Grid Modernization

Stakeholder Meeting #3-continued

January 28, 2022
NJ BPU Clean Energy Grid Modernization pursuant to Public Docket: **Docket No. QO21010085**

See overview at: [njcleanenergy.com/gridmod](http://njcleanenergy.com/gridmod)

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### Grid Modernization

The New Jersey Board of Public Utilities (“NJ BPU” or “Board”) hereby gives notice of a series of public meetings to collect stakeholder input on the current distribution grid interconnection policies and process, and potential improvements that will enable faster grid modernization and higher levels of distributed energy resource (DER) absorption.

All meetings in the series will start with a brief presentation by NJ BPU Staff recapitulating the State of New Jersey Grid Modernization (“GridMOD”) initiative and activities to date, with an emphasis on their relation to strategies outlined in the 2019 NJ Energy Master Plan. The sessions will then feature specific presentations and a facilitated comment collection that will be used in a formalized NJ BPU Proceeding at the conclusion of the series. The aim of these sessions is to facilitate a guided discussion on recognition of existing barriers, estimate economic impacts of alternative reform paths, and ultimately build the broadest consensus on aligned measures that can remove or reduce the biggest barriers to grid modernization.

The public meetings will be held at the dates, times, and manner shown below. Meeting materials, including any presentations, will be posted on this page prior to each meeting and video recordings will be available after each meeting. To receive information on this topic, please subscribe to the Renewable Energy Robo.

#### Meeting Details

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<th>Date and Time</th>
<th>Agenda Focus</th>
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<td>Oct 28, 2021 (IAM: 12PM EST)</td>
<td>Grid Modernization Context</td>
<td>NA</td>
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<td>Nov 16, 2021 (IAM: 12PM EST)</td>
<td>Stakeholder Data/Comment Ingestion</td>
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<td>Jan 14, 2022 (IAM: 1PM EST)</td>
<td>EDC Readout - Collaborative Alignment</td>
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## Agenda

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<thead>
<tr>
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<th>Presenters</th>
<th>Time (AM, except where otherwise noted)</th>
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<tr>
<td>Welcome and Opening Remarks</td>
<td>NJ BPU, Guidehouse</td>
<td>9:00 – 9:15</td>
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<tr>
<td>With brief time for clarifying questions after each presentation</td>
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<tr>
<td>Polls and Break</td>
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<td>15 min</td>
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<tr>
<td>Sunnova, ANB Systems, SEIA, MSSIA, SunRun, Tesla</td>
<td>Scheduled Presenters</td>
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<td>Polls</td>
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<tr>
<td>Stakeholder Requests to Speak</td>
<td>All</td>
<td>12:40 PM – TBD</td>
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<tr>
<td>Timeline, Next Steps, Closing Remarks</td>
<td>Guidehouse, NJ BPU</td>
<td>End (1PM)</td>
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The Need for a New Cost Allocation Paradigm

The Failure of Cost Causation to Support a Sustained DG Industry, the Evolution of Cost Sharing and the Path Forward

January 2022
Current Paradigm/Historical Context

*Cost Causer Pays 100% of interconnection costs with EDC compensated at cost*

- Driven by the historic industry paradigm which was characterized by large, centralized generation facilities sending electricity unidirectionally down to load
- Served us well for decades under that old industry structure, but over the past decade has been demonstrated to be incompatible with a sustained DG industry/high-DER future
Cost Sharing 1.0

*Retroactive Cost Sharing among interconnecting projects with EDC compensated at cost*

- Well-intentioned response to market seizure resulting from first-mover interconnection cost assessments
- Failed to elicit intended response
Cost Sharing 2.0

Prospective Cost Sharing among interconnecting projects with EDC compensated at cost

- Understandable response to lack of uptake on Cost Sharing 1.0, due to risk
- Recently approved in a NY Order, but concerns over effect of Transmission-level upgrade costs’ impact to efficacy
Multi-Beneficiary Cost Sharing

*Cost Sharing among interconnecting facilities and society at large with EDCs realizing a rate of return on the portion allocated to their rate base*

- Acknowledgement of wider Grid Modernization benefits of distribution system upgrades identified by EDCs in interconnection studies for DG facilities
- Understanding of the inappropriateness of expecting DG facilities to shoulder 100% of these costs
Ratebasing to Point of Common Coupling

Allocating the costs of the distribution system upgrades necessary to create a truly bi-directional grid and enable beneficial electrification of buildings and transport to the EDCs’ rate bases

• Argument that distribution system upgrades beyond a DG facility’s fence line are in fact Grid Modernization, and as such should be covered under EDCs’ rate cases

• Assertion that Cost Causation – while an appropriate tool to regulate historical large, centralized generation – ought not to have been applied to DG industry and should be abandoned as a regulatory tool for this segment
Q&A Discussion

Questions/Comments?
Smart Inverters and New Jersey

Brian Lydic
Chief Regulatory Engineer
IREC
MAKING THE GRID SMARTER

State Primer on Adopting the New IEEE 1547-2018 Standard for Distributed Energy Resources

JANUARY 2019
Adopting and Implementing Smart Inverters
Adopting IEEE 1547-2018

Where will the technical requirements reside?

Choose categories

Define default function states (or not)

Define default settings (or not)

Determine timeline for implementation
Adopting IEEE 1547-2018

Also:

Communications (capability vs utilization, pathways, protocols)

Process updates (mitigations, settings changes/selection)

Interconnection Agreements

Applications

Related processes (e.g. voltage complaints for DER, HCA)
Voltage regulation considerations

- IEEE 1547-2018 default is the constant power factor mode with PF=1
  - i.e., no reactive power = no voltage support

- States/utilities to clarify which voltage regulation function DERs should use; adjust from Standard defaults accordingly

- Potential for DER customer impacts
Why early adoption of voltage regulation functions?

- Certain DERs can connect to the grid where once they couldn’t (w/o upgrades)

- Increase hosting capacity of a circuit

- Functions are optimized if all or most DER systems participate in voltage regulation

- Effectiveness dramatically reduced if adopted after higher DER penetration
Voltage complaints and reporting

- Ensure complaint process handles DER complaints appropriately
- Consider reporting on how many voltage-based curtailment issues arise
- Consider metric based on voltage data to determine potential for curtailment
Details, details

- Reference Point of Applicability – application?

- Voltage requirement changed from “Range A” to “C84.1”

- New RVC, Flicker requirements (check Supplemental Review references, esp.)

- Non/limited export (for RPA, volt-watt, limit max active power, networks)
Adoption/Implementation Challenges

- Details
- Expertise level
- Having time/resources to have utilities analyze options
- Getting it all done at once
Key takeaways

- **Stakeholder group**
  - Ensure regional reliability coordinator input
  - Existing interconnection working groups can work well, but broad participation can generate support and catch other issues
  - Ensure a common understanding of the Standard, deal with differing interpretations
  - Iterative process may be required to address all issues

- **Voltage regulation**
  - Studies/modeling may be needed to determine best fit default settings
  - Plan for field data collection and review to analyze/adjust in future

- **Communications**
  - Implementation is laborious, important to get right
  - Systems that require comms should be able to comply with standardized protocols
Timeline to compliance

- **April 2018**: IEEE publishes 1547-2018
- **May 2020**: IEEE publishes 1547.1-2020
- **August 2020**: UL updates 1741 allowing start of DER testing and certification
- **Sept 2021**: UL 1741 SB revised to fill in 1547.1 gaps
- **2022-2023**: Tested and certified 1547-2018-compliant DER available on market

MD: January 1, 2022 ...extending likely to April 1, 2023
HI: January 1, 2022 ...extending (currently April 1, 2022)
LIPA: January 1, 2022 ...extending
MN: “such time the equipment is readily available”
CA: Orig. proposed Nov 1, 2022, but now proposing March 28, 2023
Basic Components of Timeline

- Testing
- Issuance of Certificate (~1-2 weeks)
- Qualified Equipment List (1 month ?)
- Shipping logistics (2-6 months, 3 typical)
Certifications Over Time (12wk test time)
What should timeline be?

- Add ~18 weeks to test time (certificate/listing/logistics)
- Uncertainty in actual timeline
- SA is similar functionality to SB
- Is a date certain necessary?
Thank you!

Brian Lydic
Chief Regulatory Engineer
brian@irecusa.org
Extra slides
Implementation Examples

- MN: Detailed reference, tech req’s only, default constant PF + VW, clean up items, comms capability only
- MD: Compliance date only for inverters, technical req’s TBD
- HI: General reference (+SRD), tech req’s and process, default VV, VW optional, no new comms, +URP
- CA: Detailed ref/full spec, tech req’s and process, default VV+VW, comms uses 2030.5 but not implemented
Smart Inverters Today

- “Grid Support Utility Interactive” per UL 1741 SA
- Voltage and frequency ride-through (i.e., per CA Rule 21 and/or HECO 14H)
- Anti-islanding with grid support
- Ramp rates (soft start and normal)
- Set PF, volt-var
- Optional: Frequency-watt, volt-watt, permit service, limit max power
Also in IEEE 1547-2018

Volt-var autonomous Vref

Other voltage regulation modes

ROCOF and phase jump ride-through

Power Quality

Islanding (Microgrids)

Fault current characterization
FuelCell Energy

New Jersey Grid Modernization
Non-EDC Readout
Docket No. Q021010085

28 January 2022
Enable The World To Live A Life Empowered By Clean Energy
FuelCell Energy at a Glance

Technology Solutions for Decarbonization Goals

- Distributed Generation (net zero)
- Distributed Hydrogen
- Carbon Capture
- Long Duration Energy ($H_2$) Storage

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<th>Notes</th>
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<tr>
<td>Danbury, CT</td>
<td>Headquarters/R&amp;D/Service</td>
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<tr>
<td>Torrington, CT</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>Taufkirchen, DE</td>
<td>Manufacturing/Service</td>
</tr>
<tr>
<td>Calgary, AB</td>
<td>Solid Oxide R&amp;D</td>
</tr>
</tbody>
</table>

Strategic Relationships

- ExxonMobil
- TOYOTA
- e.on

Global Customers

The path to net zero for each customer and situation is unique. FuelCell Energy provides technology options that enable and complement zero carbon solutions for global decarbonization efforts.

