

# Leading the Charge with State Standards for Products and Appliances

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## ABSTRACT

Since 2017, more than a dozen states have adopted energy-efficiency standards for products and appliances. The standards apply to commercial and residential products, filling gaps in federal efficiency standards. This paper presents research into three aspects of state standards: (1) What are the gross savings? (2) Who should be credited with causing these savings? and (3) To what extent do compliance issues threaten the reliability of savings estimates? This paper presents results of four studies conducted in three states – Massachusetts, New Jersey, and New York – each tackling one or more of these questions. The authors completed research in Massachusetts and New Jersey in 2023. Evaluation work in New York began in 2024 and is ongoing.

Drawing on evaluations in Massachusetts and New Jersey, the paper outlines the approach used to estimate the potential savings from state standards during the legislative process, notes differences in this approach from those typically used by energy-efficiency programs, and realigns potential gross savings with those of programs.

The paper also discusses the efforts to promulgate the standards in Massachusetts and presents recommended attribution scores based on the Program Administrators' contribution to the passage of the legislation.

Finally, the paper describes the interim learnings from the New York evaluation related to measuring compliance with the standards.

This paper delivers two important insights. First, it offers guidance to other states on ways to align standards savings with those typically used in energy-efficiency programs. Second, it explores the feasibility of implementing primary methods designed to measure compliance.

## Introduction

Seventeen states and the District of Columbia have adopted one or more state-level product and appliance standards (PAS) for energy-and/or water-efficiency, collectively referred to as “products” in this paper.<sup>1</sup> Fourteen of these jurisdictions adopted very similar PAS between 2018 and 2023. This flurry of the state-level legislation on PAS traces its origins to the Appliance Standards Awareness Project's (ASAP) “States Go First” initiative ([Mauer, deLaski, and DiMascio 2017](#)). Launched in 2017, this initiative built upon existing California PAS and savings approaches, but the ASAP initiative also reflected additional research and the involvement of numerous parties, including representatives of Program Administrators

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<sup>1</sup> The information on the history of the PAS is drawn from ASAP (2025) as well as prior versions of its website accessed in 2023 and 2024.

addressed in this paper. Designed to fill gaps in federal energy- and water-efficiency standards, the ASAP initiative involved multiple elements. Those most critical to this paper are as follows:

- Crafting a model bill that states could use as a template for drafting their own PAS.
- Creating resources that quantified the potential benefits of adopting the PAS.
- Describing the sources, assumptions, and algorithms used to estimate the benefits.
- Advocating for the adoption of the state-level PAS.

This paper describes the research undertaken by evaluators in three states to understand the energy benefits of four products: commercial fryers, computers and monitors, faucets, and showerheads.<sup>2,3</sup> Collectively, these four products account for 78% or more of the expected savings from the PAS in each of the three states (Table 1). The savings percentages are based on the most recent information available to the evaluators at the start of each study. ASAP provided the New Jersey savings estimates (by request of the authors) and served as the source of savings estimates included in the legislative fact sheet prepared for Massachusetts ([Cutler and Lewis 2020](#)). The New York State Energy Research and Development Authority (NYSERDA) provided the New York estimates, which reflect the calculations made by NYSERDA’s program contractor, building from models developed to estimate savings for the California PAS.<sup>4</sup> The New York estimates provided to the authors also include energy savings associated with New York State Law Chapter 578, which addresses water efficiency.

Table 1. Percentage of total estimated energy savings

Product	Massachusetts	New Jersey	New York
Commercial fryers	11%	15%	18%
Computers and monitors	21%	29%	10%
Faucets	27%	18%	18%
Showerheads	21%	16%	32%
% of total savings	80%	78%	78%
Cumulative Savings in Billions of BTUs	564	915	19,628

The savings calculations are based on the estimates provided to the authors by ASAP, NYSERDA, or in Cutler and Lewis (2020). The estimates presented in the last row reflect primary calculations performed by the authors to convert savings into a consistent unit of analysis. The savings percentages exclude products preempted by subsequent federal standards. The savings volumes across states differ in terms of sales volumes, the number and type of products included in the PAS, the source of the estimates, and the number of years reflected in the estimates. Massachusetts savings are from 2022 to 2025, New Jersey from 2023 to 2025, and New York 2023 to 2035.

