



# 2018 Annual Report

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

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August 13, 2019

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## EXECUTIVE SUMMARY

In 2012, the pay television industry, led by NCTA - The Internet & Television Association and the Consumer Technology Association, 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 82.1 million U.S. video subscribers, accounting for 94.3% of the market in 2018. In 2013, leading energy efficiency advocates joined with the pay television industry in an expanded version of the Voluntary Agreement.

One of the requirements of the Voluntary Agreement is the publication of an annual report. This sixth annual report provides a summary of developments for the previous calendar year, 2018. Annual reports for the previous five years as well as this report can be found at <http://www.energy-efficiency.us>.

The Voluntary Agreement has reduced the national set-top box annual energy consumption from 32 TWh in 2012 to 19.4 TWh in 2018, a reduction of 39% over the life of the Agreement, even as functionality and features of set-top boxes have increased. This 12.6 TWh reduction is more power than is generated by four typical 500 megawatt coal-run power plants in a year.<sup>1</sup> Also, in 2018 alone consumers saved more than \$1.6 billion<sup>2</sup> and avoided 8.9 million metric tons of CO<sub>2</sub> emissions.<sup>3</sup>

During the six years of the Voluntary Agreement, cumulative energy consumption has been reduced by an estimated 40.4 TWh, saving consumers approximately \$5.15 billion and avoiding 28.6 million metric tons of CO<sub>2</sub> emissions. The energy saved during this six-year period is enough to power all homes in the entire state of Pennsylvania with electricity for a year.<sup>4</sup>

1 - 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/>.

2 - This calculation is based on national average energy cost of \$0.1289 per kWh. See U.S. Energy Information Administration, Electric Power Monthly, available at <https://www.eia.gov/outlooks/steo/report/electricity.cfm>.

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

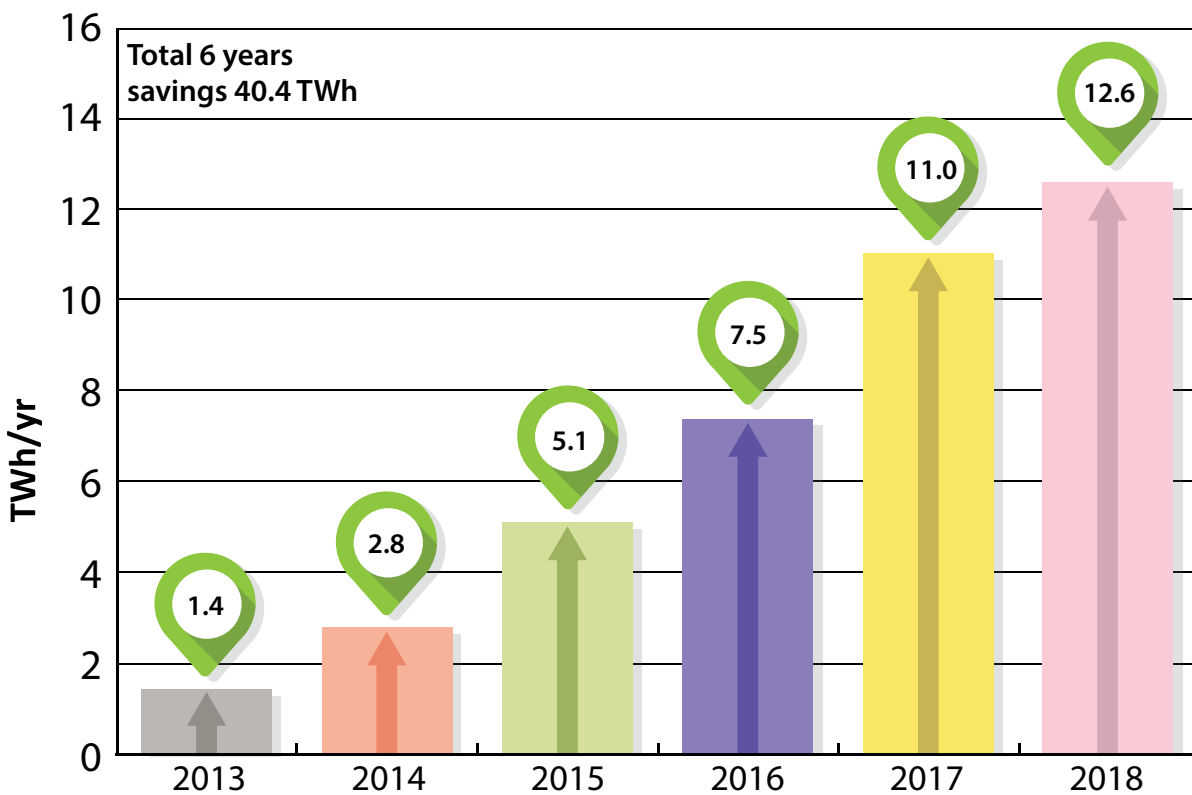
4 - 40.4 TWh is equivalent to the annual energy usage of 3,421,015 households and the annual electricity usage of 4,982,028 households. See <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>.

**Table ES-1: Voluntary Agreement Energy Savings 2013-2018**

	2013	2014	2015	2016	2017	2018	Lifetime of VA
National Energy Consumed (TWh/yr) Total	30.6	29.2	26.9	24.5	21.0	19.4	151.6
National Energy Saved (TWh/yr)	1.4	2.8	5.1	7.5	11.0	12.6	40.4
500 MW Power Plant Equivalents Saved (Rosenfelds)	0.47	0.93	1.70	2.50	3.67	4.20	13.47 <sup>a</sup>
Electricity Costs Saved (Dollars/yr)	\$169,820,000	\$350,560,000	\$645,150,000	\$941,250,000	\$1,417,900,000	\$1,624,140,000	\$5,148,820,000
CO <sub>2</sub> Avoided (Metric tons)	990,011	1,980,023	3,606,470	5,303,633	7,778,661	8,910,103	28,568,900

<sup>a</sup>The electricity generated by a typical 500 MW power is measured in Rosenfelds, which represents annual electricity output. Even at the 2012 peak, set-top boxes used 10.67 Rosenfelds annually, and that figure declined to 6.47 Rosenfelds in 2018. The Agreement has not replaced annual demand of 13 distinct power plants.

**Figure ES-1 Annual Energy Saved by the Voluntary Agreement Procurement Commitments**



These savings are driven primarily by the service providers' commitment to procure energy-efficient set-top boxes. Under the Voluntary Agreement, 90% of new set-top boxes procured by service providers after December 31, 2016 must meet the efficiency levels referred to as "Tier 2" in the Voluntary Agreement, replacing the Tier 1 levels that became effective in 2014. This report is the second in which the Tier 2 levels were in effect. In 2018, 97.7% of service providers' set-top box purchases met the Tier 2 levels, thereby meeting the procurement commitments in the Voluntary Agreement, and all service providers met the 90% commitment individually.<sup>5</sup> Contributing to the increase in savings is the fact that service providers met the more rigorous Tier 3 levels in 78.1% of set-top boxes procured in 2018, two years ahead of the effective date of Tier 3 in 2020, according to D+R's calculations and verified test results.

5 - As set forth below, this calculation is based on 2018 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.

The procurement of energy-efficient set-top boxes under the Voluntary Agreement has resulted in a substantial decrease in average energy consumption by the major types of set-top boxes. In particular, the new-unit average power usage of the most energy-intensive type of set-top box, the DVR, has fallen by 48% since 2012, and the number of DVR devices in DVR homes has declined through support for whole-home and/or cloud DVR offerings. In addition, the energy usage of each of the other two major categories of set-top boxes have also fallen sharply over that time, as shown in Table ES-2.

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

Category	TEC (kWh/yr)		Percent Change in Weighted Average
	Pre-VA (Existing Stock)	2018 Stock	
	Weighted Average		Pre-VA to 2018
<b>DVR</b>	267	138.71	-48%
<b>Non-DVR</b>	119	91.76	-23%
<b>Thin Client</b>	90	45.39	-50%

DTAs and Multi-Service Gateways were each purchased only by one service provider in 2018 in relatively small quantities.

Another major trend of note in 2018 is the continued decline in the number of new set-top boxes. The signatories purchased only 23 million new set-top boxes in 2018, half of the 46 million new set-top boxes they purchased during the first year of the Voluntary Agreement’s commitments in 2014. This decline is likely attributable to a mix of factors, including subscriber losses and the increasing prevalence and usage of options for customers to watch their programming using apps rather than through an operator-supplied set-top box. Consumers used more than 36 million customer-owned and managed devices such as Smart TVs, smartphones, tablets, personal computers, and streaming devices such as Apple TV, Roku, Google Chromecast and Amazon Fire to access the providers’ video services via apps in 2018, up by 33% from 27 million in 2017. The service provider signatories are continuing to work to enhance the functionality of their apps such as through new support for cloud DVR offerings, and investing in customer education and employee training to promote the use and awareness of apps. The growth in adoption of energy-efficient app streaming solutions further reduces the overall energy used by the signatories’ set-top boxes.

