



NYSERDA

New York 2019 Residential Building Stock Assessment

Carley Murray
NYSERDA, Sr. Project Manager

June 17, 2020 - Spring 2020 Load Forecasting Task Force

RBSA Overview

Methodology

Building Stock

Building Characteristics

Demographics

Heating and Cooling

Water Heating

Building Shell

Lighting

Appliances

Electronics

Connected Devices

Program Participation

HVAC Market Assessment

Short Term Potential Study

- > **The 2019 RBSA is the first update to the Residential Statewide Baseline Study (RSBS or Baseline), concluded in 2015**
- > **Main Objectives:**
 1. Provide a profile of existing and new homes in New York based on a representative sample of homes
 2. Determine changes in building and equipment stock from previous baseline study
 3. Update baseline conditions for high-efficiency equipment in the state
 4. Inform and develop a short-term technical, economic, and achievable potential
- > **RBSA Scope Components:**
 1. Building Assessment
 2. HVAC Market Assessment
 3. Residential Potential Study

	Survey Completes		Site Visit Completes	
	Existing Homes	New Homes	Existing Homes	New Homes
Climate Zone 4	515	38	85	5
Climate Zone 5	913	420	206	68
Climate Zone 6	407	126	70	22
Total	1,835	584	361	95



RBSA Overview and Methodology

Climate Zones and Number of Completed Survey and Site Visits

RBSA Overview

Methodology

Building Stock

**Building Characteristics
& Demographics**

Heating and Cooling

Water Heating

Building Shell

Lighting

Appliances

Electronics

Connected Devices

Program Participation

HVAC Market Assessment

Short Term Potential Study

	Existing Homes	New Homes
Average HERS Rating (Site Visit)	N/A	55.7 ▼
Built Before 1940	25%	N/A
Less than 2,000 Sq Ft	59% ▼	45% ▲
Bedrooms	3.4 ▲	3.4
Single-Family Detached Homes	88% ▲	84% ▼
Own or Buying	97% ▲	99%
Occupants	2.8	3.1
Annual Household Income of \$75,000+	53% ▲	57% ▼
Highest Education Level, Graduate Degree	39% ▲	48%

RBSA Overview

Methodology

Building Stock

**Building Characteristics
& Demographics**

Heating and Cooling

Water Heating

Building Shell

Lighting

Appliances

Electronics

Connected Devices

Program Participation

HVAC Market Assessment

Short Term Potential Study

> Survey data depict a somewhat older population in existing single-family homes than the 2015 RSBS

Occupant Ages	Existing Homes	New Homes	Statewide
Less than 5 Years	0.2 ▼	0.3	0.2 ▼
6 to 17 Years	0.4	0.5	0.4
18 to 24 Years	0.2	0.1	0.2
25 to 34 Years	0.3 ▼	0.5	0.3 ▼
35 to 44 Years	0.3	0.5	0.3
45 to 54 Years	0.4	0.4	0.4
55 to 64 Years	0.5 ▲	0.4	0.5 ▲
65 Years or older	0.5 ▲	0.3	0.5 ▲
Total Household Members	2.8	3.1	2.8

RBSA Overview

Methodology

Building Stock

**Building Characteristics
& Demographics**

Heating and Cooling

Water Heating

Building Shell

Lighting

Appliances

Electronics

Connected Devices

Program Participation

HVAC Market Assessment

Short Term Potential Study

> **New homes in Climate Zones 5 and 6 use the most electricity per home, but Climate Zone 4 results may not be representative***

Annual kWh	Climate Zone 4	Climate Zone 5	Climate Zone 6	Overall Statewide
501 to 2,500	0%	12%	0%	8%
2,501 to 6,000	75.0%	17%	24%	19%
6,001 to 12,000	25.0%	30%	48%	35%
12,001 to 20,000	0%	28%	10%	23%
20,001 or more	0%	3%	19%	8%

