NPCC Distributed Energy Resources/Variable Energy Resources Forum

August 11, 2022, 9:00 a.m. – 12:00 p.m. EDT WebEx Meeting

Dial-In: 415-655-0003 (USA) / 416-915-6530 (Canada)
Guest Code: 24304910452
Password: 73Ucsw7bjh? (73827972 from phone)
WebEx Link

Day Two NPCC Regional Standards Committee Meeting – DER VER Forum:

August 11, 2022, 9:00 a.m. – 12:00 p.m. (all times EDT)

11.0 Distributed Energy Resources (DER) Variable Energy Resources (VER) Forum Topics

11.1 Welcome and Safety Message: Gerry Dunbar, NPCC Director Reliability Standards and Criteria (9:00 am - 9:05 am)
11.2 Antitrust Compliance Guidelines, Public Notice, and Meeting Protocols: Ruida Shu, NPCC Manager of Reliability Standards (9:05 am – 9:10 am)
11.3 NPCC VER/DER Outreach Efforts: Gerry Dunbar, NPCC Director Reliability Standards and Criteria (9:10 am – 9:15 am)
11.4 Transmission and Distribution System Planning for Electrification - Damian Sciano, Director, Statewide Energy Data Integration, Con-Edison (9:15 am – 9:55 am)
11.5 Ferry Electrification, Ralph Curitti, Sr. Manager Projects, Ontario Power Generation (9:55 am – 10:35 am)

Break (10:35 am – 10:40 am)

11.6 NREL's Projections of U.S. Electric Grid Evolution (Standard Scenarios) - Pieter Gagnon, National Renewable Energy Laboratory (NREL) (10:40 am – 11:20 am)
11.7 Electric Enablement: Advancing the Grid to Accelerate Decarbonization, Alan Dulgeroff, San Diego Gas & Electric (11:20 am – 12:00 pm)
11.8 Closing – Gerry Dunbar

Northeast Power Coordinating Council, Inc. (NPCC)

Antitrust Compliance Guidelines

It is NPCC's policy and practice to obey the antitrust laws and to avoid all conduct that unreasonably restrains competition. The antitrust laws make it important that meeting participants avoid discussion of topics that could result in charges of anti-competitive behavior, including: restraint of trade and conspiracies to monopolize, unfair or deceptive business acts or practices, price discrimination, division of markets, allocation of production, imposition of boycotts, exclusive dealing arrangements, and any other activity that unreasonably restrains competition.

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- Their company's prices for products or services, or prices charged by their competitors;
- Costs, discounts, terms of sale, profit margins or anything else that might affect prices;
- The resale prices their customers should charge for products they sell them;
- Allocating markets, customers, territories or products with their competitors;
- Limiting production;
- Whether or not to deal with any company; and
- Any competitively sensitive information concerning their company or a competitor.

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Distributed Energy Resources and Variable Energy Resources Forum Disclaimer Statement

1. General

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Public Announcement

RSC and DER/VER Forum Meetings, WebEx, and Conference calls:
Participants are reminded that this meeting, WebEx, and conference call are public. The access number was posted on the NPCC website and widely distributed. Speakers on the call should keep in mind that the listening audience may include members of the press and representatives of various governmental authorities, in addition to the expected participation by industry stakeholders.

Meeting Logistics

Participants will be muted upon entry, and you are encouraged to use the "Chat" feature of the WebEx if you wish to ask a question. The questions will be answered by the presenter at the end of each presentation. NPCC DER/VER Forum will be recorded, the recording and meeting material will be posted on the DER Forum section of the NPCC website.

Thank you for your cooperation.

NPCC 2022 Outreach Activity

Gerry Dunbar

Director Reliability Standards and Criteria

August 11, 2022

NPCC 2022 – 2025 Strategic Plan

Strategic Focus Area

Reliably Integrate Resources Brought Forward by Decarbonization Objectives

- DER/VER Forums
  - May 12, 2022 --- Electric Vehicle Charging
  - August 11, 2022 --- Building Electrification
  - October 13, 2022 --- TBD

- NPCC DER/VER Guidance Document

T&D System Planning for Building & Transportation Electrification

Damian Sciano

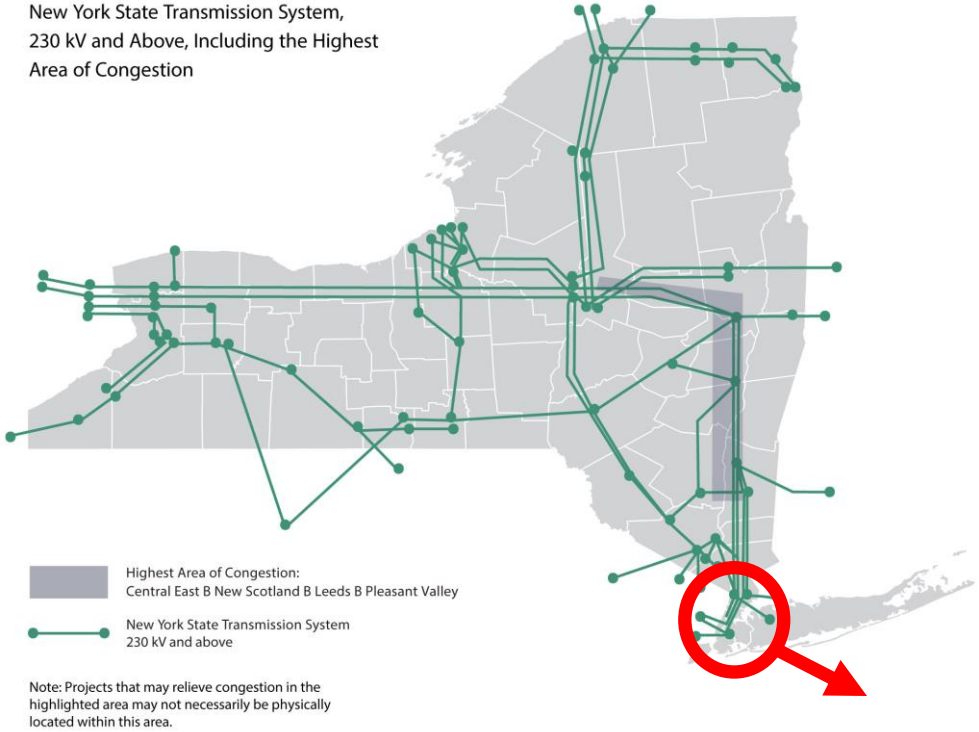
August 11, 2022

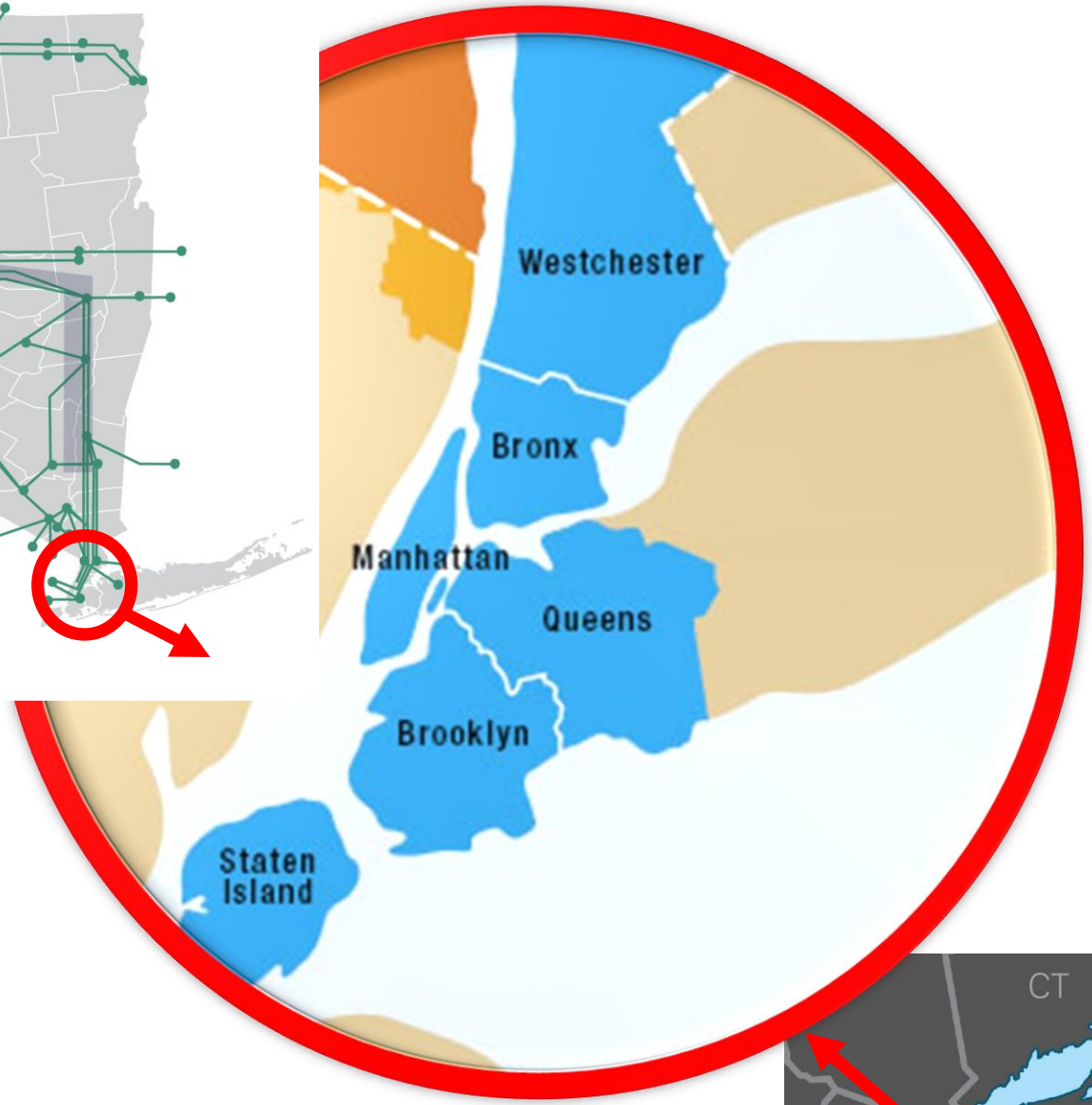
conEdison

Agenda

- NYS Landscape
  - Con Edison territory within NYS
  - REV to CLCPA
  - Building and Transportation Electrification
- Multi-value planning approach under CLCPA
- 10 Year Load Forecast & Drivers for New Area Substation
  - New Business Load Growth
  - Building Electrification and Electric Vehicle Growth
  - Energy Efficiency & NWS Impact
  - Storage as a complementary resource
- System Load Relief Plan

Con Edison System

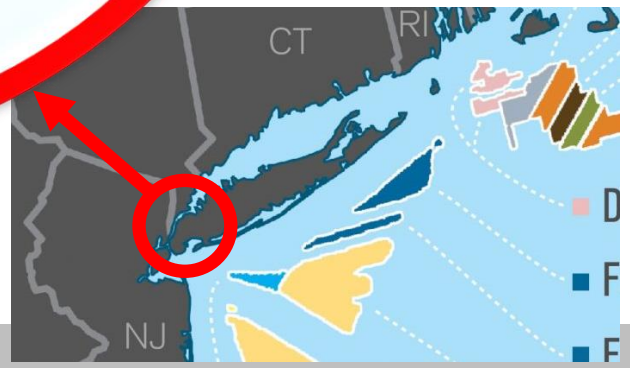




3.3 Million Electric Customers
1.1 Million Gas Customers
1,800 Steam Customers

2020 – 13.2 GW Summer Peak
(NYC = 11.5 GW Summer Peak)

2020 – 9.0 GW Winter Peak
(NYC ~ 8.0 GW Winter Peak



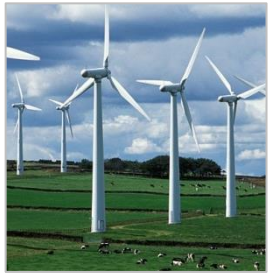
Starting in 2014, reforming the energy vision (REV) sought to restructure the energy industry with a market driven approach focusing on distribution level resources

Track One: Implementation (Order issued February 2015)
Distribution-level market design, technical platform, integrated system planning & operation, new utility business models, ownership of distributed resources

- Utilities will be the Distributed System Platform (DSP); utility ownership of DER limited to backstop
- 5-Year Implementation Plan due January 15, 2016; bi-annually thereafter
- Promoted non-wires solutions (NWS) as preferred alternative to utility infrastructure

Track Two: Regulatory & Ratemaking (Order issued May 2016)
Rate design, performance-based ratemaking, extended rate case periods

- Proposed Earnings Adjustment Mechanisms (EAM) to get utility off rate base
- Concept of regulatory assets introduced



Track Three: Renewables (No order issued)
Large-scale renewables, renewable portfolio standard

- Utility ownership was contemplated among other models
- No order was ever issued; in a way, CLCPA includes this track three effort

	REV
Goals	Green NYS
Timeframe	2030 – 50% Renewables
Philosophy	Market Driven
Focus	Distribution & DER enablement
Infrastructure	**Avoid** T&D build (NWS)
Electrification	EV focus
Key Players	Utilities Market Participants NYISO

REV envisioned a world of flat to declining utility growth via energy efficiency, distributed energy resources and grid/load defection

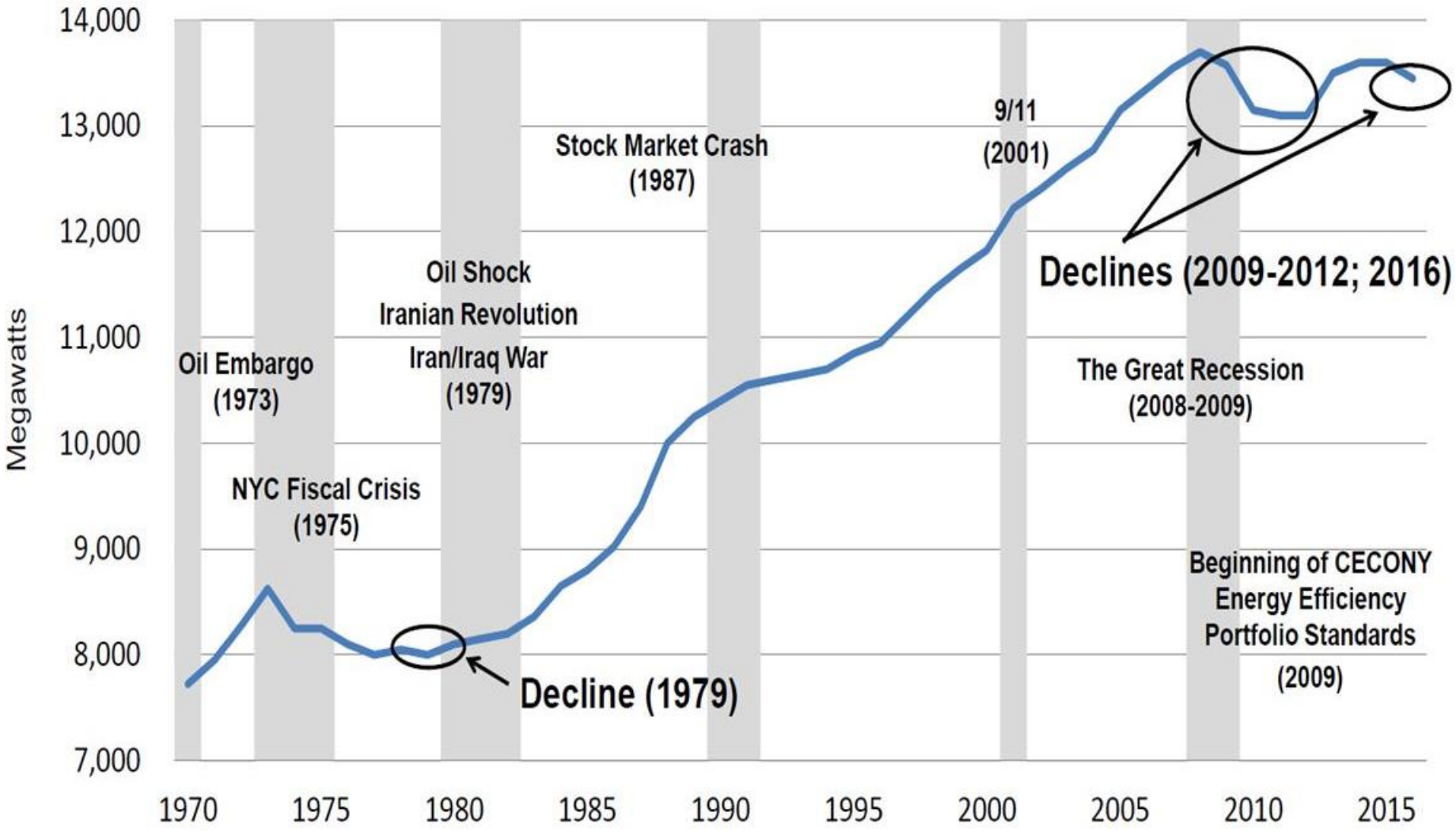


*Chart depicts Con Edison historical Load from 1970 to 2016 (NYC & Westchester)

While load growth remains flat (for now) and DER resources progressed (in particular solar) it became clear large-scale renewables were a very important piece to add to the mix

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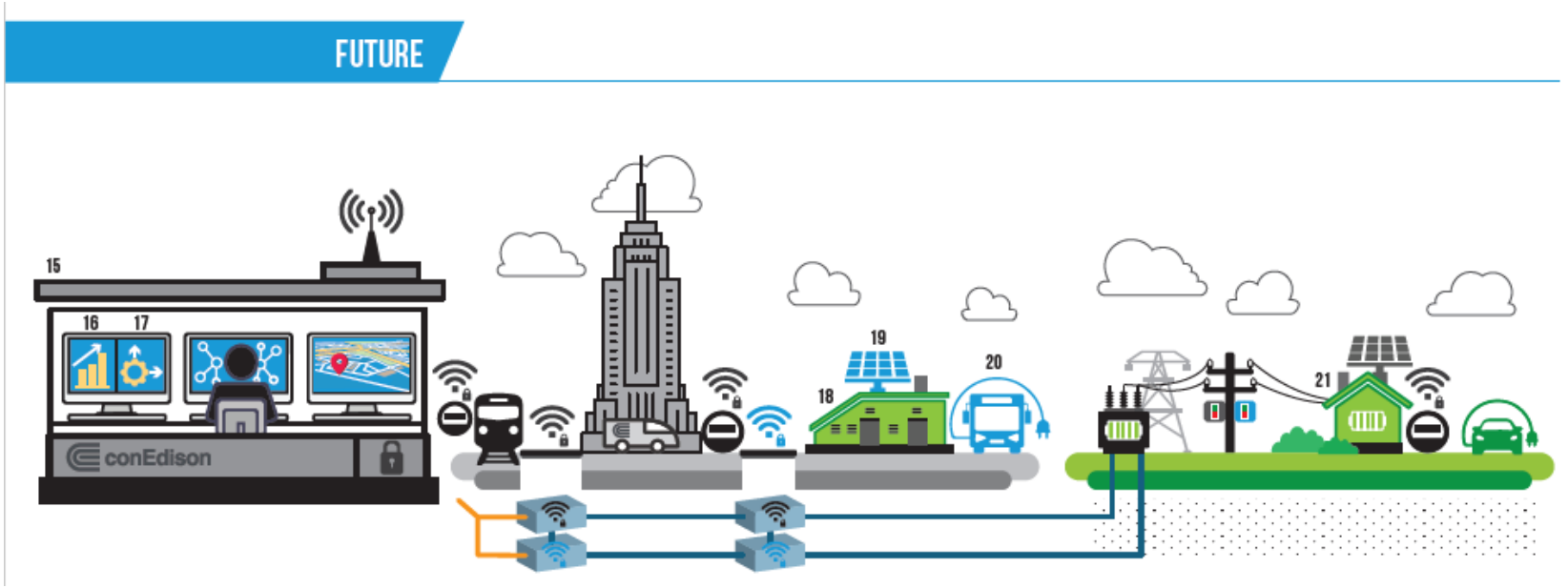
<u>Noteworthy Successes</u>

