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[redacted]
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Dear CEOs Burgess, Gillies and Pelenur

Response to joint letter 24/2/26 to distributors on NNS

I am a World Bank/EBRD retiree and consulting power engineer who has worked for most of my career outside New Zealand on various aspects of power transmission and distribution. During 2003-2011 I was a Director of Transpower NZ where I was surprised to find how NZ has been so slow to adapt new technologies since the 1980s. non-network power distribution solutions aren't new. They are in use in many overseas jurisdictions usually driven by smart (AIM) meter-controlled time-of-day pricing that promote consumer investments in the likes of demand side management, behind the meter storage control, virtual power production, and the like.

The only new thing, but not mentioned in your joint letter, is that for the first time the three NZ regulators are jointly taking a long overdue interest in such opportunities. Hopefully this is to be serious about increasing competition among the incumbent NZ power generation, distribution, and retail companies. It is apparent that for many years the incumbents (and their acolytes in the news media) have stymied previous efforts to facilitate nationwide competitive consumer investment in the efficient supply of electricity at the point of consumption. They have been promoting doubt and confusion about the economics of consumer participation in technologies such as rooftop solar even though consumers invest their own moneys to enhance the value of their assets from the day the facilities are installed.

Annex A is an example of how NZ could develop its renewable energy export potential in supporting large industrial projects such as the data centre proposed for Invercargill. Key technologies that NZ line companies must be required to invest in to support consumer funded non-network solutions include:

Advanced Metering Infrastructure (AMI), a system of smart meters, communication networks, and data management systems that enable two-way communication between utilities and customers. They allows for real-time, automated monitoring of electricity, water, or gas consumption.

Virtual Power Plant (VPP) is a cloud-based network that aggregates distributed energy resources—such as home solar batteries, solar panels, and electric vehicles—to operate as a single, coordinated power plant. Using software, it balances electricity supply and demand, feeding energy back to the grid during peak times to enhance reliability, reduce costs, and earn participants incentive

Demand Management & Demand Response (DSM): Programs that incentivize consumers to shift their electricity usage away from peak times or reduce demand when the network is constrained. This includes controlled water heating and smart home devices.

Distributed Energy Resources (DERs): Small-scale power generation and storage technologies located close to the end-user, such as rooftop solar panels, battery storage systems, and electric vehicles (EVs).

- Embedded Networks: Often used in apartment blocks, retirement villages, and commercial sites to reduce energy costs by purchasing in bulk, with the potential for integrated solar and battery storage.

- Stand-alone Power Systems (SAPS): Independent, off-grid systems (solar, battery, backup generator) used to provide power in remote or edge-of-grid areas.
- Community/Network Batteries: Installed to store local solar, manage voltage fluctuations, and provide stability, reducing the need for network augmentation.
- Demand Response: Programs that pay customers to reduce or shift energy usage during peak times to manage network load, particularly in distribution networks.
- Non-Network Options (NNO) for Transmission: Solutions like demand response, battery storage, and distributed energy resources (DER) used to defer or replace major infrastructure projects.
- Microgrids: Localized grids that can operate independently, enhancing reliability.
- Renewable Gas/Hydrogen Blending: Trialling the integration of hydrogen into existing gas networks to decarbonize residential and commercial heating.

Grid-Enhancing Technologies (GETs): Advanced, intelligent solutions that optimize existing grid infrastructure, such as dynamic line ratings and advanced power flow control.

Smart Inverters: Standardised devices that allow solar and batteries to provide frequency and voltage regulation autonomously.

International Examples & Approaches

A quick search of the internet (courtesy of Google Gemini) shows NZ to be a laggard in supporting consumers in funding their own supply options. Here is a current summary of what the rest of the world is doing to develop non network power distribution solutions:

Australia: Extensive use of rooftop solar and battery subsidies has led to rapid DER deployment, significantly higher than in New Zealand. Australian networks also use SAPS (e.g., by Base Power) for remote agricultural and residential properties. Distribution Network Service Providers (DNSPs): Companies like AusNet Services, Western Power, and SA Power Networks regularly issue tenders for these solutions. Specialist Firms include:

- Plexigrid: Provides monitoring and optimization tools for low-voltage grid efficiency.
- Watt Utilities: Specialises in embedded network management for properties.
- Genus Group: Offers integrated EPC and design services for renewable and power assets.

