



# COMMENTS ON THE APS STRAW PROPOSAL

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**Prepared For**

Massachusetts Department of Energy Resources

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## I. Summary

### A. History of the APS

The Massachusetts Alternative Energy Portfolio Standard (APS) was created to facilitate investment into low-carbon alternative energy systems in residential thermal and commercial power generation. The APS requires retail electric suppliers to obtain a percentage of the electricity they serve to their customers from alternative energy sources. The APS offers opportunity for Massachusetts business, institutions, governments, and retailers to earn an incentive for installing alternative energy systems (or distributing alternative fuels), which are not necessarily renewable, but contribute to the Commonwealth's clean energy goals by reducing greenhouse gas emissions. The APS requires a mandated percentage of the state's electric load to be met by eligible technologies. Eligible facilities and retailers generate Alternative Energy Credits (AECs), which are sold to retail electric suppliers.<sup>1</sup>

### B. Success of the APS

The APS has facilitated significant capital investment into combined heat and power (CHP) generation units. From 2010-2017, CHP generated 99% of the Alternative Energy Credits (AECs) in the APS. In 2018, renewable thermal technologies were introduced into the program. Of those technologies, liquid biofuels have experienced the most participation and growth. Residential air-and ground-source heat pumps have seen growth in the number of generation units over the last two years.

### C. Scope of the Review

Diversified Energy Specialists analyzed the APS policy, financial incentive, market dynamics, supply and demand, and greenhouse gas emissions reductions of the highest generating technologies in the program. All technologies were analyzed based on ratepayer costs, capital investment required, emissions reduction, and growth potential.

Diversified Energy Specialists analyzed the Daymark Report and the DOER's APS Straw Proposal. Analysis was completed with modeling and projections of future market dynamics in the APS program with the impact of the regulatory changes in the Straw Proposal.

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<sup>1</sup> Massachusetts Department of Energy Resources

## II. Straw Proposal Analysis

### A. Compliance Obligation

Electric load serving entities (LSEs) are obligated to purchase a certain percentage of their distributed electric load in Massachusetts from alternative energy. This is accomplished by purchasing Alternative Energy Certificates (AECs) or by the Alternative Compliance Payment (ACP), which is a cap on the price of AECs. The compliance obligation can be calculated as the Massachusetts retail electricity load, multiplied by the minimum standard percentage. Since 2014, the minimum standard has increased by 0.25% per year. As capital investment into eligible technologies in the APS has grown, the generation has reached equilibrium with the compliance obligation.

The supply of AECs has surpassed the compliance obligation and it will be necessary to increase the minimum standard to facilitate further capital investment into eligible technologies in the APS.

**Table 1: Compliance Obligation**

Compliance Year	Massachusetts Retail Electric Load (MWh)	Minimum Standard	Compliance Obligation (AECs)
<b>2010</b>	50,026,093	1.50%	626,902
<b>2011</b>	49,386,169	2.00%	911,748
<b>2012</b>	48,992,430	2.50%	1,185,236
<b>2013</b>	49,252,929	3.00%	1,448,421
<b>2014</b>	48,129,294	3.50%	1,681,759
<b>2015</b>	48,009,723	3.75%	1,799,068
<b>2016</b>	46,864,431	4.00%	1,874,261
<b>2017</b>	45,722,855	4.25%	1,942,089
<b>2018</b>	46,448,304	4.50%	2,087,123
<b>2019</b>	44,705,754	4.75%	2,182,717
<b>2020</b>	43,624,906	5.00%	2,181,245

The compliance obligation was projected through 2030 under the Straw Proposal's minimum standard increase. The Massachusetts retail electric load was projected by using the ISO-NE Final 2019 Energy Efficiency Forecast<sup>2</sup> and adding the electrification forecasts from the ISO-NE 2020 CELT Report<sup>3</sup>.

<sup>2</sup> ISO-NE Final 2019 Energy Efficiency Forecast

<sup>3</sup> ISO-NE 2020 Capacity, Energy, Loads, and Transmission Report

The Straw Proposal suggests increasing the minimum standard by 2%, from 5.5% in 2022 to 7.5% in 2030. This increase in minimum standard increases the compliance obligation by nearly 1 million AECs.

**Table 2: Projected Compliance Obligation**

Compliance Year	Massachusetts Retail Electric Load (MWh)	Minimum Standard	Compliance Obligation (AECs)
2021	44,856,000	5.25%	2,354,940
2022	45,671,000	5.50%	2,511,905
2023	46,516,000	<b>7.50%</b>	<b>3,488,700</b>
2024	47,312,000	7.75%	3,666,680
2025	48,071,000	8.00%	3,845,680
2026	48,852,000	8.25%	4,030,290
2027	49,635,000	8.50%	4,218,975
2028	50,412,000	8.75%	4,411,050
2029	51,081,132	9.00%	4,597,302
2030	51,755,477	9.25%	4,787,382

The proposed increase in the minimum standard of 2% in 2023 is moving the program forward 8 years. Even if there weren't any supply constraints proposed, this would be an aggressive minimum standard increase. This 2% increase will have a direct impact on the cost of the program to the ratepayers. An increase of this magnitude, along with the phase out of most of the generation in the APS program, will increase the ratepayer cost of electricity. While there is a slight oversupply of generation in the APS, the proposed increase is far too high. The negative impacts outweigh the potential benefits in the program, especially when a lower increase can return the program to a desired undersupply and facilitate capital investment into eligible renewable thermal technologies in the APS. The eligible technologies that remain uncapped are not capable of scaling at a rate that could handle a minimum standard increase of this size. The market will remain undersupplied every year through 2030. The modeling later in this document will show that an increase of 1% to the minimum standard in 2023 would send the necessary market signal to facilitate capital investment into renewable thermal technologies while also limiting the cost to ratepayers.

## B. Alternative Compliance Payment

The ACP price sets a ceiling on the price of AECs. Retail electricity suppliers can choose to pay the ACP price to meet compliance for each MWh they are obligated or can purchase AECs. The annual change to the ACP is determined by taking the prior year ACP and adding the result of the consumer price index for the most recent year divided by the consumer price index from the year prior.

**Table 3: Alternative Compliance Payment**

Compliance Year	Current ACP	Straw Proposal ACP
2010	\$20.00	\$20.00
2011	\$20.40	\$20.40
2012	\$21.02	\$21.02
2013	\$21.43	\$21.43
2014	\$21.72	\$21.72
2015	\$22.02	\$22.02
2016	\$22.00	\$22.00
2017	\$22.23	\$22.23
2018	\$22.64	\$22.64
2019	\$23.13	\$23.13
2020	\$23.50	\$23.50
2021	\$23.80	\$23.80
2022	\$24.28	\$24.28
2023	<b>\$24.76</b>	<b>\$40.00</b>
2024	\$25.26	\$40.00
2025	\$25.76	\$40.00
2026	\$26.28	\$40.00
2027	\$26.80	\$40.00
2028	\$27.34	\$40.00
2029	\$27.89	\$40.00
2030	\$28.44	\$40.00

\*Projected increases assume a 2% inflation rate

The Straw Proposal suggests raising the ACP to \$40.00 in 2023 and aligning the ACP in the APS with the RPS. This proposed change to the ACP and must be reconsidered, analyzing the signal it will send to the market about the value of greenhouse gas emissions reductions. Diversified Energy Specialists strongly opposes the proposed change to the ACP and believes that the wide-ranging implications of this increase need to be further considered.

When battling climate change, reducing greenhouse gas emissions are fluid, regardless of the sector that the reductions come from. RPS eligible technologies reduce emissions by 100% in most cases, with renewable electricity generation from wind, solar, and a range of other technologies. The MA RPS Class I ACP is set to be \$40.00 in 2023, meaning that 1 MWh of renewable electricity generation would receive an incentive that would be capped at \$40.00.

In the APS, technologies are eligible if they reduce greenhouse gas emissions by 50% or more versus the alternative in the thermal sector. The ACP in the APS program was set at \$20.00 when the program began. The ACP rate has increased by the consumer price index to track inflation. The ACP is \$23.80 in 2021 and projections indicate that it should

be \$24.76 in 2023, assuming a 2% inflation rate. Under current regulations, the ACP of the APS would be roughly 62% of the ACP of the RPS in 2023. Given that APS eligible technologies reduce up to 50% less greenhouse gas emissions per MWh than RPS eligible technologies, this is a logical difference in the ACP rates.

Looking at other thermal portfolio standards in New England, there are two that closely align with the eligible technologies and rulemaking of the MA APS. Looking at their ACP levels and minimum standards provides a look into the regionally accepted value of reducing emissions from the thermal sector.

**Table 4: Similar Thermal Portfolio Standards**

Thermal Portfolio Standard	2021 Minimum Standard	2021 Alternative Compliance Payment	2020 Total Generation (MWh)
<b>MA APS</b>	5.25%	\$23.80	2,361,922
<b>NH Class I Thermal</b>	1.80%	\$26.35	82,767
<b>CT Class III</b>	5.00%	\$31.00	1,252,272

Regional renewable portfolio standards appear to be aligning in 2023 with an ACP around \$40.00. Thermal portfolio standards in the region should have an ACP that is 50-75% of the RPS ACP, given the greenhouse gas emission reductions that thermal portfolio standards create versus renewable portfolio standards.

In Massachusetts, the ACP in different classes of the RPS differ. Looking at the ACP price in the MA RPS classes provides further insight into what price the ACP in the APS should be moving forward.

**Table 5: Massachusetts Portfolio Standards**

Massachusetts Program	2023 ACP	2026 ACP
<b>RPS Class I</b>	\$40.00	\$42.25
<b>RPS Class II - Renewables</b>	\$29.75	\$11.50
<b>RPS Class II – Waste-to-Energy</b>	\$29.75	\$11.50
<b>APS – Current Regulation</b>	\$24.76	\$26.28
<b>APS – Straw Proposal</b>	\$40.00	\$40.00

\*Projected increases assume a 2% inflation rate

As RPS Class II renewables (hydro) and waste-to-energy (solid waste that generates electricity or steam power) reduce their ACP to \$11.50 per MWh in 2026, while the Straw Proposal increases the APS ACP to \$40.00. The APS generates less greenhouse gas emissions reductions per MWh than the RPS Class I or II and should not have an ACP that aligns or is greater than either.

