



Seminar Solenergi i stadsplanering / Solar Neighborhood Planning
Gamla Biskopshuset, Biskopsgatan 1, Lund
2024-05-14 kl 09.30 - 15.30

IEA SHC Task 63 Solar Neighborhood Planning
Subtask D. Case Studies

Fra definisjonen av Solar Neighborhood til illustrerende verdensomspennende eksemplariske studietilfeller av solenergiplanlegging



Gabriele Lobaccaro



Mattia Manni



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**.



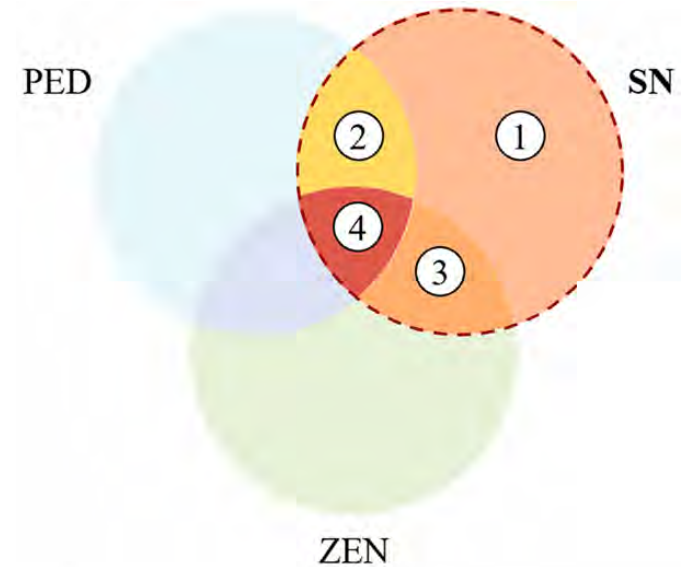
Planning and design process focuses on the **whole neighborhood**.

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

SOLAR NEIGHBORHOODS



FROM SOLAR BUILDINGS TO SOLAR NEIGHBORHOODS



Solar Neighborhood (SN)



Objective: Optimally and fully exploitation of the solar energy potential

SN categories:

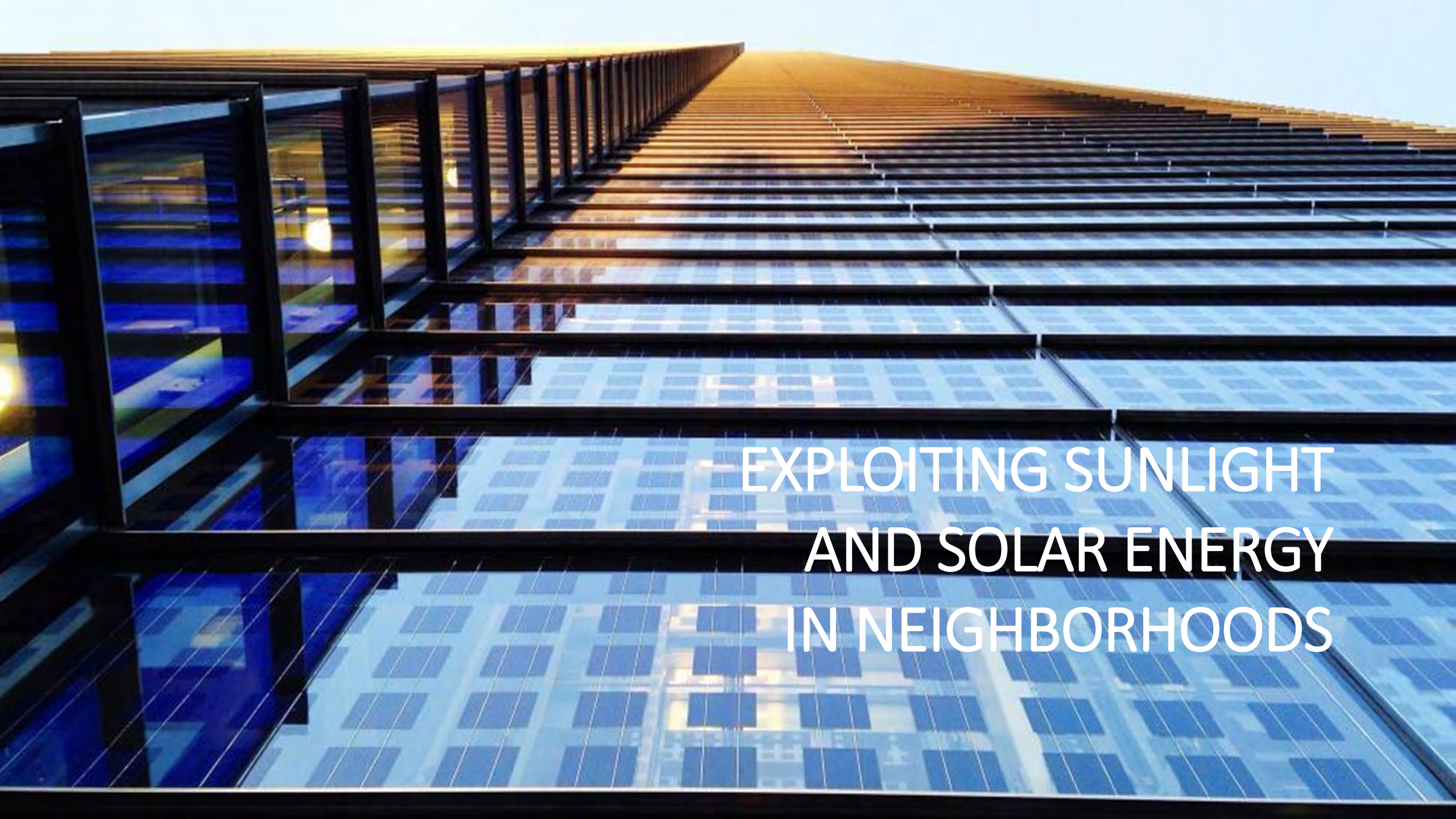
1. Pure (or target-free) SN
2. Energy-centered SN
3. Carbon-centered SN
4. Energy- and Carbon-centered SN



