



**Pollution
Probe**

**Appendix C:
Innovative Policies for
Increasing
Reliability Services:
Jurisdiction Scan**

2024





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These examples are provided to stimulate thinking and discussion about potential future net-zero reliability options for Ontario. Policies developed for other jurisdictions cannot be simply introduced into Ontario. Any new policy or mechanism to help meet Ontario's requirements would need to be designed for the specific circumstances of the Ontario energy sector.

1 Public sector-led initiatives

1.1 Australia: Integration of distributed resources

Background

- Australia has the largest penetration of roof-top distributed solar in the world, with a target of 82% of power from renewables by 2030, up from 27% in 2023.¹
- The Australian Energy Market Commission (AEMC), the energy market advisor to government and developer of market rules for the NEM (National Electricity Market), has created a Reliability Panel that is investigating and providing thought leadership on needed changes to reliability standards. The Australia Energy Market Operator (AEMO) then implements the changes.

Australia: Ancillary Services

- Australia has well-developed Frequency Control Ancillary Services (FCAS) market: Australian Energy Market Operator (AEMO) operates eight separate markets for the delivery of FCAS and purchases Network Support Control Ancillary Services (NSCAS) and System Restart Ancillary Services (SRAS) under agreements with service providers.²
- Developed a new frequency control ancillary service (FCAS), which contains two products “Very Fast Raise Contingency FCAS” and “Very Fast Lower Contingency FCAS”. The intention of these new services is to incentivise solar and other inverter-based resources to participate in frequency control.³
- Market Ancillary Services and Small Generation Aggregators – Rule Change: The rule for Integrating Energy Storage Systems (IESS) has been changed. It aims to add flexibility to the National Electricity Rules by creating a new registration category for facilities that can be bi-directional facilities. This new category, Integrated Resource Provider (IRP), accommodates different generation capabilities and bi-directional flows. The rule change also impacts the Small Generation Aggregator registration category. Starting mid-2024, all participants registered as Small Generation Aggregators will be moved to the

¹ <https://www.iea.org/news/australia-has-raised-its-climate-targets-and-now-needs-to-accelerate-its-clean-energy-transition-says-new-iea-review>

² <https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/system-operations/ancillary-services>

³ <https://www.aemo.com.au/initiatives/major-programs/fast-frequency-response>



IRP registration and labelled as Small Resource Aggregators. This mechanism has allowed aggregators to participate in ancillary services.⁴

Australia: Enabling Reliability

- Creating new rules on compensation and charges for frequency control starting in June 2025, where generating units will receive penalties or payments based on whether they are contributing to system frequency. Frequency Contribution Factors (CFs) will be calculated every 5 minutes.⁵
- Since 2021 has mandated that all new inverters installed are so-called “smart” inverters that have some ride-through capability, new rules on how inverters will remain connected to the grid in the event of grid concerns and contribute to system stability.⁶ In 2023, voluntary specifications for grid-forming inverters were published, and pilots of grid-forming battery systems that provide voltage support and synthetic inertia.⁷
- Research in Australia shows that grid-scale batteries could significantly lower overall FCAS costs, especially in reducing the costs of short-term FCAS markets (such as regulation and 6-second services), which are typically provided by fossil-fuel generators.⁸
- The Australian Renewable Energy Agency is exploring how EVs with vehicle-to-grid (V2G) abilities can participate in FCAS. The key findings from this analysis were that EV owners can benefit from participating in the NSW FCAS raise regulation market, the NSW FCAS raise 60-second contingency market, the NSW FCAS lower regulation market, and the NSW FCAS lower 60-second contingency market.⁹

Australia: Other Initiatives

- Project Symphony in Western Australia aims to support the effective integration of DERs into the Wholesale Electricity Market (WEM) and the Southwest Interconnected System (SWIS). A collaboration between AEMO, Western Power, and Synergy combines approximately 900 DERs such as rooftop solar, batteries and large appliances across 500 homes and businesses in Perth into a VPP. The project is designed to investigate how VPP could assist with network management.¹⁰
- The Regulatory Investment Test for Distribution (RIT-D) requires distribution network service providers (DNSPs) to assess the costs and, where appropriate, the benefits of non-wires solutions to address specific issues. The RIT-D has two key components: (1) a

⁴ <https://energyinnovationtoolkit.gov.au/article/regulatory-changes/market-ancillary-services-and-small-generation-aggregators-rule-change>

⁵ <https://www.aemo.com.au/initiatives/major-programs/frequency-performance-payments-project>

