MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

BRIEFING

Investigating the impact of high levels of rooftop solar and household batteries on retail bills

Date:	22 December 2025	**Priority:**	Medium
Security classification:	In Confidence	**Tracking number:**	BRIEFING-REQ-0022946

Action sought		
	Action sought	**Deadline**
Hon Simon Watts **Minister for Energy**	**Note** the contents of this briefing **Note** MBIE will discuss the findings with Rewiring then publish the research in early February 2026 **Agree** to meet with us to discuss this research's key findings	30 January 2026

Contact for telephone discussion (if required)			
Name	**Position**	**Telephone**	**1st contact**
Tamara Linnhoff	Manager, Electricity Markets Policy	Privacy of natural persons	✓
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The following departments/agencies have been consulted

Minister's office to complete:

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☐ See Minister's Notes ☐ Withdrawn

Comments

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BRIEFING

Investigating the impact of high levels of rooftop solar and household batteries on retail bills

Date:	22 December 2025	**Priority:**	Low
Security classification:	In Confidence	**Tracking number:**	BRIEFING-REQ-0022946

Purpose

You requested advice on the potential impacts of high levels of rooftop solar and small-scale batteries on the electricity market, and advice on assertions made by Rewiring Aotearoa (**Rewiring**) on the potential benefits for New Zealand's security of supply and electricity prices.

On 2 October we reported interim findings of research on the impact of faster uptake of rooftop solar PV (including some with batteries) on the wholesale market and network costs [BRIEFING-REQ-0018640]. This briefing reports on the modelling of the flow-on impact of those wholesale and network cost impacts, on households.

Executive summary

MBIE commissioned modelling to assess the impact on household energy costs of ambitious uptake scenarios for rooftop solar and small-scale battery uptake across households, farms, and businesses. Household energy costs comprise electricity bills, costs relating to rooftop solar and battery installations, and gas costs where these are present. The modelling also explored how different tariff structures, that change incentives around the timing of EV charging and solar export, could affect electricity bills.

The modelling contrasted a moderate uptake base case (around **3.5GW** by 2055) with two uptake trajectories: moderate and fast uptake rates to achieve Rewiring's ambitious target of **28GW** for rooftop solar adoption (including some with attached battery storage) by 2055. Rewiring's **28GW** target is seven times higher than the base case and reflects solar installed on around 80 percent of all homes, and a substantial number of farms and businesses.

The modelling comprises three parts, assessing the impact on:

Wholesale electricity market	+	**Network capital expenditure**	=	**Household energy costs**
On generation, security, and prices.		Costs or savings of extra or reduced network investment caused by large solar export, and demand management.		The potential flow through effect to households of wholesale and network impacts, considering also household savings from solar and demand management

We find very high levels of solar uptake (28GW by 2055) could:

Significantly affect the wholesale market:	+	**Materially increase network capex, if unmanaged:**	=	**The impact on household energy costs is uncertain: solar and battery uptake could increase or decrease bills**
• A lower spot price will benefit consumers. • Wholesale market dynamics would fundamentally change and would need to be managed (to avoid higher prices), to ensure continued incentives in grid-scale generation, as modelling shows this would still be needed in the longer term.		• Networks will need capital investment to accommodate daytime solar exports • But these costs could be substantially reduced by smart energy management		• The impact is complex and will depend on ○ New Zealand's electricity demand growth, uptake rates of solar and batteries; each household's solar, battery, EV, appliance and overall fuel specs and use. ○ To avoid costly network upgrades solar and battery uptake needs to track demand growth: if too far ahead or behind this will drive higher household bills. Smart tariffs will be critical.

The key takeaways from the modelling, given current known technologies and the interactions across wholesale, networks and retail bills, are:

- The importance of balance across electrification and related growth in demand for electricity, and the uptake of rooftop solar and household batteries. The ideal will be solar and battery uptake that just ahead of overall electricity demand growth, and neither too far in advance (causing network congestion) nor with an excessively lag (driving higher network investment costs).
- New Zealand needs a smart electricity system as we electrify so that customers choose (or panels, batteries and EVs automatically) shift demand and injection to the 'right' time periods – so that customers benefit via lower bills driven directly by changing their time of use; and indirectly via avoided network investment costs.

