



TRANSPOWER

Keeping the energy flowing

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Low-emissions economy draft report

Transpower commends the Productivity Commission (Commission) on a thorough draft report. It is an important contribution to the national discussion on how to realise the advantages that can be generated through a clear plan to deliver a low-emissions economy.

We are particularly heartened by the increasing consensus around the need to electrify more and more of the New Zealand economy in order to realise a low emissions future. In May, Transpower released its own assessment of the future of the New Zealand Energy system, [*Te Mauri Hiko – Energy Futures*](#), which reflects a number of the conclusions in the Commission's report. We ask that this submission be read alongside Transpower's *Te Mauri Hiko – Energy Futures* report.

We agree with the Commission that renewable electrification, particularly in the transport and industrial sectors, will be a key driver in New Zealand's transition to a low-emissions economy. For the electricity sector, this entails the potential doubling of electricity demand by 2050, and more complex flows of electricity throughout the entire system.

We support the Commission's focus on a fair and inclusive transition. We are currently engaging with MBIE's Electricity Pricing Review (EPR) on whether the market is delivering a fair and equitable price to consumers. The Commission's report will be a useful reference point for that review. The potential economic gains of an electrified economy will not be realised if there is not consistent focus on ensuring value to consumers.

Greater coordination across the energy sector will be critical to achieving a low-emissions economy. As owner of the national grid and system operator for the wholesale electricity market, Transpower has an important role to play in managing the transition, including adapting and evolving our operations to enable us to facilitate significant changes in the operation of the market.

Decarbonisation of transport and industrial energy consumption will require users to be confident and assured that a secure supply of renewable generation will be there to meet their demand. Enabling timely investment in new renewable electricity generation, at both a utility and consumer level, will be a major challenge that starts with ensuring investors have confidence to invest large sums of capital into inter-generational energy assets. Sending the appropriate investment signals must be a foundation of a commitment to decarbonising the New Zealand economy.

In this submission we comment on six key issues and make the following recommendations:

1. **Future Electricity market:** The Commission should provide a specific recommendation that regulators promote, coordinate and prioritise market design changes that will complement the current energy-only market, and support investment decisions that drive the transition to a low-emissions economy.
2. **Innovation in network pricing policies and signals:** The Commission should make recommendations recognising the importance of actionable prices, coherent distribution and transmission pricing, the value of peak-usage pricing in optimising infrastructure investment, and the wider societal impacts of wealth transfers.
3. **National Policy Statements for renewable generation and transmission:** The Commission should recommend that MfE and MBIE complete their Outcome Evaluation Report on the NPSET, and the Government amends the NPSREG and the NPSET to facilitate investment in renewable generation and the transmission infrastructure necessary to support it.
4. **Prioritising regulatory work programmes towards a low-emissions economy:** The Commission's final report should provide a recommendation on the prioritisation and coordination of regulatory workstreams designed to facilitate investment and innovation in the electricity sector, to support the transition to a low-emissions economy.
5. **Innovation in network investment, services and capabilities:** The Commission should amend recommendation 12.4 to recognise the importance of coordinating new distributed energy technologies with national transmission system operations in order to most effectively enable a low-emission economy.
6. **Technical standards and assurance:** The Commission's final report should recommend that regulatory agencies consider and give effect to technical standards relating to behind-the-meter technologies, including in relation to their correct installation.

Future electricity market

We agree with the Commission that New Zealand has a unique opportunity to decarbonise its economy through renewable electrification, particularly to reduce emissions from transport and industrial process heat. The modelling presented in the Commission's report and Transpower's *Te Mauri Hiko – Energy Futures* analysis shows a high degree of convergence. While some assumptions vary, as should be expected, both reports point to a potential doubling of electricity demand by 2050, principally due to electrification of transport and industrial energy demands.

For New Zealand to take up this opportunity and reliably, affordably and sustainably meet this growth in demand for electricity, over 60 TWh of new generation will be needed by 2050: most likely through a mix of different forms of utility-scale renewable generation, complemented by distributed solar photo-voltaic generation (solar PV).

The *Te Mauri Hiko – Energy Futures* base case assumes New Zealand's electricity supply will be 100% renewable by 2040, with all fossil-fuel generation retired. Today, fossil-fuel generation plays a critical role in maintaining security of electricity supply, particularly for meeting peaks in demand, and in winter - especially in dry years.

With a forecast increase in electricity generated from intermittent fuel sources (principally wind and solar), New Zealand's exposure to supply shortages in winter, especially in dry years, will grow. Based on what we know today, including assumptions around the retirement of existing fossil-fuel capacity, we do not currently see a reliable, definitely viable and affordable renewable solution to that problem. Maintaining security of supply in a system with greater penetration of weather-dependent renewables combined with the retirement of fossil-fuel plant is a critical issue that must be addressed through coordinated planning, innovation and investment.

