Grid-interactive Efficient Buildings Working Group Public Buildings and Potential Cohort Meeting

December 7, 2020

Rodney Sobin, Joyce McLaren, Chioke Harris, Chandler Miller and Natalie Mims Frick

Agenda

- Welcome!
- Wringing More Value from Building Energy Operations and Upgrades: Monetizing Demand Flexibility in Public and Institutional Buildings (NASEO)
- Prioritizing Demand Flexibility Investments: Practical Guidelines for State and Local Decision-makers, Building Owners & Energy Managers (NREL)
- Estimating Demand Flexibility Potential: Considerations for State (LBNL)
- Incorporating Demand Flexibility into State Energy Goals (LBNL)
- Wrap-up

Monetizing Demand Flexibility in Public and Institutional Buildings

(Discussion Draft)

Rodney Sobin, NASEO

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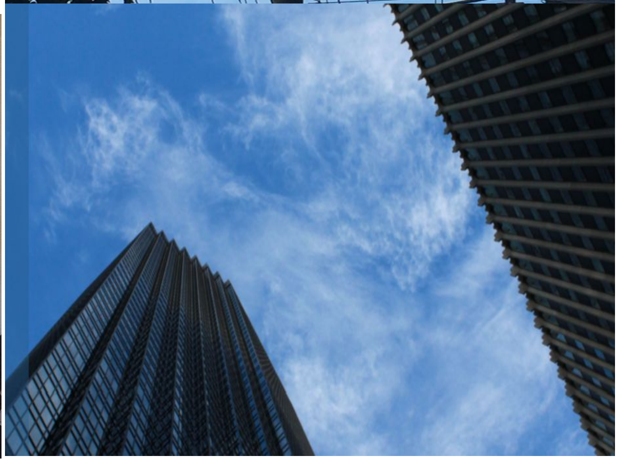

NASEO
National Association of State Energy Officials

NASEO-NARUC
GEB Working Group:
Public Buildings and Potential Cohort Meeting

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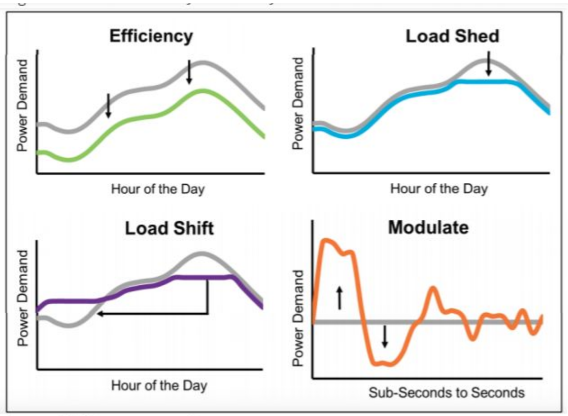
Monetizing Demand Flexibility in Public and Institutional Buildings

- Energy efficiency (EE)’s energy bill savings is well recognized.
  - Public building EE policies
  - Energy Savings Performance Contracts (ESPC)
    - EE pays for itself
  - New Energy-as-a-Service mechanisms
- Energy consumption (kWh, therms) savings
- Peak demand charge (kW) savings
  - Can be 30% to 70% of energy bill
  - But often not well understood
- **Other value streams emerging**

Monetizing Demand Flexibility in Public and Institutional Buildings

- New technology enables demand flexibility (DF) and GEBs
  - Manage/adjust demand – shed, shift, modulate
  - Can include power to the grid from onsite storage and generation
  - Opens new value streams
  - Enhances building operation, performance
  - Advances emissions and resilience goals
- Opportunities:
  - Time-of-use (TOU) and other time differentiated rates
  - Demand response (DR) programs
  - Other nascent grid services
    - Ancillary services, virtual power plant,…

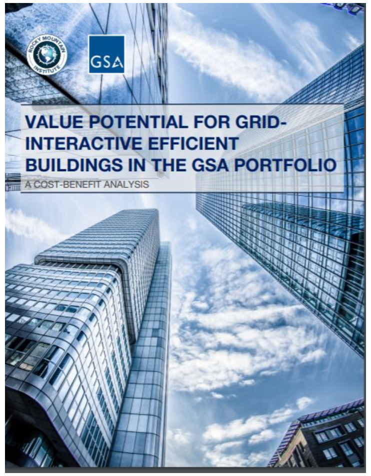


Source: U.S. Department of Energy

Baltimore Gas & Electric vehicle charging TOU rates

Monetizing Demand Flexibility in Public and Institutional Buildings

- GSA-Rocky Mountain Institute study
  - Simulated six GSA office buildings in different regions (climate, rates, markets)
  - EE, DF, onsite renewables, storage managed to:
    - Reduce demand charges
    - Take advantage of TOU rates
  - Average building would save 30% on energy bill with under 4-yr. payback (savings range 7%-60%)
  - Extrapolated to GSA-owned office building portfolio
    - $50M annual savings; ~20% annual energy spend
    - $184M investment -> $206M NPV over 8 yrs.
    - Plus $70M annual grid benefits



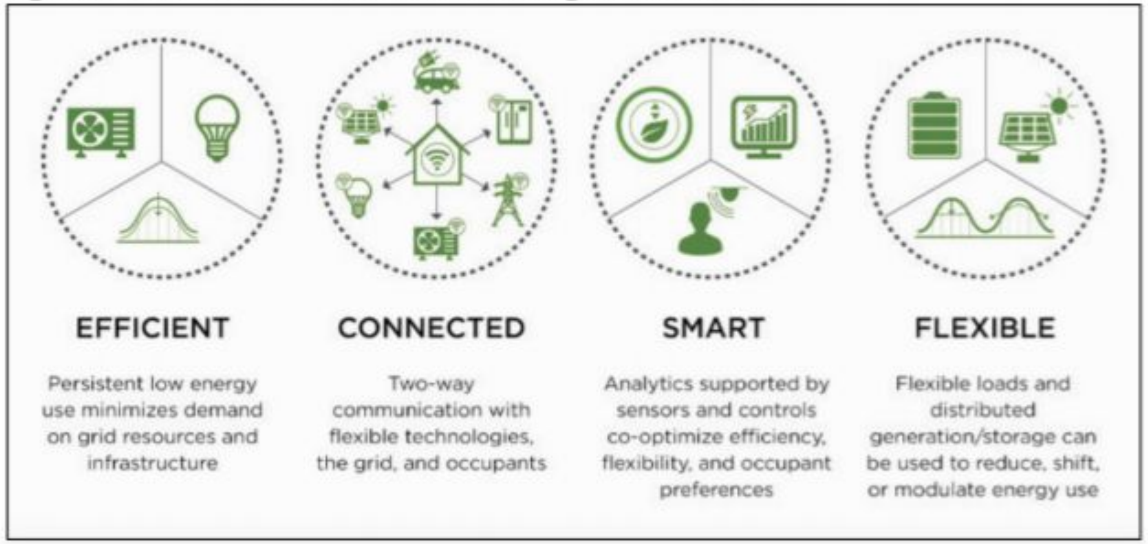
Poll Question

- Do state or other public buildings in your state make use of: (multiple answers allowed)
  - a. Demand response (DR) programs
  - b. Time-of-use or other time-differentiated rates (e.g., real time pricing)
  - c. Neither
  - d. Don’t know

