



THE UNIVERSITY
of EDINBURGH

Smart building design

ES in the built environment

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04/09/2019

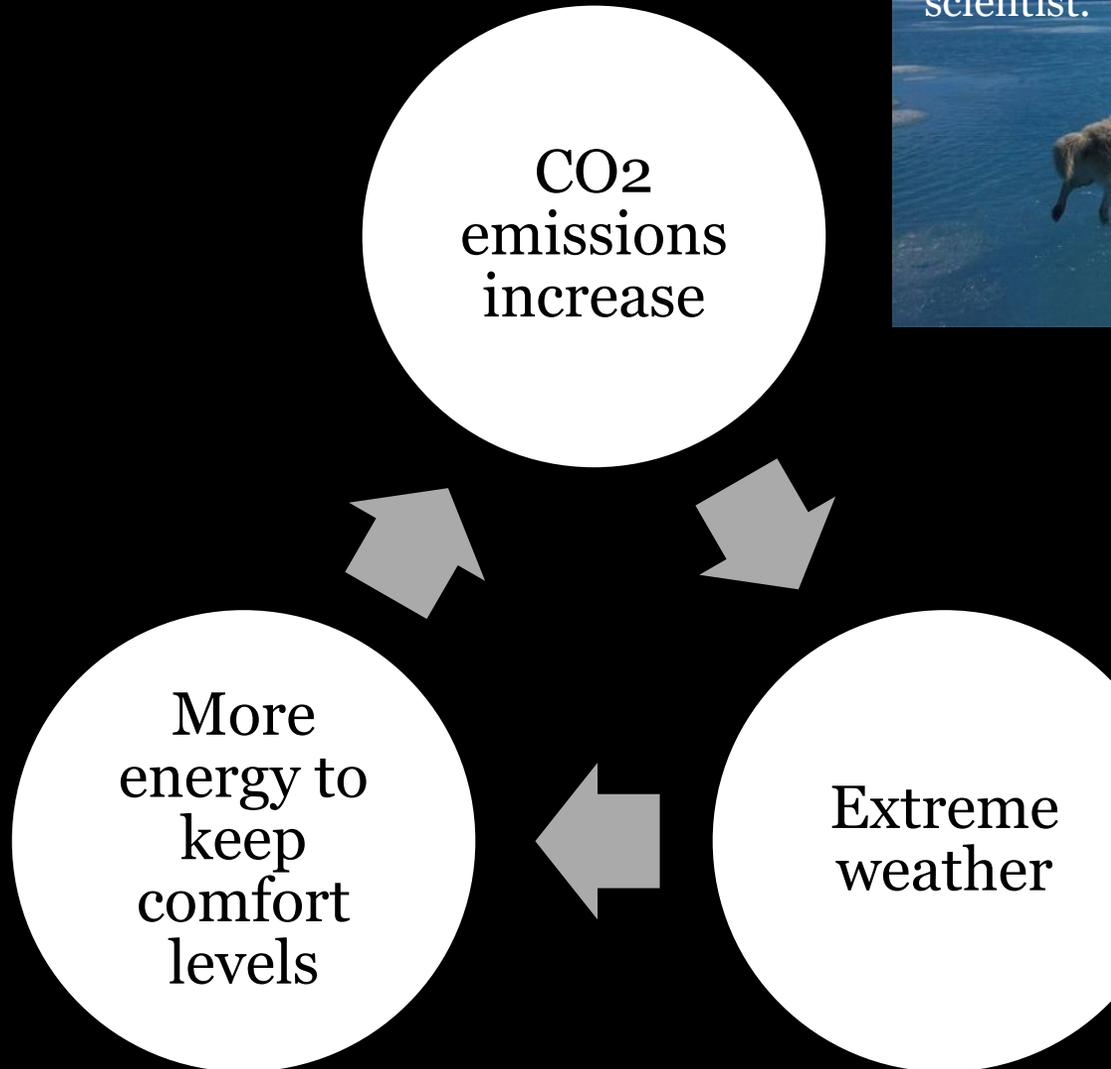
UKES 2019

Newcastle University

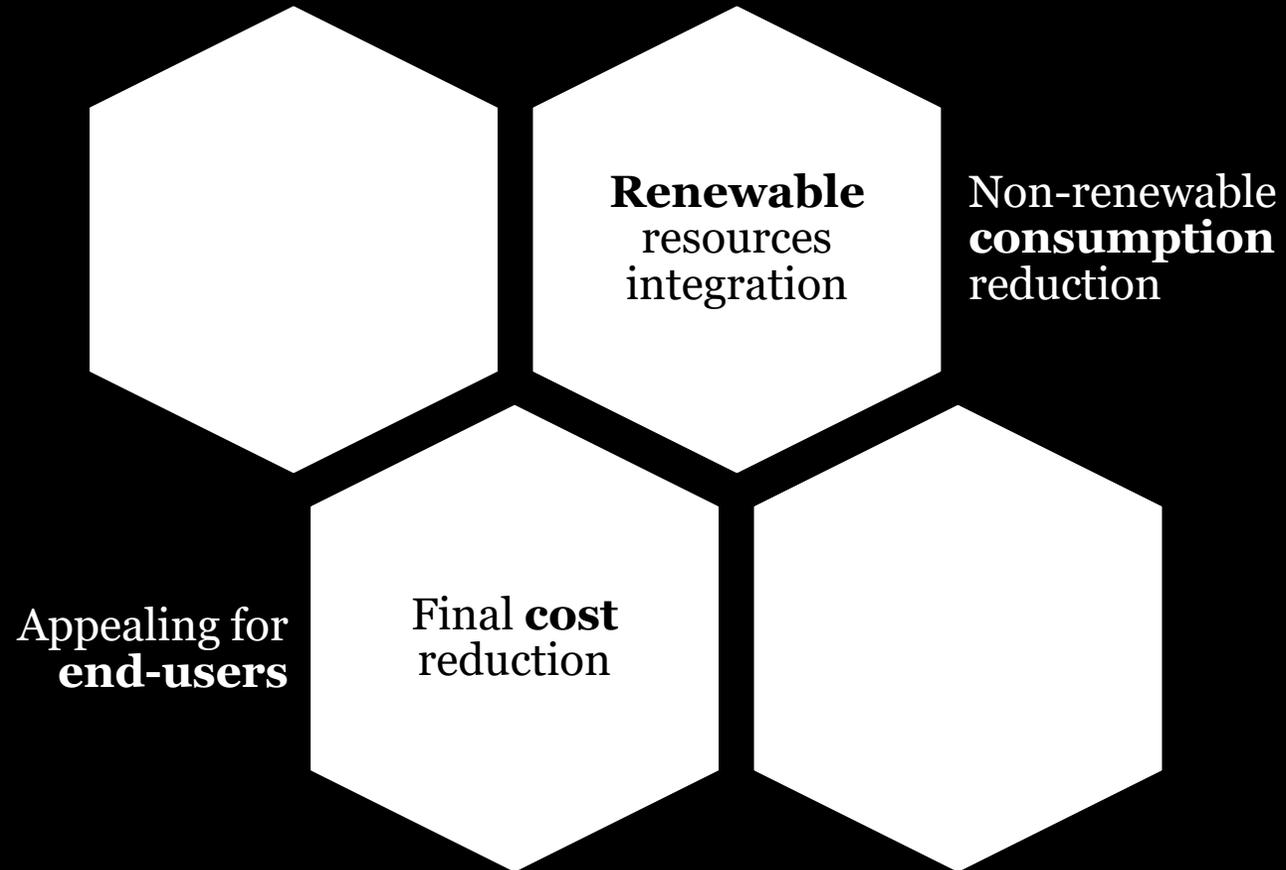
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A dangerous loop



