BUILDING ENERGY SIMULATIONS

Using ClimateStudio

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MEET OUR RESEARCH TEAM

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Research Assistant

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AGENDA

THEORETICAL

Introduction

Importance

Building Integrated Systems

Building Integrated Photovoltaics (BIPVs)

Challenges of implementing BIPV systems

What is ClimateStudio

Practice

Run the Energy Simulations

https://www.brookings.edu/essay/why-are-fossil-fuels-so-hard-to-quit/

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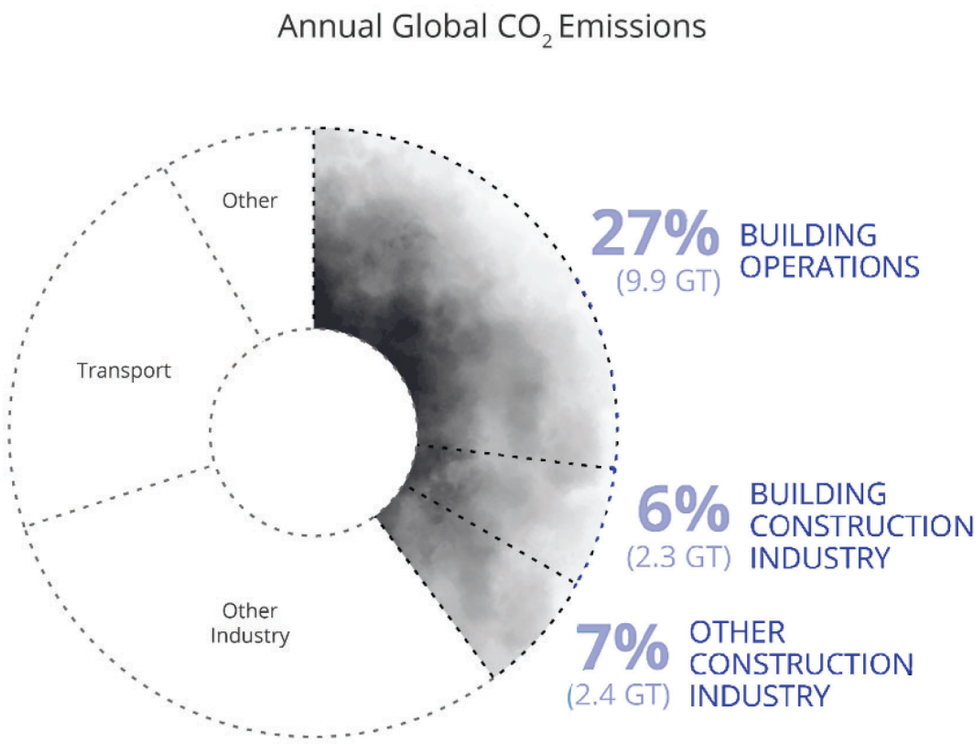
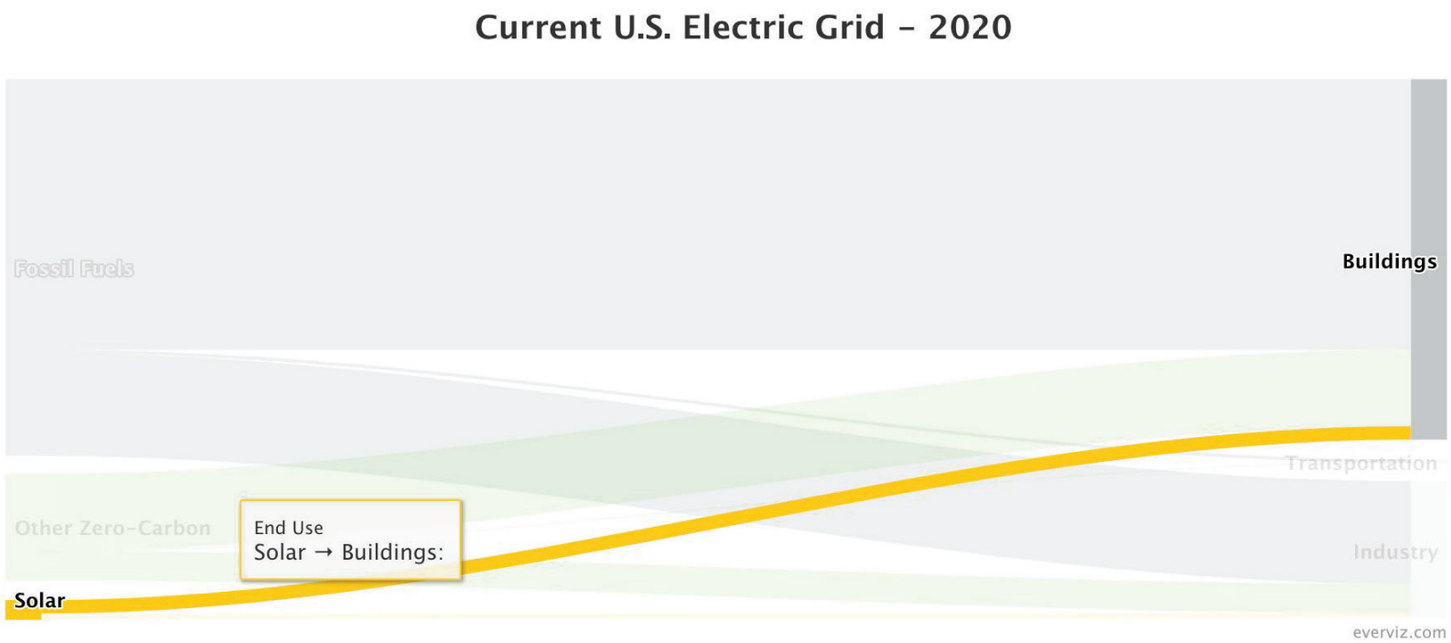


The built environment generates **40%** of annual global CO2 emissions

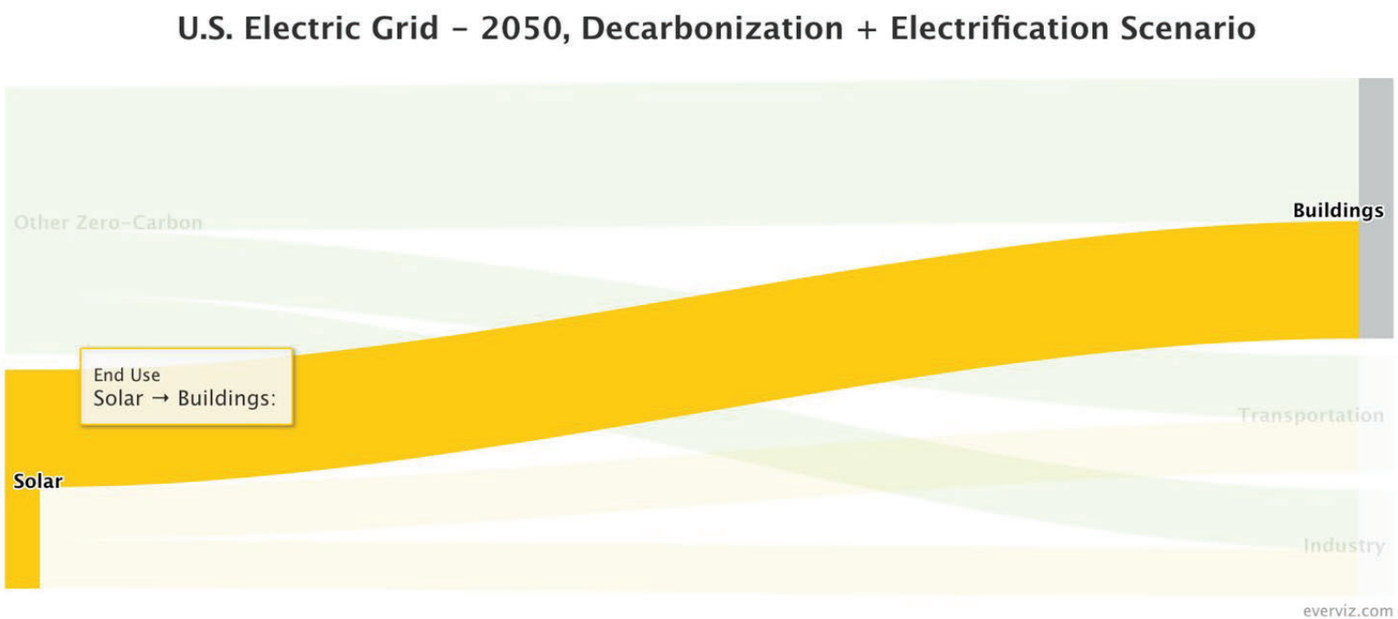
https://www.architecture2030.org/why-the-built-environment/

