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INTERNATIONAL SUSTAINABLE ECOLOGICAL ENGINEERING DESIGN FOR SOCIETY (SEEDS)

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IS PASSIVHAUS THE FUTURE OF THE UK SOCIAL HOUSING SCHEME?

– Design, Procurement and Post Occupancy Evaluation

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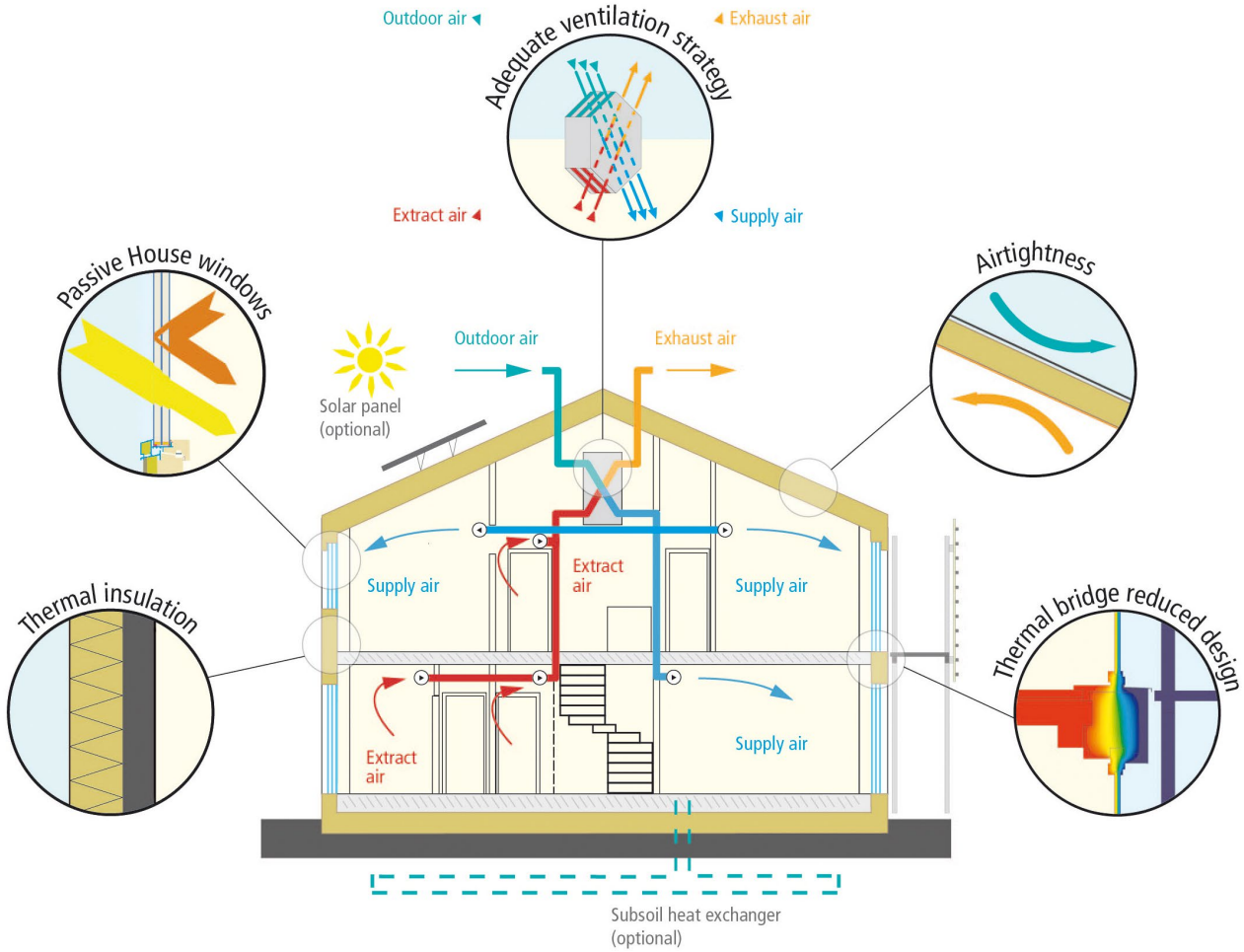
WHAT IS PASSIVHAUS?

