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Net Zero Grid Plan Planning Lab

Minutes from Workshop #2:

Identifying Barriers and Opportunities

March 4, 2022

Participant List

MassCEC

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- Rees Sweeney-Taylor
- Rhys Webb
- Fatema Alkhalifa
- Paige Asbury
- Rachel Powlen
- Sarah Smails
- Sophia Napoletano

EPRI

- Jason Taylor
- Robert Sheridan
- Greg Adams
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Eversource

- Digaunto Chatterjee
- Gerhard Walker
- Juan Martinez
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National Grid

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- Doug Ayer
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- Nancy Israel
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Office of the Attorney General

- Liz Anderson
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Executive Office of Energy and Environmental Affairs

- Undersecretary for Energy and Climate Solutions Judy Chang

Metropolitan Area Planning Council

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Northeast Clean Energy Council

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Introduction

Dr. Ariel Horowitz, Senior Program Director, MassCEC

Rob Sheridan, Technical Executive Consultant, EPRI

Overarching Goal of This Workshop: Discuss barriers to the decarbonization pathway and opportunities to mitigate those barriers. Some key questions are:

- What does a good decarbonization pathway look like?
- How do we achieve this?
- What are different stakeholders' definitions of "good"?

Workshop #3, on April 11th, will be about cost drivers.

Today's Agenda

- Welcome
- Key Considerations of Pathway Elements
- Breakout Sessions
- Plenary Discussion

Key Considerations

Rob Sheridan, Technical Executive Consultant, EPRI

Distribution Capacity Varies

- Distribution capacity varies by location
    - Typically, decreases as you move away from the substation
- Even at a particular level, the capacity can vary
    - Example: Substation capacity can range from <5 MW to >100 MW
    - In breakout rooms, capacity will be represented by a single number, but there are many variables that impact capacity values from location to location
- As you leave the substation, you go to the feeder mainline – the highest rated section which can range from <2 to >20 MW
- At the neighborhood level, typical capacity levels drop to less than 1MW and at the distribution transformer level (which serves one to several customers) the likely capacity level ranges only between 30 kW and 100kW. What limits capacity on the distribution system?
    1. Size of the equipment installed
    2. Protection settings – breakers, reclosers, fuses to protect the system from overload or to isolate grid sections

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What to Expect in Breakout Sessions

- Realistic but illustrative examples considering potential 2050 impacts of key elements of the All Options Pathway
  - These are not detailed forecasting and engineering analyses
- Focus on distribution capacity issues
  - In reality, there are other factors that influence engineering assessments
- Assessments of issues at the substation or feeder level

Eversource Breakout Room

Dr. Gerhard Walker, Principal Engineer, System Planning, Eversource
Juan Martinez, Engineering Manager, Eversource

Illustrative Example (Slide 12)

- Substation in Southeastern Massachusetts
  - Transmission level voltage: 115kV
    - Two 50MVA transformers
  - Distribution level voltage: 13kV
    - Ten distribution feeders
  - Customer level voltage: 120V-460V
    - Over 10,600 customers
    - Approximately 45MVA of DG
    - Approximately 12MVA-47MVA of load
- Small residential street: 50kVA
- Commercial buildings: 500kVA-5MVA
- Downtown Boston buildings: 1MVA-5MVA

Definitions and Base Station Load Profiles (Slides 13-22)

- Gross Load = P1+ P2 + P3 = total consumption
- Net Load = P1 + P2 + P3 – P(pv)
- Gross Load = Net Load + P(pv)
  - Eversource stations measure net load, so Eversource needs to understand local generation to calculate gross load on the system
  - In the future, Eversource hopes to use AMI to avoid having to do those calculations
  - Need to calculate gross load to understand the distribution system capacity requirements to account for the intermittency of PV generation on particularly sunny (or cloudy) days
- Looking at different scenarios from a meter on a substation
  - When distributed load **=** Generation, P(Total) reads 0 on the meter
  - When distributed load **>** Generation, P(Total) reads + on the meter

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- When capacity > Load there is headroom to serve additional load
- When distributed load **<** Generation, P(Total) reads – (negative) on the meter
  - Generation being pushed up to be used somewhere else
- These scenarios can each take place at any point in the day