The Voluntary Agreement contains additional commitments and verification tools, including deployment of automatic power down and whole-home systems, efforts to improve energy efficiency in future-generation equipment, posting of information for consumers and other stakeholders at [www.energy-efficiency.us](http://www.energy-efficiency.us) and on company websites, verification testing of randomly-selected set-top boxes from each reported category, and an audit of a randomly-selected service provider’s set-top box procurements. The signatories’ satisfaction of all of these commitments are summarized in Table 9 in Appendix A of this report.

All of the verification results support the overall findings of this report that the signatories met their commitments in 2018. The audit of the randomly-selected signatory verified its reported data, and 100% of the verification testing results were within the accepted tolerances of the measurements reported by the companies. The details of the verification results and an update on each of these measures are presented in the full report below.

The Voluntary Agreement prescribes that if a service provider signatory fails to meet a procurement commitment, it shall implement a remedial plan approved by a review panel that includes the Energy Advocates 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, one service provider missed its procurement commitment in 2017. The review panel continues to oversee the implementation of this party's remedial plan that is expected before the end of 2019 to secure ongoing savings of the required offset of more than 7 million kWh/year. The service provider will be providing quarterly updates to the review panel until the review panel is satisfied that the required energy savings are achieved.

As part of the revised Voluntary Agreement, the largest service provider signatories committed to engage directly with their supply chains, including component suppliers, to explore approaches in 2018 to further improve the energy efficiency of set-top boxes in all power states in advance of starting discussions in late 2019 to develop proposed Tier 4 energy levels. These service providers had extensive meetings and engagement with key suppliers and the Energy Advocates in 2018 to study further improvements in key components and power scaling, and expect to achieve further new efficiencies in the 2020s as a result.

Under the extension of the Voluntary Agreement, the Independent Administrator will continue to monitor these developments and publish these annual reports through the 2021 report to be issued in 2022.

## OVERVIEW OF THE VOLUNTARY AGREEMENT

Cable, satellite, and telco service providers offer pay television to approximately 87.1 million U.S. households using customer premises equipment, often referred to as set-top boxes.<sup>6</sup> Each device contains hardware and software to receive television programming and related services from service providers and process them 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 operate as highly specialized components, and the devices change frequently as the service providers introduce new services.

All set-top boxes have one thing in common: they require 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>7</sup> To reduce the amount of energy consumed by set-top boxes while protecting rapid innovation and timely introduction of new features, the pay television 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 television industry to deliver market-based energy efficiency gains that keep pace with technological innovation. The signatories of the Voluntary Agreement represent all of the major pay-TV service providers, equipment vendors, and related industry organizations in the United States. Combined, these companies provided multichannel video service to approximately 82.1 million American households in 2018, accounting for 94.3% of the market.<sup>8</sup> This figure represents an increase from 93.1% in 2017, with the increase mostly attributable to the addition of the Suddenlink systems owned by signatory Altice USA.

After extensive negotiations among the initial signatories and energy efficiency advocates, an expanded Voluntary Agreement was launched in 2013. The Natural Resources Defense Council (NRDC), the American Council for an Energy-Efficient Economy (ACEEE), the Appliance Standards Awareness Project (ASAP), the Consumer Technology Association (CTA), and NCTA - The Internet & Television Association announced this expansion in December 2013. The revised Voluntary Agreement included additional energy efficiency commitments, coverage of whole-home multifunction gateway devices, expanded provisions for transparency and accountability, and participation by energy efficiency advocates in the Steering Committee for the Voluntary Agreement.

That version of the Voluntary Agreement expired at the end of 2017. In March 2018, the signatories unanimously amended the Voluntary Agreement and extended its term for an additional four years through the end of 2021. The revised Voluntary Agreement includes new, more rigorous Tier 3 energy levels that will become applicable to the 90% procurement commitment in 2020. The signatories have estimated that these new levels are 20% more efficient, on average, than the current Tier 2 levels and will save consumers an additional \$600 million annually once the benefits of the Tier 3 commitments are fully realized. Service providers have demonstrated they are already on track to meet these Tier 3 commitments, with 78.1% of devices procured in 2018 meeting Tier 3 levels two years early, according to D+R's calculations which are supported by verification testing. The four largest service provider signatories also agreed to engage directly with their supply chains, including component suppliers, to explore approaches to further improve the energy efficiency of set-top boxes in all power states in advance of starting discussions in late 2019 to develop proposed levels for a Tier 4. These service providers had extensive meetings and engagement with key suppliers and the Energy Advocates in 2018 to study further improvements in key components and power scaling, and expect to achieve further new efficiencies in the 2020s as a result.

6 - Based on data provided by NCTA and CTA.

7 - 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.

8 - See supra note 6.



## 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.

The signatories originally estimated that consumers would save at least \$1 billion annually in energy costs several years after the 2017 effective date of Tier 2, once Tier 2 set-top boxes had largely replaced the set-top boxes in use in 2012. That objective has been surpassed, with more than \$1.6 billion in annual savings estimated in 2018.<sup>9</sup> These 2018 energy savings exceed the power generated by four typical 500 megawatt coal-run power plants<sup>10</sup> annually and will avoid 8.9 million metric tons of CO<sub>2</sub> emissions per year.<sup>11</sup>

## 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 Efficiency Advocates

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

### Cable Service Providers

- Altice
- Charter
- Comcast
- Cox Communications

### Satellite Service Providers

- AT&T/DIRECTV
- DISH Network

### Telco Service Providers

- AT&T
- CenturyLink
- Frontier
- Verizon

9 - See supra note 2. This calculation is based on national average energy cost of \$0.1289 per kWh. See U.S. Energy Information Administration, Electric Power Monthly, available at <https://www.eia.gov/outlooks/steo/report/electricity.cfm>.

10 - See supra note 1. 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. See <https://www.scientificamerican.com/article/rosenfeld-energy-savings/>.

11 - See supra note 3. Emission reduction estimates in this report are based on the U.S. Environmental Protection Agency's Greenhouse Gas Equivalencies Calculator, available at <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>.

## Other Organizations

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

Effective January 1, 2019, Altice USA (the parent company of the original signatory Cablevision) joined the Voluntary Agreement, which had the effect of bringing into the Voluntary Agreement the cable systems operated by another of Altice's subsidiaries, Suddenlink Communications in addition to its Cablevision/Optimum system that already participated in the Agreement. Suddenlink was previously the largest non-participating pay-TV provider in the United States, so its admission has meaningfully increased the percentage of U.S. consumers covered by the Agreement to more than 94%. Suddenlink's systems previously used a different mix of set-top boxes than Altice's Cablevision system, but in connection with its entry into the Agreement, Altice committed to accelerate the deployment in its Suddenlink systems of the more energy-efficient equipment used in its Cablevision system.

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

In 2018, in accordance with their commitments, representatives of the signatories provided updates to state and federal regulators and other stakeholders regarding the ongoing execution of the Voluntary Agreement.

Additional responsibilities of the Steering Committee include the following:

- Managing the Voluntary Agreement
- Hiring the Independent Administrator
- Reviewing proposals for energy allowances based on new features, which the Steering Committee can approve, reject, or add to the Voluntary Agreement, as appropriate
- Evaluating the effectiveness of the Voluntary Agreement in achieving its purposes
- Adopting new or revised efficiency measures, courses of action, and amendments to the Voluntary Agreement as technologies advance

In accordance with their obligations under the Voluntary Agreement, CTA and NCTA provided the following two reports to the Independent Administrator for 2018:

- 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, beginning in 2014).
- Information on progress with respect to other energy efficiency commitments (due by May 1 of each year, beginning in 2014).

## 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 a more rigorous Tier 2 set of levels for devices purchased after December 31, 2016. This is the second annual report in which the Tier 2 levels were in effect. Progress on these commitments is discussed in Report on Procurement Commitments, below. Service providers also made commitments relating to automatic power down, whole-home systems, engagement with the Energy Advocates and key vendors to explore approaches to further improve the energy efficiency of set-top boxes in all power states in the 2020s, a report on additional satellite-delivery customer premises equipment, and public posting of energy efficiency information for consumers. Additional information on these commitments is outlined in Progress on Other Energy Efficiency Commitments, below. All service provider commitments are outlined in Appendix A.

## 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 remedial process following the procedures set out in the Voluntary Agreement. The Independent Administrator is required to publish its findings in an annual report. This is the sixth annual report. D+R is also required to conduct a random audit of one service provider's procurement figures each year. The 2018 audit report presented in Appendix D concluded that the service provider data supported this report's conclusion of substantial compliance with its commitments.

## New Feature Allowances

The Tier 2 levels were adopted in 2013, long before they first became effective in 2017. To assure that the Voluntary Agreement did not deprive consumers of the benefits of innovation, the Tier 2 program includes a process for establishing allowances for new energy-efficient features. This process 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. One new feature allowance was proposed in 2019, for set-top boxes with embedded cable modems with up to twenty-four downstream DOCSIS channels (the current allowance covers up to eight downstream channels). The Steering Committee has convened a subcommittee to review this allowance and has indicated that it intends to establish an initial allowance and effective date by the end of this year.

## INCREASED ENERGY EFFICIENCY OF SET-TOP BOXES

Table 1 highlights the progress made by the signatories in improving the energy efficiency for each set-top box product category.