Buildings are the major elec. consumer



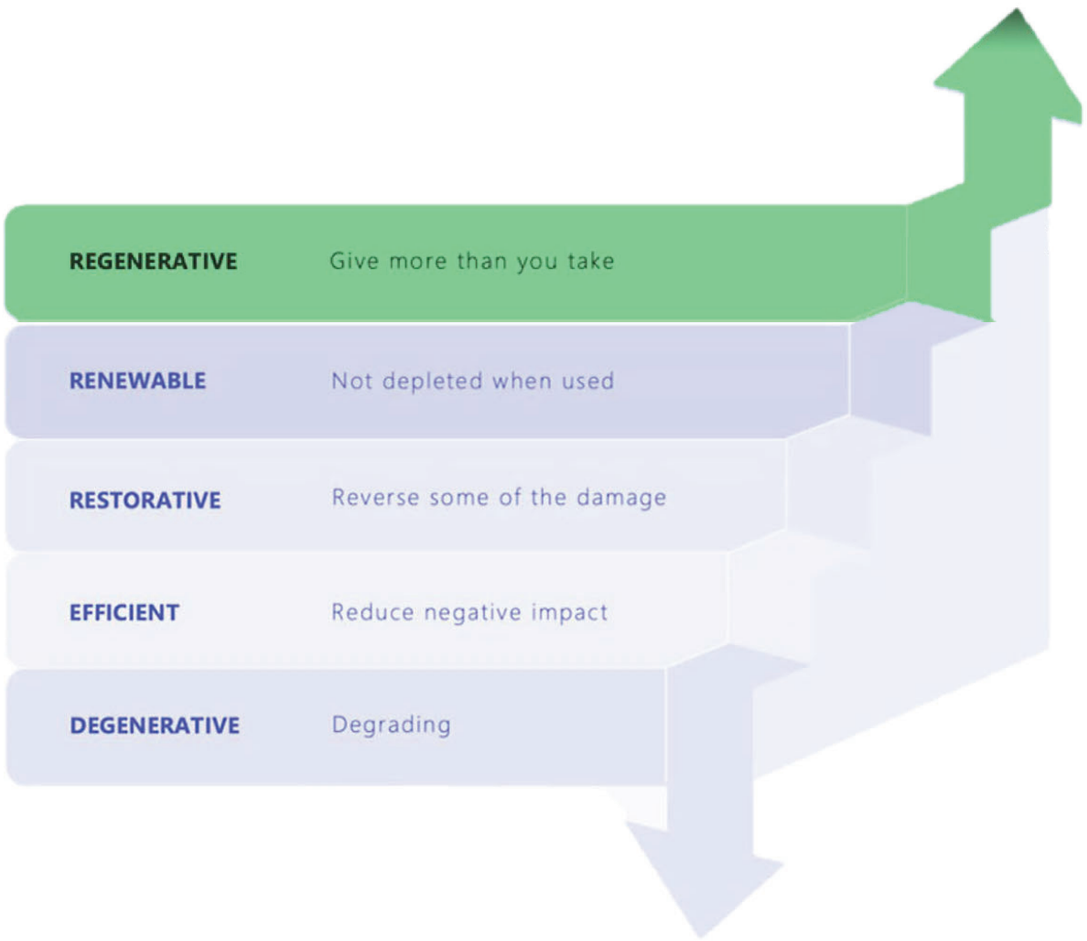
https://www.energy.gov/eere/solar/solar-futures-study

Growing PV systems



https://www.energy.gov/eere/solar/solar-futures-study

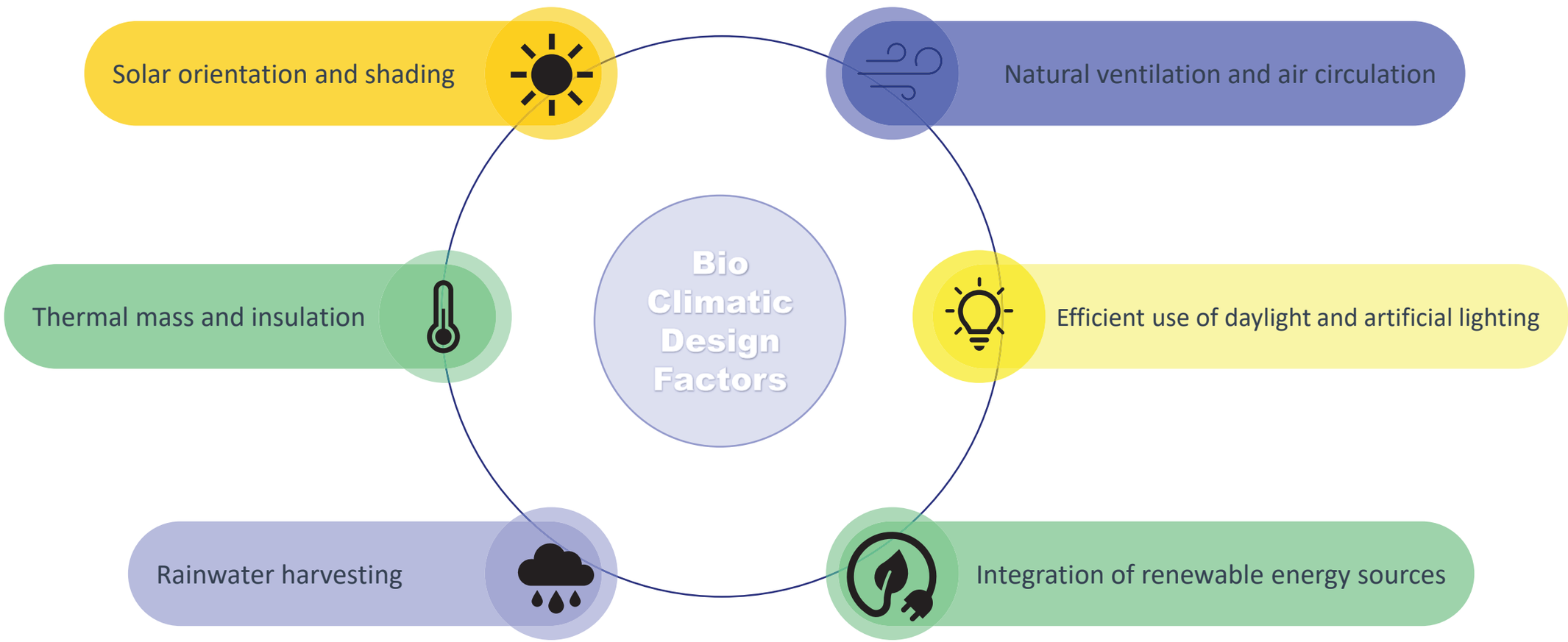
Construction of the Eisenhower Executive Office Building. Source: https://georgewbush-whitehouse.archives.gov/



