



BATTERY TECHNOLOGY

AND HOW IT WILL CHANGE THE NEW ZEALAND ENERGY SECTOR

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TRANSPOWER

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POWERING NEW ZEALAND TODAY + TOMORROW

TODAY

- Concept of storage, where and how
- Why is everyone interested
- Where is the value in NZ
- When storage is deployed how does it affect the NZ electricity system

Batteries Give You the Power

The thought of cost-effective battery storage is what keeps many power company executives awake at night. Battery storage is set to revolutionise the world's power industry as it gives homeowners the power to use more – or all – of the electricity generated by their solar

Hold off on home batteries for now, says expert

Home battery market not booming yet but consumer interest is

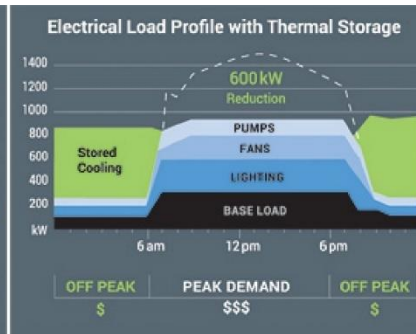
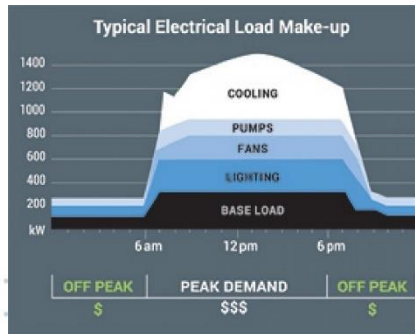
IKEA Starts Selling Solar Batteries to U.K. Homeowners

Nissan launches British-made home battery to rival Tesla's Powerwall

Sunderland plant to produce new and recycled batteries from electric cars to serve as home energy storage

The home battery wars come to NZ, but are we ready to go off the grid?

BUT WE HAVE BEEN STORING ENERGY FOREVER



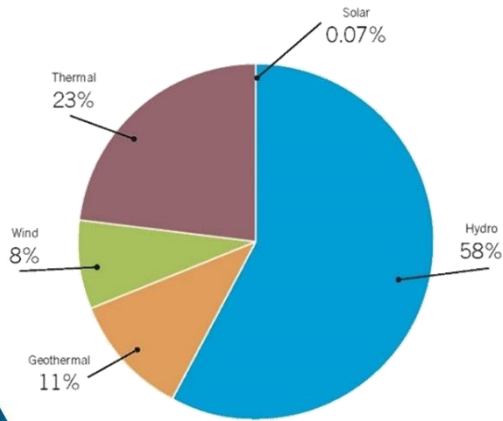


BATTERIES

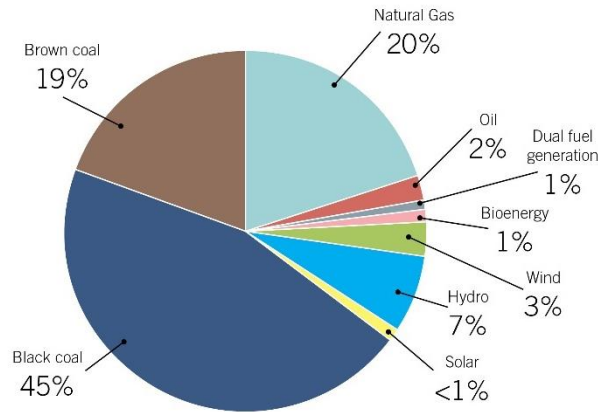
... THE NUMBER IS GROWING

GENERATION MIX MATTERS

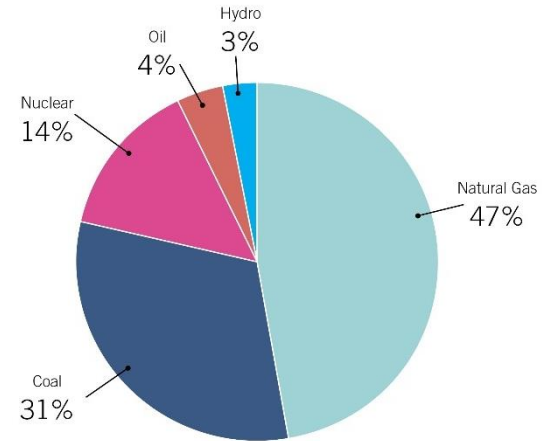
NEW ZEALAND ELECTRICITY SYSTEM GENERATION CAPACITY MIX



AUSTRALIA'S ELECTRICITY GENERATION BY SOURCE 2013



TAIWAN POWER GENERATION MIX



BATTERY STORAGE

POWER SYSTEM NATURE MATTERS

What?	NZ	Typical comparison
Renewable generation	85%	15-21%
Renewables are dispatchable	Yes – 70%	N
Large arbitrage value	N	Y
Large reserves spend	N	Y
Large Frequency Keeping spend	N	Y
Large proportion of 'must run' plant	N	Y

