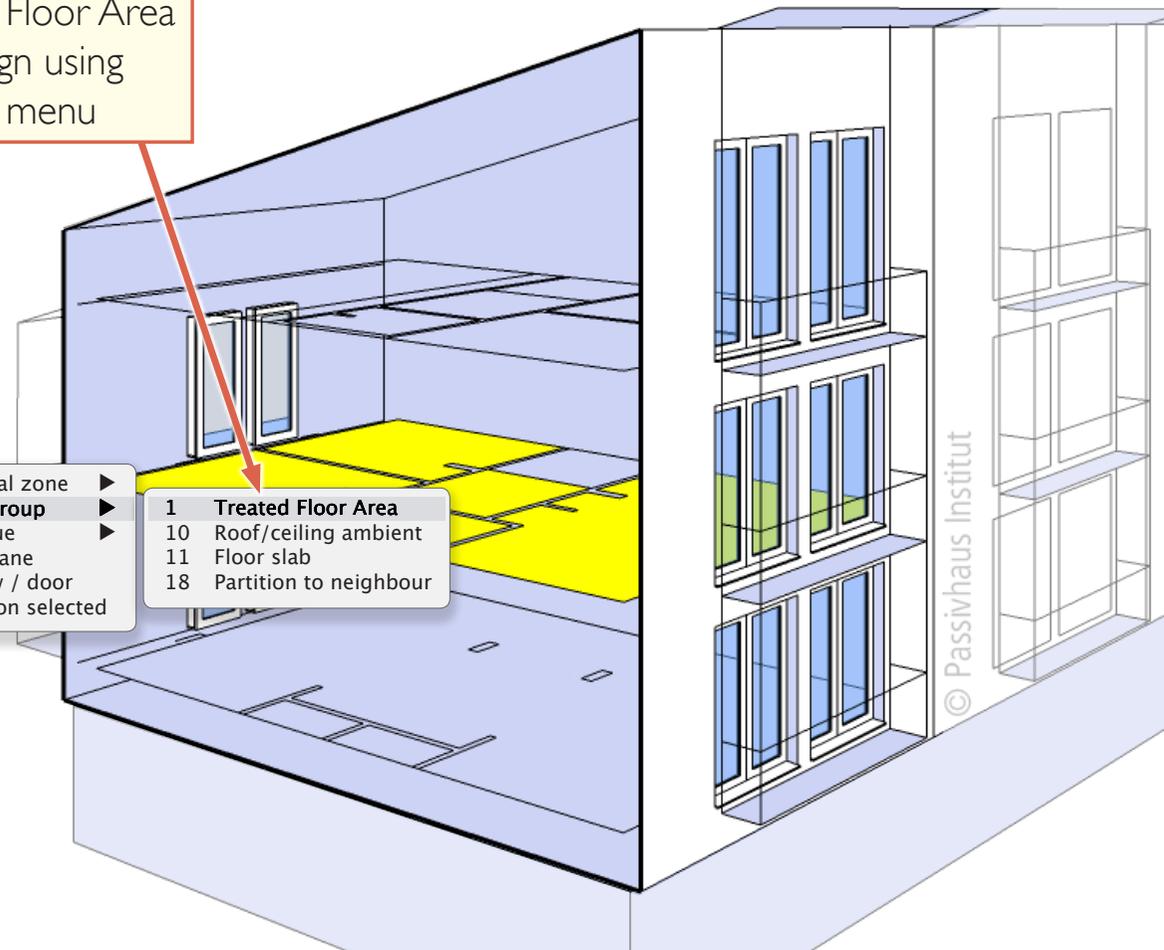
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Component Options
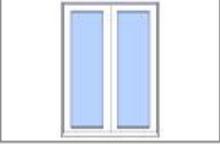
designPH_Window_MultiFrame
v0.6 beta

Scaleable dynamic window component that maintains constant frame thickness
Click "Apply" to make changes

Opening width	1.857 m
Opening height	2.76 m
Opening area (m2)	5.125
Frame depth	0.05 m
Frame type	
Frame type code	
Frame width	
Glazing type	
Glazing type code	
Cill	
Head reveal	
Left reveal	
Right reveal	
Num horiz casements	
Num vert casements	
Reveal depth	

Drei-WS-Kr08
Drei-WS-Kr12
28 Low-E 0.51 N 52 - GUARDIAN Flachglas
37 iPlus 3S - INTERPANE
Einfachverglasung
2-fach Isolierverglasung 4/12mmLuft/4
2-fach Isolierverglasung 4/16mmLuft/4
2-fach Isolierverglasung 4/20mmLuft/4
2-fach Isolierverglasung 4/25mmLuft/4
2-fach Isolierverglasung 4/30mmLuft/4
3-fach Isolierverglasung 4/10Lu/4/10Lu/4
2-fach WSVG 4/16Argon90%/4
Epsilon=0.1

