Energy generated architecture

BIPVboost & BeSmart in München – 20 April 2023

BIPV

or

No PV

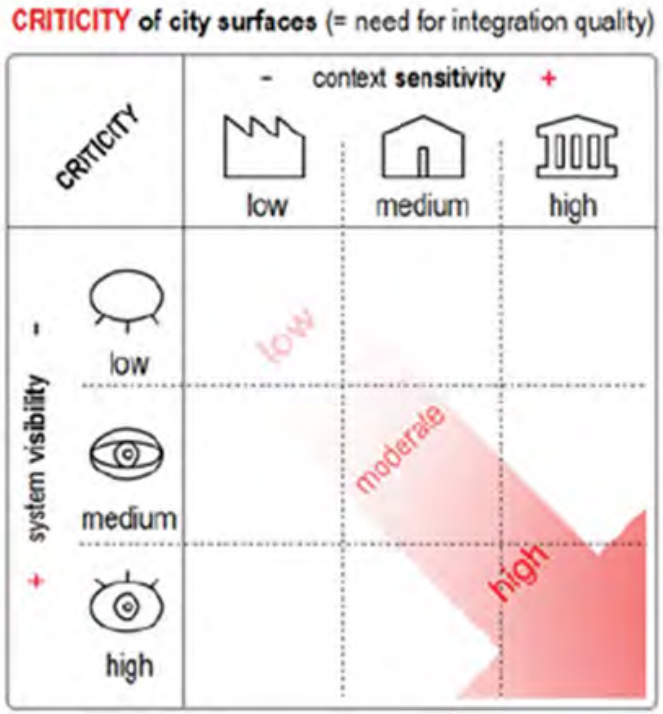

aurora INNOVATION
white
RAMBOLL
Skatteverket
Arena Magasin X
Vasakronan
Fjalars Grand 8

