MA ENERGY EFFICIENCY ADVISORY COUNCIL

→ CONSULTANT TEAM

ACTIVE DEMAND MANAGEMENT (ADM) FOR THE 2022-2024 PLAN

EEAC Consultants

April 2021

BACKGROUND ON DEMAND SAVINGS AND ACTIVE DEMAND MANAGEMENT

ACTIVE DEMAND MANAGEMENT VS. ENERGY EFFICIENCY (PASSIVE DEMAND REDUCTIONS)

Active Demand Management

Encourages customers to reduce demand at specific times, such as demand response, load curtailment, or load-shifting

Energy Efficiency (Passive Demand Reductions)

Encourages customers to reduce overall demand, without a specified time period, such as through energy efficiency or certain behavioral programs

ACTIVE DEMAND MANAGEMENT IS THE FOCUS FOR THIS PRESENTATION

▶ Types of ADM include:

Curtailment	• PAs request that participating customers reduce energy use during times of peak demand in exchange for lower energy rates or incentives
Direct Load Control	• PAs remotely manage electric demand by directly adjusting customer devices such Smart T-stats, managed EV charging, hot water systems, and other devices
Energy Storage	• PAs rely on customer-sited battery storage systems to reduce loads during peak demand periods

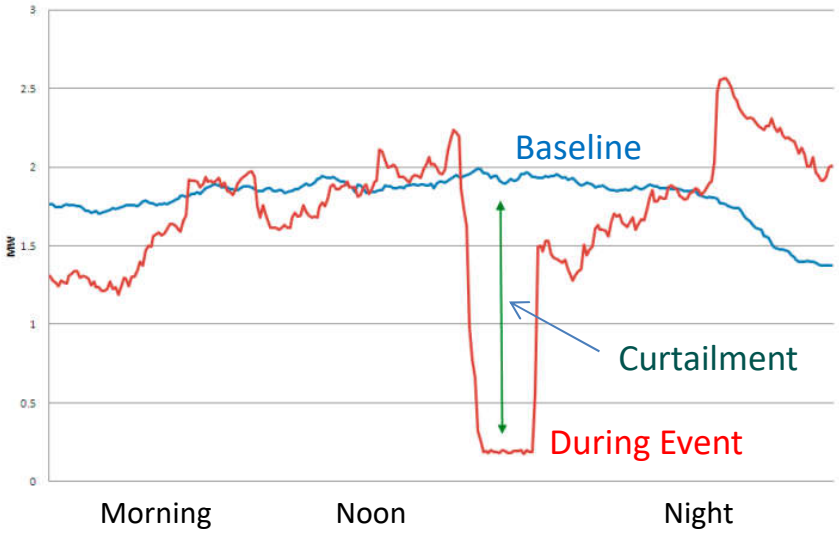
EXAMPLES OF ACTIVE DEMAND MANAGEMENT (ADM)

▶ Examples of ADM

- C&I Curtailment (demand response)
- Residential thermostats and direct load control (DLC)
- Others, including energy storage

C&I Customers

"Performance Based" – Customer Incentive of about $35 per kW per Year



Residential Customers

$25 enrollment incentive, and a $20 annual incentive for every thermostat connected to a central air conditioner.

Example technologies supported

Honeywell

ecobee

Nest

Note: Smart T-stats eligible for $100 incentive at retail and can be direct installed through RCD