Peaks in demand for electricity typically occur on cold winter evenings: battery storage alongside solar PV and in electric vehicles (EVs) can make a valuable contribution in helping meet peak demand. We think this is potentially a reliable and affordable solution if supported by the right policy and regulatory settings.

The amount of storage required to 'time-shift' excess summer electricity supply so that it can meet winter peaks, and the cost of battery storage, makes using existing battery technology for this purpose cost prohibitive. Based on current understanding of energy technologies, Transpower agrees with the Commission that fossil-fuel generation may still be needed, whether through a managed transition or more long-term.

If this assumption proves correct and is not overtaken by energy innovations, the challenge will be in setting the framework for enough, but not too much, investment in (and operation of) fossil-fuel generation. We expect future

technologies to emerge over time – potentially relatively quickly. We should plan for 100% renewable electricity to be affordable and feasible for New Zealand in the future while protecting New Zealand's economy in the short to medium-term.

Carbon pricing to drive emissions reductions

The central policy lever the Commission is relying on to drive renewable electricity investments supporting a low-emissions economy is an effective carbon price through the New Zealand Emissions Trading Scheme (ETS). We agree the ETS is essential in the pricing of carbon and sending appropriate market signals, but question whether emissions pricing can single-handedly enable the full realisation of the decarbonisation opportunity.

The final report would benefit from further discussion on how the feedback loop between emissions pricing, electricity prices to consumers and investment signals for generation development will work in the context of the New Zealand electricity market.

Electrification will only support the transition to a low-emissions economy if new generation maintains a relatively low emissions profile (i.e. it is marginal rather than average electricity emissions that count). There is considerable uncertainty around what prices our energy-only wholesale electricity market will deliver in response to higher emissions prices, materially more intermittent generation (solar and wind), and less fossil-fuel generation.

Fossil-fuel costs are a catalyst for price formation in the wholesale energy market – directly through fossil-fuel generation offers into the market and indirectly through hydro offers, which are based on an opportunity cost assessment that considers the cost of operating fossil-fuel generation when reservoirs run low, as well as the long-run marginal cost of new generation.

In a power system that continues to rely on fossil-fuel generation for peaking and in dry years, increasing the cost of fossil-fuel generation through emissions pricing will increase electricity prices overall. Renewable generators do not face an emissions cost on fuel but, when the marginal price is set by fossil-fuelled generation, they are paid for their generation based on that emissions-price adjusted marginal price. New renewable generation can rely on that price uplift in assessing the economics of new investments. Incumbent renewable generation which has already been built then has an opportunity for higher profit through increasing carbon prices under the ETS. While this dynamic may well enable investment in new generation, it is an important point that requires careful consideration within a broader market context.

While we support the ETS, it is not yet sufficiently clear to us that emissions pricing by itself will deliver the level and mix of renewable generation investment necessary to transition to a low-emissions economy. We consider

evolution in electricity market design may be needed and options should be explored.

Evolution in electricity market design

We question, as does the Stevenson et al (2018) report,¹ whether “at some time in the future New Zealand will require a market for firm energy (alongside the market for energy)”. We believe the current energy-only market provides a strong foundation for the future, however the Commission appears to suggest that such a mechanism may not be necessary as an informal financial market for firm energy already exists.

We caution against foreclosing on the idea of a formalised firm energy market, or other complementary and evolutionary market mechanisms designed to provide timely investment signals that enable efficient management of energy resources. We consider the financial arrangements referred to by the Commission may not be either adequate over the longer term, or sufficiently timely given that they are not easily accessible or transparent to new and smaller players.

In the absence of alternative means of funding, generation investment will fundamentally rest on projections of future spot prices (whether directly, or via hedge markets, vertical integration or bilateral contracts). In addition to normal uncertainties around demand and competing supply, potential investors in large-scale generation are likely to have significant doubts regarding the future trajectory of spot prices.

We consider the industry should enter into a discussion about whether the current energy-only market design will be fit for purpose to manage the transition to a highly renewable system.

The Commission should provide a specific recommendation that regulators promote, coordinate and prioritise market design changes that will complement the current energy-only market, and support investment decisions that drive the transition to a low-emissions economy.

Innovation in network pricing policies and signals

We agree that pricing for distribution services should “provide rewards and allocate costs commensurate with the marginal costs and benefits of each load and generation source”.