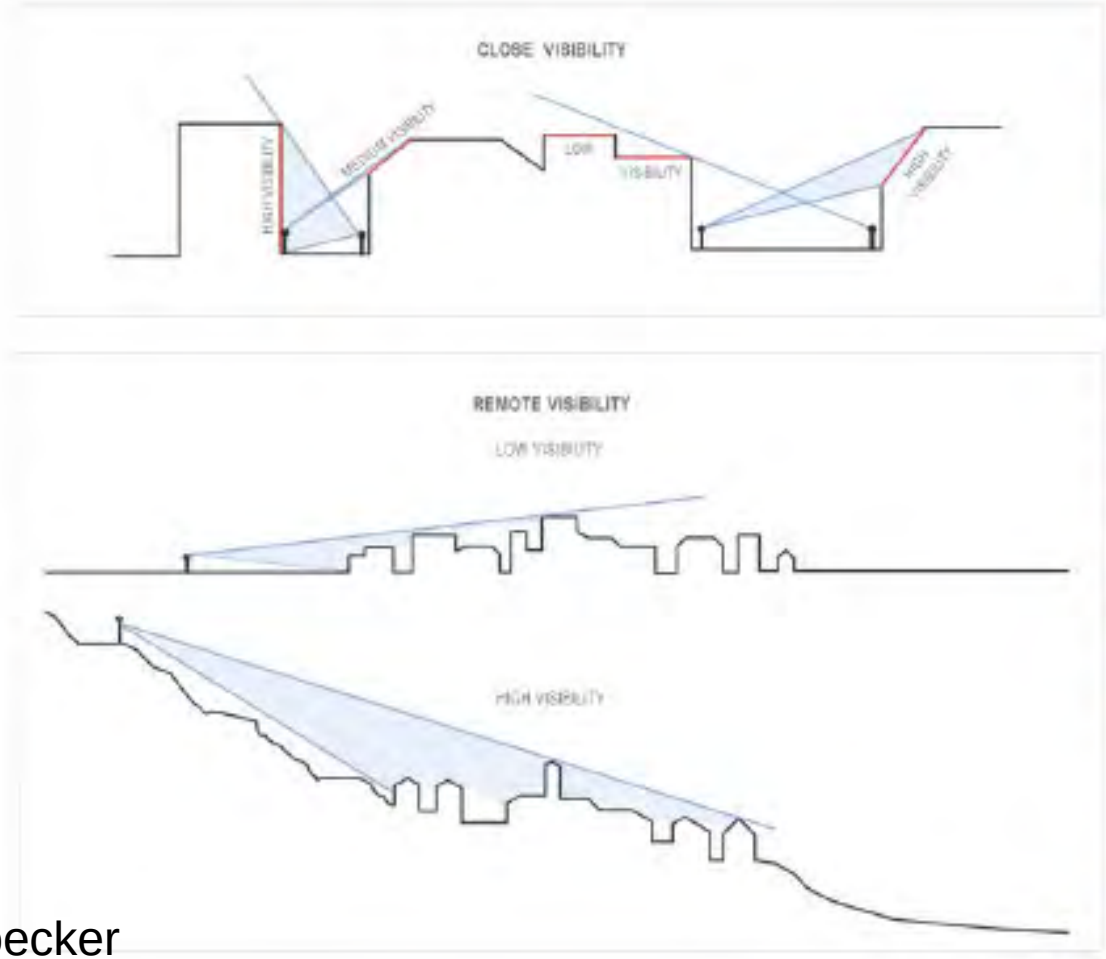
Context

Money

Environment

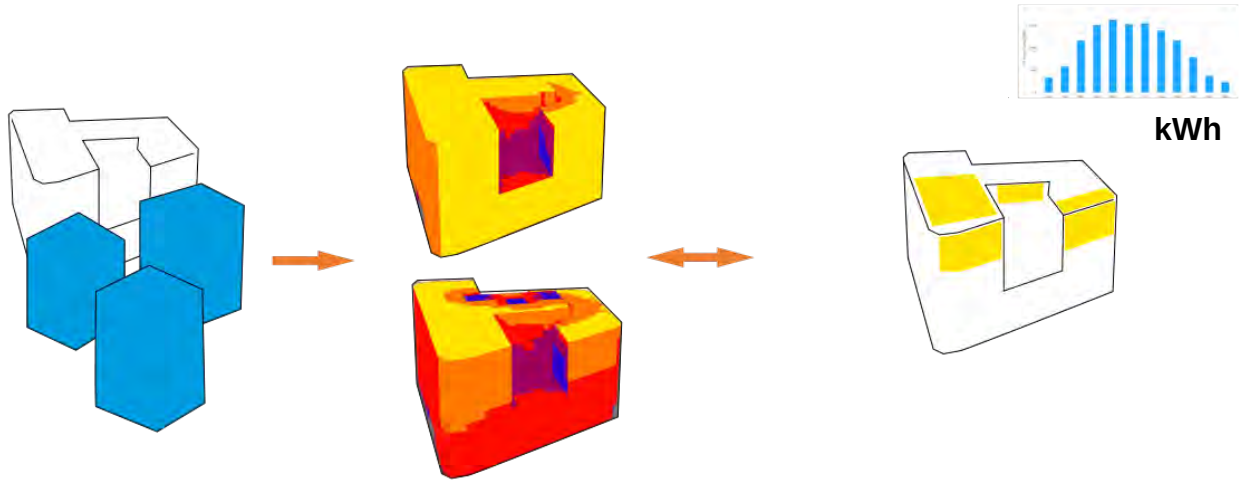
CULTURAL VALUES & URBAN CONTEXT





LESO-QSV – Munari-Probst & Roecker

EARLY STAGE

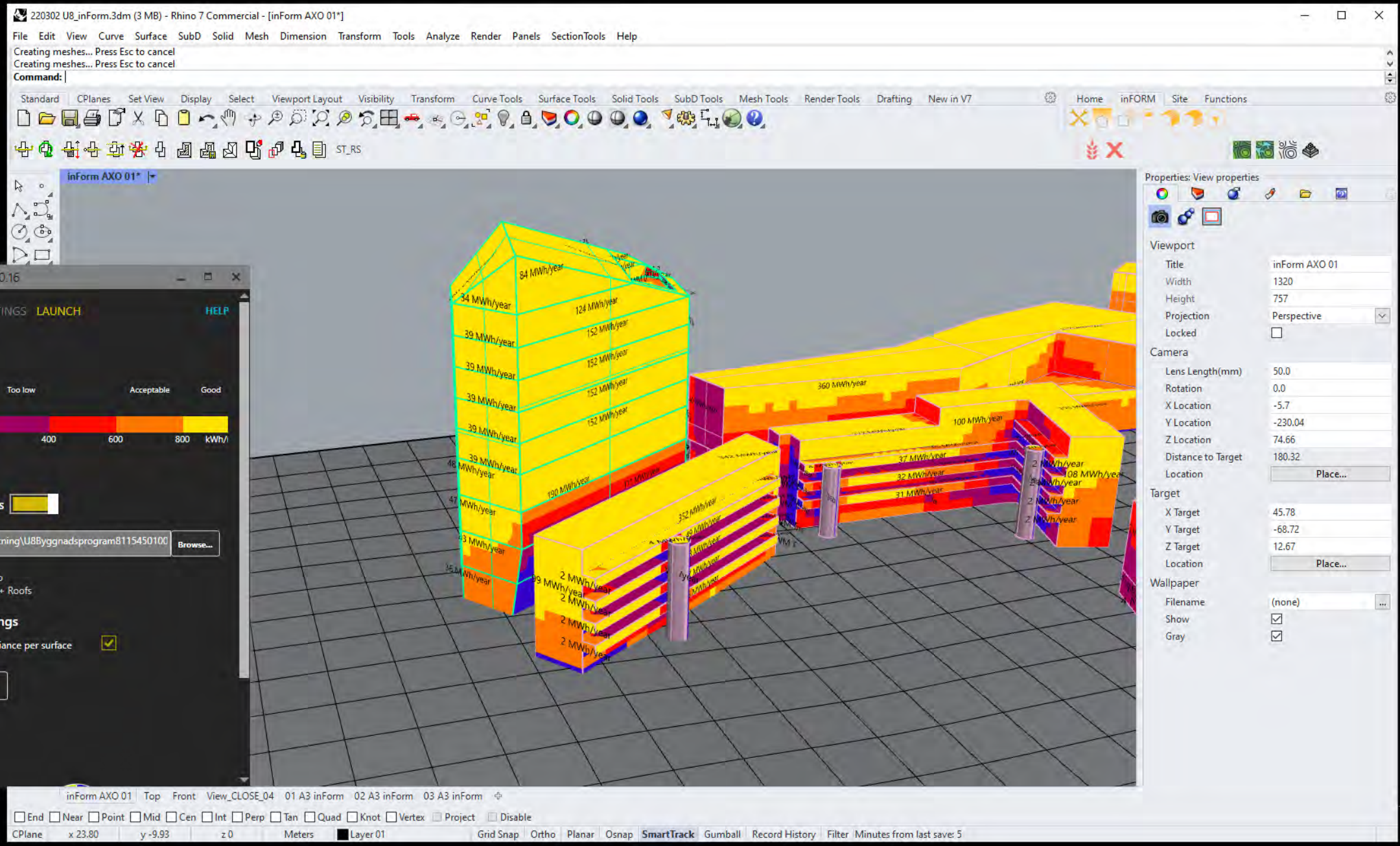


Simple model with surrounding

Analysis with and without shading, generating shadow effect

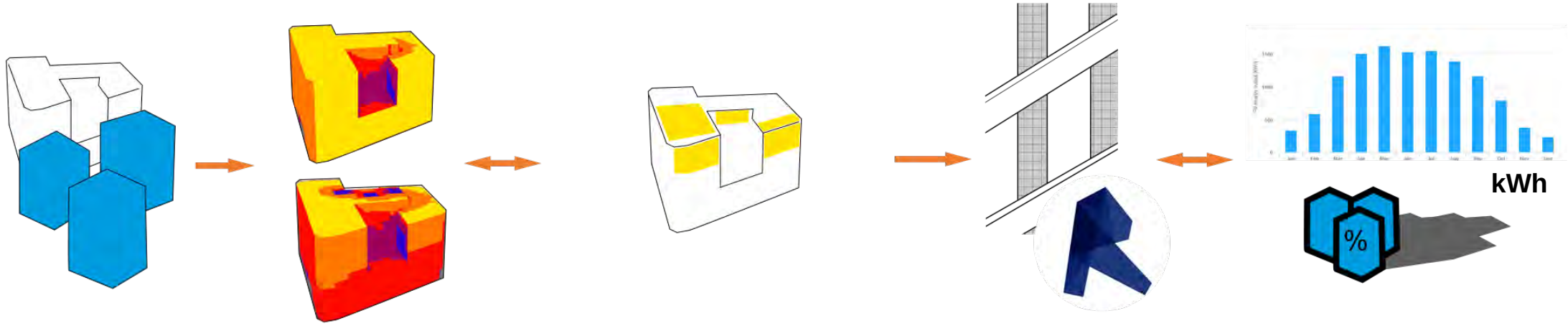
Electricity production with PV-GIS on chosen placement of PV

- **Inhouse**
- **Time efficient**


220302 U8_inForm.3dm (3 MB) - Rhino 7 Commercial - [inForm AXO 01*]
File Edit View Curve Surface SubD Solid Mesh Dimension Transform Tools Analyze Render Panels SectionTools Help
Creating meshes... Press Esc to cancel
Creating meshes... Press Esc to cancel
Command:
Standard CPlanes Set View Display Select Viewport Layout Visibility Transform Curve Tools Surface Tools Solid Tools SubD Tools Mesh Tools Render Tools Drafting New in V7
Home inFORM Site Functions
ST_RS
inForm AXO 01*
INFORM PV V0.16
MODEL SETTINGS LAUNCH HELP
Launch!
Too low
Acceptable
