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ComEd's Advanced Distribution System Planning

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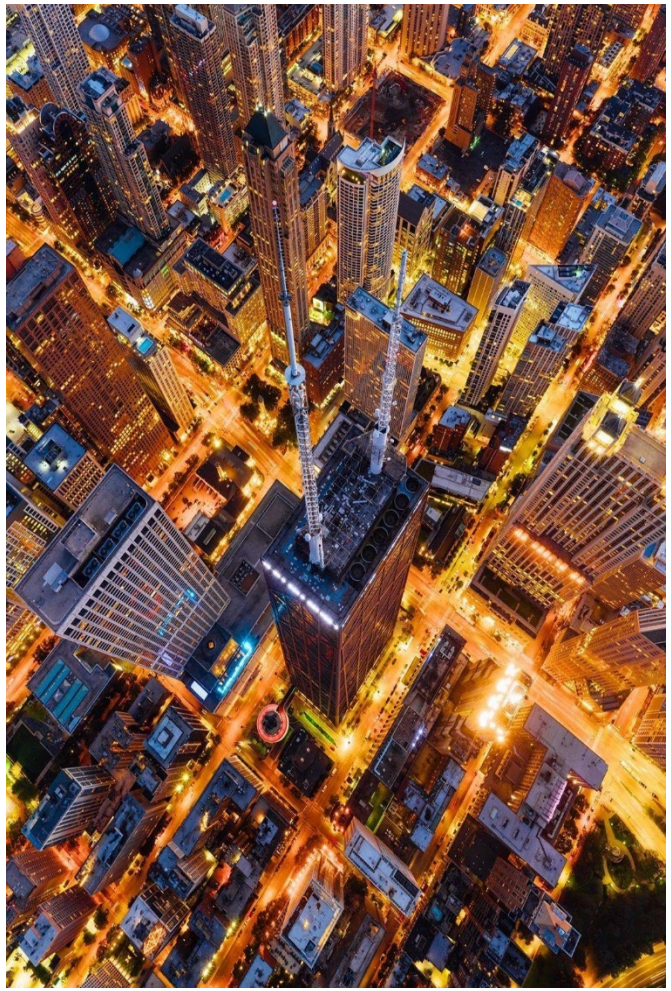
Our Company:
- One of six utilities owned by Exelon
- 6,400 Employees
- Service Territory: 11,428 square miles

Our Customers:
- More than 4.1 million customers in northern Illinois including the City of Chicago

Our Grid:
- Peak Load: 23,753 MW (7/20/2011)
- 553,800 distribution transformers
- 66,200 circuit miles of primary distribution
- 53% overhead, 43% underground
- 5,800 circuit miles of transmission
- 93% overhead, 7% underground



