Rocky Mountain Institute

Environmental Context for DERs

Presentation to:

IL Working Group 6: Regulatory and Environmental Policy

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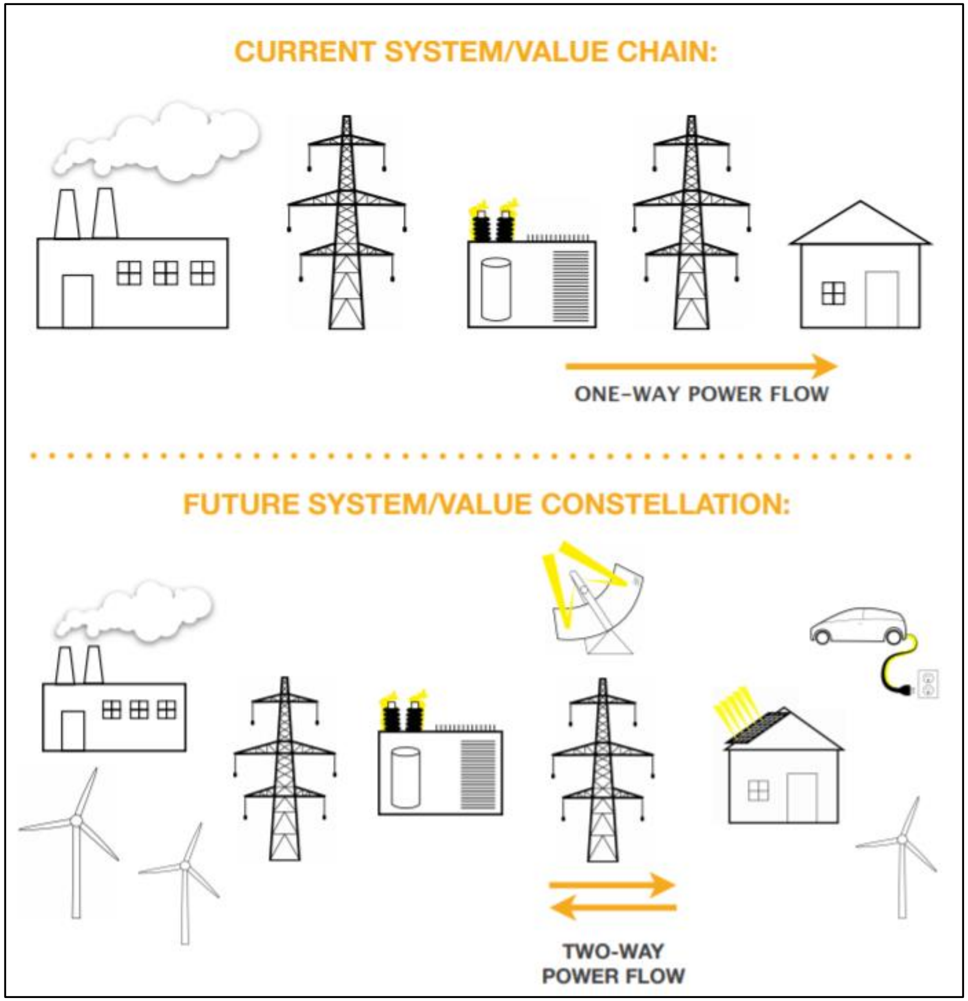
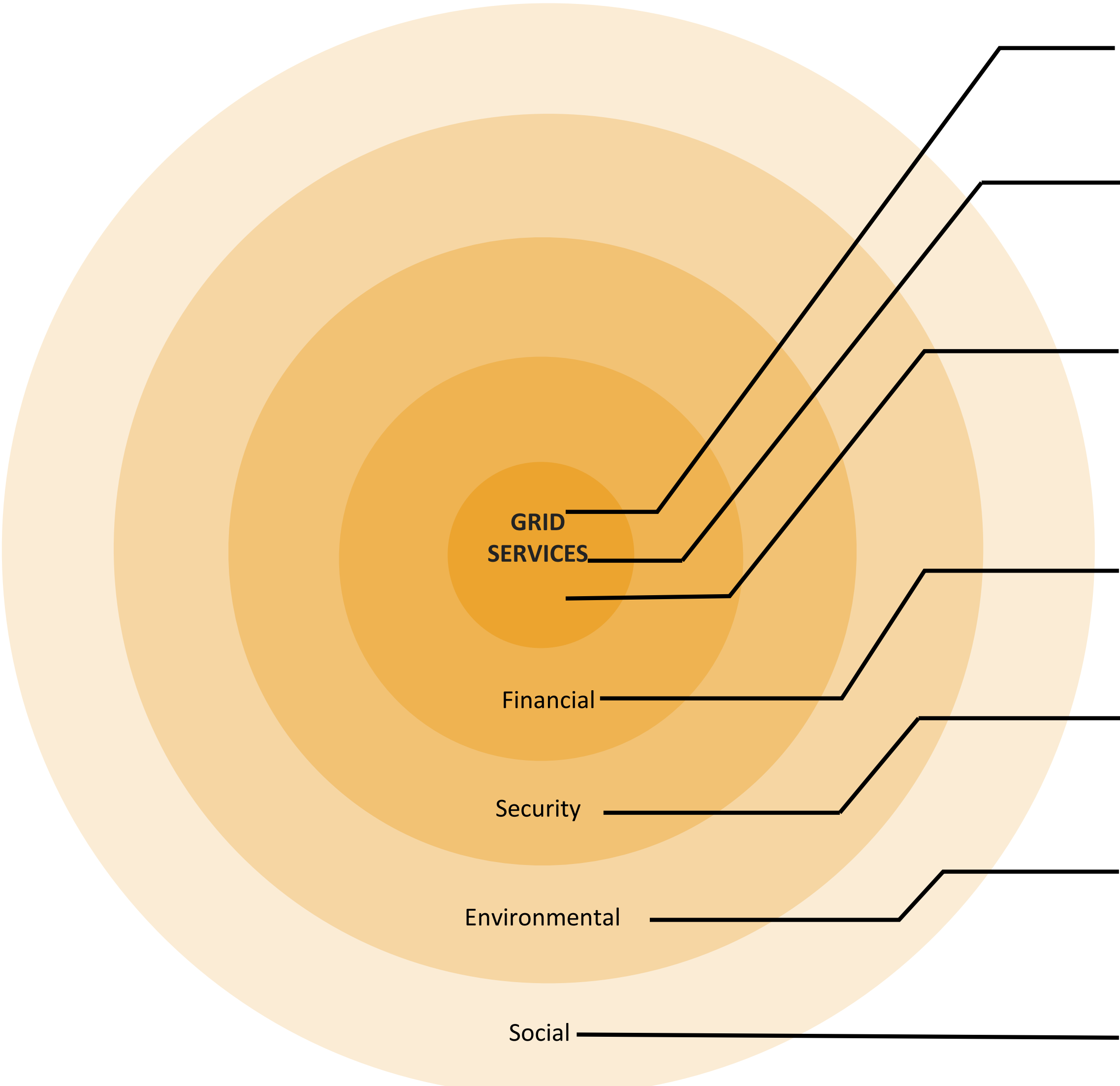
The grid is changing and the IL utility of the future can leverage DERs to capture a host of environmental and other benefits