- ~300 Patents
- > 50 Global Plant Installations
- >255 MW Capacity in Field
- >12mm MWh1 Generated

1 As of the October 31, 2021

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Global Track Record of Reliable Power Generation

**Grid Support with CHP**
- 6-month construction
- 20 MW KOSPO site built in 2018
- Power sold to grid
- Heat provided to district heating system
- Easily scalable

**Resiliency for Pharma**
- 5.6 MW with steam for company campus
- Reliable power solving local grid quality issues
- Immediate savings vs. grid
- Complements ESG goals

**Grid Support / Urban Redevelopment**
- Power sold to grid
- Enhances resiliency
- Brownfield revitalization
- 15 MW on 1.5 acres
- 12 mo. installation

**Fuel Cell / Solar Integration**
- Utility-owned, rate-based
- Enhances resiliency
- 2.8 MW fuel cell on ¼ acre
  - ~23,000 MWh/yr.
- 2.2 MW solar on ~9 acres
  - ~3,000 MWh/yr.

More than 12 Million MWh generated\(^{(1)}\)

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\(^{(1)}\) As of the October 31, 2020.
**Microgrid Operations: Industrial Campus**

**Pfizer Research Center:** pharmaceutical R&D facility

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**Project Overview**
- Grid-connected 5.6 MW fuel cell
- Provides electricity and steam to Pfizer Groton campus
- Seamless grid independent capability
- Private, Critical Facility Microgrid

**Benefits**
- Closes electrical generation gap with reliable source – makes site independent year round
- PPA with no up-front capital cost, delivers energy cost savings to Pfizer
- Enhances site sustainability profile (green energy source)

"The self-reliance this plant affords us provides that stability and reliability of operation that we need”

Michael Lallier, Site Operations Manager, Pfizer

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Building on Current Technology Strengths with Next-Gen Technologies

**INDUSTRY APPLICATION**

- Enabling microgrid power generation
- Local generation reducing above ground risk
- Improving the climate and air quality in local communities
- $1.1B of project backlog as of July 31, 2021

**PRODUCE**

In Operation

**SOLUTION**

Global Risk Action

**STATUS**

In Operation

**SUPPLY**

Commercially Available

**STORE**

Advanced Development

**CAPTURE**

Developing with EMRE

**ADDITIONAL APPLICATIONS ENABLED THROUGH OUR TECHNOLOGY PLATFORM**

- Carbon separation to support industry, such as beverage, agriculture and more
- Natural gas blending to reduce carbon
- Hydrogen to repower gas engines
- Hydrogen based storage
- Highly efficient electrolysis
- Hydrogen power generation
- Mitigating climate change

**TO-DAY**

2022+

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Enabling a Safe, Secure and Practical Journey to Carbon Zero

New Jersey’s Clean Energy Policy Timeline
Source: State of NJ DEP

- In 2018, the state set a goal of to obtain 3,500 megawatts of offshore wind power by 2030
- In November 2019 the state increased the goal to 7,500 megawatts by 2035.
- By June 2021, the New Jersey Board of Public Utilities approved 3,700 megawatts of offshore wind capacity.

New Jersey Department of Environmental Protection, Offshore Wind, accessed September 26, 2021.
Meeting RPS and emission goals while maintaining a reliable, resilient grid is a delicate and complicated task.

There is no silver bullet and incorporating carbon reducing technology while ensuring grid resiliency with dispatchable zero carbon energy will require integration with multiple technologies.
Enabling a Safe, Secure and Practical Journey to Carbon Zero

How do we decarbonize **WHILE** modernizing the grid and increasing its resiliency

**The FuelCell Energy Difference**

A unique technology provider that can:

- Capture CO₂ while producing power
- Produce H₂, power and water simultaneously
- Offer the lowest cost green hydrogen
- Provide long duration energy storage via reversible Solid Oxide Electrolyzer
- Provide decarbonizing value streams in a single platform: electricity, heat, CO₂, H₂, and water

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Our Value Proposition in the Evolving Grid

Enabling the Greening of the Grid Through Adaption and Mitigation

Natural gas and nuclear energy account for almost all of New Jersey’s electricity net generation. In 2020, the two fuels together accounted for 90% of the total electricity produced in the state¹.

Renewables, mostly solar energy, at both utility- and small-scale facilities accounted for about 8% of New Jersey’s total in-state electricity generation in 2020, ~double the 2015 share. Coal generated less than 1.5% of the state’s utility-scale net generation from coal, ~half its share from 2015. There are two coal-fired power plants left in the state, one of which is scheduled to shut down in 2024.

An integration of decarbonizing technology both in front of and behind the meter can help create a path to net zero while maintaining critical grid infrastructure and encourages further buildout of renewable generation.

Hydrogen has been identified as a critical fuel for the energy industry of the future. Additionally, hydrogen’s sustainability credentials are unmatched when compared to mineral-based energy storage. Leveraging hydrogen also allows for long duration energy storage with increasing economies of scale compared to conventional Li-Ion technology and provides the optionality of decarbonizing other sources of energy as an alternative fuel source.

¹U.S. EIA, Electricity Data Browser, New Jersey, Net generation for all sectors, annual, 2001-20

Our hydrogen and carbon capture solutions are designed to adapt to the grid and mitigate its negative impacts.
Our Value Proposition in the Evolving Grid

Renewable Scenario – Art of the possible

- Renewable Generation
  - XXX MW

- Hydrogen Energy Storage
  - Reversible Solid Oxide Electrolyzer
  - 4 - 24 hr. Duration

**Value-Add**
- Increased grid resiliency
- Enable extensive renewable integration
- >50% lower $/kWh vs. Li-Ion
- Grid-scale market opportunities
  - Arbitrage | Regulation | Reserves
- Forward Capacity Market

Creating firm, dispatchable assets from intermittent renewable generation

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Our Value Proposition in the Evolving Grid

Creating optional zero carbon fuel from intermittent renewable generation

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Energy Ecosystem of the Future

Modernizing while Decarbonizing the grid of tomorrow
Thank you

Troy Michaud
VP Global Market Strategy
tmichaud@fce.com
Co-location of solar and non-NEM eligible resources
Bloom Energy Microgrids: Resilient On-Site Power

We Deliver Clean, Reliable and Resilient Onsite Power

Over 700 sites protected

Generates Electricity without Combustion

99%+ Reduction in Local Air Pollution (NOx, PM)

Avoids Diesel Generator Use

Microgrids for Essential Business, Community, and Grid Resiliency

Representative Microgrid Customers

- AT&T
- Comcast
- Regeneron
- II-VI
- The Home Depot
- Stop & Shop
Solar Co-location with Non-NEM Eligible DERS in NJ

- New Jersey is a leader on solar: >1GW installed
- The state has already been impacted by climate induced severe weather
- NJ customers who have already installed solar are unable to install resilient DERs without losing the ability to Net Meter solar electrons.
- NJ customers who have installed resilient DERs are unable to practically install solar because they cannot Net Meter solar electrons.
- Other jurisdictions have accepted multiple meters to avoid this situation.
- This issue should be resolved so solar and resilient DERs can co-exist in New Jersey.
A Proposed Solution

“Multiple Technology Interconnection”
What is a Multiple-Technology Interconnection?

- **Definition:**
  - Net Energy Metering Multiple Technology (NEMMT) is a Net Energy Metering (NEM) approach for customers who operate a combination of NEM and non-NEM generations behind the same meter. This approach allows a customer to interconnect these technologies with the EDC grid at one service point, using one account, and still qualify for the appropriate treatment that would be available if each technology were interconnected and billed separately.

- **Key Points:**
  - When interconnected under a Multiple Technology arrangement, the NEM portion is billed/credited under NEM and the non-NEM portion is billed/credited under QF or PJM, as applicable.
  - This preserves the right for the NEM eligible renewable generator to continue net meter, while the non-NEM eligible generator is not required to shut down and can continue to support the customer.
  - In order for the EDC to determine the amount of net metered energy that should be credited at each rate, the customer must install a Net Generation Output Meter (NGOM) on each of the NEM eligible and non-NEM eligible generators.
How the billing/crediting would work

- (2) generators are interconnected behind the same meter
- Each generator has a Net Generator Output Meter (NGOM)
- Utility meter is bi-directional
- All three meters are time synced
- When export occurs, the following calculation occurs (example)
  - NGOM1 (Fuel Cell) Output (500 kW) + NGOM2 (Solar) Output (1000 kW) = 1500 kW
  - Fuel Cell = 500/1500 = 33%, Solar – 1000/1500 kW = 66%
  - Export Occurs under these conditions of 200 kWh
  - 200 kWh * 66% = 133.33 kW of compensated export under NEM
  - 200 kWh * 33% = 66.66kW of compensation export under QF/PJM
Amending Residential Solar Interconnection Rules to Allow for Future Loads

Presentation to NJ BPU January 28, 2022 Grid Modernization Stakeholder Meeting
Residential solar is expensive in the US

- Driven by policy choices we have made (quantum mechanics doesn’t respect national borders...)
- Some policy choices are conscious, some unconscious
- Some policy choices are national, some state and local
- Ad Energy’s mission is to, as we see it, fix this
- Fixing it will involve a series of policy decisions
- We are here to discuss one such decision today