CRITICAL TO INTEGRATE EFFICIENCY AND ACTIVE DEMAND MANAGEMENT

ACEEE Levels of EE/DR Integration

Where we are according to ACEEE

Direction we should go

Source: ACEEE Integrated Energy Efficiency and Demand Response Programs

CRITICAL TO INTEGRATE EFFICIENCY AND ACTIVE DEMAND MANAGEMENT

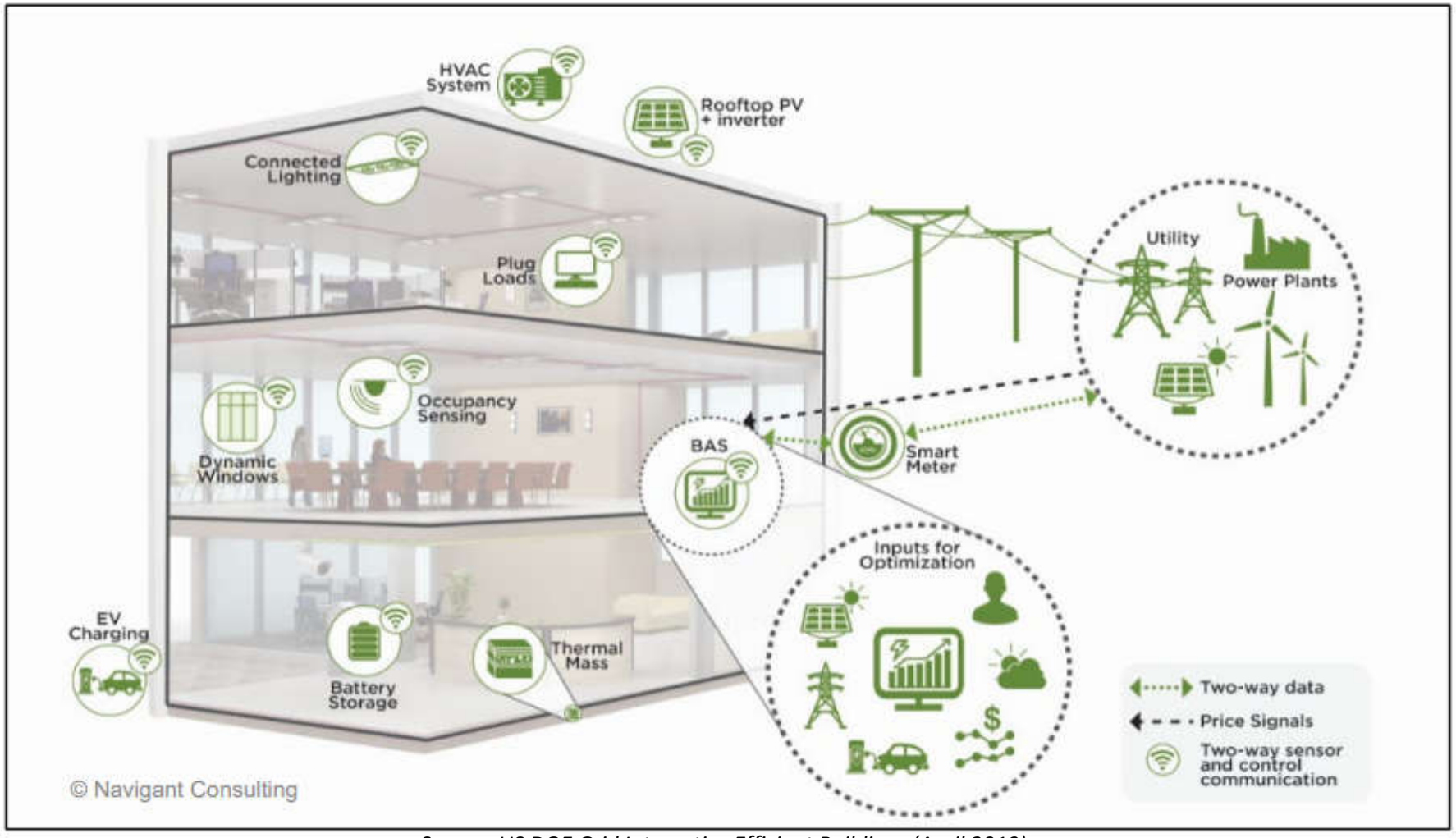
- **Level 4 Integrated Delivery**
  - NV Energy's *PowerShift* program is a fully integrated offering that includes a single energy assessment and recommendations for EE/demand measures
  - Open to both residential and commercial customers
  - Free smart thermostats that can be enrolled and controlled for "Community Energy Events" (peak demand times)
  - Rebates for other eligible energy-efficient equipment

powershift by NVEnergy

NVEnergy

https://www.nvenergy.com/save-with-powershift/smart-thermostat

CRITICAL TO INTEGRATE EFFICIENCY AND ACTIVE DEMAND MANAGEMENT



Source: US DOE Grid Interactive Efficient Buildings (April 2019)

PA POTENTIAL STUDIES – ACTIVE DEMAND OVERVIEW & RESULTS

PA POTENTIAL STUDIES OVERVIEW - ADM

- **PAs hired different contractors to complete potential studies**
- **PAs coordinated on measure lists and potential scenario definitions**
  - Differences in ADM measure bucketing
  - Differences in measures included
- **PA contractors used different assumptions**
- **Contractors recently updated studies w/ new avoided costs from AESC**
- **Consultant analysis required data extrapolation to compare between studies**

Guidehouse
- National Grid

dunsky
- Eversource

Opinion Dynamics dunsky
- Cape Light Compact

AEG
- Unitil

RESIDENTIAL ADM POTENTIAL STUDY RESULTS – NON-STORAGE

	2020 Performed MW Reduction	*2022 MW – Max Potential*	*2023 MW – Max Potential*	*2024 MW – Max Potential*
CLC	NA	*2.5*	*4.5*	*6.1*
Eversource	14.6	*40.6*	*56.3*	*72*
NGrid	12.6	*14.3*	*16.0*	*17.8*
Unitil	0.1	*0.2*	*0.6*	*1.4*
Total	**27.3**	***57.6***	***77.4***	***97.3***

- **Mostly Smart T-stat Direct Load Control (DLC)**
- **Eversource Max largely driven by direct-install Smart T-stats**

