



# 2023 Annual Report

## Voluntary Agreement for Ongoing Improvement to the Energy Efficiency of Set-Top Boxes

Prepared on behalf of the  
Steering Committee by:  
D+R International  
1751 Pinnacle Drive  
Suite 600  
McLean, Virginia 22102

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## EXECUTIVE SUMMARY

In 2012, the pay television industry, led by NCTA - The Internet & Television Association, the Consumer Technology Association, and CableLabs®, signed the [Voluntary Agreement for Ongoing Improvement to the Energy Efficiency of Set-Top Boxes](#) with the goal of increasing the energy efficiency of set-top boxes while protecting rapid innovation and timely introduction of new features. Signatories include major manufacturers of set-top boxes and the largest cable, satellite, and telco service providers, serving approximately 50.5 million U.S. video subscribers and accounting for over 93% of the traditional pay-television (pay-TV) market in 2023.

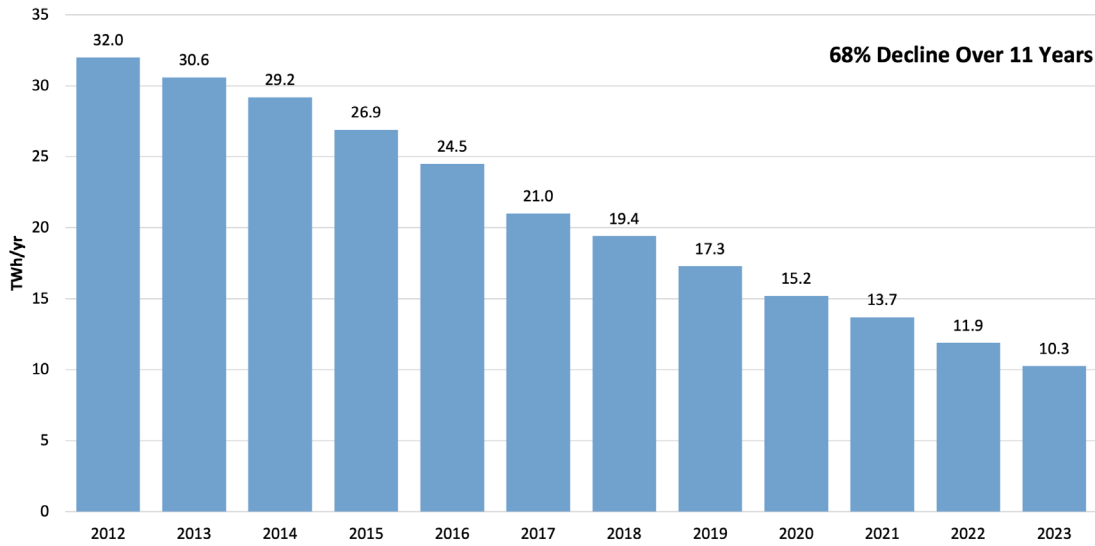
In 2013, leading Energy Advocates joined with the pay-TV industry in an expanded version of the Voluntary Agreement. One of the requirements of the Voluntary Agreement is the publication of an annual report by D+R International (D+R), acting as Independent Administrator and Independent Auditor of the Agreement. This eleventh annual report provides a summary of developments for the previous calendar year, 2023. Annual reports for the previous ten years and energy information for consumers and other stakeholders can be found at [www.energy-efficiency.us](http://www.energy-efficiency.us).

The primary commitment of the Agreement is that in each calendar year 90% of each service provider's new set-top box purchases meet prescribed energy-efficiency levels. These levels have been revised three times to become more rigorous, and this report for 2023 is the first in which the new "Tier 4" levels have applied to the parties' commitments. In 2023, 99.7% of service providers' set-top box purchases met these "Tier 4" levels, and all the service providers met the 90% commitment individually.<sup>1</sup>

National set-top box annual energy consumption has been reduced by approximately 68% under the Voluntary Agreement. As shown in Figure ES-1 below, total energy consumption of the industry's deployed set-top boxes has declined from 32 TWh in 2012 to 10.3 TWh in 2023, even as functionality and features of set-top boxes have increased. While some of this decline is due to subscriber reductions, the weighted average power usage of annual new set-top box purchases has fallen by 67% since 2013, from 122 kWh/year to 40 kWh/year.

<sup>1</sup>As set forth below, this calculation is based on 2023 procurement data submitted to D+R by service providers and corroborated by the results of independent verification testing and by the procurement audit conducted by D+R.

**Figure ES-1: Annual Energy Used by Set-Top Boxes**



This 21.7 TWh reduction is more than the power generated by seven typical 500-megawatt coal-run power plants in a year.<sup>2</sup> In 2023 alone, consumers saved over \$3.4 billion<sup>3</sup> on their utility bills and over 15 million metric tons of CO<sub>2</sub> emissions from power plants were avoided.<sup>4</sup> The following table and figure present the cumulative effect of these year-over-year declines during the eleven years of the Voluntary Agreement, during which energy consumption has been reduced by an estimated 132.1 TWh, saving consumers approximately \$18.3 billion and avoiding 93.4 million metric tons of CO<sub>2</sub> emissions. This 132.1 TWh of energy savings during this eleven-year period is more than enough to power every home in California, Oregon, and Nevada for a year.<sup>5</sup>

**Table ES-1: Voluntary Agreement Energy Savings 2013-2023**

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Lifetime of VA
<b>Total National Energy Consumed (TWh/yr)</b>	30.6	29.2	26.9	24.5	21.0	19.4	17.3	15.2	13.7	11.9	10.3	219.9
<b>Total National Energy Saved (TWh/yr)</b>	1.4	2.8	5.1	7.5	11.0	12.6	14.7	16.8	18.3	20.1	21.7	132.1
<b>500 MW Power Plant Equivalents Saved (Rosenfelds)<sup>1</sup></b>	0.5	0.9	1.7	2.5	3.7	4.2	4.9	5.6	6.1	6.7	7.2	N/A
<b>Electricity Costs Saved (Million\$/yr)</b>	\$169.8	\$350.6	\$645.2	\$941.3	\$1,417.9	\$1,621.6	\$1,916.9	\$2,217.6	\$2,510.8	\$3,040.2	\$3,475.6	\$18,307.4
<b>CO<sub>2</sub> Avoided (MMT)</b>	1.0	2.0	3.6	5.3	7.8	8.9	10.4	11.9	12.9	14.2	15.2	93.2

<sup>1</sup>The electricity generated by a typical 500 MW power plant is measured in Rosenfelds, which represents annual electricity output. At the 2012 peak, set-top boxes used 10.6 Rosenfelds annually, and that figure declined to 3.4 Rosenfelds in 2023.