Source: BloombergNEF
Amending interconnection rules to allow for future loads would have multiple benefits

Rapid electrification makes the issue important
• Rapid adoption of EV and other home electrification means that the vast majority of homes will experience load growth
• Allowing systems to be built to accommodate future electrification embeds momentum to electrify, aiding that policy goal

Larger systems are cheaper to build per installed watt
• Ad Energy’s internal financial model suggests substantial economies of scale
• An analysis of Energy Sage quotes suggests the same

Ratepayers benefit
• Net metering rules specify that any excess production is compensated at avoided cost
• Lower installed cost per watt creates an opportunity to manage down incentive levels over time
Economies of scale are very important to residential solar cost per watt

**Energy Sage**

Economies of scale of various cost categories from Ad Energy’s model

- Hardware: 93% variable
- Installation: 84% variable
- Design and permitting: 12% variable
- Cost to acquire: 10% variable
- Overall: 62% variable

**Source:** Energy Sage quoted systems in NJ in 2021
Now is the time to implement the policy

Estimating the benefit to New Jersey’s residential solar installed cost
- Assume 1 system in 4 increases from 10 kW to 14 kW (a typical EV load)
- Assume that Ad Energy’s model is correct – incremental kW cost 62% of base kW
- Overall cost is improved by 3.8%, or approximately $15m per year

Consumer protection should be a consideration
- We recommend customer signatures on a load calculator specific to planned loads

Planning grid improvements to support electrification will be important
- A local grid improvement to support a solar system today should consider likely future grid needs
Thank You!
Polls and Break
15 min
Interconnection Best Practices: Customer Facing Systems

Katherine Wyszkowski
Interconnection Policy Advocate
Katherine.Wyszkowski@sunnova.com
Working Towards a Standardized, Cohesive System

• Portal to allow for submission of application
  • Many utilities already use a portal for simplicity including PG&E California
  • Simplified system can keep cost low for level 1 interconnection
  • Provide transparency and improve applicant self sufficiency

• Standardized application for state/nation
  • Remove redundant data requests
Active Checklist

• Ability for applicant to see application status down to task level of all projects including their deficiencies
• Provide expected timeline and fees for each step
• Automatically directs customers to the application sections that are required for the specific tariff that the project is subject to
• Avoid having customers fill out sections of the application that are not required
• Ability to save and later resume application(s)
Streamlining and Automation Capabilities

- Built-in error checking as application is completed
- Auto-population of key information such as customer information and eligible rate schedule
- Built-in data validation
- Automatically notify utility’s central interconnection database of passed final building inspection
Streamlining and Automation Continued

• Use of electronic signatures

• Incorporate electronic payment ability

• Automatically notify customer when PTO is approved
Portal Communication

- All communication done within portal for better organization and accessibility
- Single point of contact
- Avoid emails and hard copies of material needing to be submitted
- Schedule inspections in the portal
- Customer feedback can be collected and managed
Other Benefits

• Timeline enforcement
  • Track completion date of each step

• FAQ Page
  • Page to share common causes of errors or delays
  • Example application
  • Instructional videos
Introduction to SolarAPP+

- NREL has created a no-cost, instantaneous, automated permitting system for simple, residential PV systems and storage
- Standardized compliance checks to immediately inform user of typos and errors
- Stays up to date with relevant code and certifications
- Piloting and adoption is easy
- Solarapp.nrel.gov
Sources


Lessons from Processing 100K Distributed Generation Interconnection Applications

Presented By:
AbhishekBalakrishnan, President, CTO - ANB Systems
S Balakrishnan, CEO - ANB Systems

Email: info@anbsystems.com

January 28, 2022
About ANB

Serving the Energy Industry
23+ Years

Tracked Over 750+ Programs

Headquartered in Houston, TX

25+ Municipal and IOUs

Total Budget Tracked Over $5.4 B
Our DG Experience

100,000+
PTO Issued

500+
Applications Submitted
Per week

2,000+
2,000+ MW
AC Capacity

750+
1.0+ M
Documents Processed

750+
Installers

80+
80+
Interconnection Agreements
Executed Daily

750+
750+
Installers

1,800+
1,800+
Unique Users

750+
750+
Documents Stored

500+
500+
Applications Submitted
Per week

100,000+
100,000+
PTO Issued

2,000+
2,000+
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Documents Stored

500+
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Applications Submitted
Per week

100,000+
100,000+
PTO Issued

2,000+
2,000+
MW
AC Capacity

80+
80+
Interconnection Agreements
Executed Daily

750+
750+
Installers

1,800+
1,800+
Unique Users

750+
750+
Documents Stored
Influential Factors for DG Interconnection

• Solar Installation Company
• Size & Type of Solar Panel System
• Property Characteristics
  • Roof Type
  • Direction
  • Shading
  • Home-owners Association Regulations
• Local Permission and Inspection Process
• Utility and Interconnection Requirements

Citation: IEEE SMARTGRID: Automating the Utility-Customer DER Interconnection Process
Interconnection Barriers

**Uncertainties**
- No standardization
- Unclear application process
- Lack of data on grid condition
- Lack of transparency in application status

**Delays**
- Processing time
- Incomplete applications
- Review complexity
- Lengthy study
- Issuing PTO

**Cost**
- Equipment
- Manual application submission
- Application fees
- Application review
- Upgrade cost

Citation: NREL Report – Review of Interconnection Practices and Costs in the Western States
Lessons Learned

Streamline  
Standardize  
Communicate  
Simplify  
Integrate

Validate  
Automate  
Inspect  
Update
Scope for Automation - DG Application

**PROCESSES**
- DG Application Capture (Addition/Updating)
- Zero-touch Approval (Application Review)

**AREAS**
- Online Application Submission
- Electronic Signature
- Uploaded Diagrams & Documents
- Application Data Validation
- Duplicate Check
- Online Fee Payment

**TOOLS**
- Configured Workflow
- Custom Business Rules
- eSignature Application
- Document Recognition System
- Payment Gateway Integration
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<td>Transformer Load, Existing DG Capacity</td>
<td>Custom Business Rules</td>
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<td>Payment Gateway Integration</td>
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<td>Online Fees (MR &amp; Upgrade Cost)</td>
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<td>ES Document Generation</td>
<td>Document Generation</td>
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<td>Customer/Installer Notification</td>
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## Scope for Automation - Installation & Approval

### PROCESSES
- Desktop Inspection
- Meter Programming
- Approval to Operate (ATO)
- Post ATO Tracking

### AREAS
- Facility Inspection Initiation
- Online Inspection Fees
- Equipment Install – Online Data Validation
- Interconnection Agreement Generation
- Agreement eSignature
- Bidirectional Meter Installation
- ATO Issue Notification

### TOOLS
- CIS / GIS Integration
- Custom Business Rules
- Payment Gateway Integration
- eSignature Application
- Automated Notifications
- Document Generation
Tools to Enhance Process

- DG Workflow Management
- Mobile Capture (Data & Documents)
- Electronic Signatures
- Online data capture forms
- Ad-hoc & Canned Reports
- Notifications, Alerts, and To-Do Lists
- Third-party Integration
- Document Recognition (OCR) & Management
- Secure Custom Portal
Goals

Fast-Track Applications
- 10 to 20%<br>- <1 Day

Typical Applications
- 60 to 70%<br>- <15 Days

Exceptional Applications
- 10 to 20%<br>- >20 Days

DG Applications

Business Process Automation
Best Practices

- Speed up the interconnection contract agreement process between stakeholders by using electronic document generation & signature processes.
- Improve the turnover on the review process on One Line and Layout Sketch diagrams through document recognition software.
- Notify required installers on the due submissions or updates on projects through adhoc & event triggered notifications.
- Adapt to process changes or extension requirements anytime through a configurable workflow designer.
- Manage data intake requirement changes through configurable data dictionary & data intake forms.
- Integrate with other utility systems (like GIS, OMS, CYMES, etc.) through configurable data import plugins and RESTful API services to facilitate distribution impacts and service study, meter programming for DG generation.
Best Practices

**Customer**

- Digital Process Flow
- Transparency in Application Status

**Installer**

- Customer Outreach

**Utility**

- Installer Training
  - DG Requirements and Expectations
  - Process Timeline Expectation
  - Bidirectional Meter Install Process
  - Government Credits or Buyback Policies
  - DG Portal Features
THANK YOU
APPENDIX
Streamline

- Apply
- Reliability Study
- Energize

Review

- Inspect
Standardize

- **Documents** - standard templates for application/process-specific documents.
- **Timeline** - standard timelines for review, inspection, and approval.
- **Across Utilities** - installers work across utilities.
Communicate

• Requirements - to utility, installer, customer and other stakeholders.

• WebEx and Training - Keep stakeholders aware of the process.
• Custom Workflow - Simplify the DG process flow.

• Advanced Business Rules.
Integrate

- Document Recognition
- CIS/GIS
- Payment Gateway
- Mobile Capture Application
Validate

• **Application Data Validation** - (E.g.: Account Number, Duplicate Applications).

• **Electric Diagram Validation** - Key data in one-line diagram (E.g.: Customer ID, VLLD).

• **Photographs** - Key data in process documents (layout sketch, AC disconnect).
Automate

- Review
- Inspect

Reliability Study
- Energize
Inspect

- Documents
- Signatures
- Photographs
- Desktop versus Onsite
Update

- Added or Removed Capacity
- Ownership Changes
- Legal Changes
- Other Requests
The important role of data access in cost-effective interconnection

Jeremiah Miller, PE
Dir. Storage Markets & Policy
SEIA
01/28/2022
Grid modernization is both an edge and system wide challenge

Some takeaways from the presentations a couple weeks ago:

• **System wide vs grid edge**: Good to see recognition of system wide issues tied to customer driven challenges like interconnection.