The Biden Administration has preliminarily set the societal cost of carbon at \$51.00 per Ton of CO<sub>2</sub>. With carbon pricing on the horizon of the climate change battle, it is important to start considering that all emissions are equal and any reduction in greenhouse gas emissions is valued at the same price. Valuing greenhouse gas

reductions from the thermal sector higher than greenhouse gas reductions from the electricity sector when the greenhouse gas emissions from both sectors have the same impact on global warming doesn't make sense. Given that the average greenhouse gas emissions reduction per MWh in the APS is 50-75% the greenhouse gas emissions reduction per MWh of the RPS, the ACP in the APS should be priced at 50-75% of the RPS ACP of \$40.00 in 2023. The analysis of equivalent greenhouse gas emissions reductions between programs indicates that the ACP in the APS should be between \$20.00 and \$30.00 in 2023. In the current regulations, the ACP in the APS is projected to be \$24.76 in 2023, which is a level that reflects the greenhouse gas emissions reduction that is created in the APS.

While it is currently more difficult to reduce emissions with renewable thermal technologies than it is to reduce emissions in the thermal sector, given technology and operational constraints, that doesn't justify providing an equivalent financial incentive for reducing less greenhouse gas emissions. In order for Massachusetts to meet its 2030 and 2050 goals, the financial incentives must be provided on an even playing field and given only based on greenhouse gas emissions reductions per MWh equivalent, not based on the difficulty of reducing emissions in one sector versus another.

It is more difficult to financially justify the ACP in the APS program than the RPS program due to the many different eligible thermal technologies in the APS program. Despite that challenge, measuring the average greenhouse gas emissions reductions from all APS technologies per MWh allows us to reach an ACP that is comparable to the RPS ACP.

The ACP doesn't impact the price per MWh of a portfolio standard unless the program is undersupplied. In the Straw Proposal's suggested changes, the APS will be undersupplied in 2023 and could continue to be undersupplied through 2030. Given that fact, it is important to analyze how the proposed increase to the ACP could impact the ratepayers. In 2020, the cost of the APS program to ratepayers was under \$10.00 per MWh. In the Straw proposal, the cost of the APS program to ratepayers could be over \$30.00 per MWh and could remain at that level through 2030.

In 2020, with a ratepayer cost of less than \$10.00 per MWh, the DOER was able to claim significant reductions in greenhouse gas emissions reductions and justify to the ratepayers that their money was well-spent. Under the Straw Proposal, the ratepayers will be paying at least three times the amount and the DOER will be able to claim significantly less greenhouse gas emissions reductions due to the supply constraints proposed. This will put the DOER in a difficult position, struggling to justify why the program will cost the ratepayer three times the amount while claiming less greenhouse gas emissions reductions. While the DOER hopes that the undersupply of generation and the raised ACP will facilitate future capital investment into a few technologies that are not being phased out, those aspirations may never come to fruition.

Increasing the ACP price will directly impact the ratepayer cost of the APS program. LSEs factor the ACP price into their projected accounting each year and increasing the ACP

will increase the cost of electricity for all ratepayers in Massachusetts. An increase to the ACP will increase the cost of electricity, which will have a greater impact on environmental justice populations. With the proposed phase out of natural gas and the lower cap on biofuels, the APS program will provide additional focus on the remaining uncapped eligible technologies. Air-source heat pumps and ground-source heat pumps are extremely expensive to install. Environmental justice populations will not have access to these or other eligible technologies in the APS due to their high cost. With a raised ACP, environmental justice populations will face higher electricity costs and will not receive a proportionate amount of greenhouse gas emissions reductions. This will widen the energy affordability gap in Massachusetts and widen the health and air-quality gap between environmental justice communities and the rest of the state.

Diversified Energy Specialists strongly opposes the Straw Proposal’s suggested increase of the ACP to \$40.00 in 2023 and urges the DOER to price the reduction of greenhouse gas emissions in the state at the same level throughout all industries.

### C. Cap on Liquid Biofuels

Liquid biofuels are capped at 20% of the generated AECs in the APS. The cap is calculated by multiplying the Massachusetts retail electric load of two years prior by the current year’s minimum standard. The number of generation units and participation in the APS program from liquid biofuels has grown significantly since becoming an eligible technology. The cap was surpassed in 2019 and in 2020.

**Table 6: Liquid Biofuels Cap**

Compliance Year	20% Cap on Biofuels (AECs)	Biofuel Generation (AECs)	Percent of AECs Minted
<b>2017</b>	408,082	410,331	98%
<b>2018</b>	421,779	292,748	100%
<b>2019</b>	434,300	557,616	78%
<b>2020</b>	464,100	667,601	68%

The Straw Proposal suggests maintaining the cap on available AECs for biofuel generation units relative to any minimum standard increase. The biofuel cap is currently 20% of the program and the number of AECs available under the cap increases each year as the minimum standard increases. Under the Straw Proposal, biofuels generation units will become a smaller percentage of the APS program each year.

Liquid biofuels generation units have experienced growth in the APS that is only rivaled by CHP. In Q1 & Q2 2020, liquid biofuels units nearly doubled the 20% cap, generating 436,184 AECs, of which only 217,150 were minted. The greenhouse gas savings from liquid biofuel generation units in the first six months of 2020 was 287,068,220 lbs. CO<sub>2</sub>e vs. the alternative. In the three and a half years that liquid biofuels were eligible in the APS, the total greenhouse gas savings has been 1,116,825,889 lbs. CO<sub>2</sub>e. In addition,

these greenhouse gas savings vs. the alternative have been accomplished at zero cost to the end user. Retailers are selling biofuel blends at the same price as heating oil.

Liquid biofuel generation units are unique in the APS program in several ways. First, a single generation unit can reduce greenhouse gas emissions in thousands of buildings at once. No modifications to equipment are needed to deliver a biodiesel blend instead of heating oil. Therefore, distributors can deliver a biodiesel blend to their entire customer base, which on average is thousands of homes, and reduce emissions on a large scale. Second, liquid biofuel generation units can provide greenhouse gas emissions to thousands of homes at no cost to the end user. Other renewable thermal technologies require significant capital investment from the end user and installation can take months. The barriers to emissions reductions from a heat pump system are significant to an end user, while a liquid biofuel generation unit can start or stop delivering biofuel blends to end users at any time with no additional cost. Third, liquid biofuel generation units can reduce emissions immediately. Since equipment modifications, construction, and capital investment are not needed, liquid biofuel generation units can generate greenhouse gas emissions savings at large scale today, helping the state meet its greenhouse gas reduction goals.

Liquid biofuels are a 'drop-in' fuel that can be delivered to any residence or commercial building with a heating oil system and can do it at no-additional cost. Environmental justice populations have a disproportionate number of fossil fuel systems for their thermal needs. The cost of retrofitting an air or ground source heat pump are significant and difficult to afford for even high-income households. Biodiesel can immediately reduce greenhouse gas emissions from environmental justice populations at no-cost.

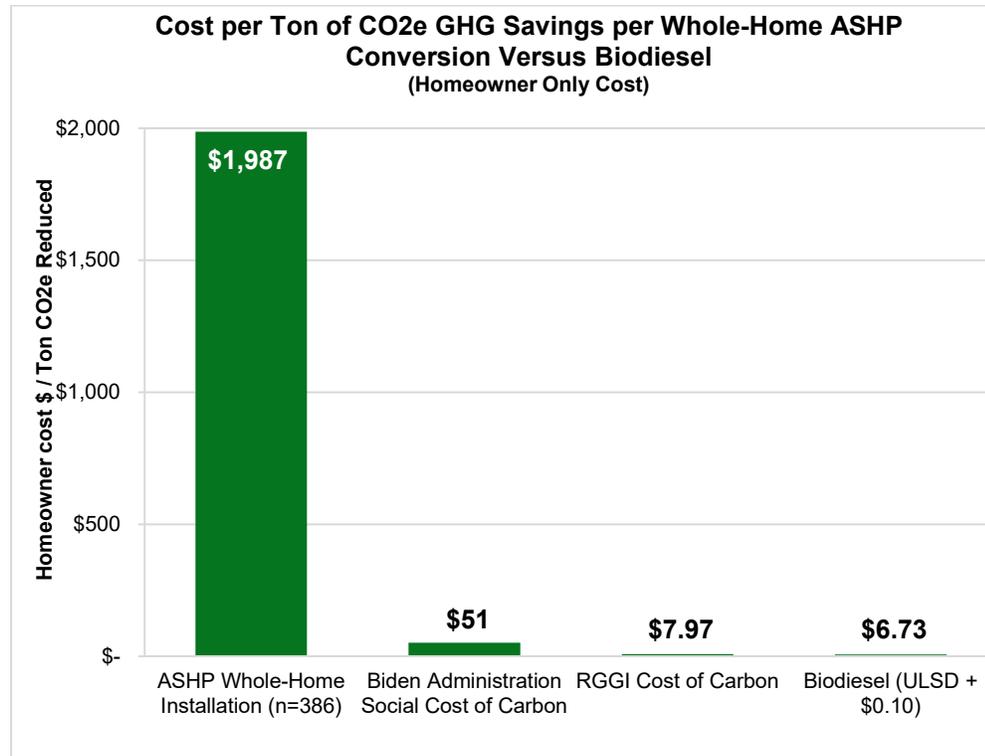
One of the goals of the 2021 APS review, stated by the DOER, is to prioritize the most greenhouse gas emissions reductions for the lowest cost. Despite that goal, the DOER has chosen to phase out the lowest-cost eligible technology that can be scaled across more than 750,000 homes in a short period of time, reducing emissions that would take decades to achieve from any other eligible technology in the APS program.

The DOER is phasing out natural gas fired APS eligible technologies because they are running on natural gas. The DOER wants to phase out liquid biofuels because a portion of the fuel is heating oil. The heating oil is not incentivized, only the biodiesel. The more gallons of biodiesel that are incentivized, the more heating oil is displaced.

Diversified Energy Specialists supports the 100% displacement of all fossil fuels in Massachusetts. To do that, the incentive for natural gas fired systems needs to be completely phased out. In addition, the incentive for biodiesel needs to be increased exponentially, not phased out. Phasing out the incentive for biodiesel is similar to promoting the further use of heating oil.

Below you will see an analysis on the cost of reducing 1 Ton of CO<sub>2</sub>e to a homeowner. The analysis looks at the homeowner cost per ton of CO<sub>2</sub> savings from an air source heat pump conversion versus biodiesel. The diagram uses a NYSERDA ASHP rebate program, where the cost per installation of a whole-home ASHP system was estimated to be \$17,286, far below the Massachusetts Clean Energy Centers data.

