MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

COVERSHEET

Minister	Hon Dr Megan Woods	**Portfolio**	Energy and Resources
Title of briefing	Proactive release of market integration/economic modelling reports to inform the NZ Battery Project Indicative Business Case	**Date to be published**	27 October 2023

List of documents to be proactively released		
Date	**Title**	**Author**
10 May 2023	*NZ Battery Project – Update on the three Portfolio component technologies (2223-3270)*	Hidde Mebus Senior Policy Advisor
1 June 2023	*NZ Battery Project – Further advice on the Portfolio option (2223-3271)*	David Stimpson Principal Policy Advisor

Information redacted **YES / NO** *[select one]*

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Some information has been withheld for the reasons of commercial information and to protect the privacy of natural persons.

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

BRIEFING

NZ Battery Project – Further advice on the Portfolio option

Date:	1 June 2023	**Priority:**	Medium
Security classification:	In Confidence	**Tracking number:**	2223-3271

Action sought		
	Action sought	**Deadline**
Hon Dr Megan Woods **Minister of Energy and Resources**	**Note** that our work since the February report back has confirmed that there are viable procurement and operating models for the Portfolio option and that our developing understanding of the option supports it being taken further for more analysis **Agree** that the Portfolio option should be taken through to the NZ Battery Detailed Business Case	7 June 2023

Contact for telephone discussion (if required)			
Name	**Position**	**Telephone**	**1st contact**
Susan Hall	Policy Director, Energy and Resource Markets	Privacy of natural persons	✓
David Stimpson	Principal Policy Adviser		

The following departments/agencies have been consulted
The Treasury and Te Waihanga have been consulted on the procurement and funding issues

Minister's office to complete:

- ☐ Approved
- ☐ Noted
- ☐ Seen
- ☐ See Minister's Notes
- ☐ Declined
- ☐ Needs change
- ☐ Overtaken by Events
- ☐ Withdrawn

Comments

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BRIEFING

NZ Battery Project – Further advice on the Portfolio option

Date:	1 June 2023	**Priority:**	Medium
Security classification:	In Confidence	**Tracking number:**	2223-3271

Purpose

To provide you with:

a) further information and analysis on possible procurement, delivery, and operating models for the Portfolio option for the NZ Battery Project

b) the Ministry of Business, Innovation and Employment's (MBIE) expectations of its economic performance following updated modelling

c) our advice on next steps for the Portfolio option.

Executive summary

In February 2023, following consideration of the Indicative Business Case (IBC) for the NZ Battery project, Cabinet invited you to report back in July 2023 with more information on the merits, risks, and trade-offs of the Portfolio option and a potential Upper Moawhango pumped hydro scheme.

Subsequent advice concluded that the Portfolio option remains a technically feasible solution to New Zealand's dry year problem [briefing 2223-3270 refers]. We advised that the woody biomass and flexible geothermal technologies remain viable, but that there are significant risks relating particularly to the flexible and low emission operation of geothermal. However, we advised that a Crown-owned and operated interruptible hydrogen solution at a scale to address the dry year problem is not recommended within the desired timeframes.

The current briefing provides further advice on the potential portfolio delivery models outlined in the IBC:

- **Option 1 – The Crown owns reserve energy (or portfolio) assets.** The Crown would, after market testing, specify, construct where necessary, and own dry year reserve generation assets employing the technologies used as the basis of the Portfolio option in the IBC
- **Option 2 – The Crown procures reserve energy services.** The Crown would procure by tender or auction a series of one-to-one contracts for dry year reserve energy services from providers
- **Option 3 – Development of a reserve energy / capacity market.** A government agent would set the amount of reserve capacity required and form this into standardised tradable certificates or tickets.

Based on our initial assessment of the three delivery models we conclude that options 1 and 2 appear feasible. Option 3 is complex, and feasibility is not assured, but it warrants further work alongside related work on capacity mechanisms through the Electricity Market Measures project. In addition, updated modelling of the refined Portfolio option, omitting hydrogen, indicates its performance in a revised Multi Criteria Analysis (MCA) could improve.

We note that our understanding of uncertainties with the Portfolio option remains less mature than the Lake Onslow option and this will require further work in the Detailed Business Case (DBC).

However, MBIE considers that the existence of viable procurement and operating models for the Portfolio option and our developing understanding of the option supports it being taken forward to the DBC.

