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Appliance Standards Savings Research

1 INTRODUCTION

In January 2022, the New Jersey Assembly Passed and Governor Phil Murphy signed Assembly Bill 5160 into law.[1] This law (officially P.L. 2021, c.464, but referred to in this memo as AB5160) establishes minimum energy and water efficiency standards for 17 different types of appliances, electronics, light bulbs, and fixtures (collectively *appliance standards*).[2] The bill went into effect in January 2023. An organization known as the Appliance Standards Awareness Project (ASAP) drafted the bill and provided information and other types of support to its advocates.[3] As part of their support, ASAP creates fact sheets with estimates of energy, water, and air pollutant reductions that would result from adopting the appliance standards (see Appendix A).

For the State of New Jersey, determining the accuracy of these savings estimates – and correcting them if needed – is important to documenting the state's progress toward the savings goals set in the New Jersey Clean Energy Act of 2018. Savings goals from appliance standards are to be applied to the state's portion of these energy savings goals. Based on information provided by the Board of Public Utilities from the Goal Setting study being conducted by Cadmus, the statewide electricity forecast for 2025 to 2027 range from 74,693 to 75,435 GWh and 458,475 to 468,059 BBtu (converted from Dth). Table 1-1 summarizes the portion of these savings that would be expected to come from the New Jersey Clean Energy Program (NJCEP) activities under the Goal Setting study's Full Compliance scenario. The reduction goal *excludes* any savings from the AB5160 appliance standards as well as code iterations or other activities outside of the NJCEP.

The DNV team, with NMR as lead, conducted research into the expected impact of the AB5160 appliance standards on the savings achieved by New Jersey. The research sought to accomplish the following.

- Determine whether the state-level savings estimates provided by ASAP were realistic, and, if not,
- Provide alternative estimates using an approach that could be completed no later than April 30, 2023.

This memo (AB5160 Memo) summarizes the results of this effort, including the following:

- Overall assessment of ASAP's methods and assumptions, and
- Alternative savings approaches and estimates.

[1] https://dep.nj.gov/appliancestandards/.

[2] https://legiscan.com/NJ/text/A5160/2020

[3] ASAP has a broader mission of advocating for higher appliance efficiency standards at the federal and state level across the nation.

Table 1-1. New Jersey Clean Energy Program Energy Savings Goals, 2025 to 2027 Fiscal Year[1,2]

	Electricity (GWh)			Natural Gas BBtu)[3]		
	2025	2026	2027	2025	2026	2027
Energy Sales Forecast (amount)	74,693	74,959	75,435	458,475	463,240	468,059
Statewide Program Reduction Goal (%)	0.18%	0.23%	0.23%	0.08%	0.08%	0.08%
Statewide Program Reduction Goal (amount)	134.4	172.4	173.5	366.8	370.6	374.4

[1] State energy forecasts from *Goal Set Scenario 1-2-3 Outputs 3.22.23_Cadmus Tables_WG,* Tab "Base NJ 2023 Net Targets" cells H23 to H25 for electricity and H89 to H91 for natural gas. NJCEP reduction goal from *NJ BPU Report - Executive Summary_20230412,* "Table 1. New Jersey Full Compliance Scenario Targets."

[2] The savings goals listed here are for the New Jersey Clean Energy Program (NJCEP) only and do not include savings from AB5160, new code iterations, or other state-induced savings outside of NJCEP.

[3] Converted from Dth

2 KEY TAKEAWAY

This memo documents a number of concerns with ASAP's savings assumptions and methodology. Section 4 discusses the concerns in detail, but the following bullets list the concerns addressed in this memo and how they were addressed in this effort:

- The Department of Energy's (DOE) rulemaking to expand the definition of GSLs preempts AB5160, negating nearly all energy savings from state-regulated GSLs.
    - Removed all GSL savings from calculations.
- ASAP calculates annual savings cumulatively rather than on the first year basis more commonly cited for energy efficiency programs.
    - Recalculated savings based on a single year rather than cumulatively.
- ASAP calculates both electric and natural gas savings using total market shipments rather than allocating savings to the fuels proportionately based on their prevalence in the market.
    - Allocated commercial fryer shipments based on their prevalence in New Jersey (using 2020 statewide commercial program data).
- ASAP's decision not to estimate computer and monitor savings after 2020 may lead to substantial underestimates of electricity savings for New Jersey.
    - Updated computer and monitor assumptions based on ENERGY STAR and industry shipment data.
- ASAP's approach holds market share of efficient equipment and total equipment sales constant over time.
    - Forecasted commercial fryer and air purifier market shares for 2025 to 2027 and recalculated sales based on new assumptions.

Table 2-1 below compares the electricity and natural gas savings originally reported by ASAP and **recommended** in this memo for application by New Jersey in 2025 to 2027. It also presents the fraction of the NJCEP energy-use reduction savings as reported in the Goal Setting study's Full Compliance Scenario. Although the savings calculated for this effort are about 30% to 40% of ASAP;s estimates, the potential appliance standards will still yield substantial savings to the state of New Jersey. The accuracy of these estimates hinges on the national and state market share and sales assumptions made by ASAP and the forecasted market shares and sensitivity analyses presented in this memo. Future impact evaluation work could examine the accuracy of the assumptions and the sensitivity of savings estimates to both the ASAP and current effort assumptions.