Good
200 400 600 800 kWh/
Unload results
\\seorefs01\ritning\U8Byggnadsprogram8115450100
Browse...
Location: Orebro
Scope: Facades + Roofs
Results settings
Show total irradiance per surface
Save in Rhino
84 MWh/year
34 MWh/year
124 MWh/year
152 MWh/year
39 MWh/year
190 MWh/year
360 MWh/year
100 MWh/year
37 MWh/year
32 MWh/year
31 MWh/year
108 MWh/year
352 MWh/year
2 MWh/year
Properties: View properties
Viewport
Title inForm AXO 01
Width 1320
Height 757
Projection Perspective
Locked
Camera
Lens Length(mm) 50.0
Rotation 0.0
X Location -5.7
Y Location -230.04
Z Location 74.66
Distance to Target 180.32
Location Place...
Target
X Target 45.78
Y Target -68.72
Z Target 12.67
Location Place...
Wallpaper
Filename (none)
Show
Gray
inForm AXO 01 Top Front View_CLOSE_04 01 A3 inForm 02 A3 inForm 03 A3 inForm
End Near Point Mid Cen Int Perp Tan Quad Knot Vertex Project Disable
CPlane x 23.80 y -9.93 z 0 Meters Layer 01 Grid Snap Ortho Planar Osnap SmartTrack Gumball Record History Filter Minutes from last save: 5

