



Daylight Glare Probability and Façade Openness Analysis of moveable Blind Systems using Raytraverse

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Radiance Workshop, UIBK – 2023/08/25

Outline

- ❖ ILM Workflow
 - ILM setup
 - Calculation in real-time

- ❖ Simulation Setup
 - Test site
 - Daylight simulation setup
 - Daylighting system
 - Reference control strategies

- ❖ Results
 - cDA
 - DGP
 - Energy demand for heating, cooling and artificial light

- ❖ Outlook: Application in Living Lab

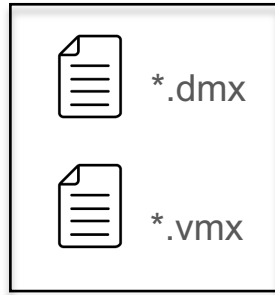
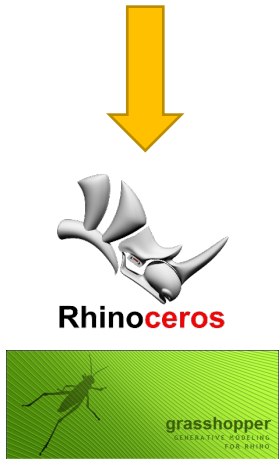
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ILM Workflow

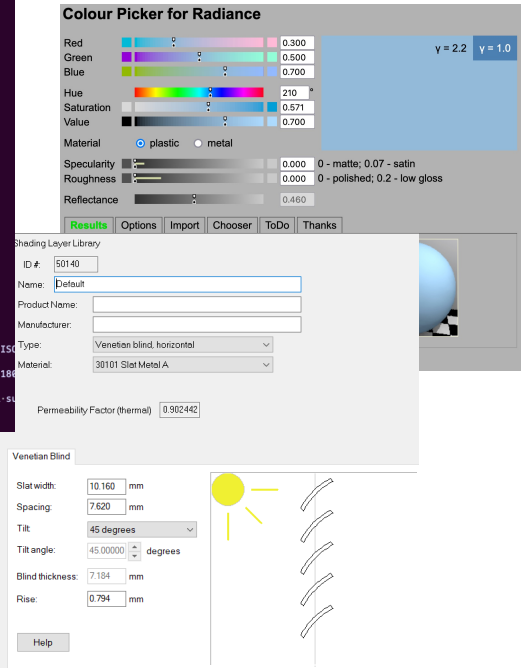
Setup

Rhino.Inside

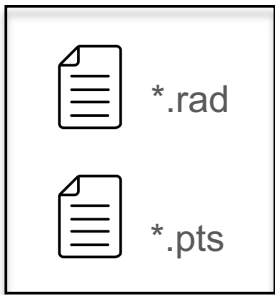


```

[cf]-
;calculation/correction-factor-
;
; Correction to vertical glass transmission = 1-
; korr_ref_tau_dir = 1-
; korr_ref_tau_dir = 1.0/0.638-
; dirt_factor-
; dirt_fac = 0.9-
;
; albedo_ground = 0.2-
;
; primenfakt_cooling** * * = 0.96-
; primenfakt_heating** * * = 0.605714286-
; primenfakt_artificial_light** * * = 2.4-
;
[loc]-
;
; location information-
; latitude [deg, N-positiv]-
; lat = 47.2639431878746-
; longitude [deg, E-positiv]-
; long = 11.34523099100398-
; altitude [masl] 5.5t-
; alt = 585-
; mean pressure [Pa] (barometric formula): [Bergfex]-
; pres = 94810-
; internal load per user [kJ/h] TOD0: Martin-fragen-SIA-
; intp = 88-
; internal load per user in [W] incl. appliances according to EN ISO
; intp = 288-
; facade orientation azimuth of surface normal (0*..N; 90*..E; 180*..S; 270*..W)
; az = 180-
; facade orientation elevation of surface normal (0* for vertical su
; TOD0 no userinput! Retrieve from window rad file-
; al = 0-
    
```