**Figure 1: Homeowner Cost per Ton of CO<sub>2</sub>e Savings per Whole-Home ASHP Conversion**



**Assumptions:**

- ✓ Electric Grid: 1,433 lbs/MWh – or 420 lbs/MMBtu
- ✓ Based on 2020 GREET natural gas as long-term marginal electric power and includes transmission and distribution losses
- ✓ Ultra-Low Sulfur Diesel (ULSD): 244 lbs/MMBtu
- ✓ Based on 2020 GREET Model Calculations
- ✓ Average cost of whole-home conversion: \$17,286
- ✓ Based on median size residence in New York of 1,764 sq. ft.
- ✓ Based on NYSERDA 2017-2019 ASHP Rebate Program Data
- ✓ ULSD boiler average efficiency: 78%
- ✓ Heat pump efficiency: COP of 2.01 @ 5°F, COP of 2.47 @ 20°F, COP of 3.09 @ 40°F, and COP of 3.71 @ 60°F
- ✓ Annual Home Heating Load: 100 MMBtu
- ✓ Annual lifecycle GHG CO<sub>2</sub>e (HHV) emissions for heating one home in tons:
  - ✓ ULSD: 15.6 Tons of CO<sub>2</sub>e
  - ✓ Whole-home electric heat pump: 6.9 Tons of CO<sub>2</sub>e
- ✓ No supplemental or backup heat sources were considered
- ✓ Heating oil was used as the baseline fuel

If the DOER wanted to prioritize the most greenhouse gas emissions for the lowest cost, they wouldn't be phasing out biodiesel.

#### D. Biofuels Minimum Blend Percentage

Biofuels are eligible in the APS program because each gallon of biofuels sold displaces a gallon of heating oil. The greenhouse gas emissions from biofuels are 66-82% less than from heating oil. Massachusetts needs to quickly reduce its reliance on fossil fuels and one of the quickest and most effective ways to do this is to increase the blend level of biofuels. Increasing the minimum blend level of biofuels from 10% to 20% in the APS program will encourage the more than 75 biofuel distributors in the APS program to increase their blend levels. This increase will lead to a reduction in the greenhouse gas emissions in the state and larger amount of greenhouse gas emissions reductions that the DOER will be able to claim in the APS program.

The heating oil industry has set goals of reaching net-zero carbon emissions by 2050. To achieve this goal, higher blend levels must be delivered. New York, Rhode Island, and Connecticut have set the standard by mandating an increasing level of biodiesel blends through 2035. I believe the incentive in the APS program should track these mandated levels in other states and encourage distributors to displace the highest number of gallons of heating oil as possible.

Diversified Energy Specialists encourages the DOER to take this one step further and increase the minimum blend percentage in the APS program to 20% in 2023, 30% in 2025, and 50% in 2030. One of the most equitable and low-cost ways for Massachusetts to meet its 2030 and 2050 greenhouse gas emissions reduction goals is to accelerate the use of biodiesel to displace heating oil.

#### E. Biofuels Feedstock

The DOER should consider expanding feedstock eligibility for liquid biofuel generation units to the Federal Renewable Fuel Standard definition of advanced feedstocks. The DOER should also require that eligible liquid biofuel under the Federal RFS definition of advanced feedstocks generate RINs in the Federal RFS. These feedstocks reduce greenhouse gas emissions by greater than 50% versus heating oil, meeting the eligibility requirement set for all renewable thermal technologies in the APS.

Soy-derived biomass-based diesel and other feedstocks have been blended with heating oil in Massachusetts for years. Expanding eligibility to these feedstocks would encourage higher blends of biodiesel at the wholesale level and would allow the DOER to claim greenhouse gas emissions reductions through the APS program for the millions of gallons that are currently being blended in the state but are unaccounted for. Expanding

feedstock eligibility would lower the current barriers to entry in the APS for distributors and reduce greenhouse gas emissions on a large scale in the near term.

#### F. Natural Gas Phase Down

CHP has generated the most AECs of any technology since the program began. CHP generated greater than 75% of the AECs in 2018.

The Straw Proposal suggested phasing CHP and fuel cell generation units utilizing natural gas down in 2023 and eventually phasing them out in 2030.

**Table 7: Straw Proposal Natural Gas Phase Down**

Compliance Year	AEC per MWh Generated
<b>2023</b>	0.7
<b>2024</b>	0.6
<b>2025</b>	0.5
<b>2026</b>	0.4
<b>2027</b>	0.3
<b>2028</b>	0.2
<b>2029</b>	0.1
<b>2030</b>	0.0

Diversified Energy Specialists supports the phase out of AECs generated by thermal technologies that are fired by natural gas. To meet the Massachusetts greenhouse gas emissions reductions goals of 2030 and 2050, fossil fuels need to be displaced by renewable thermal technologies.

Diversified Energy Specialists supports the Straw Proposal’s suggestion to phase out natural gas fired renewable thermal technologies by 2030, but believes the phase down is too fast in the early years. Many CHP generation units utilizing natural gas have come online recently or will come online soon. These generation units anticipated receiving an APS incentive for the life of their system and made large capital investments based on current regulations. Some of the CHP generation units utilizing natural gas are universities and hospitals. Given the significant capital investment into these generation units, Diversified Energy specialists would suggest a consistent phase out to 2030, rather than a 30% reduction in 2023. Reducing the factors applied to their generation by 12.5% per year, each year until 2030 when they will be completely phased out, will allow the generation units that have just come online to generate a portion of the incentive that they anticipated. In addition, the anticipated undersupply in 2023, which will increase the cost of the program to the ratepayer, would be less severe, while still facilitating capital investment into eligible renewable thermal technologies.

## G. Small Air and Ground Source Heat Pump Eligibility

The Straw Proposal suggests that small air and ground source heat pump generation units must submit a heat load calculation/design submittal that proves the generation unit provides full displacement.

The Straw Proposal also suggests that small air and ground source heat pump generation units which receive a MassSave incentive will not be eligible for the APS.

The EEAC has proposed significant changes to the MassSave program. These changes phase out heating oil incentives by 2024 and plan to phase out natural gas incentives in the future. The changes will provide a larger financial incentive to air and ground source heat pumps. Specifically, MassSave plans to provide incentives for residential air and ground source heat pumps which provide partial displacement of the residences heat load. Given these changes to the MassSave program, requiring small air and ground source heat pump generation units to provide full displacement to be eligible for the APS program makes logical sense. In addition, it is important that residential installations of air and ground source heat pump are not able to ‘double dip’ in the MassSave incentive and the APS program. Using both systems benefit charges in the MassSave program and ratepayer funding in the APS program will provide far greater incentive at far greater cost to the ratepayer than both the EEAC and DOER intend.

Diversified Energy Specialists supports both proposed changes.

In addition, Diversified Energy Specialists proposes that the DOER add an additional requirement to small air and ground source heat pump eligibility. Using a heat load calculation or design submittal to demonstrate that the small air and ground source heat pump system has the capacity to provide full displacement doesn’t necessarily ensure that the system is providing full displacement. Many field studies, including the ISO-NE 2020 Heating Electrification Report, has shown that despite installing an air source heat pump system that has the capacity to provide full displacement, many residences chose not to remove their legacy heating system and don’t use their air source heat pump system for 100% of their annual heat load. Given this analysis of consumer behavior and the DOER’s desire to only provide incentive to small air and ground source heat pump generation units that provide full displacement, the DOER should require the removal of the legacy heat source to be eligible for the APS.

Diversified Energy Specialists suggests that the DOER require applications for small air and ground source heat pump generation units to provide a design submittal that proves the removal of the legacy heat source.

### III. APS Eligible Renewable Thermal Technology Analysis

To better understand the barriers to emissions reduction and adoption of the largest generation technologies in the APS, a list of key metrics was developed that demonstrate the value of each technology in the APS.

Capital Investment Required: The capital investment required to reduce greenhouse gas emissions vs. the alternative. The cost of the Generation Unit. (High, Moderate, Low, Zero)

Greenhouse Gas Reduction Per Generation Unit: All generation units the APS must reduce greenhouse gas emissions by 50% or more vs. the alternative, but some generation units reduce more emissions per AEC than others. (High, Moderate, Low)

Widespread Adoption Potential: Considering the capital investment required, the emissions reduction vs. the alternative, and the level of the supply chain incentivized. (High, Moderate, Low)

Adoption Speed: How quickly can generation units begin providing emissions savings to Massachusetts? (Slow, Moderate, Fast)

Greenhouse Gas Savings to Massachusetts: The total emissions savings from the technology in the APS. (High, Moderate, Low)

