Utility Remuneration and Responding to Distributed Energy Resources

Energy Storage Canada

www.poweradvisoryllc.com

September 2019

Outline

- Energy Storage Canada (ESC) has retained Power Advisory LLC (Power Advisory) as an expert consulting resource for the Ontario Energy Board (OEB) consultation on Utility Renumeration (EB-2018-0288) and Responding to Distributed Energy Resources (DERs) (EB-2018-0287)
- **Energy Storage Canada** is the national trade association for the energy storage industry
- The OEB has convened a stakeholder meeting to discuss the dual consultations and to hear stakeholder input on foundational questions:
  - What objectives should the Utility Remuneration and Responding to DERs initiatives aim to achieve?
  - What specific problems or issues should each initiative address?
  - What principles should guide the development and selection of policy options?

Ontario Energy Board

EB-2018-0288

EB-2018-0287

September 17, 2019

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Outline of Presentation

- Energy Storage Resources (ESRs), game changer
  - Overview of services offered by Energy Storage Resources (ESR)
  - Impact of ESRs on Distribution System and Customers
- Responses to OEB questions
- Commentary on non-wires alternatives (NWAs)
  - NWA assessment models
  - Operation and control of NWAs
  - Risk exposure of NWA solutions
  - Value stacking coordination

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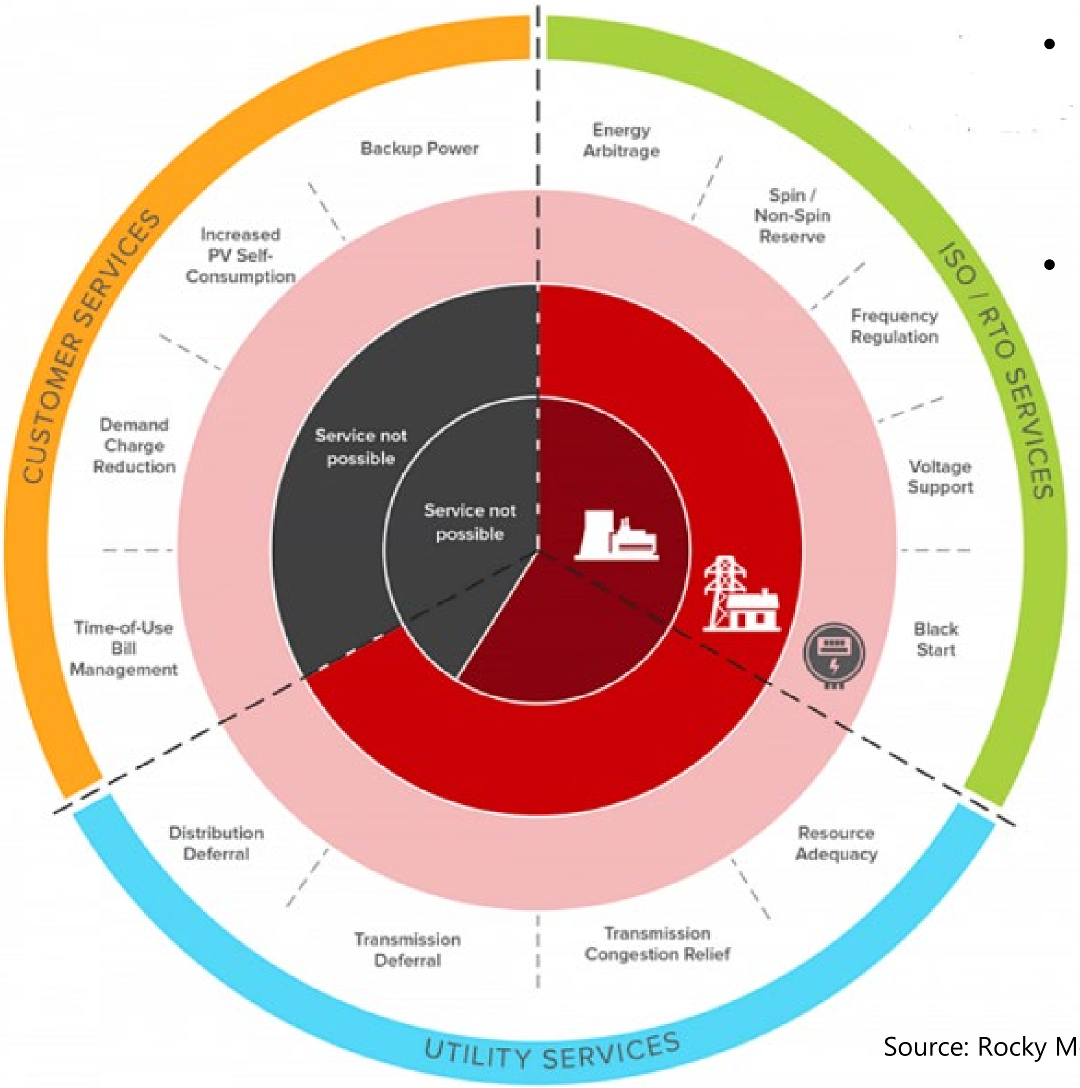
Energy Storage Resources Game Changer

