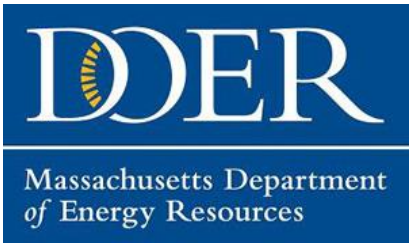
ALTERNATIVE ENERGY PORTFOLIO STANDARD
2020 MINIMUM STANDARD REVIEW SUMMARY



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Purpose

Per 225 CMR 16.07(3), the Department of Energy Resources ("DOER") was required to complete a 2020 APS Minimum Standard Review ("APS Review") of the Alternative Energy Portfolio Standard ("APS") by December 31st 2020, which must include a public comment period and should cover, but not be limited to:

1. an examination of the costs and benefits of the program to ratepayers,
2. an examination of the effectiveness of the program in meeting the energy and environmental goals of the Commonwealth, and
3. an evaluation of whether the Minimum Standard or its rate of increase, as established in 225 CMR 16.07(2), should be adjusted.

This document is a summary of the APS review undertaken in 2020.

Background

In the spring of 2019, DOER contracted with Daymark Energy Advisors ("Daymark") to analyze the APS and on October 30, 2020 DOER released the Alternative Energy Portfolio Standard Review ("Daymark Review"). The Daymark Review modeled current incentive levels under the APS by technology, assessed future supply and demand scenarios of the APS market, and analyzed the greenhouse gas ("GHG") emissions reductions by technology. The Daymark Review included some main conclusions:

- **Necessary Incentive Level Varied by Technology.** The necessary incentive level for renewable thermal technologies varies by comparison technology;
- **Gap in Incentive Level for Some Technologies.** The current incentive levels under the APS are not adequate to support the adoption of many renewable thermal technologies,
- **Cost-effective without APS Incentives.** Combined heat and power systems currently do not require an APS incentive,
- **Cost-Effectiveness.** Small renewable thermal systems achieve emissions reductions for the lowest cost,
- **Unbalanced Market.** if business as usual continues, supply will quickly out pace demand, and there are potential policy levers to address supply-demand imbalance such as:
    - reducing the qualification of CHP for the APS,
    - utilizing Biofuels and Biogas as a bridge fuel,
    - increasing demand to accommodate large renewable thermal potential, and
    - moving the APS obligation to natural gas local distribution companies[1].

The final recommendation from the Daymark Review included further stakeholder engagement to assess the applicability and impact of any changes modeled in the report prior to a promulgation of regulations.

On November 5, 2020, DOER sought public comments on a set of targeted stakeholder questions, in compliance with 225 CMR 16.07(3). The stakeholder questions focused on the three regulatory required areas to be assessed in the APS Review. DOER accepted responses until December 4, 2020 and received approximately 100 responses from stakeholders.

[1] Moving the obligation to natural gas local distribution companies is not currently in DOER's authority and would require a statutory change by the Massachusetts Legislature.

Summary of Findings

1) an examination of the costs and benefits of the program to ratepayers

DOER utilized information directly from stakeholders, supplemented with information from the Daymark Review, to both quantitatively and qualitatively analyze the costs and benefits of the APS program. Table 1 below shows the estimated cost of the program, from 2015-2019. The costs were calculated by taking the cost of settled Alternative Energy Certificates ("AECs") and adding it to total amount of Alternative Compliance Payments ("ACP") received. To determine the AEC price, DOER utilized the stakeholder comments submitted in response to one of the stakeholder questions posed, asking stakeholders to provide the historical sale price of AECs since 2015. DOER averaged these prices for each year that it received from commenters. The analysis estimates that compliance costs for the program have declined due to the increase supply of AECs in the market, despite the obligation increasing each year by 0.25%.