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

Category	TEC (kWh/yr)							Percent Change in Weighted Average					
	Pre-VA (Existing Stock)	Procurement Data											
		Weighted Average											
	Weighted Average	2013	2014	2015	2016	2017	2018	2012 to 2018	2013 to 2018	2014 to 2018	2015 to 2018	2016 to 2018	2017 to 2018
DVR	267	195.37	179.39	170.61	161.28	142.90	138.71	-48%	-29%	-23%	-19%	-14%	-3%
Non-DVR	119	108.55	103.27	92.57	85.61	90.83	91.76	-23%	-15%	-11%	-1%	7%	1%
Thin Client	90	51.42	49.98	49.13	46.91	44.33	45.39	-50%	-12%	-9%	-8%	-3%	2%
DTA <sup>a</sup>	39	57.60	49.26	46.50	49.91	54.86	55.85	43%	-3%	13%	20%	12%	2%

<sup>a</sup>While the increase in DTA power has previously been explained by the addition of HD and advanced video processing (AVP) capabilities after 2012, the continued increases in recent years and the fact that only 71% of 2018 DTA purchases met Tier 2 could potentially be a cause for concern if DTA purchases were continuing at high levels. However, DTA purchases have declined by 95%, from 9.2 million in 2015 to 427,480 in 2018. Since DTAs use relatively little power and are being purchased only in small and declining quantities, the change in new DTA power has only a very small effect on national energy consumption.

The continuation in 2018 of the small increase in energy consumption in the non-DVR category seen in 2017 after the downward trend in previous years is likely attributable to new functionalities such as Ultra High Definition 4K Video, High Efficiency Video Processing, and multiple tuners to stream live video to client devices.

One service provider, Altice (the parent company of Cablevision), reported the purchase of a single model of a multi-service gateway in 2017 and 2018 that met the applicable Tier 2 levels, as noted in Appendix B. The multi-service gateway category is excluded from the above table because there is no baseline with which to compare these devices and no change between 2017 and 2018 since the model is the same. In accordance with the confidentiality requirements of the Voluntary Agreement, this report also excludes multi-service gateways from all calculations showing the number of units purchased by category because that figure would reveal Altice's individual purchase figures.<sup>12</sup> The model is reported in Appendix B and meets the applicable Tier 2 levels, and the relatively small quantity purchased would not have a material impact on this report's assessment of the overall national energy consumption of set-top boxes.

## REPORT ON PROCUREMENT COMMITMENTS

Under the Voluntary Agreement, the service providers committed that 90% of set-top boxes they purchased after December 31, 2016 would meet the Tier 2 efficiency levels. This is the second year in which this Tier 2 procurement commitment has been evaluated, and the fifth year in which the procurement commitment is in force. All service providers that signed the Voluntary Agreement submitted procurement data for 2018 on time. These providers are: Altice, AT&T (separately for AT&T/DIRECTV and its U-verse telco services), Charter, Comcast, Cox, CenturyLink, DISH, Frontier, and Verizon. Details about the set-top boxes purchased by these providers are shown in Appendix B. 97.7% of the set-top boxes purchased by these service providers met the Tier 2 commitment, as shown in Table 2 below.

<sup>12</sup> - Section 8.6 of the Voluntary Agreement seeks to protect the confidentiality of Altice's procurement figures by precluding this report from disclosing the number of Multi-Service Gateway units it purchased in 2018, which could readily be deduced if a total national figure were reported.

**Table 2: Voluntary Agreement Signatory Set-Top Box Procurement 2018**

Category	Units		Percent Meeting Tier 2
	Total Procured	Number Meeting Tier 2 <sup>a</sup>	
DVR	6,304,346	6,133,497	97.3%
Non-DVR	10,066,928	9,837,380	97.7%
Thin Client	6,316,550	6,316,550	100.0%
DTA	427,480	302,400	70.7%
<b>Totals</b>	<b>23,115,304</b>	<b>22,589,827</b>	<b>97.7%</b>

<sup>a</sup>In 2018, all reported Multi-Service Gateway devices met Tier 2 levels.

All service providers met the Voluntary Agreement procurement commitment in 2018.

The service provider that missed its 2017 procurement proposed a remedial plan to offset the extra energy associated with its 2017 deployments that exceeded the commitment level, as required by the Agreement.<sup>13</sup> D+R calculated that the provider needs to offset more than 7 million kWh/year under this standard. Remediation plans must be approved by a unanimous vote of a review panel that includes the Energy Advocates and the two trade association members of the Steering Committee. The service provider's first remediation proposal was not accepted, but its second proposal was unanimously approved and remediation efforts remain ongoing under the plan. The service provider will be providing quarterly updates to the review panel until the energy savings target is achieved, which it expects to occur by the end of 2019. Further details of the plan are not included in this report because they would reveal the identity of the service provider.

## IMPACT ON NATIONAL ENERGY CONSUMPTION

In 2012, service providers began working with energy efficiency 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	Units	National Energy Consumption	500 MW Power Plant Equivalents
		kWh/yr	Millions	TWh/yr	Rosenfelds
Cable	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
Satellite	DVR	283	21	5.9	2.0
	Non-DVR	110	58	6.4	2.1
Telco	DVR	140	6	0.8	0.3
	Non-DVR	90	21	1.9	0.6
<b>U.S. Total</b>		<b>-</b>	<b>225</b>	<b>32</b>	<b>10.6</b>

13 - As previously reported, one service provider fell short of its procurement commitment in 2017, with only 71% of its purchases meeting Tier 2 due to a delay in the availability of its Tier 2 solution until after the start of 2017.

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. Under the terms of the Voluntary Agreement, D+R does not collect a census of deployed legacy equipment. Instead, it has employed a model that assumes that newly purchased devices generally replace older (less energy-efficient) and broken equipment from the same category rather than add to total deployed stock.<sup>14</sup> However, the total deployed stock estimate is adjusted to account for changes in subscriber levels as shown in Table 4 below.

**Table 4: Change in Subscribers from 2012-2018**

Segment	Percent Change <sup>a</sup>						
	2012 to 2013	2013 to 2014	2014 to 2015	2015 to 2016	2016 to 2017	2017 to 2018	2012 to 2018
Cable	-4.5%	-0.3%	-0.5%	-1.7%	-3.7%	-2.2%	-12.3%
Satellite	1.0%	0.1%	-1.9%	3.0%	-9.2%	-7.5%	-14.3%
Telco	25.4%	8.2%	-0.9%	-20.9%	2.0%	-3.5%	4.7%

<sup>a</sup>Based on data provided by the Steering Committee (for 2012) and service providers (for 2013-2018).

As a result of the changes in subscribership levels and replacement assumptions, D+R estimates total stock levels as shown in Table 5.

**Table 5: Estimates of Total Deployed Units in the Market in 2013-2018**

Category	Units					
	2013 <sup>a</sup>	2014 <sup>a</sup>	2015 <sup>a</sup>	2016 <sup>a</sup>	2017 <sup>a,b</sup>	2018 <sup>a,b</sup>
DVR	54,038,000	54,599,000	53,890,000	52,674,000	49,892,000	47,672,000
Non-DVR	130,344,000	122,650,000	112,668,000	96,327,000	92,563,000	89,139,000
Thin Client	10,561,000	20,299,000	28,774,000	39,784,000	34,958,000	32,447,000
DTA	31,633,000	31,543,000	31,396,000	30,866,000	29,722,000	29,074,000
<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>

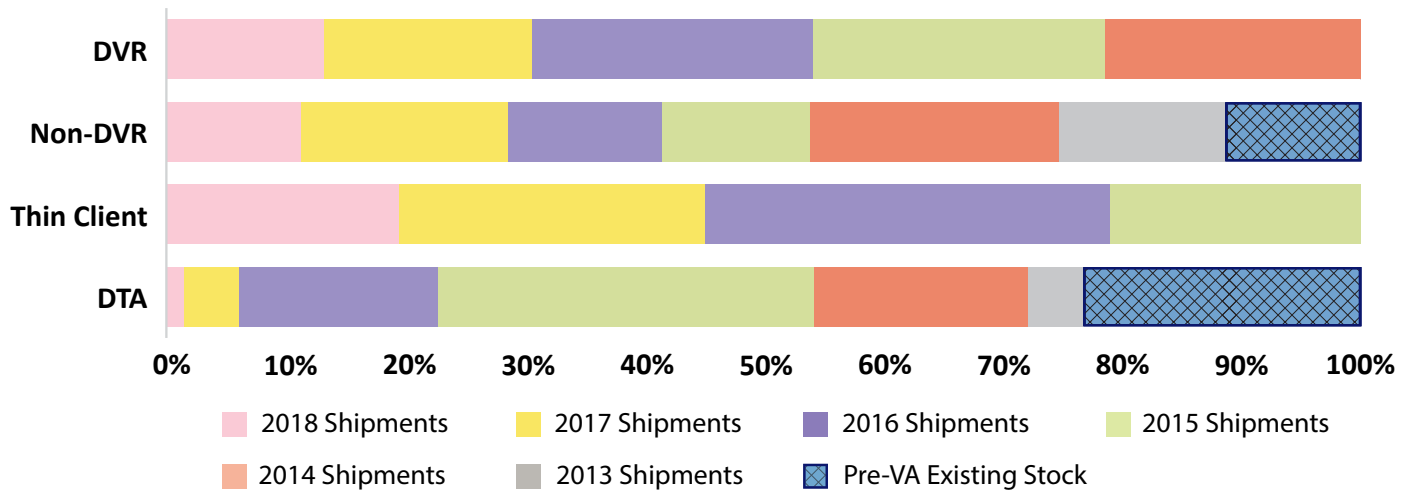
<sup>a</sup>Units are rounded for this table, but D+R did not round any figures when calculating the national footprint estimate.

