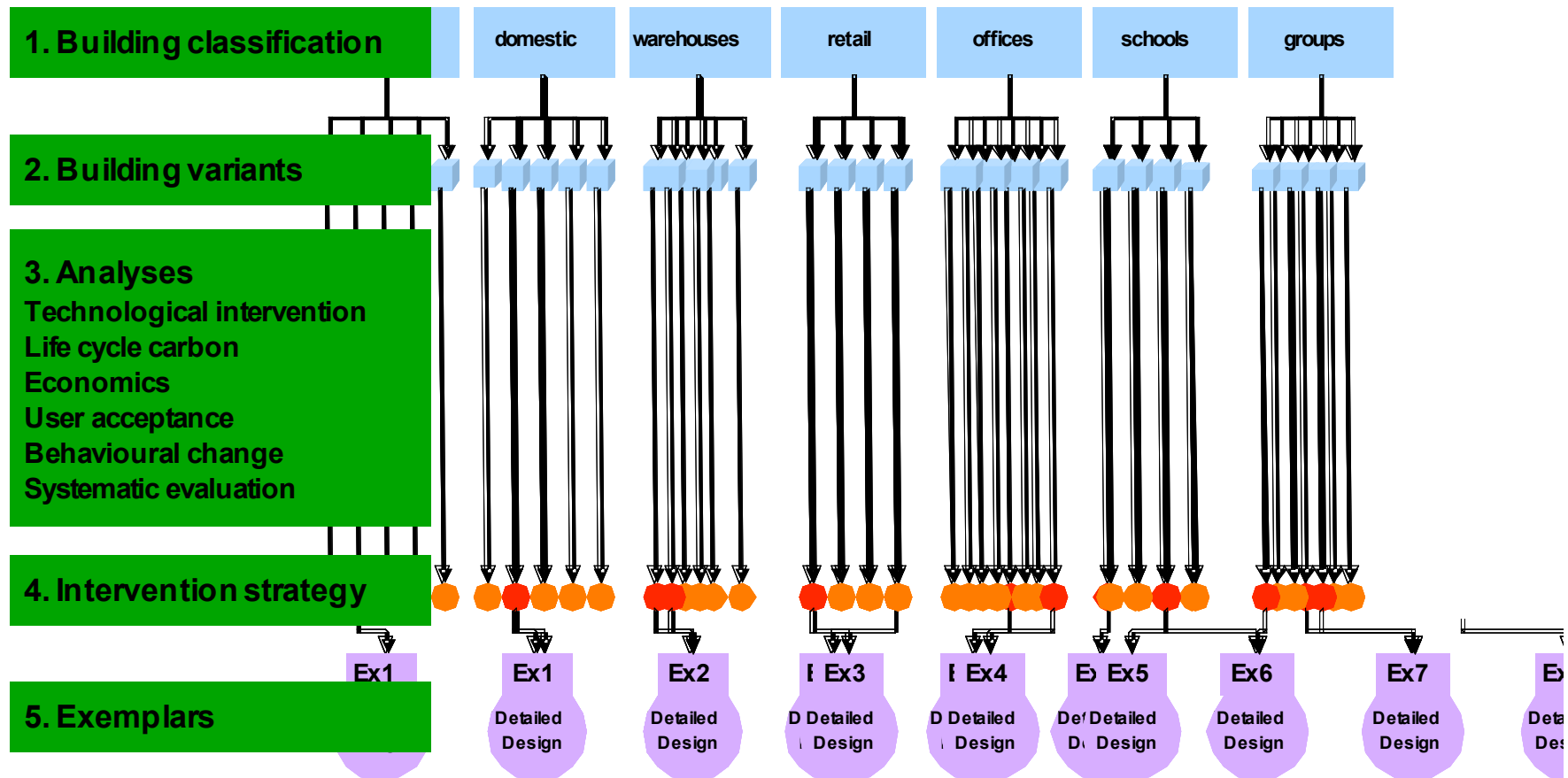


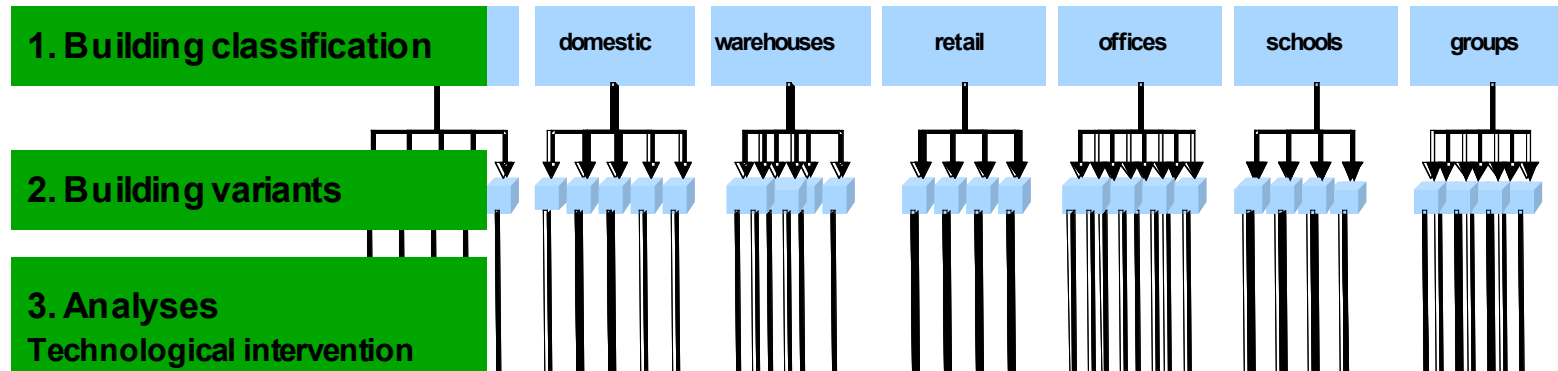
Reducing CO₂ emissions through refurbishment of UK housing

Andrew Peacock


Tarbase overview



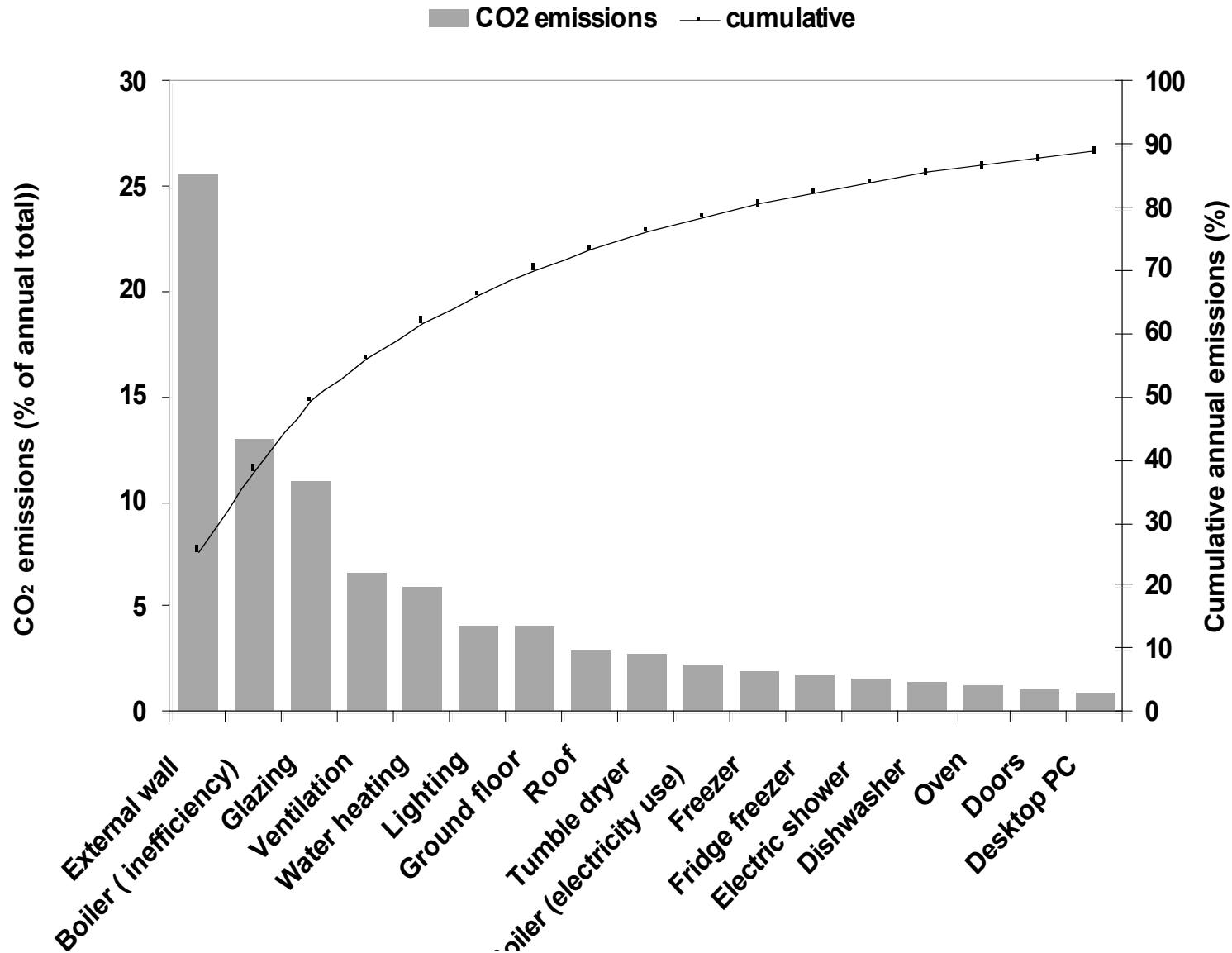
Tarbase overview



Variant 7

Building Variant Number	Building Description	q (kWh pa)	e (kWh pa)
7	 <p>Pre 1900 detached dwelling Solid wall construction Occupation: Family – 3 adults working 1 child Location: Manchester</p>	26362	5230