Recommended action

The Ministry of Business, Innovation and Employment recommends that you:

a **Note** that Cabinet considered the Indicative Business Case (IBC) for the NZ Battery Project in February 2023 and invited you to report back in July 2023 with more information on the merits, risks, and trade-offs of the Portfolio option and the potential Upper Moawhango pumped hydro scheme

Noted

b **Note** that this briefing provides further information and analysis on the Portfolio option procurement and delivery/operating models, and indicative findings of our updated modelling

Noted

Portfolio option delivery models considered

c **Note** that the potential portfolio delivery models outlined in the Indicative Business Case (IBC) comprised:

i. Option 1 – The Crown owns reserve energy (portfolio) assets

ii. Option 2 – The Crown procures reserve energy services

iii. Option 3 – Development of a reserve energy / capacity market

Noted

d **Note** that further work would be required in the Detailed Business Case (DBC) to assess the pro and cons of Option 1 – Crown owns reserve energy assets

Noted

e **Note** that a feasible procurement path can be seen for Option 2 – Crown procures reserve energy services

Noted

f **Note** that Option 3 – Development of a reserve energy / capacity market would require more work in the DBC to resolve its design complexities before it could be accepted or rejected as a viable delivery model for the Portfolio option

Noted

g **Note** there is a range of potential operating models for options 1 and 2 that could address concerns over the discouragement of wider market investment in new generation and that these models would require further exploration in the DBC

Noted

Updated economic modelling of the Portfolio option

h **Note** that updated modelling of the refined Portfolio option, omitting hydrogen, indicates that its performance would improve through a revised Multi Criteria Analysis (MCA)

Noted

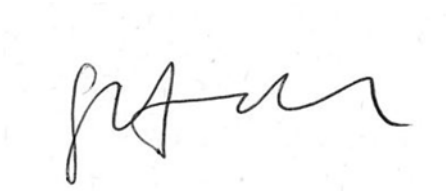
Next steps

i **Note** officials consider that the Portfolio option should be taken through to the DBC for further analysis because it remains technically viable, procurement and operating models are likely to exist, and updated modelling suggests that it would improve its performance through the MCA

Noted

j **Agree** that the Portfolio option should be taken through to the NZ Battery DBC

Agree



Susan Hall
Policy Director
Policy Energy and Resource Markets
MBIE

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Hon Dr Megan Woods
Minister of Energy and Resources

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Background

1. The NZ Battery Project is investigating large-scale, long-term renewable energy storage options that could address New Zealand's 'dry year problem.' The first stage of this work has been completed resulting in an Indicative Business Case (IBC) which was reviewed by the Treasury's Gateway Review Panel in October 2022.

2. The IBC considered two main options:

    - A pumped hydro scheme at Lake Onslow
    - A Portfolio option which includes the following components:
        - new geothermal plant operated flexibly
        - combustion of processed woody biomass
        - interruptible hydrogen electrolysis and storage as green ammonia.

3. The Portfolio option showed promise in the IBC; it outperformed the Lake Onslow option in a multi-criteria analysis (MCA) that was used to identify a preferred Battery option albeit at a slightly higher financial cost. However, it was acknowledged that significant uncertainties remain around the deliverability and technical and economic feasibility of each of the elements of the Portfolio option that would need to be investigated further.

4. Cabinet considered the project and associated IBC in February 2023 and agreed to progress the project to the next phase of work which at a high level would involve:

    - Commencing phase 2a on the Lake Onslow option, which would include further technical design and development and policy work. The purpose of the next phase of the project will be to prepare detailed designs and undertake policy work to further inform the potential operating models of such a scheme and its impact on the market.
    - Further work on two other options that could address the dry year problem: a portfolio of other technologies; and, subject to iwi engagement, further preliminary investigations into a potential North Island pumped hydro location at Upper Moawhango.

5. You were invited to report back to the Cabinet Economic Development Committee in July 2023 with more information on the merits, risks, and trade-offs of the Portfolio option and the potential Upper Moawhango pumped hydro scheme. We will brief you on Upper Moawhango separately.

6. On 23 March 2023, we advised you that we would work to improve our understanding of the Portfolio option and provide you with further advice on [briefing 2223-3099 refers]:

    - The components of the Portfolio option. Briefing 2223-3270 informed you of MBIE's developing understanding of the three alternative technologies identified in the Indicative Business Case (IBC).
    - Procurement and delivery options for the Portfolio option. This is the focus of this briefing. This briefing also provides you with an update on MBIE's expectations of how a differently configured Portfolio option will perform under updated economic modelling.