So complementary policies to support a smart electricity system, and for customers to use the smart capabilities of their systems, will be key to avoid an unintended consequence of very high levels of solar and battery uptake driving higher overall costs to consumers.

This modelling was designed to test the impacts of Rewiring's ambitious uptake scenarios, on wholesale, network and retail costs. The modelling did not produce an 'optimal' uptake rate that ensures optimal benefits to New Zealand consumers of faster uptake of rooftop solar and household batteries.

We consider Rewiring's ambitious target to be optimistic, and the level of 'smartness' the system (and consumers) would need, to ensure no overall cost inflation to all consumers, is also likely to be a stretch-assumption. As such, we are exploring commissioning further work to consider the impact of more moderate uptake rates, and if possible, advice on an optimal pathway.

Recommended action

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

a **Note** the contents of this briefing

Noted

b **Note** MBIE will discuss the findings with Rewiring then publish the research in early February 2026

Noted

c **Agree** to meet with us to discuss this research's key findings

Yes/No

privacy of natural persons

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22 / 12 / 2025

Hon Simon Watts
Minister for Energy

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Recap: The first stage of research explored the effects on wholesale markets and on network capital expenditure

The modelling tested the impacts of different uptake rates to the same 2055 target

1. This modelling was designed to test the impacts of Rewiring's ambitious uptake scenarios, on wholesale, network and retail costs. The modelling did not produce an 'optimal' uptake rate that ensures optimal benefits to New Zealand consumers of faster uptake of rooftop solar and household batteries.

2. This section recaps our 2 October briefing on the potential impact of Rewiring's uptake ambition for rooftop solar (including some with batteries) on the wholesale market (provided by Jacobs) and network investment costs (provided by ANSA) [BRIEFING-REQ-0018640]. The modelling comprises three parts, assessing the impact on:

Wholesale electricity market	+	**Network capital expenditure**	=	**Household energy costs**
On generation, security, and prices.		Costs or savings of extra or reduced network investment caused by large solar export, and demand management.		The potential flow through effect to households of wholesale and network impacts, considering also household savings from solar and demand management

3. We worked collaboratively with Rewiring to understand their uptake trajectories and their assumptions behind claims made in their research, to inform this modelling.

4. The modelling contrasted a moderate uptake base case (around **3.5GW** by 2055)[1] with two uptake trajectories: moderate and fast uptake rates to achieve Rewiring's ambitious target of **28GW** for rooftop solar adoption (including some with attached battery storage) by 2055. Rewiring's **28GW** target is seven times higher than the base case and reflects solar installed on around 80 percent of all homes,[2] and a substantial number of farms and businesses.

Modelling findings relating to a) wholesale market outcomes and b) network costs

5. The research carried out by Jacobs (wholesale impacts) and ANSA (network cost impacts) finds increasing solar and battery uptake to Rewiring's ambitious target may increase system costs overall: it could decrease average wholesale spot prices but could also deter investment in some new grid-scale generation; and could require additional network capital investment.

6. In summary this modelling finds high levels of solar (28GW) envisaged by Rewiring could:

Significantly affect the wholesale electricity market:	
A lower spot price will benefit consumers. Wholesale market dynamics would fundamentally change and would need to be managed (to avoid higher prices), to ensure continued incentives in grid-scale generation, as modelling shows this would still be needed in the longer term.	• Reduce the average annual wholesale spot price by $10-15/MWh until around the early to mid-2040s. • Increase seasonal volatility in spot prices, and delay in new grid-scale renewable investments by the market, and heighten the system's reliance on thermal generation for winter supply. • The operations of key generation plant may be at risk by the medium-term, so we may see a slowdown in generators' investment in plant necessary for long-term security of supply.