- German building performance standard
- Uses a passive design strategy to achieve built environment comfort with minimum energy consumption.
- Requires a robust, well-insulated and airtight building envelope, and a highly efficient mechanical ventilation system



WHAT IS PASSIVHAUS?

- The principles of the Passivhaus ensures the energy consumption target is met.

Primary energy demand	≤ 120 kWh/m^2. yr
Space heating demand	≤ 15 kWh/m^2. yr
Space cooling demand	≤ 15 kWh/m^2. yr
Or Specific heating/ cooling load	≤ 10 W/m^2
Airtightness	≤ 0.6 air changes/ hr @ n50
Overheating	Temperatures exceeding 25°C cannot occur in a building for more than 10% of the occupied year

PASSIVHAUS DEVELOPMENT

- To date, there are over 33,000 units certified projects worldwide.

- There are 73 social housing Passivhaus projects (including 69 new build and 4 refurbished) documented in the UK.

UK projects counter (estimate as of June 2022)

1490+ CERTIFIED UNITS

340 CERTIFIED PROJECTS

MORE THAN **7400** UNITS UNDER DEVELOPMENT

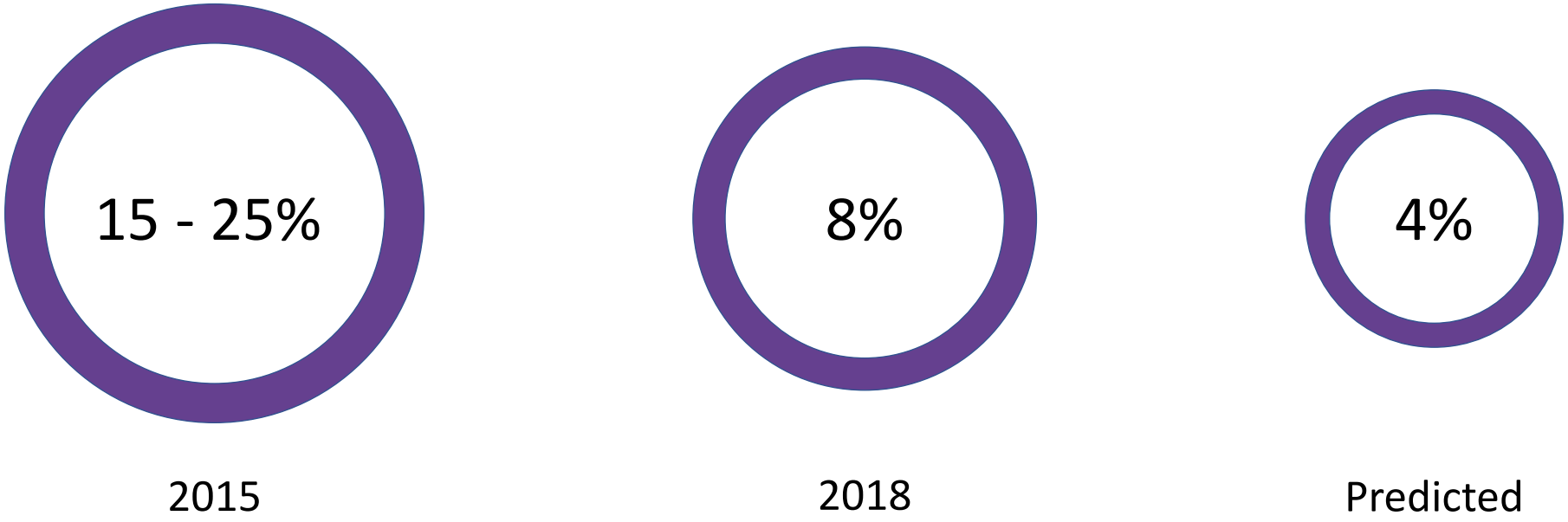
280+ PROJECTS UNDER DEVELOPMENT

Questions

- What are the barriers and challenges to implementing Passivhaus as social housing model?
- How to overcome those barriers and challenges?
- Is Passivhaus the future of the UK social housing scheme?

