

*Bringing ideas  
to life*



## HPR project structure and objectives

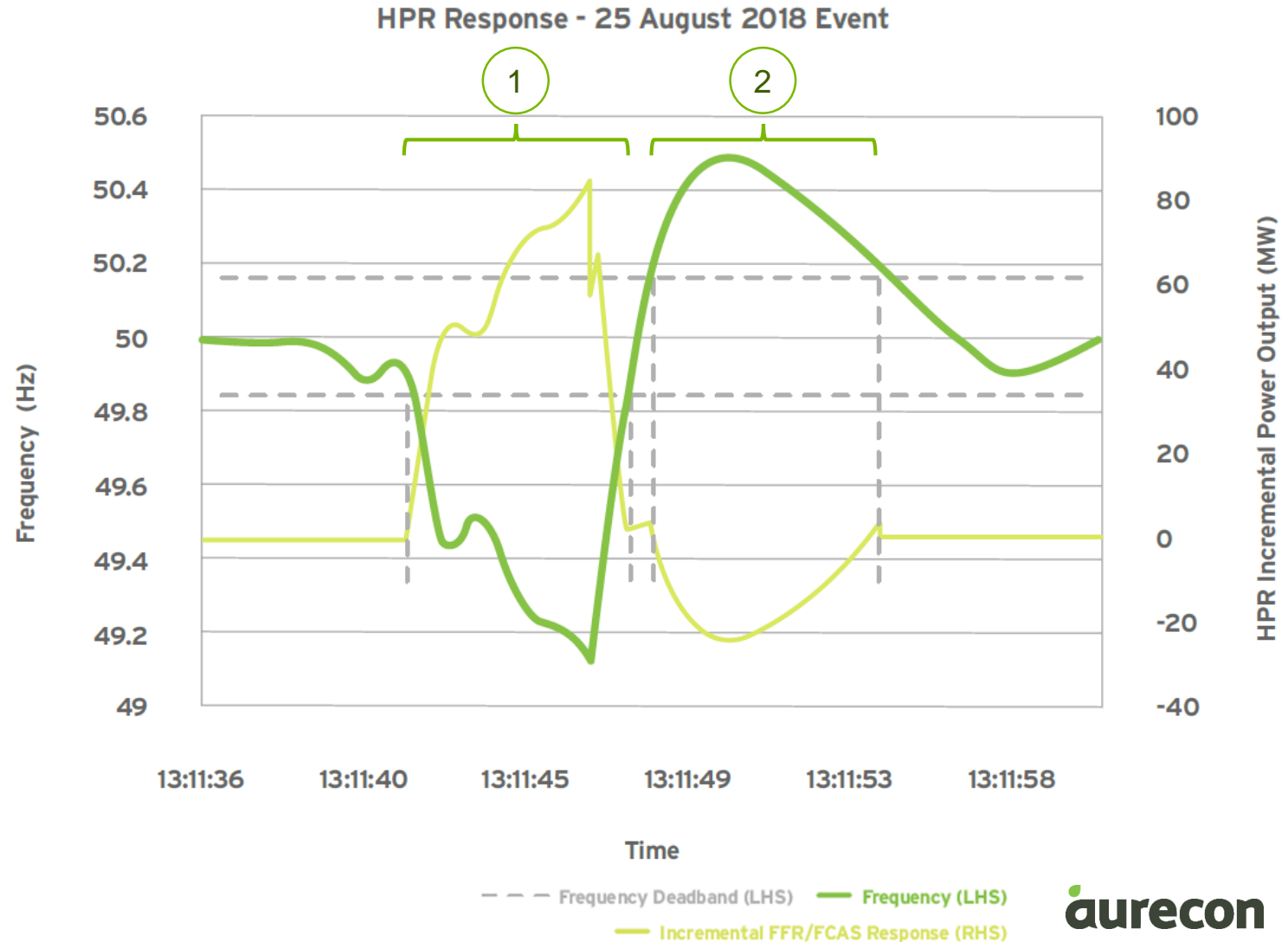
<p>HPR</p> <hr/> <p>100MW, 129MWh</p>	<p>Battery Capacity</p>	<p>Project Objectives</p>	<p>Services Provided</p>
<p>SA Government Reserved Capacity</p>	<p>70MW, 10MWh</p>	<ul style="list-style-type: none"> <li>• Improved System Security for SA network</li> <li>• Downward pressure on ancillary services prices</li> <li>• Improved reliability of supply</li> </ul>	<ul style="list-style-type: none"> <li>• Participation in System Integrity Protection Scheme (SIPS)</li> <li>• Fast Frequency Response</li> <li>• Contingency FCAS</li> <li>• Regulation FCAS</li> <li>• Back-up reliability measure</li> </ul>
<p>Neoen Market Capacity</p>	<p>30MW, Balance of energy</p>	<ul style="list-style-type: none"> <li>• Commercial market participation</li> <li>• Optimised bidding across energy and all eight FCAS markets</li> </ul>	<ul style="list-style-type: none"> <li>• Energy Arbitrage</li> <li>• Regulation FCAS</li> <li>• Contingency FCAS</li> </ul>

# Fast Frequency Response

- First of its kind on the NEM
- Fast dispatch of active power in response to frequency disturbances (~ 100 ms)
- Slows RoCoF during contingency event and supports return to normal frequency band