Impact of Energy Storage Resources on Distribution Systems

Energy Storage Resource Service Offerings



- A key benefit of ESRs is the versatility to offer variety of services to wholesale markets, grid operators (e.g., LDCs), and customers
- Scheduling and coordination of providing services an important hurdle to maximize the opportunity for ESRs

Source: Rocky Mountain Institute

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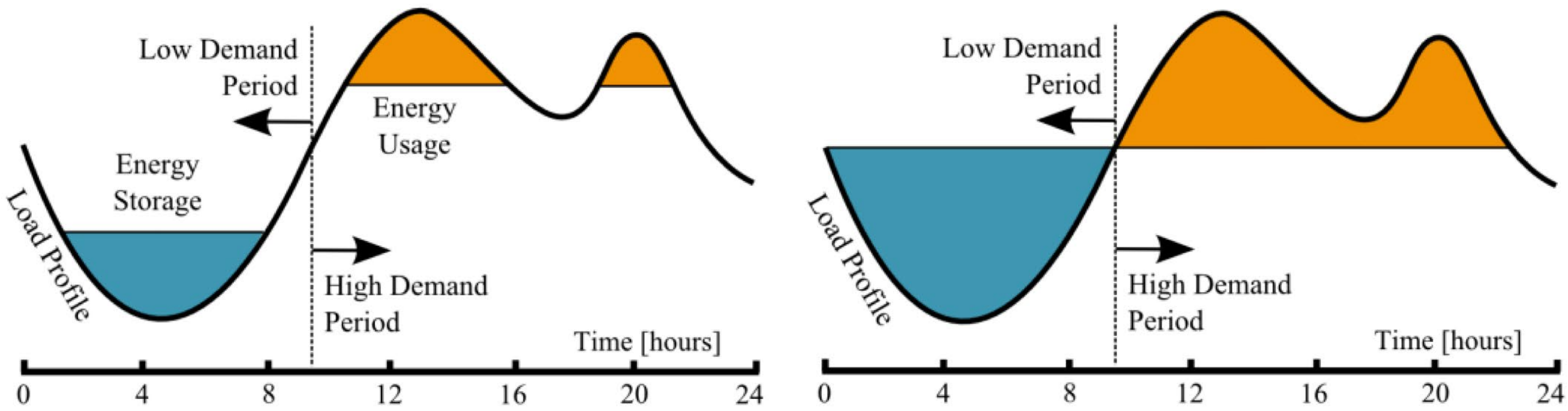
ESR Impact on Customer Demand Profile

Source: Energies



- ESRs provide the ability for customers to manage their distribution system consumption independent of their energy needs
- The consumption pattern of the customer does not change which is highly beneficial for customers that have inflexible demand (e.g., restaurants, schools, etc.), instead the ESR is operated to adjusted to consumer from the grid when it is lower cost
- In other words, inflexible customer demand profiles can become highly flexible with ESRs

