Bonneville Power Administration

CONSERVATION RESOURCE ENERGY DATA

THE RED BOOK

Fiscal Year 2019

Bonneville
POWER ADMINISTRATION

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Introduction

On Dec. 5, 1980, the 96th Congress passed the Pacific Northwest Electric Power Planning and Conservation Act, or Act, Public Law 96-501. The overall purpose of the Act was to:

- Assist the electrical consumers of the Pacific Northwest through use of the Federal Columbia River Power System to achieve cost-effective energy conservation.
- Encourage the development of renewable energy resources.
- Establish a representative regional power planning process.
- Assure the region of an efficient and adequate power supply.

Since then, the Bonneville Power Administration, or BPA, in compliance with the Act, has sponsored and funded various energy conservation programs for the benefit of Pacific Northwest consumers. These programs have been successful due to the work of BPA's utility customers.

Purpose

The Resource Energy Data, or RED, Book summarizes data on the savings pertaining to the BPA energy-conservation acquisition programs. The document provides information and references for general audiences and for use in preparing general publications.

Important Note On Using The Data

The data contained in the RED Book are sensitive to changes in the assumptions surrounding them. Use this information with care to ensure the correct characterizations of the data are accurately used and communicated.

The RED Book information is presented to the nearest tenth of an average megawatt, or aMW, in most of the tables. The reported aMW savings are first-year savings only and not the measure-life or program-life savings. Measure life is the estimated median time a measure will remain in place or the time until the structure in which a measure is installed ceases to exist. It should also be noted that the savings in this report are reported by completion date.

Reported savings include transmission and distribution line-loss credits to account for transmission, and distribution line-loss savings resulting from the acquisition of conservation. During the transmission and distribution of electricity, a certain amount of electricity is lost due to electrical resistance inherent in conductors. Since conservation causes less electricity to be consumed by the end users, less electricity is generated and transmitted; there is a corresponding reduction in line losses. The inclusion of line-loss savings allows conservation savings and generation to be compared at the same point in the electrical system, which is often referred to as the "busbar." The line-loss savings factor has varied over time. In the past, the line-loss factor was calculated by the Regional Technical Forum, or RTF, and there was one number for all measures. The factor came from data submitted to the RTF by BPA and other utilities that knew their average line-loss factor. Through fiscal year, or FY, 2005, all conservation savings include a line-loss factor of 7.5% (2.5% for the aluminum Direct Service Industry Conservation Modernization program). For FY 2006 - FY 2009, the line-loss credit was 7.625% and was revised to 9.056% for FY 2010 - FY 2016.

As of FY 2017, with the introduction of the Seventh Power Plan, the line-loss credit varied by measure. The RTF began using a new version of Pro Cost — a model that characterizes the costs and benefits of conservation measures and programs — and newly developed Total Resource Cost Test, or TRC, benefit-cost ratios. The site vs busbar relationship now depends on the measure's load shape and the extent to which that measure saves energy during heavy load hours. A measure that saves energy during heavy load hours has greater busbar savings than a measure that does not save as much energy during peak hours. Essentially, busbar savings will reflect measure savings during regional peak load hours. This change required BPA to update every current and new Unit Energy Savings, or UES, measure with the new version of Pro Cost, which resulted in individual busbar savings for each measure.

The data in this edition of the RED Book are as reported through June 2020. The data should be used as "official data" until the next annual publication of the RED Book. Adjustments to the data are captured annually in the RED Book, if information from evaluations or other sources indicate savings should be revised.

If you have any questions about how to represent or use this information, please contact Adam Morse at 503-230-5722 or armorse@bpa.gov.