C&I ADM POTENTIAL STUDY RESULTS – NON-STORAGE

	2020 Performed MW Reduction	*2022 MW – Max Potential*	*2023 MW – Max Potential*	*2024 MW – Max Potential*
CLC	0.8	*1.3*	*1.7*	*2.0*
Eversource	55.4	*82.7*	*95.5*	*108.3*
NGrid	57.1	*75.7*	*77.7*	*79.2*
Unitil	1	*1.1*	*1.3*	*1.4*
Total	**114.5**	***160.8***	***176.2***	***190.9***

- **Site-specific curtailment plans, often utilizing controls**
- **Only ~18MW of this potential is back-up onsite generators**

RESIDENTIAL ADM POTENTIAL STUDY RESULTS – STORAGE

	2020 Performed MW Reduction	*2022 MW – Max Potential*	*2023 MW – Max Potential*	*2024 MW – Max Potential*
CLC	-	*0.5*	*1.1*	*1.6*
Eversource	0.1	*3.9*	*5.6*	*7.4*
NGrid	1	*3.5*	*11.8*	*24.0*
Unitil	-	-	-	-
Total	**1.1**	***7.9***	***18.5***	***33***

- **National Grid saw substantially more Res storage potential**
- **No PA modeled Income Eligible storage potential**

C&I ADM POTENTIAL STUDY RESULTS – STORAGE

	2020 Performed MW Reduction	*2022 MW – Max Potential*	*2023 MW – Max Potential*	*2024 MW – Max Potential*
CLC	0.2	*0.03*	*0.06*	*0.08*
Eversource	2.8	*29.9*	*44.8*	*59.7*
NGrid	9.1	*0.5*	*1.8*	*2.7*
Unitil	-	-	-	-
Total	**12.1**	***30.4***	***46.6***	***62.5***

- **Eversource saw substantially more C&I storage potential**
  - Higher demand rates for Greater Boston improve customer economics

CONSULTANT NOTES ON PA POTENTIAL STUDIES

- **Inconsistent approaches for**
  - Storage daily dispatch
  - Direct install measures w/ upfront cost support
  - Segmentation of Residential (SF, MF, Low Income)
- **Widely different results of potential and costs**
  - Some justifiable differences across service territory
  - Wide range of estimated potential (MW) and measure mix
  - Different costs and costs per MW
- **Limited co-delivery of EE/ADM programs**
  - Most modeling of program interaction was around reduced overall loads from EE driving less ADM potential
  - Studies saw little additional potential for ADM from EE measures that give customer greater control over energy use

CONSULTANT ADM RECOMMENDATIONS

KEY AREAS OF FOCUS

- **Residential Smart T-stat direct load control (DLC)**
  - Market rate
  - Income Eligible Customers
- **Small Biz Smart T-stat direct load control (DLC)**
- **Medium/Large C&I curtailment**
- **Storage**
  - C&I
  - Residential (market rate and low & moderate income)
- **EV charging and mobility**

RESIDENTIAL THERMOSTATS – DIRECT LOAD CONTROL

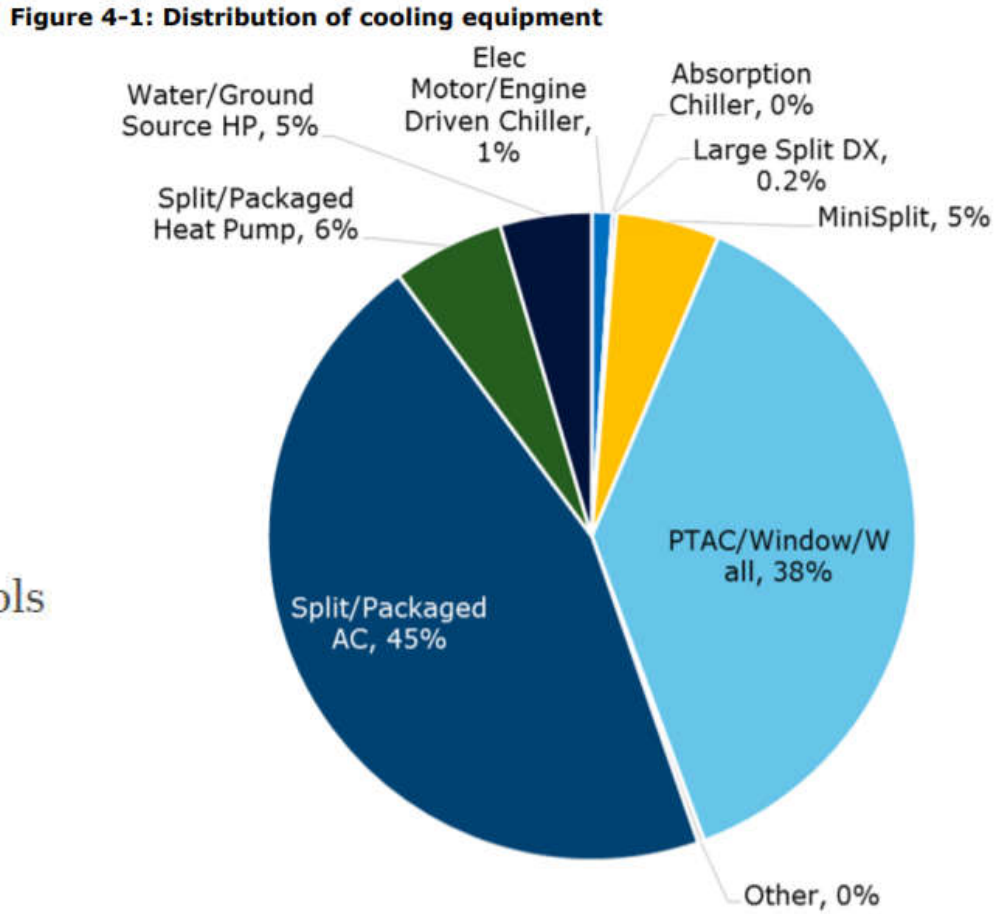
- **HVAC/Smart T-stats represent the largest opportunities for residential ADM savings**
  - 35% of MA 1-4 unit households have central AC or central heat pumps (791k homes)
  - Only 4% currently enrolled in ADM programs (31k)