Monetizing Demand Flexibility in Public and Institutional Buildings

- How to reap these value streams via--
  - Building energy services
  - Equipment procurement and design-build/design-bid-build projects
  - ESPC
  - Energy-as-a-Service

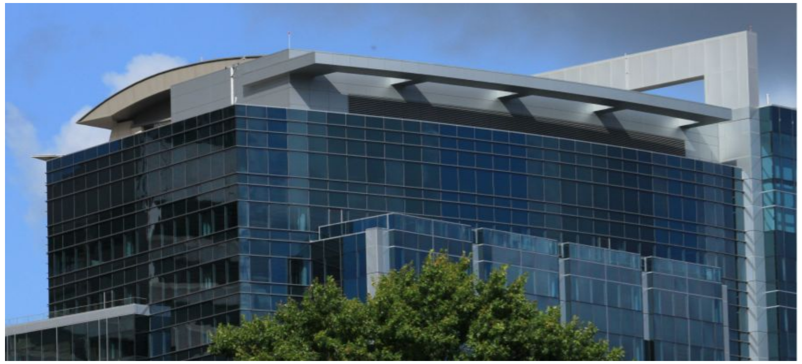
Figure 1. Grid-interactive efficient building characteristics



Source: U.S. Department of Energy

Monetizing Demand Flexibility in Public and Institutional Buildings

- Building energy services
  - Facility operators may not be familiar with or incentivized to do DF
  - Options:
    - Direct operators to seek cost-effective demand reduction, TOU, DR, and grid service opportunities
    - Education and training on opportunities while assuring and enhancing building operations and services
    - Financial incentives
      - In-house staff—shared savings, bonuses
      - Contracted service—shared savings
    - Hire DR aggregator service provider



+ Monetizing Demand Flexibility in Public and Institutional Buildings

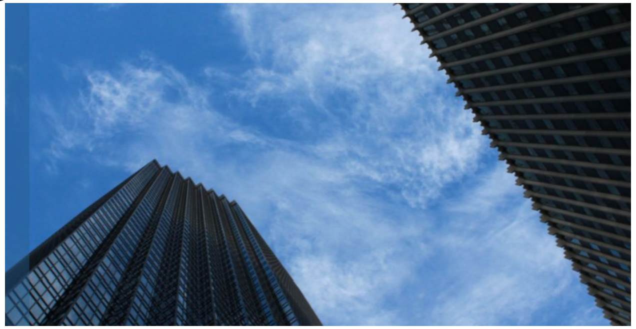
- Equipment procurement and design-build/design-bid-build projects
  - Specify grid-interactive capabilities in building management systems
  - Specify, as appropriate, grid-interactive capabilities in equipment and appliances
    - E.g., thermostats, water heaters, smart plugs/power strips, lighting controls
  - Consider interoperability and standards to assure compatibility among components and with utility
    - Also, attention to cybersecurity
  - Assure proper commissioning, operator training, O&M

Monetizing Demand Flexibility in Public and Institutional Buildings

- ESPC [and Utility Energy Service Contracts - UESC]
  - Issue: uncertainty of future DR revenues, future TOU rate design
  - Responses:
    - Inform/educate agencies, operators, procurement officers, others on DF opportunities and how they can fit in ESPC
    - Include demand savings explicitly
    - Use actual rates (incorporate TOU) rather than blended rates.
    - Participate in DR programs (easier if fixed payment option)
    - Consider shared savings incentives for greater savings (if legal)
      - Add building operation service contract with incentives
      - Add DR aggregator services
    - Regarding uncertain future TOU rate structures:
      - Consider 3-5 yrs. TOU savings guarantee then either (1) deem outyear savings (if legal) or (2) adjust guarantee

Monetizing Demand Flexibility in Public and Institutional Buildings

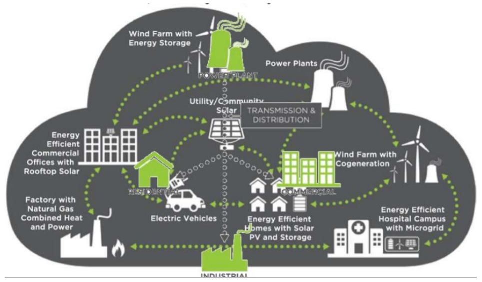
- Energy-as-a-Service (EaaS): an emerging approach
  - Typically, customer pays energy service provider recurring fee—like utility payment or subscription—for energy services
  - Usually includes facility upgrades with no upfront customer capital – like ESPC
  - Often, EaaS service provider contracts with financial investor who may or may not have title or security interest in equipment
  - Highly varied and customized thus far; can incorporate range of financing and contracting elements—
    - ESPC, power purchase agreement (PPA), efficiency savings agreement, shared savings agreement, energy asset concession arrangement



Monetizing Demand Flexibility in Public and Institutional Buildings

- Energy-as-a-Service (EaaS) (continued)
  - Inform/educate agencies, operators, procurement officers, others on EaaS
  - Include DF and grid-interactive functionality and services in EaaS
  - Provide shared savings incentive for additional savings

  - As a new and often customized public private partnership mechanism, consider legal strictures—
    - Is there a savings guarantee? Does it fit ESPC authority?
    - Will title or security interest in equipment convey? Legal?
    - Is shared savings with private provider legal? …



+ Monetizing Demand Flexibility in Public and Institutional Buildings

Wringing More Value from Building Energy Operation and Upgrades: Monetizing Demand Flexibility in Public and Institutional Buildings

- *Draft* paper (~10 pp.) covers topics just discussed
- Includes resource citations and links
- Requesting review and reaction:
  - Is this useful? How can it be improved? Other approaches and considerations to include?
  - Is your state implementing or considering DF/GEB in operations, procurement, upgrades? What are you finding? What help and resources would be useful?
- Comments welcome. Plan virtual meeting in January.