ES can be a solution



ES challenges

1

Integration in buildings

- Additional tools
- Size and aesthetics

ES challenges

1

Integration in buildings

- Additional tools
- Size and esthetics



ES challenges

1

Integration in buildings

- Additional tools
- Size and esthetics



ES challenges

1

Integration in buildings

- Additional tools
- Size and esthetics

2

Affordability

- Life cycle
- Loss of efficiency



ES challenges

1

Integration in buildings

- Additional tools
- Size and esthetics

2

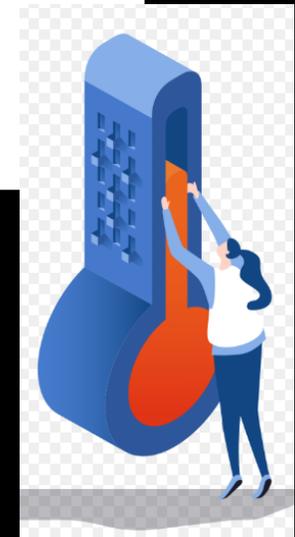
Affordability

- Life cycle
- Loss of efficiency

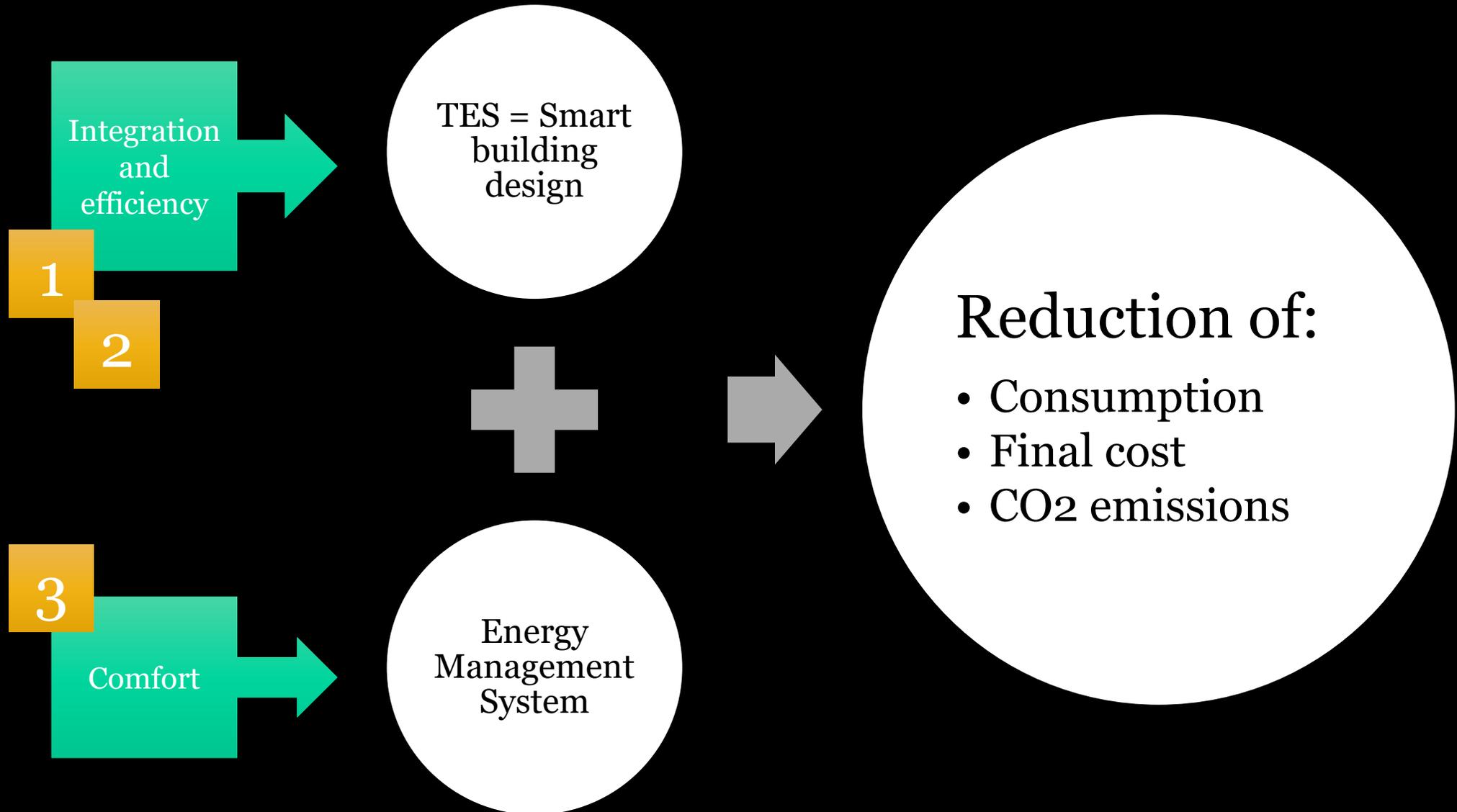
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Comfort

