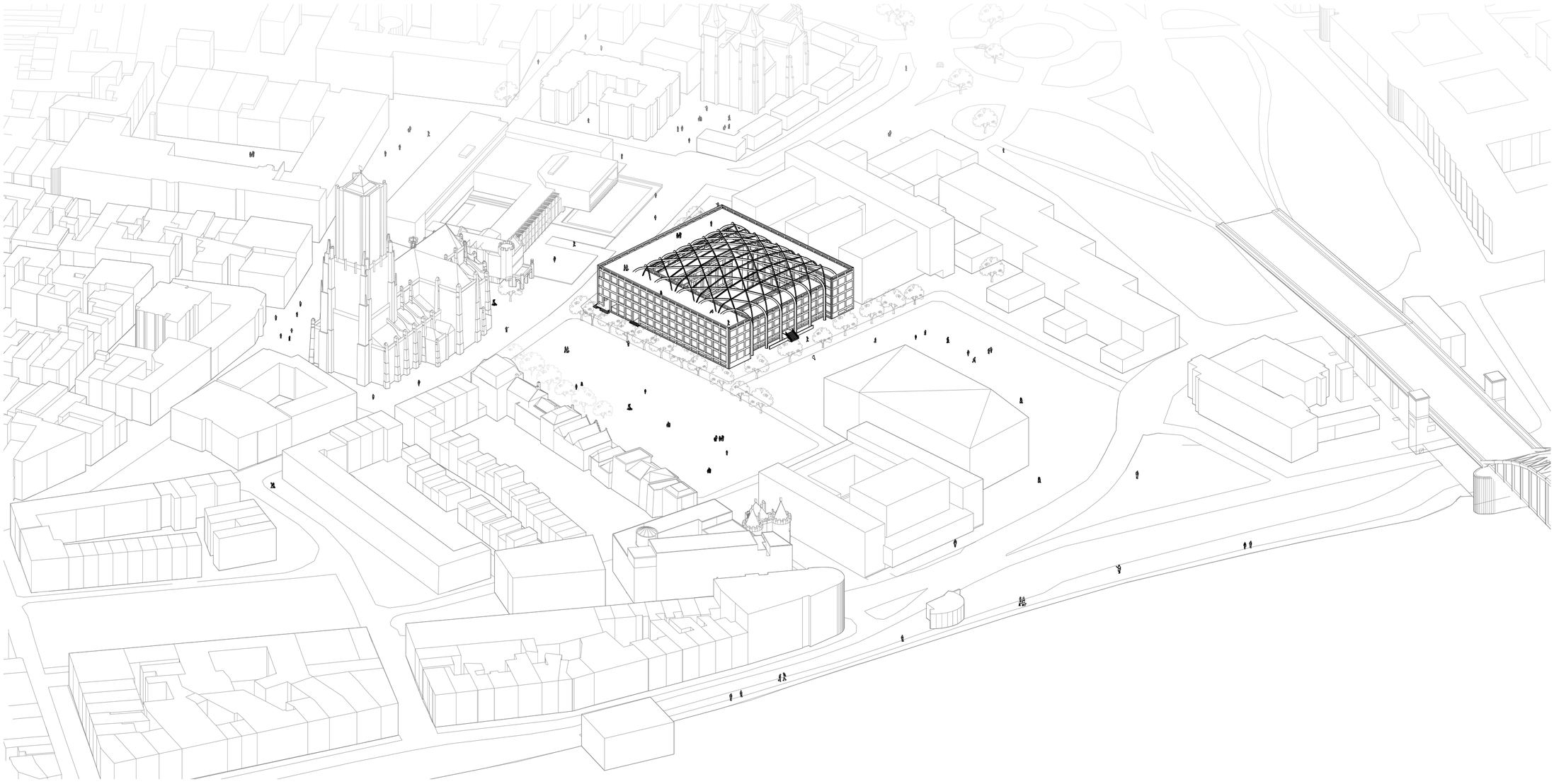


1:5000 - Context

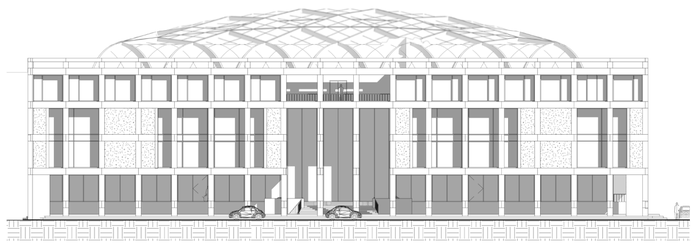
by Daan Reinders
Architectural Engineering

