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Ontario Energy Board Stakeholder Meeting

Responding to DER

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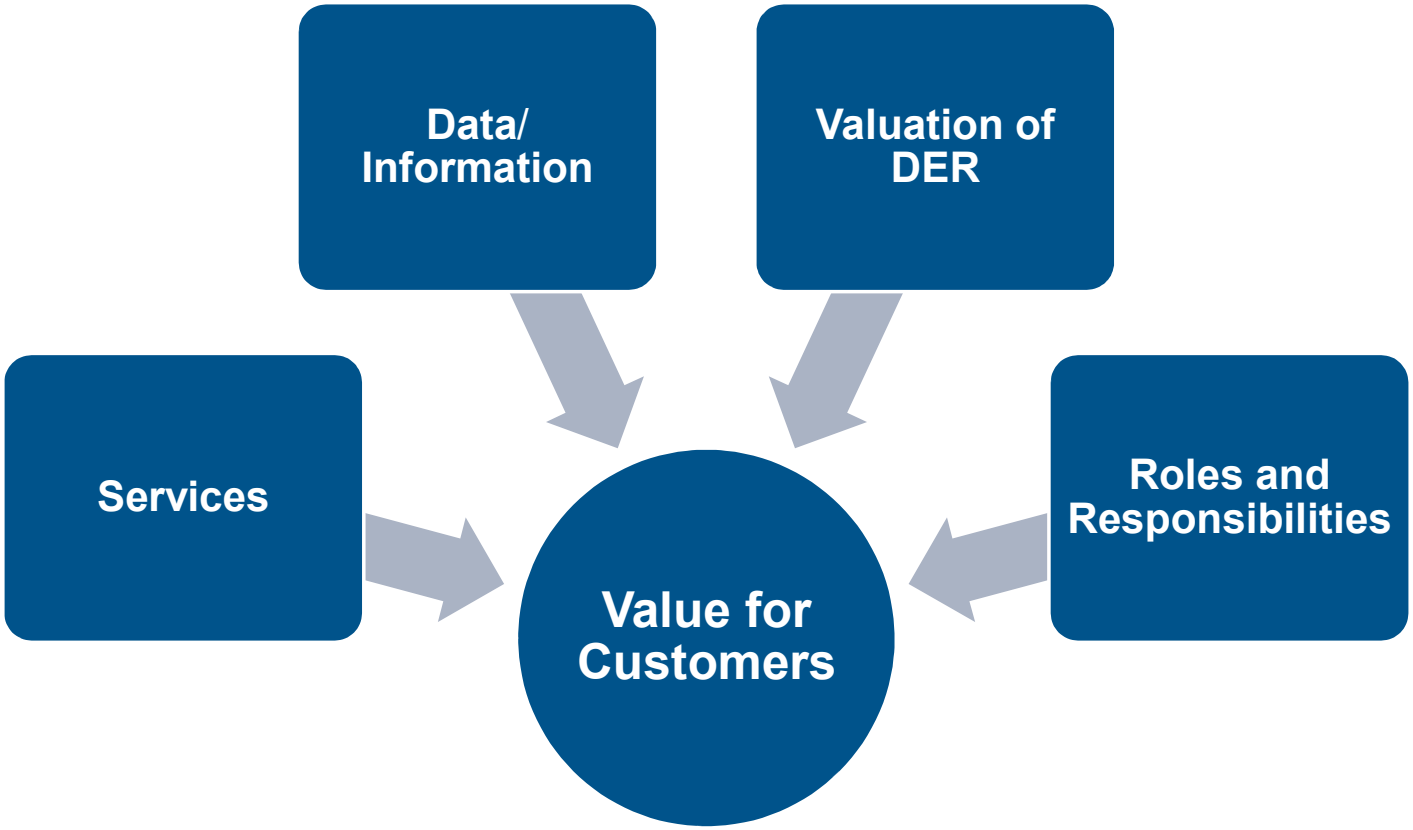
August 27, 2019

Agenda

- Introductions
- Illustrative Discussion on Four Topics
- Final Thoughts
- Q&A



About ICF

ICF has supported DER consultations in other jurisdictions, such as New York, California, Nevada and Oregon. Based on our experience, this presentation has been prepared to share some key insights and lessons learned. The concepts, figures, examples and insights shared are intended to generate discussion, not to presuppose or preclude any policy outcomes in Ontario.