⁶ <https://www.aemo.com.au/initiatives/major-programs/nem-distributed-energy-resources-der-program/standards-and-connections/as-nzs-4777-2-inverter-requirements-standard>

⁷ <https://www.aemo.com.au/-/media/files/initiatives/engineering-framework/2023/nem-engineering-roadmap-fy2024--priority-actions.pdf?la=en&hash=DED803FB758F555EE934A898367E66C6>

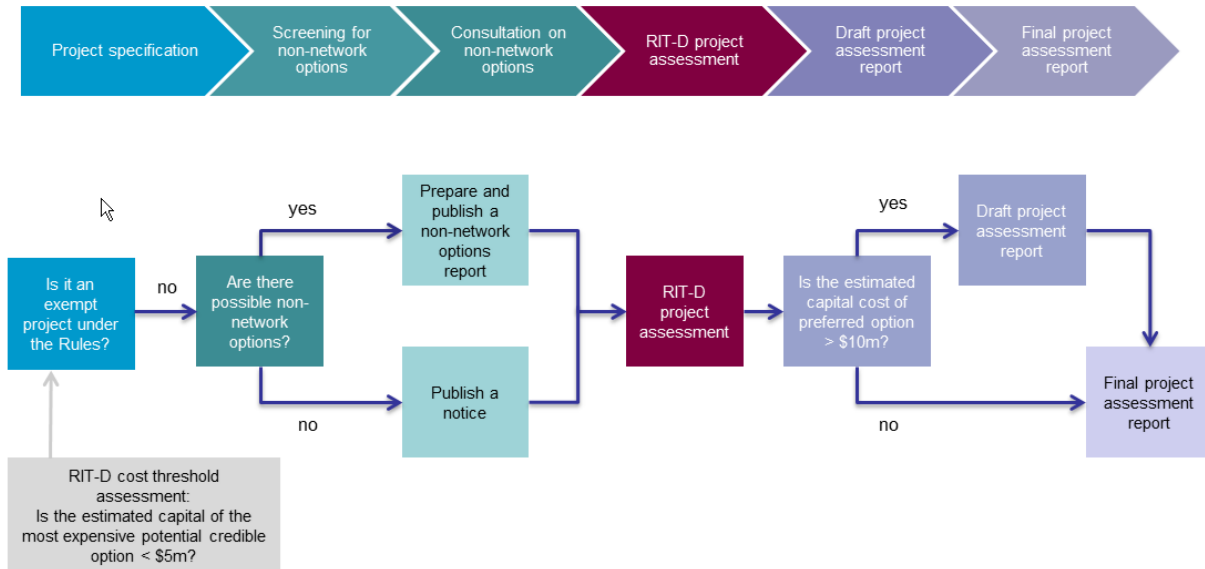
⁸ <https://www.sciencedirect.com/science/article/pii/S0140988323000993>

⁹ <https://arena.gov.au/knowledge-bank/arena-vehicle-to-grid-insights-final-report/>

¹⁰ <https://aemo.com.au/en/initiatives/major-programs/wa-der-program/project-symphony>

cost-benefit test and a project assessment process, including project specification and (2) screening for non-network options (Figure 1).¹¹

Figure 1: Regulatory investment test for distribution¹²



1.2 USA

1.2.1 New York: Dispatchable resources

- NYISO has defined a new class of resources, Dispatchable Emission-Free Resources (DEFs). DEFs are a classification of emission-free resources that provide the reliability attributes of synchronous generation and can be dispatched to provide both energy and capacity over long durations.
- A singular DEF will not be expected to provide all the essential characteristics or reliability services that a fossil-based generation does. However, DEFs in the aggregate will need to provide comparable reliability attributes.¹³
- Brooklyn Queens Demand Management Demand Response Program allows commercial, industrial, and residential customers to cut back on their energy use for a few hours and earn compensation.¹⁴

¹¹ <https://energy-rules.aemc.gov.au/ner/347/37884>; <https://www.aemc.gov.au/energy-system/electricity/energy-system>

¹² <https://www.aemc.gov.au/energy-system/electricity/energy-system>

¹³ <https://www.nyiso.com/documents/20142/2248481/2023-2032-Comprehensive-Reliability-Plan.pdf>

¹⁴ <https://www.coned.com/en/business-partners/business-opportunities/brooklyn-queens-demand-management-demand-response-program>