North America (USA & Canada) Non-Wires Alternatives (NWAs) also known as non-wires solutions—are used by utilities to defer or replace traditional "poles and wires" infrastructure projects like new substations or transmission lines. These solutions use distributed energy resources (DERs) to manage load at specific grid points, improving cost-effectiveness and reliability. As of early 2023, the US had 692 microgrids (4.4 GW capacity) used by airports, military bases, and corporations like NRG Energy to provide "islandable" power during macrogrid outages. Front-of-the-Meter Storage: Battery storage is currently the NWA technology of choice in the US for providing rapid capacity support.

- New York: A pioneer through the Reforming the Energy Vision (REV) framework. Major utilities like Con Edison, National Grid, and NYSEG actively issue RFPs for NWA projects.

- Con Edison (New York): The Brooklyn Queens Demand Management (BQDM) project is a landmark NWA that used 52 MW of demand response and 17 MW of energy efficiency to defer a $1.2 billion substation upgrade.
- Central Hudson (New York): Implements targeted demand response and energy efficiency programs to manage peak loads.
- Maine: Central Maine Power (CMP) evaluates all planned projects for NWA suitability as part of the state's goal to reach 100% clean energy by 2040.
- Ontario, Canada: The IESO and Alectra Utilities have conducted demonstration projects in the York Region to explore market-based DER services.
- Other Notable States: California (energy storage mandates), Massachusetts (grid modernisation plans), and Connecticut (grid-side enhancement demonstrations)

In South America, non-network solutions (often called non-wires alternatives or decentralised energy resources) are primarily used to address two challenges: integrating massive growth in wind and solar to prevent grid congestion, and providing power to "last mile" populations in isolated regions.

Brazil: Grid Modernization & Storage

- BESS Deployment: Brazil is moving toward a Distribution System Operator (DSO) model, using Utility-Scale Battery Energy Storage Systems (BESS) as "shock absorbers" to manage solar peaks.
- Distributed Generation (DG): DG now represents 15% of Brazil's installed capacity (36.4 GW of solar as of Jan 2025), significantly reducing the need for new long-distance transmission lines.
- Retrofit Projects: Large-scale modernization of existing substations (e.g., Siemens Energy's AXIA project) is being used to increase efficiency without building new infrastructure.

Chile: Curtailment Reduction & PMGD

- PMGD (Small/Medium Generation): Chile has over 3,200 MW of distributed assets (under 9MW each) that use a "stabilized price regime" to bypass traditional grid constraints.
- Demand-Side Response: New 2025/2026 regulations focus on integrating flexible demand and storage to stop wasting abundant renewable energy through curtailment.

Colombia: Energy Communities & Microgrids

- Energy Communities: The 2022–2026 National Development Plan allows citizens to form communities to generate and commercialize energy locally.
- Non-Interconnected Zones (NIZ): In over half of Colombia’s land area, solar microgrids and hybrid solar-diesel systems are the primary alternative to costly grid expansion.
- Storage Policy: A 2025 regulatory proposal outlines rules for 5 MW+ grid-connected and off-grid storage to handle climatic variability.

United Kingdom

The UK has one of the most advanced markets for local flexibility, with all Distribution Network Operators (DNOs) now required to test for non-network solutions before investing in traditional infrastructure. National Grid and local Distribution Network Operators (DNOs) actively tender for flexibility services, such as battery storage and demand-side response, to manage "B road" local network constraints.

- Flexibility Markets: In 2024, the UK flexibility market contracted 9GW of capacity, delivering roughly £300m in consumer savings.
- Day-Ahead Markets: New platforms like ElectronConnect (piloted by SSEN) began launching in late 2025, allowing providers to participate in flexibility markets at shorter notice.
- Virtual Power Plants (VPPs): UK Power Networks is scaling London's first VPP, using household solar and batteries to meet peak demand instead of upgrading cables.
- Standardisation: The Open Networks programme and the new Market Facilitator role (operated by Elexon since late 2025) aim to standardise products and settlement across all DNOs.
- Key Platforms: Piclo Flex and Electron are primary independent platforms used by DNOs to tender for flexibility services.