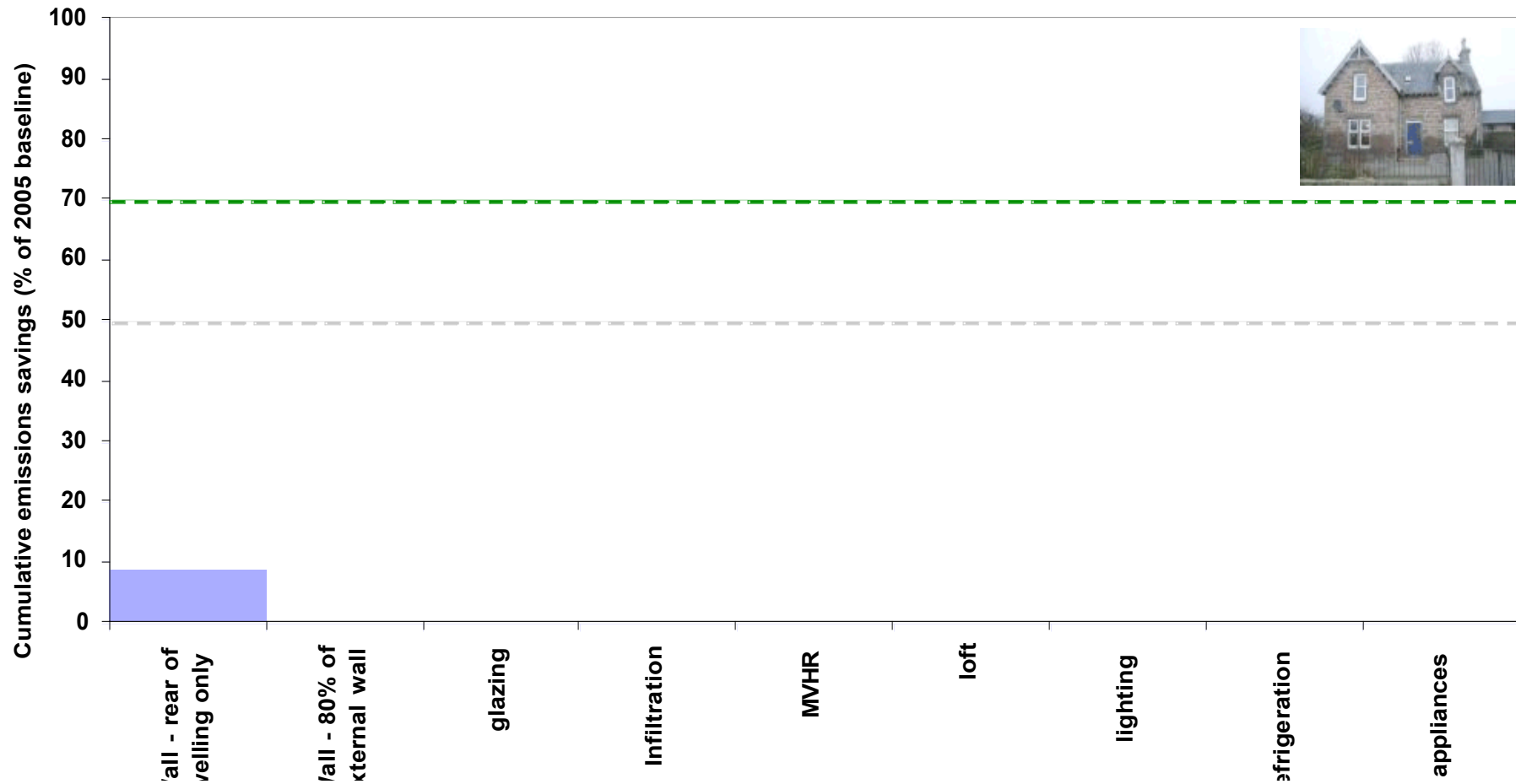
Attribution of CO₂ emissions V7



Building Fabric and Ventilation	End use equipment	Energy production
Loft insulation	Lighting	Micro-CHP
Cavity wall insulation	Stirling cycle refrigeration	Solar PV
External wall insulation	VIP refrigeration	Micro-wind
Glazing	Ovens	Solar Thermal
Reduced infiltration	Washing machines	Heat Pumps
MVHR	Dishwashers	Biomass
	TV's	
	PC's	
	Tumble dryers	
	Reduced standby loads	