- WINDOW data (BSDF, 2D-SHGC)
- ILM ini-file



ILM-Modul



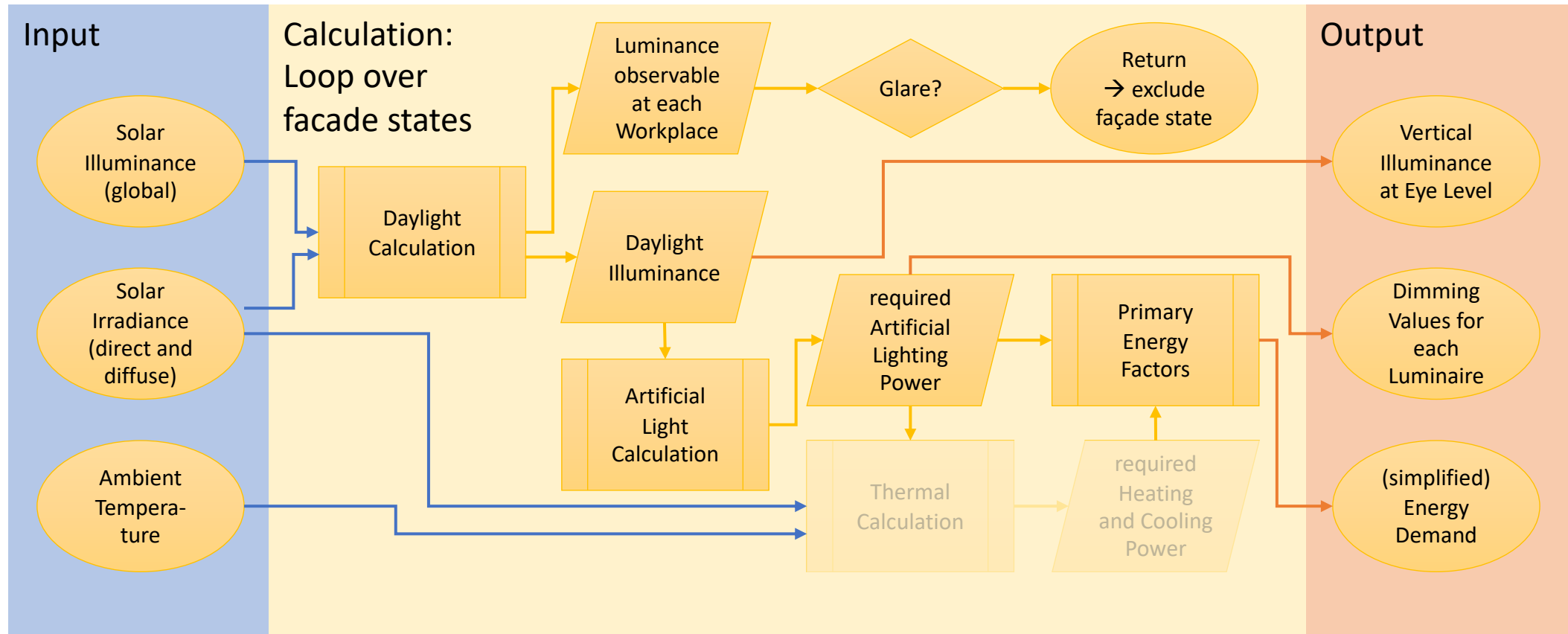
Architectural Drawing

Detailed planning (Daylight/ Artificial light/ Energy Efficiency)

Planning control strategies

ILM Workflow

Calculation in real-time

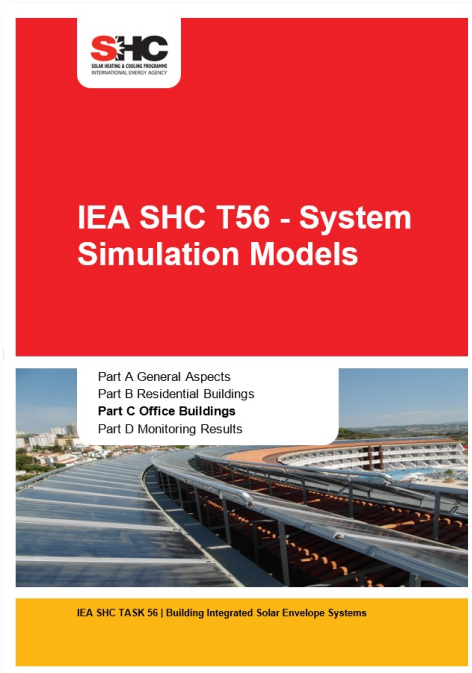


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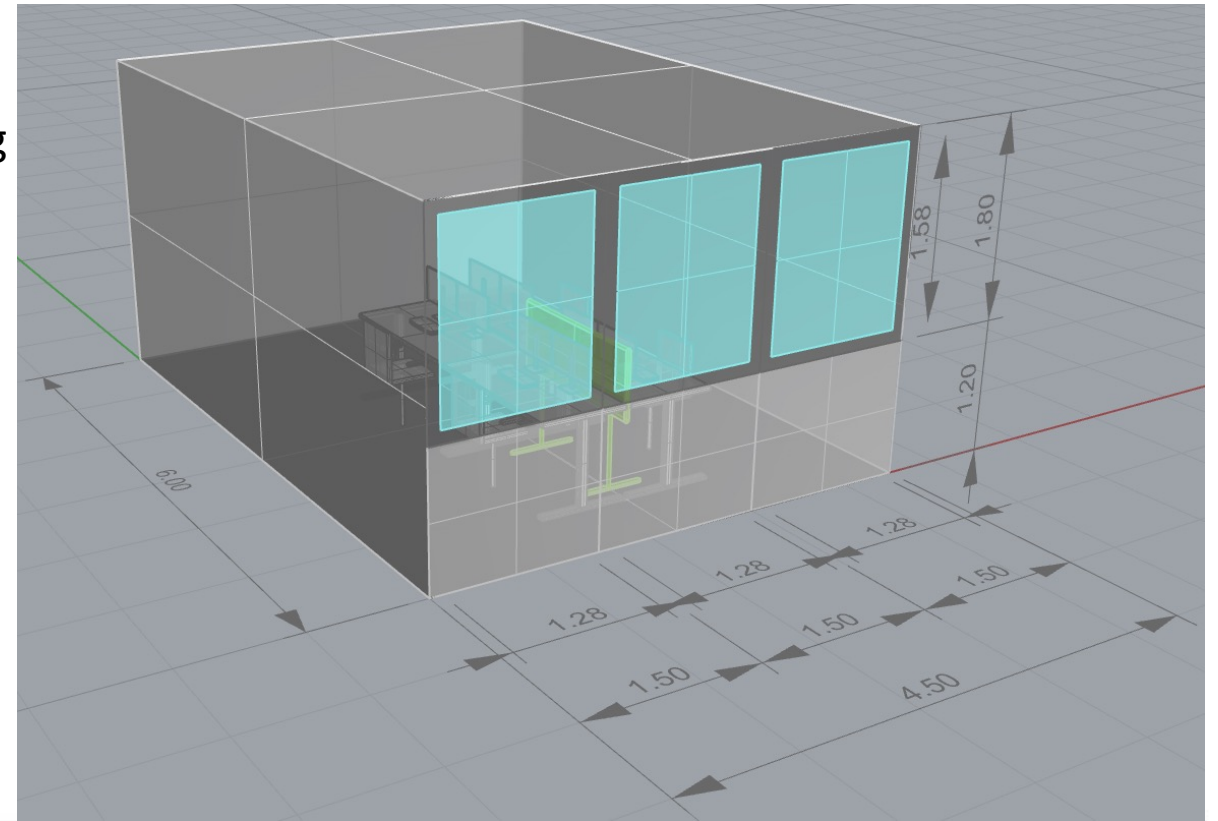
Simulation Setup

Test site



IEA SHC Task 56
Building Integrated Solar
Envelope
Systems for HVAC and Lighting
<https://task56.iea-shc.org/>

- Definition of reference office building
- Comparison of different building simulation tools