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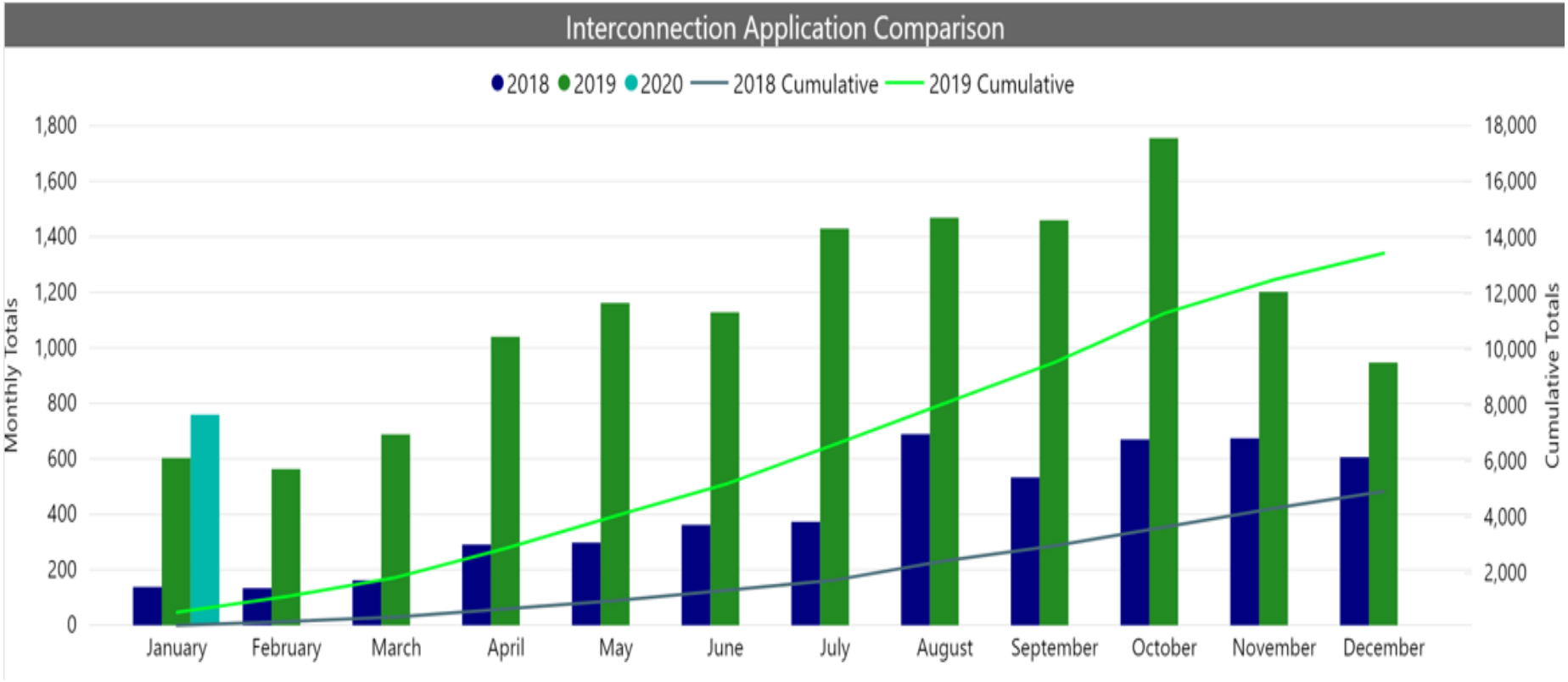
Increasing Interconnection Requests Changing Grid



Data as of 1/27/2020

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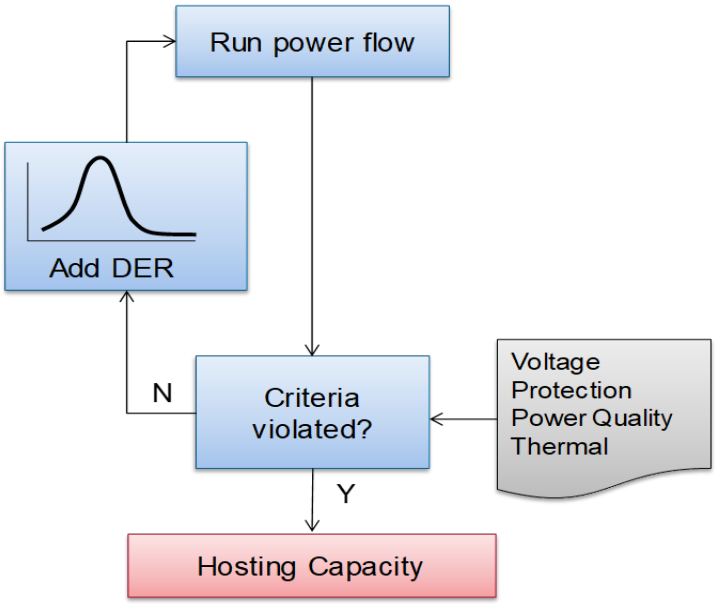
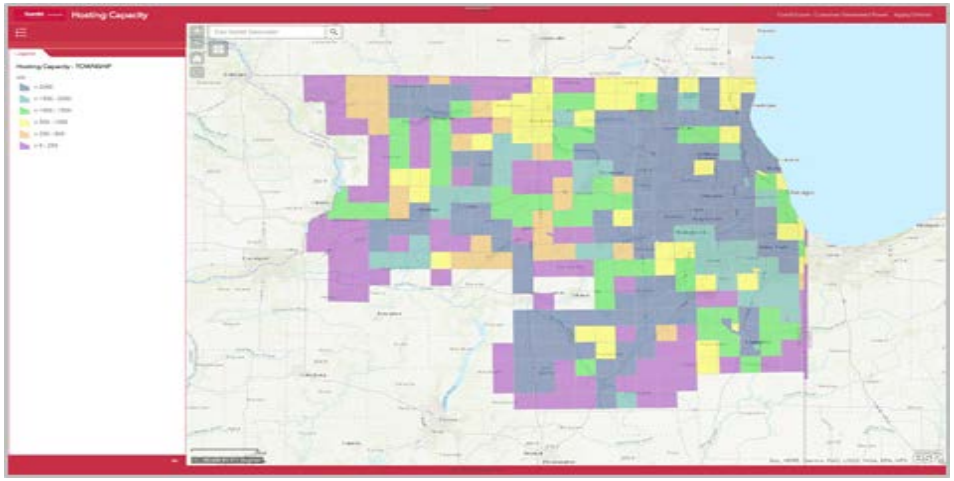
Advanced Planning Tools to Integrate DER