- DERs provide an **environmental benefit** when they result in the **reduction of environmental or health impacts** that would otherwise have been created → avoidance metrics
- Key drivers include primarily the environmental impacts of the **marginal resource being displaced**
- There are **4 key areas** of environmental benefits that DERs can provide:
  1. Carbon
  2. Criteria air pollutants
  3. Water
  4. Land

Typically only a subset of all the functions DERs provide are considered:

The goal for this session is to problem solve how IL can take more into account



ENERGY
- energy
- system losses

CAPACITY
- generation capacity
- transmission & distribution capacity + O&M
- DER installed capacity

GRID SUPPORT SERVICES
- reactive supply & voltage control
- regulation & frequency response
- energy & generator imbalance
- synchronized & supplemental operating reserves
- scheduling, forecasting, and system control & dispatch

FINANCIAL
- fuel price hedge
- market price response
- non-energy utility costs

SECURITY RISK
- reliability & resilience

ENVIRONMENTAL
- carbon emissions
- criteria air pollutants (SOx, NOx, PM10)
- water
- land

SOCIAL
- Economic development (jobs and tax revenues)

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DERs include a variety of technologies with abundant application potential

Distributed energy resources (DERs) are demand- and supply-side resources that can be deployed throughout an electric distribution system to meet the energy and reliability needs of the loads served by that system. DERs can be owned by the user, a third party, or the utility, and can be used for a wide variety of applications.