Overarching Focus: Customers

Ensure cost-effectiveness for customers, and/or decrease system costs.

Enable customers to choose innovative technologies.

Enhance the customer experience and create value for customers.

DER Services

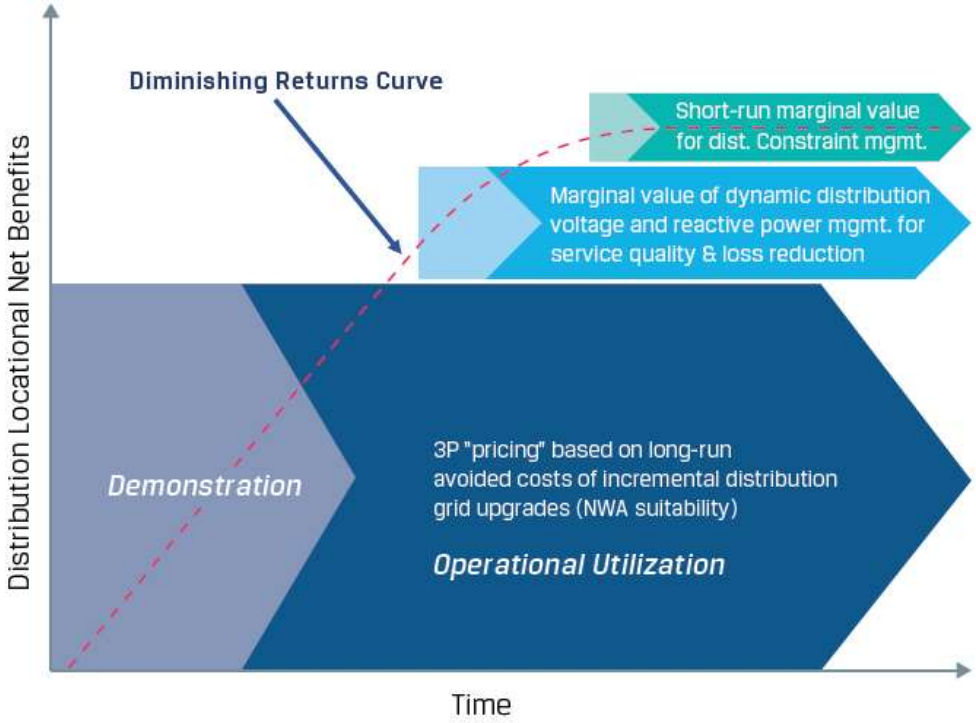
What Services Can DER Provide to the Distribution System?

Value Category		Benefit (+) or Cost (-)	# of Studies
Utility System Impacts			
Generation	Avoided Energy Generation	+	15
	Avoided Generation Capacity	+	15
	Avoided Environmental Compliance	+	10
	Fuel Hedging	+	9
	Market Price Response	+	6
	Ancillary Services	+/-	8
Transmission	Avoided Transmission Capacity	+	15
	Avoided Line Losses	+	11
Distribution	**Avoided Distribution Capacity**	+	**14**
	Resiliency & Reliability	+	**5**
	Distribution O&M	+/-	**4**
	Distribution Voltage and Power Quality	+/-	**6**
Other Costs	Integration Costs	-	13
	Lost Utility Revenues	-	7
	Program and Administrative Costs	-	7
Societal Impacts			
Broader Impacts	Avoided Cost of Carbon	+	8
	Other Avoided Environmental Costs	+	9
	Local Economic Benefit	+	3

- There is near consensus amongst regulators and utilities that DER can help avoid the need for new distribution capacity.
- A discussion is needed on distribution resiliency & reliability; O&M; voltage and power quality. Ontario could develop its own framework to evaluate these categories.
- The value to customers (i.e., choice, avoided outages, bill reduction) is highly customer specific and estimates vary.

