

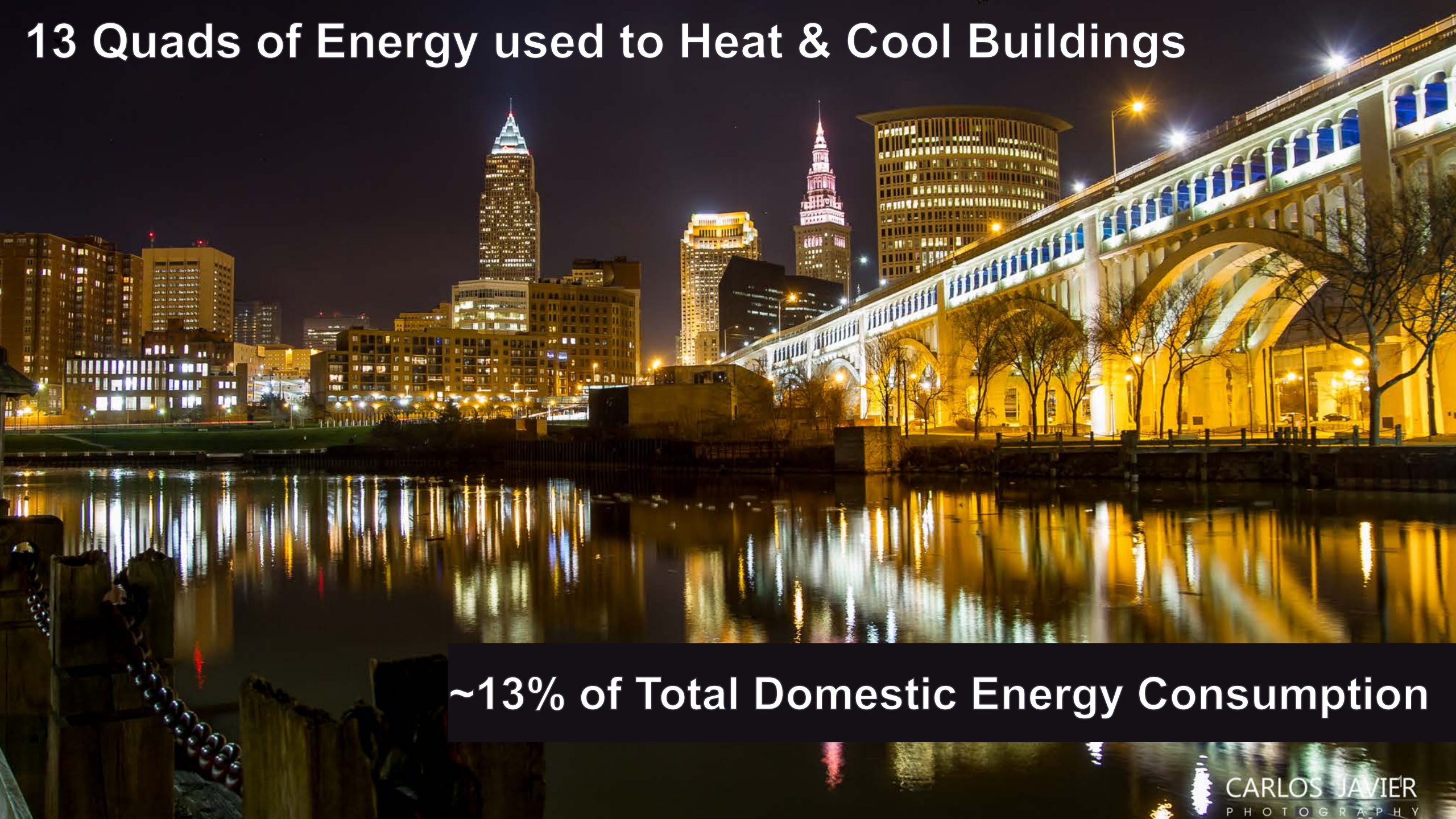
# **Smarter Structures:** Synchronizing Building Envelope Technologies

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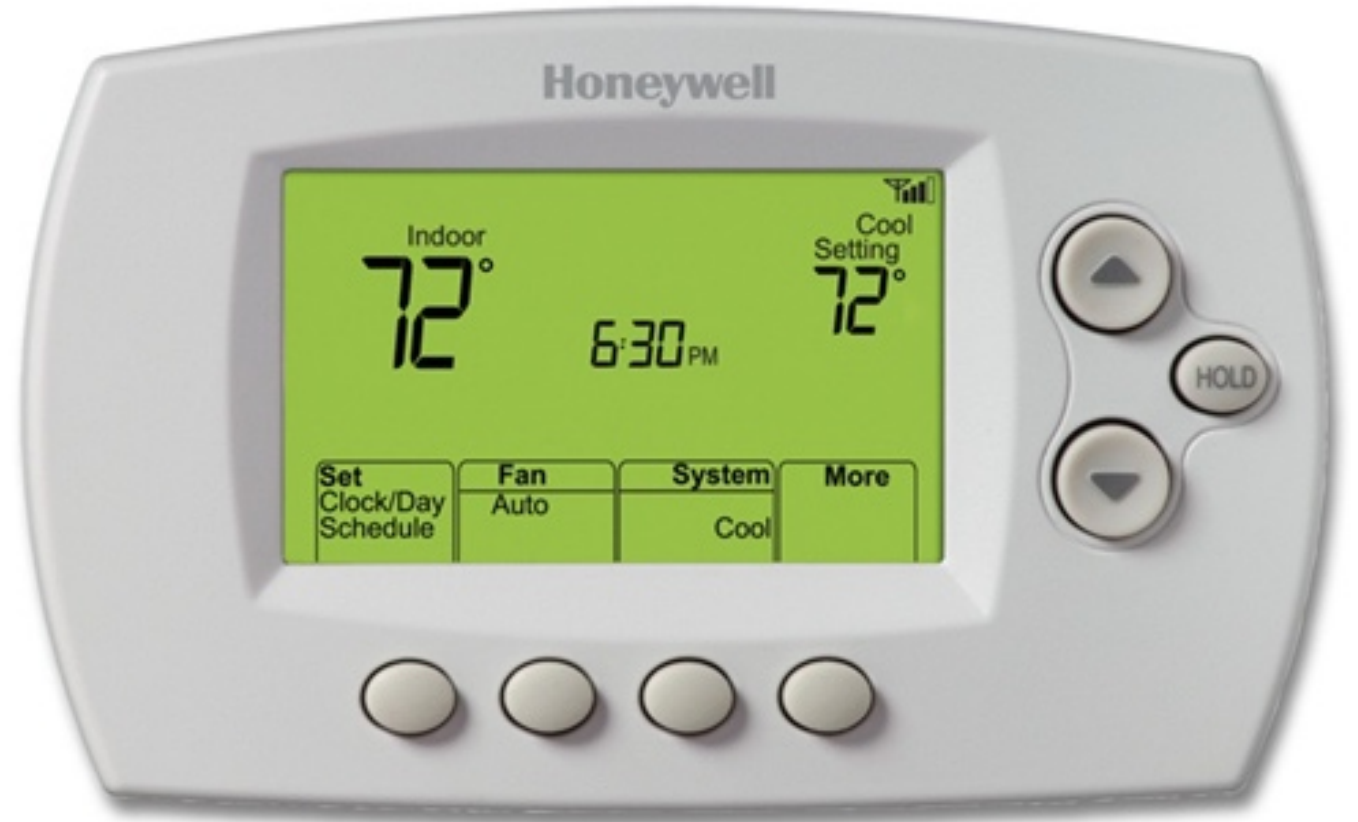
# 13 Quads of Energy used to Heat & Cool Buildings