© Ginnerup Architects, 2023

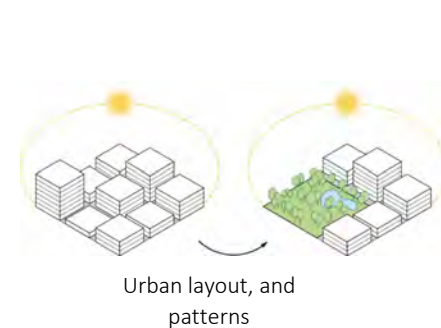
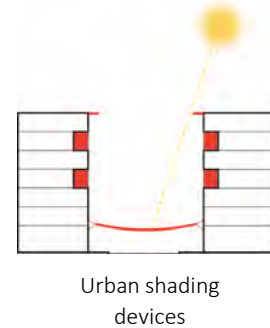
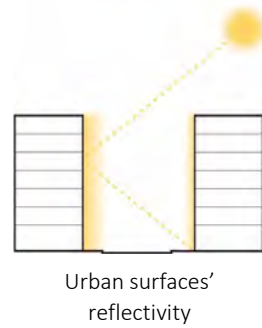
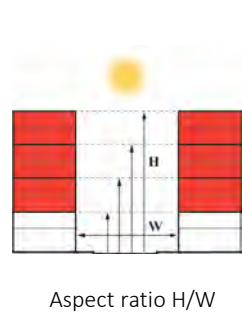
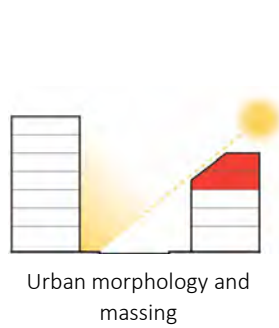
WHAT ARE SOLAR NEIGHBORHOODS?

*“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”.***

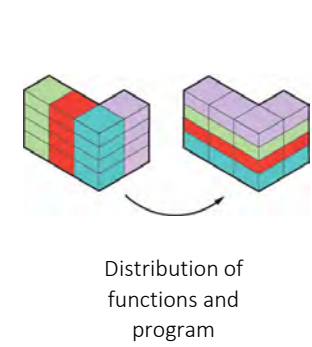
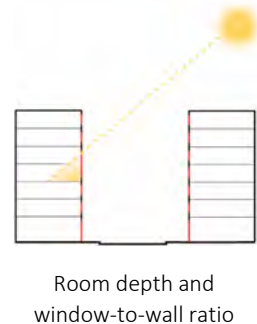
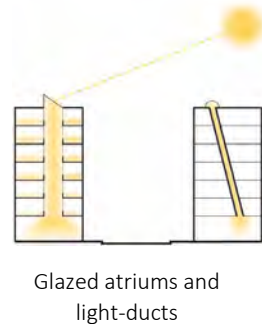
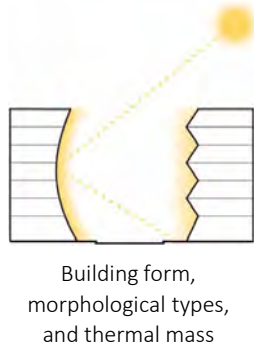


EXPLOITING SUNLIGHT
AND SOLAR ENERGY
IN NEIGHBORHOODS

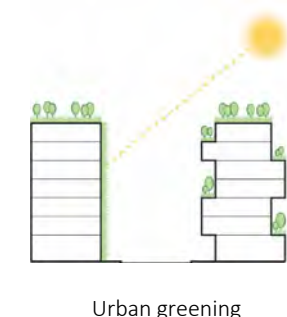
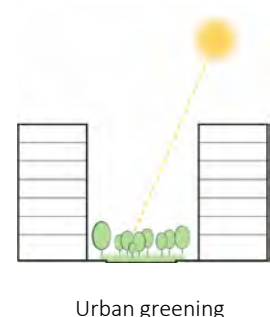
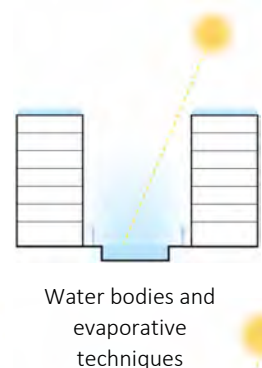
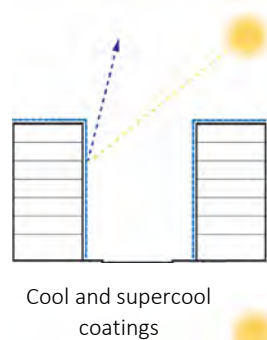
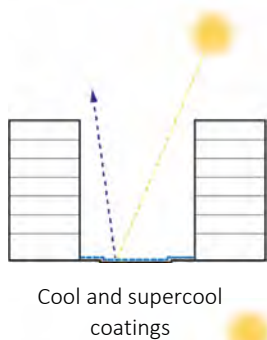
Passive Solar Strategies
Neighborhood scale



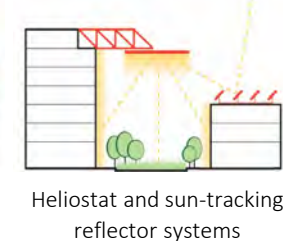
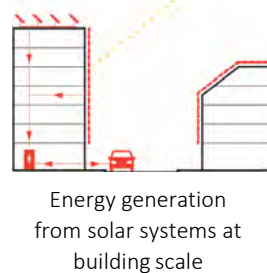
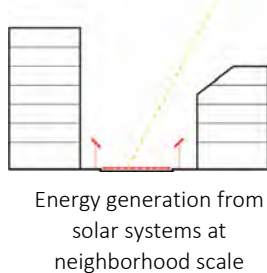
Passive Solar Strategies
Building scale



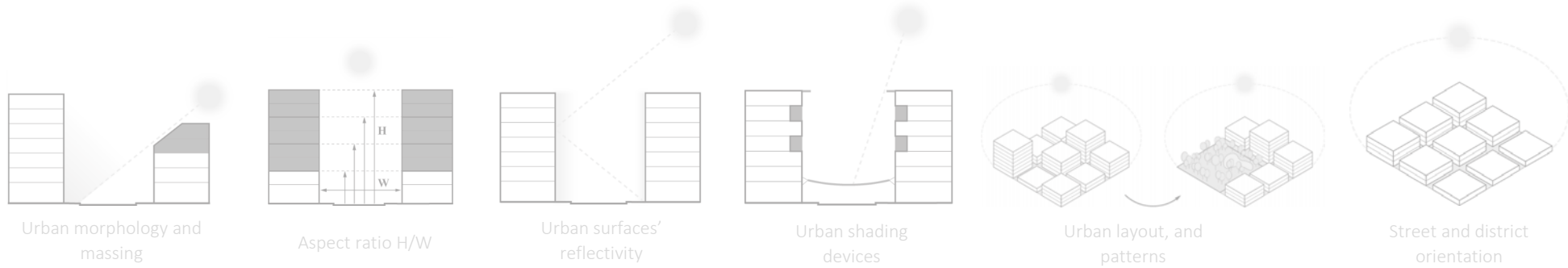
Passive Solar Strategies
Other strategies