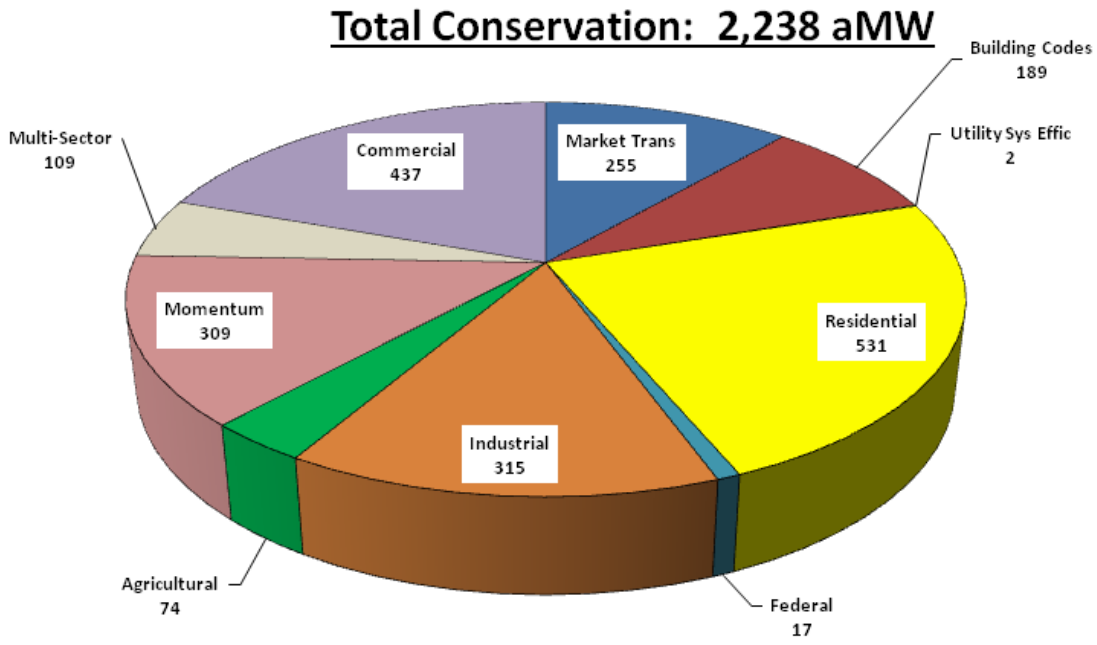
Overview

BPA estimates a cumulative total of 2,238 aMW of energy have been achieved from BPA and its utility customers' conservation programs since FY 1982[1]. This cumulative total includes adjustments to some of the incremental energy savings reported in previous editions of the RED Book. These adjustments account for changes in the reported number of installed conservation measures in previous fiscal years, changes in estimated energy savings for certain measures based on subsequent program evaluations, and installed measures that are no longer delivering energy savings. For example, energy savings from the Conservation Modernization, or ConMod, legacy program (See glossary) are not included in the current total due to the closing of some aluminum industry plants where conservation projects were implemented.

Figure 1 illustrates the relative contributions from various sector and program categories toward BPA's cumulative energy savings.

FIGURE 1. BPA's Cumulative Conservation Savings (aMW) by Sector, FY 1982 - 2019*

*FY 2016 - 2019 Momentum Savings were not yet available at report time.



1 Beginning in FY 2007, utility-funded conservation savings are included in the RED Book (in addition to BPA-funded conservation savings).

The Multi-Sector[2] savings include, for example, billing credits, competitive acquisitions and flex agreements. The 189 aMW of building codes consist of 129 aMW for residential building codes and 60 aMW for commercial building codes. Building-code savings are a result of new building codes that were passed in 1985, and model conservation standards — or codes close to Model Conservation Standards, or MCS, — that were implemented in Washington in 1991, and in Oregon, Idaho and Montana in 1992. Commercial MCS were implemented in Washington in 1994 and Oregon in 1996. Savings from building codes and MCS are estimated through backward-looking methodology in the load forecast, and therefore, are only approximate.