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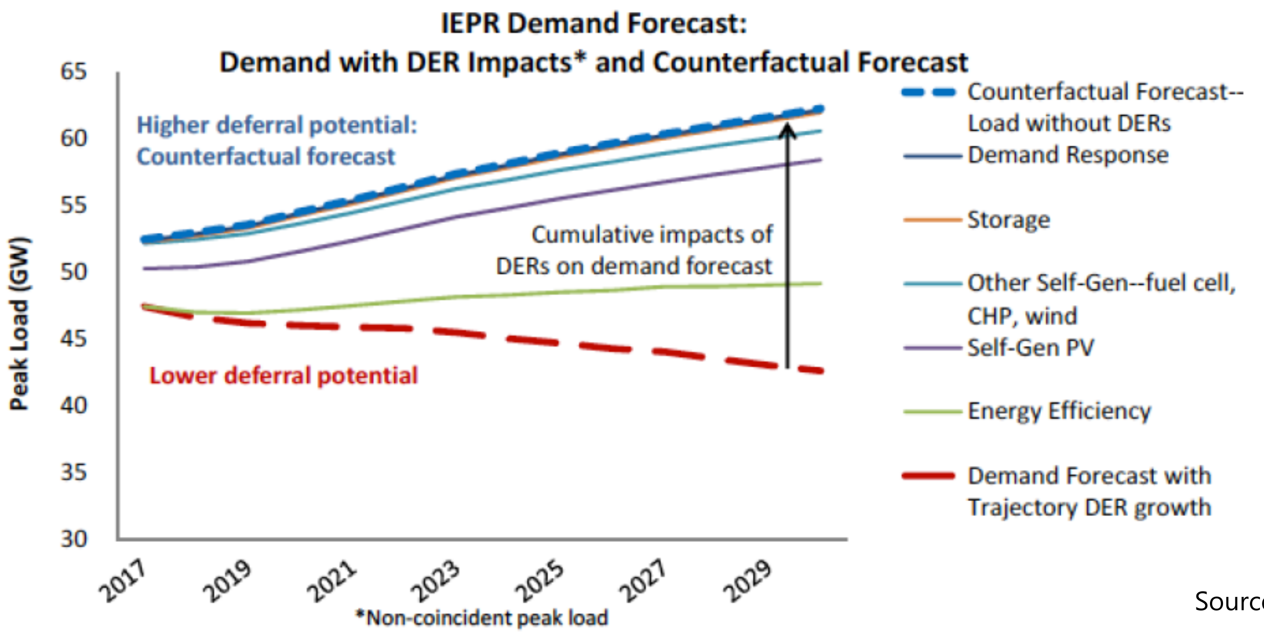
DER Impact on Distribution System Forecasting



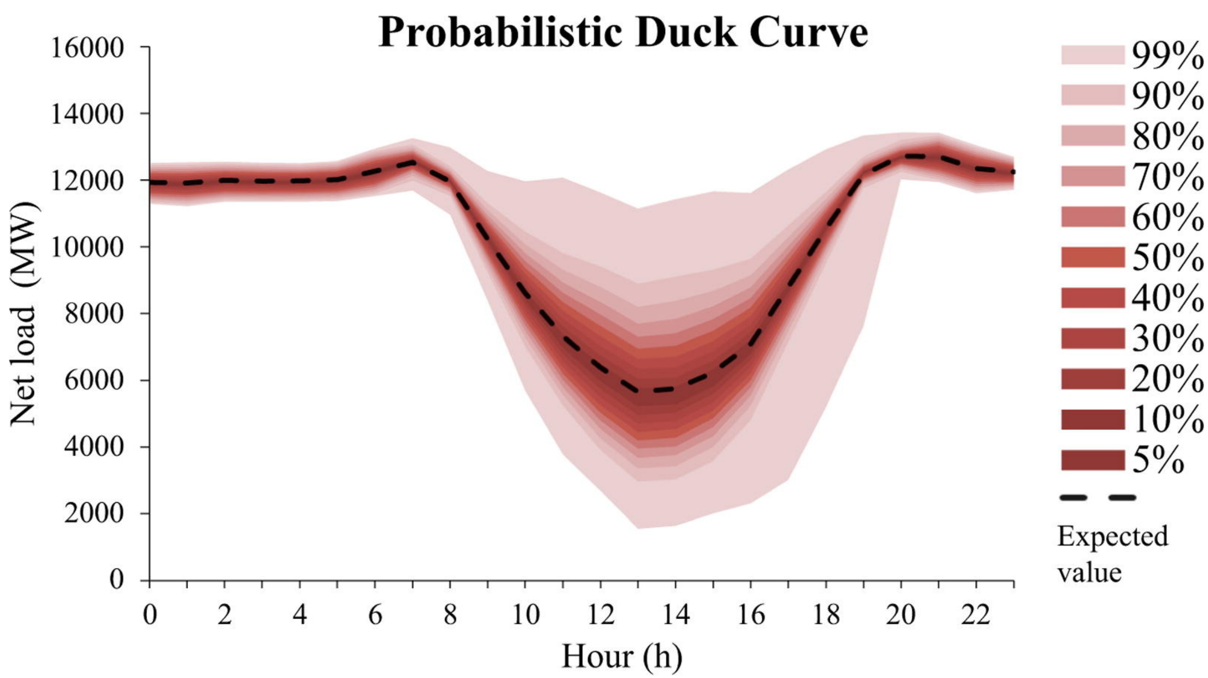
Forecast simplified for illustrative purposes. Actual counterfactual forecast must be adjusted for Codes and Standards and peak shift, and impact of EVs is included in forecast but not shown on this chart