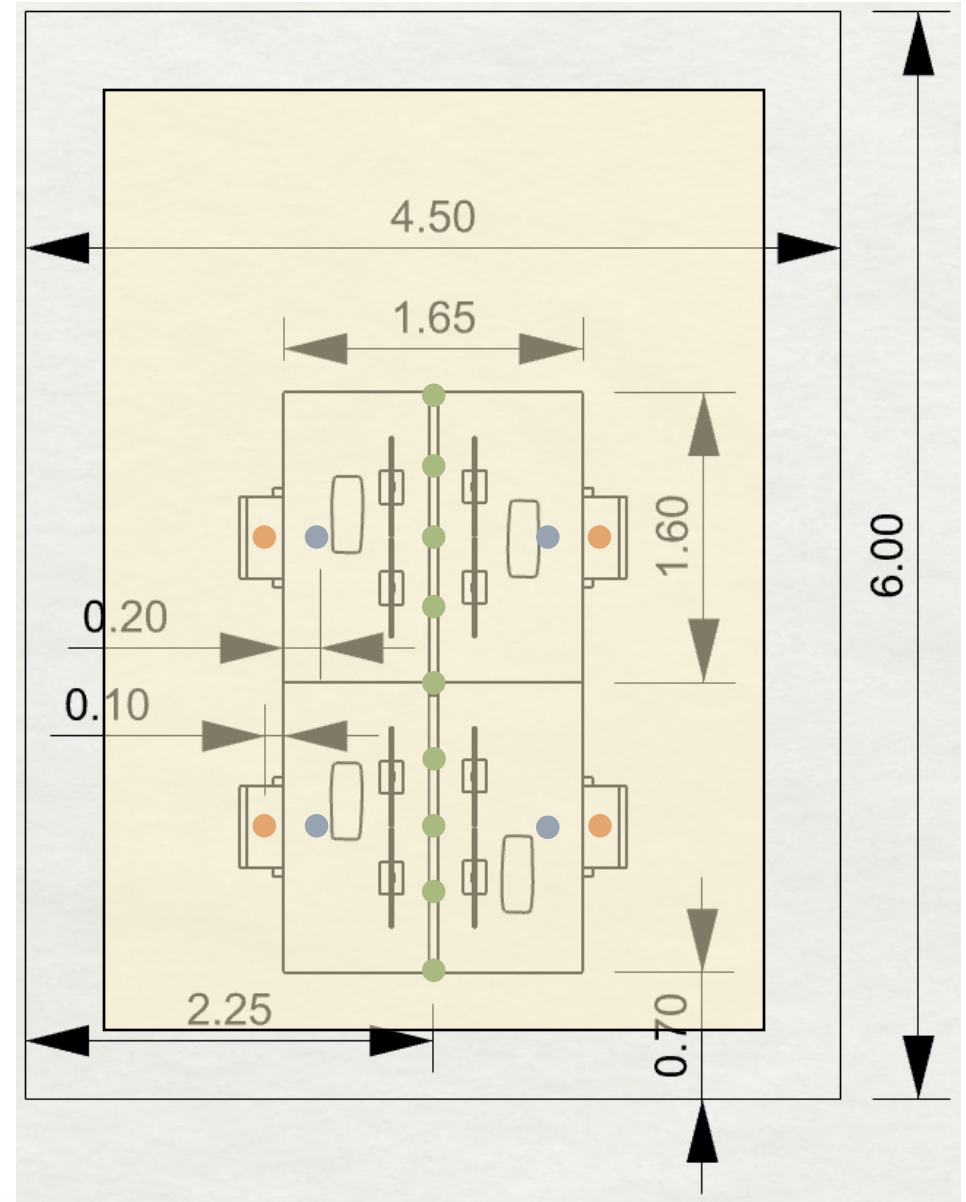
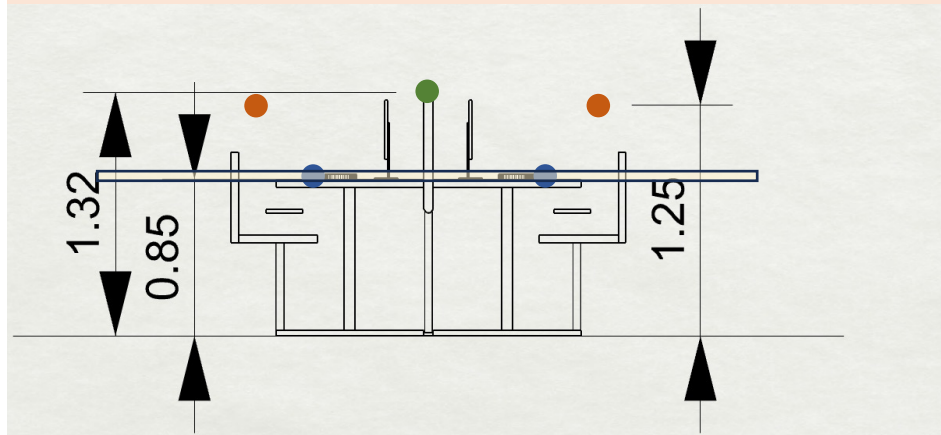


Simulation Setup

Daylight simulation setup

Measurements of Interior and virtual sensor points

- horizontal illuminance at desk-level
- Illuminance grid in 0.5 m resolution
- Horizontal illuminance on partition wall
- vertical illuminance at eye-level
- Glare detection at eye-level