Table 1: Estimated Cost of APS 2015-2019

Year	AECs Settled for Compliance	Average AEC Price	ACPs Made	ACP Value	Total Program Cost
2015	891,994	$21.20	902,605	$22.02	$38,783,404.92
2016	943,999	$21.35	928,636	$22.00	$40,580,830.65
2017	1,800,115	$21.73	141,974	$22.23	$42,277,081.26
2018	1,910,223	$17.88	43,845	$22.64	$35,143,458.41
2019	2,179,379	$15.38	50,038	$23.13	$34,665,331.07

These findings were supported by responses that DOER received from the Retail Electricity Suppliers, who provided an analysis of compliance costs in their responses to the stakeholder questions. However, it should be noted that DOER has heard from some stakeholders and confirmed through market reports that AEC prices have dropped as low as $4 and varied widely since 2019.

DOER took a dual approach to analyzing the benefits received by the APS program looking both at historical benefits highlighted by stakeholders in their public comments and a future look at potential APS benefits in a business as usual case identified in the Daymark Review.

The historical benefits of the APS program stakeholders identified included how the APS drove technological adoption by providing a financial incentive to make APS eligible projects more economical. Stakeholders commented that these projects would not have gone forward without the APS incentives and the installation of the technologies led to both quantitative and qualitative benefits that include, but were not limited to, the following:

Increased resiliency and reliability – Stakeholders commented on the resiliency and reliability benefits of APS eligible technologies, specifically Combined Heat and Power ("CHP") systems. Stakeholders highlighted the ability of CHP systems to island from the electric grid, meaning in the case of an electrical outage, the CHP system is still able to operate and provide power. This is especially critical in facilities such as hospitals, which are roughly 10% of the CHP systems qualified under the APS. Commercial entities also highlighted how the utilization of CHP reduces the risk of outages and decreased operations

and allows for higher productivity. Lastly, stakeholders identified the benefits that CHP provides for supporting the electric grid and providing stability by shaving peak load and reducing the demand for the expansion of transmission and distribution infrastructure, especially as electrification becomes more widespread.

Emissions reductions – Stakeholders commented that the APS reduced emissions and help the Commonwealth to achieve the 2050 emissions reductions mandates established by the Global Warming Solutions Act ("GWSA"). Commenters recognized electrification through heat pumps paired with distributed renewable energy as a main strategy to decarbonize the building sector. In facilities where electrification is not feasible, stakeholders identified CHP systems as a way to increase efficiency and therefore reduce emissions when compared to traditional HVAC systems such as boilers, furnaces, and chillers utilizing natural gas, oil, or propane and the electric grid.

Lower energy costs – Many stakeholders stated the APS provided a benefit of lower energy costs due to the implementation of APS eligible technologies. Stakeholders identified that especially in cases where customers were using delivered fuels such as oil and propane, switching to fuels such as wood pellets, wood chips, and heat pumps provided economic benefits through reduced operation costs. Additionally, the improved efficiency of CHP systems provided an overall lower energy burden than traditional natural gas boilers, furnaces, and chillers.

Investments in the local economy – Stakeholders provided variety of examples about how the APS program benefits the local economy. Commenters noted that woody biomass technologies such as wood pellets and wood chips create a market for low grade wood that benefits both the landowners and the professional foresters. Renewable thermal technologies were identified as supporting small and local installation businesses. Lastly, commenters identified the benefits to the Massachusetts economy from manufacturing and processing facilities that can operate more, with fewer energy outages, leading to more production and profitability.

Many stakeholders commented that the benefits of the APS program have declined because fewer eligible systems are being installed due to the lower and more volatile AEC prices in recent years. Many commenters noted that if the APS were to stabilize and yield an AEC price that incentivized broader participation in the program, the benefits that the APS is providing would increase.

The Daymark Review also assessed the potential benefits from GHG emission reductions associated with the APS program. In a scenario where supply and demand are balanced, the number of AECs coming from CHP systems are capped, and renewable thermal systems are given increased incentives, the APS has the ability to mitigate upwards of 4,000,000 metric tons of CO_2in 2030 compared to business as usual. However, the Daymark Review concluded that, similar to the comments made by stakeholders, these reductions would be contingent on the rate of technology adoption as modeled in the report, which was based on a $15/AEC sale price, and these reductions would likely not be achievable unless the APS market was stabilized with an AEC price of at least $15/AEC.