1.2.2 California: Energy storage

- Energy storage enhancements initiative: This initiative aims to enhance the optimization, dispatch, and settlement of energy storage and other similarly situated resources, improve grid reliability and help ISO operators fully use storage resources.
- Allows for storage to provide “regulation up” and “regulation down” services, and better communicating state of charge of the battery assets. It will do this by ensuring that prices are discoverable by sector participants.¹⁵

1.3 Great Britain

1.3.1 Local flexibility markets

- To facilitate growth in intermittent renewables, the UK government saw the need for greater “flexibility” in the electrical system. Ofgem’s definition of flexibility is: “modifying generation and/or consumption patterns in reaction to an external signal such as a change in price, to provide a service within the energy system”.¹⁶
- The government’s and Ofgem’s Smart Systems and Flexibility Plan (2021) states that flexibility could save consumers GBP10 billion per year in energy costs by 2050 and reduce the total cost of the net zero transition by up to GBP70 billion.
- The electricity system operator and the seven distribution network operators in Great Britain develop the flexibility markets for their territory and hold regular tenders throughout the year.¹⁷
- The Energy Networks Association, an industry association, defined five flexibility products in an updated list developed in February 2024 in partnership with the industry through its Open Networks initiative. Table 1 and Figure 2 below provide information on the products¹⁸
- In the 12 months before August 2023, 4.6 GW of flexibility services were tendered, and 2,400 MW was contracted, with more expected to be contracted. In comparison, 1,871 MW was contracted the year prior. 70% of the technology was non-emitting, primarily storage, solar and biofuels.¹⁹

¹⁵ <https://www.caiso.com/InitiativeDocuments/FinalProposal-EnergyStorageEnhancements.pdf>

¹⁶

https://www.ofgem.gov.uk/sites/default/files/docs/2019/09/ofgem_fi_flexibility_platforms_in_electricity_markets.pdf

¹⁷ Note that this program only applies to Great Britain (England, Scotland and Wales). Northern Ireland, although part of the UK, has a different energy regulatory environment as it is part of the all-island Ireland grid.

¹⁸ [https://www.energynetworks.org/assets/images/2023/Aug/on-flexibility-products-alignment-\(feb-2024\).pdf?1708550095](https://www.energynetworks.org/assets/images/2023/Aug/on-flexibility-products-alignment-(feb-2024).pdf?1708550095)

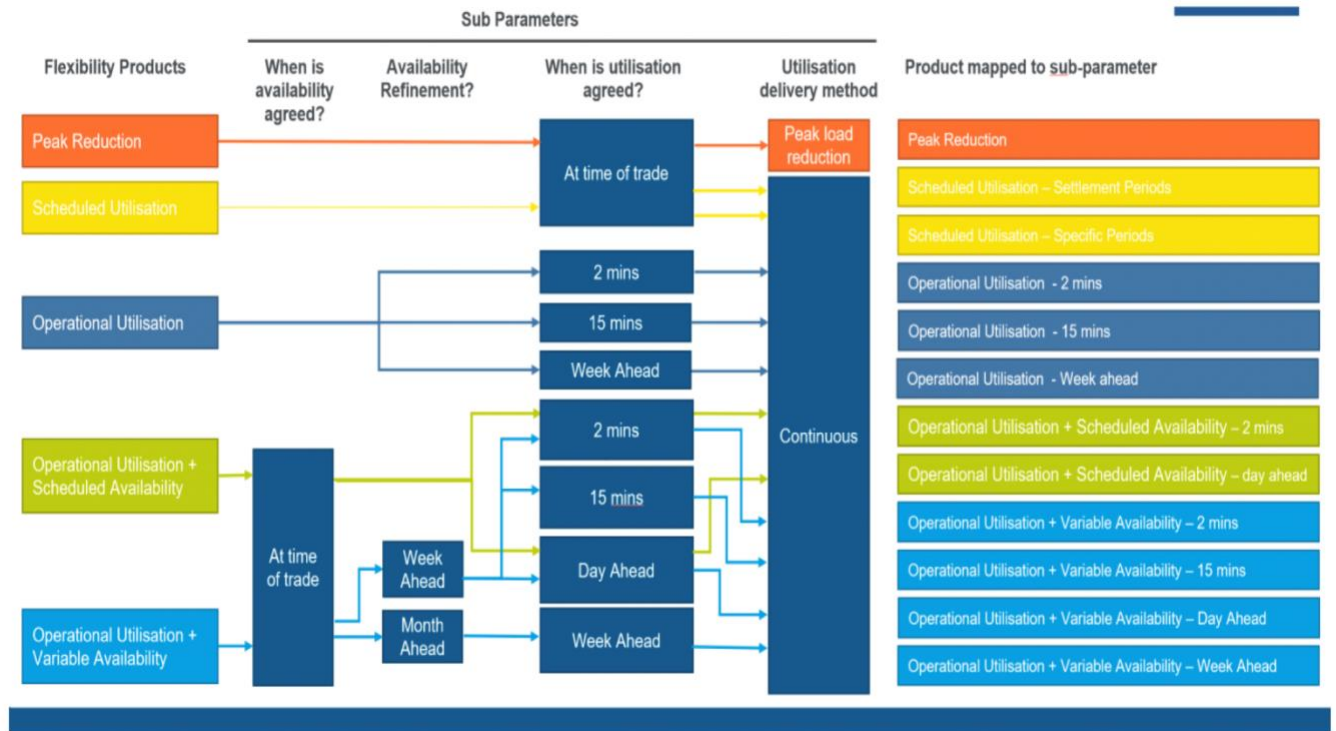
¹⁹ <https://www.energynetworks.org/newsroom/great-britain-reaches-new-record-in-contracted-flexibility>