7. Based on our work since February 2023, MBIE considers that the Portfolio option should be taken forward for further analysis through a Detailed Business Case (DBC).

Summary description of Portfolio option delivery models

Any proposed approach under the Portfolio option needs to provide deep storage

8. Any viable option that might be proposed under a portfolio approach needs to provide deep storage capacity available over weeks or even months. Our previous briefing updated you on our developing understanding of the three portfolio technologies. We advised that we do not consider hydrogen a viable part of a Crown owned and operated solution to the dry-year problem.

Three potential portfolio delivery options were identified in the IBC

9. The IBC identified the following three delivery models for the Portfolio option:

   Option 1 – **Crown owns reserve energy (portfolio) assets.** The Crown would, after market testing, specify, construct where necessary, and own dry year reserve generation assets employing the technologies used as the basis of the Portfolio option in the IBC for initial modelling purposes.[1]

   Option 2 – **Crown procures reserve energy services.** The Crown would procure by tender or auction a series of one-to-one contracts for dry year reserve energy services. This would avoid asset ownership. The procurement approach would be agnostic as to the technologies providers might propose, beyond a requirement for proposals based on renewable energy sources and potential scale and deliverability criteria. At this stage, we expect that these technologies could include biomass, geothermal and hydrogen, along with pumped hydro and demand response.

   Option 3 – **Development of a reserve energy / capacity market**. Under this option, a government agent (e.g., the regulator), would set the amount of reserve capacity required and form this into standardised tradable certificates or tickets as further outlined below and in ***Appendix One***.

Relative to Lake Onslow, the Portfolio option offers the ability to stage commitments and costs, but would have greater regulatory complexity

10. Lake Onslow would be a significant infrastructure project with substantial capital costs incurred in a single investment. It would have environmental and cultural impacts but may be expected to offer potentially significant benefits to the electricity system. As with the Lake Onslow option, if the portfolio were to be Crown-owned and constructed under Option 1, the environmental, social, and technical challenges and risks would fall directly to the Crown.

11. However, if Options 2 and 3 were favoured, the impacts would be different. Those options would involve Crown procurement activity, but with some of the risks transferred to private parties. The Portfolio option would offer more optionality to vary the scale and timing of commitments and costs to the Crown. On the other hand, there would be greater contractual and regulatory complexity compared with an option like Lake Onslow that would involve just one Crown-owned asset. This briefing updates you on our understanding of what would be required.

12. Overall, we conclude that there are several delivery models available for the Portfolio option. But further work would need to be done through the NZ Battery project DBC process, which would include market testing and engagement.

[1] Demand response would also play a role – NZ Battery has assumed demand response plays a dry year role in all the options modelled.

Option 1 – Crown owns reserve energy assets

Direct government ownership of portfolio assets under Option 1 would need to be further assessed in the DBC

13. The procurement of Option 1 would likely be similar to an approach taken for the Lake Onslow option. It would involve direct Crown-ownership and responsibility for design, build and operation, but with a wider range of assets. A comparative advantage would be that construction of each asset could be spread over time, keeping options open and spreading costs over time. While work to date has identified technologies that we consider could form part of a Crown-owned and operated Portfolio option, the next step in the process (through the DBC) would involve further testing the market for suitable technologies. This would help ensure that there is not a technology option that has been omitted.

14. Further work would be required in the DBC to further assess the pro and cons of Option 1. On the one hand, there are risks arising from direct ownership and responsibility for the design, build and operation of likely complex assets. On the other hand, the reasons advanced in the IBC in favour of full or partial Crown ownership of Lake Onslow may also apply to the Portfolio option. These reasons are the improved ability to consent, fund and communicate the national benefits of the project, along with retention of flexibility to respond to market changes and adjust asset size and capability.

Option 2 – Crown procures reserve energy services

A feasible procurement path can be seen for Option 2

15. Under Option 2, the Crown would go to the market to ask generators and suppliers to offer generation or demand response capacity as a service, at a specified worthwhile minimum scale to help address New Zealand's dry year problem.

16. This might involve biomass and geothermal technologies but market testing under this option would remain open to any technology that could provide dry year support services, including demand response.