• **Interconnection ultimately is about customer relationships, yet... several concerns:**
  - **Generation only?** Narrow thinking about customers seeking to change their grid use through the lens of generation.
  - **Proactive consideration of load?** Lack of consideration of changes in customer grid use for controllable load.
  - **Solutions scalable for storage?** More troubling, especially lack consideration of how energy storage is cost effective for many applications and also needs thoughtful interconnection innovations.

Customers should be at the heart of all grid modernization.
Need system wide services innovation

- **Need customer focused innovation** for new generation, storage, and load relationships but also for system wide services.
- **Grid modernization needed**: With our aging grid, but also with our electrification of heat and mobility to meet our decarbonization goals, we will need traditional reinforcements.
- **Prioritize full stack flexibility**: For system wide solutions, we need customer centered full stack flexibility services procurement to be at heart of finding the most affordable solutions.

[Image: Increasing Hosting Capacity]

https://jointutilitiesofny.org/sites/default/files/REV-EG-Hosting-Capacity-July-2016-FINAL.pdf
Need system wide services innovation **and** innovative interconnection relationships

- **Options:** There are a range of flexible interconnection technologies: smart inverters; storage; power system control for limited/no-export; topology switching; DERMS; etc.
- **Relationships:** Yet flexible interconnection is more than a set of technical specifications.
- **Choice:** Flexible interconnection is a customer choice compared to firm interconnection (i.e. Restricted grid use vs 100% grid use)
- **Customer rights** for choosing flexible interconnection are critical, including data rights.

[Image of diagram: Increasing Hosting Capacity]

https://jointutilitiesofny.org/sites/default/files/REV-EG-Hosting-Capacity-July-2016-FINAL.pdf
Acting on Customer Centered Solutions

• **System-wide Solutions: Full Stack Flexibility Services – Procure as a First Priority!**
  - To mention a few, flexibility services include non-wires alternatives, smart wires and enhanced grid technologies, independent connection providers, energy efficiency and conservation, demand management, and so forth.
  - Only after finding these are insufficient should the most expensive grid upgrades be approved, and increasingly even these should be competitive. For example, community and campus microgrid solutions, offshore wind connections, new substation procurement, etc.

• **Customer Relationship Services – Prosumer Centered?**
  - Controllable load: how are you engaging customers to more provide load services to support grid modernization?
  - Generation: for connecting new generation, are you providing the full range of options to customers for the most affordable solutions grid edge investments?
  - Storage: are you considering how storage is both dispatchable generation and controllable load, and its further deployment will significantly alter how customers use the grid?

• **Protecting Vulnerable Populations to Energy Transformation Risks?**
  - Not all customers are able to fully participate in these new services, so how are you protecting vulnerable populations?

• **Analyzing competing system-wide and customer driven solutions required DATA ACCESS!**
  - Customer rights to data during interconnection are critical to finding the most affordable grid edge solutions to modernize the grid
WEF 2017: “In terms of connections procedures, government-funded trials in the UK have demonstrated how to reduce connection costs by up to 90% and connection time by about seven months. This allows for faster and cheaper connections, supporting flexible management of energy flows and utilizing data such as real-time network hosting capacity. Success at this level requires a digitized grid with active network management.”

(Emphasis added)
Better Flexible Interconnection Data Aligns to System-wide Digitalized Energy Systems

The most affordable and effective decarbonization investments need a combination of customer led and utility supported solutions.

Yet analysis is constrained by lack of data access.

And there is growing concern that digital monopolies and a range of solutions biases constrain finding the most affordable solutions.

Is industry able to analyze the most cost-effective grid modernization investments? Especially when customer solutions can defer or mitigate some?

Are solar & DER customers able to analyze their most cost-effective interconnection options?

Flexible vs Firm Interconnection & Data Access

**Flexible Interconnection**
- Managed grid access during grid constraints, typically acceptable with 95-99% grid access
- Risk of curtailment provides market-based decision making for firm vs flexible interconnection; enables enhanced, dynamic hosting capacity assessments; choice is essential
- DER developers & customers have the right to request grid data and the models used to analyze curtailment risks
- Can provide faster and cheaper interconnection; market-based customer relationship
- Practical pathway for future customers who may want to deploy storage

**Firm Interconnection**
- Firm or 100% access to the grid
- Always the best choice when grid utilization is low; lots of excess hosting capacity
- Customer access to grid data necessary for long term planning horizons, like locating future community solar plants or community microgrid solutions
- Relies upon “static hosting capacity” that is based on snapshot, worst case conditions that are rare
- Fit and forget customer relationships
Define the Principles for Customer and System-Wide Innovations

The industry therefore needs to define the principles for acting on innovation, for grid edge interconnection of new generation, storage (and load!), and system-wide clean energy infrastructure investments. We therefore need:

- **Defined customer rights** that put customers at the center of grid modernization and that support their ability to make reliability and resiliency investments, leveraging their value for all customers.

- **Aligned incentives** so that monopoly operators act in the interests of all consumers. Special attention should focus on mitigation and where possible removing data and customer relationship monopolies.

- **Cost reflective** charges for monopoly services that reflect incremental costs and benefits of how consumers and other parties use the system. This includes minimizing harmful distortions arising from the recovery of fixed charges for using energy networks.

- **A level playing field** so that all technologies and business models can compete equally, without barriers to entry to the market.

- **Efficient allocation of risk** so that those best placed to manage the uncertainty inherent in a rapidly changing system shoulder the risks involved.

- **Harnessing markets and competition** where it can bring benefits to consumers.

- **Support for vulnerable communities** to address energy bill burdens and build resiliency.

Principles adapted from Ofgem, 2017
Data Access and Short-term Relationship Priorities

Customer Centered Interconnection = Customer centered grid modernization
- Proactively provide the full range of interconnection options for generation and storage (and controllable load!)
- Digitize and shift to industry management of submitting and tracking interconnection applications
- Embrace holistic process and planning solutions: e.g. no more physical signatures/payments!; systematically allow pre-applications!
- Ensure industry access to grid data for evaluating the most affordable grid modernization options

Increase Level 1 to 15 or 20 kW - Expedite processing and reducing costs
- Pilot moving to a “connect and manage” relationship for generation, and “connect and value grid services” relationship for storage
- Move to “free the roof” relationships, allowing customers and DER developers to manage their investment risk for sizing generation and storage; support upsizing solar concurrent with EV and electrification of heat deployment incentives

Enforce Interconnection Timelines - Establish performance and service metrics, and guarantees
- Clear and explicit interconnection timelines for expeditiously processing the increasing volume of applicants

Interconnection and Grid Access Data
- Establish grid data rights for industry due diligence studies of grid constrain management solutions for interconnecting to constrained grids; establish robust principles of access for customers to connect to constrained grids

Interconnection Cost Certainty and Predictability
- Ensure actual system upgrade costs fall within a reasonable range (+ or - 25%) of the utilities’ initial estimates
- Provide firm vs flexible upgrade costs; ensure customers always have both choices available and data rights to investigate

Move Beyond the Cost-Causer Principle and Reform Cost-Allocation
- States across the country are exploring cost allocation models where utilities can recover upgraded hosting capacity costs through the ratemaking process or a regulatory asset and interconnection customers using the upgraded capacity pay a proportional share of the costs to reduce the amounts needed to be recovered
- Move for instance to determining reinforcement costs based on a Common Connection Charging Methodology (CCCM) that holistically considers shallow versus deep recovery for new generation, storage, and load.

Move Beyond Confrontation to Genuine Mutual Collaboration
- Appoint a Customer Negotiation Commission for short-term conflict resolution and establish long-term collaborative processes like those recently noted in Hawaii (https://puc.hawaii.gov/energy/pbr/)
Achieving the NJ Solar Energy Requirements for 2030 and 2050: Challenges and Opportunities from the Point of View of the Solar Industry

BPU Docket No. Docket No. QO21010085

*Grid Modernization*

October 21, 2021

Lyle Rawlings, P.E. President
Topics:

1. The scale of the challenge for solar development
2. The need for multi-stakeholder study of optimization pathways
3. List of some of the main pathways – means and methods
4. Likely measures for grid modernization – the low-hanging fruit
   - Short-term
   - Mid- to long-term
5. Likely measures for grid modernization – the not so low-hanging fruit
6. How to get it done
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How high could NJ solar generation get as a percent of total load in 2018, 2021, and 2030?

NJ Solar Generation as % of Total Load for 2018, 2021, and 2030
(based on total load for May 1, 2018)
Circuits closing or severely restricted – ACE
(black is closed, red is restricted to <250 KW)
Circuits severely restricted – JCP&L (red is restricted to <100 KW)
Circuits severely restricted – JCP&L (red is restricted to <100 KW)

Feb. 2020:
Circuits severely restricted – PSE&G (red is restricted to <100 KW)
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2. The need for multi-stakeholder study to identify, at a high level, optimal pathways for the renewable energy transition

Tools for achieving a transition to renewable energy are many and varied, and some are surprising. Finding the optimal combination of these measures, and in the right amounts, is a multi-disciplinary optimization study.

It is a necessary precursor to approaching the task of making the grid renewable-ready with the lowest cost and highest reliability, and in the least amount of time. Without this level of study, we are “shooting in the dark” when we undertake costly grid modernization measures.

Perhaps the best example of such a study in the U.S. is the Minnesota Solar Pathways study. Commissioned by the Minnesota Dept. of Commerce and led by Clean Power Research, it featured collaboration among governmental agency, renewable energy industry, utility company, and environmental stakeholders.

There were surprising findings regarding the overall cost of a transition to 100% renewables, and regarding the best measures to get there.