- Base Station Load Profile – No Solar Case
  - Ex. Transformer with 30MVA limit and customer consumption of 5MVA at 5:30AM → 25MVA of head room
  - At 6pm, head room could be 5MVA
- **Question** from Joanna Troy, DOER: If you have multiple telemetry points, would you put them in the same data set? Is it better to have more data?
  - Answer from Mr. Martinez and Dr. Walker: The more telemetry on the feeder, the more accurate the data. They can determine the difference between net and gross load and know exactly what is happening on the system.
- **Question** from Joanna Troy, DOER: Do you have telemetry on all your feeders?
  - Answer from Dr. Walker and Mr. Martinez: Eversource has most substations with telemetry and some without. Depends on costs to install it and to retain data as well as the location.
  - For some feeders, telemetry is on the feeder line
- Head Room is the capacity of the substation vs the maximum net load
- Hosting Capacity is the amount of DER that can be accommodated on the existing system without adversely impacting power quality or reliability.
- Planning Load Definitions:
  - Maximum Net Planning Load: look at highest case load conditions with low DG output
  - Minimum Net Planning Load: look at lowest load case conditions with high DG output
- Capacity Definitions:
  - Installed Substation Capacity: sum of all installed transformers
  - Firm (Operational) Substation Capacity): consideration of an N-1 event (loss of largest asset). The capacity of the remaining transformers when the largest transformer is out of service.
    - E.g., station with two 62.5MVA transformers has a firm capacity of 62.5MVA
  - Eversource plans the system to ensure that it remains operational under N-1 contingency conditions, thus the N-1 case sets the firm capacity.
- **Question** from Jeremy McDiarmid, NECEC: What is Eversource's approach to using N-1 as a planning tool compared to other distribution systems? Some say it's too conservative.
  - Answer from Dr. Walker: N-1 is the national standard and demonstrates how the system is operated. It measures the ability to lose one asset and still operate. It doesn't target every piece of infrastructure, only the big items that would take a while to replace.
- Base Station Load Profile, now with 45MW of solar
  - Dip in net load increases headroom of the station in the middle of the day due to solar generation

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    - But the peak underlying gross load is still the same, and so for planning purposes the head room is the same with or without solar
    - Addition of 45MW solar has not changed the load the utility plans for because the peak is the same
- Solar Profile Definitions
    - Clear Sky Profiles: used for planning low load conditions
    - Historic Solar Profiles: Used for calculating gross load data
    - Peak Load Planning Profile: Used for peak load conditions (considers a 90/10 weather probability)
        - Peak load dictated by max. load and lowest generation – typically in the summer – could switch to winter as electric heating picks up
        - Low load condition (in April/May)
- **Question** from Ariel Horowitz, MassCEC: How informed by actual facility characteristics are the clear sky profile and the peak load planning profiles?
    - Dr. Walker: for every facility, they convert this into output which is facility informed. These are just weather profiles – planning capacity takes weather profiles and converts them into actual, facility-informed profile.
    - This is Global Irradiance Data, the weather-assumed input
- Peak load planning profile: What could it have been under clear sky conditions and compare it to historic load profiles

Electric Vehicle Profiles (Slides 23-25)

- Load profiles mainly driven by:
    - Number of vehicles
    - Time of arrival
    - Distance traveled
- Not driven as much by:
    - Charging power
    - Size of battery
    - How often vehicles plug in
- STATION SPECIFIC based on customer make up
- Will soon be the biggest load on the system
- Sample EV Profile – Commercial Area, Industrial Park
    - In residential areas – spike up at school drop-off system in areas without a school bus system
    - Profiles are station-specific based on customer mix and traveler data
- **Input** from Jeremy McDiarmid, NECEC: Should focus on identifying where the trends are going to be, but can't be so precise so that they can plan for a future that may stray from the prediction

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- Gerhard: Eversource has very granular data based on customer data, so predictions are less of a forecast and based on actual travel data
- **Question** from Dr. Horowitz, MassCEC: When does too much precision become a problem?
  - Juan Martinez: If EVs come in faster than they can install reinforcements, everything will halt, so they need to preemptively reinforce the system. That's why this scenario is crucial at substation/transmission level.
  - Dr. Walker: We can't be stuck in a system where electrification overtakes the buildup speed of the system. If you ever get behind, you can't call for more fossil-fuel based products.