## 25 August 2018 case study

1. HPR provides low frequency support to all connected mainland NEM regions
2. HPR provides high frequency support to the separated SA region

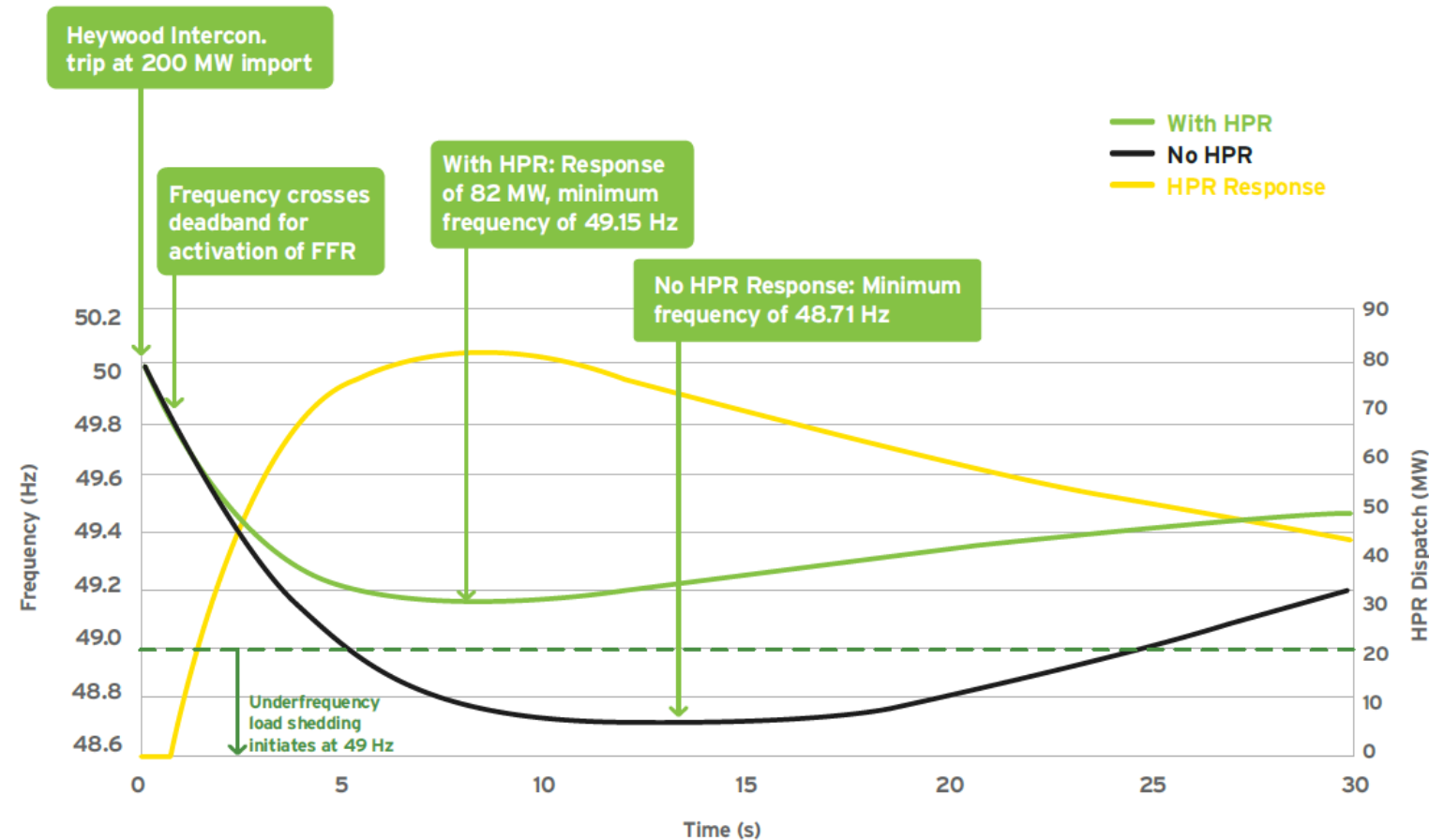


## FFR / Contingency FCAS dispatch

- Aurecon modelling shows the potential for HPR to avoid or reduce load shedding due to contingency events on the network
- Modelled scenario shows frequency maintained above 49 Hz with HPR – UFLS avoided
- Without HPR frequency falls to < 49 Hz – UFLS required
- FFR is of particular benefit to South Australia in the event of loss of the Heywood interconnector

Modelled scenario:

