

Microgrids and Distributed Generation

E2Tech Energy Forum

April 17, 2014



**CENTRAL MAINE
POWER**

Corporate Perspective:

- **Distributed Energy Resources (DER) benefit consumers and have broad social and environmental benefits as well.**
- **The grid is the critical enabling system for these technologies; the social and economic benefits are a product of the connection.**
- **Utilities gauge costs & benefits on a system basis:**
 - Safe and adequate service
 - Just and reasonable rates

Characteristics of a Microgrid

- **Small scale electricity distribution system connecting multiple customers to shared distributed generation sources.**
- **Capable of disconnecting from the grid (islanding), and maintaining a stable supply/demand balance and power quality.**
- **Most successful models include combined heat and power units that serve multiple facilities.**
- **May include renewable generation and energy storage such as grid-scale battery systems.**

Microgrid Installations

Drivers

- **Increased reliability in emergency conditions**
- **Government incentives and policies**
- **Low price of natural gas**
- **Advances in technology (especially in generation)**

Trends

- **Installed in limited applications (university/military)**
- **Niche opportunity to create limited, self-sustaining “islands” for disaster situations, e.g, a hospital, nursing home, and public safety facilities**
- **Taking existing options—back-up generation or dual-feed agreements—to the next level of reliability**

Distributed Energy Resources

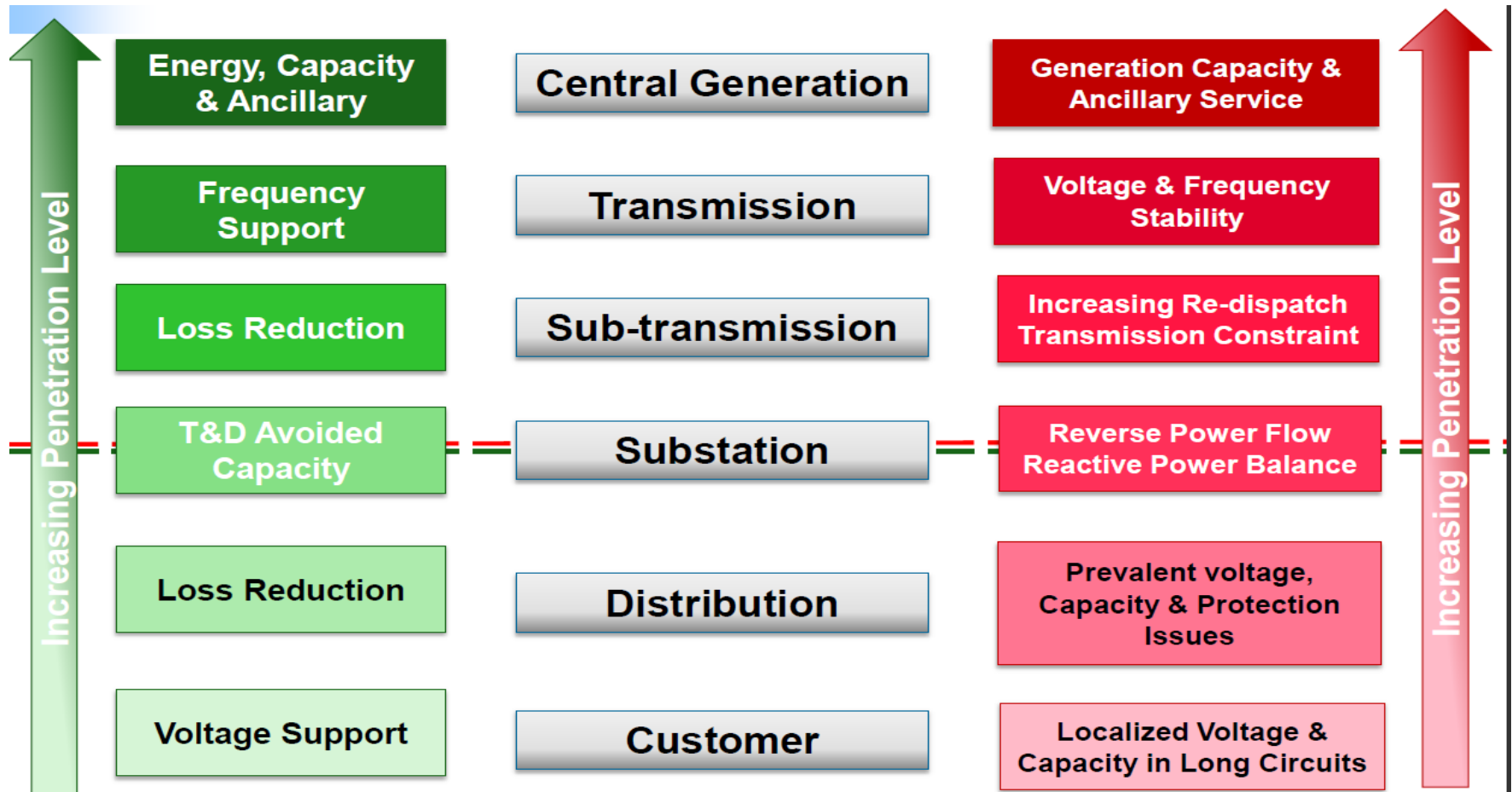
Drivers

- **Government policies matched with incentives**
- **Interest in environmental sustainability**
- **Advances in technology (especially in generation)**
- **Improving economics- technology and policy driven**

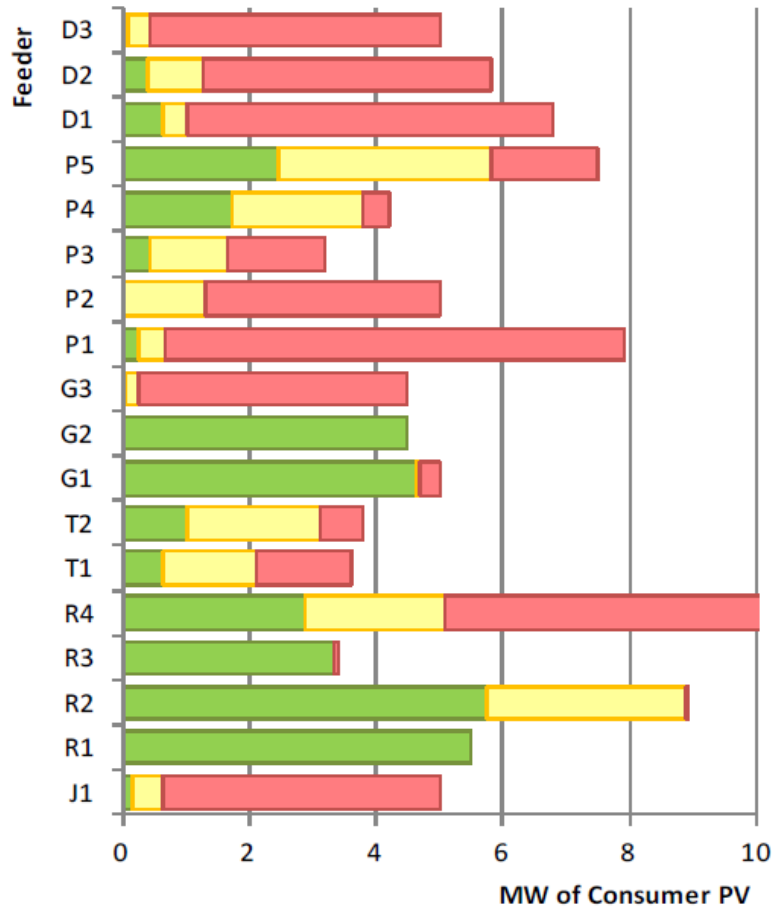
Trends

- **Increasing numbers of small, grid-connected installations**
- **Primarily intermittent resources, most commonly PV**
- **Located on distribution level circuits**
- **Costs & benefits are not matched to rate design**