<sup>b</sup>Altice's Multi-Service Gateways purchased in 2017 and 2018 are excluded from this table. See supra note 12.

The next step in estimating national energy consumption is to account for products procured in 2018. The signatories purchased nearly 10 million fewer set-top boxes in 2018 than in 2017, likely due at least in part to a decline in subscribership and also to the increasing prevalence and usage of options for customers to watch their programming without a set-top box, as discussed below. D+R subtracts 2018 set-top box procurements from the total units listed in Table 6, using the new replacement assumptions described above. This methodology yields multiple sets of stock – one for each purchase year – each with its own weighted average TEC values. The weighted average TEC values for each of the purchase year sets are shown in Figure 1.

14 - From 2013 to 2016, purchases of thin clients were assumed to replace non-DVRs since this category was relatively new to the market. It is now more reasonable to assume that thin clients are generally replacing like devices, rather than non-DVRs, since the earlier generations of these categories of set-top boxes have reached replacement age.

**Figure 1: Distribution of Current Inventory by Year of Procurement (Percentage of Units)**



Multiplying the number of units purchased each year that still remained in the field at the end of 2018 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 this calculation year over year for the lifetime of the VA.

**Table 6: National Energy Consumption for Devices Based Upon Year of Purchase**

Category	Pre-VA (before 2013)	2013	2014	2015	2016	2017	2018	2018 National Energy Consumption (TWh/yr)
DVR Purchases from Each Year Remaining in Field	0	0	10,207,886	11,671,180	11,219,933	8,268,205	6,304,346	
DVR TEC Average (kWh/yr)	267.0	195.4	179.4	170.6	161.3	142.9	138.7	7.7
Non-DVR Purchases from Each Year Remaining in Field	10,162,478	12,360,006	18,646,064	10,977,499	11,535,694	15,390,556	10,066,928	
Non-DVR TEC Average (kWh/yr)	119.0	108.6	103.3	92.6	85.6	90.8	91.8	8.8
Thin Client Purchases from Each Year Remaining in Field	0	0	0	6,832,030	11,010,506	8,287,414	6,316,550	
Thin Client TEC Average (kWh/yr)	90.0	51.4	50.0	49.1	46.9	44.3	45.4	1.5
DTA Purchases from Each Year Remaining in Field	6,771,048	1,334,238	5,201,332	9,169,913	4,831,980	1,337,930	427,480	
DTA TEC Average (kWh/yr)	39.0	57.6	49.3	46.5	49.9	54.9	55.8	1.4
<b>Total 2018 National Energy Consumption (TWh/yr)</b>								<b>19.4</b>

**Table 7: National Energy Consumption of Installed Set-Top Boxes 2012-2018**

	2012 (Pre-VA)	2013	2014	2015	2016	2017	2018
Estimate of Total Deployed Units in the Market	225,000,000	226,576,000	229,092,000	226,727,000	219,651,000	207,135,000	198,331,000
National Energy Consumed (TWh/yr)	32.0	30.6	29.2	26.9	24.5	21.0	19.4
500 MW Power Plant Equivalents (Rosenfelds)	10.67	10.20	9.73	8.97	8.17	7.00	6.47
CO <sub>2</sub> Emitted (Metric Tons)	22,628,832	21,638,821	20,648,809	19,022,362	17,325,200	14,850,171	13,718,729

These improvements in energy efficiency spurred by the Voluntary Agreement have had an increasingly significant role in reducing national energy consumption. The Voluntary Agreement reduced national set-top box energy consumption from 32 TWh/year in 2012 to 19.4 TWh/year in 2018, which is a reduction of 39%. This 12.6 TWh reduction represents consumer savings of over \$1.6 billion<sup>15</sup> and avoidance of 8.9 million metric tons of CO<sub>2</sub> in 2018 alone.<sup>16</sup> During the six years of the Voluntary Agreement, cumulative energy consumption has been reduced by an estimated 40.4 TWh, saving consumers approximately \$5.15 billion and avoiding 28.6 million metric tons of CO<sub>2</sub> emissions.

15 - See supra note 2.

16 - See supra note 3.



## 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 2018 reporting year is presented in Appendix D. 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

2018 marks the first year in which lab verification testing replaced the historical field verification testing program. The objective of lab verification testing is to compare tested energy usage determined by an accredited, independent third party to the modal power and annual energy use values reported by the service providers to the Independent Administrator and to the energy levels applicable to the procurement commitment. The verification testing program requires the Independent Administrator to randomly select one model from each category of set-top boxes reported by service providers to be tested by an accredited third-party approved by the Steering Committee, or under a supervised signatory testing program with an accredited observer approved by the Steering Committee. As demonstrated below, the 2018 test results submitted by service providers to D+R confirmed that the energy usage of service providers' set-top boxes observed by the independent third parties is consistent with the energy information provided to consumers and is in substantial compliance with the procurement commitments of the Voluntary Agreement.

The verification test results are measured in two ways: against the Voluntary Agreement's energy allowances and also against the energy levels reported by the service providers. The first measurement assures compliance with the Voluntary Agreement's procurement commitment, and the second assures the accuracy of the savings calculations included in this report, as well as the accuracy of figures reported to consumers. One hundred percent (100%) of tested set-top boxes measured within the applicable Tier 2 energy efficiency levels, and one hundred percent (100%) of the devices tested were at or below the values reported by service providers, with the applicable tolerance levels applied.

The TEC measured across all verification tests performed in 2018 was 8.84 kWh/year less than the TEC levels reported by the service providers, compared to 5.52 kWh/year less in 2017 field verification results. These test results corroborate the energy savings calculations to be included in the Independent Administrator's annual report because they suggest that the actual energy usage of the new-model set-top boxes in the home are, on average, less than have been reported by the service providers.

## PROGRESS ON OTHER ENERGY EFFICIENCY COMMITMENTS

The Voluntary Agreement established other energy efficiency commitments, some of which are specific to certain industries or providers.

### Whole-Home Systems

Whole-home set-top boxes use home network interfaces (HNIs) to share content with other video client devices over a high-bandwidth home network. HNIs can provide the following functions while consuming a fraction of the energy required by stand-alone fully-featured set-top boxes with built-in tuners and DVRs:

- Shared DVR functionality to set-top boxes without DVR capability
- Transcoding to serve a variety of customer-owned video devices
- Channel tuning capabilities to thin client devices that do not need to connect directly to the service provider's headend

The satellite signatories committed to make energy-efficient whole-home servers and clients available to all new and existing subscribers in 2013, and since then AT&T/DIRECTV and DISH have offered nationwide availability of their DIRECTV "Genie" (<https://www.att.com/directv/experience/genie.html>) and DISH "Hopper" and "Joey" (<https://www.dish.com/equipment/dvrs/hopper-3/#>) whole-home DVR servers and clients, and these energy-saving devices have been widely adopted by consumers. These configurations continue to become even more energy-efficient. The EPA ENERGY STAR program has noted the efficiency of whole-home architectures, stating that households "can experience significant energy savings through the deployment of multi-room thin-client devices in homes that are currently served by two or three high-power STBs with DVR functionality."<sup>17</sup>

AT&T (with respect to its U-verse services), CenturyLink, Frontier, and Verizon continued to meet their commitment that energy-efficient whole-home architectures will be available to all new and existing subscribers. Whole-home architectures serve content to multiple remote or client devices within a consumer's home more efficiently than configurations involving multiple DVR set-top boxes throughout the home.

Although not required by the Voluntary Agreement, cable operators have also deployed new whole-home solutions. Comcast customers can use the whole-home capabilities of a single X1 DVR to perform recording and playback functions from their non-DVRs rather than needing additional DVRs. Cox continues to employ a similar arrangement in a majority of its New Contour installations. Altice has eliminated DVR hard disk drives in the home altogether for new installations through the use of cloud DVR services available to all of its set-top boxes within the home.

The successful implementation of whole-home DVRs or cloud DVR in most of the signatories' systems has likely contributed to a decline in the purchases of new DVRs over the past two years. From 2013 through 2016, the signatories purchased between 11.2 and 12.7 million DVRs annually. In the early years of whole-home DVR, the decline in the number of DVRs deployed per DVR household was at least partly offset by increased demand for DVR functionality. However, with DVR adoption now more mature and stable, DVR purchases declined to 8.3 million in 2017 and 6.3 million in 2018. While new DVRs in 2018 are much more energy-efficient than in 2012 (using 48% less power as calculated above), DVRs with hard-drives are still the most energy-intensive set-top boxes in a home, so their replacement with non-DVRs, thin clients or apps saves even more energy.