In summary, the APS does have the opportunity to provide benefits, but it must be balanced against the cost of the program that is borne by electric ratepayers. DOER will further assess how best to balance the supply and the demand for the program and how it can be improved to achieve cost effective GHG emission reductions.

2) *An examination of the effectiveness of the program in meeting the energy and environmental goals of the Commonwealth*

In December 2020, the Executive Office of Energy and Environmental Affairs ("EEA") released the Massachusetts Decarbonization Roadmap to 2050 ("2050 Roadmap")[2] and the interim Massachusetts Clean Energy and Climate Plan for 2030 ("2030 CECP")[3] both of which are tasked with identifying the policies and strategies that the Commonwealth will need to implement to reach the 2050 GWSA emissions mandates. Within each of these reports, decarbonizing the building sector is highlighted as a major policy that will need to be accelerated especially over the next 10 years and through 2050. The 2050 Roadmap identifies the APS as a strategy to achieve this policy (paired with other incentives such as MassSave) and estimates that there will need to be roughly 100,000,000 conversions to heat pumps by 2030. Table 2 below shows the historic number of air source heat pump ("ASHP") and ground source heat pump ("GSHP") participating in the APS between 2015-2019.

Table 2: Heat pump participation in the APS program[4]

	Air Source Heat Pump	**Ground Source Heat Pump**
2015	27	29
2016	83	43
2017	78	26
2018	233	74
2019	425	101
2020*	720	47
Total	**1,566**	**320**

*Does not include all Q4 2020 systems

These numbers do not encompass the full number of heat pump installations in the Commonwealth and it is possible that incentives from MassSave or consumers own purchasing preferences could have been the driving factor behind these installations. However, these numbers do identify an opportunity for the APS to be improved to further support the installation of heat pumps to meet the Commonwealth's 2030 goals.

Other technologies, such as solar thermal and woody biomass, have experienced slower rates of adoption to heat pumps and could be bolstered to support the decarbonization of the building sector to meet the state's goals. Table 3 below shows the number of solar thermal and woody biomass systems participating in the APS between 2015-2019. With relatively few alternatives for water heating, solar thermal offers significant potential for emissions reductions, if widely deployed. Woody biomass provides a potential

[2] https://www.mass.gov/doc/ma-2050-decarbonization-roadmap/download
[3] https://www.mass.gov/doc/interim-clean-energy-and-climate-plan-for-2030-december-30-2020/download
[4] https://edit.mass.gov/doc/aps-qualified-units-list-6

opportunity to achieve these goals, however the lifecycle greenhouse gas emission reductions are highly dependent on the feedstocks used for the fuel.

Table 3: Number of Solar thermal and woody biomass projects participating in the APS program[5]

	Solar Thermal	Woody Biomass
2015	101	24
2016	74	8
2017	70	5
2018	114	23
2019	141	15
2020*	81	7
Total	**581**	**82**

*Does not include all Q4 2020 systems

Biofuels that utilize appropriate feedstocks are identified in the 2050 Roadmap as an opportunity to quickly replace fuel oil, resulting in GHG emission reductions. This option could serve as a bridge solution until the system reaches its end of life, at which point the system could be replaced with a preferred technology, such as a heat pump. Eligible Liquid Biofuels in the APS have hit the maximum number of AECs allowed to be minted in 2019[6]. Approximately 27% of residences in Massachusetts utilize fuel oil[7] and the biofuel industry responses to the stakeholder questions indicated that there is significant potential for liquid biofuels to expand in Massachusetts. However, they stated that the current cap on AECs for the technology and the lower certificate prices will make the expansion unlikely.

Table 4 below shows the total number of CHP systems, by fuel type, and fuel cells that are qualified to participate in the APS program.