Residential-code savings from 2003 to present are no longer counted; Commercial-code savings are not counted as of 2005 because it is estimated the codes would have reached current standards by those dates. In 2003, Idaho adopted a code equivalent to the 1988 MCS. Oregon and Washington codes went beyond MCS by this time, and current practice in Montana was equivalent to the MCS. Although the national energy codes and international energy codes on which Idaho codes were finally based may have been influenced by MCS efforts in the Pacific Northwest, it was appropriate to stop counting additional new benefits due to BPA's and the region's conservation efforts in the 1980s and 1990s.

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Multi-Sector is a "pseudo sector" that makes no sector distinction for the savings achieved.

TABLE A: BPA's Total Conservation Savi

Table A summarizes the cumulative energy savings for FY 1982-2011, and the incremental energy savings for each fiscal year through 2019.

	Total FY 82-2011	FY 2012	FY 2013	F 20
Residential	371.9	21.3	22.7	25
Commercial	277.5	14.9	21.8	17
Industrial	175.5	15.8	19.4	15
Agricultural	39.2	1.8	1.9	4.
Multi-Sector	108.9	0.0	0.0	0.
Federal	0.0	0.0	4.2	1.
Utility System Efficiency	0.0	0.0	0.0	0.
Sectors Subtotal	**973.0**	**53.7**	**70.0**	**65**
Residential Building Codes	128.6	0.0	0.0	0.
Commercial Building Codes	59.9	0.0	0.0	0.
Building Codes Subtotal	188.5	0.0	0.0	0.
Market Transformation	183.7	10.9	12.5	16
Momentum Savings	49.1	47.2	54.3	60
TOTAL SAVINGS	**1394.3**	**111.8**	**136.8**	**14**
CO_2 Reduction (tons)	4,685,659	383,740	469,341	484,

*FY 2016-2019 Momentum Savings were not yet available at report time.

3 Expired measures are not included as they are no longer delivering savings.

4 The market transformation savings contained in Table A reflects the approximate level of funding that BPA and utilities.

ings[3-4] FY 1982-2019 Incremental aMW*

Y 14	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	Total FY 82-19
5.1	21.7	21.5	22.0	12.9	11.7	**531.0**
.3	21.4	17.1	20.6	23.3	23.4	**437.2**
.6	17.5	21.0	19.9	15.3	14.8	**314.8**
5	7.6	4.2	4.5	5.2	5.5	**74.3**
0	0.0	0.0	0.0	0.0	0.0	**108.9**
6	2.8	1.1	5.0	1.1	1.4	**17.2**
8	0.2	0.1	0.6	0.3	0.3	**2.3**
.0	**71.2**	**64.9**	**72.6**	**58.1**	**57.0**	**1,485.7**
0	0.0	0.0	0.0	0.0	0.0	**128.6**
0	0.0	0.0	0.0	0.0	0.0	**59.9**
0	0.0	0.0	0.0	0.0	0.0	**188.5**
.2	14.1	4.0	3.7	4.9	5.0	**254.9**
0.2	97.8	TBD	TBD	TBD	TBD	**308.6**
1.3	**183.1**	**68.9**	**76.4**	**63.0**	**62.0**	**2,237.7**
,901	628,359	236,465	262,064	216,278	451,975	**7,818,781**

Carbon Dioxide Reduction From Conservation

For any given amount of conservation, there is a reduction in carbon dioxide, or CO_2, emissions relative to the average generation resource mix in the region[5]. For FY 2019, the conservation savings of 57 aMW reduces annual CO_2 emissions by more than 415,000 tonnes (metric tons). This is equivalent to having approximately 38,000 fewer automobiles on the road. For the period FY 1982-2019, the cumulative conservation savings of 2,238 aMW reduces annual CO_2 emissions by more than 7.8 million tonnes. This is equivalent to having approximately 1.5 million fewer automobiles on the road.