However, we also caution against introducing unnecessary complexity. Prices should ensure a good or service is consumed by those that value it most,

¹ Stevenson, T., Batstone, S., Reeve, D., Poynton, M., & Comendant, C. (2018). Transition to zero net emissions by 2050: Moving to a very low-emissions electricity system in New Zealand. Wellington: New Zealand Productivity Commission. Available [here](#).

enable consumers to make price-quality trade-offs, and be actionable, i.e. consumers need to understand and be able to respond to the price signals.

We expect the role for peak usage charging, at both transmission and distribution level, to grow over-time with the emergence of new technologies and growth in demand for renewable electricity. We stress the importance of Transpower's own peak usage charges for curbing peak demand and delaying the need for future transmission investment. These peak usage charges also lead to flow-on effects for other infrastructure investment across the supply chain.

One effect of peak-usage pricing is to incentivise off-peak demand. We agree with the Commission's finding (F11.7) that "Without measures to encourage off-peak charging [of electric vehicles] the additional electricity load could ... put significant pressure on the existing network, and require large investments to provide additional capacity".

As submitted to the Commission in 2017, we consider that current regulatory arrangements do not provide a clear pathway for investment in transmission that would enable future and timely connection of new generation in geographies most likely to deliver utility-scale renewable energy options (hydro, geothermal, and wind).

The most likely pathway would see the first mover generation in a region bear the full cost of new transmission until additional generation capacity also connects to the grid. Typically, that transmission, due to economies of scale, would be sized to serve the full resource potential of a region. (We provided an example of this in our first submission, in relation to new wind generation in the Wairarapa). The result is possible bias towards incremental generation growth in regions already well-served by transmission facilities, even if there are more economic generation options in other regions.

Any reform of transmission and distribution prices will give rise to wealth transfers. Our view is the wider societal impacts on consumers of all types is an important consideration in planning the transition. In summary, transmission and distribution pricing need to be future-focussed and coherent and we support moderate and incremental reform.

The Commission should make recommendations recognising the importance of actionable prices, coherent distribution and transmission pricing, the value of peak-usage pricing in optimising infrastructure investment, and the wider societal impacts of wealth transfers.

National Policy Statements for renewable generation and transmission

To better enable the infrastructure required to support a low-emissions economy we consider the National Policy Statements on Renewable Electricity Generation (NPSREG) and Electricity Transmission (NPSET) must be revised and strengthened.

In a doubling of New Zealand's current electricity demand, there will be obvious tensions in relation to where new renewable generation is located and its potential visual and amenity impact.

New wind and hydro generation schemes may be sought in landscapes that have outstanding natural character or features of importance. Connecting new renewable generation projects to the existing grid network, will require new grid infrastructure that may impact on a range of social, natural and cultural values.

The NPSET is intended to enable national grid projects to proceed in high-value natural environments, under limited circumstances. However, Transpower has experienced ongoing challenge to this intent as different decision-makers grapple with counter arguments, such as the perceived conflicts between the NPSET and the 'protection' policies in the New Zealand Coastal Policy Statement (NZCPS).

This uncertainty, conflicting interpretation and debate is markedly increasing risk to grid investment projects.

Provisions relating to new grid assets are the subject of continual submission, evidence, mediation and appeals in each of the country's 67 district plan and 11 regional council planning instruments. Each individual plan and policy review process is highly time consuming and costly - not just for Transpower and councils, but also environmental NGOs, the Department of Conservation and other groups.²

In 2015, the MfE and MBIE commenced reviews on the effectiveness of the NPSET and NPSREG. The Outcome Evaluation Report of the NPSREG confirmed that, for the most part, it had not achieved its purpose.³ Renewable electricity generation consent applicants were no more certain or less time-consuming and expensive. Regional and district plans did not present consistent approaches. The Outcome Evaluation Report on the NPSET has

² For example, Transpower appeared in the High Court twice last year to protect its position under the NPSET: *Transpower v Auckland Council* [2017] NZHC 281; *Royal Forest & Bird Protection Society of NZ v BOP Regional Council* CIV 2017-470-57.

³ [Report of the Outcome Evaluation of the National Policy Statement for Renewable Electricity Generation](#), Ministry for the Environment and Ministry for Business, Innovation and Employment, December 2016.

not yet been released, but may reach similar conclusions, particularly regarding the competing tensions in the NPSET and the NZCPS.

The Commission should recommend that MfE and MBIE complete their Outcome Evaluation Report on the NPSET, and the Government amends the NPSREG and the NPSET to facilitate investment in renewable generation and the transmission infrastructure necessary to support it.