Table 2-1. Comparison of ASAP and Recommended Appliance Standards Savings Estimates

	ASAP	Recommended First-Year Savings		
	Cumulative 2025[1]	2025	2026	2027
Electricity GWh	414.6	114.7	114.7	114.7
Natural Gas BBtu	1,187	393.6	390.4	387.0
Fraction of State Goal Electricity	308%	85%	67%	66%
Fraction of State Goal Gas	324%	107%	105%	103%

[1] ASAP estimates based on their 2021 New Jersey Fact Sheet with two exceptions: 1) Includes 2020 Fact Sheet computer and monitor savings; 2) Excludes state-regulated GSL savings due to federal preemption.

3 METHODOLOGICAL OVERVIEW

This section provides an overview of the methods, with more details presented in Section 5.

The first step of this research was to review the ASAP documentation of its initial (in 2017) and updated approach (through 2021) to estimating national and state energy savings that would result from the of appliance standards.[4] This review concluded that ASAP strives to provide accurate estimates but also identified concerns with its approach (Section 4). To address these concerns, the following steps were taken:

- Removed state-regulated general service lamps (GSLs) from the analysis, as the revised federal definition of GSLs encompasses nearly all the bulbs included in AB5160
- Calculated first-year savings for most appliances included in AB5160 (Section 0),
- Identified computer and monitor sales estimates for 2020 through 2022, recalculated first-year savings, and conducted a sensitivity analysis of possible future sales trends (Section 5.2), and
- Identified air purifier and commercial fryer ENERGY STAR market share (i.e., the percentage of shipments that are ENERGY STAR qualified), projected market shares for 2025 to 2027, and recalculated measure savings based on the projected market shares.

After completing all updates to estimates, first-year savings for New Jersey were calculated across all measures and compared to statewide energy savings targets as reported in the Cadmus goal setting report.

[4] The information summarized here can be found on ASAP's website: most current estimates https://appliance-standards.org/document/report-overview-states-go-first and archives back to 2019 https://appliance-standards.org/state-standards-model-bill-and-analysis-archives. ASAP also provided New Jersey-specific standards savings estimates for 2020 and 2021.

4 OVERALL ASSESSMENT OF THE ASAP APPROACH

The review of ASAP's approach yielded the following observations. The observations in red font potentially have the greatest implications for states attempting to accurately claim savings from appliance standards.

The Department of Energy's (DOE) rulemaking to expand the definition of GSLs preempts AB5160, negating nearly all energy savings from state-regulated GSLs. In May 2022, five months after New Jersey passed AB5160, the Department of Energy (DOE) re-adopted an expanded definition of GSLs that encompassed most of the lamps defined as state-regulated GSLs in AB5160. Both AB5160 and the expanded federal GSL definition took effect in January 2023, meaning that New Jersey did not implement the state-regulated GSL standard before the federal law took effect. While a few very low-lumen bulbs remain state-regulated GSLs, the savings are too small to estimate without reliable sales data. *Therefore, the calculations presented in this memo exclude all savings from GSLs.*

ASAP strives to provide realistic savings assumptions based on available shipment, baseline, and market information. ASAP's approach relies on four inputs (see below for equations):

- Annual product sales in 2020, usually operationalized as shipments
- Average product lifetimes
- Per-unit energy and/or water savings
- Portion of sales already meeting the recommended standard levels

The organization regularly updates both the underlying savings assumptions – including existing shares of efficient appliances – and estimation approaches as new information becomes available.[5] ASAP's approach makes sense given the breadth of their efforts in terms of the number of appliances and their advocacy in states across the nation. In short, ASAP does an admirable job at estimating savings, given persistent data issues and market uncertainties.

ASAP calculates *annual savings* cumulatively rather than on the *first* year basis more commonly cited for energy efficiency programs. When ASAP presents "annual savings for 2025" they account for any sales between the assumed compliance date and 2025. In contrast, most energy-efficient programs estimate *first-year savings* resulting from in-program sales in a single program or calendar year.[6] Specifically, ASAP's calculations are as follows, with the calculation of *number of installed units* being the source of concern:[7]

> *Annual savings = Number of installed units * Per-unit savings * (1 – % of shipments already meeting recommended standard)*

where the number of installed units is:

> *Before full stock turnover: Annual shipments * (Number of years after compliance date + 0.5)*
>
> *After full stock turnover: Annual shipments * Average product lifetime*

ASAP's 2021 fact sheet for New Jersey assumed a compliance date of 2023. As no measures would achieve their full product lifetime by 2025, ASAP's 2021 estimation approach effectively multiplied first-year savings by 2.5 to yield estimates of 2025 savings for New Jersey.

