

# Electricity Storage Plant

Storage device capacityMWh

Does the storage form part of a CHP scheme?

Yes

No

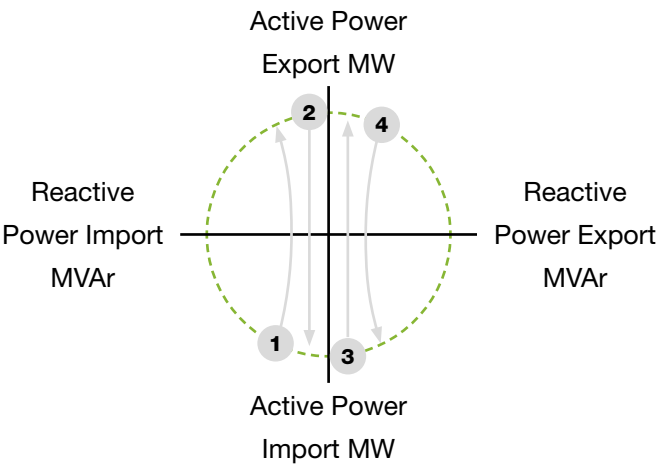
Please describe the operational mode (eg frequency response, generation arbitrage)

For the intended control mode or to meet a specific commercial service are there any known technical or operational requirements? For example the scheme may be required to operate at a Power Factor other than which might be required by the DNO as measured at the Connection Point?

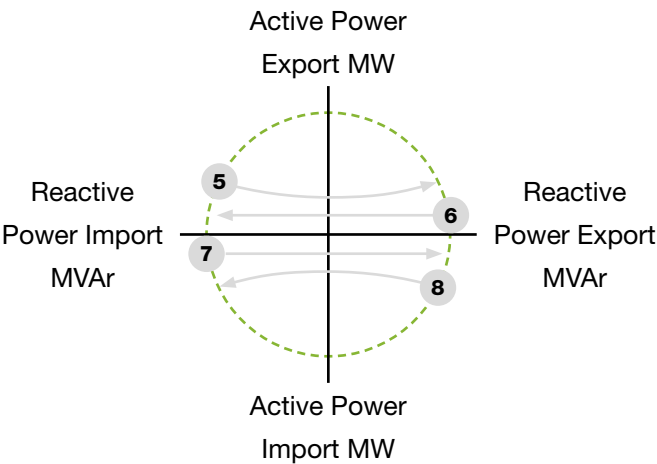
Please provide details below

## Diagrammatical representation of example active power swings

Active power swings



Reactive power swing



These diagrams assume the other vector (MW or MVar) does not change during the power swing.

A more onerous condition, from a voltage step change perspective, occurs when the power factor is maintained and both vectors change from one operational mode to the other. In this case the swing would move diagonally between quadrants.

# Electricity Storage Plant

## Active and Reactive Power swing requirements (refer to diagram for example numbering) (see Note 9)

### Change from Import Active Power to Export Active Power (swing 1 and / or 3)

#### Initial values:

MW Import	MVAr			MW/s
<input type="text"/>	<input type="text"/>	<input type="radio"/> MVAr Import	<input type="radio"/> MVAr Export	<input type="text"/>

#### Final values

MW Export	MVAr		
<input type="text"/>	<input type="text"/>	<input type="radio"/> MVAr Import	<input type="radio"/> MVAr Export

### Change from Export Active Power to Import Active Power (swing 2 and / or 4)

#### Initial values:

MW Export	MVAr			MW/s
<input type="text"/>	<input type="text"/>	<input type="radio"/> MVAr Import	<input type="radio"/> MVAr Export	<input type="text"/>

#### Final values

MW Import	MVAr		
<input type="text"/>	<input type="text"/>	<input type="radio"/> MVAr Import	<input type="radio"/> MVAr Export

Change from Import Reactive Power to Export Active Power  
(swing 5 and / or 7)

Initial values:

MVAr Import	MW			MVAr/s
<input type="text"/>	<input type="text"/>	<input type="radio"/> MW Import	<input type="radio"/> MW Export	<input type="text"/>