But New Jersey’s characteristics are different...
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11 Important Infrastructure Means & Methods for Renewable Transition

1. **Generation Mix** – How much wind vs. solar vs. other is optimal?
2. **Geographic Mixing** – variations cancel each other out across distances. Crossing time zones conveys additional advantages.
3. **Load shaping and Demand Management** – Load control and real-time pricing tied to the supply vs. load balance
4. **Utilize inverter capabilities** e.g., Volt-VAR control (massive potential for voltage control)
5. **Solar smoothing with ramp-up and ramp-down control** – ramp-up control simply programmed into inverters; ramp-down through highly accurate forecasting
6. **Enable reverse flow through substations** – can often be a change in SCADA
7. **Overbuild and Curtail** solar power – the overbuild can be cheaper than batteries
8. **Storage** (battery, etc.)
9. **Electric Vehicle-to-Grid (V2G)** – utilize the massive capacity that will be available in vehicles when they’re plugged in.
10. **Upgrading substations and circuits** – more capacity to move power “uphill”
11. **Complex, system-wide changes in control and transactions**
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Several PV systems connect to a circuit without the cost burden of upgrades, then the last one bears the cost of upgrades.

1. The arrangement does not represent fair, rational, or orderly development.
2. Viable, efficient projects are economically locked out, hampering the achievement of goals.
3. Many upgrades are not associated with a project or group of projects. Many necessary measures are system-wide or state-wide.
Who should be responsible for Grid Modernization?

• Through legislation and regulation, utilities will be made responsible for providing service to Electric Vehicle charging stations. They will make the required investments, and recover the costs through the rate base.

Why is this the case for the state’s EV transformation, but not for its solar transformation?

• Many of the grid modernization measures discussed here are area-wide or system-wide or state-wide measures. Most are the natural role of utility companies.

• The state is already behind in making the grid ready for renewables. Without entities who have the capabilities, resources, and financial wherewithal to do the work, who are positioned and ready, the development of renewables will be delayed or halted.
Appendix:

Costs, Benefits, and Affordability of a Clean Energy Future In New Jersey
Can we afford a clean energy future?

MSSIA Mini-study on the affordability of electric power in NJ relative to other states:

Rates: New Jersey ranks 10th out of the 50 states and D.C. All the other states in the Northeast have higher rates than Jersey, except Maine, which is very slightly lower than Jersey.

Bills: (Per Capita Expenditures on Electricity): New Jersey ranks 30th due to its low average usage. Being more efficient at using energy helps keep bills low in states like New Jersey and California.

Affordability: (Percent of Personal Income Spent on Electricity): New Jersey ranks 45th. The national average percent of personal income spent on electricity is 0.79%. New Jersey’s percent of income spent on electricity is 0.61%, placing it near the bottom of all US states and D.C.
Can we afford a clean energy future?

DOE Solar Futures Study, September 8, 2021: “A renewable-based grid will create significant health and cost savings – Reduced carbon emissions and improved air quality result in savings of $1.1 trillion to $1.7 trillion, far outweighing the additional costs incurred from transitioning to clean energy. The projected price of electricity for consumers does not rise by 2035, because the costs are fully offset by savings from technological improvements.”

Lawrence Berkeley Laboratory, 2018: “Impacts of High Variable Renewable Energy (VRE) Futures on Wholesale Electricity Prices, and on Electric-Sector Decision Making”
40% to 50% Solar and Wind by 2030 will reduce wholesale costs in NYISO by 39%
NYISO – with 40-50% Wind & Solar, Wholesale costs drop 39%

### Wholesale Price Effects of 40-50% Wind & Solar

<table>
<thead>
<tr>
<th></th>
<th>Southwest Power Pool</th>
<th>NYISO (New York)</th>
<th>CAISO (California)</th>
<th>ERCOT (Texas)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Impacts in 2030</strong></td>
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<tr>
<td>relative to baseline with 2016 wind &amp; solar shares</td>
<td>Wind</td>
<td>Balanced</td>
<td>Solar</td>
<td>Wind</td>
</tr>
<tr>
<td><strong>Lower Average Prices</strong></td>
<td>$/MWh</td>
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<td>$/MWh</td>
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<td></td>
<td>0</td>
<td>-19%</td>
<td>-21%</td>
<td>-27%</td>
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<td></td>
<td>-12</td>
<td>-17%</td>
<td>-17%</td>
<td>-23%</td>
</tr>
<tr>
<td><strong>More Hours &lt;$5/MWh</strong></td>
<td>6%</td>
<td>8%</td>
<td>13%</td>
<td>2%</td>
</tr>
<tr>
<td>In baseline: 0% of all hours</td>
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<tr>
<td><strong>Changes in Diurnal Price Profile</strong></td>
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<td>red baseline shows 2016 wind &amp; solar shares</td>
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<tr>
<td><strong>More Price Variability</strong></td>
<td>1.8x</td>
<td>2.1x</td>
<td>2.5x</td>
<td>2.1x</td>
</tr>
<tr>
<td><strong>Higher AS Prices</strong></td>
<td>5x</td>
<td>6x</td>
<td>9x</td>
<td>2x</td>
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<tr>
<td><strong>Regulation Down</strong></td>
<td></td>
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<tr>
<td><strong>Change in Timing of Top Net-Load Hours</strong></td>
<td>Shift from 4pm to 7pm</td>
<td>Shift from 3pm to 5-7pm</td>
<td>No further shift 7pm</td>
<td>Shift from 3pm to 6-8pm</td>
</tr>
</tbody>
</table>
Can we afford a clean energy future?

The Attribute Value of solar power in NJ is $170 per MWH

Solar energy is a high-value renewable resource that will play a key role in securing a renewably-fueled future.

The services delivered by solar power in New Jersey are worth more than the incentive payments that are necessary to deliver them (Source: The Value of Distributed Solar Electric Generation to New Jersey and Pennsylvania. Clean Power Research, Perez, Norris, & Hoff, Nov. 2012. Commissioned by MSEIA)
Can we afford a clean energy future?

MSSIA Mini-study (ongoing, unpublished*): “Costs, Benefits, and Rate Impacts of Green Energy Programs – 2021 to 2050” Considered the costs of all green energy and EV programs, including associated infrastructure costs, on electric bills. Offsetting electric market benefits and societal benefits were also estimated.

Even without considering any benefits, electric rates, on average, barely move relative to 2021 as the cost of renewables drop and older, more expensive incentives gradually drop off.

When the depression of wholesale costs from renewable sources & bill reductions due to energy efficiency, each year typical residential bills will drop an average of $1.19 ($34.57 by 2050).

Savings in the social cost of carbon, and savings in the cost of local pollution provide an additional $6.12 per month savings. Transportation cost savings due to EV's, jobs & economic growth, and other benefits would provide additional value.

* Study calculations and estimates available. White paper under development.
Creating a planet run by the sun.
Today’s Agenda

01 | Hawaii’s Smart Inverter Interconnection. The upgrade deferral/avoidance success story
02 | Hosting Capacity Calculations Benchmark
03 | Limited Export
Early Smart Inverter Certification Challenges

- 2011 and 2016: Smart Community Project called JUMPSmartMaui. Maui, Hawaii, U.S.
- A smart community constructed by Hawaiian and Japanese stakeholders.
- **Objective**: effective utilization of renewable energy that had been penetrating on a larger scale and grid edge management.
w. Default Activation States for Functions: Unless otherwise provided by the utility, the default activation status for an Advanced Inverter shall be as follows:

- Anti-islanding – Mandatory Activation
- Transient Overvoltage – Mandatory Activation
- Low/High Voltage Ride-Through – Mandatory Activation
- Low/High Frequency Ride-Through – Mandatory Activation
- Frequency-Watt $P_{pre}$ - Mandatory Activation
- Volt-Watt $P_{rated}$ – **Mandatory Activation**
- Volt-var – Mandatory Activation
- Normal and Soft-Start Ramp Rate – Mandatory Activation
- Fixed power factor – Mandatory Deactivation

These default activation states may be modified by mutual agreement between the utility and Customer-Generator.
Estimating Curtailment / NWA Impact V-W

Fig. 3  Conceptual illustration of estimated curtailment as a function of AMI voltage for a hypothetical day in which the voltage peaks at 1.1 p.u. (which is much higher than seen in field data and outside of tariff rules, but useful for illustrative purposes)
Hawaiian Electric has historically used a technical subscreen of 166% of the service transformer rating in relation to aggregate export capacity.

Today, based on learnings from NREL’s VROS study, customers on “saturated” service connections can elect to activate volt/watt within the inverter to avoid paying for utility service upgrade as long as the service transformer is not overloaded.

In the event of excessive curtailment, the utility is required to resolve.

Figure 12. Secondary design for highest curtailed customer (dark red dot) in the M34 feeder
Prior Example of Hawaii Customer Options

We understand this is disappointing to you, but incorrectly installed systems can result in unacceptable voltage fluctuations that can damage appliances and electronics in your home as well as that of your neighbors’. Without adequate protective measures in place, stray voltage from unsafe installations present a significant risk to the safety of our line workers and to the public in general.

As a result, you now have the following options to carefully consider:

1. Proceed with an Interconnection Requirements Study (IRS) for your ISE application.
2. Proceed with activating Advanced Inverter Grid Support Functions.
3. Proceed with ISE Application without daytime export.
4. Apply for and install a Customer Self-Supply system.
5. Withdraw your ISE interconnection application.

Each option is described in detail below. You have **90 days** from the date shown on the letter to inform us of your decision and to provide the corresponding requirements related to your choice.
BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF HAWAI'I

In the Matter of

PUBLIC UTILITIES COMMISSION
DOCKET NO. 2019-0323

Instituting a Proceeding to Investigate
Distributed Energy Resource Policies
Pertaining to the Hawaiian Electric
Companies.

