energies

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# Some Detailed Calculation Processes of the Results

In the manuscript, the relative data and the process of how to obtain the original and optimized day-head generation schedules are already shown in detail in Section 5. Here is the process of how to get the results in Table 8 in the manuscript based on the original and optimized day-head generation schedules, which is not the main content of the manuscript.

**1. Equivalent Reactance:**

(1) Equivalent reactance of the original day-head generation schedules:

Based on the parameters given in Table 3 and the original day-head generation schedules in Table 4 in the manuscript.

$$\boldsymbol{Y}_{PP}=\mathrm{j}\begin{bmatrix} -6.12304 & 1.886792 & 1.926782 & 0 & 0 & 0 \\ 1.886792 & -1.88679 & 0 & 0 & 0 & 0 \\ 1.926782 & 0 & -12.8197 & 4.545455 & 4 & 0 \\ 0 & 0 & 4.545455 & -4.54545 & 0 & 0 \\ 0 & 0 & 4 & 0 & -9.10204 & 5.102041 \\ 0 & 0 & 0 & 0 & 5.102041 & -5.10204 \end{bmatrix}$$

$$\boldsymbol{Y}_{PB}=\mathrm{j}\begin{bmatrix} 2.309469 & 0 & 2.347418 & 0 & 0 & 0 \end{bmatrix}$$

$$X_{\Sigma}=\mathrm{Im}\left(\frac{1}{\boldsymbol{Y}_{PB}^{T}\boldsymbol{E}-\boldsymbol{Y}_{PB}^{T}\boldsymbol{Y}_{PP}^{-1}\boldsymbol{Y}_{PB}}\right)=0.1074$$

(2) Equivalent reactance of the optimized day-head generation schedules:

Based on the parameters given in Table 3 and optimized day-ahead thermal generation plant commitment in Table 5 in the manuscript.

$$\boldsymbol{Y}_{PP}=\mathrm{j}\begin{bmatrix} -6.12304 & 1.886792 & 1.926782 & 0 \\ 1.886792 & -1.88679 & 0 & 0 \\ 1.926782 & 0 & -6.47224 & 4.545455 \\ 0 & 0 & 4.545455 & -4.54545 \end{bmatrix}$$

$$\boldsymbol{Y}_{PB}=\mathrm{j}\begin{bmatrix} 2.309469 & 0 & 2.347418 & 0 \end{bmatrix}$$

$$X_{\Sigma}=\mathrm{Im}\left(\frac{1}{\boldsymbol{Y}_{PB}^{T}\boldsymbol{E}-\boldsymbol{Y}_{PB}^{T}\boldsymbol{Y}_{PP}^{-1}\boldsymbol{Y}_{PB}}\right)=0.0591$$

**2. Equivalent Inertia Constant**

(1) Equivalent inertia constant of the original day-head generation schedules:

Based on the parameters given in Table 2 and the original day-head generation schedules in Table 4 in the manuscript.

$$T_{JC}=1.5s\times5+1.5s\times5=15s$$

$$T_{ZY}=3.12s\times2=6.24s$$

$$T_{JQ}=1.5s\times5=7.5s$$

$$T_{BLS}=3.12s\times2=6.24s$$

$$T_{J}=\sum_{i=1}^{N_p}U_{Pi}T_i=15s+6.24s+7.5s+6.24s=34.98s$$

(2) Equivalent inertia constant of the optimized day-head generation schedules:

Based on the parameters given in Table 2 and optimized day-ahead thermal generation unit commitment in Table 6 in the manuscript.

$$T_{JC} = 1.5s \times 5 + 2.63s \times 3 + 3.12s \times 2 = 21.63s$$

$$T_{ZY} = 3.59s \times 1 + 3.59s \times 1 = 7.18s$$

$$T_{JQ} = 1.5s \times 5 + 3.12s \times 2 = 13.74s$$

$$T_J = \sum_{i=1}^{N_p} U_{Pi} T_i = 21.63s + 7.18s + 13.74s = 42.55s$$

## 3. Thermal Generation Cost

(1) Thermal generation cost of the original day-head generation schedules:

Based on the parameters given in Table 2 and the original day-head generation schedules in Table 4 in the manuscript.

