```
B : Charge
D_s: Self Discharge Rate
C\, : Charge Rate
D\ : {\bf Discharge}\ {\bf Rate}
 \begin{array}{l} \nu & : \text{Roundtrip Efficiency} \\ T_t & = T_{t-1} + \frac{1}{r_a}(T_{a,t} - T_{t-1}) + \frac{1}{r_b}(T_{b,t} - T_{t-1}) + \frac{1}{r_h}L_{TCL}a_{tcl,t} + q \\ T_{b,t} & = T_{b,t-1} + \frac{1}{r_b}(T_{t-1} - T_{b,t-1}) \\ T & : \text{Indoor Temperature} \end{array} 
           : Outdoor Temperature
           : Building Temperature
L_{TCL}: Nominal Heating Power
          : Unintentional Heat Gain
a_{ess} \in [-1, 1]
a_{fdr} \in [-1, 1]^H

a_{tcl} \in [-1, 1]

a_* = 0
a_t
s_t, a_t, r_t, s_{t+1}
s_t, s_{t+1}
\pi(s_t), \pi(s_{t+1}), H(a, s)
min(Q_1, Q_2)
Q(s,a)
a_* = Uniform(-1,1)
```

Table 1: Accumulated rewards split by origin per setting. Evaluation was done after every epoch and the best result is shown.

Experiment	Algorithm	ESS	FDR	TCL	DISCOMFORT	Total	SAVEI
	IDLE	0.00	-1207.53	-5099.46	-6144.05	15604.1	
Initial Setting	Threshold	523.19	-1012.63	-5033.79	-1159.65	21372.26	
	PPO	-23.78	-1263.76	-5498.38	-1951.5	19317.72	
	SAC	85.66	-1150.97	-5421.83	-3207.93	18360.07	
Experiment	Algorithm	ESS	FDR	TCL	DISCOMFORT	Total	SAVEI
STACKED CARBON INTENSITY	IDLE	0.00	-1207.53	-5099.46	-6144.05	15604.1	
	Threshold	523.19	-1012.63	-5033.79	-1159.65	21372.26	
	PPO	0.00	-1225.71	-5696.45	-1354.04	19778.94	
	SAC	124.05	-1190.63	-5438.74	-1464.48	20085.34	
Experiment	Algorithm	ESS	FDR	TCL	DISCOMFORT	Total	SAVEI
EASED EXPLORATION	Idle	0.00	-1207.53	-5099.46	-6144.05	15604.1	
	Threshold	523.19	-1012.90	-5033.79	-1159.65	21371.99	
	PPO	-1	-1	-1	-1		
	SAC	657.56	-879.83	-13175.57	-4388.83	10268.47	
Experiment	Algorithm	ESS	FDR	TCL	DISCOMFORT	Total	
Terminal Reward	IDLE	0.00	-1207.53	-5099.46	-6144.05	15604.1	
	Threshold	523.19	-1012.63	-5033.79	-1159.65	21372.26	
	PPO	-16.92	-1244.29	-5995.35	-2038.94	18759.64	
	SAC	-9.08	-1122.2	-8500.46	-4916.73	13506.67	

Table 2: Accumulated rewards split by origin per setting. Evaluation was done after every epoch and the best result is shown.