Europe

Europe focuses on "flexibility markets" where grid operators buy services from consumers to balance the grid. The EU is accelerating non-network solutions through the EU Action Plan for Grids (November 2023) and the European Grids Package (December 2025).

- Regulatory Shift: Recent updates to the TEN-E Regulation and the Electricity Market Design reform mandate that DSOs prioritise "grid-friendly" projects and flexible connection agreements over traditional expansion where cost-effective.
- Grid Hosting Capacity: Under "Action 6" of the EU Grid Action Plan, a pan-EU portal is being developed to show available grid capacity, helping developers plan storage and EV charging projects where the grid can handle them.
- Incentive Evolution: New guidance from the European Commission (October 2025) encourages member states to reform tariff structures to better remunerate users providing flexibility.
- Technology Focus: Increasing use of Dynamic Line Rating (DLR) and Smart Inverters (Voltage Optimization) to squeeze 20-40% more capacity out of existing lines without building new ones.

Germany: E.ON partners with large industrial users, such as the CyrusOne data centre in Frankfurt, to implement on-site gas-powered systems (61 MW) as a "time-to-power" solution that bypasses immediate grid reinforcement needs.

In Asia, non-network solutions (often termed non-wires alternatives or grid-edge solutions) are rapidly expanding as a primary strategy to manage surging electricity demand from data centres and urbanisation without the delays of traditional "poles and wires" expansion.

Japan: Virtual Power Plants (VPPs) & Demand Response

- Demand Response (DR): Businesses now actively support grid stability by powering down or switching to backup sources in exchange for payments.
- Major Players: Enel X Japan operates the world's largest C&I VPP, while TEPCO and Chubu Electric are scaling domestic VPP deployments.

Southeast Asia: Microgrids & Battery Storage (BESS)

- Microgrids: Used extensively to bypass weak infrastructure, providing reliable backup for data centres and remote communities.
- BESS Expansion: Singapore launched the region's largest BESS (285 MWh) to meet daily household needs during discharge.
- ASEAN Smart Grids: The Ember "Wired for Profit" report (2025) highlights that unlocking flexibility in existing plants and adopting smart EV charging can avoid major system overhauls.

India: Smart Metering & Standalone BESS

- Smart Meters: Rapid deployment of three-phase smart meters is enabling high-precision demand-side management (DSM).

Taiwan: Following major earthquakes in April 2024, Enel X mobilised a Virtual Power Plant (VPP), aggregating 30 MW of demand response from over 50 commercial users to stabilise the grid for Taipower.

China: Is the global leader in DERs, China accounts for nearly half of new global distributed solar capacity. VPPs and large-scale EV managed charging are key strategies to avoid massive distribution upgrades. non-network solutions are primarily driven by the "New Three" industries (EVs, lithium batteries, and solar) and the transition toward a Distribution System Operator (DSO) model to manage 900 GW of distributed wind and solar. The Strategic Frameworks for Chinese investment in non-network solutions (2025–2030) include:

- **Generation-Grid-Load-Storage Integration**: A unique Chinese model linking smart microgrids, storage, and AI to industrial parks to manage local demand.
- **15th Five-Year Plan (2026–2030)**: State Grid is investing **US$574 billion** to upgrade distribution networks and explore off-grid and microgrid models.
- **Energy Law (2025)**: Legally formalises "smart microgrids" and "energy consumption management" as technological priorities for future distributed energy.

Key Non-Network Technologies

Gigawatt-Scale Virtual Power Plants (VPPs):

- China targets 20 GW of VPP capacity by 2027 and 50 GW by 2030.

- The first GW-scale residential VPP launched in Jiangsu Province in 2025, integrating millions of household appliances.

