Emerging distribution planning analyses

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Distribution Systems and Planning Training for Southeast Region
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Outline

1) Introduction
2) Distributed Energy Resources (DER) growth and load forecasting
3) Hosting capacity
4) Locational net benefits analysis and distribution deferral opportunities
Introduction
DERs can impact system costs and reliability

► Impacts on the bulk power system
  ■ Variability
  ■ Generation not aligned with demand
  ■ May lead to oversupply
  ■ Provision of energy only – may not be providing capacity or ancillary services
  ■ Operational reliability – visibility, controls and communications

► Impacts on the distribution system
  ■ Depends on DER profile compared to feeder loading
  ■ Depends on location
  ■ Depends on DER capabilities and functionalities

► Deployment is optimized on customer economics. Customer economics and utility cost drivers often do not align.
Passive DER planning can be a mess

Autonomous DER deployment with little information/guidance

- Customer decides what DER to install, how big, where, and how to operate it
  - Utilities must manage integration
  - Unfavorable locations lead to expensive interconnection, with no one happy
- If the next DER requires upgrade or mitigation, that next customer is responsible, even though it might enable future DERs
- Utility compensates customer (e.g., net metering, fixed tariff)
  - Compensation may not reflect actual net value that DER brings
- Does utility need generation at that time and place? What is the value of demand flexibility at that time and place?
Proactive planning is more effective

Tell customers where the grid needs help. Tell customers what services the grid needs. Incentivize them.

- Load/DER forecasting helps resource planners avoid overbuilding and feeds into analysis of which feeders may be stressed by DER in the near-term.
- Hosting capacity shows how much more DER can be managed on a given feeder easily, or where interconnection costs will be low/high.
- Together, these can identify feeders that are likely to see DER growth and may need proactive upgrades.
- Locational net benefits analysis helps determine the benefits of specific services at a specific location to guide developers.
- Defer some traditional infrastructure investments through cost-effective non-wires alternatives that provide specific services at specific locations
- Leverage customer and third-party capital investments
- Inform rates and tariffs
DER Growth and Load Forecasting

Feeding into the resource planning and distribution planning processes
1. DER Growth and Load Forecasting

Example of load forecasting with DER

Con Edison, *Distributed System Implementation Plan*, June 30, 2016
### 1. DER Growth and Load Forecasting

Where does the data come from?

<table>
<thead>
<tr>
<th>Distributed Photovoltaics (PV) Data source</th>
<th>Source</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic and socio-economic (customer characteristics)</td>
<td>US Census Bureau</td>
<td>Census tract/zip code</td>
</tr>
<tr>
<td>Demographic and socio-economic (customer characteristics)</td>
<td>Experian</td>
<td>Customer (res. only)</td>
</tr>
<tr>
<td>PV adoption history (historical PV adoption)</td>
<td>CA DGStats Database</td>
<td>zip code</td>
</tr>
<tr>
<td>IEPR forecast of solar PV (system level PV forecast)</td>
<td>CEC</td>
<td>System</td>
</tr>
<tr>
<td>GIS and parcel data (GIS info showing new development)</td>
<td>Integral Analytics</td>
<td>Zip code and/or parcel</td>
</tr>
<tr>
<td>PV adoption history and metered output where available</td>
<td>IOUs</td>
<td>Customer</td>
</tr>
<tr>
<td>Energy usage (historical energy usage)</td>
<td>IOUs</td>
<td>Customer</td>
</tr>
<tr>
<td>Service accounts and rate structure</td>
<td>IOUs</td>
<td>Customer</td>
</tr>
<tr>
<td>System topology (electrical topology showing customer, circuit, substation, IOU system)</td>
<td>IOUs</td>
<td>Electrical hierarchy</td>
</tr>
<tr>
<td>PV technical potential and profile (technical potential; typical solar shapes)</td>
<td>NREL</td>
<td>Zip code</td>
</tr>
<tr>
<td>Building stock growth forecast (Moody’s forecast)</td>
<td>New Solar Homes Partnership</td>
<td>System</td>
</tr>
</tbody>
</table>