Assets would be privately owned and used to support several long-term contracts for service

17. Assets would be privately owned, but government might choose to own some elements after testing the value expected from bids received. It is expected there would be several contracts with private providers. As a result, precise services, and contractual terms, would vary depending on the type of technology underpinning each contract. Different types of technology would vary in their operating characteristics such as speed and extent of ramp up and ramp down, and in their ability to store and replenish energy stocks.

18. There might be one contract for an asset type, or contracts with many service providers for the same asset type such as biomass plants in multiple locations. Depending on the favoured contractual or operating model, the regulator or operator may choose to cut up (slice) and auction interests in asset operation (in accordance with the contract terms) out to multiple market participants, who could then decide when and at what price to offer electricity into the market. This would have the benefit of a greater number of parties setting offers, therefore diversifying and strengthening decision making.

19. Contract length could be long term (decades) given the lead time and cost of significant new investments such as biomass and geothermal plant, plus the potential long life of such assets. The contracts would be between government and asset owners as service providers and are not expected to be tradeable. This feature distinguishes Option 2 from Option 3. The call for services and contracts could take place in stages over many years. This would allow solutions to change as our understanding of the nature of the dry problem evolves.

The scale of the procurement would be large with complex contracts, therefore posing high but not insurmountable risks

20. Regardless of ownership, the financial scale of providing a dry year solution would be significant. The cost of a Portfolio option under this delivery model was not investigated through the IBC. However, the total escalated, undiscounted capital costs of construction of a base case of the three identified portfolio technologies was $13.2 billion. Ongoing operating costs were expected to be very considerable. After adjusting for the possibility of a smaller portfolio solution without hydrogen (discussed in paragraph 54 of this briefing) a large and potentially enduring cost would remain.

Contracts would focus on risk sharing

21. At their core, any contract would be about risk sharing. The Crown might expect private sector investors to take the construction cost risks but the private sector would look to the Crown to share to a material extent the risks on the revenue side (how often would the plant run and what revenue would it receive). Conceptually there would be a range of ways to achieve this risk sharing so the Crown would benefit from when the plant was used extensively. The Crown would want to deal with parties with the financial strength to take on the risk of the project to manage the risk of a party walking away.

22. The Ultra-Fast Broadband (UFB) programme followed this type of co-funding model. Chorus and other local fibre companies contracted bore the construction cost risk, but the Government shared the uptake risk. The return of capital funding by the local fibre companies to the Government was linked to the level of uptake for fibre connections. The result after 10 years is that the baseline uptake for fibre connections predicted has been well exceeded and the Crown has consequently been recovering its investment sooner than expected.

Option 2 would require an administrative overhead for government

23. Complex ongoing contracts would be needed across several service providers along with complicated regulatory settings. Substantial systems, resources, and administrative funding would be needed from government for upfront procurement and ongoing monitoring. The procurement, contracting, and governance issues and risks would be high, but not insurmountable. However, this should be further investigated through the DBC.

Market capability and market interest is uncertain

24. Without market testing the costs and deliverability of the Portfolio options are uncertain. However, one NZ Battery portfolio technology – woody biomass – is being actively investigated by credible partners in New Zealand and is developing globally as an option.

25. Through the DBC, we would explore further the extent to which there would be a case for a clear and strong commitment by the Crown to share risk, and the extent to which the market may present credible options.

26. Market engagement would be needed to better understand market interest, challenges, and any mitigations. The aim of this engagement would be to test the market's ability to deliver services as well as its willingness and appetite to participate in different forms of Crown procurement. The results of this engagement would increase the Crown's understanding of the market's ability to deliver a Portfolio option, which would inform the assessment of this option as a potential NZ Battery solution.

Engagement with Treasury has raised no conceptual barriers to the funding and financing of this model

27. Under Option 2, proposals for dry year capacity services would be invited from providers who would own, or build, the supporting assets. The combined programme of works would likely form a "*large and complex*" project as defined in emerging guidance from the Treasury on funding and financing for large or complex investments.

28. It is expected that the DBC would identify revenue streams from portfolio solution beneficiaries, followed by the need for financing to spread costs over time. Crown investment could be considered for any residual funding gap left after exploration of funding from beneficiaries and financing from commercial sources. The expectation would be that the Crown is a funder of last resort.