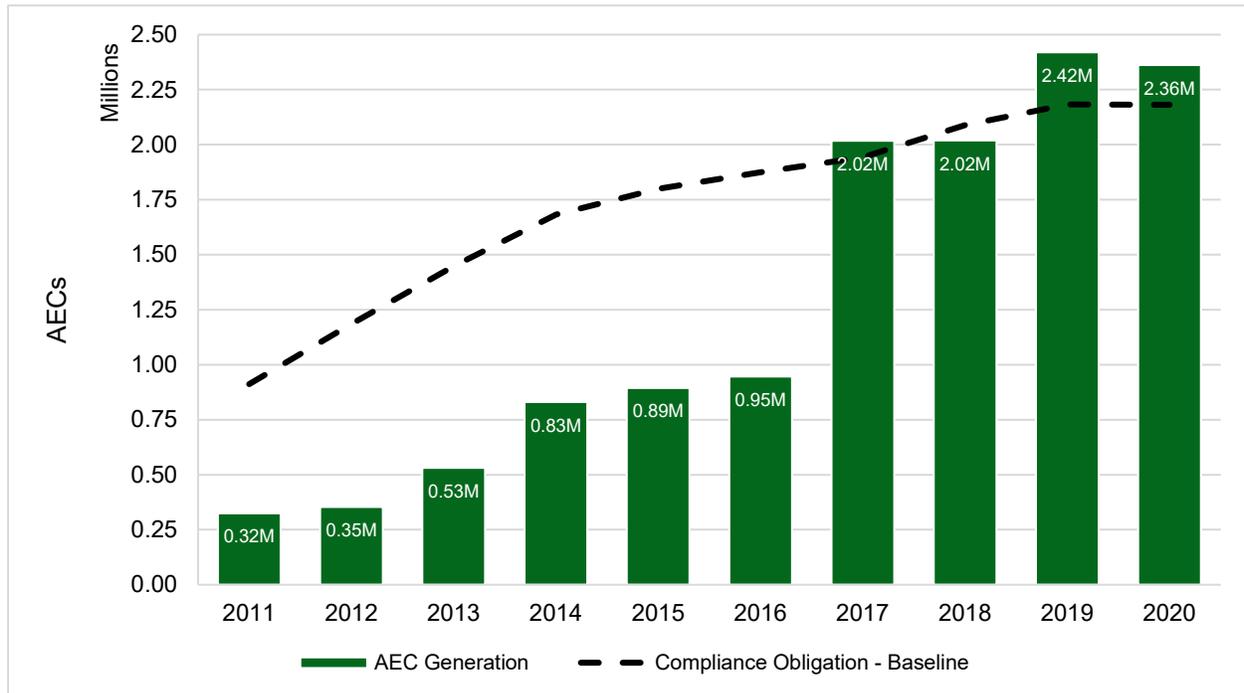
**Table 8: Technology Comparison**

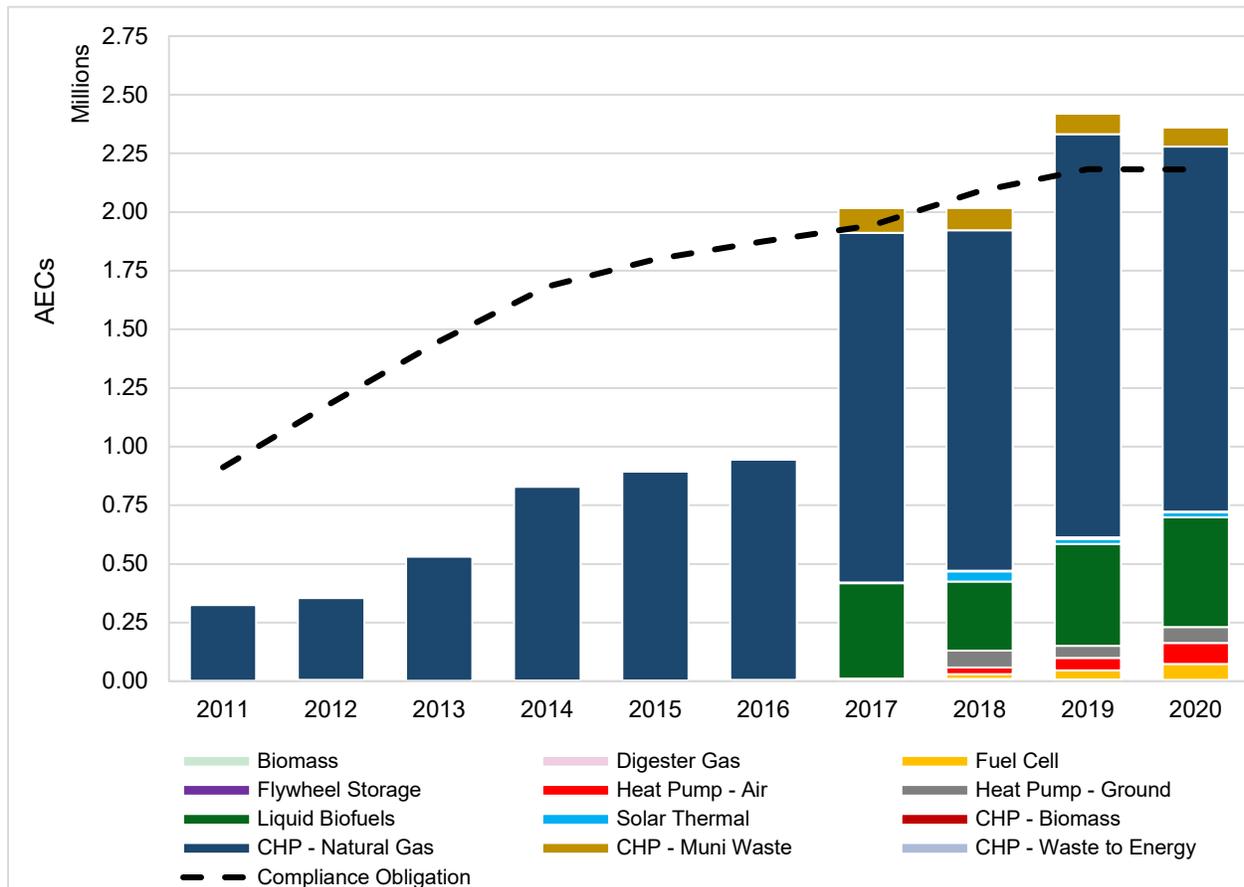
Technology	Capital Investment Required	GHG Reduction per Unit	Widespread Adoption Potential	Adoption Speed	GHG Savings to MA
<b>CHP</b>	High	High	Low	Slow	Moderate
<b>ASHP</b>	High	Moderate	Low	Slow	Low
<b>GSHP</b>	High	Moderate	Low	Slow	Low
<b>Biofuels</b>	Zero	High	High	Fast	High
<b>Solar Thermal</b>	High	Moderate	Low	Slow	Low

Expanding the cap on liquid biofuels in the APS program is the only option for reducing greenhouse gas emissions at a low cost and alleviating the undersupply that will plague the market under the Straw Proposal through 2030.

#### IV. Historical Supply & Demand Analysis

**Figure 2: Compliance Obligation vs. AEC Generation (2010-2020)**



**Figure 3: Historical AEC Generation by Technology vs. Compliance Obligation (2011-2020)**


### A. Projected Supply and Demand – Straw Proposal

Increasing the obligation by 2% in 2023, while phasing down the supply from the two largest generation technologies in 2023 and raising the ACP to \$40.00 will undersupply the market through 2030. The program will be expensive for ratepayers and will generate less greenhouse gas emission reductions than it has in the past. There are no remaining uncapped eligible technologies that can scale generation. The only technology that could realistically generate the millions of MWh needed for this market to return to equilibrium is intermediate and large air source heat pump generation units. The problem with that aspiration is that consumer behavior has proven air source heat pumps are not installed in commercial or industrial buildings. The cost to install a whole-home air source heat pump system in a 1,590 square foot home is \$21,479.<sup>4</sup> Only a few intermediate and large ASHP generation units have come online in the nearly 4-years that they have been eligible in the APS program. The consumer behavior regarding heat pumps will not change at the commercial level over the next 5-years. The result

<sup>4</sup> <https://www.masscec.com/blog/2020/09/29/september-whole-home-heat-pump-pilot-update-still-time-apply>

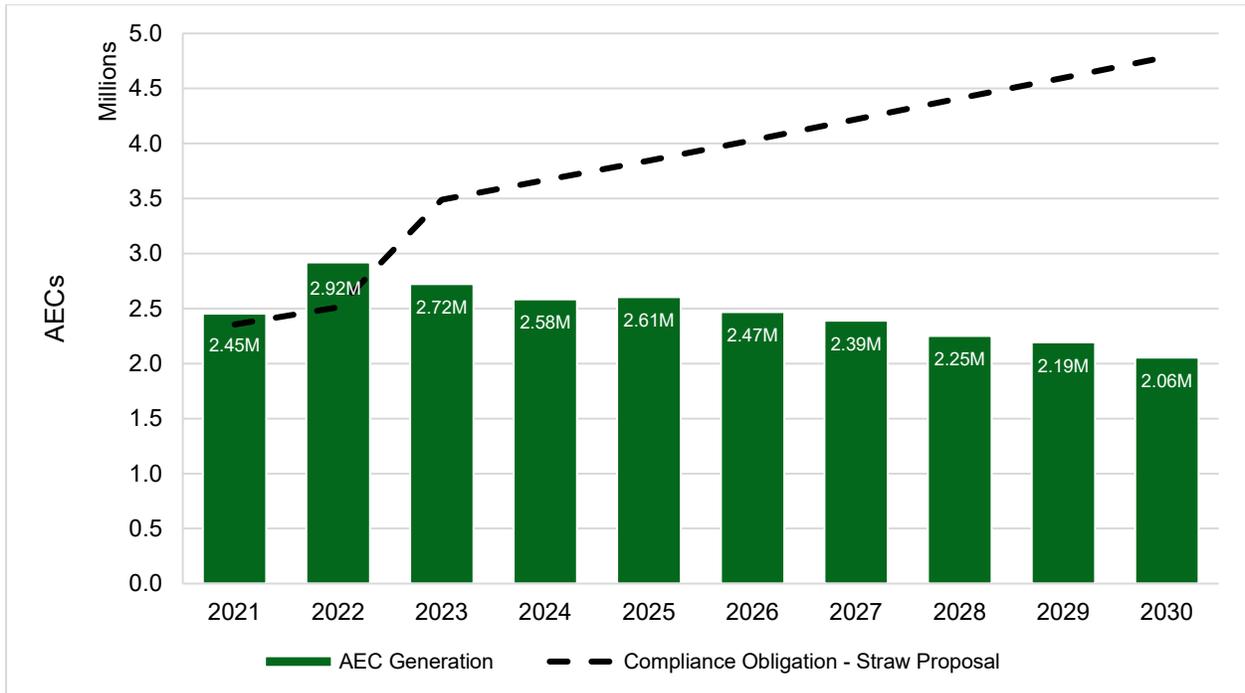
is that the APS program will be undersupplied, extremely expensive for ratepayers, and won't provide cost-effective greenhouse gas emissions reductions. The table below outlines the market dynamics in the APS program if the straw proposal were enacted.

