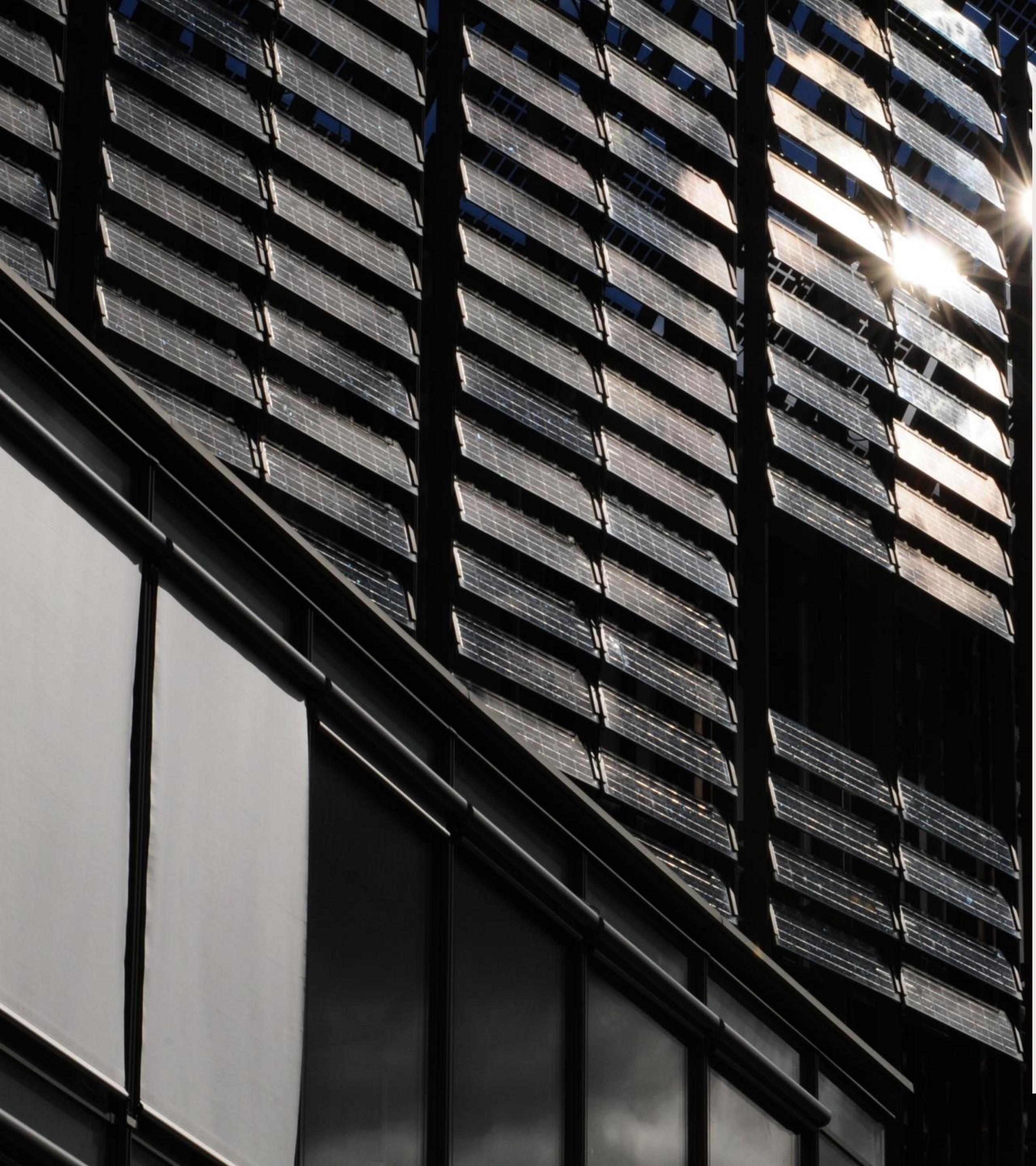


IEA SHC Task 63 Solar Neighborhood Planning

Seminar Wednesday 29.11
Kosmopol, København DK

Subtask D. Case Studies

Solar Neighborhood Planning: lesson learned collection of case studies

Gabriele Lobaccaro

Mattia Manni

NTNU
Fakultet for ingeniørvitenskap
Institutt for bygg- og miljøteknikk

WHAT ARE SOLAR NEIGHBORHOODS?

*"Solar neighborhoods are **communities prioritizing** the exploitation of **solar energy**, with **limited energy management** systems. Buildings' **morphology** and **relations**, building envelope and material **features** are designed to maximize the efficiency of **passive and active solar strategies**. Solar neighborhoods are characterized by a microclimate that enables **adequate thermal and visual comfort**, and **high life standards**, both **indoors and outdoors**".*

M. Manni, M. Formolli, A. Boccalatte, S. Croce, G. Desthieux, C. Hachem-Vermette, J. Kanters, C. Ménézo, M. Snow, M. Thebault, M. Wall, G. Lobaccaro, Ten questions concerning planning and design strategies for solar neighborhoods, Building and Environment, Volume 246, 2023,

FROM SOLAR BUILDINGS TO SOLAR NEIGHBORHOODS

SOLAR BUILDINGS

Planning and design process focuses on the **single building**.