- **Focus on direct-install and targeted outreach to homes w/ central cooling**
  - Opt-out programs for all new direct install Smart T-stats
  - Include Smart T-stats w/ all program supported central AC/central HPs (especially new construction)
  - Smart T-stats > Programmable T-stats

- **Small % of DLC enrolled customers on discount rate but no specific program for income eligible customers**

SMALL C&I THERMOSTATS – DIRECT LOAD CONTROL

- **Cooling nearly ubiquitous in MA businesses**
- **Over 200k small C&I customers state-wide**
- **Small business direct install program supports HVAC controls/T-stats**



HVAC System Upgrades & Controls

Heating System Controls

LARGE C&I - CURTAILMENT

- **Larger C&I curtailment programs deliver site-specific demand reductions through a variety of mechanisms**
  - Building Management Systems (BMS)
  - Lighting Controls
  - Manual or automated shutdowns of non-essential equipment
  - On-site generators

- **Example – City of Boston Building Automation Systems**
  - Initiative to upgrade BMS across City-owned buildings
  - ESCO works w/ curtailment service provide to develop load shedding protocols into BMS at time of installation to enable DR participation

ENERGY STORAGE

- **Mass Save an important part of the storage value stack**
  - Connected Solutions (Pay-for-Performance w/positive BCR)
  - SMART storage adder
  - Federal Investment Tax Credit
  - Modified Accelerated Cost Recovery System (MACRS) depreciation
  - Clean Peak Standard

- **Higher renewable integration will require substantial build-out of energy storage**
  - Legally binding 45% GHG reduction goal by 2030
  - The electric system will need ~500 MW of additional storage by 2024 with the additions of intermittent renewables and other changes, and much of that will be BTM battery storage
  - New storage will be participating in the EE program ADM offering to receive the valuable incentive (with the five-year incentive lock)

ELECTRIC VEHICLES (EV)

- **U.S. EV sales project five-fold growth from 2020-2025**
  - Almost 20,000 MOR-EV rebates reserved/issued so far
  - 2/3 of EV owners have or plan to install Level 2 chargers

- **PAs working on proposals for EVs, managed charging, and transportation electrification**

- **EEAC consultant planning estimates for ADM and storage do not yet include values for EVs**