ESS         0.00         -66.23         523.19         -23.78         85.66           FDR         -1207.53         -1215.82         -1012.63         -1263.76         -1150.97           TCL         -5099.46         -15043.22         -5033.79         -5498.38         -5421.83           SAVED CARBON         BASE         -10018.28         783.76         -478.93         -180.15           SAVED CARBON         BASE         -10018.28         783.76         -478.93         -180.15           ESS         0.00         -66.23         523.19         0.00         124.05           FDR         -1207.53         -1215.82         -1012.63         -1225.71         -1190.63           FDR         -1207.53         -1215.82         -1012.63         -1225.71         -1190.63           FDR         -5099.46         -15043.22         -5033.79         -5696.45         -5438.74           TCL         -6144.05         -8212.51         -1159.65         -1354.04         -1464.48           SAVED CARBON         BASE         -10018.28         783.76         -615.17         -198.33           TCL         -5099.46         -5033.79         -5644.43         -13175.57         -159.33         -1012.90						
FDR         -1207.53         -1215.82         -1012.63         -1263.76         -1150.97           TCL         -5099.46         -15043.22         -5033.79         -5498.38         -5421.83           SAVED CARBON         BASE         -10018.28         783.76         -478.93         -180.15           ESS         0.00         -66.23         523.19         0.00         124.05           FDR         -1207.53         -1215.82         -1012.63         -1225.71         -1190.63           TCL         -5099.46         -15043.22         -5033.79         -5696.45         -5438.74           TCL         -6144.05         -8212.51         -115.965         -1354.04         -1464.48           SAVED CARBON         BASE         -10018.28         783.76         -615.17         -198.33           ESS         0.00         523.19         233.85         657.56         -1598.33           FDR         -1207.53         -1012.90         -1085.54         -879.83         -879.83           TCL         -5099.46         -5033.79         -5644.43         -13175.57         -1012.90         -1085.54         -879.83         -879.83           SAVED CARBON         BASE         783.49         -189.13		IDLE	RANDOM	THRESHOLD	PPO	SAC
TCL         -5099.46 -6144.05 -8212.51 -1159.65 -1951.5 -3207.93         -5498.38 -5421.83 -1159.65 -1951.5 -3207.93           SAVED CARBON         BASE         -10018.28 783.76 -478.93 -180.15           ESS         0.00 -66.23 523.19 0.00 124.05           FDR         -1207.53 -1215.82 -1012.63 -1225.71 -1190.63           TCL         -5099.46 -15043.22 -5033.79 -5696.45 -5438.74 -6144.05 -8212.51 -1159.65 -1354.04 -1464.48           SAVED CARBON         BASE -10018.28 783.76 -615.17 -198.33           ESS         0.00 523.19 -1012.90 -1085.54 -879.83 -1012.90 -1085.54 -879.83           TCL -5099.46 -5033.79 -6144.05 -1207.53 -1012.90 -1085.54 -879.83 -1012.90 -189.13 -7090.85           TCL -6144.05 -6144.05 -1159.65 -2205.01 -4388.83 -1001.80 -189.13 -7090.85           SAVED CARBON         BASE -783.49 -189.13 -7090.85           ESS         0.00 -66.23 -1207.53 -1215.82 -1012.63 -1244.29 -1122.2 -1207.53 -1215.82 -1012.63 -1244.29 -1122.2 -1207.53 -1215.82 -1012.63 -1244.29 -1122.2 -1207.53 -1215.82 -1012.63 -1244.29 -1122.2 -1207.53 -1215.82 -1012.63 -1244.29 -1122.2 -1207.53 -1215.82 -1012.63 -1244.29 -1122.2 -1207.53 -1215.82 -1012.63 -1244.29 -1122.2 -1207.53 -1215.82 -1012.63 -1244.29 -1122.2 -1207.53 -1215.82 -1012.63 -1244.29 -1122.2 -1207.53 -1215.82 -1012.63 -1244.29 -1122.2 -1207.53 -1215.82 -1012.63 -1244.29 -1122.2 -1207.53 -1215.82 -1012.63 -1244.29 -1122.2 -1207.53 -1215.82 -1012.63 -1244.29 -1122.2 -1207.53 -12	ESS	0.00	-66.23	523.19	-23.78	85.66