**Table 9: Projected Market Dynamics – Straw Proposal**

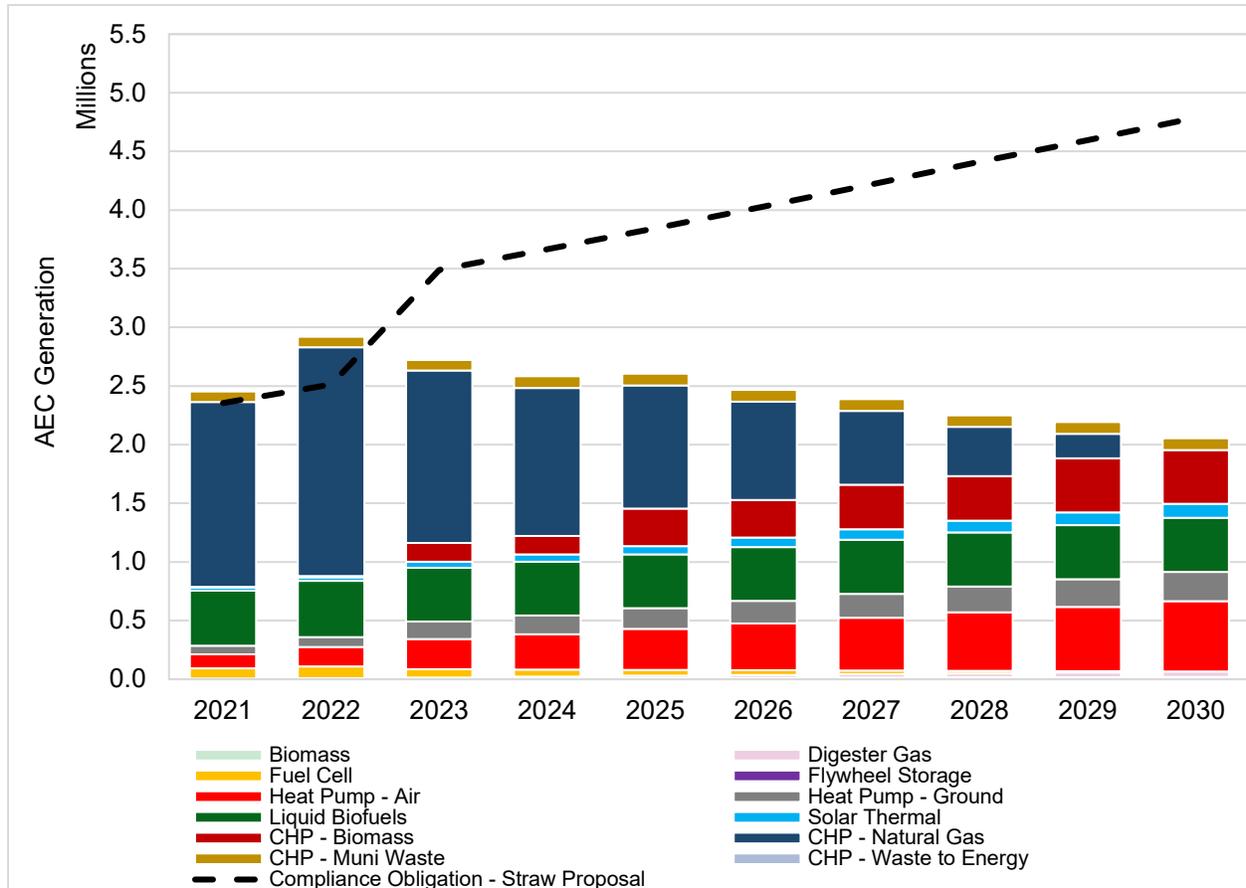
Compliance Year	Massachusetts Retail Electric Load (MWh)	Minimum Standard	Compliance Obligation (AECs)	AEC Generation	Over / Under Supply	Banked AECs from Prior year(s)	ACP Payments (AECs)
2010	50,026,093	1.50%	626,902	227,134	399,768	8,818	391,470
2011	49,386,169	2.00%	911,748	324,922	586,826	515	593,947
2012	48,992,430	2.50%	1,185,236	351,179	834,057	7,636	827,661
2013	49,252,929	3.00%	1,448,421	531,781	916,640	1,239	921,626
2014	48,129,294	3.50%	1,681,759	831,080	850,679	7,347	835,505
2015	48,009,723	3.75%	1,799,068	894,602	904,466	261	902,605
2016	46,864,431	4.00%	1,874,261	945,003	929,258	2,869	928,636
2017	45,722,855	4.25%	1,942,089	2,017,892	-75,747	3,847	141,974
2018	46,448,304	4.50%	2,087,123	2,016,118	66,562	221,624	43,870
2019	44,705,754	4.75%	2,182,717	2,420,318	-237,601	317,814	40,000
2020	43,624,906	5.00%	2,181,245	2,361,992	-180,747	354,882	50,000
2021	44,856,000	5.25%	2,354,940	2,453,410	-98,470	375,000	25,000
2022	45,671,000	5.50%	2,511,905	2,919,874	-407,969	450,000	15,000
2023	46,516,000	7.50%	3,488,700	2,721,571	767,129	575,000	192,129
2024	47,312,000	7.75%	3,666,680	2,583,000	1,083,680	0	1,083,680
2025	48,071,000	8.00%	3,845,680	2,605,000	1,240,680	0	1,240,680
2026	48,852,000	8.25%	4,030,290	2,467,000	1,563,290	0	1,563,290
2027	49,635,000	8.50%	4,218,975	2,389,000	1,829,975	0	1,829,975
2028	50,412,000	8.75%	4,411,050	2,251,000	2,160,050	0	2,160,050
2029	51,081,132	9.00%	4,597,302	2,193,000	2,404,302	0	2,404,302
2030	51,755,477	9.25%	4,787,382	2,055,000	2,732,382	0	2,732,382

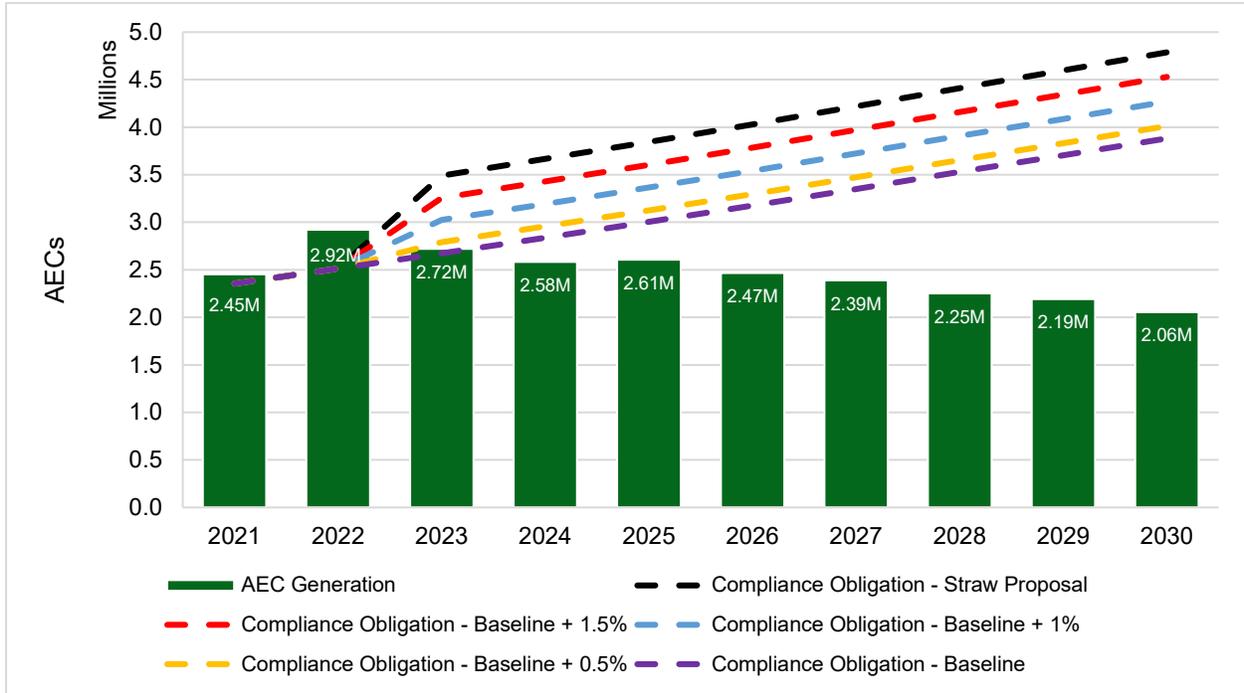
\*In the Final 2019 Energy Efficiency Forecast, published on May 1, 2019, ISO-NE forecasts a CAGR of 1.03% in Electricity sales in MA from 2020-2028, which was extended to 2030. Also taken into consideration was electrification forecasts (conversions) from transportation and heating in Massachusetts from the ISO-NE 2020 CELT report. These forecasts add an additional 888 GWh to the grid load from transportation and 548 GWh from heating by 2030.

**Figure 4: Projected AEC Generation vs. Compliance Obligation (2021-2030P)**



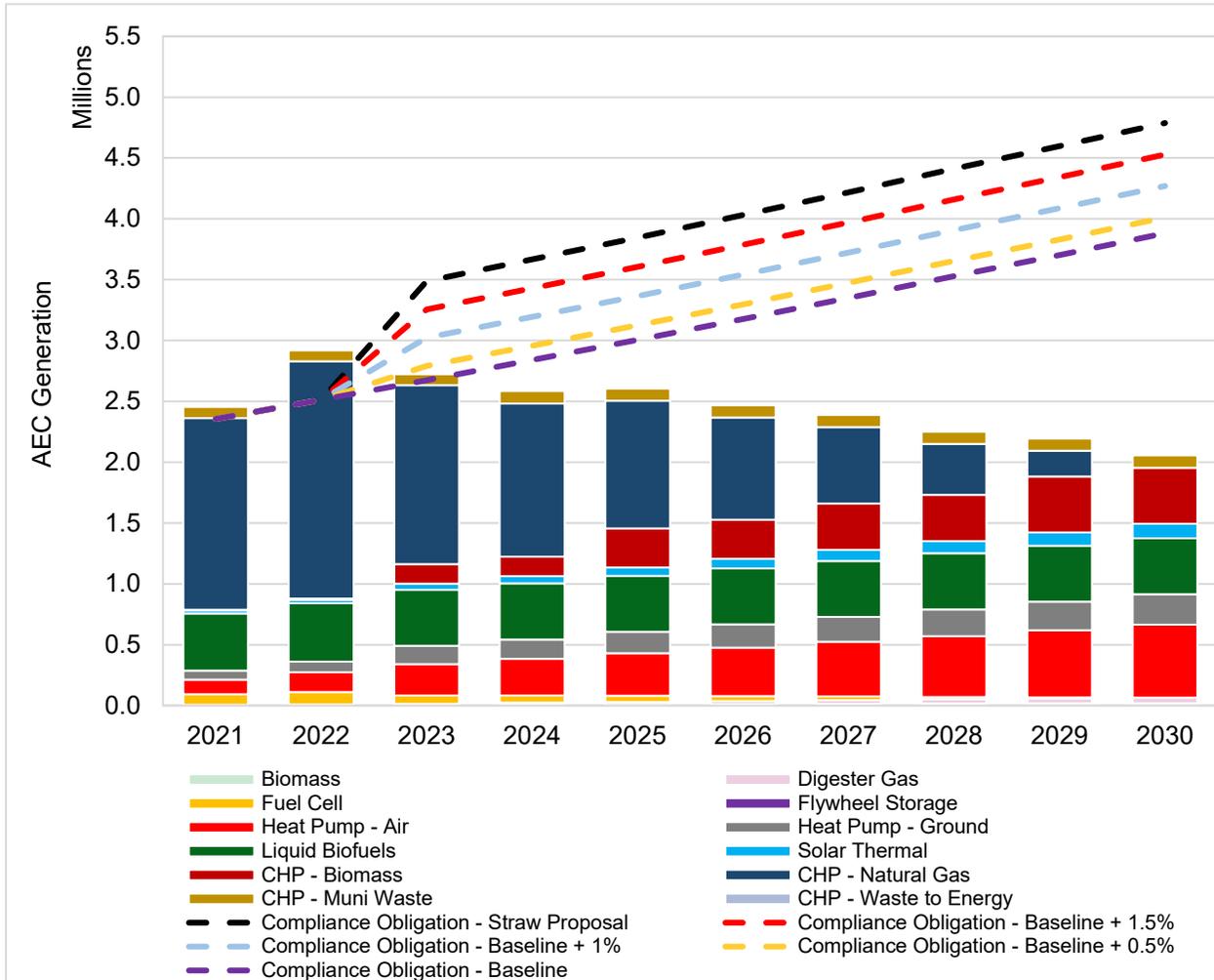
**Figure 5: Straw Proposal Projected AEC Generation by Technology vs. Compliance Obligation (2021-2030P)**