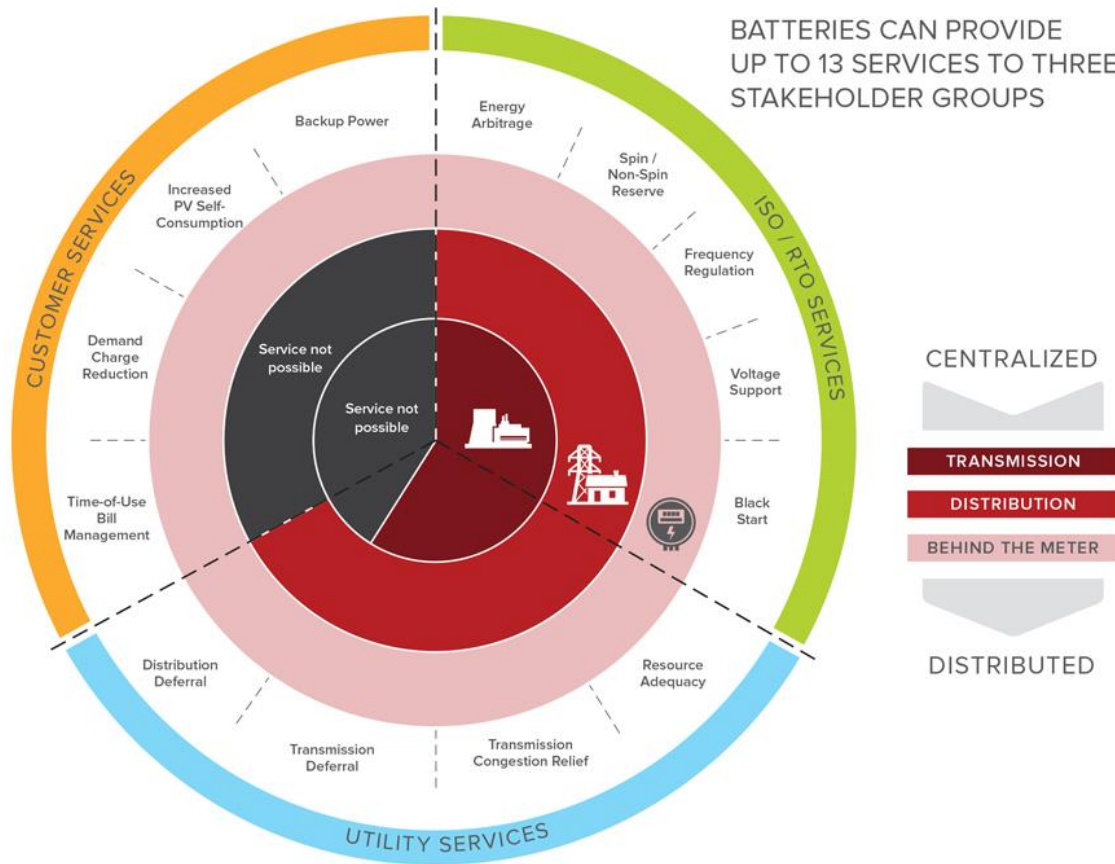


WHAT VALUE?

WHAT VALUE COULD BATTERIES ADD IN NEW ZEALAND?

WHAT CAN A BATTERY DO?

BATTERIES CAN PROVIDE UP TO 13 SERVICES TO THREE STAKEHOLDER GROUPS



SCENARIO-BASED APPROACH

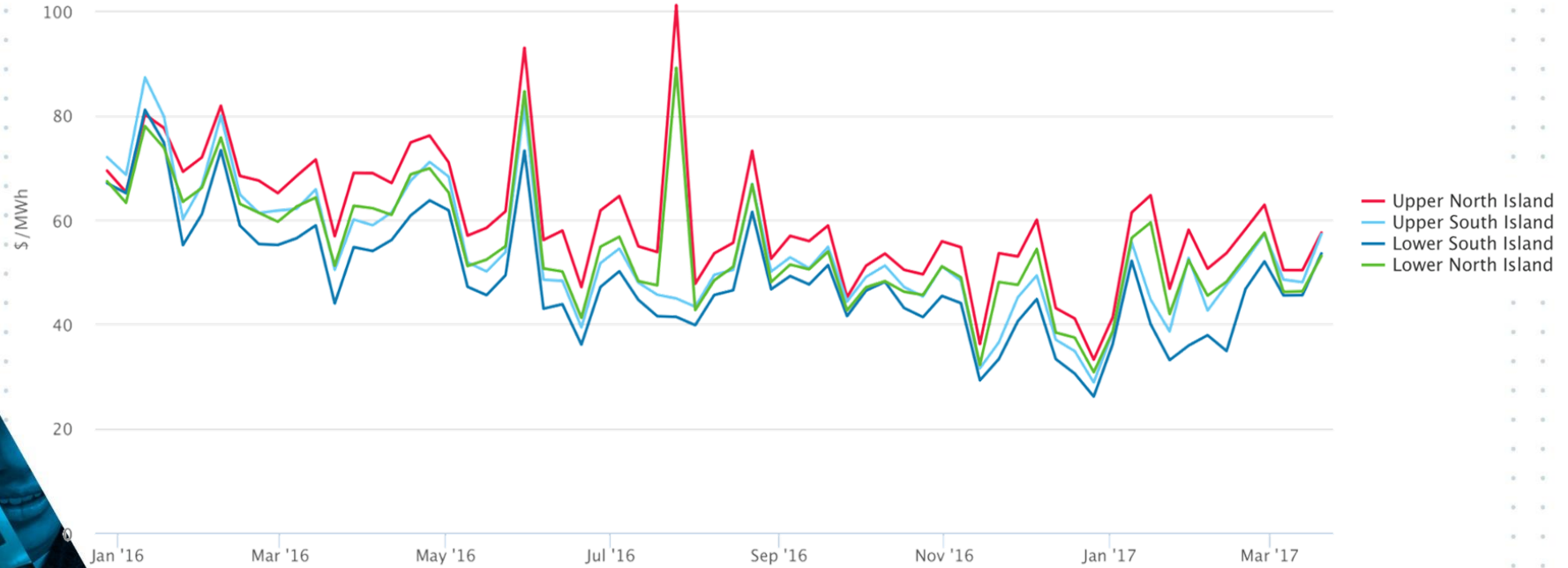
We investigated various applications for battery storage that would make sense, depending where on the electricity system the battery was located.

We considered how batteries could best benefit owners and derive additional revenue from providing other services, where compatible.

These applications were applied to case studies which were evaluated for a range of high-level assumptions using a range of industry metrics.

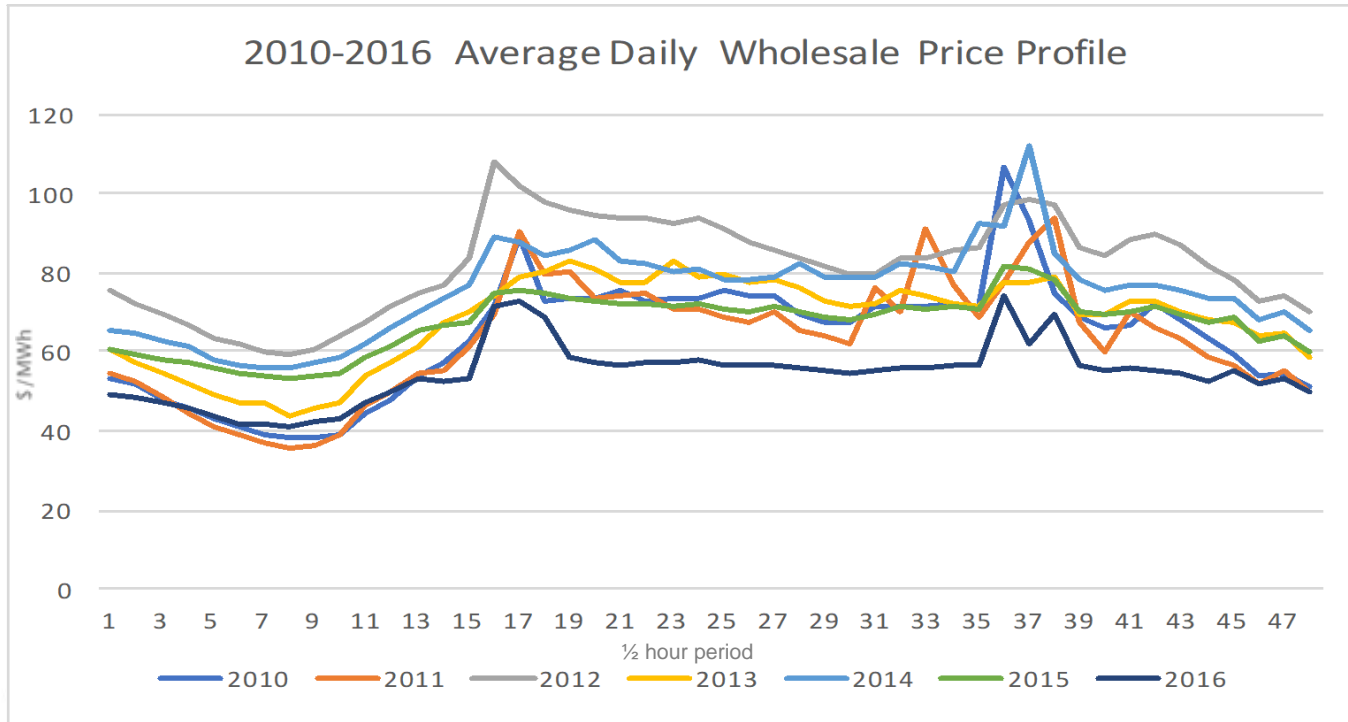
We fully developed the five most promising case studies – outlined in our report.