Prioritizing Demand Flexibility Investments

Practical Guidelines for State and Local Decision-makers, Building Owners & Energy Managers

Joyce McLaren, Chioke Harris, Sam Koebrich, Thomas Bowen

December 7, 2020

DRAFT Material for Discussion Only

Goals for this presentation

- Introduce report purpose & contents
- Explore some topics from the report
- Use poll questions to:
  - help you think about demand flexibility in your context
  - guide the development of the report.

Prioritizing Demand Flexibility Investments

GRID MODERNIZATION LABORATORY CONSORTIUM
U.S. Department of Energy

Challenge: Current information about the potential of demand flexibility measures remains high level or vague.

"it depends...on your climate…on building type…"

Our Goal: Provide actionable information on high value, near-term demand flexibility investments to inform:

- state/city/utility program design
- legislative or regulatory action
- building owner investment

Prioritizing Demand Flexibility Investments

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U.S. Department of Energy

The report will cover how to:

- Address specific system peaks & grid congestion challenges
- Understand how to focus demand flexibility efforts to address higher level energy priorities
    - energy affordability
    - emissions reduction
    - renewables integration
- Select a building type to focus early demand flexibility efforts
- Design programs to leverage existing partners & networks
- Select and implement high value measures in a building
- Estimate regional impact

Actionable information on implementing demand flex measures

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U.S. Department of Energy

For market-ready, high value measures:

- Describe the measure & associated technology
- Applicability to building types, climate zones, energy priorities and grid challenges
- Impact on occupant comfort and considerations
- Cost to install & expected payback
- Expected changes to building loads

For a specific building type (e.g. large office):

- ❖ Example of implementing a suite of measures
  - ➢ Impact on building load
  - ➢ Cost & savings
- ❖ Impact of scaling up to a city, region or state level

Understanding Electricity System Challenges is Key to Program Impact

Understanding when the system peak occurs and which building types and end uses contribute most to that peak, can help identify building types and demand flexibility measures to target. Other system challenges due to high variable generation or transmission constraints may also drive flexibility needs.

Poll Question #1: Understand electricity system challenges

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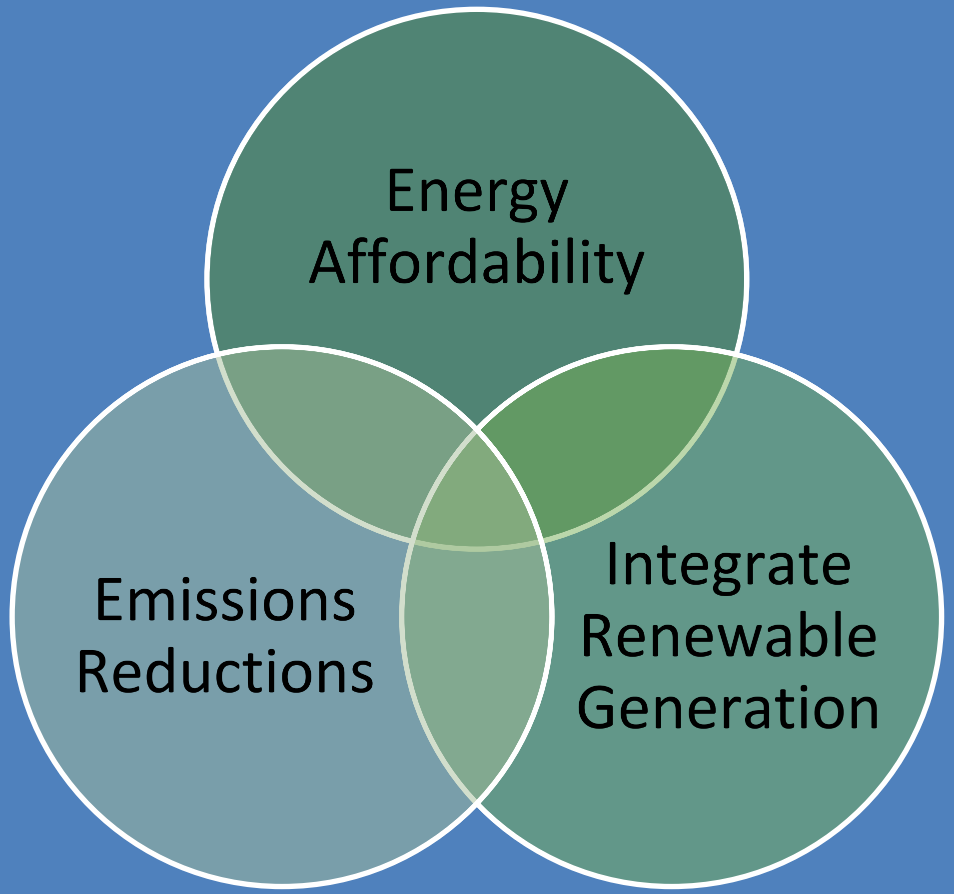
The main electricity system challenges (current or anticipated) in my state are:

- Winter peaks, driven by heating and lighting loads
- Summer peaks, driven by daytime air conditioning loads
- Transmission constraints due to weather
- Transmission constraints due to locations of generation and load
- High mid-afternoon ramp rates due to solar (duck curve)
- Distribution constraints from DERs (rooftop solar)
- High wind

Existing High-Level Energy Priorities Can Guide Demand Flexibility Program

Keeping existing priorities in mind will help you focus demand flexibility investments and design programs or policies that best support existing state and local goals.



Poll Question #2: State Energy Priorities

What are the highest level energy priorities for your state:

- Energy Affordability
- Integrate Renewable Energy
- Emissions Reductions
- Other

Poll Question #3: Supporting legislation & regulations

What legislative or regulatory mechanisms are in place (or being considered) that could be used to support/enable demand flexibility?