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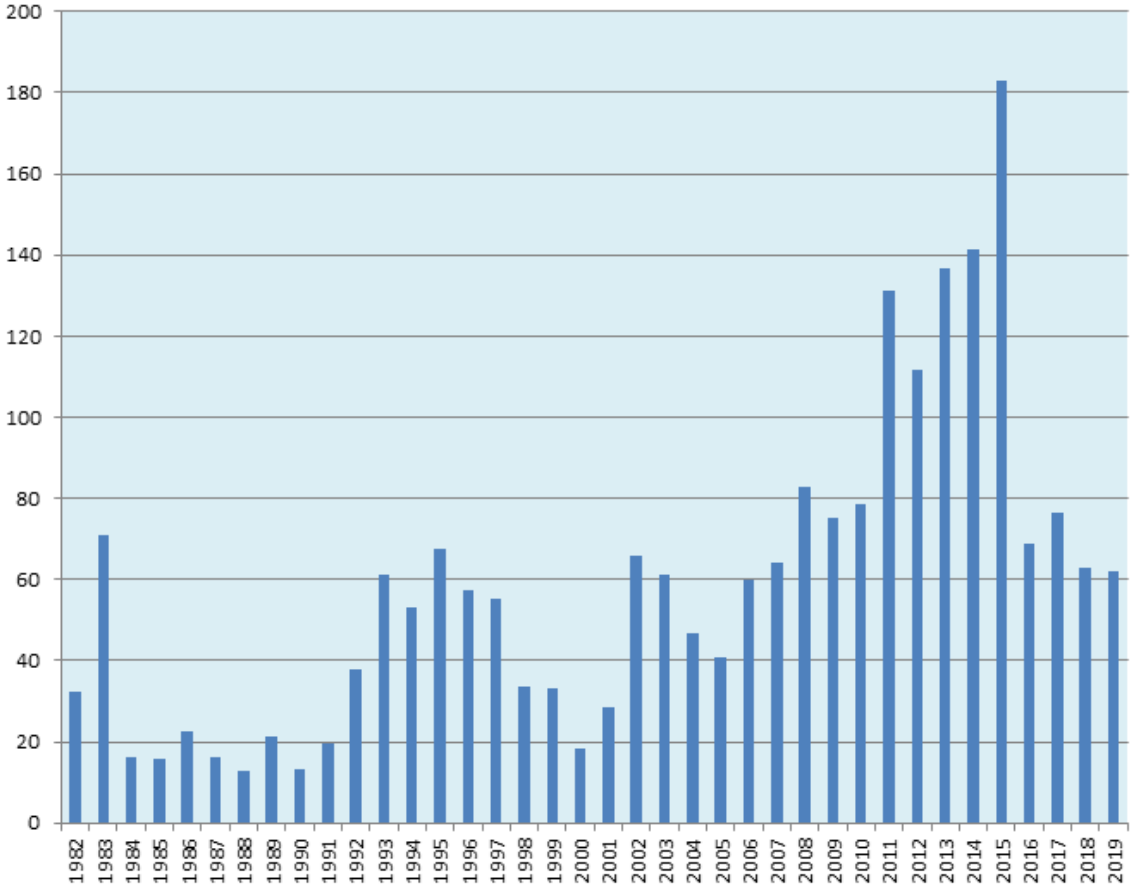
Starting in FY 2019, the conversion rate of emissions avoided for every 1 aMW was changed from 3,431 tonnes to 7,289 tonnes of CO2. This is consistent with the Northwest Power and Conservation Council methodology.

