Solar energy in tropical buildings

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Solar Energy Research Institute of Singapore (SERIS)

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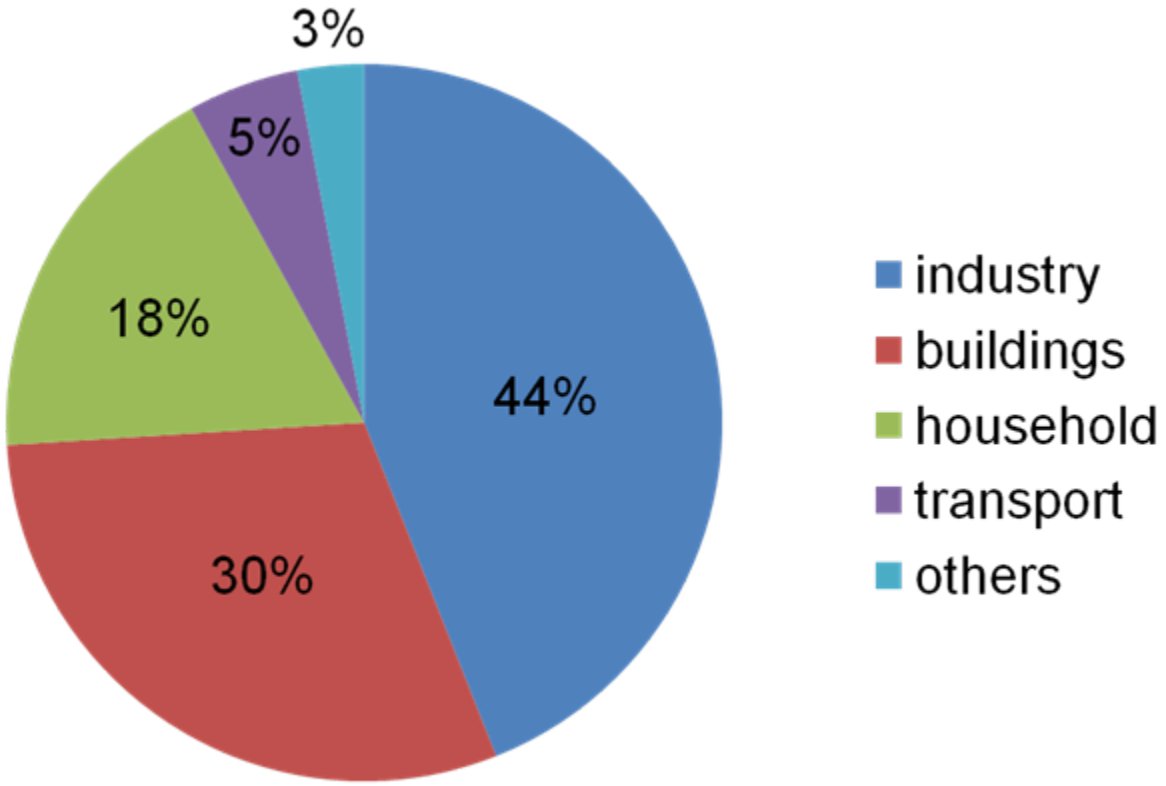
Singapore electricity consumption