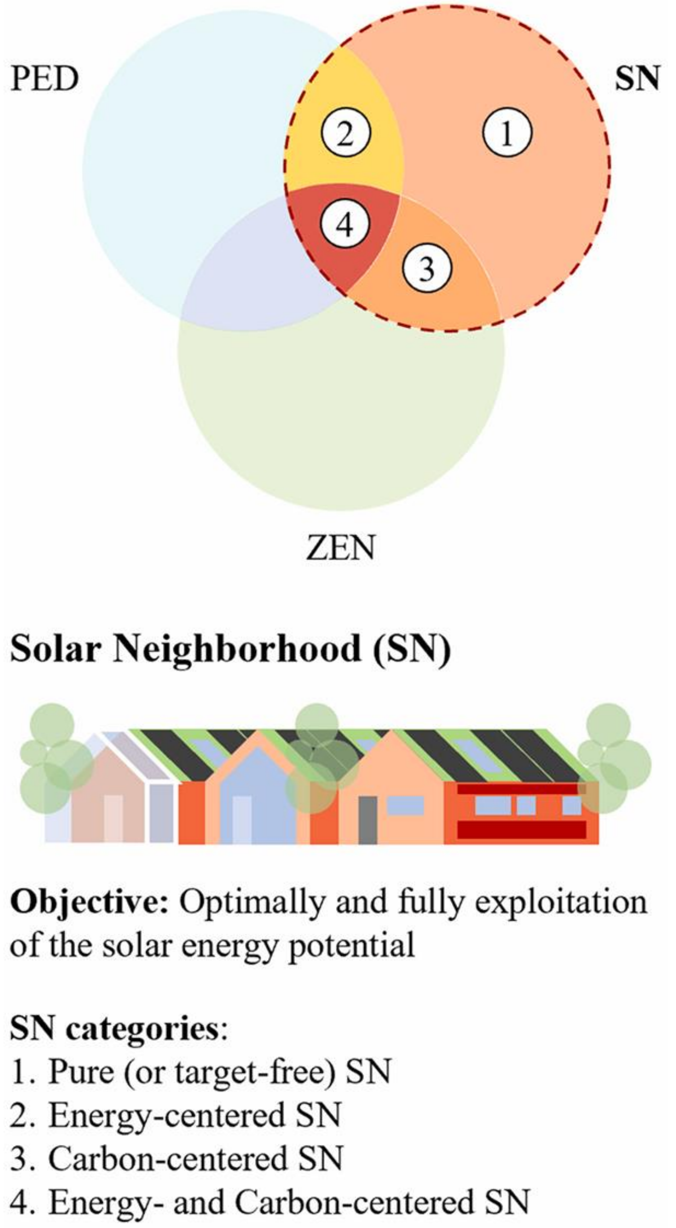
A group of buildings implementing solar strategies at **building scale**.

SOLAR NEIGHBORHOODS

Planning and design process focuses on the **whole neighborhood**.

Solar strategies are implemented at **multiple scales**.

FROM SOLAR BUILDINGS
TO SOLAR NEIGHBORHOODS



M. Manni, M. Formolli, A. Boccalatte, S. Croce, G. Desthieux, C. Hachem-Vermette, J. Kanters, C. Ménézo, M. Snow, M. Thebault, M. Wall, G. Lobaccaro,
Ten questions concerning planning and design strategies for solar neighborhoods, Building and Environment, Volume 246, 2023,

Q1 | What is a solar neighborhood?

Q2 | What aspects should be considered in the planning and design process of a solar neighborhood?

Q3 | Which are the passive and active solar strategies in solar neighborhoods?

Q4 | How are the passive and active solar strategies applied in solar neighborhoods?

Q5 | What are the challenges of implementing passive solar strategies into solar neighborhoods?

Q6 | What are the challenges of implementing active solar strategies into solar neighborhoods?

Q7 | How can the digitalization of the built environment support the planning of solar neighborhoods?

Q8 | How can the planning strategies and design solutions for solar neighborhoods impact on the "total environment"?

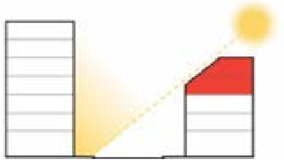
Q9 | What legislative agenda is needed to support solar neighborhoods?

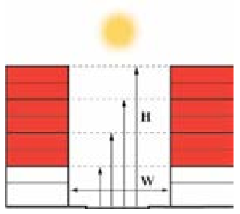
Q10 | What is next in planning and design strategies for solar neighborhoods?

M. Manni, M. Formolli, A. Boccalatte, S. Croce, G. Desthieux, C. Hachem-Vermette, J. Kanters, C. Ménézo, M. Snow, M. Thebault, M. Wall, G. Lobaccaro,
Ten questions concerning planning and design strategies for solar neighborhoods, Building and Environment, Volume 246, 2023,

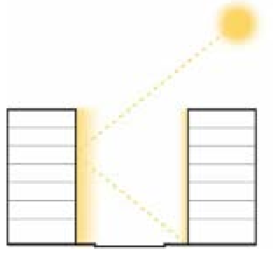
EXPLOITING SUNLIGHT IN SOLAR NEIGHBORHOODS

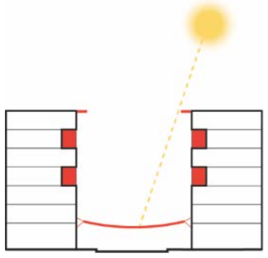
Passive Solar Strategies
Neighborhood scale

