**Table.1** Parameters of the system

|  |  |  |
| --- | --- | --- |
| Variable | Company | Numerical value |
| *V*sto Hydrogen tank volume. | m3 | 950 |
| *SOC*min Lower limit of state of charge. | % | 10 |
| *SOC*max Upper limit of state of charge. | % | 90 |
| *P*elmin Lower limit of electrolytic cell power. | MW | -30 |
| *P*elmax Upper limit of electrolytic cell power. | MW | 0 |
| *P*fcmin Lower limit of fuel cell power. | MW | 0 |
| *P*fcmax Upper limit of fuel cell power. | MW | 30 |
| *P*batmin Lower battery power limit. | MW | -10 |
| *P*batmax Upper battery power limit. | MW | 10 |
| *P*windmin Lower limit of fan power. | MW | 0 |
| *P*windmax Upper limit of fan power. | MW | 60 |
| *P*pvmin Lower limit of photovoltaic unit power. | MW | 0 |
| *P*pvmax Upper limit of photovoltaic unit power. | MW | 60 |
| *P*Fmin Lower limit of gas unit power. | MW | 0 |
| *P*Fmax Upper limit of gas unit power. | MW | 30 |
| △*P*elmax Upper limit of electrolytic cell power increment. | MW/min | 40 |
| △*P*fcmin Lower limit of fuel cell power increment. | MW/min | -6 |
| △*P*fcmax Upper limit of fuel cell power increment. | MW/min | 6 |
| △*P*batmin Lower limit of battery power increment. | MW/min | -10 |
| △*P*batmax Upper limit of battery power increment. | MW/min | 10 |
| △*P*Fmax Upper limit of power increment of gas unit. | MW/min | 6 |

**Table.2** Flexibility indicators in different scenarios

|  |  |  |  |
| --- | --- | --- | --- |
| Scene | *E*IR（MW/min） | *E*IO（MW） | *E*IC（MWh） |
| 1 | 5.631 | 26.173 | 32.089 |
| 2 | 1.627 | 12.63 | 16.5 |
| 3 | 0 | 1.1 | 3.62 |

**Table.3** Maximum/Minimum Flexibility indicators in different scenarios

|  |  |  |  |
| --- | --- | --- | --- |
| Scene | *r*+n,max/ *r*-n,max（MW/min） | *p*+n,max/ *p*-n,max（MW） | *e*+n,max/ *e*-n,max（MWh） |
| 1 | 10.25/0 | 51.2/0 | 62.91/0 |
| 2 | 4.67/0 | 20.7/-10.5 | 36.27/-7.54 |
| 3 | 0/0 | 0/-2.1 | 0/-3.52 |

**Table.4** System flexibility under different permeability

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Scene | Fan | PV | *E*IR(MW/min) | *E*IO(MW) | *E*IC(MWh) |
| 1 | 0% | 0% | 0 | 0 | 0 |
| 2 | 15% | 25% | 0.74 | 3.52 | 1.35 |
| 3 | 25% | 15% | 0.77 | 3.33 | 1.27 |
| 4 | 30% | 30% | 0.87 | 7.96 | 2.92 |
| 5 | 40% | 40% | 2.15 | 10.62 | 11.76 |
| 6 | 50% | 50% | 10.65 | 26.65 | 30.65 |