Sources of sales, shipments, and savings assumptions vary considerably, with the Department of Energy (national laboratories and ENERGY STAR), various California agencies and entities, industry associations (e.g., NEMA), and some utility-based studies being among the most common. Some of the sources may be biased or the information dated, but this challenge is all too common in market-level energy-efficiency research because sales, shipment, and per-unit savings data are often difficult to access (and may not always exist).

[5] Updates tend to be annual, but ASAP did not provide updates for 2018 or 2022.

[6] Energy efficiency programs also calculate lifetime savings, usually by multiplying annual savings by the product's measure life, but sometimes making more complex adjustments to address certain market or equipment conditions. A next step could involve calculating lifetime savings from the standards.

[7] J. Mauer, A. deLaski, and M. DiMascio. 2017. *States Go First: How States Can Save Consumers Money, Reduce Energy and Water Waste, and Protect the Environment with New Appliance Standards.* Page 55. ASAP and ACEEE. Washington, DC.

ASAP develops national sales estimates and then allocates sales to individual states, but the information they use for the allocation is dated. The organization uses information from the United States Census Bureau (at the state level) and the Energy Information Administration (EIA at the regional level), among other sources, to allocate savings to individual states. Energy-efficiency evaluation firms commonly use similar approaches when attempting to allocate national data to individual states. Unfortunately, communication with ASAP suggests that they have not updated their state-allocation assumptions since developing initial savings estimates in 2017. It is unclear whether the magnitude of changes in state and regional appliance saturation and usage data have been large enough to impact savings allocations to individual states. Therefore, the implication of this shortcoming remains unknown.

ASAP calculates both electric and natural gas savings using total market shipments rather than allocating savings to the fuels proportionately based on their prevalence in the market. Fuel-use configurations vary across measures, with examples below.

- Dual-fuel – An integrated gas and electric convection oven can use both fuels. ASAP incorrectly assumes full unit annual savings for each fuel rather than allocating annual savings between the two fuels, thereby overstating the use of both fuels.
- One fuel or another – Fryers can be fueled by natural gas or electricity, but not both. ASAP incorrectly assumes every compliant shipment was an electric unit and also that every compliant shipment was a natural-gas unit, thereby overstating the use of both fuels.
- Variable indirect fuel – Dishwashers run on electricity, but much of their savings derives from reduced hot water use. The hot water may be created by electricity or fossil fuels. ASAP does not address variable indirect fuel situations directly, so the implication of this assumption remains unclear.

ASAP provides equations and assumptions for savings calculations, but this study was unable to replicate some of them. This inability could reflect measure-specific assumptions not clearly laid out in ASAP's methods or calculation errors on the part of ASAP or the study team. This implication for savings is unknown.

ASAP's decision not to estimate computer and monitor savings after 2020 may lead to substantial underestimates of electricity savings for New Jersey. The COVID-19 pandemic drastically altered computer and monitor shipments due to the rise of remote work followed by supply chain issues. This situation created concerns about the availability and usefulness of shipment data from 2020 to 2022. Accordingly, ASAP excluded computer and monitor savings from its 2021 fact sheet, the most recent available when New Jersey passed AB5160. Savings estimates from the 2020 fact sheet (based on earlier shipment data) suggested that computers and monitors would provide substantial electricity savings. Accurately accounting for New Jersey savings from AB5160 requires an estimate of computer and monitor savings despite the market uncertainties created by COVID-19.

ASAP's approach holds market share of efficient equipment and total equipment sales constant over time. ASAP recognizes this as a shortcoming but also says that, because both sales and efficient shares tend to rise over time, the two trends should "cancel each other out." However, such cancelling would require a balance between sales and efficient share increases, an assumption that may not prove accurate in practice. The implication of this assumption for savings estimates likely varies across product and their markets.

ASAP's approach overestimates savings in some states and underestimates them in others by assuming the same market share across all states. In reality, market assessments across geographies show substantial variation in efficient-product sales across states due to social and economic differences and the presence and strength of energy-efficiency programs promoting such products.

5 ADDRESSING CONCERNS WITH THE ASAP APPROACH

This memo describes research that responds to four of the concerns cited above: 1) Calculating first-year as opposed to cumulative savings, 2) Updating computer and monitor savings estimates after 2020, 3) For commercial fryers, allocating shipments between electric and natural-gas using models, and 4) For air purifiers and commercial fryers, addressing changing baseline efficient market share over time. Some or all of the other shortcomings could be addressed in an impact evaluation, should the SWE decide to move forward with this study.

5.1 First-Year Savings Calculations for Most Appliances

Excluding air purifiers, commercial fryers, computers, and monitors, this exploration into AB5160 savings estimates that the New Jersey appliance standards will lead to electricity savings of 51.6 GWh and fossil fuel savings of 342.4 BBtu.