DER Hosting Capacity Analysis:

- Determine DER per feeder that can be accommodated without impacting power quality or reliability under existing control and infrastructure configurations.
- After all feeder models were created, they were analyzed to determine Hosting Capacity amount per feeder.





Visualization:

- ComEd displays results via a dynamic scaling that colors to highest hosting capacity at township, section, quarter-section, sixteenth-section & feeder

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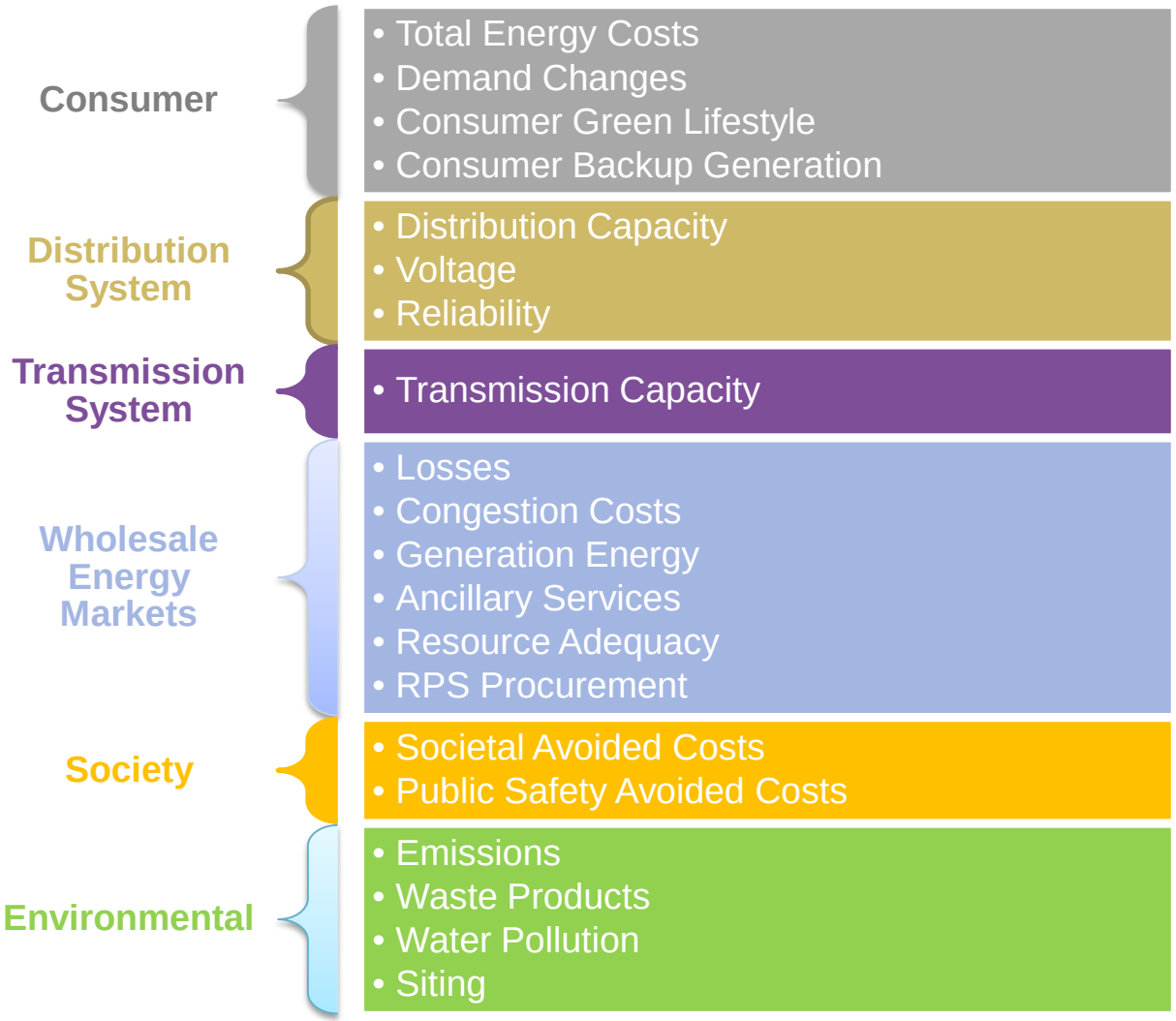
Valuing DER's Contributions to the Grid