EXAMPLE OF AN ASSUMPTION



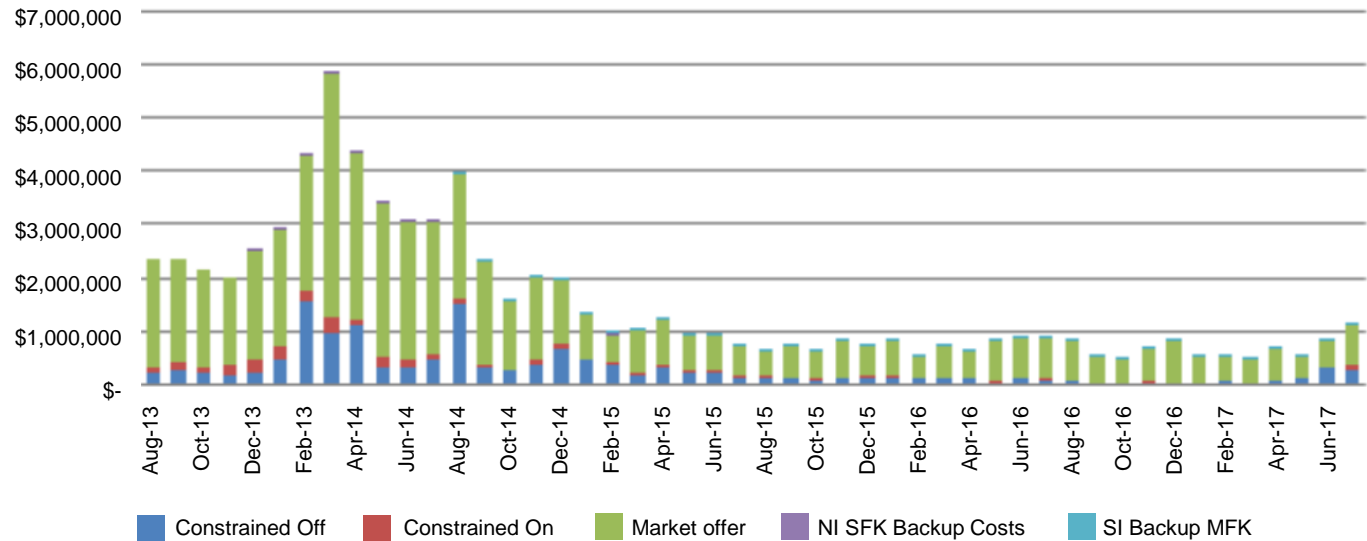
BATTERY STORAGE

EXAMPLE OF AN ASSUMPTION



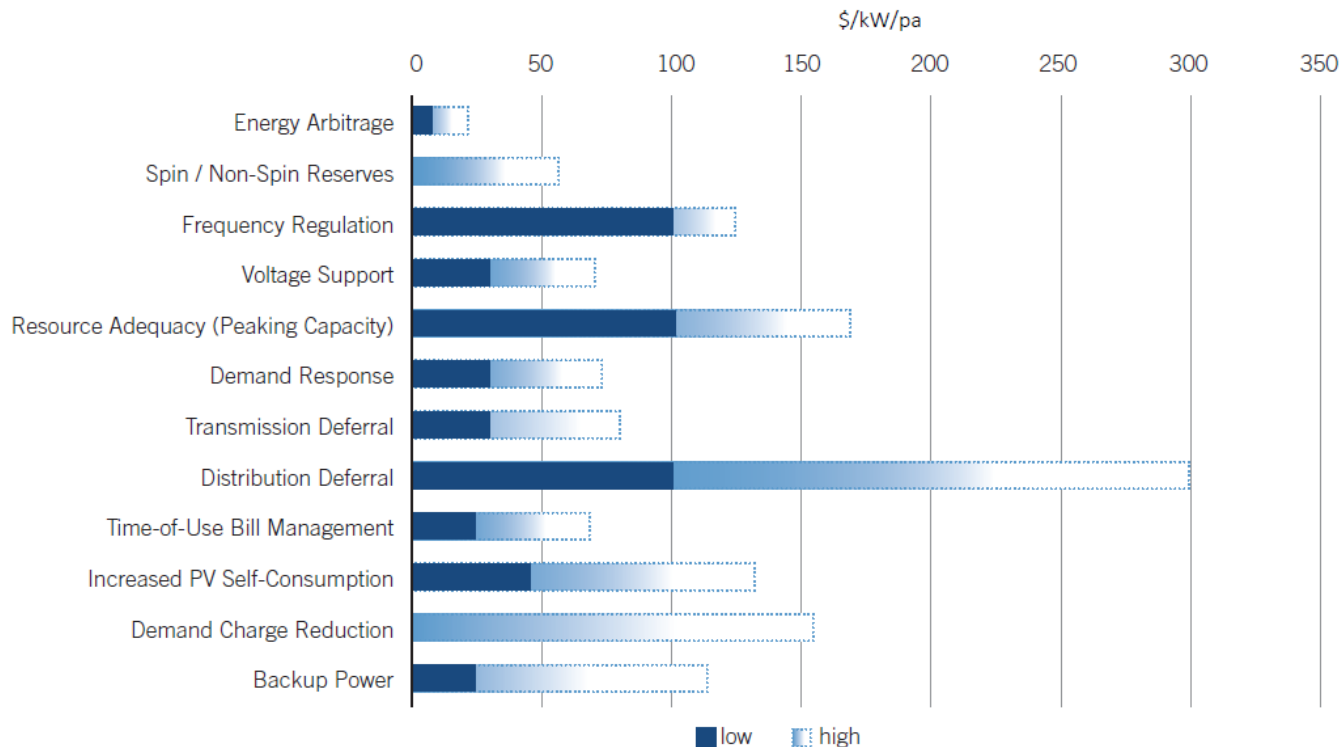
EXAMPLE OF AN ASSUMPTION

Frequency Keeping (past four years)