- Indoor temperature



Our contribution: smart house with sustainable heating/cooling system



Our contribution: smart house with sustainable heating/cooling system



Traditional house

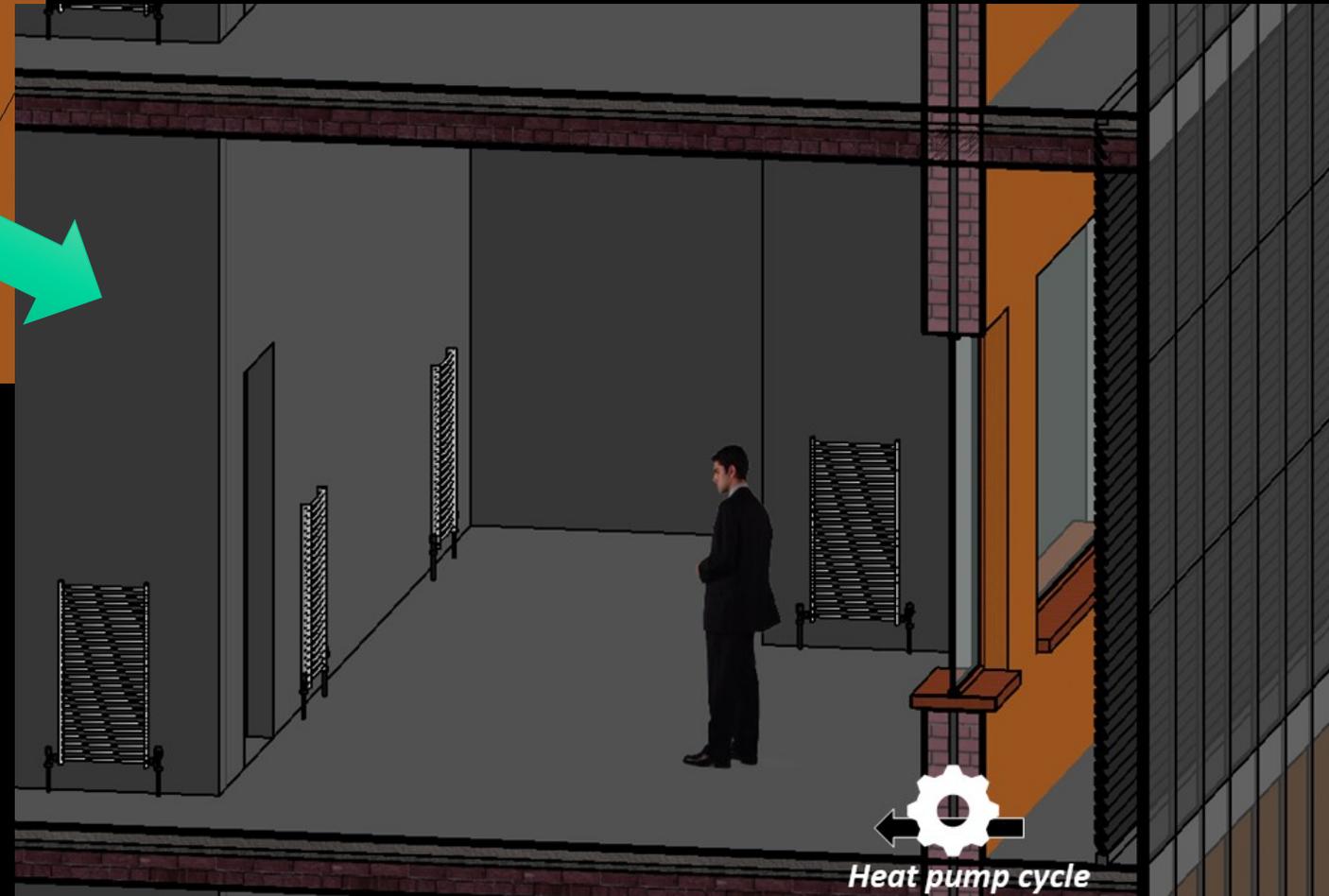
Our contribution: smart house with sustainable heating/cooling system