Value to Distribution Grid

- DER value is realized by various parties.
- Several categories of value are potentially realized from DER.
- Some value streams are associated with value to the distribution grid.
- Distribution grid value streams are much more dependent on DER location, type and time.

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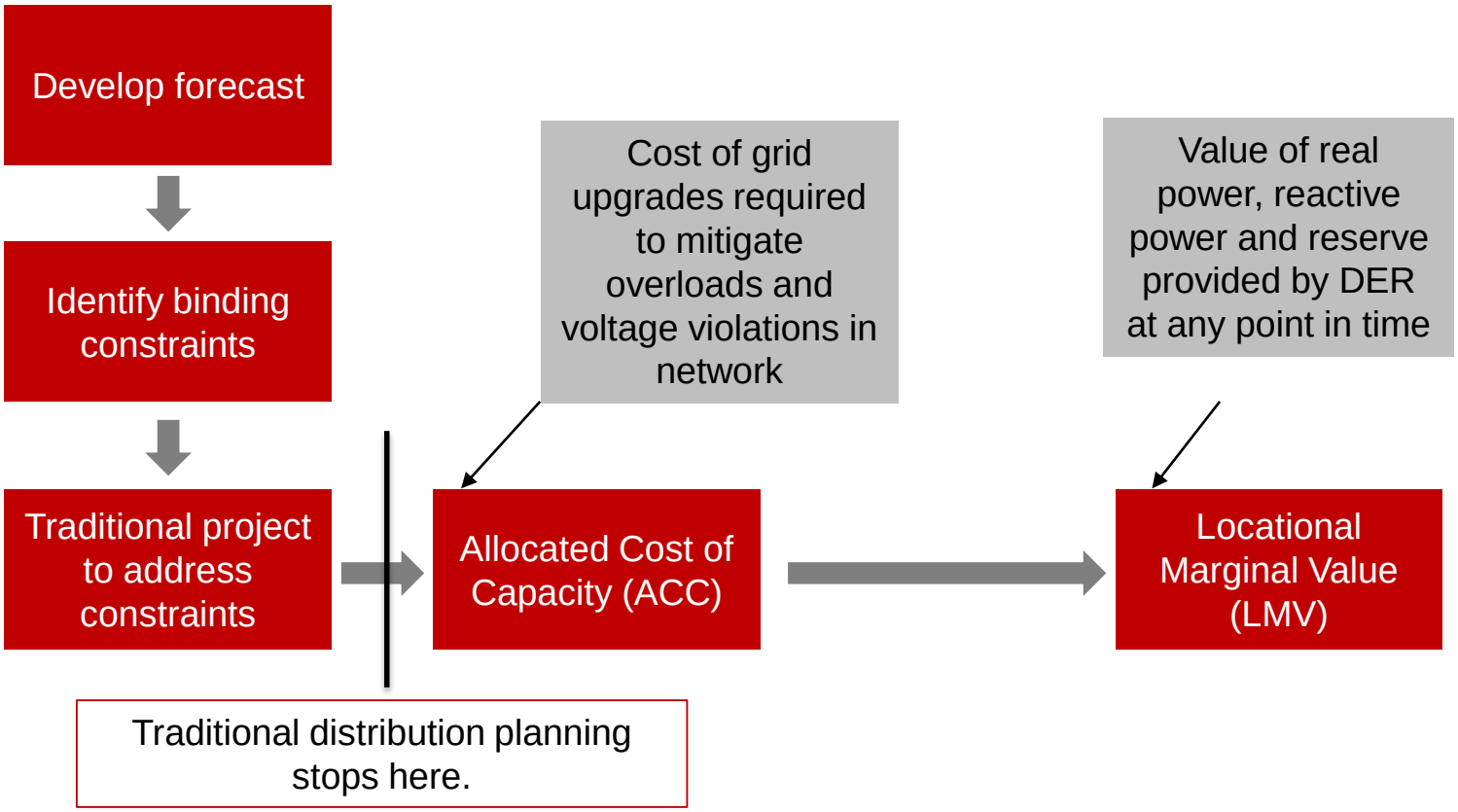
New Methodology for Valuing DER