BARRIERS IN DELIVERING PASSIVHAUS

- Capital investment - Passivhaus standard is still widely viewed as costly and precarious.



(Barnes , 2015; Passivhaus Trust, 2019; Forde. 2020)

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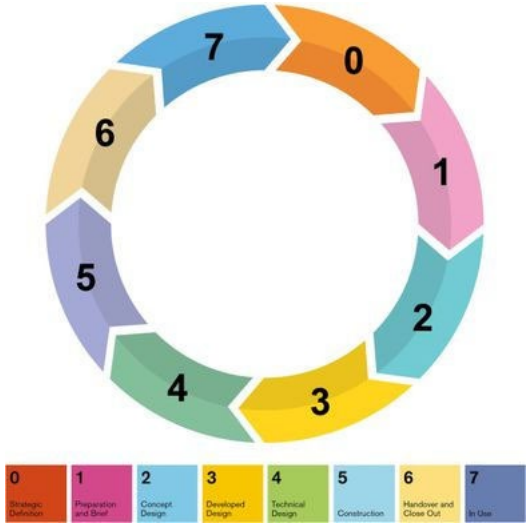

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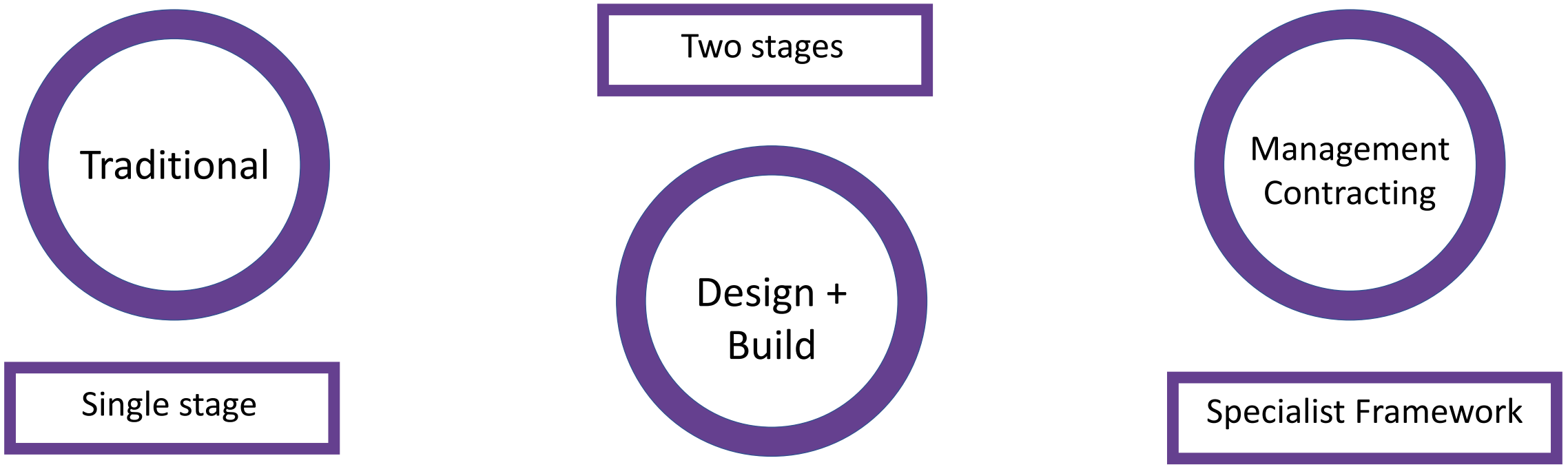