CONSULTANT TEAM RECOMMENDATIONS

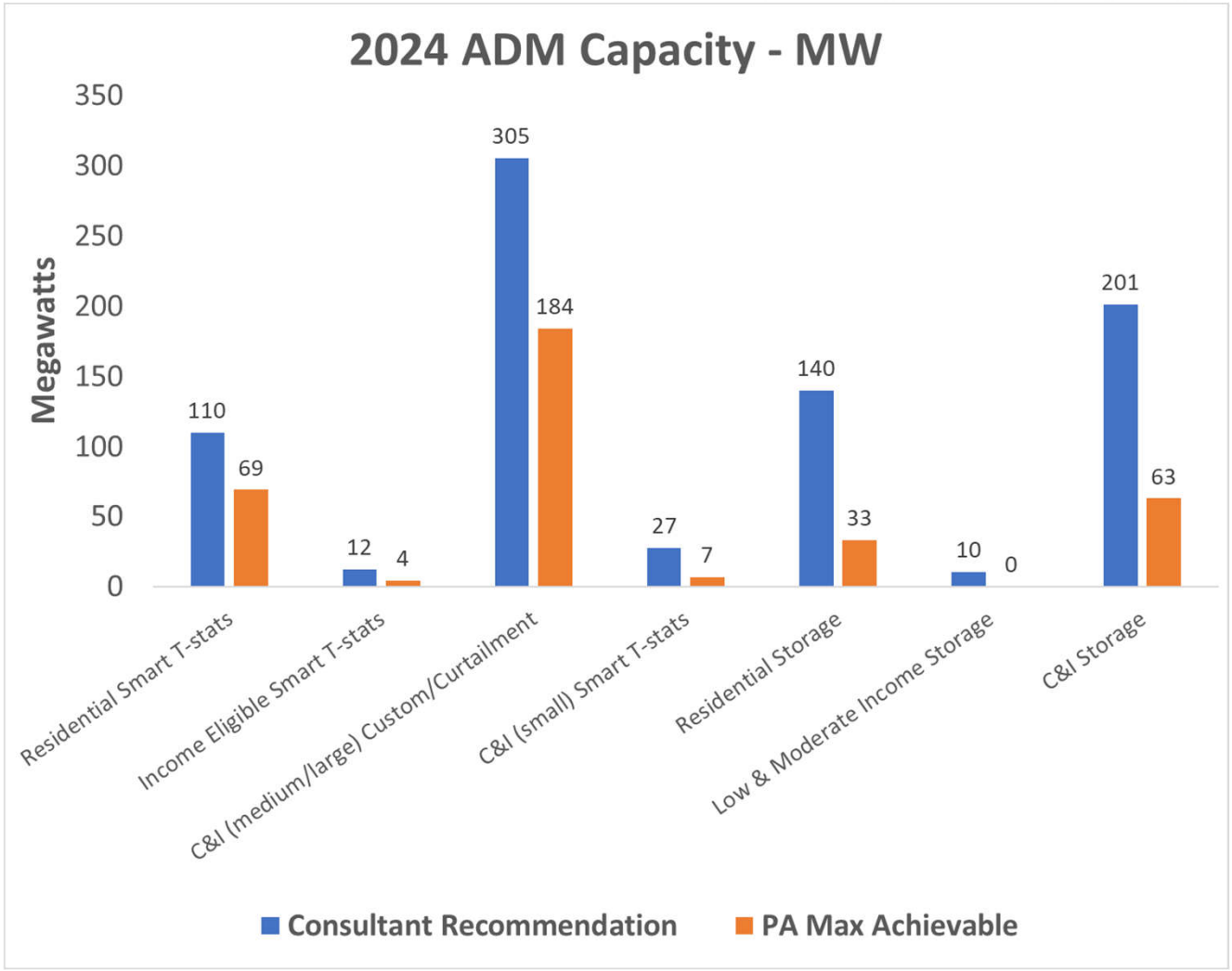
Sector	Technology	2019 Plan MW	2020 Plan MW	2021 Plan MW	2022 Plan MW	2023 Plan MW	2024 Plan MW
Residential	Smart T-stats	7	11	14	45	70	110
Income Eligible	Smart T-stats	0	0	0	4	8	12
C&I (medium/large)	Custom/Curtailment	96	132	165	210	255	305
C&I (small)	Smart T-stats	0	0	0	13	19	27
Total Active Demand - Curtailment		**103**	**143**	**179**	**281**	**361**	**454**

Sector	Technology	Plan MW	Plan MW	Plan MW	Plan MW	Plan MW	Plan MW
Residential	Storage	0	2	4	20	50	140
Low & Moderate Income	Storage	0	0	0	2	5	10
C&I	Storage	1	12	17	30	75	201
Total Active Demand - Storage		**1**	**14**	**22**	**77**	**155**	**351**

Total Active Demand - All Technologies/Sectors	**104**	**157**	**201**	**358**	**516**	**805**

- **The above does not account for additional ADM from**
  - Residential non-thermostat measures
  - Curtailment of larger central plant systems for Multi-family or MF storage
  - Managed EV charging (passenger or fleet vehicles, or other mobility)