~13% of Total Domestic Energy Consumption

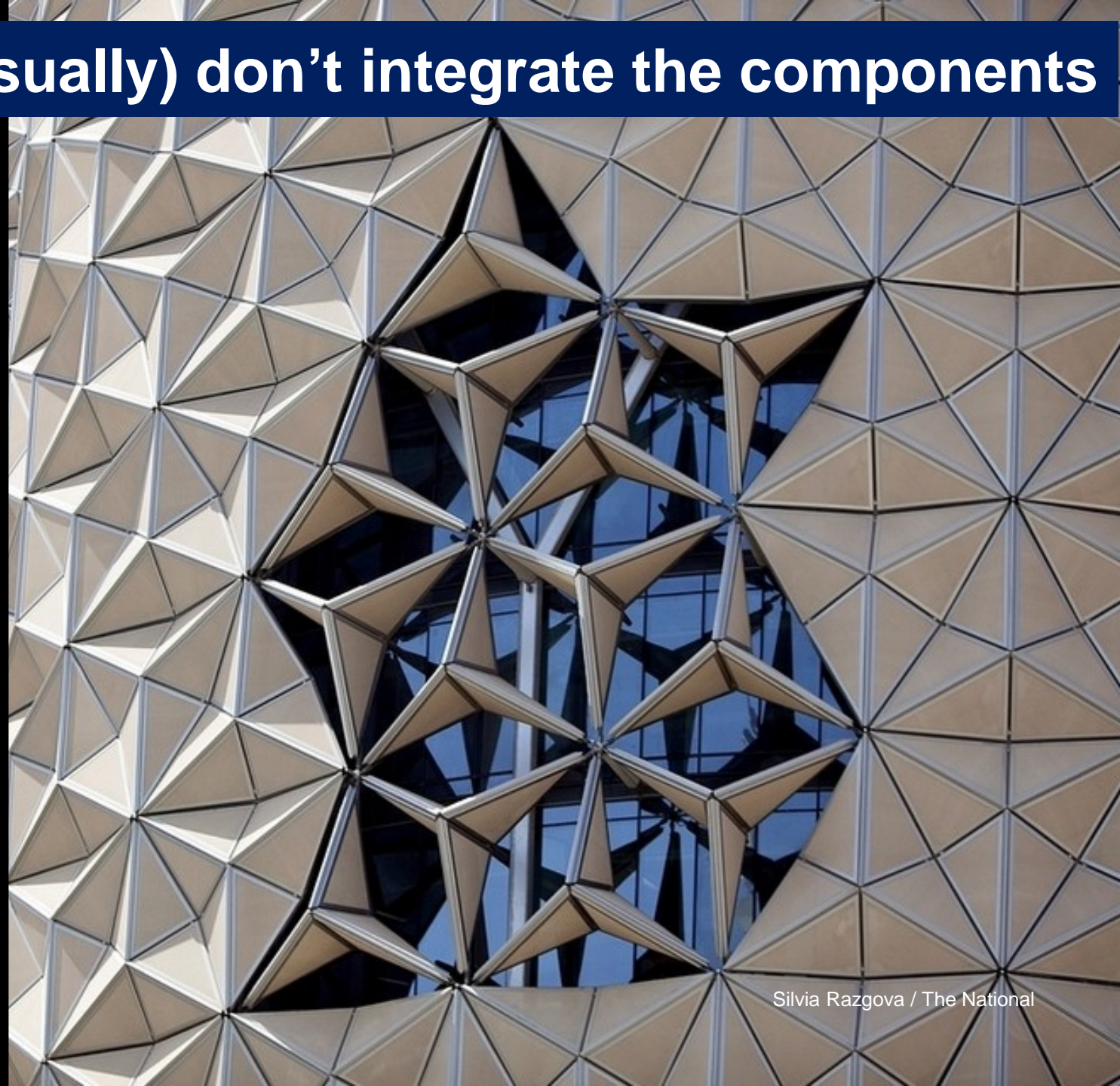


# We modify building envelopes all the time...



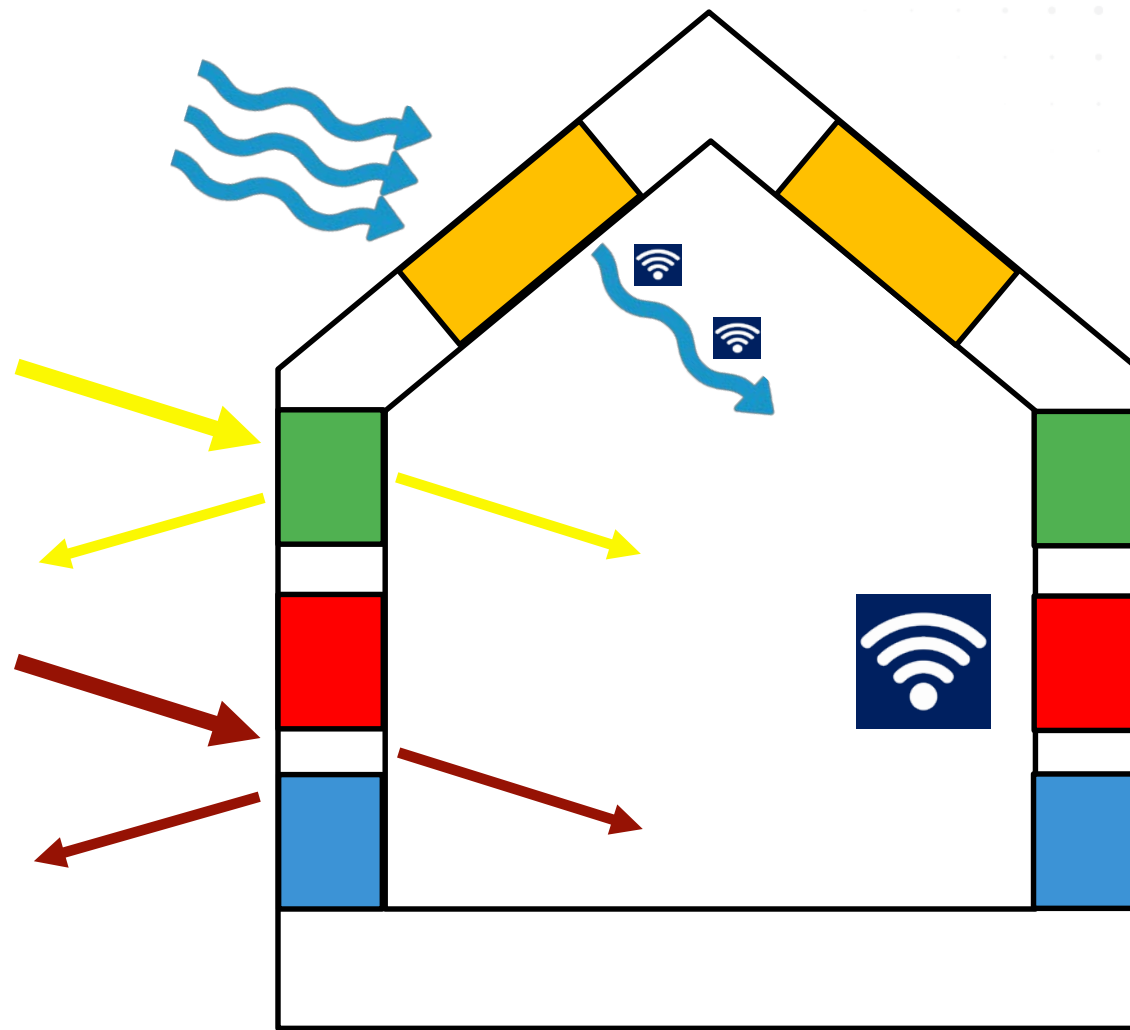
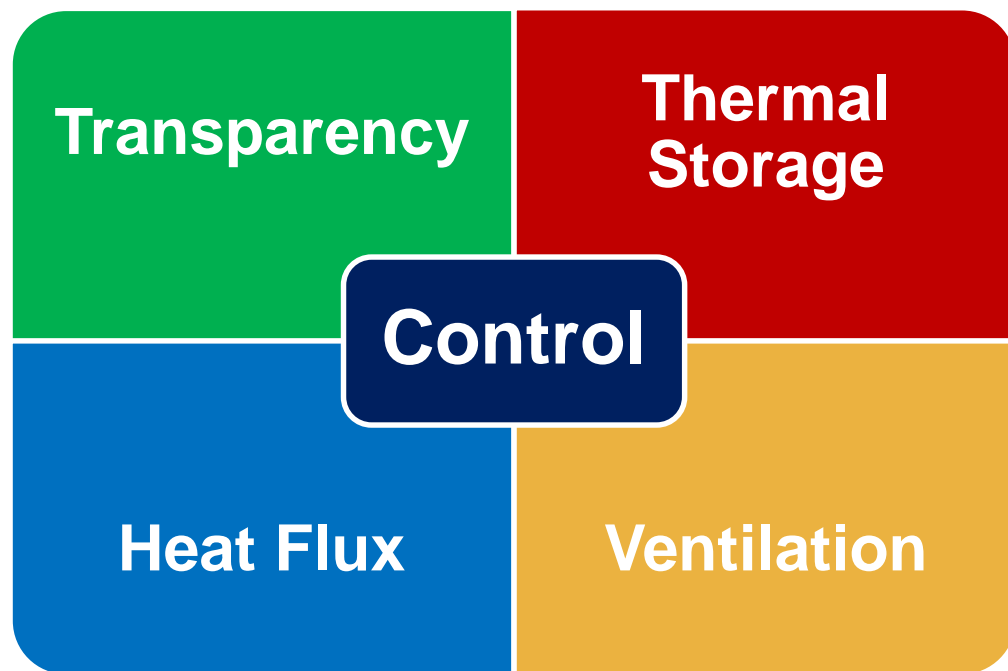