EARLY STAGE

DETAILED DESIGN



Simple model with surrounding

Analysis with and without shading, generating shadow effect

Electricity production with PV-GIS on chosen placement of PV

BIM modelling of PV

Electricity production with PV-GIS and shadow effect

- **Inhouse**
- **Time efficient**

- **Generic object**
- **Object for multipurpose**

Architects' digital tools for BIPV-design

Task 15

Enabling framework for the acceleration of BIPV

2023 03 10 / White arkitekter AB

AUTHORS

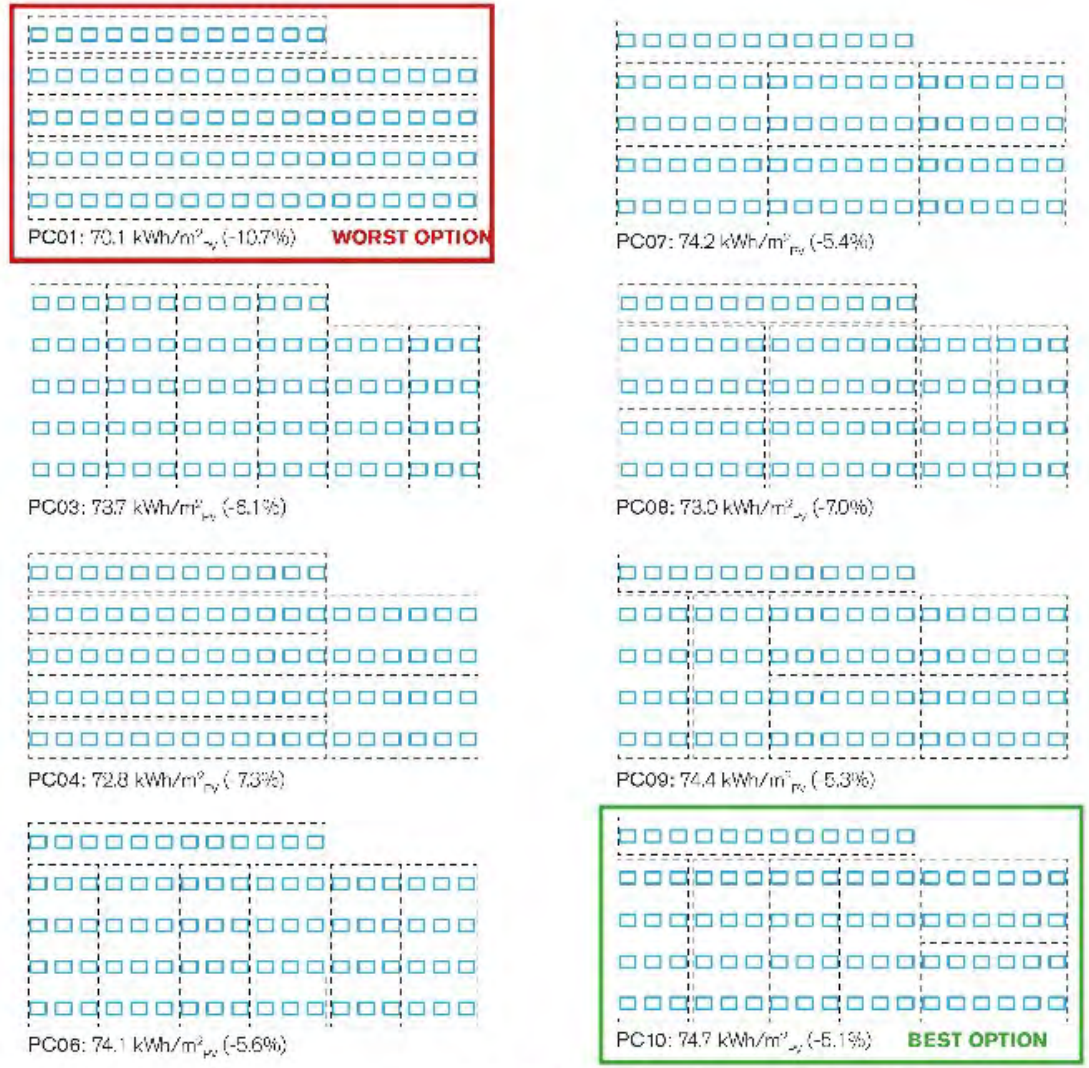
Rickard Nygren
Julia Sandgren
Alan Andrews

IEA PVPS

white

Figur 5: Southeast facade, annual estimated energy production for different panel combinations. Total PV area 308.5 m², PV efficiency factor 0.15. Simulations consider the position of the sun every 5 minutes for a whole year and use typical climate data for Arlanda (Stockholm).

Figure 3: annual solar irradiation on the PV panels.



Figur 4: Southwest facade, annual estimated energy production for different panel combinations. Total PV area 121.8 m², PV efficiency factor 0.15. Simulations consider the position of the sun every 5 minutes for a whole year and use typical climate data for Arlanda (Stockholm).

What is the cost?

foto: Jerker Lokranz

		Non-active		Active	Power per Module		extra
		€/m^2		€/m^2	Wp		/m^2
Company A		**95**		**250**	205		+ 163 %
Company B		**170**		**290**	188		+ 71 %
Company C		**200**		**335**	175		+ 68 %
Company D		**210**		**435**	185		+ 107 %
Compnay E		**70**		**335**	180		+ 379 %

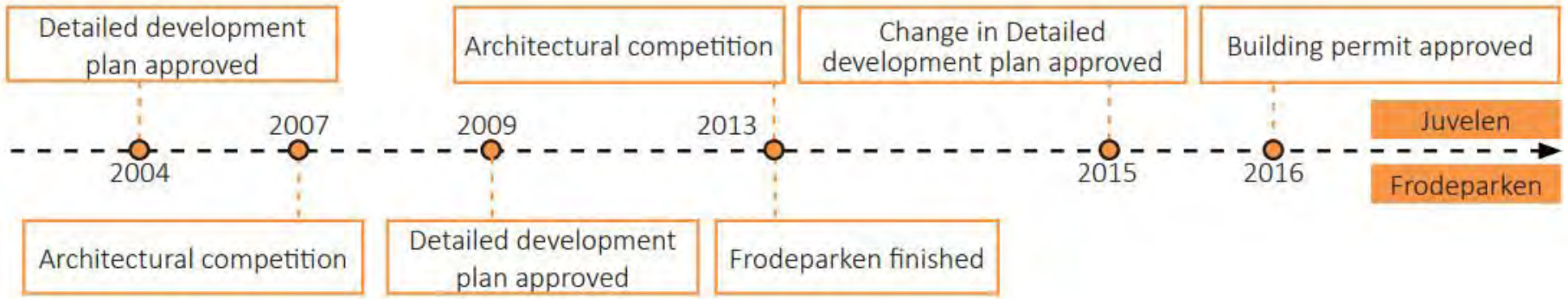
foto: Jerker Lokranz

What is the environmental cost?