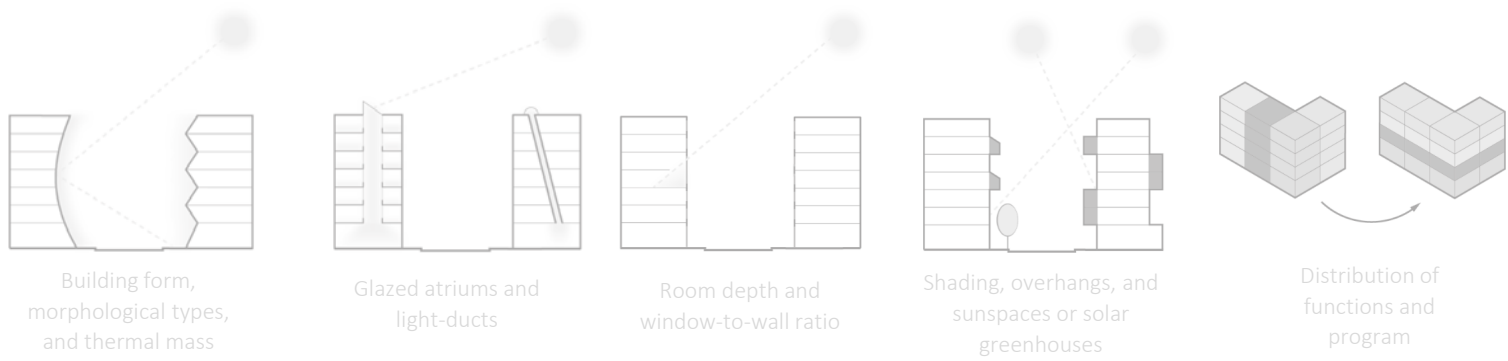
Active Solar Strategies
Building and Neighborhood scale



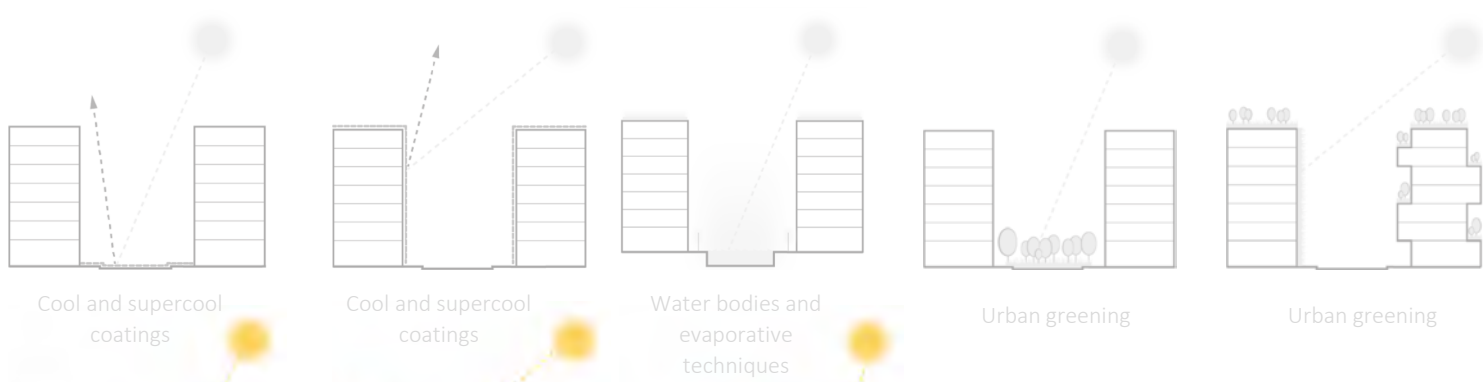
Passive Solar Strategies
Neighborhood scale