- Over 3,000 MW solar (DC)
  - Hosting capacity maps
  - Value of DER
- Non-wires solutions and BCA Framework in place
- Zero emission credits (ZEC)
- Starting point for electric vehicles
- Grid innovation/modernization

Even prior to this realization, the value of the T&D system as an enabler for greening the grid and meeting customers needs

Grid Innovation became important for REV and even more critical to the CLCPA



Grid Innovation efforts can be grouped into three focus areas:

Reliability & Resiliency

To meet and exceed customer expectations in an era of increasingly diverse resources

Safety & Security

To protect people, data, and infrastructure in an ever changing environment

Clean Energy & Flexibility

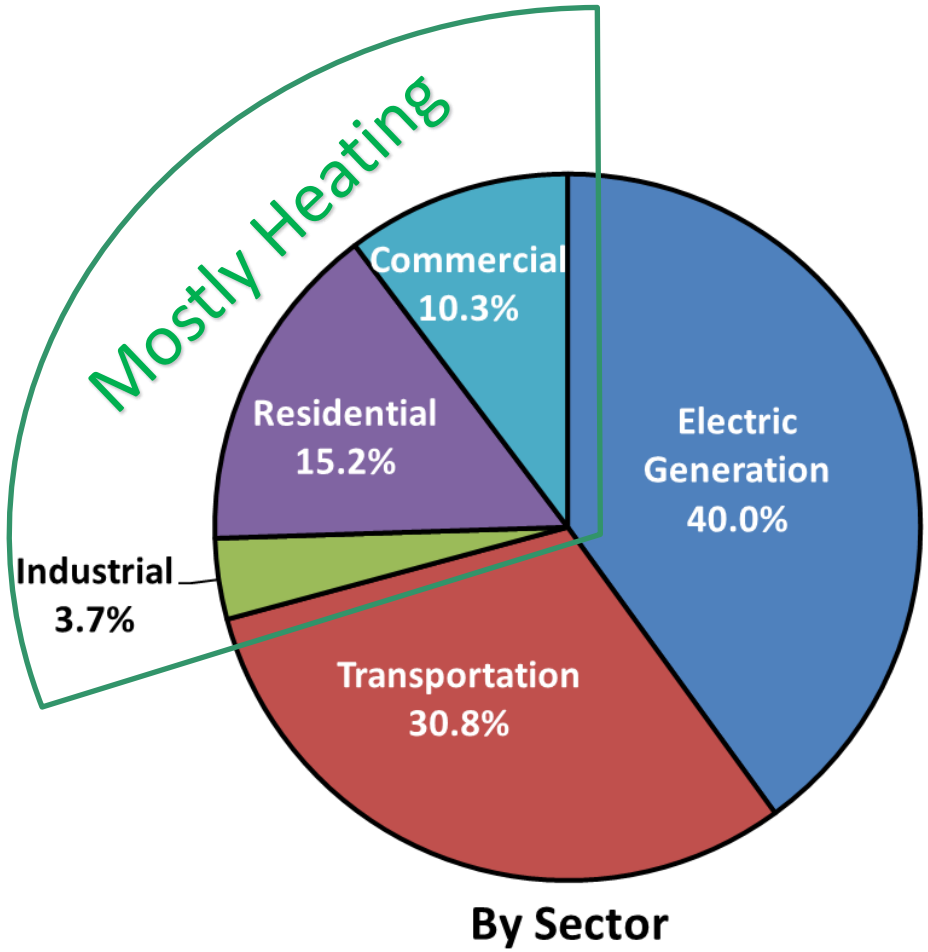
To enable customer choice – including clean, reliable, affordable energy

In 2019, NYS enacted the CLCPA law which directed significant focus on large scale renewables, deep decarbonization and electric T&D buildout

	REV	CLCPA
Goals	Green NYS	Full Decarbonization
Timeframe	2030 – 50% Renewables	2030 – 70% renewable electricity 2040 – 100% carbon neutral electric 2050 – Full decarbonization
Philosophy	Market Driven	Statutory Mandates
Focus	Distribution & DER enablement	Transmission & large-scale renewable integration
Infrastructure	**Avoid** T&D build (NWS)	**Aggressively** build T&D
Electrification	EV focus	EV & Heating
Key Players	Utilities Market Participants NYISO	All of the above +: **NYPA** Renewable Generators Building owners

Focus is now on expediting CLCPA enabling T&D projects under State jurisdiction and cost sharing and avoiding gas infrastructure wherever possible

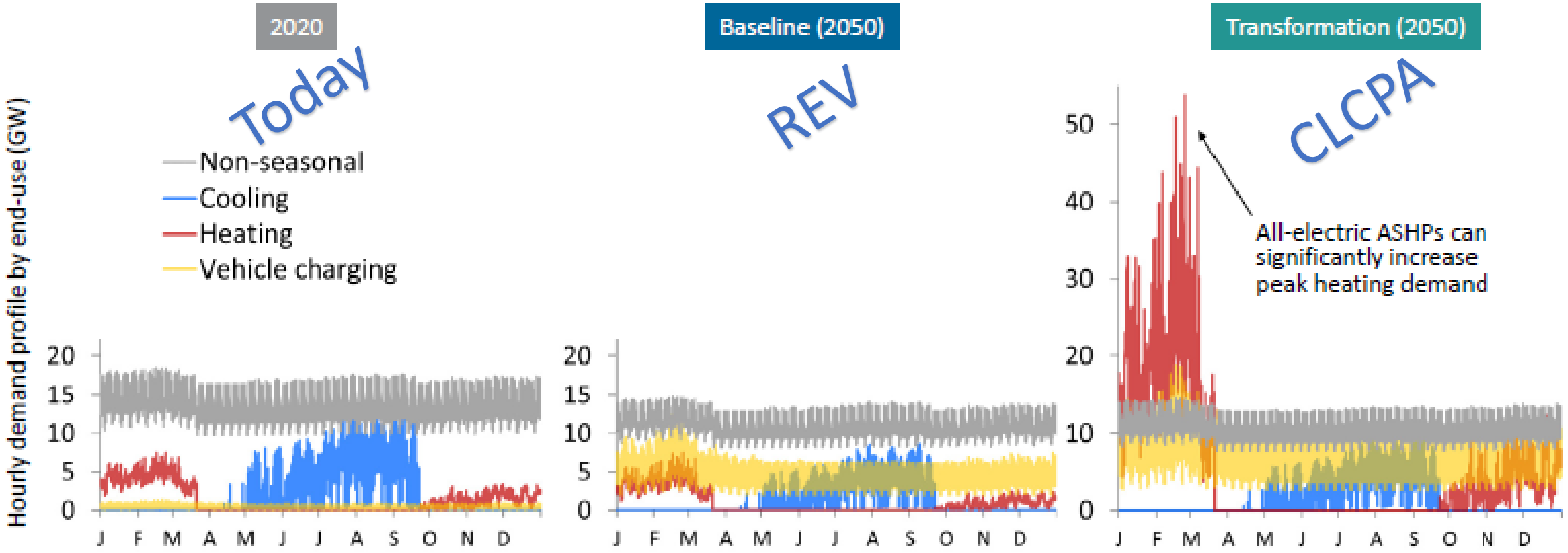
CLCPA looks to fully decarbonize via building electrification (heating) and transportation electrification (electric vehicles)…



Source: NYSERDA Patterns and Trends New York Energy Profiles: 2002–2016 (January 2019)

…building electrification is more pronounced downstate and transportation less pronounced but still significant (think NYC skyline and subway availability)

EPRI Study on various electrification scenarios show significant growth potential



Source: EPRI: Electrification Scenarios for New York's Energy Future 2020

Summary of CLCPA Goals and Zero Emission Vehicle Targets

Green the Supply

Increase Demand (Electrify)

70% renewable energy by 2030, 100% clean energy by 2040

9,000 MW of offshore wind by 2035 Master Plan being written for 20GW (total) beyond that

6,000 MW of solar energy by 2025 10,000 MW by 2030 (DC name plate)

6,000
~~3,000~~ MW of energy storage capacity by 2030 (1,500 MW by 2025)

Reduce energy consumption by 185 trillion British thermal units (BTUs) from the State's 2025 forecast

850,000 zero emission vehicles (ZEVs) by 2025

40 percent emissions reductions in absolute terms from 1990 levels by 2030, 85 percent emissions reductions by 2050

**Items in red highlight additions from CLCPA (or changes made leading up to CLCPA)*

Greening the supply primarily requires transmission investment with limited distribution additions

Transmission Investment to:

- Unbottle portions of the 138kV system via connections to 345kV
  - Facilitates the retirement of in-city gas/oil turbines
- Connect offshore wind (9GW moving to 20GW with new Master Plan) & Hydro
  - Working with offshore wind developers and 1.2GW Hydro developer
  - Looking at clean energy hubs as well as other proposed solutions
- Statewide transmission upgrades to facilitate flow of renewables from north to south and potentially from south to north (think offshore wind at night)
- Solicit bulk storage projects

Distribution investment to:

- Interconnect large community DG projects
- Facilitate distribution storage to complement bulk effort and improve reliability

Building electrification and transportation electrification may potentially require considerably more infrastructure

Transmission:

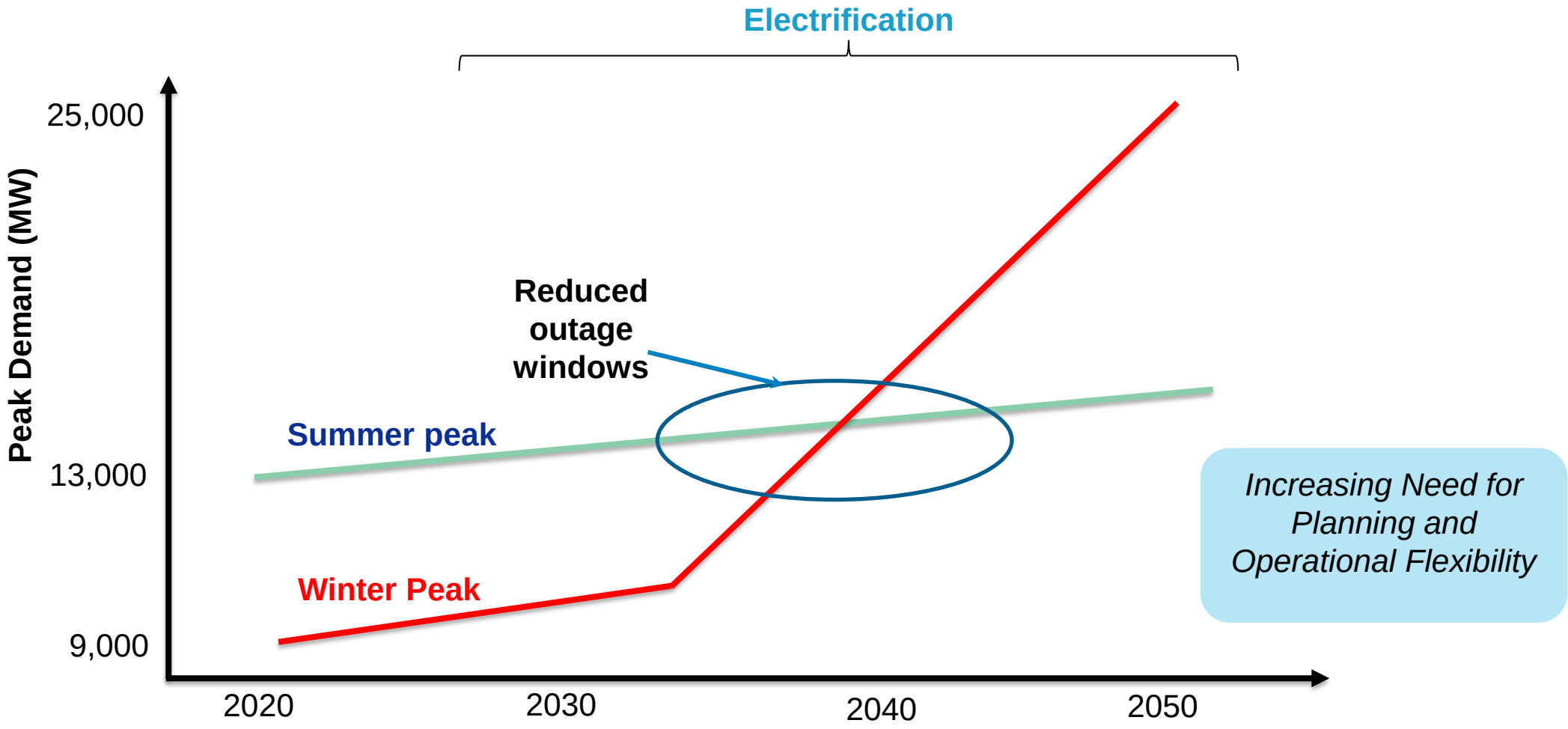
- Significant increase in load may drive significant transmission additions within the system (beyond getting offshore wind and hydro to the T&D system)
  - Potential to leverage some sourcing builds
  - Looking for multi-value projects that help both T&D

Distribution:

- Significant increase in load is expected to drive significant distribution additions
  - Significant increases in area substation builds
  - Significant increases in feeder runs
  - Significant increases in transformation and secondary mains
- Looking to propensity models that help anticipate offsets like solar and storage
- Looking for ways to promote customer owned storage as well as utility owned storage
  - Customer choice
  - Demand response initiatives (including FERC 2222)
  - Non-wires solutions (NWS)

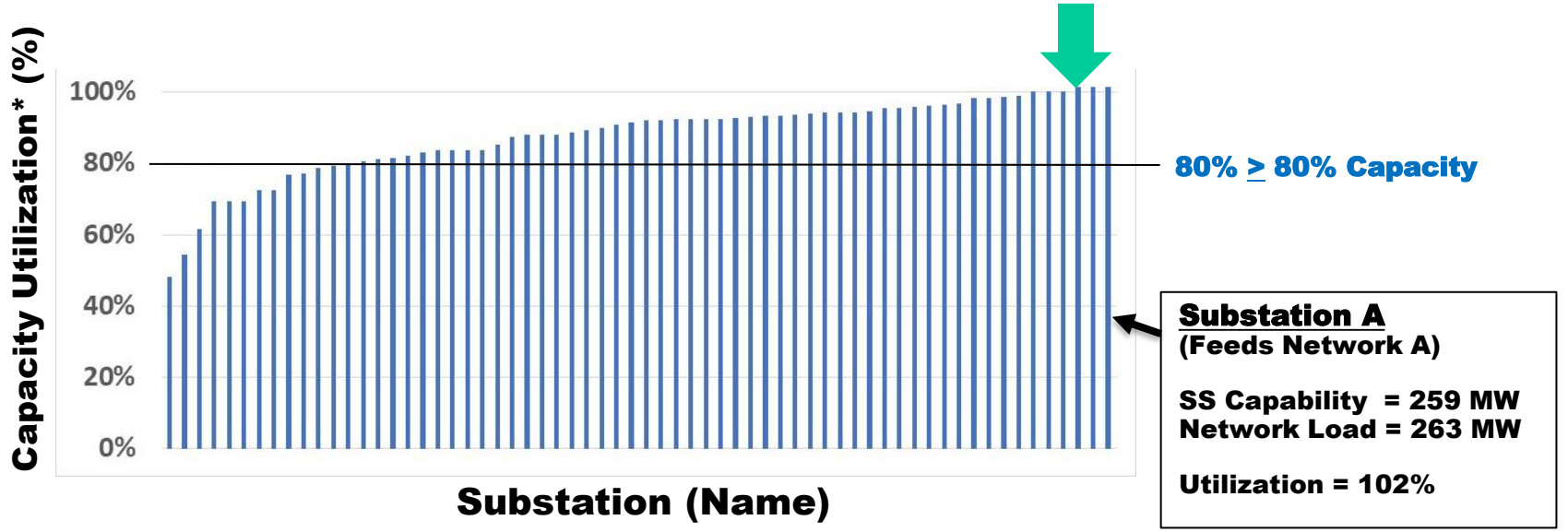
CLCPA is expected to have a major impact on system peak

Future Peak Forecasts – System Level



RECAP ON ROLE OF NWS: REV focus was a DER marketplace enabled by a Distributed System Platform (DSP)

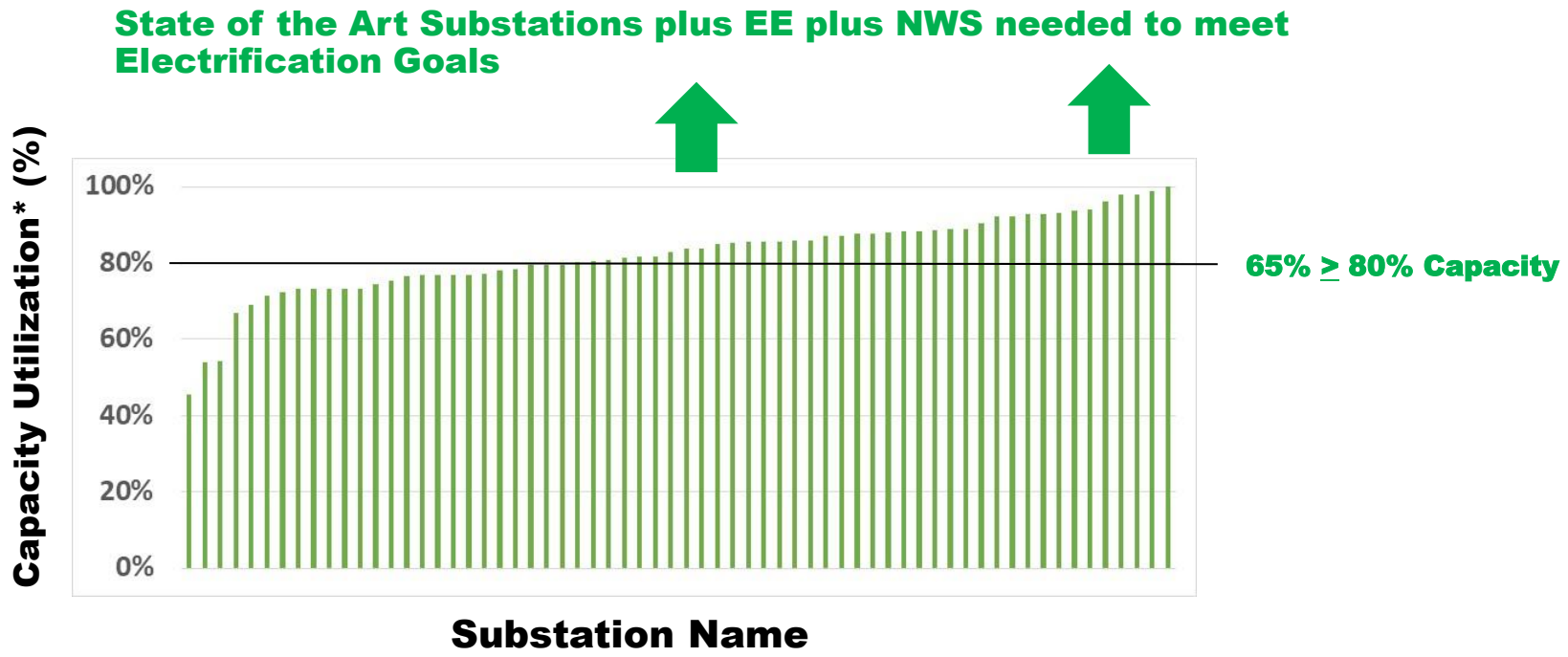
Non-wires solutions (NWS) addressed capacity constraints and energy efficiency and demand response kept downward pressure on customer usage