17 - U.S. Environmental Protection Agency, *Set-Top Boxes*, available at [https://www.energystar.gov/products/electronics/set\\_top\\_boxes\\_cable\\_boxes](https://www.energystar.gov/products/electronics/set_top_boxes_cable_boxes).

## 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 has been posted on company websites since 2014. In 2015, service providers worked to enhance the accessibility of such information on their websites, for example by optimizing related terms in their search tools. D+R annually confirms that this information is readily available to the public from the links listed in Appendix C of this report. D+R again reviewed all links provided by the signatories to ensure that they still worked and presented the required information. When the service provider website did not contain all of the required information, D+R reached out to the relevant company to update the information, and then confirmed that the update was made. To make the information even more readily accessible, in 2016, the signatories published a new website, [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.

## Next-Generation Video Delivery

The four largest service provider signatories committed to continue to engage with the Energy Advocates, the manufacturer signatories, component suppliers and software developers to explore approaches to further improve the energy efficiency of set-top boxes in all power states, with a special emphasis on efficiencies in standby power, while preserving a good consumer experience. The cable operators committed, as they had under the prior version of the Voluntary Agreement adopted in 2013, to continue to work with suppliers to develop specifications for new model set-top boxes that operate in a reduced power consumption mode while still functioning with cable system architectures and meeting consumer expectations for quick start-up time and functionality.

The efforts undertaken to date under the Voluntary Agreement to reduce set-top box power in standby modes have contributed to significant improvements in energy efficiency, though not always in the ways that were initially envisioned. Pursuant to their 2013 commitments, the cable operators attempted to develop "deep sleep" modes in which most functionalities were turned off, with a goal of reducing power draw to approximately three watts or less. Trials of set-top boxes in these deep sleep modes were unsuccessful because of the intolerable length of time for the devices to wake and display video services. When the time required to wake devices from deeper sleep modes is too long, dissatisfied customers seek to disable sleep modes altogether. However, associated development efforts led to improved abilities to tailor and reduce power usage for various functions even when the set-top box is turned on. As a result, the power usage of newer model set-top boxes in all modes has declined significantly since adoption of the initial Voluntary Agreement. The cable operators had extensive meetings and engagement with key suppliers in 2018 to build upon these developments, and expect to achieve further new efficiencies in the 2020s as a result.

The revised Voluntary Agreement also recognized emerging technology changes in the video marketplace by providing that in addition or in the alternative to the above power scaling commitment, cable operators may pursue strategies to reduce the overall energy usage in typical homes through other means such as IP delivery or architectures that reduce the number of operator-supplied devices in the home. Charter now offers low-power Apple TV IP devices as one of its equipment options.<sup>18</sup> Comcast and Cox now offer very low-power IP set-top boxes; these devices currently must be connected to a higher-powered, fully-featured set-top box in the home, but in the future will instead be able to connect directly to the customer's Internet router when the companies complete their transitions to all-IP delivery. This migration to IP will therefore eliminate a higher-powered set-top box from the home. Altice offers a multi-service gateway that combines the modem, Wi-Fi router, primary cable set-top box and telephone adapter all into a single device that uses much less energy than its features would as separate devices. As detailed in the next section, all of the service provider signatories are supporting apps that enable customers to access live and on-demand content on a screen such as a television or tablet without any operator-supplied set-top box. The cable operators are committed to continuing to pursue these strategies that improve the overall energy efficiency in the delivery of their services.

## Automatic Power Down

Automatic power down (APD) monitors parameters related to viewing and user activity. If the parameters indicate that no user activity or viewing is occurring, APD enables the device to transition to sleep mode. For example, DIRECTV's HR54-700 Genie Whole Home DVR APD implementation reduces power by approximately 10%, from 12.10W in on mode to 11.01W in APD mode. The satellite signatories committed that, effective January 1, 2013, at least 90% of new set-top boxes will include an "Automatic Power Down" (APD) feature with a default value of four hours or less. In 2018, 100% of the set-top boxes purchased by DISH and AT&T/DIRECTV met this requirement.

## Satellite Study on Residential Premises Equipment

The satellite service providers completed their commitment to prepare a joint study on the energy use of all additional residential premises equipment that they deploy to support their multichannel video services. The study was first presented to the Energy Advocates and then to the Steering Committee. The study evaluated the energy usage of outdoor units (ODUs), low noise block downconverters (LNBS), multi-switches, broadband converters, video wireless access points (VWAPs), and wireless video bridges (WVBs). The Energy Advocates and satellite service providers discussed approaches that reduce the energy footprint of a satellite installation by streamlining the number of separate power-drawing devices in the home, such as:

- *Multi-switch devices*, which have been needed to support multiple direct connections of more than three set-top boxes to a single ODU, have been phased out of most new installations because thin clients can be connected to the whole-home set-top box rather than to the ODU, and also because the satellite service providers have integrated RF switching into their LNBS.
- *Broadband converters* have been used to interface with the customer's home network to deliver on-demand services to the set-top box. Newer set-top box models have integrated MoCA (Multimedia Over Coax) and Wi-Fi which eliminates the need for these separate devices in most homes.
- *Wireless video bridges* are occasionally used to enable thin clients to be connected to the whole-home set-top box via Wi-Fi. AT&T/DIRECTV integrated this capability into its newest whole-home DVR model, eliminating the need for a separate bridge device.

<sup>18</sup> - This offering started in 2019 so Apple TV is not listed in Table 10, but will be in the next report.

The study found that the aggregate energy use of additional premises equipment is trending downwards due to the phase-out of these equipment types, as well as the decreasing number of satellite subscribers. The Energy Advocates and satellite service providers also discussed measures that generally guard against continued power draw by this equipment after the discontinuance of services.

## VIEWING WITHOUT OPERATOR-SUPPLIED SET-TOP BOXES

All of 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 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,<sup>19</sup> and three-quarters can stream video to their televisions.<sup>20</sup>

The service providers reported that consumers used more than 36 million of these customer-owned and managed devices to access the providers' video services via apps in 2018, up by 33% from 27 million in 2017.<sup>21</sup> 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 an operator-supplied set-top boxes in 2018. 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. The service provider signatories are continuing to work to enhance the functionality of their apps such as through new support for cloud DVR offerings, and investing in customer education and employee training to promote the use and awareness of apps.

19 - Nielson, *The Nielsen Total Audience Report Q3 2018* (2019), available at <https://www.nielsen.com/us/en/insights/2019/q3-2018-total-audience-report/#>.

20 - Jeff Baumgartner, *Study: 74% of U.S. TV Homes Have at Least One Connected TV Device* (Jun. 2018), available at <https://www.multichannel.com/blog/study-74-u-s-tv-homes-have-at-least-one-connected-tv-device> (includes Smart TVs and TVs connected to the Internet with a connected device).

21 - The 2017 figure has been revised from the original version of D+R's prior report to better reflect actual customer usage of devices to watch video, and the 2018 figure is based on the same revised methodology.

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

Service Provider	Platform	App Name	Live TV (YES/NO)	On-Demand (YES/NO)	DVR (YES/NO)
Altice	Amazon Kindle Fire HD	Optimum	Yes	Yes	No
	Android	Optimum	Yes	Yes	No
	Apple iOS	Optimum	Yes	Yes	No
	PC	Optimum	Yes	Yes	No
AT&T/DIRECTV	Android TV	DIRECTV Now	Yes	Yes	Yes
	Apple TV	DIRECTV Now	Yes	Yes	Yes
	Google Chromecast	DIRECTV Now	Yes	Yes	Yes
	Roku	DIRECTV Now	Yes	Yes	Yes
	Roku TV	DIRECTV Now	Yes	Yes	Yes
	Samsung TV	DIRECTV Now	Yes	Yes	Yes
	Amazon Kindle Fire HD	DIRECTV, U-Verse	Yes	Yes	Yes
	Android	DIRECTV, U-Verse, DIRECTV Now	Yes	Yes	Yes
	Apple iOS	DIRECTV, U-Verse, DIRECTV Now	Yes	Yes	Yes
	MAC	DIRECTV, U-Verse, DIRECTV Now	Yes	Yes	Yes
	PC	DIRECTV, U-Verse, DIRECTV Now	Yes	Yes	Yes
	Amazon Fire TV	U-Verse, DIRECTV Now	Yes	Yes	No
CenturyLink	Amazon Kindle Fire HD	Prism TV app	Yes	Yes	No
	Android	Prism TV app	Yes	Yes	No
	Apple iOS	Prism TV app	Yes	Yes	No
	Roku	Prism TV app	Yes	Yes	No
	Roku TV	Prism TV app	Yes	Yes	No
Charter	Android	Spectrum TV	Yes	Yes	No
	Apple iOS	Spectrum TV	Yes	Yes	No
	Roku	Spectrum TV	Yes	Yes	No
	Roku TV	Spectrum TV	Yes	Yes	No
	Samsung TV	Spectrum TV	Yes	Yes	No
	Xbox One	Spectrum TV	Yes	Yes	No
	MAC	Spectrum.net	Yes	Yes	No
	PC	Spectrum.net	Yes	Yes	No
Comcast	Amazon Kindle Fire HD	Stream	Yes	Yes	Yes
	Android	Stream	Yes	Yes	Yes
	Apple iOS	Stream	Yes	Yes	Yes
	MAC	Stream	Yes	Yes	Yes
	PC	Stream	Yes	Yes	Yes
	Roku	Stream	Yes	Yes	Yes
	Samsung TV	Stream	Yes	Yes	Yes
Cox	Amazon Kindle Fire HD	Contour	Yes	Yes	No
	Android	Contour	Yes	Yes	No
	Apple iOS	Contour	Yes	Yes	No
	Mac	Contour	Yes	Yes	No
	PC	Contour	Yes	Yes	No