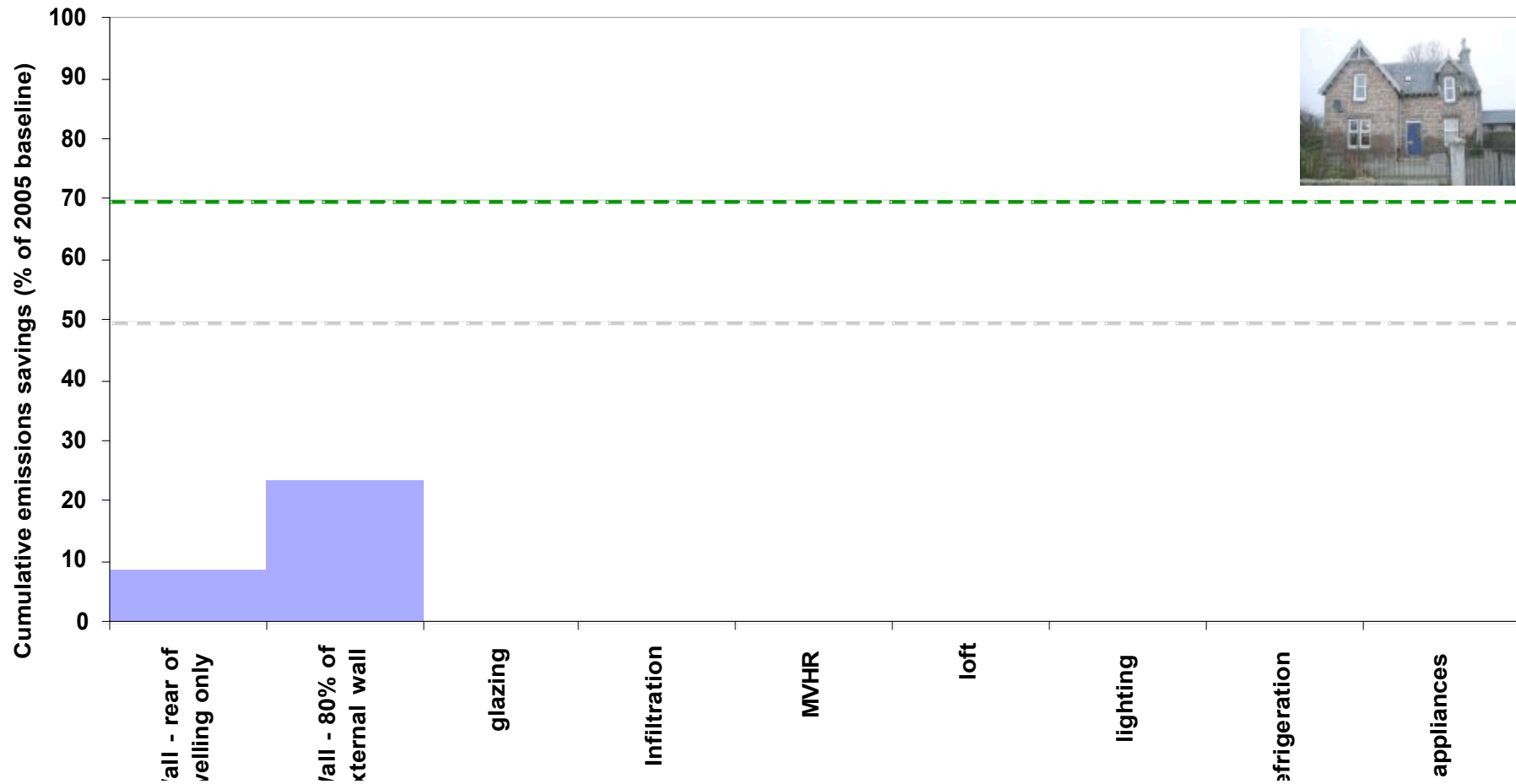
Demand side interventions

Variant 7



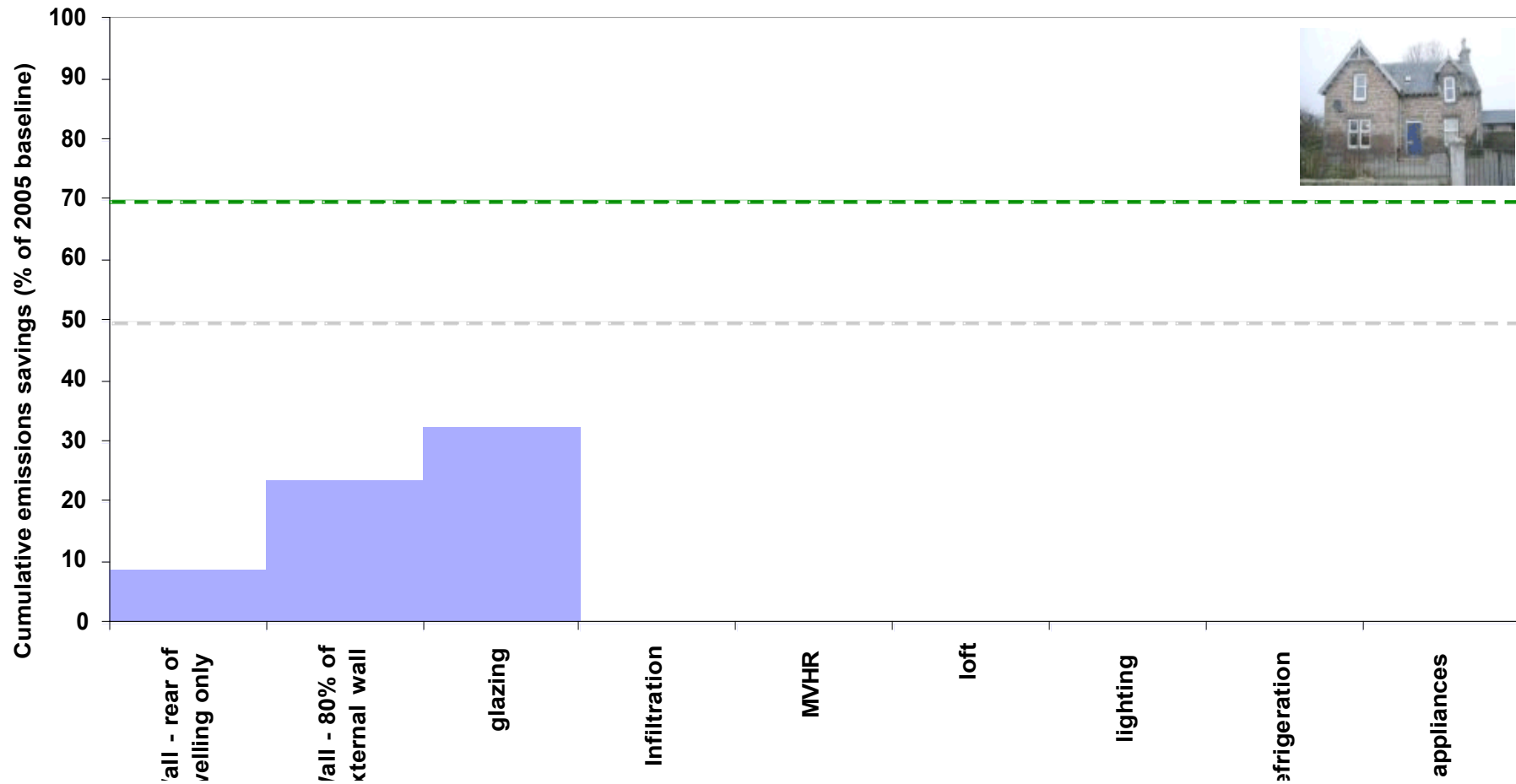
Demand side interventions

Variant 7



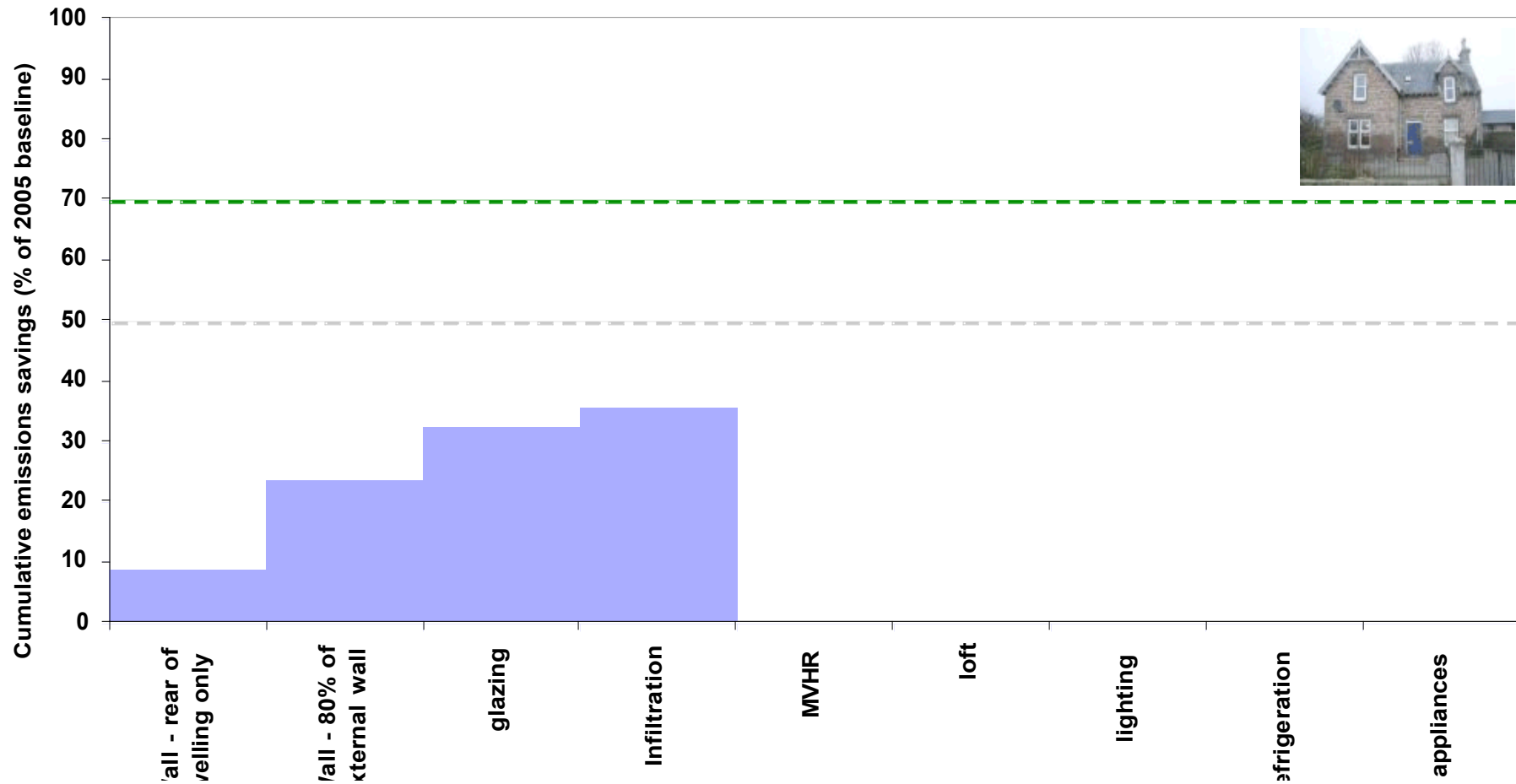
Demand side interventions

Variant 7



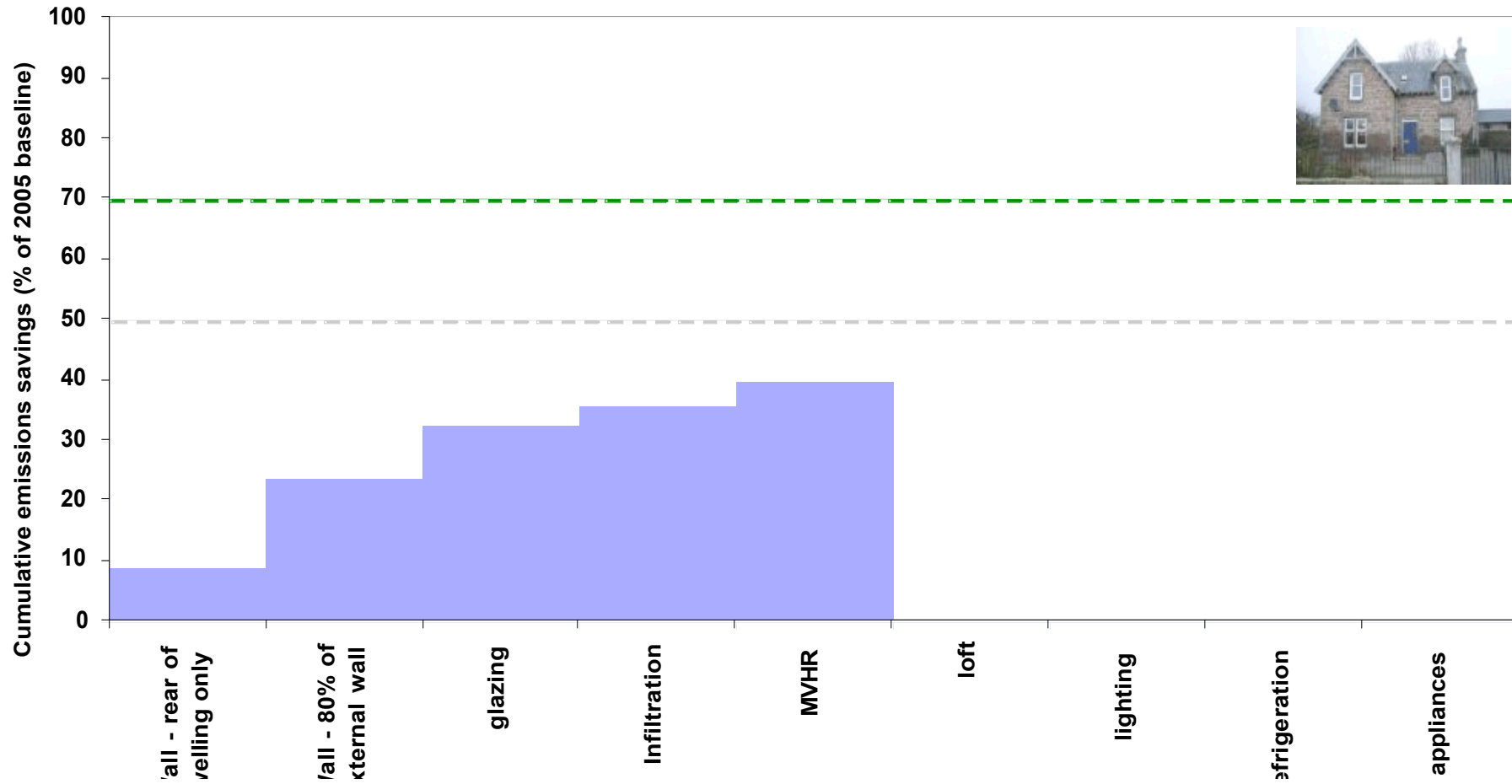
Demand side interventions

Variant 7



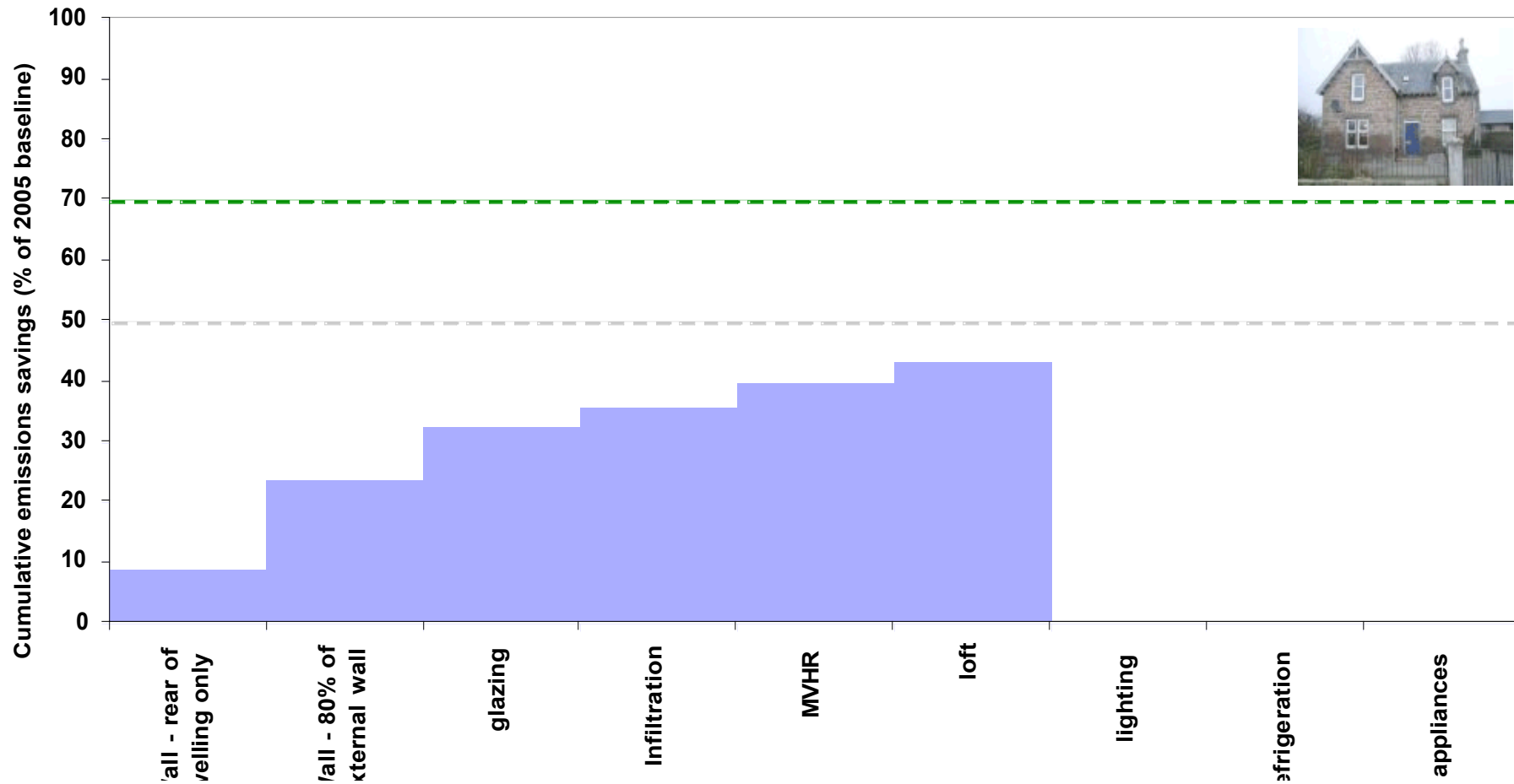