Table 1: Flexibility products in Great Britain

Type	Payment	Description	Example
Peak reduction	Utilization payment only	This product seeks a reduction in peak power over time	This product could be used where energy efficiency measures are planned that would reduce a sites overall electricity consumption, but specifically during peak periods.
Scheduled Utilization	Utilization payment only	In this product, the time that flexibility is delivered has been pre-agreed in advance, such as with providers that cannot respond in real-time or near to real-time.	This service can be used to manage seasonal peak demands and defer network reinforcement.
Operational Utilization	Utilization payment only	This product allows for the use of flexibility services delivered nearer to real time. The assets will be dispatched for the required level of service that is based upon actual network needs.	A network operator could use this product to restore network supplies following an unplanned outage/fault.
Operational Utilization + Scheduled Availability	Availability and Utilization payments	This product procures, at a defined time in the contract, the ability to deliver an agreed change following a network abnormality. The assets will be dispatched as required.	An example for this product is when a network operator is planning for sufficiency of flexible services based upon short-medium range forecasting of network constraints.
Operational Utilization + Variable Availability	Availability and Utilization payments	This product allows for network operators to procure a level of contracted capacity, but then refine the requirements closer to the event. Assets will be dispatched only as needed.	An example for this product is when a network operator is planning for sufficiency of flexible services based upon long-range forecasting of network constraints.

Figure 2: Flexibility products mapped to product outcomes²⁰



1.3.2 Bulk system stability services

- Traditionally stability in the UK bulk system (which they define as inertia, short circuit levels and dynamic voltage support) was provided by synchronous generation. As more non-synchronous generators connect, the Electricity System Operator (ESO) in the UK has to consider alternative sources of stability²¹
- In 2021 the ESO launched the Stability Market Design initiative, which completed in 2023 and the ESO is now designing stability markets based on the findings
- The new market is expected to have short-term markets coupled with longer-term contracts, which will build on existing markets run by the ESO
- The assessment indicated the recommended approach will reduce re-dispatching costs by between GBP 30 million in 2026 and GBP 58 million in 2030, while also reducing emissions by 0.4mtCO₂ in 2026 and 0.3mtCO₂ in 2030, primarily due to lower fossil fuel generation.²²

²⁰ [https://www.energynetworks.org/assets/images/2023/Aug/on-flexibility-products-alignment-\(feb-2024\).pdf?1708550095](https://www.energynetworks.org/assets/images/2023/Aug/on-flexibility-products-alignment-(feb-2024).pdf?1708550095)

²¹ <https://www.nationalgrideso.com/industry-information/balancing-services/stability-market>

²² <https://www.nationalgrideso.com/future-energy/projects/stability-market-design>



1.4 Ireland: Using demand response to increase renewable energy generation

- The Republic of Ireland and Northern Ireland operate a single electricity system with two regulators and system operators, with a joint Single-Electricity Market Council setting policy.
- The Irish “Shaping Our Electricity Future” initiative, the two Irish transmission system operators, EirGrid and SONI, has a goal of increasing the amount of non-synchronous generation penetration for Irish demand, primarily wind and solar, which has increased from 50% to 75% since 2011, to 95% by 2030.
- Under the “Shaping Our Electricity Future” initiative, to increase the flexibility needed in the system to allow for the increase in non-synchronous generation the grid operators are:
 - Holding auctions to purchase Low Carbon Inertia Services, including reactive services²³
 - Developing a Ramping Margin Tool (RMT) to calculate generation ramping reserve requirements and to monitor ramping reserve availability
 - Evaluating minimum number of synchronous generators that are needed to maintain voltage and stability
 - Evaluating nodal trials to use distributed wind for voltage support
 - Considering 520 MW of EV charging as price responsive.²⁴