Image Source: ICF, The Hunt for the Value of Distributed Solar, February 2019

Time Horizon for DER Services



Note: 3 Ps – Procurements, Pricing, Programs

- The types of services that DER can provide will evolve as system capabilities grow.
- In the near term, the largest value is likely to come from the long-run avoided costs of distribution capacity.
- Three main mechanisms exist today to procure DER in this early phase:
  - Non-wires alternatives (NWA) procurement. NWAs can include a portfolio of DER such as solar PV, demand response and EE measures;
  - Pricing of DER services (such as voltage and reactive power support) through tariffs; and
  - Energy efficiency programs.
- In the longer term, value may accrue from the use of DER for real-time grid operations and to resolve dynamic operational constraints and reduce losses.

Image Source: ICF, Missing Links in the Evolving Distribution Markets, 2017

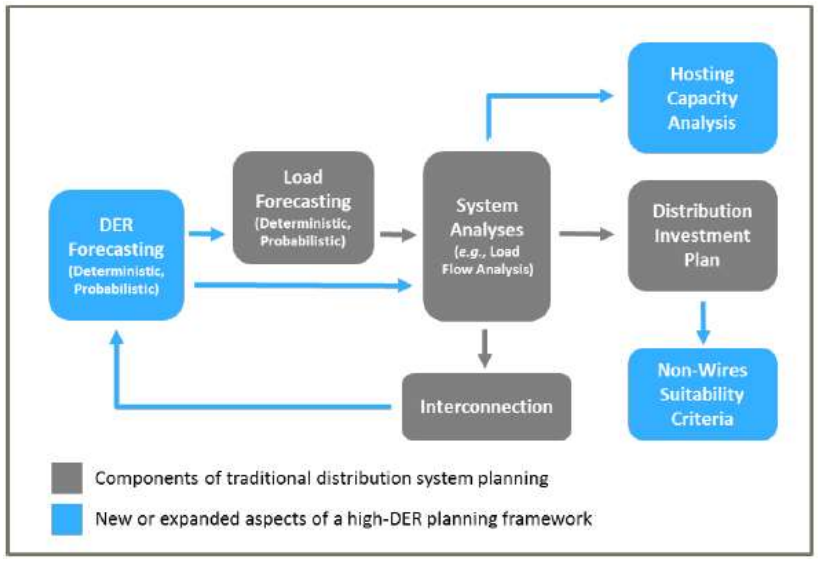
Required Grid Modernization Investments

Investments	Stage 1: Grid Modernization	Stage 2: Operational Market	
	Reliability & Operational Efficiency	Enable DER Integration	DER Value Capture
Advanced Metering Infrastructure	✓	✓	✓
Distribution Automation	✓	✓	
Advanced Distribution Management System	✓	✓	✓
Distributed Energy Resource Management System		✓	✓
Data Analytics		✓	✓
Geographic Information System ("GIS")	✓	✓	
Communications Infrastructure	✓	✓	✓
System Data Platform		✓	✓
Volt/VAR Optimization/ Conservation Voltage Reduction	✓	✓	✓

- Procuring services from DER will require investments in monitoring and control, communications, protection and data acquisition technologies.
- In some cases, the use of techniques such as feeder switching and load balancing and the use of low-cost equipment such as voltage regulators and capacitor banks may suffice for real-time operations.
- The net benefits of procuring operational services from DER may diminish as the need for system investment grows with increasing DER penetration.

Image Source: Joint Utilities of New York, Supplemental DSIP

How May Distributors Facilitate DERs?



Note: The figure is meant to be illustrative and does not reflect all the distribution planning processes or feedback loops that may develop as the planning process matures.

