Kilpaddoge Energy Ltd

System Services - An Investors Perspective

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Kelwin Power Plant

An enhanced wind farm that offers more (and better) ancillary services than equivalent steam/gas plant.

13 x 2.85MW GE Wind turbines

13 x 0.2MW Saft Li-Ion batteries

2MW of Maxwell ultra-capacitors

2MW of Freqcon full converter

2MW of Cummins diesel engines

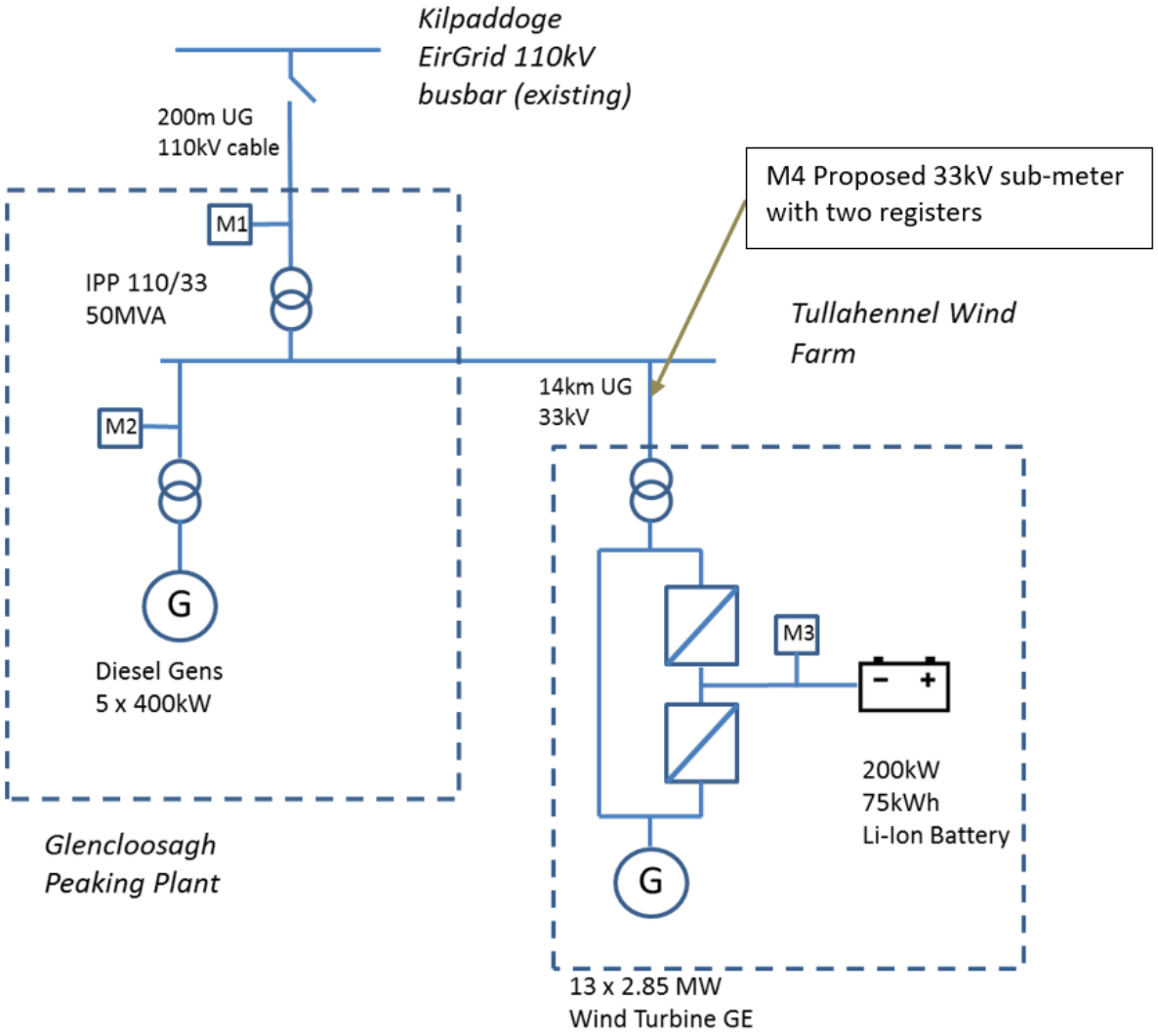
Kelwin Power Plant

Ultrcapacitors responding in <150ms
2MW of ultrcapacitors
5 x 0.4MW diesel engines

Offers Fast Frequency Response (<150ms)
Primary Operating Reserves
Secondary Operating Reserves
Tertiary Operating Reserves
Ramping
Reactive power

All for zero carbon emissions.

DC sub-metering?