RBSA Overview

Methodology
Building Stock

**Building Characteristics
& Demographics**

Heating and Cooling

Water Heating

Building Shell

Lighting

Appliances

Electronics

Connected Devices

Program Participation

HVAC Market Assessment

Short Term Potential Study

> Existing Homes Annual Electricity Usage from Site Visit Data

Annual kWh	Climate Zone 4	Climate Zone 5	Climate Zone 6	State wide
500	6%	0%	2%	3%
501 to 2,500	3% ▼	3% ▼	3% ▼	3% ▼
2,501 to 6,000	24%	30%	30%	27%
6,001 to 12,000	55% ▲	49%	41%	51% ▲
12,001 to 20,000	11%	14%	17%	13%
20,001+	1%	4%	6%	3%

RBSA Overview

Methodology

Building Stock

Building Characteristics
& Demographics

Heating and Cooling

Water Heating

Building Shell

Lighting

Appliances

Electronics

Connected Devices

Program Participation

HVAC Market Assessment

Short Term Potential Study

- > Fewer homes heat primarily with fuel oil
- > Primary heating with fuel oil dropped from 25% to 19% statewide

	Climate Zone 4	Climate Zone 5	Climate Zone 6	Statewide
Natural Gas	67% ▲	72% ▲	41% ▲	65% ▲
Fuel Oil	26% ▼	10% ▼	20%	19% ▼
Electricity	4%	9%	13% ▲	7%
Propane	0.2% ▼	6% ▼	13%	4% ▼
Wood/ Wood Pellets	0%	2% ▼	8% ▼	2% ▼

RBSA Overview

Methodology

Building Stock

Building Characteristics
& Demographics

Heating and Cooling

Water Heating

Building Shell

Lighting

Appliances

Electronics

Connected Devices

Program Participation

HVAC Market Assessment

Short Term Potential Study

- > More homes use Air Conditioning (AC)
- > 90% of homes statewide use air conditioning, up from 85% in the 2015 RSBS
- > Smart thermostats gained share of homes with central heating or cooling systems

	Central AC	Room or Window AC	Heat Pump	No AC
2015 RSBS	35%	48%	2%	15%
2019 RBSA	45% ▲	40% ▼	5% ▲	10% ▼

RBSA Overview

Methodology

Building Stock

Building Characteristics
& Demographics

Heating and Cooling

Water Heating

Building Shell

Lighting

Appliances

Electronics

Connected Devices

Program Participation

HVAC Market Assessment

Short Term Potential Study

> **Smart thermostats get traction**

> **11% of homes with central heating or cooling use a smart thermostat**

	Climate Zone 4	Climate Zone 5	Climate Zone 6	Statewide
Smart	14%	10%	4%	11%
Manual	19% ▼	23% ▼	40%	23% ▼
Programmable	67%	67%	56%	66% ▲

RBSA Overview

Methodology

Building Stock

Building Characteristics
& Demographics

Heating and Cooling

Water Heating

Building Shell

Lighting

Appliances

Electronics

Connected Devices

Program Participation

HVAC Market Assessment

Short Term Potential Study

- > Gas water heating gains share
- > New homes adopt newer technology

	Climate Zone 4	Climate Zone 5	Climate Zone 6	Statewide
Natural Gas	71% ▲	72% ▲	40% ▲	67% ▲
Electricity	7%	16% ▼	32% ▼	14% ▼
Fuel Oil	21% ▼	5%	10%	14% ▼
Propane	0% ▼	6% ▼	15%	5% ▼
Solar	0%	0.3%	0.8%	0.2%

RBSA Overview

Methodology

Building Stock

Building Characteristics
& Demographics

Heating and Cooling

Water Heating

Building Shell

Lighting

Appliances

Electronics

Connected Devices

Program Participation

HVAC Market Assessment

Short Term Potential Study

- > New homes leak less
- > Air sealing potential remains
- > Insulation opportunities exist
- > Blower door testing showed significant potential among existing homes