- **Question** from Joanna Troy, DOER: What is the impact of managed EV charging? What is the scale where you won't allow more EV charging?
  - The more people that charge EVs in different locations throughout the day, the better. It geographically and temporally shifts load across time and space. The worst case is that everyone only charges at home at the same time.
  - Charge management without utility action can cause problems, or it could be a benefit. Impacts will vary and depend on the specifics of the substation or feeder.
  - Until it is clear how FERC Order 2222 impacts charging behavior and how much leverage the EDCs will have over charge management, the company will assume the unmanaged scenario

<u>Electric Heating Profiles (Slide 26)</u>

- Mainly driven by:
  - Average MW/sqft peak heating demand
  - Total number of sqft electrically heated
  - External temperatures
- Will shift to a winter peaking load
- Station specific

<u>Combined Profiles (Slides 27-30)</u>

- Combined profiles include EVs, heat, PV.
- Planning for cold snap days: when heating source gets less efficient, but you need even more heat
- Combined Profile: Winter 2030
  - Winter peak at 40MW does not exceed summer peak
- Combined Profile: Summer 2030
- Combined Profile: Spring 2030
  - Very negative load profile
  - Design of the station is driven by solar buildup
- Combined Profile: Winter 2050

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  - Load peak is in winter due to significant heating profile – increased by 5-fold
    - Cold snaps: can be managed, but peak is still at 100MW. Heat pumps lose flexibility since they have to heat buildings so much

Considerations for Mitigation (Slide 31)

- Developing a traditional solution for substation capacity issues
  - Evaluation of transfer capacity and feeder reconfiguration
  - Basic station upgrades such as transformer replacement
  - Station rebuild for larger transformers, typically to modern safety and reliability design standards
- Consideration of Non-Wire Alternatives vs Capacity Projects
  - Can we defer the need from a technical standpoint? How long can we defer the upgrade?
  - Can we defer the need from a benefit/cost ratio standpoint?
  - Can we defer the need from a reliability standpoint?

Multi-Year-8760 Modeling: An Overview (Slide 32)

- Existing model uses default 24-hour and 12-month profiles and does not include upgrades.
- Forecasting component
  - Every customer has its own load profile and utilities have to be aware of this when planning for next 10 years.
  - Planning forecast requirements:
    - Consider what happens at distribution level – need growth curves
    - Need to know if electrification and heating will increase
    - Instead of 24-hour or 12-month default profile, planning models now requires 8760- and 24-hour schedules
    - Large customer load or DER conditions need to be considered in forecasting
  - To account for new businesses after 5-10 years, years 3-10 need to be modeled as Projection Growth Curve targeting specific areas
- Planning component:
  - Need to know capital plan for the next 1-5 years and proposed upgrades for the next 3-10 years
    - E.g., new reinforcements, transformers, feeders
    - Can model the next 1-5 years based on in-service data
  - Significant system upgrades, new feeders, changes to feeders that affects LCC (load carrying capability
  - To complicate the scenario, all stations are connected and load can be shifted between them. If one system upgrades, need to consider how they interact and how to adjust.
- **Question** from Dr. Horowitz: Please highlight the asset condition piece. It's one of the hardest pieces to coordinate from a policy perspective vs operational replacements.

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- Answer from Juan Martinez and Dr. Walker: Need to include an asset condition plan for next 10 years. If done correctly, capacity upgrades and asset replacements can be done at the same time so that you only have to touch the area once.

Non-Wire Alternatives (Slide 33)

- Non-Wire Alternatives (NWA): Modifies the load to fit the asset, rather than changing the asset to fit the load
    - Can be energy storage, solar generation, fuel cells, energy efficiency, demand response, etc.
    - Every project Eversource does goes through a non-wire alternative screening process
    - Different NWA solutions have different limitations whereas traditional options do not

Considerations for Mitigation (Slides 34-40)

- Forecast
    - Identify how often they experience constraints on an annual basis
        - How many MWh it is per year
    - Can go over station capacity: power violation
    - Can go under capacity: headroom
- Solar profile
    - Solar profile for peak loads is considered at weather-adjusted output
    - Due to the time of solar generation vs the time of peak, have a marginal coverage of the power violation
- Storage
    - If you have multiple days of capacity constraints, do you still have the system capacity to recharge battery in between events?
    - Start with 0 charge, battery uses headroom to charge up during the morning
    - A buffer is kept between charging load and headroom for safety reasons
    - Battery discharges at the end of day to mitigate power and energy violations
    - Technically capable of managing load constraints
- Multiple - Combination of resources
    - Can combine energy efficiency, solar, storage, and demand response
- Benefit Cost
    - Financial feasibility determined by rate payer impact
    - Create 2-3 solutions to address issue and prioritize most financially sound solutions
    - Have to consider the cost of replacing the asset at end of life as part of the total ratepayer impact calculation
        - Example: A 2040 replacement due to asset age costs $50M versus spending $70m in 2030
        - Ratepayer impact should not be considered at the full $70M because ratepayers would have incurred $50M cost 10 years later.