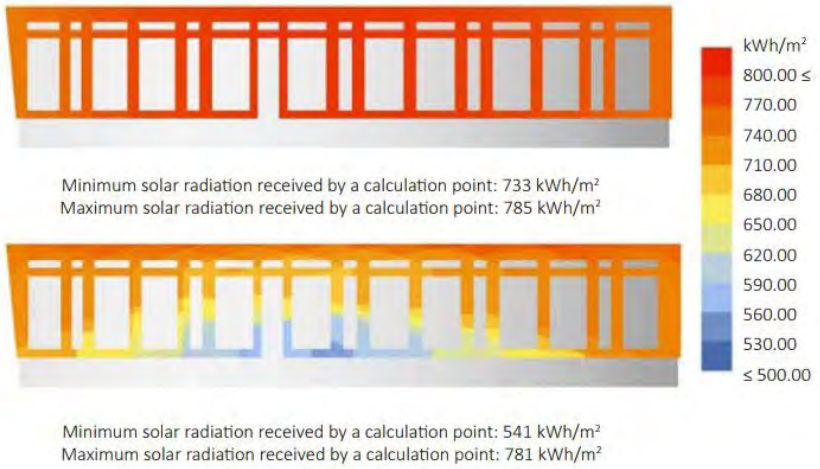

Midsummer Slim

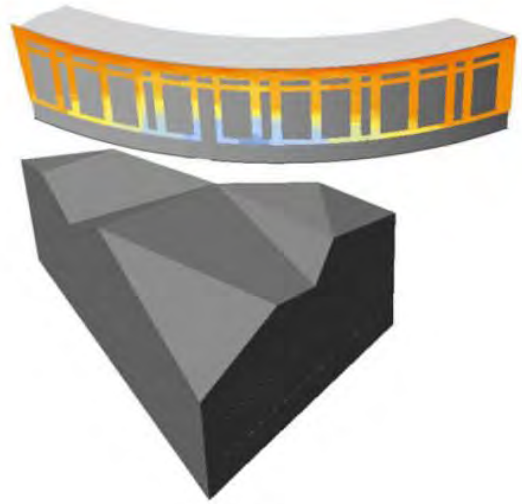

1/5 of CO_2
Midsummer Slim

Development plan


Detailed development plan approved
Architectural competition
Change in Detailed development plan approved
Building permit approved
2004
2007
2009
2013
2015
2016
Juvelen
Frodeparken
Architectural competition
Detailed development plan approved
Frodeparken finished


Frodeparken
New building
BHKP
BSHKP
PARK
VI


Minimum solar radiation received by a calculation point: 733 kWh/m²
Maximum solar radiation received by a calculation point: 785 kWh/m²
kWh/m²
800.00 ≤
770.00
740.00
710.00
680.00
650.00
620.00
590.00
560.00
530.00
≤ 500.00
Minimum solar radiation received by a calculation point: 541 kWh/m²
Maximum solar radiation received by a calculation point: 781 kWh/m²