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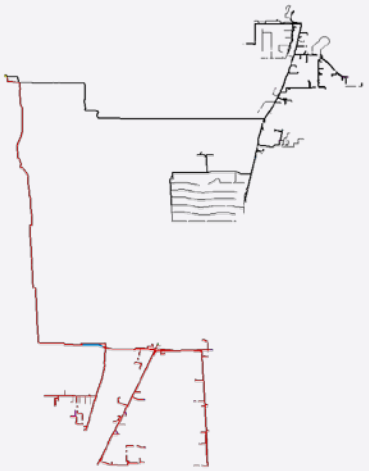
Energy Storage Tool for Planning and Analysis

Feeder Model



Battery Size

- Time-series power flow simulations size the battery system (CYME and Python)

Economics

- Battery cost - Argonne National Labs “BatPac” (Excel/Crystal Ball)
- Optimal BESS charge/discharge
- Valuation for
  - Peak shaving
  - Time arbitrage
  - Ancillary market

Benefit Cost Analysis

- Cost-benefit analysis (MATLAB and Excel/Visual Basic)
- NPV of BESS vs T&D upgrades

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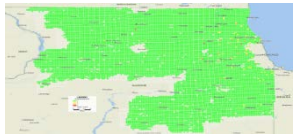
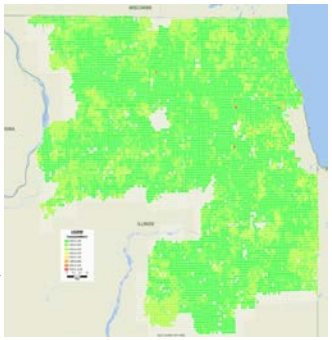
Using Metrics to Identify Optimal Locations for Microgrids

ComEd developed a resilience metric approach to produce a robust screening for prime locations for microgrid deployment, based on inputs impacting resilience and need for resilient power infrastructure