Source: CPUC

- The rapid adoption of DERs such as ESRs and solar generation along with flexible load resources (e.g., smart appliances) will increase the complexity and uncertainty of forecasting distribution system needs
- In addition, DERs adopted by customers will primarily serve the customers needs that might not be directly linked to distribution system needs
  - E.g., reduction of customer peak demand does not align 1:1 with reduction distribution system peak demand

Probabilistic Planning

- While DERs can lead to increased complexity and issues for distribution system planning, as non-wires alternatives (NWAs), DERs can offer services to the distribution system to help resolve emerging power system needs
- For distribution systems to adopt NWAs (e.g., ESRs), an overhaul of the distribution system planning processes and regulatory framework is required
- Further, power system planning will need to become more "probabilistic" versus "deterministic" to properly reflect uncertainty of future system needs



Source: State Grid Qinghai Electric Power Company, Xining, China

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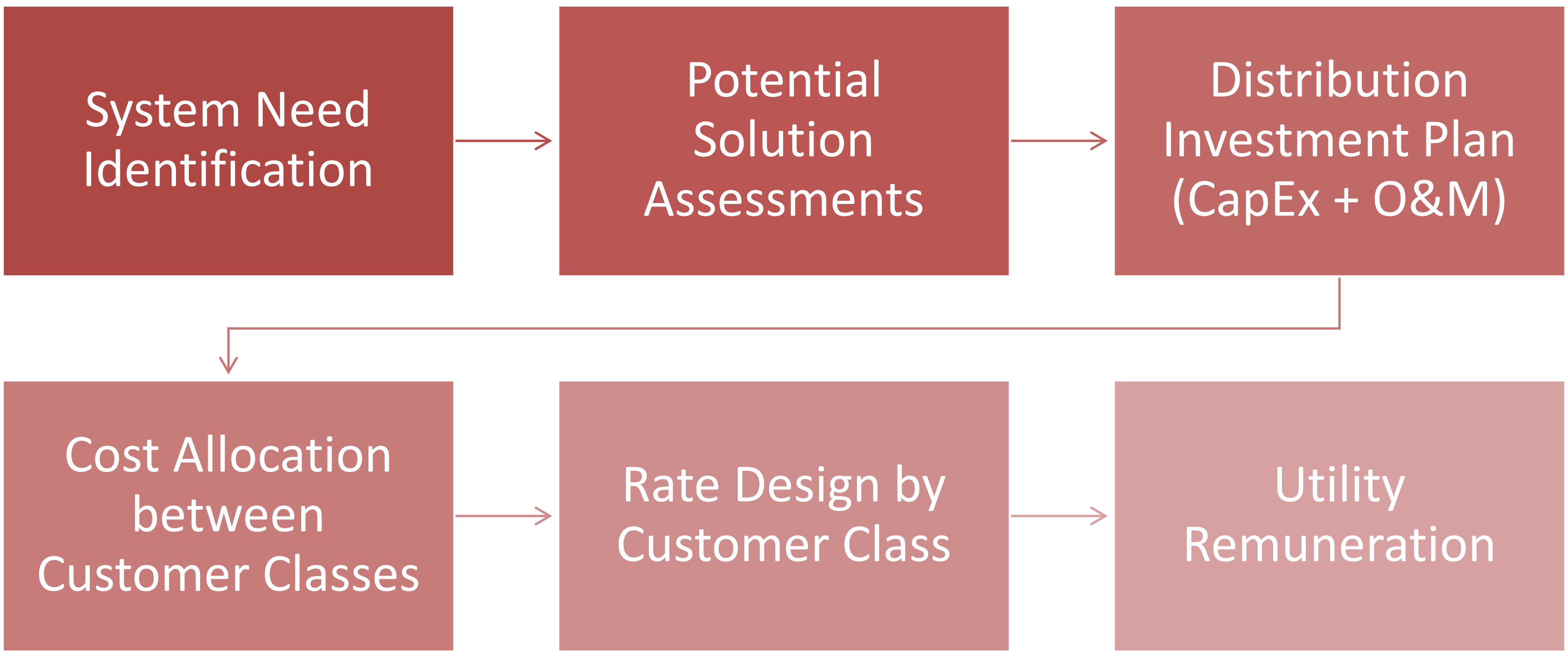
Response to OEB Questions

High-level process for Distribution System Planning



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OEB Q1: What objectives should the Utility Remuneration and Responding to DERs initiatives aim to achieve?

