Supplementary Material

# Supplementary Figures and Tables

## Supplementary Figures

(A) Active power of CDG (B) Reactive power of CDG

**Supplementary Figure 1** Controlled distributed power output in Scheme Ⅰ

(A) Active power of NDG (B) Reactive power of NDG

**Supplementary Figure 2** PV system output in Scheme Ⅰ

(A) Active power of CDG (B) Reactive power of CDG

**Supplementary Figure 3** Controlled distributed power output in Scheme Ⅱ

(A) Active power of NDG (B) Reactive power of NDG

**Supplementary Figure 4** PV system output in Scheme Ⅱ

(A) Active power of CDG (B) Reactive power of CDG

**Supplementary Figure 5** Controlled distributed power output in Scheme Ⅲ

(A) Active power of NDG (B) Reactive power of NDG

**Supplementary Figure 6** PV system output in Scheme Ⅲ

(A) Active power of CDG (B) Reactive power of CDG

**Supplementary Figure 7** Controlled distributed power output in Scheme Ⅳ

(A) Active power of NDG (B) Reactive power of NDG

**Supplementary Figure 8** PV system output in Scheme Ⅳ

(A) Active power of CDG (B) Reactive power of CDG

**Supplementary Figure 9** Controlled distributed power output in Scheme Ⅴ

(A) Active power of NDG (B) Reactive power of NDG

**Supplementary Figure 10** PV system output in Scheme Ⅴ

(A) Active power (B) Reactive power

**Supplementary Figure 11** ESS charging and discharging power in Scheme Ⅴ

## Supplementary Tables

Supplementary Table 1 Standard IEEE 33-Node Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| nodal | nodal | Branch Circuit Impedance | Nodes Load(kVA) |
| 1 | 2 | 0.0922+j0.047 | 100+j60 |
| 2 | 3 | 0.4930+j0.2511 | 90+j40 |
| 3 | 4 | 0.3660+j0.1864 | 120+j80 |
| 4 | 5 | 0.3811+j0.1941 | 60+j30 |
| 5 | 6 | 0.8190+j0.7070 | 60+j20 |
| 6 | 7 | 0.1872+j0.6188 | 200+j100 |
| 7 | 8 | 0.7114+j0.2351 | 200+j100 |
| 8 | 9 | 1.0300+j0.7400 | 60+j20 |
| 9 | 10 | 1.0440+j0.7400 | 60+j20 |
| 10 | 11 | 0.1966+j0.0650 | 45+j30 |
| 11 | 12 | 0.3744+j0.1238 | 60+j35 |
| 12 | 13 | 1.4680+j1.1550 | 60+j35 |
| 13 | 14 | 0.5416+j0.7129 | 120+j80 |
| 14 | 15 | 0.5910+j0.5260 | 60+j10 |
| 15 | 16 | 0.7463+j0.5450 | 60+j20 |
| 16 | 17 | 1.2890+j1.7210 | 60+j20 |
| 17 | 18 | 0.3720+j0.5740 | 90+j40 |
| 18 | 19 | 0.1640+j0.1565 | 90+j40 |
| 19 | 20 | 1.5042+j1.3554 | 90+j40 |
| 20 | 21 | 0.4095+j0.4784 | 90+j40 |
| 21 | 22 | 0.7089+j0.9373 | 90+j40 |
| 22 | 23 | 0.4512+j0.3083 | 90+j50 |
| 23 | 24 | 0.8980+j0.7091 | 420+j200 |
| 24 | 25 | 0.8960+j0.7011 | 420+j200 |
| 25 | 26 | 0.2030+j0.1034 | 60+j25 |
| 26 | 27 | 0.2842+j0.1447 | 60+j25 |
| 27 | 28 | 1.0590+j0.9337 | 60+j20 |
| 28 | 29 | 0.8042+j0.7006 | 120+j70 |
| 29 | 30 | 0.5075+j0.2585 | 200+j600 |
| 30 | 31 | 0.9744+j0.9630 | 150+j70 |
| 31 | 32 | 0.3105+j0.3619 | 210+j100 |
| 32 | 33 | 0.3410+j0.5362 | 60+j40 |