ACH50	Climate Zone 4	Climate Zone 5	Climate Zone 6	Statewide
Less than 5	5%	15%	24%	12%
5 to Less than 10	32%	48%	30%	38%
10 to Less than 15	30%	20%	32%	27%
15 to Less than 20	20%	7%	8%	13%
More than 20	12%	11%	6%	11%
Mean	13.8	10.7	10.2	12.1

RBSA Overview

Methodology

Building Stock

Building Characteristics
& Demographics

Heating and Cooling

Water Heating

Building Shell

Lighting

Appliances

Electronics

Connected Devices

Program Participation

HVAC Market Assessment

Short Term Potential Study

- > **Lighting transformation continues**
- > **LED bulbs now far outnumber CFLs, and inefficient bulbs have dramatically declined**
- > **Energy efficient lighting makes up more than half of all bulbs installed in homes**
- > **Potential remains despite the rapid transformation of the lighting market**

	2015 RSBS	2019 RBSA
CFL/LED	30%	52% ▲
Inefficient	60%	37% ▼
Linear		
Fluorescent	8% (T12 only)	8% (All)
Other	2%	2%

RBSA Overview

Methodology

Building Stock

Building Characteristics
& Demographics

Heating and Cooling

Water Heating

Building Shell

Lighting

Appliances

Electronics

Connected Devices

Program Participation

HVAC Market Assessment

Short Term Potential Study

- > Old appliances
- > Multiple refrigerators and freezers
- > Fuel differences
- > ENERGY STAR appliances

Age, in Years	Refrigerator (Primary)	Freezer	Clothes Washer	Dryer
Less than 2	10%	6% ▼	11 ▼	7% ▼
2 to 4	11%	9%	17%	12%
5 to 9	28%	24%	29%	32%
10 to 14	26%	20%	24%	26%
15 to 19	14%	16%	13%	13%
20+	11%	25%	6%	10%

RBSA Overview

Methodology

Building Stock

Building Characteristics & Demographics

Heating and Cooling

Water Heating

Building Shell

Lighting

Appliances

Electronics

Connected Devices

Program Participation

HVAC Market Assessment

Short Term Potential Study

- > LED lead the way
- > Televisions trending larger
- > Signs of streaming
- > More computers used less*
- > Electronic plug load equipment saw both an increase and decrease in the number of devices per home

	2015 RSBS	2019 RSBA
Cell Phone	2.1	2.3 ▲
Cordless Phone	1.5	1.5
Cable and Satellite TV Boxes	1.0	0.6 ▼
DVD/Blue Ray Player	0.8	0.7 ▼
Video Gaming System	0.6	0.5 ▼
Stereo System	0.6	0.5 ▼
VCR	0.3	0.2 ▼

Computers Hours of Use per Day: Consideration for COVID-19 and NY Pause

- > Survey participants reporting owning more computers than in the 2015 RSBS but using them fewer hours per day
- > The COVID-19 global pandemic resulted in “NY Pause” starting March 2020 which will dramatically impact the estimates reported in the 2019 RBSA

	2015 RSBS		2019 RBSA	
	Number	Hours per Day	Number	Hours per Day
Desktop	0.4	3.1	0.7 ▲	2.6 ▼
Laptop	1.1	3.2	1.3 ▲	2.8 ▼

RBSA Overview

Methodology

Building Stock

Building Characteristics & Demographics

Heating and Cooling

Water Heating

Building Shell

Lighting

Appliances

Electronics

Connected Devices

Program Participation

HVAC Market Assessment

Short Term Potential Study

> Connected devices gain traction

> Thermostats get “connected”

Of homes with central heating and/or cooling, 16% statewide have a connected thermostat according to survey data

> Digital assistants stand out

Connected Homes with Each Type of Connected Device	Climate Zone 4	Climate Zone 5	Climate Zone 6	Statewide
Have at Least One Device	31%	20%	13%	24%
Type of Device in Homes with at Least One Device				
Thermostat	54%	51%	34%	52%
Security	39%	32%	36%	37%
Lights	32%	35%	40%	33%
Other	16%	20%	31%	19%
Pool Pump	2%	1%	0%	2%
Major Appliance(s)	1%	3%	5%	2%