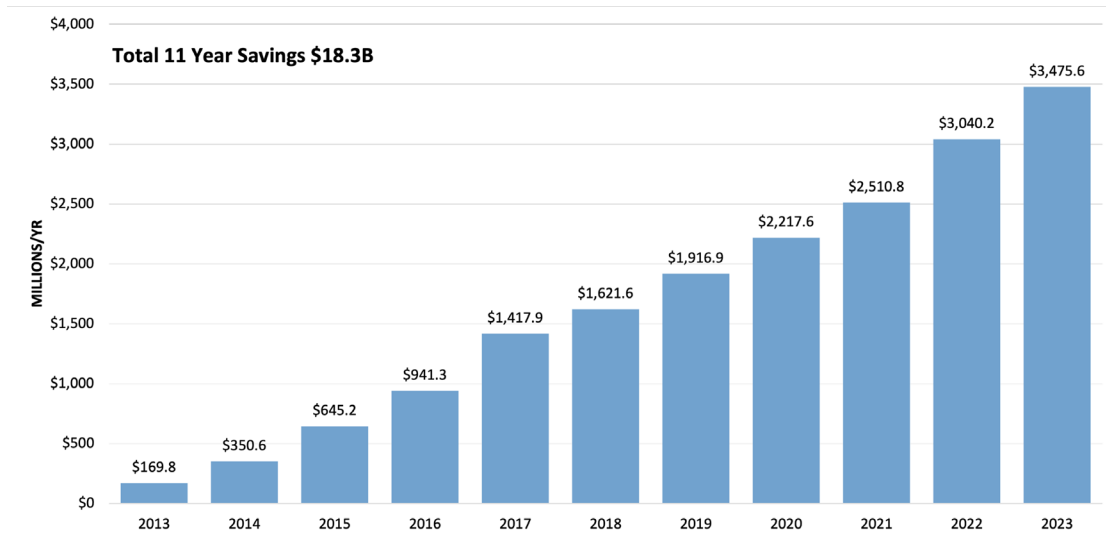
<sup>2</sup>A common unit in measuring energy-efficiency savings is the "Rosenfeld" (3 terawatt hours per year), the same amount of electricity generated by a conventional 500-megawatt coal-run power plant each year. See <https://www.scientificamerican.com/article/rosenfeld-energy-savings>.

<sup>3</sup>This calculation is based on the national average residential energy cost of 15.98 cents per kWh for 2023. See U.S. Energy Information Administration, Electric Power Monthly, <https://www.eia.gov/todayinenergy/detail.php?id=61903#:~:text=On%20average%2C%20higher%20electricity%20prices,15.98%20cents%2FkWh%20in%202023>

<sup>4</sup>Emission reduction estimates in this report are based on the U.S. Environmental Protection Agency's Greenhouse Gas Equivalencies Calculator, <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>.

<sup>5</sup>EIA State Energy Data System (SEDS): 2022 (updates by energy source), Table F19, Electricity Consumption Estimates, 2022, Residential, [https://www.eia.gov/state/seds/sep\\_fuel/html/pdf/fuel\\_use\\_es.pdf](https://www.eia.gov/state/seds/sep_fuel/html/pdf/fuel_use_es.pdf).

**Figure ES-2: Annual Electricity Consumer Savings Under the Voluntary Agreement**



The market for the purchase of new set-top boxes is fundamentally different than over a decade ago when the Voluntary Agreement was adopted:

- The total number of deployed set-top boxes has declined by 46% since 2012 due to subscriber losses and consumer adoption of streaming apps that enable viewing on smart TVs, smartphones, tablets, and other devices without the need for set-top boxes.
- In 2014, the signatories purchased more than 46 million set-top boxes, but in 2023, new purchases declined to only 5.4 million units.
- Over three-quarters of all purchases in 2023 were IP Non-DVR set-top boxes, a category that was not defined when the Agreement began. The weighted average power usage of these new IP Non-DVR devices in 2023 was only 24.3 kWh/year. By contrast, the primary concern of the Energy Advocates that led to the establishment of the Agreement were DVRs that at that time used an estimated 267 kWh/year.
- Purchases of DVRs have decreased significantly from 12.7 million in 2014 (27% of all purchases) to fewer than 366,000 in 2023 (only 7% of purchases) as service providers have shifted from deploying a DVR for each television, to whole-home DVR services that use one DVR per home or cloud DVR services that do not require the use of DVR set-top boxes at all.
- The percentage of U.S. televisions that are connected to a pay-TV set-top box has declined from 58% in 2016 down to 32% in 2023.<sup>6</sup>

Meanwhile, set-top boxes have not only become far fewer in number, but those that remain are much more energy efficient. The most significant improvement in 2023 occurred in the category which had the most purchases, Non-DVRs. Non-DVRs represented three-quarters of all set-top boxes purchased in 2023, and nearly 90% of Non-DVR purchases in 2023 were IP Non-DVRs. Because IP Non-DVRs tend to be lower powered than non-IP devices, the weighted average TEC for Non-DVR decreased by 28% in 2023 from the prior year and now has fallen by 74% from 2012 to 2023. Energy usage of the other two major categories of new set-top boxes has also declined over this period, as shown in Table ES-2 below.

**Table ES-2: Weighted Average Typical Energy Consumption (TEC) for Major Set-Top Box Categories**

Category	Weighted Average TEC (kWh/yr)		Percent Change in Weighted Average Pre-2013 to 2023
	Pre-2013 Stock	2023 Purchases	
DVR	267	128.9	-52%
Non-DVR	119	31.5	-74%
Thin Client	90	55.8	-38%

The Voluntary Agreement prescribes third-party verification testing of randomly selected set-top boxes from each service provider signatory in each reported category. The 2024 verification testing successfully confirmed that the energy use of each of the tested models is consistent with the levels reported by the signatories. The signatories’ performance in meeting their procurement commitments was

<sup>6</sup>CNN, *Cable companies are replacing ancient cable boxes with these tiny new gadgets* (January 18, 2024) (“Thirty-two percent of all TVs in the US have a set-top box,” citing Leichtman research), available at <https://www.cnn.com/2024/01/18/tech/cable-box-xumo/index.html> / Leichtman Research Group, 71% of TV households have a live pay-TV service (October 26, 2021), available at <https://www.leichtmanresearch.com/wp-content/uploads/2021/10/LRG-Press-Release-10-26-2021.pdf>

also validated through D+R's review of procurement data of all signatories and D+R's successful detailed audit of one randomly selected party's records.

In 2021, the signatories unanimously amended the Voluntary Agreement and extended its term for an additional four years through 2025 with new, more rigorous Tier 4 energy levels applicable to the 90% procurement commitment that went into effect January 1, 2023. This is the first report for the Tier 4 commitments. The signatories estimated at that time that by the end of the extended term of the agreement, the total energy used by set-top boxes in the United States would be only one-third of the energy used by set-top boxes in 2012 when the agreement was initially signed. That reduction objective has already been achieved as of the end of 2023. The Independent Administrator will continue to monitor these developments and publish these annual reports through the 2025 report, to be issued in 2026.

## OVERVIEW OF THE VOLUNTARY AGREEMENT

Cable, satellite, and telco service providers offer pay television to approximately 54 million U.S. households.<sup>7</sup> These services, historically, relied upon the use of customer-premises equipment, often referred to as set-top boxes, to make the services accessible to consumers' televisions. Each device contains hardware and software to receive television programming and related services from service providers and process it for home networks, display devices, and recording devices. The underlying delivery network and the types of service provided vary widely among service providers. As a result, set-top boxes are highly specialized equipment, and the devices change as the service providers introduce new services.

As with all electronic devices, set-top boxes must utilize power to operate. In aggregate, set-top boxes in the United States consumed an estimated 32 TWh of electricity in 2012, constituting 18% of residential consumer electronics electricity consumption and 2.2% of all residential electricity consumption.<sup>8</sup> To reduce the amount of energy consumed by set-top boxes while protecting rapid innovation and timely introduction of new features, the pay-TV industry crafted the [Voluntary Agreement for Ongoing Improvement to the Energy Efficiency of Set-Top Boxes](#). The Voluntary Agreement provides a framework for the pay-TV industry to deliver market-based energy-efficiency gains that keep pace with technological innovation. The signatories of the Voluntary Agreement represent all the major pay-TV service providers, equipment vendors, and related industry organizations in the United States. Combined, these companies reported providing multichannel video service to approximately 50.5 million American households in 2023, accounting for approximately 93% of the traditional live pay-TV market. An expanded Voluntary Agreement was launched in 2013 with the entry of the Natural Resources Defense Council (NRDC) and the American Council for an Energy-Efficient Economy (ACEEE) as "Energy Advocates" that monitor and participate in all aspects of the program. The revised Voluntary Agreement included additional energy-efficiency commitments, coverage of whole-home multi-service gateway devices, and expanded provisions for transparency and accountability.