1.5 Norway: Increasing frequency response

- Norway is one of the most electrified jurisdictions in the world, with over half of energy consumption coming from electricity. Norway is also a large exporter of electricity to Europe.
- Statnett, the Norwegian transmission system operator, has a number of frequency markets that are aligned with other jurisdictions in the Nordic power market.²⁵
- Local utilities have been trialling local flexibility markets through aggregation since 2019. A new initiative, NorFlex, has been trialling how aggregation of services in a local flexibility market can be offered to both local utilities and at the transmission level using Statnett’s manual Frequency Restoration Reserves (mFRR), which is manually dispatched when required. The process is facilitated by a third party, NODES.²⁶
- A new initiative, HouseholdFlex, is examining the development of smart households and the potential for providing flexibility services.²⁷

²³ <https://www.semcommittee.com/files/semcommittee/media-files/Annex%201%20-%20TSOs%20LCIS%20Recommendations%20Paper%20-%20%20Contractual%20Arrangements.pdf>

²⁴ https://www.eirgrid.ie/site-files/library/EirGrid/Shaping-Our-Electricity-Future-Roadmap_Version-1.1_07.23.pdf

²⁵ <https://www.statnett.no/globalassets/05-dokumentlisteblokker/introduksjon-til-reserver/how-the-reserve-markets-works.pdf>

²⁶ <https://nodesmarket.com/norflex-project-demonstrate-integration-to-statnetts-mfrr-market/>;
<https://www.statnett.no/en/about-statnett/innovation-and-technology-development/our-prioritised-projects/norflex/>

²⁷ <https://smartinnovationnorway.com/en/project/householdflex/>



1.6 Sweden: Promotion of local markets

- The government’s strategy for electrification, released in 2022, calls for investigations into how flexibility on the demand side can assist in electrification.
- There are two pilots in Sweden for flexibility markets offering different services
 - 1) The sthlmflex flexibility marketplace
 - The marketplace is managed by Svenska kraftnät (TSO), Ellevio (regional distribution system operator (DSO)), Vattenfall Eldistribution (regional DSO), and E.ON Energidistribution AB (local DSO). The market operator is NODES.
 - Based in Stockholm, with the city divided into three geographical market zones.
 - The DSOs trade congestion management services offered by providers in the three zones, with delivery periods contracted seasonally. The minimum bid size is 0.1 MW and providers are dispatched with one hour’s notice from NODES.
 - Providers can also provide manual Frequency Restoration Reserves (mFRR) to the TSO. The minimum bid size is 1 MW (can be aggregated, as long as all the resources are in the same market zone). Resources must respond within 15 minutes of activation from NODES.²⁸
 - In winter 2022/2023, a total of ten different flex providers participated in the market, with a total of 4,641 different pre-qualified flex resources, an increase from 2130 flex resources in winter 2021/2022. Most were heat pumps, EV chargers and back-up generation units, and home energy management systems.
 - Pilot was planned to end in 2022 but is now permanent.²⁹
 - 2) The Effekthandel Väst flexibility marketplace
 - Located in Gothenburg. Göteborg Energi Elnät, the local DSO, purchases the services. It is based on the NODES marketplace
 - Providers can supply services for peak and congestion management of the distribution network. Flexibility providers provide bids for services on NODES, with the DSO accepting the bids that clear. Service providers need to be able to reduce or produce 0.05 MW to participate.
 - Providers are also able to sell demand response services to Svenska kraftnät, including frequency response.³⁰

1.7 Ontario: The IESO York Region Non-Wires Alternatives (NWA)

- Developed by Alectra, with NRCan and the IESO, the York Region NWA Demonstration Project aims to understand how local distributed energy resources (DERs) can meet local, regional, and provincial electricity needs

²⁸ <https://publications.jrc.ec.europa.eu/repository/handle/JRC130070>; <https://www.svk.se/sthlmflex>

²⁹ <https://www.svk.se/press-och-nyheter/nyheter/sthlmflex/2023/stadigt-okat-intresse-for-sthlmflex---nu-planeras-en-permanent-marknadsplats-for-eleffekt/>