RBSA Overview

Methodology

Building Stock

Building Characteristics & Demographics

Heating and Cooling

Water Heating

Building Shell

Lighting

Appliances

Electronics

Connected Devices

Program Participation

HVAC Market Assessment

Short Term Potential Study

- > Participation in energy efficiency programs remained nearly the same compared to the 2015 RSBS
- > Participation in an AC rebate or recycling program increased

Insulation	40%
Heating Equipment	26%
AC Equipment	25% ▲
Lighting	18%
Other	16%
Water Heating Equipment	16%
Refrigerator or Freezer Recycling	14%
Appliances	9%
Clothes Washer	5%

RBSA Overview

Methodology

Building Stock

Building Characteristics
& Demographics

Heating and Cooling

Water Heating

Building Shell

Lighting

Appliances

Electronics

Connected Devices

Program Participation

HVAC Market Assessment

Short Term Potential Study

HVAC Market Assessment Objectives

1. **Update baseline conditions for sales of high-efficiency equipment installations for the state**
2. **Determine common practices in the residential HVAC and water heater market**

> **Equipment-specific Trends**

Furnaces and Boilers: Natural gas furnaces and boilers continue to dominate the market

Air-source Heat Pumps: The air-source heat pump market is growing; Workforce challenges, such as finding trained installers and a lack of customer understanding and/or confidence are substantial challenges for air-source heat pump installers

Air Conditioning: Central air conditioning units are more prevalent and more efficient. However, less efficient units still account for the majority of central air-conditioner sales

RBSA Overview

Methodology

Building Stock

Building Characteristics & Demographics

Heating and Cooling

Water Heating

Building Shell

Lighting

Appliances

Electronics

Connected Devices

Program Participation

HVAC Market Assessment

Short Term Potential Study

Short Term Potential Study

- > **Defines the single-family segment as including buildings with one to four housing units**
- > **Considers Climate Zones 4, 5, and 6, new and existing homes, all major residential single-family end uses, and the most prominent fuel types (electricity, natural gas, fuel oil, and propane)**
- > **Estimates the energy efficiency resources achievable in the New York State single-family segment over a 10-year period, from 2019 - 2028**
- > **Energy efficiency potentials throughout this report are presented as savings at the customer site. The results do not include potential from fuel-switching measures**

Fuel Type	2028 Forecast Sales (TBtu)	Technical Potential 2028 (TBtu)	Technical Potential Percentage of Sales	Economic Potential 2028 (TBtu)	Economic Potential as a Percentage of Sales
Electricity	126	38	30%	34	27%
Natural Gas	354	144	41%	76	21%
Other Fossil Fuels	106	34	32%	32	30%
Total	586	216	37%	142	24%

Cumulative Energy Efficiency Potential, Technical and Economic, 2019-2028



NYSERDA

Potential Study Conclusions

- > **LED lighting represents significant, cost-effective energy efficiency savings in 2019 and perhaps beyond**
- > **Specialty LED lighting, including lamps exempt from the EISA 2020 backstop standard, represent significant, cost-effective energy savings from 2019 through 2028**
- > **Residential connected load measures—smart thermostats and behavioral energy feedback—offer opportunities and substantial energy savings potential**
- > **Appliance recycling measures contribute significant, cost-effective energy efficiency potential**
- > **Natural gas energy efficiency economic potential occurs primarily within retrofit measures, as lower natural gas avoided costs render most equipment replacements noneconomic**

Links and Resources

Questions?

> **[NYSERDA Building Stock Assessment \(2019\)](#)**

[Building Stock Study](#)

[HVAC Market Assessment](#)

[Short Term Potential Study](#)

Open NY data

[NYS Residential Building Stock Assessment Data - Survey](#)

[NYS Residential Building Stock Assessment Data – Onsite](#)

> **Carley Murray, Sr. Project Manager**

Carley.Murray@nyserda.ny.gov

518.862-1090, ext. 3277