TCL         -6144.05         -8212.51         -1159.65         -1951.5         -3207.93           SAVED CARBON         BASE         -10018.28         783.76         -478.93         -180.15           ESS         0.00         -66.23         523.19         0.00         124.05           FDR         -1207.53         -1215.82         -1012.63         -1225.71         -1190.63           TCL         -5099.46         -15043.22         -5033.79         -5696.45         -5438.74           SAVED CARBON         BASE         -10018.28         783.76         -615.17         -198.33           ESS         0.00         523.19         233.85         657.56         -5134.04         -1464.48           SAVED CARBON         BASE         -10018.28         783.76         -615.17         -198.33           TCL         -5099.46         -5033.79         -5644.43         -13175.57         -1798.33           TCL         -6144.05         -1159.65         -2205.01         -4388.83         -4388.83           SAVED CARBON         BASE         783.49         -189.13         -7090.85           FDR         -1207.53         -1215.82         -1012.63         -1244.29         -1122.2 <th< td=""><td>FDR</td><td>-1207.53</td><td>-1215.82</td><td>-1012.63</td><td>-1263.76</td><td>-1150.97</td></th<>	FDR	-1207.53	-1215.82	-1012.63	-1263.76	-1150.97
Saved Carbon   Base   -10018.28   783.76   -478.93   -180.15     Idle	mar.	-5099.46	-15043.22	-5033.79	-5498.38	-5421.83
SAC   SAC	ICL	-6144.05	-8212.51	-1159.65	-1951.5	-3207.93
ESS	SAVED CARBON	Base	-10018.28	783.76	-478.93	-180.15
FDR         -1207.53         -1215.82         -1012.63         -1225.71         -1190.63           TCL         -5099.46         -15043.22         -5033.79         -5696.45         -5438.74           -6144.05         -8212.51         -1159.65         -1354.04         -1464.48           SAVED CARBON         BASE         -10018.28         783.76         -615.17         -198.33           ESS         0.00         523.19         233.85         657.56         5657.56         57		IDLE	RANDOM	Threshold	PPO	SAC
TCL         -5099.46 -15043.22 -5033.79 -5696.45 -5438.74 -6144.05 -8212.51 -1159.65 -1354.04 -1464.48 SAVED CARBON         -1464.48 -1444.48	ESS	0.00	-66.23	523.19	0.00	124.05
TCL         -6144.05         -8212.51         -1159.65         -1354.04         -1464.48           SAVED CARBON         BASE         -10018.28         783.76         -615.17         -198.33           ESS         0.00         523.19         233.85         657.56         FDR           FDR         -1207.53         -1012.90         -1085.54         -879.83         -879.83           TCL         -5099.46         -5033.79         -5644.43         -13175.57         -6144.05         -1159.65         -2205.01         -4388.83           SAVED CARBON         BASE         783.49         -189.13         -7090.85           ESS         0.00         -66.23         523.19         -16.92         -9.08           FDR         -1207.53         -1215.82         -1012.63         -1244.29         -1122.2           TCL         -5099.46         -15043.22         -5033.79         -5995.35         -8500.46           TCL         -6144.05         -8212.51         -1159.65         -2038.94         -4916.73           SAVED CARBON         BASE         THRESHOLD         PPO         SAC	FDR	-1207.53	-1215.82	-1012.63	-1225.71	-1190.63
The state of the	TCI	-5099.46	-15043.22	-5033.79	-5696.45	-5438.74
TDLE	ICL	-6144.05	-8212.51	-1159.65	-1354.04	-1464.48
ESS 0.00 523.19 233.85 657.56 FDR -1207.53 -1012.90 -1085.54 -879.83  TCL -5099.46 -5033.79 -5644.43 -13175.57 -6144.05 -1159.65 -2205.01 -4388.83  SAVED CARBON BASE 783.49 -189.13 -7090.85  ESS 0.00 -66.23 523.19 -16.92 -9.08 FDR -1207.53 -1215.82 -1012.63 -1244.29 -1122.2  TCL -5099.46 -15043.22 -5033.79 -5995.35 -8500.46 -6144.05 -8212.51 -1159.65 -2038.94 -4916.73  SAVED CARBON BASE -10018.28 783.76 -949.57 -3324.75  ENSEMBLE THRESHOLD PPO SAC  ESS 657.56 FDR -879.83 TCL -5033.79 -1159.65	SAVED CARBON	Base	-10018.28	783.76	-615.17	-198.33