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    - Instead, ratepayer impact is net present value of $20 million (difference in nominal cost) plus change in net present value (in 2022) from accelerating project 10 years.
  - Storage solutions can increase CO_2 emissions because they are less than 100% efficient and "waste" some energy over a charge-discharge cycle. Therefore, they function as a net addition to load over time.

National Grid Breakout Room

Presenters

- Samer Arafa, Principal Engineer, Future of Electric, National Grid

Challenges of the Urban Grid in 2050 (Slide 44)

The following issues are considered in the development of distribution system plans:

- Feeder level device limits
  - Example: Wire has thermal capacity to carry the maximum current load or generation at any given time
- Substation level limits
  - Often the aggregate of the individual feeder capacities exceeds the substation capacity.
  - The total capacity of all feeders from a substation generally exceeds the capacity of the substation. Therefore, to increase load on a feeder, you need to ensure there is capacity on the feeder at the substation.

- Transmission level limits
  - What happens to lines when the load is too low or too high?
- Reliability
  - Does the voltage and frequency stay within acceptable limits?
- Resiliency
  - What is the ability to recover quickly after an outage?
- Asset Conditions
  - For example, CA wildfires were caused by "severe wear" on steel parts

National Grid's illustrative example considered a single distribution feeder serving over 3300 customers in north central Massachusetts.

Feeder Overview (Slide 45-46)

- Base Case 2021 Load Profile
  - Net load and capacity fluctuate depending on each season
  - Sometimes, the net power in the feeder reaches 0
  - 3332 customers with a summer peak at 6pm

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Feeder Forecasts (Slide 47-53)

- Net Load Normal Growth by 2050 with Energy Efficiency
  - Low concern
  - Absent electrification initiatives, this feeder would not be expected to exceed its capacity within the study horizon
- Electric Vehicle (EV) Load for 2050
  - In this assessment, EV charging behaviors do not change with the seasons
  - Customers are likely to charge at work or directly after they come home
  - Is 8MW a reasonable peak for 3332 customers?
    - Should contemplate time of use incentives to change where and when the peak occurs.
  - Question: At what point during the day will EVs typically be charged? What percentage of battery is depleted during the day? When would be the best time to charge the car without exceeding capacity?
    - Answer: People typically leave their house and drive 20-30 miles to and from work. They would probably charge their car during work hours and at home
- Electric Heat Pump (EHP) Load for 2050
  - EHPs are winter-dominant loads and will peak in the early morning hours in the winter.
  - Is 4MW reasonable for 3332 customers?
  - EHPs on this feeder would require 4MW in the winter and peak in early morning hours
  - **Question** from Undersecretary Chang: Would you be saving in the summer if you're using air conditioning?
    - Answer: Heat pumps in the winter use more power than air conditioning in general, so the winter months are still a burden in comparison to the summer.
- Additional Solar Added by 2050
  - The feeder is fully saturated with 14MW of solar.
  - The goal: Leverage the additional loads from EHP and EV to increase hosting capacity to enable more solar.
    - An increase in hosting capacity of 6MW may develop as load increases over time
    - Both behind-the-meter and in-front-of-the-meter, but mostly in front.
  - Winter peaks reduced due to weak irradiance or possible snow coverage.
- Net Load
  - Run into issues at 7-8pm
  - During the winter, most of the day is spent above the limit of the wire
  - How much of that load can be shifted?
    - Many programs are looking into increasing the flexibility of loads
    - Do they need to add more or upgrade the distribution infrastructure? Or do they need to shift when and where the loads are?
- Total Load for 2050 – Excluding Forecasted Generation
  - Winter:

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        - More challenging than summer due to EHPs consuming more power for heating than air conditioning
        - Solar less reliable than in the summer
        - Can't charge a battery very far in advance, so need new technology with longer strategies
    - Spring:
        - If you can operate in real time, you can communicate with customers.
            - Can ask to charge EVs at 3pm instead of 6pm, for example, or ask for schools to be slightly cooler.
    - Summer:
        - Only run into issues at 6pm once the sun goes down
        - Can work with customers to charge EVs earlier in the day because the net load dips early in the morning

Excessive DG Solution – Active Resource Integration (Slide 54)

- The added 6MW of DG would bring the total DG on the feeder to 20MW – exceeding capacity
- The assumption is that EV load will be available to balance solar generation
    - National Grid will need to monitor load in real time to curtail solar generation in case the load drops for any reason
- **Question** from Undersecretary Chang: Would customers be asked to install solar that is more than a traditional scoping? Is solar limited by rooftop capacity?
    - **Answer**: Yes. Upgrade cost is a limiting factor. What we are doing with a ground mount is instead of shrinking cost. The goal is to talk and collaborate. If you operate with 6MW today, you will be operating at 5MW tomorrow. The plan is to use distribution control tech to curtail. This is for utility-scale solar.