- Determine how to support **expanded customer choice** for meeting their energy needs in addition to realizing **mutual benefits of DER adoptions** for all customers
- Understand how DERs will change distribution system, specifically:
  - **Design and planning**
  - **Operation**
  - **Capital requirements**
  - **Short- and long-term cost of service**
- Improve access to **distribution system information/data** and participation in **distribution system decision-making**
- Establish a process for utilities to pursue the most **cost-effective viable solutions** to distribution system needs that provides fair and equal treatment for NWAs and traditional utility assets
- Determine how utilities can earn a reasonable rate of return on cost-effective viable solutions **regardless of the entity delivering the service** (e.g., customer program participation, third-party service agreements, traditional distribution solutions)

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Impact on Distribution Systems

Design

- Requires a definition of Energy Storage Resources
- Publish greater inform on distribution system status and need
- Shift to probabistic planning from deterministic planning process
- Fair and equal assessment process for NWAs solutions versus traditional Dx solutions to distribution system needs
- Integrate reliability contracts or service agreements with NWAs

Operation

- Changing use of Dx system (i.e., two way flow, transactional network)
- Need increased visibility of DERs including changes to OMS, CIS, etc.
- Determine process for 'control' of DERs for distribution system needs
- Value stacking analysis

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Impact on Distribution Systems

Capital Requirements

- New equipment to monitor and enhance visibility in the near-term
- Enhanced metering infrastructure for tariff design to offer customers distribution costs that reflect cost causality principles more accurately
- New modeling capabilities in planning process (i.e., probability analysis, large data storage)
- Capability to control of DERs (either direct or through scheduling & dispatch)

Short- and long-term cost of service

- Prepare for more active consumers and increased monitoring capabilities
- Enhancement to OMS, CIS, and system control tools
- Increased granularity of tariff design for customers

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OEB Q2: What specific problems or issues should each initiative address?

Responding to DERs

- **Definition and unique treatment for ESRs**
- What distribution system information needs to be published for customers and stakeholders engagement
- What changes to connection process and responsibilities are needed for DERs
- How distribution system planning process and operation must change due to growth in DERs
- What options are available for NWAs to offer services to LDCs to address system needs
- Changes to rate design to maintain and enhance cost causality principles for customers deploying DERs and other load flexibility tools

Utility Renumeration

- How distribution system investments should be categorized (e.g., capex versus opex, totalex, etc.)
- How LDCs can earn a reasonable rate of return on services provided by DERs (either owned by LDC, third-party or customers)
- Who bears merchant risk for DER value stacking

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OEB Q3: What principles should guide the development and selection of policy options?

- Support customer choice in meeting their energy needs
- Cost causality of distribution system costs reflected in cost allocation and rate design
- Rate design that reflect the value of connection to the distribution network (e.g., transactional purposes, minimum standard of power quality/reliability/safety)
- Recognize value stacking opportunities and requirement for coordination with other electricity markets (e.g., IESO-administered market)
- Distribution system investment decision making process based on:
  - Viability
  - Cost-effectiveness
  - Scalability
  - Technology & ownership agnostic

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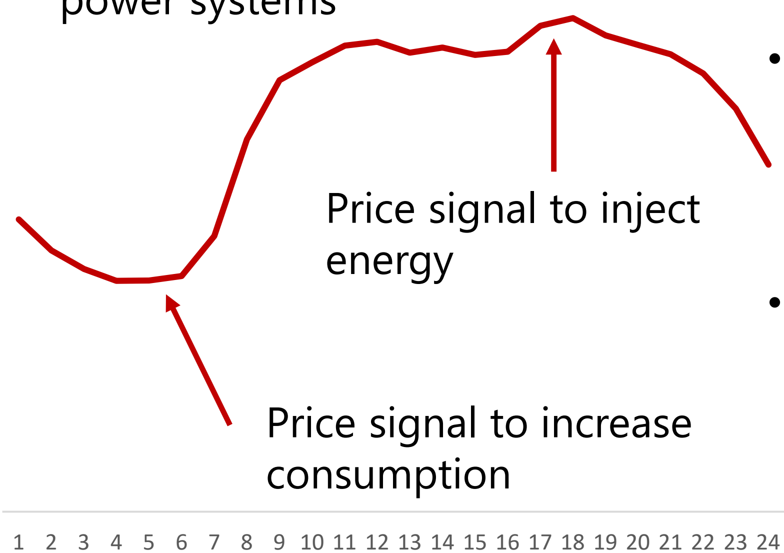
Price Signals for ESRs