As noted above, ASAP calculates *annual savings* as the cumulative savings achieved from all sales under the new standards since the compliance date, accounting for stock turnover (based on an assumed measure life). Energy efficiency programs usually track *first-year savings* from the program sales in a given program or calendar year. *Lifetime savings* (which could potentially be calculated in an impact evaluation) are usually calculated by multiplying annual savings by the measure life of the appliance, sometimes with adjustments for market or product characteristics.

The SWE requested first-year savings for 2025 to 2027. Given the need to produce results by April 30, 2023, a simple approach was taken to estimate first-year savings for most measures. This approach involved dividing the ASAP 2021 estimates of 2025 savings by 2.5 (the time elapsed between the 2023 compliance date and 2025) to produce first-year estimates (Table 5-1). This calculation suggests an estimated electricity savings of 51.6 GWh and fossil fuel savings of 342.4 BBtu *without* computers, monitors, air purifiers, and commercial fryers, which are addressed separately below.[8] These estimates would be applied to 2025, 2026, and 2027, as this study has not attempted to predict annual changes in sales or baseline market shares.

[8] ASAP does not distinguish fossil fuel savings by fuel type.

Table 5-1. Estimated First-Year Energy Savings for New Jersey from Appliance Standards[1]

	Electric Savings (GWh)		Fossil Fuel Savings (BBtu)	
Appliance	ASAP 2025	2025 to 2027[3] First-Year	ASAP 2025	2025 to 2027 First-Year
Commercial Dishwasher	3.6	1.4	86	34.4
Commercial Hot Food Cabinet	7.8	3.1	0	0.0
Commercial Oven	2.7	1.1	24	9.6
Commercial Steam Cooker	4.9	2.0	26	10.4
Electric vehicle service equipment	2.2	0.9	0	0.0
Faucets	10.4	4.2	380	152.0
High color rendering index, cold temperature, or impact-resistant fluorescent lamp	43.9	17.6	0	0.0
Portable Electric Spa	27.1	10.8	0	0.0
Ventilating Fan	6.4	2.4	0	0.0
Showerhead	9.4	3.8	340	136.0
Water cooler	10.9	4.4	0	0.0
GSL Lighting – excluded[2]		NA		NA
Total *without* Computers, Monitors, Air Purifiers, or Commercial Fryers[4]	**129**	**51.6**	**856**	**342.4**
2026 State Goals, for reference	**NA**	172.4	**NA**	370.6

[1] Computers and monitors and air-purifiers and commercial fryers are addressed separately. and appliances that only yielded water savings.

[2] Excluded GSLs because the federal standards that went into effect in 2023 encompass most of the state-regulated GSLs, so New Jersey cannot claim the savings due to federal preemption.

[3] Computed first-year savings is equal to ASAP 2025/2.5

[4] Results subject to rounding error

5.2 Computers and Monitors

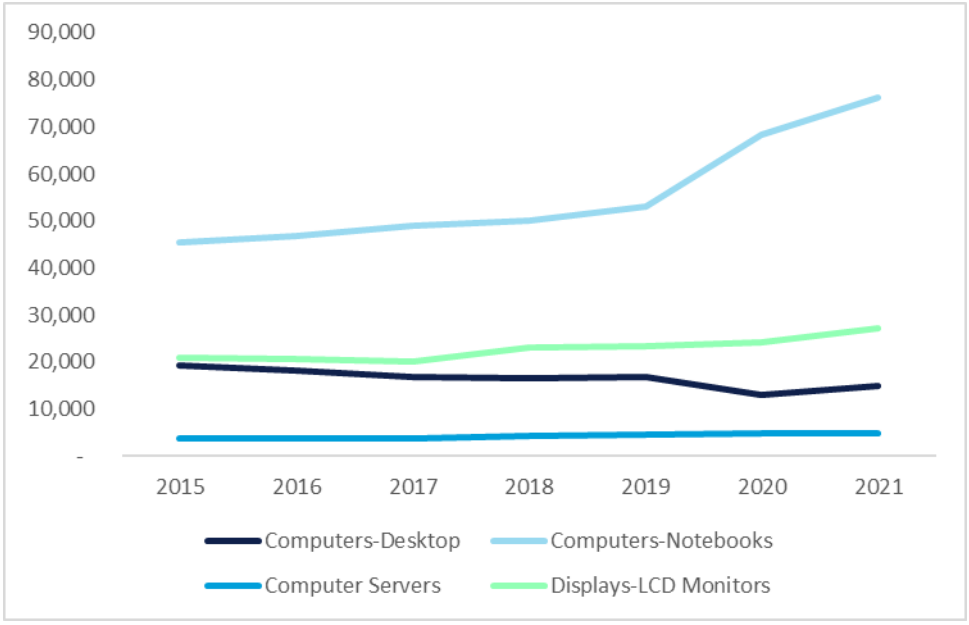
In its 2020 New Jersey fact sheet, ASAP estimated that the state would save 192.3 GWh in 2025 from computers and monitors, assuming a 2022 compliance date. Only state-regulated GSLs garnered greater predicted savings. Since New Jersey can no longer claim GSL savings, computers and monitors likely account for the majority of appliance standard savings in New Jersey. However, because ASAP has not recalculated computer and monitor savings since 2020, the question of how much savings these two products will yield remains unanswered. This AB5160 memo provides a defensible estimate of first-year computer and monitor savings for 2025 to 2027, including a sensitivity analysis of future computer and monitor sales trends in a post-COVID world.