Simulation Setup

Daylighting system

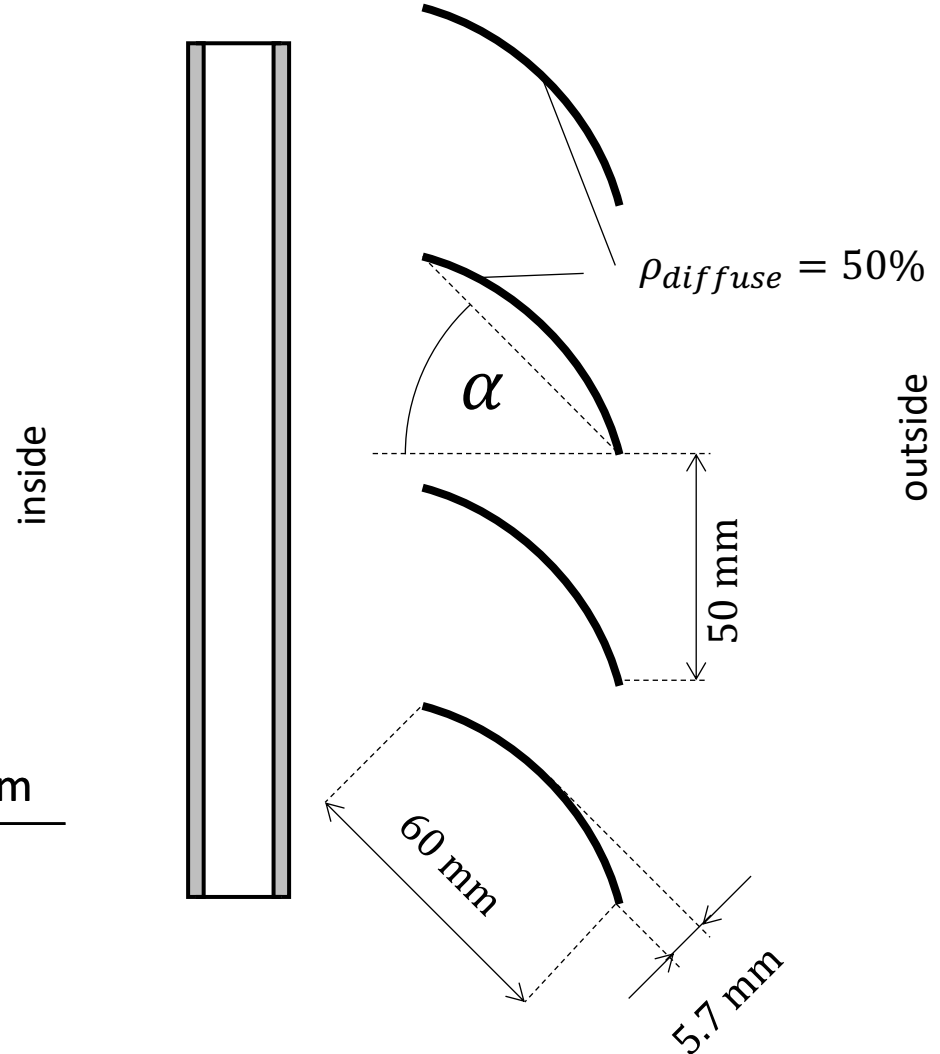
- Lamella Angles

$$\alpha \in \{0, 10, 15, 25, 35, 45, 60, 75\}$$

- Deployed or fully Retracted

- Window Properties

	Rome	Stuttgart	Stockholm
SHGC	0.33	0.59	0.63
Tau, vis	0.42	0.71	0.65
U [W/m ² /K]	1.26	1.35	0.9



Simulation Setup

Reference control strategies

Strategy 1: *open / closed*

- Facade system is retracted, when the global radiation is below: $I_g = 200 \text{ W/m}^2$
- Otherwise it is deployed at 45°

Strategy 2: *Cut-off*

- Facade system is retracted, when the global radiation is below threshold: $I_g = 150 \text{ W/m}^2$
- Otherwise it is deployed at the maximum angle possible, where no direct solar radiation enters the room

Strategy 3: no movement

- Fully retracted
- Constantly at 0°

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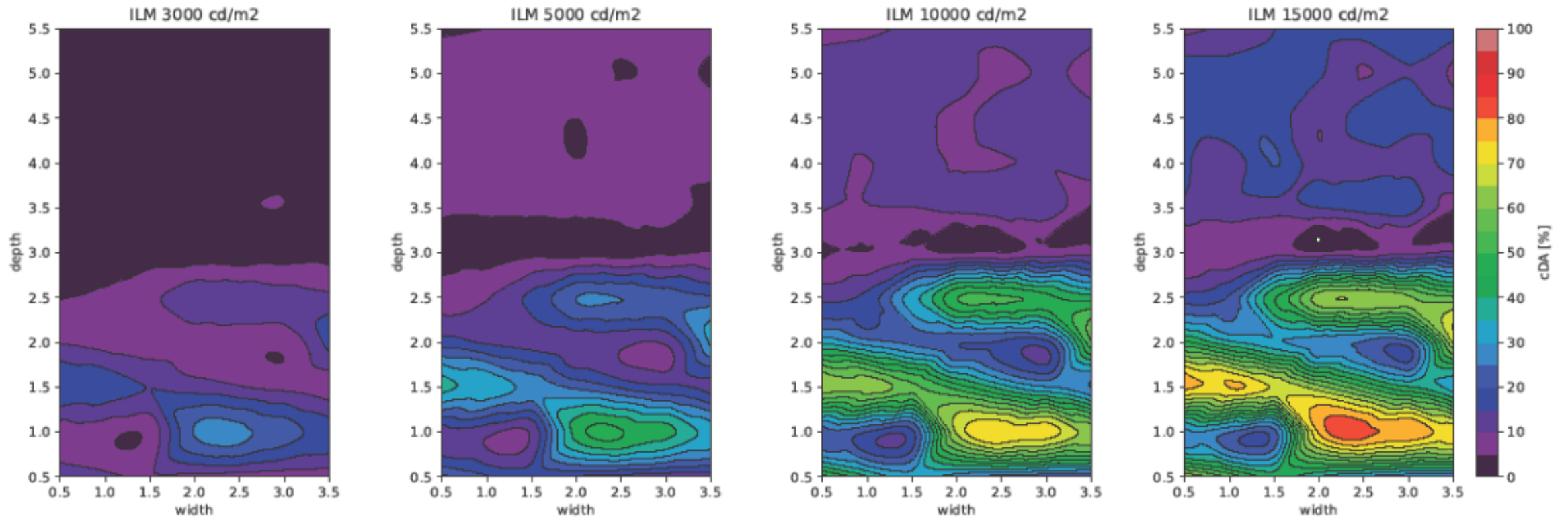
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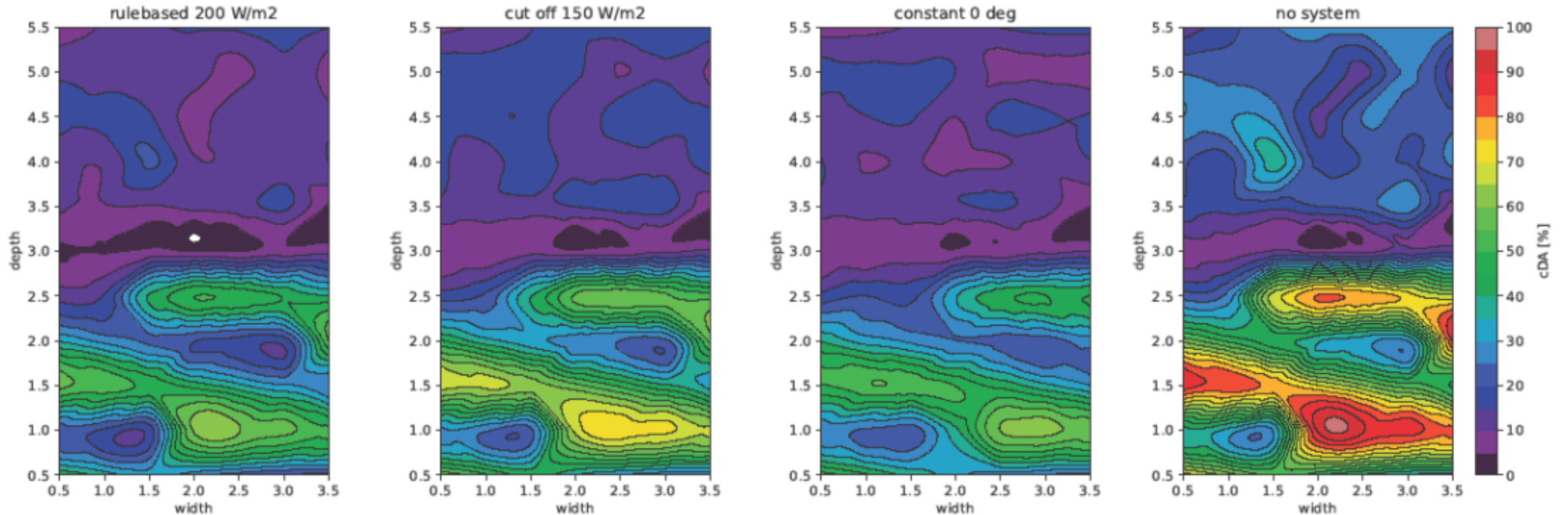
Results