Itron, Distribution Forecasting Working Group Final report June 28, 2018
Load profiles/shapes are important

- “Peak” is moving because of a changing grid
- Resource adequacy now needs to be based on hourly data – can’t just look at peak hour/day
- System peak is different from circuit peak

Source: PG&E, Distribution Resources Plan, 2015
Load profiles/shapes are important

- “Peak” is moving because of a changing grid
- Resource adequacy now needs to be based on hourly data – can’t just look at peak hour/day
- System peak is different from circuit peak

Graphic: W. Henson, ISONE, 2016

Source: PG&E, Distribution Resources Plan, 2015
Findings from DER growth

- DERs likely to cluster
- To estimate DERs, we need to understand load and adoption patterns
- Past behavior may not be indicative of future behavior

Residential

Non-Residential

PG&E, Distribution Resources Plan Webinar, Aug. 3, 2015
National Grid example: Impacts on load forecasting

- Reconstruct historical load by adding energy efficiency (EE), demand response (DR), PV, and storage back in and removing EVs.
- Use hourly profiles because each of these has variability during the day/season.
- Determine EE, PV, DR, storage, EV growth. Determine load growth. Construct net load forecasts for peak demand.

**Figure 2: Historical (actual & weather-adjusted) and Projected Summer Peaks**

National Grid example: Impacts on load forecasting

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- Use hourly profiles because each of these has variability during the day/season
- Determine EE, PV, DR, storage, EV growth. Determine load growth. Construct net load forecasts for peak demand

National Grid example: DER impacts on peak

What’s happening to the PV contribution? The peak hour shifts during those years to a later hour when PV provides less contribution.
National Grid example: Different DER scenarios show potential futures

National Grid example:
Different DER scenarios show potential futures

National Grid example: Differences in scenarios greatest at midday

1. DER Growth and Load Forecasting

National Grid example:
Differences in scenarios greatest at midday
In 2017, created hourly forecasts for each substation and each feeder.
- Calibrated with actual peak load for each feeder.
- Developed hourly customer load profiles for feeder model.
- Put into GRIDLAB-D.
Considerations for DER growth and load forecasting

► Which DER are considered?
► Are hourly profiles considered? Does timing of system peak change?
► What data is used to determine growth rates for new DER and how does it vary by location?
► What scenarios are used to model potential futures and do they encompass a broad enough range for planning purposes?
► What range of uncertainty is used in examining inter-annual variability on feeders? On the bulk power system? For example, the average over the last 20 years? Planning for a 1 in 10 year event? A 1 in 20 year event?
Integration Capacity Analysis/Hosting Capacity

Inform customers and distribution planning, streamline interconnection, improve real-time operations
2. Hosting Capacity Analysis

Why?

► Guide development: Which locations are easier or harder to interconnect?
► Technical screen: Streamline and potentially automate the interconnection process
► Inform distribution planning, such as where to proactively upgrade the grid to accommodate autonomous DER growth
► Dynamic hosting capacity: operational use; real-time impacts of DER

2. Hosting Capacity Analysis

Why?

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► Technical screen: Streamline and potentially automate the interconnection process

► Inform distribution planning, such as where to proactively upgrade the grid to accommodate autonomous DER growth

► Dynamic hosting capacity: operational use; real-time impacts of DER

Graphic: EPRI. *Impact Factors, Methods, and Considerations for Calculating and Applying Hosting Capacity*, Feb 2018
2. Hosting Capacity Analysis

Why?

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► Technical screen: Streamline and potentially automate the interconnection process
► Inform distribution planning, such as where to proactively upgrade the grid to accommodate autonomous DER growth
► Dynamic hosting capacity: operational use; real-time impacts of DER

Graphic: ICF, Integrated Distribution Planning, August 2016
2. Hosting Capacity Analysis

Why?