AGC - Planibel Tri (4:/10/4/10/:4 Kr 90%)
AGC - Planibel Tri (4:/12/4/12/:4 Kr 90%)
AGC - Planibel Tri (4:/14/4/14/:4 Ar 90%)
AGC - Planibel Tri (4:/16/4/16/:4 Ar 90%)
AGC - Planibel Tri (4:/18/4/18/:4 Ar 90%)
AGC - Planibel Tri (4:/8/4/8/:4 Kr 90%)

Apply
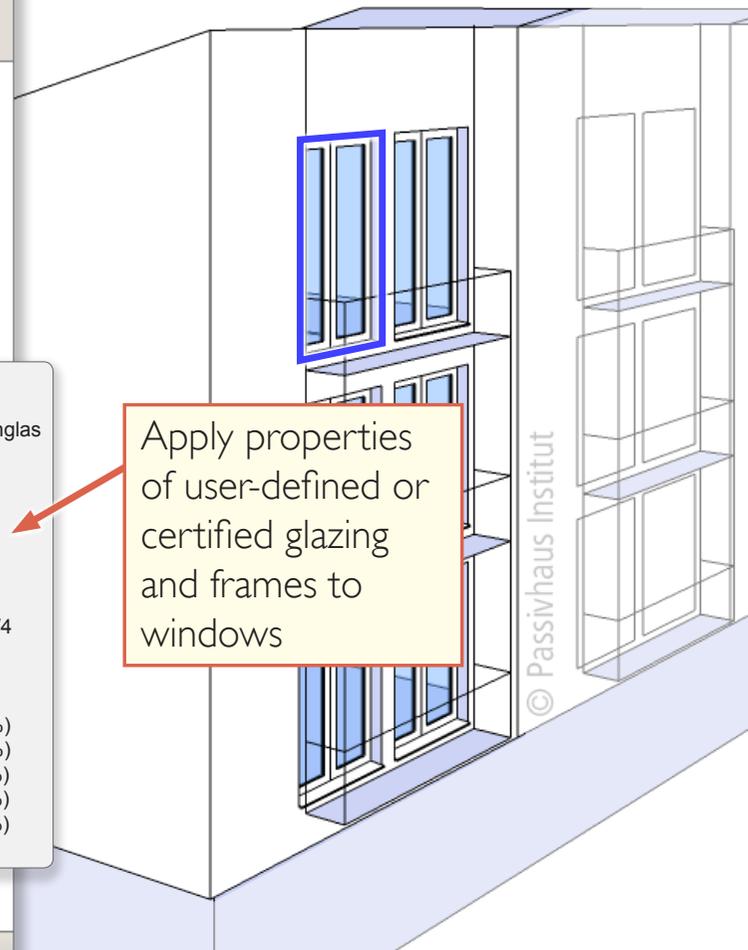
Apply properties of user-defined or certified glazing and frames to windows

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- User interface
- Create model
- Automatic analysis
- Export to PHPP
- **Refine model**
- Workflows
- Summary