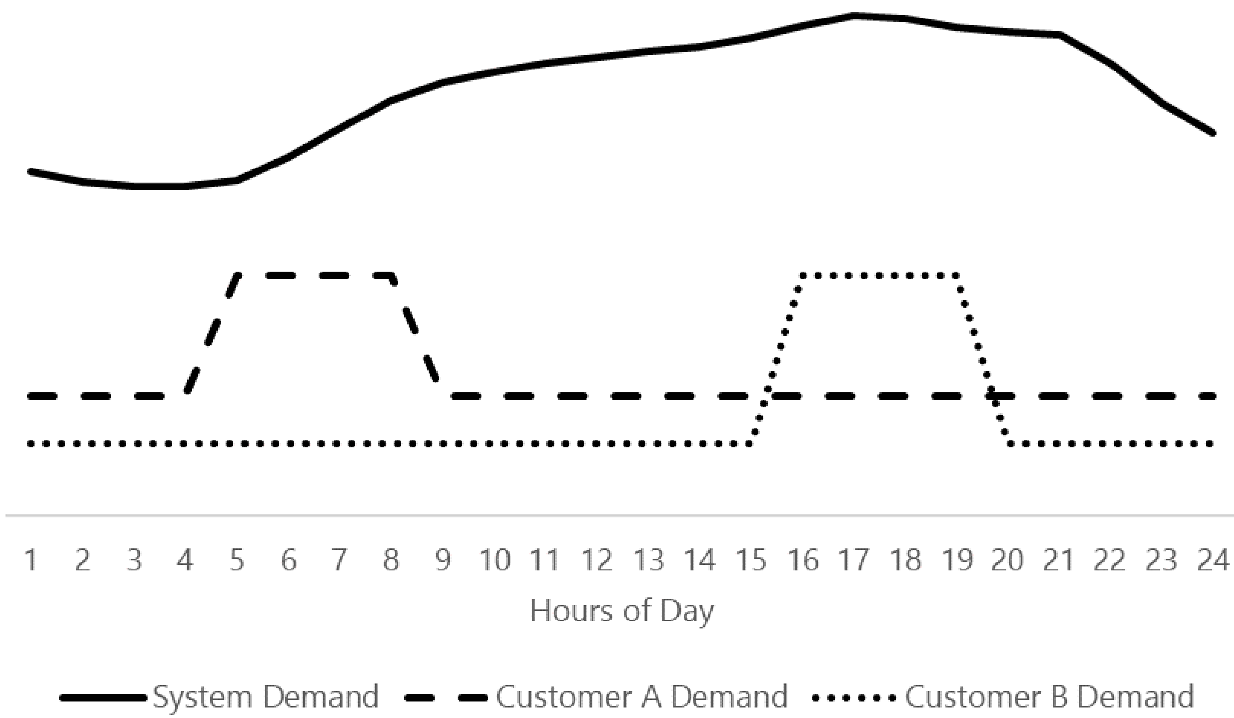
- The IESO Hourly Ontario Energy Price (HOEP) generally reflects the supply/demand balance in a given hour in the province, the pool price does not reflect the capacity constraint in the distribution system
  - For example, HOEP could peak at 4pm but a local area of a distribution system might experience thermal capacity constraints earlier in the day depending on the local supply/demand balance
- ESRs are utilization resources first and foremost; that is, ESRs do not inject new energy into the electricity system but instead optimize the usage of existing resources and power systems



- Appropriate price signals is needed for ESRs to inform the optimal time periods to inject energy and consume energy; therefore a price signal for distribution system use is needed in addition to HOEP
- Appropriate price signal for distribution system usage will increase utilization of existing assets and optimize the passive control of ESRs

Non-coincident peak demand charges flawed

- Customer A & B have the same customer peak demand.
- Customer A's peak occurs during system demand's off-peak hours, while Customer B's peak occurs during the coincidental system peak.
- Under NCP charges, both customers pay the same amount, even though Customer B's peak will result in higher system costs for all customers (i.e., free-riding)