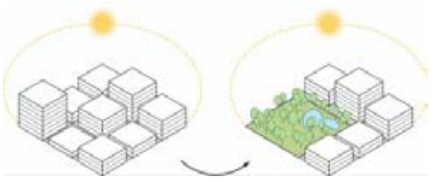

Urban morphology and massing

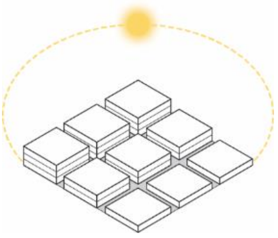


Aspect ratio H/W

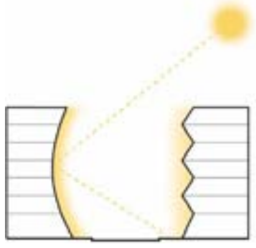

Urban surfaces' reflectivity

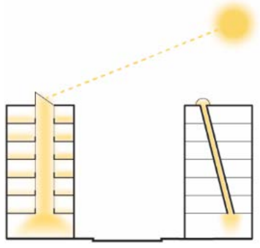

Urban shading devices

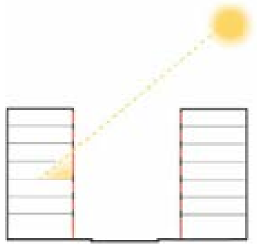

Urban layout, and patterns

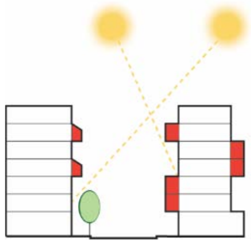

Street and district orientation

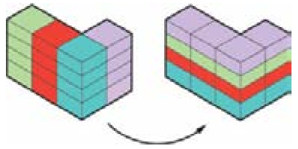
Passive Solar Strategies
Building scale


Building form, morphological types, and thermal mass

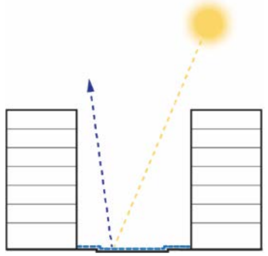

Glazed atriums and light-ducts

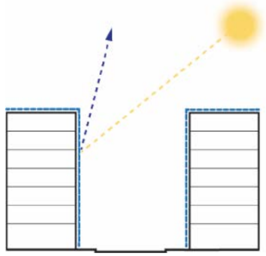

Room depth and window-to-wall ratio

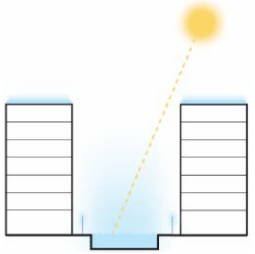

Shading, overhangs, and sunspaces or solar greenhouses

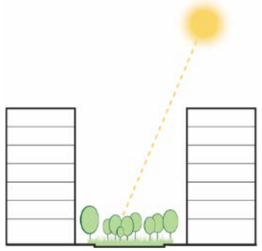

Distribution of functions and program

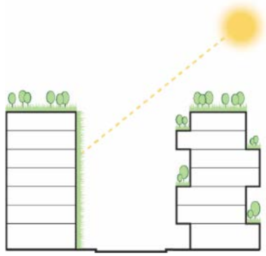
Passive Solar Strategies
Other strategies