Prioritising regulatory work programmes in support of low-emissions transition

While neither the Electricity Authority nor the Commerce Commission have an explicit focus on emissions reductions, both regulators have programmes of work directed at facilitating the uptake of new technologies, many of which are low-emissions. There may also be a role for the Climate Change Commission to consider regulatory impediments in the electricity sector to transitioning to low-emissions economy.

The Commission's final report should provide a recommendation on the prioritisation and coordination of regulatory workstreams designed to facilitate investment and innovation in the electricity sector, to support the transition to a low-emissions economy.

Innovation in network investment, services and capabilities

We agree with the Commission that new investment will be required in transmission assets and services to enable the electrification of the economy. While the period between now and 2025 is relatively well understood, it is also the time when critical steps must be taken to ensure we are prepared for a post 2025 future.

An opportunity to plan grid assets for the future

Multiple new grid connections will be required before 2050 to connect new renewable generation. In parallel, many existing transmission lines will need major renewal and refurbishment in the period 2025 – 2035.

This is an opportunity to take a long-term view and plan for a grid that will enable a decarbonised economy. We see potential to reconfigure elements of the grid around the core higher voltage lines, reinforcing capacity in some areas and rationalising it in others.

Transmission planning will continue as it currently does around ensuring security of supply, albeit with a much clearer view of emerging technologies and their potential impact on the whole electricity system. This will involve greater cooperation with all other elements of the industry, from generation through to local networks and retailers.

Innovation in network system operation

We agree with the Commission that “unless well designed and managed, an increasing proportion of intermittent renewable energy can pose significant challenges for transmission system operation”. As the grid operator and system operator, we will continue to invest in our grid and transmission system operation services and products to ensure the power system can adapt as the electricity system evolves.

We see transmission system operations (TSO) evolving from central coordination of a few larger participants today, to grid-level balancing and stabilisation of many more and much smaller participants. We expect innovation to ensure efficient investment in the integration of distributed energy resources (DER) and demand response (DR) at network distribution level.

It will be important to understand as early as possible the impact of changes to the mix of generation sources and technologies used at distribution level on the ability of the TSO to manage a stable power system. Our recently-released studies on the impact of high levels of solar PV is part of an ongoing programme of technical investigation to inform industry participants and policy makers.⁴

We agree with the Commission, and Stevenson et al. 2018, that distribution system operation (DSO) functions, independent of distribution network ownership, will be created. We agree DSO functions will be important to ensure competitive access to network infrastructure, coordinate more complex energy flows, meet preferences for security, quality and reliability, and ensure rewards and costs for load and generation are allocated efficiently and for the long-term benefit of consumers.

Innovation to strengthen capability of local network services

We agree with the Commission that local networks will need to invest in their assets to effectively manage increasing peak loads, greater solar PV and battery penetration, and EV charging. We also agree with recommendations for the Electricity Authority’s programme of work to include strengthening the capability of distribution services (R12.4).

Coordination and planning across distribution and transmission systems will be critical to realising the opportunities that will come from emerging distributed energy technologies.

The Commission should amend recommendation 12.4 to recognise the importance of coordinating new distributed energy technologies with national transmission system operations in order to most effectively enable a low-emission economy.

⁴ Solar PV in New Zealand, Transpower December 2017. Available [here](#).

Technical standards and assurance

'Behind-the-meter' emerging technologies – such as smart appliances and domestic energy generation and storage options – will need to be well designed and managed to ensure their contribution is positive and does not create new problems requiring costly solutions.

Getting the best out of consumers' behind-the-meter investments will result in less required investment in utility-scale infrastructure, and will be an important contributor to an affordable and renewable electricity supply for consumers.

Technical standards and assurance mechanisms will be required to ensure that new technologies are incorporated optimally. For example, inverter standards have recently been recommended, and include household solar and EVs (primarily an over-voltage problem). Assurance that such equipment is installed correctly will be equally important.

In a wider context, standards and assurance for cyber security will be increasingly important as we become ever more dependent on reliable and secure electricity supply, as will formats and protocols for access to and sharing of electricity data across the supply chain.

The Commission's final report should recommend that regulatory agencies consider and give effect to technical standards relating to behind-the-meter technologies, including in relation to their correct installation.

Conclusion

The Commission's final report will make a highly significant contribution in advancing a common understanding around the opportunities and challenges facing New Zealand as it moves towards electrifying and decarbonising its economy.

Bringing the full range of stakeholders together under a common vision for New Zealand's energy future – and indeed New Zealand's economic future – is critical if we are to maximise the opportunity that we face. Transpower thanks the Productivity Commission for its leadership on this report and looks forward to continued engagement on this important piece of work.

Yours sincerely



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