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

Service Provider	Platform	App Name	Live TV (YES/NO)	On-Demand (YES/NO)	DVR (YES/NO)
<b>DISH</b>	Amazon Kindle Fire HD	DISH Anywhere	Yes	Yes	Yes
	Apple iOS	DISH Anywhere	Yes	Yes	Yes
	Android	DISH Anywhere, SlingTV	Yes	Yes	Yes
	MAC	DISHAnywhere.com, SlingTV	Yes	Yes	Yes
	PC	DISHAnywhere.com, SlingTV	Yes	Yes	Yes
	Amazon Fire TV	SlingTV	Yes	Yes	Yes
	Android TV	SlingTV	Yes	Yes	Yes
	Apple TV	SlingTV	Yes	Yes	Yes
	Google Chromecast	SlingTV	Yes	Yes	Yes
	LG TV	SlingTV	Yes	Yes	Yes
	Roku	SlingTV	Yes	Yes	Yes
	Roku TV	SlingTV	Yes	Yes	Yes
	Samsung TV	SlingTV	Yes	Yes	Yes
	Xbox One	SlingTV	Yes	Yes	Yes
<b>Frontier</b>	Android	FrontierTV	Yes	Yes	Yes
	Apple iOS	FrontierTV	Yes	Yes	Yes
	PC	FrontierTV	Yes	Yes	Yes
<b>Verizon</b>	Amazon Kindle Fire HD	Fios TV	Yes	Yes	Yes
	Android	Fios TV	Yes	Yes	Yes
	Apple iOS	Fios TV	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>36,532,394</b>		

The impact of consumer adoption of pay-TV apps on set-top box energy usage is starting to show through a precipitous decline in operator purchases of new set-top boxes. The signatories purchased only 23 million new set-top boxes in 2018, only half of the 46 million new set-top boxes they purchased during the first year of the Voluntary Agreement's commitments in 2014. While some of this reduction is due to subscriber losses and other factors, app usage can replace or reduce demand for set-top boxes in a variety of ways. For example, the use of apps to view MVPD content on televisions can render a set-top box unnecessary for that television. It was estimated that in 2017, for the first time, a majority of all streaming content is viewed on televisions rather than PCs and mobile devices.<sup>22</sup> One analyst concluded that "there has been an enormous surge in the use of connected televisions" and that "[n]ew data shows many subscribers prefer the app experience" to operator set-top boxes even on their TVs.<sup>23</sup> App usage on other devices can replace set-top boxes as well. While the use of apps on mobile devices outside the home typically would expand consumer access to providers' video services rather than replace set-top boxes, mobile devices are also often used by consumers inside the home to watch programming in rooms that do not have, and now do not need, a set-top box.

In addition, as of the end of 2018, approximately 4 million consumers subscribed to DISH's SlingTV service or DIRECTV Now service, neither of which use a service provider supplied set-top box. Cable operators have started to offer similar services to their Internet subscribers. The energy-efficient IP streaming devices used to receive these services, which may be purchased at retail or provided by the service provider, further reduce the overall energy used by set-top boxes.<sup>24</sup>

22 - Conviva, *All-Screen Streaming TV Census Report Q1 2018* (Apr. 2018), available at <https://www.conviva.com/research/convivas-screen-streaming-tv-census-report-q1-2018>.

23 - Colin Dixon, nScreenMedia, *Connected TV dominates premium streamed video viewing*, (Apr. 25, 2018), available at <http://www.nscreenmedia.com/conviva-streaming-tv-connected-tv-growth/> and *TV Everywhere users prefer apps to operator set-top boxes* (Apr. 24, 2017) available at <http://www.nscreenmedia.com/tv-everywhere-users-prefer-apps/>, citing Adobe, *Adobe Digital Insights 2017: The State of Digital Video* (Apr. 18, 2017).

24 - This report has not attempted to estimate any incremental energy usage in service providers' networks that may be associated with the increased use of apps to watch video.



## CONCLUSION

In 2018, 97.7% of set-top boxes purchased by the signatories met the Tier 2 energy efficiency levels of the Voluntary Agreement, with all service providers meeting the individual 90% commitment. As a result, the Voluntary Agreement reduced national energy consumption of set-top boxes from 32 TWh/year in 2013 to 19.4 TWh/year in 2018, a reduction of 39%, even as the functionality of set-top boxes increased. These savings have been confirmed year-by-year through independent verification testing and procurement audits. The signatories are expected under the terms of the Voluntary Agreement to continue to work toward additional savings through their implementation of Tier 3 efficiency levels in 2020 and continued efforts to improve the energy efficiency of set-top boxes in all power states through ongoing engagement with key suppliers that can lay the foundation for discussions, scheduled to begin in 2019, of possible Tier 4 energy levels in the future.

## APPENDIX A: VOLUNTARY AGREEMENT COMMITMENTS

Table 9 lists the commitments of the signatories of the Voluntary Agreement along with the status of the signatories' progress toward these commitments.

**Table 9: Voluntary Agreement Commitments**

Commitments	Group	Status
90% of set-top boxes purchased after December 31, 2016 meet Tier 2.	All Service Providers	Each signatory met its 90% commitment individually. Overall, 97.7% of set-top boxes purchased by the signatories in 2018 met Tier 2.
Prepare annual procurement report for prior year by April 1.	All Service Providers	All service providers submitted to Independent Administrator in 2018.
Provide energy efficiency information to subscribers and potential subscribers of set-top boxes purchased since January 1, 2014.	All Service Providers	D+R verified that the information is available from the website <a href="http://energy-efficiency.us">energy-efficiency.us</a> and company websites listed in Appendix C, and followed up and confirmed changes with the signatories that needed to update the information.
90% procurement of set-top boxes with automatic power down feature.	Satellite	100% deployment in 2018.
Make whole-home servers and clients available to all new and existing subscribers.	Satellite	Offered throughout the United States 2013-2018.
Prepare joint report on energy use of all additional residential premises equipment that they deploy to support their multichannel video service.	Satellite	The report was delivered and is summarized in this annual report.
Work with suppliers to develop set-top boxes with next-generation power management, and deploy such economically feasible new models that successfully perform on a cable operator's network and support all of the operator's services in its ordinary set-top box replacement cycle. In addition to or in lieu of the foregoing efforts in regards to traditional QAM set-top boxes, a cable operator may pursue strategies to reduce the overall energy usage in typical homes through other means such as IP delivery or architectures that reduce the number of operator-supplied devices in the home.	Cable	The cable operators had extensive meetings and engagement with key suppliers in 2018 to pursue continued improvements in energy efficiency in all power states. Charter is offering Apple TV as one of its equipment options. Comcast and Cox are offering very low-power IP client devices for secondary TVs. Altice has integrated the modem, router, and set-top box into a single device. All of the service provider signatories are supporting apps that enable customers to access live and on-demand content on a screen such as a television or tablet without any operator-supplied set-top box.
Use reasonable efforts to design and manufacture equipment to enable improved set-top box energy efficiency while meeting the service providers' functional and operational specification.	Equipment Manufacturers	Manufacturers' efforts to date are reflected in the energy savings reported by service providers, and there is ongoing development of next-generation set-top boxes with lower-power silicon solutions.
Whole home architectures will be available to all new and existing subscribers. Whole-home architectures serve content to multiple remote or client devices within a consumer's home more efficiently than configurations involving multiple DVR set-top boxes throughout the home.	Telco	Deployed throughout the United States 2014-2018.

## APPENDIX B: SET-TOP BOXES PURCHASED BY VOLUNTARY AGREEMENT SIGNATORIES IN 2018

Table 10 lists the reported typical energy consumption (TEC) for each model of set-top box purchased by Voluntary Agreement signatories in 2018. 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. Modal power and 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 maximum allowable TEC for a product using the base-type allowances outlined in Table 11 and the feature allowances outlined in Table 12. Table 12 also includes descriptions of the features abbreviated in Table 10 in the “Claimed Allowances” column. The Voluntary Agreement sets forth rules for how to claim feature allowances, so the column for claimed allowances lists only the features used when calculating the maximum allowable TEC for the specific product.

The template used to collect the information reported in this Appendix is posted at <https://www.energy-efficiency.us/library/pdf/2018-STB-VA-Reporting-Template.xlsx>. Procurement data submitted by service providers is subject to one random audit per year and the Steering Committee has the option to direct the Independent Administrator to conduct additional audits as necessary. An asterisk indicates models that were evaluated through third-party verification testing under the Voluntary Agreement.