**Based on 2014 Area Substation and Sub-transmission Capacity*

In this scenario, the goal was to defer or avoid T&D builds

RECAP ON ROLE OF NWS: Under electrification, NWS is important but a small offset to needed T&D electrification needs



*Based on 2020 Area Substation and Sub-transmission Capacity (does not include impact of Covid-19)

To meet aggressive CLCPA goals, we need to build and build fast

Alignment with NYC Clean Energy Vision via Multi-Value Projects

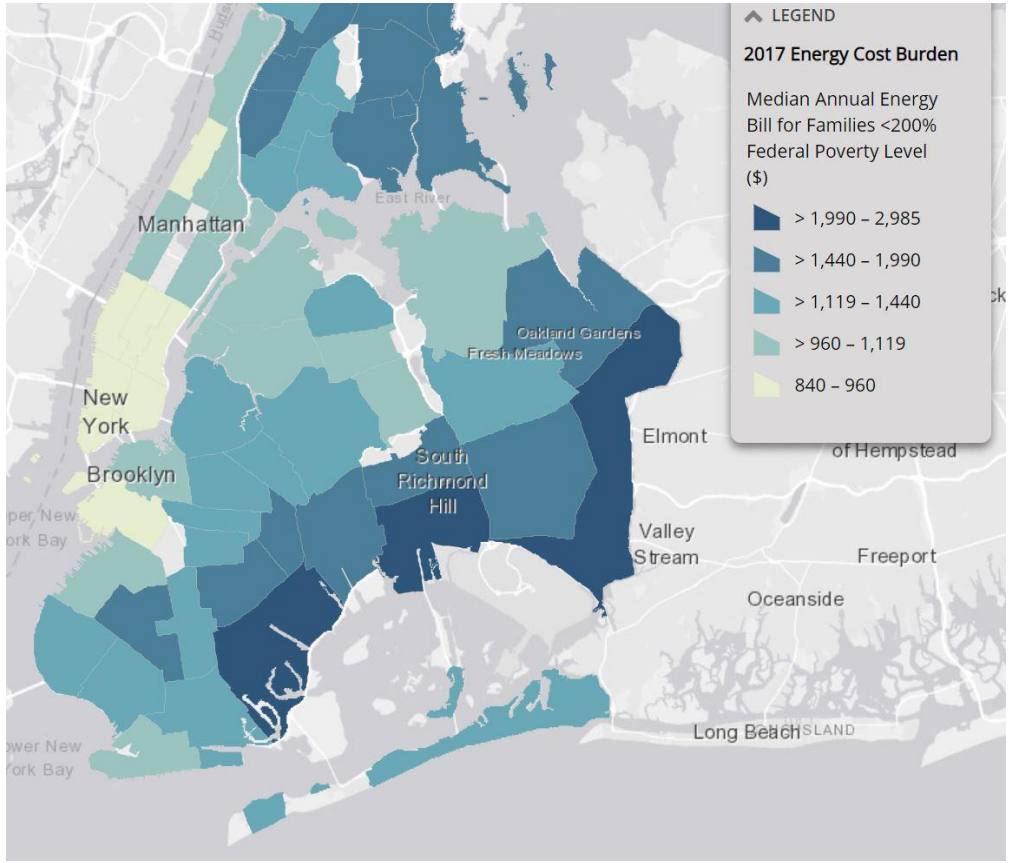
Projects that benefit both T&D might include some or all of these traditional benefits

- Transmission upgrades to facilitate clean energy sourcing
- Transmission upgrades that facilitate a new area substation
  - Proximity to growing distribution needs
  - Improvements to reliability and resiliency
- Projects with space to facilitate complementary energy storage

These projects should also have societal benefits as outlined on the next four slides…

Climate Justice & LMI Potential

Energy Cost Burden



Source: NYC Community Energy Planning Tool

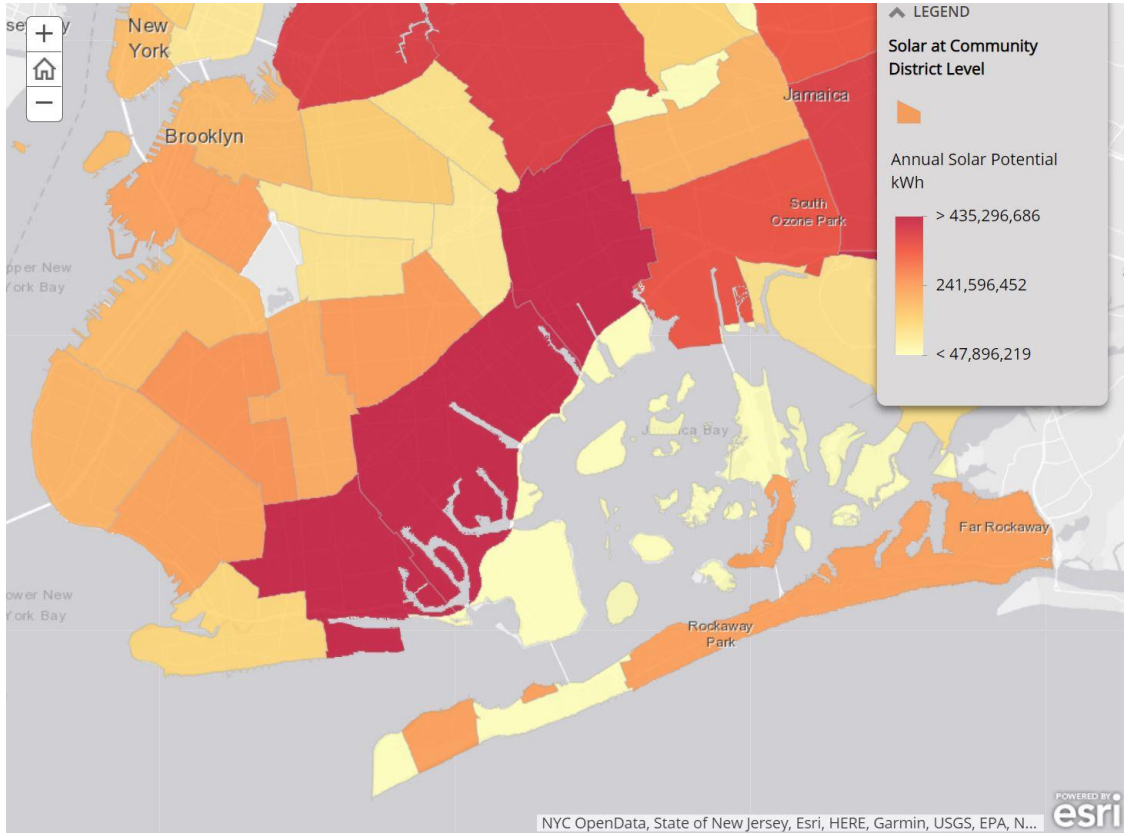
Potential for Shared Benefits

- Potential for DER Integration
- Current customers do not see as much value from renewable projects
- Potential for integrated storage, solar and/or wind to deliver benefits back to customers

DER Integration

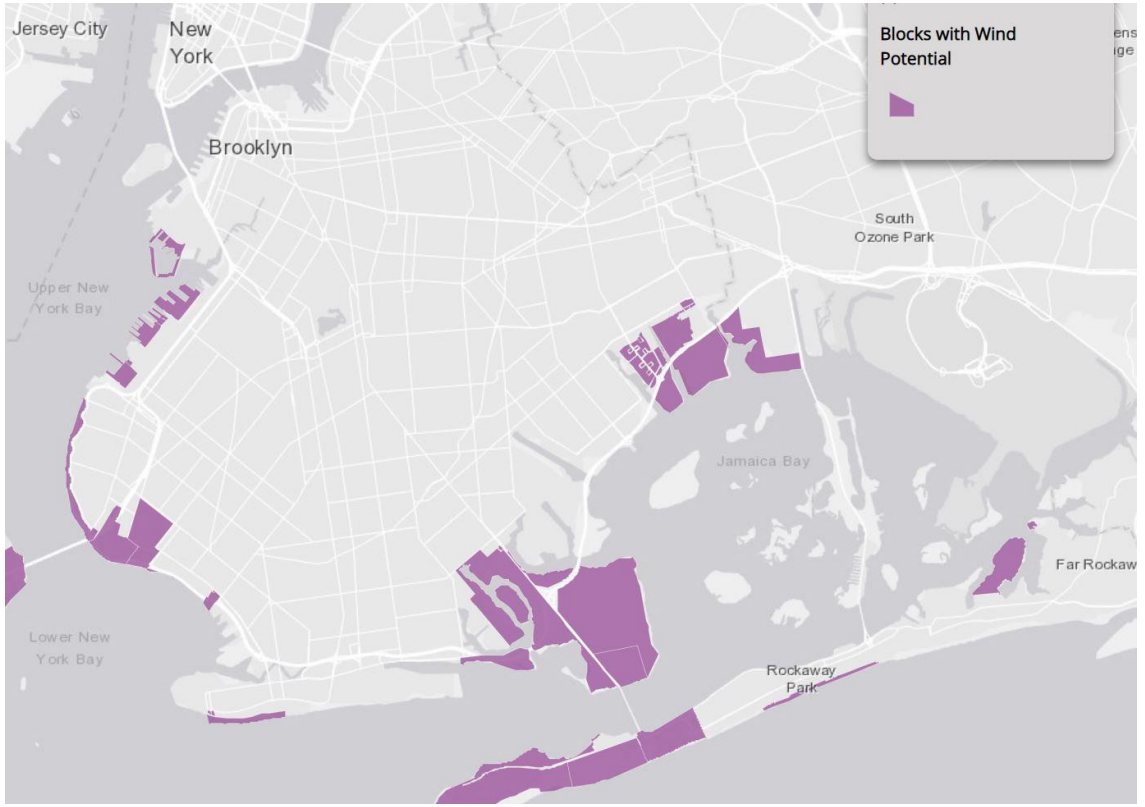
New York City has identified Southeastern Brooklyn as having the potential for substantial penetration of Distributed Generation

Solar Potential



**NYC Community Energy Planning Tool*

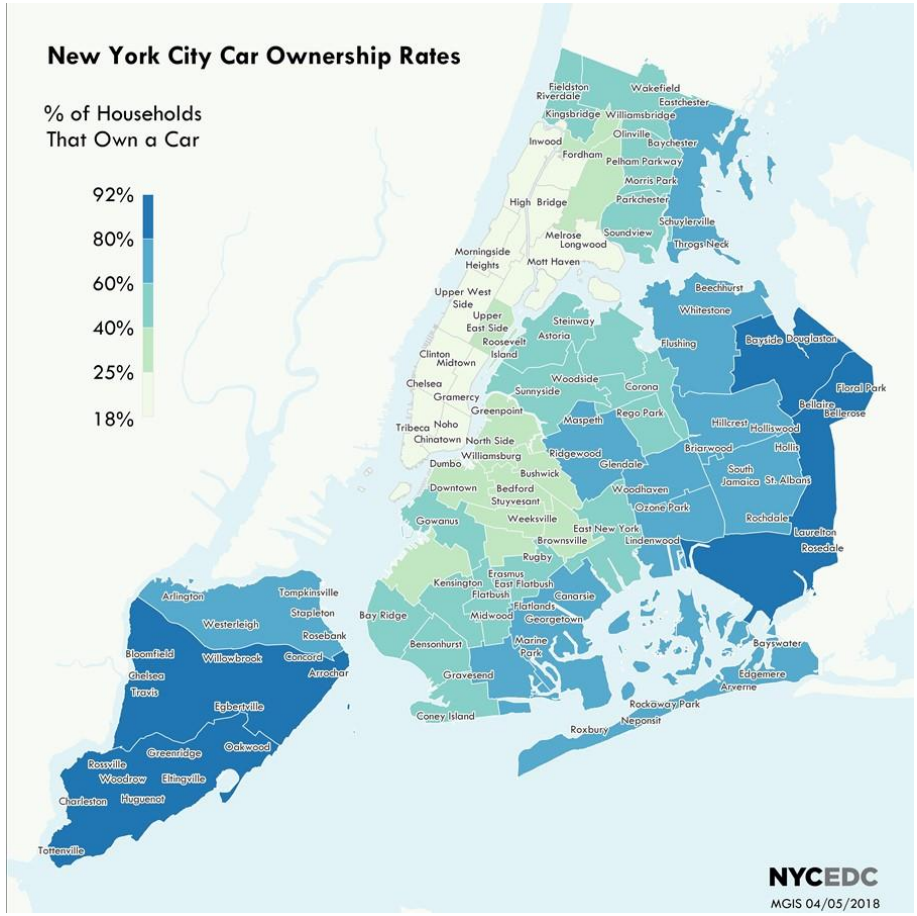
Wind Potential



**NYC Community Energy Planning Tool*

Electrification and Electric Vehicles

NYC Car Ownership Rates



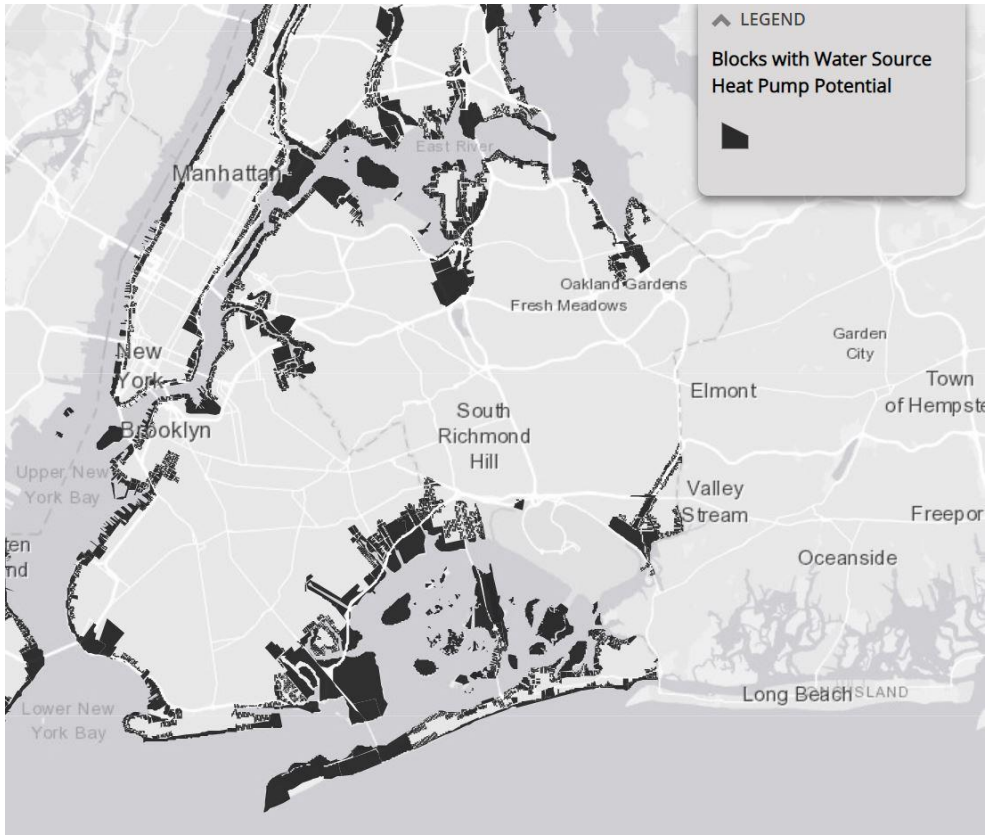
Potential for EV Expansion

EV Make Ready Programs through 2025

- $395M for PowerReady EV Charger Program
  - Customer & Utility Side Incentives
  - 18,539 L2 Chargers Goal
  - 457 DCFC Goal
  - Emphasis on Environmental Justice Areas
  - Continued advancement of Medium & Heavy-duty charging programs
  - ~238,000 EV's in Con Ed Territory by 2025

Electrification Drivers

Potential for Ground Water Heat Pumps

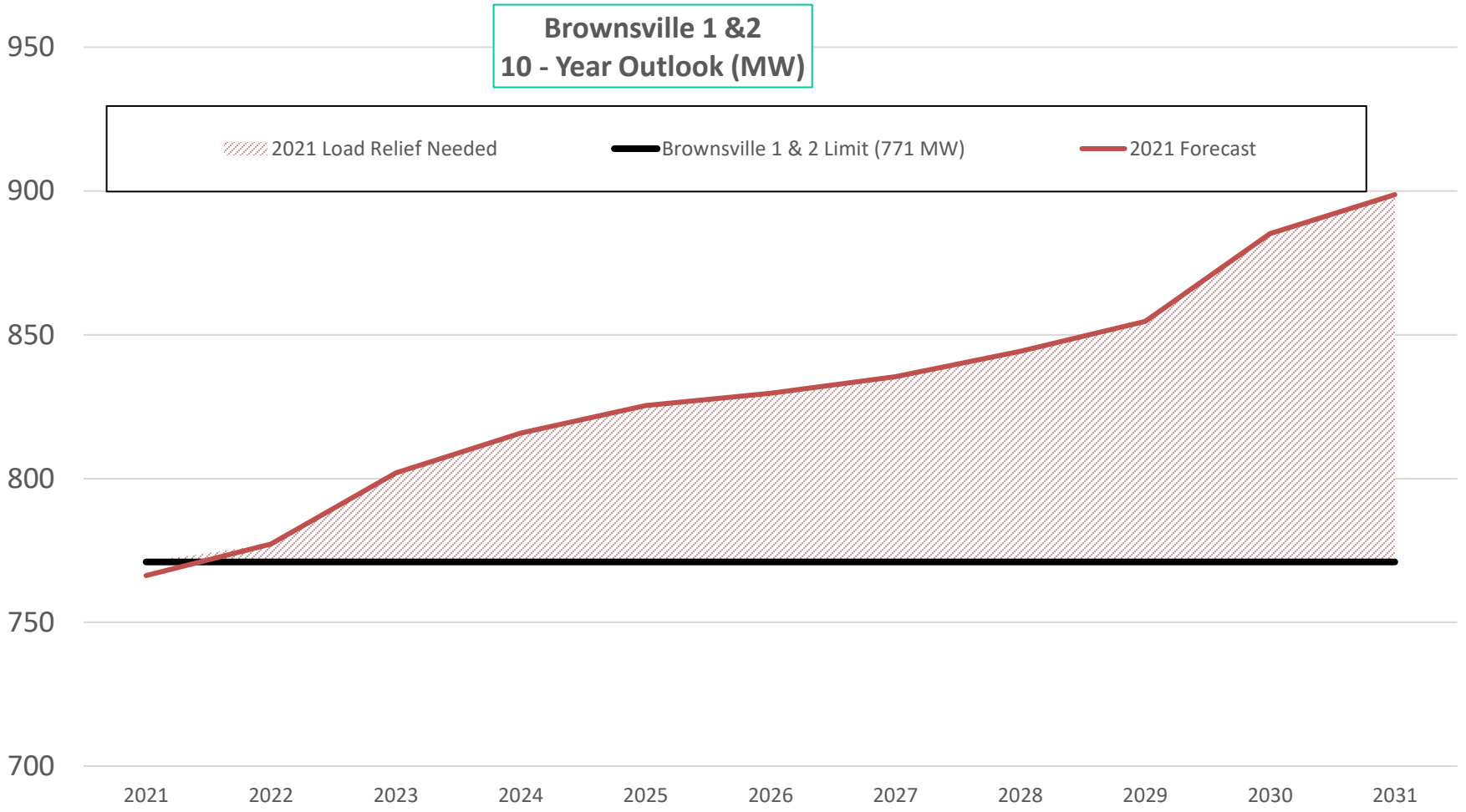


Source: NYC Community Energy Planning Tool

Electrification Drivers

- Potential for Water Source Heat Pumps
- NYC Interested in prioritizing areas better suited for decarbonization
- Various stakeholder goals