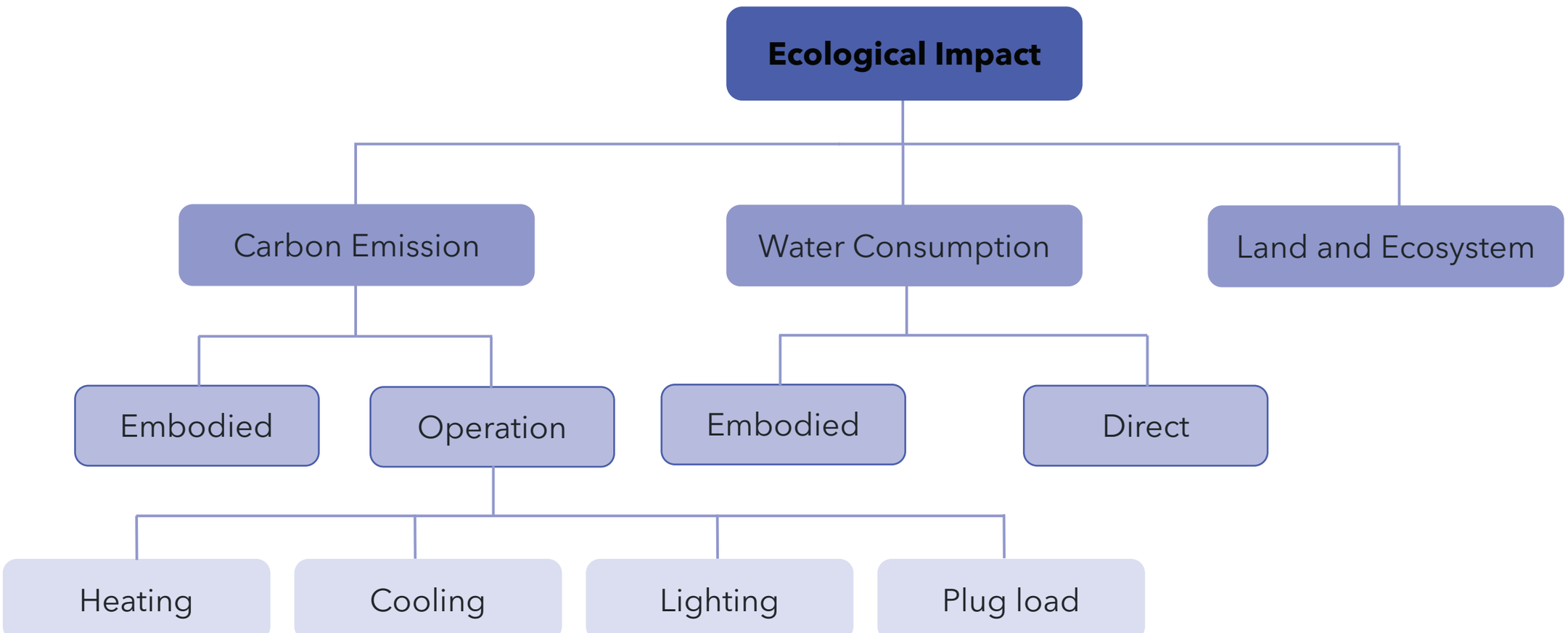
The new definition of the **sustainable** design