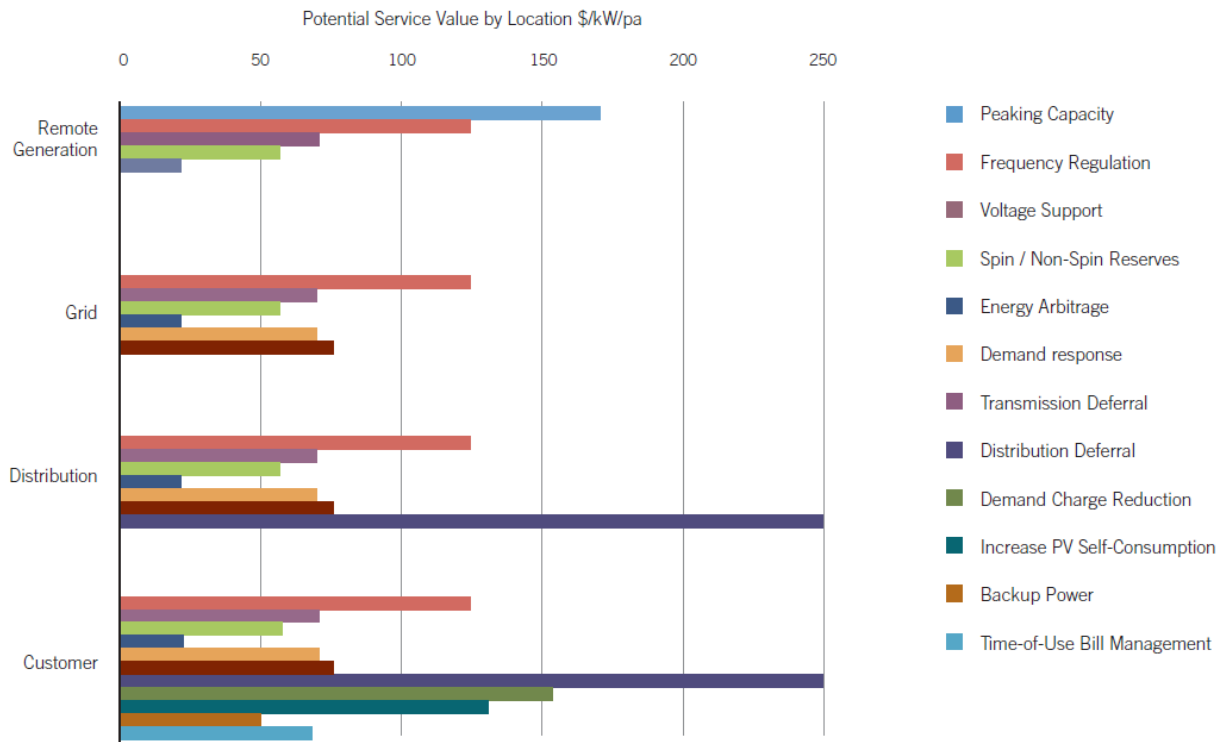


BATTERY STORAGE

WHAT POTENTIAL VALUE IS THERE? – BY SERVICE



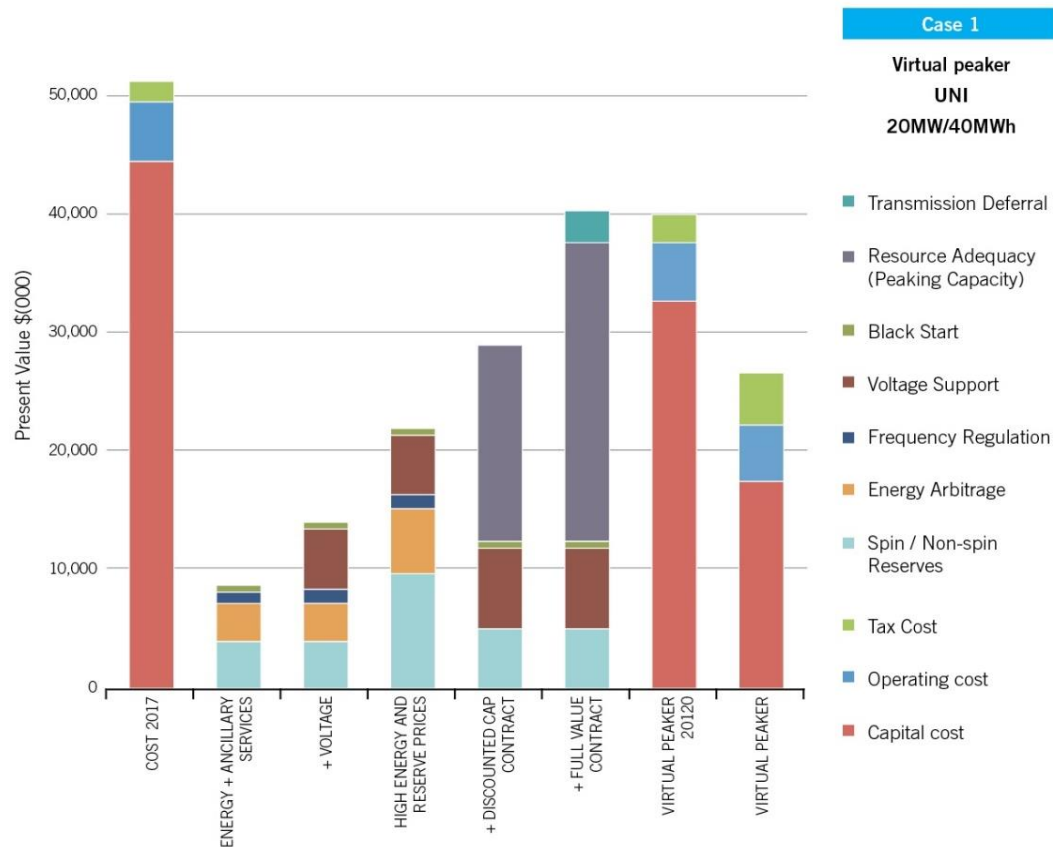
WHAT POTENTIAL VALUE IS THERE? – BY SUPPLY CHAIN LOCATION