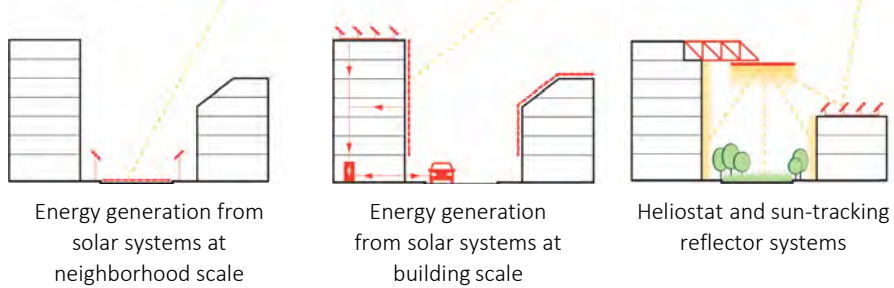
Passive Solar Strategies
Building scale



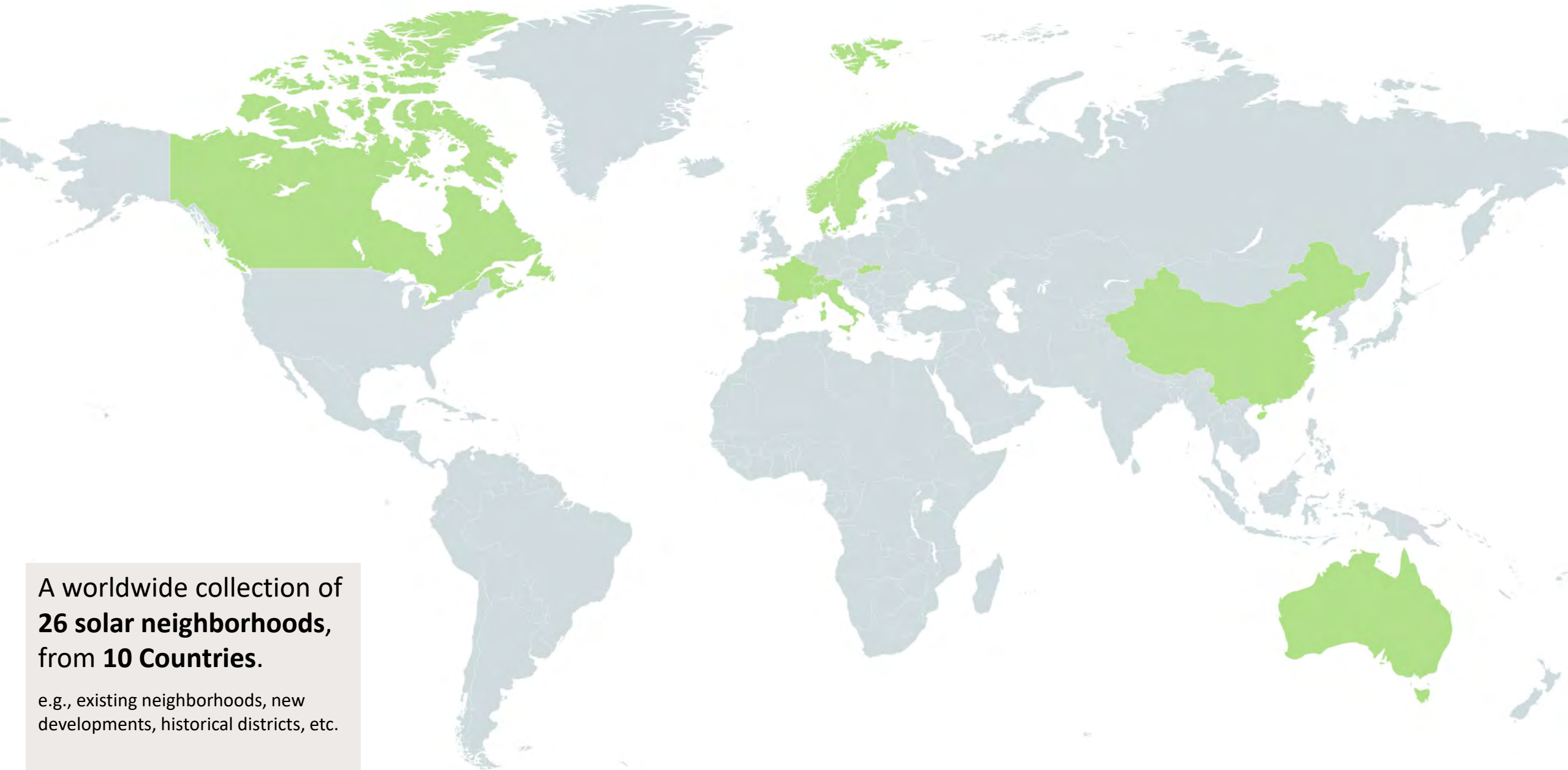
Passive Solar Strategies
Other strategies



Active Solar Strategies
Building and Neighborhood scale



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

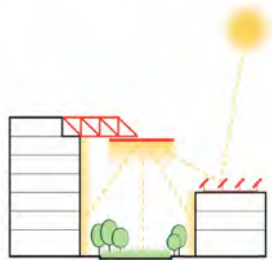
New Neighborhood

Solar Landscape

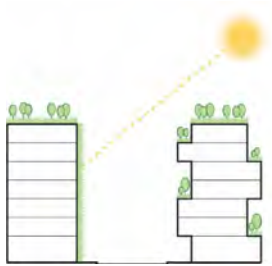


A worldwide collection of **26 solar neighborhoods**, from **10 Countries**.

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



Heliostat and sun-tracking reflector systems



Urban greening



© archdaily.com, 2018



© Domus, 2014

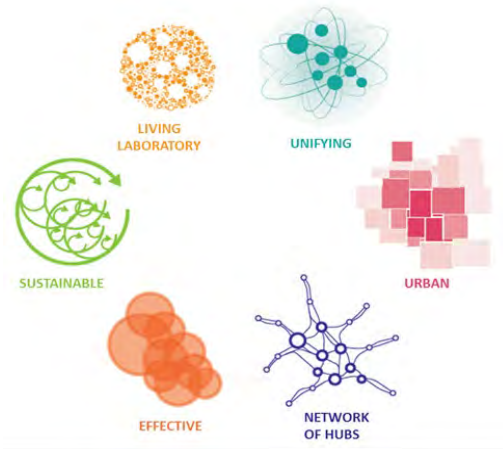


© Tensile, 2023

ONE CENTRAL PARK

Sydney, Australia

New neighborhood



© gemini.no, 2023



© Tolstad, 2023



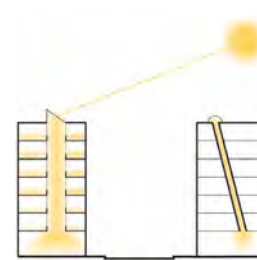
© Wang, 2023



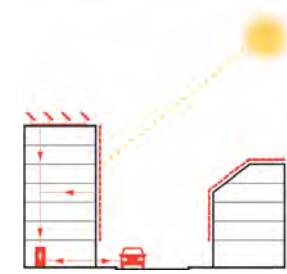
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GLØSHAUGEN CAMPUS Trondheim, Norway