**Figure 6: Straw Proposal Projected AEC Generation vs. Compliance Obligation (2021-2030P)**
**Straw Proposal with a Range of Minimum Standard Increases in 2023 to Consider**


**Figure 7: Straw Proposal Projected AEC Generation by Technology vs. Compliance Obligation  
(2021-2030P)**

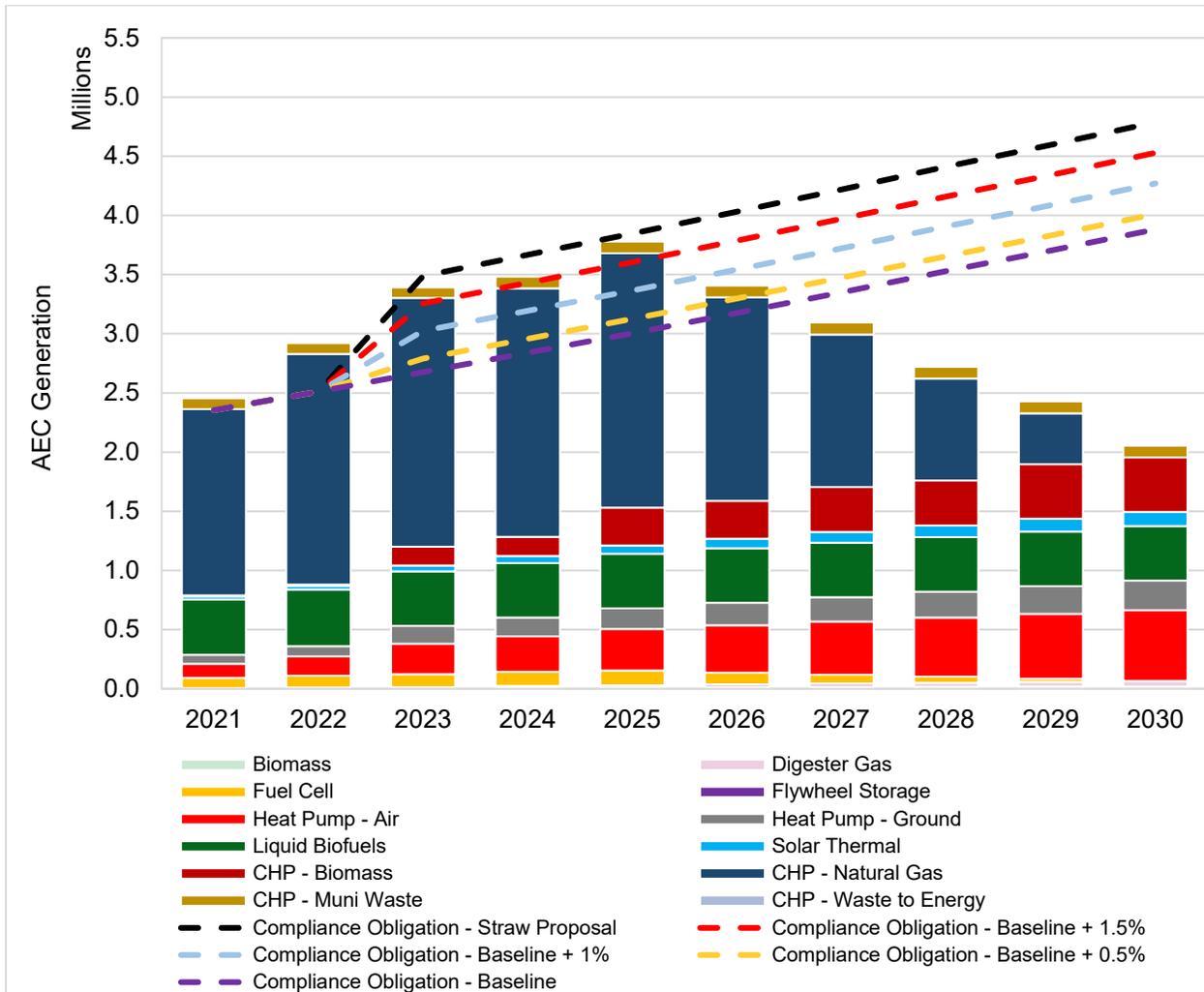
**Range of Minimum Standard Increases in 2023 to Consider**



## B. Scenario Analysis – Alternatives to the Straw Proposal

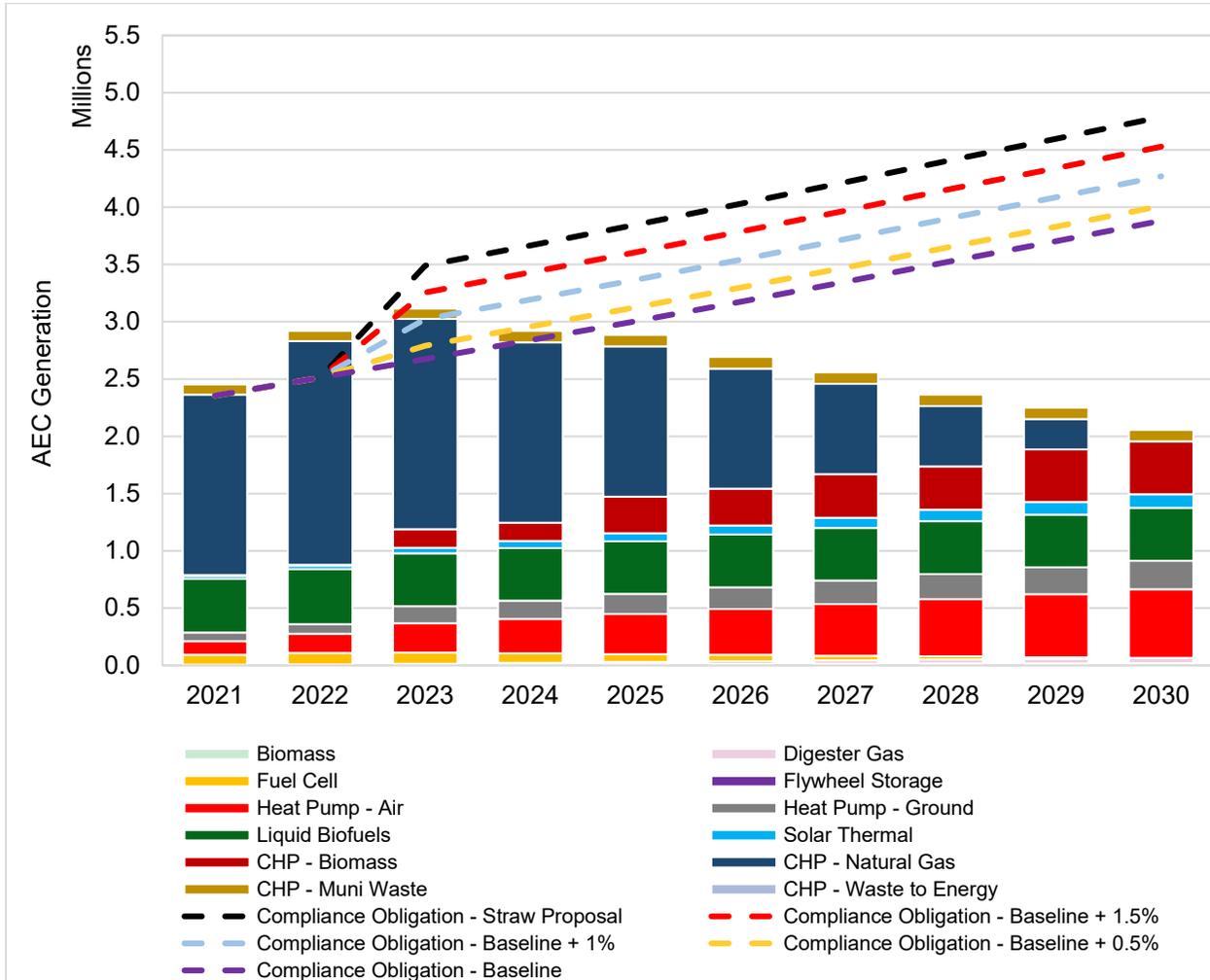
**Scenario 1: Straw Proposal with natural gas phase out in 2026 reducing 0.2 per year**

**Projected AEC Generation by Technology vs. Compliance Obligation (2021-2030P)**



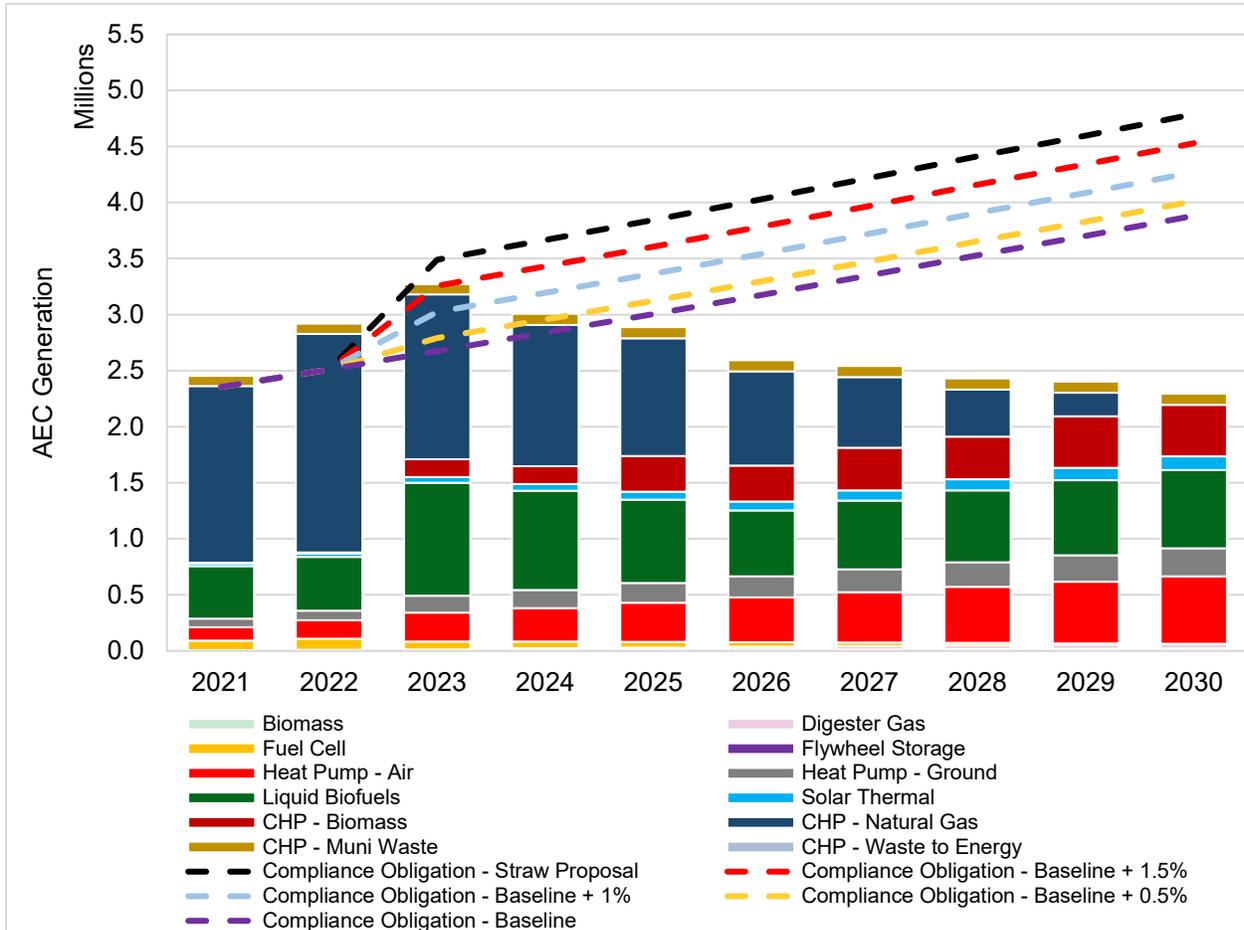
**Scenario 2: Straw Proposal with natural gas phase out in 2023 at .125 reduction per year**