Option 3 – Development of a reserve energy / capacity market

A reserve capacity market would be an addition to our existing energy only market

29. New Zealand operates an energy-only market (EOM) where generators are paid only for energy they deliver. Because they can bid into that market at any price, an energy-only market should allow all generators that are required to meet demand to recover their full operating and capital costs over time. However, in some cases, this may mean peaking or reserve generators recover their capital from a small number of spot price peak periods. Generators may also earn revenue from forward contracts to smooth out price and revenue volatility.

Our current energy only market risks insufficient investment to cover a dry year

30. Since its introduction in 1996, the EOM has created efficiencies, and investment has been sufficient. MBIE's transition work programme is assessing the extent to which we are now facing a different situation, with significant expected demand increases arising from extensive electrification of the economy and the gradual retirement of fossil-fuel plant that currently supply dry year security.

31. The NZ Battery project is premised on the concern that risk-averse generation investors will not invest sufficiently in renewable dry year reserve capacity because of:

    (i) The high costs of investment and concern that a future electricity market structure and rules will create a risk of insufficient revenues.

    (ii) Misalignment of incentives on generators who, to avoid risk of insufficient revenue are likely to under build, compared with governments faced with the social impacts of electricity shortage.

Capacity mechanisms make additional payments to generators to ensure sufficient plant is available

32. Some other electricity markets combine the EOM and its payments for energy delivered, with additional 'availability' payments to some or all generators to ensure sufficient plant or capacity is available to meet the range of conditions that might occur. Such availability payments are often called **'capacity markets'** or '**capacity mechanisms'** (CM). This reduces generation investment risk which improves overall generation adequacy.

A reserve capacity market is a targeted CM where capacity is called on in specified situations

33. A "***reserve CM***" (RCM) is a targeted CM that makes upfront payments to generators to hold generation capacity in reserve (supported by appropriate fuel stocks or flows). This reserve capacity can be called on in pre-specified situations. Overseas, this may be for unforeseen increases in demand or in times of generation or transmission failures.

34. These operating principles could also be applied to a dry year problem. Reserves could include services provided by excess energy generation capacity ("overbuild"), battery-like storage and dispatch systems, and demand response programmes.

35. Given the scale of the dry year problem, any RCM would need to be comprehensive and credible enough to support major new generation investment and industrial-scale demand response programmes, whether supported by smaller, incremental solutions. Reserve capacity may also be able to operate in the market at other times (such as a calm and cloudy period) when it is not required to be held in reserve.

Capacity markets have worked internationally, but there are concerns about their operation in New Zealand

36. Ernst and Young (EY) have conducted a review of international examples of RCMs for the NZ Battery project. Their review did not identify any technical barriers to the operation of an RCM in the New Zealand context to maintain security of supply in dry years[2]. They observe that reserve / targeted capacity markets have been used successfully in several overseas electricity markets including Colombia, Sweden, and France.

37. The Electricity Authority's (EA) Market Development Advisory Group (MDAG) and Boston Consulting Group (BCG) do not support CMs in New Zealand's currently EOM. MDAG's view (at this stage in its work) is that while CMs have generally achieved their objectives internationally, they come at a high cost through a tendency to over-procure resources and there are other preferable solutions focused on improvements to the existing energy only market[3]. BCG's concerns were the need for significant government intervention to implement CMs and their uncertain effectiveness[4].

To establish a targeted capacity market the regulator would form the required capacity into tradable certificates

38. Any capacity market would need to be integrated into the market rules. This would suggest that the EA as the regulator may be the appropriate body for its implementation., however this would need to be determined.

39. To establish a targeted capacity market, the regulator would identify the amount of required reserve capacity and form this into standardised tradable certificates or tickets as further outlined in ***Appendix One***. Analysis of international experience and our dry year problem indicates two potential approaches to the purchase of the required capacity:

    a) A centralised approach with purchase by the regulator, through a competitive auction, of reserve capacity formed into standard tradable certificates. The tradable certificates under this approach would differentiate this option from the one-to-one contracts anticipated in Option 2.

    b) A decentralised approach with purchase of reserve capacity required directly by market participants in a standard certified format able to be traded in a market.

40. The costs, benefits and risks of each approach would vary in terms of the role of the regulator, who carries the risk of non-service delivery, the extent of competition, regulatory complexity created and costs to government. New markets would need to be established - involving complex tradable products, the effectiveness and feasibility of which are uncertain at present.