FRODEPARKEN - UPPSALA

NCC Headquarters

NCC HUVUDKONTOR - SOLNA

Magasin X

MAGASIN X - UPPSALA

BE SMART
Together for Active and Efficient Buildings

white

FACADE, DETAILS

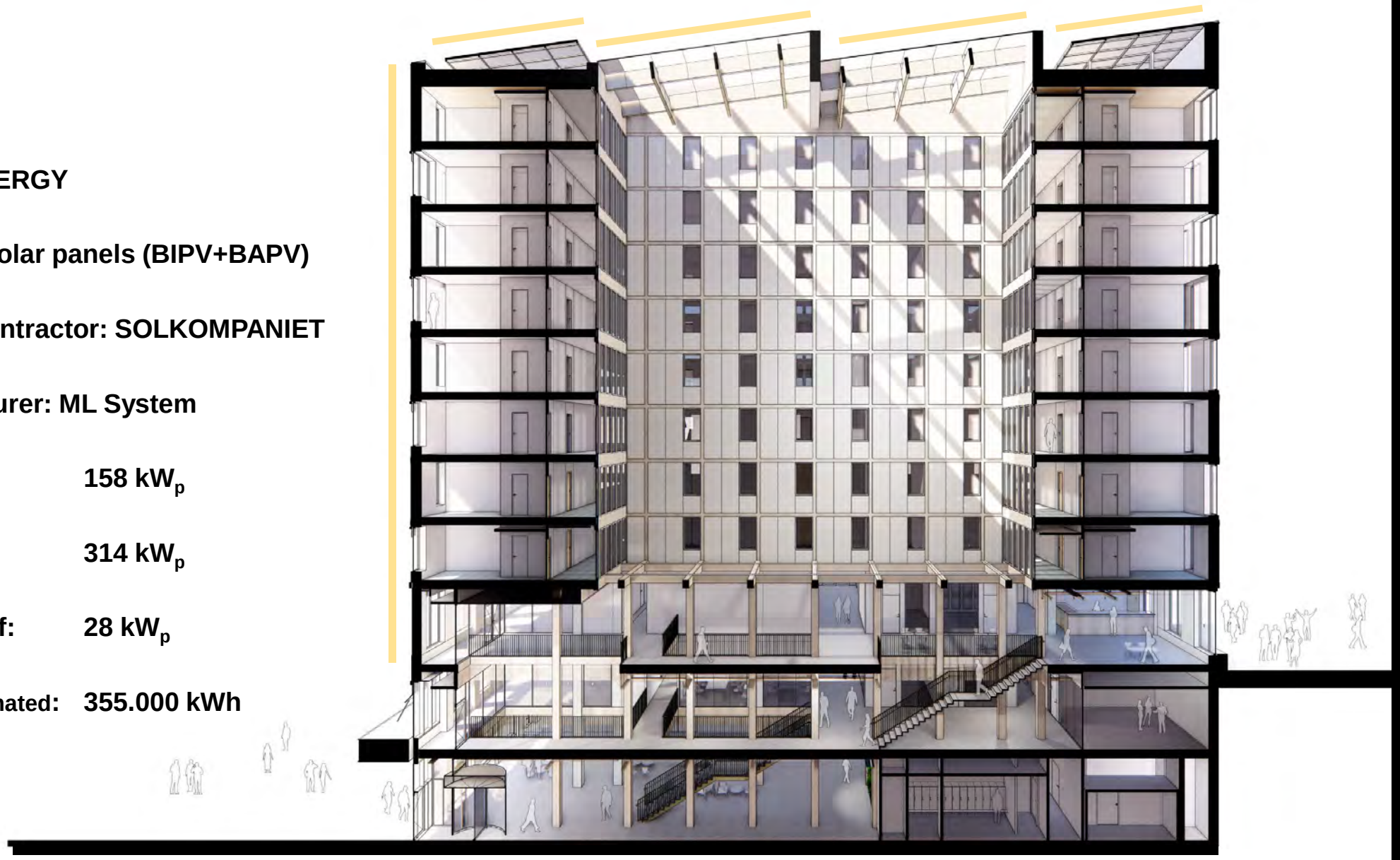
North-east and north-west

South-east and south-west

House of Choice


HOUSE OF CHOICE
Our ambition has been to work as architectural as possible with the zero energy goal as a guiding light.
-Raimo Joss
white

- **ZERO ENERGY**
- **2500 m² solar panels (BIPV+BAPV)**
- **PV Subcontractor: SOLKOMPANIET**
- **Manufacturer: ML System**
- **Facade: 158 kW_p**
- **Roof: 314 kW_p**
- **Glass roof: 28 kW_p**
- **Yield estimated: 355.000 kWh**



HOUSE OF CHOICE, SOLNA

byggherre: Fabege

arkitekt.: White

Exterior materials

Exteriört trä
Thermowood,
Gran.

Markisolett
Solskyddsväv,
Cream

Fönster, dörrar,
solskyddsram
RAL 1035 PERLBEIGE

Solcell typ 1 kulör,
grå, matt yta.

Solcell typ 2 kulör,
grå, halvblank yta.

Solcell typ 3 kulör,
mässingston,
halvblank yta.

Målad betong kulör
NCS S- 5000 N Silkesmatt.

Betong, matrisgjutning.
Exempel på skuggverkan.

Tegel: Ströjer B 722 Silver Grey. (Med fogkulör NCS 5000 N)

(Alla material och kulörer enligt föreskrift eller likvärdigt.)

Crest

KRONA:
Sträckt ramverk och fyllning av slät betong NCS 5000N.
Listverk RAL 1035 Perlbeige

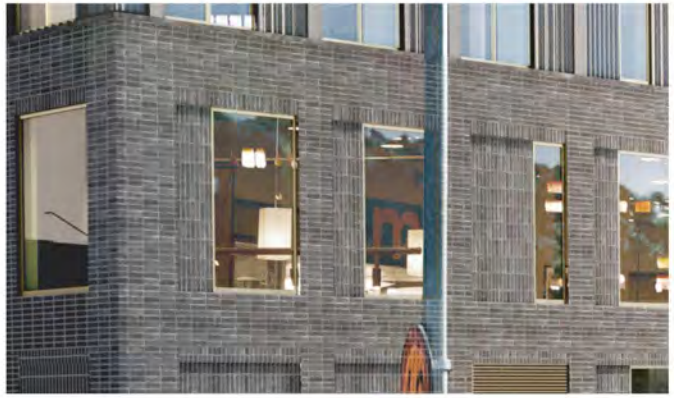
Waist

MIDJA:
Ramverk av slät betong.
Fyllning av matrisgjuten vågig betong NCS 5000N, med inslag av slät betong.

Mot sydväst solceller:
Typ 1 Grå matt etsat glas.
Typ 2. Grå Vågigt reflekterande glas.
Typ 3. Kulör lika karm RAL 1035.

Plinth

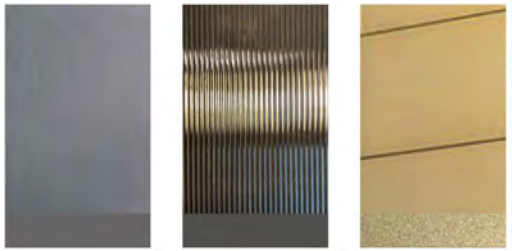
SOCKEL:
Tegel Silver Grey med fogfärg lika betong NCS 5000N.
Fönster/Partier RAL 1035 Perl-beige.