[1] The 3.5GW by 2055 base case was modelled to be consistent with the Climate Change Commission's electrification pathway.
[2] Currently around 38% of homes in Australia have solar panels fitted, source - solarcalulator.com.au.

Materially increase network capex costs, if unmanaged: Networks will need capital investment to accommodate daytime solar exports These costs can be substantially reduced by smart management	• If solar exports aren't very well managed, a high uptake could drive a significantly (costly) network investment ($200 to $300 per household per year). • Smart systems can reduce the cost increase to about $100 per household per year.
The impact on household energy costs is uncertain: Solar and battery uptake could increase or decrease bills	• The overall impact is complex and will depend on ○ New Zealand's electricity demand growth, uptake rates of solar and batteries; each household's solar, battery, EV, appliance and overall fuel specs and use. • To avoid costly network upgrades solar and battery uptake needs to track demand growth: if too far ahead or behind this will drive higher household bills. Smart tariffs will be critical.

7. The key to ensuring minimal (or no) average bill inflation due to solar and battery uptake will be widespread adoption of smart energy systems to ensure consumers (or their panels, batteries and EVs automatically) can and do shift their demand and injection in response to dynamic pricing signals to the 'right' time periods – so that customers benefit via lower bills driven directly by changing their time of use; and caused indirectly via avoided network investment costs.

8. This nuance contrasts with Rewiring's general message that very high levels of distributed energy will reduce system costs overall through broad savings in energy and network costs.

9. This modelling examined a fast and more moderate speed pathways to an optimistic **28GW** uptake level compared to a base case of **3.5GW,** by 2055. The modelling did not examine pathways to a lower final uptake level (above the base case) or attempt to derive an optimised solar uptake pathway. So, this modelling does not tell us if there is a 'sweet spot': an uptake rate where system benefits always offset higher network costs, even without smart energy management.

10. We consider the low base case unlikely to be optimal. While it avoids reducing incentives for wholesale investment (which the modelling shows will be needed to meet future demand) and doesn't drive the extra network investment required by the Rewiring scenarios, it has very little solar uptake. That means the base case misses out on the benefits the model predicts when consumers have solar and batteries - like being able to manage their own energy use more effectively.

11. In a recent meeting with SEANZ, they outlined research they are due to publish shortly which examined a future growth pathway for solar that yielded around **8GW**. Free and frank opinions

The impact of high solar and battery uptake on household costs

12. The third stage of research, commissioned from Sapere economic consultancy and delivered late November, aimed to assess the potential effects of wholesale and network impacts (described above) on household energy costs. Household energy costs comprise electricity bills, costs relating to rooftop solar and battery installations, and gas costs where these are present. The modelling also explored how different tariff structures, that change incentives around the timing of EV charging and solar export, could affect electricity bills.

This model examines a range of scenarios: different levels of overall demand; different technology specifications; and different households

13. The impact of high solar and battery uptake rates is complex and will depend also on New Zealand's overall electricity demand growth.

14. At a more granular level, households differ in size, energy demand, energy efficiency and many further characteristics. The model allows for the examination of 60 distinct household profiles, reflecting variations in:
    - rooftop solar installation with and without household battery energy storage systems
    - patterns of appliance use (e.g. lighting, heating, water-heating)
    - electric vehicle (EV) adoption and charging management
    - the household's fuel options: if gas is used alongside fully electric appliances.

15. The key deliverable for this third stage of the modelling work has been a model that MBIE, EECA and the EA can use going forwards to explore the potential effect on household retail bills of different inputs such as wholesale and network costs - with or without solar, batteries and EVs - also under different tariff or retail pricing designs.

16. In addition, a short report was delivered by Sapere that describes how the new model evaluated expected impact on household costs for a subset of the scenarios that the model can examine. This details the findings for several scenarios combining:
    - electrification speed (growth in overall demand early vs late uptake of EVs and electric appliances)
    - rooftop solar plus battery uptake rates (early vs late)
    - pricing structures (flat, time-of-use, peak pricing).