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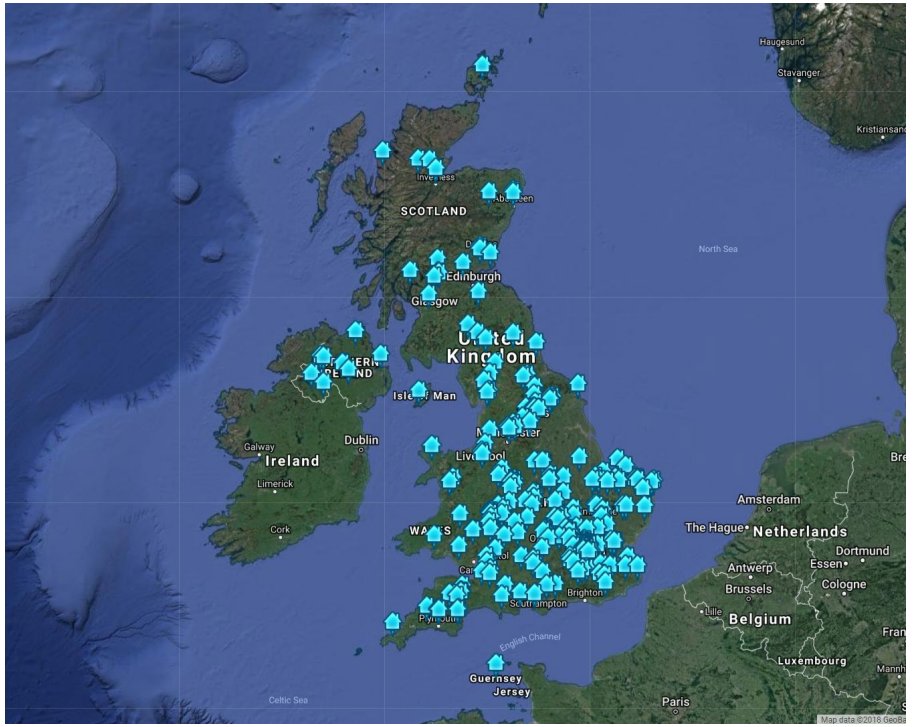

Map of UK Passivhaus Projects, Passivhaus Trust

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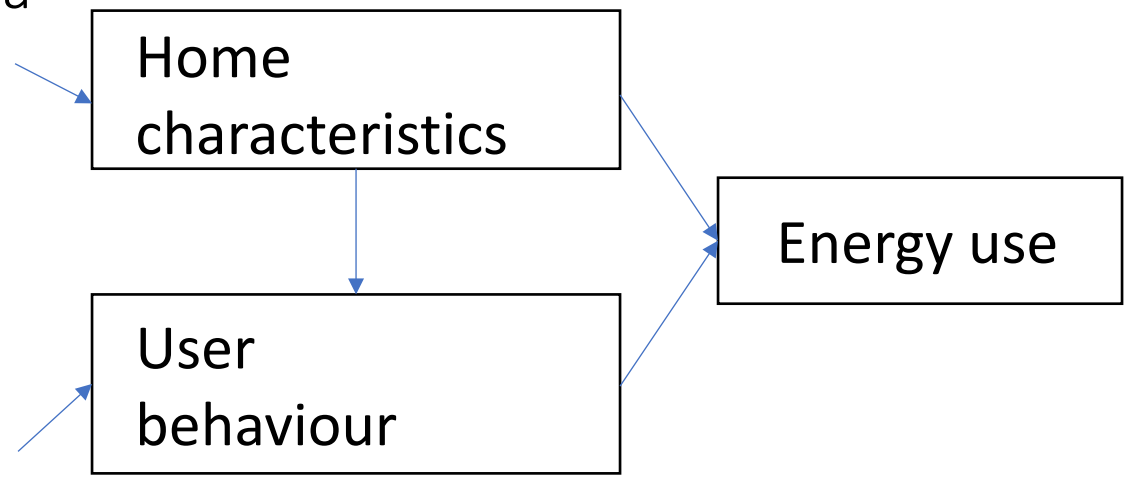
  - Overheating
  - Air quality
  - Technology challenge
  - Performance gap

(Fletcher et al., 2017; Moreno-Rangel et al., 2021; Gupta, 2019; Zhao and Carter, 2016)