5.2.1.1 Shipment Data Sources

The research into AB5160 computer and monitor savings relied on computer and monitor shipment data from ENERGY STAR (2015 to 2021)[9] and from Gartner, Inc. (a business management consulting firm) to produce estimates of computer and monitor savings.[10]

Shipment data were updated in the following manner. Total national shipments of computers and monitors were calculated annually for 2015 to 2021 using ENERGY STAR data on ENERGY STAR shipments and market share (see Appendix B for the detailed data).[11] ENERGY STAR lists shipments and market share for the numerous computing devices encompassed by AB5160 (Figure 5-1), so this memo relied on 2021 ENERGY STAR shipments to calculate the point estimate of first-year savings.

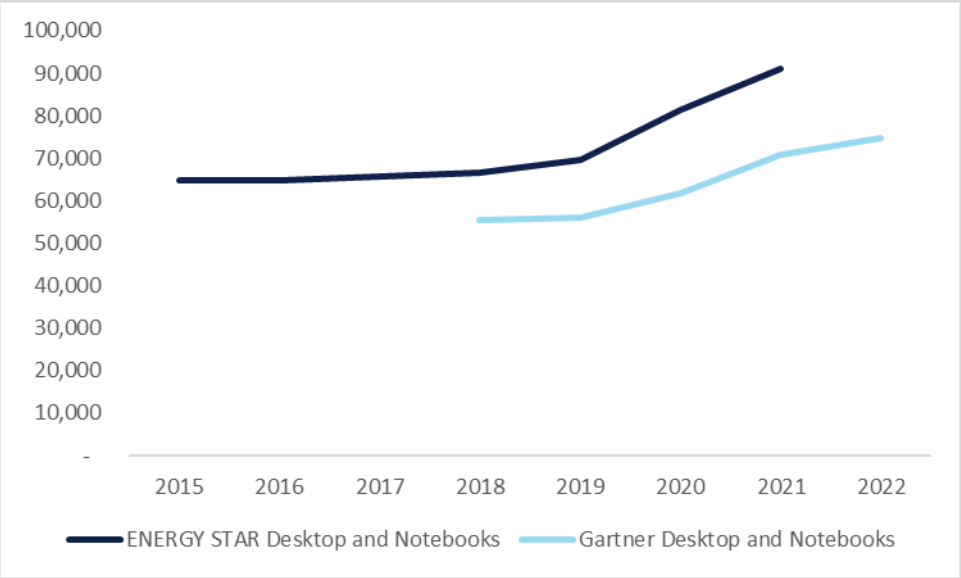
Figure 5-1: ENERGY STAR Total Shipments by Computer and Monitor Equipment Type



Gartner provided quarterly national computer shipments for combined desktop and notebook computers for 2018 to 2022 and were aggregated to represent the full year. Annual Gartner shipments of these two types of computers generally were about 80% of estimated shipments derived from ENERGY STAR data, but the overall trends mirrored each other (Figure 5-2). Gartner notes that computer shipments began to decrease in the third quarter of 2022, and the consulting firm expects the downward trend to continue through 2024. The Gartner shipment data does not include monitors or computer servers, so they could not stand in as the primary shipment source for this study. Therefore, the calculation of AB5160 savings used Gartner data to inform the sensitivity analysis, basing the high-end scenario on the 5% sales increase reported between 2021 and 2022.

[9] https://www.energystar.gov/partner_resources/products_partner_resources/brand_owner_resources/unit_shipment_data.
[10] https://www.gartner.com/en with information on computer shipments located in the "Newsroom" https://www.gartner.com/en/newsroom
[11] Total shipments = ENERGY STAR shipments / ENERGY STAR market share.

Figure 5-2: Comparison of Total Desktop and Notebook Computer Shipments: ENERGY STAR vs. Gartner



5.2.1.2 Computer and Monitor Savings Calculations

The following assumptions were made to estimate computer and monitoring savings.

First, ASAP's per-unit savings assumptions were accepted for each type of computer and monitor. The source of the standard, California's Title 20, does not list per-unit savings but instead provides equations to calculate savings.[12] The inputs needed to apply to the equations to New Jersey computer and monitor sales were not available. Additionally, ASAP notes that its per-unit computer and monitor savings assumptions already account for baseline sales, so the calculations presented here do not include the adjustment for baseline efficient product market share.