Demand side interventions

Variant 7



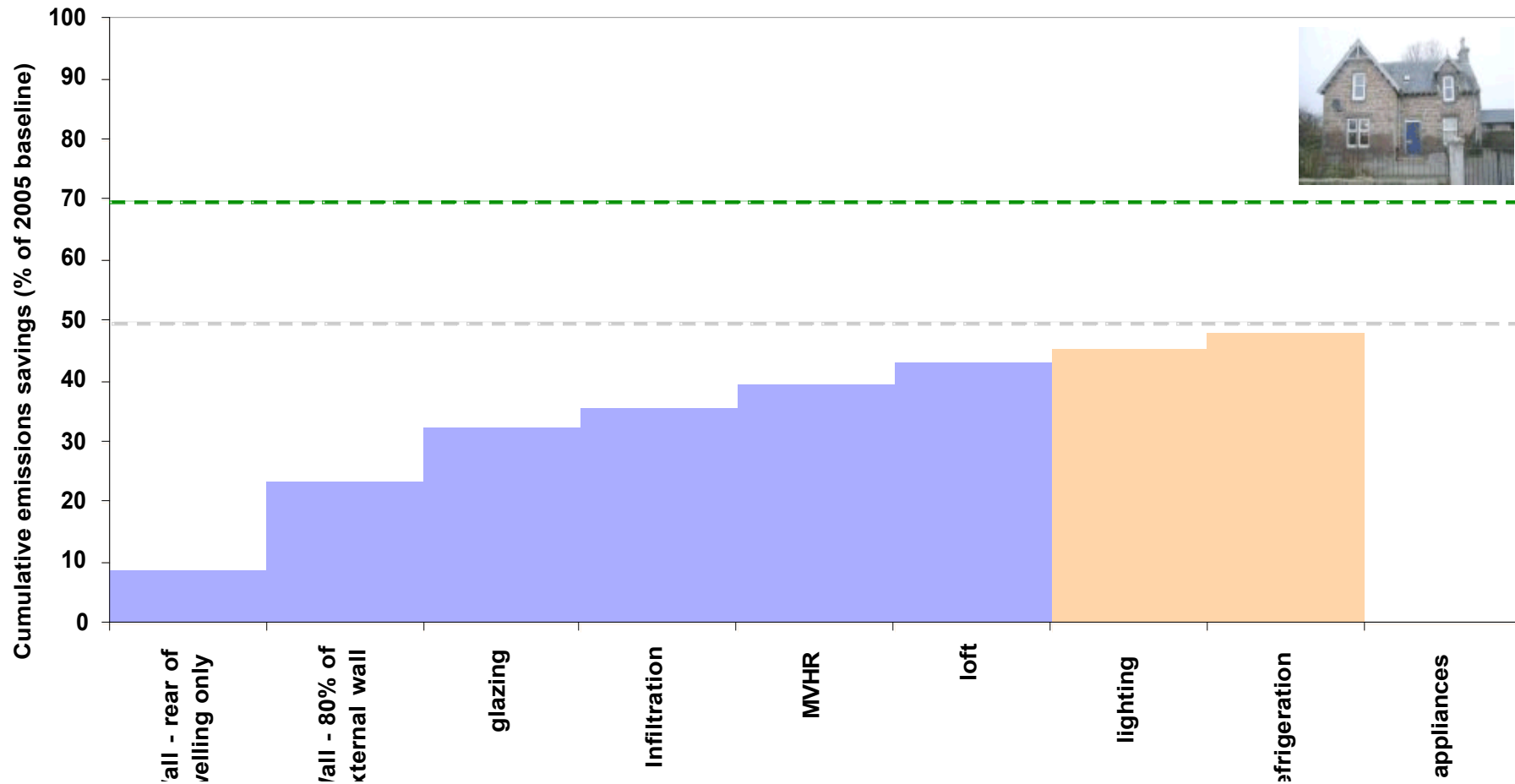
Demand side interventions

Variant 7



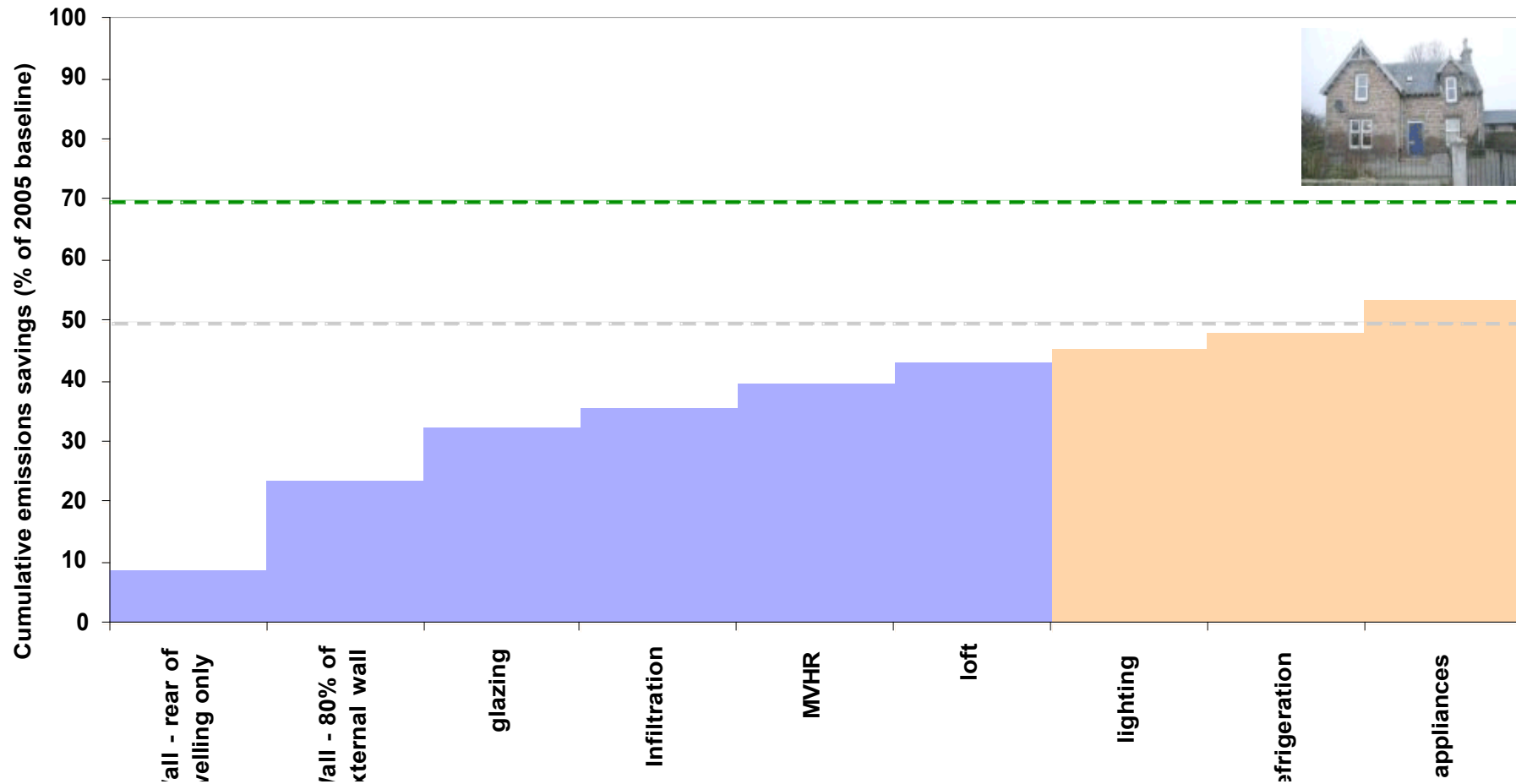
Demand side interventions

Variant 7

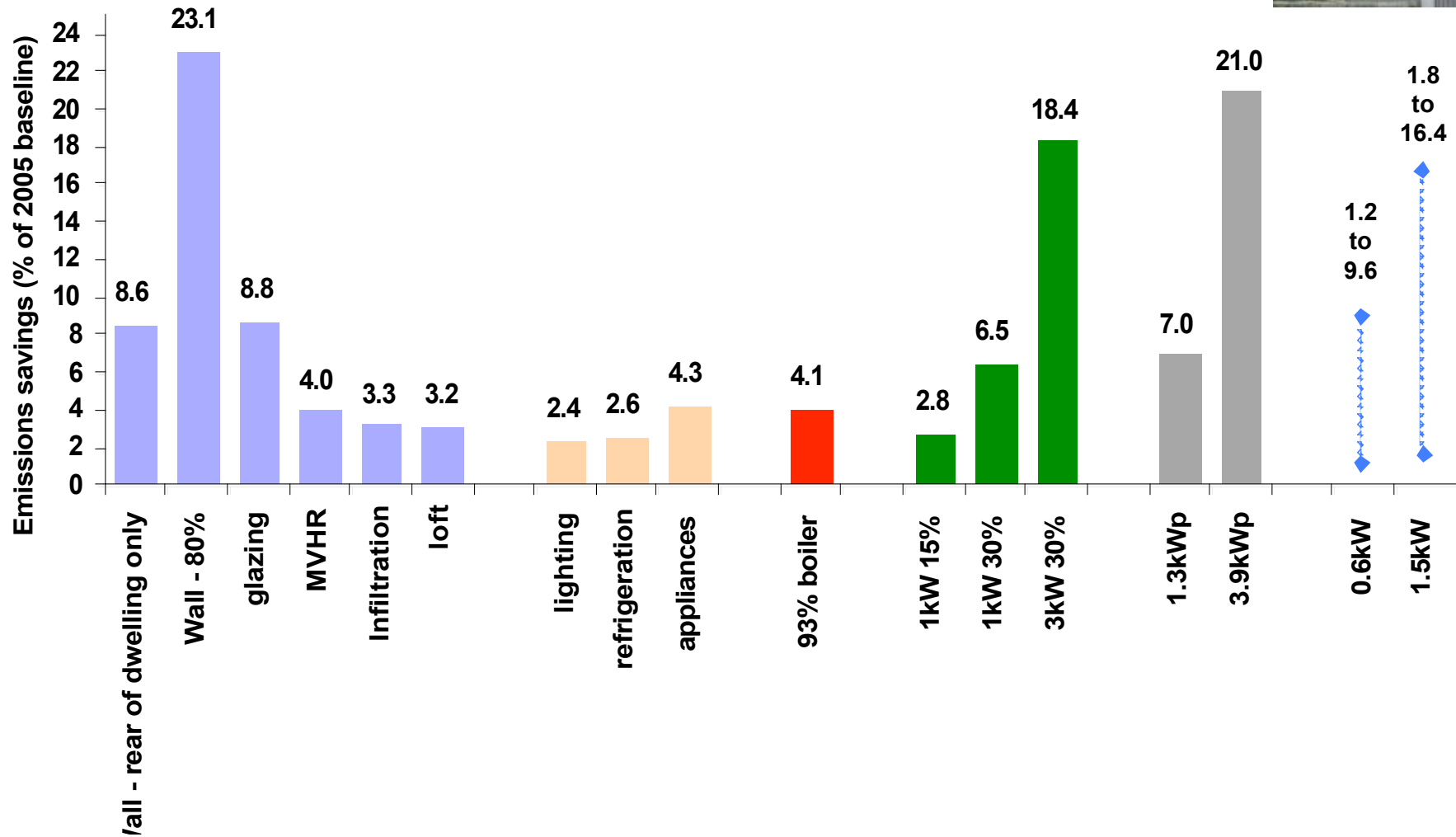


Demand side interventions

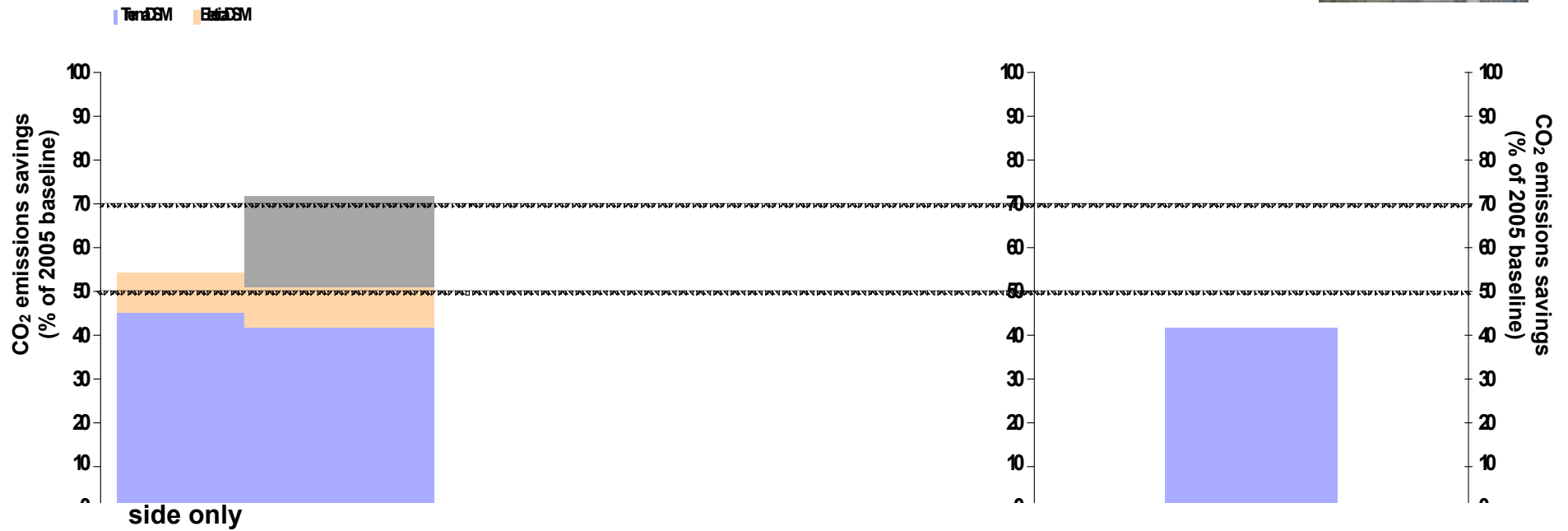
Variant 7