Importance of the building sector

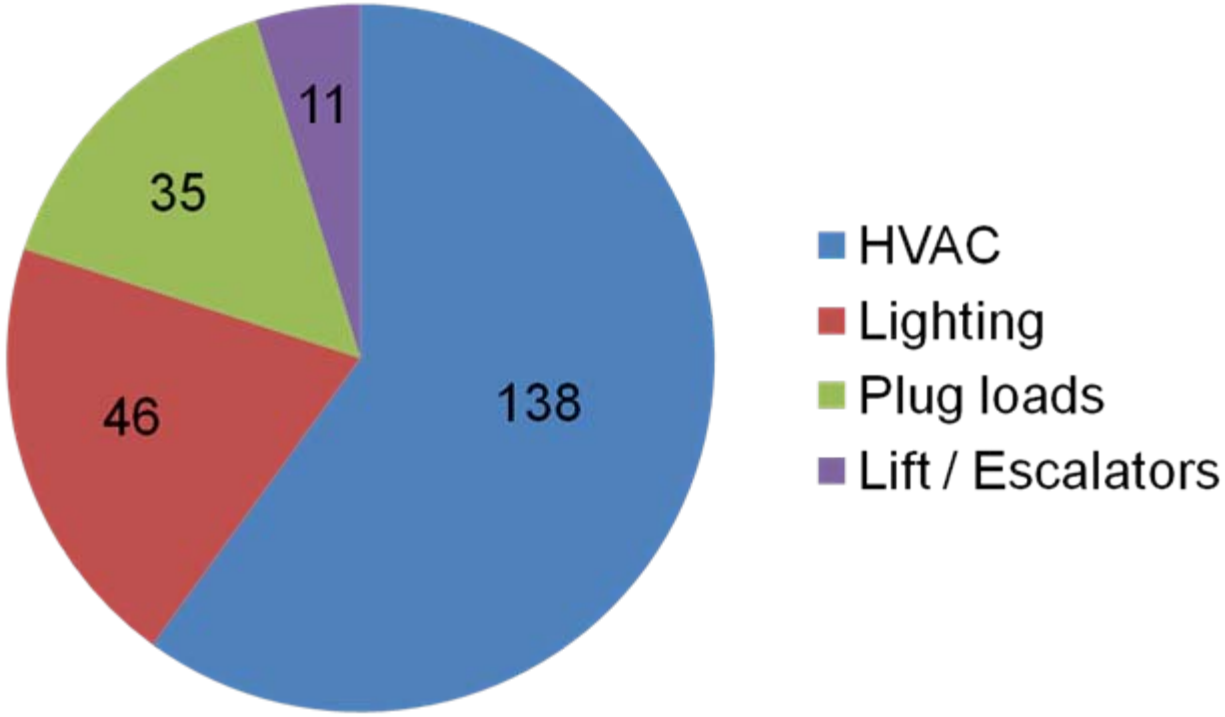


Sources: BCA, SEAS, 2007

Building electricity consumption

Importance of air-conditioning in Singapore

consumption in $kWh_{el}/(m^2 \cdot yr)$, Singapore, gross floor area



Sources: NUS Energy Sustainability Unit (ESU), based on energy auditing on 104 office buildings

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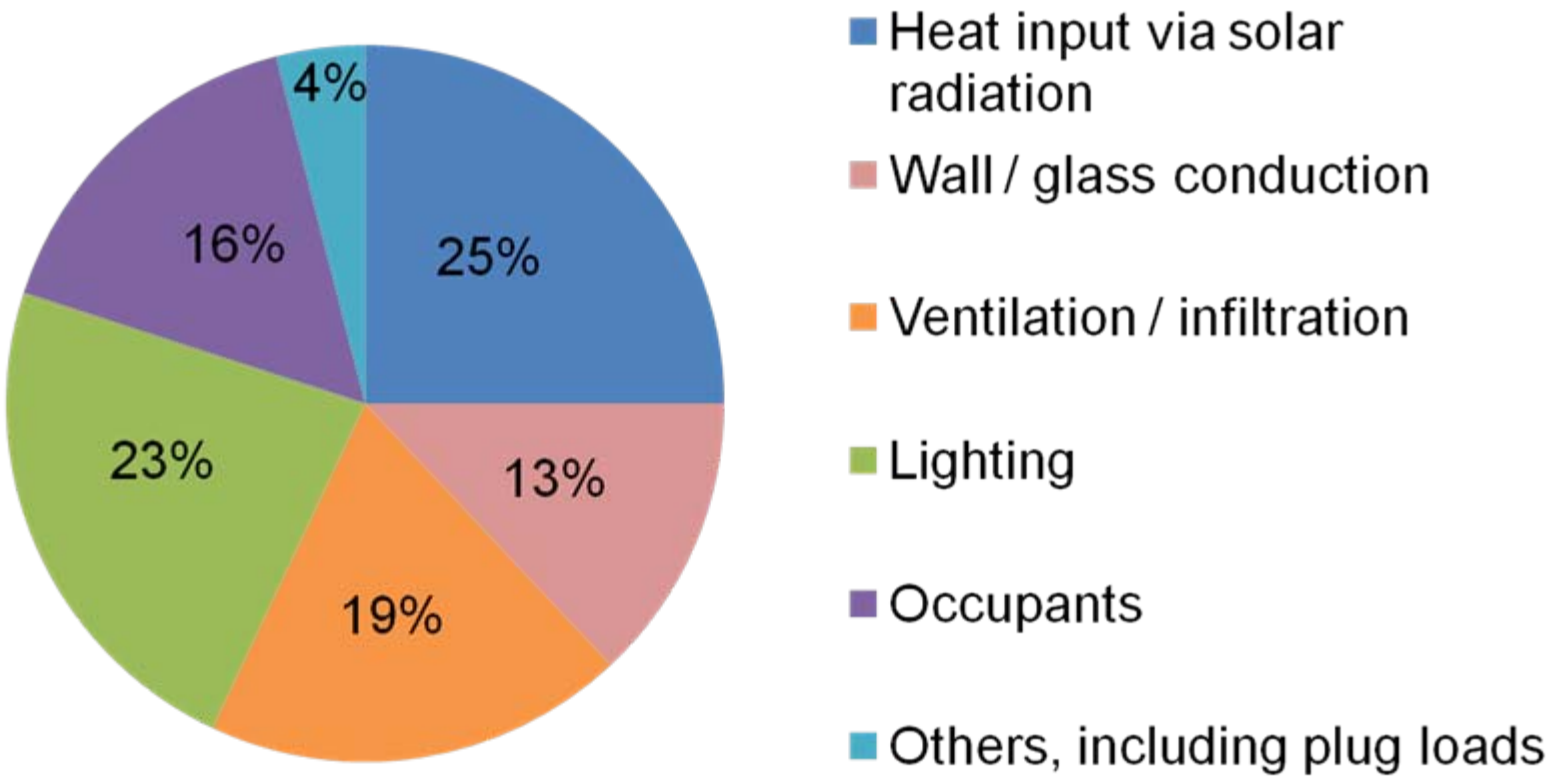
Thermal cooling loads in buildings