Options to Solve Summer Challenges (Slide 55)

- The traditional solution has been to upgrade limiting elements
- Flexible load and energy storage operations developed through Grid Mod will allow for loads to be shifted from peak hours using DERMS technology
    - E.g., A washer and dryer that detects hours where the least amount of power is used and starts cycle then
- Now, National Grid wants to communicate in real-time to allow for further optimization and extend asset lifetime
    - Day-ahead window to real-time window

Options to Solve Winter Challenges (Slide 56)

- Net load on feeder exceeds capacity during most of the day
- Flexible load and short-term energy storage are not strong options. Instead:

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    - Upgrade existing wired systems or substation transformers (reconductor, dual feed, etc.)
    - Serving (reallocating) load from neighborhood feeders if they have the capacity
    - Long-duration energy storage
    - New technologies as a demand response solution
        - E.g., Home freezers: food is not affected by extreme cold – this allows freezers to get very cold
    - Dynamic pricing
        - If customers know certain time frames will have higher prices, they will make different decisions
        - Inform consumers and provide incentives
        - DERMS technology can tell devices not to operate during peak hours to spread out power usage throughout the day

<u>Issues (Slide 57)</u>

- At some point, people are going to need to drive, and they won't always be able to wait long periods of time to accumulate load.
    - You can move the peak, but it will always exceed the line so upgrades will have to be made.
    - Working around upgrading can buy time but upgrading is inevitable.
- Serving from Neighborhood Feeders
    - The substation transformer is only rated for 14MVA, while the forecasted peak load on the single feeder reaches 18MVA
    - If the total load across all feeders is greater than the station transformer nameplate rating, then the transformer will need to be upgraded

<u>Residential Feeder Discussion</u>

- **Question**: Have you considered the potential of dispatch of electricity from EV batteries during times of peak demand (V2G)?
    - National Grid has not considered this to date, however it recognizes it as another form of energy storage that can be used to shift peaks.
- What drives cost?
    - Some capacity increase will be necessary because of electrification of buildings, etc.
- **Question**: Does the peaky-ness of profile affect wear and tear and cost of the substation?
    - You want to delay the upgrade. Capacity rating is dependent on the shape of the load cycle. As you flatten it, the ratings tend to fall. Flat ratings would have less of a thermal capacity.
    - This is a smaller issue because as assets are upgraded they can be sized appropriately.
- **Input**: It would be great to have a system that tells you how much it can handle without any effects to its efficiency etc. (How many EHPs can you take on this 3332 feeder)

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- **Question**: Load profiles did not include V2G explicitly, so the problem can be shown, but yes – V2G is one of the potential solutions in the future
  - V2G could be enabled by direct load control (demand response programs)
  - TVR/dynamic pricing or other future market constructs

Commercial Feeder Overview

- Base load
  - National Grid is currently studying 1.9MW in the area
    - 7-mile feeder with a lot of commercial properties
    - The graph assumes we will see 3x that over the next 30 years
  - Assumes that charging occurs in off-peak hours and that similar behavior will occur throughout the years
  - In 2021:
    - Peak load was reached in the Spring, not Summer
    - Afternoon load was the highest
    - Load in the spring and summer shared similar characteristics
- Commercial electric heating load for 2050
  - Assumption is 5MW winter-peaking heat pump load
    - EHPs are mostly impacting winter loads
- Solar generation by 2050
  - Winter solar production reduced due to weak irradiance or possible snow coverage
  - Limited land available
- Total load
  - High evening load caused by fleet charging and normal operations
- Net load (Load + DG)
  - Winter becomes one of the most challenging parts of the year

Options to Solve Summer and Spring Challenges

- Flexible load and energy storage will allow for loads to be shifted from peak operation hours using DERMS technology
- Lowest cost solution would be fleet EV customers agreeing to customized charging schedules
- Solutions will only defer upgrades, and asset conditions will eventually require changes

Options to Solve Winter Challenges

- Net load exceeds load during most of the day
- Flexible load and short-term energy storage are not strong options, instead:
  - Upgrade existing wire system
  - Serving load from neighboring feeders if they have capacity
  - Long-term energy storage
  - New technology as a demand response

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Serving From Neighboring Feeders

- You can transfer load from one feeder to another using ADMS and FLISR technologies.
- If people are interested in changing their behavior, there is an opportunity for this.