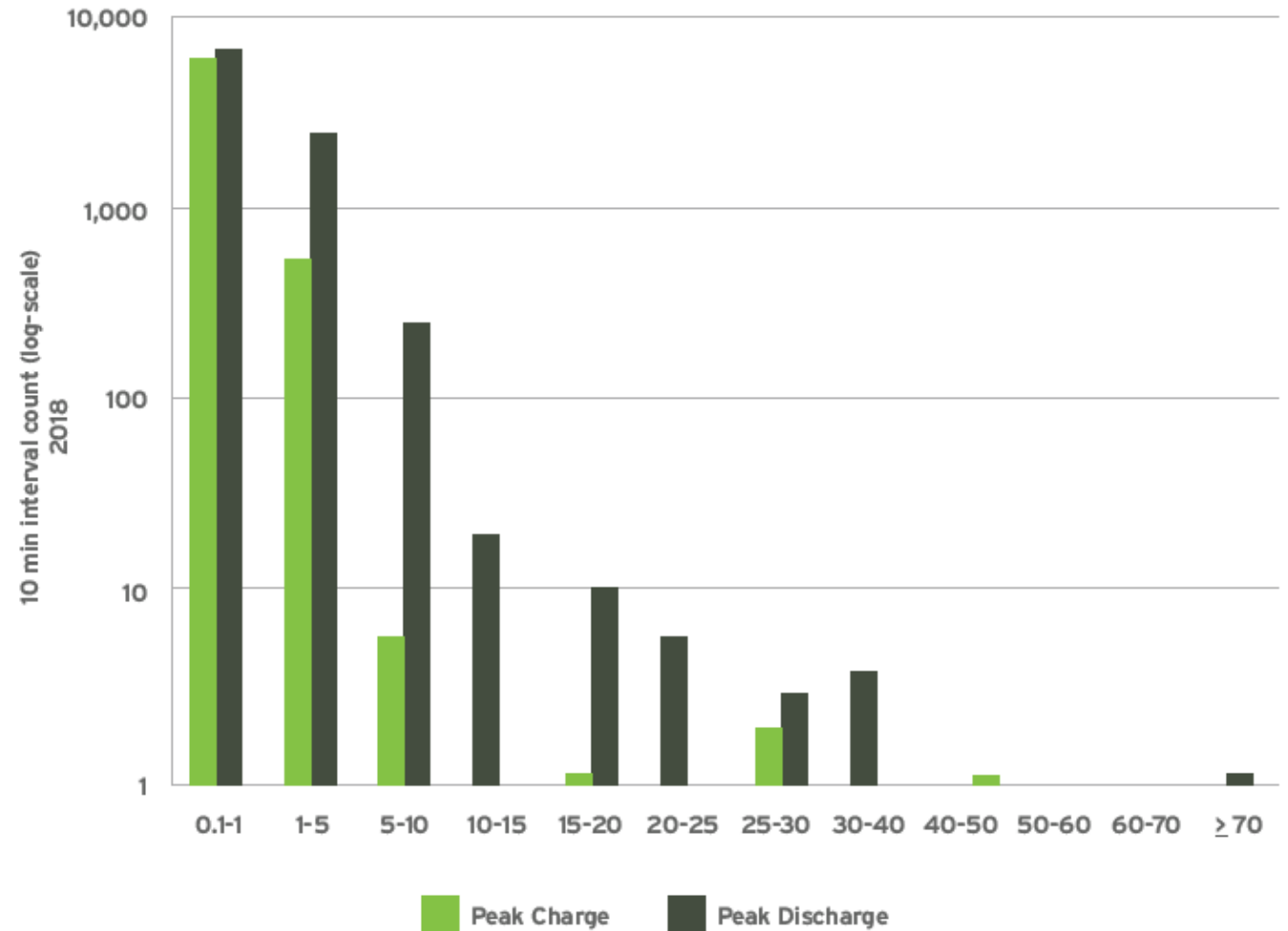
Parameter	Value
SA network load	800 MW
Heywood interconnector Import flow	200 MW
SA asynchronous generation	200 MW
SA synchronous generation:	Total: 400 MW
Modelled contingency event	Trip of Heywood interconnector



Source: Aurecon modelling

## HPR's FFR / Contingency FCAS dispatch

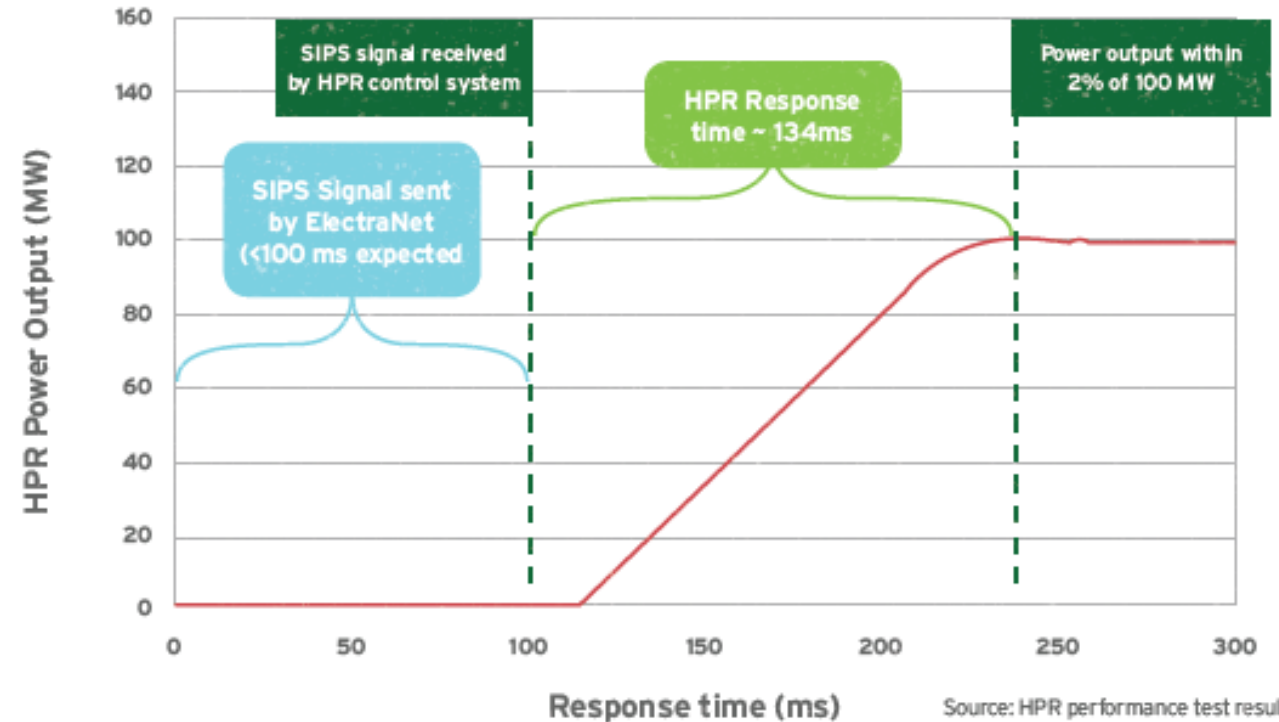
- HPR provides Contingency FCAS services in all six markets (fast, slow and delayed services for both raise and lower contingency FCAS)
- Speed of HPR's FFR capability provides a premium Contingency FCAS service
- Regular response to small frequency disturbances at a low MW range – supports Regulation FCAS
- Occasional response, as required to large contingency events
- Small, regular response indicates need for reform in Reg-FCAS / primary frequency control