Managed EV Charging (V2G):

- With EVs making up nearly 50% of new car sales, Vehicle-to-Grid (V2G) models are being used as mobile batteries to shave peak load by up to 20%.
- Cities like Shanghai and Shenzhen use time-of-use pricing to successfully redistribute demand away from peak hours.

Non-Outage Operation Technology:

- State Grid's "no power cut is the best service" principle uses insulating pole and glove methods to maintain/upgrade networks without disconnecting customers.

Energy Storage Mandates:

- Most provinces now require 10–20% of new generation capacity to be paired with storage for local "peak shaving".

Market and Regulatory Shifts

- Unified National Power Market: A 2026 strategic priority to allow distributed generation and aggregators direct market access for ancillary services.
- Incremental Distribution Networks: China allows non-state actors to fund and operate "incremental" networks to accommodate rising distributed renewables.

Emerging Technology Trends

- AI & IoT Integration: AI-driven analytics are now standard for predicting maintenance needs and optimizing microgrid efficiency in real-time.
- Blockchain Energy Trading: Peer-to-peer (P2P) trading platforms are emerging within microgrids, allowing individuals to sell excess energy directly to neighbours.
- Digital Twins: Companies like Arup are using digital replicas to link asset conditions to real-time decision-making for grid resilience.

Annex A

'World's largest Battery' to provide 100-hour iron-air storage for Google data center

US tech giant Google announced on Tuesday that it will build a new data center in Pine Island, Minnesota. The battery has a 30 GWh capacity and a 100-hour duration. The new facility will be powered by 1.9 gigawatts (GW) of clean energy from wind and solar, coupled with a 300-megawatt battery, claimed to be the 'world's largest', with a 30-gigawatt-hour (GWh) capacity and 100-hour duration.

Google is currently working with Xcel Energy to build 1.4 GW of wind power and 200 MW of solar power, both of which will feed Form Energy's battery, helping the new data center operate on clean energy for longer periods. The new facility will be Google's first in Minnesota, and about an hour southeast of Minneapolis. With the scale of storage products currently underway in China and other geographies, it's difficult to verify if the 30 GWh figure is indeed the 'world's largest'. However, the planned battery would dwarf a 19 GW lithium-ion project in the UAE.

How does the long-duration battery work?

Long-duration batteries help data centers function smoothly during nights or lulls, unlike grid-scale lithium-ion batteries, which do the same, but for shorter periods. Form Energy's batteries work very differently from most large batteries today. Instead of using lithium like the batteries in electric cars, they store electricity by making iron rust and then reversing the rusting process to release the energy when needed.

When oxygen from the air passes over small pieces of iron inside the battery, the iron rusts and produces electricity. To recharge the battery, an electric current removes the oxygen from the rust, turning it back into iron and releasing it again. Form's iron-air batteries are heavier and less efficient than their counterparts; they can only return about 50% to 70% of the energy used to charge them, while lithium-ion batteries return more than 90%.

However, Form's batteries have one distinct advantage. They are cheaper than lithium-ion batteries, costing about $20 per kilowatt-hour of storage, which is almost three times as cheap. Solar and wind power are widely used, but Form's iron-air batteries are still a new technology. The company's first battery is now being installed in Minnesota with Great River Energy. It will store 150 MWh of electricity and can supply to the grid for up to 100 hours, delivering about 1.5 MW at peak output.

Developing the concept

The project also introduces an unusual utility fee system to Minnesota. This system is designed to help power companies invest in clean energy without running afoul of regulators, who typically want them to choose the cheapest electricity options. To speed up clean energy projects without raising residents' electricity bills, Google and Xcel Energy created a new contract type in Minnesota called the Clean Energy Accelerator Charge (CEAC). It follows a similar model to the Clean Transition Tariff (CTT) that Google previously developed with NV Energy. As part of the CEAC deal, Google will inject $50 million to support Xcel's Capacity Connect program, which will install many smaller batteries across the grid to increase power capacity and make the system more reliable.

Google revealed its partnership with Xcel Energy has demonstrated a new way to power data centers while promoting cleaner, more affordable energy for local communities.