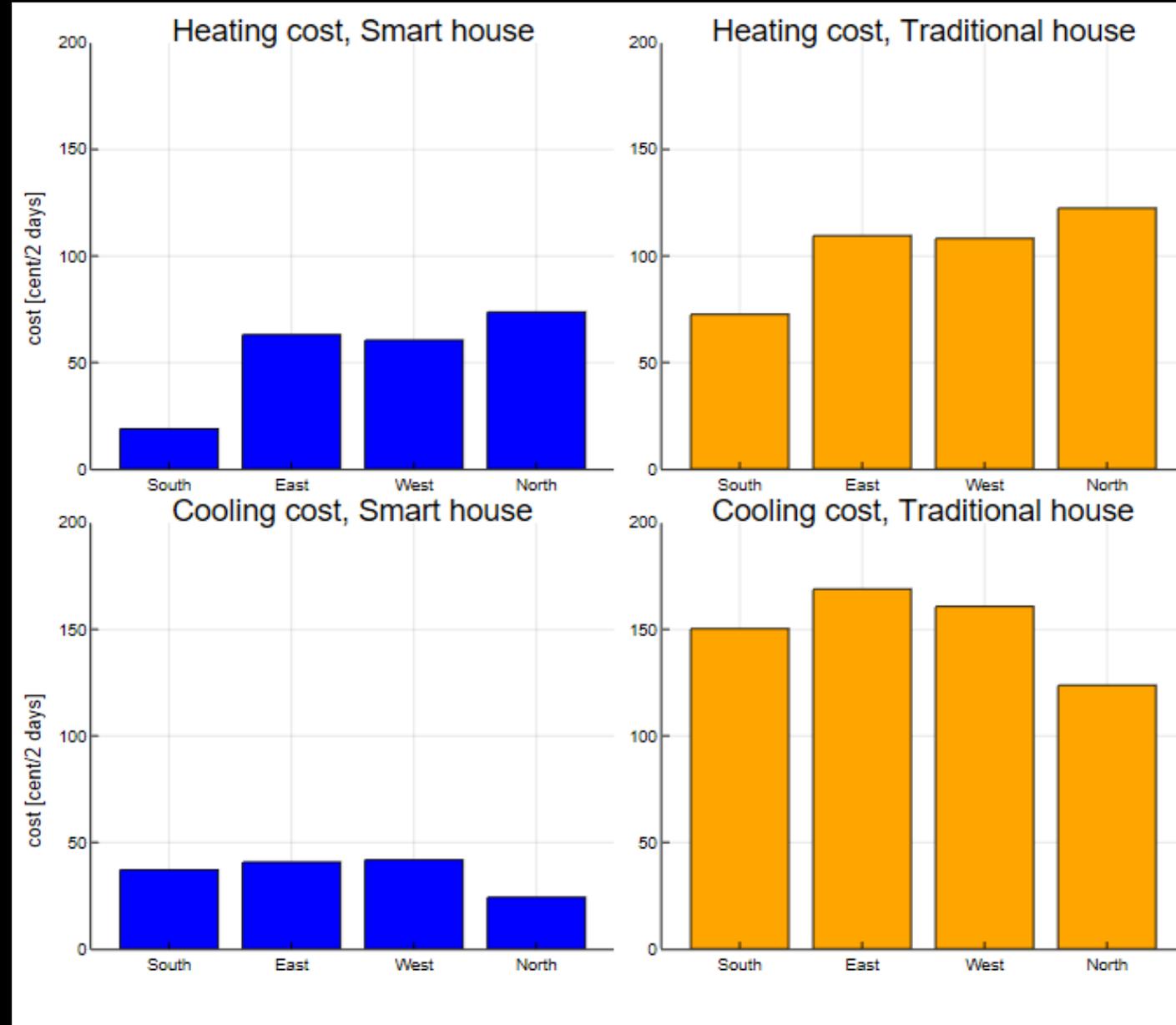
Traditional house



Smart house:
Double skin façade + smart shading + EMS



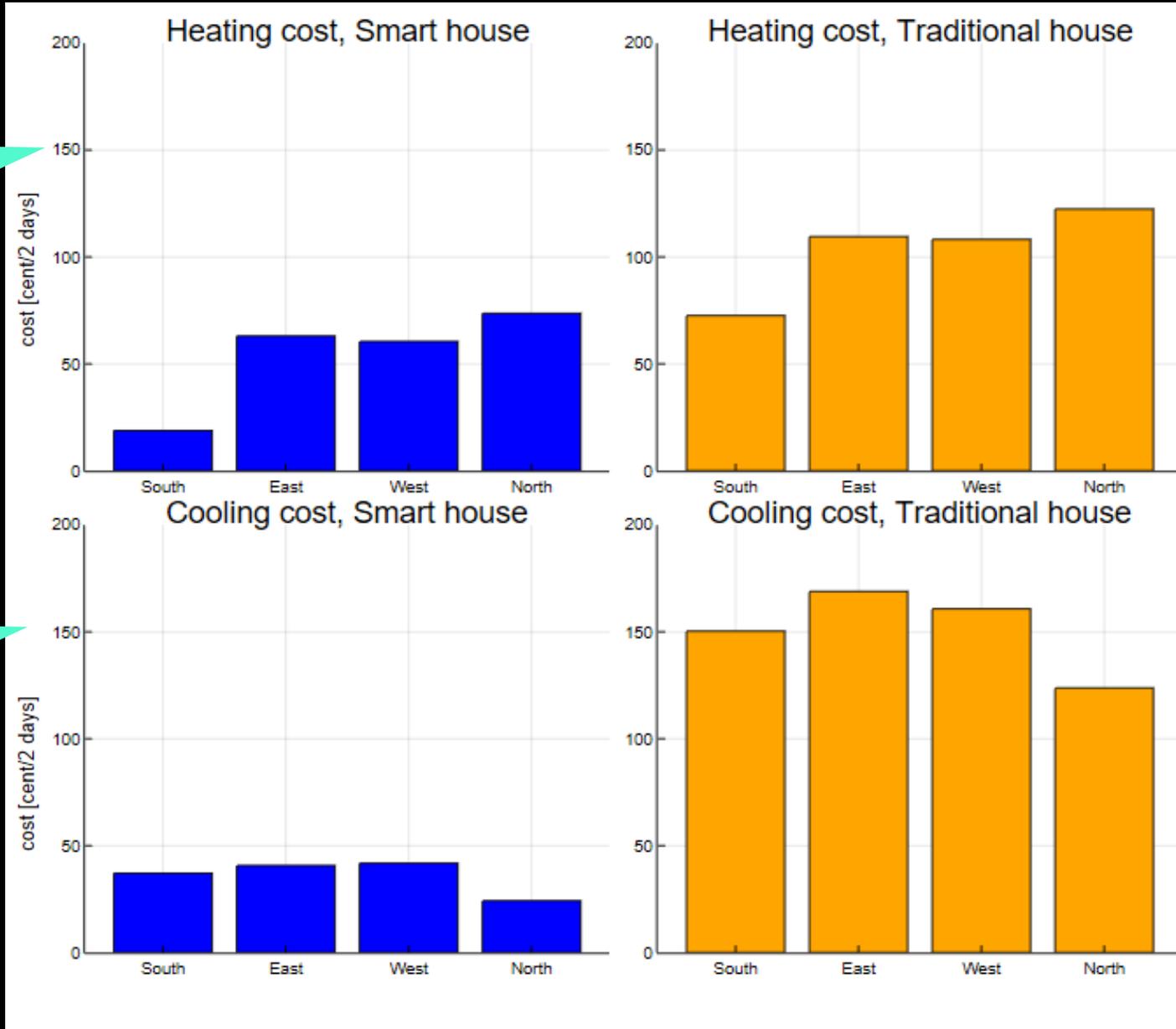
The results: heating/cooling cost reduction