Add or edit properties of user-defined Glazing types library in Dialog window

| Heat Balance | Areas | U-values | **Components** |

▼ User-defined Glazing

| ID code	Glazing type name	g-value	U-value W/(m²K)
01ud	Drei-WS-Kr08	0.50	0.70
02ud	Drei-WS-Kr12	0.50	0.58
03ud	28 Low-E 0.51 N 52 – GUARDIAN Flachglas	0.52	0.51
04ud	37 iPlus 3S-INTERPANE	0.52	0.60
92ud	Einfachverglasung	0.87	5.80
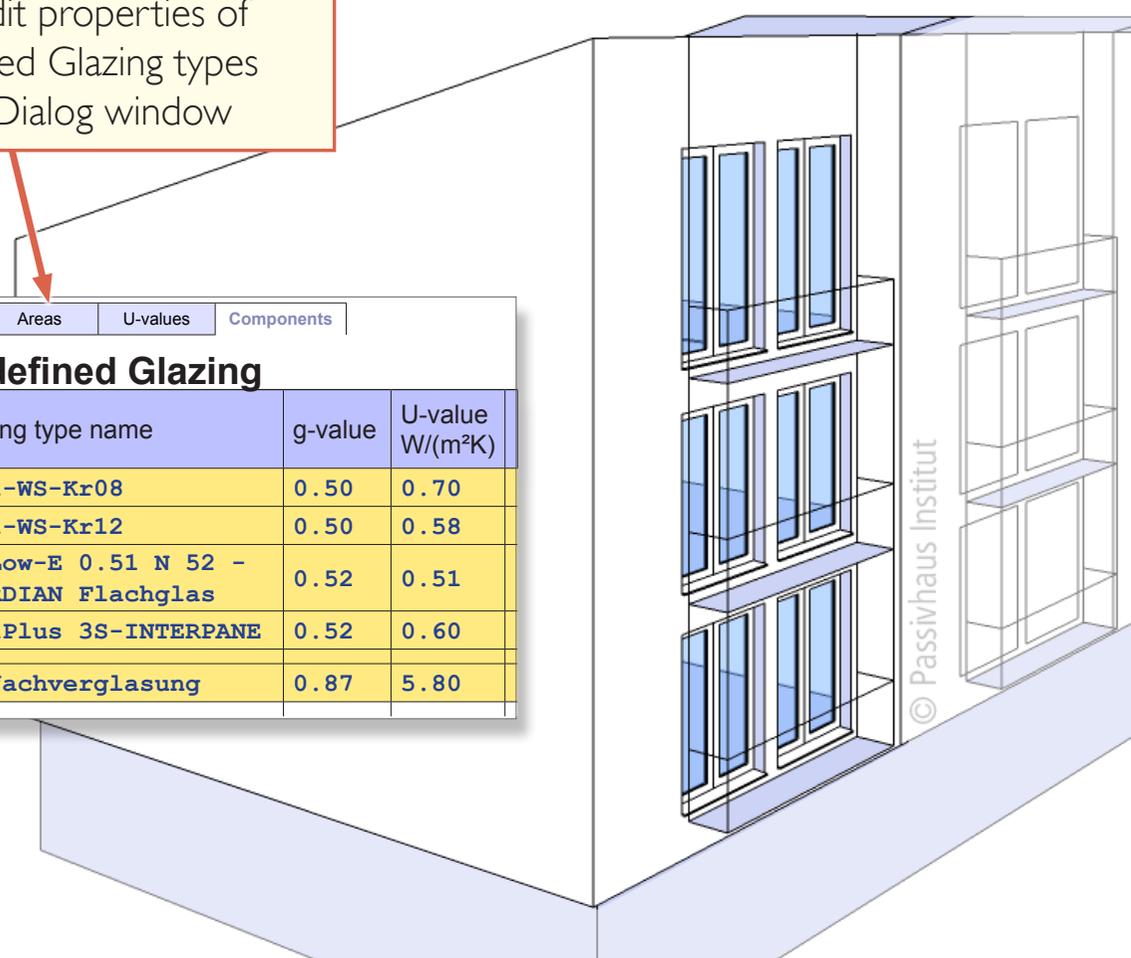
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User interface