...but we (usually) don't integrate the components





# Ways in which envelope technologies can manipulate energy flow

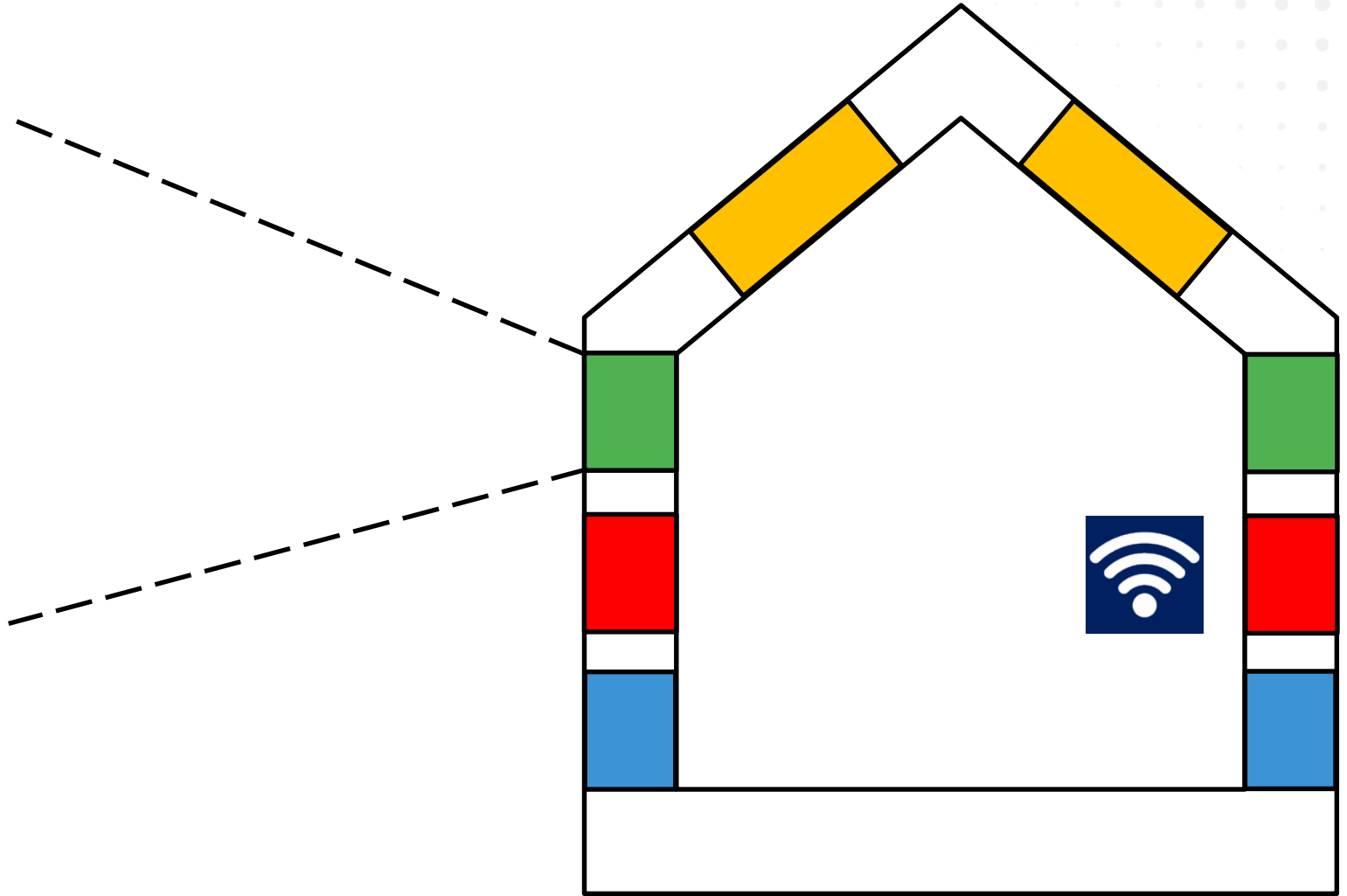


# Ways in which envelope technologies can manipulate energy

## Transparency

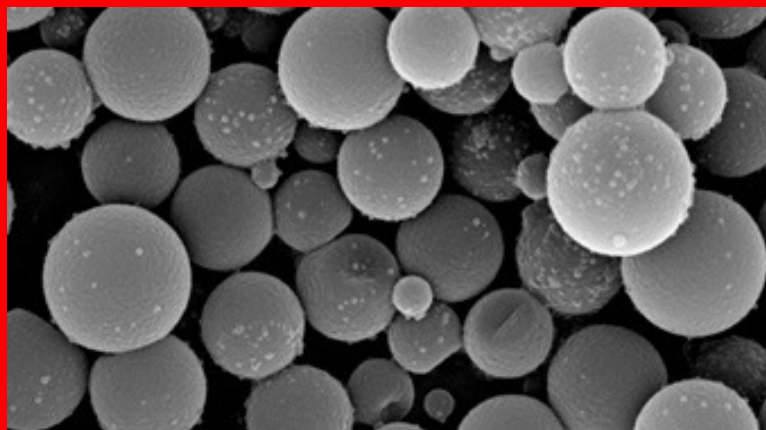


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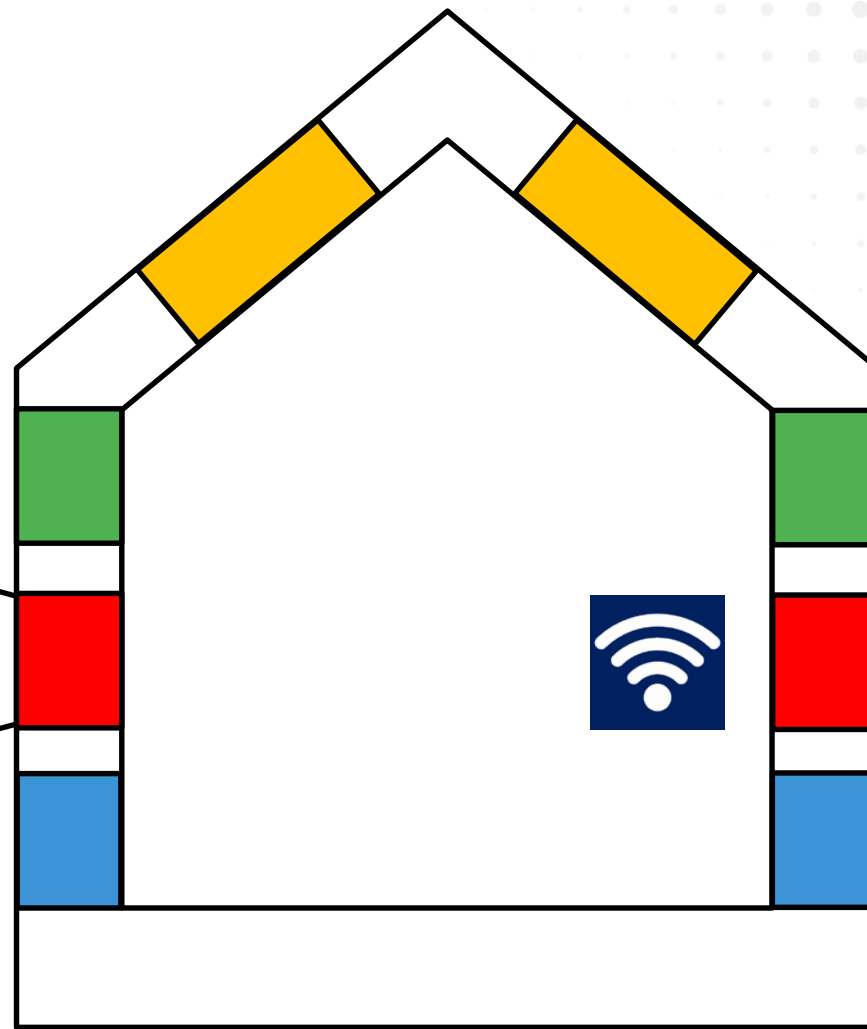