This paper compiles learnings from four studies: two studies in Massachusetts, one in New Jersey and one in New York. The Massachusetts and New Jersey studies were completed in 2023, while the New York research started in 2024 and is ongoing. Two of the studies reviewed and updated the assumptions ASAP used to calculate potential energy savings from the standards, with the New Jersey study ([Wilson-Wright et al. 2023](#)) laying the groundwork for the more in-depth study in Massachusetts ([NMR and DNV 2023](#)). The third study ([NMR 2023](#)) sought to determine who caused the PAS savings to happen, as an

<sup>2</sup> Computers and monitors are separate products, but potential savings estimates group them.

<sup>3</sup> All three states adopted PAS on additional products, with the list varying slightly across the states. The standards for each state can be found by clicking the state name: [Massachusetts](#), [New Jersey](#), [New York](#). Room air cleaner and general service lamp state standards were preempted by subsequent federal standards.

<sup>4</sup> The views expressed in this paper are those of the authors and do not necessarily reflect the views of the New York State Energy Research and Development Authority.

order by the Massachusetts Department of Public Utilities (DPU) required such documentation for the Program Administrators to claim them ([DPU 2022](#)). The fourth study is underway in New York. One of the objectives of the four-year study in New York is to determine the volume and portion of sales meeting the PAS over time, with the data collection activities in subsequent years incorporating the learnings from prior years. This will help NYSERDA assess how the PAS contribute to New York's climate goals, and the effectiveness of their efforts to support retailers and manufacturers in complying with the PAS.

This paper has three sections: Estimated Savings Review, Standards Promulgation, and Verifying Compliance and Naturally Occurring Market Adoption (NOMAD). Each section discusses the relevant methods, learnings, and recommendations (where applicable) for that topic. The conclusions section provides general guidance to states that either have adopted or will adopt state-level PAS.

## **Estimated Savings Review**

The impetus for the savings review research in Massachusetts and New Jersey stemmed from a concern raised in both states that the PAS savings estimates developed by ASAP seemed high compared to those typically achieved by energy-efficiency programs.<sup>5</sup> An energy-efficiency evaluation consultant and an evaluator team – co-authors on this paper – operated in both Massachusetts and New Jersey. They facilitated an informal arrangement with the New Jersey Board of Public Utilities (NJ BPU), the Massachusetts Program Administrators and Energy Efficiency Advisory Council (EEAC) consultants. The evaluators conducted initial explorations and updates on the savings assumptions in New Jersey and then applied the New Jersey learnings to a more comprehensive review of ASAP's methods in Massachusetts. Both studies calculated alternative PAS savings based on the reviews and recommended the states adopt these revised savings.

## **Savings Review Methodology**

The New Jersey study began with a review of the ASAP documentation of its approach to estimating national and state energy savings that would result from the PAS (Mauer, deLaski, and DiMascio 2017). This review (see below) led the evaluators to conduct a web search to identify more recent sales (operationalized as shipments) estimates for computers and monitors and commercial fryers.<sup>6</sup> They also projected fryer sales through the 2025 to 2027 triennial program cycle using a simple growth rate, accounted for the portion of fryer sales by cooking fuel, and recalculated energy savings for the full suite of PAS. The evaluators compared the recalculated savings to those reported by ASAP during the legislative process.

The second phase of this research, conducted for the Massachusetts Program Administrators and EEAC consultants, delved more deeply into the ASAP documentation, tracking down and reviewing many of ASAP's original sources, conducting web searches to identify updated sales and savings assumptions for most products included in the standards, and allocated savings from cooking and water heating proportionately to fuel use in Massachusetts, when available, and New England, when Massachusetts-specific results were not available. As in New Jersey, the evaluators compared the recalculated savings to those reported by ASAP during the legislative process.

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<sup>5</sup> Wilson-Wright et al. (2023) and NMR and DNV (2023) offer full discussions of the savings review process and the steps taken to update savings for additional products not discussed in this paper.

<sup>6</sup> The study also included room air cleaners, but this paper excludes their savings, which have been preempted by federal standards.