STIPULATION FOR PROPOSED REVISIONS
TO TARIFF RULE 14H VOLT-WATT FUNCTION
Volt-Watt Stipulation: Excerpts

- Because Volt-Watt control, in combination with Volt-VAR, “autonomously adjust inverter output based on local conditions without requiring communication with any other devices, they are good candidates for non-wire alternatives to increase PV hosting capacity when the limiting factor is voltage constraints in a transformer secondary service with very large numbers of PV systems.”

- Moreover, one would expect the economics to support the non-wires alternative of such system-wide activation of Volt-Watt in combination with Volt-VAR, rather than funding the costs for additional voltage studies and traditional upgrades, which ultimately result in increased costs to customers.

- In March 2021, the Companies expanded Quick Connect to all circuits, such that, even on circuits with 30% or less circuit hosting capacity, customers can now install and energize their systems prior to application submittal so long as the system is operating in a non-export mode until conditional approval is granted by the Companies. One of the conditions to utilize the Quick Connect process is for the customer to activate Volt-Watt so that the Companies can mitigate high-voltage risk in allowing customers to “install first, get approval later.”
Quick Connect unrestricted circuits where % available is greater than or equal to 30% and the circuit is not 2.4 kV or 4 kV allow for export programs Customer Grid-Supply Plus (GSP) and Smart Export (ISE) for projects less than 25 kW.

Quick Connect restricted circuits where % available is below 30% are available to export programs (GSP and ISE) on Oahu, Maui, and Hawaii Island only if they are energized in a non-exporting mode until conditional approval is granted by Hawaiian Electric or remains in a non-export mode if conditional approval is denied.

2021 Quick Connect Program

New solar systems that meet basic requirements to be installed and energized without full prior approval from Hawaiian Electric.

All circuits are eligible for Quick Connect non-export programs: Customer Self-Supply (CSS) or Net Energy Metering Plus.

Quick Connect unrestricted circuits where % available is greater than or equal to 30% and the circuit is not 2.4 kV or 4 kV allow for export programs Customer Grid-Supply Plus (GSP) and Smart Export (ISE) for projects less than 25 kW.
Volt-Watt Stipulation: Excerpts

- **Through the analysis of AMI voltage data**, if a voltage issue is identified as described in subpart (a) below, then the Companies will evaluate and implement solutions as needed to mitigate the voltage issue to protect the customer from excessive volt-watt curtailment.

- Once the need to investigate is triggered, the Companies will investigate the voltage issue and also utilize the Proposed Method to estimate the amount of curtailment occurring at the system to supplement the voltage data and facilitate transparency for the customer. Based on the investigation, the **Companies will proceed with solutions, including upgrades as needed, to address the high-voltage risk.**

- The Companies commit to fixing the voltage issue causing the curtailment, including completing any necessary upgrades, as follows: (1) for an overhead secondary mitigation, **within six (6) months of identifying the voltage issue and triggering the need to investigate**; and (2) for an underground secondary mitigation, within nine (9) months of identifying the voltage issue and triggering the need to investigate.
Hosting Capacity Benchmark Calculations
Managing Distributed PV Adoption

- Utility policies evolved ahead of formal interconnection proceedings at the PUC in order to keep up with customer demand, regulatory and political pressure.
- Hosting capacity screens and policies evolved from 10% of peak load to 250% of estimated gross daytime minimum load over a five year period.

Hawaiian Electric Policies

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>February-April</td>
<td>HECO proposes DG moratorium on neighbor islands, quickly retracts. Circuit penetration limit increased from 10% to 15% of system peak load.</td>
</tr>
<tr>
<td>2011</td>
<td>October</td>
<td>Limit increased to 50% of circuit daytime minimum load.</td>
</tr>
<tr>
<td>2012</td>
<td>October</td>
<td>Limit increased to 75% for small systems &lt;10kw.</td>
</tr>
<tr>
<td>2013</td>
<td>September</td>
<td>Limit increased to 100%; De facto moratorium on O‘ahu pending circuit studies.</td>
</tr>
<tr>
<td>2014</td>
<td>March</td>
<td>Limit increased to 120%; circuit studies completed.</td>
</tr>
<tr>
<td>2015</td>
<td>April</td>
<td>Limit increased to 250% estimated gross daytime minimum load.</td>
</tr>
</tbody>
</table>
Customer PV pushing the limits?

Distribution feeders have sufficient capacity to accommodate dramatic changes in load.

Consumer solar is far less impactful compared to market participants taking over the distribution feeder, although utility modeling practices likely assume similar extreme variations of aggregate solar resources when modeling the impacts during daylight hours.

Significant variation in load on a distribution feeder from a single large battery facility participating in CAISO.
Hosting Capacity within NJ Interconnection Rules

- The existing hosting capacity thresholds within New Jersey Interconnection rules require updating and, if followed, creates an unfriendly customer experience.
  - Level 1: (e) If a customer-generator facility is to be connected to a radial line section, the aggregate generation capacity connected to the circuit, including that of the customer-generator facility, shall not exceed 10 percent (15 percent for solar electric generation) of the circuit’s total annual peak load, as most recently measured at the substation.
  - (p) If a customer-generator facility is to be connected to a single-phase shared secondary, the aggregate generation capacity connected to the shared secondary, including the customer-generator facility, shall not exceed 20 kilovolt-amps (kVA).
  - (p) If an application for level 1 interconnection review is denied because it does not meet one or more of the applicable requirements in this section, an applicant may resubmit the application under the level 2 or level 3 interconnection review procedure, as appropriate.
Benchmark Calculations for Hosting Capacity

- The existing hosting capacity thresholds within New Jersey Interconnection rules and EDC policies require updating and, if followed, creates an unfriendly customer experience.
  - To provide greater clarity on hosting capacity processes, recommend standardize utility data collection based on best practices for utilization within interconnection processes.
    - Calculate peak and minimum gross load by adding the existing DER output to the recorded SCADA data. This calculation negates the impact of the existing DER on the load measured at the feeder and substation level so that total, raw load can be properly allocated.
Use of Certified Limited Export Controls
National testing standard to certify export control

- UL 1741 CRD for PCS means the certification requirement decision for power control systems for the standard titled "Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources". (March 8, 2019), Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook IL 60062-2096
Additional Definition Examples

- Beyond the need to update screening thresholds within specific technical review screens and make processes friendly for customs and utility staff, new definitions are needed to specify in greater detail how the DER will operate and be assessed.
  - **Aggregate Capacity or Aggregate Generation Capacity** means the aggregated ongoing operating capacities of all small generator facilities across multiple points of common coupling, within a defined portion of the distribution system.
  - **Ongoing operating capacity** means the actual simultaneous Generating Capacity, taking into account the operational differences of load offset and export. If the contribution of energy storage to the total contribution is limited by programming of the maximum active power output, use of a power control system, use of a power relay, or some other mutually agreeable, on-site limiting element, only the capacity [defined as ongoing operating capacity] that is designed to inject electricity to the utility's distribution or transmission system (other than inadvertent exports and fault contribution) will be used within certain technical screens and evaluations.
  - **Export capacity** means the maximum possible simultaneous generation of the Generating Facility, and is calculated as the maximum amount of export as permitted by limiting the amount of the Generating Facility’s export at the Point of Common Coupling.
Additional Topics

- **Increase Level 1 system size threshold**
  - RI and CT have recently increased their “simplified” review threshold to 25 kW.
  - NY has an expedited process for projects 50 kW or less (25 kW maximum for residential).

- **System sizing for anticipated electrification**
  - Allowed in other states including MA, MD (up to 200% of historical usage), CA, and CT (EV & heat pump allowances)

- **Proactive Grid Planning and Upgrades**
  - The recommendations in the presentation align with Goals 2.1 and 5.1 of the Energy Master Plan.
  - The anticipated doubling of peak demand and total electricity usage will require significant distribution system upgrades. A coordinated approach of upgrading the system to meet load and to increase DER hosting capacity needs to be developed to avoid unnecessary spending and maximize DER value to the grid.
Contact Information:

Steven Rymsha, Public Policy Director
Grid Solutions
steven.rymsha@sunrun.com
808-220-7377
INTERCONNECTION REFORM TO ACCELERATE RESIDENTIAL SOLAR & STORAGE

Arushi Sharma Frank
Tesla Energy
NJ BPU Grid Modernization, Interconnection Process Stakeholder Meeting 4 Submission
01/28/2022
SMART HOMES AT EASTON PARK
DRIVEN BY UTILITY TECHNOLOGY APPROVALS
Problem
• A future of high residential solar penetration requires battery storage
• Solar + Storage installations can be costly and complex
• Interconnection and electric service rules are slow to evolve

Solution
• Develop a transparent pathway for distributed generation interconnection solutions to go through EDC technical, field, and legal review and approval
• Tesla Backup Switch reduces cost and install times for residential storage: an adapter that locates between customer meter socket and EDC revenue meter, it reduces storage install times by 10X and reduces project costs
  • Compliant with National Electric Code
  • Certified to UL 414, UL 2735, UL 916, UL 1741 PCS
  • Approved by utilities in other states

RESIDENTIAL STORAGE INTERCONNECTION REFORM
ESSENTIAL FOR GRID MODERNIZATION
Whole-home backup requires extensive re-wiring of the home electrical panel
  - Either re-wiring the service disconnect and main panel grounding
  - Or re-wiring each individual home load circuit

Multiple additional boxes are added to the customer's wall.