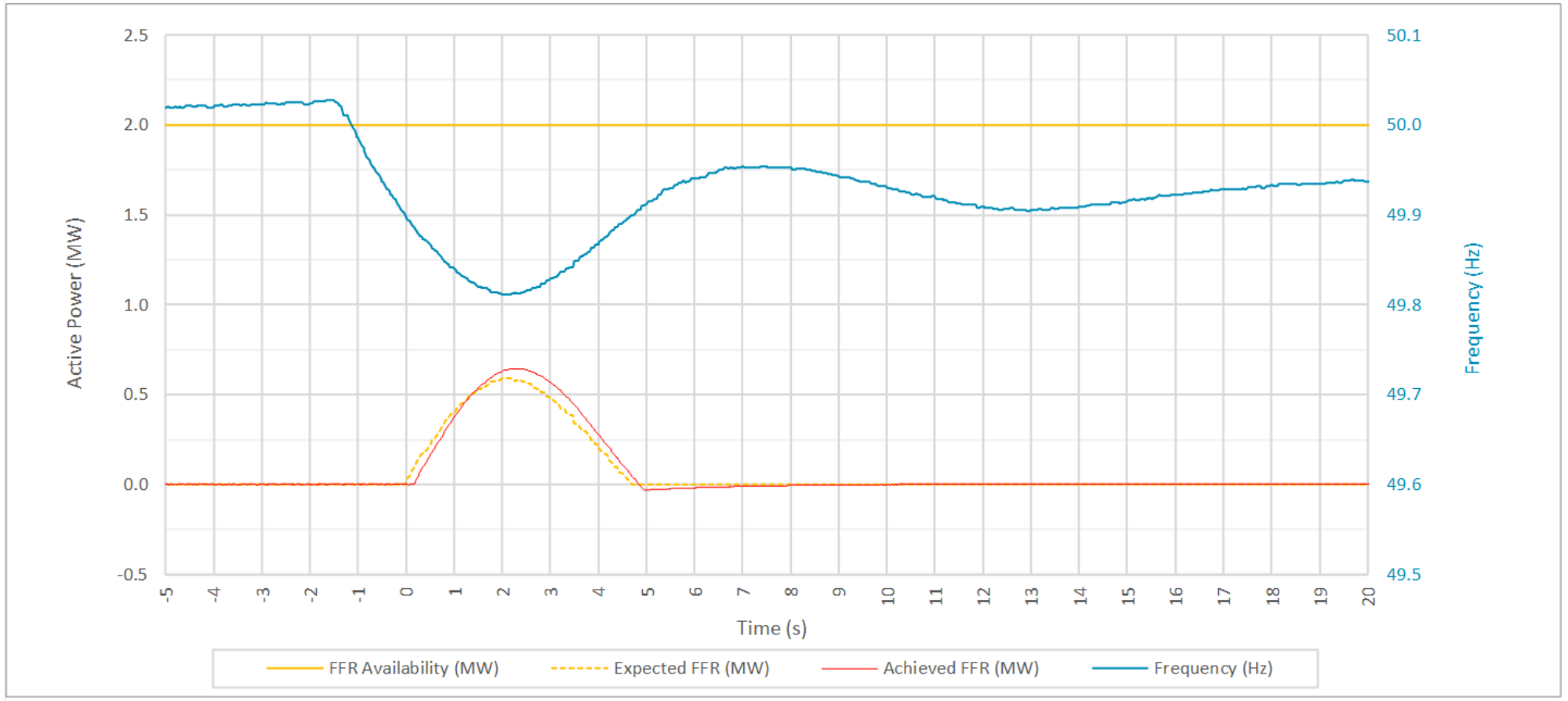


Ultracapacitor response

Unit ID:	Kelwin Hybrid PPM
Reg Cap (MW):	2
Response Trigger (Hz):	49.9
FFR Trajectory (Hz):	0.3
Frequency Nadir (Hz):	49.811

Event Date:	28/09/2019
Event Start Time:	12:42:10.574
Pre-Event Output (MW):	-0.005
Contracted FFR Response time (s):	**2.00**
Achieved FFR Response time (s):	N/A

Max Available FFR (MW):	2.00
Max Expected FFR (MW):	0.59
Max Achieved FFR (MW):	0.65
% Time FFR Achieved up to 10s:	91%
Energy [0-10] vs [10-20]:	PASS



DS3 Investment Choices

Auction

- 3 winners, 15 losers
- Need to recover 5x devex?
- Winners curse
- Revenues fixed 6 years
- But residual risks (business rates, TUoS, TLAF, Import charges, market interactions, technology, capacity revenue, reactive power revenue)

Tariffs

- Contract available if you build (probably)
- 2x higher revenue
- 2-3 years remaining (Apr-'23)
- Temporal Scarcity Scalar
- Sensitive to windiness
- Sensitive to EirGrid SNSP cap
- Adjust or early terminate if €235m budget risk

Are auctions really so cheap?