# Ways in which envelope technologies can manipulate energy

## Thermal Storage



MikroCaps

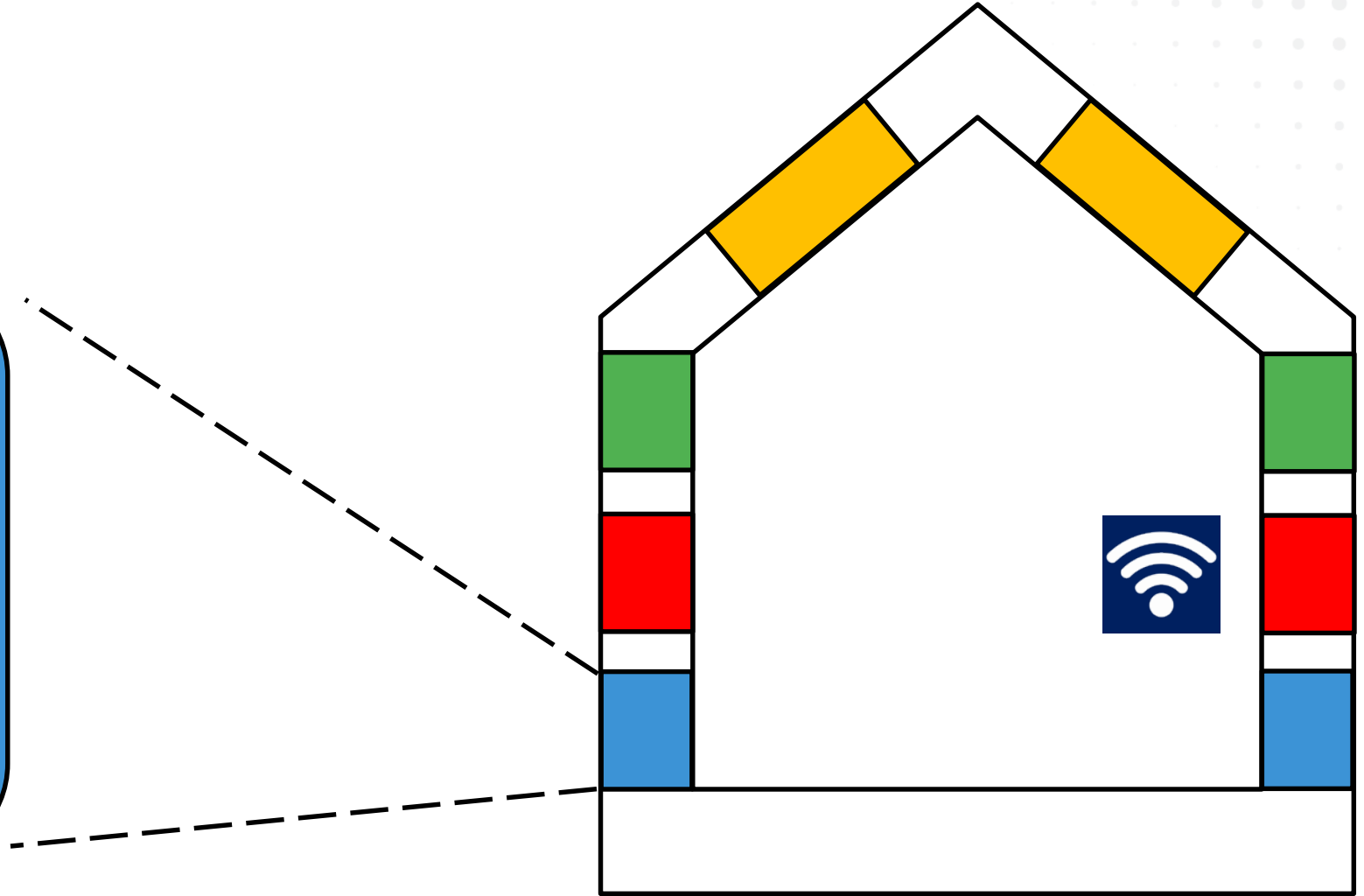


# Ways in which envelope technologies can manipulate