**Table 10: Set-Top Boxes Procured by Voluntary Agreement Signatories in 2018**

Service Provider	Base Type	Primary Function	Brand	Model No.	Claimed Allowances	Modal Characteristics (W)		TEC (kWh/yr)	Meets Tier 2
						On	Sleep		
Altice	Cable	Multi-Service Gateway	Sagemcom	DGCI384*	APD (hrs)(4), Adv Video(2), D3, HD, Multi-room, MS, MS-A, W-HNI, MIMO-2.4(3), MIMO-5(4), RTG, HEVP	28.50	26.44	236.8	Yes
Altice	Cable	Non-DVR	Sagemcom	DCIWA384*	APD (hrs)(4), Adv Video(2), HD, HNI, MS, W-HNI, MIMO-2.4(3), MIMO-5(4), HEVP	10.88	9.05	84.0	Yes
AT&T	IP	DVR	ARRIS	VIP 2262V2	Adv Video(2), DVR, HD, HNI, S-DVR, MS, MS-A	12.06	10.33	99.4	Yes
Charter	Cable	Non-DVR	Humax	101H - ODN	APD (hrs)(4), Adv Video, D3, HD, HEVP	12.86	12.47	110.1	Yes
Charter	Cable	DVR	Humax	201H - ODN	APD (hrs)(4), Adv Video, DVR, D3, HD, MS, MS-A, HEVP	16.17	15.63	138.7	Yes
Charter	Cable	Non-DVR	Technicolor	101T - ODN*	APD (hrs)(4), Adv Video, D3, HD, HEVP	13.48	12.33	111.1	Yes
Charter	Cable	DVR	Technicolor	201T - ODN*	APD (hrs)(4), Adv Video, DVR, D3, HD, MS, MS-A, HEVP	16.79	14.16	133.6	Yes
Charter	Cable	DVR	Technicolor	8640HDC2 - P*	APD (hrs)(4), Adv Video, CableCARD, DVR, D2, HD, MS	20.37	17.35	159.9	No
Charter	Cable	Non-DVR	Technicolor	4640HDC2 - P*	APD (hrs)(4), Adv Video, CableCARD, D2, HD	13.03	9.72	93.7	Yes
Charter	Cable	Non-DVR	ARRIS	DCX3200M/P3 - ODN*	APD (hrs)(4), Adv Video, CableCARD, D2, HD, HNI, M-HNI	13.72	11.55	106.5	Yes
Charter	Cable	DVR	ARRIS	DCX3520E - iGuide*	Adv Video, DVR, D2, HD, MS	20.70	20.14	179.3	No
Charter	Cable	Non-DVR	Samsung	SMT-H3362 - ODN	APD (hrs)(4), Adv Video, CableCARD, D2, HD, HNI, M-HNI	12.75	11.99	107.1	Yes
Charter	Cable	Non-DVR	ARRIS	DCX3220E - iGuide*	Adv Video, D2, HD	10.88	10.57	94.2	No
Charter	Cable	DVR	ARRIS	DCX3510 - ODN*	APD (hrs)(4), Adv Video, CableCARD, DVR, D2, HD, HNI, M-HNI, S-DVR, MS	19.73	15.28	145.6	Yes
Charter	Cable	Non-DVR	ARRIS	110A - Spectrum	APD (hrs)(4), Adv Video, D3, HD, HEVP	11.50	11.06	97.7	Yes
Charter	Cable	DVR	ARRIS	210A - Spectrum	APD (hrs)(4), Adv Video, DVR, D3, HD, MS, MS-A, HEVP	15.79	11.80	113.6	Yes
Charter	Cable	Non-DVR	Technicolor	110T - Spectrum	APD (hrs)(4), Adv Video, D3, HD, HEVP	14.14	13.12	118.5	Yes
Charter	Cable	DVR	Technicolor	210T - Spectrum	APD (hrs)(4), Adv Video, DVR, D3, HD, MS, MS-A, HEVP	17.77	13.60	130.4	Yes
Charter	Cable	Non-DVR	Humax	110H - Spectrum*	APD (hrs)(4), Adv Video, D3, HD, HEVP	13.54	12.97	115.2	Yes
Charter	Cable	DVR	Humax	210H - Spectrum*	APD (hrs)(4), Adv Video, DVR, D3, HD, MS, MS-A, HEVP	17.53	13.78	130.1	Yes
Comcast	IP	Non-DVR	Pace	PX051AEI	Adv Video, HD, HNI, W-HNI, MIMO-5(4)	6.59	3.78	47.5	Yes
Comcast	IP	Non-DVR	Pace	PXD01ANI*	Adv Video, HD, HNI, M-HNI	5.70	4.87	47.0	Yes
Comcast	IP	Non-DVR	Cisco	CXD01ANI*	Adv Video, HD, HNI, M-HNI	5.68	4.41	45.2	Yes
Comcast	Cable	DVR	ARRIS	AX014ANM*	Adv Video, DVR, D3, HD, M-HNI, Multi-room, MS, MS-A	16.93	14.91	141.0	Yes
Comcast	Cable	DVR	ARRIS	AX014ANC*	Adv Video, CableCARD, DVR, D3, HD, M-HNI, Multi-room, MS, MS-A	17.47	15.34	145.3	Yes

**Table 10: Set-Top Boxes Procured by Voluntary Agreement Signatories in 2018 (cont.)**

Service Provider	Base Type	Primary Function	Brand	Model No.	Claimed Allowances	Modal Characteristics (W)		TEC (kWh/yr)	Meets Tier 2
						On	Sleep		
Comcast	Cable	Non-DVR	Pace	PX022ANM*	Adv Video, CableCARD, D3, HD, M-HNI, Multi-room, MS, MS-A	14.50	13.34	122.8	Yes
Comcast	Cable	Non-DVR	Pace	PX022ANC*	Adv Video, CableCARD, D3, HD, M-HNI, Multi-room, MS, MS-A	15.21	13.93	128.6	Yes
Comcast	Cable DTA	Cable DTA	Pace	PXD01ANI DTA*	Adv Video, HD, HNI	6.23	6.20	54.5	Yes
Comcast	Cable DTA	Cable DTA	Evolution	DMS2004UHDW*	Adv Video, HD	6.77	6.74	59.2	No
Comcast	IP	Non-DVR	ARRIS	AX061AEI	Adv Video, HD, HNI, W-HNI, MIMO-2.4(2), MIMO-5(2)	4.80	3.35	36.8	Yes
Comcast	IP	Non-DVR	Technicolor	TX061AEI*	Adv Video, HD, HNI, W-HNI, MIMO-2.4(2), MIMO-5(2)	4.02	3.13	32.0	Yes
Cox	IP	Non-DVR	Cisco	CXD01ANI*	Adv Video, HD, HNI, M-HNI	5.98	4.58	47.3	Yes
Cox	Cable	DVR	ARRIS	AX013ANC*	Adv Video, CableCARD, DVR, D3, HD, M-HNI, Multi-room, MS, MS-A	24.81	23.18	211.4	Yes
Cox	Cable	Non-DVR	Pace	PX022ANC*	Adv Video, CableCARD, D3, HD, M-HNI, Multi-room, MS, MS-A	16.41	14.44	136.6	Yes
Cox	Cable	Non-DVR	Pace	PX022ANM*	Adv Video, CableCARD, D3, HD, M-HNI, Multi-room, MS, MS-A	15.43	13.46	128.0	Yes
DIRECTV	Satellite	DVR	DIRECTV	HR54-200*	APD (hrs)(4), Adv Video, DVR, HD, HNI, M-HNI, Multi-room, MS, MS-A	12.20	11.10	100.1	Yes
DIRECTV	Satellite	DVR	DIRECTV	HR54-500*	APD (hrs)(4), Adv Video, DVR, HD, HNI, M-HNI, Multi-room, MS, MS-A	12.66	12.64	110.8	Yes
DIRECTV	Satellite	DVR	DIRECTV	HR54-700*	APD (hrs)(4), Adv Video, DVR, HD, HNI, M-HNI, Multi-room, MS, MS-A	12.10	11.01	99.3	Yes
DIRECTV	Thin Client	Thin Client	DIRECTV	C41W-100*	APD (hrs)(4), Adv Video, HD, HNI, W-HNI, MIMO-5(4)	7.20	5.57	53.0	Yes
DIRECTV	Thin Client	Thin Client	DIRECTV	C41W-500*	APD (hrs)(4), Adv Video, HD, HNI, W-HNI, MIMO-5(4)	7.17	5.73	53.9	Yes
DIRECTV	Thin Client	Thin Client	DIRECTV	C61-100*	APD (hrs)(4), Adv Video, HD, HNI, M-HNI	5.40	4.25	40.2	Yes
DIRECTV	Thin Client	Thin Client	DIRECTV	C61-500*	APD (hrs)(4), Adv Video, HD, HNI, M-HNI	5.43	4.22	40.1	Yes
DIRECTV	Thin Client	Thin Client	DIRECTV	C61-700*	APD (hrs)(4), Adv Video, HD, HNI, M-HNI	5.28	4.10	39.0	Yes
DIRECTV	Thin Client	Thin Client	DIRECTV	C61-200*	APD (hrs)(4), Adv Video, HD, HNI, M-HNI	5.41	4.23	40.1	Yes
DIRECTV	Thin Client	Thin Client	DIRECTV	C61k-700*	APD (hrs)(4), Adv Video, HD, HNI, M-HNI, HEVP	9.50	4.10	49.8	Yes
DIRECTV	Thin Client	Thin Client	DIRECTV	C61W-400*	APD (hrs)(4), Adv Video, HD, HNI, W-HNI, MIMO-5(4)	6.53	5.03	47.9	Yes
DIRECTV	Thin Client	Thin Client	DIRECTV	C61W-700*	APD (hrs)(4), Adv Video, HD, HNI, W-HNI, MIMO-5(4)	6.56	5.22	49.2	Yes
DIRECTV	Satellite	DVR	DIRECTV	H44-100*	APD (hrs)(4), Adv Video, DVR, HD, HNI, M-HNI, Multi-room, MS, MS-A	9.79	9.05	81.2	Yes
DIRECTV	Satellite	DVR	DIRECTV	H44-500*	APD (hrs)(4), Adv Video, DVR, HD, HNI, M-HNI, Multi-room, MS, MS-A	10.37	9.37	84.7	Yes
DIRECTV	Satellite	DVR	DIRECTV	HS17-100*	APD (hrs)(4), Adv Video, DVR, HD, M-HNI, Multi-room, MS, MS-A, XCD, MIMO-5(4)	20.20	18.92	169.1	Yes