The parties have twice unanimously extended the Voluntary Agreement, with the latest amendment extending its commitments through 2025. The most recent amendment defines more rigorous Tier 4 energy levels that went into effect at the beginning of 2023. The reductions in the new allowance levels are particularly significant for Internet Protocol (IP) Non-DVR set-top boxes, which represent approximately 75% of purchases in 2023. The Tier 4 base allowance for IP set-top boxes was reduced by 62.5%, from 40 kWh/year to 15 kWh/year, and several allowances for additional functionalities were also reduced, as listed in Table 12.

This report covers the first year (2023) in which the Tier 4 levels are in effect.

## Voluntary Agreement Objectives

The primary objective of the Voluntary Agreement is to continue improvements in the energy efficiency of set-top boxes without jeopardizing their intended uses and functionalities. Further, energy-efficiency improvements are expected to preserve or enhance the customer experience and be sufficiently flexible to adapt to technological innovations and market competition, while also improving functionality, offering service enhancements, and fostering rapid innovation.

In the first year of the Tier 4 energy levels, consumers saved more than \$3.4 billion and avoided 15.4 million metric tons of CO<sub>2</sub> emissions compared to the national set-top box energy use and related emissions from the base year of 2012.<sup>9</sup> These 2023 energy savings exceed the power generated by seven typical 500-megawatt coal-run power plants.<sup>10</sup>

<sup>7</sup>This figure is based on data provided by NCTA and CTA and does not include customer counts for third-party streaming services.

<sup>8</sup>Bryan Urban; Victoria Shmakova; Brian Lim; Kurt Roth, Energy Consumption of Consumer Electronics in U.S. Homes in 2013, Final Report to the Consumer Electronics Association (CEA\*), Fraunhofer USA Center for Sustainable Energy Systems (2014). This report estimated 31 TWh of use in 2013, which is consistent with the annual report's estimate of ongoing declines under the Voluntary Agreement since set-top boxes used 32 TWh in 2012.

<sup>9</sup>U.S. Environmental Protection Agency, *supra*, note 4.

<sup>10</sup>Scientific American, *supra*, note 2.

# Voluntary Agreement Signatories and Steering Committee

The current signatories and participants in the Voluntary Agreement are listed below. Each of these entities participates in the Steering Committee.

## Energy Advocates

- American Council for an Energy-Efficient Economy (ACEEE)
- Natural Resources Defense Council (NRDC)

## Cable Service Providers

- Altice USA
- Charter Communications (“Spectrum”)
- Comcast
- Cox Communications

## Satellite Service Providers

- AT&T/DIRECTV
- DISH Network

## Telco Service Providers

- AT&T
- Frontier
- Verizon

## Manufacturers

- CommScope<sup>11</sup>
- Sagemcom
- Vantiva

## Other Organizations

- Cable Television Laboratories (CableLabs)
- Consumer Technology Association (CTA)
- NCTA – The Internet & Television Association

The composition of the Steering Committee allows the Voluntary Agreement to offer a multi-stakeholder approach, while permitting rapid adjustments as the technological landscape changes.

The Voluntary Agreement obligates the Steering Committee to designate an Independent Administrator and publish an annual report. The Steering Committee designated D+R International, Ltd. as the Independent Administrator and Auditor in 2013, and D+R has continued in this role.

The Voluntary Agreement requires that the Steering Committee meet at least once annually. The Steering Committee convened on June 8 and July 20, 2023.

Representatives of the signatories have continued to provide updates to state and federal regulators and other stakeholders regarding the ongoing execution of the Voluntary Agreement.

<sup>11</sup>CommScope's set-top box division was purchased by Vantiva in January 2024. CommScope is participating in the preparation of this 2023 report, but will thereafter no longer appear as a separate signatory.



CTA and NCTA are required to provide the following two reports to the Independent Administrator, both of which were provided for this 2023 report:

- The estimated total number of U.S. residential multichannel video subscribers and the number served by service providers participating in the Voluntary Agreement during the reporting period (due by April 1 of each year); and
- Information on progress with respect to other energy-efficiency commitments (due by May 1 of each year).

## Service Provider Commitments

The primary service provider commitment is that at least 90% of its set-top box purchases will meet specified energy- efficiency levels. The original levels were replaced by Tier 2 levels in 2017, Tier 3 levels in 2020, and now Tier 4 levels in 2023. Service providers also commit to public posting of energy-efficiency information for consumers. Additional information on other service provider commitments is outlined in [Progress on Other Efficiency Commitments](#), below.

## Independent Administrator and Auditor Role

The Voluntary Agreement obligates the Steering Committee to designate an Independent Administrator and an Independent Auditor. The Steering Committee designated D+R as the Independent Administrator and Auditor in 2013. D+R has continued in this role since its appointment. Under the Voluntary Agreement, the Independent Administrator must aggregate and compile confidential procurement data submitted by service providers and assess whether there is substantial compliance with the service provider commitments. If these commitments are not met, the Independent Administrator initiates a remediation process following the procedures set out in the Voluntary Agreement. The Independent Administrator is required to publish its findings in an annual report. The 2023 Annual Report is the eleventh report published. D+R also oversees third-party lab verification of the energy use of selected models reported by each signatory and is required to conduct a random audit of one service provider's procurement figures each year. The 2023 procurement audit report is presented in Appendix C.

## New Feature Allowances

The Voluntary Agreement includes a process that enables new features to be deployed without advance notice or permission, so that companies can secure the competitive benefits of first-mover advantages and so that consumers are not delayed from accessing new features. At the same time, the process assures that such new features are promptly and transparently brought within the bounds of the Voluntary Agreement's commitments to energy efficiency.

If a service provider deploys a set-top box that includes a new feature with no allowance, and the presence of the feature causes the set-top box to exceed the allowable TEC, the new feature process permits the service provider to set and report an appropriate initial allowance based upon its best estimate of the amount of energy consumed by the new feature. No new feature allowances were submitted for the 2023 reporting period.

## INCREASED ENERGY EFFICIENCY OF SET-TOP BOXES

Table 1 demonstrates the continued progress made by the signatories in improving the energy efficiency of set-top boxes. The most significant improvement in 2023 occurred in the category which had the most purchases, Non-DVRs. Non-DVRs represented three-quarters of all set-top boxes purchased in 2023, and nearly 90% of Non-DVR purchases in 2023 were IP Non-DVRs. Because IP Non-DVRs tend to be lower powered than non-IP devices, the weighted average TEC for Non-DVR decreased by 28% in 2023 from the prior year and now has fallen by 74% from 2012 to 2023, as illustrated in Table 1 below.