Source: Aurecon graph of analysed HPR data provided by Tesla

# System Integrity Protection Scheme (SIPS)

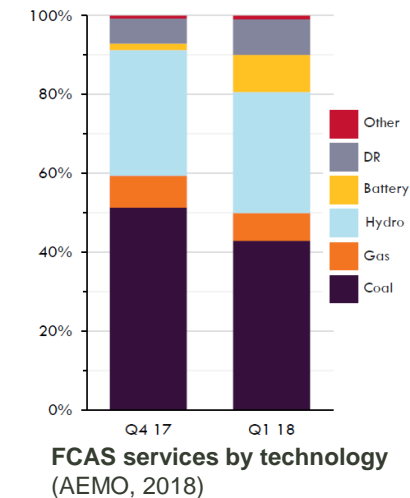
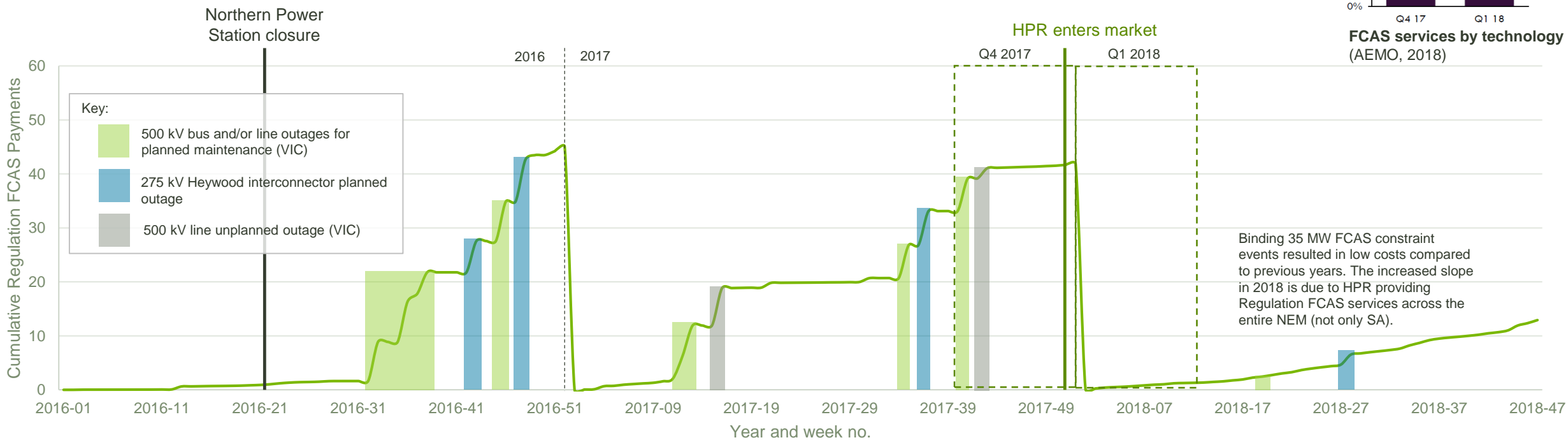
- Reduces likelihood of SA Network separation and System Black under certain conditions – e.g. 28 September 2016 event
- HPR provides a near instantaneous 70 – 140 MW support to the interconnector
- Potentially prevents 200 MW of load shedding in next stage of SIPS