Second, the sensitivity analysis presents two alternative scenarios. The low-end scenario sets total shipments equal to the average of 2015 to 2019 shipments but boosts notebook volumes given upward sales trajectory (Figure 5-1). The high-end scenario multiplies all 2021 ENERGY STAR shipments by 5%, the percentage by which Gartner shipments increased between 2021 and 2022. Because Gartner predicts declining sales through 2024, an even higher shipment volume scenario is not needed.[13]

Finally, when ASAP calculated computer and monitor savings for New Jersey and the nation, New Jersey accounted for 3.4% of the estimated computer and monitor savings for the entire nation. **Therefore, after calculating national savings, 3.4% of them were allocated to New Jersey.**

Table 5-2 shows the savings calculations for computers and monitors.

[12] Available at https://govt.westlaw.com/calregs/Document/ID57ED4435CCE11EC9220000D3A7C4BC3?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default).

[13] That is, while computer and monitor sales may increase between 2025 to 2027, the base will likely be similar to pre-pandemic sales.

Table 5-2: Computer and Monitor Savings Estimates and Sensitivity Analysis[1]

	First-Year Savings 2025 to 2027			Sensitivity Analysis			
Product	**2021 Shipments (millions)**	**Per-unit Annual Savings (kWh)**	**First-Year Savings (GWh)**	**Low-end Shipments (millions)**	**Low-end Savings (GWh)**	**High-end Shipment (millions)**	**High-end Savings (GWh)**
Column	A	B	C	D	E	F	G
Calculation	NA	NA	B x A	NA	B x D	NA	B x F
Computers-Desktop	14,817	49	726.0	14,817	726.0	15,558	762.3
Computers-Notebooks	76,273	4	305.1	51,493	206.0	80,087	320.3
Computers-Workstations	1,205	37	44.6	909	33.6	1,265	46.8
Computer Servers	4,704	24	112.9	3,980	95.5	4,939	118.5
Displays-LCD Monitors	27,267	28	763.5	21,680	607.0	28,630	801.6
National Total	124,265		1,952.0	92,878	1,668.1	130,478	2,049.6
New Jersey Portion of National Total (3.4%)			66.4		56.7		69.7

[1] **Results subject to rounding error**

5.3 Allocating Fuel Type for Commercial Fryers

Because of their large impact on natural gas savings,[14] this effort took a closer look at shipments and market share for commercial fryers (see Section 5.4). This closer look revealed the concern about how ASAP treats shipments of appliances that could be fueled by either electricity or natural gas. This research effort had access to New Jersey Clean Energy Program statewide program commercial sales from 2020.[15] Therefore, when updating commercial fryer savings, the New Jersey program data were used to allocate shipment by fuel type. The New Jersey program data indicate that, across the new construction and retrofit programs, the statewide program had supported 33 commercial fryers in 2020; 12% of these (four units) were electric fryers. The study applied this percentage to ASAP's estimate of 100,000 commercial fryer shipments, assuming that 12,000 (12%) of the fryers were electric and the remaining 88,000 were natural gas.

5.4 Changes in Efficient Baseline Over Time

To examine the potential magnitude of ASAP's assumption that market share remains stable over time, research was conducted into the availability of efficient product market share over time for the following measures: air purifiers on the electric side and commercial fryers on the natural gas side. These measures were selected because ASAP indicated that they had lower market share (43% for air purifiers and 21% for commercial fryers) and/or high savings potential (13% of electric savings for air purifiers and 28% of natural gas savings for commercial fryers). The market share research did not examine computers or high color rendering index, cold temperature, or impact-resistant fluorescent lamps because ASAP calculated savings in a manner that excluded market share. Market shares for faucets and showerheads were not examined because the market shares in the ASAP calculations were high already (62% to 99% for faucets and 75% for showerheads). The market share data used in this current effort come from ENERGY STAR, the same source used by ASAP.

Figure 5-3 show the market share trends for air purifiers and commercial fryers, operationalized as the portion of national shipments meeting ENERGY STAR qualification. Commercial fryers exhibit an upward trend, spanning 2011 to 2021. The average annual percentage change in market share for commercial fryers was 8% after removing the outlying value from 2013. Air purifiers show a strong upward trend from 2012 to 2019, the years for which data are available. ENERGY STAR stopped reporting air purifying market share after 2019 due to the impacts COVID-19 had on its shipments. The average annual percentage change in air purifier market share from 2012 to 2019 was 16.9%.