- Building codes
- Appliance standards
- Utility tariff design
- Utility programs/incentives
- Utility regulations
- Other
- None

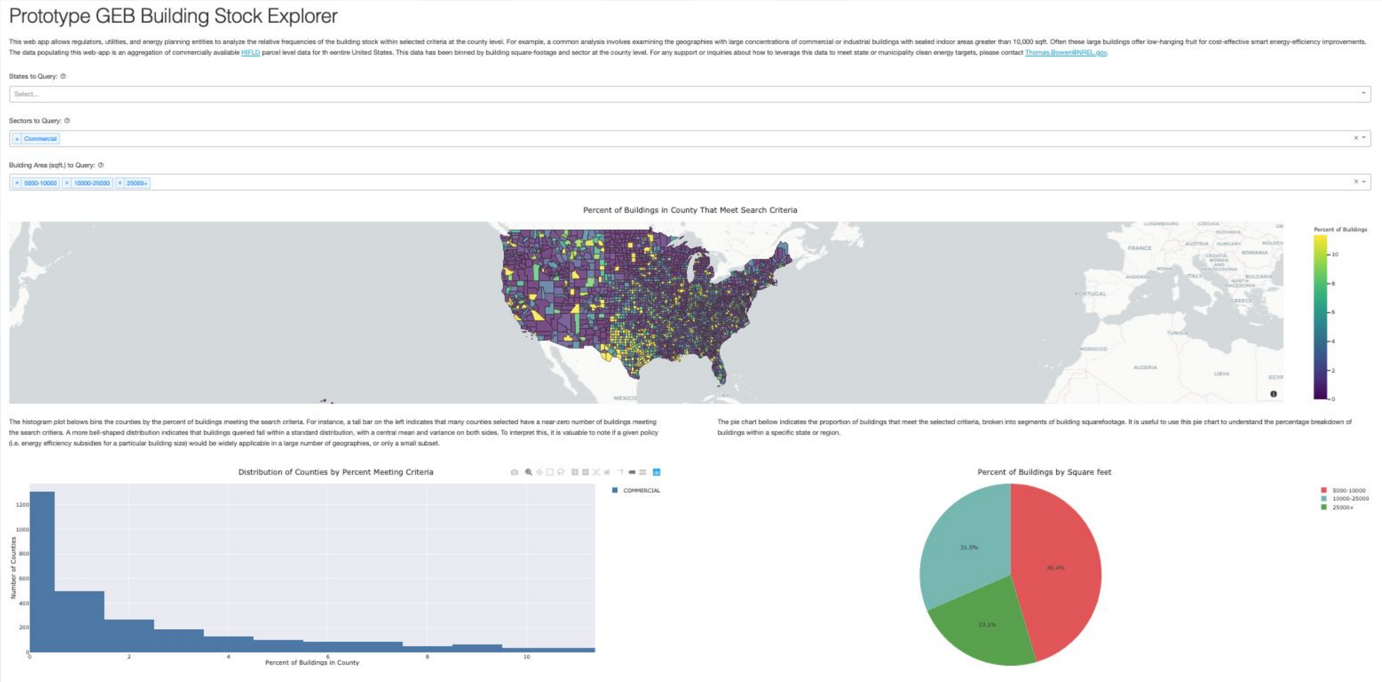
Focus Demand Flexibility on a Single Building Type

This helps focus efforts on high value technologies, measures, and partners in order to achieve higher impact.

Building Stock Explorer

NREL is developing a building stock explorer that visualizes the open-source Homeland Infrastructure Foundation-Level Data (HIFLD) to help locate concentrations of building types and sizes.

- State (results by county)
- Sector
  - Residential
  - Commercial
  - Industrial
  - Government
- Square Feet
  - 100-1000
  - 1000-2500
  - 2500-5000
  - 5000-10,000
  - 10,000-25,000
  - 25,000+