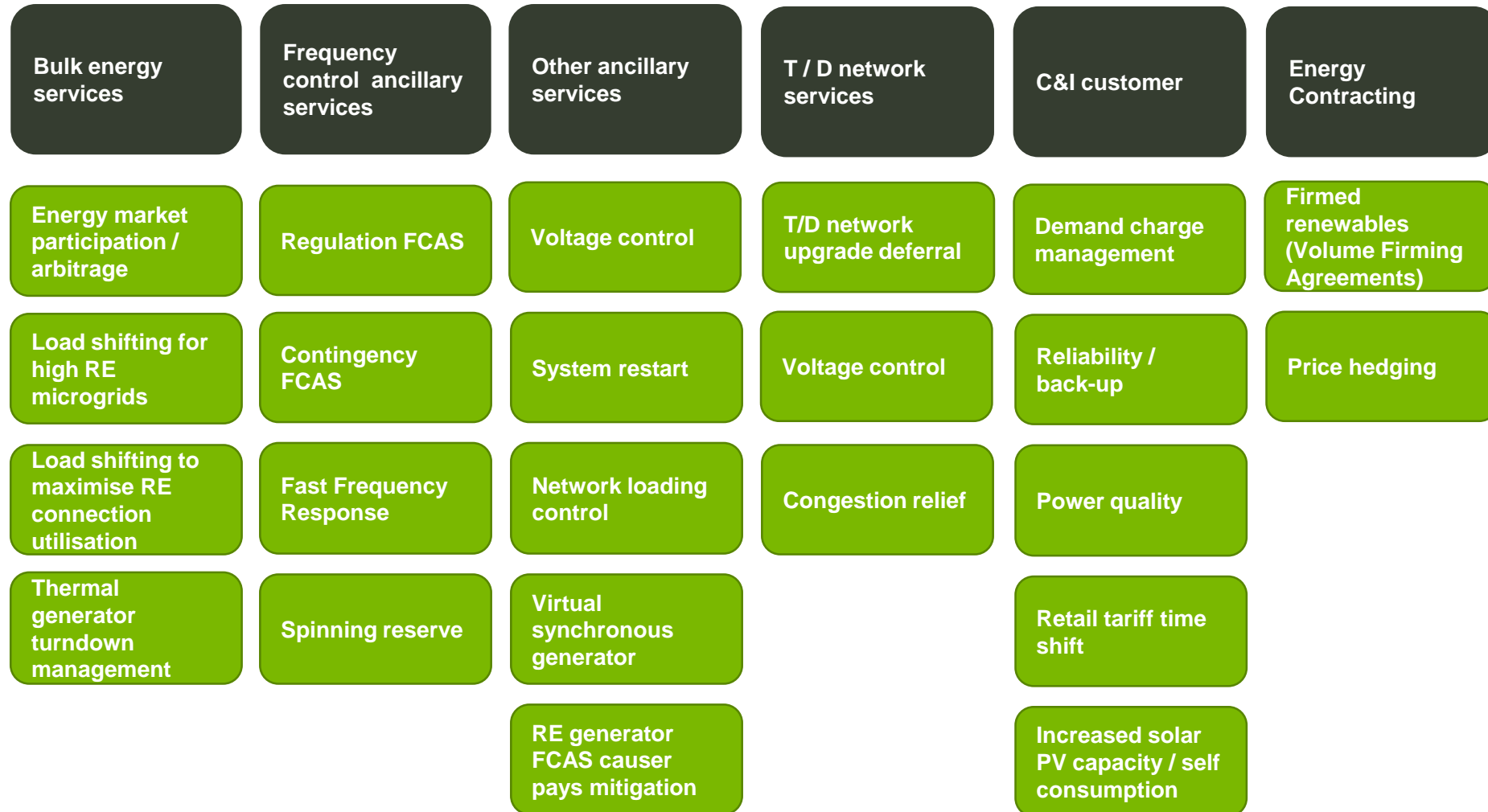
Source: HPR performance test results  
Assumes HPR is in standby at the time for a 100 MW discharge response

# Market impact – Regulation FCAS

HPR has boosted supply and competition in the Regulation FCAS market, reducing the pricing impact of AEMO constraints