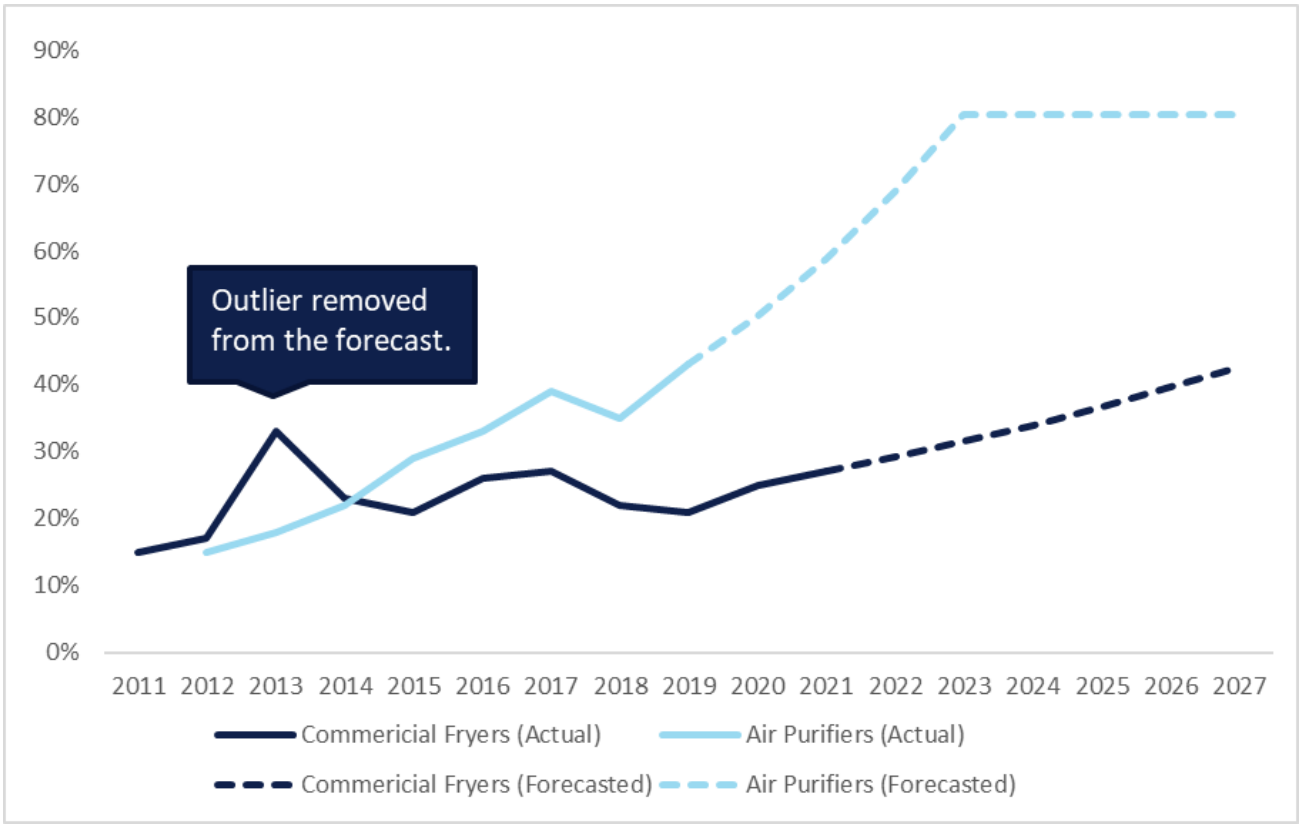
The average annual percentage changes were applied to the last year for which ENERGY STAR reported market share for the two products (Table 5-3). This method forecasts commercial fryer market shares of about 36% to 47% in 2025 to 2027. The same approach, however, yields market shares of over 100% for 2025 to 2027, which is not possible. The approach capped market share at 80%, the value forecasted for 2023. The 2023 value (80%) was selected as the later years approached (94% in 2024) then exceeded 100% market share.[16]

[14] Electric ccommercial fryers also exist, and this memo reports forecasted savings for them. However, electric commercial fryers represent a small portion of expected electricity savings due to the appliance standards.

[15] File name: *RCGB Report - FY20 Installed Measures (06-01-2021).* Provided to the NMR in support of the as part of the *New Jersey Recommended Net-to-Gross Ratios Overall Report* study.

[16] The 2023 value (80%) was selected over the 2024 value (94%) in recognition that COVID may have altered trends in ways not captured in the ENERGY STAR data and this analysis. The 80% value represents a compromise between the 43% used by ASAP (from 2019) and assuming 100% market share by 2025.

Figure 5-3. ENERGY STAR Market Share Trends for Air Purifiers and Commercial Fryers[1]



[1] Includes forecasted values presented in Table 5-3.

Table 5-3. Forecasted Market Shares for Air Purifiers and Commercial Fryers

	2019[1]	2020	2021	2022	2023	2024[2]	2025[2]	2026[2]	2027[2]
Air Purifiers	43%	50%	59%	69%	80%	80%	80%	80%	80%
Commercial Fryers	21%	25%	27%	29%	31%	34%	37%	40%	43%

[1] Market share used by ASAP

[2] Capped at 80% as forecasts approached and exceeded 100%.

Table 5-4 compares the original ASAP 2025 assumptions and savings and the 2025 to 2027 assumption and savings resulting from this current effort. The results make clear that, because baseline market shares tend to increase over time, projected future savings using the methods outlined in this memo are much lower than estimated by ASAP. Future examinations of changing market shares over time will be most critical for high savings measures and/or those with rapidly changing baselines. The results also show the implication of ASAP's application of the same shipment share to both electric and natural gas models of the same measure, rather than allocating shipments by the prevalence of these measures by fuel type.