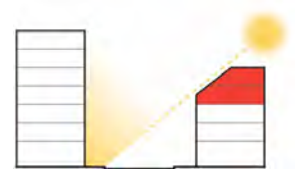
Existing neighborhood



Glazed atriums and light-ducts



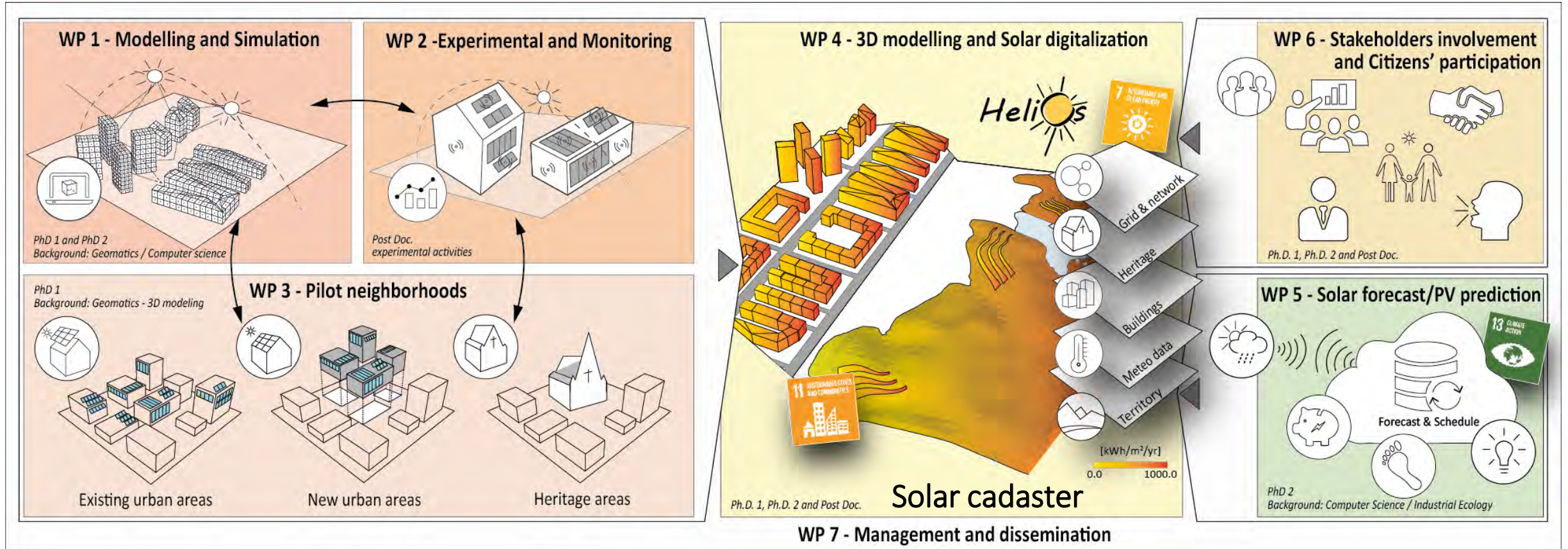
Energy generation from solar systems at building scale



Urban morphology and massing

HELIOS, Trondheim, Norway

enHancing optimal ExpLoitatIO n 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;

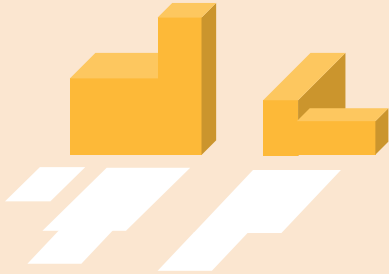
USMB/INES - University Savoie Mont Blanc / National Institute of Solar Energy (France);

UCB Lyon 1/CETHIL - Claude Bernard University / Centre d'énergie et de thermique de Lyon (France).

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**



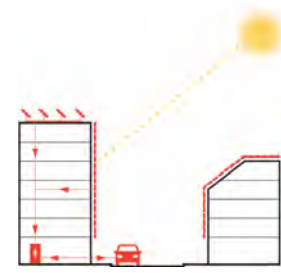
Supporting various stakeholders in the **solar planning** activity



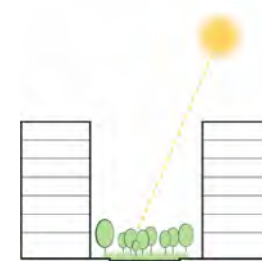
Enhancing **social acceptability** of solar strategies in sensitive urban areas

BLATCHFORD DEVELOPMENT Edmonton, Canada

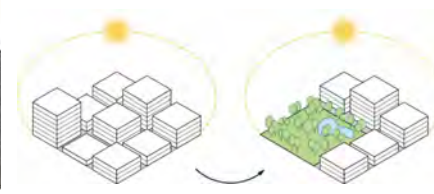
New neighborhood



Energy generation from solar systems at building scale



Urban greening



Urban layout, and patterns



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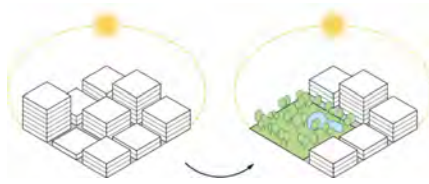
WEST5 NET-ZERO ENERGY COMMUNITY

London, Ontario , Canada

New neighborhood



Energy generation from solar systems at building scale



Urban layout, and patterns



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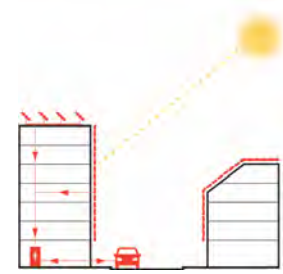


© s2e Technologies, London, Ontario

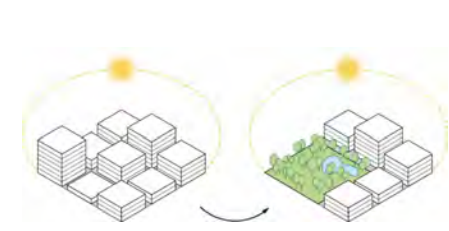
EVE PARK

London, Ontario , Canada

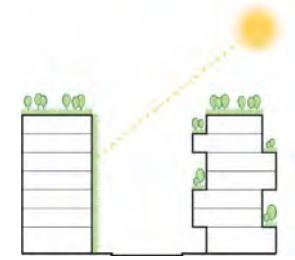
New neighborhood



Energy generation from solar systems at building scale



Urban layout, and patterns



Urban greening

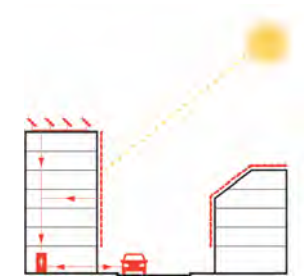




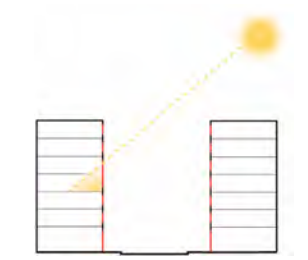
The Implement of Photovoltaic Modules

© Yujun Yang and Yupeng Wang

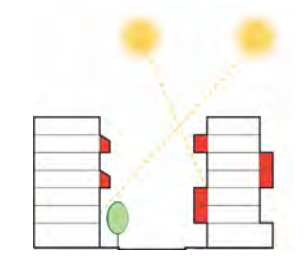
Roof Shading	
Photo-Electrothermal Synergy	
Faux Metal	
Light-transmitting Facade	
Faux Concrete	
Faux Stone	
Light-transmitting Roof	