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Non-Wires Alternatives

Commentary on NWAs integration into Distribution Systems

Non-Wires Alternative Assessment Model

- The following is a high-level overview of key components of a NWAs assessment model that could consider the unique benefits of ESRs

Needs Identification

- Forecast of compliance violations of power system standards (i.e., reliability, power quality, safety)
- Needs report publicly published and stakeholder consulted

Proposed Solutions

- Open call to third parties & customers for solutions to identified needs
- Ensure costs are "net" of other revenue (e.g., wholesale market review)
- Regulatory backstop/traditional solution

Solution Assessment

- Viability of solution to address need
- Cost-effectiveness compared to other viable solutions
- Scalability (i.e., can be adjusted to meet uncertain needs)

Regulatory Oversight

- Analysis and verification of preferred solution
- For reliability contracts, prudency of key provisions

Operation and Control of ESRs

- To deliver services to the distribution system required to meet power system needs in real-time, LDCs need the ability to direct the operation of ESRs
  - Operation of ESRs depends on the attributes of the ESR technology and can include directing the consumption or injection of energy, the ramp rate, the duration, etc.
- Instructing ESR operations requires:
  - A communication protocol, the ability to inform the ESR what operation is required including an activation notification
  - Measurement and verification of ESR operation to validate performance
  - Compensation for operation

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Range of ESR operational control

- There is a range of options for ESR operational control that offer trade-offs in control of ESR, confidence in results and compensation
- Generally, more control by a LDC requires higher amounts of compensation since additional service revenue expectations are lower
  - For example, if LDC can assume control of ESR unilaterally, the ability for ESR to perform other services is greatly reduced

Less LDC Control ⟷ *More LDC Control*

Passive	Schedule & Dispatch	Direct Control
• Price signal and rate design inform ESR operations (e.g., critical peak pricing) • Confidence of response by ESR is low • Compensation is avoided cost savings	• ESRs contracted by LDC will require a communication protocol to schedule & dispatch ESR operations • Confidence is somewhat dependant on penalties for failure to follow dispatch • Compensation is based on commitment and performance	• Control of ESR performed by LDC, requires notification when control will be activated • Confidence is high • Compensation high due to reduced additional revenue confidence, as well as potential equipment degradation

Risk Exposure of NWAs Investments for Rate-Payers

- A process is needed to determine if viable and cost-effective NWAs should be included in LDC investment plans as well as to determine cost allocation & rate-design
- Due to value stacking opportunities, the support and deployment of ESRs by a LDC primarily revolves around merchant risk exposure
- ESRs can offer services to meet needs of LDCs for a net cost (i.e., costs less revenue from additional service offerings, therefore reducing the cost to rate-payers
  - For LDC-owned ESRs, should rate-payers bear the risk of revenue shortfall from additional services that can be offered by the ESR?
- Third-party or customer-owned ESRs could offer electricity products at a net cost of additional revenue expectations to LDC through a service agreement (e.g., a reliability contract)
- **How LDCs will be compensated for investments through service agreements compared to physical assets will influence distribution system design, operation, capital requirements and the cost of service delivery**

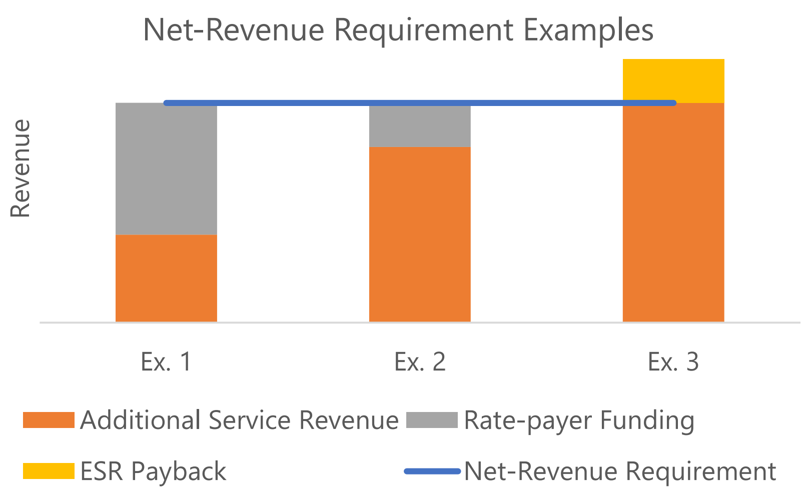
Conceptual NWA Service Agreement Model Examples

