**Supplementary parameters**

As shown in constraint (11) of the main text, the electricity price for main grid users is primarily determined by the power purchase costs and reserve capacity costs paid by the power grid to power generation entities. For the sake of explanation, this paper assumes that the power generation side includes the wind farm and thermal power units. Therefore, constraint (11) can be written as (S1):

 (S1)

where *c*g,us is the electricity price indicator for grid-side users, and are the total electricity sales prices of the wind farm and thermal units in the energy market, respectively, is the reserve cost paid by the main grid to balance the uncertainty of wind power output, is the power consumption of grid-side users, ∆*t* is the time interval, *T*c is the total evaluation time period.

The load forecast data from Elia (Elia Group 2023) are used and converted to the required scale. The unit reserve capacity compensation price for thermal power units is $26.6/MWh. To balance wind power output deviations, thermal power units need to adjust their output in the balancing market. The upward and downward adjustment prices for thermal units are set at 1.3 and 0.7 times the grid-connected electricity price in the day-ahead energy market for the same time period, respectively.

**References**

Elia Group. “Total load.” 2023. https://www.elia.be/en/grid-data/Load-and-Load-Forecasts.