USER BEHAVIOUR AND PERFORMANCE

Size, type, insulation level, surface area
Heating system and energy type
Layout

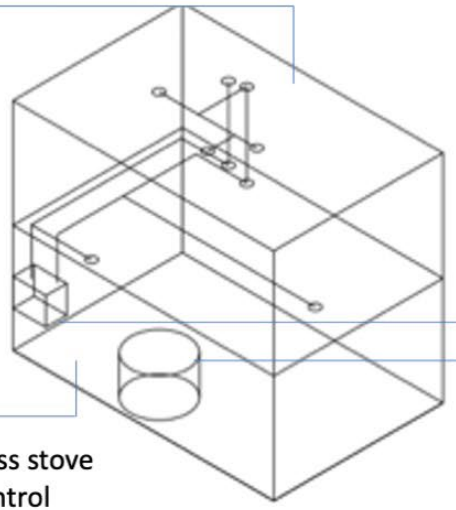
Social and economic demographics
Occupancy pattern
Knowledge
Attitudes
Value pattern

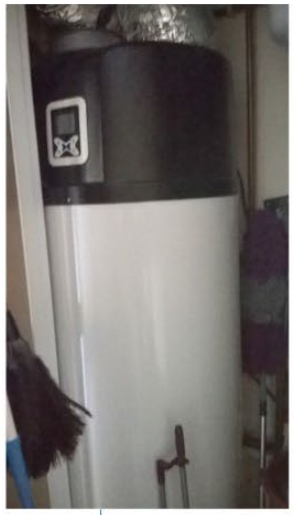


'The more the building is insulated, the more the lifestyle proportionally influences the heating loads' (de Meester et al., 2013).

HYBRID SYSTEM WITH MVHR

Solar thermal hot water system and control





Thermal water tank
And control

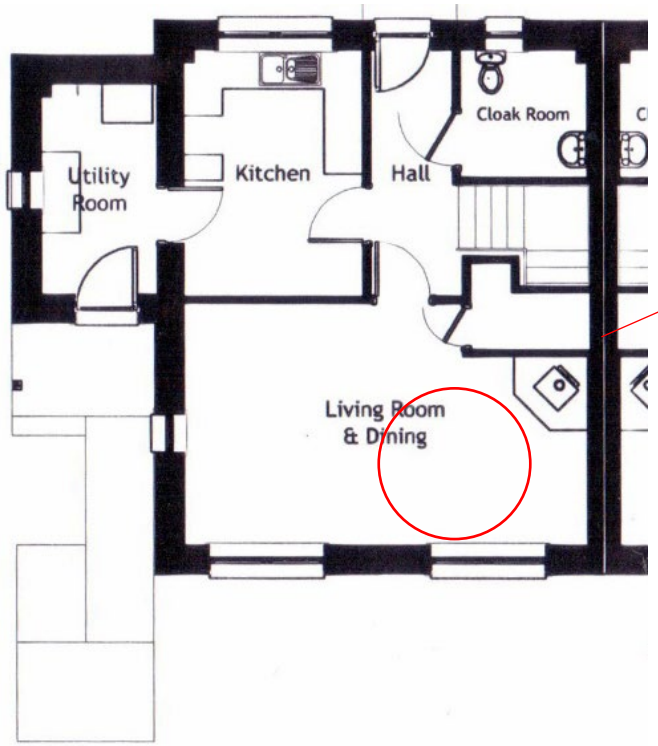
Bio-mass stove
and control

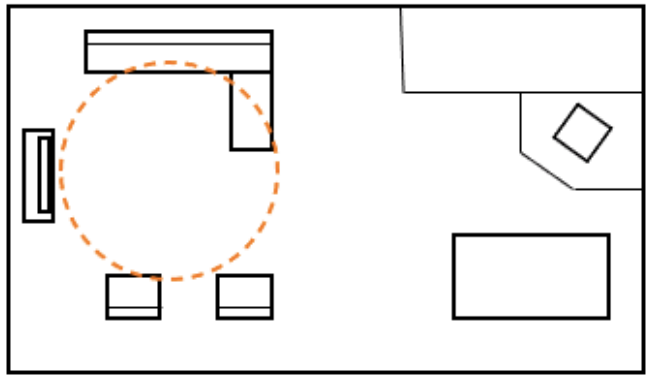
MVHR and control

	DO project				SL project	
						
Household code	DO1	DO2	DO3	DO4	SL1	SL2
Bioclimatic region	Scotland East					
Construction type	Timber					
Floor area (sq.m)	103	103	88	88	74	80
Household size	3	5	2	2	2	2
Occupants age group	18-60	18-60	18-60	60+	60+	18-60
Occupation date	2011 -2013				07/2015	
Interview date	05/2014				10/2015	