FDR         -1207.53         -1012.90         -1085.54         -879.83           TCL         -5099.46         -5033.79         -5644.43         -13175.57           -6144.05         -1159.65         -2205.01         -4388.83           SAVED CARBON         BASE         783.49         -189.13         -7090.85           ESS         0.00         -66.23         523.19         -16.92         -9.08           FDR         -1207.53         -1215.82         -1012.63         -1244.29         -1122.2           TCL         -5099.46         -15043.22         -5033.79         -5995.35         -8500.46           FDR         -6144.05         -8212.51         -1159.65         -2038.94         -4916.73           SAVED CARBON         BASE         -10018.28         783.76         -949.57         -3324.75           ESS         657.56           FDR         -879.83           TCL         -5033.79         -1159.65		Idle	THRESHOLD	PPO	SAC	
TCL         -5099.46 -6144.05 -1159.65 -2205.01 -4388.83         -5644.43 -13175.57 -2205.01 -4388.83           SAVED CARBON         BASE         783.49 -189.13 -7090.85           ESS         0.00 -66.23 -1215.82 -1012.63 -1244.29 -1122.2 -1012.63 -1244.29 -1122.2 -1012.63 -1244.29 -1122.2 -1012.63 -1244.29 -1122.2 -1012.63 -1244.29 -1122.2 -1012.63 -1244.29 -1122.2 -1012.63 -1244.29 -1122.2 -1012.63 -1159.65 -2038.94 -4916.73 -1159.65 -2038.94 -4916.73 -1159.65 -2038.94 -4916.73 -10018.28 -	ESS	0.00	523.19	233.85	657.56	
TCL         -6144.05         -1159.65         -2205.01         -4388.83           SAVED CARBON         BASE         783.49         -189.13         -7090.85           IDLE         RANDOM         THRESHOLD         PPO         SAC           ESS         0.00         -66.23         523.19         -16.92         -9.08           FDR         -1207.53         -1215.82         -1012.63         -1244.29         -1122.2           TCL         -5099.46         -15043.22         -5033.79         -5995.35         -8500.46           -6144.05         -8212.51         -1159.65         -2038.94         -4916.73           SAVED CARBON         BASE         -10018.28         783.76         -949.57         -3324.75           ESS         657.56         FDR         -879.83         -879.83         -5033.79         -1159.65           TCL         -5033.79         -1159.65         -10015.28         -10015.28         -10015.28         -10015.28	FDR	-1207.53	-1012.90	-1085.54	-879.83	
SAVED CARBON   BASE   783.49   -189.13   -7090.85	TCL	-5099.46	-5033.79	-5644.43	-13175.57	
Tole		-6144.05	-1159.65	-2205.01	-4388.83	
ESS 0.00 -66.23 <b>523.19</b> -16.92 -9.08 FDR -1207.53 -1215.82 <b>-1012.63</b> -1244.29 -1122.2 -5099.46 -15043.22 <b>-5033.79</b> -5995.35 -8500.46 -6144.05 -8212.51 <b>-1159.65</b> -2038.94 -4916.73 SAVED CARBON BASE -10018.28 <b>783.76</b> -949.57 -3324.75 ESS 657.56 FDR -879.83 TCL -5033.79 -1159.65	SAVED CARBON	Base	783.49	-189.13	-7090.85	
FDR         -1207.53         -1215.82         -1012.63         -1244.29         -1122.2           TCL         -5099.46         -15043.22         -5033.79         -5995.35         -8500.46           -6144.05         -8212.51         -1159.65         -2038.94         -4916.73           SAVED CARBON         BASE         -10018.28         783.76         -949.57         -3324.75           ESS         657.56         FDR         -879.83         -5033.79         -1159.65         -1159.65		IDLE	RANDOM	THRESHOLD	PPO	SAC
TCL         -5099.46 -15043.22 -5033.79 -5995.35 -8500.46 -6144.05 -8212.51 -1159.65 -2038.94 -4916.73 -4916.73           SAVED CARBON         BASE -10018.28 -	ESS	0.00	-66.23	523.19	-16.92	-9.08
TCL -6144.05 -8212.51 -1159.65 -2038.94 -4916.73 SAVED CARBON BASE -10018.28 783.76 -949.57 -3324.75  ENSEMBLE THRESHOLD PPO SAC  ESS 657.56 FDR -879.83 TCL -5033.79 -1159.65	FDR	-1207.53	-1215.82	-1012.63	-1244.29	-1122.2
-6144.05 -8212.51 -1159.65 -2038.94 -4916.73 SAVED CARBON BASE -10018.28 783.76 -949.57 -3324.75  ENSEMBLE THRESHOLD PPO SAC  ESS 657.56 FDR -879.83 TCL -5033.79 -1159.65	TCI	-5099.46	-15043.22	-5033.79	-5995.35	-8500.46
ENSEMBLE THRESHOLD PPO SAC  ESS 657.56 FDR -879.83 TCL -5033.79 -1159.65	ICL	-6144.05	-8212.51	-1159.65	-2038.94	-4916.73
ESS 657.56 FDR -879.83 TCL -5033.79 -1159.65	SAVED CARBON	Base	-10018.28	783.76	-949.57	-3324.75
FDR -879.83 TCL -5033.79 -1159.65		Ensemble	THRESHOLD	PPO	SAC	
$\begin{array}{ccc} & -5033.79 \\ -1159.65 \end{array}$	ESS	657.56				
-1159.65	FDR	-879.83				
-1159.65	TCL	-5033.79				
SAVED CARBON 1050.37	IOL	-1159.65				
	SAVED CARBON	1050.37				