Plenary Discussion

Questions from breakout rooms

- Shannon Beale, AGO: Can the utilities speak more generally about any equity considerations that go into planning conversations?
  - Digaunto Chatterjee, Eversource: This is a newer area for Eversource
    - Have a requirement to look at EJ consumers under information in the docket
    - Looking at four specific impacts:
    1. Quantify the number of EJ and LMI community members that will benefit from upgrades
    2. Looking at construction of substations and feeders, where are they traversing, how many miles of feeders are in EJ and LMI communities?
    3. Looking at the impact of how much energy of EJ and LMI communities is being served off DERs and looking at how much more clean energy they would have access to after upgrades
    4. They have a capital plan and an associated implementation schedule but is there a sequencing of that can prioritize access to clean energy to EJ communities?
        - Much harder to solve – Eversource has not done this step yet
  - Shannon Beale: Equity is an issue that is top of mind for the AGO. The National Grid breakout group had discussion about EJ concerns of NWAs.
  - Samer Afara: As much as they can use technology collaboration to defer upgrades, everybody benefits. Much of it will be about creativity and increasing size of toolbox to save customers money, especially LMICs.
- Jeremy McDiarmid, NECEC:
  - It is helpful to overlay the impacts of DER, EV, heating and put an equity lens over it. However, it is difficult to predict the future and better to accept that uncertainty of how the future will unfold. This should be factored into planning and approval of cost recovery for utility assets. We can't spend the next 10 years planning super precisely; we have to do siting and cost recovery otherwise lack of infrastructure build out will be a barrier.
- Undersecretary Chang: Thinks there's less uncertainty than Jeremy (quite certain where they are headed) and, regardless of uncertainty, they have to plan ahead of need.
  - Don't want utilities to be constrained
  - Appreciative of the compilation of National Grids load profiles and how it piles up at feeder level

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- Really important to ask:
  - How much can we accommodate now without upgrades?
  - How much can we accommodate with next step of upgrades and how much would that cost?
  - What is the incremental from that function? Large? Not very large? Need to do more load control or demand response?
  - What can we accommodate in the next 3-5 years?
- People are reluctant to switch to electric vehicles and heating due to concerns the system won't accommodate new load
- Plan ahead of need!!
- She has yet to see any analysis of types of upgrades and cost, then distributing that cost of use when their use is higher.
  - Doesn't know if rates have to be increased because she hasn't seen the data yet
  - Utilities are just assuming that rates will need to be raised.
- Digaunto Chatterjee: There is a time scale. The worst outcome is to keep looking at last year's load to project future load and then start to plan. EDCs need to accommodate investments and then rates can start to come down. The current capacity is not enough to accommodate 2040-2050 load. They need to plan for 2030, 2050, demand assessment (anticipated EVs, heat pumps, etc.) and then let policymakers decide best trajectory from that.
- Ariel Horowitz: how policy upgrades interact with reliability and asset condition work?
  - How can we defer replacements?
  - Replacements will be necessary even if they don't decarbonize
  - In how many cases can they get to that level of deferral instead of deferring all projects?
  - Digaunto Chatterjee: would enable clean energy and electrification due to standardization of parts

- Galen Nelson: For Samer, the National Grid breakout room discussed how, certain times of the year, there is back feeding onto the transmission system. How many feeders has this happened to and how many hours of the 8760 is this happening? Is this set to increase or decrease?
  - Samer: first happened in Spring 2018. National grid allows for back feeding on the system. The load is going to help reduce a lot of the back feeding
  - Unable to quantify the response, can only give an overview.
- Undersecretary Chang: Digaunto said a significant amount of their system cannot accommodate next 3-5 years. She is concerned and needs to understand why that is. Additionally, Digaunto said they will build out a lot and rates will increase before they come down because they're building ahead of need.
  - Digaunto: First question – realized they have 340-ish MW of DER. Stations in the south never meant to accommodate lots of load
    - Not 3-5 year, but southern Massachusetts is an example of what happens when infrastructure is behind the curve

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- Would have to rebuild about 11 stations to interconnect 30-40 MW of DER
- If they do that, they also enable ~1GW of DER solar which allows for reverse power flow once they build out systems and this energy can be transferred to other areas.