Final values

MVAr Export	MW		
<input type="text"/>	<input type="text"/>	<input type="radio"/> MW Import	<input type="radio"/> MW Export

Change from Export Reactive Power to Import Active Power  
(swing 6 and / or 8)

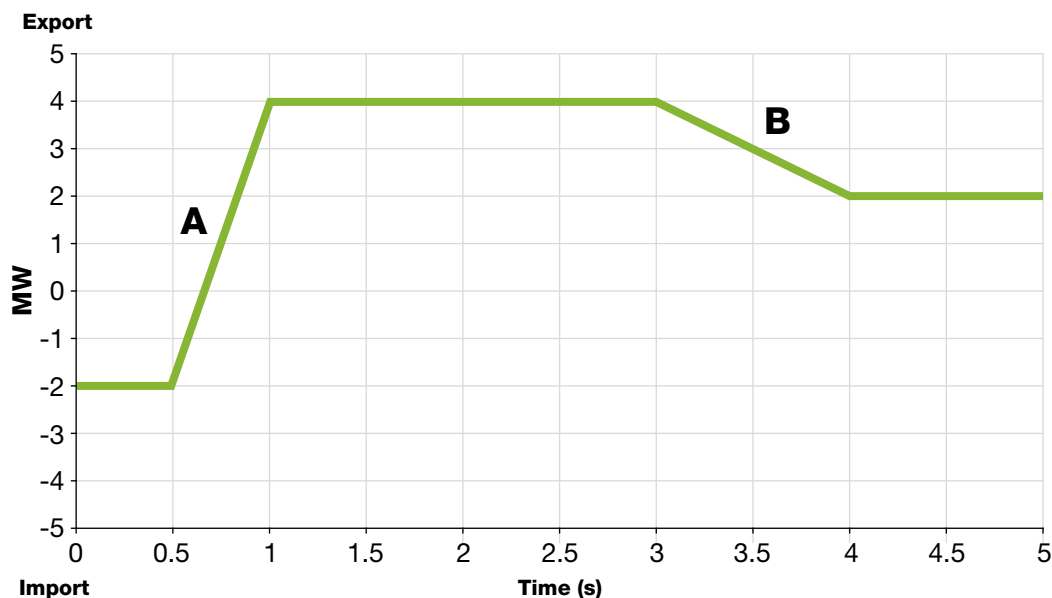
Initial values:

MVAr Export	MW		
<input type="text"/>	<input type="text"/>	<input type="radio"/> MW Import	<input type="radio"/> MW Export

Final values

MVAr Import	MW		
<input type="text"/>	<input type="text"/>	<input type="radio"/> MW Import	<input type="radio"/> MW Export

## Example of Ramp Rate / Total Power Swing (Change in MW)



### A - Example of ramp which transitions from import to export

$$\text{Ramp rate (Positive)} = (2+4) \text{ MW} / 0.5\text{sec} = 12 \text{ MW per sec}$$

$$\text{Total power swing} = (2+4) \text{ MW} = 6 \text{ MW}$$

### B - Example of ramp during export

$$\text{Ramp rate (Negative)} = (4-2) \text{ MW} / 1 \text{ sec} = 2 \text{ MW per sec}$$

$$\text{Total power swing} = (4-2) \text{ MW} = 2 \text{ MW}$$

**Note 9** – System design studies will be undertaken in accordance with P28 to assess the worst case voltage step change based on the worst case power swing of both Active Power and Reactive Power required by the Customer. It is recognised that the design and operation of the Electricity Storage System may mean that these parameters will not all change simultaneously and to ensure that the connection design meets the Customer's requirements an accurate representation the Electricity Storage Plant operation should be detailed here.

The outcome of the studies and hence the possible need for network reinforcement is dependent on the change in magnitude and direction of both Active Power and Reactive Power. It should be noted that the Connection Agreement will be based on the values provided in this form and if the Electricity Storage Plant owner wishes to change the operating arrangements in the future, it will be necessary for them to formally request a Modification to their Connection Agreement so that the DNO can assess the capacity of the distribution system to accommodate the revised operating regime.