- Depending on the type of DER, Distributors may facilitate DERs that add value in two ways:
  - Providing efficient access to the distribution system; and,
  - Providing data in an efficient and timely way.
- As DER penetration increases, especially generation, expanded SCADA, monitoring and protection and expanded or new control room functions, will be needed.
- Distribution companies can develop new techniques to forecast for load and DER.
- New market rules and participation models can facilitate DER participation in wholesale electricity markets.

Image Source: Joint Utilities of New York, Supplemental DSIP

Data and Information; System Planning and Operation of DERs

Data Requested by DER Providers

	What data will provide the most value?	Required Data (GIS):	Why does the data provide value?
	Granular peak demand, load shapes, and load forecasts. Data at the substation level is recommended, but even more detail (e.g. at the feeder level) would be useful for appropriately developing and sizing DER resources to best meet system needs.	**Substations**: - Unique ID - Substation Name	- Online Mapping - Cross-reference data from many sources, allowing ties from GIS to Interconnect Lists
	Detailed insight into areas of the utility system that have or will require significant infrastructure upgrades - and where DER could provide benefit.	**Distribution & Transmission lines**: - Circuit ID - Substation ID/Name	- Allows GIS data to be tied to substation data - Use GIS data to complete spatial analysis with developer customer data
Nice to Have:	Detailed customer data, as near to real-time as possible.	**Distribution & Transmission lines** - distribution & transmission line attributes, such as conductor size	- Can be used to evaluate potential thermal capacity of a feeder and estimate re-conductoring costs
	Presentation at Joint Utilities of New York, **June 16, 2016**, System Data EG Meeting	Joint Utilities of New York (JUNY) **August 17, 2017**, System Data Stakeholder Engagement Group (EG) Meeting	

Moving from a general to specific request adds value for all parties

Sources: NRG presentation at JUNY June 16 2016 System Data EG Meeting
Joint Utilities of New York (JUNY) August 17 2017 System Data Stakeholder Engagement Group (EG) Meeting

Examples of Utility Monitoring and Control Requirements for DER

DER Monitoring Requirements	Value of DER Monitoring for Utilities
Per Phase Voltage and Current **Three Phase Real and Reactive Power** **Power Factor**	**Distribution Planning:** Aids in asset management – transformer sizing, phase balancing, load planning, protection. **DER Interconnection:** Future hosting capacity determination. **Distribution Operations:** Reconfiguration planning and circuit restoration.

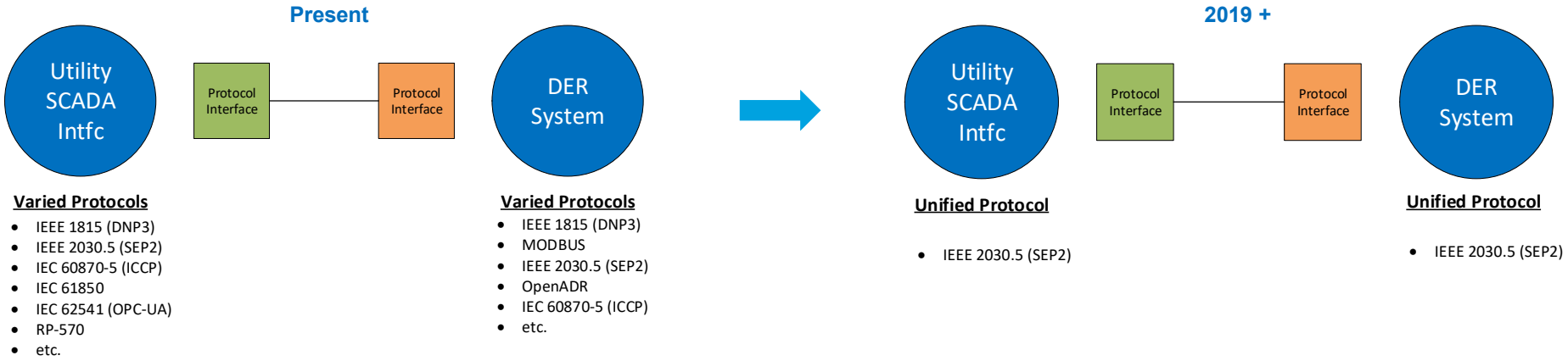
DER Control Requirements	Value of DER Control for Utilities
Point of Common Coupling (PCC) recloser is mapped in accordance with DNP3, IEC 61850 etc. **PCC recloser is capable of capturing sequence of events analysis** **PCC recloser must report the status of the disconnecting device**	**Distribution Planning:** Safety, feeder reconfiguration, maintenance, restoration. **High DER Penetration Scenario:** Curtailment of DER during over-generation. **Advanced Control:** Respond to control inputs for distribution level services.