► Guide development: Which locations are easier or harder to interconnect?
► Technical screen: Streamline and potentially automate the interconnection process
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► Dynamic hosting capacity: operational use; real-time impacts of DER

Graphic: PG&E, Distribution Resources Plan Webinar, Aug. 3, 2015
Data Inputs

- Feeder models
- GIS data of distribution infrastructure
- SCADA data at substation - loading
- Current and future DER (or scenarios) – size, location, type, control, aggregation
- Voltage regulation – operational field settings
- Grid configuration – operational reliability

2. Hosting Capacity Analysis

Power system criteria for hosting capacity

**Power System Criteria**

- **Thermal**
  - Substation transformer
  - Primary conductor
  - Service Transformer
  - Secondary Conductor

- **Power Quality/Voltage**
  - Sudden (fast) voltage change
  - Steady-state voltage
  - Line regulator or substation LTC
  - Capacitor switching

- **Protection**
  - Relay reduction of reach
  - Sympathetic tripping
  - Element fault current
  - Reverse power flow (backfeed)

- **Reliability/Safety**
  - Unintentional islanding
  - Operational flexibility

*Integration of Hosting Capacity Analysis into Distribution Planning Tools, EPRI, 2015*
2. Hosting Capacity Analysis

We don’t know where the PV will be interconnected

There are 4,000-5,000 nodes on this feeder where PV could be interconnected.

Graphic: S. Matic, GE Energy Consulting, 2017
PV location makes a huge difference

Feeder voltage profile

**PV = 0%**

2. Hosting Capacity Analysis

PV location makes a huge difference

Feeder voltage profile

Single PV = 20%

2. Hosting Capacity Analysis

PV location makes a huge difference

Feeder voltage profile

Single PV = 20%

2. Hosting Capacity Analysis

PV location makes a huge difference

Feeder voltage profile
Distributed PV = 20%

# Summary of Hosting Capacity Methodologies

<table>
<thead>
<tr>
<th>Type</th>
<th>Load levels</th>
<th>Scenarios</th>
<th>Run time</th>
<th>Data intensive</th>
<th>Application</th>
<th>Example users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stochastic</td>
<td>Varies</td>
<td>Thousands</td>
<td>Hours</td>
<td>Yes</td>
<td>Planning, information</td>
<td>Pepco, ComEd</td>
</tr>
<tr>
<td>Streamlined</td>
<td>576</td>
<td>Many</td>
<td>Minutes</td>
<td>Yes</td>
<td>Planning, information</td>
<td>PG&amp;E originally</td>
</tr>
<tr>
<td>Iterative</td>
<td>576</td>
<td>One DER</td>
<td>Hour(s)</td>
<td>Yes</td>
<td>Planning, information, interconnection study</td>
<td>SCE, SDG&amp;E, PG&amp;E</td>
</tr>
<tr>
<td>Hybrid/DRIVE</td>
<td>2</td>
<td>Centralized, distributed, rooftop PV</td>
<td>Minutes</td>
<td></td>
<td>Planning, information, interconnection study</td>
<td>Xcel, NY, National Grid, TVA</td>
</tr>
</tbody>
</table>

This is a generalized summary. Specific approaches may vary.
2. Hosting Capacity Analysis

Xcel Energy example: Hosting Capacity Analysis (HCA)

- November 2019 study
  - 1,050 feeders were analyzed using EPRI’s DRIVE tool
  - Examined distributed generation (not batteries, not EVs)
  - Examined peak and minimum load
  - Compared results to actual interconnection studies
  - Outreach and stakeholder engagement for desired data outputs
  - Cost of analysis, license, mitigation, etc. - $630k

- Results in heat maps and tables
  - 129 feeders have zero HC – most of these have significant DER already

- Case study sensitivity analysis on one feeder
  - Big impacts from feeder loading, DER location

- Mitigation options analysis on 95 feeders with zero HC from 2018 study
  - Over a third of these could increase HC (by about 2MW on average) for <$5k