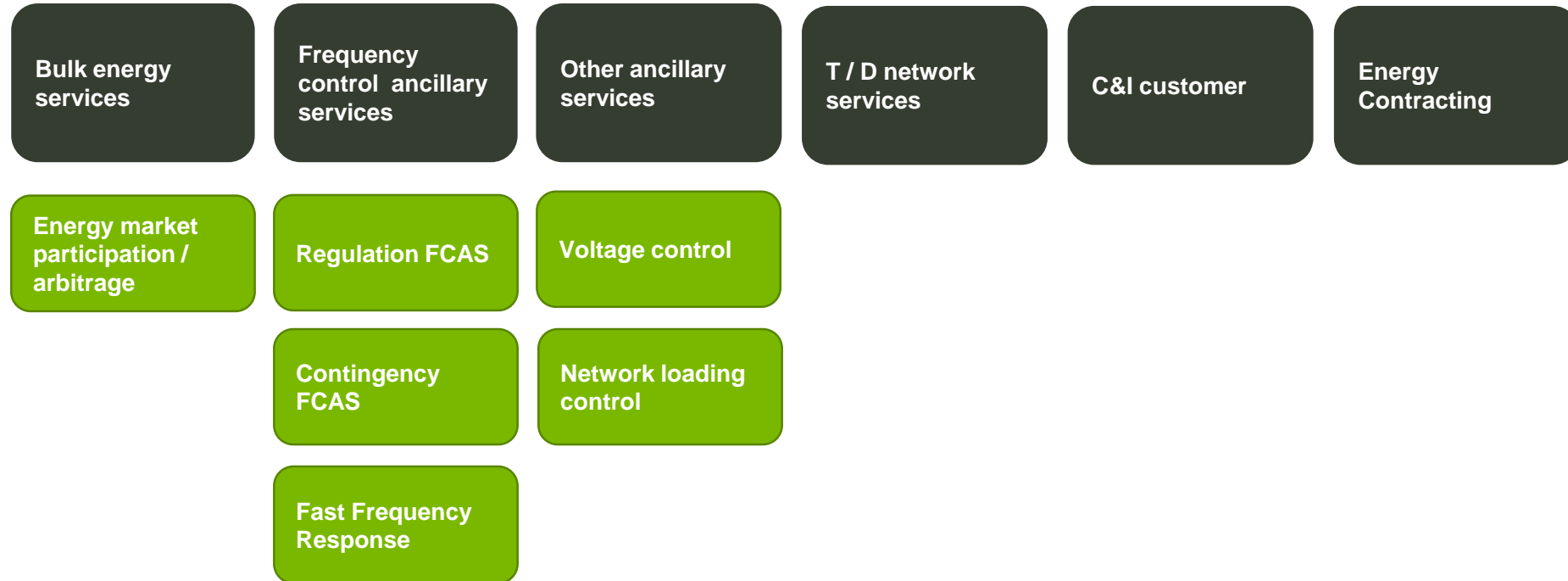


## BESS services and potential business case elements – Overview

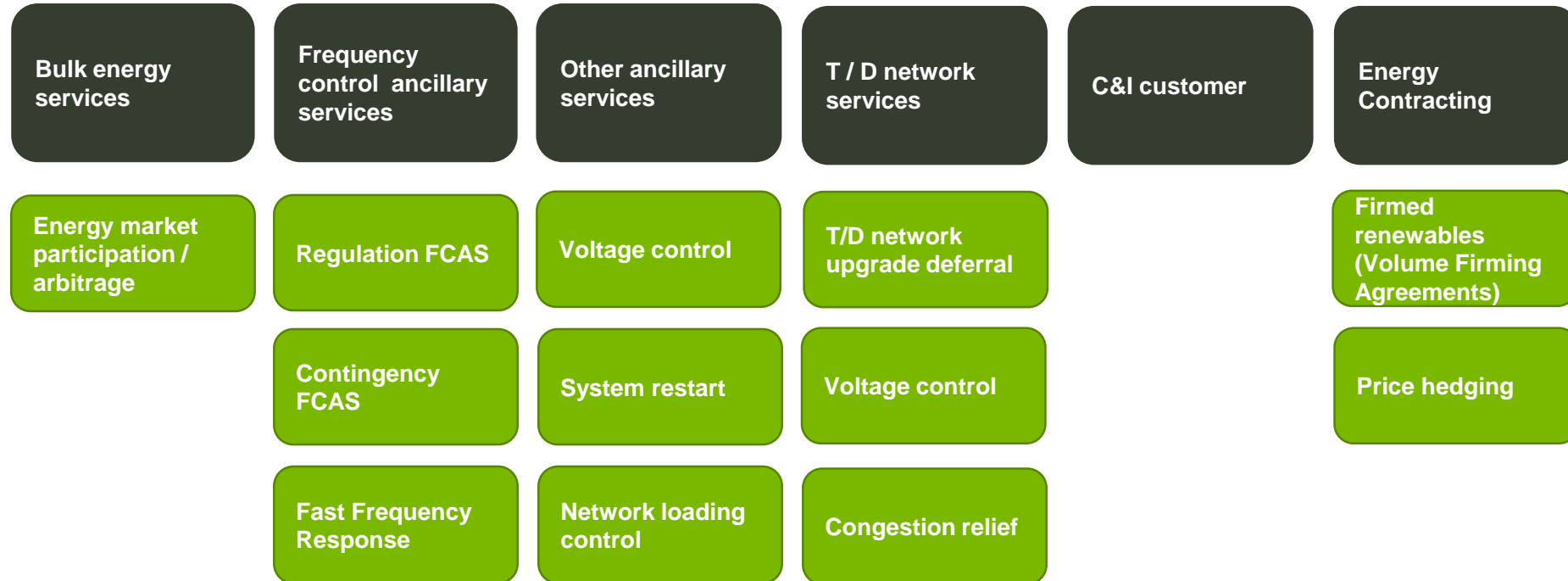




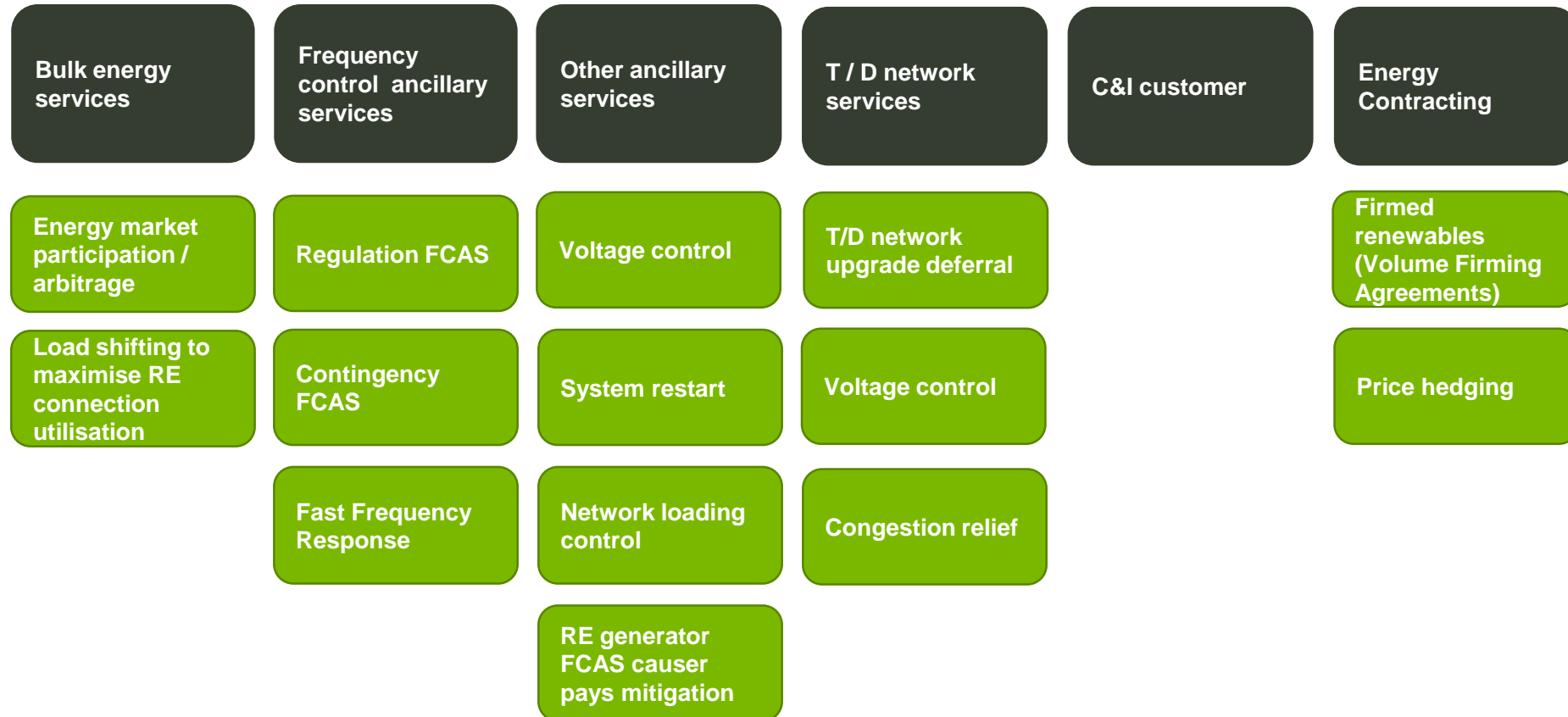