## Savings Review Results

**Review of ASAP's approach.** Both studies concluded that ASAP relied on a sound process in developing estimates of national and state energy savings resulting from the adoption of the PAS. ASAP also regularly updates its assumptions as new information becomes available. This paper's authors recognize that ASAP's mission is to advocate for product and appliance standards ([ASAP 2025](#)). Their reports and supplemental materials are transparent and carefully referenced. Yet, some aspects of ASAP's savings approach differ from those typically followed by energy efficiency programs, including those in Massachusetts and New Jersey. These divergences reflect the different research objectives: ASAP seeks to demonstrate the potential energy savings of adopting PAS, while evaluators typically calculate savings to assess clients' progress on specific goals or targets. The most impactful differences include the following:

- *ASAP held NOMAD and shipments (a proxy for sales) constant when forecasting savings.* This stands in contrast to ample trend data that suggests that both NOMAD and shipments change over time in response to market shifts and the implementation of new ENERGY STAR® specifications, among other factors. ASAP recognized this shortcoming, but they argued that their approach likely “cancel each other out” (Mauer, deLaski, and DiMascio 2017, p. 55). Evaluators are obliged to determine these sales and NOMAD change over time.
  - *Resolution:* The evaluators identified historic shipment and NOMAD trend data from web searches. In New Jersey, they used a simple annual growth rate to forecast NOMAD but kept ASAP's shipment estimate. Evaluators improved this method in Massachusetts by forecasting both shipments and NOMAD using Excel's FORECAST.ETS function.
- *ASAP defined savings for a given year as those that accumulate from the standards' compliance date through the year for which savings are being estimated.* This stands in contrast to how energy-efficiency programs in Massachusetts and New Jersey define annual savings, which are the savings achieved in the first year after an item is purchased. Subsequent year and lifetime savings associated with an installation are solely associated with the program year of installation. They do not accumulate as program credit the next year.
  - *Resolution:* In New Jersey, for all products except computers, monitors, and commercial fryers, the evaluators divided the ASAP estimates by 2.5 years, the ASAP assumed elapsed time between PAS implementation and 2025. In Massachusetts, the evaluators forecasted shipments and NOMAD and used the results to calculate annual savings.
- *ASAP estimates savings at the national level and then allocates savings to states based on demographic, economic, and climatic characteristics, including the allocation of shipments by fuel for products that could use either fuel.* ASAP provided a general description of the sources and considerations they used when allocating national savings to states, but they did not publicly release the allocation details for individual states. Evaluators need to develop transparent and jurisdiction-specific allocation bases.
  - *Resolution 1:* Using national and state-level fact sheets for the same years, the evaluators divided each state's savings by national savings for many products separately, yielding the product-specific proportion of national savings ASAP assigned to the state. After revising national estimates, the evaluation reallocated savings to the states using the same percentages.
  - *Resolution 2:* For cooking fuel, the evaluators assigned commercial fryer heating fuel proportion to program sales in New Jersey (source is not public). In Massachusetts, the evaluators referenced a residential energy use characterization study ([Guidehouse 2022](#)) for allocating heating fuel for faucets and showerheads. They used New England cooking

fuel data from Commercial Building Energy Consumption Survey (CBECS)([EIA 2018](#)) to allocate commercial fryer savings.

**Review of computer and monitor per-unit savings assumptions.** The computer and monitor PAS are based on California Title 20. The evaluators reviewed the California Energy Commission (CEC) research that served as the basis for the California standards for these products ([Singh, Rider, and Pasha 2016](#)). The CEC accounted for an already-compliant market share (NOMAD) in their estimates of computer and monitor savings. However, the final analysis did not note what the per-unit savings were before this accounting. The implication is that the CEC assumed that the compliant market share would remain constant over time. The evaluators did not identify any updated CEC per-unit savings assumptions for computers and monitors since 2016. Given their large contribution to energy savings and the rapid change in the computer and monitor market, the evaluators found it necessary both to isolate per-unit savings and to allow shipments and NOMAD to vary over time.

- *Resolution:* The evaluators used information from ASAP, the CEC, and ENERGY STAR to back into estimates of per-unit savings for these products. They were then able to apply NOMAD to these pre-adjusted per-unit savings.

