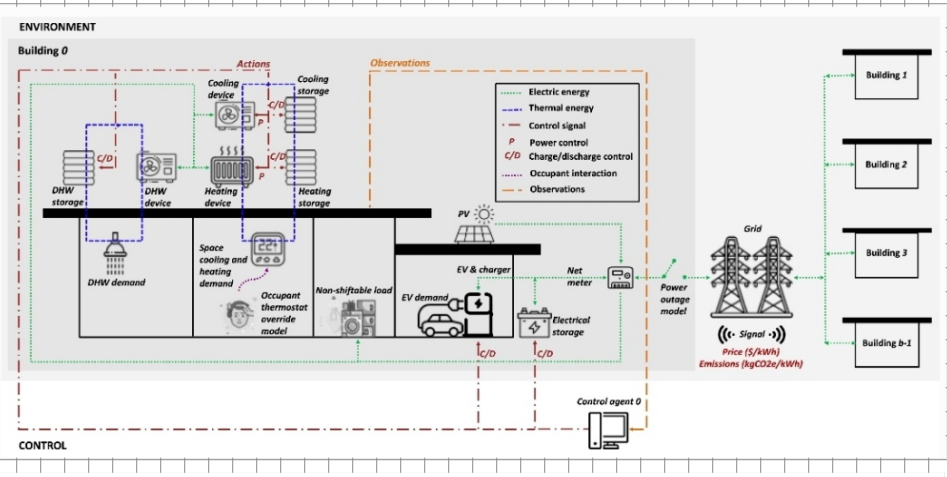
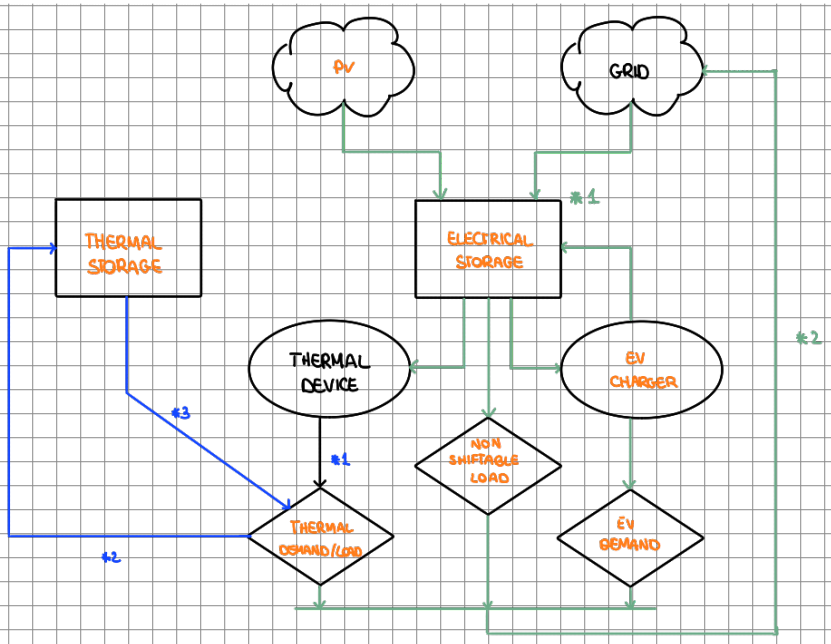


Table A.2
Action space.

Name	a_t range	Description
Energy storage system		
cooling_storage	[-1, 1]	Proportion of cooling_storage capacity to be charged ($a_t > 0$) or discharged ($a_t < 0$).
heating_storage	[-1, 1]	Proportion of heating_storage capacity to be charged ($a_t > 0$) or discharged ($a_t < 0$).
dhw_storage	[-1, 1]	Proportion of dhw_storage capacity to be charged ($a_t > 0$) or discharged ($a_t < 0$).
electrical_storage	[-1, 1]	Proportion of electrical_storage capacity to be charged ($a_t > 0$) or discharged ($a_t < 0$).
electric_vehicle_storage	[-1, 1]	Proportion of electric_vehicle_storage capacity to be charged ($a_t > 0$) or discharged ($a_t < 0$).
Electric device		
cooling_device	[0, 1]	Proportion of cooling_device nominal power to be supplied.
heating_device	[0, 1]	Proportion of heating_device nominal power to be supplied.



- Any thermal load (heating, cooling and DHW) is satisfied using the associated device's nominal power (#1). The remaining power after load satisfaction is used to charge the associated storage (#2), which is used as the first source for satisfying the associated thermal load (#3)
- Any electrical device/load is supplied following the order: electrical storage, pv system, ev charger/vehicle, grid (#1). Any excess in electricity supply is sent back to the grid (#2)

$$\text{Score}_{\text{Control}} = w_1 \cdot \text{Score}^{\text{Comfort}}_{\text{Control}} + w_2 \cdot \text{Score}^{\text{Emissions}}_{\text{Control}} + w_3 \cdot \text{Score}^{\text{Grid}}_{\text{Control}} + w_4 \cdot \text{Score}^{\text{Resilience}}_{\text{Control}}$$

PHASE WEIGHTS

$$\text{Score}^{\text{Comfort}}_{\text{Control}} = U$$

$$\text{Score}^{\text{Emissions}}_{\text{Control}} = G$$

$$\text{Score}^{\text{Grid}}_{\text{Control}} = \overline{R, L, P_d, P_n}$$

$$\text{Score}^{\text{Resilience}}_{\text{Control}} = \overline{M, S}$$

- U = UNMET HOURS (M = 1 - THERMAL RESILIENCE, i.e. discomfort in power outage)
  - ↳ proportion of time steps when a building is occupied and indoor temperature falls outside a comfort band

$$U = \sum_{i=0}^{b-1} u^i_{control} / b \quad \leftarrow \text{n buildings}$$

- u = num/den
- $num = \sum_{t=0}^{n-1} \begin{cases} 1 & \text{if } |T_t - T_t^{setpoint}| > I \text{ and } O_t > 0 \text{ (and } F_t > 0\text{)} \\ 0 \end{cases}$ (power outage signal)
- $den = \sum_{t=0}^{n-1} \begin{cases} 1 & \text{if } O_t > 0 \text{ (and } F_t > 0\text{)} \\ 0 \end{cases}$

T_t : indoor temperature at time t
$T_t^{setpoint}$: indoor temperature setpoint at time t
O_t : #occupants at time t
I : thermal comfort band

- G = CARBON EMISSIONS
  - ↳ emissions from imported electricity (when PV does not satisfy electricity demand)

$$G = \sum_{i=0}^{b-1} g^i_{control} \Big/ \sum_{i=0}^{b-1} g^i_{baseline}$$

- $g = \sum_{t=0}^{n-1} \max(0, e_t \cdot B_t)$
  - e_t : building net electricity consumption (KWh)
  - B_t : emission rate (Kg CO2e/KWh)
    - ↳ carbon emitted per KWh imported from the net

Building carbon emissions:
- ↳ control - controlled system
- ↳ baseline - not controlled system

- S = NORMALIZED UNSERVED ENERGY
  - ↳ proportion of unmet demand due to supply shortage

$$S = \sum_{i=0}^{b-1} s^i_{control} / b$$

- $s = s^{served} / s^{expected}$
- $s^{served} = \sum_{t=0}^{n-1} \begin{cases} q_n^{served} & \text{if } F_t > 0 \\ 0 \end{cases}$
- $s^{expected} = \sum_{t=0}^{n-1} \begin{cases} q_n^{expected} & \text{if } F_t > 0 \\ 0 \end{cases}$

q_n : building level energy demand (cooling, dhw, non-shiftable load)