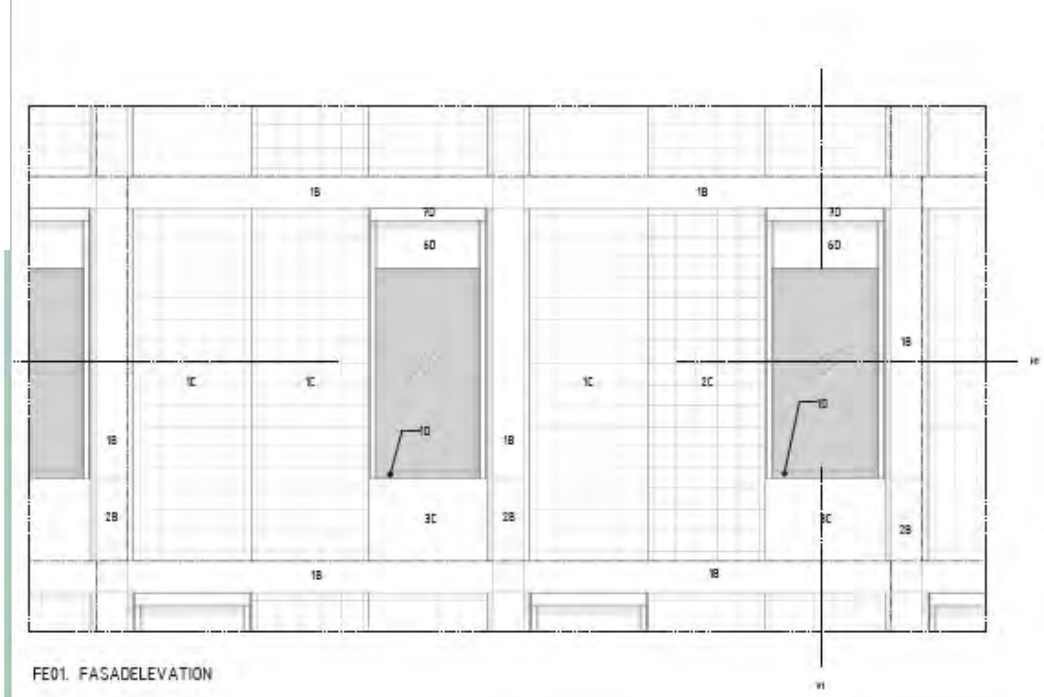
Detail, PV facade

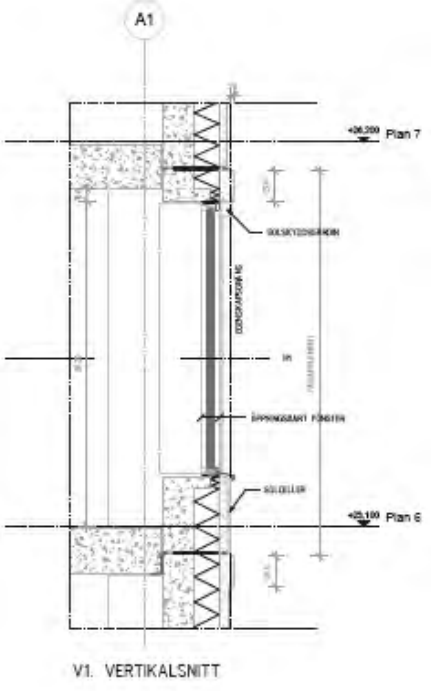
- Within grid of facade elements
- Variation by different glass textures
- Facade elements enable exterior cables

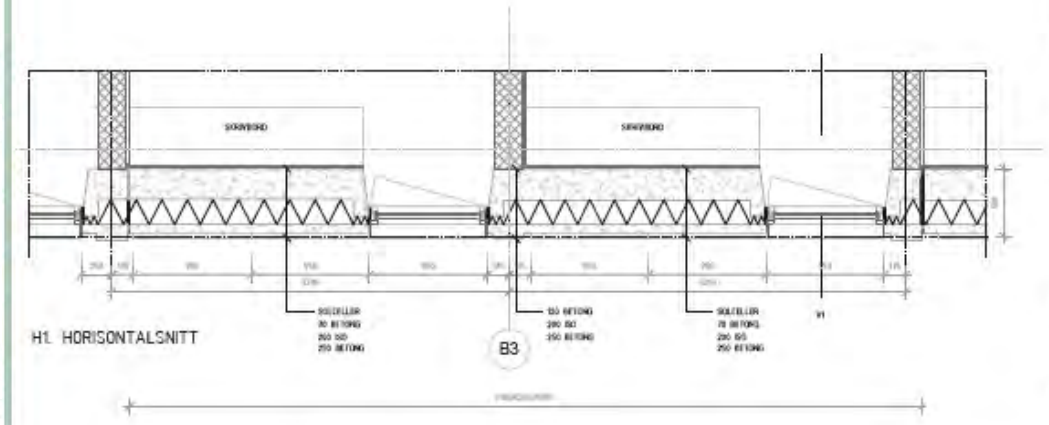
Inzoomad fasadvy, gråskala solceller

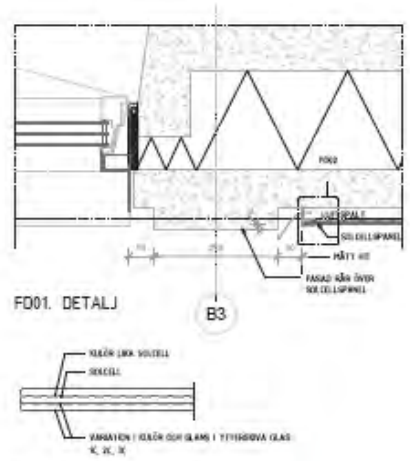


Referenser. 1. Gråskala solceller 2. Kamrkultur 3. Strukturglas solceller (ISSOL)