Energy generation from solar systems at building scale



Room depth and window-to-wall ratio



Shading, overhangs, and sunspaces or solar greenhouses

HSCE BUILDING, XI'AN JIAOTONG UNIVERSITY

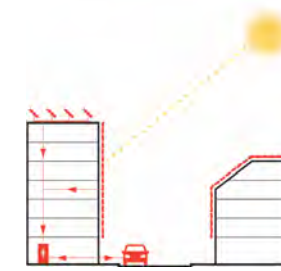
Xi'an, China
New Urban Areas



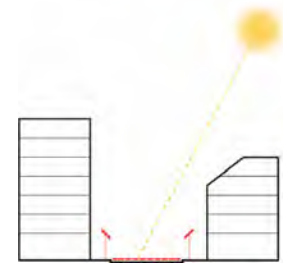
ZAC FERNEY-GENÈVE INNOVATION

Ferney-Voltaire, France

New neighborhood



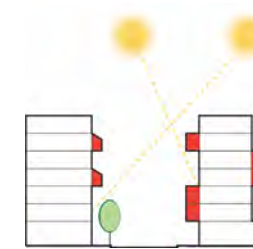
Energy generation from solar systems at building scale



Energy generation from solar systems at neighborhood scale



© SPL Territoire d'Innovation



Shading, overhangs, and sunspaces or solar greenhouses



Photovoltaic panels that should represent 20% of the available area of the Plaimboeuf site.

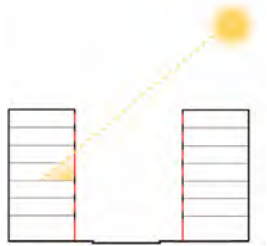
Green roofs (at least 50% of the available roof's area)