2. Hosting Capacity Analysis

Xcel Energy example: Heat map results for HCA

## 2. Hosting Capacity Analysis

### Xcel Energy example: Mitigation

<table>
<thead>
<tr>
<th>Category</th>
<th>Impacts</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>Overvoltage</td>
<td>Adjust DER power factor setting, reconductor</td>
</tr>
<tr>
<td></td>
<td>Voltage Deviation</td>
<td>Adjust DER power factor setting, reconductor</td>
</tr>
<tr>
<td></td>
<td>Equipment Voltage Deviation</td>
<td>Adjust DER power factor setting, adjust voltage regulation equipment settings (if applicable), or reconductor</td>
</tr>
<tr>
<td>Loading</td>
<td>Thermal Limits</td>
<td>Reconstructor, replace equipment</td>
</tr>
<tr>
<td>Protection</td>
<td>Additional Element</td>
<td>Adjust relay settings, replace relays, replace protective equipment</td>
</tr>
<tr>
<td></td>
<td>Fault Current</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Breaker Relay</td>
<td>Adjust relay settings, replace relays, move or replace protective equipment</td>
</tr>
<tr>
<td></td>
<td>Reduction of Reach</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sympathetic Breaker Relay</td>
<td>Adjust relay settings, replace relays, move or replace protective equipment</td>
</tr>
<tr>
<td></td>
<td>Tripping</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unintentional Islanding</td>
<td>Installation of Voltage Supervisory Reclosing</td>
</tr>
</tbody>
</table>

Are these the only mitigation options? No. Does Xcel use all of these options today? No. But this strikes a balance between a semi-automated process and cost-effective capabilities that we are on the cusp of using in the near future.

2. Hosting Capacity Analysis

Xcel Energy example: Hosting Capacity violations

94 Feeders With Zero Hosting Capacity

2. Hosting Capacity Analysis

Xcel Energy example: Hosting Capacity gain and cost

Considerations for hosting capacity analysis

- What is the goal or use case for your utility?
- Does HC provide value in this use case?
- Does the utility have appropriate data so that results are meaningful and accurate?
- How can privacy be protected as data is used or as HC results are publicized?
- Is the HC method appropriate for the use case and the available data?
- How will results be communicated to developers and other stakeholders?
- What is the cost of doing this analysis in terms of engineering labor and money? Are the costs outweighed by the benefits?
Locational Net Benefits Analysis

Preparing for Non-Wires Alternatives
Why LNBA?

► What is the value of providing this service at this time at this location?

► Compensation for DER
  ■ Inform compensation such as value of solar tariff or net metering; programs and incentives; and rate design

► Non-wires alternatives (NWA)
  ■ What are the costs of the traditional upgrades that the utility would otherwise undertake?
  ■ What is the suitability of NWAs to distribution system needs?
  ■ Public tool and heat map
  ■ Prioritization of candidate distribution deferral opportunities
  ■ Determine cost-effectiveness, compare projects
3. Locational Net Benefits

Benefits of DERs

Ben Kellison, “Unlocking the Locational Value of DER 2016: Technology Strategies, Opportunities, and Markets,” January 2016,
These value streams have ripple effects

If you avoid X distribution losses
Then you avoid Y transmission losses associated with X
A generator avoids producing X+Y
Possibly less capacity is needed to serve X+Y
Possibly even less capacity due to reserve planning margin

Calculate the localized impacts first

Ben Kellison, “Unlocking the Locational Value of DER 2016: Technology Strategies, Opportunities, and Markets,” January 2016,
Stacking the value stream for rooftop PV

25-year levelized Value of Solar

<table>
<thead>
<tr>
<th>Year</th>
<th>DPV</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7.1MW</td>
<td>20MW</td>
<td>50MW</td>
<td>100MW</td>
</tr>
<tr>
<td>UPV</td>
<td>19MW</td>
<td>89MW</td>
<td>89MW</td>
<td>89MW</td>
</tr>
</tbody>
</table>