energy

## Heat Flux

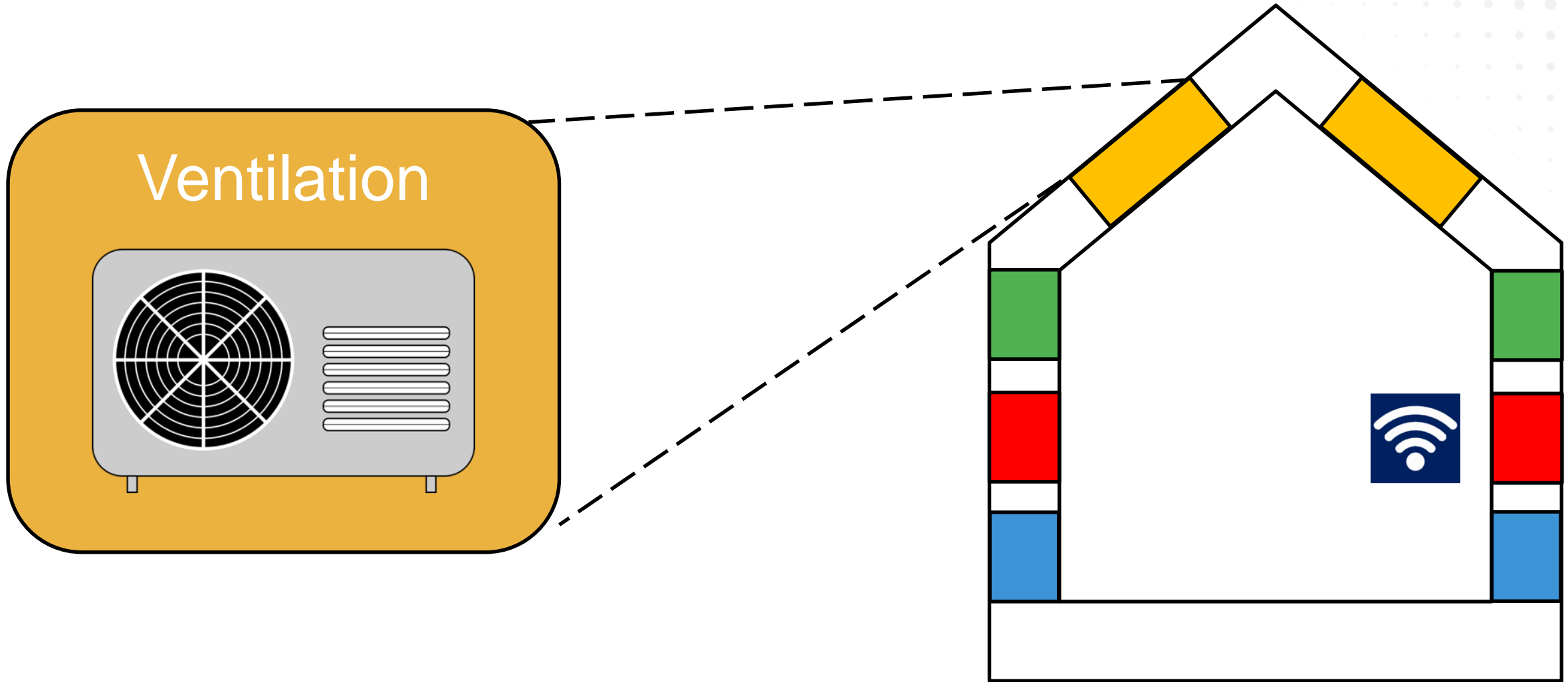


EnergyFlo

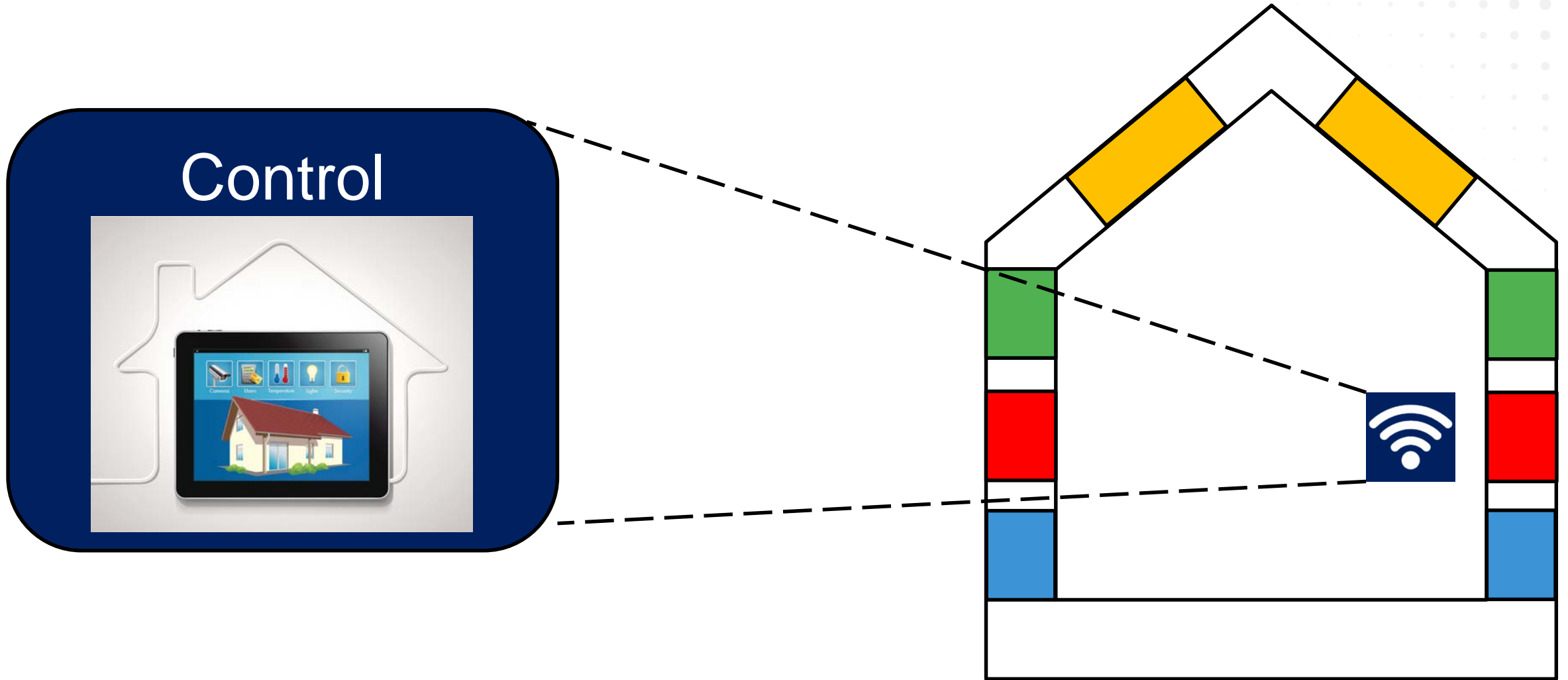




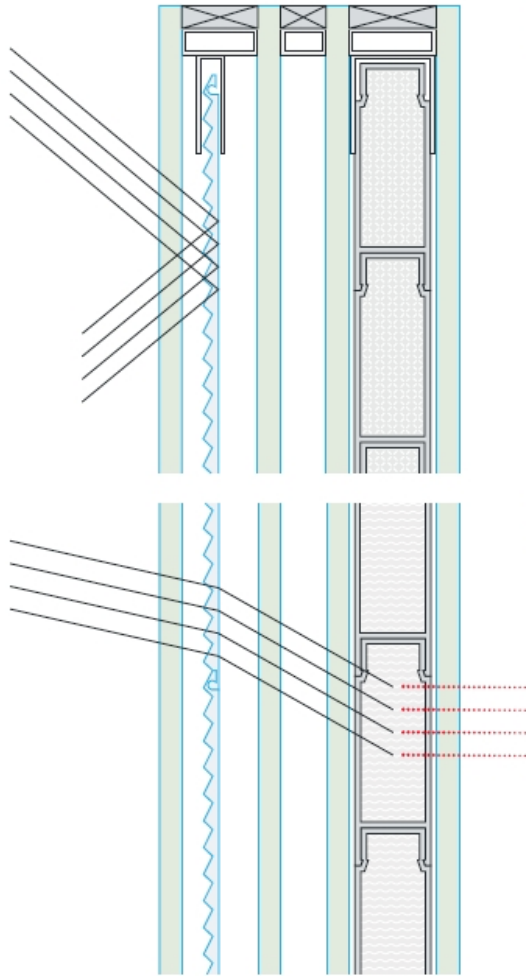