Dozens of wire terminations are required

Resulting installation is costly

Resulting installation can be confusing for emergency personnel/contractors/EDC employees
SOLUTION: ISOLATION DEVICES AT CUSTOMER METER SOCKET

Old Way

New Way
• Less intrusive for customer & more streamlined installs on diverse property sizes and configurations

• Improved aesthetics & customer experience

• Easier to install on more premises, 10X faster installs = less stress on available labor, easier logistics, improved install safety

• Less material and labor costs passed to customer (e.g. realized in $500 Tesla credit for customers using Backup Switch)

• No EDC maintenance requirements (any issue at the site, simply pull it out)
### Customer-sited Switches and Adapters present the biggest single-change potential for residential DG customer installation cost savings

<table>
<thead>
<tr>
<th><strong>Tesla Backup Switch</strong></th>
<th>Tesla’s solar and storage installation for residential homes; installs under an hour and allows for safe disconnects and whole-home backup with the battery when the grid is in an outage.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Simple ConnectDER</strong></td>
<td>A meter panel adapter that reduces install time under an hour, allows resident to quickly “swap in” additional self-generation components on the home as they are introduced to the market, installed nationwide.</td>
</tr>
<tr>
<td><strong>Smart ConnectDER</strong></td>
<td>The Smart ConnectDER™ goes beyond Simple ConnectDER by including onboard metering, communications, and controls. For utilities, it unlocks alternative tariff models and grid management capabilities like load unmasking. This meter collar operates in parallel with the utility’s grid and can be factory-configured to terminate DER field wiring to either the load side or line side of the utility meter. For homeowners and installers, it comes with all the same benefits of the Simple ConnectDER — lower cost and fewer boxes and wires on the side of your house.</td>
</tr>
<tr>
<td><strong>EZ-Connect</strong></td>
<td>UL Listed, 200-amp manual transfer switch automatic disconnect for solar when the grid goes into an outage, allows transfer load to your back-up device, being developed for use nationwide.</td>
</tr>
<tr>
<td><strong>SolarLink</strong></td>
<td>During a power outage, PV systems shut down to prevent dangerous back-feeding of the utility lines. If these systems did not shut down, solar panels could energize the utility lines, creating an extremely dangerous situation for line-workers. SolarLink avoids this issue by automatically disconnecting from the utility grid when utility power is lost. It will be made available in a meter panel/socket-based adapter and surface mount.</td>
</tr>
<tr>
<td><strong>Green Meter Adapter</strong></td>
<td>Used in California PG&amp;E, the GMA is an alternative for solar and solar-storage installations to upgrading an electric panel and service to save time and additional cost; installed in meter panel.</td>
</tr>
<tr>
<td><strong>RMA – Renewable Meter Adapter</strong></td>
<td>The device simplifies the interconnection process, allowing customers to bypass electric service panel upgrades that are often required to support rooftop solar systems. This allows customers to eliminate the hassle and cost of associated construction to walls, stucco and landscaping, which can cost upwards of $10,000, as well as related delays and additional permitting requirements. Since becoming available in 2015, more than 6,500 SDG&amp;E customers have saved nearly $8 million in solar installation costs by using the Renewable Meter Adapter.</td>
</tr>
<tr>
<td><strong>Generlink</strong></td>
<td>UL-listed, socket-mounted transfer switch that provides a safe and convenient way to connect portable generator power to the home; installed behind utility revenue meter, the GenerLink delivers generator power directly to customer breaker box, eliminating the hassle of running power cords through the home.</td>
</tr>
</tbody>
</table>
3.11 Meter Attachments

No attachments by the customer or the customer’s agent are permitted to Company-owned meters, meter circuits, or ancillary meter devices. This includes grounds attached to meter sockets from the telephone or CATV companies.

The following are considered un-authorized connections when not made, installed, or performed by a FirstEnergy employee or an authorized representative of FirstEnergy:

- Any adapter placed between the revenue meter and meter socket.
- Attachments or connections to the potential or current circuits of transformer rated revenue meters.
- Any connection inside the meter socket.

The Company will supply, upon request by a customer, kWh and/or kvarh pulses from a Company-owned meter for demand control purposes. A cost will be assessed to the customer in accordance with specific Company charges for this connection.
NJ GRID MODERNIZATION OBJECTIVE

REMOVE CONFLICT WITH NEW JERSEY UNIFORM CONSTRUCTION CODE (N.J.A.C. 5:23-1.3)

Sources:
https://www.state.nj.us/dca/divisions/codes/codreg/pdf_regs/njac_5_23_1.pdf

Tesla Meter Sockets

I would like to take this opportunity to remind everyone of the Intent and Purpose (N.J.A.C. 5:23-1.3) of the UCC. This section tells us that the intent and purpose of the regulations are: “to permit to the fullest extent feasible the use of modern technical methods, devices and improvements,...” and “to eliminate restrictive, obsolete, conflicting, and unnecessary construction regulations that tend to unnecessarily increase construction costs or retard the use of new materials, products, or methods of construction, or provide preferential treatment to types or classes of materials or products or methods of construction.”

It has come to the Department’s attention that several local enforcing agencies, as well as a few electric utilities, may have overlooked this section of the regulations.

Tesla has developed a product that inserts between the utility meter and the meter enclosure. This product is intended to monitor the utility power and communicate with an electrical storage system installed in the owner’s premises. Under 2017 NEC, Article 230.82(6), this equipment is permitted to be installed prior to the service disconnecting means.

This product has UL approval under Standards 414 Meter Socket, 2735 Electric Utility Meters, and 916 Energy Management Equipment. The Department received multiple calls/emails about local enforcing agencies and electric utility companies refusing to accept this product. Under 5:23-3.8(d)(2), only products listed, labeled, and approved from a NRTL are acceptable. This product has met the requirements of the regulations.

It is not our authority to dictate that products meet a particular standard unless the Code gives us that authority. If the product being proposed has met the requirements of 3.8(d)(2), then we, in the code enforcement community as well as the public utilities, should not refuse the use of this product.

If you have any questions regarding this topic, contact the Code Assistance Unit at (609) 984-7609.

Note: This issue has been discussed internally within the Board of Public of Utilities (BPU); they do not endorse or otherwise approve the specifications, installation, or usage of the equipment, as it is not their area of work. However, BPU sees no reason to oppose this article nor take any position on this situation.

Source: Scott Borsos
Bureau of Construction Project Review
EXAMPLE: UPDATED ELECTRIC SERVICE RULES

3.5.1 Acceptable Meter Sockets

Acceptable meter sockets are those manufactured in accordance with current EUSERC, ANSI-C12, and UL/ANSI-414 requirements. The customer must provide and install the meter socket, complete with terminal lugs, meter jaws, manual link bypasses or safety sockets (when required), and sealing means for all sections. All sockets shall be ring-type. The meter socket and service equipment shall be NEMA type 3R (rainproof), in good condition with no holes, dents or damage, and plumb in all directions. The installation shall be made with sufficient materials and installed such that it remains plumb for the duration of the service.

Consult the Power Company for approved meter socket types, or refer to the lists of acceptable meter sockets online at https://www.pacificpower.net/working-with-us/builders-contractors/electric-service-requirements.html and https://www.rockymountainpower.net/working-with-us/builders-contractors/electric-service-requirements.html.

Stainless steel meter enclosures are recommended for coastal areas and corrosive atmospheres. This will prevent early failure due to corrosion.

3.5.6 Additional Fixtures on Meter Installations

The meter socket, cabinet, and enclosure are provided by the customer for the exclusive use of the Power Company. The customer shall not make or allow the attachment of any device or fixture on any meter socket, cabinet, or enclosure, except as indicated below.

Where permitted by the authority having jurisdiction, one inter-set device may be installed between the meter socket and the meter. The customer must obtain approval from the authority having jurisdiction for the device and its listed and intended application. The company reserves the right to remove the device and return it to the customer if it adversely affects its ability to deliver power to any customer. Contact the Power Company at 1-888-221-7070 to request the specific requirements for installing an inter-set device.
**Meter Collar Devices**

Rules for Electric Meter and Service Installations (REMSI)

Collars are installed between the residential electric meter and a meter socket. When you interconnect with PPL, we will install this device at no cost to you. The Smart ConnectDER® allows for an easy connection between the utility meter and your DER installation as well as providing the necessary communications to collect and report data from your installation.

Manufacturer’s model number designation is subject to change by the manufacturer at their discretion. The manufacturer does not support multiple meter collars installed on the same meter base/socket.

This list will be updated as additional models / manufacturer’s equipment are reviewed. However, the review will be done on an as-needed basis only or by specific request.

**Additional Meter Collar Devices**

The following lists the manufacturers and model numbers that have been submitted on previous projects, reviewed by PPL EU, and accepted for use. If other manufacturers or models are proposed for use, please submit all pertinent technical information to PPL Electric Utilities for review.

Manufacturer’s model number designation is subject to change by the manufacturer at their discretion. The manufacturer does not support multiple meter collars installed on the same meter base/socket.

This list will be updated as additional models / manufacturer’s equipment are reviewed. However, the review will be done on an as-needed basis only or by specific request.