GE, Solar Program Design Study, 2017
3. Locational Net Benefits

**PG&E example:** Distribution Investment Deferral Framework (DIDF)

- Transparent process to create candidate deferral shortlist, grid mod investments, & proactive hosting capacity upgrades to accommodate forecasted DER growth
- 5 year planning horizon
- Grid Needs Assessment (GNA)
- Investment projects
- Technical and timing screens
  - Capacity, reactive power, voltage, reliability (backtie), resiliency (microgrid)
  - Can DER provide required service?
  - Operating date
- Prioritization metrics
  - Cost-effectiveness
  - Forecast certainty
  - Market assessment

Source: PG&E’s 2018 Distribution Deferral Opportunity Report, Sep. 4, 2018
3. Locational Net Benefits

PG&E example:
Grid Needs Assessment (GNA)

► GNA Report and Spreadsheet
  - 6994 separate grid needs
  - Location
  - Distribution service required
  - Primary driver of grid need
  - Date needed
  - Equipment/Facility rating
  - Forecasted deficiency over 5 years
  - What mitigation options are possible? Can they be mitigated through distribution switching and load transfers?

Graphic showing four Distribution Planning Regions: PG&E
### PG&E example: Grid Needs Assessment

<table>
<thead>
<tr>
<th>Project Type</th>
<th>Distribution Capacity</th>
<th>Voltage Support</th>
<th>Reliability (Back-tie)</th>
<th>Resiliency (microgrid)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substation/Bank</td>
<td>59</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>69</td>
</tr>
<tr>
<td>Feeder</td>
<td>107</td>
<td>0</td>
<td>23</td>
<td>0</td>
<td>130</td>
</tr>
<tr>
<td>Distribution Line</td>
<td>631</td>
<td>6153</td>
<td>11</td>
<td>0</td>
<td>6795</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>797</strong></td>
<td><strong>6153</strong></td>
<td><strong>44</strong></td>
<td><strong>0</strong></td>
<td><strong>6994</strong></td>
</tr>
</tbody>
</table>

PG&E Example
Qualitative Prioritization Methodology

► Cost-effectiveness – Projects with higher costs or higher LNBA are ranked higher. DER can potentially provide a high value by avoiding expensive solutions.
  ■ Unit costs
  ■ LNBA $/kW-yr
  ■ LNBA $/MWh-yr

► Forecast certainty – How certain is the grid need? Near-term needs and locations with SCADA are ranked higher.
  ■ Forecasted need
  ■ SCADA available
  ■ # customers on asset

► Market assessment – How likely can DER successfully meet the requirements? Projects that are day-ahead, have fewer grid needs, fewer days/year and lower overcapacity are ranked higher
  ■ Real-time or day-ahead notification
  ■ Days/year
  ■ Number of grid needs
  ■ Hours per call
  ■ Overcapacity

Engineering judgment and experience play into all three metrics
### 3. Locational Net Benefits

**PG&E example:**
Performance and operational requirements

<table>
<thead>
<tr>
<th>Candidate Deferral</th>
<th>Grid Need Location</th>
<th>Real Time (RT) or Day Ahead (DA)</th>
<th>Offer Size (MW)</th>
<th>Delivery Months</th>
<th>Calls/Year</th>
<th>Delivery Hours</th>
<th>Hours Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpaugh New Feeder</td>
<td>Corcoran 1112</td>
<td>DA</td>
<td>4.4</td>
<td>Jun-Sep</td>
<td>113</td>
<td>3:00PM-10:00PM</td>
<td>7</td>
</tr>
<tr>
<td>Calflax Bank 2</td>
<td>Calflax Bank 1</td>
<td>DA</td>
<td>4.8</td>
<td>May-Aug</td>
<td>92</td>
<td>4:00PM-8:00AM</td>
<td>16</td>
</tr>
<tr>
<td>Santa Nella</td>
<td>Canal Bank 1</td>
<td>DA</td>
<td>1.2</td>
<td>Jun-Aug</td>
<td>75</td>
<td>5:00PM-8:00PM</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Canal 1103</td>
<td>DA</td>
<td>4</td>
<td>Jun-Sep</td>
<td>122</td>
<td>3:00PM-10:00PM</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Ortiga 1106</td>
<td>DA</td>
<td>3.8</td>
<td>Jun-Sep</td>
<td>122</td>
<td>4:00PM-10:00PM</td>
<td>6</td>
</tr>
<tr>
<td>FMC 1102</td>
<td>FMC 1101</td>
<td>RT</td>
<td>0.8</td>
<td>Jun-Sep</td>
<td>4</td>
<td>12:00AM-12:00AM</td>
<td>12</td>
</tr>
</tbody>
</table>