Source: LinkedIn

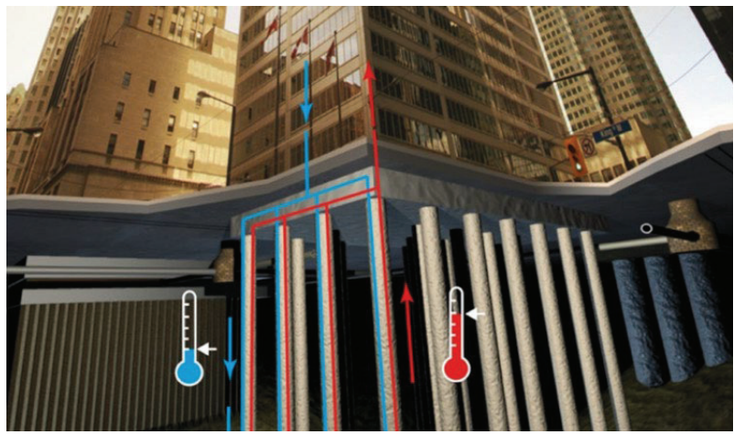
1. Bio-climatic design

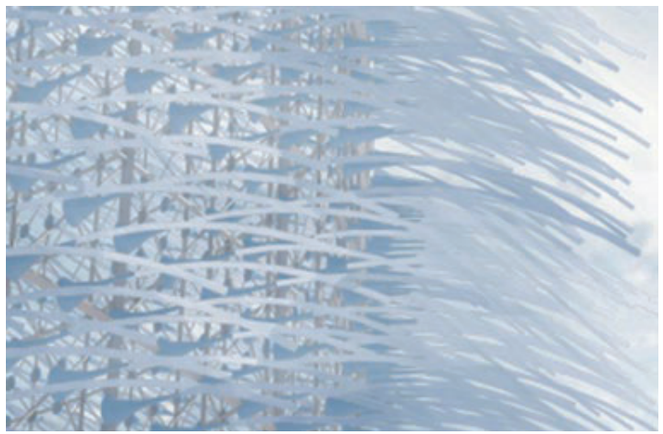


2. Minimizing the impact



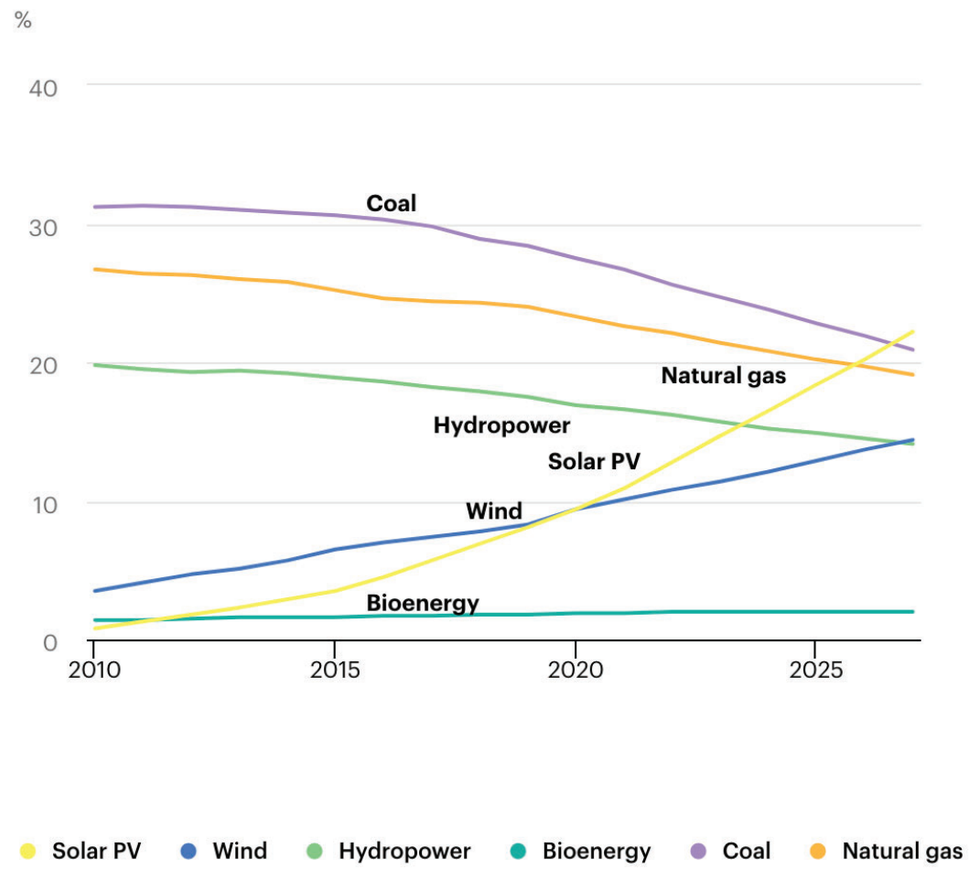
3. Maximizing the generation





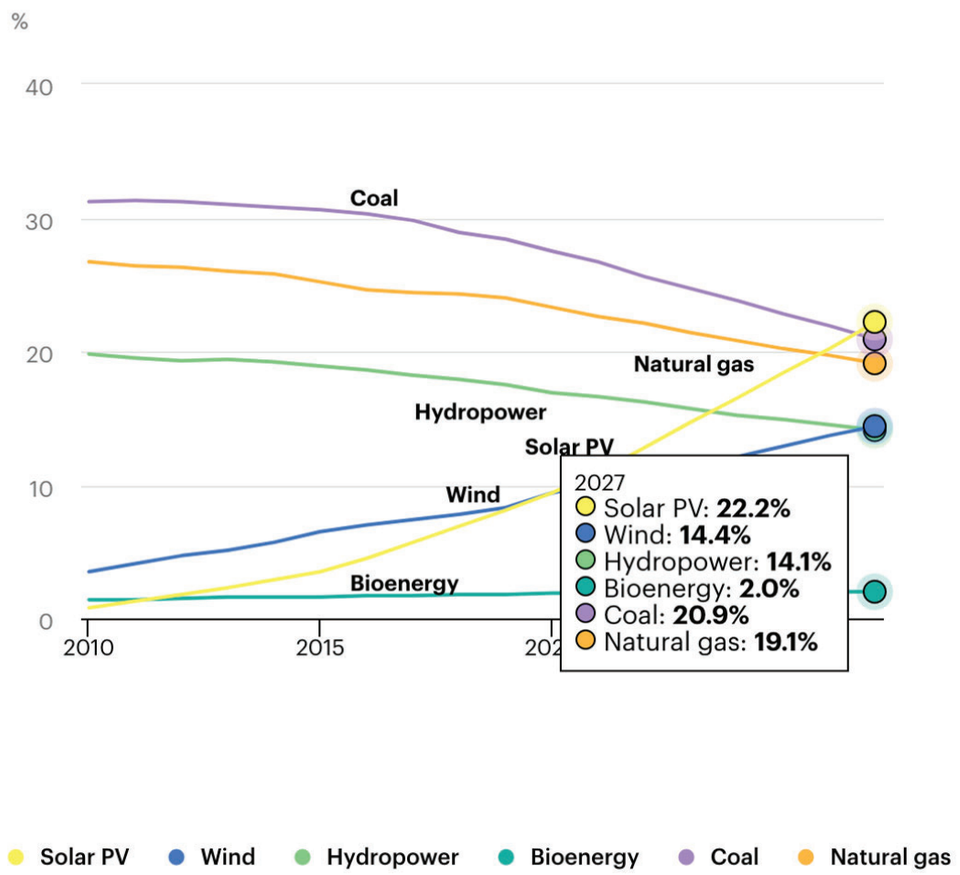
https://www.ise.fraunhofer.de/en/key-topics/integrated-photovoltaics/building-integrated-photovoltaics-bipv.html
https://www.encyclopedie-environnement.org/en/soil/geothermal-energy-source-green-energy-buildings/
https://www.alamy.com/stock-photo-the-strata-building-in-the-elephant-and-castle-london-whose-wind-turbines-48073080.html
https://www.facadetectonics.org/articles/biofacades-integrating-biological-systems-with-building-enclosures

Fast Growing Solar Industry



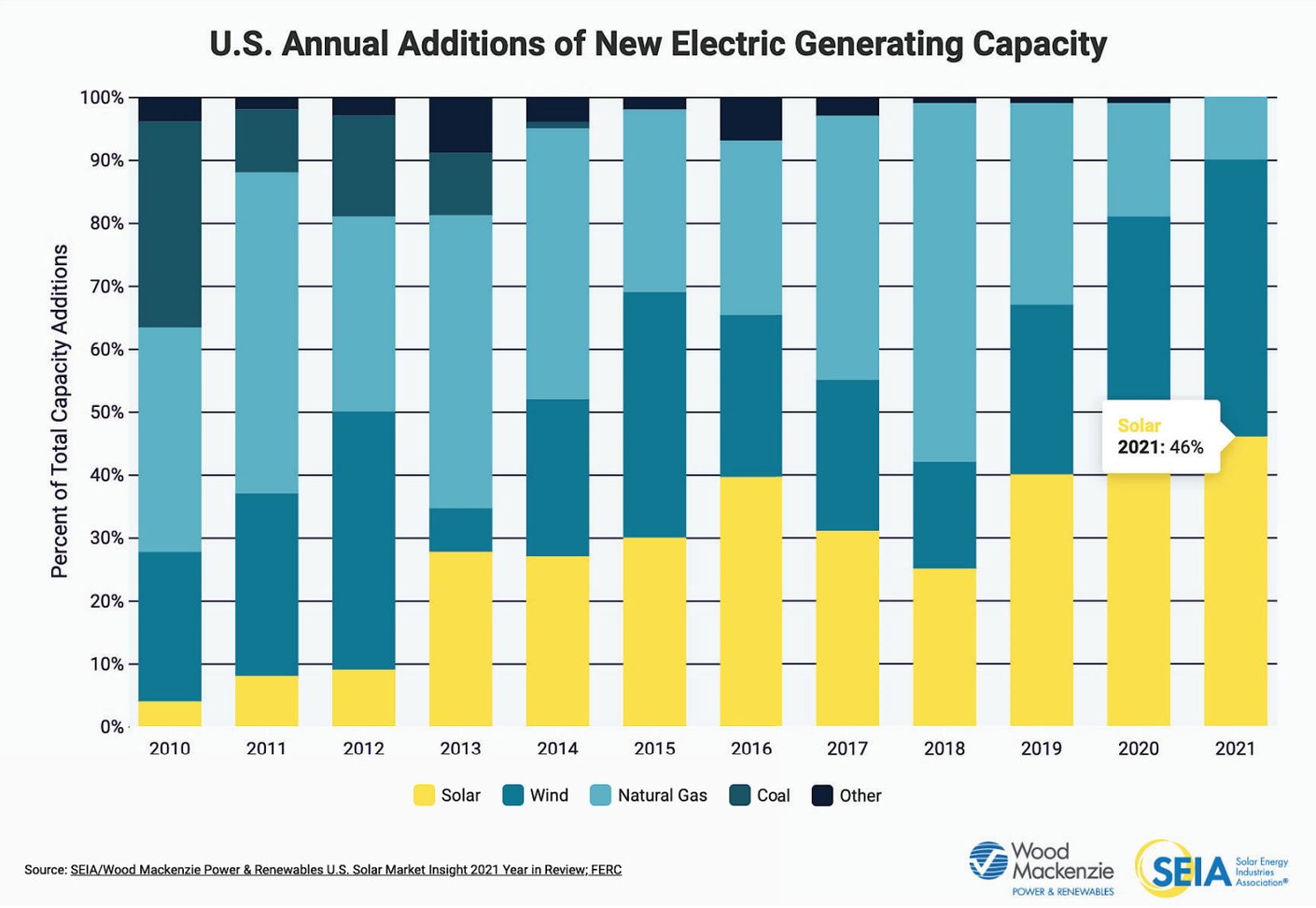
https://www.iea.org/energy-system/renewables/solar-pv

Fast Growing Solar Industry



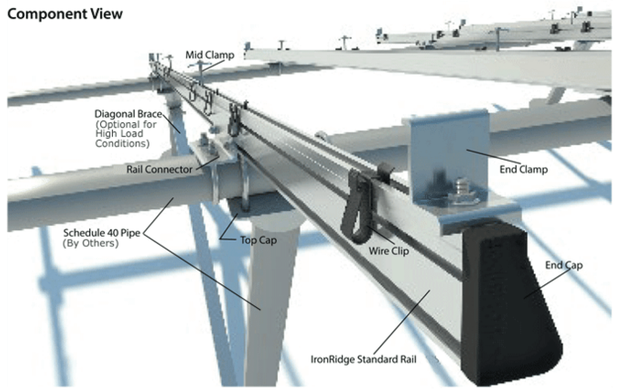
https://www.iea.org/energy-system/renewables/solar-pv