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[2] Page 14, EY report to MBIE, *New Zealand electricity market – Capacity markets study,* May 2023.
[3] Page 21, MDAG Library of Options.
[4] Page 174, Boston Consulting Group (BCG) *The Future is Electric – A Decarbonisation Roadmap for New Zealand's Electricity Sector,* October 2022.

More work is required to determine the feasibility of a capacity market

41. Our interim conclusion is that the identified risks and complexities associated with introducing a capacity mechanism into New Zealand's market would be very complex and potentially costly. However, we consider more investigatory work on this option is required to ascertain its feasibility in the dry-year context and to confidently rule it in or out. The Electricity Market Measures (EMM) Issues Paper considers whether capacity mechanisms (or other forms of incentives) are required to support the development of new renewable or dispatchable capacity during transition. Submissions on the EMM Issues Paper will help inform our analysis, and if necessary, we can carry out further market engagement on this option through the DBC process.

As stated in the IBC, there are a range of potential operating models for the Portfolio option

A key challenge is how to operate dry year assets and not discourage wider market investment in new generation

42. A principal concern for the operation of dry year reserve assets is the potential disincentive on wider investment in generation if the assets are not quarantined for dry year use only and able to always make offers into the market. New investors expect to recoup their investment at least in part from periodic spot market price spikes. Their concern arises if the offer price from a dry-year asset is too low or if investors in new generation fear a future government or regulator may "change the rules": and operate outside dry year risk conditions to lower electricity prices.

43. The IBC identified that there are a range of operating models for Lake Onslow that would involve a greater or lesser degree of private sector involvement. This applies equally for Options 1 and 2 described above.

44. One option is security of supply operation mode (SOS) where energy is reserved/quarantined for dry-year risk use only with offers into the spot market triggered by deployment rules around when a dry year event is called. This approach would work best for technologies like geothermal which, once built, have a low marginal operating cost. However, these cost economics make running geothermal as baseload very attractive. Under this model, then, capacity would need to be clearly ring fenced and to operate only in a dry year

45. An alternative would be to regulate for flexible operation of an asset, but with adequate storage required. This approach would work for technologies that have a large amount of storage such as pumped hydro and woody biomass. As a dry year solution, these technologies could operate in the spot market under normal conditions, provided they retained storage to also deliver on their dry year reserve contracted responsibilities. This model is likely the most economically attractive option for private investment because the plant could be earning revenue by providing firming capacity during more normal market conditions, while always retaining the storage to deliver in a dry year. In turn, this would reduce the level of Crown support required.

46. These options would require further exploration through the DBC.

Update on Portfolio option modelling results

A theoretical portfolio of biomass, geothermal and hydrogen was modelled for the IBC

47. The Portfolio option presented in the IBC included three technology options (biomass, geothermal and hydrogen) based on concept designs developed by WSP.

48. In preparing the IBC, we assessed that each of the three technologies alone could not provide the required dry year cover. The WSP concept designs were therefore combined into a Portfolio option, to provide a meaningful comparison to the Lake Onslow option. The Portfolio option in the IBC had a marginally lower Benefit Cost Ratio (0.40) than Lake Onslow (0.42), but a slightly better overall score under the MCA.

49. The IBC presented the best available information at the time of its drafting for comparing the options. In seeking to improve our understanding of the Portfolio option, we recognised that a different and smaller configuration of the technologies could provide a better balance of costs and risks for dry year support.

Since the IBC we have discounted hydrogen as a likely feasible Crown owned and operated dry year solution

50. Previous advice has indicated that the hydrogen concept design in the IBC is high risk as an option for dry year supply security due to the uncertain development of an ammonia market at sufficient scale on which this solution depends [briefing 2223-3270 refers]. Further modelling results also indicate there are few electricity system benefits from hydrogen as a dry year solution. This reflects that, while it is assumed to operate in a flexible way outside of peak times, the additional demand, and hence new generation investment required would still add costs to the system.