The results: heating/cooling cost reduction

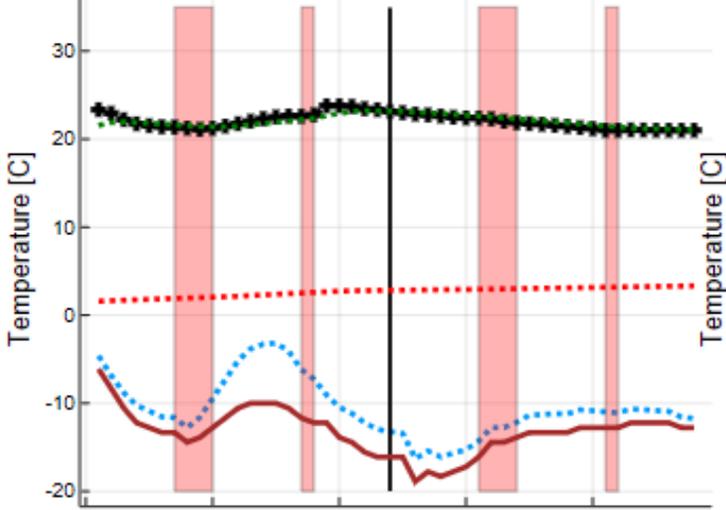
50 % less

76 % less

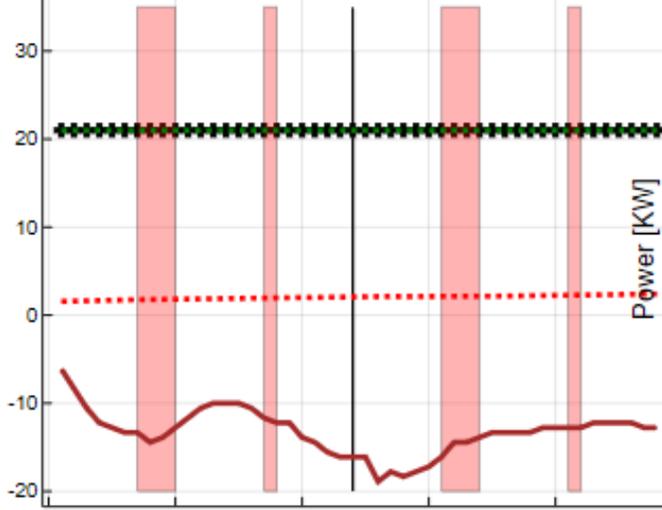


The results: heating/cooling consumption reduction

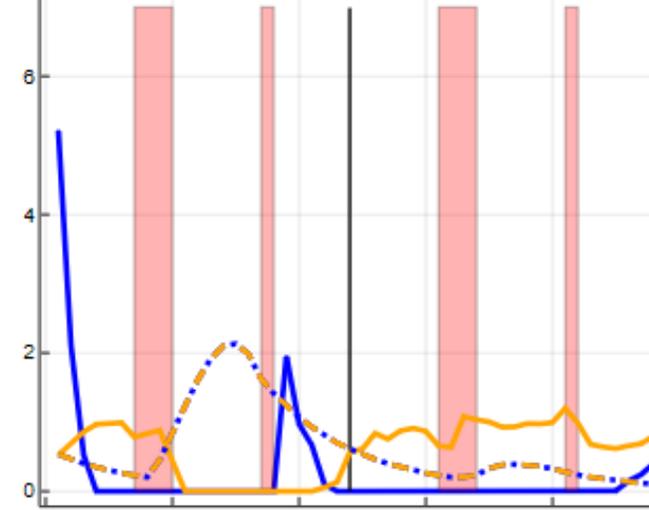
Winter temperatures of Smart house, South



Winter temperatures of Trad, South

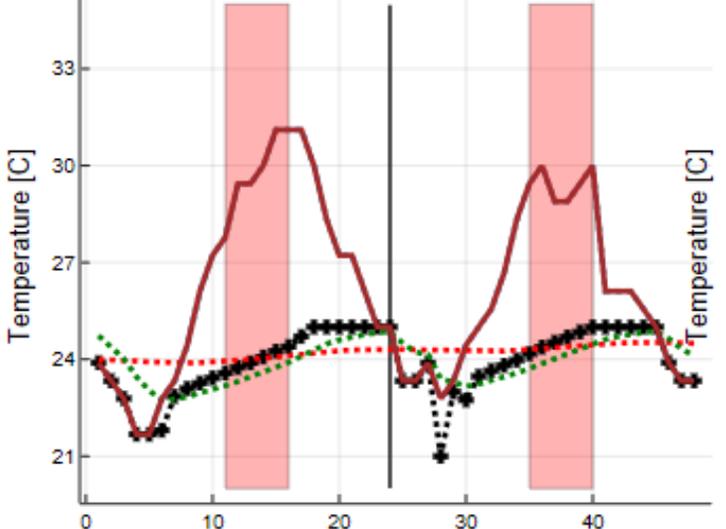


Smart vs Traditional house, heating

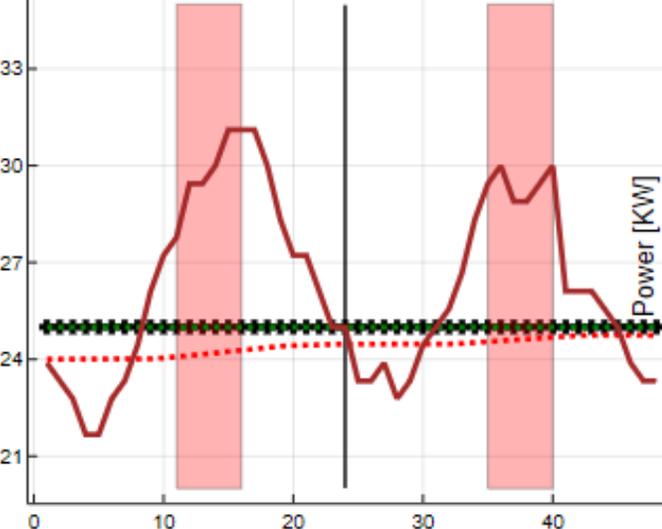


- Air-cavity
- Living zone
- Ext wall
- Internal walls and floors
- Outside
- Smart house
- Trad
- Solar gains into living zone, DYN
- Solar gains into living zone, Trad

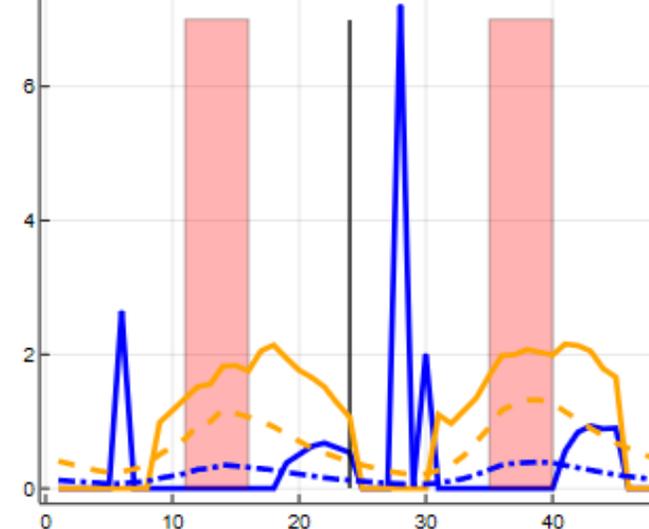
Summer temperatures of Smart house, South