Cool and supercool coatings

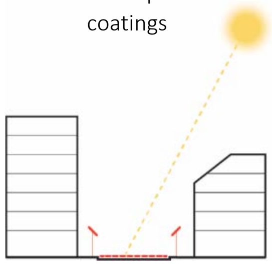

Cool and supercool coatings

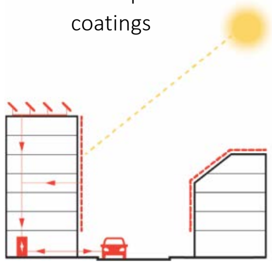

Water bodies and evaporative techniques

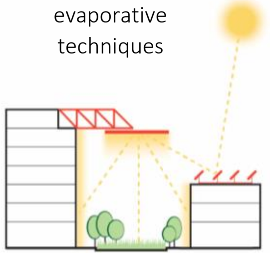

Urban greening


Urban greening

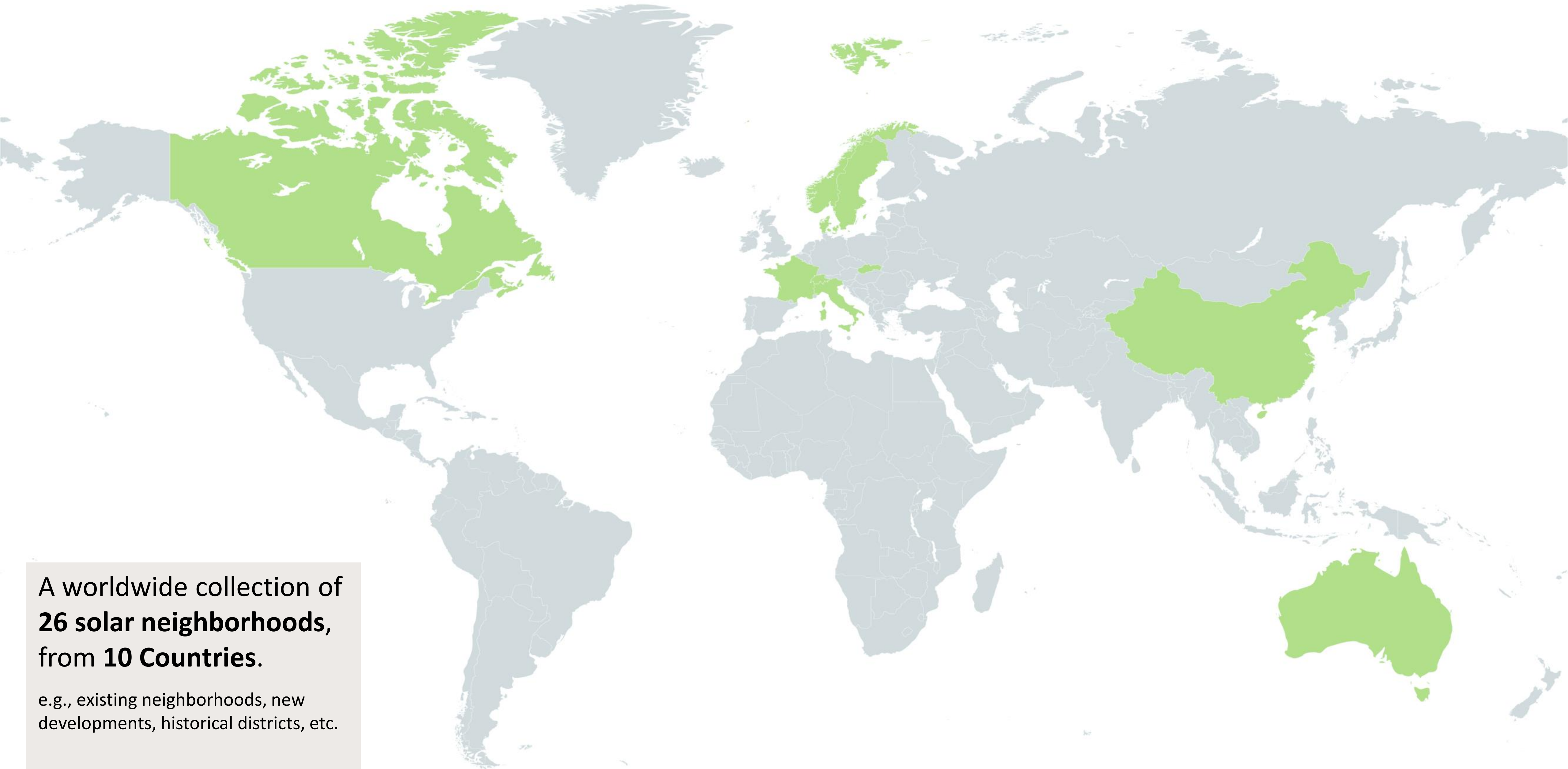
Active Solar Strategies
Building and Neighborhood scale


Energy generation from solar systems at neighborhood scale


Energy generation from solar systems at building scale


Heliostat and sun-tracking reflector systems

IEA SHC TASK 63 – CASE STUDIES



A worldwide collection of **26 solar neighborhoods**, from **10 Countries**.

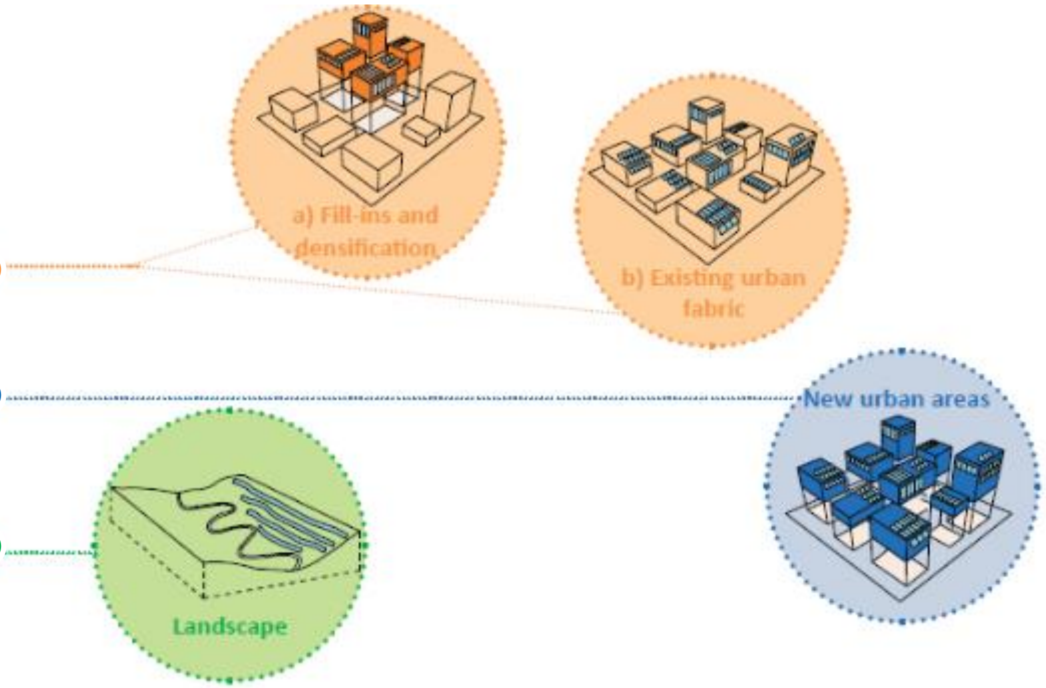
e.g., existing neighborhoods, new developments, historical districts, etc.