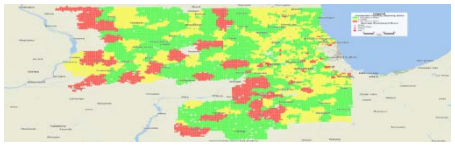
Critical Infrastructure Metric



Resilience Metric

Reliability Metric

Substation Metric



Capacity Planning Metric

$$Resilience\ Metric\ =\ a_1 * Critical\ Infrastrucuture\ Metric + a_2 * Reliability\ Metric + a_3 * Capacity\ Planning\ Metric + a_4 * Substation\ Metric$$

where a_1, a_2, a_3, a_4 are weighing factors for individual metrics

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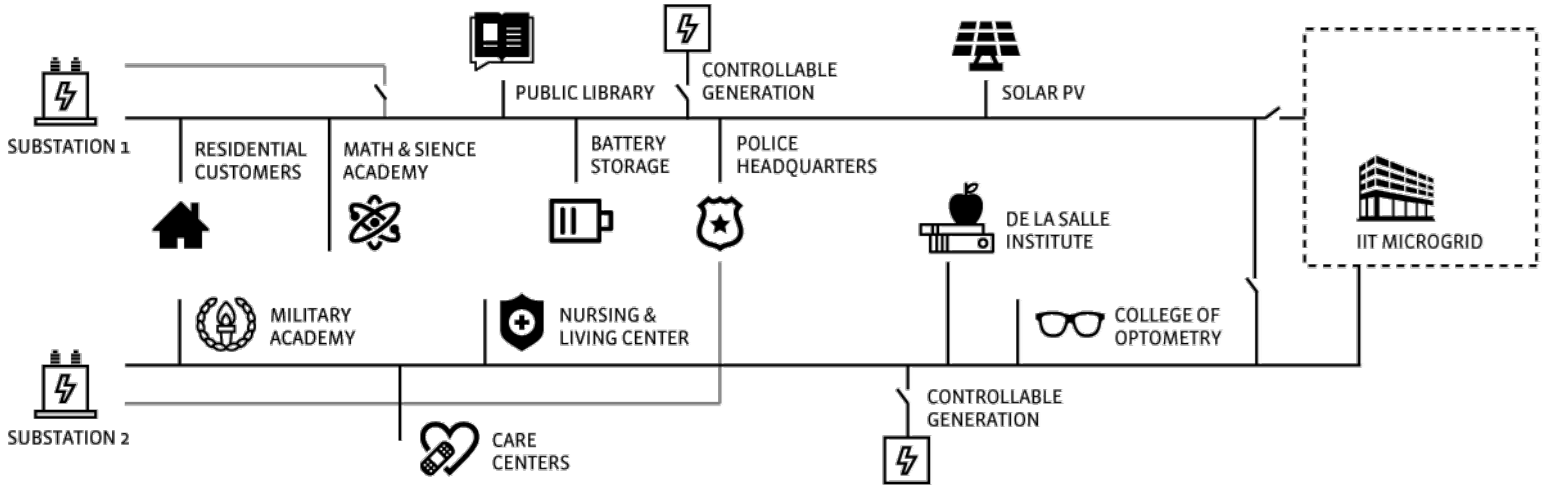
Bronzeville Community Microgrid (BCM)

- The Bronzeville Community Microgrid enables a green, resilient, sustainable neighborhood for consumers.
- 7 MW aggregate load, serving approximately 1,000 residences, businesses and public institutions
- Installation of first utility-operated microgrid cluster powered by DER including solar PV and energy storage
- Demonstration of advanced technologies supported by six grants from the Department of Energy
- These technologies have been developed with partnerships with universities, vendors, and national labs



