Electronic Supplementary Material

Given that the CAES system has a novel system structure, to verify the system model, this paper sets the system structure and main parameters according to Ref. [28], and some main parameters of the present model are compared with the data in Ref. [28]. The validation results are shown in Table S1, and the error of all results is less than 0.5%. It can be considered that the model meets the accuracy requirements of thermodynamic analysis.

Table S1 Model validation

Parameter	Design value	Model value
Power of compression train/MW	25.2	25.2
Power of expansion train/MW	25.2	25.2
Compression time/h	16.75	16.81
Expansion time/h	12	12.05
RTE/%	71.64	71.68

The work fluid data of the reference CAES system can be found in Table S2 and Table S3. The corresponding status points are shown in Fig. S1.

Table S2 Working fluid parameters of reference CAES system

State point	Working fluid	Pressure/bar	Temperature/◦C	Flow rate/(kg·s^{-1})
1	air	1	20	500
2	air	5.06	210	500
3	air	4.99	60	500
4	air	4.92	40	500
5	air	20.05	210	500
6	air	19.78	60	500
7	air	19.52	40	500
8	air	79.57	210	500
9	air	78.56	60	500
10	air	77.58	40	500
11	air	101.52	67.74	500
12	air	100	40	500
13	air	80	40	722.19
14	air	78.8	190	722.19
15	air	18.57	49.95	722.19
16	air	18.29	190	722.19
17	air	4.31	49.95	722.19
18	air	4.24	190	722.19
19	air	1	49.95	722.19

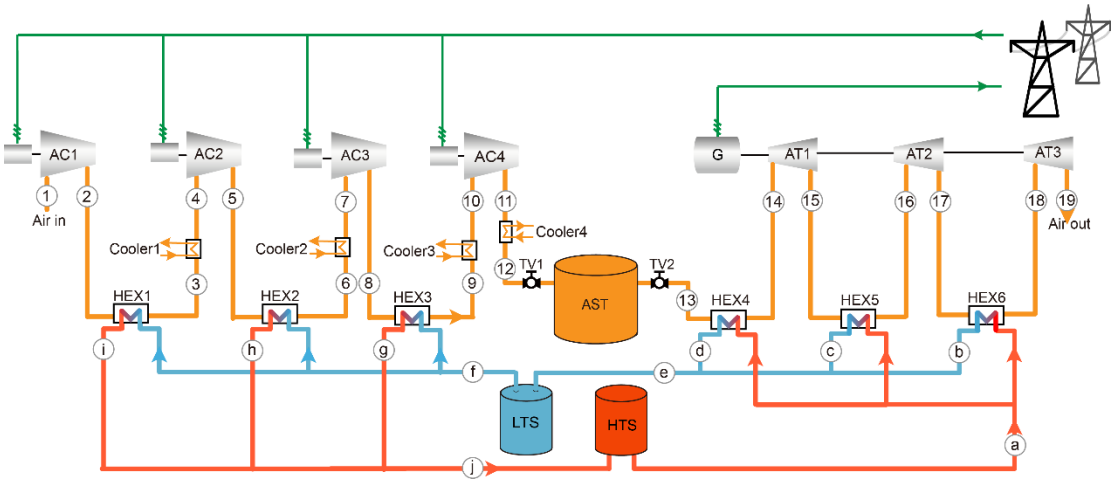

Fig. S1 Schematic diagram of reference CAES system.

Table S3 Thermal storage working fluid parameters for AA-CAES

State point	Working fluid	Pressure/bar	Temperature/◦C	Flow rate/(kg·s^{-1})
a	Water	15	200.00	1846.44
b	Water	15	59.95	615.24
c	Water	15	59.95	615.24
d	Water	15	50.00	615.96
e	Water	15	50.00	1846.44
f	Water	15	50.00	1282.53
g	Water	15	200.00	427.51
h	Water	15	200.00	427.51
i	Water	15	200.00	427.51
j	Water	15	200.00	1282.53