PG&E example: Candidate projects

- PG&E identified 18 candidate deferral opportunities totaling 83 MW
  - Tier 1: four projects totaling 19.3 MW that are more likely to be deferrable with DER
  - Tier 2: two projects totaling 2.1 MW that have some red flags; monitor status
  - Tier 3: 12 projects totaling 62 MW with multiple, major red flags; unlikely that DER can be successfully sourced

## 3. Locational Net Benefits

### PG&E example: Candidate projects

<table>
<thead>
<tr>
<th>Tier</th>
<th>Candidate Deferral</th>
<th>Cost Effectiveness</th>
<th>Forecast Certainty</th>
<th>Market Assessment</th>
<th>Over-capacity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Unit Cost ($/kW-yr)</td>
<td>LNBA ($/MWh/yr)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Alpaugh New Feeder</td>
<td>$3,600</td>
<td>$89</td>
<td>$88</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Calflax Bank 2</td>
<td>$6,070</td>
<td>$88</td>
<td>$60</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Santa Nella New Bank &amp; Feeder</td>
<td>$7,256</td>
<td>$55</td>
<td>$78</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Camp Evers 2107</td>
<td>$1,720</td>
<td>$202</td>
<td>$2,100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FMC 1102</td>
<td>$1,700</td>
<td>$232</td>
<td>$4,830</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Brentwood 2105</td>
<td>$640</td>
<td>$59</td>
<td>$612</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Estrella Substation (hypothetical)</td>
<td>$18,500</td>
<td>$209</td>
<td>$293</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Pueblo Bank 3</td>
<td>$6,936</td>
<td>$21</td>
<td>$110</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oceano 1106</td>
<td>$425</td>
<td>$18</td>
<td>$64</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rosedale 2102</td>
<td>$400</td>
<td>$24</td>
<td>$84</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rob Roy 2105</td>
<td>$500</td>
<td>$18</td>
<td>$63</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Peabody 2106</td>
<td>$390</td>
<td>$8</td>
<td>$28</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Madison 2101</td>
<td>$105</td>
<td>$13</td>
<td>$45</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Martin SF H 1108</td>
<td>$180</td>
<td>$9</td>
<td>$33</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Martin SF H 1107</td>
<td>$150</td>
<td>$4</td>
<td>$15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Avenal 2101</td>
<td>$65</td>
<td>$6</td>
<td>$21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Edenvale 2108</td>
<td>$95</td>
<td>$7</td>
<td>$24</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dairyland 1110 New Feeder</td>
<td>$3,887</td>
<td>$96</td>
<td>$24</td>
<td></td>
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Considerations for LNBA

- What is your use case for LNBA and is the calculation methodology appropriate for that use case?
- How are needs screened? Are these screens so restrictive that they eliminate projects that seem viable?
- What criteria do you use to prioritize candidate projects? To what extent did engineering (or other) judgment change prioritization of projects and why?
- Is there data or infrastructure that could give more certainty to the overall process?
Resources

- NREL on DPV benefits and costs: [https://www.nrel.gov/docs/fy14osti/62447.pdf](https://www.nrel.gov/docs/fy14osti/62447.pdf)
- EPRI on hosting capacity: [https://www.epri.com/#/pages/product/1026640/](https://www.epri.com/#/pages/product/1026640/)
Any Questions?

Contact Debbie Lew at
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303-819-3470
Table 3.3.1. New York Assumptions for Version 2.0 of BCA Handbook

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