**Table 10: Set-Top Boxes Procured by Voluntary Agreement Signatories in 2018 (cont.)**

Service Provider	Base Type	Primary Function	Brand	Model No.	Claimed Allowances	Modal Characteristics (W)		TEC (kWh/yr)	Meets Tier 2
						On	Sleep		
<b>DIRECTV</b>	Satellite	DVR	DIRECTV	HS17-500*	APD (hrs)(4), Adv Video, DVR, HD, M-HNI, Multi-room, MS, MS-A, XCD, MIMO-5(4)	19.48	18.34	163.6	Yes
<b>DISH</b>	Satellite	DVR	DISH	Hopper 3*	APD (hrs)(4), Adv Video(2), DVR, HD, HNI, M-HNI, Multi-room, MS-A, XCD, HEVP	24.23	22.50	201.8	Yes
<b>DISH</b>	Thin Client	Thin Client	DISH	Wireless Joey	APD (hrs)(4), Adv Video, HD, HNI, W-HNI, MIMO-5(3)	7.83	7.49	66.2	Yes
<b>DISH</b>	Thin Client	Thin Client	DISH	Joey 3*	APD (hrs)(4), Adv Video, HD, HNI, M-HNI, HEVP	5.10	4.81	42.8	Yes
<b>DISH</b>	Satellite	Non-DVR	DISH	Wally*	APD (hrs)(4), Adv Video, HD, HEVP	7.99	7.77	68.5	Yes
<b>DISH</b>	Satellite	DVR	DISH	Hopper Duo*	APD (hrs)(4), Adv Video(2), DVR, HD, HNI, M-HNI, Multi-room, MS, HEVP	14.19	13.75	121.5	Yes
<b>Frontier</b>	IP	DVR	ARRIS	VIP5662EW*	APD (hrs)(4), Adv Video, DVR, HD, HNI, S-DVR, MS, MS-A, W-HNI, MIMO-5(4), HEVP	13.03	13.03	111.7	Yes
<b>Frontier</b>	IP	Non-DVR	ARRIS	VIP4402W*	APD (hrs)(4), Adv Video, HD, HNI, W-HNI, MIMO-5(2), HEVP	6.35	6.35	55.7	Yes
<b>Frontier</b>	Thin Client	Thin Client	ARRIS	IPC815W*	APD (hrs)(4), Adv Video, HD, HNI, M-HNI, W-HNI, MIMO-5(3)	6.66	6.66	56.6	Yes
<b>Frontier</b>	Cable	DVR	ARRIS	FMS2	APD (hrs)(4), Adv Video, DVR, HD, HNI, S-DVR, MS, MS-A, W-HNI, HEVP	15.06	15.06	136.1	Yes
<b>Verizon</b>	Cable	DVR	ARRIS	1100*	APD (hrs)(4), Adv Video, CableCARD, DVR, HD, HNI, M-HNI, Multi-room, MS, MS-A, XCD	22.70	22.70	198.9	Yes
<b>Verizon</b>	IP	Non-DVR	ARRIS	1100 P2*	APD (hrs)(4), Adv Video, HD, HNI, M-HNI	7.00	7.00	61.4	Yes
<b>Verizon</b>	Cable	DVR	ARRIS	4100	APD (hrs)(4), Adv Video, CableCARD, DVR, HD, HNI, M-HNI, Multi-room, MS, MS-A, XCD, XCD-A, HEVP	19.68	15.44	146.1	Yes
<b>Verizon</b>	IP	Non-DVR	ARRIS	4100	APD (hrs)(4), Adv Video, HD, HNI, W-HNI, MIMO-5, HEVP	8.78	5.99	59.7	Yes

Table 11 presents the base allowances for set-top boxes under Tier 2.

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

Base Type (Use topmost if multiple apply)	Tier 2 Allowance (kWh/yr)
DTA	25
Cable (CBL)	45
Satellite (SAT)	50
Internet Protocol (IP)	45
Thin Client (TC)	12

Table 12 sets forth the features listed for set-top boxes and outlines the feature allowances under Tier 2.

**Table 12: Set-Top Box Feature Allowances**

Set-Top Box Feature Allowances		
Feature	Description	Tier 2 TEC Allowance (kWh/yr)
Adv Video	Advanced Video Processing	8
Cable CARD	CableCARD	15
DVR	Digital Video Recorder (DVR)	45
D2	DOCSIS 2.0	20
D3	DOCSIS 3.0	50
HD	High Definition (HD)	12
HNI	Home Network Interface	10
M-HNI	MoCA HNI	12
S-DVR	Shared DVR	20
Multi-room	Multi-room	40
MS	Multi-stream	8
MS-A	Multi-stream Additional	8
XCD	Transcoding Base	13
XCD-A	Transcoding Additional	5
W-HNI	WiFi HNI	15
MIMO-2.4	MIMO WiFi HNI 2.4	2
MIMO-5	MIMO WiFi HNI 5	4
RTG	Routing	27
HEVP	High Efficiency Video Processing	10
UHD-4	Ultra High Definition - 4K	5
TELE	Telephony	4
AP	WiFi Access Point	8

## APPENDIX C: CONSUMER-FACING 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 13: Consumer-Facing Energy Efficiency Information**

Service Provider	Consumer Information Location
Altice	<a href="https://energy.cablelabs.com/cablevision/">https://energy.cablelabs.com/cablevision/</a>
AT&T/DIRECTV	<a href="https://www.att.com/ecms/dam/att/consumer/help/pdf/ATT-Receiver-Products-ENERGY-STAR.pdf">https://www.att.com/ecms/dam/att/consumer/help/pdf/ATT-Receiver-Products-ENERGY-STAR.pdf</a>
CenturyLink	<a href="http://www.centurylink.com/home/help/television/prismtv/prism-set-top-boxes-save-energy.html">http://www.centurylink.com/home/help/television/prismtv/prism-set-top-boxes-save-energy.html</a>
Charter d/b/a Spectrum	<a href="http://www.spectrum.net/support/tv/digital-receiver-energy-use/?domain-redirect=true">http://www.spectrum.net/support/tv/digital-receiver-energy-use/?domain-redirect=true</a>
Comcast	<a href="https://www.xfinity.com/support/cable-tv/set-top-box-energy-usage/">https://www.xfinity.com/support/cable-tv/set-top-box-energy-usage/</a>
Cox Communications	<a href="https://www.cox.com/residential/support/conserving-energy-with-your-digital-receiver.html">https://www.cox.com/residential/support/conserving-energy-with-your-digital-receiver.html</a>
DISH Network	<a href="https://www.mydish.com/support/energy-efficiency">https://www.mydish.com/support/energy-efficiency</a>
Frontier	<a href="https://frontier.com/~media/HelpCenter/Documents/tv/fios/set-top-box-equipment-efficiency.ashx">https://frontier.com/~media/HelpCenter/Documents/tv/fios/set-top-box-equipment-efficiency.ashx</a>
Verizon	<a href="https://www.verizon.com/Support/Residential/Tv/FiosTv/Receivers/User+Guides/User+Guides.htm#energy">https://www.verizon.com/Support/Residential/Tv/FiosTv/Receivers/User+Guides/User+Guides.htm#energy</a>





# 2018 Annual Report

## Audit Results

In 2012, the pay television 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 efficiency 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 is 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 2018 procurement data, which was used to develop the findings published in the 2018 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 has determined that the data submitted by the service provider for the audit is consistent with the annual report submitted by that service provider.

August 13, 2019

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