17. The household impact modelling suggests two main factors determine what households pay:
    - *Total system costs:* the combined cost of wholesale electricity, transmission, and distribution based on overall demand.
    - *Retail pricing structures*: how those costs are allocated to consumers (e.g., flat rates, time-of-use pricing, peak charges).

This modelling is indicative, and the findings should be treated with caution.

18. All energy system modelling to longer-term time horizons produces findings about possible direction of travel and cannot be definitive: there are too many unknowns about demand, supply, decisions of market participants and future policy.

19. For example:
    - The future of smart tech and currently unknown technology developments are not factored into this modelling. Future technologies are unknown, which will drive changes in the cost (and relative costs across) grid-scale generation, rooftop solar and home batteries, and vehicle to grid charging.
    - No wider new policy levers have been assumed, such as policies under current development that aim to improve security of supply by improving supply of firm generation and so reduce wholesale prices.

Key findings for when rooftop solar and batteries become cheaper for households:

20. Key insights on the savings for households possible across scenarios are:
    - Household rooftop solar and batteries can eventually become cheaper than buying electricity from the grid under all scenarios and for all household types, by the 2040s.
    - For households with high electricity use and early electrification (e.g., EVs), rooftop solar and batteries can already be competitive today - depending on pricing structures.

- Solar-only systems often look cheaper than rooftop solar and batteries in the modelling, but this assumes the wider power system already has lots of battery storage. Without that, solar-only (without household batteries) would cause problems driven by big midday export peaks, so wouldn't avoid network upgrade costs.

21. The ideal situation is that households who help reduce system costs (by shifting demand or installing solar and batteries) should benefit enough to justify their investment, while overall costs for everyone also go down.

Scenario	Key findings	Household type	Rooftop solar (plus battery for some rows)	Annual savings by 2050
Late electrification / late solar (baseline)	Costs rise slowly, giving time to plan.	All-electric, no EV	~2044	$250–$300
Early electrification / late solar	Network costs surge early. Solar plus battery becomes attractive around 2032 for most households, saving $500–$1,000 per year by 2050.	High-use (home all day, 2 EVs)	~2032	$900–$1,000
Early electrification / early solar	Savings appear sooner and are larger for high-use households.	High-use (home all day, 2 EVs)	Immediate	$750–$1,000
Accelerated solar plus battery	Wholesale prices drop sharply, making grid supply cheap for a while – but solar plus battery still wins long-term.	Most households	~2041/42	$400–$600
Herded electrification (poorly designed EV tariffs)	Costs explode for everyone, showing the importance of smart pricing	All households	~2032 (but too late to avoid costs)	$500+ (after costs incurred)

Uptake of solar and batteries should not excessively exceed or lag overall electricity demand growth, and a smart electricity system will be critical for a least cost system

22. The value this research provides is less its numerical outputs, and more the trends that arise if specific trajectories are followed. This research clearly demonstrates that solar and batteries can be beneficial, but if not very well managed will have unforeseen negative consequences for generation and network investment resulting in higher household bills.

23. Overall conclusions from the analysis on household impacts are:
    - Rooftop solar combined with a household battery will have a useful role to play long-term cost control and peak management.
    - Having solar is beneficial in lowering consumer energy costs but while household batteries will be beneficial for network management and for high usage households, they may not greatly benefit other households without favourable pricing structures or tariffs.
    - Timing matters:
        - Network capex will increase as overall grid-demand rises, but through the use of smart demand management (including batteries) these costs can be reduced by over 60 per cent and in optimal scenarios with significant levels of system management by closer to 90 per cent.
        - Early investment in solar combined with a battery could avoid these costs, and lower wholesale prices.

- Incentives for demand shifting (across time of day), and for solar and battery uptake, are important:
    - Incentives for solar and battery uptake could save on network costs if early enough; and would need to be well-designed (require demand shifting to occur) to avoid unnecessary network spending.
    - Poorly designed EV tariffs can cause 'herding' (where many households charge EVs at the same time), this would drive costs related to higher demand peaks.
    - So, dynamic, cost-reflective pricing is critical to encourage efficient investment and avoid "winners and losers" or rate shocks.