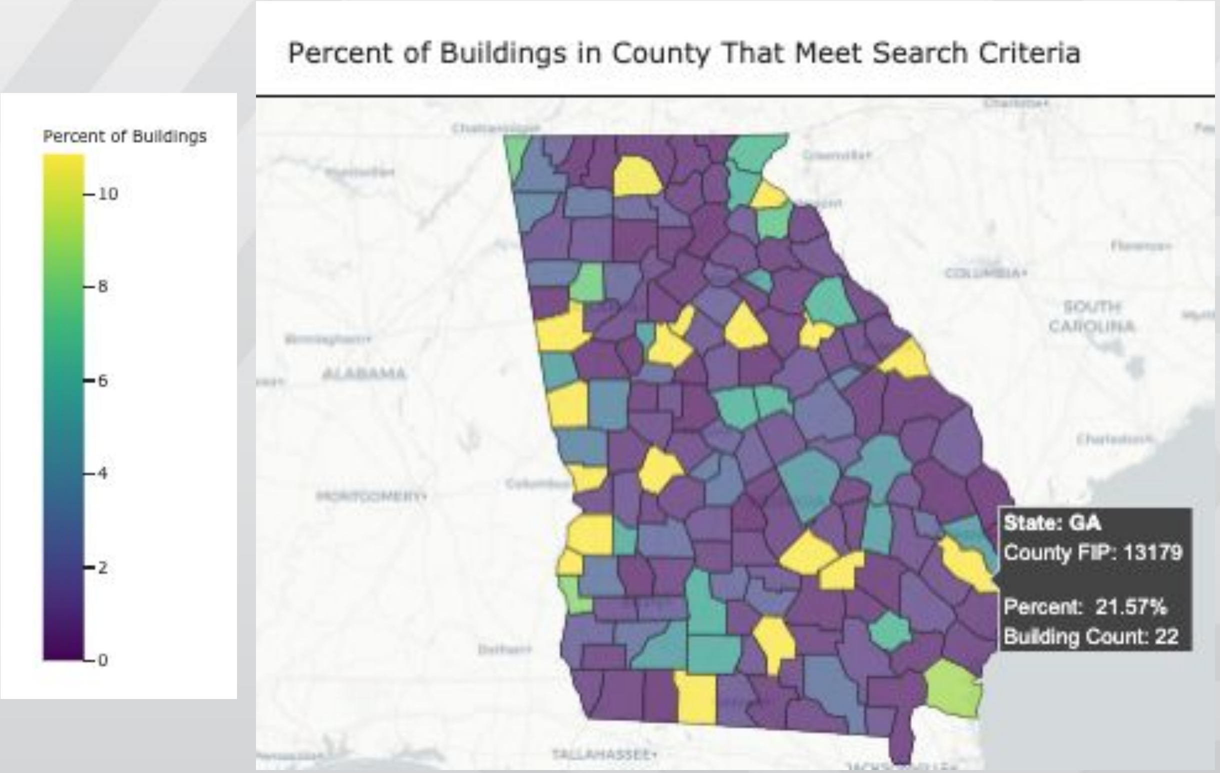


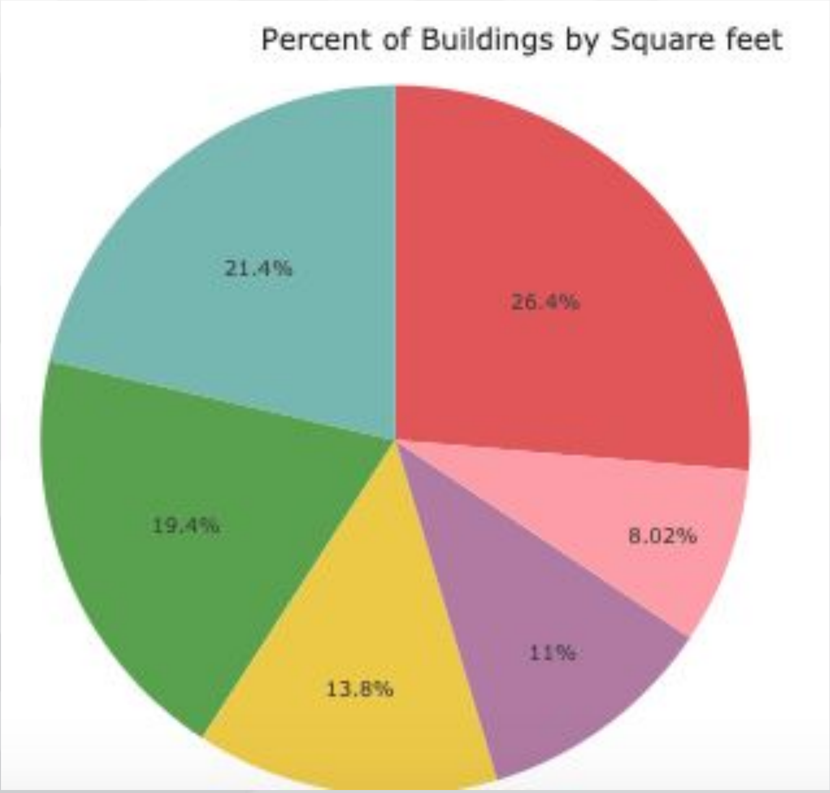
- ❖ % of buildings in county meeting criteria
- ❖ Number of buildings in county
- ❖ Histogram: distribution of counties
- ❖ % of buildings in search type by square feet

Building Stock Explorer

NREL is developing a building stock explorer that visualizes the open-source Homeland Infrastructure Foundation-Level Data (HIFLD) to help locate concentrations of building types and sizes.

Government Buildings in Georgia





Poll Question #4: Identify common building types

What building types are you considering targeting for demand flexibility?

- Government buildings
- Office buildings
- Warehouses
- Retail
- Hotels/lodging
- Restaurants and small commercial
- Multi-family homes
- Single-family homes
- Industrial/Manufacturing/Processing facilities
- Other

Easing Implementation Through Existing Pathways

Leveraging existing efficiency program partners and networks can accelerate the deployment of new flexibility-focused programs.

Poll Question #5: Key Partners & Existing Networks

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Make use of existing relationships and networks to help design effective programs and obtain early buy-in. Upstream/midstream/downstream program designs will rely on different partner relationships.

- Which industries or networks do you already have relationships with?
  - Manufacturers / OEMs
  - Distributors
  - Installers / Contractors
  - Retailers
  - Utilities
  - Other

Discussion

Thank you for participating! Please tell us your thoughts about:

- Feedback on content of the report & ideas to make it most useful
- Feedback on the Building Stock Explorer
- Results of the poll questions

Thank you

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https://geb-buildingstock.herokuapp.com/
beta version

Estimating Demand Flexibility Potential: Considerations for State

Chandler Miller and Natalie Mims Frick, Berkeley Lab

GEB Working Group - Public Buildings and Potential Cohort Meeting

December 7, 2020

Overview

- LBNL is developing a document to support states interested in estimating demand flexibility potential at various scales — e.g., community, utility service area, statewide, regional.
- State or local governments that are interested in estimating demand flexibility potential — alongside energy efficiency potential — can use this guide to consider the scope of the study and data needs.
- The guide will provide a review of current methods and tools that states can consider using in demand response (DR)/demand flexibility and efficiency potential studies.
- Today we will review scoping questions and consider them in three case studies.
- Future presentations will detail key study components, such as data, assumptions and tools.

Questions to Help Determine Objective and Scope

- What is the purpose of the analysis? How will the study be used — e.g., integrated resource plans (for vertically integrated states), distribution system planning, transmission planning, demand-side management plans?
- What is the geographic scope of the analysis — e.g., utility service area, statewide, region?
- What policies will be considered?
- Will the study consider technical, economic, achievable potential? For example:
  - What perspective will be used to identify economic potential (e.g., societal, consumer, electric system)?
  - How will economic potential be determined (e.g., comparison with proxy resource avoided cost, capacity expansion modeling)?
  - How will achievable potential be defined?
  - How will the study incorporate customer adoption and participation assumptions into estimating achievable potential?
- What is the timeframe of the study, and how will changes in technology over time (e.g., availability, cost, deployment) be addressed? For example:
  - How will the study consider market transformation, technology maturation, and electrification?
  - What advanced metering infrastructure assumptions will be used for the future?
- What energy efficiency and demand flexibility measures and programs are in scope?
  - How are the interactions between efficiency and demand flexibility considered?

Minnesota Energy Efficiency Potential Study: Load Management and Demand Response (1)

The Minnesota Energy Efficiency Potential Study: Load Management and Demand Response (2019) is a statewide study identifying demand response technical potential for 2020-2029. The DR potential study is an appendix to the energy efficiency potential study. The study was funded through a grant to the Minnesota Department of Commerce, Division of Energy Resources, through an applied R&D program that is funded by Minnesota ratepayers.

- **Policy Drivers**
  - Minnesota law requires that all measures in utility Conservation Improvement Program plans (CIPs) reduce overall energy use. This limited the scope of DR measures assessed in the study.
  - Price-based measures (e.g., time-of-use tariffs) were excluded from the study. Demand response can also be implemented through rate cases or special riders, but the study only considered measures that the utilities can implement as part of their CIPs.
- **Constraints**
  - The study does not consider energy efficiency and demand response interactions.
  - The study provides recommendations for utilities in Minnesota and the regulators who oversee utility program investment but is not binding.