Cost/Benefit Considerations of DER



Distribution Feeder Impacts: Illustration



All penetrations are acceptable, regardless of location

Some penetrations are acceptable, depends on location

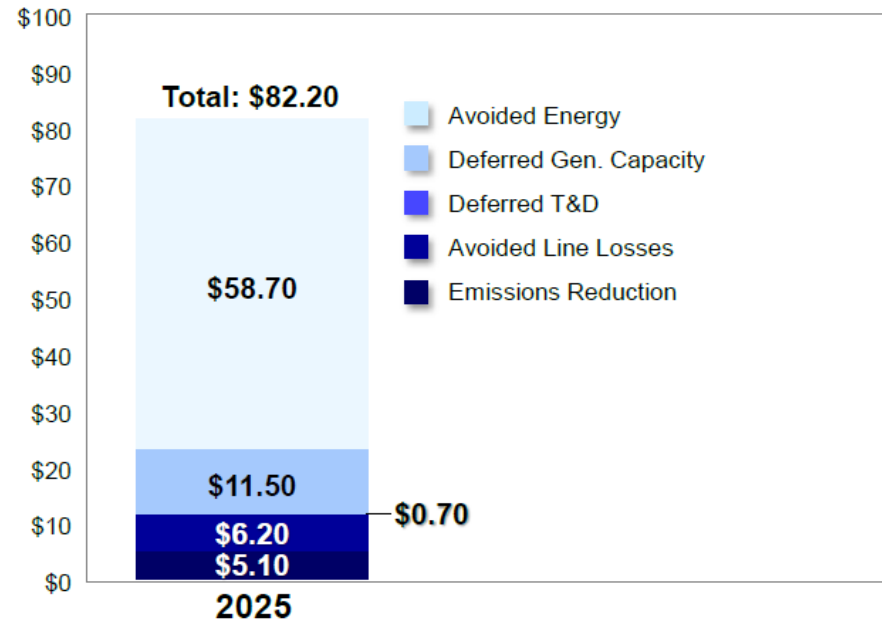
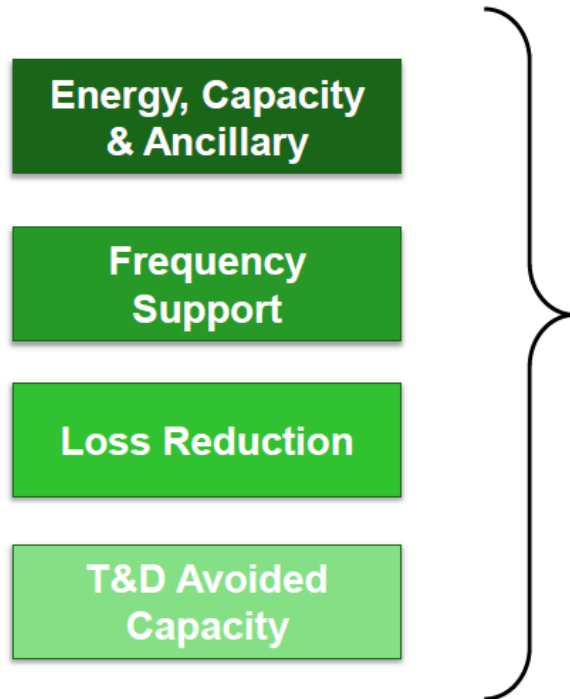
No penetrations are acceptable, regardless of location

Each feeder has

- a unique hosting capacity
- a unique “range” that can be accommodated
- unique constraint that limits hosting capacity

**EPRI Methodology and Tools Provide Accurate Insight
Compared to Rules of Thumb**

From System Impact to Benefit/Cost



Xcel Energy Avoided Cost for 59MW of PV Deployment (\$/MWh)

Source: "Costs and Benefits of Distributed Solar Generation on the Public Service Company of Colorado System," Xcel Energy Services, Denver, May, 2013.

Utility Considerations with Microgrids and DER

1. Standardize interconnection rules, technical guidelines, operating rules, and communications protocols
2. Assessment and deployment of advanced distribution technologies (utility and consumer)
3. Integrate DER with Grid Planning (distribution and transmission)
4. Align policy and regulations