SUMMARY

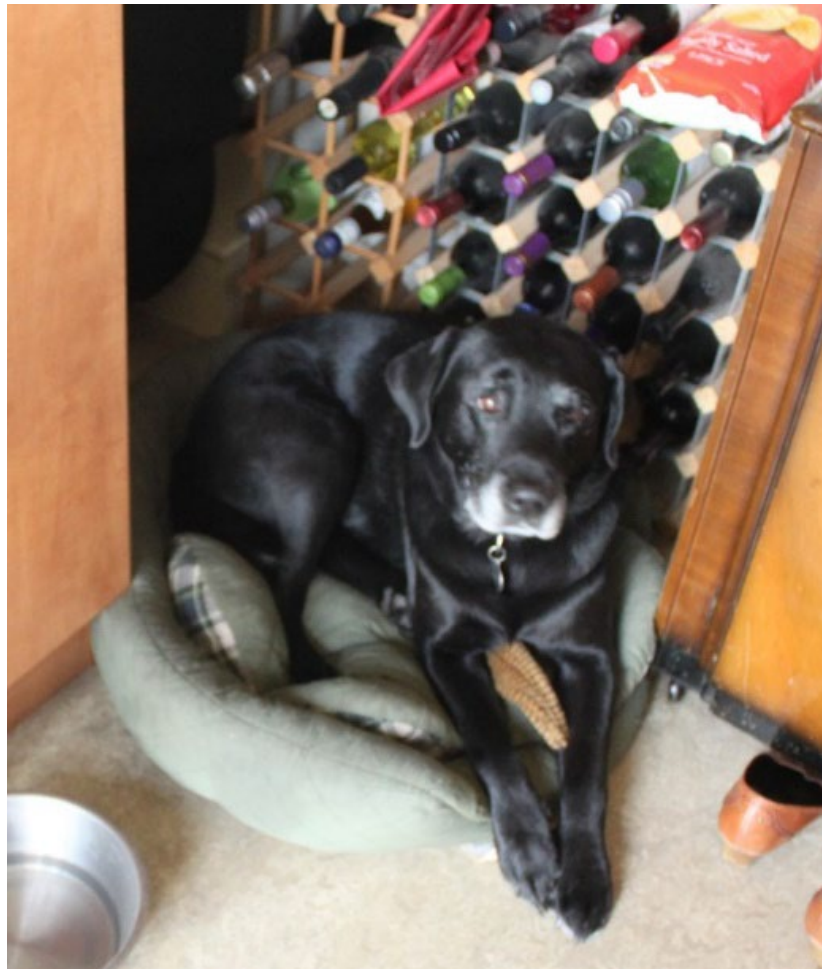
Project DO	Project SL
• High comfort level • Learning curve: occupants were encouraged to learn and adapt, trial and error • Control panels with easy accessibility • Good support and communication in community • Active change of lifestyle – co-evolvement	• Low comfort level • Occupants were restricted in behavioural adaptation by the housing association • Control panels with low accessibility • Poor communication within the community and with housing association • Limited adaptation





Layout change

Stove indicator



…That's why we keep our dog during the winter, he heats up the house… (occupant)