CASE STUDY EXAMPLES TELL THE STORY

BATTERY AT GENERATION SITE

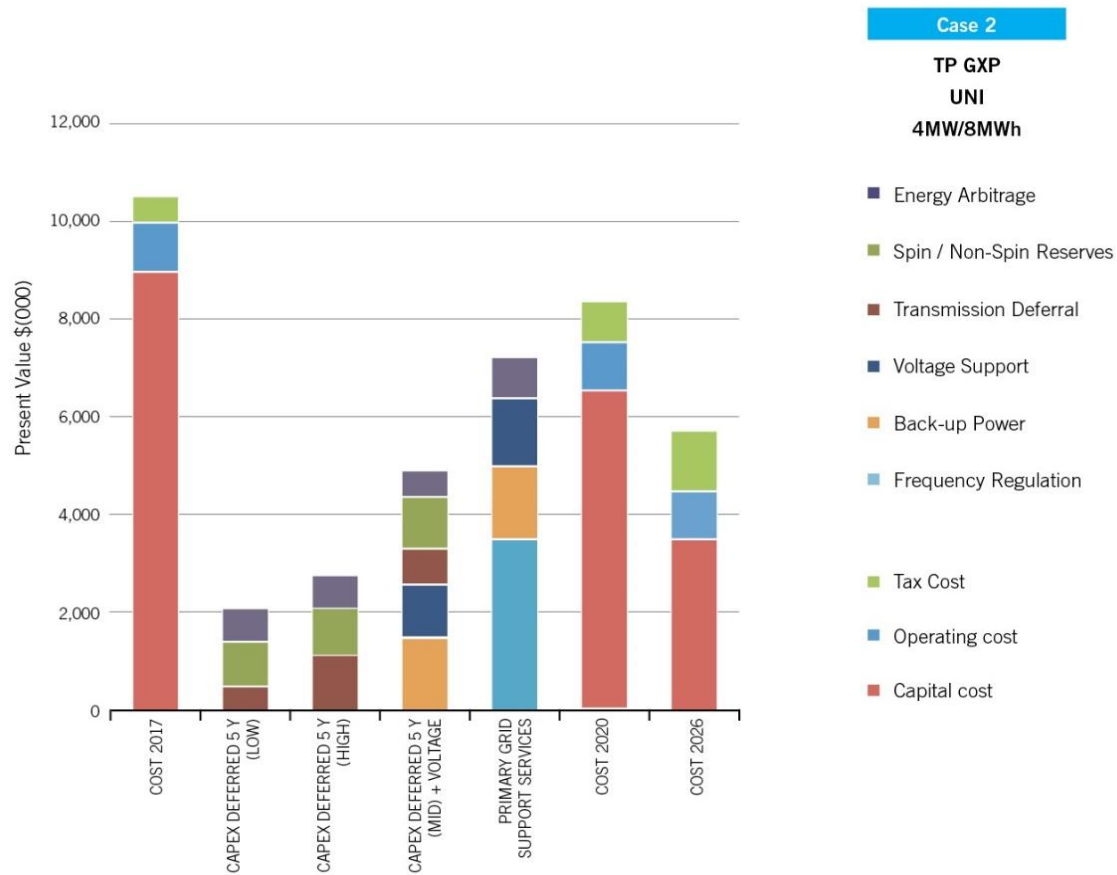
COSTS AND POTENTIAL REVENUE STREAMS FOR GENERATION-SITE BATTERY



CASE STUDY EXAMPLES TELL THE STORY

GRID- CONNECTED BATTERY

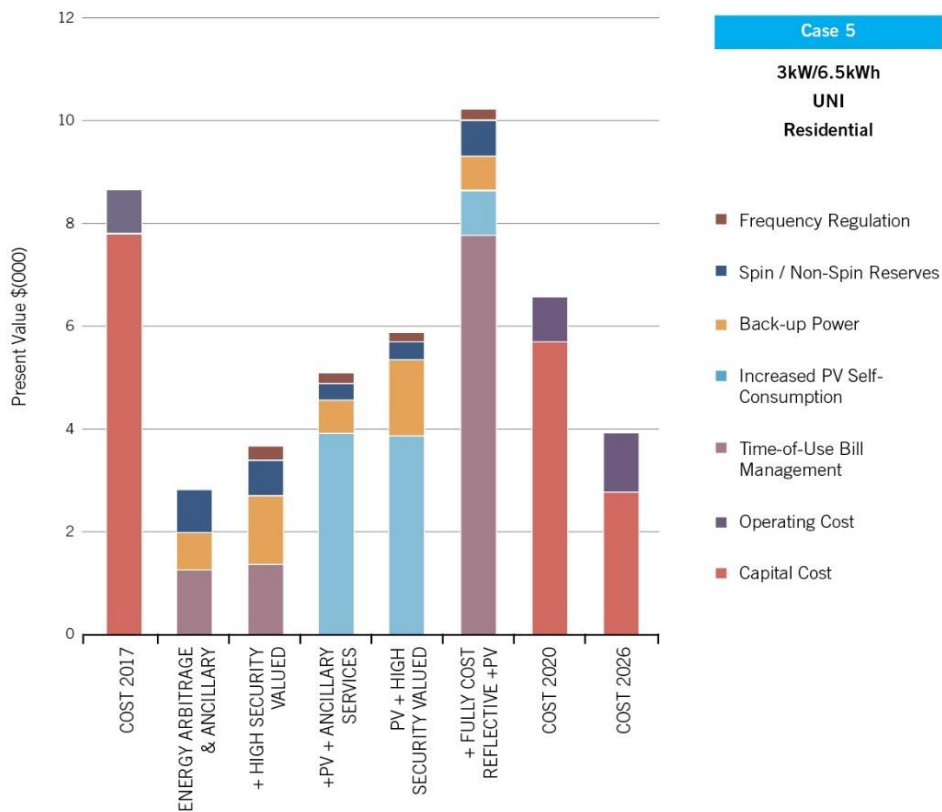
COSTS AND POTENTIAL REVENUE STREAMS FOR TRANSMISSION SUBSTATION SITE BATTERY



CASE STUDY EXAMPLES TELL THE STORY

RESIDENTIAL BATTERY SITE

COSTS AND POTENTIAL REVENUE STREAMS FOR BATTERY AT A RESIDENTIAL HOME