Sources: New York Interim JU Monitoring and Control Criteria (September 1, 2017)
NREL, Monitoring and Control of PV Power Systems – Use Cases and Examples, presented at NY ITWG meeting on 1/18/2017

Protocol Standardization – California Smart Inverter Rules Example

Inverter: A power electronics-based device that transforms a direct current (DC) electric signal into an alternating current (AC) signal. Energy exporting DERs such as solar PV and batteries produce DC signals, that must be transformed into AC prior to injection into the electric grid.

US jurisdictions are moving to standardized communication and monitoring protocols for inverters, DER and DER aggregators to make the DER integration process more efficient.



Action

- As of August 24, 2019 all inverters in California are required to have and be shipped with default IEEE 2030.5 capabilities, dictating the Utility – Aggregator and Utility – DER interface requirements.

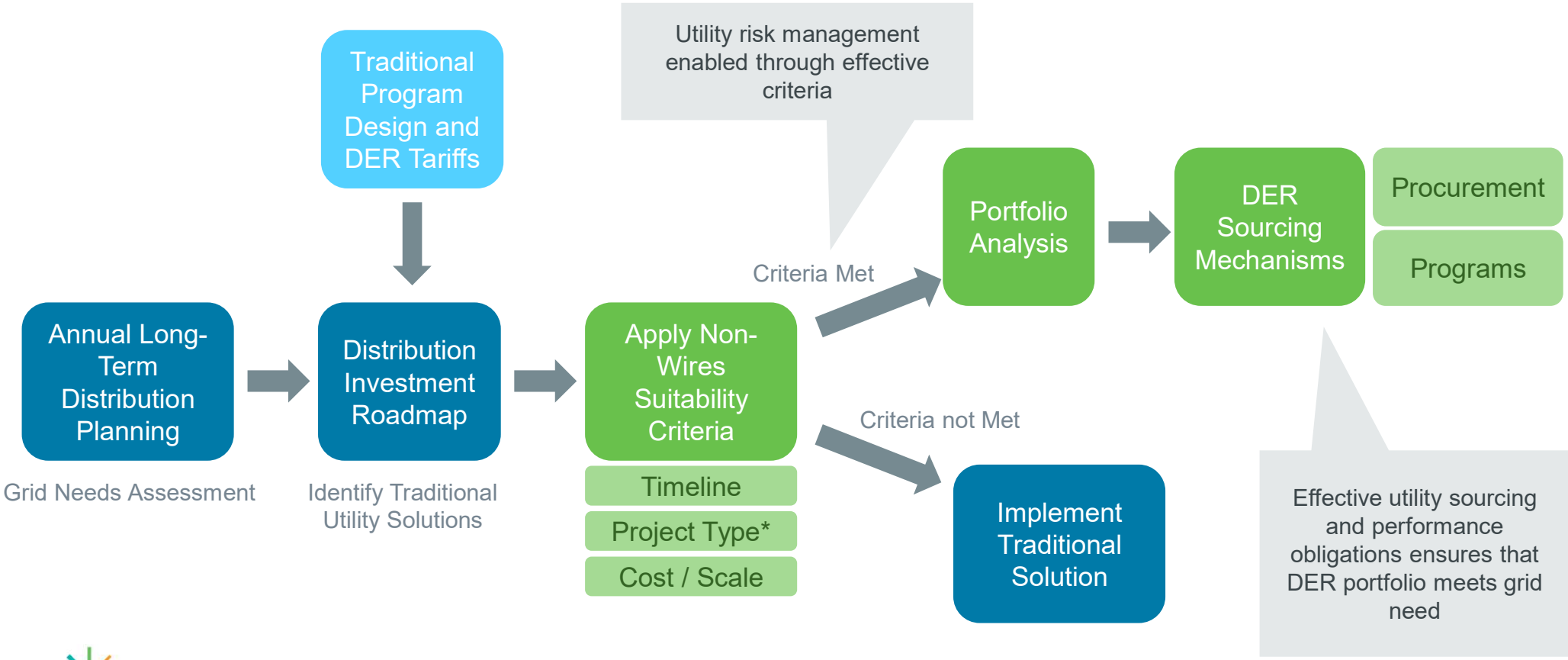