IEA SHC TASK 63 – CASE STUDIES

Existing and heritage Neighborhood

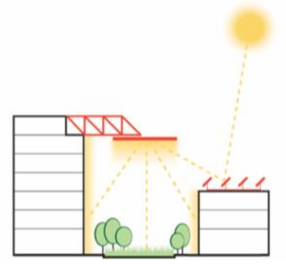
New Neighborhood

Solar Landscape

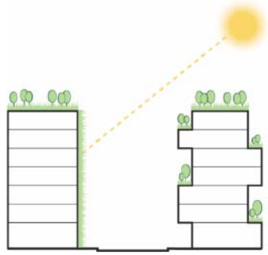


A worldwide collection of **26 solar neighborhoods**, from **10 Countries**.

e.g., existing neighborhoods, new developments, historical districts, etc.



Heliostat and sun-tracking reflector systems



Urban greening

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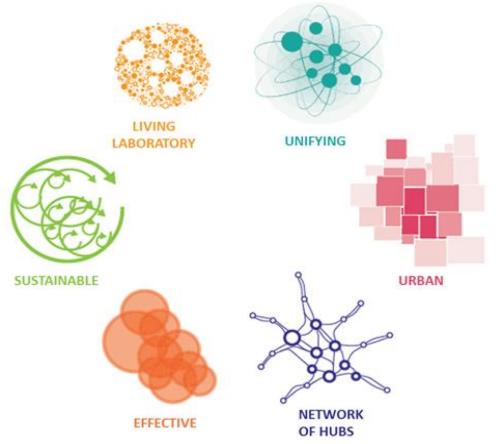
ONE CENTRAL PARK
Sydney, Australia

New neighborhood

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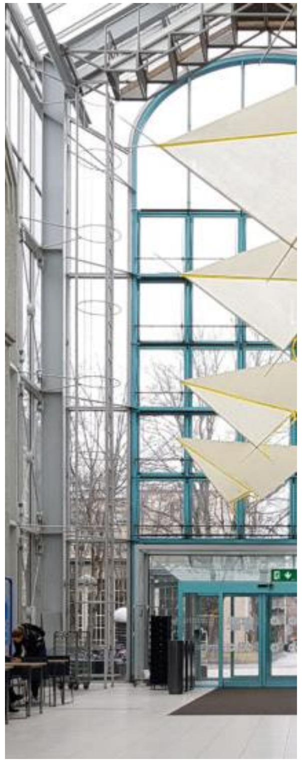
© Wang, 2023


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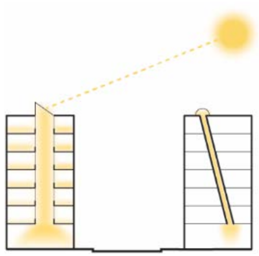
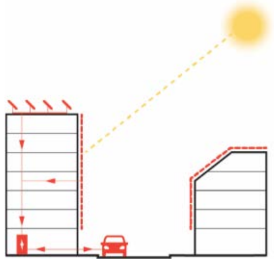
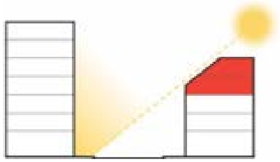
GLØSHAUGEN CAMPUS Trondheim, Norway