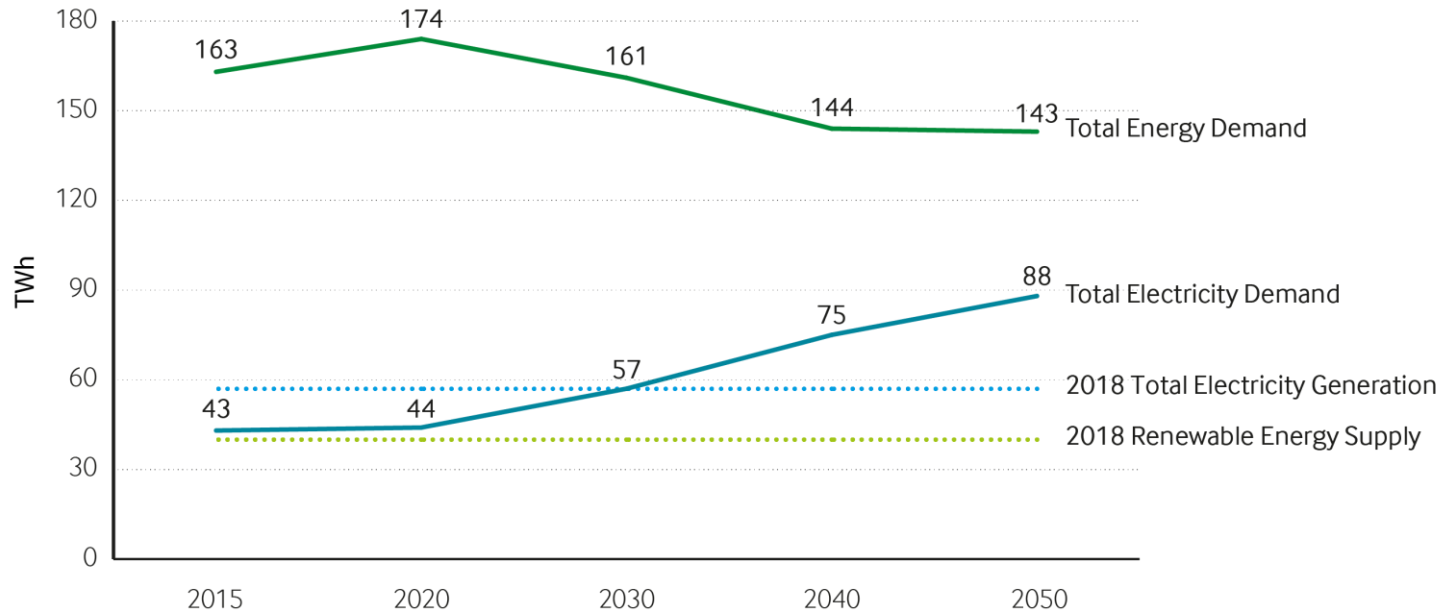


FINDINGS

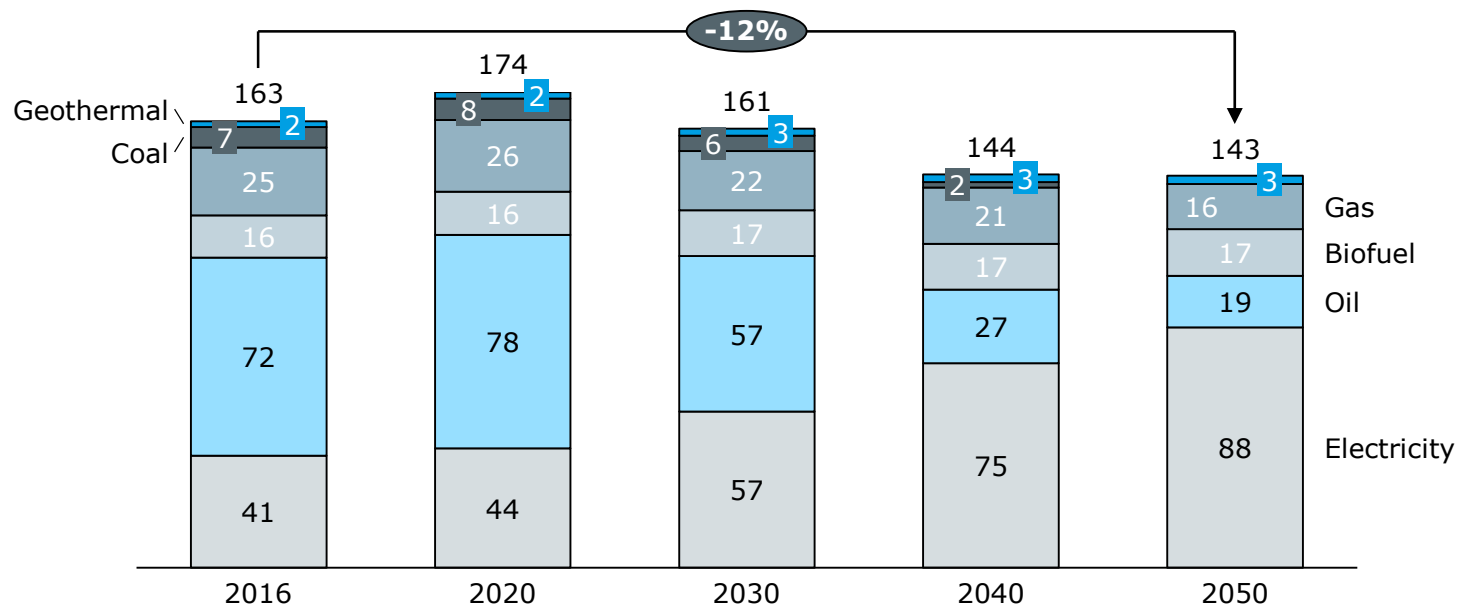
- Most value located closer end customer providing greater range services
- Appropriate markets, systems and platforms required to enable end-customers to realise value
- Value of each service differs widely depending on where in electricity supply chain and where in New Zealand the battery is
- Only specific customer installations economic today – many more by 2020-2026



