Appendix

Small size IETS:

The parameters of TDN, CHP, EDN, TS, ambient temperature, and expectation of real-time price are from Ref. [A1]. Other parameters are listed in Table A1-Table A2.

Table A1 Expectation of RES output

Time-slot	1	2	3	4	5	6
$\overline{P}_n^{\mathrm{RES}}(t)$ (kW)	0	0	0	0	0	0
Time-slot	7	8	9	10	11	12
$\overline{P}_n^{\mathrm{RES}}(t)$ (kW)	0	107.38	39.51	83.28	128.02	156.90
Time-slot	13	14	15	16	17	18
$\overline{P}_n^{\mathrm{RES}}(t)$ (kW)	145.77	169.98	165.62	130.25	-89.93	-42.51
Time-slot	19	20	21	22	23	24
$\overline{P}_n^{\mathrm{RES}}(t)$ (kW)	-15.90	0	0	0	0	0

Table A2 Parameters of BS

$\overline{P}_{\mathrm{c},n}^{\mathrm{BS}}$	24kW	$\overline{E}_n^{\mathrm{BS}}$	80kWh	$\eta_{\mathrm{ESS,c}}$	0.98	β_{ESS}	\$0.01/kW
$\overline{P}_{\mathrm{d},n}^{\mathrm{BS}}$	24kW	$\underline{E}_n^{\mathrm{BS}}$	0kWh	$\eta_{\mathrm{ESS,d}}$	0.98		

The forecasting errors of electrical and thermal loads, real-time price, and RES output are assumed to follow the normal distribution $N(0,0.03^2)$, $N(0,0.1^2)$, and $N(0,0.2^2)$, respectively.

Medium size IETS:

The parameters of TDN, EDN, TS, and ambient temperature are from Ref. [A1]. CHP 1 is chosen as the balance unit to maintain the mass flow balance in TDN. Other parameters are listed in Table A3-Table A5.

Table A3 Expectation of RES output and real-time price

Time-slot	1	2	3	4	5	6
$\overline{P}_1^{\mathrm{RES}}(t)$ (kW)	0	0	0	0	0	0
$\overline{P}_2^{\mathrm{RES}}(t)$ (kW)	0	0	0	0	0	0
$\overline{P}_3^{\mathrm{RES}}(t)$ (kW)	0	0	0	0	0	0
$\varepsilon(t)$ (\$)	0.124	0.107	0.094	0.084	0.083	0.093
Time-slot	7	8	9	10	11	12
$\overline{P}_1^{\mathrm{RES}}(t)$ (kW)	0	19.84	72.95	153.75	236.34	289.66
$\overline{P}_2^{\mathrm{RES}}(t)$ (kW)	0	46.20	129.18	236.51	328.46	327.90

$\overline{P}_3^{\mathrm{RES}}(t)$ (kW)	0	19.84	72.95	153.76	236.34	289.66
$\varepsilon(t)$ ($)	0.084	0.089	0.113	0.140	0.159	0.162
Time-slot	13	14	15	16	17	18
$\overline{P}_1^{\mathrm{RES}}(t)$ (kW)	269.11	304.58	305.76	240.47	167.24	78.49
$\overline{P}_2^{\mathrm{RES}}(t)$ (kW)	437.63	451.02	430.90	389.41	288.95	153.06
$\overline{P}_3^{\mathrm{RES}}(t)$ (kW)	269.11	304.58	305.76	240.47	167.24	78.49
$\varepsilon(t)$ ($)	0.172	0.170	0.162	0.160	0.157	0.160
Time-slot	19	20	21	22	23	24
$\overline{P}_1^{\mathrm{RES}}(t)$ (kW)	29.34	0	0	0	0	0
$\overline{P}_2^{\mathrm{RES}}(t)$ (kW)	67.60	0	0	0	0	0
$\overline{P}_3^{\mathrm{RES}}(t)$ (kW)	29.34	0	0	0	0	0
$\varepsilon(t)$ ($)	0.167	0.169	0.169	0.161	0.150	0.139

Table A4 Parameters of BS

$\overline{P}_{\mathrm{c},n}^{\mathrm{BS}}$	36kW	$\overline{E}_n^{\mathrm{BS}}$	120kWh	$\eta_{\mathrm{BS,c}}$	0.98	β_{BS}	$0.001/kW
$\overline{P}_{\mathrm{d},n}^{\mathrm{BS}}$	36kW	$\underline{E}_n^{\mathrm{BS}}$	0kWh	$\eta_{\mathrm{BS,d}}$	0.98		

Table A5 Cost coefficients of CHP

	$a_{n,5}$	$a_{n,4}$	$a_{n,3}$	$a_{n,2}$	$a_{n,1}$	$a_{n,0}$
CHP 1	0.0013	0.0013	0.00024	0.015	0.018	0
CHP 2	0.0013	0.0013	0.00024	0.015	0.018	0

The forecasting errors of electrical and thermal loads, real-time price, and RES output are assumed to follow the normal distribution $N(0,0.03^2)$, $N(0,0.1^2)$, and $N(0,0.2^2)$, respectively.

ADP-IL:

The maximum iteration of ADP-IL is set as 2500 (small size IETS) and 10000 (medium size IETS). The step size used in off-line pre-learning are given as

$$\alpha_n = \frac{1}{N(R_t^{x,n})}, \tag{A1}$$

where $N(R_t^{x,n})$ represents the number of visits by the off-line pre-learning algorithm to the state $R_t^{x,n}$.

[A1] Liu B, Meng K, Dong ZY, Wei W. Optimal dispatch of coupled electricity and heat system with independent thermal energy storage. IEEE Trans Power Syst 2019;34(4): 3250-3263.