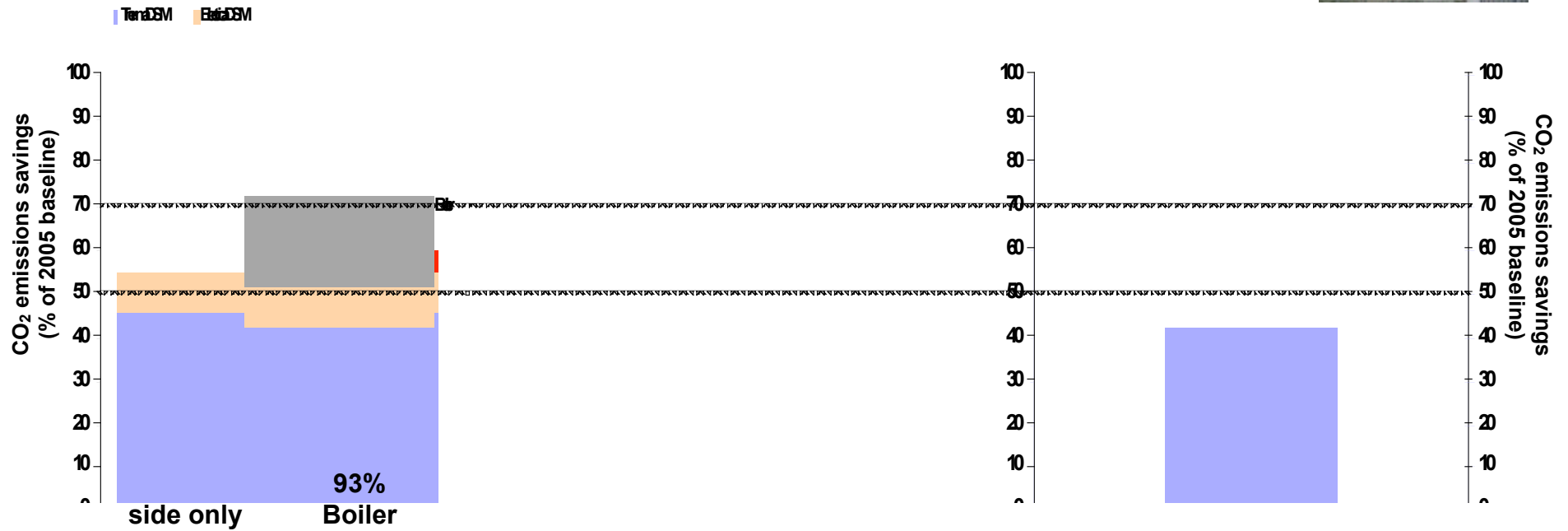
Technological Interventions Variant 7



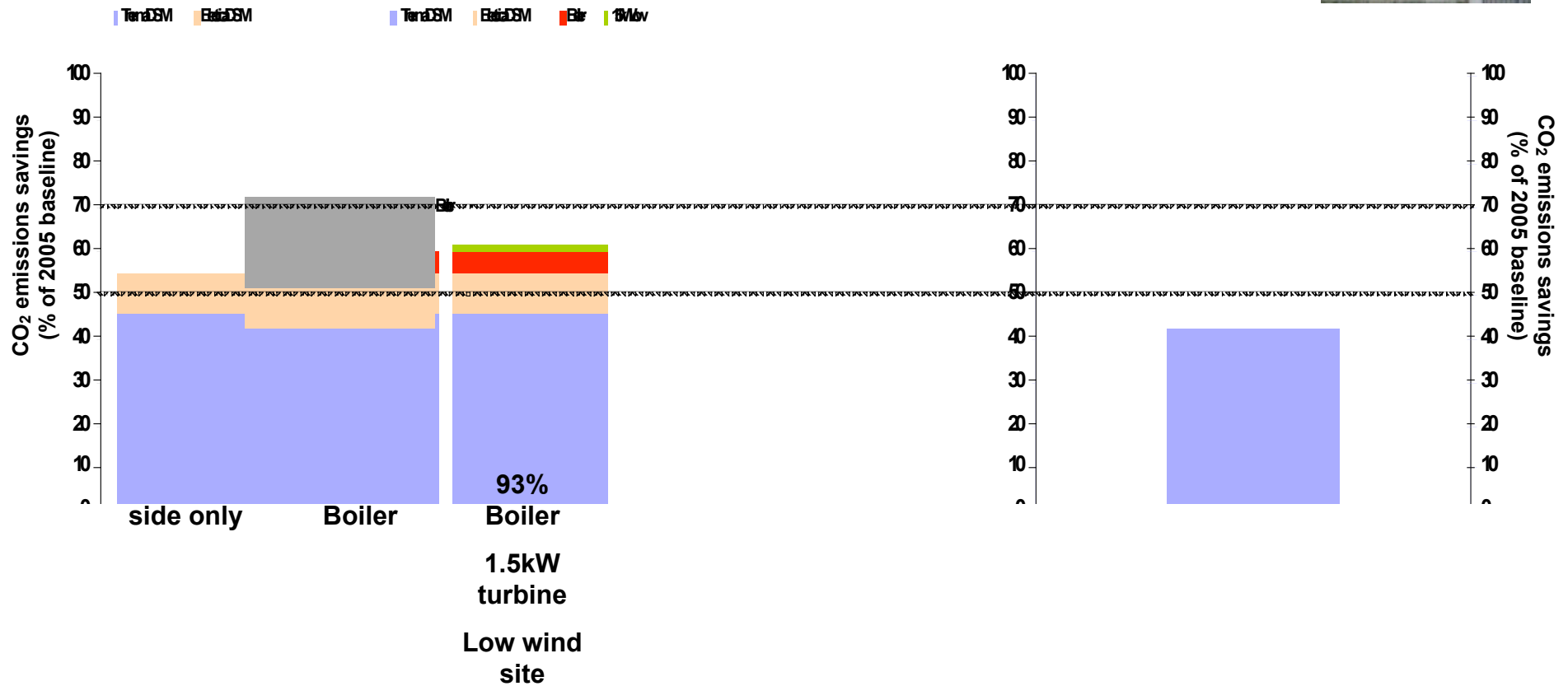
Technological intervention sets for Variant 7



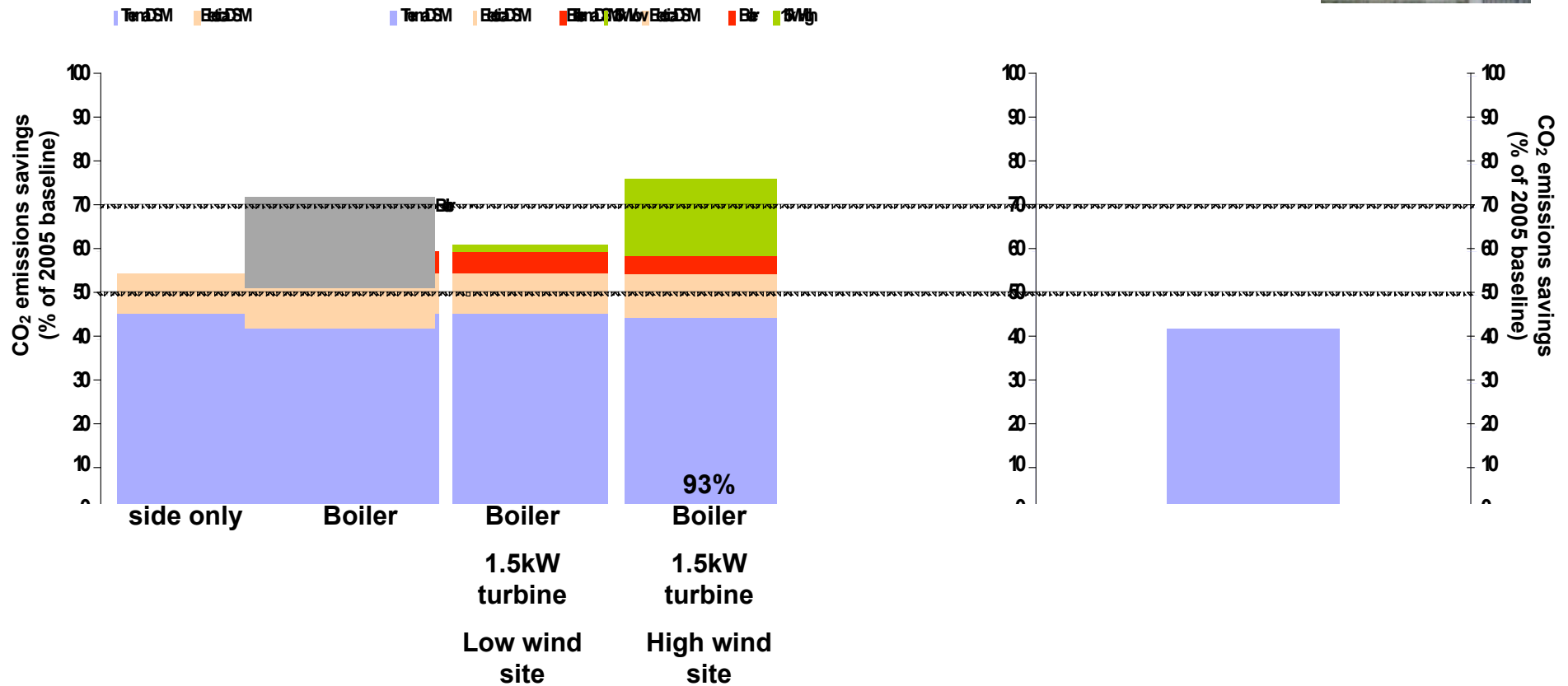
Technological intervention sets for Variant 7



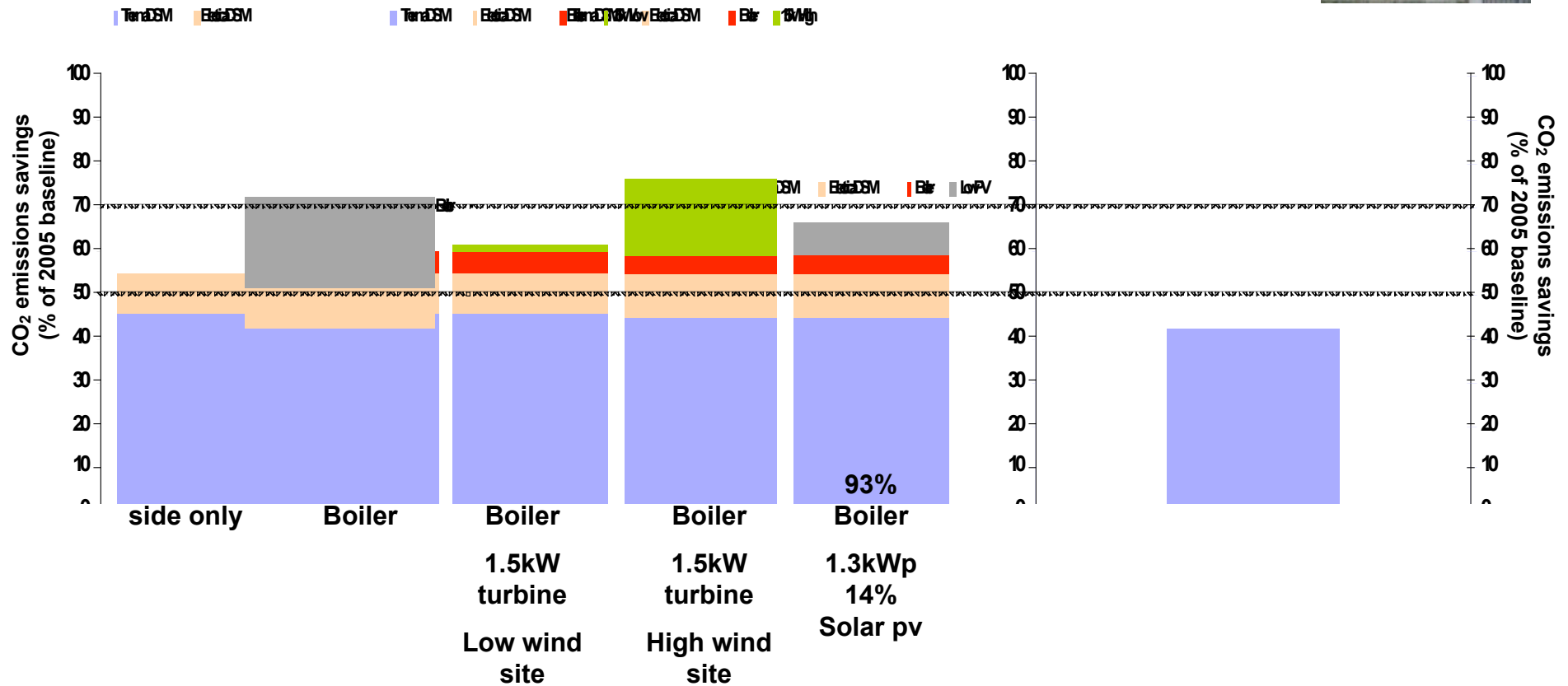
Technological intervention sets for Variant 7