PALACE OF JUSTICE ARNHEM AS ENERGETIC CATALYST

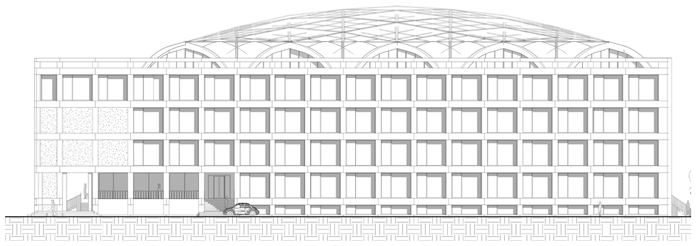
The built environment is a major consumer of energy in which many improvement steps have to be made. This project investigates how energy can be more efficient by reducing, reusing and producing energy on an urban and building scale. The research showed that the implementation of a sustainable collective heating system around the Palace of Justice can significantly reduce the energy consumption for heating. Comprehensive renovations improving the building energy performance reduce the energy consumption to a minimum.

The proposed sustainable integrated renovation of the Palace of Justice shows what such renovation can look like. The combination of modern sustainable techniques and more common interventions opens up the traditional approach to energetic sustainability resulting in a monumental nearly zero energy building. With its role as an energetic catalyst, the addition of public functions and the increase of accessibility, the Palace of Justice is firmly embedded in the city and society and can therefore last for many years to come.