**NOMAD for lavatory faucets.** The Massachusetts research included reviewing the changes ASAP made to its savings assumptions after the passage of the PAS in that state. The 2023 savings assumptions (ASAP 2023) set residential lavatory compliant market share (NOMAD) at 96% and public lavatory compliant market share at 100%. The Massachusetts Program Administrators, EEAC consultants, and evaluators zeroed out lavatory faucets savings due to the high NOMAD rate. The New York research described below seeks to verify faucet NOMAD through primary research.

- *Resolution:* The Massachusetts evaluation assumed lavatory faucet savings to be zero due to high levels of PAS-compliant NOMAD.

**Uncertainty due to the COVID-19 pandemic.** ASAP could not have anticipated the COVID-19 pandemic when it launched the “States Go First” initiative in 2017, and the pandemic was in its earliest stages when ASAP developed the fact sheets that informed PAS legislation in Massachusetts and New Jersey. Nevertheless, the COVID-19 pandemic shocked markets, most notably for the products reviewed in these studies, computers, monitors, and commercial fryers. These products saw rapid shifts in shipments between 2020 and 2023 ([Gartner 2023](#); ENERGY STAR 2020 to 2023 reports accessible via the [shipment archives](#)).

- *Resolution:* In New Jersey, the evaluators identified alternative computer data from Gartner (2023) and used that to inform a sensitivity analysis of future sales trends for computers and monitors. In Massachusetts, the evaluators conducted a sensitivity analysis on shipment and market share forecasts developed from ENERGY STAR shipment data with and without the 2022 shipment data, the most recent available at the time of the original study.

**Detailed calculations for commercial fryers.** This paper presents detailed calculations for commercial fryers as an example of how the evaluators resolved many of the issues identified in the savings assumptions review. Table 2 presents the first-year ASAP and evaluator assumptions used to calculate PAS savings for electric and natural gas commercial fryers in Massachusetts. The legislative fact sheet that used ASAP-derived savings estimates (Cutler and Lewis 2020) for Massachusetts yielded commercial fryer estimates of 232 MWh and 65 thousand MMBtu, while the evaluation placed those estimates at about 61

to 62 MWh and 73 to 75 thousand MMBtu. Wilson-Wright et al. (2023) and NMR and DNV (2023) provide additional details and the data sources for commercial fryers and other products.

Table 2. Massachusetts first-year savings assumptions for commercial fryers

Assumptions	Shipments	Shipments by fuel	Per-unit savings	Market share	MA % of nation	Annual savings
Electricity		%	kWh	%	%	MWh
ASAP 2020	100,000	100%	163	29%	2.0%	232
2023	133,000	19%	163	26%	2.0%	61
2024	136,000	19%	163	27%	2.0%	62
2025	139,000	19%	163	28%	2.0%	62
<b>Natural gas</b>		%	<b>MMBtu</b>	%	%	<b>Thousand MMBtu</b>
ASAP 2020	100,000	100%	46	29%	2.0%	65
2023	133,000	81%	46	26%	2.0%	73
2024	136,000	81%	46	27%	2.0%	74
2025	139,000	81%	46	28%	2.0%	75

Values subject to rounding error.

**Other Product and Aggregated PAS Savings Comparisons.** Table 3 compares the ASAP and final evaluated first-year (2025) savings estimates for the other products highlighted in this paper. The most common reasons evaluated savings differ from ASAP-based estimates include that the evaluators allowed shipments and NOMAD to change over time, adjusted for water heating fuel allocations, and adopted some different per-unit savings assumptions for computers and monitors. The evaluators removed lavatory faucet savings in Massachusetts, as ASAP indicates that nearly all models shipped meet the standards, an assumption the research in New York aims to verify empirically. In New Jersey, evaluated faucet and showerhead savings equal those of ASAP adjusted to reflect the first year of savings, rather than cumulative savings.

Table 3. ASAP and evaluated first-year (2025) savings estimates for computers and monitors, faucets, showerheads, and the full suite of PAS

Product	Fuel	Unit	New Jersey	New Jersey	Massachusetts	Massachusetts
			ASAP	Evaluated	ASAP	Evaluated
Computers and monitors	Electric	MWh	76,920	56,717	34,371	29,487
Faucets	Electric	MWh	4,160	4,160	6,811	1,073
Faucets	Fossil fuel	Thousand MMBtu	152	152	145	42
Showerheads	Electric	MWh	3,760	3,760	5,343	975
Showerheads	Fossil fuel	Thousand MMBtus	136	136	103	42

Values subject to rounding error. In New Jersey, evaluators limited their effort to converting cumulative savings to first-year savings by dividing cumulative savings by 2.5 (the assumed years of compliance included in the cumulative estimates).