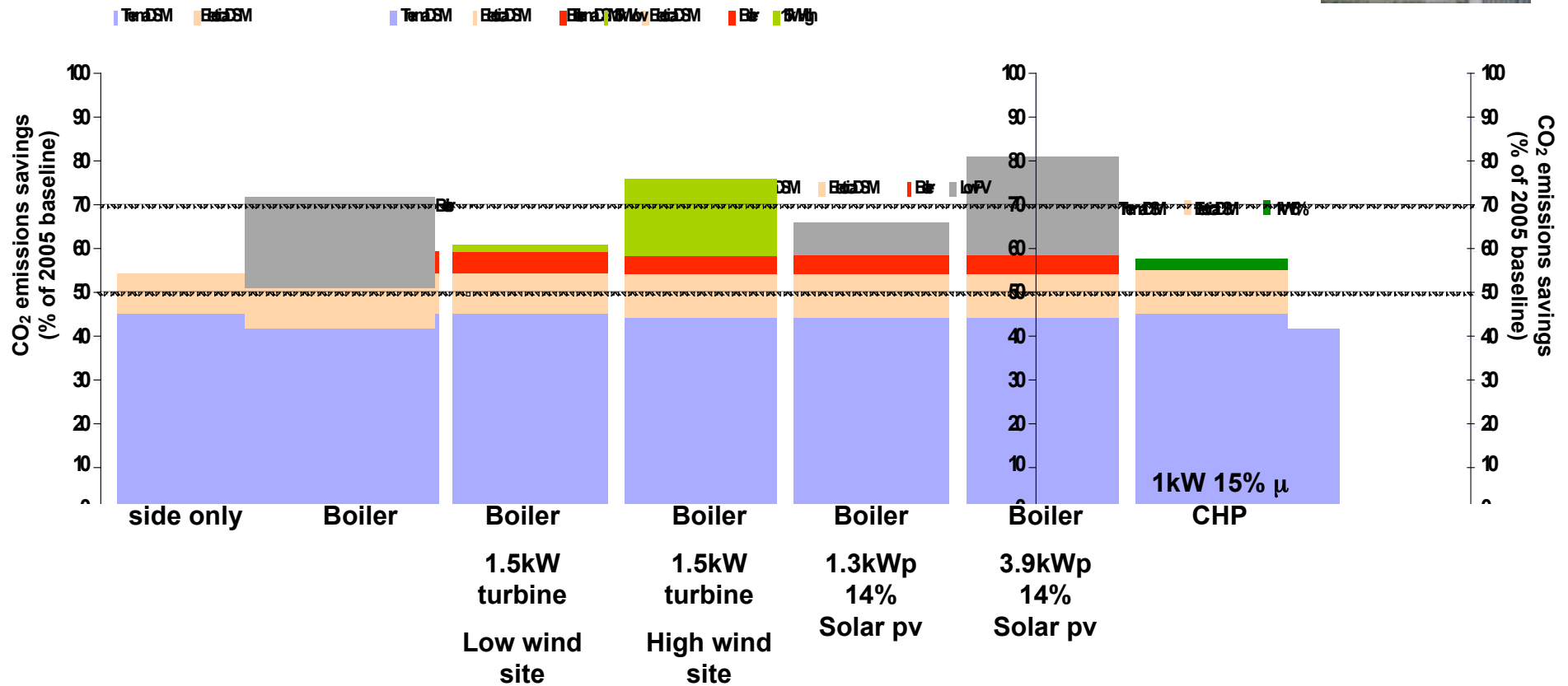
Technological intervention sets for Variant 7



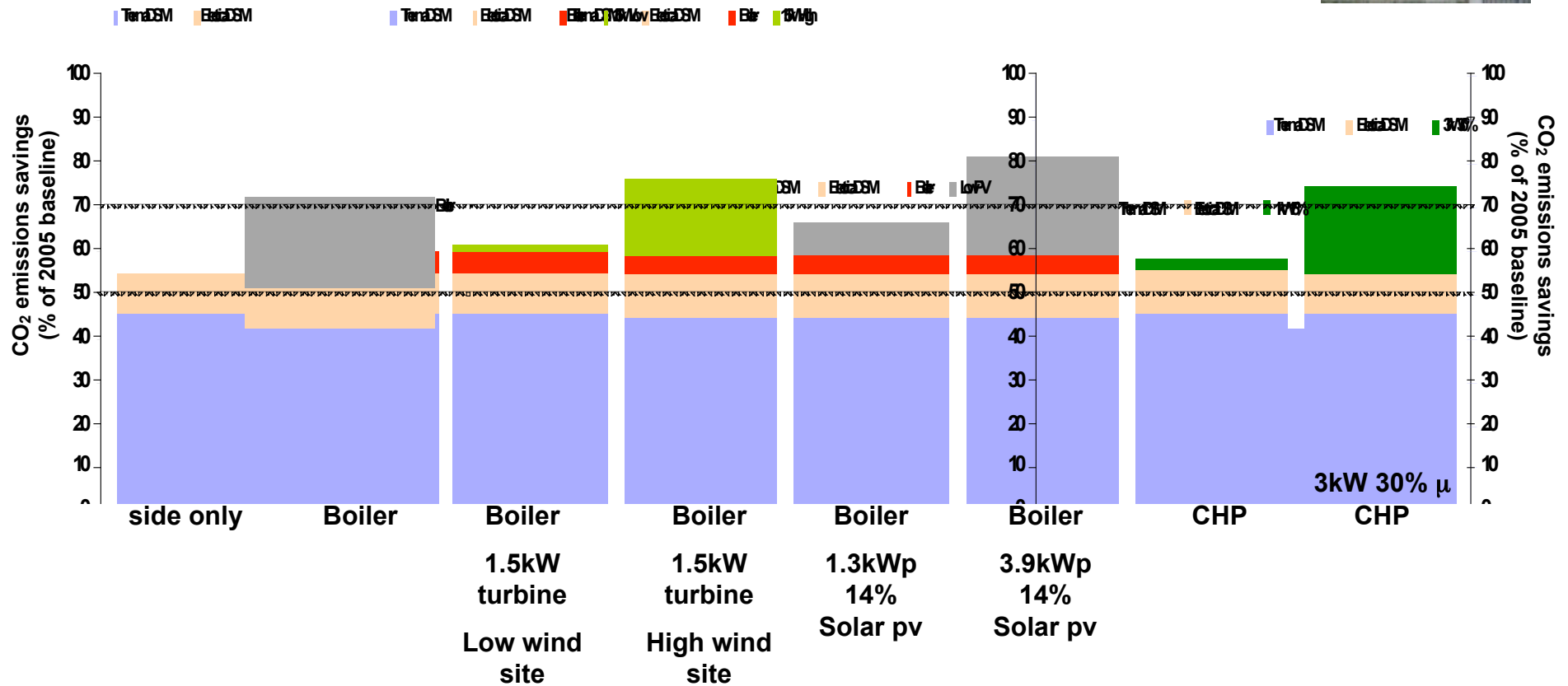
Technological intervention sets for Variant 7



Technological intervention sets for Variant 7

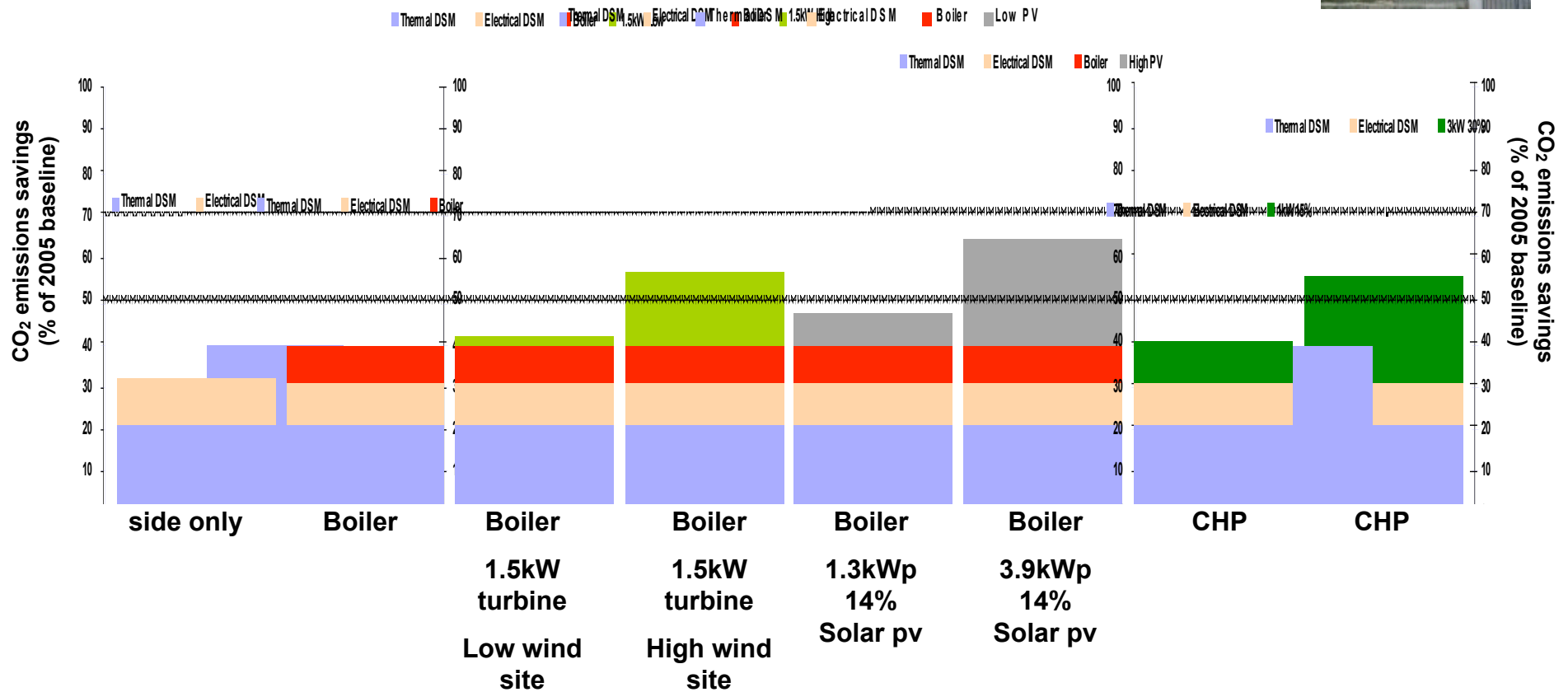


Technological intervention sets for Variant 7



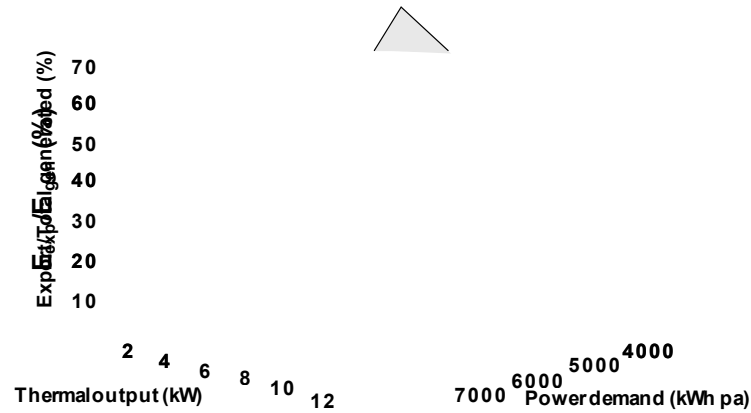
Technological intervention sets for Variant 7