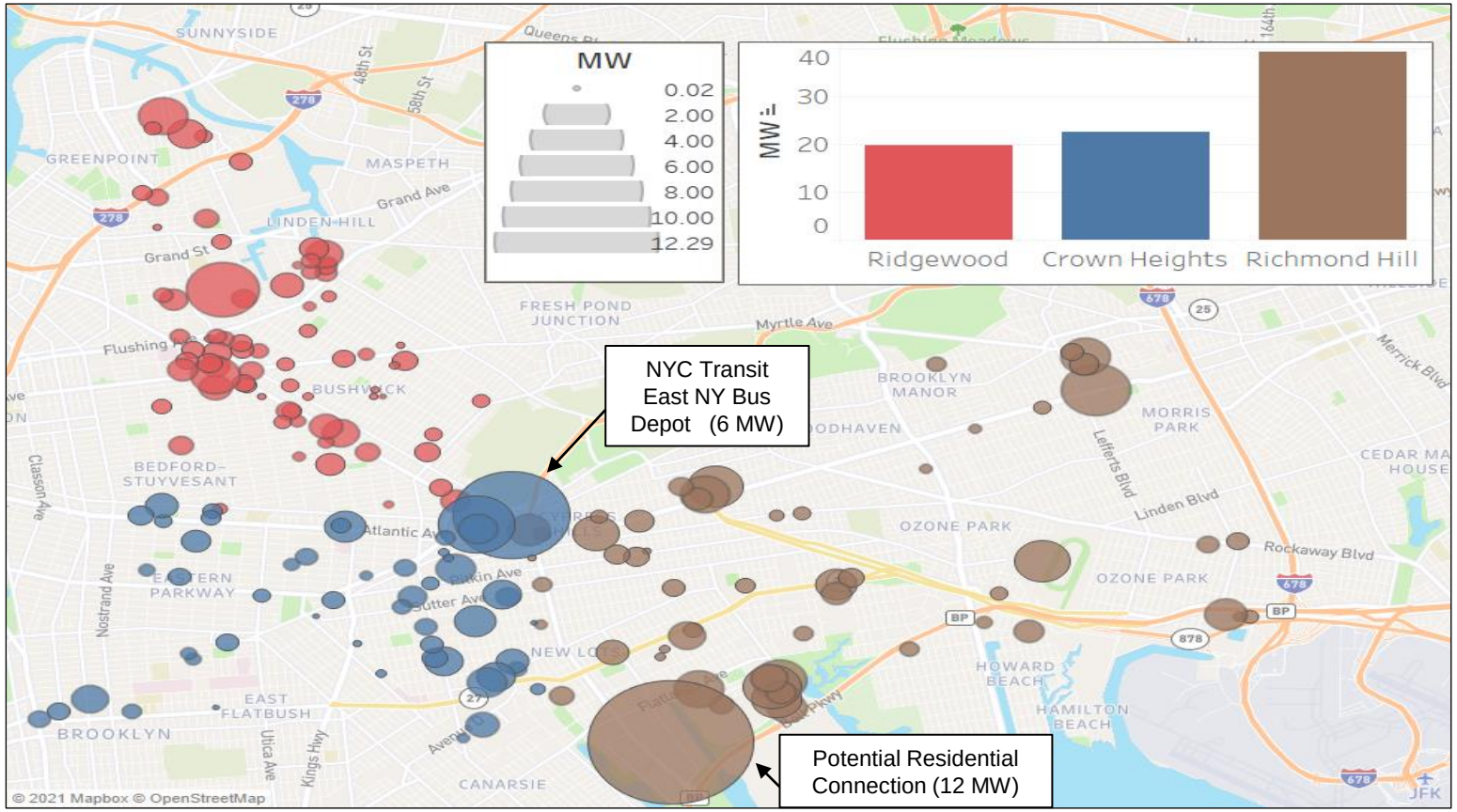
10 Year Load Forecast for Brownsville 1 & 2



- Accelerated load growth due to electrification exceeding station capacity as early as 2022
- N-1 design limitations

Impact of Load Growth

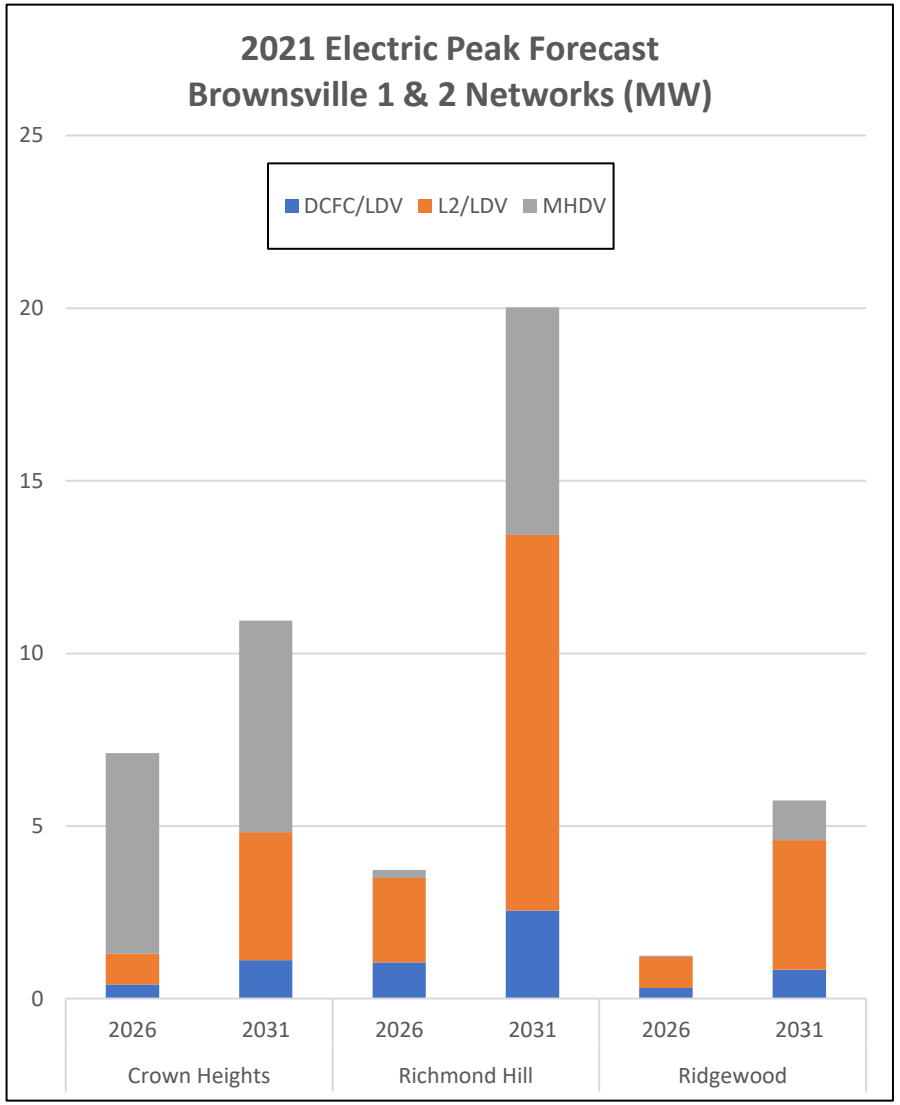
Networks served by Brownsville 1 & 2 area stations project significant new business load growth



Projected Load Growth from New Service Applications – Brownsville 1 & 2 Networks

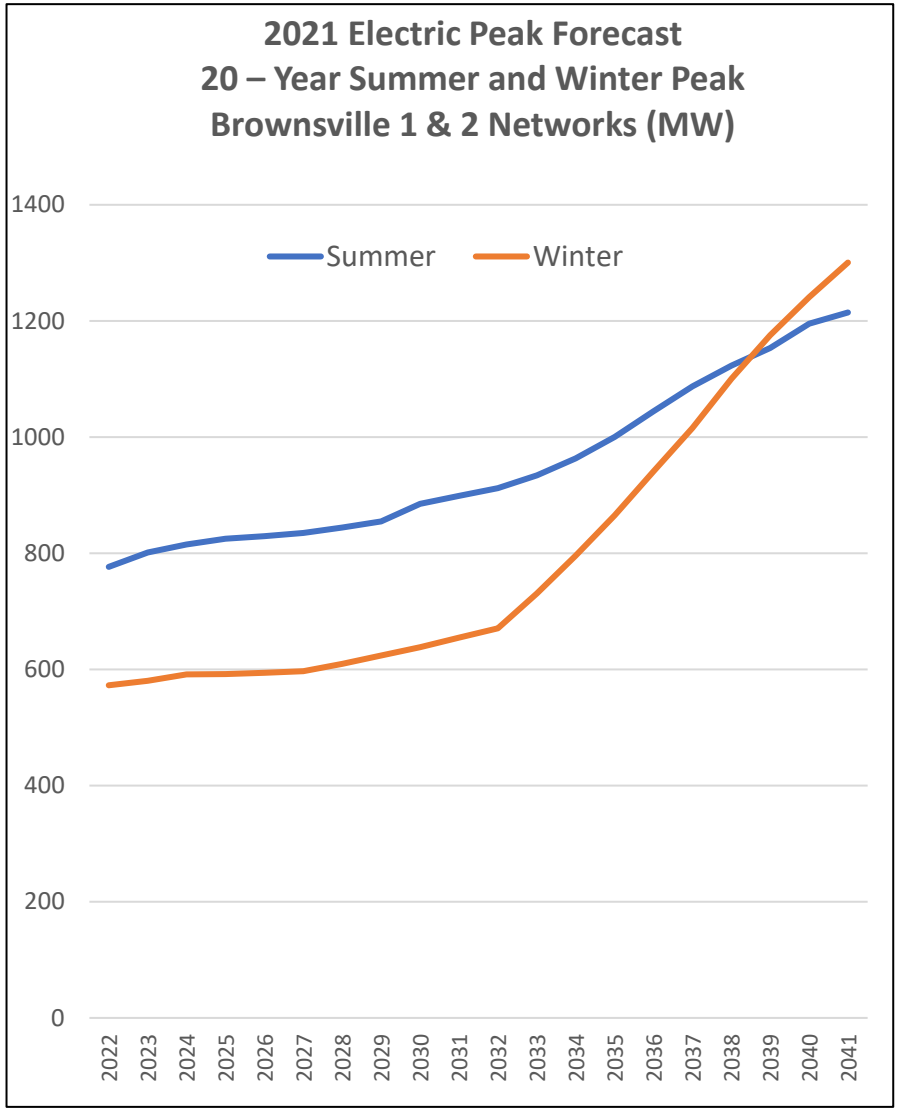
Electric vehicle load growth in Brownsville Area

- Light Duty Vehicles (LDV):
  - Areas served by the Brownsville 1 & 2 could see a significant increase in demand as LDV adoption accelerates
  - Large amount of LDV's currently registered in these areas
    - Estimated just 10% conversion of existing LDV's in the area to electric could increase peak demand ~ 20 MW
  - Large land area devoted to parking facilities
- Medium & Heavy-Duty Vehicles
  - 2 NYC Transit Bus Depots housing approximately 420 buses
    - Current 6 MW application for new service at NYC Transit East New York Depot
  - 3 Industrial Business Zones where potential commercial vehicle electric demand is concentrated
  - Significant share of NYC school bus fleet based out of Brownsville area



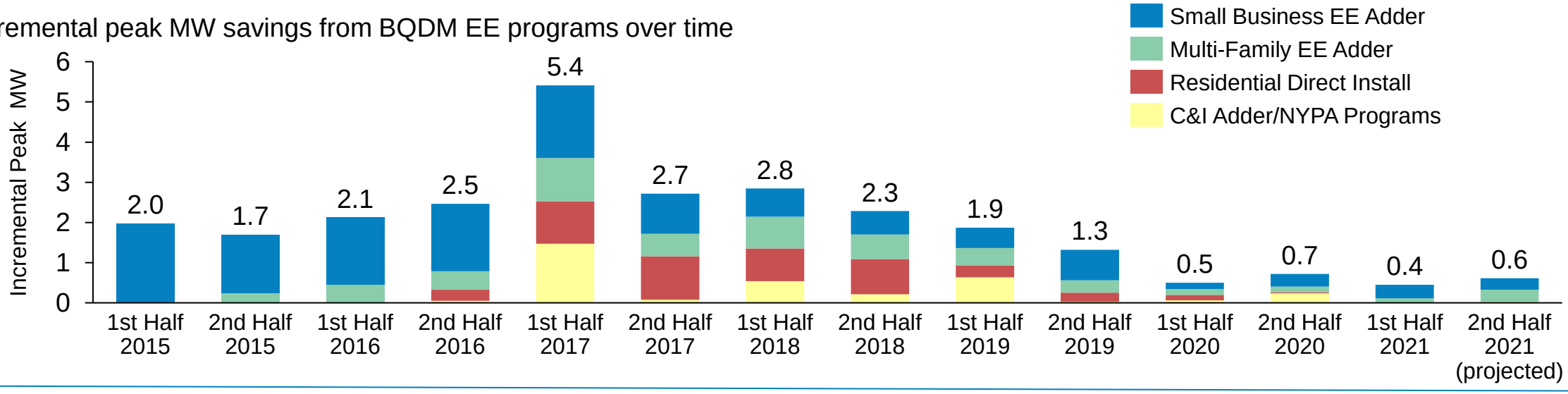
Heating Electrification potential in Brownsville Area

- Space Heating and Appliances
  - Areas served by Brownsville 1 & 2 have a high potential impact for electrification of heating
    - Oil to electric heating
    - Gas to electric heating
  - These areas have a larger share of building area dedicated to small (1 to 3 family) residential buildings vs the rest of NYC
  - NYC gas ban may disproportionally impact areas where new development is concentrated



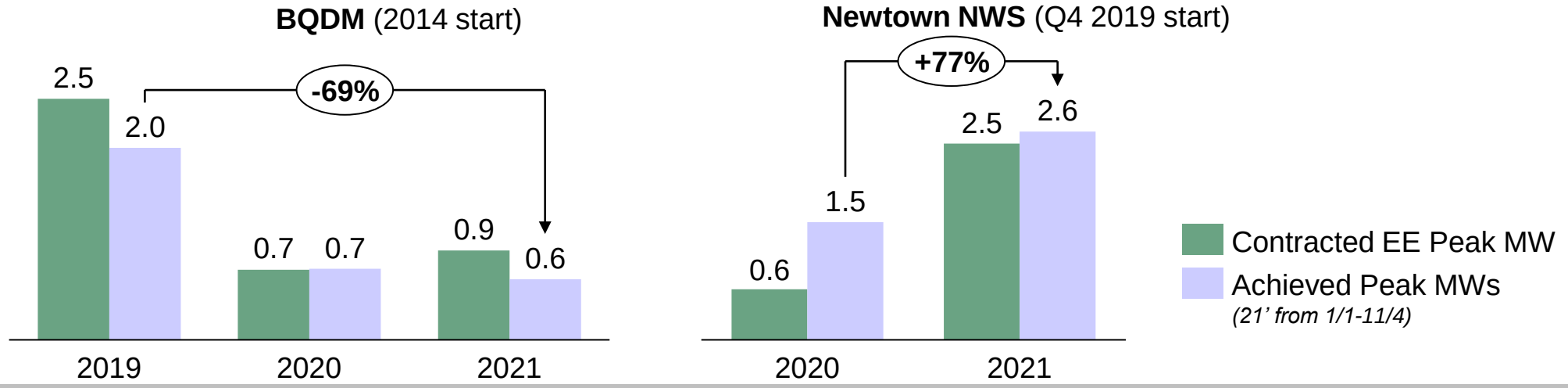
EE Saturation in Brownsville Networks

Incremental peak MW savings from BQDM EE programs over time



Comparison contracted EE MW goals for primary NWS Adder programs

Achieving smaller EE Adder goals in BQDM has been increasingly challenging; early year EE Adder achievement remains high in other areas



Non-Wire Solutions (NWS) & Storage

- NWS has installed 5.8 MW of energy storage systems at three locations in the region of Brooklyn supplied by the Brownsville 1 & 2 area stations to date
  - 4.3 MW is third-party operated, and 1.5 MW is utility owned and operated
- Planned market expansion of NWS energy storage offering in Q1 2022
  - Intention to continue working with both customers and City to evaluate sites
- Remaining NWS-BQDM funding to drive increased adoption of energy storage and EE through program expansion for delivery by 2026
  - Battery Storage - deploy 20 MWh battery system on company property next to Brownsville Substation
  - Deploy 3 MW of additional EE and develop 15 MW of customer sided batteries

Energy Storage to Support Gateway

Brownsville ESS

- Deploy 20MWh System on Company-owned property next to Brownsville Substation
  - **Option 1**: 5 MW / 4hrs system
  - **Option 2**: 3.3 MW / 6hrs system
- Benefits
  - Primary: support gateway portfolio of solutions to fill MW deficit; Load Relief - Peak Shaving and VARs Support.
  - Secondary: NYISO market participation
- Utilize BQDM funding to commission system by 2025

System Load Relief Planning

Gateway is Part of a Larger Plan to Address Load Growth and Electrification

- Queens SS Extension *(Advanced from 2030 to 2027)*
  - Additional Transformer and 138kV Supply Feeder from Vernon
- Load Transfers & Plans to De-Load Brownsville *(Needed by 2027)*
- Gateway Park Area Station *(In Service in 2028)*

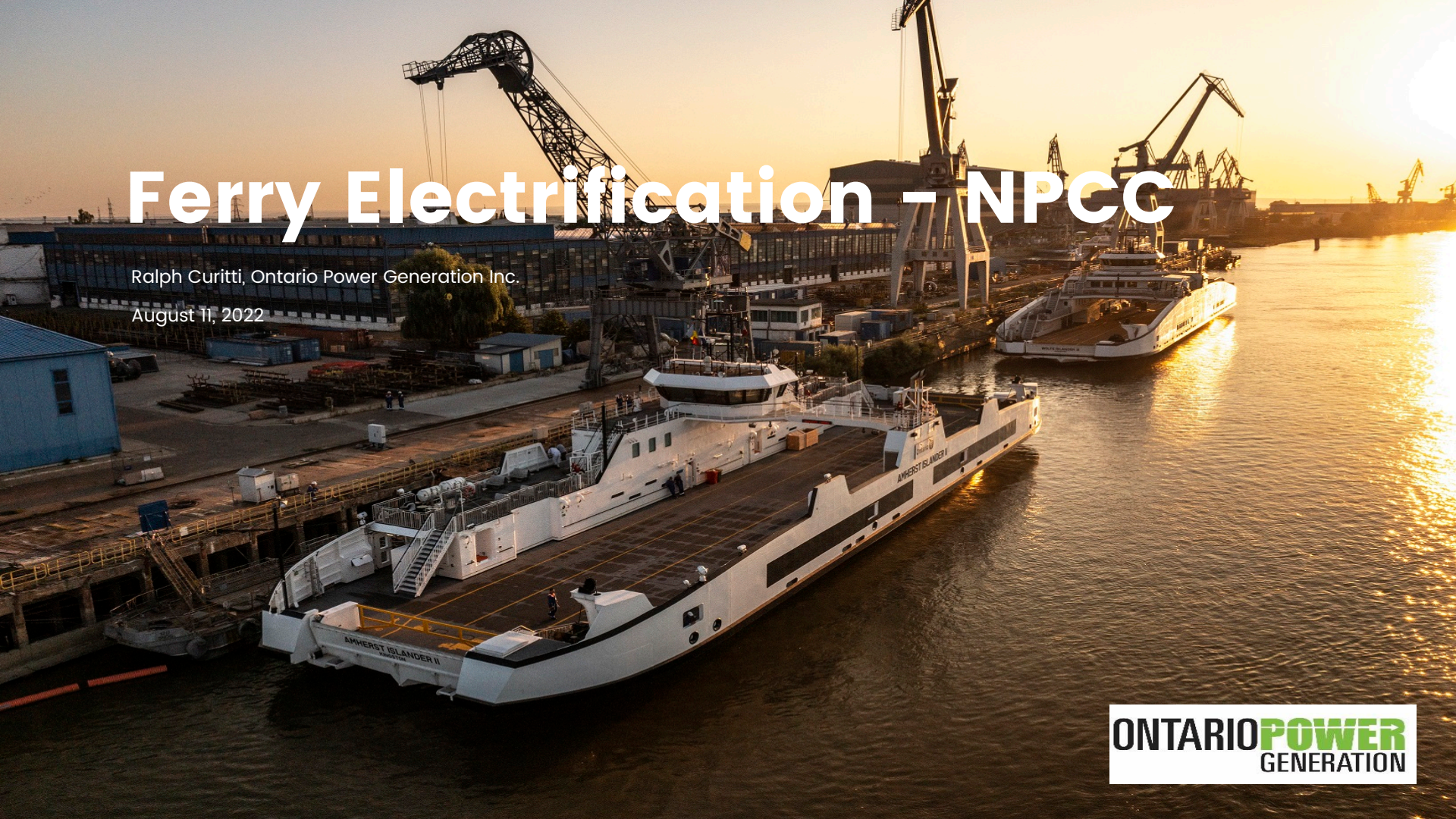
Gateway Park Substation is a Multi-value Project that we believe will jump start our clean energy future

Questions?