BPA'S Total Historical Conservation Savings

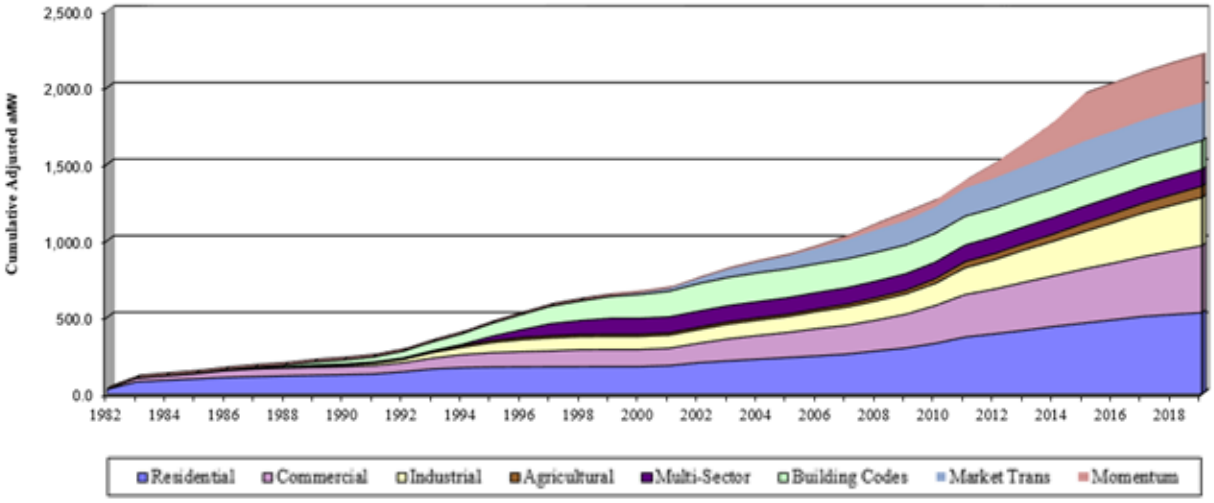
Figure 2 illustrates the annual conservation achievements, FY 1982-2019.



* FY 2016-2019 Market Momentum Savings not yet available at time of report.

Figure 3 illustrates the yearly contributions from each sector toward BPA's total savings for FY 1982-2019. [6]

FIGURE 3: BPA's Cumulative Conservation Savings (aMW) by Sector, FY 1982-2019*



* FY 2016-2019 Market Momentum Savings not yet available at time of report.

Conservation in FY 2012-2019

The savings for 2012 onward will be considered separately from prior years due to post-2011 policy shifts and the associated change in the funding model. From 2012 onward, funds are distributed to utilities based on each utility's share of the BPA's Tier One power. Funds are fully allocated to utilities at the start of each rate period, and additional funds are not available except under specific conditions. Under this new funding mechanism, the available funds from BPA are known as the Energy Efficiency Incentive, or EEI. Within this new policy framework, BPA has continued to offer third-party programs that provide program delivery directly to customers, using either EEI or the utility's own funding. Table B below provides additional information on conservation savings beginning with FY 2012.