Summer temperatures of Trad, South

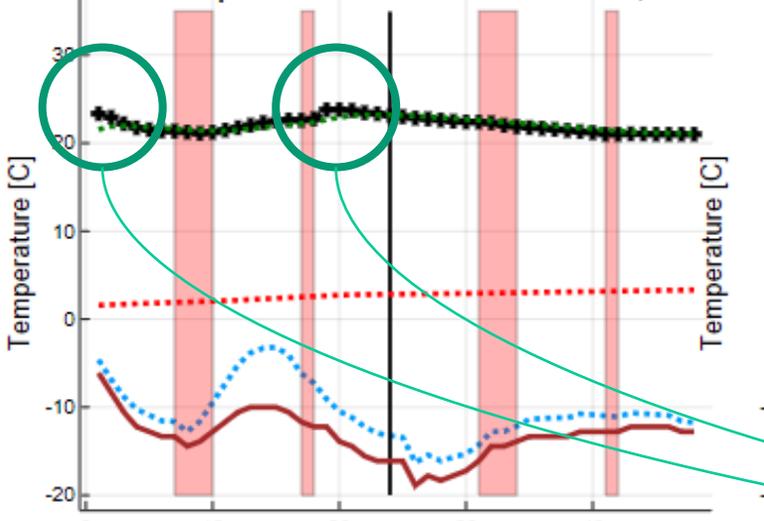


Smart vs Traditional house, cooling

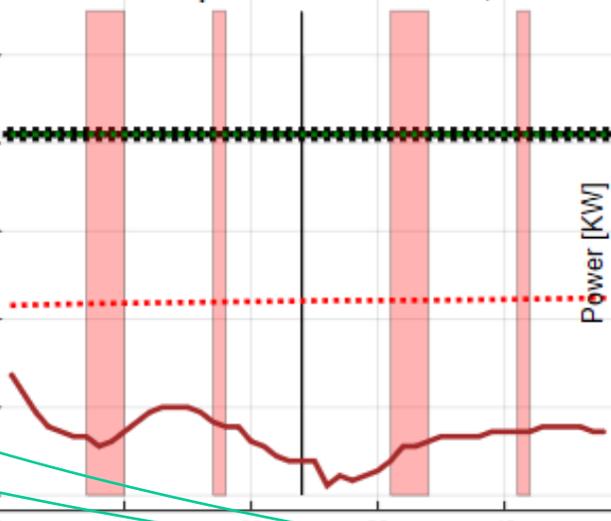


The results: heating/cooling consumption reduction

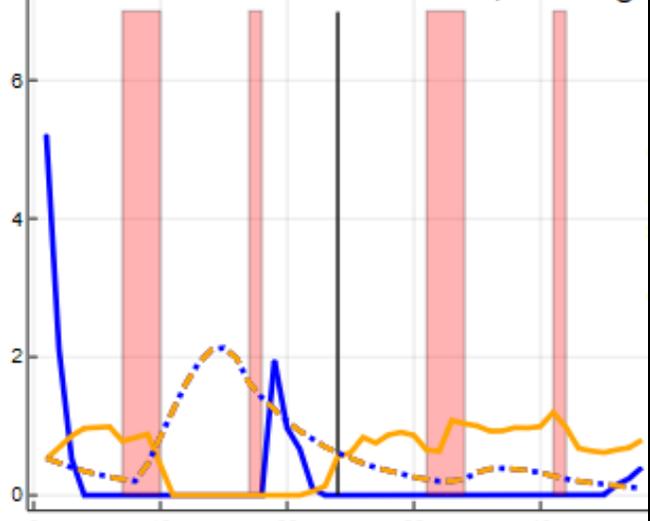
Winter temperatures of Smart house, South



Winter temperatures of Trad, South

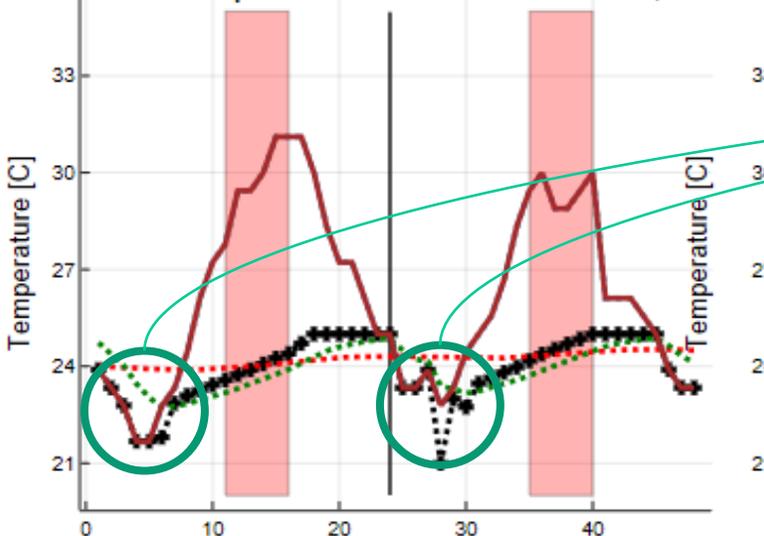


Smart vs Traditional house, heating

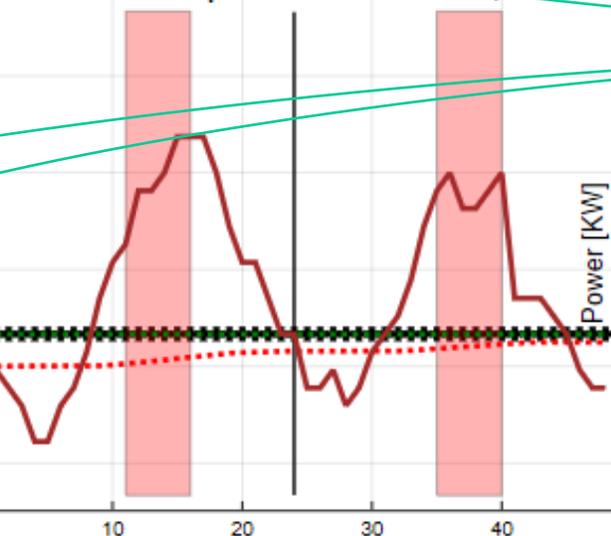


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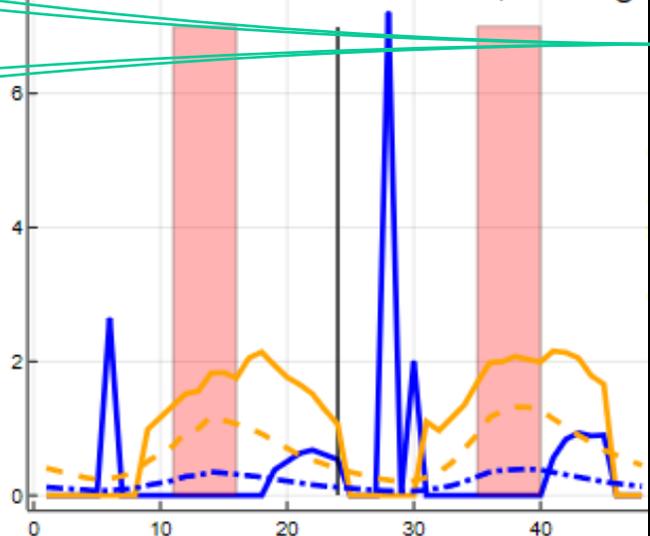
Summer temperatures of Smart house, South