Implication

- Standardization of data protocol for use by utility, end point device and aggregator.
- Standardization of inverter data model for monitoring and control.
- Advanced inverter functionality removes the need for external monitoring and control devices, reducing costs to developers/ aggregators.
- Vendors migrate to a single standard to lower costs and ensure interoperability with clients.

Source: ICF

Valuation Of DER

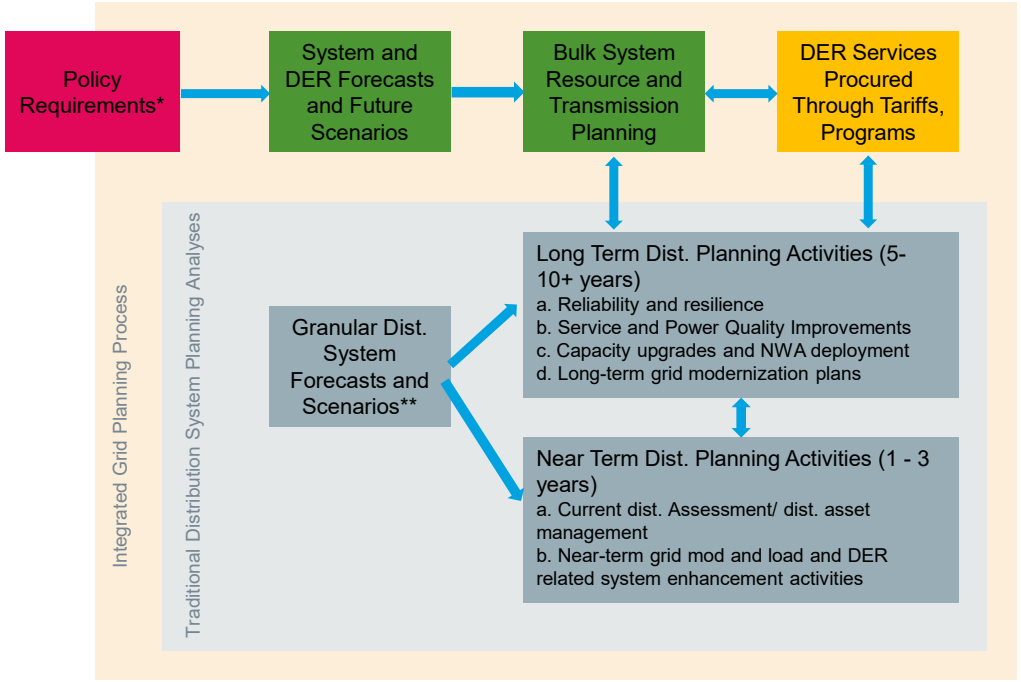
The Concept of Suitability Criteria



* Categories of project types suitable for NWA are on slide 5

Roles And Responsibilities

DER Integration Requires Increased Coordination for Efficient Grid Planning



Task Owner

- Regulator
- Utility Transmission Owners/ ISOs
- Utility Distribution System Planners
- DER Aggregators/ Providers

* Policy requirements include mandates related to emissions reductions, increasing the penetration of a particular resource type etc.