6 Building code savings are included in the Residential and Commercial savings.

TABLE B: BPA's Annual Conservation Savings (aMW), FY 2012-2019*

Residential	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2012-19
Low Income Weatherization, State Implemented	0.3	0.4	0.1	0.2	0.2	0.3	0.1	0.2	1.7
Programmatic Low Income Weatherization, Utility Self-Funded	0.2	0.3	0.1	0.3	0.1	0.2	0.1	0.1	1.4
Programmatic Low Income Weatherization, EEI Funded	0.5	0.3	0.4	0.4	0.5	0.3	0.5	0.3	3.0
Programmatic Utility Self-Funded	4.9	10.2	6.4	8.2	5.8	11.8	3.2	5.5	55.9
Programmatic EEI Funded	15.5	11.6	18.2	12.7	14.9	9.5	9.1	5.7	97.0
Residential Subtotal	**21.3**	**22.7**	**25.2**	**21.7**	**21.5**	**22.0**	**12.9**	**11.7**	**159.1**
Programmatic Commercial									
Programmatic Utility Self-Funded	3.6	7.5	5.6	7.8	5.0	9.0	7.1	11.8	57.3
Programmatic EEI Funded	11.3	14.3	11.7	13.6	12.1	11.6	16.2	11.6	102.4
Programmatic Commercial Subtotal	**14.9**	**21.8**	**17.3**	**21.4**	**17.1**	**20.6**	**23.3**	**23.4**	**159.7**
Programmatic Industrial									
Programmatic Utility Self-Funded	2.1	8.3	4.5	2.9	2.4	8.3	5.9	4.2	38.6
Programmatic EEI Funded	13.7	11.1	11.1	14.6	18.6	11.6	9.4	10.6	100.7
Programmatic Industrial Subtotal	**15.8**	**19.4**	**15.6**	**17.5**	**21.0**	**19.9**	**15.3**	**14.8**	**139.3**
Programmatic Agricultural									
Programmatic Utility Self-Funded	1.1	1.2	1.4	1.3	0.0	0.2	1.2	1.7	8.1
Programmatic EEI Funded (with SIS Adjustment)	0.6	0.6	3.1	6.3	4.2	4.3	4.0	3.8	26.8
Programmatic Agricultural Subtotal	**1.7**	**1.8**	**4.5**	**7.6**	**4.2**	**4.5**	**5.2**	**5.5**	**34.9**
Programmatic Utility Systems Efficiency									
Programmatic Utility Self-Funded	-	0.0	0.4	0.0	-	0.5	0.1	0.1	1.1
Programmatic EEI Funded	-	-	-	-	0.1	0.1	0.2	0.2	0.6
Programmatic Utility Sys. Efficiency Subtotal	**-**	**0.0**	**0.4**	**0.0**	**0.1**	**0.6**	**0.3**	**0.3**	**1.7**
TOTAL PROGRAMMATIC FEDERAL	**0.0**	**4.2**	**1.6**	**2.8**	**1.1**	**5.0**	**1.1**	**1.4**	**17.2**
MOMENTUM SAVINGS	**47.2**	**54.3**	**60.2**	**97.8**	**TBD**	**TBD**	**TBD**	**TBD**	**259.4**
MARKET TRANSFORMATION	**10.9**	**12.5**	**16.2**	**14.1**	**4.0**	**3.7**	**4.9**	**5.0**	**71.3**
TOTAL SAVINGS	**111.8**	**136.7**	**140.8**	**183.0**	**68.9**	**76.4**	**63.0**	**62.0**	**842.6**
All EEI-Funded Programmatic Savings	**41.5**	**42.1**	**46.0**	**50.4**	**51.5**	**42.4**	**40.4**	**33.5**	**347.7**
All Self-Funded Programmatic Savings	**11.9**	**27.5**	**18.3**	**20.6**	**13.3**	**29.9**	**17.6**	**23.4**	**162.4**
All Programmatic Savings	**53.4**	**69.6**	**64.3**	**70.9**	**64.8**	**72.3**	**58.0**	**56.8**	**510.2**

* FY 2016-2019 Market Momentum Savings not yet available at time of report.

Momentum Savings

Momentum Savings result when an end-user chooses an efficient option without receiving a financial incentive directly from an energy-efficiency program. Many factors may drive such choices, including the "momentum" generated by past efficiency programs, new codes and standards, corporate sustainability policies and technology trends. Momentum Savings are energy savings that are:

- Cost effective.
- Not directly paid for by utilities.
- Not part of the Northwest Energy Efficiency Alliance, or NEEA, Net Market Effects.
- Above the Northwest Power and Conservation Council's Power Plan baseline, or Council baseline.

Momentum Savings require a fundamentally different quantification approach than programmatic savings, because there is no centralized record of them. A rich body of work exists documenting the approaches to, limitations of, and the results of quantifying programmatic savings. Evaluators have sought to refine these approaches and results from more than 30 years, and continue seeking to advance the methodologies. The methodologies for calculating Momentum Savings build upon these approaches.

Starting in 2010, BPA has performed market research and analysis to quantify Momentum Savings for residential and non-residential lighting, codes and standards, residential hot water, and residential heating, ventilation, and air-conditioning, or HVAC. The results of the analyses provided BPA's share of the regional Momentum Savings for 2010-2015, and is summarized below. Research performed by BPA is ongoing, and 2016-2019 Momentum Savings values currently only include savings from NEEA.