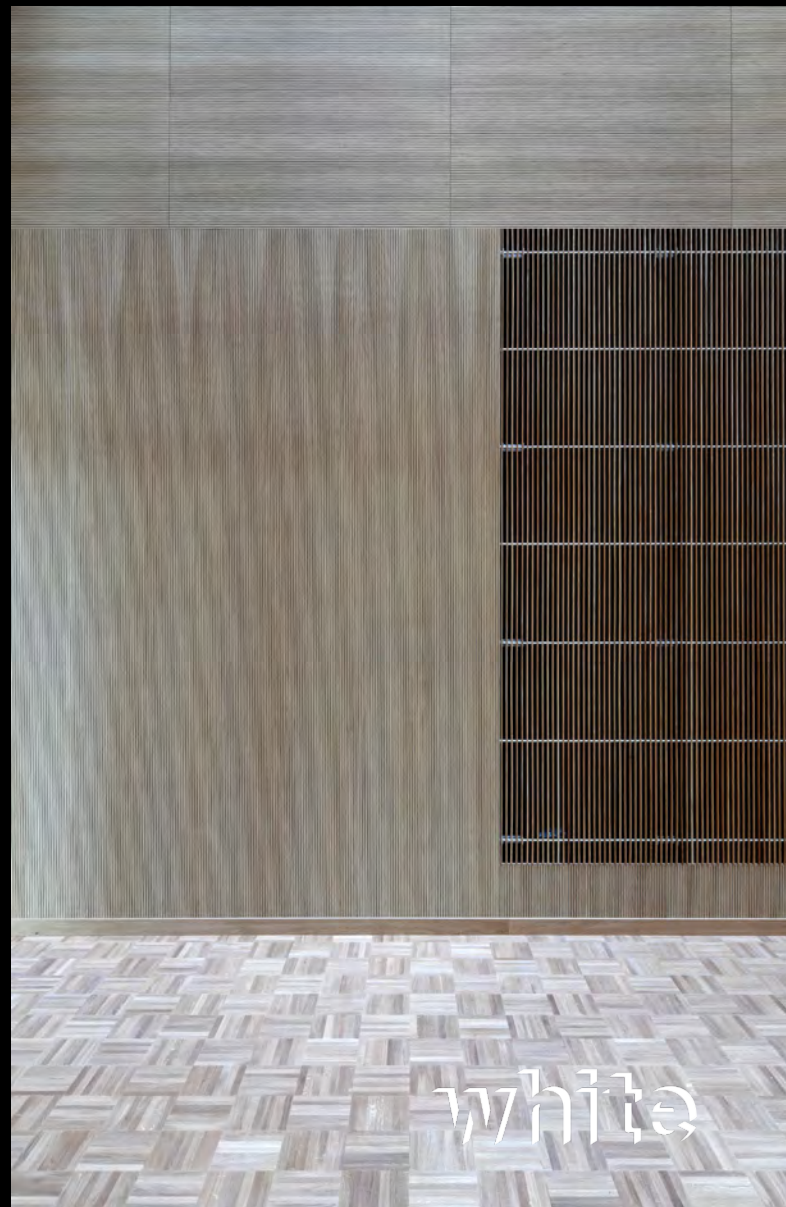




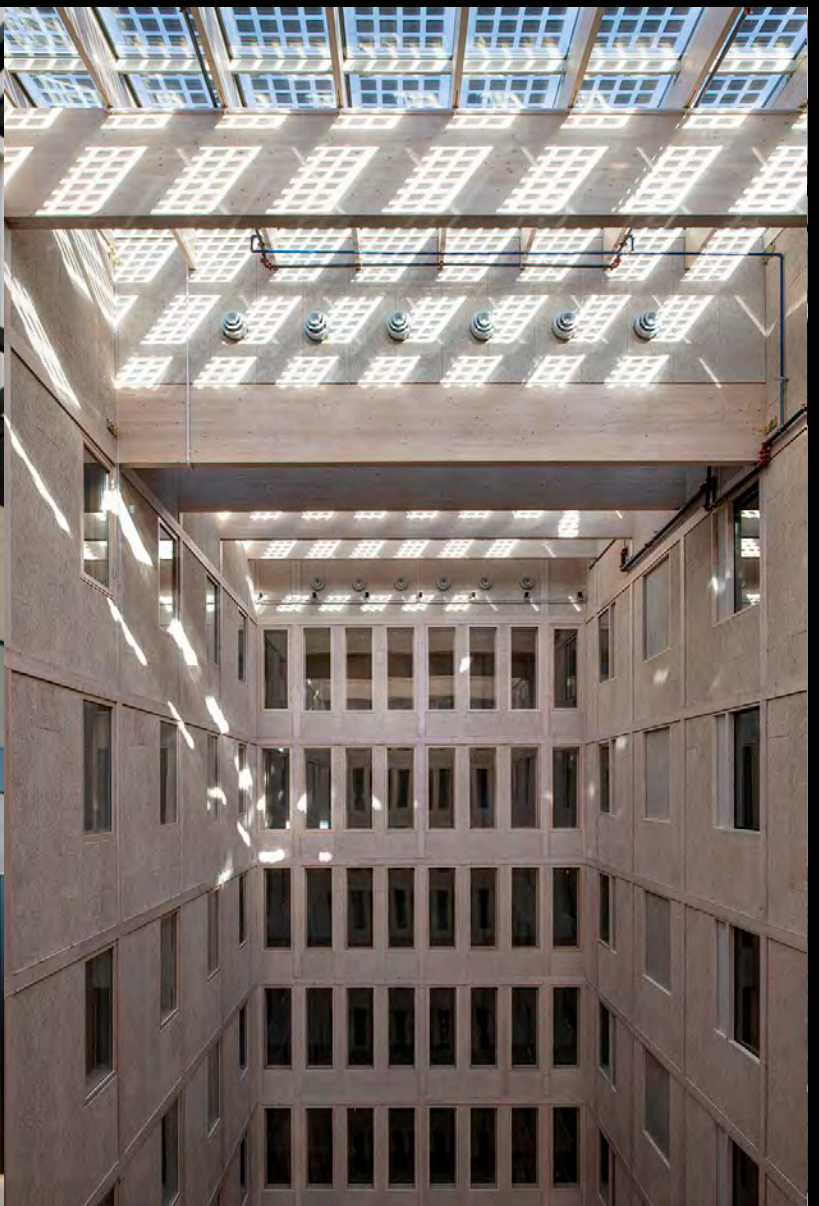




HOUSE OF CHOICE



HOUSE OF CHOICE



HOUSE OF CHOICE

Vielen Dank!

rickard.nygren@white.se