Ferry Electrification – NPCC

Ralph Curritti, Ontario Power Generation Inc.

August 11, 2022



ONTARIO POWER GENERATION

Agenda

1 | Introduction

2 | Project Background

3 | Relationships

4 | Scope

5 | Modes of Operation

6 | Charging System

7 | Challenges & Benefits

8 | Questions

Who we are

Ontario Power Generation is a climate change leader with one of the most diverse generating portfolios in North America.

In 2014, OPG closed the last of its coal stations. This remains the world's single largest climate change action.

Since then, the company has been focused on the future and is investing in innovative technologies that will drive clean economic renewal – from transportation electrification, to small modular reactors, energy storage, micro grids, and medical isotopes.

Our Impact

We are Ontario's largest clean power generator, 100 per cent owned by the Province of Ontario

We employ more than 10,700 skilled and dedicated people and put thousands more to work across the province through its clean energy projects and supply chain.

Our industry-leading development partnerships with Indigenous Communities create lasting economic benefits.

Our Assets

2 **Nuclear** Stations

2 Leased **Nuclear** Stations

2 **Thermal** Stations

1 **Solar** Facility

66 **Canada Hydroelectric** Stations

85 **US Hydroelectric** Stations

4 **Atura Power Gas-Fired** Stations

Project Background

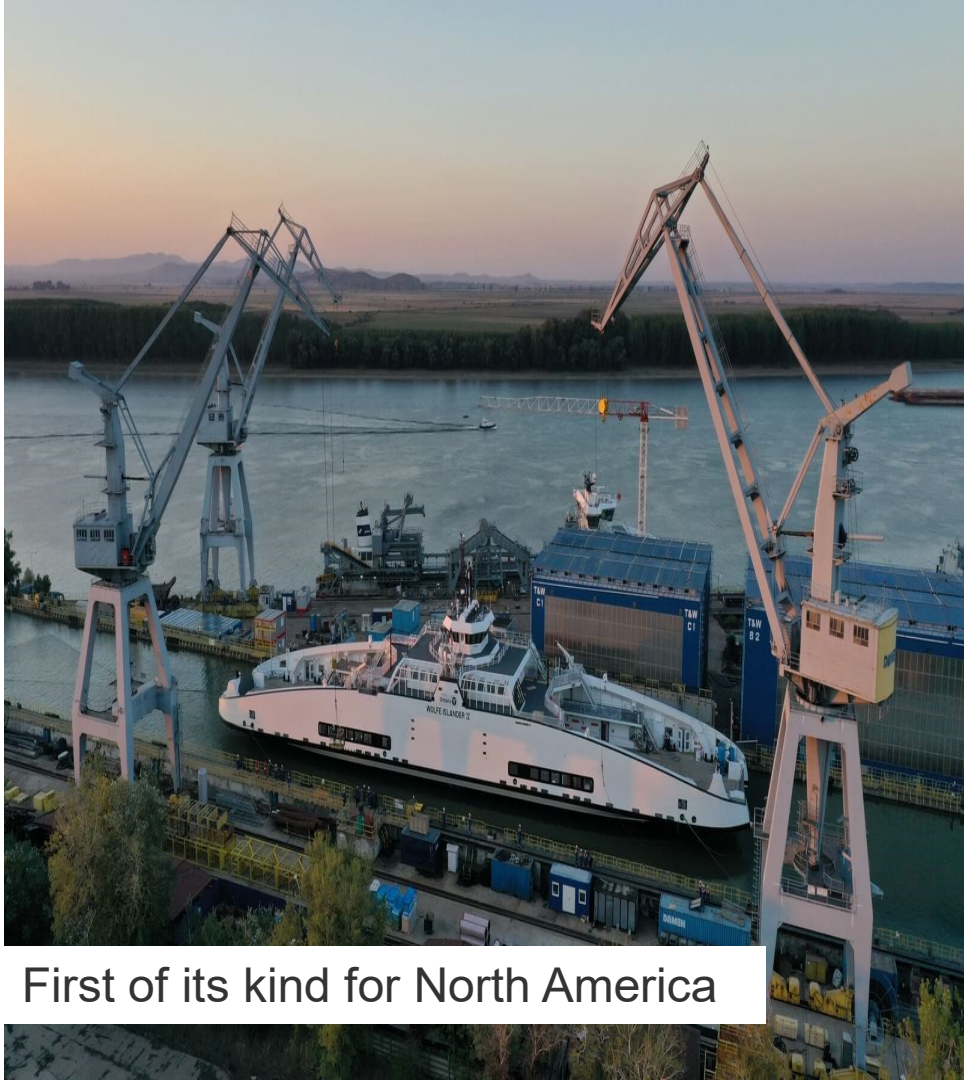
2017: Damen Shipyards awarded contract by MTO to supply 2 hybrid vessels

2019: Amherst Islander Launch
2020: Wolfe Islander Launch

2020: Energy services agreement executed between OPG & MTO (Load Displacement and Electrification Infrastructure)

2021: Super Servant - Atlantic Transport

Today: Installation pending dock construction completion



First of its kind for North America

Ferry Locations

Amherst Island:

- 20 min Travel Time
- 270,000 Passengers Annually
- 130,000 Vehicles Annually

Wolfe Island:

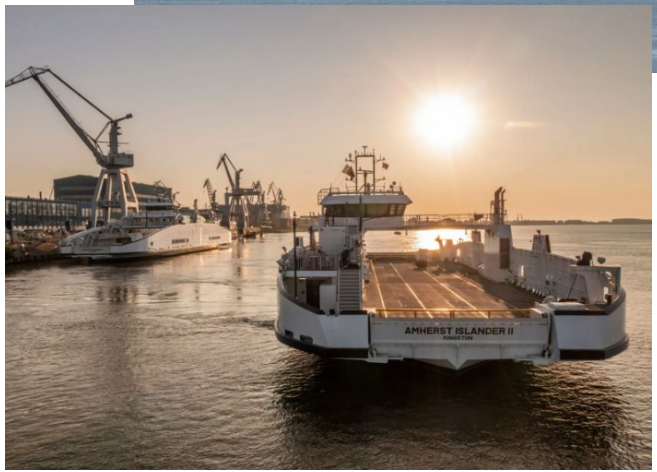
- 20 min Travel Time
- 1 Million Passengers Annually
- 500,000 Vehicles Annually

Ferry Specifications

- Manufactured by Damen - Galati Romania Shipyard
- Fully electric with diesel generators and propulsion backup
- Ice Class hull and thrusters for -25C operation

Amherst Islander II

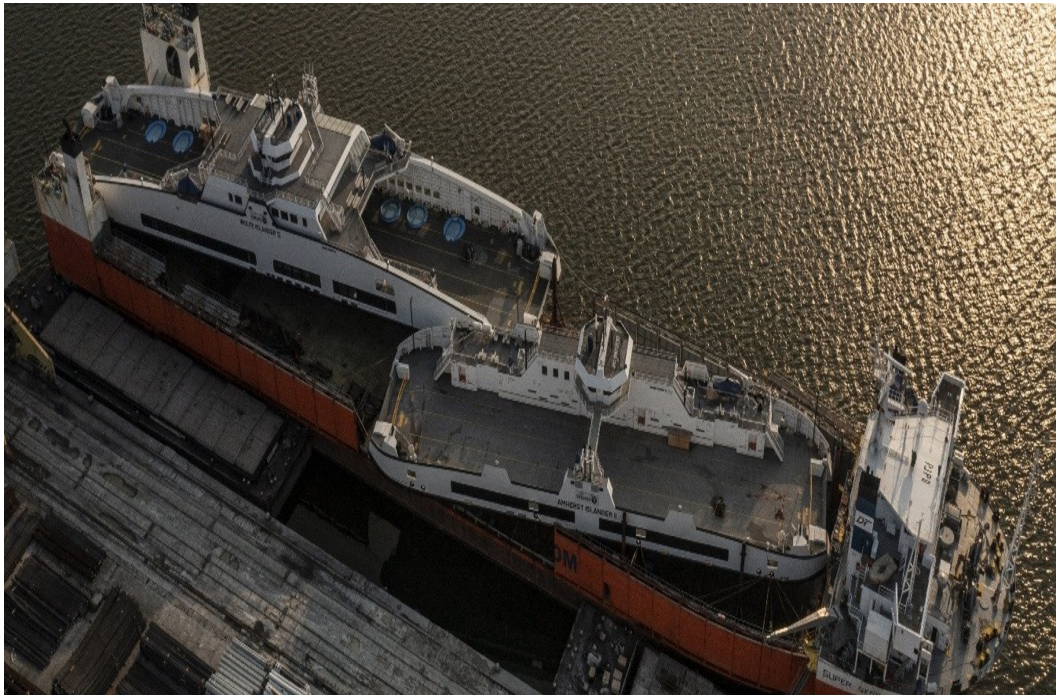
- 68 meters in length, 42 car capacity
- 1.9MWh Battery system onboard
- 9 knots operating speed



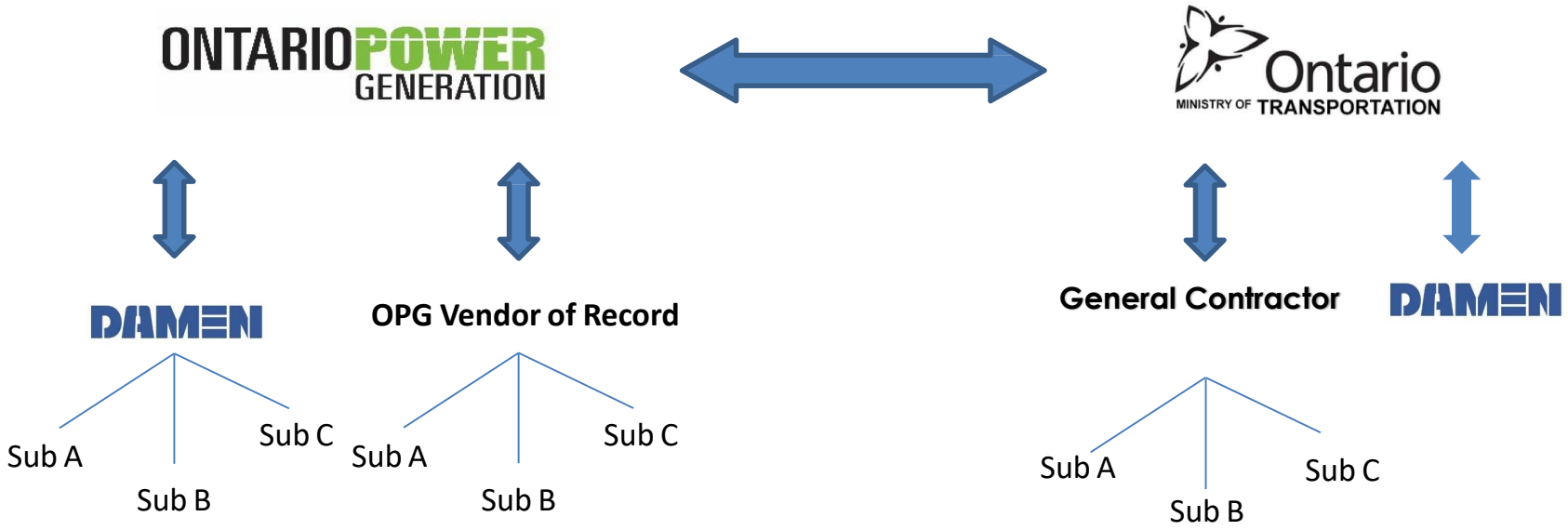
Wolfe Islander IV

- 98 meters in length, 83 car capacity
- 4.6MWh Battery system onboard
- 12 knots operating speed

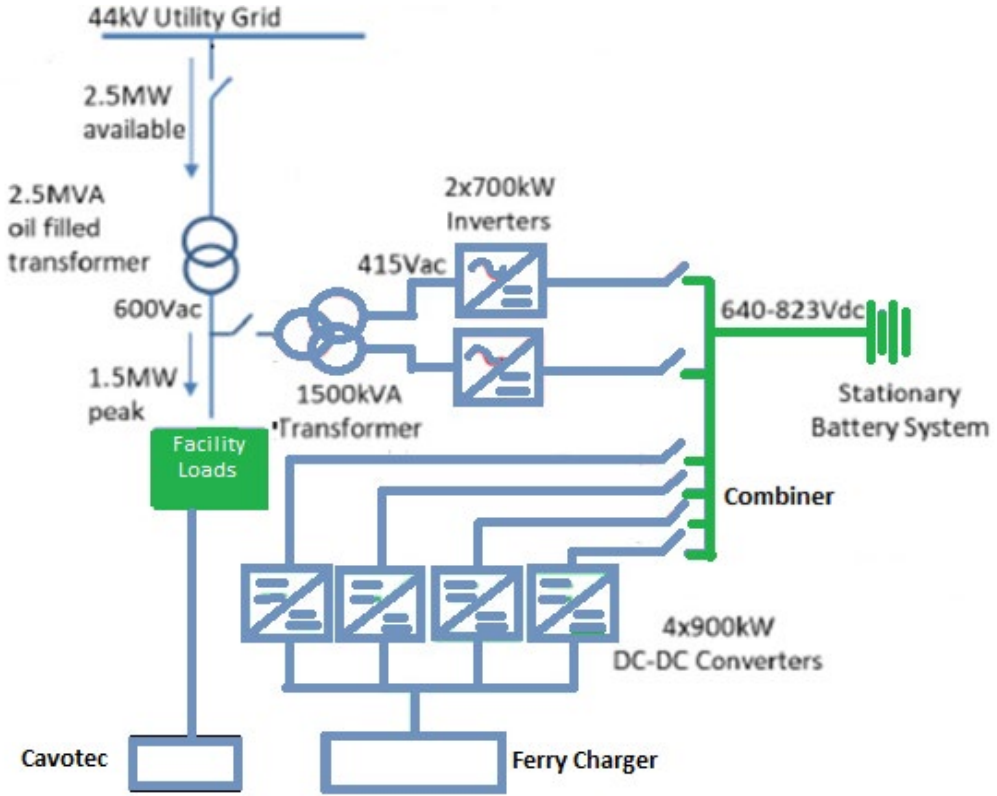
Transport Across the Atlantic “Super Servant 4”



RELATIONSHIPS



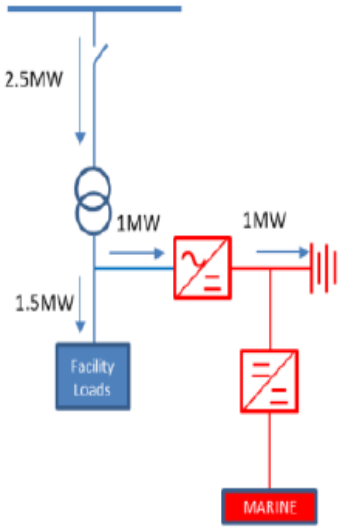
Scope of Work



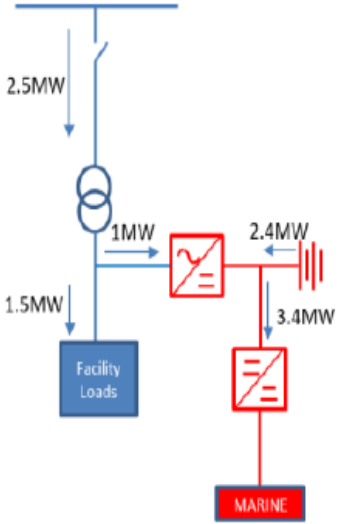
MTO Charging Infrastructure

- Delivering load displacement and charging infrastructure to MTO
- Engineer, Procure, Construct (EPC) electrification infrastructure
- Charging system integration and commissioning
- Operate and Maintain battery storage system

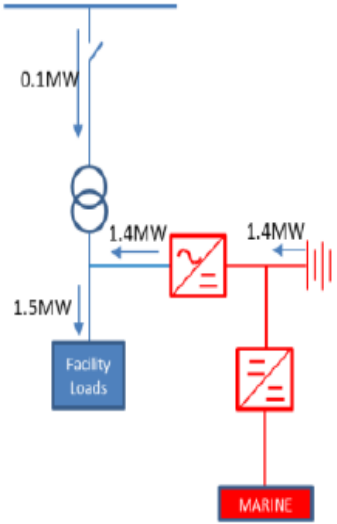
Modes of Operation (Kingston)



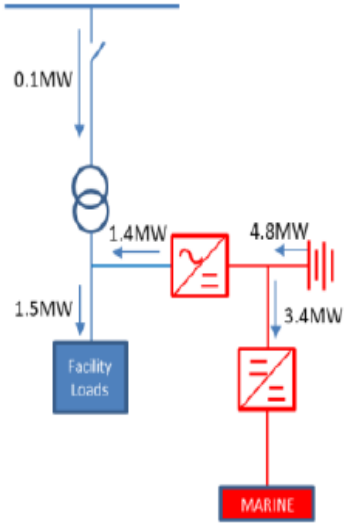
B. Charging BESS



C. Charging Ferry



D. Load Displacement

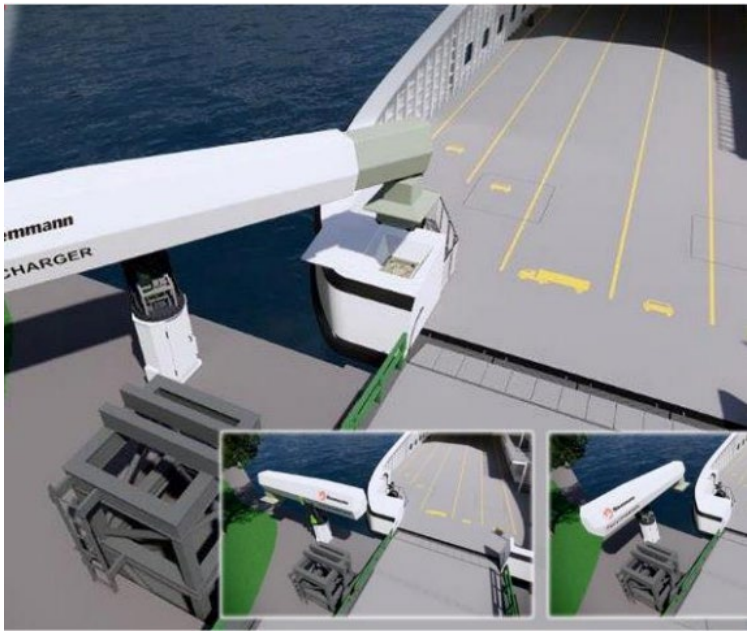


E. Charging Ferry & Load Displacement

Charging System

Bow-Type Charging System

- Small footprint with Arm on ramp
- High power, largest movement compensation
- DC to DC fast charging system “refuel” in 10 minutes
- 21hrs of duty daily
- 7,850 charges per year, 10-year lifespan



Amherst Island

- 2.6MW BESS Storage at both terminals

Wolfe Island

- 4.8MW BESS Storage Kingston, 4.2MW Marysville

Unique Challenges

Auto-Mooring System

- Ferries need to be moored rapidly and accurately
- Need to maximize charging time while moored
- Fast auto-mooring system installed at each of four terminals
- Automated mooring that is remotely operated from ferry
- No onshore crew required to moor vessel

Fire Safety

- Fire load and rating increase due to battery storage
- Protected by improved fire suppression system
- Water is piped in running alongside the battery racks and behind each battery module

The Benefits

Green House Gas Reduction

- With both new ferries operating as fully electric, there will be an estimated reduction of 7.44 million kg CO2e/year (the equivalent of taking 5,138 passenger cars off the road)
- Over the 60year lifespan of the two ferry vessels there will be an estimated reduction of 446 million kg CO2e if the ferries are fully electric rather than diesel-electric.