Existing neighborhood

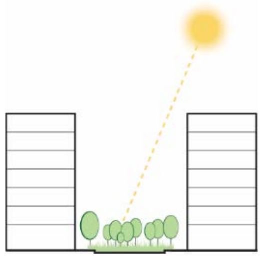

Glazed atriums and light-ducts


Energy generation from solar systems at building scale

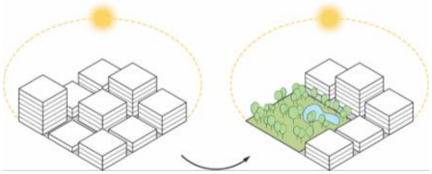

Urban morphology and massing

BLATCHFORD DEVELOPMENT Edmonton, Canada

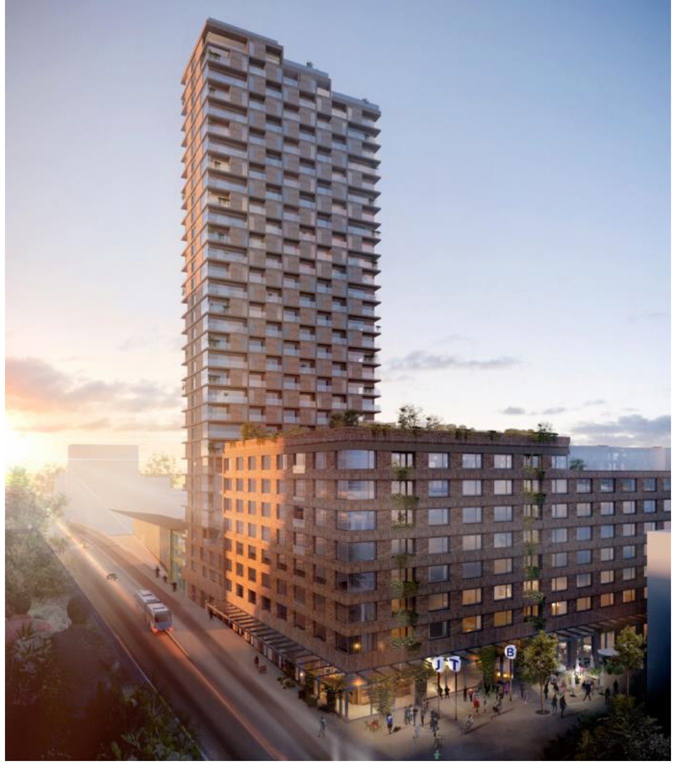
New neighborhood



Urban greening



Urban layout, and patterns



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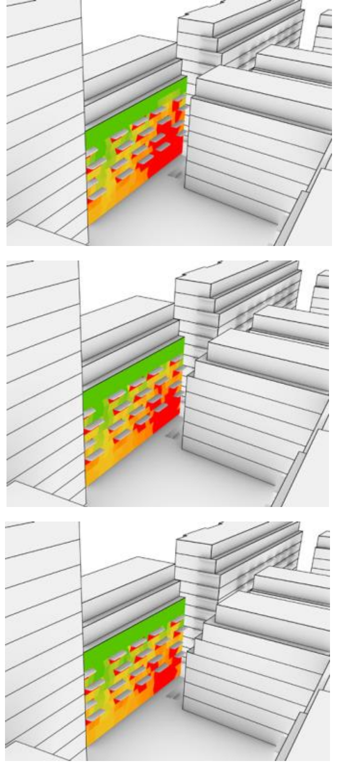

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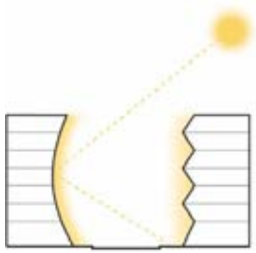
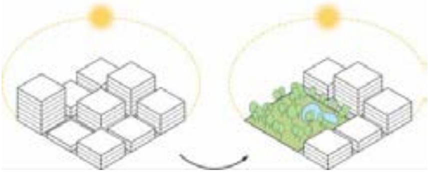
VEDDESTA 13:1
Stockholm, Sweden

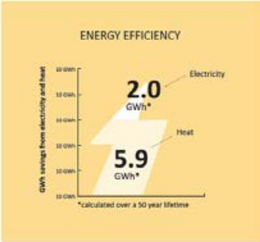
New neighborhood



Building form, morphological types, and thermal mass



Urban layout, and patterns

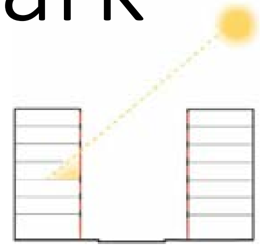


© Ginnerup Arkitekter

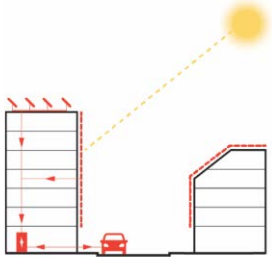
SØNDERHAVEN

Brædstru, Denmark

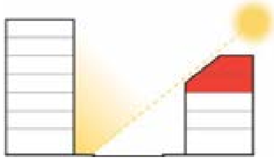
New solar settlement



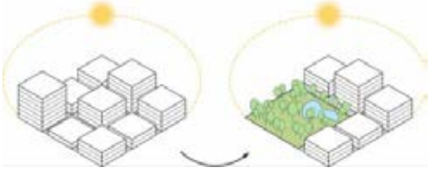
Room depth and window-to-wall ratio



Energy generation from solar systems at building scale



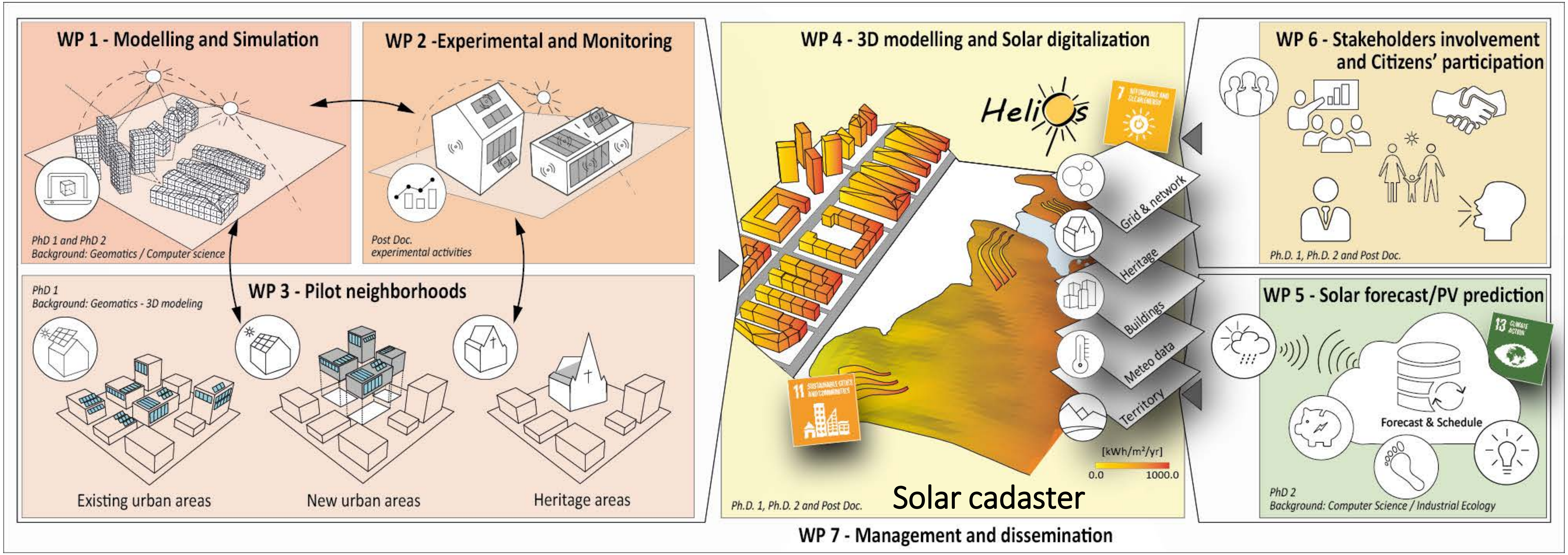
Urban morphology and massing



Urban layout, and patterns

HELIOS, Trondheim, Norway

enHancing optimal ExpLoitatIOn of Solar energy in Nordic cities through digitalization of built environment / Dec. 2021 - Apr.2026