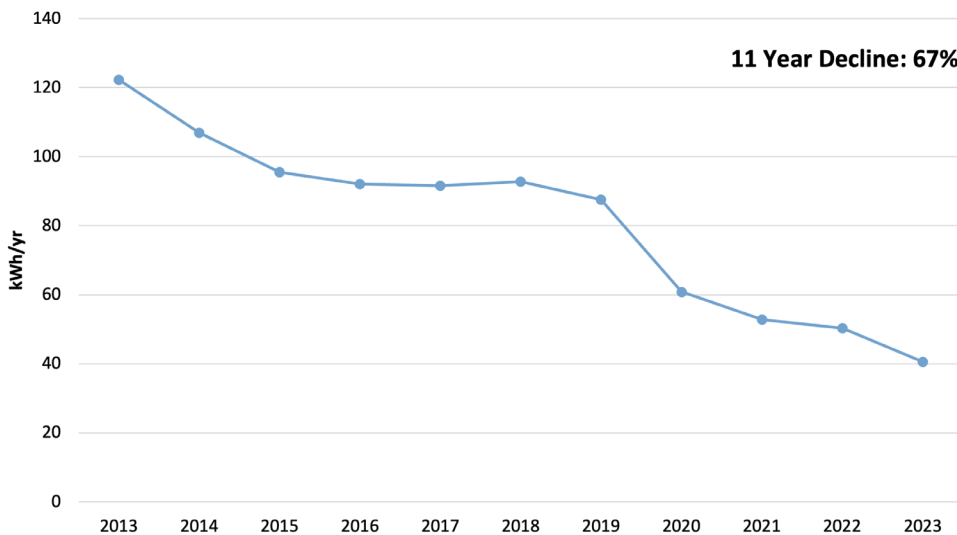
**Table 1: Weighted Average Typical Energy Consumption of New Purchases for Major Set-Top Box Categories**

Category	Weighted Average TEC of New Purchases (kWh/yr)												Percent Change in Weighted Average
	Pre-VA	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2012 to 2023
DVR	267	195.4	179.4	170.6	161.3	142.9	138.7	134.4	144.8	146.5	143.6	128.9	-52%
Non-DVR	119	108.6	103.3	92.6	85.6	90.8	91.8	74.1	49.0	42.5	44.0	31.5	-74%
Thin Client	90	51.4	50.0	49.1	46.9	44.3	45.4	45.4	48.0	47.6	49.1	55.8	-38%

DTAs were not purchased in 2023.

The weighted average of new DVRs purchased in 2023 decreased by more than 10% relative to 2022 purchases and has now fallen by more than half since the start of the Voluntary Agreement. More importantly, the number of DVRs continues to decline: as reported in the [Progress on Other Efficiency Commitments](#) section below, Non-DVR devices are replacing higher-energy DVR devices in facilitating whole-home entertainment systems that provide content to multiple devices without the need for multiple DVRs throughout the home. No new DTAs were purchased in 2023. Thin Client is the only category that shows a rise in average power consumption in 2023, which was caused by a shift toward devices that support Wi-Fi and 4K ultra-high definition television. However, in the big picture, the overall annual weighted average TEC of all set-top box purchases has declined by 67% since the start of the Voluntary Agreement, as shown in Figure 1 below. The decline from more than 122 kWh/year for the first reported purchases in 2013 to 40 kWh/ year corroborates the national energy consumption estimated savings of 68% over that same period as calculated below, since this metric is independent of stock estimates and subscriber count adjustments.

**Figure 1: Weighted Average TEC of Purchased Set-top Boxes by Year**



## REPORT ON PROCUREMENT COMMITMENTS

Under the Voluntary Agreement, the service providers committed that 90% of set-top boxes they purchased in 2023 would meet the Tier 4 efficiency levels. 2023 is the first year in which the Tier 4 procurement commitment has been evaluated, and the tenth year in which a procurement commitment is in force.

99.7% of all set-top boxes purchased by the service provider signatories in 2023 met the Tier 4 commitment levels. The total procurement figures for the reported categories of set-top boxes can be found in Table 2 below.

**Table 2: Set-Top Box Procurement by Set-Top Box Category in 2023**

Category	Units Procured*	Number Meeting Tier 4*	Percent Meeting Tier 4
DVR	387,936	387,936	100.0%
Non-DVR (Non-IP)	481,208	465,080	96.6%
Non-DVR (IP)	4,094,644	4,094,644	100.0%
Thin Client	495,948	495,948	100.0%
<b>Total</b>	<b>5,459,736</b>	<b>5,443,608</b>	<b>99.7%</b>

All of the service providers met the Tier 4 Voluntary Agreement procurement commitment in 2023.

The Voluntary Agreement prescribes that if a service provider signatory fails to meet a procurement commitment, it shall implement a remedial plan with new savings measures that offset the extra energy associated with the set-top boxes that caused it to miss its commitment. As previously reported, remediation plans have successfully been completed in each instance in prior years in which a signatory missed its procurement commitment.

## IMPACT ON NATIONAL ENERGY CONSUMPTION

In 2012, service providers began working with Energy Advocates to estimate the energy consumption of set-top boxes and the number of units installed in subscriber households. Using service provider and energy-efficiency advocate reports and data on product trends, the signatories developed the base case shown in Table 3, representing the market in 2012.

**Table 3: Base Case – 2012 Estimated Energy Consumption**

Segment	Category	TEC (kWh/yr)	Units (Millions)	National Energy Consumption (TWh/yr)	500 MW Power Plant Equivalents (Rosenfelds)
<b>Cable</b>	DVR	282	27	7.5	2.5
	Non-DVR	139	57	7.9	2.6
	Thin Client	90	2	0.1	0.0
	DTA	39	33	1.3	0.4
<b>Satellite</b>	DVR	283	21	5.9	2.0
	Non-DVR	110	58	6.4	2.1
<b>Telco</b>	DVR	140	6	0.8	0.3
	Non-DVR	90	21	1.9	0.6
<b>U.S. Total</b>		-	<b>225</b>	<b>32</b>	<b>10.6</b>

To gauge the Voluntary Agreement's impact on energy consumption at the national level, D+R estimates energy savings over the base case. The first step is to estimate changes in set-top box stock levels. Historically, under the terms of the Voluntary Agreement, D+R has used a model to estimate changes in the stock levels instead of collecting a census of deployed legacy equipment. However, to assure the accuracy of these reports, D+R collected comprehensive data from each signatory of their deployed inventory as of December 31, 2023. The 2023 stock data survey results were used for the 2023 national footprint estimate and included in Table 4 below. To estimate the inventory of all set-top boxes in the market, the stock data collected from signatories was scaled up by 1.07 to account for the percentage of the market covered by the signatories.

**Table 4: Estimates of Total Deployed Units in the Market from 2013-2023**

Category	Units*										
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
DVR	54,038,000	54,599,000	53,890,000	52,674,000	49,892,000	47,672,000	44,412,000	40,901,000	36,898,000	33,163,000	32,501,000
Non-DVR	130,344,000	122,650,000	112,668,000	96,327,000	92,563,000	89,139,000	83,572,000	77,440,000	80,206,000	74,417,000	62,671,000
Thin Client	10,561,000	20,299,000	28,774,000	39,784,000	34,958,000	32,447,000	28,625,000	25,208,000	21,797,000	19,003,000	20,697,000
DTA	31,633,000	31,543,000	31,396,000	30,866,000	29,722,000	29,074,000	28,683,000	27,494,000	15,718,000	14,478,000	6,577,000
<b>Total</b>	<b>226,576,000</b>	<b>229,092,000</b>	<b>226,727,000</b>	<b>219,651,000</b>	<b>207,135,000</b>	<b>198,331,000</b>	<b>185,293,000</b>	<b>171,043,000</b>	<b>154,619,000</b>	<b>141,060,000</b>	<b>122,447,000</b>

\*Units are rounded for this table, but D+R did not round any figures when calculating the national footprint estimate.

D+R notes that had it used its prior model instead of the new inventory data, its total energy usage estimate in this report for 2023 would have been 10.5 TWh, very close to the 10.3 TWh estimated by this report. The model accordingly has been demonstrated to be reliable and D+R plans to return to using it next year with the 2023 inventory data as its new starting point.