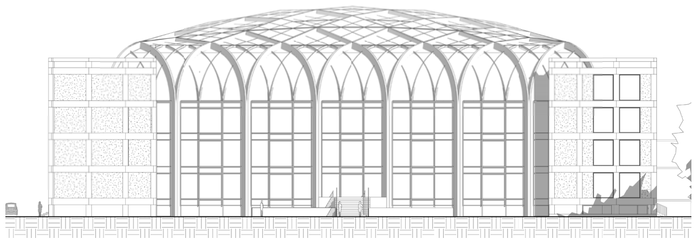
FACADES



1:500 - North facade



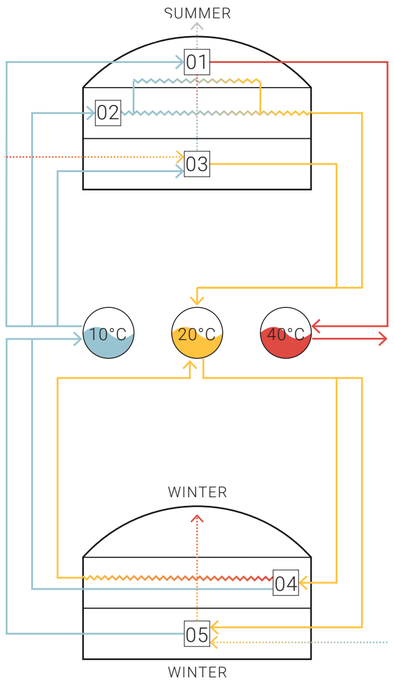
1:500 - West facade



1:500 - South facade

REDUCE

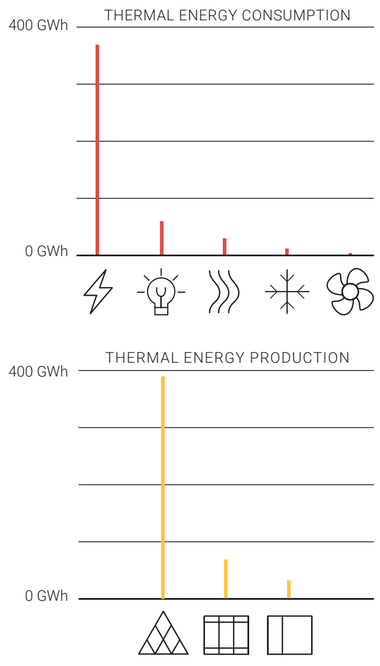
The first step towards the improvement of the energy performance of the built environment is reducing the building energy consumption. By re-insulating the uninsulated Palace of Justice to the current new building insulation standards, the thermal energy demand is reduced from 2.2 GWh to only 0.3 GWh. This thermal energy is provided by high-efficiency heat pumps. This high efficiency is realized by using low-temperature heating and the connection to the proposed collective sustainable thermal energy system. By the introduction of natural ventilation preheated in an air labyrinth, the energy consumption for air conditioning systems has been reduced.



RE-USE

The re-use of energy is realized by the implementation of multiple climate zones, allowing to create a surplus of heat in the summer and re-using it in winter, as shown in the left image. In summer heat is stored by the circulation of cold water through the office and atrium floors (2), the recovery of heat out of the exhaust ventilation air (1) and the storage of the residual heat of the process of cooling the ventilation air (3). In winter this heat is reused in the heat pumps of the low-temperature floor heating system (4) and the air condition system (5). The residual cold of the process of heating is returned to the collective thermal energy system, creating an interseasonal balance.