Project owner: *NTNU / IV / IBM*
Project manager: *Ass. Prof. Gabriele Lobaccaro*
NTNU Partners: *IDI, IndEcol, MTP, IMA*
National partners: *SINTEF Community, Trondheim Kommune*

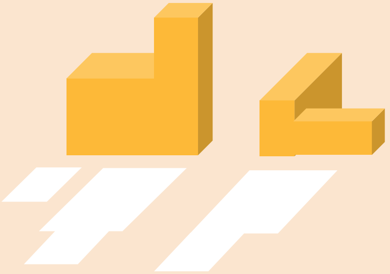
International partners:
HEPIA - Geneva School of Eng., Arch. and Landscape – Univ. of Applied Sciences and Arts Western Switzerland;
USMB/INES - University Savoie Mont Blanc / National Institute of Solar Energy (France);
UCB Lyon 1/CETHIL - Claude Bernard University / Centre d'énergétique et de thermique de Lyon (France).

https://www.ntnu.no/helios

HELIOS, Trondheim, Norway

enHancing optimal ExpLoitatIOn of Solar energy in Nordic cities through digitalization of built environment / Dec. 2021 - Apr.2026

The development and validation of **advanced numerical models for solar radiation analysis** within the built environment enables:



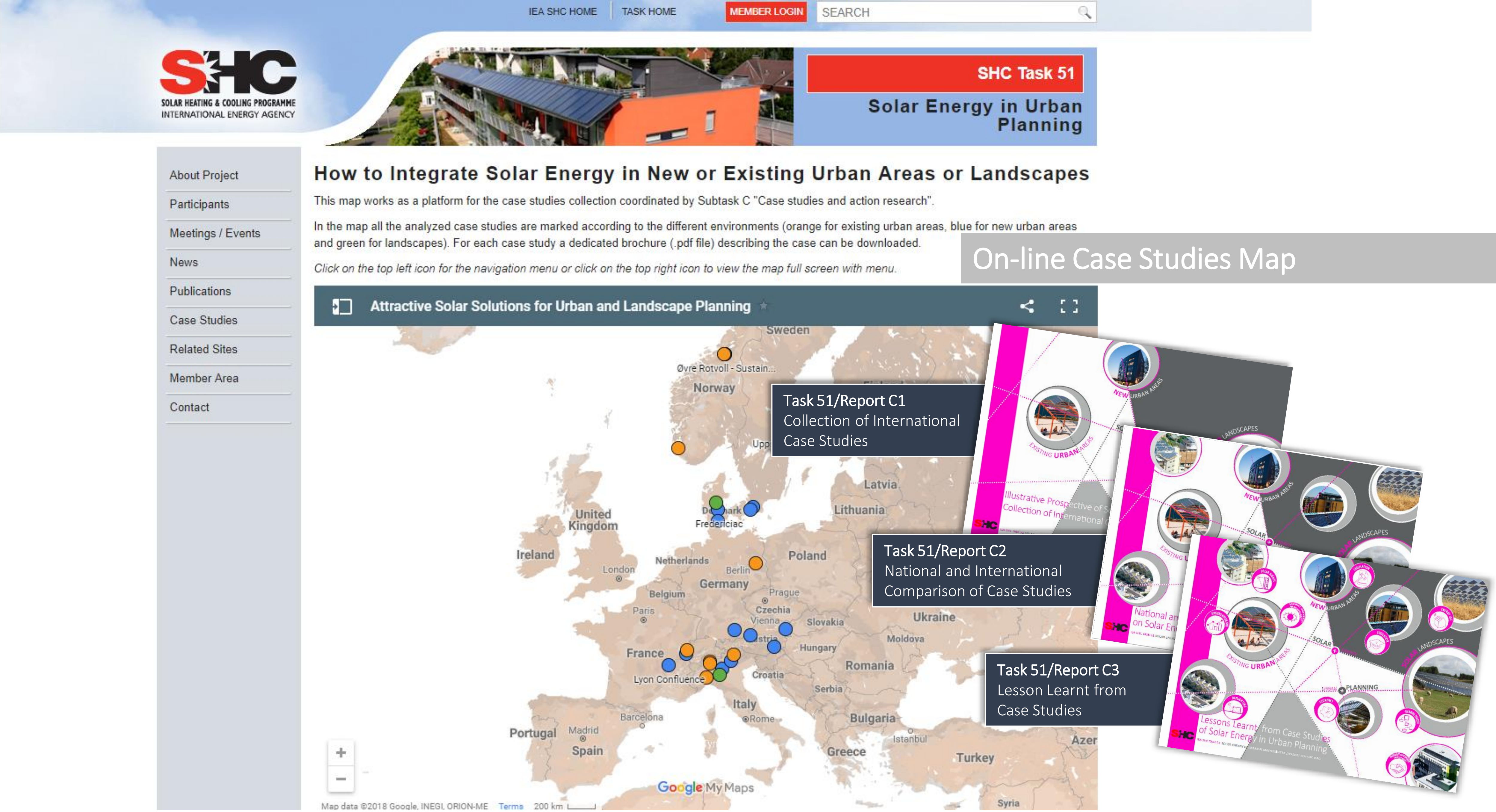
Boosting the transition from 2D solar maps to **3D solar cadastres**