CONSULTANT TEAM RECOMMENDATIONS COMPARED TO PA MAX ACHIEVABLE



DIFFERENCES BETWEEN CONSULTANT RECOMMENDED AND PA MAX ACHIEVABLE

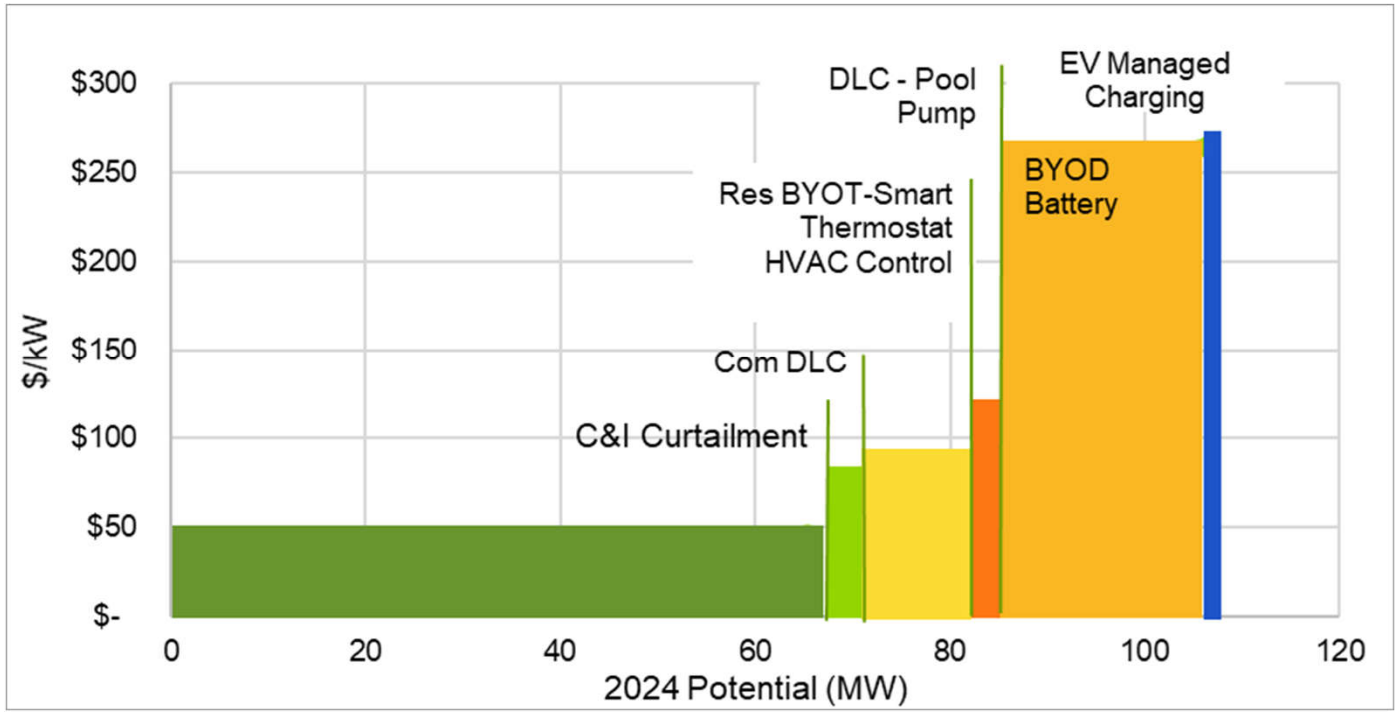
- **Res DLC T-stats**
  - Consultants target market is all customers w/ central AC, not just those who already have Smart T-stats
  - All PA studies should have modeled Max w/ direct install support
- **C&I Curtailment**
  - PA potential studies identify +1,100MW of technical potential for C&I ADM, some of which would be Max achievable when paired w/ EE controls support
- **Small Biz DLC T-stats**
  - Second most cost-effective DR measure in Eversource/Dunsky study
  - Enhanced program delivery for small biz an Equity WG priority
- **Storage**
  - State of Charge identified ~360MW of behind-the-meter storage potential
  - All of this and more will be required to integrate renewables onto grid

THANK YOU

Questions?

NATIONAL GRID DR SUPPLY CURVE (BAU)