Minnesota Energy Efficiency Potential Study: Load Management and Demand Response (2)

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- **Notable Aspects of the Study Approach**
  - Leveraged extensive customer, building, and utility data from the Minnesota energy efficiency potential study
  - Included potential estimates for all utilities in Minnesota.
  - Focused on base scenario with some sensitivity analysis

DR programs included in study

- Direct load control (DLC) - central and window AC, heating, thermostats
- Lighting controls
- Refrigeration
- Irrigation load control

- **Participation Assumptions**
  - Year 1 participation rates were assumed to be 1% of eligible customers for the majority of DR measures (see appendix).
  - DR adoption grew from year one rates based on technology specific growth rates (see appendix).
  - A sensitivity analysis considered the impact of higher and lower participation on the DR potential.
- **Results and Recommendations**
  - The study estimated that existing DR potential could be doubled by 2029.
  - There is concern that DR measures will increase energy usage and/or conflict with the state's carbon dioxide emissions reduction goal.

Michigan Demand Response Potential Study (1)

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The State of Michigan Demand Response Potential Study (2017) is a statewide study that identified demand response technical, realistic high and realistic low achievable potential for 2018-2037.

- **Policy drivers**
  - Act 341, which updated several energy laws in the state and established an integrated resource planning process, required the Michigan Public Service Commission to conduct statewide Energy Waste Reduction (efficiency) and DR potential studies.

Demand response programs included in study

- DLC (AC, water heaters, appliances, thermostats)
- Price-based (TOU, variable, peak time, real-time)
- Energy Storage (thermal, battery)
- Irrigation Load Control
- Ancillary Services
- Behavioral
- Capacity Bidding
- Emergency Curtailment
- Demand Buyback
- Voltage optimization

- **Constraints**
  - The study focused on peak-shedding DR programs, including the DR potential of thermal and battery storage.
  - All estimated potential excluded the impacts of existing DR programs.
  - DLC of smart appliances, battery storage, peak time rebate, and ancillary service programs were not economic and excluded from the achievable potentials.
  - Emergency curtailment were excluded from the achievable potentials because the program operates outside of typical peak shedding hours.

State of Michigan Demand Response Potential Study (2)

- **Notable Aspects of the Study Approach**
  - A residential customer survey was used to assess their attitude towards DR programs and collect information on appliance saturation. This included an inquiry about their interest in participating in time-based rate and DLC programs.
  - DR providers and utility staff were also interviewed. Insights included that EE combined with DR is attractive to small and medium businesses because it maximizes their savings opportunity.
- **Participation Assumptions**
  - Realistic low and high achievable potential participation rates were assigned to each program (see appendix).
  - Residential and C&I assumptions were based on market research.
  - A program hierarchy was used to assign participation and then prevent customers from participating in another program that targets the same end use.
  - Secondary sources used to benchmark participation in storage, ancillary services, and voltage optimization programs
- **Results and Recommendations**
  - Variable peak pricing and time-of-use rate programs were large contributor to the achievable potentials.
  - Recommended strategies for successful implementation and improving potential estimates

The California Demand Response Potential Study, Phase 3: Final Report on the Shift Resource through 2030 (1)

Demand response measures included in study

Sector	End Use	Shift Strategy
Res	Space cooling	Pre-cooling + thermostat
Res	Space heating	Pre-heating + thermostat
Com	HVAC	Pre-cooling + thermostat + insulation
Res	Water heating	Pre-heating + scheduling
Res	Pool pumps	Dynamic scheduling
Industrial	Irrigation pumping	Dynamic scheduling
Industrial	Wastewater pumping	Dynamic scheduling
Industrial	Industrial process	Dynamic scheduling
Com	Refrigeration	Warehouse pre-cooling
Res/Com	EV Charging	Dynamic scheduling
All	Thermal Energy Storage	Dispatch scheduling
All	Battery Energy Storage	Dispatch scheduling

The California Demand Response Potential Study, Phase 3: (2020) is a statewide study identifying DR technical and achievable potential for 2020-2030.

- **Motivation**
  - Supporting CPUC “Order Instituting Rulemaking (OIR) to Enhance the Role of Demand Response in Meeting the State's Resource Planning Needs and Operational Requirements" (13-09-011)
  - Addresses how shift DR could alleviate curtailment of variable renewable energy resources and smooth evening ramping
- **Constraints**
  - The study focused on resources that have flexible timing and are aligned with system needs
  - Study was limited by which loads could be disaggregated from smart meter data

The California Demand Response Potential Study, Phase 3: Final Report on the Shift Resource through 2030 (2)

Methodology
Define clusters of customer demographics
Collect and categorize customer smart meter data
Disaggregate customer loads by end-use
Generate base load forecasts
Generate electrification, EV, and weather load forecast scenarios
Determine load requirement to provide DR by end-use
Define possibilities for pairing DR technologies with end-use to meet load requirements
Apply customer economics and decision modeling to determine estimate DR potential under different pathways

- **Notable Aspects of the Study Approach**
  - To accomplish load shift, model applies points of shed (load reduction) and take (load increase) for each resource
  - The study modeled customer smart meter data to create disaggregated end-use load shape forecasts
  - Load flexibility potential is calculated by maximizing DR resource contribution for provided cost constraints
- **Participation Assumptions**
  - No programs or market-integrated dispatchable products currently exist for Shift for predicting participation rates
  - Participation model based on demographics, measure costs, and historical rates of Shed DR. Shift DR participation is expected to be higher
- **Results and Recommendations**
  - The final results show a supply curve of shiftable load procurement available at or below a $/kWh/year cost.
  - The 2020 Shift resource available could theoretically absorb the average volume of curtailed variable renewable energy in 2019 and meet 50% of evening ramping.

Next steps

- Identify steps in DF potential study approach based on literature review
- Discuss data needs and challenges to estimating DF potential and solutions being used today
- Highlight available tools for state to use in developing demand flexibility potential
- Guidance on content to include in a Request for Proposals for a DF potential study

- Please let us know if what specific topics you're most interested in.

Forthcoming GEB National Value and Potential Study

GRID MODERNIZATION LABORATORY CONSORTIUM
U.S. Department of Energy

On **Monday January 11 from 3-5 pm ET** Brattle Group will present the preliminary results of their *Grid-interactive Efficient Buildings: National Value and Potential* study to the working group. Please contact Rodney Sobin or Ed Carley if you would like to listen in!