No external wall insulation

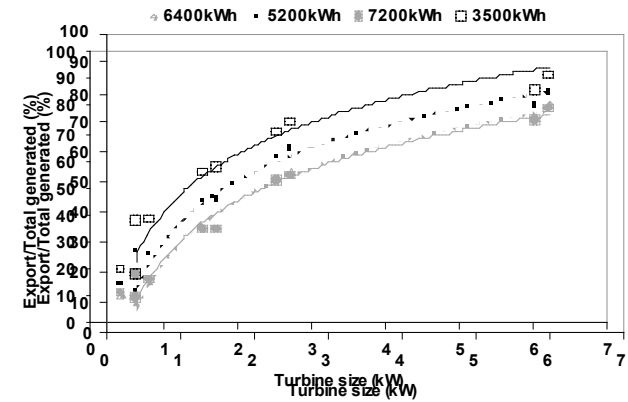


Supply Demand matching of micro-generation systems

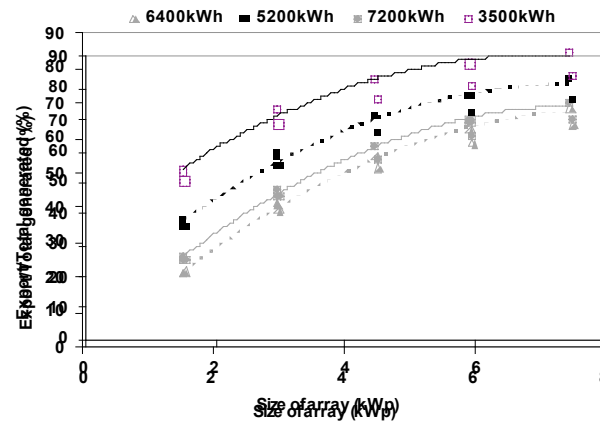
a) Micro -CHP



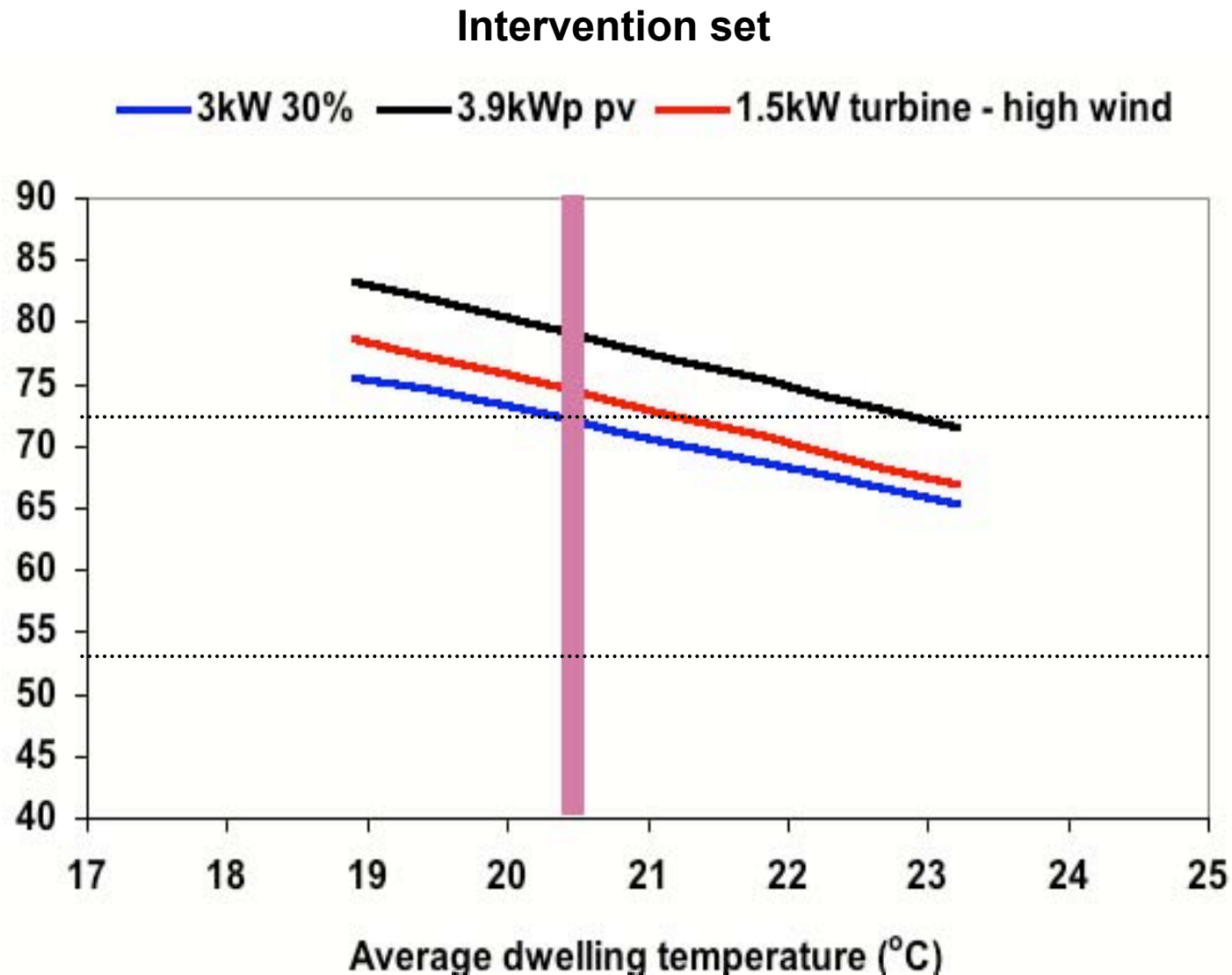
b) Micro -wind



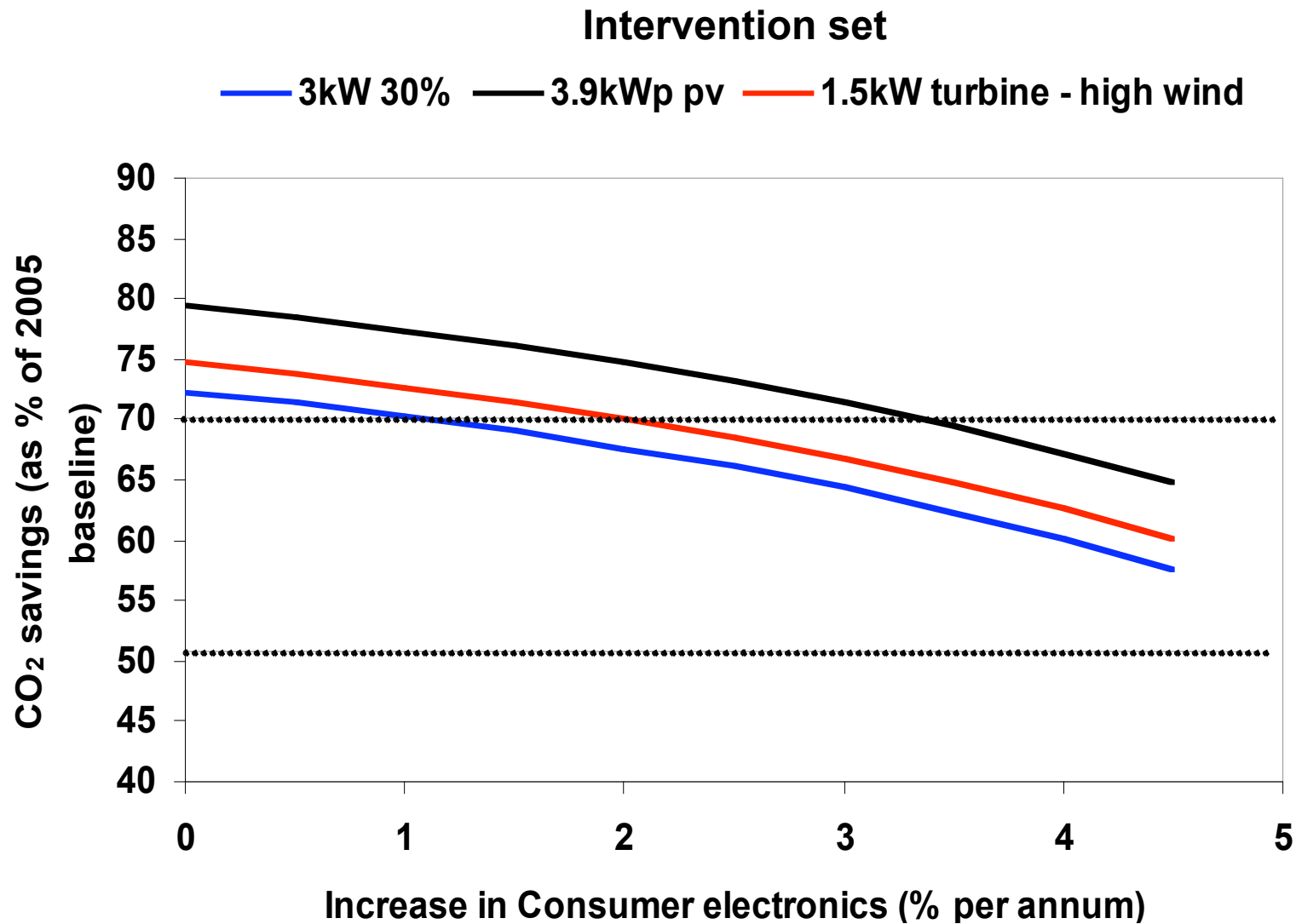
c) Solar -PV



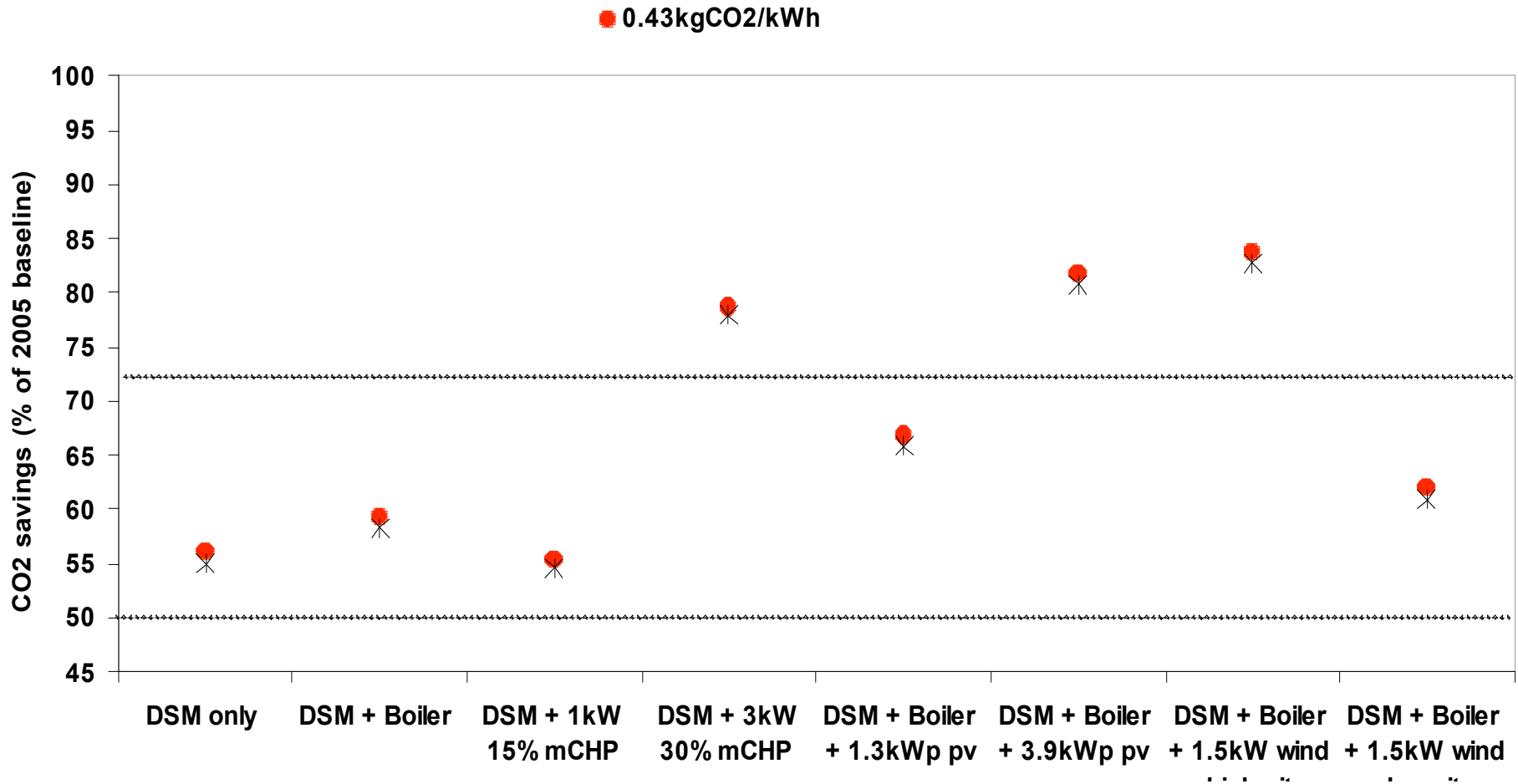
Effect of dwelling temperature on CO₂ emissions attributable to intervention set



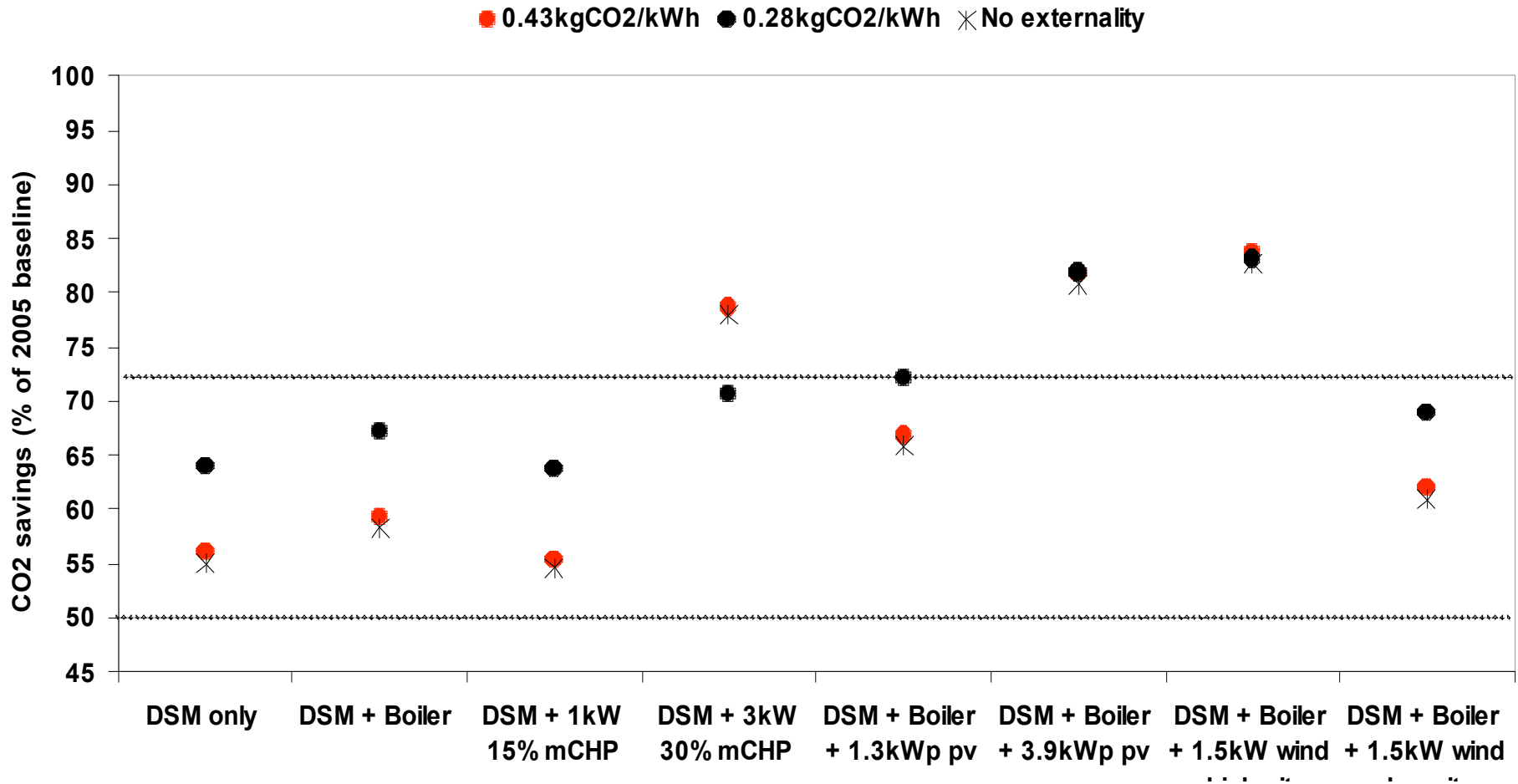
Effect of consumer electronics growth on CO₂ emissions attributable to intervention sets



Effect of external factors on CO₂ emissions attributable to intervention sets – V7

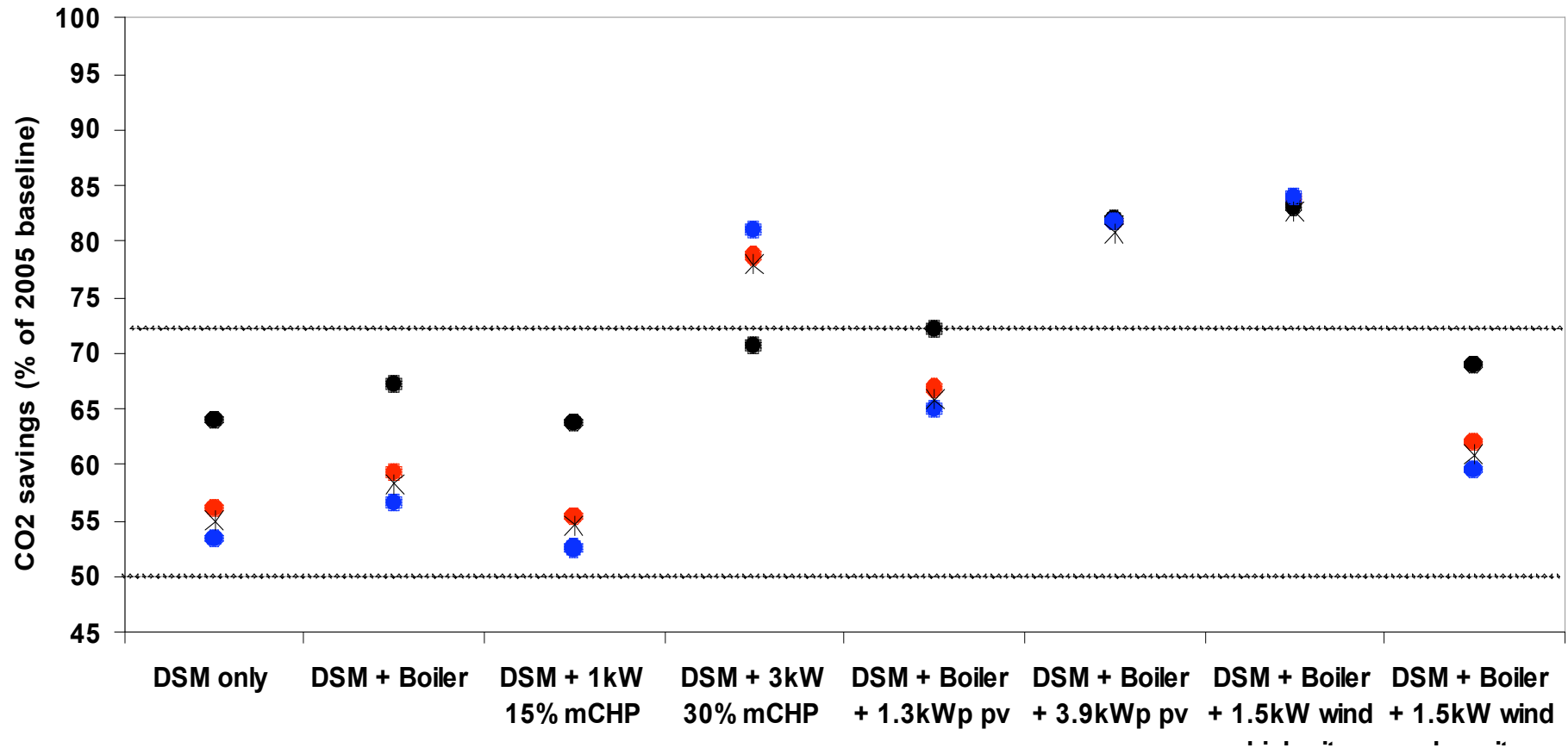


Effect of external factors on CO₂ emissions attributable to intervention sets – V7