The next step in estimating national energy consumption is to account for products procured in 2023. The signatories purchased approximately 1,841,000 fewer set-top boxes in 2023 than in 2022 as shown in Table 5.

**Table 5: Total Signatory Set-Top Box Units Procured in 2014 and from 2021-2023**

Category	Total Units Procured				Percent Change
	2014	2021	2022	2023	2014 to 2023
DVR	12,710,777	759,555	442,828	387,936	-97%
Non-DVR	18,646,064	6,444,722	6,315,175	4,575,852	-75%
Thin Client	9,738,163	923,849	468,853	495,948	-95%
<b>Subtotal</b>	<b>46,296,336</b>	<b>8,176,366</b>	<b>7,300,716</b>	<b>5,459,736</b>	<b>-88%</b>

D+R assumes the 2023 set-top box procurements replace the oldest deployed units. This methodology yields multiple sets of stock (one for each purchase year) each with its own weighted average TEC values. The remaining stock estimates for each of the purchase year sets are shown in Table 6.

Multiplying the number of units purchased each year that remained in the field at the end of 2023 and the average TEC for that category of device at the time of its purchase produces the estimated national energy consumption shown in Table 6. Table 7 displays the results of this calculation year-over-year for the lifetime of the Voluntary Agreement.

**Table 6: 2023 National Energy Consumption Calculation**

Category	Pre-VA (before 2013)	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2023 National Energy Consumption (TWh)*
DVR Purchases from Each Year Remaining in Field	0	0	0	0	8,770,498	8,268,205	6,304,346	5,848,219	1,719,840	759,555	442,828	387,936	
DVR TEC Average (kWh/yr)	267.0	195.4	179.4	170.6	161.3	142.9	138.7	134.4	144.8	146.5	143.6	128.9	4.7
Non-DVR Purchases from Each Year Remaining in Field	0	0	0	0	1,021,105	15,390,556	10,066,928	8,319,044	10,537,923	6,444,722	6,315,175	4,575,852	
Non-DVR TEC Average (kWh/yr)	119.0	108.6	103.3	92.6	85.6	90.8	91.8	74.1	49.0	42.5	44.0	31.5	4.2
Thin Client Purchases from Each Year Remaining in Field	0	0	0	0	0	6,426,545	6,316,550	4,592,236	1,473,453	923,849	468,853	495,948	
Thin Client TEC Average (kWh/yr)	90.0	51.4	50.0	49.1	46.9	44.3	45.4	45.4	48.0	47.6	49.1	55.8	0.9
DTA Purchases from Each Year Remaining in Field	0	0	0	0	4,474,255	1,337,930	427,480	127,850	86,959	48,240	73,860	0	
DTA TEC Average (kWh/yr)	39.0	57.6	49.3	46.5	49.9	54.9	55.8	51.2	51.4	54.9	38.2	N/A	0.3
<b>Total 2023 National Energy Consumption (TWh)</b>													<b>10.3</b>

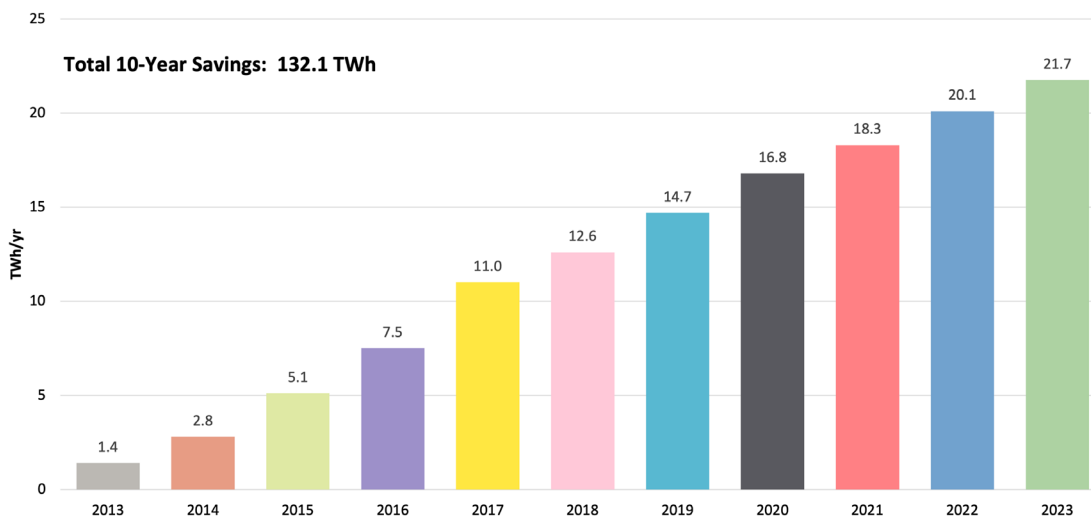
**Table 7: National Energy Consumption of Installed Set-Top Boxes 2012-2023**

	2012 (Pre-VA)	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
<b>Estimate of Total Deployed Units in the Market</b>	225,000,000	226,576,000	229,092,000	226,727,000	219,651,000	207,135,000	198,331,000	185,293,000	171,043,000	154,619,000	140,481,000	122,447,000
<b>National Energy Consumed (TWh/yr)</b>	32.0	30.6	29.2	26.9	24.5	21.0	19.4	17.3	15.2	13.7	11.9	10.3
<b>500 MW Power Plant Equivalents (Rosenfelds)</b>	10.6	10.2	9.7	9.0	8.2	7.0	6.5	5.8	5.1	4.6	4.0	3.4
<b>CO<sub>2</sub> Emitted (MMT)</b>	22.6	21.6	20.6	19.0	17.3	14.9	13.7	12.2	10.7	9.7	5.1	4.3

The significant decrease in Table 7 in the in estimated CO<sub>2</sub> emissions beginning in 2022 results in part from a change to the use of a new EPA formula for such calculations. In prior reports, D+R used the EPA Greenhouse Gas (GHG) conversion factor for “avoided” electricity consumption to estimate all CO<sub>2</sub> emissions associated with set-top boxes. In 2022, the EPA introduced a second GHG conversion factor that can be used to calculate CO<sub>2</sub> emitted from actual electricity usage that was not avoided. EPA’s reasoning for two separate conversion factors is that while energy efficiency improvements are generally assumed to first reduce demand for marginal power plants that are brought online as necessary to meet demand, baseline products are assumed to cause CO<sub>2</sub> emissions at the national average rate (which is lower because of renewable energy sources). Therefore, in this report, D+R continued to use EPA’s “avoided” conversion factor in Table ES-1 to estimate the CO<sub>2</sub> emissions avoided because of the Voluntary Agreement, but used EPA’s newer conversion factor in Table 7 to estimate the CO<sub>2</sub> associated with the pay-TV industry’s total energy footprint of deployed devices (but only for years 2022 and 2023 to align with the availability of EPA conversion data). Details about these conversion factors are available on [EPA’s GHG Calculator website](#).

The Voluntary Agreement has played an increasingly significant role in improving energy efficiency and reducing national energy consumption. The overall 21.7 TWh reduction in annual usage in 2023 compared to 2012 represents consumer savings of more than \$3.4 billion<sup>12</sup> and avoidance of over 15 million metric tons of CO<sub>2</sub> in 2023 alone.<sup>13</sup> As shown in Figure 2 below, during the eleven years of the Voluntary Agreement, cumulative energy consumption has declined by an estimated 132.1 TWh, saving consumers approximately \$18.3 billion and avoiding 93.4 million metric tons of CO<sub>2</sub> emissions. That CO<sub>2</sub> savings is the equivalent of removing approximately 21.9 million cars from the road for a year.<sup>14</sup>

**Figure 2: Annual Energy Saved by the Voluntary Agreement Procurement Commitments**



<sup>12</sup>U.S. Energy Information Administration, supra, note 3.