**Recommended Estimated PAS Savings.** Table 4 compares the ASAP and final evaluated savings estimates across all the PAS in Massachusetts and New Jersey, comprising those discussed in this paper and all other products (13 electric and six fossil fuel) included in the standards and not preempted by subsequent

federal standards. Note that the New Jersey savings differ from those reported in Wilson-Wright et al. (2023) because this paper’s authors removed the room air cleaner savings due to subsequent federal standards. The evaluators recommended that their clients adopt the total PAS evaluated first year savings:

- New Jersey: 108,340 MWh (84% of the first-year ASAP estimate) and 394 thousand MMBtu (83% of the first-year ASAP estimate).
- Massachusetts: 49,889 MWh (72% of the first-year ASAP estimate) and 191 thousand MMBtu (58% of the first-year ASAP estimate)

Table 4. ASAP and evaluated first-year (2025) savings estimates for select products and all PAS

Fuel	Unit	New Jersey			Massachusetts		
		ASAP	Evaluated	% of ASAP	ASAP	Evaluated	% of ASAP
Electric	MWh	128,960	108,340	84%	68,600	49,889	73%
Fossil fuel	Thousand MMBtus	475	394	83%	330	191	57%

Values subject to rounding error.

## Standards Promulgation in Massachusetts

### Background

In 2011, the Massachusetts Program Administrators started engaging with stakeholders, such as ASAP, who were advocating for the adoption of energy-efficient product standards into Massachusetts law. In 2021, the Massachusetts Climate Act ([MA Climate Act](#)) was signed into law by Governor Baker. The Climate Act included the PAS discussed in this paper. ASAP and the Massachusetts Program Administrators supported the creation of these standards. Subsequently, the Massachusetts DPU ordered the Program Administrators to conduct a study that measures attribution to advance product standards included in the Climate Act:

*In addition, as the Attorney General and DOER correctly note, the Program Administrators must be able to show that any savings associated with the appliance standards (or other codes and standards advancement activities) are directly attributable to the Program Administrators’ lobbying efforts. The Department finds that the Program Administrators cannot count these claimed savings towards their performance incentive goals without a showing in the Term Report that, but for their actions, the legislation would not have been passed (DPU 2022).*

In following the directive to study the issue, a group of Program Administrators and EEAC consultants, collectively called the Working Group, reviewed the wording of this order in the planning stages of the study that yielded the *Standards Promulgation and Attribution Report* (NMR 2023, hereafter the standards promulgation study). Various Working Group members interpreted the DPU order differently and agreed to analyze and report the results based on two evidentiary standards:

- A binary attribution standard under which the Program Administrators receive zero credit unless it is shown definitively that no standard would have passed in the absence of the Program Administrators’ intervention, and
- A partial attribution standard under which the Program Administrators receive partial credit, allowing for the possibility that they were influential in the passing of the standards while

acknowledging other organizations or individuals may have also played a critical role in the process.

## **Methodology**

The standards promulgation study (NMR 2023) included a program documentation review, secondary research, and 11 in-depth interviews: two with program administrator and implementation staffs, one with program administrator government relations staff, and eight with key stakeholders involved in the state-level standards development, product selection, legislation, and advocacy processes. After completing the study tasks and summarizing the learnings, the evaluators led a consensus process with the Working Group to develop the binary and partial attribution rates.

## **Learnings**

The research indicated that the Massachusetts Program Administrators had little to no impact on the development and selection of the PAS or on the incorporation of the PAS into proposed legislation. The stakeholders interviewed for this study credited ASAP as the primary party responsible for the research, development, and selection of the draft PAS. ASAP was also responsible for determining the stringency of the standards efficiency requirements that went into the Climate Act. ASAP drafted the selected standards into a model bill for legislators to adopt into their state legislation.