As research continues and BPA finalizes its savings for reporting, BPA anticipates reporting savings for non-residential lighting and residential HVAC for the 2016-2019 time period (and beyond). BPA is also currently exploring the feasibility of quantifying Momentum Savings (going back to 2016) for commercial HVAC and adjustable-speed drives.

Due to changes in the federal administration, there has been limited activity since 2016 with regard to more efficient standards. Therefore, BPA has not updated any of its standards models, and is not currently claiming any Momentum Savings from standards for 2016-2019, beyond what NEEA claims and reports to BPA. If new efficiency standards are enacted, BPA will assess whether to develop additional standards models.

TABLE C: Momentum Savings 2010-2019*

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Quantified Momentum Savings										
NEEA-reported Momentum Savings	13.02	13.78	16.69	16.5	24.82	28.19	10.74	9.04	16.27	18.65
BPA-reported Standards Momentum Savings	3.83	3.77	3.65	3.87	3.69	15.22	TBD	TBD	TBD	TBD
BPA reported Market Momentum Savings	-27.37	-8.62	26.87	33.91	31.66	54.37	TBD	TBD	TBD	TBD
Momentum Savings	**-10.52**	**8.93**	**47.21**	**54.28**	**60.17**	**97.78**	**TBD**	**TBD**	**TBD**	**TBD**
NEEA Savings										
NEEA Momentm Savings	13.02	13.78	16.69	16.5	24.82	28.19	10.74	9.04	16.27	18.65
NEEA Net Market Effects	12.86	11.32	10.88	12.45	16.19	14.1	3.97	3.73	4.92	5.01
NEEA Remaining Savings	**25.88**	**25.1**	**27.57**	**28.95**	**41.01**	**42.29**	**14.71**	**12.77**	**21.19**	**23.66**

Note: For 2010-2015, savings are adjusted for a 1.09056 busbar, reported on calendar year and against the Northwest Power and Conservation Council's Sixth Plan baseline. For 2016-2019, savings are adjusted for a 1.0749 busbar, reported on calendar year and against the Northwest Power and Conservation Council's Seventh Plan baseline.

* Results as of July 22, 2020. 2016-2019 Momentum Savings are not yet available at time of this report.

Glossary

Term	Definition
Average megawatt, or aMW	aMW refers to a unit of energy output over a year, equivalent to the energy produced by the continuous operation of one megawatt of capacity over a period of time. It is also an average of one million watts transferred over a period of time (often a year, thus average annual megawatts). One aMW is therefore equivalent to one megawatt produced continuously for 8,760 hours (the number of hours in a year) for a total of 8,760 megawatt-hours.
Billing credit	Adjustment to the BPA customer's electric power bill, or the equivalent cash payment, for a reduction in the customer's net requirement of capacity and energy purchased from BPA resulting from an independently undertaken conservation activity.
BPA direct funded	Various savings fall under this category of funding and include BPA contributions for market transformation, one-time grants for pilot projects (agricultural) and direct installations of measures during BPA-funded audits under the Energy Smart Grocer program.
Conservation	Conservation means any reduction in electric-energy consumption resulting from an increase in the efficiency of electric-energy use, production or distribution; the direct application of a renewable resource; or modifications in consumer behavior that decrease energy consumption.
Conservation Modernization, or ConMod	ConMod was a legacy conservation program designed to save energy in the Northwest aluminum industry. The program was designed to save energy by offering a 5-mill (0.5 cent) incentive for every kWh of energy saved while producing one pound of aluminum.
Direct acquisition	Programs that pay for energy-efficiency measures that result directly from actions taken, such as installing measures, rather than from paying someone for activities, such as code enforcement, or employing other programs that indirectly cause conservation to occur. Acquisition is a term from the Northwest Power Act used when conservation activity is equivalent to, and as reliable as, acquiring actual generation-produced energy. Under the Power Act, acquisition of energy, whether through conservation or through generation, must be done under contracts that allow for rigorous verification.
Energy Conservation Agreement, or ECA	ECA is a resource acquisition contract with utility customers intended to reduce BPA's load obligation through mechanisms for delivering energy savings. This contract was the successor to the expired CAA contracts.
Energy conservation measures, or ECM	Materials or equipment installed or activities implemented to produce electric energy savings. A specific action or installed device that saves energy. Also referred to as a conservation measure.
First-year savings	BPA programs are reported in terms of the savings that occur in one year, although the cost effectiveness of measures is based on the expected life of the measure. Measures can last 10, 20 or more years. Therefore, total savings are calculated by multiplying the first-year savings by the measure life.