A smaller portfolio option can be modelled without hydrogen

51. We have therefore modelled a smaller portfolio option, reduced in scale from 2.4 TWh to 1.6 TWh over three months. This utilises the same scale of biomass (1.0 TWh) and flexible geothermal (0.6 TWh) as in the IBC but excludes the hydrogen component entirely. Our work since February 2023 suggests that the 0.8 TWh contribution previously assumed from interruptible hydrogen could be offset by greater (0.6 TWh) overbuild of wind and solar and increased use of green peakers[5] (<0.1 TWh). The reason hydrogen's contribution can be replaced with a smaller contribution from wind and solar is that the need for generation to supply the hydrogen electrolyser is avoided. However, whether this degree of overbuild and increased supply of green peakers is needed would need to be further investigated and confirmed through the DBC.

A portfolio solution that excludes hydrogen may also perform differently under a multi-criteria analysis and the option should therefore be taken into the DBC

52. A portfolio solution that excludes hydrogen may also perform differently under a multi-criteria analysis as part of the DBC given some risks are avoided. However, there will be trade-offs across the multiple criteria, so the overall effect is difficult to anticipate. On balance the revised modelling provides a further reason to take the Portfolio option into the DBC for further assessment.

Uncertainties remain around our understanding of the Portfolio option

53. We note that risks and uncertainties remain with the Portfolio option, as outlined in briefing 2223-3270. Our understanding of these has improved since the February report back but still remains less mature relative to our understanding of the risks of the Lake Onslow option. Substantial further work would be required in the DBC to bring the Portfolio option to a similar level of confidence.

[5] "Green peakers" are fast-start peaking generators fuelled by internationally sourced renewable-diesel.

Conclusions and next steps

54. MBIE's view is that the Portfolio option justifies further analysis through the DBC because it remains technically viable, procurement and operating models are likely to exist, and different configurations of the option suggest that it could improve its performance through the MCA.

55. We are considering the range of work that would be required to investigate the issues identified in this briefing, and any timing implications of this for the next phases of work. In mid-June, we will provide advice to you on this and on next steps in the project, for your consideration alongside the draft Cabinet paper for your report back to the Cabinet Economic Development Committee.

Appendices

Appendix One. Portfolio option procurement models

Appendix One. Portfolio option procurement models

'First approximation' to be refined through DBC	**(IBC Option 1.) Crown procures & <u>owns</u> reserve capacity generation assets**	**(IBC Option 2. Crown procures <u>contracts</u> for reserve capacity services**	**(IBC Option 3.) Development of a reserve energy / capacity market**	
			a) Centralised	**b) Decentralised**
Conclusions	*Feasible*	*Feasible*	*Uncertain feasibility - requiring further work alongside option 2*	
Asset owner	Government	Largely private, but govt might own some elements such as a biomass wood stack with rights auctioned off as for Lake Onslow virtual slicing of storage	Private	
Operator (who also sets need)	Government agency	Central party e.g., regulator through system operator ("Operator") or an 'NZ Battery service provider'		
Service	Asset not service	Bespoke, negotiated service definition, requiring similar testing & certification regimes as for Option 3.	Service is standardised into one/a few defined products ("certificates"). Operator is the certifying authority and determines whether an existing or future asset owner could physically and reliably deliver the service	
Contractual arrangement	Government directly owns	Operator contracts for services (provided by privately held assets)	The certificate is a standard contract with <u>Operator</u> to be available and deliver if called	The certificate is a standard contract with <u>a Retailer</u> to be available and deliver if called
Awards / Results	Several asset procurements over time	RFP or similar tender approach followed by detailed service negotiation, likely with several providers	The number of certificates required to meet the need is put up for auction. Participants offer (into an auction) their ability to meet X quantity of certificates at what price.	Retailers (including their wholesale counterparts for heavy industry) required to hold number of certificates based on their size of load. They can deal bilaterally with generators. Operator runs a registry and auction
Procurement process	Market sounding followed by a contracting model appropriate to scale and risks of design & build	Market soundings followed by tenders or auction	System operator led auction processes	Retailers buy capacity directly from generators
Construction market impacts	Risks arising from what would be one of NZ's largest projects to be explored in DBC.			Key risk as for other options, but risks transferred to market participants
Contract type and length	Construction and operation contracts for Government owners could be less than asset lives	Govt contracts for services likely to be long term with operations potentially shared across several parties (e.g.: virtual slices)	System operator centrally contracts most likely on long term? basis with a range of supplier of reserve energy services?	
Administrative costs	Large and complex procurement processes required		Design, operation, and enforcement of market systems a significant cost – most likely to system operator and passed on to consumers	