The study found causal evidence that the Program Administrators' support in the legislative process helped get the proposed standards passed. The Program Administrators made the most influential contributions during the legislative process with their support and advocacy efforts. Their efforts included industry outreach and securing industry support of the PAS, writing letters of support for the bill, and providing testimony at legislative hearings. The Program Administrators' active engagement in the legislative process showed the state legislators that the state PAS received broad support from different interest groups.

Given these findings and the uncertainty in the DPU order regarding attribution, the Working Group concluded that the interview responses did not indicate a clear and definitive direction on whether the Program Administrators' efforts had an impact on the passage of the standards. The Working Group ultimately arrived at a mutually agreed upon partial attribution rate of 20% based on a qualitative assessment of the evidence presented in interview findings. This attribution rate acknowledges the impact of the Program Administrators' efforts in industry outreach, writing letters to show support, and giving testimony at legislative hearings.

For the binary attribution rate, the study sought to conclude definitively whether the standards would not have passed without program administrator intervention but was unable to do so. Several stakeholder interview respondents suggested that while the Program Administrators' involvement certainly helped, it is likely the standards would have passed without their active engagement and support. The Working Group unanimously agreed to recommend a binary attribution rate of 0%.

## **Recommendations**

The study recommended that the Massachusetts DPU should consider a binary attribution factor of 0% and partial attribution of 20% for the savings generated from Program Administrator advocacy efforts to pass the appliance standards in the 2021 Climate Act. Based on the DPU decision, the Program Administrators would either be able to claim 20% of the evaluated savings from NMR and DNV (2023) or no savings at all. As of June 2025, the DPU had not decided whether to adopt the binary or partial attribution factor.

## Verifying Compliance and NOMAD

The New York State Senate Bill S9405 gave NYSERDA “the express authority” to “establish energy and water efficiency performance standards and promulgate regulations to achieve them” and “conduct investigations and reporting requirements” ([NY Senate 2022, Amended Section 16-106](#)). New York adopted PAS for 21 products in December 2022, and these standards became effective in June 2023 ([NYSERDA 2025](#)). The PAS serve a critical role in helping New York meet the goals of its Climate Act (NY Climate Act).

NYSERDA and its program contractor are actively engaged in PAS compliance support with retailers and manufacturers. NYSERDA has also developed an indirect benefits framework that establishes guidelines for measuring energy savings and other benefits that “arise from NYSERDA’s influence to spur adoption without NYSERDA’s assistance and are not directly tracked by the initiatives” ([NYSERDA 2023, 6](#)). The indirect benefits framework applies to NYSERDA’s codes and standards efforts, as they do not incentivize the adoption of the products but support market actors in their efforts to comply with building codes and product standards when established.

NYSERDA competitively procured independent evaluation consultants to assess the effectiveness of their compliance support and characterize the market for PAS product categories. This section summarizes the steps evaluators have taken – and plan to take – to estimate the compliance rate and determine NOMAD.

### Search for Sales Data

Initially, the NYSERDA study planned to purchase sales data for New York, a comparison state, and the US overall to establish baseline sales and assess NOMAD for the PAS. To accomplish this, the sales dataset needed to include, at a minimum, state-level sales volumes by model number, as the evaluators would need to verify compliance with the State Appliance Standards Database (SASD) and the Modernized Appliance Efficiency Database System (MAEDbS). These compliance databases require model numbers rather than Universal Product Codes (UPCs) or Stock Keeping Units (SKUs). Unfortunately, after conversations with six possible sales data sources, the evaluators found that no sales datasets met the minimal requirements. Trade groups such as the Association of Home Appliances Manufacturers (AHAM) and Air-Conditioning, Heating, and Refrigeration Institute (AHRI) do not cover the types of products included in the PAS.

NYSERDA and the evaluators have temporarily tabled the search for sales data. They have left open the possibility of turning to regional or national data and perhaps looking at sales of the PAS categories broadly or making use of UPCs and SKUs to the extent possible, all possible avenues of research suggested by the initial sales data search. Other evaluation activities, ongoing and planned, may also yield information that can be used to approximate compliance and NOMAD.