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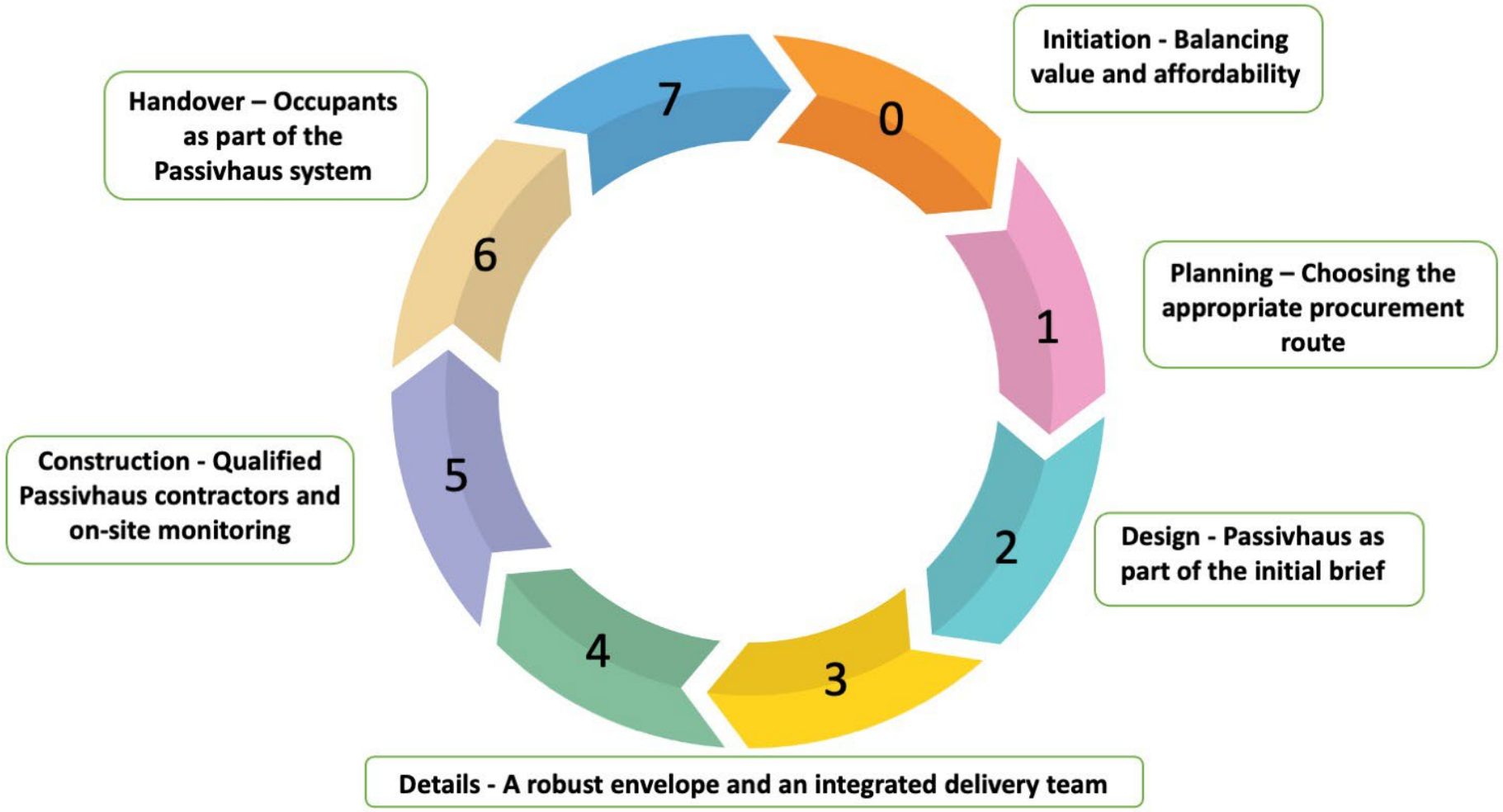
OVERCOMING THE BARRIERS

- RIBA Stage 0: Initiation - Balancing value and affordability
- RIBA Stage 0-1: Planning – Choosing the appropriate procurement route
- RIBA Stage 1-2: Design - Passivhaus as part of the initial brief
- RIBA Stage 3-4: Details - A robust envelope and an integrated delivery team
- RIBA Stage 5: Construction - Qualified Passivhaus contractors and on-site monitoring
- RIBA Stage 6-7: Handover – Occupants as part of the Passivhaus system

(Zhao, 2022)

FURTHER RESEARCH



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THANK YOU!

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