$$C_{JC} = \sum_{t=1}^{24} \sum_{j=1}^{2} u_{ij} (a_{ij} + b_{ij} P_{ij}^t + c_{ij} (P_{ij}^t)^2) \Delta t = 904107\$$$

$$C_{ZY} = \sum_{t=1}^{24} u_{ij} (a_{ij} + b_{ij} P_{ij}^t + c_{ij} (P_{ij}^t)^2) \Delta t = 188209\$$$

$$C_{JQ} = \sum_{t=1}^{24} u_{ij} (a_{ij} + b_{ij} P_{ij}^t + c_{ij} (P_{ij}^t)^2) \Delta t = 452053\$$$

$$C_{BLS} = \sum_{t=1}^{24} u_{ij} (a_{ij} + b_{ij} P_{ij}^t + c_{ij} (P_{ij}^t)^2) \Delta t = 188209\$$$

$$C = 904107\$ + 188209\$ + 452053\$ + 188209\$ = 1732578\$$$

(2) Thermal generation cost of the optimized day-head generation schedules:

Based on the parameters given in Table 2 and optimized day-ahead thermal generation schedules in Table 7 in the manuscript.

$$C_{JC} = \sum_{t=1}^{24} \sum_{j=1}^{3} u_{ij} (a_{ij} + b_{ij} P_{ij}^t + c_{ij} (P_{ij}^t)^2) \Delta t = 931402\$$$

$$C_{ZY} = \sum_{t=1}^{24} \sum_{j=1}^{2} u_{ij} (a_{ij} + b_{ij} P_{ij}^t + c_{ij} (P_{ij}^t)^2) \Delta t = 255695\$$$

$$C_{JQ} = \sum_{t=1}^{24} \sum_{j=1}^{2} u_{ij} (a_{ij} + b_{ij} P_{ij}^t + c_{ij} (P_{ij}^t)^2) \Delta t = 731494\$$$

$$C = 931402\$ + 255695\$ + 731494\$ = 1918591\$$$

## 4. TTC Calculation

TTC is calculated using the transient stability constrained continuation power flow method, using the Power System Analysis Software Package (PSASP). The model of thermal generation unit is a synchronous generator and the model of wind farm is a doubly fed induction generator. The contingency is the N-1 fault that happens on each of the transmission lines in the transmission channel, and the fault removal time is 0.1s.

(1) TTC of the original day-head generation schedules:

Based on the original day-head generation schedules in Table 4 in the manuscript, take the generation schedule of period 1 as the initial operation point. Increase the output of the wind farms in proportion to their original output, decrease the output of the generators in the receiving-side system, and perform power flow calculation and transient stability time domain simulation to check if the system is able to stay stable. The maximum steady state power that can be delivered through the transmission channel is TTC, under the condition that the system is able to stay transient stable after a fault occurs.

When the power delivered through the transmission channel is 4404 MW, the system is able to stay stable, as shown in Figure A:

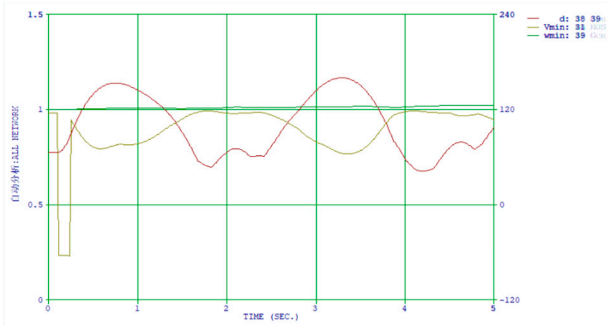


**Figure S1**. Stable rotor angle when power delivered through the transmission channel is 4404 MW.

When the power delivered through the transmission channel is 4405 MW, the system is unable to stay stable, as shown in Figure B:

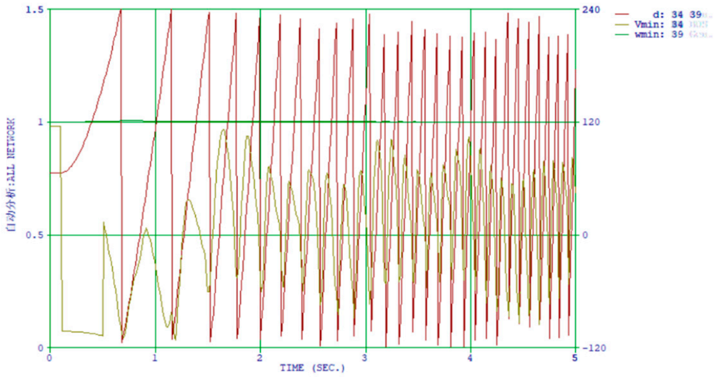


**Figure S2.** Unstable rotor angle when power delivered through the transmission channel is 4405 MW.

Therefore, the corresponding TTC of the original day-head generation schedules is 4404 MW.

(2) TTC of the optimized day-head generation schedules:

Based on the original day-head generation schedules in Table 7 in the manuscript, take the generation schedule of period 1 as the initial operation point. The process to get the corresponding TTC is the same as above, and the of the optimized day-head generation schedules is 5105 MW.

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