Figure 15-14. Supply Curve for Cost-Effective DR Sub-Options

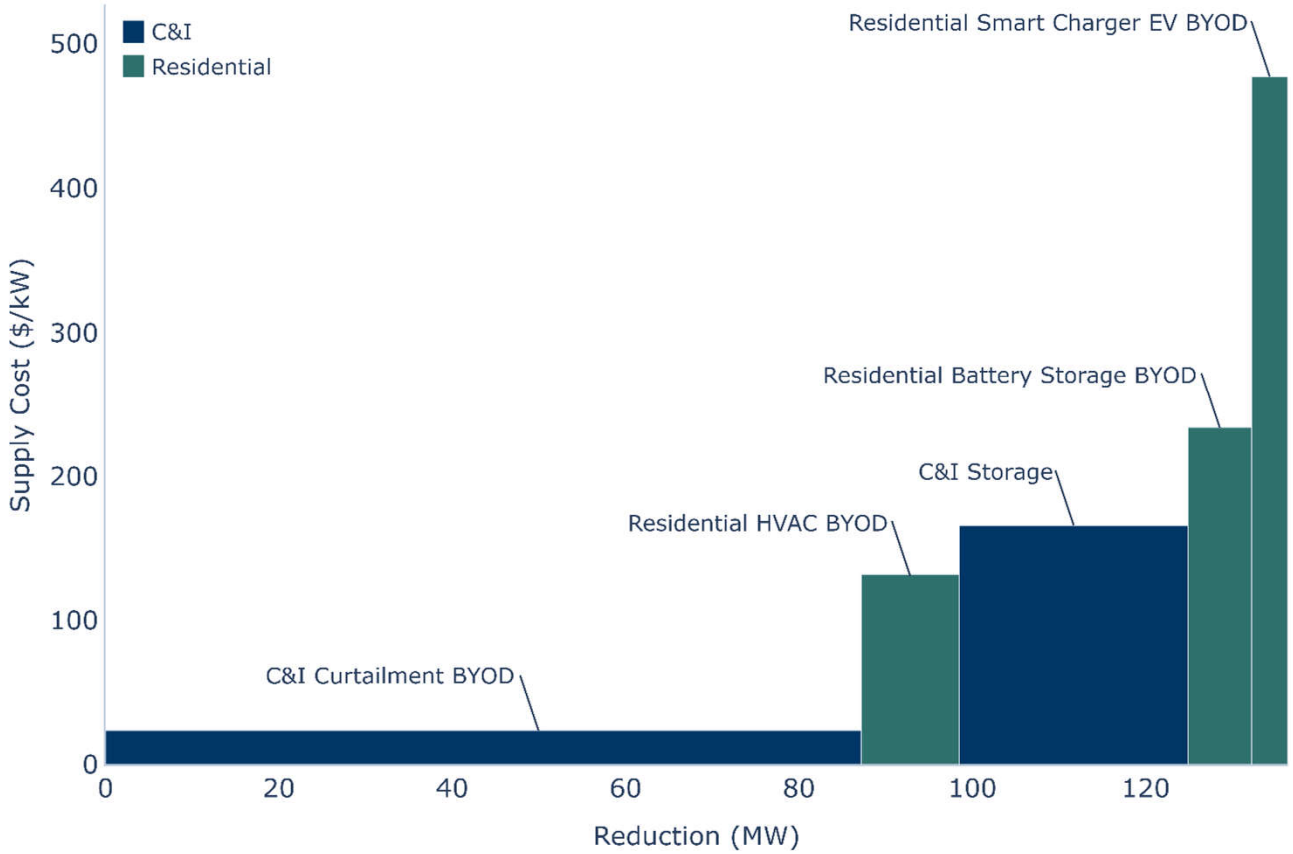


Source: Guidehouse Potential Study

No Max scenario supply curves shown for NGrid study

EVERSOURCE DR SUPPLY CURVE (BAU)