# BESS services and potential business case elements – HPR



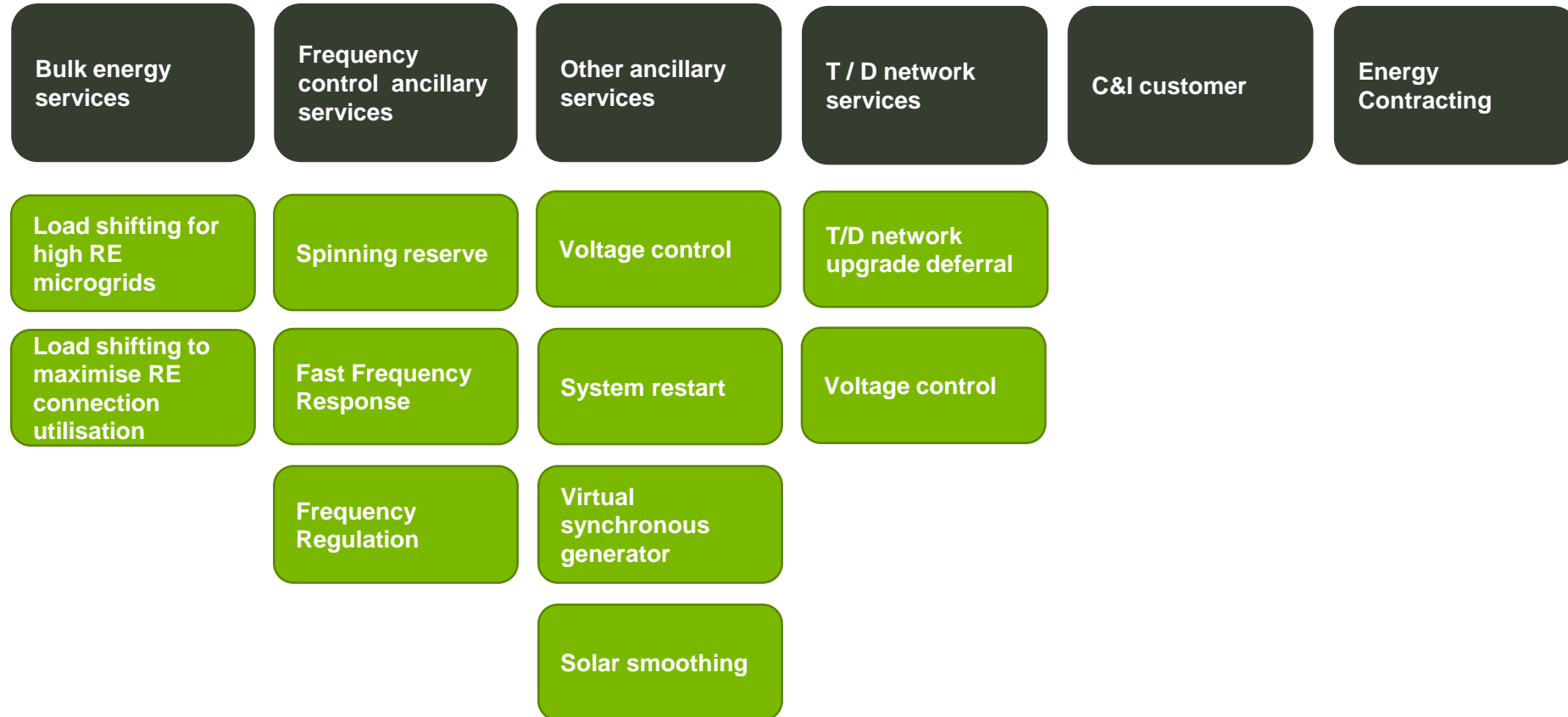
## BESS services and potential business case elements – Standalone grid connected