Effect of external factors on CO₂ emissions attributable to intervention sets – V7

● 0.43kgCO₂/kWh ● 0.28kgCO₂/kWh ● 0.48kgCO₂/kWh ✕ No externality

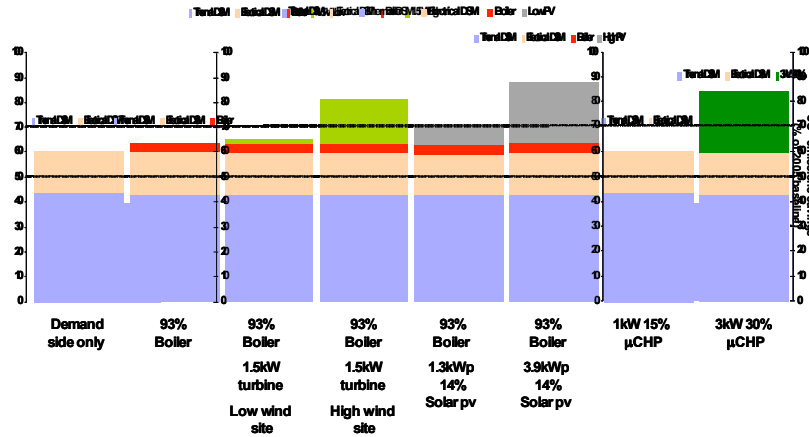


- **A methodology has been developed for assessing the CO₂ emissions attributable to intervention sets**
- **The contribution of demand side measures outweigh supply side measures**

Sensitivity analysis can be performed on these intervention sets based on external factors studied

- **This methodology is being extended to consider other performance metrics**

Carbon



Embodied energy

Whole Life Cycle cost

User Acceptance

- Reduced utility bill from approx €2000 to €900
- What would you do with the €1100?
- Do we need to disassociate CO₂ savings and € savings