Source: SK Chou. Large building cooling load.
In: International Journal of Energy Research 1997

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Where can we improve

National Library Building
Singapore

- Better windows for lower thermal transmission of solar radiation, reduced heat conduction and infiltration/ventilation
- Better walls and roofs for reduced heat conduction
- Use of daylight for reduction of electrical lighting
- Building integrated photovoltaics harnessing solar energy
- Energy efficient air-conditioning systems (e.g. solar assisted)

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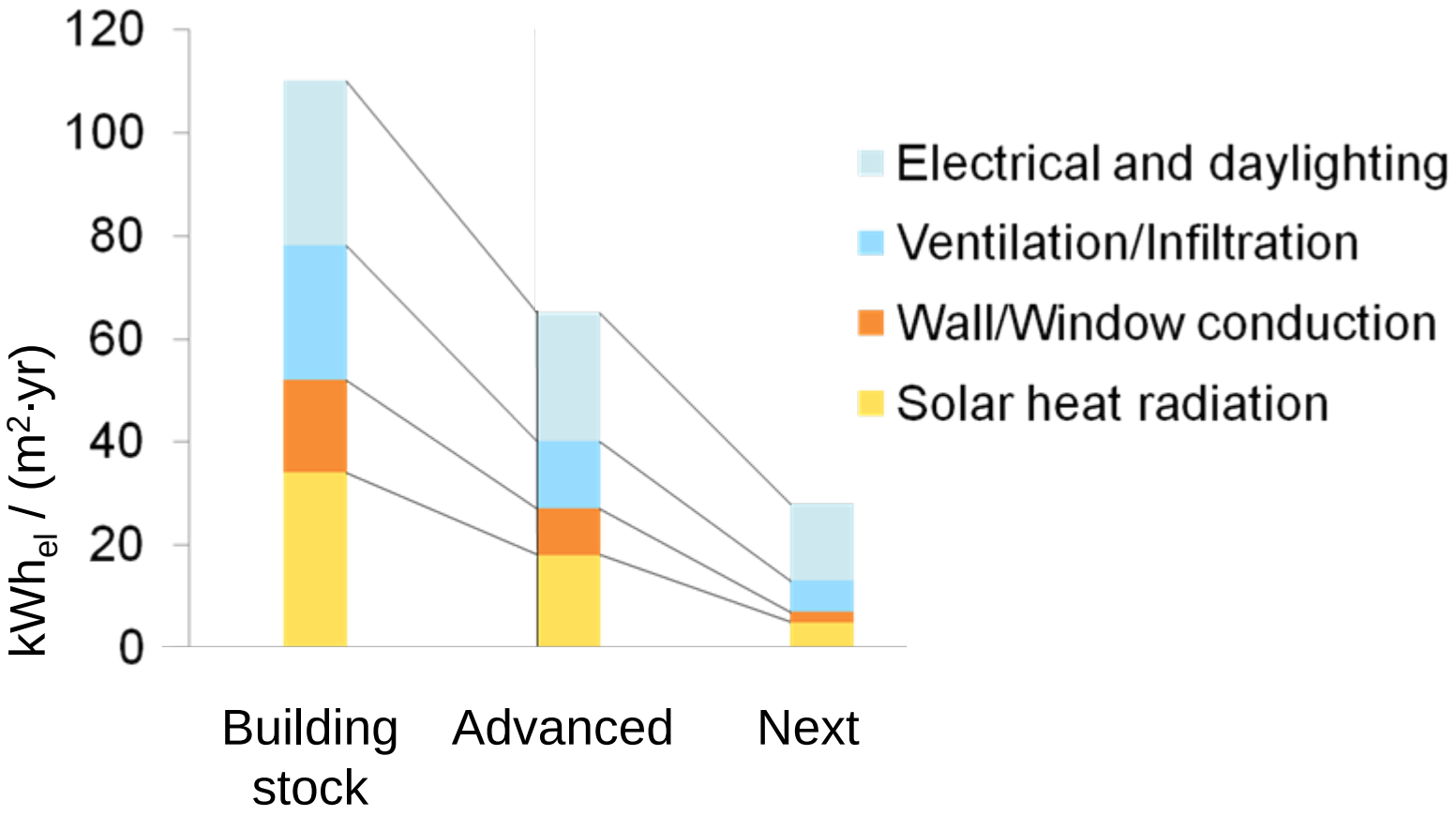
Possible improvements - 1

Reduction of electricity consumption for envelope related loads



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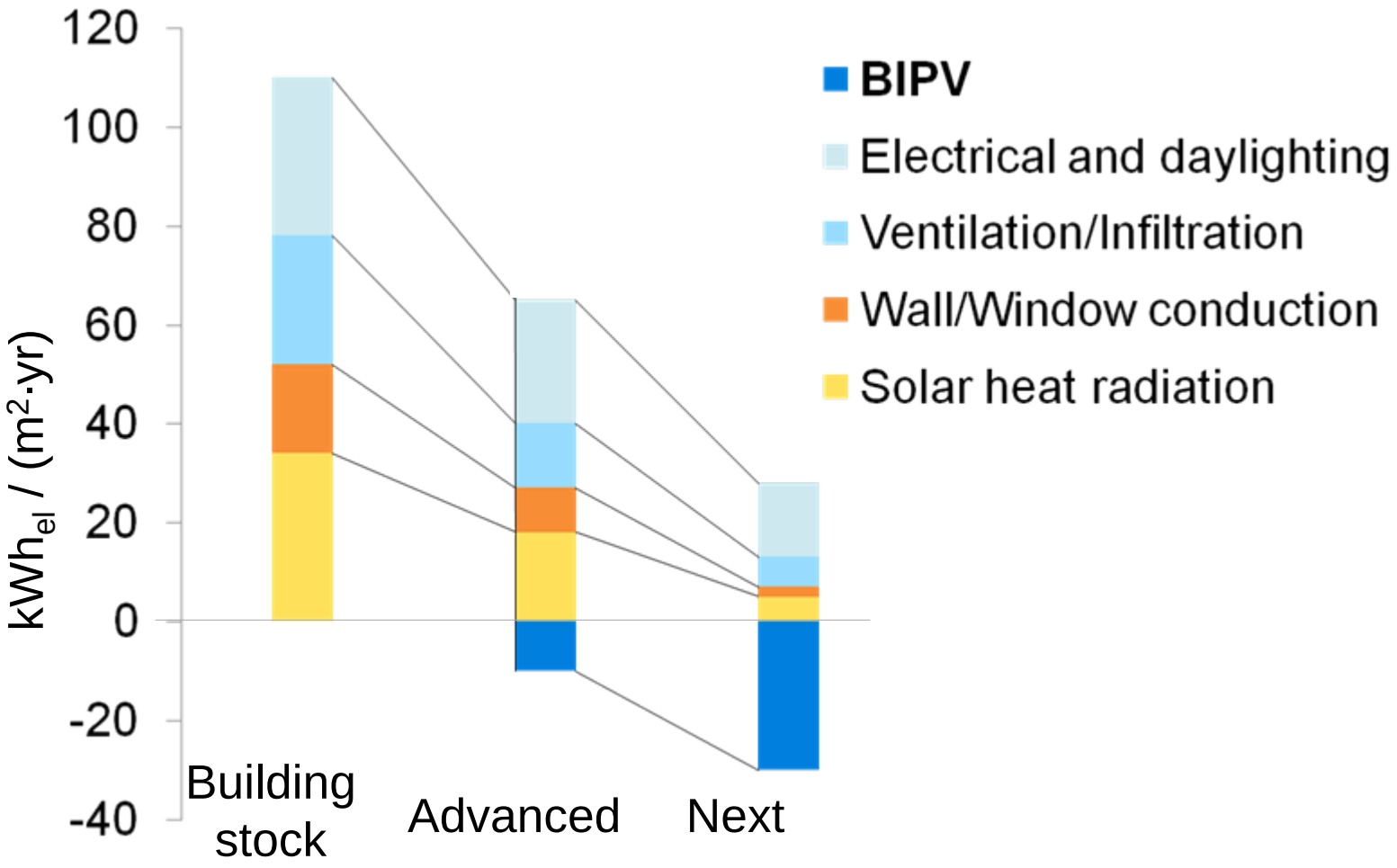
Possible improvements - 2