Incorporating Demand Flexibility into State Energy Goals

Natalie Mims Frick, Berkeley Lab

Contributions by Lisa Schwartz

GEB Working Group - Public Buildings and Potential Cohort Meeting

December 7, 2020

State Opportunities to Promote Demand Flexibility

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U.S. Department of Energy

- We are developing model language for states and local governments seeking to include demand flexibility in achieving their energy-related goals.
  - We are focused on policies that impact buildings (e.g., resource standards, benchmarking, integrated resource planning, distribution system planning, building energy codes).
  - We are prioritizing model language development based on state needs.
- Today we are sharing model language that states can consider using to incorporate demand flexibility in the following policies:
  - Benchmarking, transparency and reporting
  - Building performance standards
  - Energy efficiency resource standards

1. Benchmarking, Reporting and Transparency Policies

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- Benchmarking and transparency (B&T) policies* boost energy efficiency in buildings by focusing on the simple action of measuring energy use, comparing it to buildings of similar type and size, and making that data publicly available.
- These local and state efforts seek to unlock new energy efficiency opportunities in existing buildings by promoting data-driven decision making and creating stronger market signals.
  - Building owners, managers, and operators can use the data to identify opportunities to cost-effectively reduce wasted energy and water.
- IMT has model ordinance language for a policy to improve the performance of existing buildings, which includes benchmarking and reporting.

* Mims Frick et al. (2017), *Evaluation of U.S. Building Energy Benchmarking and Transparency Programs: Attributes, Impacts, and Best Practices*

Including Demand Flexibility in B&T Policies

The following options may not be applicable to all B&T policies.

- Most U.S. benchmarking policies use [ENERGY STAR Portfolio Manager]() for data reporting. Electric **demand (kW)** can be tracked in ENERGY STAR Portfolio Manager. This is a starting point for understanding the building's peak demand and its alignment with electric system peak periods. This information facilitates tracking reductions in electricity demand over time.

- Options to encourage demand flexibility in benchmarking data reporting include:
  - a) If the applicable electricity rate includes demand charges, require electric utilities to provide building owners with the building's monthly peak demand hour, and the monthly peak demand hour for the utility system, as part of the utility data requirements.
  - b) If the applicable electricity rate includes demand charges, require the building owner to report monthly peak demand (kW) using data provided by the utility. The owner also could be required to provide the hours during which the peak demand charges apply. This would help identify opportunities to reduce building peak demand during those hours.
  - c) Require the building owner to calculate and report the building's monthly demand intensity (kW/SF).

2. Building Performance Standards

- Building performance standards (BPS) are policies that encourage or require buildings to meet energy consumption or air pollutant emissions reduction goals through measurable actions.
- BPS typically apply to existing buildings and can be coupled with B&T policies.
- Compliance options include prescriptive paths (e.g., identifying specific technologies to install) or a performance path (e.g., use a baseline to measure building performance towards achieving a goal).
- Goals can be based on a reduction requirement (e.g., 20% reduction over 3 years) or an absolute requirement (e.g., reduce lighting demand to x kW per square foot).
- Several cities and Washington state have adopted a building performance standard (ACEEE 2020).

Including Demand Flexibility in BPS Policies (1)

The following options may not be applicable to all BPS policies.

- When establishing the BPS, states (or local governments) can require the consideration of demand response and demand flexibility technologies. For example:
  - By *Month X, 20XX*, the *department* must establish by rule a state energy performance standard for covered *public/residential/commercial* buildings. The *department* shall consider the use of demand response and demand flexibility technologies in rules for complying with the standard.
- Additional compliance options can be offered to encourage building owners to install technologies that enable demand flexibility or participate in demand response programs.
  - **Option a. Demand flexibility technology option.** When implementing an efficiency upgrade, if the owner installs equipment capable of automated load management in response to a signal from the utility, aggregator or regional grid operator, including installation of demand response controls, configuration/programming to deploy the control strategy, installation of hardware to receive signals (e.g., WiFi, ZigBee, BACnet, Ethernet or hard wire), and compliance with the OpenADR 2.0 communication protocol, it will *contribute to compliance (e.g., X points toward meeting required ENERGY STAR score)*.
  - California's Title 24 includes prescriptive requirements for nonresidential buildings for this type of demand-responsive equipment.

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Including Demand Flexibility in BPS Policies (2)

- Additional compliance options (cont'd)
  - **Option b. Demand flexibility program participation option.** If covered buildings have an opportunity to participate in DR programs (via utility or aggregator), participation in the program and completion of the following activities *will count towards compliance (e.g., X points toward meeting required ENERGY STAR score)*.
    - Design a system with the capability for real-time, fully-automated DR based on external initiation by a DR Program Provider. Semi-automated DR may be used in practice.
    - Enroll in a minimum one-year DR participation amount contractual commitment with a qualified DR program provider, with the intention of multiyear renewal, for at least 10% of the estimated peak electricity demand. Peak demand is determined under Energy and Atmosphere Prerequisite Minimum Energy Performance.
    - Develop a comprehensive plan for meeting the contractual commitment during a DR event.
    - Include the DR processes in the scope of work for the commissioning authority, including participation in at least one full test of the DR plan.
    - This option draws on the Leadership in Energy and Environmental Design (LEED) DR credit.

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Including Demand Flexibility in BPS Policies (3)

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- Additional compliance options (cont'd)
  - **Option c**. If covered buildings do not have an opportunity to participate in DR programs (via utility or aggregator) the *building owner or operator* can provide infrastructure to take advantage of future demand response programs or dynamic, real-time pricing programs. Completion of the following activities *will count towards compliance (e.g., X points toward meeting required ENERGY STAR score)*.
    - Install interval recording meters with communications and ability for the building automation system to accept an external price or control signal.
    - Develop a comprehensive plan for shedding at least 10% of building estimated peak electricity demand. Peak demand is determined under EA Prerequisite Minimum Energy Performance.
    - Include the DR processes in the scope of work for the commissioning authority, including participation in at least one full test of the DR plan.
    - Contact local utility representatives to discuss participation in future DR programs.
    - This option also draws on the LEED DR credit.

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3. Energy Efficiency Resource Standards

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- Energy efficiency resource standards (EERS) “require utilities to to achieve a certain percentage of energy savings based on the amount of electricity or natural gas sold in the state” (National Conference of State Legislatures).
- EERS are a well-established policy. Texas created the first EERS in the U.S. in 1999.
- State public utility commissions, utility resource planners, efficiency utility/program administrators and implementers are increasingly interested in peak demand reductions from electricity efficiency programs to ensure electricity system reliability at the most affordable cost.
- Yet few states have included a demand reduction requirement in their EERS. The examples on the next few slides are options for states to shift from an energy-only EERS to an energy and demand reduction requirement.

- ACEEE has model language for EERS here.

Including Peak Demand Reductions in an EERS
Setting Goal or Standard

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The following suggestions may not be applicable to all EERS policies.