- **Global Power Products – GenerLink Transfer Switch**
  - MA23-N, Non-Surge (30 AMP)
  - MA23-S, Surge (30 AMP)
  - MA24-N, Non-Surge (40 AMP)
  - MA24-S, Surge (40 AMP)

- **Tesla Backup Switch**
  - Meter collar that communicates directly with Powerwall; the Backup Switch automatically detects grid outages, providing a seamless transition to backup power.
  - Model #1624171

Source: PPL, Rules for Electric Meter & Service Installations
• 06/09/2021
  • First *Powerwall* + Install in Utility service territory (shared Solar/Storage Inverter)

• 09/30/2021
  • Tesla immediately begins providing $500 Point-of-Sale rebate for all PV+ Powerwall Purchases in Utility Service Area

• 10/14/2021
  • First 9 Solar Roofs Installed in Easton Park new homes

• 10/18/2021
  • First Tesla Backup Switch & Powerwall + Installs in Easton Park

• 1/10/2022
  • Standardized Interconnection Package for all new homes includes install specs for each DER component on homes
(A.5) A QUALIFYING RETAIL UTILITY’S INTERCONNECTION STANDARDS FOR DISTRIBUTED ENERGY RESOURCES MUST ALLOW FOR CUSTOMER OWNERSHIP AND USE OF A METER COLLAR ADAPTER TO PERMIT THE INTERCONNECTION OF DISTRIBUTED ENERGY RESOURCES AND FOR ELECTRICAL ISOLATION OF THE CUSTOMER’S SITE FOR ENERGY BACKUP PURPOSES. THE QUALIFYING RETAIL UTILITY SHALL, WITHIN ONE HUNDRED EIGHTY DAYS AFTER THE EFFECTIVE DATE OF THIS SUBSECTION (1)(e)(1)(A.5), ADOPT A TRANSPARENT PROCESS FOR APPROVING CUSTOMER-OWNED METER COLLAR ADAPTERS THAT MEET MINIMUM SAFETY REQUIREMENTS. THE COMMISSION SHALL RESOLVE ANY DISPUTES CONCERNING THE SUBSTANCE OR PROCEDURES INVOLVED IN THE APPROVAL PROCESS OR ITS APPLICATION IN ANY SPECIFIC CASE. THE APPROVAL PROCESS MUST TAKE NO MORE THAN SIXTY DAYS AFTER THE DATE OF SUBMISSION FOR APPROVAL OF A SPECIFIC METER COLLAR ADAPTER BY THE PROPOSING PARTY. APPROVED METER COLLAR ADAPTERS MUST BE UL LISTED AND MUST BE SUITABLE PER THE ADAPTER’S UL LISTING DOCUMENTATION FOR USE IN METER SOCKETS OF UP TO TWO HUNDRED AMPERES. THE QUALIFYING RETAIL UTILITY SHALL DEFINE AND PUBLISH IN ITS TARIFFS A PROCESS TO REQUEST AND INSTALL A METER COLLAR ADAPTER, WHICH PROCESS IS TIMELY AND NOT UNDULY BURDENSOME TO THE CUSTOMER. THE QUALIFYING RETAIL UTILITY SHALL POST ON ITS WEBSITE ITS LIST OF APPROVED METER COLLAR ADAPTERS, WHICH LIST MUST BE UPDATED AT LEAST ANNUALLY.

Backup switch approvals by these utilities allow Tesla to pass on $500 savings per customer (PV-Solar):

Adoption discussions underway in these utility service areas:
Example – Utility Pilot Timeline and Approach

**Month 1**
- Execute Test Plan and Field Pilot MOU between Equipment Vendor and EDC (EDC may have internal partners – DER Incubator, Innovation Sandbox, Meter Lab, Meter Vendor Lab)

**Month 6**
- 6 month in-field pilot. Example: can install Backup Switch with Powerwall Battery in up to 50% of the anticipated residential battery volume in the state

**Coordinate Pilot Review and Approval via Environmental Engineering Staff, Division of Energy, NJBPU**
Proposed General Terms based on other pilots

- Clear installation parameters - who installs, removes devices, duration of removal, commitment to comply with utility rules
- Develop communications process between utility staff and vendor/customer agents
- Stipulate necessary training documentation, in-person demos for personnel
- Clarify grey areas in electrical service rules – what is an extension of the customer-owned meter socket, what is utility property or process requiring permission?
- Provide assurances about the term of a pilot, demonstration, cap on customers enrolled in a program
Create regulatory sandboxes or pilots with capped project numbers so EDCs can learn from field installations.

Clarify Electric Service Rules to allow customer-sited DG and backup solutions including behind the revenue meter in the customer meter socket.

Develop a transparent process for reviewing new customer-sited new technologies (MOUs and Time-Bound Reviews).

Align EDC storage device review & approval timelines with statewide storage adoption targets.

MULTIPLE PATHWAYS TO ALLOW NEW CUSTOMER-SITED DER TECH
"Energy-specific sandboxes must be carefully and thoughtfully designed, and … there are good arguments for … target[ing] the energy industry, particularly the power sector. The energy system is transforming toward a largely distributed and renewables-based future that will require an updated regulatory framework. Trialing some targeted policy changes now, at limited scale, will help ensure that the rules governing the system keep pace with the energy transformation."

Guidehouse

- Support Accelerated EDC Learning from Field Installations
- Provide Regulated Forum for Organized Study of New Technology and New Processes
ADDITIONAL RECOMMENDATIONS – GRID MODERNIZATION

Feedback on January 14 EDC Readout Stakeholder Session

 ✓ Increase Level 1 Scope to 15 - 20 kW, expedite processing and reducing costs for Small Customer DERs

 ✓ Smart Homes Ecosystem Upgrades Initiative in New Jersey, Sandbox approach - BPU/EDCs, create consistent process for Residential Upgrades

 ✓ Online Portal for Application Tracking, Submission, Pre-population of forms by EDC staff where possible, tracking/accountability features

 ✓ Electronic Payments and Signatures (ref. New NJ Law A5033/S3279 for Auto Sales E-Signature)

 ✓ Better data access (enhance existing repositories of information, streamline access – e.g. pre-app reports, dist. system maps)

 ✓ Fund a DER IX Ombudsman Position (e.g., Interconnection Ombudsman, NY Central Hudson Electric; DG & Clean Energy Ombudsperson, MA DPU)
**Meter collar device/adapter to safely island the home from the grid**

- The biggest single-change potential for customer cost savings
- **Not** a means for electrically connecting a generation source
- **Not** a line side tap
- The Backup Switch contains:
  - A latching relay to disconnect the home from the grid so that it can be backed up safely
  - Sensing equipment so that we can safely operate the relay and backup power sources
  - Intelligence and communication to ensure safe operation
- Certified under the same **UL 414 standard** as the **meter socket**.
  - Additional certification: UL 2735, UL 916, UL 1741 PCS
Safe whole-home backup from a battery energy storage system requires an integrated, automated means of disconnecting the home from the grid.

Today’s hardware requires ~ 10++ hours on site for installation.

The ANSI type 2S meter socket is a standard interface available in customer homes which allows a simple, safe alternative to rewiring the home
- Governed by existing safety standards
- Backup Switch is an example of a clean energy DG solution that takes less than 1 hour by installing at the customer meter panel
  - [https://www.tesla.com/support/energy/powerwall/learn/tesla-backup-switch](https://www.tesla.com/support/energy/powerwall/learn/tesla-backup-switch)
Residential PV-Storage installation with no load relocation
# Tesla Backup Specifications

## Performance Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Load Rating</td>
<td>200A, 120/240V Split phase</td>
</tr>
<tr>
<td>Short Circuit Current Rating</td>
<td>10 kA with any breaker¹</td>
</tr>
<tr>
<td></td>
<td>22 kA with minimum 22 kA breaker¹</td>
</tr>
<tr>
<td>Communication</td>
<td>CAN</td>
</tr>
<tr>
<td>Product Compatibility</td>
<td>Powerwall 2 with Backup Gateway 2, Powerwall+</td>
</tr>
<tr>
<td>Expected Service Life</td>
<td>21 years</td>
</tr>
<tr>
<td>Warranty</td>
<td>10 years</td>
</tr>
</tbody>
</table>

¹ See section 27.12.4 in UL 414.

## Environmental Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature</td>
<td>-40°C to 50°C (-40°F to 122°F)</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-40°C to 85°C (-40°F to 185°F)</td>
</tr>
<tr>
<td>Enclosure Rating</td>
<td>NEMA 3R</td>
</tr>
</tbody>
</table>

## Mechanical Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>176 mm x 205 mm x 74 mm (6.9 in x 8.1 in x 2.9 in)</td>
</tr>
<tr>
<td>Weight</td>
<td>2.8 lbs</td>
</tr>
<tr>
<td>Meter and Socket Compatibility</td>
<td>ANSI Type 2S, ringless or ring type</td>
</tr>
<tr>
<td>External Service Interface</td>
<td>Contactor manual override², Reset button</td>
</tr>
<tr>
<td>Conduit Compatibility</td>
<td>1/2-inch NPT</td>
</tr>
</tbody>
</table>

² Manually overrides the contactor position during a service event.

## Compliance Information

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Standards</td>
<td>USA: UL 414, UL 2735, UL 916, CA Prop 65</td>
</tr>
<tr>
<td>Emissions</td>
<td>FCC, ICES</td>
</tr>
</tbody>
</table>
Polls
Stakeholder Remarks
Timeline and Next Steps

- Timeline
- Next Steps and Outcomes
- Submitting Comments
- Closing Remarks
proceedings and recordings from prior meetings are available at: njcleanenergy.com/gridmod
Next Step and Outcomes
Continued engagement

• **Draft Report Review and Comment - April 22, 2022**
  – Guidehouse and NJ BPU will present the draft report

• **Outcomes include:**
  – Gap analysis and proposed roadmap
  – Identified modifications and updates to meet the Clean Energy Plan
  – Potential directives from the NJ BPU
Submitting Comments

njcleanenergy.com/gridmod

• Please submit comments directly to Docket No. QO21010085 as detailed in the public notice. Comments are considered “public documents” for purposes of the State’s Open Public Records Act and any confidential information should be submitted in accordance with the procedures set forth in N.J.A.C. 14:1-12.3. Written comments, including questions regarding the stakeholder process, may also be submitted to:

  Aida Camacho-Welch
  Secretary of the Board
  44 South Clinton Avenue, 1st Floor
  Post Office Box 350
  Trenton, NJ 08625-0350
  Phone: 609-292-1599
  Email: board.secretary@bpu.nj.gov
NJ BPU Closing Remarks

Paul Heitmann, NJ BPU
Project Team

New Jersey Board of Public Utilities

Paul Heitmann  
Program Manager  
BPU Clean Energy Division

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