# Ways in which envelope technologies can manipulate energy



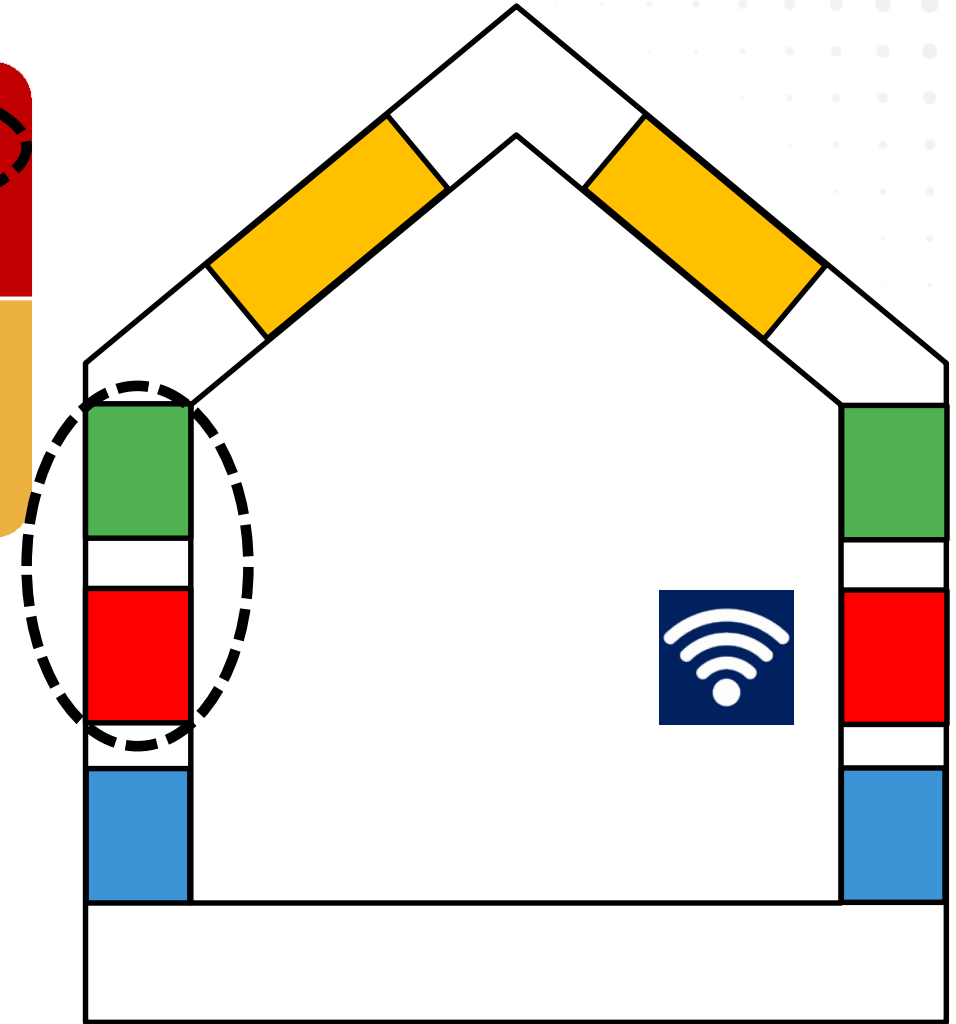
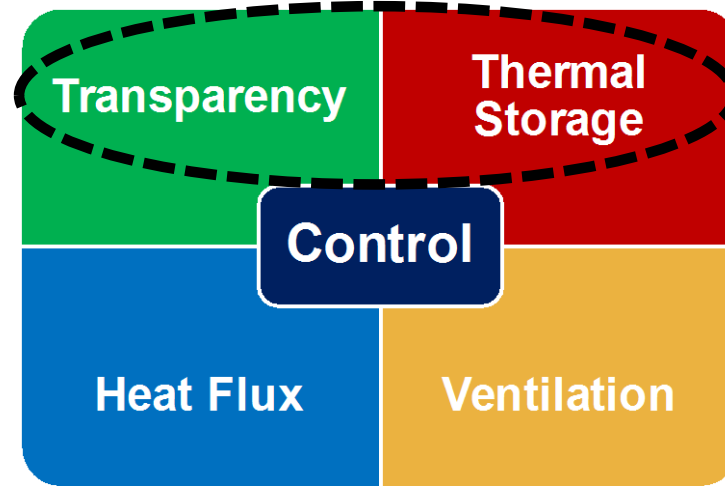
# Ways in which envelope technologies can manipulate energy