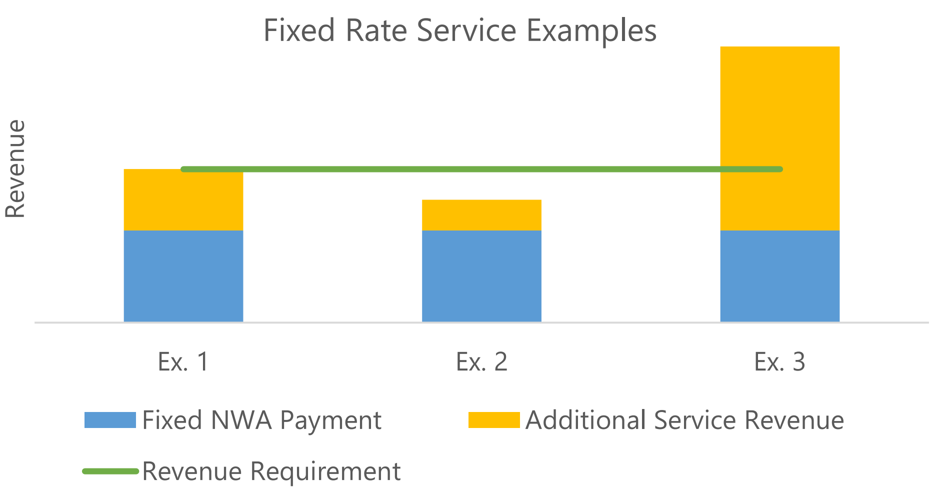
Model 1: Net-revenue requirement

- A net-revenue requirement is determine for an ESR that includes a forecast of additional service revenue
- Rate-payers pay net-revenue requirement depending on the amount of actual additional service revenue (i.e., similar to a contract-for-differences)

Model 2: Fixed Rate Service

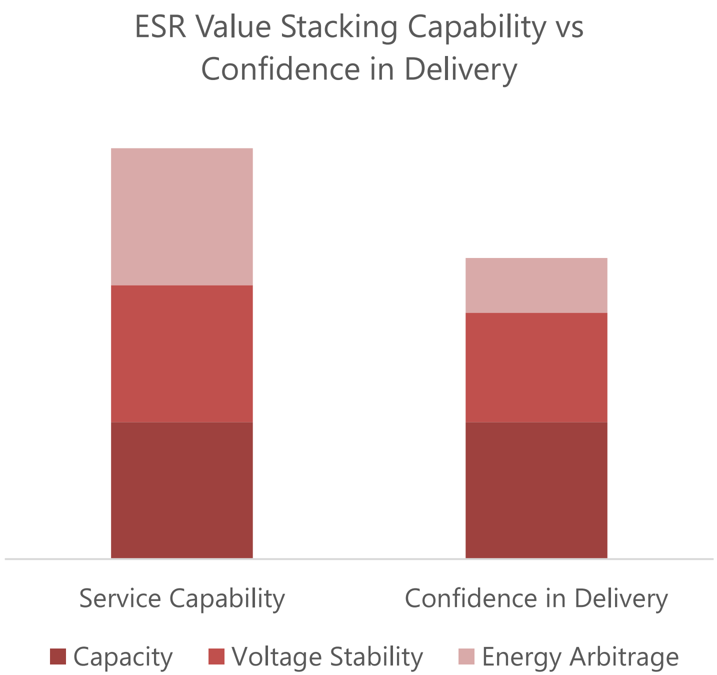
- Same net-revenue requirement analysis; however fixed payment for NWA service determined based on forecast of additional services
- Rate-payers only fund NWA service cost, additional service revenue risk/opportunity borne by LDC or third-party service provider





Value Stacking Coordination

- A key benefit of ESRs is the ability to value stack and offer multiple services to different market participants
- An issue for value stacking is coordination of service offerings between different entities (e.g., wholesale markets, customers, grid operators)
- Higher-priority service offerings from an ESR have a higher confidence of delivery of the service, while lower priority services logically have a lower confidence of delivery



- An objective of an ESR is to offer the service with the highest value at a given time
- Certain services (e.g., essential reliability services) must be high priority due to consequence of failure to provide service (i.e., potential power system instability)
- Coordination and communication protocol needed between different entities for operation of ESR to offer multiple services

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