Term	Definition
HVAC	Heating, ventilation and air conditioning systems include furnaces, ducts, air control system filters, baffles, motors, vents, sensors and chillers. These systems present many efficiency improvement opportunities. HVAC systems are found in houses and industrial facilities, but the primary use of the term is associated with cooling, heating and venting of air within large commercial structures.
Legacy	Legacy refers to the conservation activities started prior to FY 2000 that are still operating. These include low-income weatherization, the Energy Northwest pay-for-performance contract, the Tacoma Fort Lewis program and some others with minor savings impacts.
Line Loss	The electric energy lost (dissipated) during transmission and distribution of electricity.
Load following	Load following generally refers to automatic adjustments in generation that follow changes in customer load in order to maintain a continuous balance between loads and generation.
Low-Income Residential Weatherization (states)	This program mitigates the rising energy costs that make it difficult for low-income citizens to adequately heat their homes. The program helps conserve energy resources in state programs (for example, Community Action Partnership) and thereby reduces the need to obtain energy from more costly conventional energy resources. Low income means household income that is at or below 125 percent of the federal poverty level.
Market transformation	A program designed to cause new technologies to be built or accepted as standard practice. Market transformation refers to a specific programmatic effort operated through the Northwest Energy Efficiency Alliance that receives funding directly from BPA and additional funding from utilities.
Model Conservation Standards, or MCS	MCS were called for in the Northwest Power Act. The Northwest Power and Conservation Council, authorized through the NW Power Act to set standards and plan for future conservation and power acquisition, and BPA worked together to set the MCS and to encourage utilities to create programs to begin promoting such standards. MCS was designed as an early step in energy-efficiency code standards, which three of the four Northwest states served by BPA eventually adopted.
Momentum Savings	Momentum Savings are energy savings that are cost effective, not directly paid for by utilities, not part of the Northwest Energy Efficiency Alliance, or NEEA, Net Market Effects , and above the Northwest Power and Conservation Council's Power Plan baseline (Council baseline).
Multi-sector	Multi-sector is a catchall term for savings that don't fit into a single sector.
Sector	Sector refers to a segment of a market, such as residential, commercial, industrial and agricultural end users. Each sector employs a different approach and program design specific to its contents.

	Definition
System efficiencies	System efficiencies refer to improvements in transmission, distribution and transformers that save energy. Examples include lower-loss transformers (silicon core), reconductored distribution lines with higher voltage and conservation voltage reduction, which lowers the voltage on distribution lines and saves energy during low-load time periods.
Utility	Utility refers to an electric utility that is either consumer-owned or investor-owned. A consumer-owned utility can be a municipal electric utility, a public utility district, an irrigation district, a cooperative, a mutual corporation or an association that is engaged in the business of distributing electricity to one or more retail electric customers.
Utility self-funded	Beginning in FY 2007 and continuing through today, utilities can choose to self-fund conservation and achieve credit towards the conservation adjustment as described in the Tiered Rates Methodology, which went into effect in FY 2012. To be eligible, conservation activities must meet the same requirements as BPA-funded activities.
Weatherization	Modifying a building envelope to reduce energy consumption for heating or cooling. Weatherization measures can include adding insulation, installing storm windows and doors, caulking cracks and adding weather stripping.