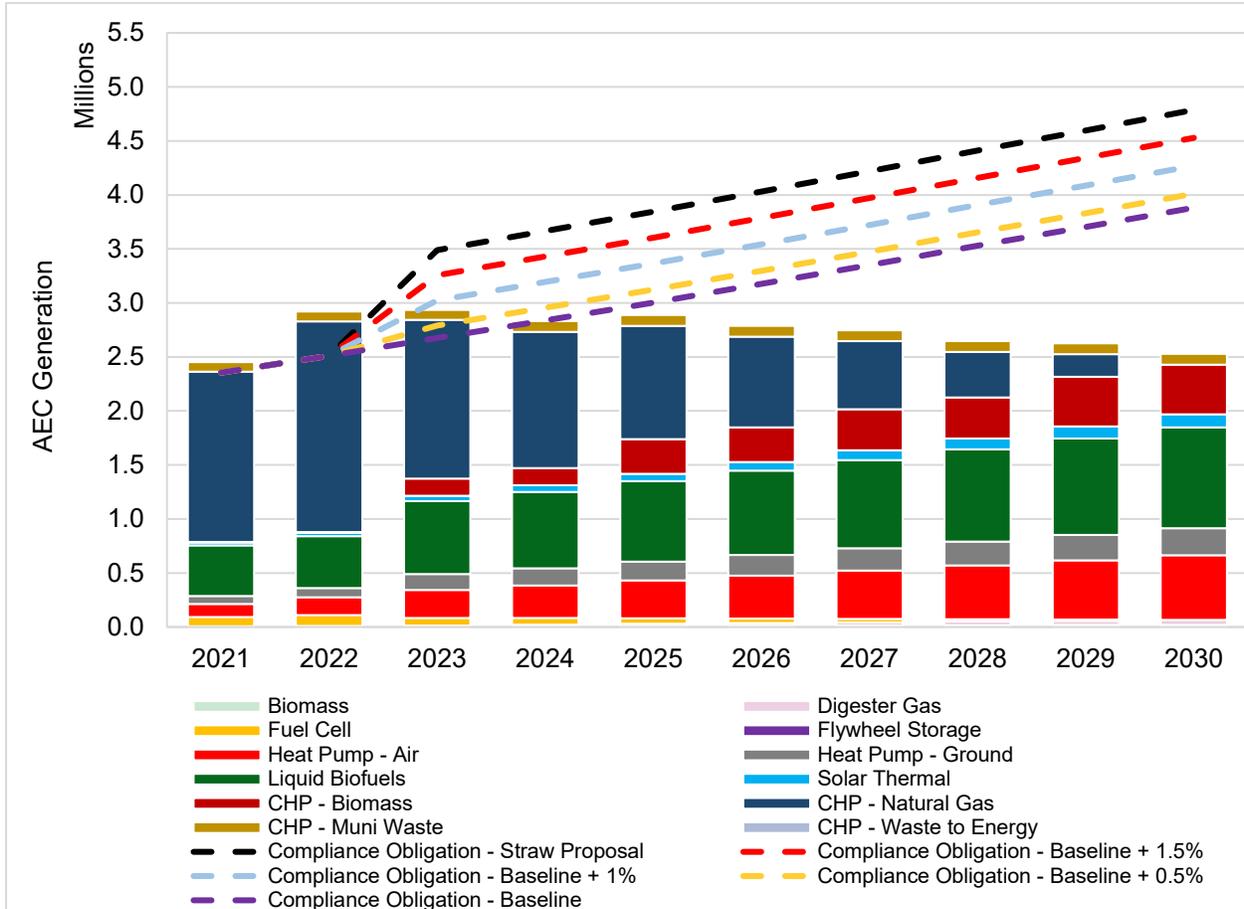
**Projected AEC Generation by Technology vs. Compliance Obligation (2021-2030P)**