PRODUCE

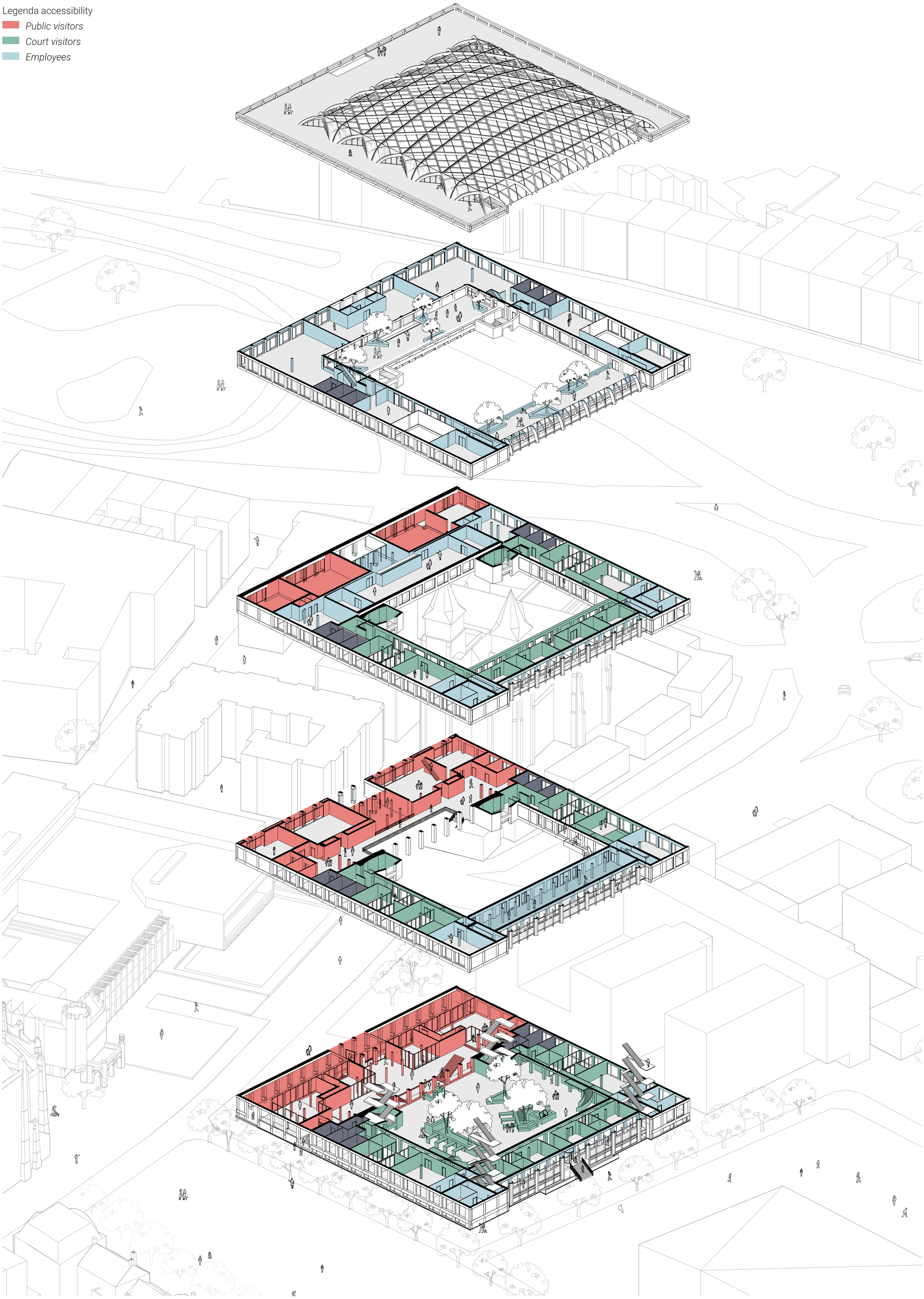


The total annual electricity consumption for appliances, lighting, heating, cooling and ventilation is 515,000 kWh. The renovated Palace of Justice is designed for harvesting solar energy. This is done on the roof, the south- and west facade, as shown respectively in the graph on the left. On an annual basis, the building yields a total of 485.000 kWh. This makes the building an NZEB in the field of electrical energy. In terms of heat, the building provides 400.000 kWh of thermal energy to the heat grid on an annual basis. In winter, the building uses 230.000 kWh of thermal energy from the heat grid. In terms of heat, the building is therefore a net-positive building.