24. Thus, the key takeaways from the modelling, given current known technologies and the interactions across wholesale, networks and retail bills, are:

    a. The importance of balance across electrification and related growth in demand for electricity, and the uptake of rooftop solar and household batteries. The ideal will be solar and battery uptake that just ahead of overall electricity demand growth, and neither too far in advance (causing network congestion) nor with an excessively lag (driving higher network investment costs).

    b. New Zealand needs a smart electricity systems to ensure consumers (or their panels, batteries and EVs automatically) can and do shift their demand and injection in response to dynamic pricing signals to the 'right' time periods – so that customers benefit via lower bills driven directly by changing their time of use; and indirectly via avoided network investment costs.

Work is underway aimed at developing the smart system we need

25. You are currently considering a proposal to accelerate uptake or rooftop solar and household batteries using a possible combination of grants and financing tools [BRIEFING-REQ-0025158 Solar package draft Cabinet paper].

26. The table below summarises wider key actions underway across agencies. All elements support a smarter electricity system.

Focus	Action	Entity	Timing
Smart device deployment	Changes to modernise the Energy Efficiency and Conservation Act	MBIE / EECA	Bill progress through 2026
	Developing smart EV charging regulations	MBIE / EECA	2026 (dependant on Bill)
	Flexibility, hot water and V2G trials	EECA	Ongoing
	Raising export limits (alongside wider solar and battery installations work programme)	EA	Decisions by mid-2026
Consumer behaviour change	Better export and demand-shifting rewards	EA	Decisions made, in force by July 2026
	Research, information and best practice for consumers	EECA	Ongoing
	Enabling multiple trading relationships	EA	Decisions by mid-2026
Data	Improving network visibility	EA	Decisions by mid-2026
	Consumer Data Right for electricity	MBIE	Cabinet approved late 2025, Regulations mid-2026

27. The Electricity Authority is also developing a ‘digitalisation roadmap’ which we expect they will publish early next year, outlining a framework and a longlist of actions that will enable a smarter electricity system.

Rewiring had asserted rooftop solar could ‘save 15 days hydro storage’

28. Rewiring considers rooftop solar a more efficient investment for New Zealand, and that fully electrifying New Zealand homes would significantly reduce costs to consumers over time, while significantly lowering emissions.

29. Rewiring had made a specific claim in the media and in its recent 2025 Manifesto, on the extent of this benefit. Namely that 5,000 farms with mid-size solar systems could provide 30% more electricity to the grid, and an 11% increase in solar production during a dry year *would allow for an additional 15 days of hydro storage.*

30. As reported to you in early October, the wholesale market modelling considered Rewiring’s claim relating to an additional 15 days of hydro. The modelling found that even under the moderate and fast uptake scenarios, winter supply risk remains. While solar helps keep lake levels higher before winter, low solar output in winter means more hydro is used then - leading to lower lake levels by July/August and greater risk to supply. The modellers did not find the same ’15 days extra storage’ Rewiring points to.

Next steps

31. This modelling was designed to test the impacts of Rewiring’s ambitious uptake scenarios, on wholesale, network and retail costs. The modelling did not produce an ‘optimal’ uptake rate that ensures optimal benefits to New Zealand consumers of faster uptake of rooftop solar and household batteries.

32. We consider Rewiring’s ambitious target to be optimistic, and the level of ‘smartness’ the system (and consumers) would need, to ensure no overall cost inflation to all consumers, is also likely to be a stretch-assumption. As such, we are exploring commissioning further work to consider the impact of more moderate uptake rates, and if possible, advice on an optimal pathway.

33. MBIE plans to discuss the modelling results with Rewiring in mid-January, then publish the results of modelling the effects on consumer bills, along with the earlier two reports, in early February 2026. We will provide you with reactive media Q&A the week prior.