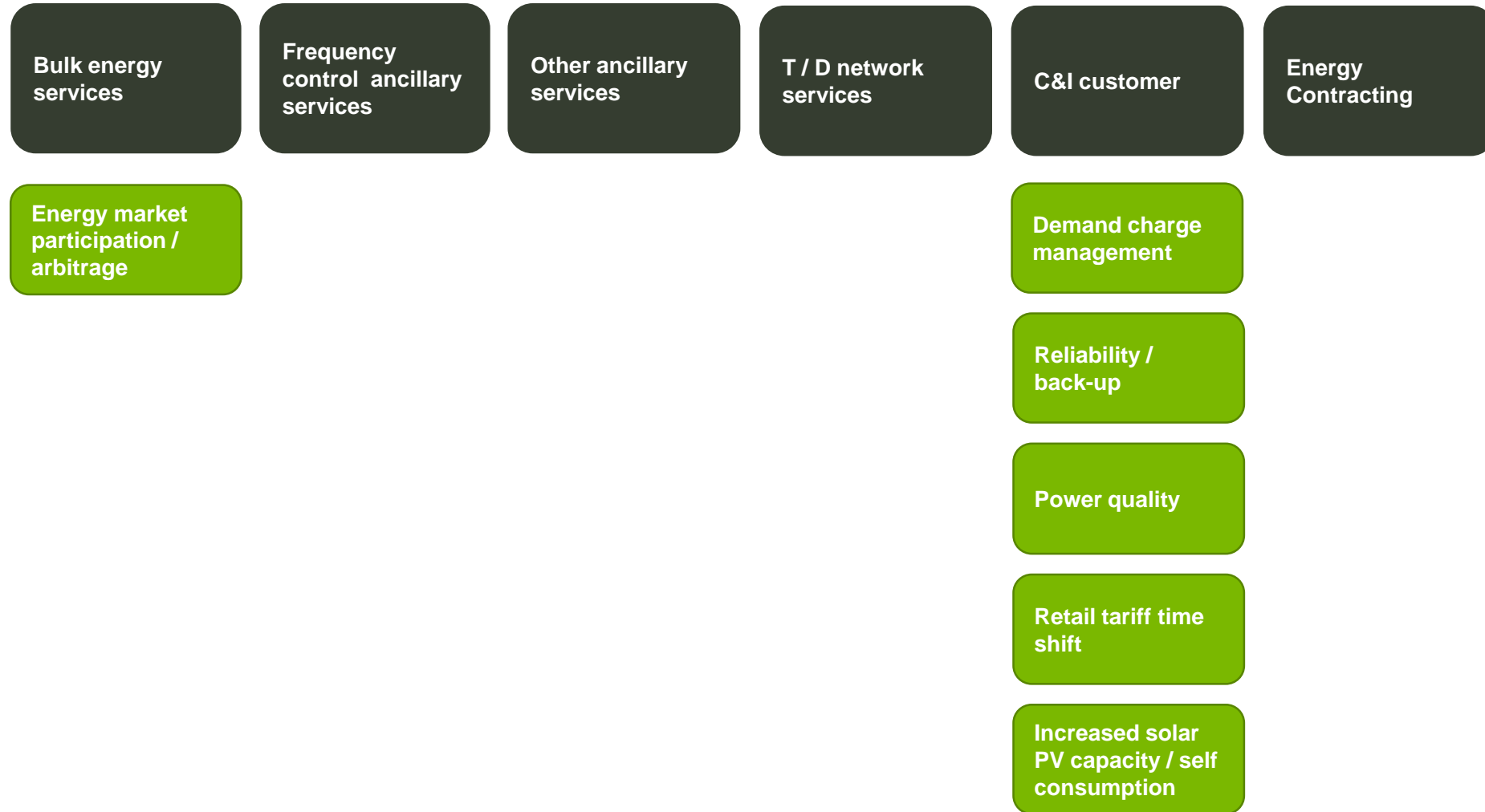
## BESS services and potential business case elements – RE integrated



## BESS services and potential business case elements – Isolated systems



## BESS services and potential business case elements – C&I customers



## Emerging challenges and opportunities

- Transition to increasing renewable energy will require increased deployment of energy storage to ensure a reliable and secure power system
- Batteries are well suited to provide a range of energy and ancillary services
- New frameworks are emerging and need development to recognise the capability of batteries, strengthen commercial cases and streamline deployment
- HPR's first operational year has provided insights which will help further optimise overall energy system design, and provided confidence that this technology can be readily integrated into that system





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