cDA



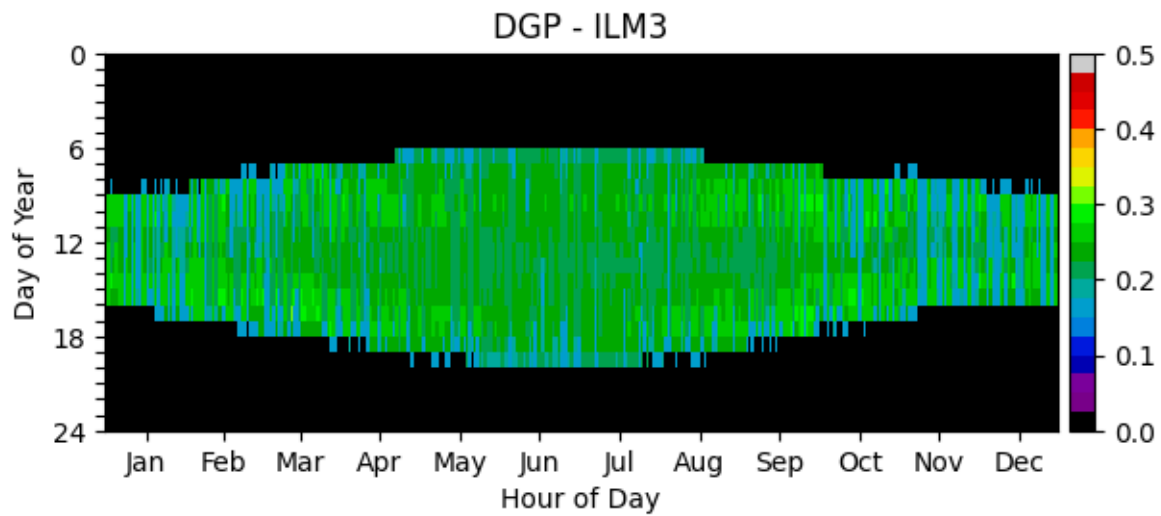
Results

cDA



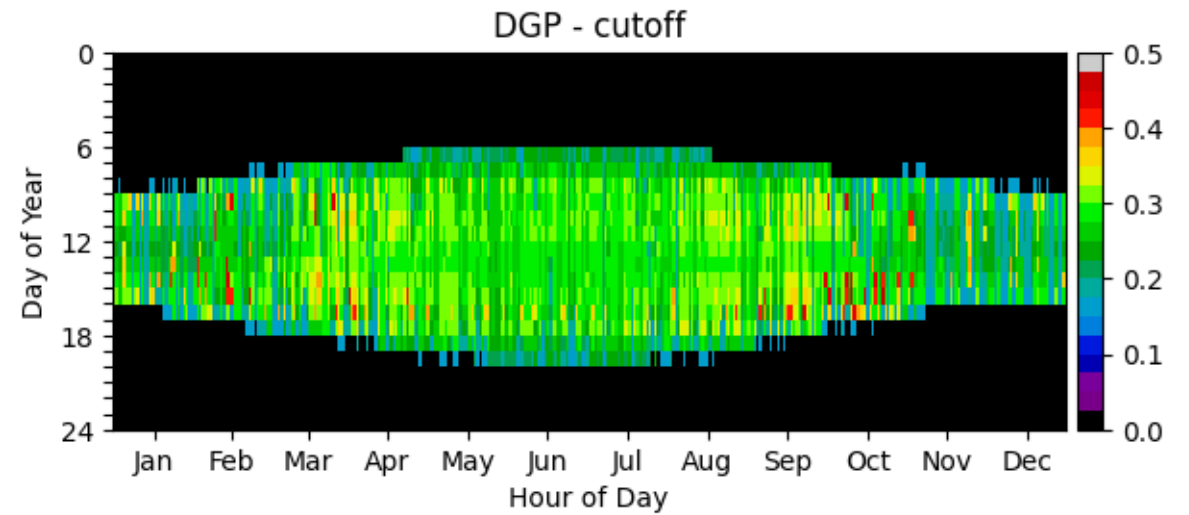
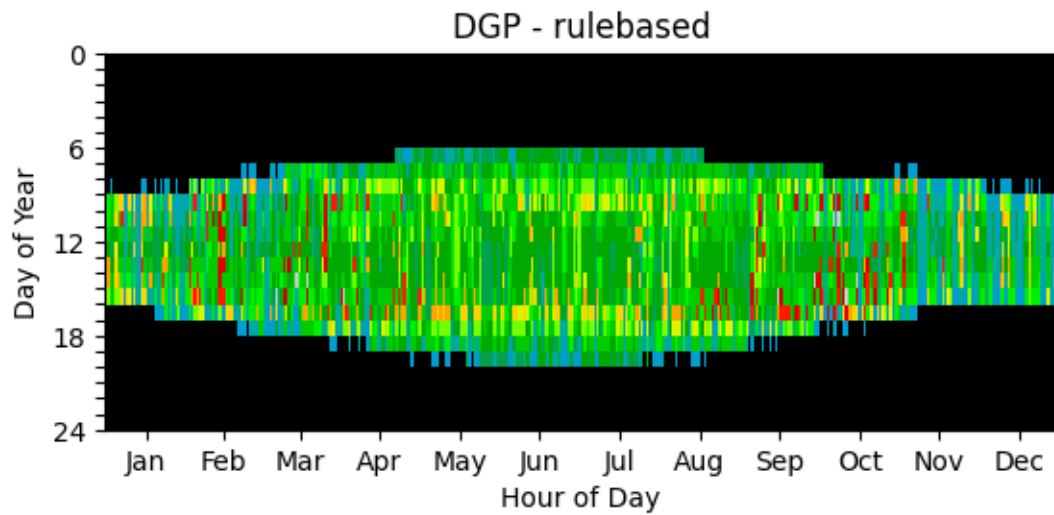