Stella Terminal – Utility Buildings

Millhaven Terminal


QUESTIONS?
AMHERST ISLANDER II
KINGSTON

ONTARIO POWER GENERATION

Where a brighter tomorrow begins.

Power Sector Electrification Projections and Research

Pieter Gagnon
8/11/22
NPCC DER/VER Forum

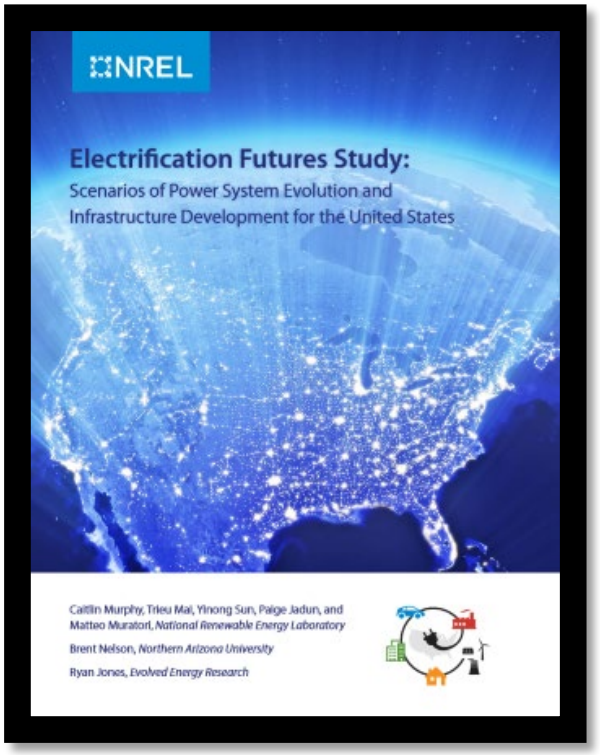
Agenda

1. NREL's Projections of Power Sector Electrification
2. Demand-side Decisions Under Electrification
3. Upcoming Projections and Data from NREL

This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by the Strategic Analysis Office within the Office of Energy Efficiency and Renewable Energy in the U.S. Department of Energy.. The views expressed in the deck do not necessarily represent the views of the DOE or the U.S. Government.

NREL's Projections of Power Sector Electrification

NREL's Electrification Futures Study



→ What we're looking at today

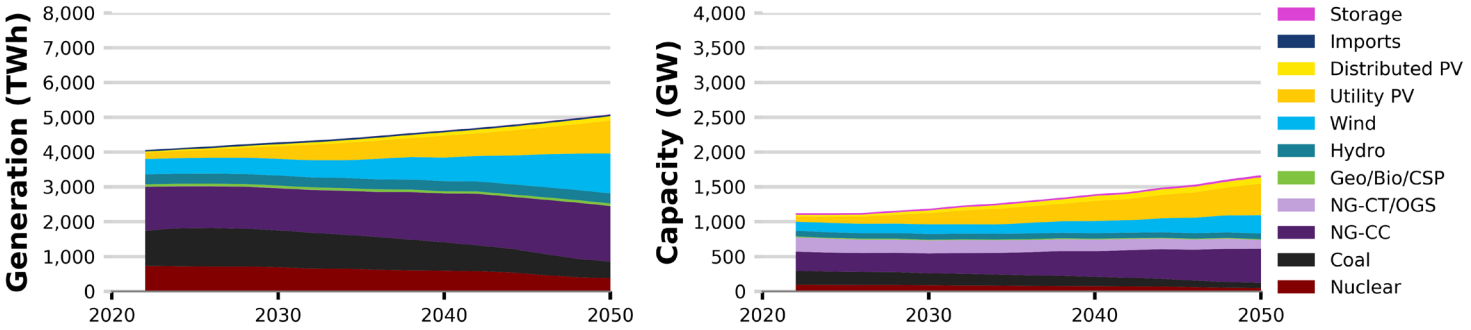
Check back in December 2022 for new projections

https://scenarioviewer.nrel.gov/
NREL Standard Scenarios
NREL Cambium

NREL's Electrification Futures Study

These projections were done in 2020, new ones are forthcoming in December

Non-electrification projection, central estimates for fuel and technology costs

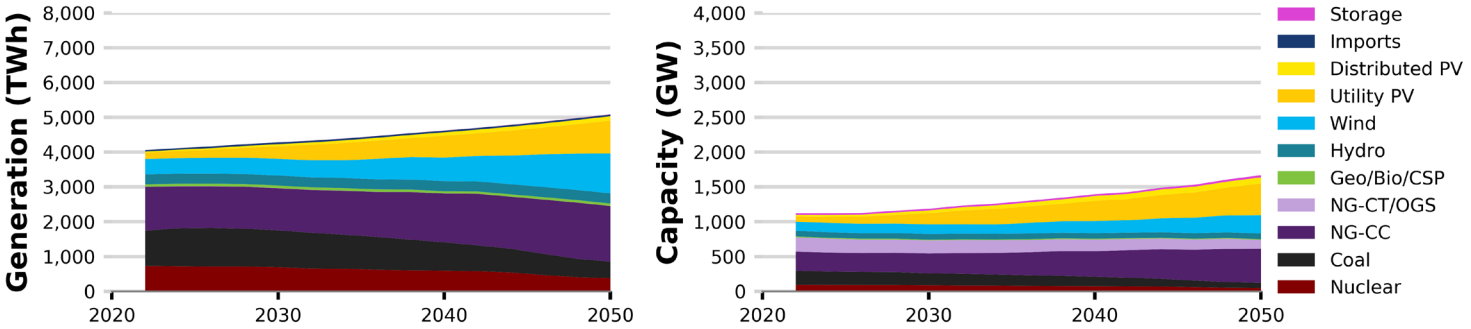


Least-cost buildout, subject to policy and operational constraints

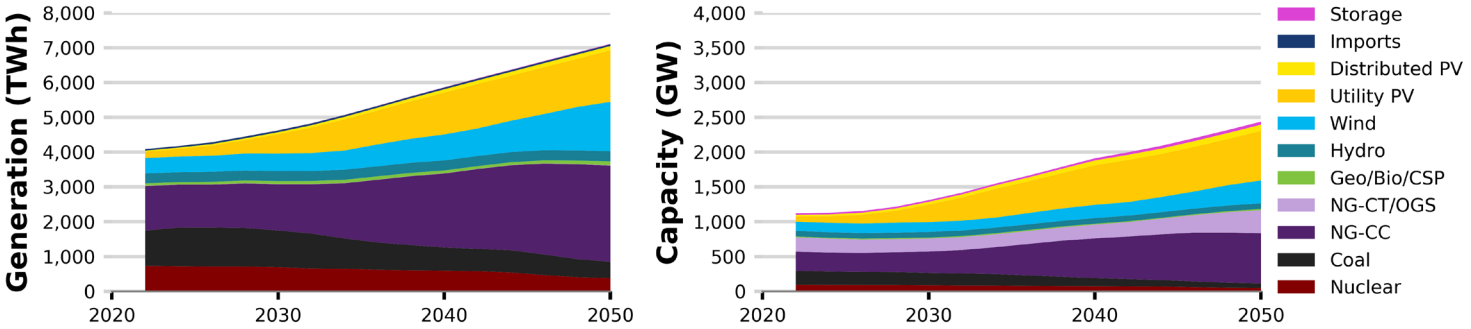
NREL's Electrification Futures Study

These projections were done in 2020, new ones are forthcoming in December

Non-electrification projection, central estimates for fuel and technology costs



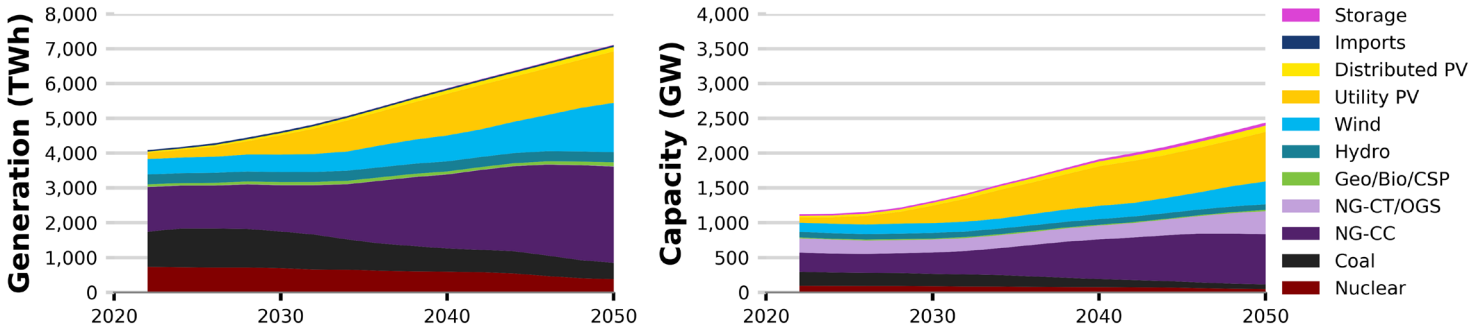
"High" electrification projection, central estimates for fuel and technology costs



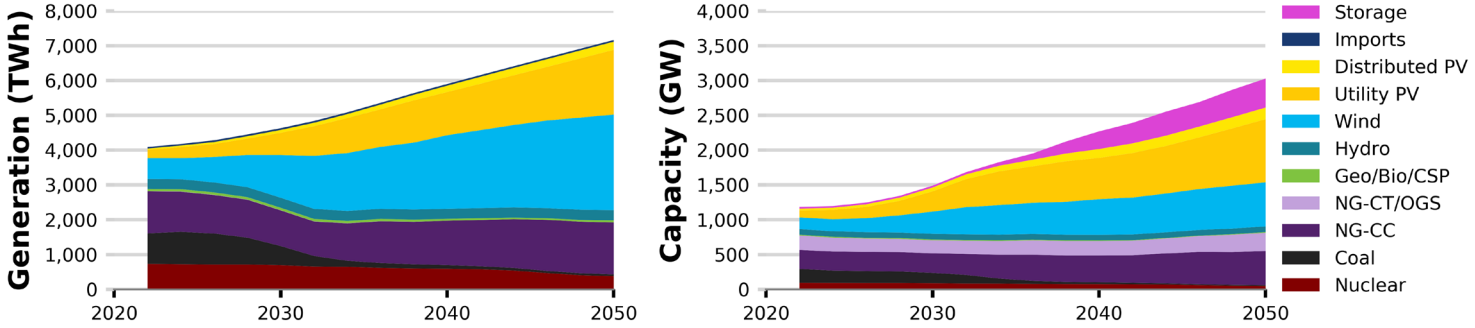
NREL's Electrification Futures Study

These projections were done in 2020, new ones are forthcoming in December

"High" electrification projection, central estimates for fuel and technology costs



"High" electrification projection, "low" costs for renewables, central estimates for fuel costs



Demand-side Decisions Under Electrification

Demand-side Decisions Under Electrification

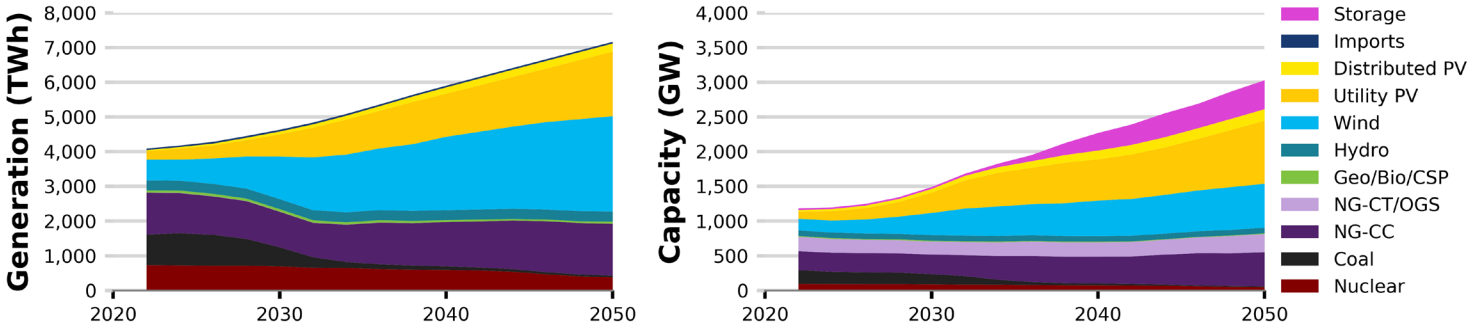
Example Questions:

"If I electrify X device, what are the consequences of that decision?"

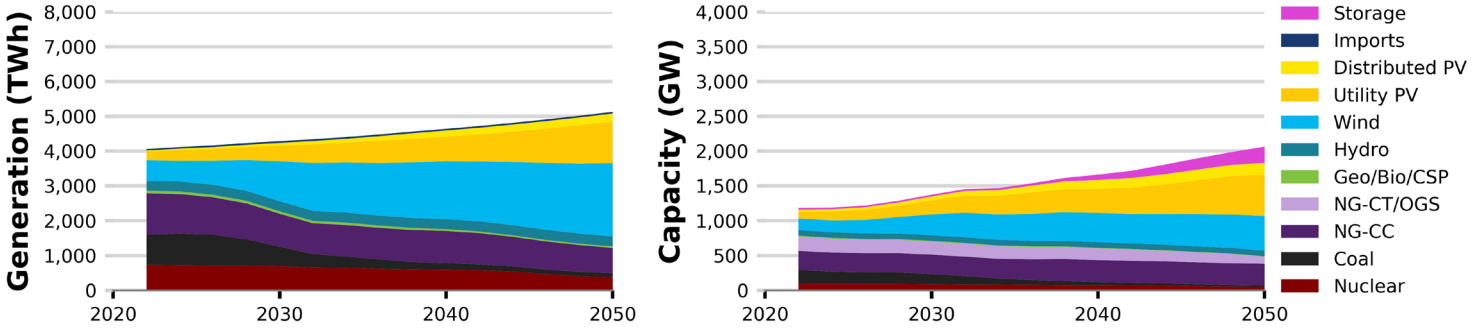
In low-cost renewable contexts, only looking at operational impacts is often not sufficient, you also need to examine *induced structural change*.

Demand-side Decisions Under Electrification

"High" electrification projection, "low" costs for renewables



"Reference" electrification projection, "low" costs for renewables



Electrification induces more electric generator capacity to be built – potentially an important phenomena to capture

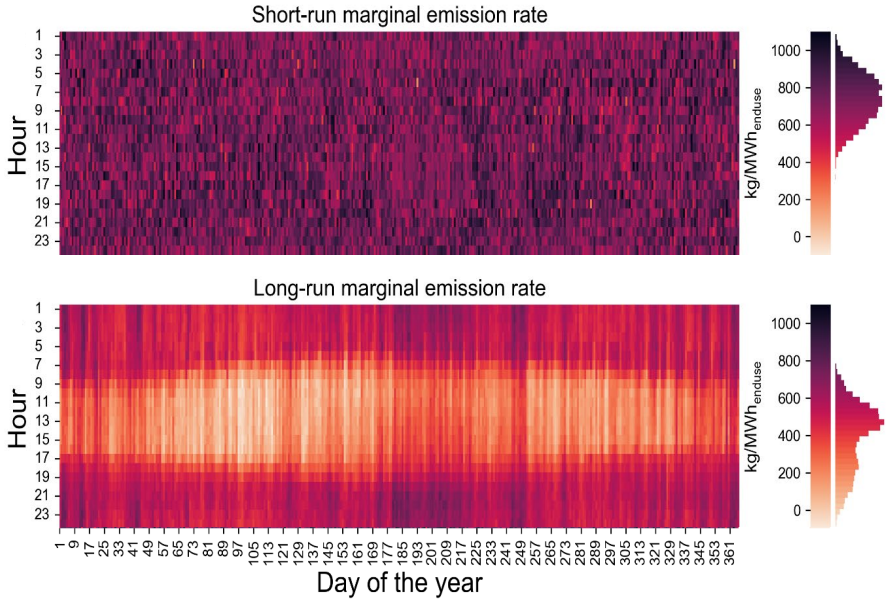
An example of the impact of incorporating structural change

Short-run marginal emission rate

Emission rate of the next unit of electricity *considering the grid's structure as fixed*

Long-run marginal emission rate

Emission rate of the next unit of electricity *incorporating how load could influence the grid's structure*



Upcoming Projections and Data from NREL

Upcoming work

NREL's Standard Scenario Projections (released annually ~December)

- 50+ different potential futures of the US electric sector
- https://www.nrel.gov/analysis/standard-scenarios.html

NREL's Cambium Data Sets (released annual ~December)

- Much more detailed data for a subset of the Standard Scenarios
- https://www.nrel.gov/analysis/cambium.html

NREL's Cambium Data Sets (released annual ~December)

- These datasets (and others) available at: https://scenarioviewer.nrel.gov/

Northeast Power Coordinating Council
August 11, 2022

Electric Enablement

ADVANCING THE GRID TO ACCELERATE DECARBONIZATION

Alan Dulgeroff – Director of Electric System Planning

SDGE

4,100 Square Miles

3.7 Million Residents

2 Counties (San Diego & Orange

25 Communities

18 Federally recognized Tribes

Coastal, mesa, valley, mountain & desert terrain

ENVISION · PLAN · OPERATIONALIZE

Innovating a grid that accelerates decarbonization and delivers value and choice for all customers