### Exploratory Survey

One of those other evaluation activities involves surveying suppliers of plumbing fixtures and commercial kitchen equipment. Some of the survey objectives include understanding the respondents’ awareness of the PAS, documenting self-reported changes in their stocking practices, and characterizing sales trends following the PAS implementation in June 2023. The survey will also help NYSERDA understand retail stock turnover to help assess how long it might take to sell through non-compliant products manufactured prior to the new PAS effective date.

The evaluators and the survey vendor, however, have experienced difficulties in prior similar survey efforts. Challenges have included identifying a sample frame that represents the population of

suppliers, finding the right person to survey at retail or distributor locations, and securing enough responses to meet desired precision targets (for this study, 10% sampling error at the 90% confidence level). These challenges have the potential to impact the reliability and validity of survey results. For the NYSERDA study, the evaluators attempted to mitigate these concerns by fielding an exploratory survey to assess the strength of the sample frame, feasibility of using the survey methodology to meet study objectives, clarity of survey language, and adequacy of the offered \$50 incentive.

The approach rested on developing a sample frame of plumbing fixture and commercial kitchen equipment suppliers in New York using data from Data Axle, supplemented with contact information identified through web scraping. The evaluators assigned contacts to strata representing different store types and location in the state. To recruit respondents for the exploratory survey, the evaluators sent an advance e-mail to 60 potential respondents across all sampling strata with information on how to complete the survey online or by phone. Over the course of four weeks and multiple contact attempts, the evaluators had successfully completed only three surveys, each with plumbing suppliers.

Despite the lackluster success of the exploratory survey, the large number of contacts in the sample frame coupled with the inability to locate sales data adequate to address questions of compliance and NOMAD has led the evaluators and NYSERDA to decide to field the full survey as mixed mode in 2025.

### **Next Steps**

NYSERDA and the evaluators plan to continue their data collection efforts, incorporating lessons learned from the initial attempts to identify adequate sales data and field an exploratory survey. The evaluators will embark on the full supplier survey in Q3 2025, hoping that the large sample frame and mixed mode approach can yield enough completes from which to answer a subset of the study's research questions. The evaluators will also field a shelf-stocking study focused on plumbing fixtures with the purpose of determining compliance rates based on stocking, comparing compliance rates over time, and providing insights into the accuracy of the program contractor's retail stock turnover models. This effort will target the same sample frame as the survey, seeking 70 completes from hardware and home improvement stores throughout the state.

NYSERDA and the evaluators will also continue to investigate the potential for purchasing sales data or market reports that provide valuable information, even if they cannot be used to determine New York compliance rates or NOMAD. Contingent tasks also under consideration include scraping websites for retailers and distributors in New York and another state, in-depth interviews with distributors and manufacturers, and surveys of owners and managers of commercial kitchens, including restaurants, school cafeterias, and conference centers, among others.

### **Conclusions**

The studies summarized in this paper provide important insights into PAS for other states that have adopted or are considering adopting their own PAS. The most important learning is this: *The potential savings from PAS are substantial, even when adjusting for changes in shipments, NOMAD, dated per-unit assumptions, or cumulative versus first-year savings.* The PAS are a powerful tool to increase widespread energy efficiency and secure energy savings and carbon reductions.

The explorations of estimated savings, standards promulgation, and compliance and NOMAD verification collectively establish that no perfect approach exists to estimate potential savings for or demonstrate the impact of PAS at the state-level. By turning to non-traditional sources of information and accepting imperfect assumptions, Massachusetts and New Jersey successfully revised PAS savings estimates in a manner that should be replicable in other states.

The standards promulgation research additionally suggests that standards promulgation is a complex process with many stakeholders. Program Administrators can play an important role in facilitating the passage of PAS. However, at least for the Massachusetts PAS discussed in this paper, organizations like ASAP and other advocates for PAS also were critical in the passage of PAS. The broader applicability of the findings from this study depends on how states treat attribution and the ways in which a state engages ASAP and other entities in the development of their standards. For example, one would be hard-pressed not to give California credit for their PAS energy savings, given that a substantial number of the standards advanced in other states are based on California Title 20.

Passage of the PAS, however, does not guarantee compliance. How then do states ensure compliance? The interim results of the New York study have not yet been able to provide a definitive answer to this question, but the paper's authors will persist in pursuing a combination of established and innovative approaches to measure NOMAD and compliance.

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