Solar energy rapidly growing in the US



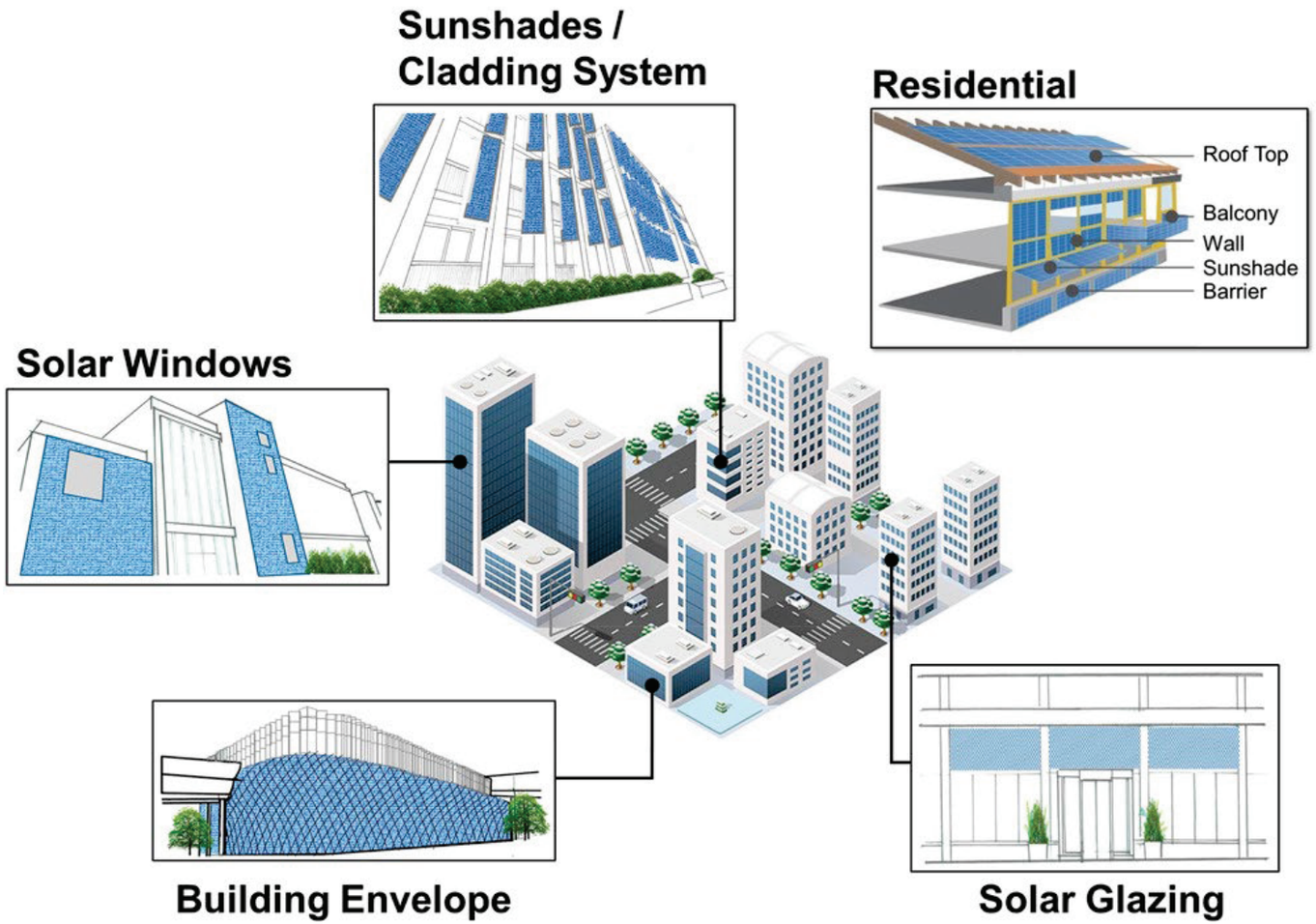
https://pv-magazine-usa.com/2023/01/13/orsted-to-commence-construction-on-471-mw-texas-solar-project/?utm_source=dlvr.it&utm_medium=linkedin

Solar farms



https://sunwatts.com/20-solar-panel-ground-mounting-kit-ironridge/

Building integrated PV (BIPV) systems



Opportunities:

- Integrated into the existing system
- No need for extra material to install the PV system*
- Cost-effective
- On-site electricity
- Positive aesthetic impacts

Challenges:

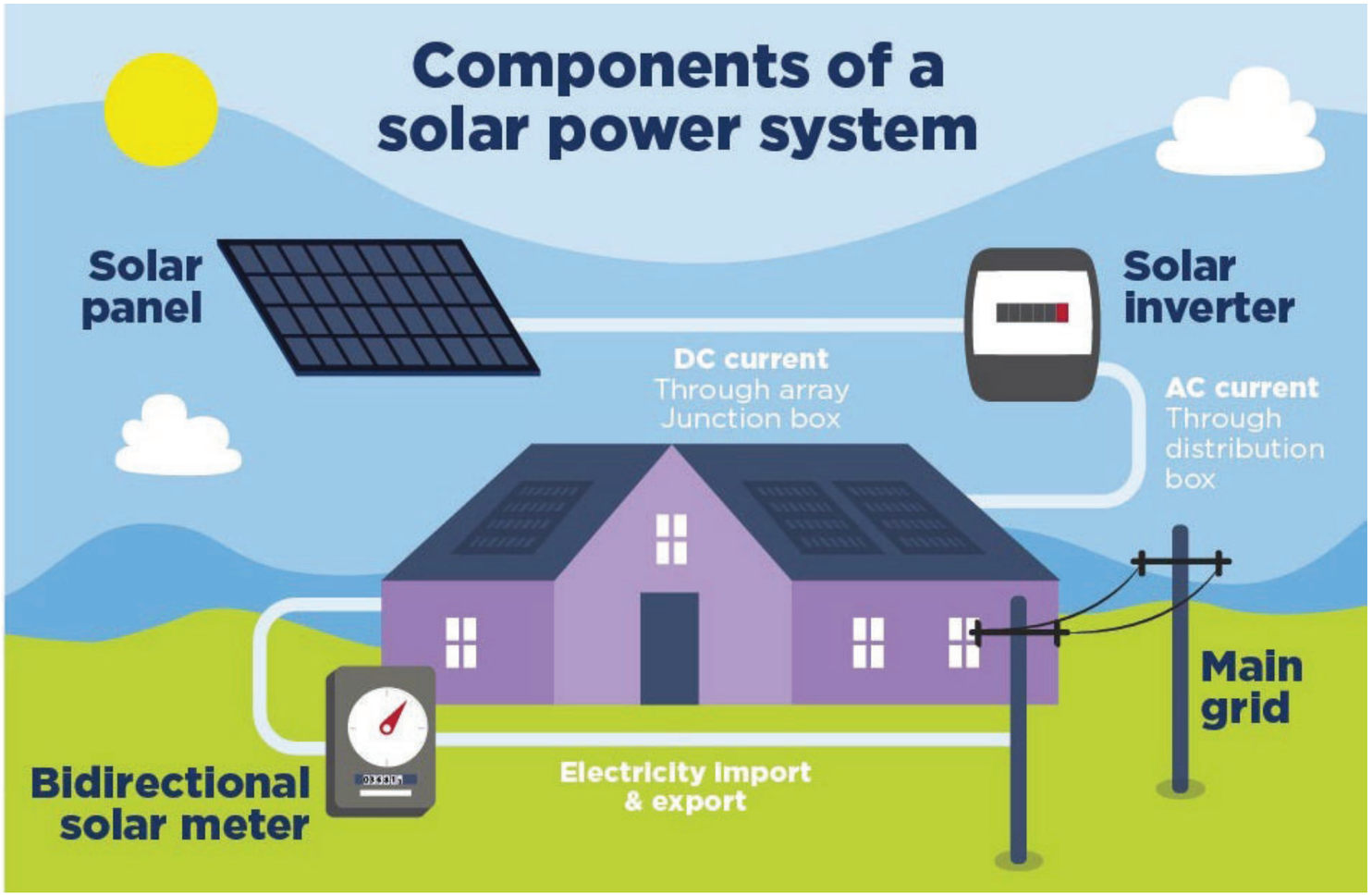
- Partial Shadows
- Duck Curve

Advanced Materials, Volume: 34, Issue: 25, First published: 26 October 2021, DOI: (10.1002/adma.202104661)