Accessible roofs

© SPL Territoire d'Innovation



Energy generation from solar systems at building scale

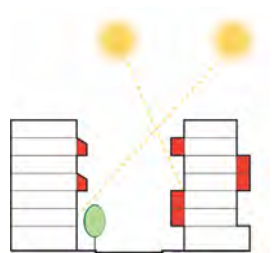


Room depth and window-to-wall ratio

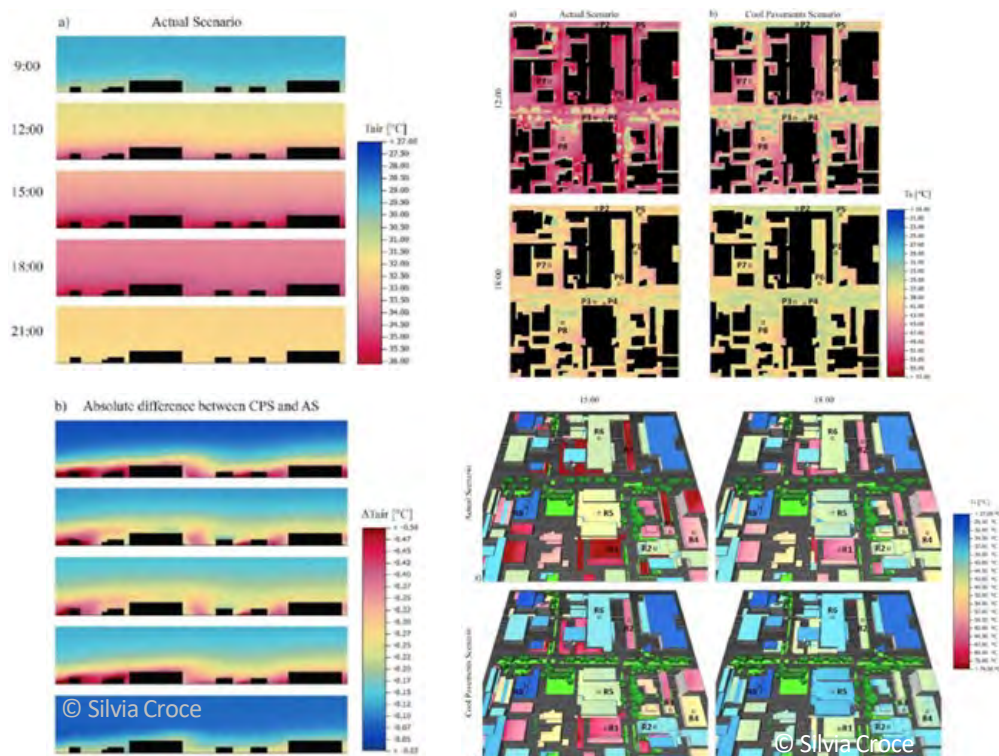
SINFONIA, BRESCIA-PALERMO DISTRICT

Bolzano, Italy

Existing Urban Areas

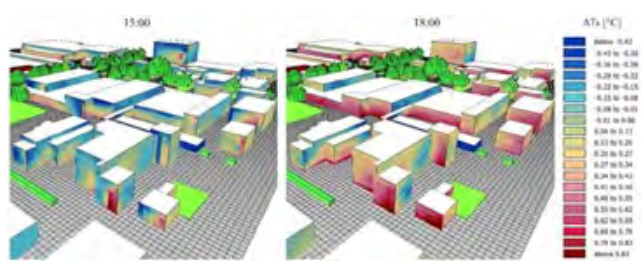


Shading, overhangs, and sunspaces or solar greenhouses

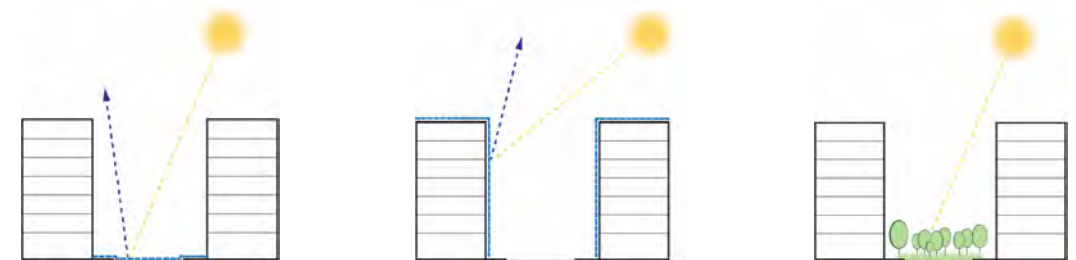


Area ZIP Nord Padua, Italy

Existing Urban Areas



Energy generation from solar systems at building and neighborhood scale



Cool and supercool coatings

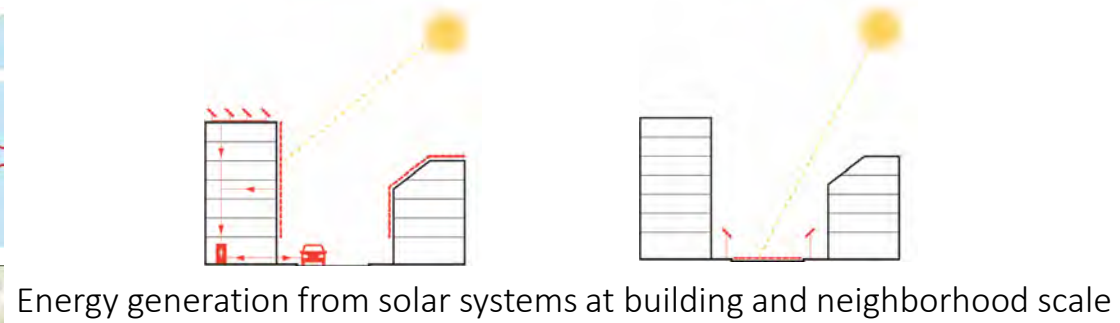
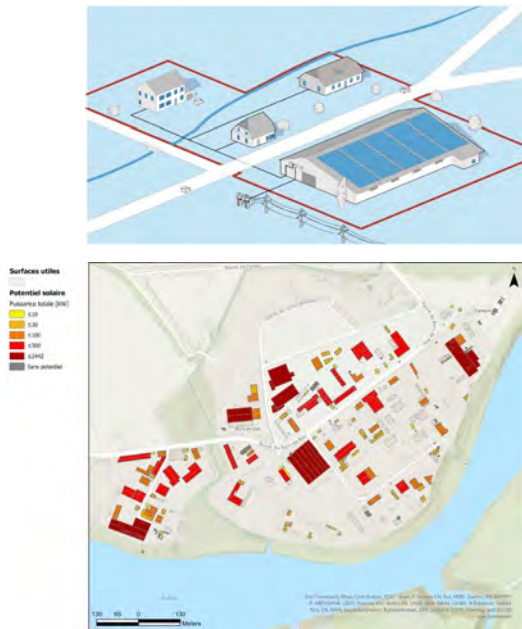
Urban greening



ZIBAY

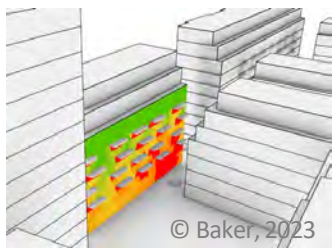
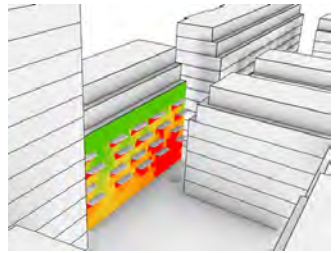
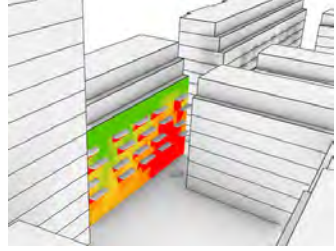
Satigny, Switzerland

New Industrial Area





© White arkitekter, 2023



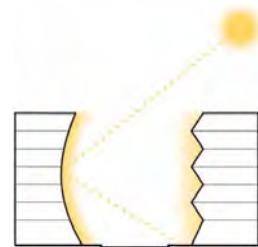
© Baker, 2023



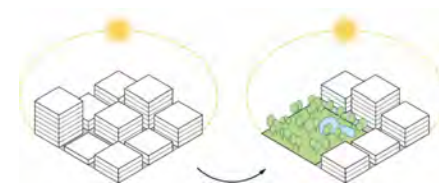
© AIX Arkitekter, 2023

VEDDESTA 13:1 Stockholm, Sweden

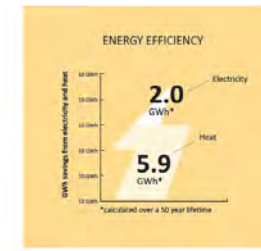
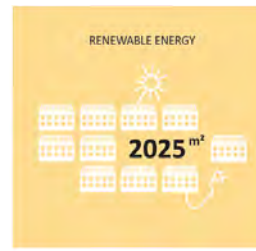
New neighborhood



Building form, morphological types, and thermal mass



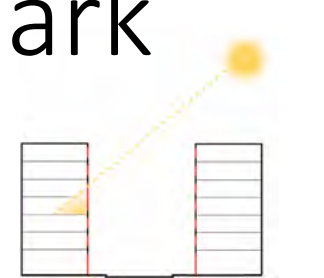
Urban layout, and patterns



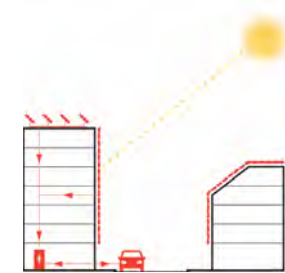
SØNDERHAVEN

Brædstrup, Denmark

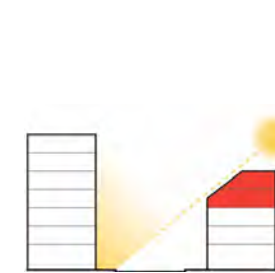
New solar settlement



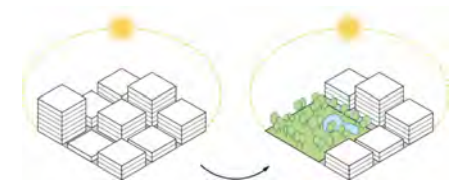
Room depth and window-to-wall ratio



Energy generation from solar systems at building scale



Urban morphology and massing



Urban layout, and patterns

IEA SHC TASK 63 – SCIENTIFIC OUTCOMES



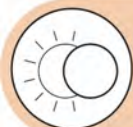
Q1 | What is a solar neighborhood?



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?