- **Goal based on a percentage:** The commission shall establish energy savings and peak demand reduction goals to be achieved by *an electric utility*, taking into account the utility's cost-effective demand-side management potential, the need for electricity resources, the benefits of demand-side management investments, and other factors as determined by the commission. The energy savings and peak demand reduction goals must be *at least X percent* of the utility's retail system peak demand, measured in megawatts, in the base year and *at least X percent* of the utility's retail energy sales, measured in megawatt-hours, in the base year. The base year is *YYYY*. The goals shall be met in *XXXX*, counting savings in *XXXX* from demand-side management measures installed starting in *YYYY*. The commission may establish interim goals and may revise the goals as it deems appropriate.
- **Goal based on top hours:** By *XX/XX/20XX*, the weather-normalized demand of the retail customers of each *electric utility* shall be reduced *by a minimum of X%* of annual system peak demand in the *XXX* hours of highest demand. The reduction shall be measured against the *electric utility's* peak demand for *XX/XX/20XX*, through *XX/XX/20XX (baseline period).*
- **Goal based on load growth:** Each electric utility annually will acquire additional cost-effective energy efficiency, subject to cost ceilings established by the *commission*, for the utility's residential and commercial customers equivalent to *not less than XX percent of the electric utility's annual growth in demand of residential and commercial customers in the previous calendar year by Month, XX of each year beginning with the 20XX calendar year.*
- **Absolute value as goal:** By *XX/XX/20XX*, each *electric utility* will reduce peak-load demand for electricity through energy efficiency programs by *XXX megawatts.*

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Including Peak Demand Reductions in an EERS: *Reporting Requirements*

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The following suggestions may not be applicable to all EERS policies.

- Each *electric utility* shall file an annual report by no later than *(##) days* after the end of each program year, make a public version available for publication on the *agency's* website, and serve a copy on each party to the case in which the demand side programs were last established, modified, or continued. Annual reports shall include at a minimum the following information, and all models and spreadsheets shall be provided as executable versions in native format with all links and formulas intact:
  - An affidavit attesting to the veracity of the information;
  - A list of all approved demand-side programs and the following information for each approved demand-side program:
    - Actual amounts expended by year, including customer incentive payments
    - Energy savings impacts
    - Peak demand savings impacts including:
      - Peak period definition (for both summer and winter, if applicable) used to determine program impacts
        - Peak period start hour
        - Peak period end hour
        - Peak period start month
        - Peak period end month
      - Gross peak demand savings
        - Summer kW
        - Winter kW
    - A comparison of the actual annual peak demand and energy savings impacts to the annual demand and energy savings targets.

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Next Steps

Poll question: What model language would you like to be developed next?

- Please let me know your state's needs.
- We anticipate developing model language states can consider and adapt to incorporate demand flexibility toward meeting their own state's goals, including:
  - Other energy standards (e.g., clean energy or clean peak standard)
  - Utility planning applications (demand side management, integrated resource planning, distribution system planning)
  - State Lead-by-Example, with a focus on buildings

Questions?

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Appendix

Minnesota Participation Rates

Table 3: Year One Demand Response Measure Penetration

Demand Response Measure	Year One (2020) Penetration
Central A/C (DLC)	2.0%
Dehumidifier with Smart Plug	1.0%
Electric Heat (DLC)	1.0%
Irrigation Load Control	1.0%
Lighting Controls	1.0%
Refrigeration	1.0%
Residential Smart Thermostat (Cooling)	2.0%
Residential Smart Thermostat (Heating)	2.0%
RTU Cooling	1.3%
Commercial Smart Thermostat	1.0%
Window A/C with Smart Plug	1.0%

Table 5: Demand Response Participation Growth Rates by Measure

Demand Response Measure	Demand Response Program Participation Growth rate
Central A/C (DLC)	-15%
Dehumidifier with Smart Plug	15%
Electric Heat (DLC)	-15%
Irrigation Load Control	15%
Lighting Controls	15%
Refrigeration	20%
Residential Smart Thermostat (Cooling)	25%
Residential Smart Thermostat (Heating)	25%
RTU Cooling	20%
Commercial Smart Thermostat	25%
Window A/C with Smart Plug	15%

Michigan DR Study Participation Rates - DLC/Curtailment

Customer Class	Program Option	Participation Low Case	Participation High Case
Residential	Behavioral	20.0%	50.0%
Residential	DLC Central AC	19.6%	23.8%
Small C&I	DLC Central AC	6.0%	7.2%
Residential	DLC Water Heating	23.0%	23.0%
Small C&I	DLC Water Heating	6.0%	6.0%
Residential	DLC Smart Thermostats	3.5%	4.2%
Small C&I	DLC Smart Thermostats	1.1%	1.6%
Residential	DLC Smart Appliances	5.0%	7.5%
Small C&I	DLC Smart Appliances	3.8%	5.6%
Large C&I	Emergency Curtailment	6.3%	6.3%
Extra-large C&I	Emergency Curtailment	34.9%	34.9%
Irrigation & Water Pumping	Irrigation Load Control	5.0%	10.0%

Michigan DR Potential Study Participation Rates - Rates/Economic Dispatch

Customer Class	Program Option	Participation Low Case	Participation High Case
Residential	Time-of-Use Rates	30.0%	75.0%
Small C&I	Time-of-Use Rates	13.0%	60.0%
Medium C&I	Time-of-Use Rates	13.0%	60.0%
Large C&I	Time-of-Use Rates	40.0%	75.0%
Extra-large C&I	Time-of-Use Rates	40.0%	75.0%
Irrigation & Water Pumping	Time-of-Use Rates	13.0%	50.0%
Residential	Variable Peak Pricing Rates	6.8%	24.1%
Small C&I	Variable Peak Pricing Rates	6.3%	7.0%
Medium C&I	Variable Peak Pricing Rates	19.0%	22.0%
Large, Extra-large C&I	Variable Peak Pricing Rates	10.0%	15.0%
Irrigation and Water Pumping	Variable Peak Pricing Rates	5.0%	15.0%
Residential	Peak Time Rebate	20.3%	8.0%
Small C&I	Peak Time Rebate	6.3%	7.0%
Large and Extra-large C&I	Real Time Pricing	5.0%	10.0%
Medium C&I	Demand Buyback	18.0%	24.0%
Large and Extra-large C&1	Demand Buyback	15.0%	20.0%
Large C&I	Capacity Bidding	12.0%	16.0%
Extra Large C&I	Capacity Bidding	30.0%	40.0%