BIPV system components

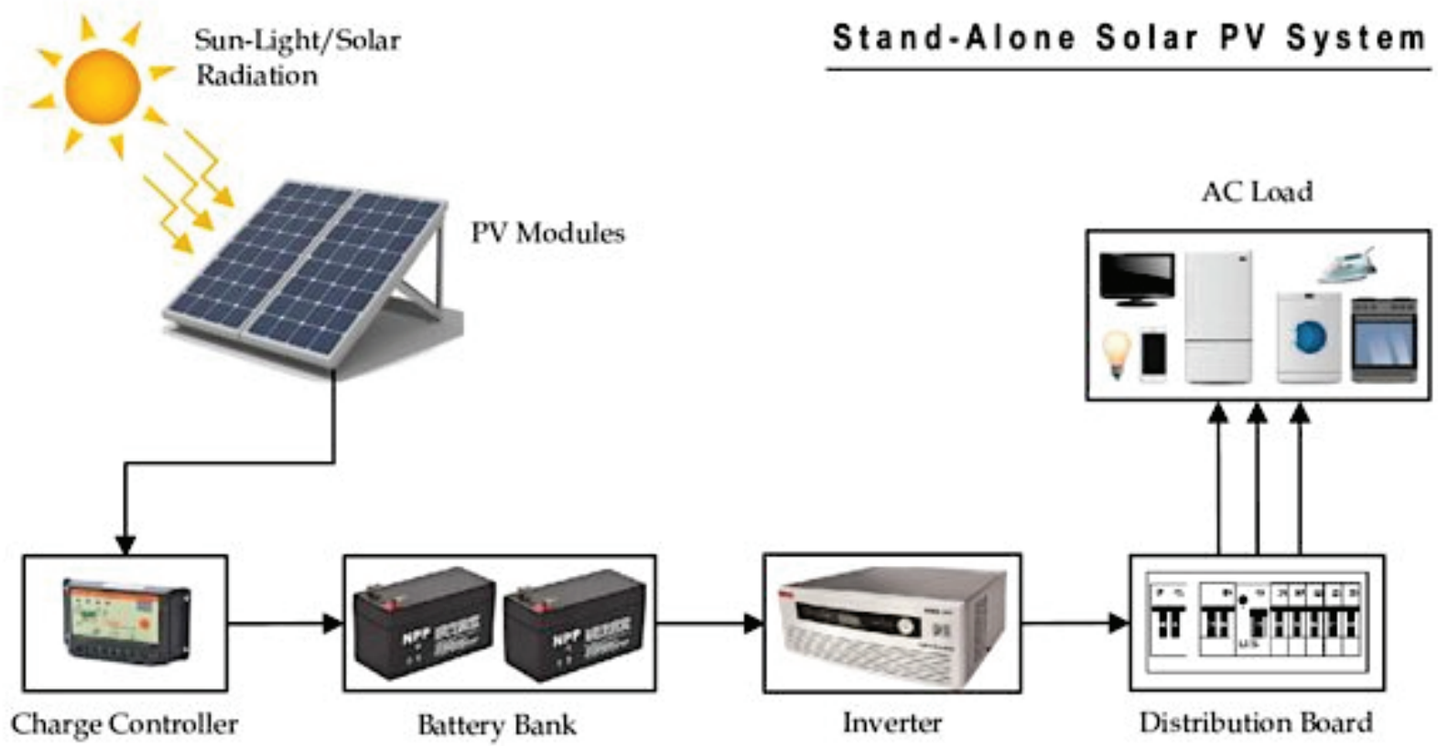
- Stand alone
- Tied to the grid
- Combination

Tied-to-the-grid BIPVs

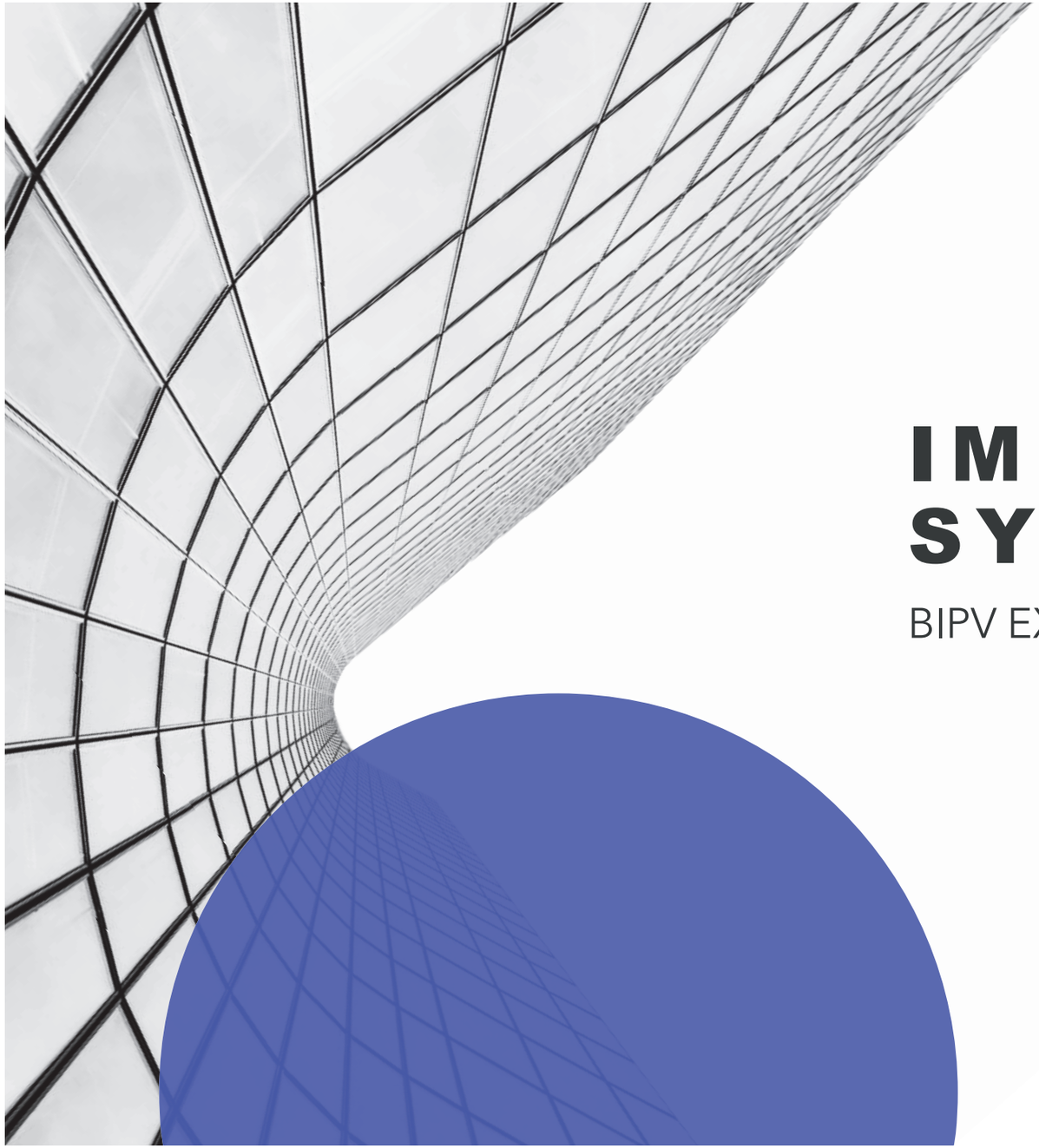


https://www.powerstone-tec.com/news/the-components-and-impacts-of-bipv-solar-power-plants

Stand-alone BIPVs



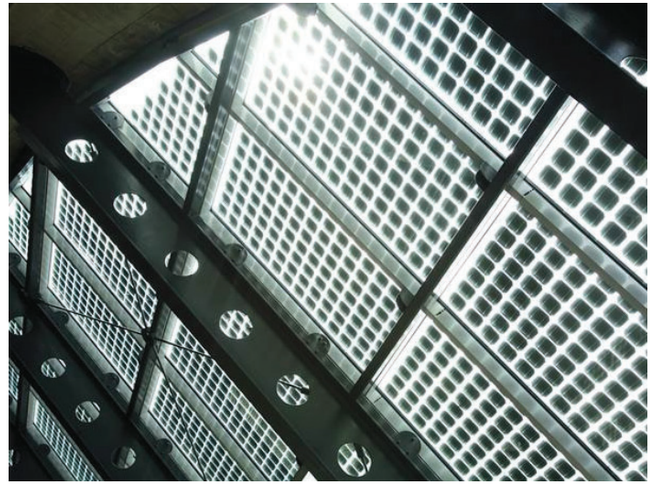
Ali, Waqas, Haroon Farooq, Ata Ur Rehman, Qasim Awais, Mohsin Jamil, and Ali Noman. "Design considerations of stand-alone solar photovoltaic systems." In *2018 International conference on computing, electronic and electrical engineering (ICE Cube)*, pp. 1-6. IEEE, 2018.