Table 5-4. Forecasted Energy Savings for Air Purifiers and Commercial Fryers

	ASAP			Current Effort				
	Shipments	Market Share	2025 Savings	Shipments	Market Shares	2025 Savings	2026 Savings	2027 Savings
Air Purifiers (GWh)	5,700,000	43%	18.5	5,700,000	80%	6.4	6.4	6.4
Commercial Fryers (GWh)	100,000	21%	0.3	12,000	36.7%, 39.6%, 42.7%	0.04	0.03	0.03
Commercial Fryers (BBtu)	100,000	21%	132.4	88,000	36.7%, 39.6%, 42.7%	69.2	66.0	62.6

5.5 First-Year Savings Estimates and State Savings Goals

The estimated electricity savings resulting from AB5160 are between 66% and 85% of the statewide program reduction goal from the Clean Energy Act. Fossil fuel savings are between 103% and 107% of the statewide reduction goal for natural gas savings.

Table 5-5 combines the computer and monitor savings estimates (including the sensitivity analysis, Table 5-2) with the savings estimates for all other products (Table 5-1). Fossil fuel savings are about 367 to 374 BBtu, while estimates of electricity savings are about 114 GWh (conservatively; but could be as high as 128 GWh). These estimates suggest that the statewide standards for electricity are about 85% of the 2025 and two-thirds of the 2026 and 2027 NJCEP energy use reduction goals (per the Goal Setting study's full compliance scenario). The standards achieve between 103% and 107% of the NJCEP natural gas goal. Cumulatively, if the state achieves both the goals of the NJCEP as reported in the full compliance scenario goal setting study and the appliance standards savings reported in this memo, total NJCEP and appliance standard savings would be as high as 288 GWh and 761 BBtu. The accuracy of these estimates hinges on the national and state market share and sales assumptions made by ASAP and the forecasted market shares and sensitivity analyses presented here. Future impact evaluation work could examine the accuracy of the assumptions and the sensitivity of savings estimates to these assumptions.

Table 5-5. First Year Savings and Contribution to State Savings Goals – Conservative Approach[1]

	Electricity (GWh)			Fossil Fuels[2](BBtu)		
	2025	2026	2027	2025	2026	2027
Computers and Notebooks	56.7	56.7	56.7	0	0	0
Updated Air Purifiers	6.4	6.4	6.4	0	0	0
Updated Commercial Fryers	0.04	0.03	0.03	69.2	66.0	62.6
Other Appliances	51.6	51.6	51.6	324.4	324.4	324.4
First Year Standard Savings	114.7	114.7	114.7	393.6	390.4	387.0
Statewide Program Reduction Goal	134.4	172.4	173.5	366.8	370.6	374.4
First-Year Savings from Standards as % of Reduction Goal	85%	67%	66%	107%	105%	103%
Total Statewide Savings (assuming achievement of goal from other programs)	249.1	287.1	288.2	760.4	761.0	761.4

[1] Applied the low-end computer savings scenario to limit the possibility of overcounting savings. Total appliance standards savings for electricity using the high-end scenarios would be 127.7 in 2025. Natural gas savings remain the same.

[2] Appliance standard savings are for all fossil fuels, while the statewide reduction goal applies to natural gas only.

APPENDIX A: ASAP 2020 AND 2021 NEW JERSEY FACT SHEETS

2020 New Jersey appliance standards

2021 State Appliance Standards

APPENDIX B: Computer and Monitor Shipment Data from ENERGY STAR

	2015	2016	2017	2018	2019	2020	2021
ENERGY STAR SHIPMENTS (thousands)							
Computers-Desktop	7,566	9,238	8,699	10,348	13,403	6,813	6,223
Computers-Notebooks	43,106	37,904	44,005	41,072	43,440	60,706	64,832
Computers-Workstations	77	177	187	135	355	377	506
Computer Servers	543	682	334	719	1,228	1,176	NA
Displays-LCD Monitors	19,438	10,752	19,009	18,533	20,151	20,783	23,030
ENERGY STAR MARKET SHARE							
Computers-Desktop	39%	51%	52%	63%	80%	52%	42%
Computers-Notebooks	95%	81%	90%	82%	82%	89%	85%
Computers-Workstations	10%	21%	21%	14%	33%	33%	42%
Computer Servers	15%	18%	9%	17%	27%	25%	NA
Displays-LCD Monitors	93%	52%	94%	80%	86%	NA	NA

	2015	2016	2017	2018	2019	2020	2021
TOTAL SHIPMENTS (thousands)							
Computers-Desktop	19,400	18,114	16,729	16,425	16,754	13,102	14,817
Computers-Notebooks	45,375	46,795	48,894	50,088	52,976	68,209	76,273
Computers-Workstations	770	843	890	964	1,076	1,142	1,205
Computer Servers	3,620	3,789	3,711	4,229	4,548	4,704	4,704[1]
Displays-LCD Monitors	20,901	20,677	20,222	23,166	23,431	24,247[2]	27,267[2]

[1] Set equal to 2020 due to lack of data.

[2] Calculated based on the weighted percentage increase of desktops and laptops due to lack of data.