EXPLODED VIEW

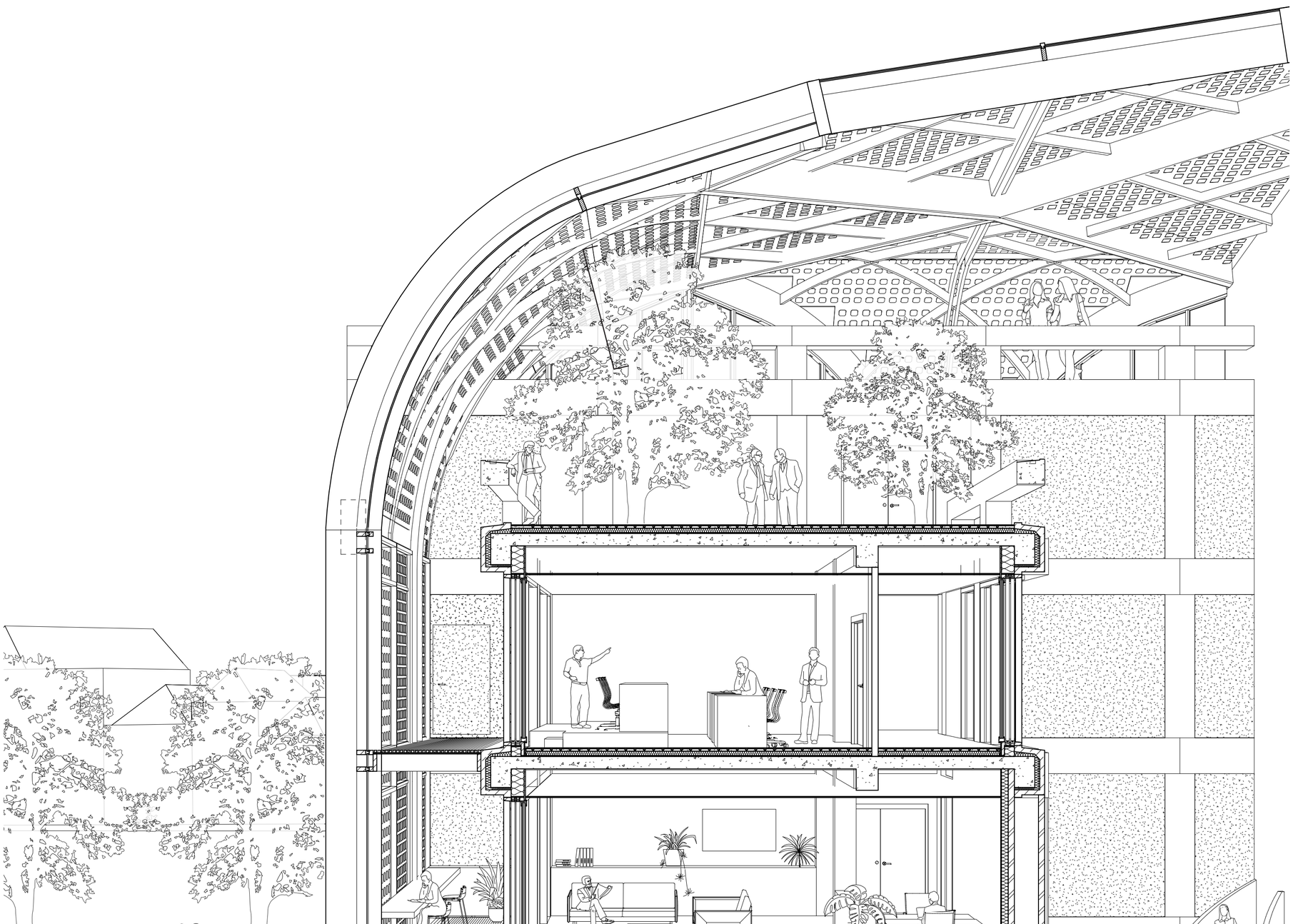
Legenda accessibility

- *Public visitors*
- *Court visitors*
- *Employees*



BUILDING SECTION

1:50 - South facade



1 Finishing
50 mm heating screed
60 mm thermal insulation
15 mm original tiles
100 mm reinforced concrete flooring

2 Ornamental prefab concrete facade elements
80 mm cavity insulation
300 x 300 mm reinforced concrete collumns
210 mm mineral wool
20 mm plywood

3 ColorBlast Kromatic solar panel
55 mm polycarbonate sliding insulating screens
HR+++ triple glazing

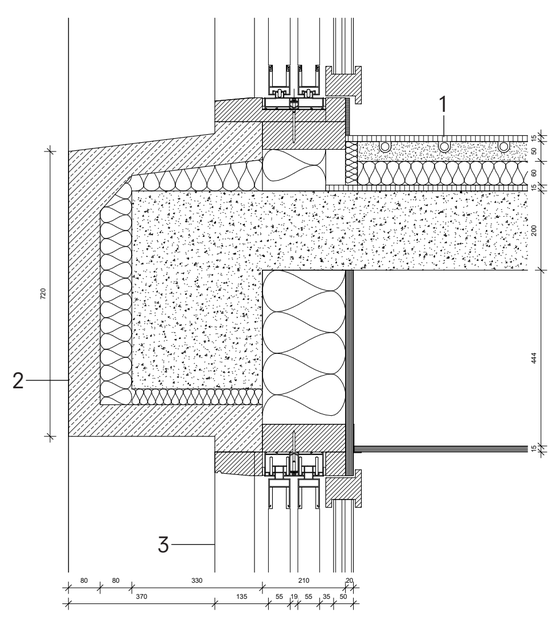
4 150 x 900 mm cross laminated timber
100 x 100 mm rainwater drainage
60 mm thermal insulation
Technical shaft
20 mm battens