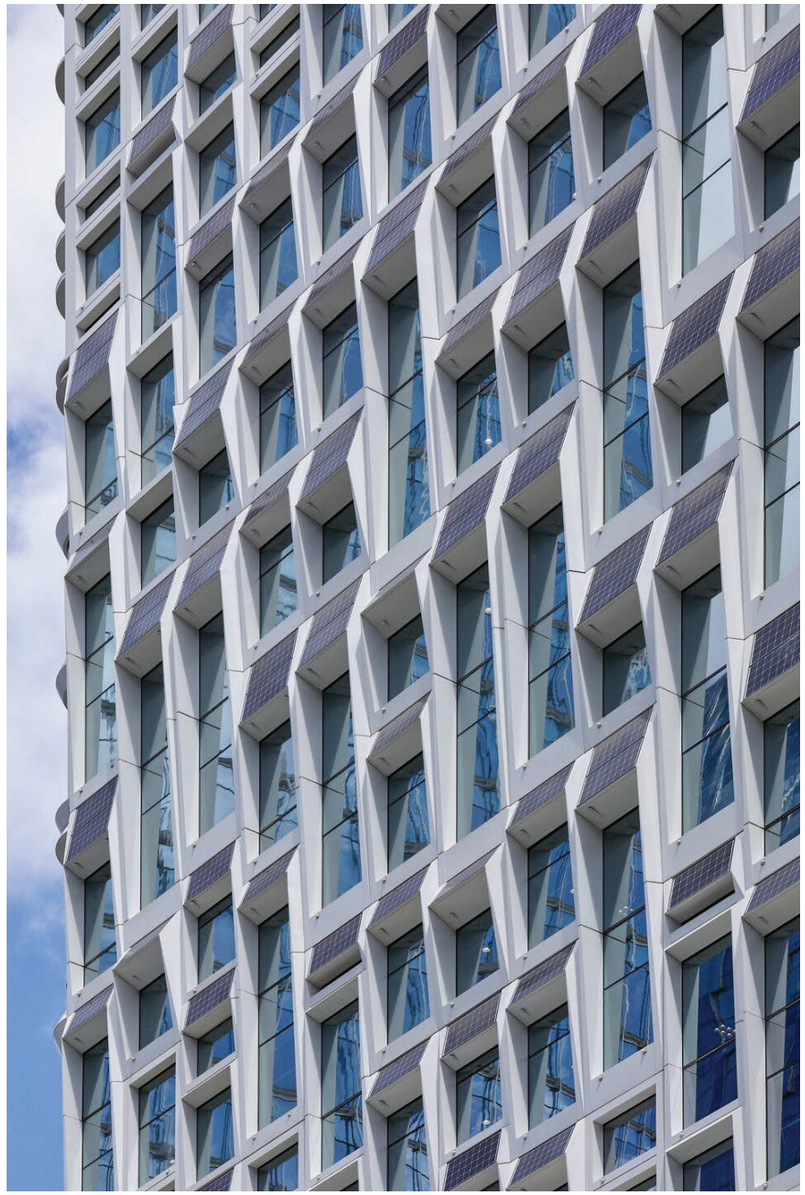
IMPLEMENTED SYSTEMS

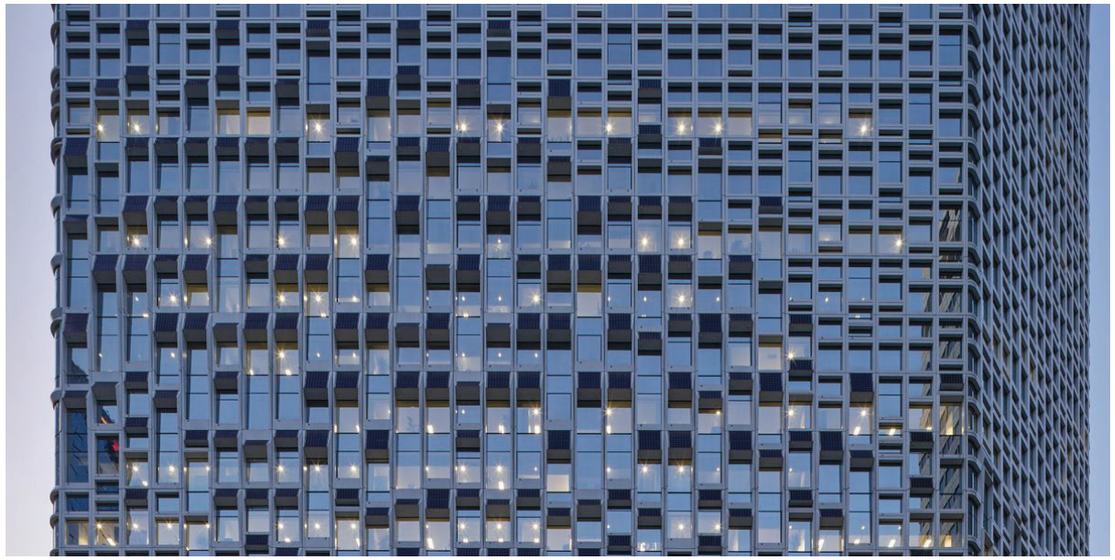
BIPV EXAMPLES

OLV hospital Aalst, Belgium



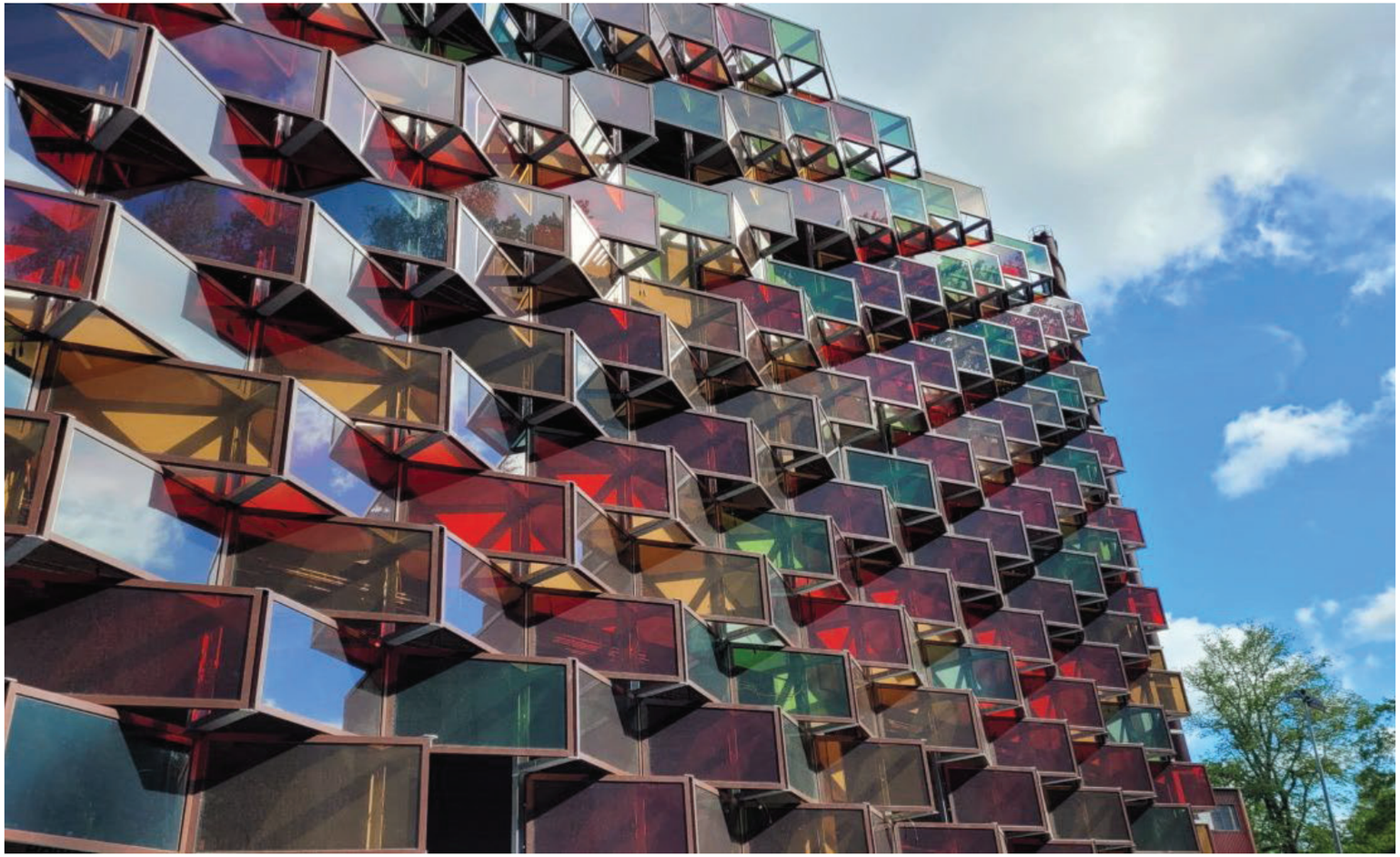
Hanwha HQ, South Korea

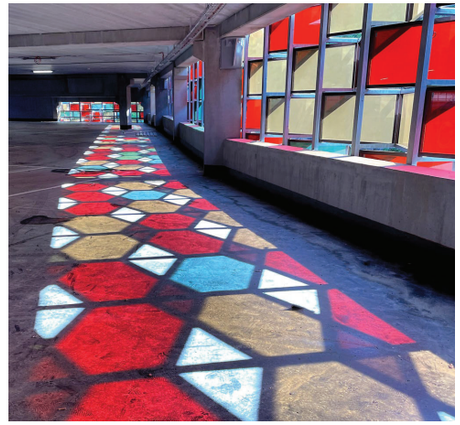




https://www.unstudio.com/en/page/11994/hanwha-headquarters-remodelling

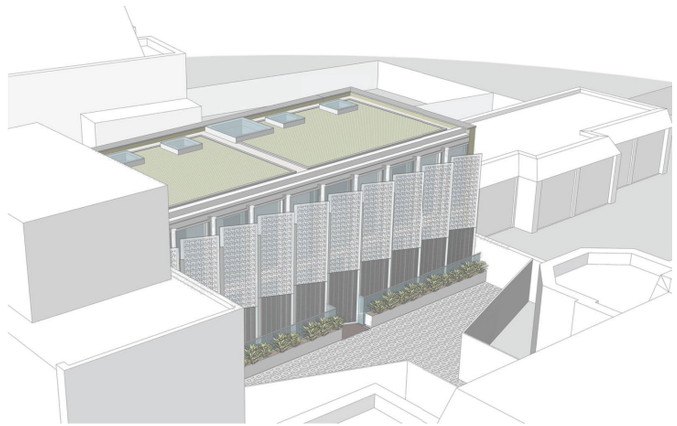
Parking, Sweden

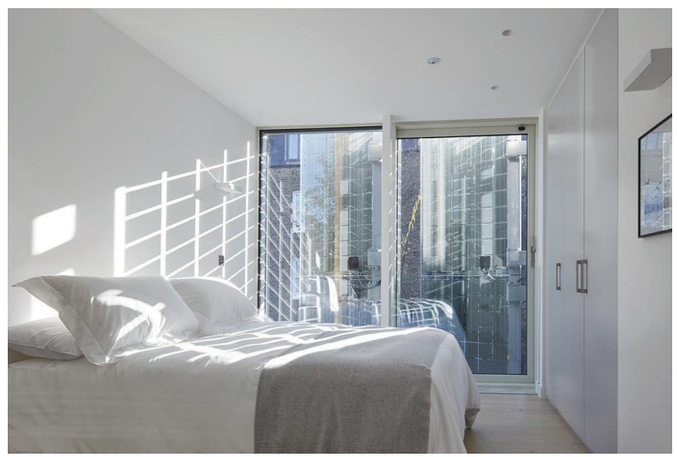




https://soltechenergy.com/en/