** These forecasts include DER output forecasts and DER adoption scenarios.

Source: Adapted from DSPx: Planning for a Modern Grid, Distribution Systems and Planning Training for Mid-Atlantic Region and NARUC-NASEO Task Force on Comprehensive Electricity Planning

Final Thoughts

Walk-Jog-Run Framework; Focused on Value

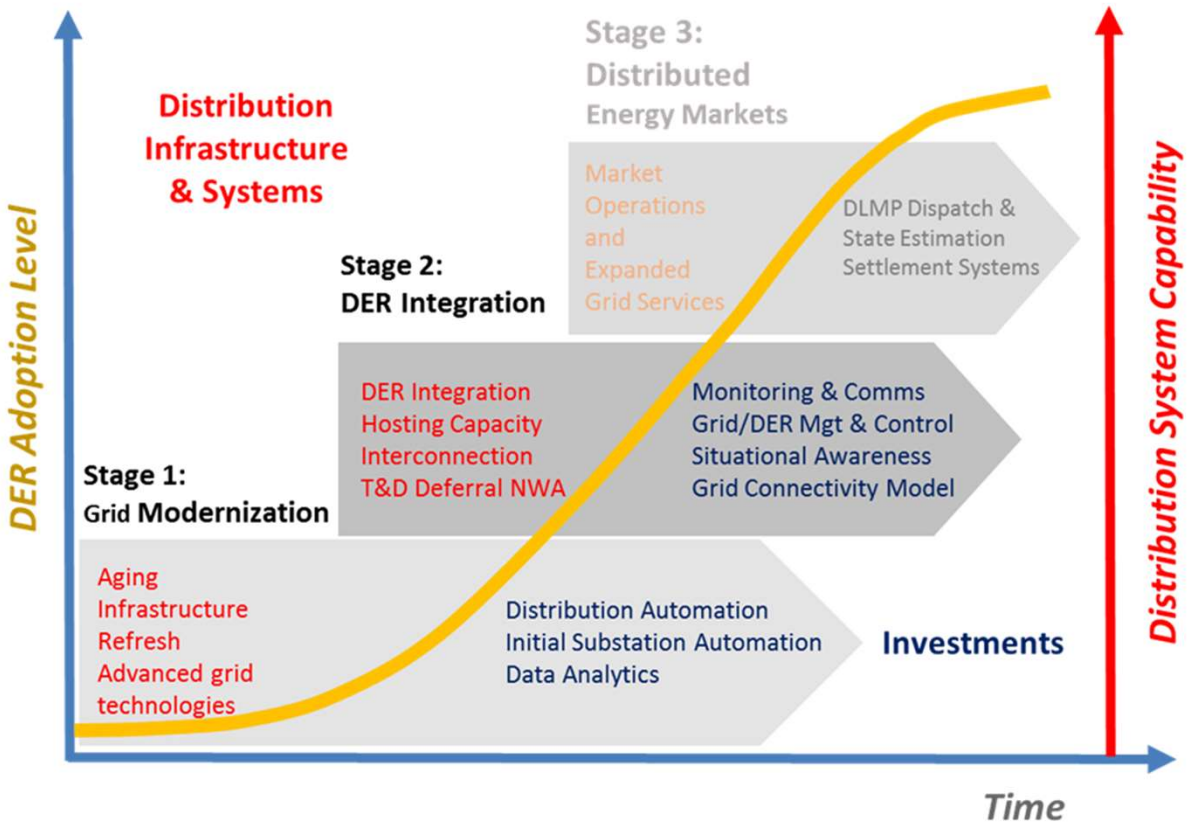


Image Source: Adapted from NY JU SDSIP

Thank You.