# Recent examples of systems integration

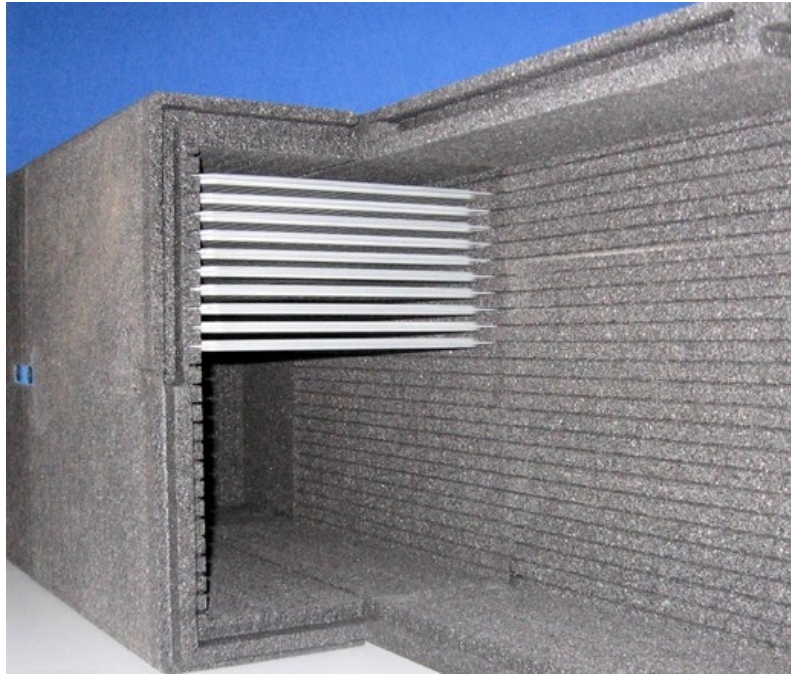


GlassX AG

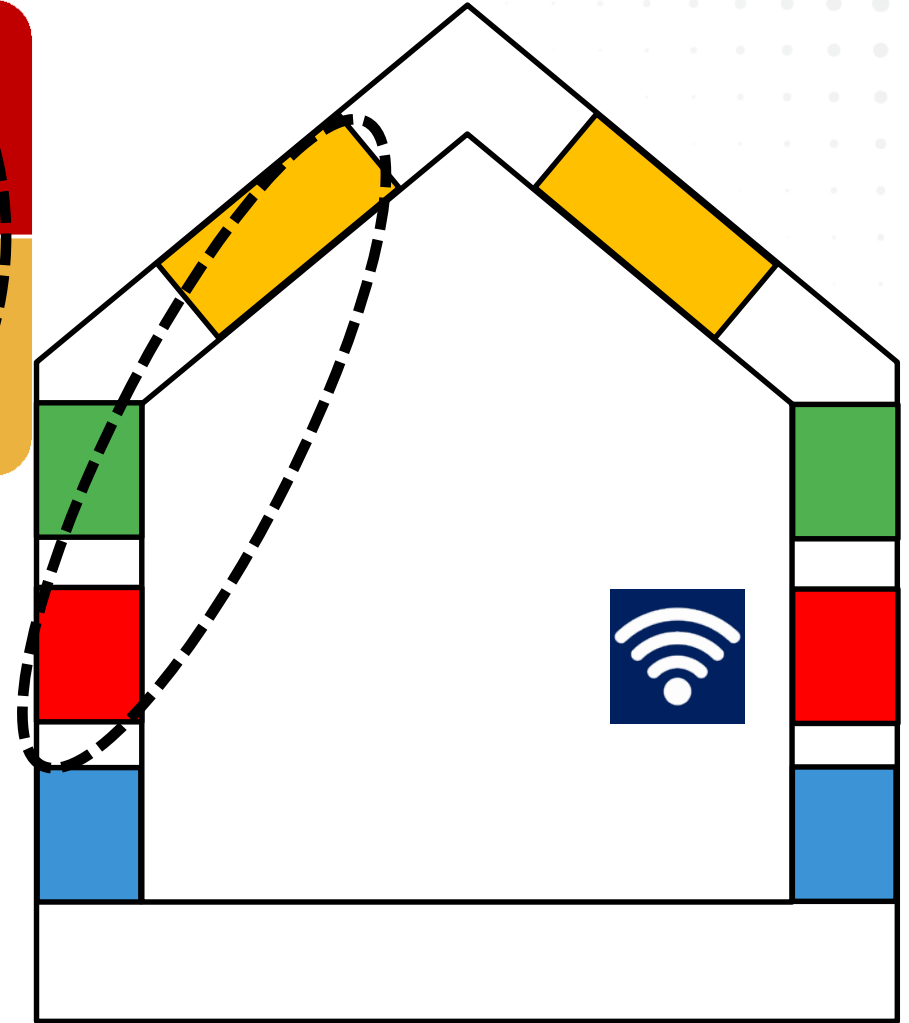
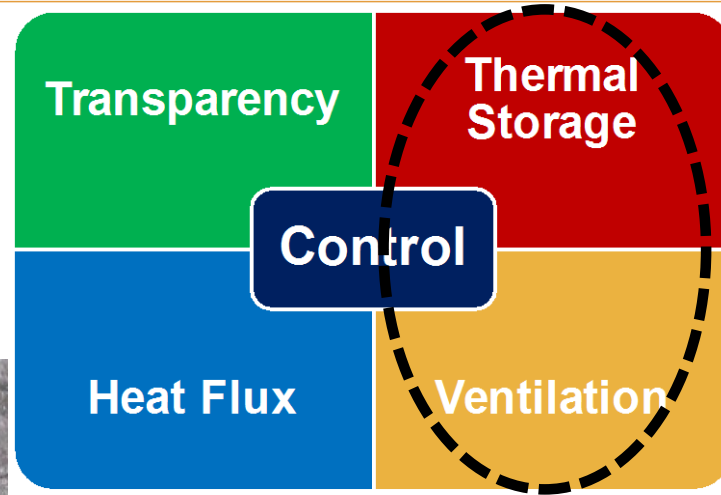