<sup>13</sup>U.S. Environmental Protection Agency, supra, note 4

<sup>14</sup>U.S. Environmental Protection Agency (EPA), Greenhouse Gas Equivalencies Calculator, <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results>.

## AUDIT AND VERIFICATION

### Procurement Audit

D+R is required to conduct an audit of one randomly selected service provider's procurement figures each year. The audit report for the 2023 reporting year is presented in Appendix C. D+R determined that the data submitted by the service provider for the audit is consistent with the annual report submitted by that service provider.

### Verification Testing

The Voluntary Agreement prescribes third-party verification testing of models chosen by the Independent Administrator. Every model tested measured within the applicable Tier 4 energy-efficiency levels, and 100% of the devices tested were at or below the values reported by the service providers. These results validate and support the findings in this report.

## PROGRESS ON OTHER ENERGY-EFFICIENCY COMMITMENTS

The Voluntary Agreement established other energy-efficiency commitments described below.

### Consumer Access to Energy-Efficiency Information

All service providers committed to provide subscribers and potential customers with reasonable access to energy-efficiency information for set-top boxes purchased since January 1, 2014. This information makes it easier for consumers to learn about energy-efficient set-top boxes and typical set-top box energy consumption. This information is posted on company websites from the links listed in Appendix B of this annual report and at [www.energy-efficiency.us](http://www.energy-efficiency.us), which offers a single site from which the public may conveniently link to each provider's information, the Independent Administrator's Annual Reports, the Voluntary Agreement, and related news and information. D+R again confirmed that this information is readily available to the public from the links listed in Appendix B of this report.

## Viewing Without Operator-Supplied Set-Top Boxes

All the service provider signatories are continuing to enable their customers to watch video programming without the use of operator-supplied set-top boxes through their support of apps. These apps can be used on hundreds of millions of consumer-owned Internet-connected devices, such as smartphones, tablets, personal computers, select smart TVs, game consoles, and low-power streaming devices such as Apple TV, Roku, Google Chromecast, and Amazon Fire. Nearly all U.S. TV households have at least one of these devices.

Signatories reported that the number of unique customer-owned and managed devices used to access video services via apps was approximately 42.7 million in 2023, a 16% decline from 2022. A 10% reduction in pay-TV subscribers was seen during the same period.

Table 8 lists the supported TV and other platforms and devices used by consumers to view each service provider's content using its app without operator-supplied set-top boxes in 2023. The table indicates whether the service provider's app on each platform supports access to linear (live TV) content, on demand content, and/or recording capability, which are among the features that help make apps an attractive alternative to a set-top box.

App usage can replace or reduce demand for set-top boxes in a variety of ways. For example, the use of apps to view pay-TV and other video content on televisions can render a set-top box unnecessary for that television. Many Smart TVs that use Samsung, LG, Roku, Android, or Amazon Fire operating systems can access select service provider apps without set-top boxes. Seventy-nine percent of American households now have at least one smart TV.<sup>15</sup> D+R reported last year that consumers use 88% of these smart TVs to access video directly without a set-top box or streaming device.<sup>16</sup> A new report found that nearly three-fourths of consumers turn first to apps and streaming video menus when watching video instead of live TV, up from less than half only a year before.<sup>17</sup>

App usage on other devices can replace set-top boxes as well. As described in prior reports, the viewing of video on smartphones and tablets is now ubiquitous in U.S. households. The use of these non-TV mobile devices to access video service provider apps inside the home reduces the demand for additional set-top boxes in additional rooms around the home. Set-top box usage has also declined as the number of subscribers to multichannel video services has decreased by more than 40% under the period covered by the Voluntary Agreement from 92 million in 2013 to 54 million in 2023. The continued decline in the number of traditional video subscribers combined with the increase in use of these alternative options to access video content has resulted in a sharp decrease in the percentage of U.S. televisions that are connected to a set-top box, from 58% in 2016 down to 32% in 2023.<sup>18</sup>

The combination of this decline and the significant improvement in the energy efficiency of the set-top boxes that remain in use has reduced the relevance of the set-top box category to national energy policy since the adoption of the Voluntary Agreement.

<sup>15</sup>Hub Entertainment Research, *Connected Home 2024* (April 2024), -- [Smart TVs Pass the 200 Million Milestone | TV Tech \(tvtechnology.com\)](https://www.tvtechnology.com/news/smart-tvs-pass-the-200-million-milestone)

<sup>16</sup>Annual Report, citing TV Technology, *Smart TV Ownership Rises to 76% of TV Households* (April 2023) (citing Hub Entertainment Research, *Connected Home 2023* (April 2023)), available at <https://www.hubresearchllc.com/reports/?category=2023&title=2023-connected-home>.

<sup>17</sup>Adtaxi, *Streaming TV Trends & Analysis* (Spring 2024), available at <https://digital.adtaxi.com/report/2402-mr-streamingtv>.

<sup>18</sup>CNN, *Cable companies are replacing ancient cable boxes with these tiny new gadgets* (January 18, 2024) ("Thirty-two percent of all TVs in the US have a set-top box," citing Leichtman research), available at <https://www.cnn.com/2024/01/18/tech/cable-box-xumo/index.html>.

**Table 8: Platforms and Apps Used by Customers to View Content Without Set-Top Boxes**

Service Provider	Platform	App Name	Live TV	On-Demand	DVR
			Yes / No		
Altice USA	Android	Altice One App	Yes	Yes	Yes
	Apple iOS	Altice One App	Yes	Yes	Yes
	Apple TV	Altice One App	Yes	Yes	Yes
	MAC	Altice One App	Yes	Yes	Yes
	PC	Altice One App	Yes	Yes	Yes
AT&T/DIRECTV	Amazon Fire TV	DIRECTV, U-Verse, DIRECTV Stream	Yes	Yes	Yes
	Amazon Kindle Fire HD	DIRECTV, U-Verse, DIRECTV Stream	Yes	Yes	Yes
	Android	DIRECTV, U-Verse, DIRECTV Stream	Yes	Yes	Yes
	Android TV	DIRECTV, DIRECTV Stream	Yes	Yes	Yes
	Apple iOS	DIRECTV, U-Verse, DIRECTV Stream	Yes	Yes	Yes
	Apple TV	DIRECTV, DIRECTV Stream	Yes	Yes	Yes
	Google Chromecast	DIRECTV, DIRECTV Stream	Yes	Yes	Yes
	MAC	DIRECTV, DIRECTV Stream	Yes	Yes	Yes
	PC	DIRECTV, DIRECTV Stream	Yes	Yes	Yes
	Roku	DIRECTV, DIRECTV Stream	Yes	Yes	Yes
	Roku TV	DIRECTV, DIRECTV Stream	Yes	Yes	Yes
	Samsung TV	DIRECTV Stream	Yes	Yes	Yes
Charter	Android	Spectrum TV	Yes	Yes	Yes
	Apple iOS	Spectrum TV	Yes	Yes	Yes
	Apple TV	Spectrum TV	Yes	Yes	Yes
	Google Chromecast	Spectrum TV	Yes	Yes	Yes
	MAC	Spectrum.net	Yes	Yes	Yes
	PC	Spectrum.net	Yes	Yes	Yes
	Roku	Spectrum TV	Yes	Yes	Yes
	Roku TV	Spectrum TV	Yes	Yes	Yes
	Samsung TV	Spectrum TV	Yes	Yes	Yes
	Xbox One	Spectrum TV	Yes	Yes	Yes
Comcast	Amazon Fire TV	Stream	Yes	Yes	Yes
	Amazon Kindle Fire HD	Stream	Yes	Yes	Yes
	Android	Stream	Yes	Yes	Yes
	Apple iOS	Stream	Yes	Yes	Yes
	Apple TV	Stream	Yes	Yes	Yes
	Google Chromecast	Stream	Yes	Yes	Yes
	LG TV	Stream	Yes	Yes	Yes
	MAC	Stream	Yes	Yes	Yes
	PC	Stream	Yes	Yes	Yes
	Roku	Stream	Yes	Yes	Yes
	Roku TV	Stream	Yes	Yes	Yes
	Samsung TV	Stream	Yes	Yes	Yes
	XClass TV	Stream	Yes	Yes	Yes
Cox	Android	Contour	Yes	Yes	Yes
	Apple iOS	Contour	Yes	Yes	Yes
	MAC	Contour	Yes	Yes	Yes
	PC	Contour	Yes	Yes	Yes