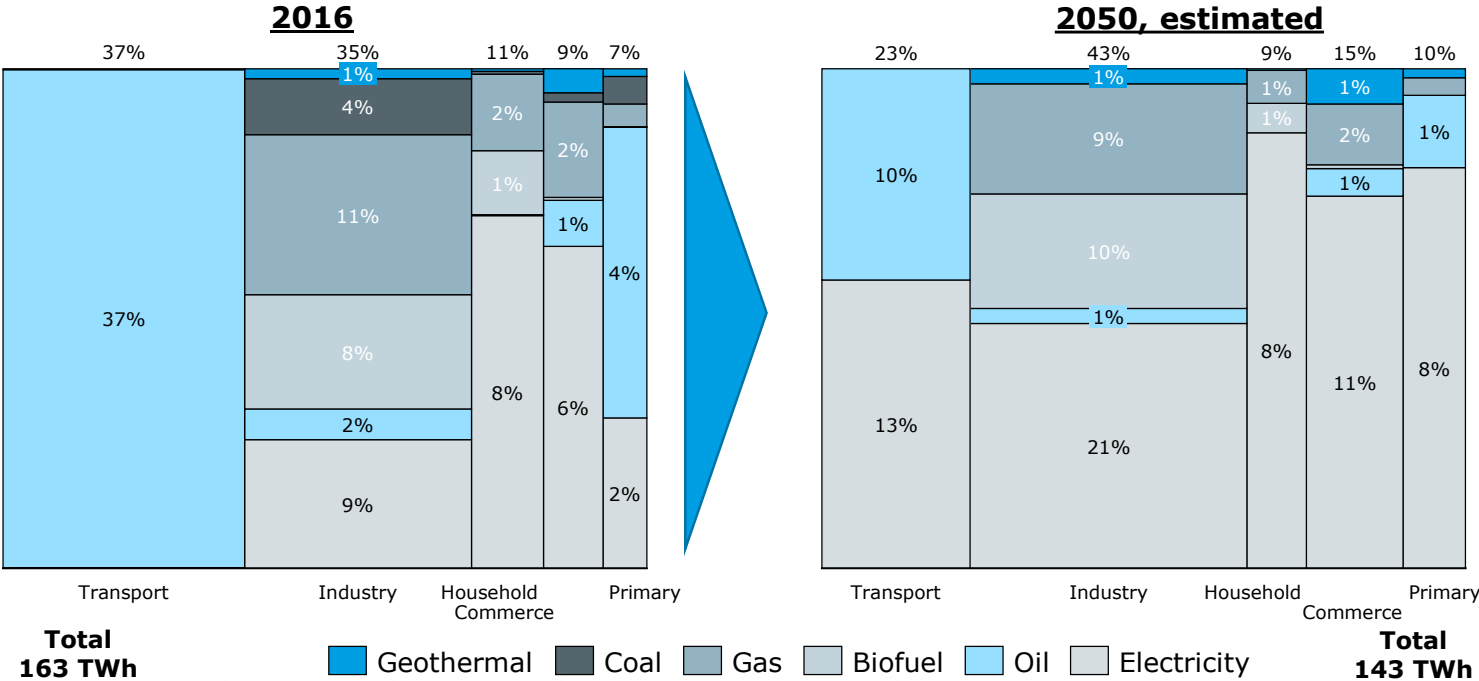
MODELLED SUPPLY AND DEMAND



TOTAL ENERGY CONSUMPTION BY FUEL TYPE

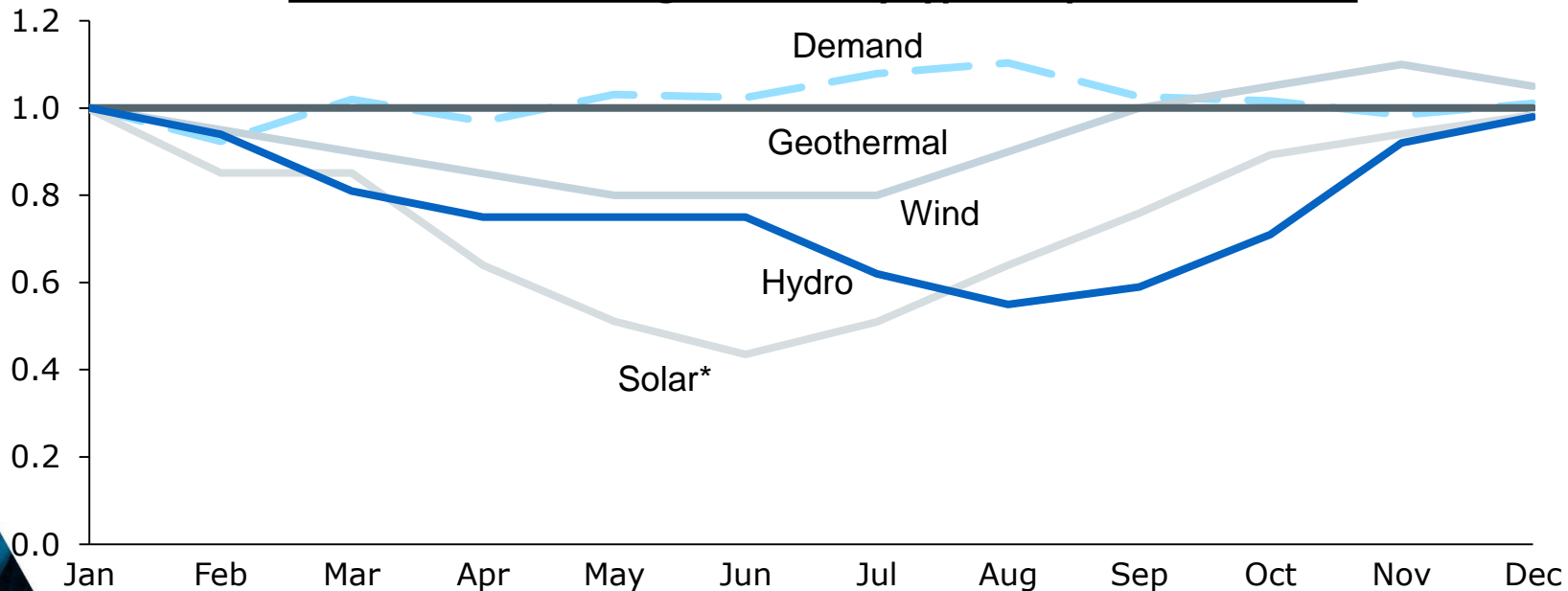


THE FUTURE IS ELECTRIC

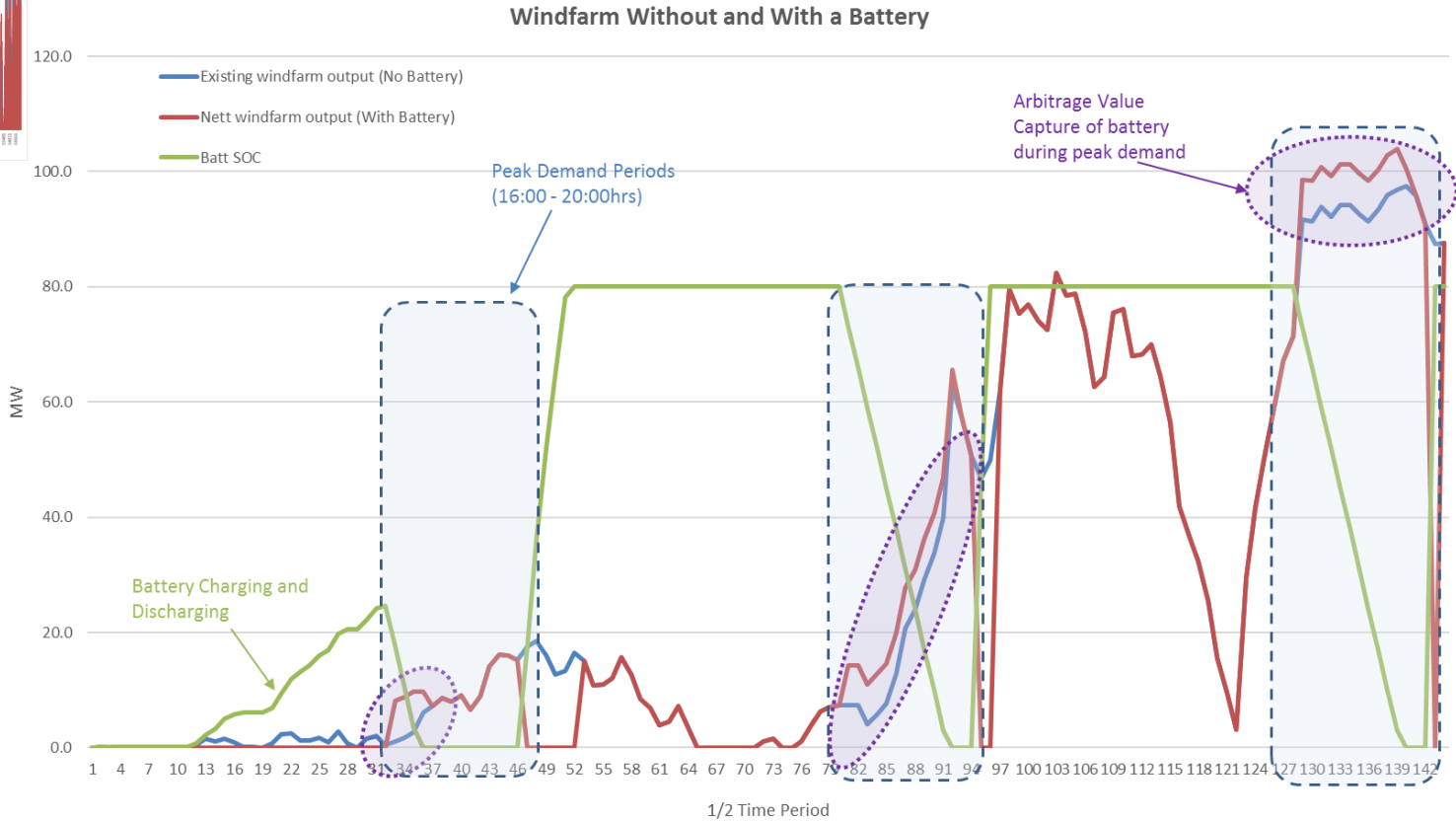
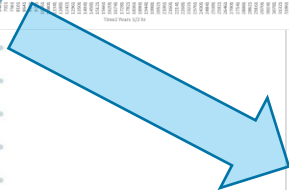
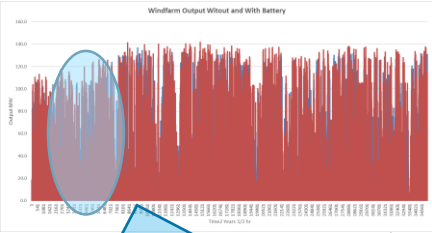


2050 WINTER SUPPLY MIX

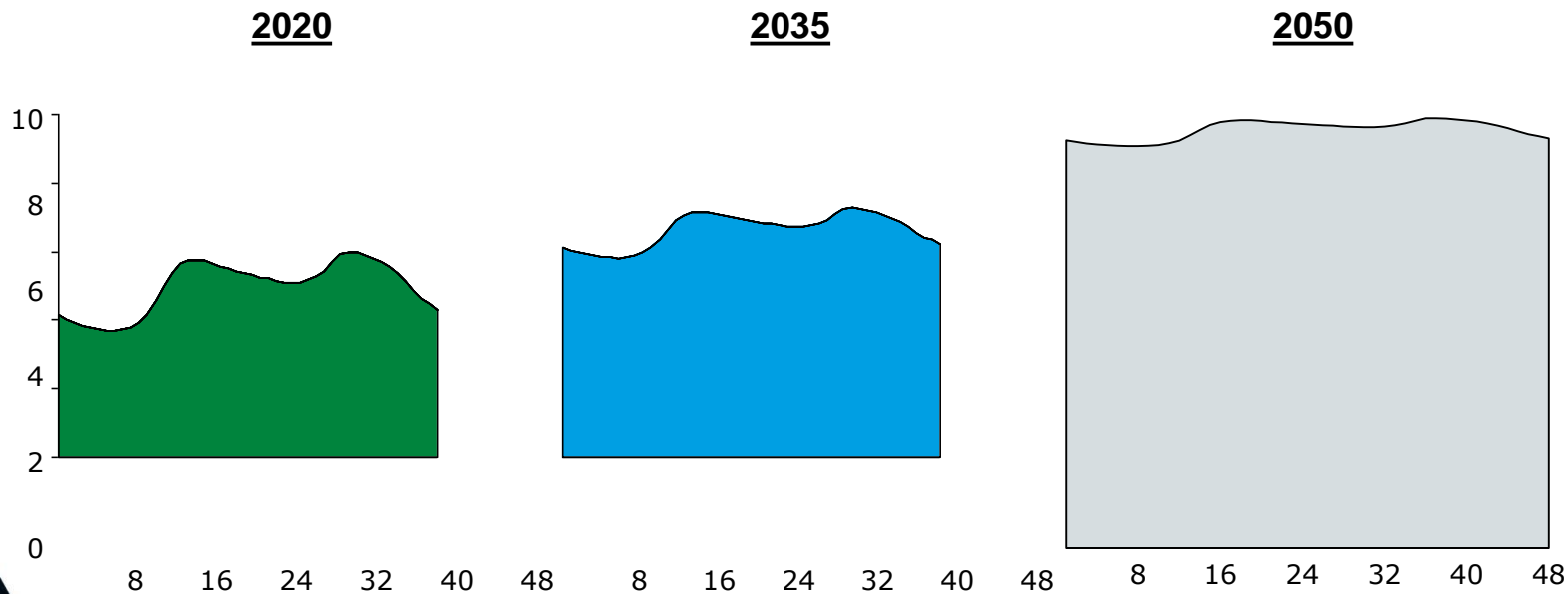
Normalised seasonal generation by type compared to demand



INSERT WINDFARM GRAPH OUT WITH AND WITHOUT STORAGE



HALF-HOURLY PEAK INCREASES



SO HOW WILL STORAGE CHANGE NZ ELECTRICITY SYSTEM

Initial storage deployment

- Intermittent generation becomes more dispatchable and valuable
- Initially ancillary services offer additional revenue streams

Once storage wide spread and ubiquitous,

- Intermittent generation is more dispatchable and valuable
- kW, kVar, security, dispatchability is King,
- ancillary service revenue anticipated to trend to zero
- Grid transfer capacity can double with security reducing to N, end consumer still N-1
- Every person/organisation is a participant and has a consumption/production profile



THANKYOU FOR YOUR ATTENTION

- Questions and discussion?
- For more information andrew.renton@transpower.co.nz

READ MORE AT

[HTTPS://WWW.TRANSPOWER.CO.NZ/RESOURCES/BATTERY-STORAGE-NEW-ZEALAND](https://www.transpower.co.nz/resources/battery-storage-new-zealand)

[HTTPS://WWW.TRANSPOWER.CO.NZ/ABOUT-US/TRANSMISSION-TOMORROW/SOLAR-POWER-NEW-ZEALAND](https://www.transpower.co.nz/about-us/transmission-tomorrow/solar-power-new-zealand)

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