34. We recommend you meet with us for a Deep Dive to discuss this research’s key findings.

Annex

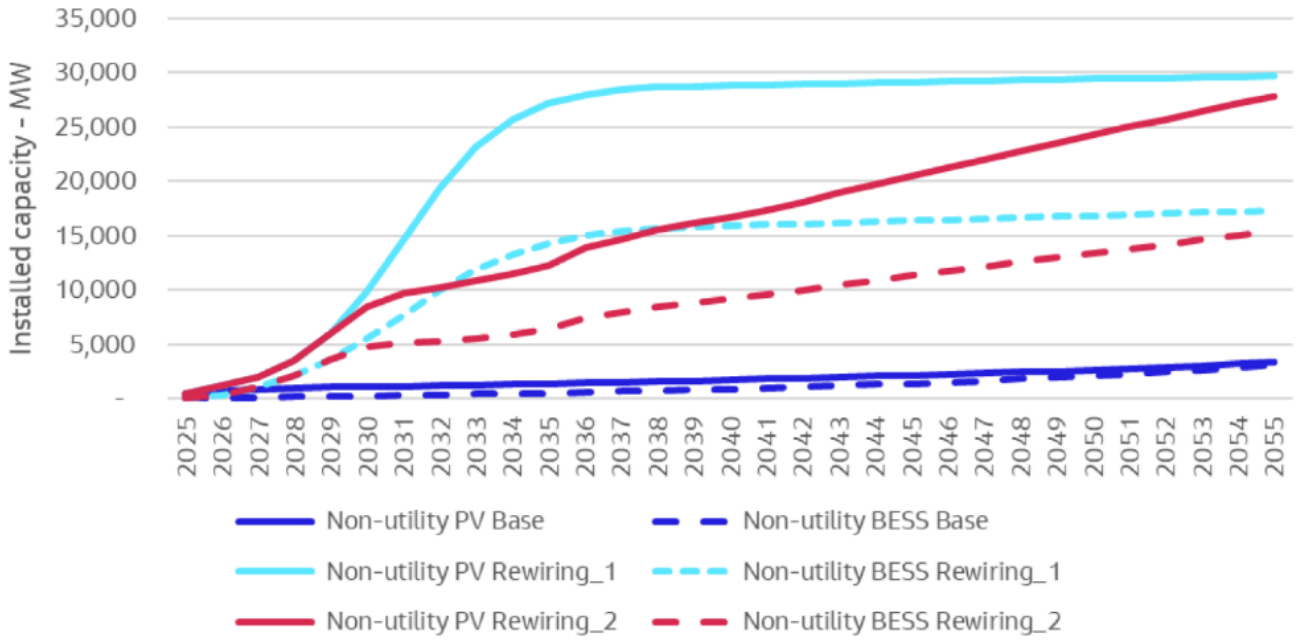
Annex One: Scenarios for rooftop solar and battery uptake rates

Annex One: Scenarios for rooftop solar and battery uptake rates

The modelling contrasted, for rooftop solar and battery uptake:

A base case: **3.5GW by 2055**	**with**	**Rewiring's more optimistic final uptake level:** **28GW of installed solar capacity by 2055**
This reflects the Climate Change Commission's electrification pathway and incorporates the modeller's projections of capital costs and grid-scale generation development.		**This reflects uptake by 80 percent of households and a majority of farms and commercial sites (around 7 times higher than base case).** Two Rewiring uptake scenarios were modelled: **1. Rewiring fast:** achieves around 75 per cent of the target 28GW by 2035. **2. Rewiring moderate:** still achieves 28 GW, but at a more moderate uptake rate.[3]
Dark blue line on Figure 1		**Light blue line** on Figure 1 **Red line** on Figure 1

Modelled uptake rate for solar PV and batteries by scenario:



[3] Because of the differences in the rate of uptake in the two Rewiring scenarios, the volumes of solar don't completely align in 2055, so are referred to in the report as being around 28 GW. The actual value modelled for case 1 in 2055 was 29.723 GW with 27.830 GW for case 2. This compares to 3.467 GW in the Base case.