5 Wooden framing curtain-wall
Monocrystalline intergrated double glazing
Wooden lamella curtain-wall

6 Filling lath
100 x 100 mm rainwater drainage
60 mm thermal insulation
Technical shaft
20 mm battens

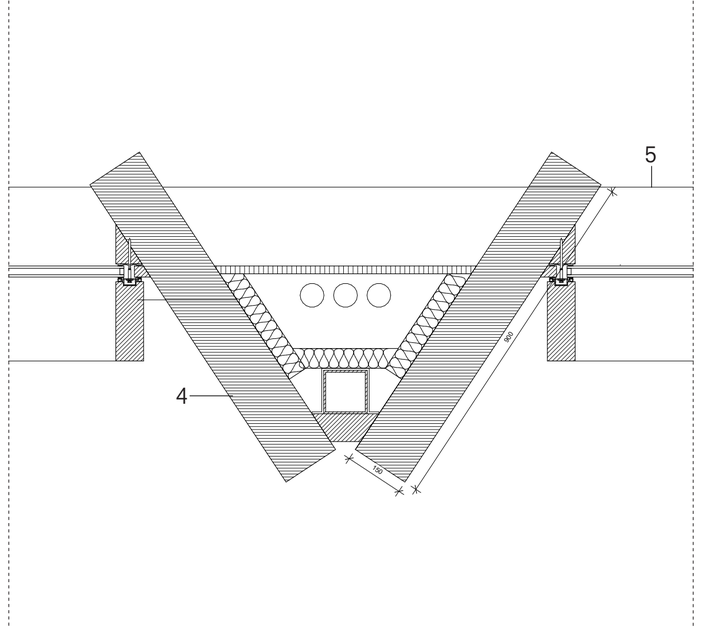
01 Interior detail

1:5 - Vertical detail



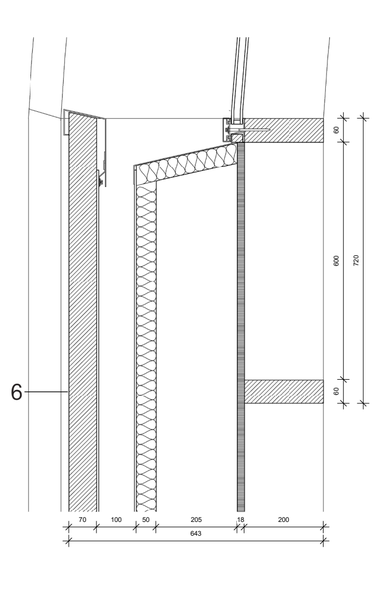
02 Structural column

1:5 - Horizontal detail



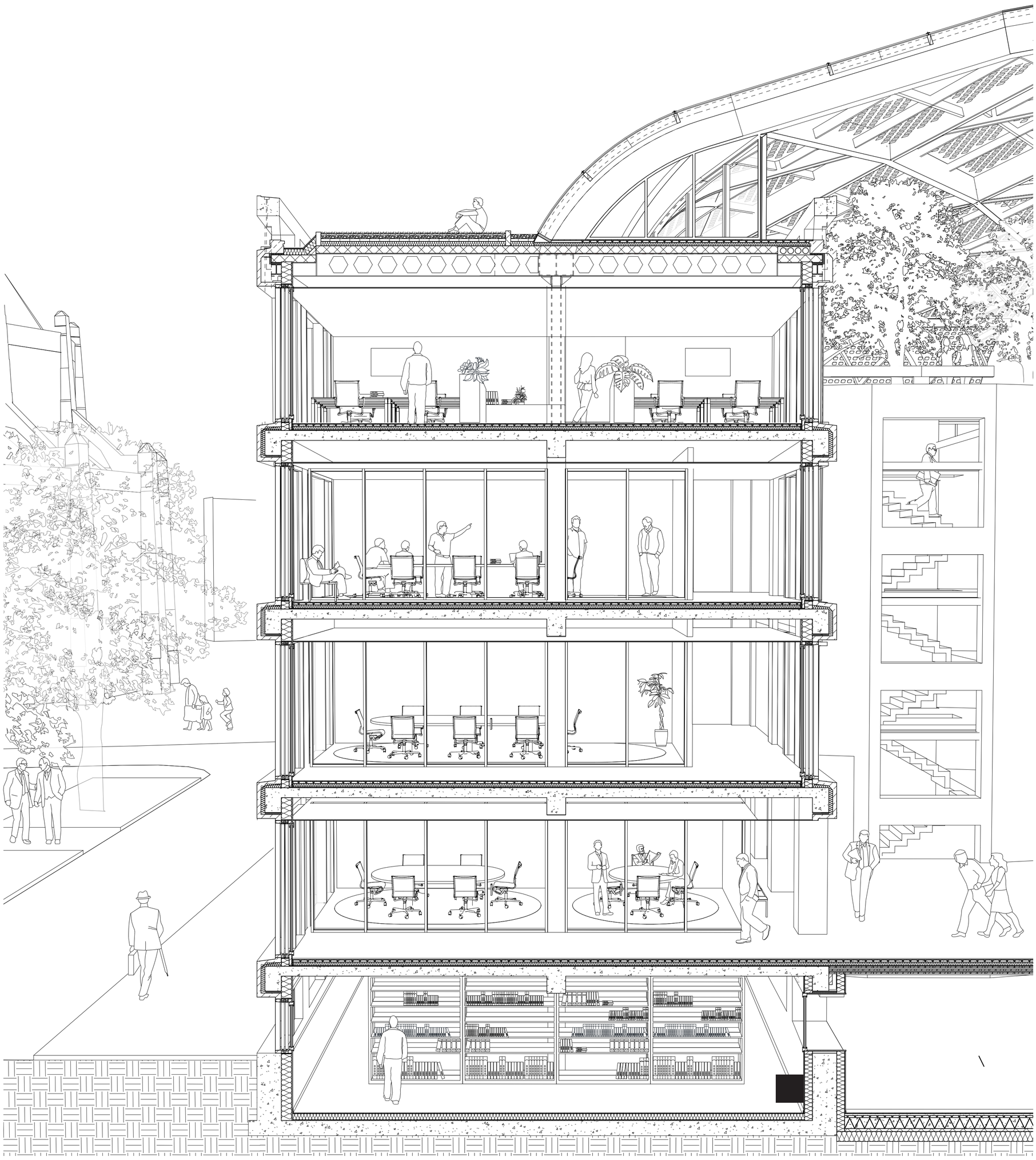
03 Structural column

1:5 - Vertical detail



BUILDING SECTION

1:50 - West facade



7 900 x 150 mm laminated timber structure