[5] https://www.mass.gov/doc/aps-qualified-units-list-5/download
[6] https://www.mass.gov/doc/cap-on-eligible-liquid-biofuels
[7] https://www.mass.gov/service-details/how-massachusetts-households-heat-their-homes

Table 4: Qualified CHP and fuel cell systems in APS Program[8]

	Qualified Systems	Capacity (MW)
Natural Gas CHP	96	499.888
Woody Biomass CHP	2	0.709
Digester Gas CHP	2	0.420
Natural & Digester Gas CHP	2	2.300
Natural Gas Fuel Cell	19	8.654

The vast majority of the systems are natural gas, though there are a handful utilizing qualified renewable fuels such as woody biomass and biogas. While CHP systems are more efficient, the benefit they offer is limited by their efficiency and the feedstocks of the fuel. Going forward, fossil fuels used in most CHP and fuel cells will need to be phased out and alternative approaches should be assessed.

Table 5 below shows the number of CHP systems that qualified for the APS program between 2009-2020.

Table 5 Qualified CHP systems 2009-2020[9]

	Qualified Systems	Capacity (MW)
2009	5	22.836
2010	5	7.170
2011	12	14.250
2012	12	22.374
2013	8	261.150
2014	1	0.060
2015	17	18.935
2016	11	12.360
2017	11	84.349
2018	15	7.996
2019	12	10.987
2020	2	1.500

[8] https://edit.mass.gov/doc/aps-qualified-units-list-6
[9] https://www.mass.gov/doc/aps-qualified-units-list-5/download

The APS has been effective at increasing the installation of CHP systems and has contributed to the development of the market. As noted in Table 4, the majority of these systems are natural gas. These systems typically have a lifespan of 20-30 years, meaning that a system which begins operating today could be operating well into the 2040s and 2050s.

These data suggest that the APS has supported installation of CHP and renewable thermal technologies and contributed to the Commonwealths goals. However, with the new CECP goals to reduce GHG emissions by 2030, and the current low price for AECs in the APS market, the APS regulations should be revised. The revisions should focus on encouraging technologies that reduce GHG emission and should serve as a transition for the market as alternative approaches are contemplated to increase wider adoption of renewable thermal technologies. These goals for the APS would support the findings from the Daymark Review which noted that renewable thermal technologies are one of the most cost effective ways to achieve GHG emissions reductions. Additionally, the 2050 Roadmap identifies industries, such as manufacturing, as particularly challenging to decarbonize and a suitable fit for higher efficiency technologies such as CHP when other alternatives are not feasible.

3) *an evaluation of whether the Minimum Standard or its rate of increase, as established in 225 CMR 16.07(2), should be adjusted.*

The Daymark Review assessed the APS minimum standard and its current rate of increase and potential adjustments. The Daymark Review concludes that in the business as usual case, the APS would begin to be oversupplied in 2019 and would remain oversupplied unless program modifications were made. This was supported by the number of AECs that were minted in 2019, which was approximately 14% over the projected 2019 obligation and in line with the Daymark Review. As new Generation Units are qualified under the APS, especially larger CHP systems, the APS oversupply will become more dramatic. Unlike other environmental attribute markets, there are limited renewable thermal markets available to market participants. It is likely that the oversupply modeled in farther out years would not be as significant as determined by the Daymark Review, due to the fact that the large oversupply would yield lower AEC prices, which would slow technology adoption.

While an oversupply can be beneficial to ratepayers by suppressing AECs prices that will drive down compliance costs, a program that has limited support for renewable thermal technologies is not beneficial in the absence of alternative approaches to encourage the decarbonization in the building sector and reduce GHG emissions. The majority of stakeholders agreed that the minimum standard for the APS is too low and should be revised. Suggestions included both a one-time increase to absorb any oversupply in the existing market and a change to the rate of increase. Stakeholders shared that these are needed to keep up with the number of APS eligible systems anticipated to come online to meet the Commonwealth's ambitious decarbonization goals.