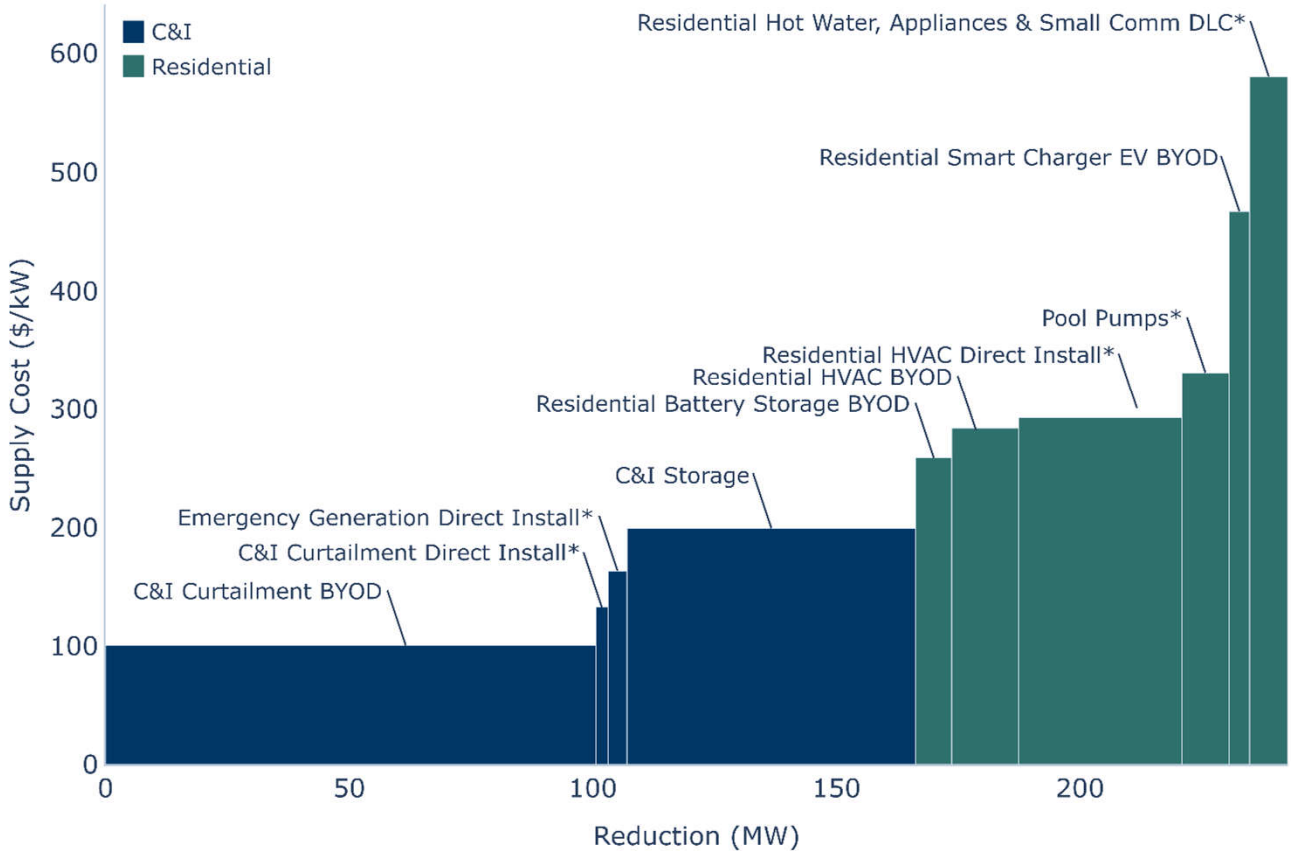
Figure 1-9. Supply curve – BAU Scenario



Source: Dunsky Potential Study

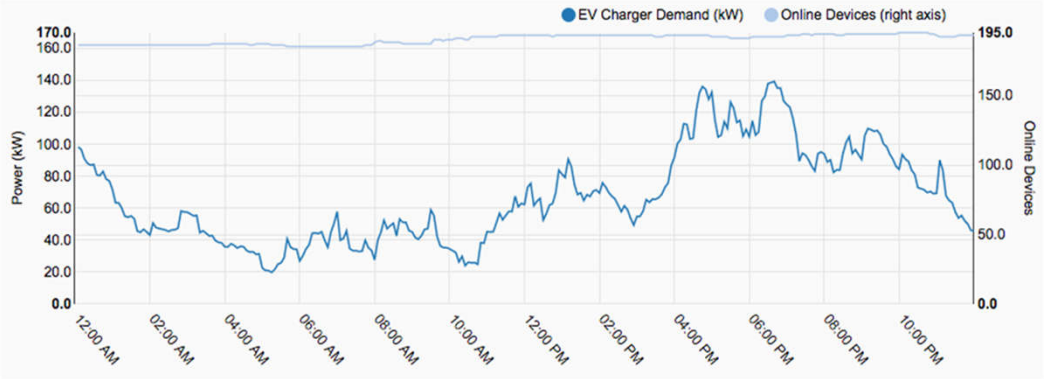
EVERSOURCE DR SUPPLY CURVE (BAU+ AND MAX)

Figure 1-10. Supply curve – BAU+ and Max(*) Scenarios



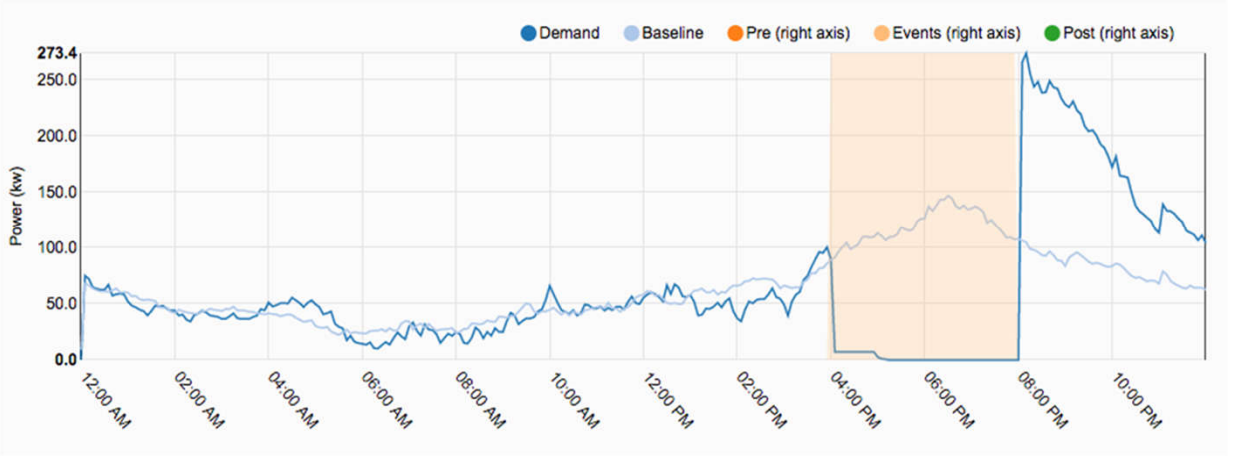
Source: Dunsky Potential Study

CONTROLLING EV LOADS – VT EXAMPLE



3/4/21:
non-event day

3/5/21 peak event:
150 kW curtailed
1 opt out (99% participation)



Source: Green Mountain Power