Results

DGP



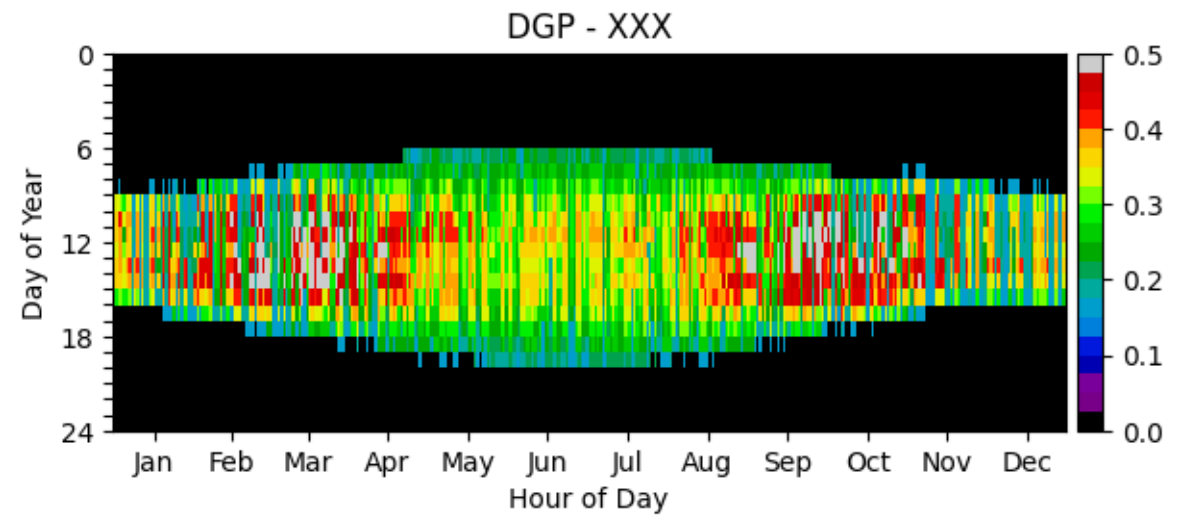
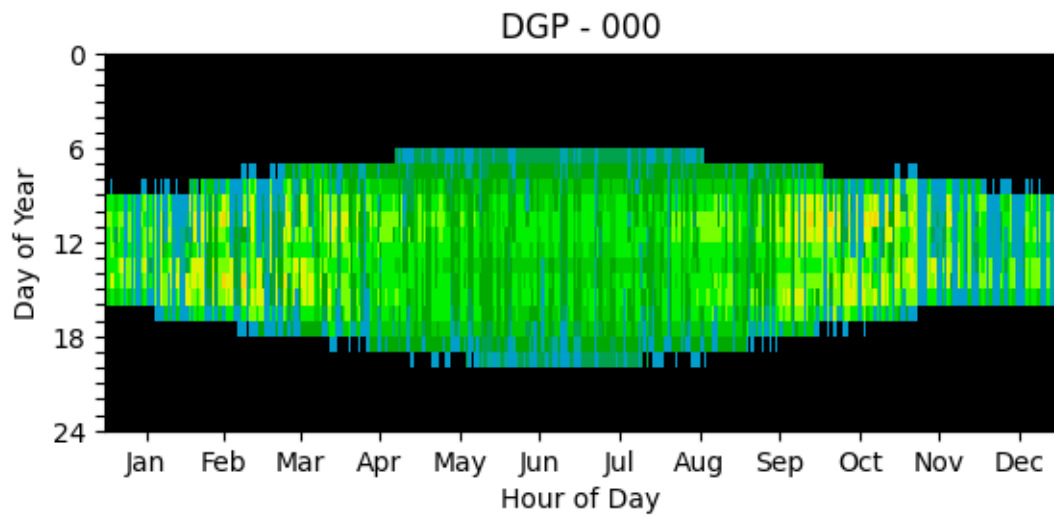
Results