Supporting various stakeholders in the **solar planning** activity

Enhancing **social acceptability** of solar strategies in sensitive urban areas

https://www.ntnu.no/helios

On-line Case Studies Map



Task 51/Report C1
Collection of International Case Studies

Task 51/Report C2
National and International Comparison of Case Studies

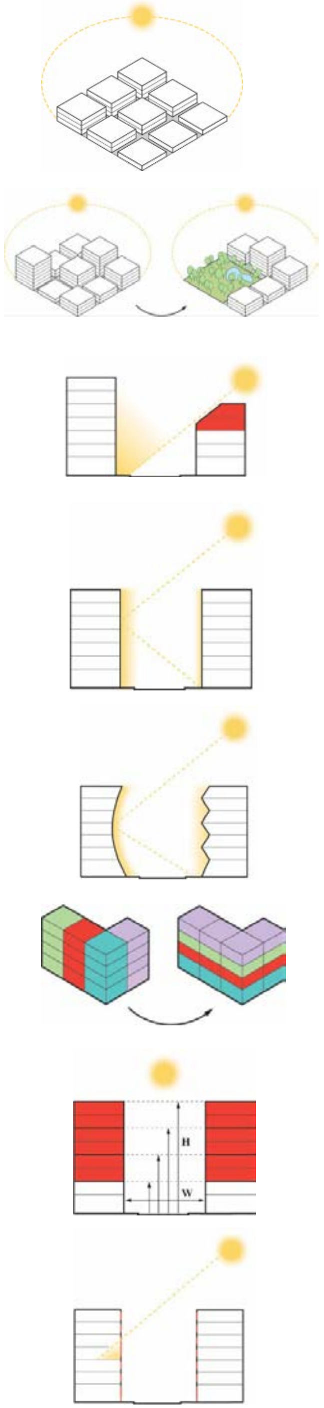
Task 51/Report C3
Lesson Learnt from Case Studies

Link: http://task51.iea-shc.org/case-studies

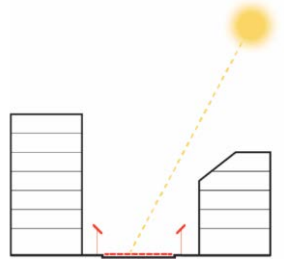
Critical aspects	Challenges and opportunities
Social	• Balancing building uses with passive strategies to optimal uses of surfaces. • Evaluate the tradeoffs between conflicting uses of solar gain and between scales. • Increase user acceptance and impact of passive solar strategies in highly sensitive/constrained urban areas.
Layout	• Guarantee daylight and visual comfort. • Mitigate UHI effects and inter-building reflections. • Design effective technological solutions • Optimize building shape, orientation, interior layout. • Apply building form and massing to guarantee right-to-light or right-to-shade according to the building uses.
Material	• Improve indoor/outdoor thermal comfort. • Adoption of new materials to improve visual comfort.
Modeling	• Develop form-finding workflows for solar neighborhoods. • Reduce computational time for solar energy simulations. • Model of natural elements (e.g., trees, vegetation). • Develop digital clones of materials and technologies.

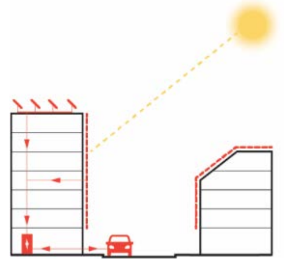
Lesson Learned

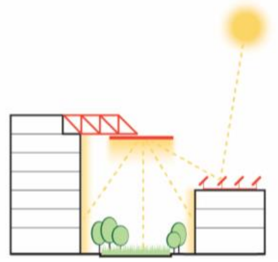
What are the challenges of implementing passive solar strategies into solar neighborhoods?



Critical aspects	Challenges and oppotunities
Location	• Balance the competing uses of surfaces by implementing multi-functional solutions.
Urban planning	• Couple solar access and urban planning for different interventions. • Electrification of heating and cooling systems.
Modeling	• Develop approaches to process inter-building reflections. • Make data available in the project early-design stages. • Develop key performance indicators to visualize and communicate results. • Develop urban canopy models to assess impact of BIPV on the urban microclimate.
Architectural integration	• Achieve high quality of integration through colored panels, layout, and sustainable materials. • Adapting urban regulations for heritage protected areas.
Energy management	• Implement peak shaving strategies (e.g., batteries). • Increase self-consumption of energy produced on-site.
Social acceptance	• Increase end-user acceptance of active solar strategies through a structured legislative agenda.
Economy	• Reduce investment costs for complex solar installations.







Lesson Learned

What are the challenges of implementing active solar strategies into solar neighborhoods?

7 of 10

people will live in cities by 2050, according to the World Bank Group.

Average **building height** and **urban density** are increasing. This makes harder for people to **access** and exploit **sunlight**.

© Glen Musk, Adresseavisen

This can ultimately result into **social injustice**.

THANKS FOR YOUR ATTENTION

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Mattia Manni
mattia.manni@ntnu.no

NTNU Fakultet for ingeniørvitenskap Institutt for bygg- og miljøteknikk