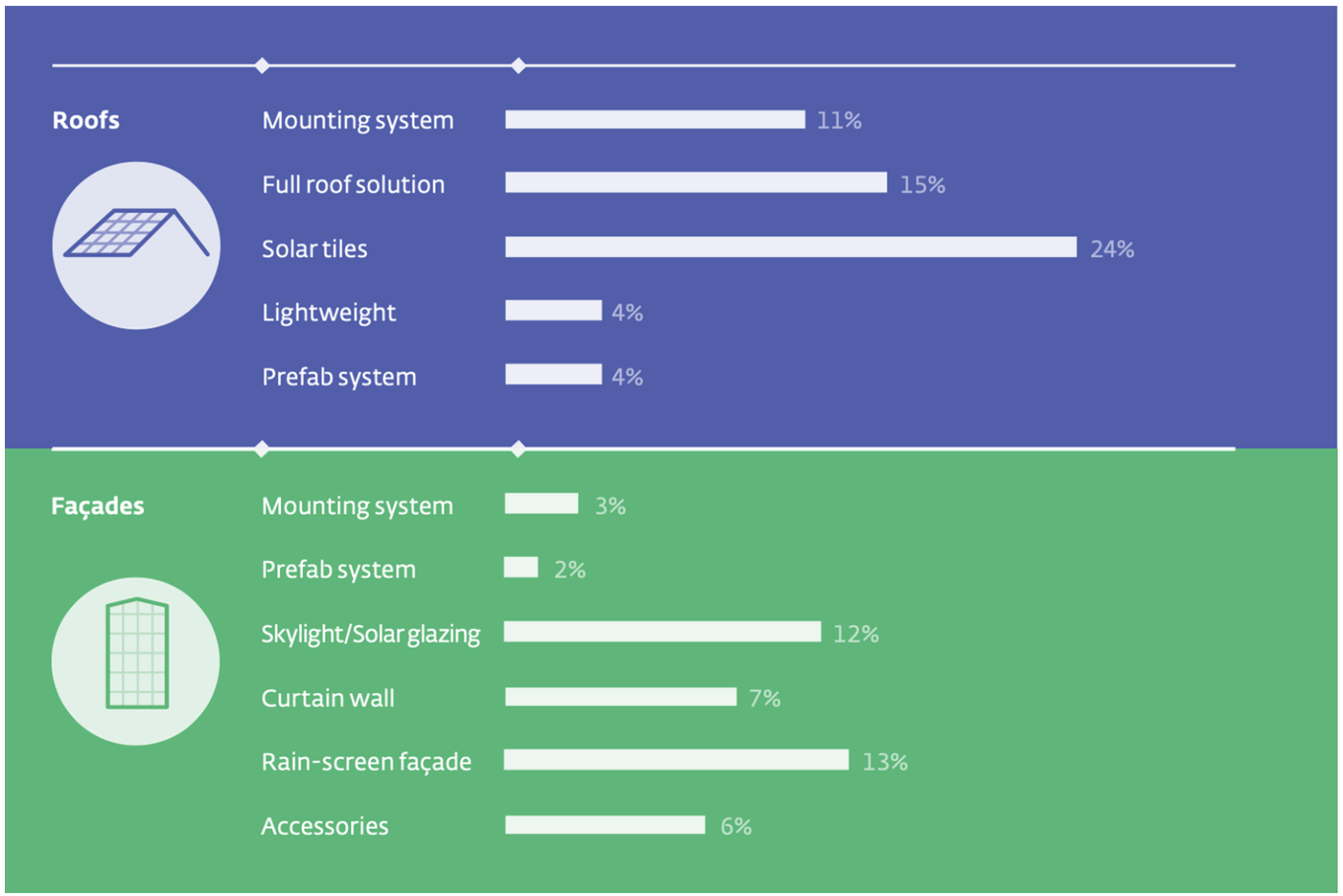
House, London





http://www.hcla.co.uk/projects/type/740-fulham-road

Distribution of different BIPV systems



BIPV Challenges

- Lack of rooftop space to mount and install roof-mounted PV system
- Partial Shadows from panels self-shading or surrounding objects
- Duck curve and grid reliability
- Software limitations
- Discrepancies between real-world applications and software simulations