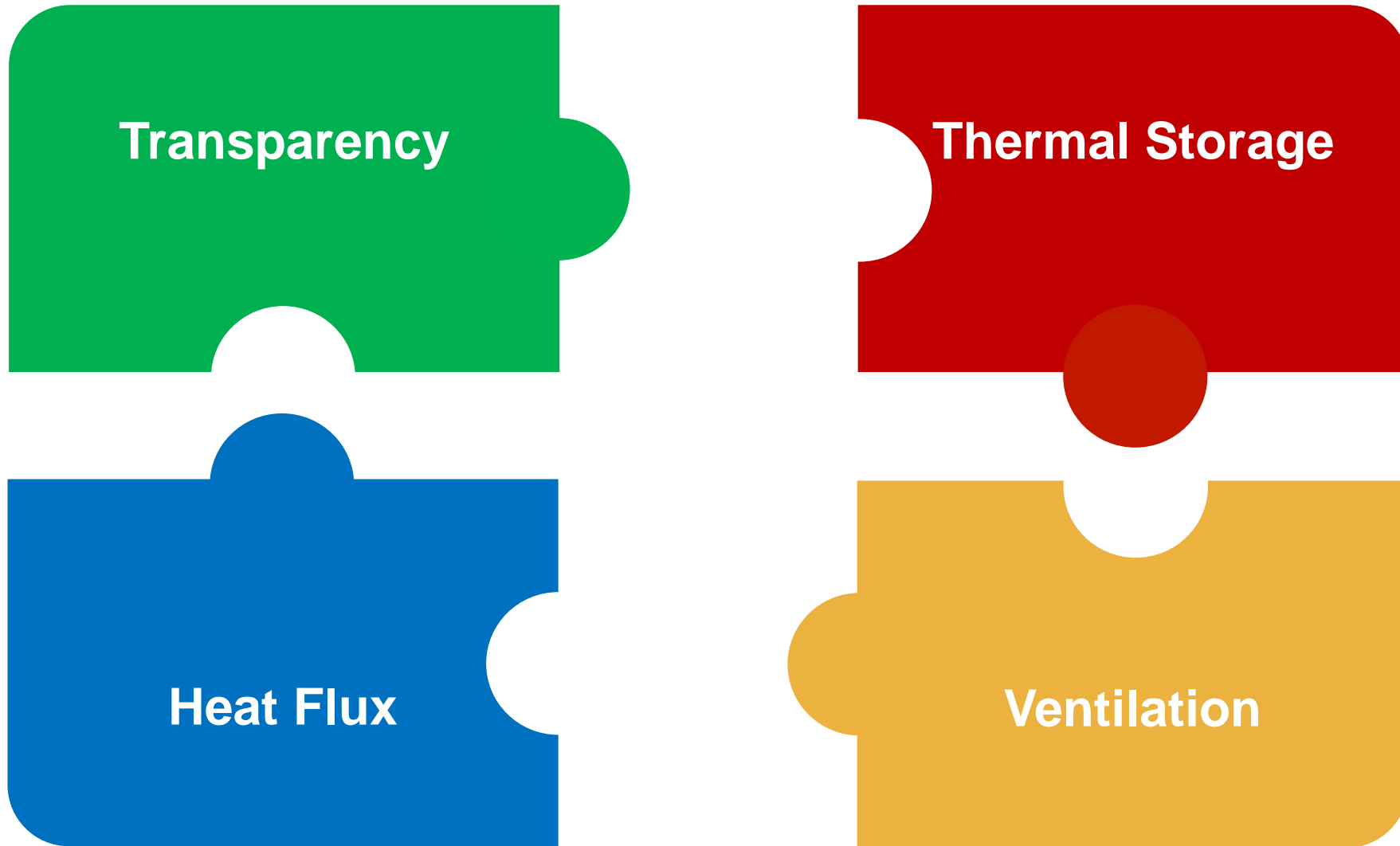
# Recent examples of systems integration



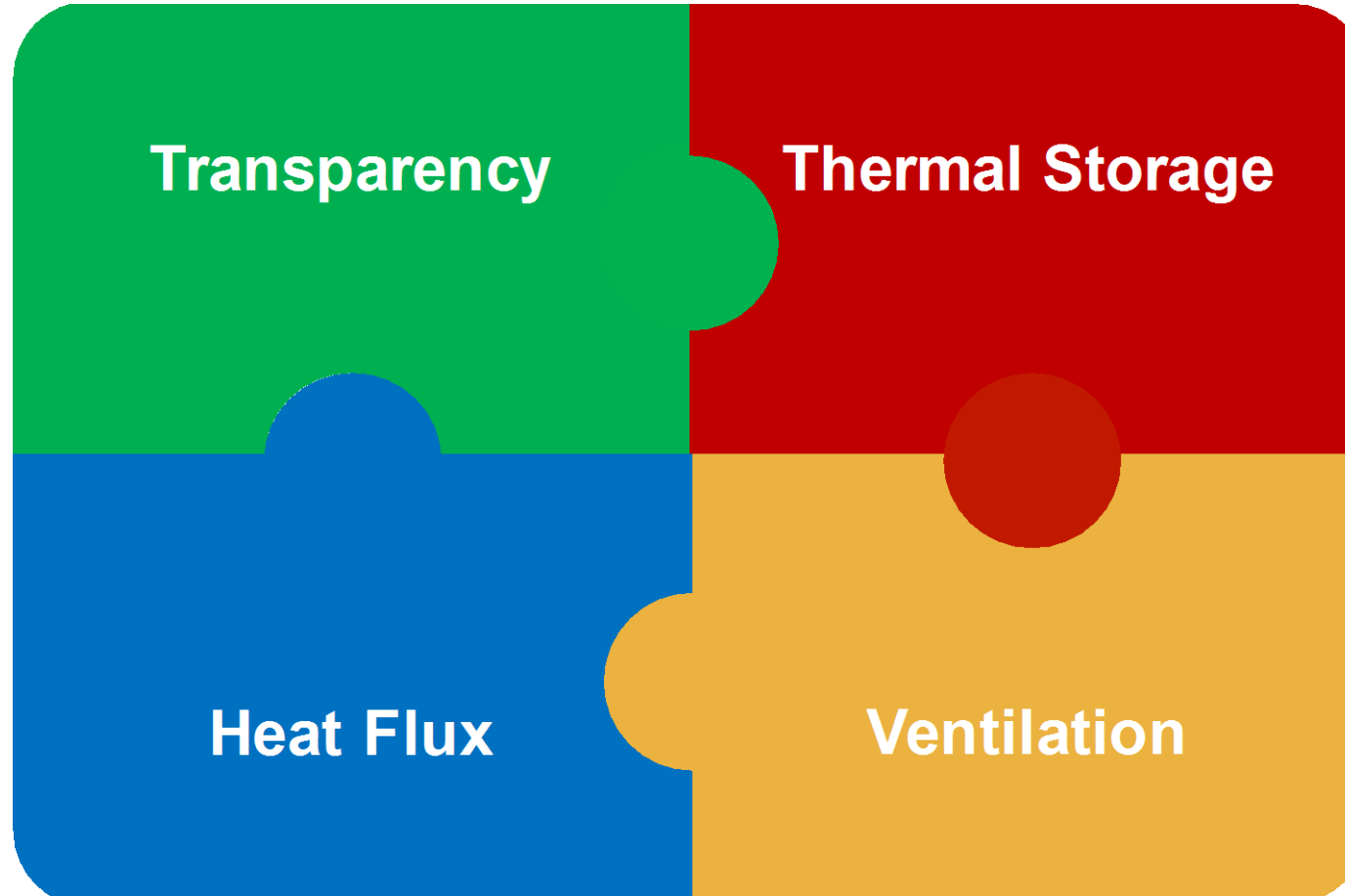
Rubitherm Technologies GmbH



# Envisioning a truly integrated system



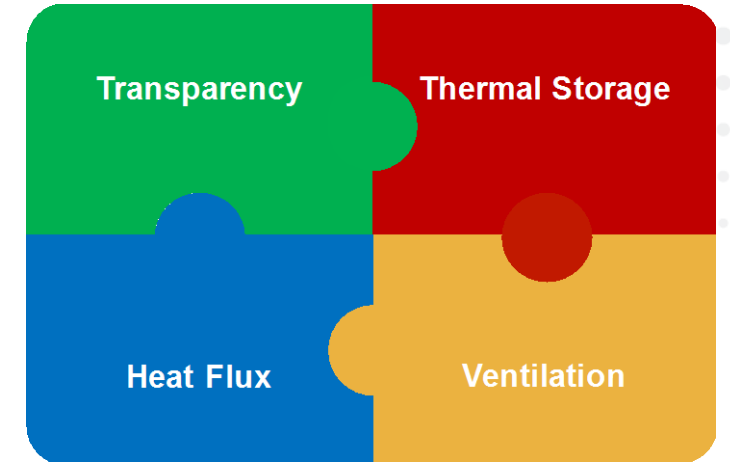
# Envisioning a truly integrated system





# Envisioning a truly integrated system

- Which technologies are best suited?
- What response times are necessary?
- What kind of control systems? Sensors?



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