³⁰ <https://www.goteborgenergi.se/foretag/elnat/effekthandel-vast>



- Project objectives include exploring the use of auctions to secure local capacity, energy, and reserve services; assessing the interest and ability of different DERs to compete in providing capacity; effectively procuring capacity, energy, and reserve services; driving community engagement and development through local solutions; and evaluating the unique operational and reliability characteristics of DERs compared to traditional transmission and distribution infrastructure.³¹

2. Private sector-led initiatives and innovative business models

These examples are provided to stimulate thinking and discussion about potential future business models for Ontario. Business models developed for other jurisdictions cannot be simply introduced into Ontario. Any new policy or market to help meet Ontario’s requirements would need to be designed for the specific circumstance of the Ontario energy sector.

In addition, a selection of innovative business models are presented. This list is not intended to be comprehensive; rather, it is here to help illustrate the range of innovative business models that have been developed.

Australia	Reposit Power (Solar energy equipment supplier)	Offers residential customers 7 years of no electricity bills if they purchase the solar/storage/controller package from Reposit Power. ³² Reposit controls the system, and acts as an aggregator/VPP to sell services in various ancillary markets. ³³ As of 2021, Reposit has delivered 121.4 MWh in network dispatches. ³⁴
UK	Octopus Energy (retail energy supplier company)	Flux tariff is designed to work with solar and storage systems to optimize energy use depending on market rates. It optimizes storage discharge when grid value is high. ³⁵
USA (California)	OhmConnect	OhmConnect is a VPP using smart plugs, smart appliances and smart meters to allow Ohm to alter electricity demand to provide services to the electricity system. ³⁶ Customers are rewarded if they respond to grid requirement in a 24-hour window, or for automatically connected devices with a 15 minute warning. ³⁷

³¹ <https://www.alectra.com/nwa>

³² <https://repositpower.com/no-bill> Up to 120% of monthly pre-contract consumption.

³³ <https://www.cornwall-insight.com/wp-content/uploads/2024/03/I2Z-Report-2024.pdf>

³⁴ <https://www.aer.gov.au/system/files/Reposit%20Power-%20Electricity%20Distribution%20Ring-fencing%20Draft%20Guideline%20Submission%20-%202019%20July%202021.pdf>

³⁵ <https://octopus.energy/smart/flux/>

³⁶ <https://www.ohmconnect.com/about-us/news/resi-station>

³⁷ <https://www.cornwall-insight.com/wp-content/uploads/2024/03/I2Z-Report-2024.pdf>



USA (California)	Sunrun	Sunrun created a 34-MW virtual power plant with 8,500 residential solar and storage customers. The program dispatches electricity at peak times in the summer. ³⁸
USA (Hawaii)	Sunrun	Sunrun operates a VPP in Hawaii that dispatches power at times of peak demand in the system. Customers can receive credit and reduce their bills. ³⁹
Czech Republic	Nano Energies	Nano Energies combines facilities with a minimum of 0.2 MW to respond to grid events and to provide flexibility and ancillary services. Nano Energies also works with industrial customers. Company started in the Czech Republic, and has expanded to Slovakia, Croatia, Hungary and Romania. ⁴⁰
	1Komma5	Manages customer’s electricity use to benefit from low market price times (such as high renewables) to charge storage or EVs or to pre-heat or pre-cool. ⁴¹
Ontario	Lakeland Holding Group, Opus One Solutions Energy ULC and the town of Parry Sound.	<p>Evaluating reliability in load in the SPEEDIER project Project SPEEDIER aims to create a “Smart, Proactive, Enabled Energy Distribution - Intelligently, Efficiently and Responsive” grid that builds towards a net zero smart community in Parry Sound, Ontario.</p> <p>Project SPEEDIER addresses the issue of reducing load on a constrained transmission system. To achieve this, it deploys commercially available products (e.g. solar panels) while demonstrating developing technologies. SPEEDIER accomplishes this by integrating DERs using GridOS management and microgrid systems to balance energy consumption and electricity generation from renewable sources.⁴²</p>

³⁸ <https://investors.sunrun.com/news-events/press-releases/detail/289/sunrun-and-pge-expand-collaboration-on-distributed-power>

³⁹ <https://www.sunrun.com/solar-by-state/hi>

⁴⁰ <https://nanoenergies.eu>

⁴¹ <https://1komma5grad.com/en/offer/energymanager-heartbeat>

⁴² <https://www.speedier.ca/wp-content/uploads/2022/12/SPEEDIER-Final-Public-Report-Rev2.1.pdf>