On site electricity generation



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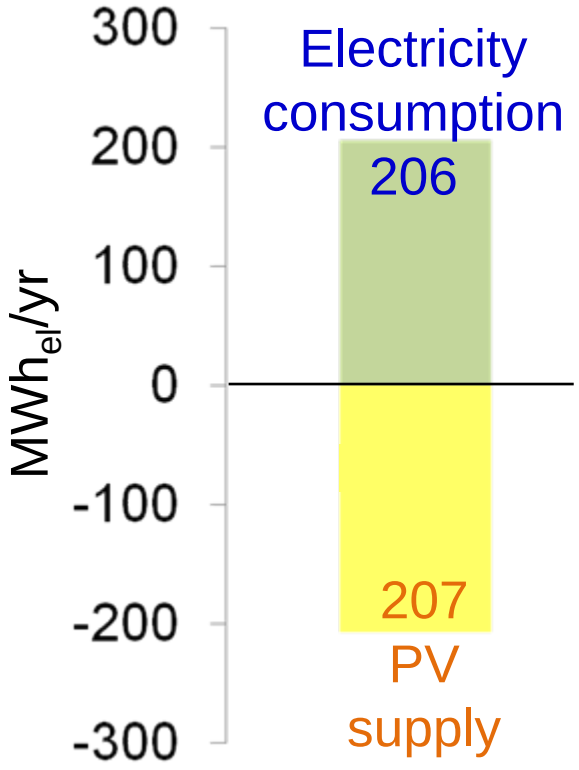
Case study: Zero-energy building

Building integrated photovoltaic

(Building integrated PV at ZEB)



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Case study: Zero-energy building

Complex fenestration systems

Solar control with:

- Integrated blinds
- Electrochromic films
- See-through photovoltaic

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Case study: zero-energy building

Daylight collection and transportation

Daylight utilization:

- Vertical light pipes
- Horizontal mirror ducts

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SERIS R&D

Solar and energy efficient buildings

Technologies:	R&D scopes:
Facade (e.g. fenestration systems)	Design: concept, simulation, specification, prototype
Building integrated photovoltaic	Assessment: analytical monitoring, feasibility study
Heat powered air-conditioning (e.g. dehumidification)	Measurements: laboratories and on-site

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Thank you for your attention!

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