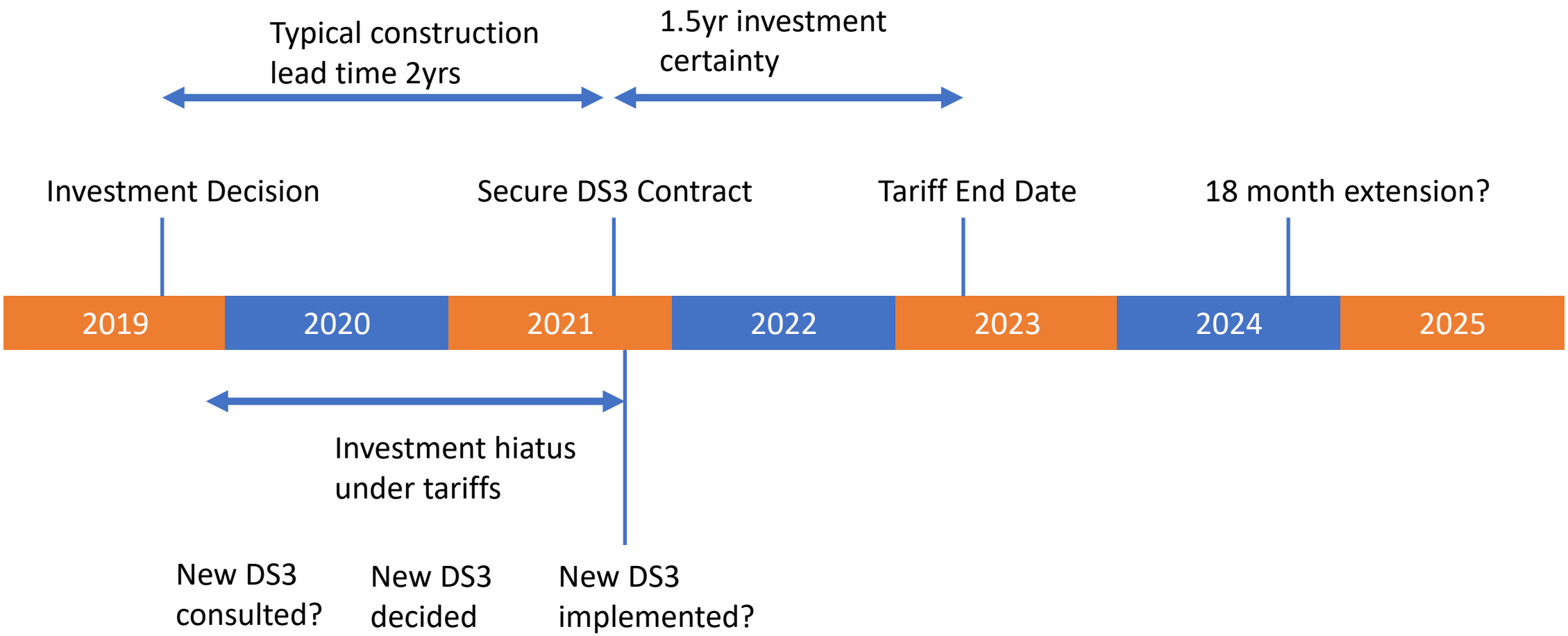
- Recent DS3 auctions cleared at **€57k**/MW/year for 6 years for a ½ hr battery. Some additional revenue from capacity, energy and reactive power. Capex c.€500k/MW.
- The CRU/EirGrid "Outcomes" note refers to tariffs for a battery yielding **€318k**/MW/year, nearly **6x** more expensive.
- However this comparison was based on a 2025 scenario, i.e. after the end of the tariff contract period (2023), and is simply not relevant.
- Using actual 2018 data, we calculate that a battery in 2018 would have earned **€118k**/MW/year under tariffs.
- This is still **2x** more than the auction price, but seems reasonable given that the term is half the term at <3 yrs, 12 month termination, SNSP variability, contract only after build etc. etc…

http://www.eirgridgroup.com/how-the-grid-works/ds3-programme/ds3-consultations-and-pub/index.xml

Hybrids are difficult…

Problem	Solution
Investors' risk appetite	Separate companies
Rigid grid capacity	Dynamic sharing of grid
Reactive power unsplittable	Master controller
High impact, low prob. (e.g. €1.3m DS3)	Proportion caps to contract size
Allocation of risk	Enable agents or reallocation agreements

New build under tariffs



Impressions so far…

- DS3 is delivering new non-battery capability (demand side, fossil)
- DS3 allows a multiple services per contract. This enables hybrid sites or unusual technologies which can deliver a subset of the 14 services (c.f. UK).
- Tariffs have a higher cost of finance. Not attractive to banks.
- New build under tariffs is more difficult than it needs to be, given “levers”.
- Budget of €235m looks unlikely to be breached

FoForecast Spend 18-19	FFR	POR	SOR	TOR1	TOR2	RRD	RRS	SSRP	SIR	RM1	RM3	RM8	Total (€m)
RCROI Spend (€m)	1.4	10.4	10.4	9.6	8.8	6.6	2.4	16.8	10.7	2.3	2.9	3.3	85.6
NINI Spend (€m)	0.1	5.7	3.7	2.9	4.0	2.1	0.6	2.5	2.3	0.9	1.4	1.2	27.5
													113.1

Questions?