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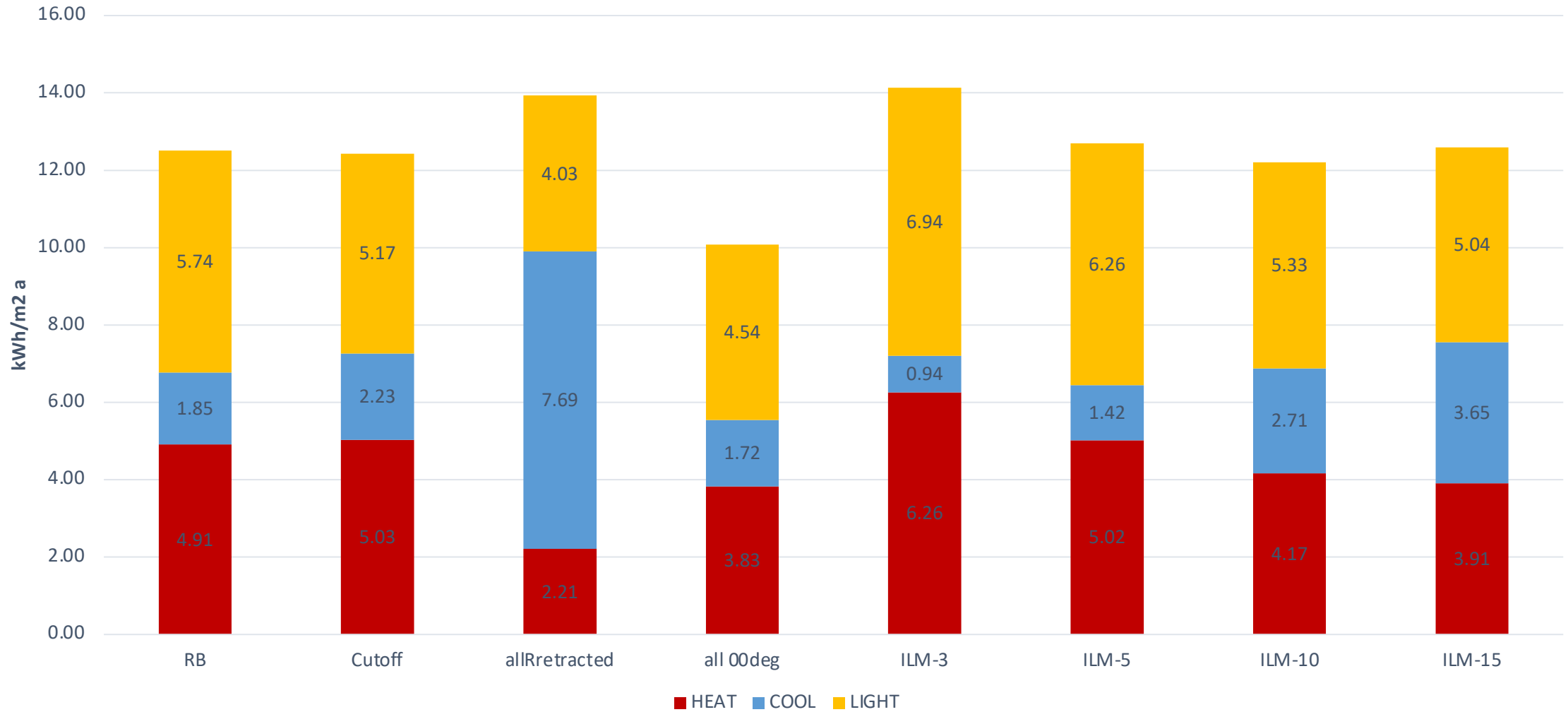


Results

DGP



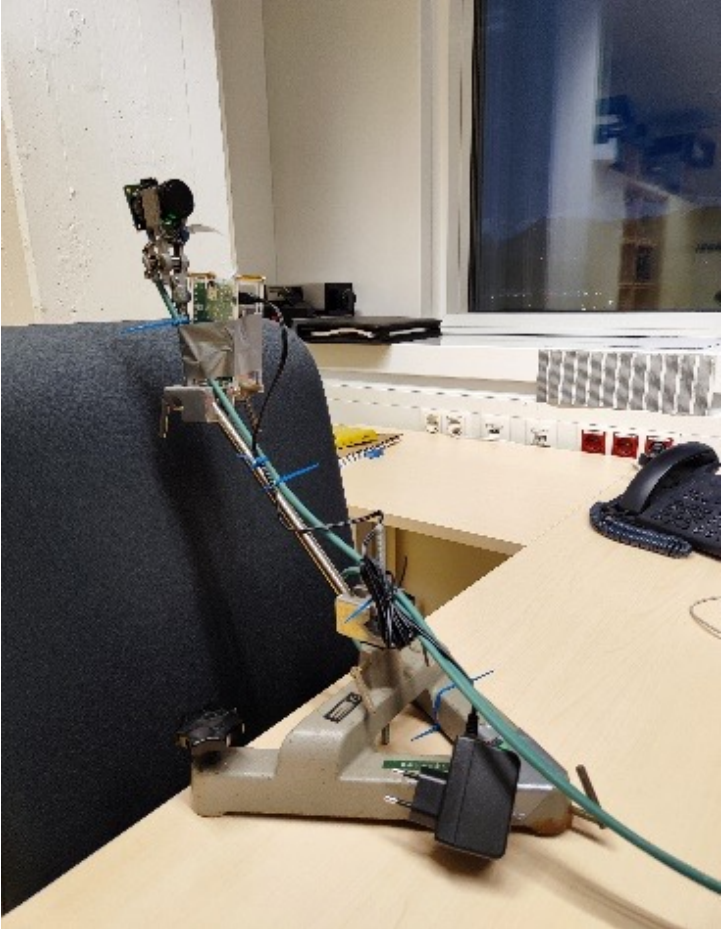
Energy demand for heating, cooling and lighting (yearly)