Types of DERs

- Distributed generation (DG)
  - Solar photovoltaics (PV)
  - Combined heat and power (CHP)
  - Diesel generators
  - Gas-fired turbines
  - Fuel cells
- Distributed storage
  - Batteries
  - Thermal storage
  - Flywheels
- Demand-side management (DSM)
  - Energy efficiency (EE)
  - Demand response (DR)
  - Electric vehicles (EVs)

DER Applications

- Normal operating cost savings
  - Demand charge reduction
  - Energy savings
- Infrastructure cost savings
  - Capacity deferral
- Improved power quality
  - Voltage regulation
  - Frequency control
- Increased resiliency
  - Energy security
  - Reliability

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DER capabilities can be leveraged to provide a diverse set of benefits

Environmental Benefits

- **Carbon** - The value from reducing carbon emissions is driven by the emission intensity of displaced marginal resource and the price of emissions.
- **Criteria Air Pollutants** - The value from reducing criteria air pollutant emissions—NOX, SO2, and particulate matter—is driven by the cost of abatement technologies, the market value of pollutant reductions, and/or the cost of human health damages
- **Water** - The value from reducing water use is driven by the differing water consumption patterns associated with different generation technologies, and is sometimes measured by the price paid for water in competing sectors
- **Land** - The value associated with land is driven by the difference in the land footprint required for energy generation and any change in property value driven by the addition of DERs

Grid Benefits

- ◆ Reduced peak kW demand to lower utility demand charges
- ◆ Electricity generation to reduce commodity costs

- ◆ (yellow) Reduced peak demand allows for reduced capacity infrastructure (e.g., substation transformers)
- ◆ (yellow) Power quality capabilities reduce need for dedicated infrastructure (e.g., capacitors)

- ◆ (grey) Lower peak demand resulting in reducing generation capacity required
- ◆ (grey) Reduced quantity and size of backup generators required

◆ **Operating Cost Savings**

◆ (yellow) **T&D Capacity Deferral**

◆ (grey) **Generation Capacity Deferral**

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Policies to support DERs are important to ensure benefits are captured

➢ There are a wide range of policies that have been employed at state and federal levels to incentive DER deployment. Some key examples include:

State-Level	Federal-Level
Renewable Portfolio Standards	Investment Tax Credit
Clean Fuel Standards	Production Tax Credit
Greenhouse gas emissions targets	SOx & NOx
Carbon pricing (RGGI, CA AB32)	Renewable Fuel Standard
Net metering	FERC Order 841 / 845
Performance based ratemaking	
Value of DER	

Some states have also developed planning processes to specifically consider DER environmental benefits

NY Benefit Cost Analysis Example

Value Component	BCA Framework Component
Energy	Avoided energy
System Losses	Avoided Tx losses Avoided distribution losses
Generation Capacity	Avoided generation capacity
T&D Capacity	Avoided Tx infrastructure and O&M Avoided distribution infrastructure Avoided O&M (distribution) Incremental T&D costs
Grid Support Services	Avoided ancillary services Added ancillary service costs
Financial: Market Price Response	Wholesale market price impacts
Financial: Fuel Price Hedge	Not addressed and not applicable to NY
Financial: Non-Energy Utility Costs	Program administration costs Lost utility revenue Shareholder incentives
Security: Reliability and Resiliency	Net avoided outage costs Net avoided restoration costs
Environment: Carbon	Net avoided greenhouse gases
Environment: Other Factors	Net avoided criteria air pollutants Avoided water impacts Avoided land impacts Net non-energy benefits
Social: Economic Development	Not addressed

CA NWA Screening Criteria Example

Valuation for NWAs

Quantitative Factors:

- Net market value
- Resource adequacy value
- Energy value benefit
- Ancillary services value benefit
- Renewables portfolio standard benefit
- Reduced greenhouse gas emissions benefit
- Renewable integration cost/reduced cost benefit
- Distribution deferral value
- Transmission deferral value
- Contract payments cost; and

Qualitative Factors:

- Project viability
- Voltage and other power quality services
- Equipment life extensions
- Societal net benefits,
- Other factors such as supplier diversity, counterparty concentration, site diversity, and technology/end-use directory to help market transformation

Demo C Reporting Metrics

- DER Capacity Output
- DER Energy Output
- Local Utility System Voltage
- Utility Circuit Load
- Utility Circuit Energy
- Utility to DER dispatch request
- Utility System Energy Mix
- DER Project Capacity Factor
- DER Project Capacity Cost
- DER Project Energy Cost
- DER Reactive Power Output
- Distribution Capacity and Hosting Capacity Service Effectiveness
- DER Readiness & Assurance
- Process Evaluation
- Point of Common Coupling Voltage Support
- Turn Around Efficiency
- DER Operational Mode Validation
- DER Real Power Output
- DER Reactive Power Output
- Communication Latency/Resiliency
- LNBA Validation
- Effectiveness of proposed autonomous operations

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IL must consider the entire toolkit at its disposal to support DERs

- Some parting thoughts to prime discussion:
  - There are a wide variety of DERs, which ones should IL focus on fostering?
  - How do grid planning, net metering compensation, utility business models, and incentive policies overlap?
  - Which frameworks are most effective for ensuring capturing the range of values from DERs?