PE-Film vapour barier
ColorBlast Kromatix solar panel
200 x 70 mm timber substructure

8 Monocrystalline intergrated double glazing

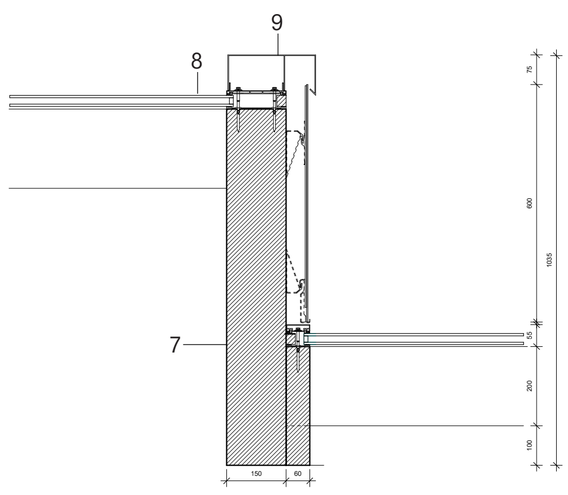
9 Cabling tray for solar panels

10 300 x 70 mm timber sub-structure
PE-Film vapour barier
30 mm thermal/acoustic insulation
100 x 100 mm rainwater drainage
30 mm thermal/acoustic insulation
PE-Film vapour barier
300 x 70 mm timber sub-structure

11 Cable tray
LED lighting

04 Roof structure

1:5 - Vertical detail



05 Roof substructure

1:5 - Vertical detail