NuGrid

NREL Transforming ENERGY

Argonne NATIONAL LABORATORY

ILLINOIS INSTITUTE OF TECHNOLOGY

UNIVERSITY of DENVER

QUANTA TECHNOLOGY

SIEMENS

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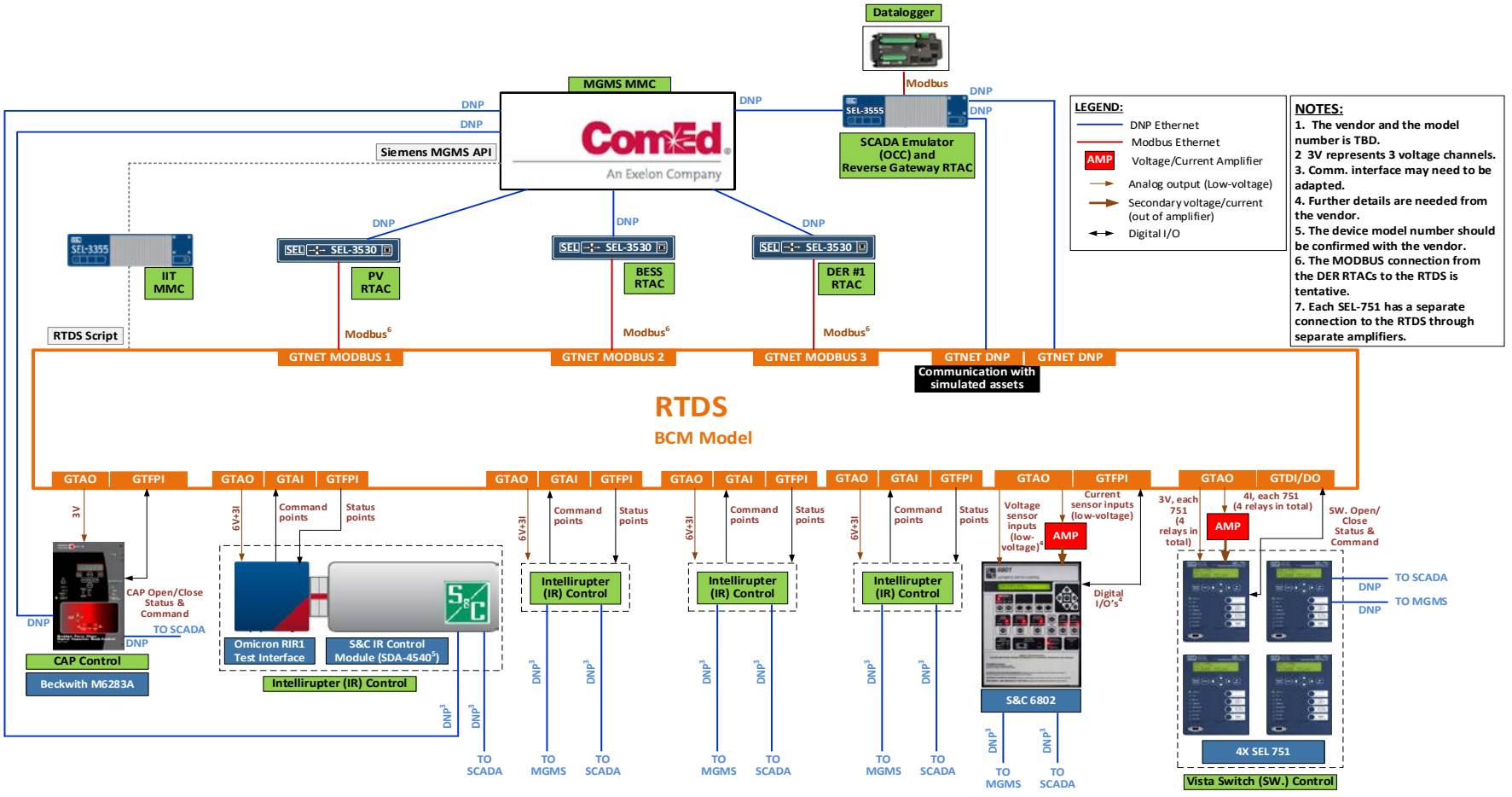
Advanced Model for Testing Emerging Technology

•Advance modeling capability for hardware in the loop (HIL) test on emerging technology



What Advanced Planning Models Enable

	Modernize for Reliability	Resiliency and Security	Customer Choice – DER Acceleration	Decarbonization / Electrification	"Connected Communities"
Customer Value by Stage	*Improving reliability for customers by creating a smarter grid that can "self-heal" and minimize disruptions*	*Ensuring resiliency and security against threats - cybersecurity attacks and extreme weather events*	*Enabling customers to adopt DER, e.g. solar, storage, and ultimately transact as prosumers in an open marketplace*	*Achieving climate change objectives, through electrification – transport, business and residential*	*Providing better city services for citizens – broader infrastructure role, e.g., water, leveraging data and technology*

Affordability **Reputation** **Social**

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