**Table 8: Platforms and Apps Used by Customers to View Content Without Set-Top Boxes (continued)**

Service Provider	Platform	App Name	Live TV	On-Demand	DVR
			Yes / No		
DISH	AirTV Mini	Sling	Yes	Yes	Yes
	Amazon Echo Show	Sling	Yes	Yes	Yes
	Amazon Fire Tablet	Sling	Yes	Yes	Yes
	Amazon Fire TV	Sling, Dish Anywhere	Yes	Yes	Yes
	Android OS	Sling, Dish Anywhere	Yes	Yes	Yes
	Android TV	Sling, Dish Anywhere	Yes	Yes	Yes
	Apple iOS	Sling, Dish Anywhere	Yes	Yes	Yes
	Apple TV	Sling	Yes	Yes	Yes
	Cox Contour Stream Player	Sling	Yes	Yes	Yes
	Google Chromecast	Sling	Yes	Yes	Yes
	Google Nest Hub	Sling	Yes	Yes	Yes
	LG Smart TV	Sling	Yes	Yes	Yes
	MAC	Sling.com, DishAnywhere.com	Yes	Yes	Yes
	PC	Sling.com, DishAnywhere.com	Yes	Yes	Yes
	Roku	Sling	Yes	Yes	Yes
	Roku Smart TV	Sling	Yes	Yes	Yes
	Samsung Smart TV	Sling	Yes	Yes	Yes
	TiVo Stream	Sling	Yes	Yes	Yes
	Vizio Smart TV	Sling	Yes	Yes	Yes
	Xbox	Sling	Yes	Yes	Yes
Xfinity Flex	Sling	Yes	Yes	Yes	
Xfinity X1	Sling	Yes	Yes	Yes	
Verizon	Amazon Fire TV	fios tv home	Yes	Yes	Yes
	Android	fios mobile	Yes	Yes	Yes
	Android TV	fios tv home	Yes	Yes	Yes
	Apple iOS	fios mobile	Yes	Yes	Yes
	Apple TV	fios tv home	Yes	Yes	Yes
	MAC	tv.verizon.com	Yes	No	No
	PC	tv.verizon.com	Yes	Yes	No
<b>Number of unique, customer-owned and managed devices that have accessed video services via apps during Reporting Period</b>			<b>42,667,331</b>		

## CONCLUSION

In 2023, 99.7% of set-top boxes purchased by the signatories met the Tier 4 energy-efficiency levels of the Voluntary Agreement. All service providers met the 90% procurement commitment under the Agreement.

National energy consumption of set-top boxes has declined from 32 TWh/year in 2012 to 10.3 TWh/year in 2023 under the Voluntary Agreement, a reduction of 68% even as the functionality of set-top boxes increased. Consumers have saved \$18.3 billion and 93.2 million metric tons of CO<sub>2</sub> emissions have been avoided. The savings have been confirmed year-by-year through an analysis of independent verification testing and procurement audits. The total energy footprint of set-top boxes in customers' homes used to access pay-TV services continues to decline as a result of improved energy efficiency, declining subscribership, and consumer use of apps as an alternative to set-top boxes.

## APPENDIX A: SET-TOP BOXES PURCHASED BY VOLUNTARY AGREEMENT SERVICE PROVIDER SIGNATORIES IN 2023

Table 9 lists the reported typical energy consumption (TEC) for each model of set-top box purchased by Service Provider signatories in 2023. These values are reported TEC, rather than calculated TEC. In the Voluntary Agreement, service providers have the option to publish a "reported TEC" that rounds up calculated TEC values for reporting purposes to account for production variances. Reported TEC figures in this Appendix are rounded up to the next one-tenth digit (e.g., 99.11 kWh/year would be rounded up to 99.2 kWh/year). Please note that the same model could have variances in TEC for several reasons, including differences in reported versus calculated TEC, enabling of different product features, and/or deployment of the device by service providers running different software. The Voluntary Agreement calculates the maximum allowable TEC for a product using the base-type allowances outlined in Table 10 and the feature allowances outlined in Table 11. Table 11 also includes descriptions of the features abbreviated in Table 10 in the "Claimed Allowances" column. The Voluntary Agreement sets forth rules for claiming feature allowances, so the column for claimed allowances lists only the features used when calculating the maximum allowable TEC for the specific product to qualify toward meeting the signatory's commitment.

The template used to collect the information reported in this Appendix is posted at <https://www.energy-efficiency.us>. The data submitted by service providers is subject to third-party lab verification and procurement audits as described in the report. An asterisk indicates models that have been evaluated through third-party verification testing in the current year and/or in previous years under the Voluntary Agreement.