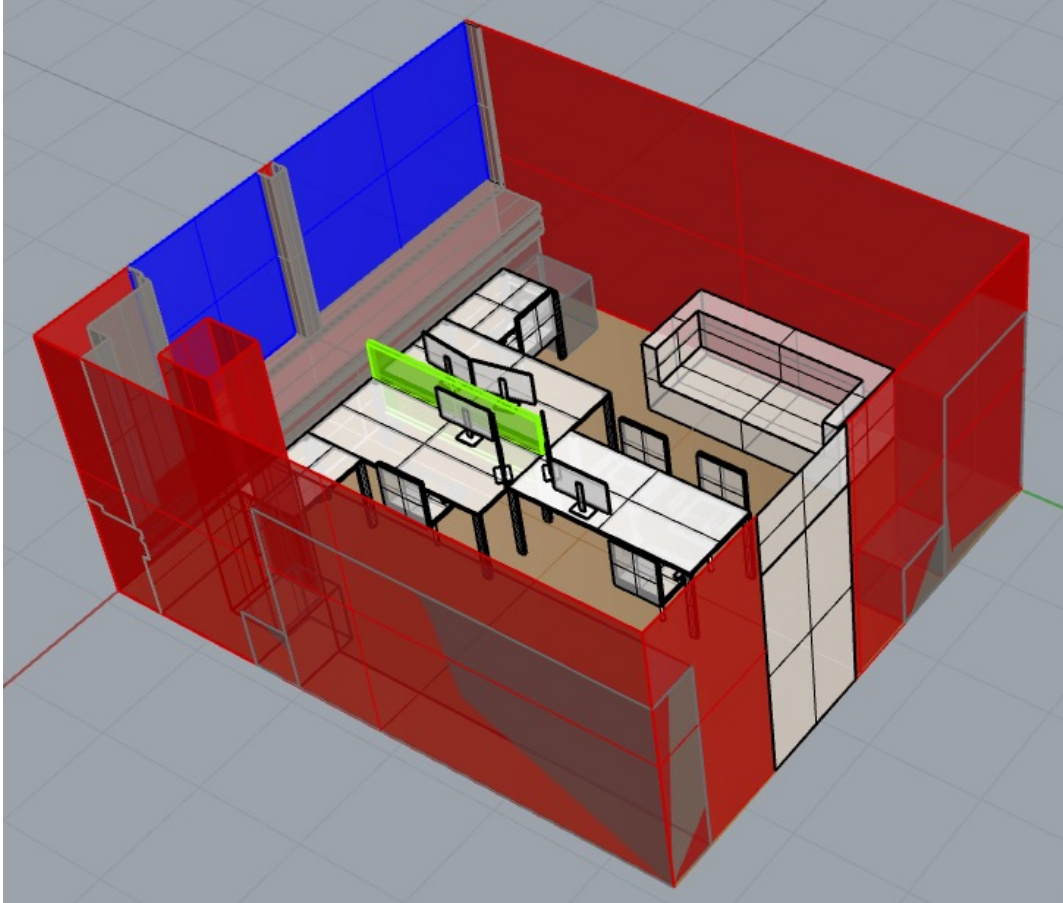
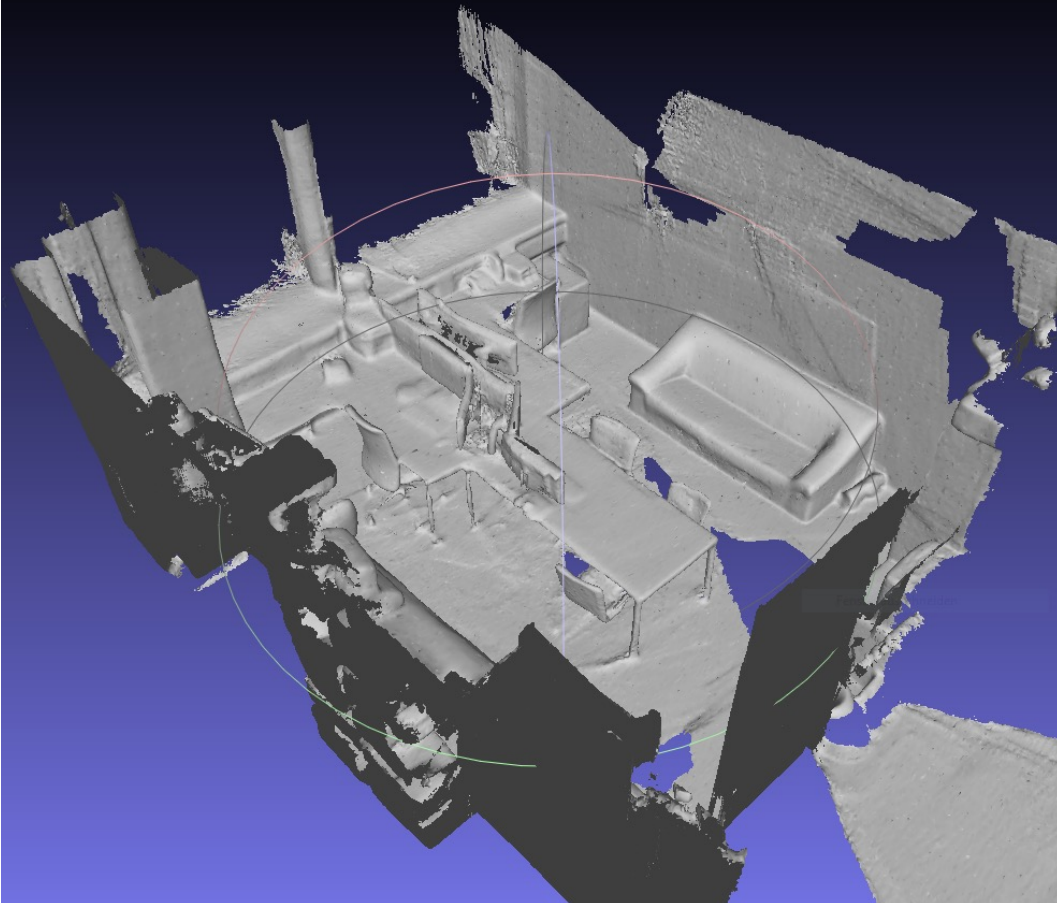
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Thanks for your attention!