CLEAN | RELIABLE

The electric sector is a key enabler to decarbonizing California's economy

Electric Sector

Clean, reliable electricity will help enable decarbonization across the economy

Transportation

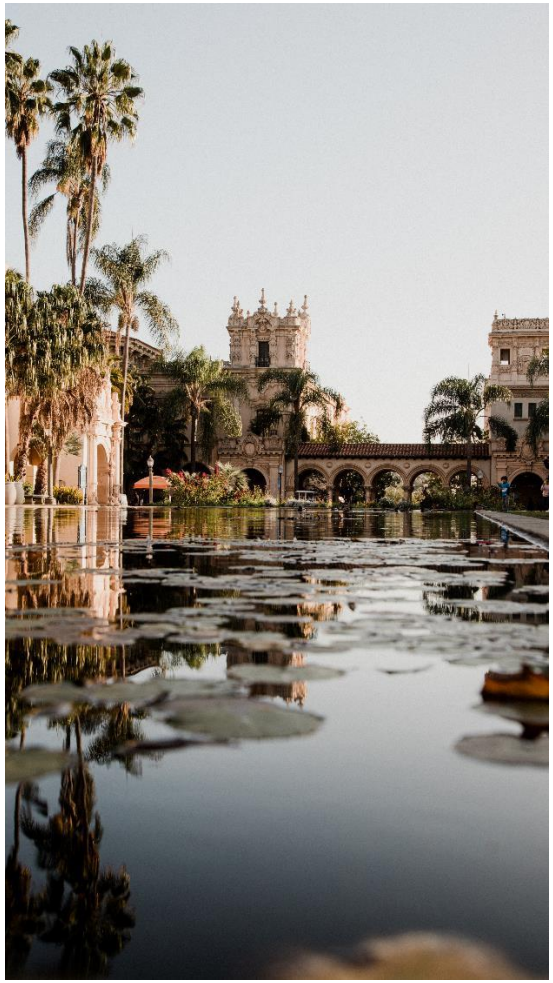
Switch to electric vehicles drives decarbonization

Buildings

Use of electric space and water heating reduces emissions

Industry

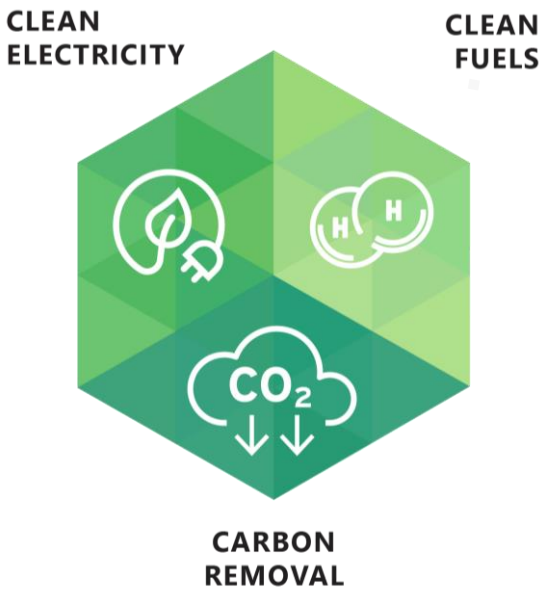
Electrification of select industrial processes reduces emissions



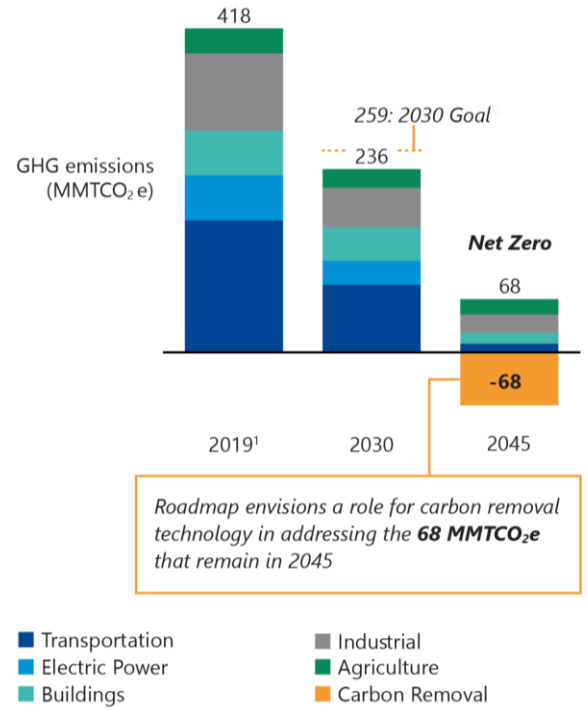
NET ZERO

SDG&E recommends a diversified approach to decarbonization, utilizing clean electricity, clean fuels and carbon removal to achieve the state's 2030 and 2045 GHG goals

SDG&E's Diversified Approach to Decarbonization



California GHG Emissions

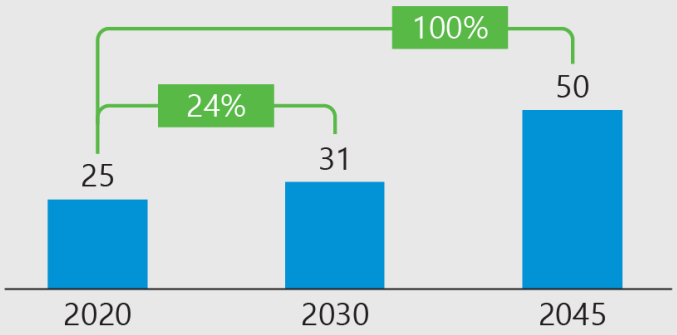


1) *Actual emissions are based on CARB's 2019 Inventory (2021 Edition). California Senate Bill (SB) 32 requires a 40% reduction of 1990 economy-wide emissions by 2030. EO B-55-18 established a statewide goal to achieve carbon neutrality by 2045.*

CONSUMPTION | DEMAND

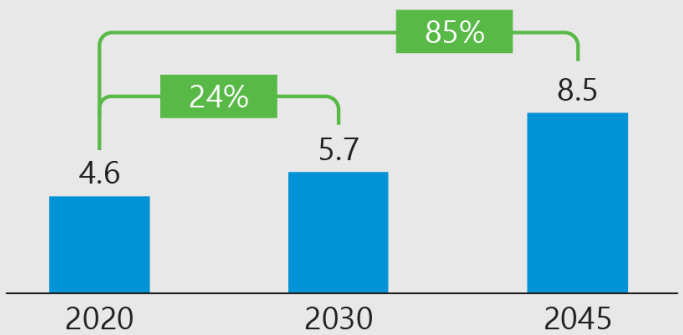
Electricity consumption and net peak demand are expected to increase significantly

SDG&E Electricity Consumption (TWh)



SDG&E's projected electricity consumption doubles from 2020 to 2045, primarily driven by transportation electrification

SDG&E Net Peak Demand (GW)[1]



SDG&E's projected electric net peak demand grows by 85% from 2020 to 2045

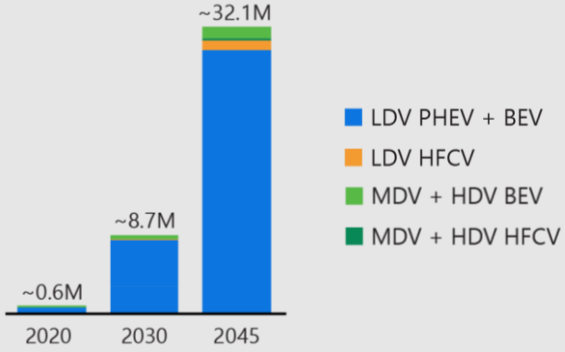
1) *Net peak demand = base load – behind the meter generation*

1) Net peak demand = base load – behind the meter generation
2) See slide 14 for California electricity consumption and net peak demand

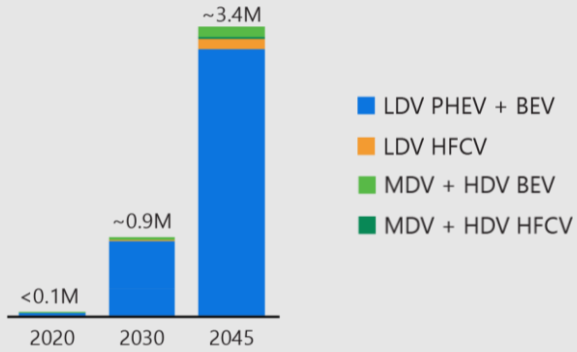
ELECTRIFYING TRANSPORTATION

A monumental transition to electric vehicles will be needed to decarbonize the transportation sector

California Zero Emission Vehicles Adoption[1]



SDG&E Service Area Zero Emission Vehicles Adoption[1]



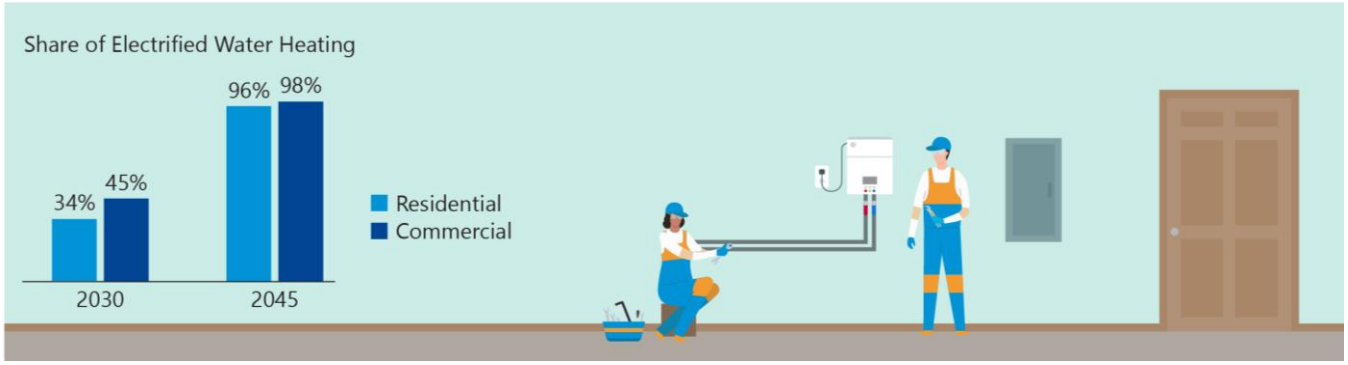
SDG&E Service Area Chargers[2]

	2020	2030	2045
EV chargers	~7K	~180K	~640K

1) *2020 represents actuals based on CEC ZEV and Infrastructure Statistics (YE-2020, updated April 2021) for light-duty only, within California and the SDG&E service area. 2030 + 2045 shown are projected ZEVs for light-duty, medium-duty, and heavy-duty.*
2) *2020 chargers represent actuals based on SDG&E's Accelerate to Zero study (San Diego County Only, reflects light-duty, medium-duty, and heavy-duty). 2030 + 2045 shown are projected for light-duty, medium-duty, and heavy-duty.*

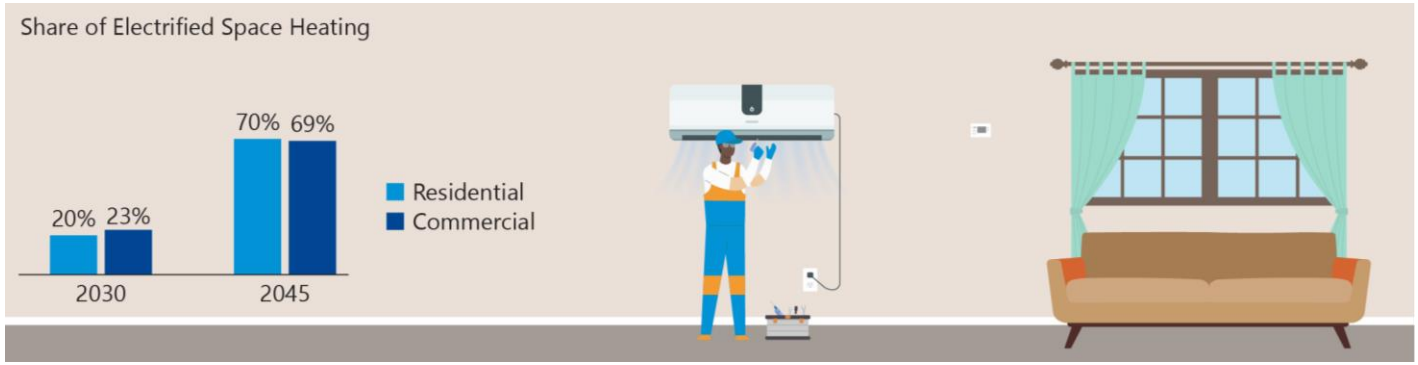
DECARBONIZING BUILDINGS

Buildings can be decarbonized by electrifying space and water heating equipment or substituting the burning of natural gas with clean fuels.



The share of electrified water heating appliances grows to 96% or higher for both residential and commercial applications

Electrified space heating grows substantially, albeit at a slower pace due to longer useful lives of gas furnaces

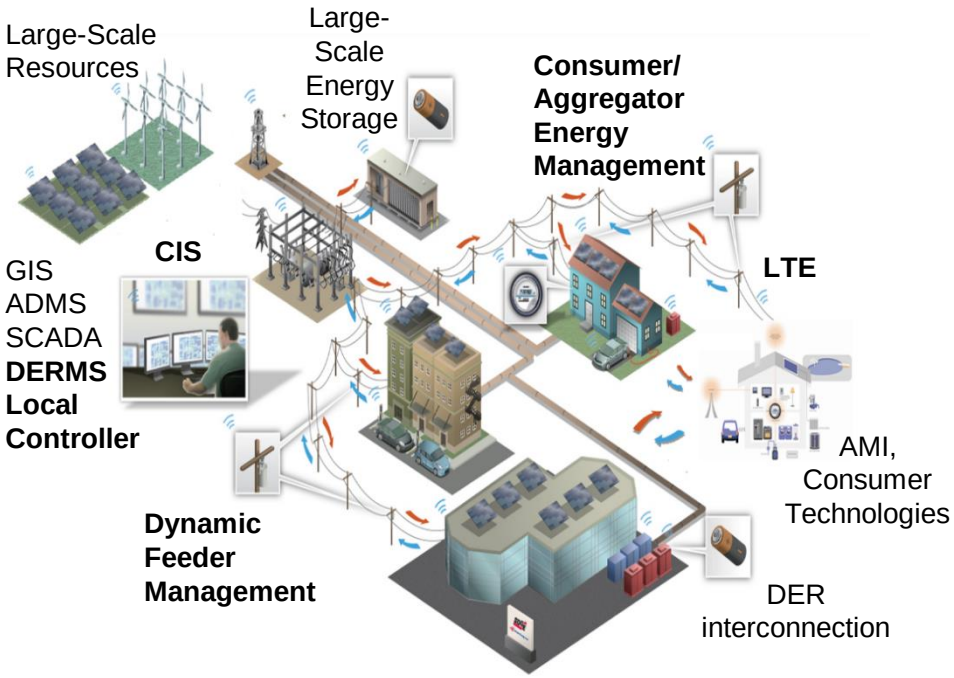


ADVANCED TECHNOLOGY

Building on a strong technology foundation, driven by safety and reliability; anticipating and adapting to grid changes, by planning and implementing new systems and analytics

Innovating new technologies

- Envision (CIS); monitor value and potential for markets
- Advanced communication and sensing (LTE)
- Near real-time forecasting
- Local | microgrid controller (LADC)
- Dynamic feeder management
- DER Management System (DERMS)



ENVISION · PLAN · OPERATIONALIZE

Advancing planning and interconnection to further operationalize distributed resources

ADVANCED SIMULATION

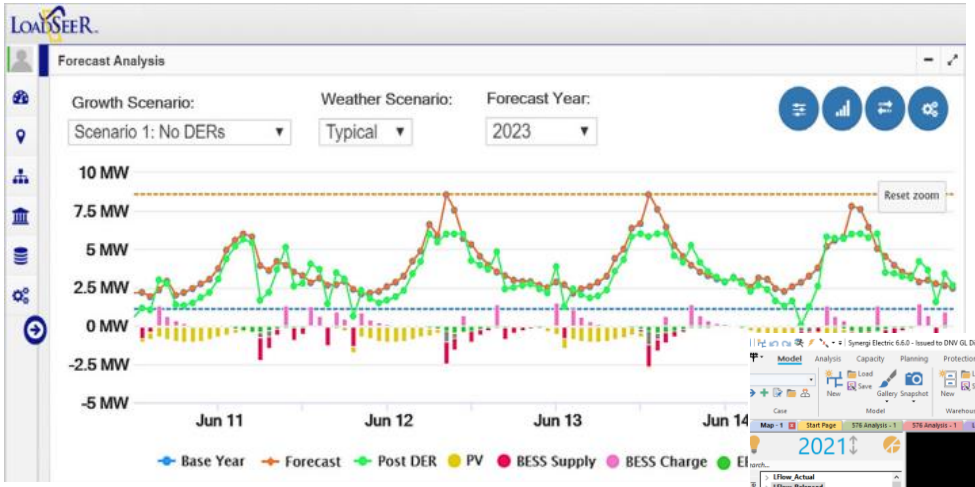
INTEGRATED TESTING

GEOSPATIAL HOSTING

INTERCONNECTION STREAMLINING

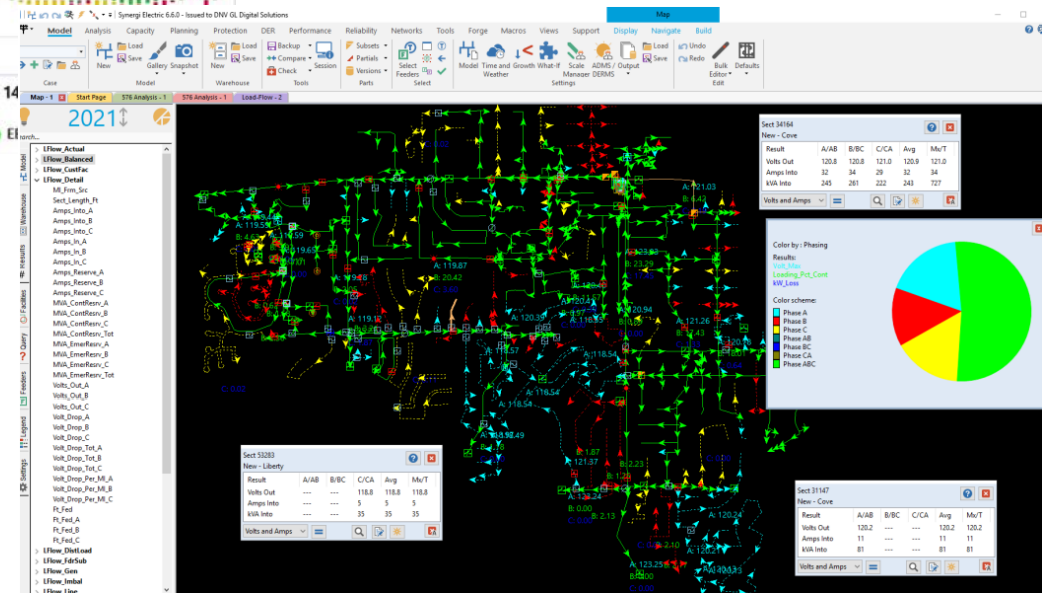
ADVANCED SIMULATION

Hourly forecasting and simulation of more diverse load and resources, with highly integrated systems and data