Summer temperatures of Trad, South



Smart vs Traditional house, cooling



House – Thermal storage

Conclusion

To reduce the energy consumption of the house:

Key-concept

$$\text{House} = \text{TES}$$

Conclusion

House = TES

Level of capacity
connected to a temperature

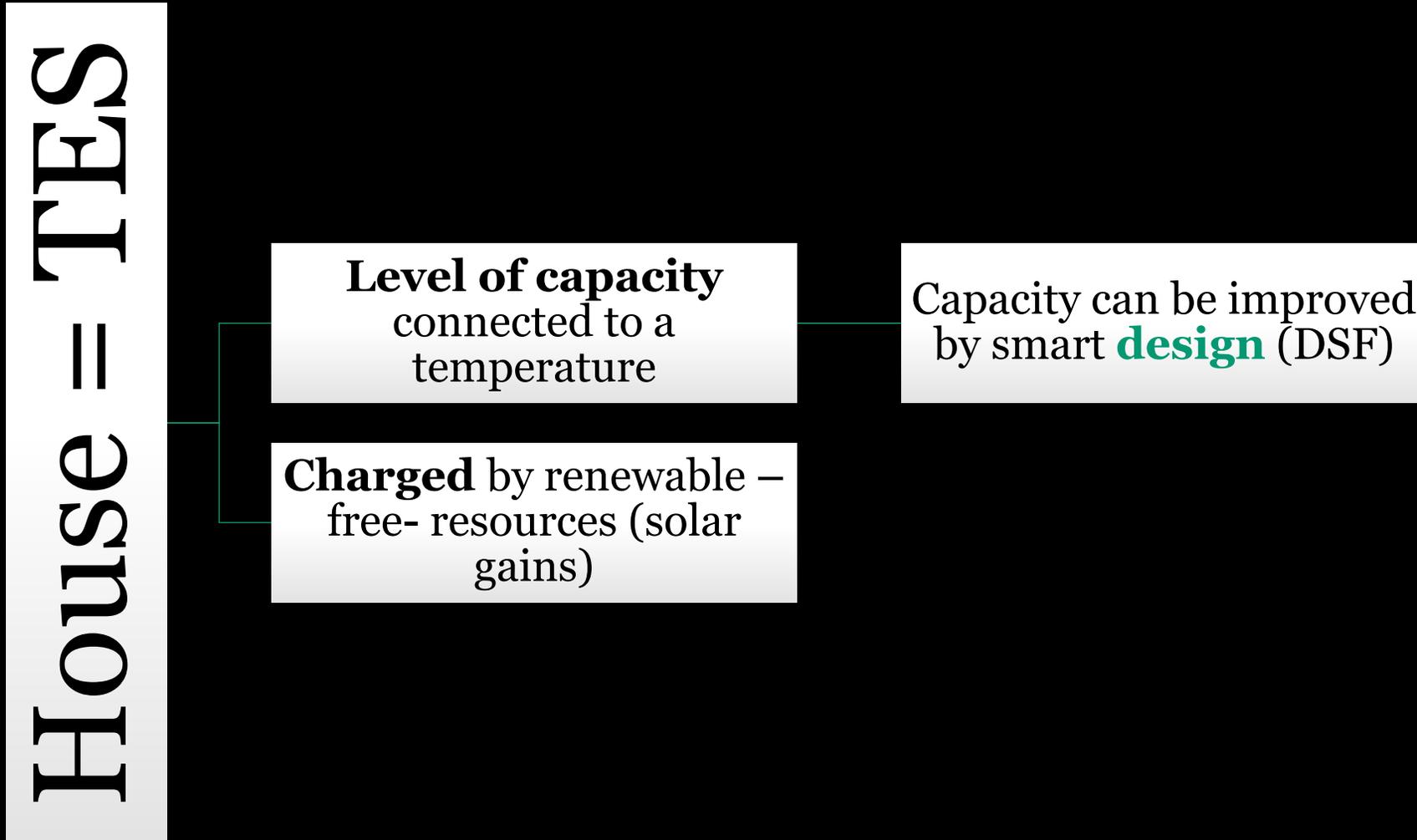
Conclusion

House = TES

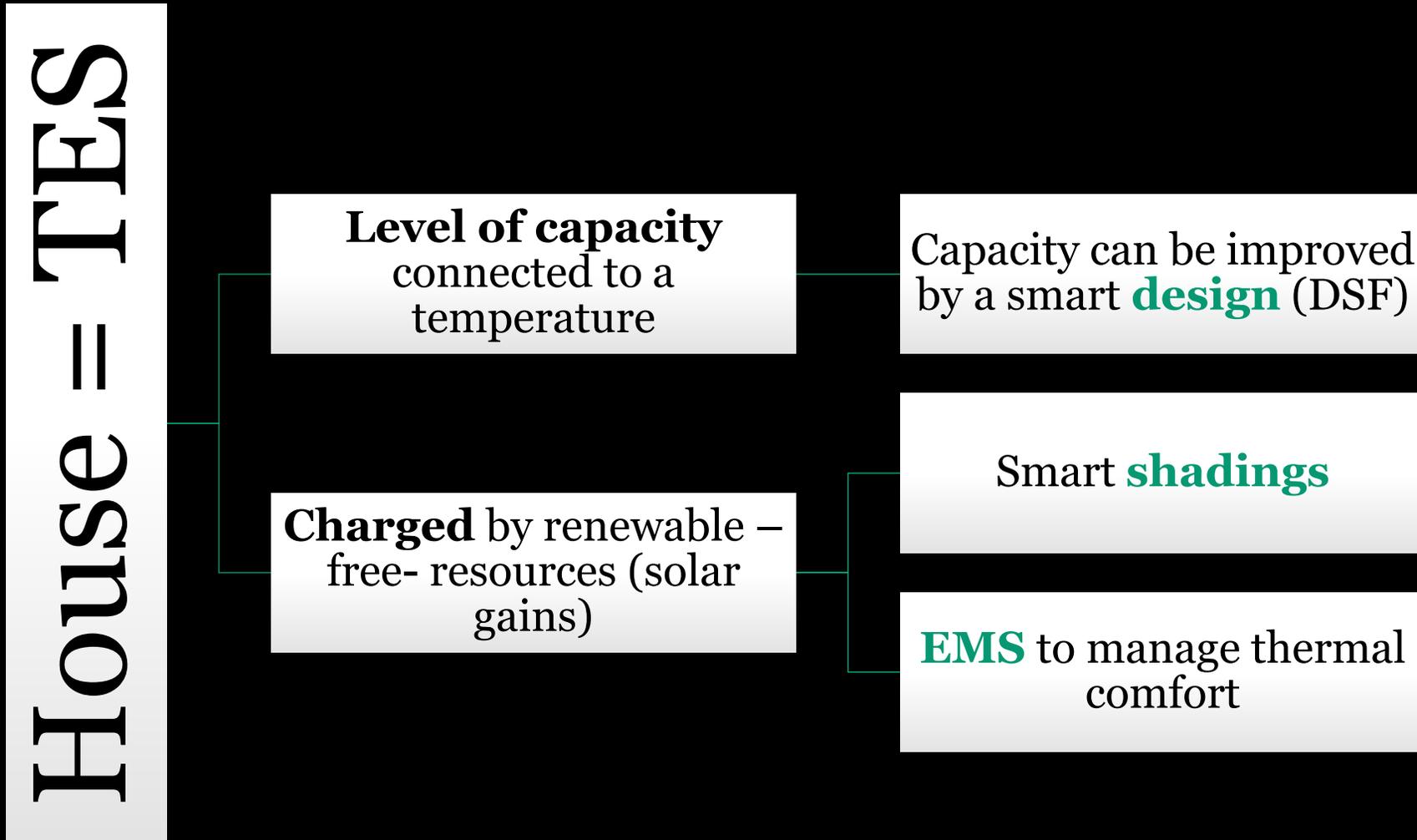
Level of capacity
connected to a
temperature

Capacity can be improved
by smart **design** (DSF)

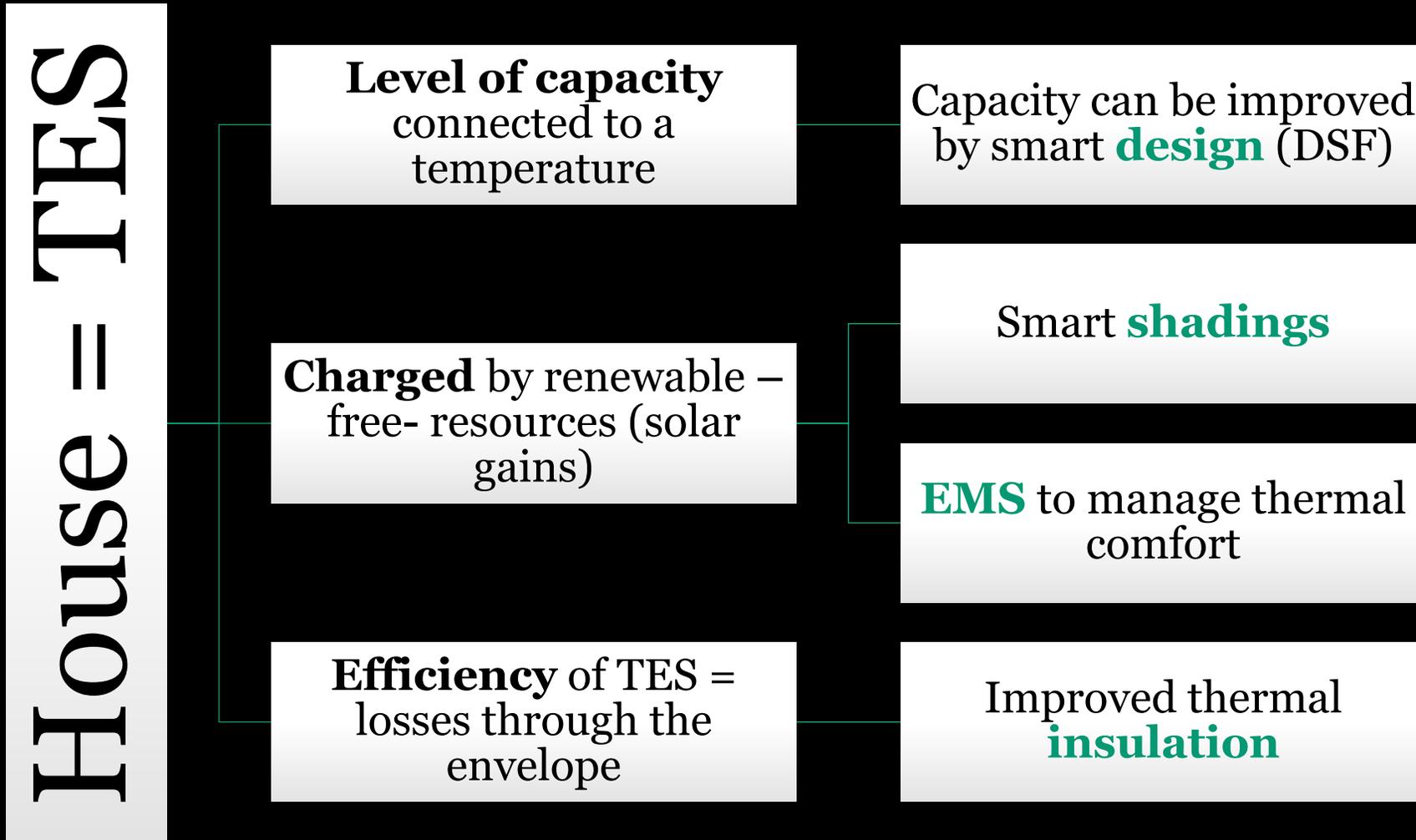
Conclusion



Conclusion



Conclusion



Thank you !