Create model

Automatic analysis

Export to PHPP

Refine model

Workflows

Summary

Add or edit properties of user-defined Frame types library in Dialog window

| Heat Balance | Areas | U-values | Components |

▼ User-defined Frames

ID code	Frame type name	Frame U-value W/(m²K)	Frame width (m)
01ud	normal-PU-auf-holz	0.59	0.135
02ud	Stoß-PU-auf-holz	0.59	0.070
03ud	breit-PU-auf-holz	0.59	0.150
13ud	VOR Passivhaus-Rahmen; mittlere therm. Qualität	0.75	0.140
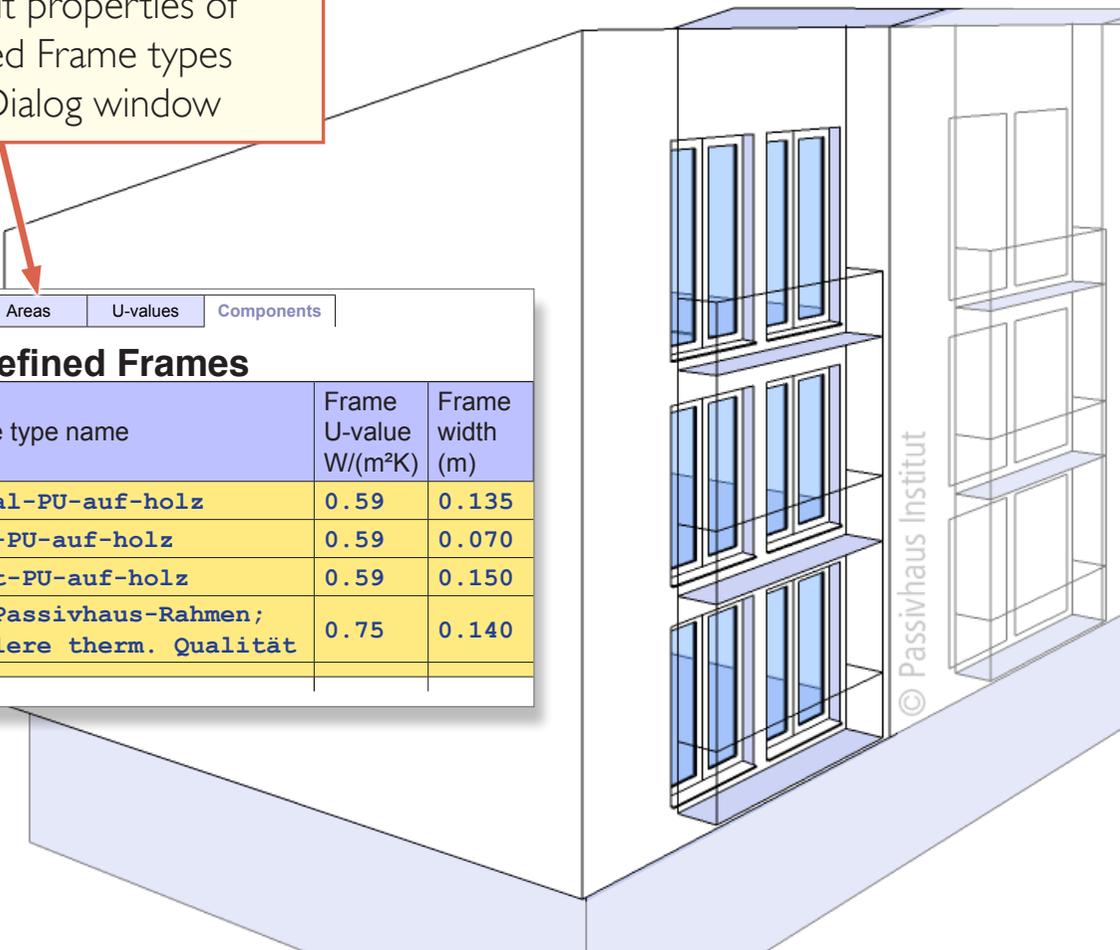
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User interface

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Summary

Q_H: 17 kWh/m²
TFA: 156 m²
FHLF: 2.51
U-av: 0.15 W/(m²K)

"Dashboard" display:
Shows key results eg: specific space heat demand, TFA, average U-value, form-factor

Roof

External wall - ambient

Shading objects (non-thermal)

Floor slab

User-defined Treated Floor Area

External wall - ambient

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User interface
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Summary

Create model

Start from scratch or use saved model

Use default specifications

▼Default U-Values

	Area Group	Assembly name	U-Value (W/(m² K))
8	Exterior Wall - Ambient	PH Wall	0.1
9	Exterior Wall - Ground	PH Wall-G	0.15

or...

Model analysis

Q_H: 14 kWh/m²
TFA: 156 m²
FHLF: 2.51
Uav: 0.126 W/(m²K)

Apply properties to model

Assign thermal zone ▶
Assign area group ▶
Assign U-value ▶   PH Wall   [U=0.10]
Set ground plane   PH Roof   [U=0.10]
Insert window / door   PH Floor   [U=0.15]
Run analysis on selected ─────────────
                        HLZ24~ALtb [U=1.44]
                        Vollziegel38~ [U=1.64]
                        ...

Edit properties in library

▼Assembly U-values

Assembly name	Total thick-ness (m)	U-value (W/(m² K))
PH Wall	0.5	0.1
PH Roof	0.5	0.1
PH Floor	0.5	0.15

Refine model

Draw TFA

Add shading objects

Draw ground surface

Add neighbours and site model

Export to PHPP

▼Areas

Building Element	Assigned to Group	Dim A (m)	Dim B (m)	To-tal	Win-dow Areas (m²)	Net Area (m²)	Assem. desc.	U-value
Roof	Roof/Ceiling - Ambient		7.17		0		PH Roof	0.1
Wall_S	Exterior Wall - Ambient		7.17		25.15		PH Wall	0.1
Wall_N	Exterior Wall - Ambient		7.17		8.52		PH Wall	0.1
Floor Slab	Floor Slab				0		PH Floor	0.15

Design a Passive House in 3D!

■ Advantages of designPH:

- Export geometry to PHPP for quicker data entry
- Visually verify the thermal envelope in 3D
- Test models quickly using default specifications
- Simple energy balance for preliminary results
- More effective iterative design process

■ Automatic model analysis

- Automatic recognition of temperature zones, building elements and area groups
- Manual over-ride of automatic properties
- Estimated or user-defined Treated Floor Area
- Colouring of model surfaces to indicate status
- Restore applied materials after analysis
- Recognition of external shading objects
- Schedules of areas, windows and TFA etc