LOADSEER

SYNERGI



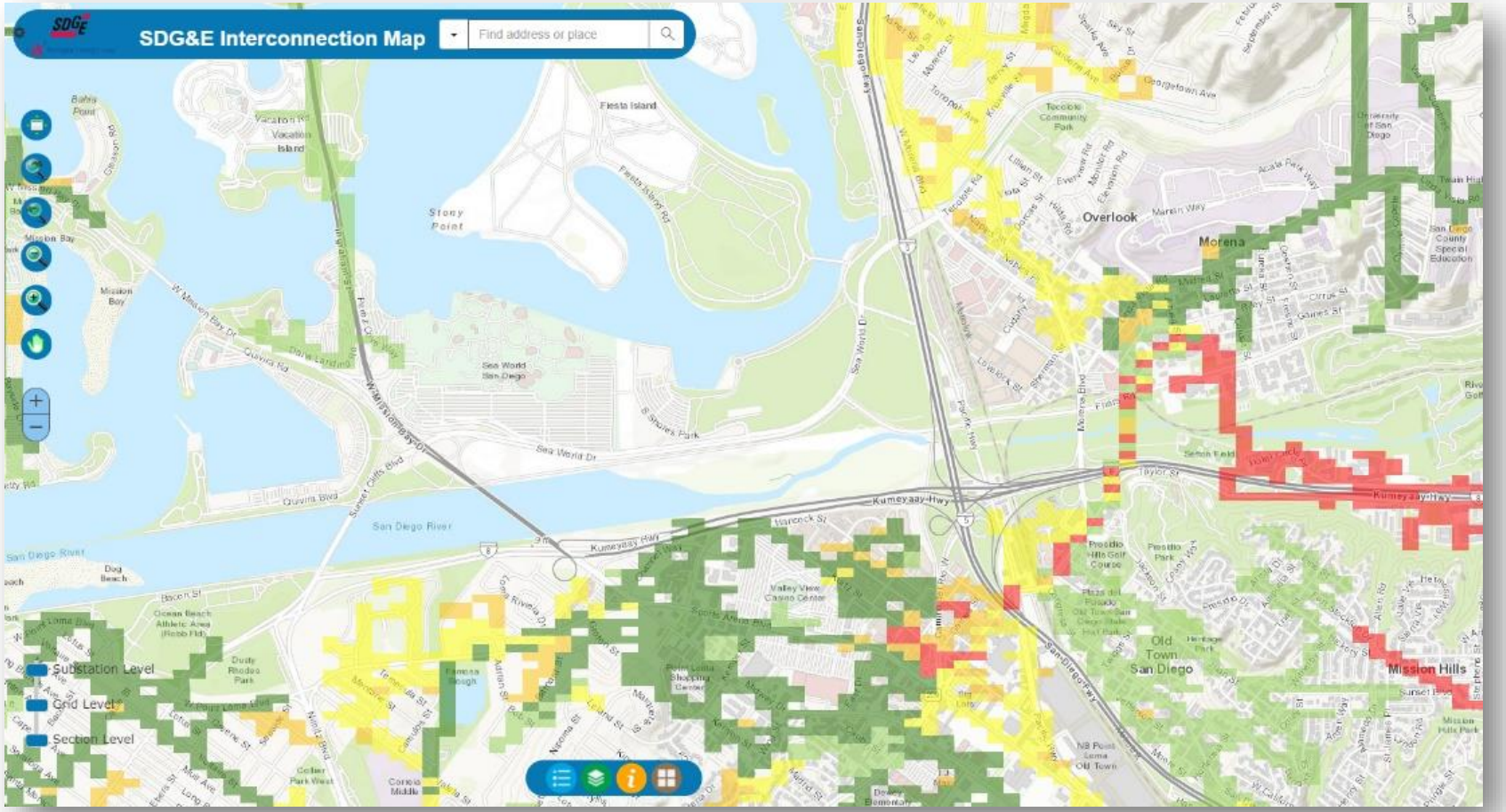
INTEGRATED TESTING

Simulating advanced integrations of new technologies at SDG&E's Integrated Test Facility (ITF)

- Promote internal and external collaboration to coordinate and integrate advanced technologies
- Provide a place for SDG&E to develop institutional knowledge and intellectual capital
- Compliment efforts to enhance safety, reliability, and efficiency:
  - Situational Awareness
  - Power Systems
  - Distributed Energy Resources
  - Home Area Network
  - Information Security
  - Communications | Foundational Systems

GEOSPATIAL HOSTING

Providing preliminary load and resource geospatial hosting capacity in an Integration Capacity Analysis (ICA) portal



INTERCONNECTION STREAMLINING

Tailoring systems and processes for professional and passionate employees, promotes an outstanding customer experience

Automated application process and online tool for contractors and customers to manage interconnection projects (launched 2013)

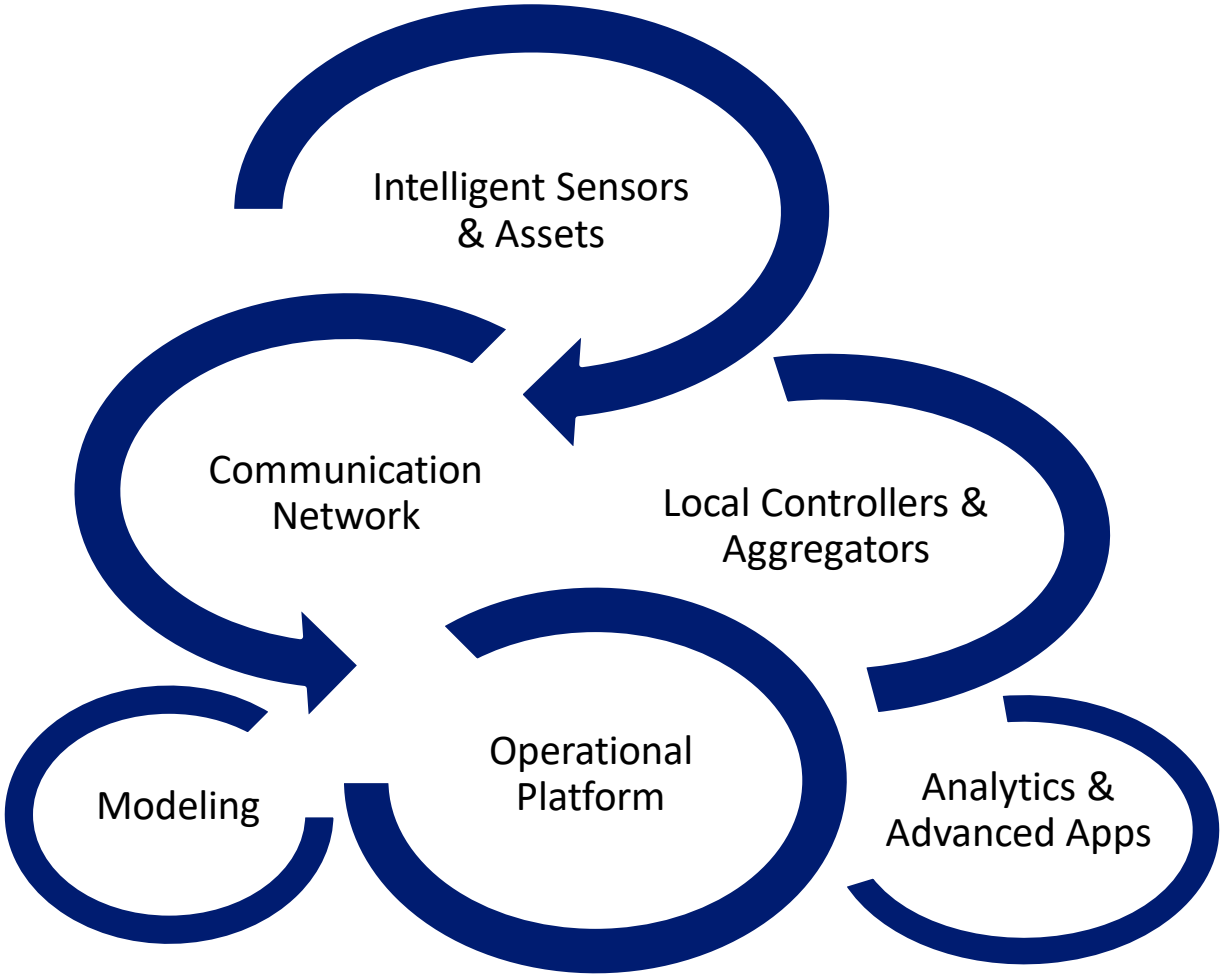
Real-time status updates and notifications with 24/7 self-service management portal

Over 230,000 interconnections requests and 1,600 MW nameplate generation authorized

Achieved a three-day average application processing time for residential applications

ENVISION · PLAN · OPERATIONALIZE

Improving visibility, management and control



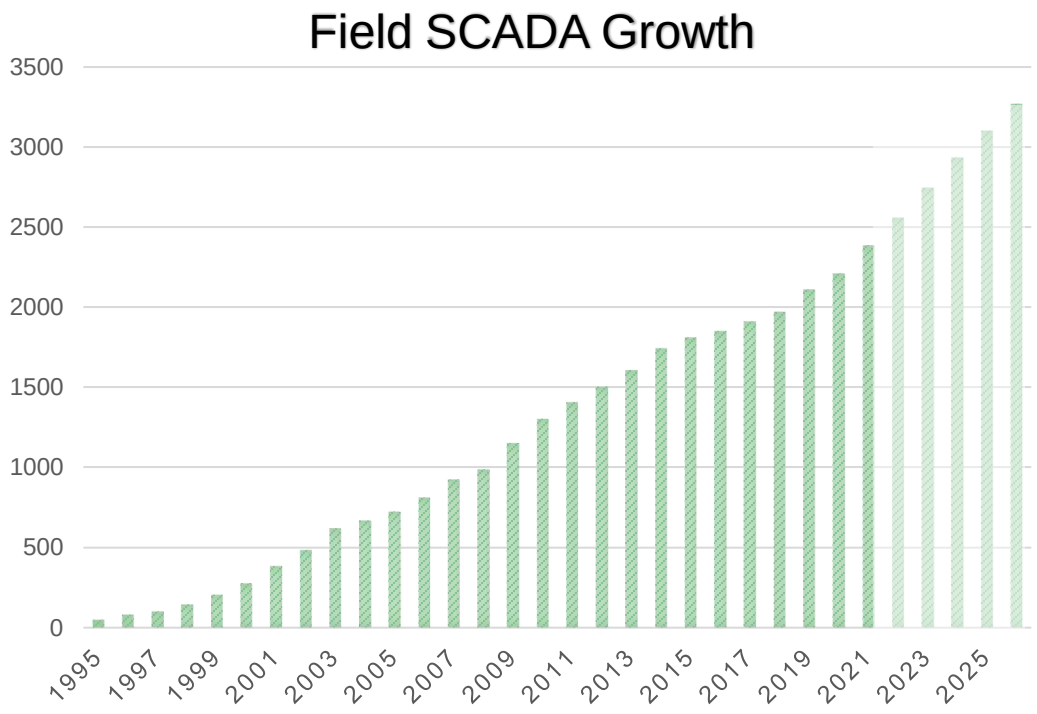
SYSTEM AUTOMATION

Automating early and systemwide fostered experience and outcomes

Power Quality Monitors: 160+

Substation SCADA: 100+

Wireless Fault Indicators: 500+

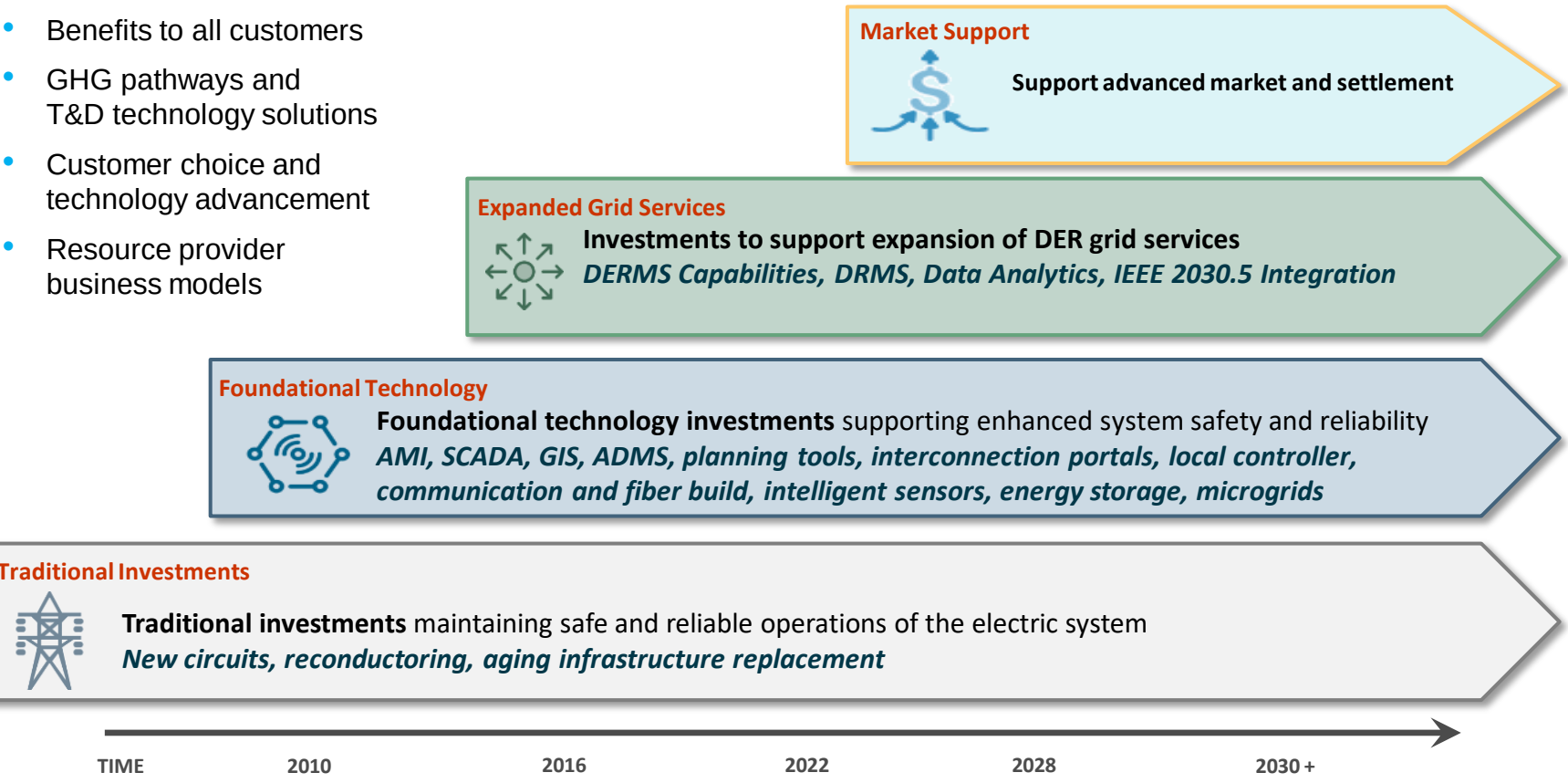


LAYERED CAPABILITIES

SDG&E's approach to transforming its grid is focused on value and layered capabilities best positioned for potential futures

Options | outcomes driven by value

- Benefits to all customers
- GHG pathways and T&D technology solutions
- Customer choice and technology advancement
- Resource provider business models



QUESTIONS

INFORMATION REGARDING FORWARD LOOKING STATEMENTS

This presentation contains statements that constitute forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995. Forward-looking statements are based on assumptions with respect to the future, involve risks and uncertainties, and are not guarantees. Future results may differ materially from those expressed in any forward-looking statements. These forward-looking statements represent our estimates and assumptions only as of the date of this presentation. We assume no obligation to update or revise any forward-looking statement as a result of new information, future events or other factors.

In this presentation, forward-looking statements can be identified by words such as “believes,” “expects,” “intends,” “anticipates,” “plans,” “estimates,” “projects,” “forecasts,” “should,” “could,” “would,” “will,” “confident,” “may,” “can,” “potential,” “possible,” “proposed,” “in process,” “under construction,” “in development,” “opportunity,” “target,” “outlook,” “maintain,” “continue,” “goal,” “aim,” “commit,” or similar expressions, or when we discuss our guidance, priorities, strategy, goals, vision, mission, opportunities, projections, intentions or expectations.

Factors, among others, that could cause actual results and events to differ materially from those described in any forward-looking statements include risks and uncertainties relating to: California wildfires, including the risks that we may be found liable for damages regardless of fault and that we may not be able to recover all or a substantial portion of costs from insurance, the wildfire fund established by California Assembly Bill 1054, in rates from customers or a combination thereof; decisions, investigations, regulations, issuances or revocations of permits and other authorizations, renewals of franchises, and other actions by (i) the California Public Utilities Commission (CPUC), U.S. Department of Energy, U.S. Federal Energy Regulatory Commission, and other regulatory and governmental bodies and (ii) states, counties, cities and other jurisdictions in the U.S. in which we do business; the success of business development efforts and construction projects, including risks in (i) completing construction projects or other transactions on schedule and budget, (ii) the ability to realize anticipated benefits from any of these efforts if completed, and (iii) obtaining the consent or approval of partners or other third parties, including governmental entities and regulatory bodies; the resolution of civil and criminal litigation, regulatory inquiries, investigations and proceedings, and arbitrations; changes to laws; actions by credit rating agencies to downgrade our credit ratings or to place those ratings on negative outlook and our ability to borrow on favorable terms and meet our debt service obligations; the impact of energy and climate policies, legislation and rulemaking, as well as related goals set, and actions taken, by companies in our industry, including actions to reduce or eliminate reliance on natural gas generally and any deterioration of or increased uncertainty in the political or regulatory environment for California natural gas distribution companies and the risk of nonrecovery for stranded assets; the pace of the development and adoption of new technologies in the energy sector, including those designed to support governmental and private party energy and climate goals, and our ability to timely and economically incorporate them into our business; weather, natural disasters, pandemics, accidents, equipment failures, explosions, acts of terrorism, information system outages or other events that disrupt our operations, damage our facilities and systems, cause the release of harmful materials, cause fires or subject us to liability for property damage or personal injuries, fines and penalties, some of which may not be covered by insurance, may be disputed by insurers or may otherwise not be recoverable through regulatory mechanisms or may impact our ability to obtain satisfactory levels of affordable insurance; the availability of electric power and natural gas and natural gas storage capacity, including disruptions caused by failures in the transmission grid or limitations on the withdrawal of natural gas from storage facilities; the impact of the COVID-19 pandemic, including potential vaccination mandates, on capital projects, regulatory approvals and the execution of our operations; cybersecurity threats to the energy grid, storage and pipeline infrastructure, information and systems used to operate our businesses, and confidentiality of our proprietary information and personal information of our customers and employees, including ransomware attacks on our systems and the systems of third-party vendors and other parties with which we conduct business, all of which may become more pronounced in the event of geopolitical events and other uncertainties, such as the conflict in Ukraine; the impact on competitive customer rates and reliability due to the growth in distributed and local power generation, including from departing retail load resulting from customers transferring to Community Choice Aggregation and Direct Access, and the risk of nonrecovery for stranded assets and contractual obligations; volatility in inflation and interest rates and commodity prices, including inflationary pressures in the U.S., and our ability to effectively hedge these risks and with respect to inflation and interest rates, the impact on our cost of capital and the affordability of customer rates; changes in tax and trade policies, laws and regulations, including tariffs and revisions to international trade agreements that may increase our costs, reduce our competitiveness, or impair our ability to resolve trade disputes; and other uncertainties, some of which may be difficult to predict and are beyond our control.

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NPCC 2022 Outreach Activity

Gerry Dunbar

Director Reliability Standards and Criteria

August 11, 2022

NPCC 2022 – 2025 Strategic Plan

Strategic Focus Area

Reliably Integrate Resources Brought Forward by Decarbonization Objectives

- NPCC DER/VER Forums
  - October 13, 2022
- NPCC DER/VER Guidance Document
  - 2022 Enhancements

NPCC 2022 Planned Outreach Activity

Comments/Suggestions:

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NPCC 2022 Corporate Goals

NPCC DER/VER Guidance Document