SHC Task 51
Solar Energy in Urban Planning

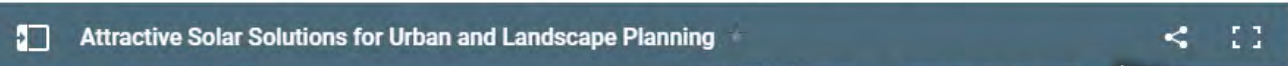
- About Project
- Participants
- Meetings / Events
- News
- Publications
- Case Studies
- Related Sites
- Member Area
- Contact

How to Integrate Solar Energy in New or Existing Urban Areas or Landscapes

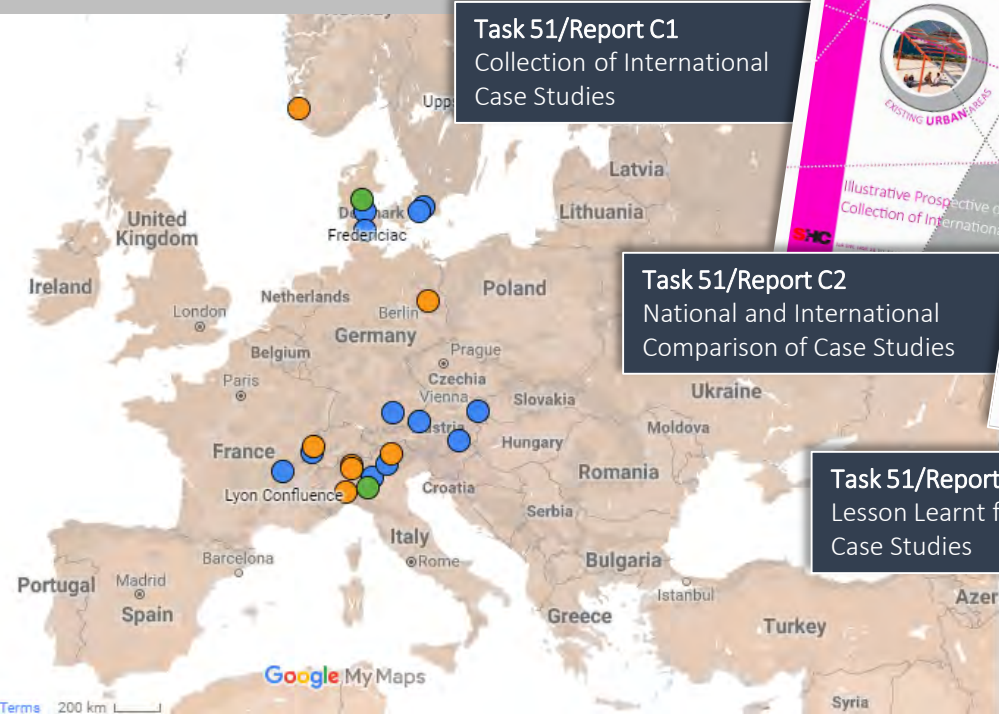
This map works as a platform for the case studies collection coordinated by Subtask C "Case studies and action research".

In the map all the analyzed case studies are marked according to the different environments (orange for existing urban areas, blue for new urban areas and green for landscapes). For each case study a dedicated brochure (.pdf file) describing the case can be downloaded.

Click on the top left icon for the navigation menu or click on the top right icon to view the map full screen with menu.



On-line Case Studies Map



Task 51/Report C1
Collection of International Case Studies

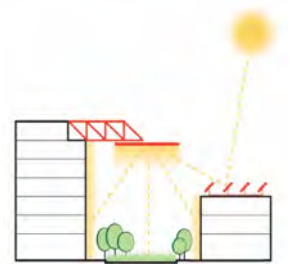
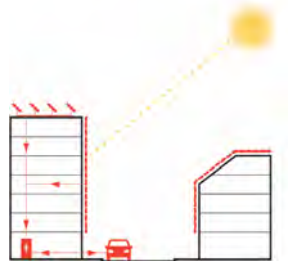
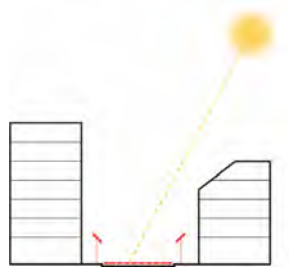
Task 51/Report C2
National and International Comparison of Case Studies

Task 51/Report C3
Lesson Learnt from Case Studies





Critical aspects	Challenges and opportunities
Location	<ul style="list-style-type: none"> Balance the competing uses of surfaces by implementing multi-functional solutions.
Urban planning	<ul style="list-style-type: none"> Couple solar access and urban planning for different interventions. Electrification of heating and cooling systems.
Modeling	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Achieve high quality of integration through colored panels, layout, and sustainable materials. Adapting urban regulations for heritage protected areas.
Energy management	<ul style="list-style-type: none"> Implement peak shaving strategies (e.g., batteries). Increase self-consumption of energy produced on-site.
Social acceptance	<ul style="list-style-type: none"> Increase end-user acceptance of active solar strategies through a structured legislative agenda.
Economy	<ul style="list-style-type: none"> Reduce investment costs for complex solar installations.



Lesson Learned

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



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

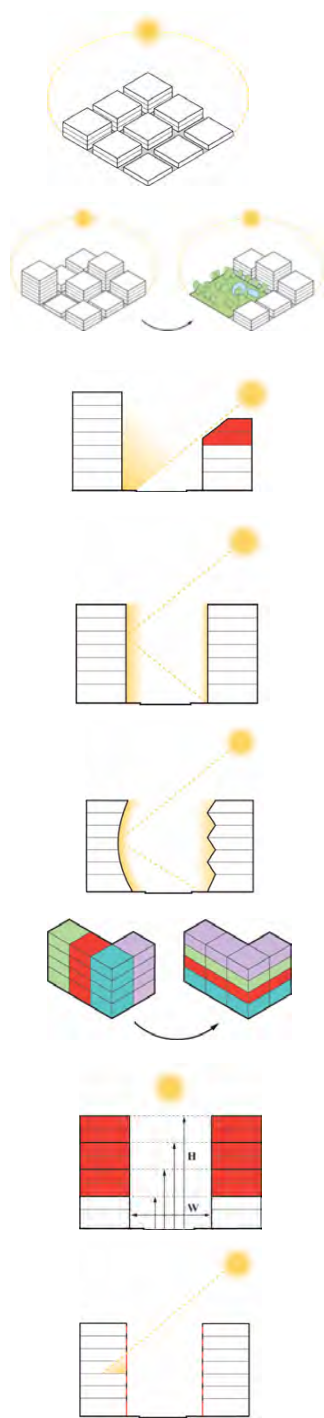
- Guarantee **daylight** and **visual comfort**.
- Mitigate **UHI effects** and **inter-building reflections**.
- Design **effective technological solutions**.
- Optimize **building shape, orientation, interior layout**.
- Apply **building form and massing** to guarantee **right-to-light** or **right-to-shade** 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?



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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**.





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





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THANKS FOR YOUR ATTENTION



Gabriele Lobaccaro
Gabriele.lobaccaro@ntnu.no



Mattia Manni
mattia.manni@ntnu.no



IEA SHC Task 63 Solar Neighborhood Planning

THANKS TO IEA