

# FREEDM DGI: Power Management Test Plan

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## Precondition:

- The Group Management module (GM) pushes the peer list when group reorganization takes place.
- State Collection module collects the load state of each node and computes the normalized values.

| Case | Current State of the System |        |        | Action Performed by Power Management   | Expected State of the System |             |             | As Expected? | Test Date |
|------|-----------------------------|--------|--------|--|------------------------------|-------------|-------------|--------------|-----------|
|      | Node 1                      | Node 2 | Node 3 |  | Node 1                       | Node 2      | Node 3      |              |           |
| 1    | Normal                      | Normal | Normal | Do Nothing   |                              |             |             | Yes          | 09/8/11   |
| 2    | Normal                      | Normal | Demand | Local load optimization at Node 3*   |                              |             |             | Yes          | 09/8/11   |
| 3    | Normal                      | Normal | Supply | Node 3 could sell power to grid*   |                              |             |             | Yes          | 09/8/11   |
| 4    | Normal                      | Demand | Normal | Local load optimization at Node 2*   |                              |             |             | Yes          | 09/8/11   |
| 5    | Normal                      | Demand | Demand | Local load optimization at Nodes 2&3*  |                              |             |             | Yes          | 09/8/11   |
| 6    | Normal                      | Demand | Supply | Migration from Node 3->2 as long as i) lease is not expired or ii) GM notifies that 2 has failed         |                              | Δ           | Reduce DESD | Yes          | 09/14/11  |
| 7    | Normal                      | Supply | Normal | Node 2 could sell power to grid*   |                              |             |             | Yes          | 09/14/11  |
| 8    | Normal                      | Supply | Demand | Migration from Node 2->3 as long as i) lease is not expired or ii) GM notifies that 3 has failed         |                              | Reduce DESD | Δ           | Yes          | 09/14/11  |
| 9    | Normal                      | Supply | Supply | Nodes 2&3 could sell power to grid*  |                              |             |             | Yes          | 09/14/11  |
| 10   | Demand                      | Normal | Normal | Local load optimization at Node 1*   |                              |             |             | Yes          | 09/21/11  |
| 11   | Demand                      | Normal | Demand | Local load optimization at Nodes 1&3*  |                              |             |             | Yes          | 09/21/11  |
| 12   | Demand                      | Normal | Supply | Migration from Node 3->1 as long as i) lease is not expired or ii) GM notifies that 1 has failed         | Δ                            |             | Reduce DESD | Yes          | 09/21/11  |
| 13   | Demand                      | Demand | Normal | Local load optimization at Nodes 1&2*  |                              |             |             | Yes          | 09/21/11  |
| 14   | Demand                      | Demand | Demand | Local load optimization at Nodes 1,2&3*  |                              |             |             | Yes          | 09/21/11  |
| 15   | Demand                      | Demand | Supply | Migration from Node 3->1/ 3->2 as long as i) lease is not expired or ii) GM notifies that 1/2 failed     | Δ                            | Δ           | Reduce DESD | Yes          | 09/21/11  |
| 16   | Demand                      | Supply | Normal | Migration from Node 1->2 as long as i) lease is not expired or ii) GM notifies that 2 has failed         | Reduce DESD                  | Δ           |             | Yes          | 09/21/11  |
| 17   | Demand                      | Supply | Demand | Migration from Node 2->1/ 2->3 as long as i) lease is not expired or ii) GM notifies that 1/3 has failed | Δ                            | Reduce DESD | Δ           | Yes          | 09/21/11  |
| 18   | Demand                      | Supply | Supply | Migration from Node 2->1/ 3->1 as long as i) lease is not expired or ii) GM notifies that 1 has failed   | Δ                            | Reduce DESD | Reduce DESD | Yes          | 09/21/11  |

\* Not incorporated in the current version

Δ Make physical setting to accept incoming power over the shared power bus.

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|    |        |        |        |  |             |             |             |     |          |
|----|--------|--------|--------|--|-------------|-------------|-------------|-----|----------|
| 19 | Supply | Normal | Normal | Node 1 could sell power to grid*   |             |             |             | Yes | 09/28/11 |
| 20 | Supply | Normal | Demand | Migration from Node 1->3 as long as i) lease is not expired or ii) GM notifies that 3 has failed       | Reduce DESD |             | $\Delta$    | Yes | 09/28/11 |
| 21 | Supply | Normal | Supply | Nodes 1&3 could sell power to grid*  |             |             |             | Yes | 09/28/11 |
| 22 | Supply | Demand | Normal | Migration from Node 1->2 as long as i) lease is not expired or ii) GM notifies that 2 has failed       | Reduce DESD | $\Delta$    |             | Yes | 09/28/11 |
| 23 | Supply | Demand | Demand | Migration from Node 1->2/ 1->3 as long as i) lease is not expired or ii) GM notifies that 2/3 failed   | Reduce DESD | $\Delta$    | $\Delta$    | Yes | 09/28/11 |
| 24 | Supply | Demand | Supply | Migration from Node 1->2/ 3->2 as long as i) lease is not expired or ii) GM notifies that 2 has failed | Reduce DESD | $\Delta$    | Reduce DESD | Yes | 09/21/11 |
| 25 | Supply | Supply | Normal | Nodes 1&2 could sell power to grid*  |             |             |             | Yes | 09/21/11 |
| 26 | Supply | Supply | Demand | Migration from Node 1->3/ 2->3 as long as i) lease is not expired or ii) GM notifies that 3 has failed | Reduce DESD | Reduce DESD | $\Delta$    | Yes | 09/21/11 |
| 27 | Supply | Supply | Supply | Nodes 1, 2 & 3 could sell power to grid*   |             |             |             | Yes | 09/21/11 |

- Faults needed to be tested after integration-

- 1) The supplying node's DGI fails during a migration. (Cases 6,8,12,15-18,20,22-24,26)
- 2) The receiving node's power electronics fail during a migration. (Cases 6,8,12,15-18,20,22-24,26)
- 3) More supply nodes exist in comparison to demand nodes – potential congestion (Cases 18,24,26)

- State change during a power migration-result of integrating with State collection

- 4) The supplying node's load changes to Normal or Demand during a migration. (Cases 6,8,12,15-18,20,22-24,26)
- 5) The receiving node's load changes to Normal or Supply during a migration. (Cases 6,8,12,15-18,20,22-24,26)

\* Not incorporated in the current version

$\Delta$  Make physical setting to accept incoming power over the shared power bus.