**Table 9: Set-Top Boxes Procured by Voluntary Agreement Service Provider Signatories in 2023**

Service Provider	Base Type	Primary Function	Manufacturer	Model No.	Claimed Allowances	Reported Modal Power (W)		TEC (kWh/yr)	Meets Tier 4
						On	Sleep		
Altice USA	IP	Non-DVR	Sagemcom	CS 50001*	HNI, WiFi (n) LP, WiFi (ac) LP, HEVP	2.33	1.99	22.0	Yes
Altice USA	IP	Non-DVR	Apple	MN873LL/A	HNI, WiFi (n) LP, WiFi (ac) LP, HEVP	1.70	0.82	15.0	Yes
AT&T/DIRECTV	Satellite	DVR	DIRECTV	HR54-500*	APD (hrs), DVR, DVR-A, HNI, M-HNI, Multi-room, MS, MS-A	12.66	12.64	110.8	Yes
AT&T/DIRECTV	Satellite	DVR	DIRECTV	HS17-500*	APD (hrs), DVR, DVR-A, M-HNI, Multi-room, MS, MS-A, XCD, WiFi (ac) HP, WiFi Addl HP(2), UHD-4	19.48	18.34	163.6	Yes
AT&T/DIRECTV	Thin Client	Thin Client	DIRECTV	C71K-700	APD (hrs), HNI, M-HNI, HEVP, UHD-4	9.50	4.10	49.8	Yes
AT&T/DIRECTV	Thin Client	Thin Client	DIRECTV	C71KW-400 (GEM)*	HNI, WiFi (ac) LP, WiFi Addl LP(2), HEVP, UHD-4	6.69	5.91	58.0	Yes
Charter	Cable	Non-DVR	CommScope	110A*	APD (hrs), D3, D3 above 8x4(2), HEVP	12.78	11.80	110.0	Yes
Charter	Cable	Non-DVR	Humax	110H*	APD (hrs), D3, D3 above 8x4(2), HEVP	13.47	12.55	115.0	Yes
Charter	IP	Non-DVR	Apple	A2843*	HNI, WiFi (n) LP, WiFi (ac) LP, HEVP	2.91	0.80	20.0	Yes
Charter	IP	Non-DVR	Sercomm	SCXI11BEI*	HNI, WiFi (n) LP, WiFi (ac) LP, HEVP	3.43	2.00	26.0	Yes
Comcast	IP	Non-DVR	Sercomm	SCXI11AEI-BCO*	HNI, WiFi (n) LP, WiFi (ac) LP, HEVP, UHD-4	3.63	2.51	31.0	Yes
Comcast	IP	Non-DVR	Sercomm	SCXI11BEI-BCO*	HNI, WiFi (n) LP, WiFi (ac) LP, HEVP, UHD-4	2.98	2.49	28.0	Yes
Comcast	IP	Non-DVR	W-NEWEB	WNXI11AEI*	HNI, WiFi (n) LP, WiFi (ac) LP, HEVP, UHD-4	3.57	2.46	30.0	Yes
Cox	IP	Non-DVR	Sercomm	SCXI11BEI*	HNI, WiFi (n) LP, WiFi (ac) LP, HEVP	2.87	2.18	25.0	Yes
DISH	Thin Client	Thin Client	DISH	Wireless Joey 4*	APD (hrs), HNI, WiFi (ac) HP, WiFi Addl HP, HEVP, UHD-4	6.83	6.33	57.0	Yes
DISH	Satellite	Non-DVR	DISH	Wally*	APD (hrs), HEVP	8.10	7.80	70.0	No
DISH	Satellite	DVR	DISH	Hopper Duo*	APD (hrs), Adv Video-A, DVR, M-HNI, Multi-room, MS, WiFi (ac) LP, HEVP	14.33	13.94	124.0	Yes
DISH	Thin Client	Thin Client	DISH	Joey 4*	APD (hrs), HNI, M-HNI, HEVP, UHD-4	6.40	5.90	53.0	Yes
Verizon	Cable	DVR	CommScope	4100P2	APD (hrs), Adv Video-A, DVR, M-HNI, Multi-room, MS, MS-A, XCD, XCD-A, HEVP, UHD-4	19.70	15.50	147.0	Yes
Verizon	Cable	Non-DVR	CommScope	4100*	APD (hrs), HNI, WiFi (ac) HP, WiFi Addl HP(2), HEVP, UHD-4	8.80	6.00	60.0	Yes
Verizon	IP	Non-DVR	CommScope	F3544K49203*	APD (hrs), WiFi (n) LP, WiFi (ac) LP, HEVP, UHD-4	3.91	2.27	24.0	Yes
Verizon	Cable	DVR	CommScope	4100ATV*	Adv Video-A, DVR, M-HNI, Multi-room, MS, MS-A, XCD, XCD-A, HEVP, UHD-4	10.92	10.92	96.0	Yes

**Table 10: Set-Top Box Base Allowances**

Base Type (Use topmost if multiple apply)	Tier 4 Allowance (kWh/yr)
Cable (CBL)	45
Satellite (SAT)	50
Internet Protocol (IP)	15
Thin Client (TC)	25

Table 11 sets forth the features listed for set-top boxes and outlines the feature allowances under the now applicable Tier 4.

**Table 11: Set-Top Box Feature Allowances**

Feature	Description	Tier 4 TEC Allowance (kWh/yr)
Adv Video-A	Advanced Video Processing	8
APD (hrs)	Automatic Power Down (4 hrs)	-
D3	DOCSIS 3.0	40
D3 above 8x4	DOCSIS 3.0 above 8x4	11
DVR	Digital Video Recorder (DVR)	15
DVR-A	DVR Additional	10
HEVP	High Efficiency Video Processing	10
HNI	Home Network Interface	10
M-HNI	MoCA HNI	12
MS	Multi-stream	8
MS-A	Multi-stream Additional	8
Multi-room	Multi-room	20
UHD-4	Ultra High Definition - 4K	5
WiFi (ac) HP	WiFi (ac) HP	20
WiFi (ac) LP	WiFi (ac) LP	16
WiFi (n) LP	WiFi (n) LP	9
WiFi Addl HP	WiFi above 2x2 HP	3
WiFi Addl LP	WiFi above 2x2 LP	3
XCD	Transcoding Base	13
XCD-A	Transcoding Additional	5

\*APD (Automatic Power Down) is used to calculate TEC but does not have a specific allowance.

## APPENDIX B: CONSUMER ACCESS TO SET-TOP BOX ENERGY-EFFICIENCY INFORMATION

Set-top box energy information for consumers is available at [www.energy-efficiency.us](http://www.energy-efficiency.us), and for each service provider at the links below.

**Table 12: Links for Consumer Access to Energy-Efficiency Information**

Service Provider Signatory	Consumer information Location
Altice USA	<a href="https://energy.cablelabs.com/alticeusa/">https://energy.cablelabs.com/alticeusa/</a>
AT&T/DIRECTV	<a href="https://www.directv.com/content/dam/images/support/sf-pdf/DIRECTV-Receiver_Energy-Info.pdf">https://www.directv.com/content/dam/images/support/sf-pdf/DIRECTV-Receiver_Energy-Info.pdf</a>
Charter	<a href="https://www.spectrum.net/support/general/energy-usage-your-charter-equipment">https://www.spectrum.net/support/general/energy-usage-your-charter-equipment</a>
Comcast	<a href="https://www.xfinity.com/support/articles/set-top-box-energy-usage">https://www.xfinity.com/support/articles/set-top-box-energy-usage</a>
Cox Communications	<a href="https://www.cox.com/residential/support/conserving-energy-with-your-digital-box.html">https://www.cox.com/residential/support/conserving-energy-with-your-digital-box.html</a>
DISH	<a href="https://support.dish.com/products/receivers/energy-efficiency">https://support.dish.com/products/receivers/energy-efficiency</a>
Frontier	<a href="https://content.frontier.com/-/media/documents/helpcenter/tv/fiber-tv/set-top-box-equipment-efficiency.pdf">https://content.frontier.com/-/media/documents/helpcenter/tv/fiber-tv/set-top-box-equipment-efficiency.pdf</a>
Verizon	<a href="https://www.verizon.com/support/residential/tv/equipment/stb-dvr">https://www.verizon.com/support/residential/tv/equipment/stb-dvr</a>

## APPENDIX C: 2023 PROCUREMENT AUDIT REPORT

In 2012, the pay-TV industry signed a Voluntary Agreement with the goal of increasing the energy efficiency of set-top boxes, while protecting rapid innovation and timely introduction of new features. Signatories of the Voluntary Agreement include major manufacturers of set-top boxes and the largest cable, satellite, and telco service providers and leading Energy Advocates.

The Voluntary Agreement requires the service providers to submit annual procurement data to an Independent Administrator, who collects and analyzes the data, then publishes the findings in an annual report. Data from the individual service providers are aggregated for publication in the annual report to protect this highly confidential information. To verify the accuracy of the reported procurement data, the Voluntary Agreement requires a random audit of one service provider each year. In accordance with the confidentiality requirements of the Voluntary Agreement, the name of the service provider is not published.

D+R conducted an audit of the 2023 procurement data, which was used to develop the findings published in the 2023 Annual Report. D+R randomly selected the service provider by creating an Excel spreadsheet and using the “random” function, after excluding the signatory that was successfully audited last year in accordance with the terms of the Voluntary Agreement.

D+R requested raw data from the selected service provider to verify the procurement data submitted, which included invoice data and specification sheets. D+R determined that the data submitted by the service provider for the audit is consistent with the annual report submitted by that service provider.

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