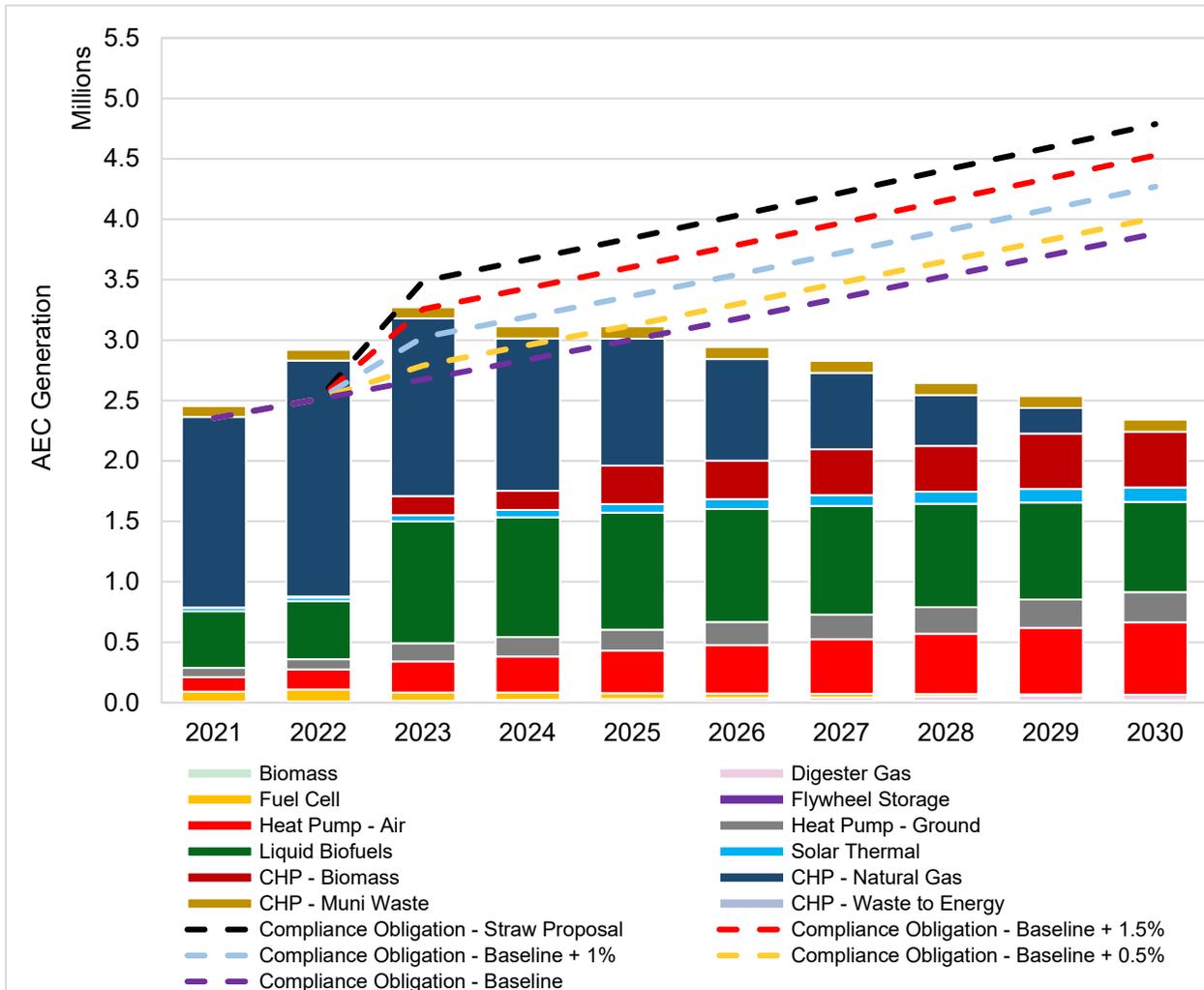


**Scenario 3: Straw Proposal with the biofuel cap at 30% in 2023, phasing down 5% per year, flat at 15% from 2026-2030**

**Projected AEC Generation by Technology vs. Compliance Obligation (2021-2030P)**

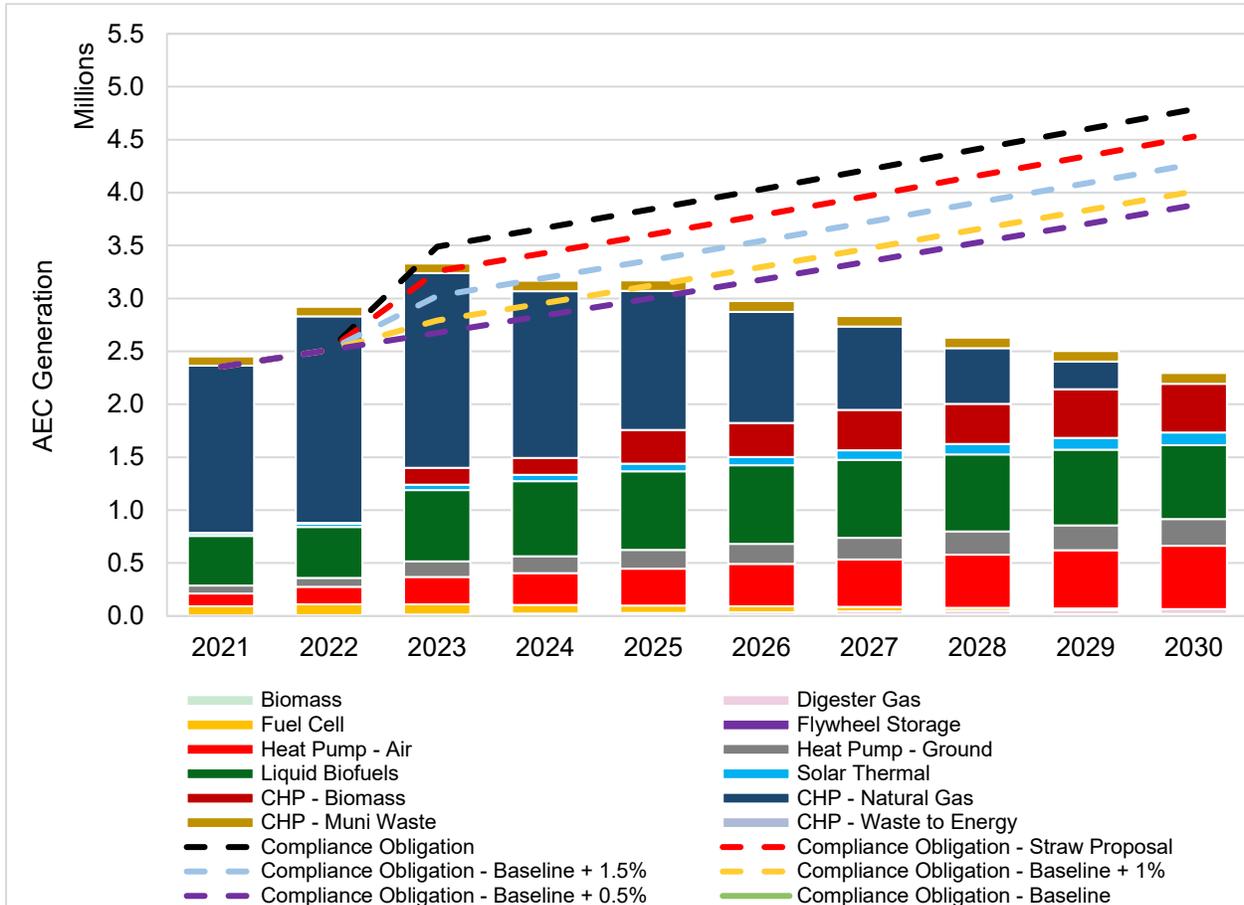


**Scenario 4: Straw Proposal with the biofuels cap at 20% through 2030**
**Projected AEC Generation by Technology vs. Compliance Obligation (2021-2030P)**


**Scenario 5: Straw Proposal with the biofuels cap at 30% in 2023, phasing down 2% per year**
**Projected AEC Generation by Technology vs. Compliance Obligation (2021-2030P)**


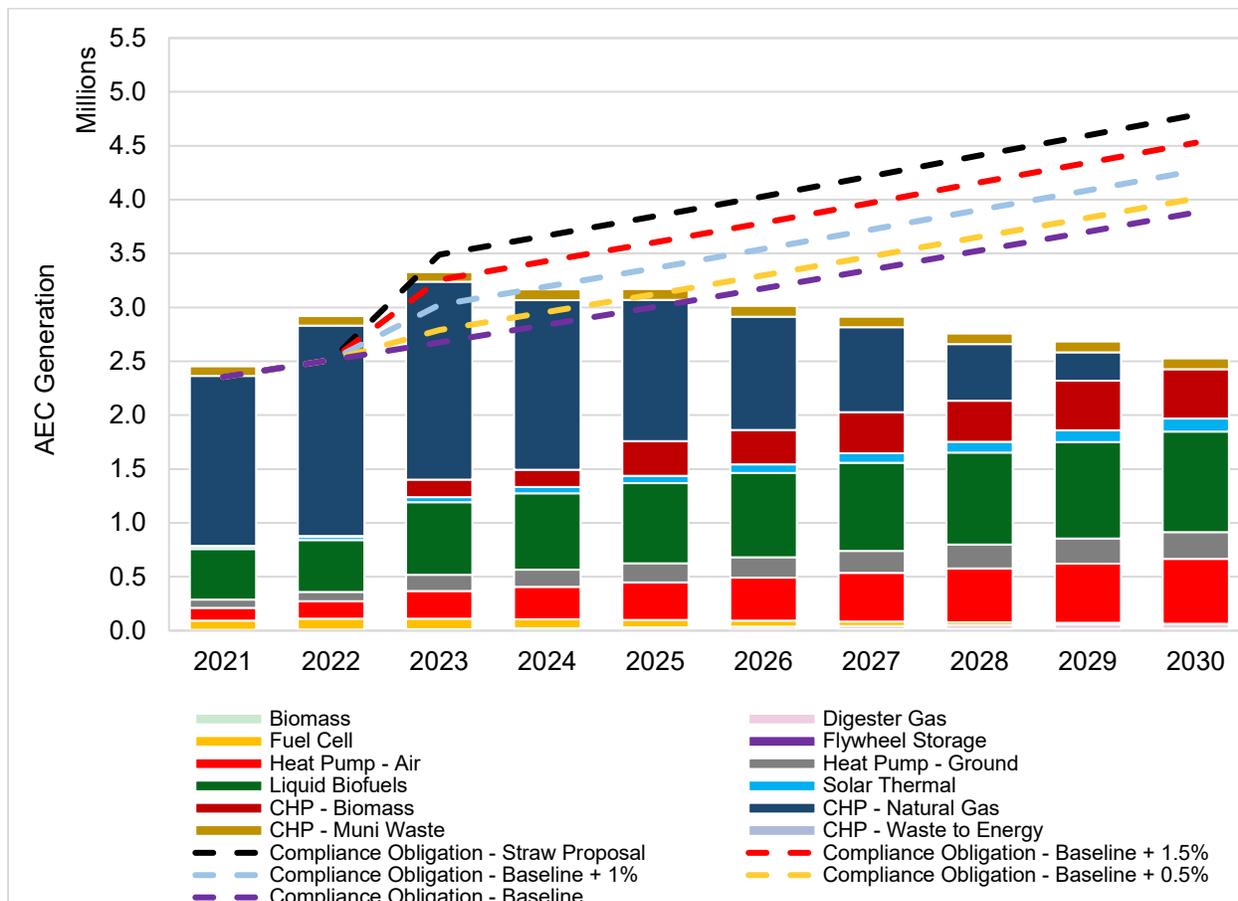
**Scenario 6: Straw Proposal with natural gas phase out .125 per year starting in 2023 and biofuels cap at 20% in 2023 reducing 1% per year starting 2026**

**Projected AEC Generation by Technology vs. Compliance Obligation (2021-2030P)**



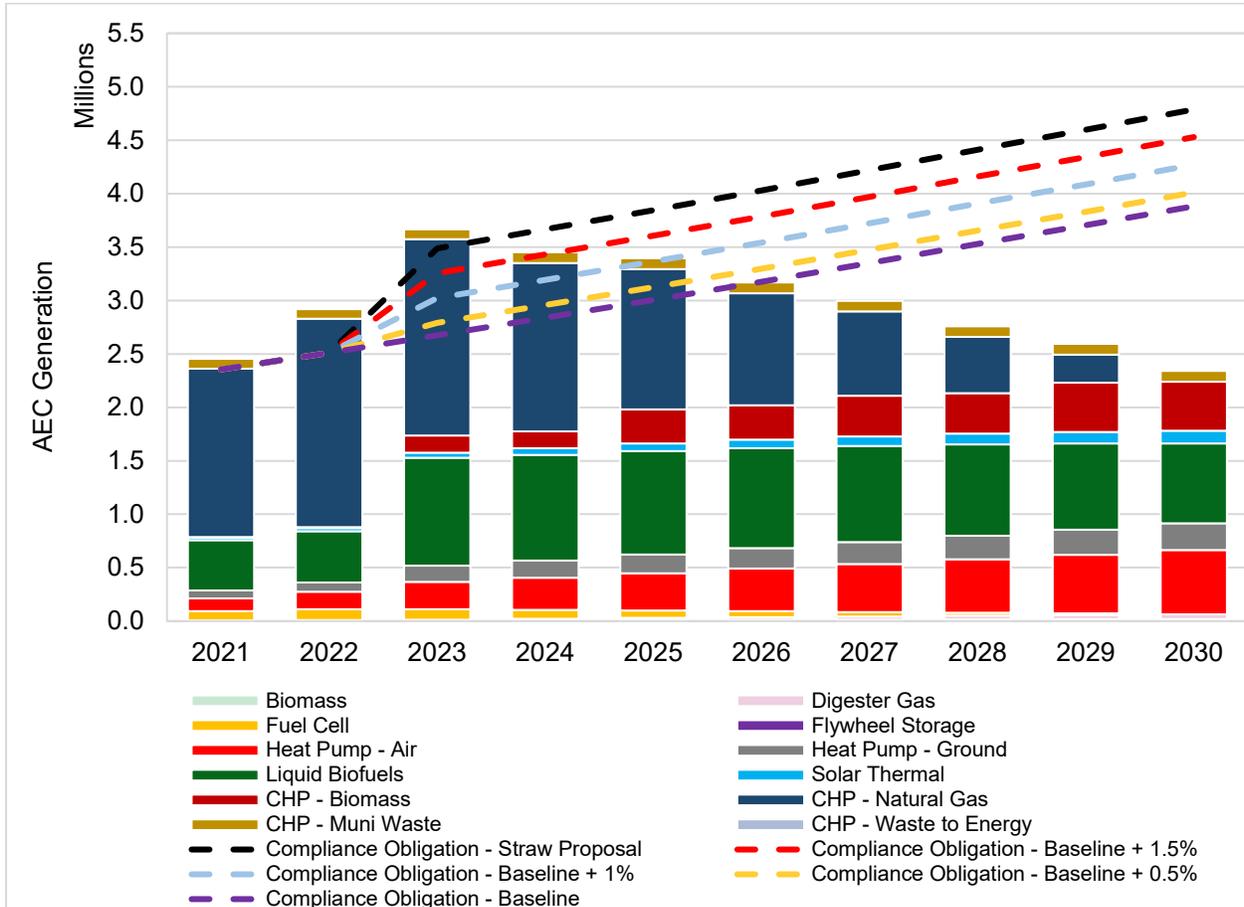
**Scenario 7: Straw Proposal with biofuels cap at 20% through 2030 and natural gas phase out .125 per year**

**Projected AEC Generation by Technology vs. Compliance Obligation (2021-2030P)**



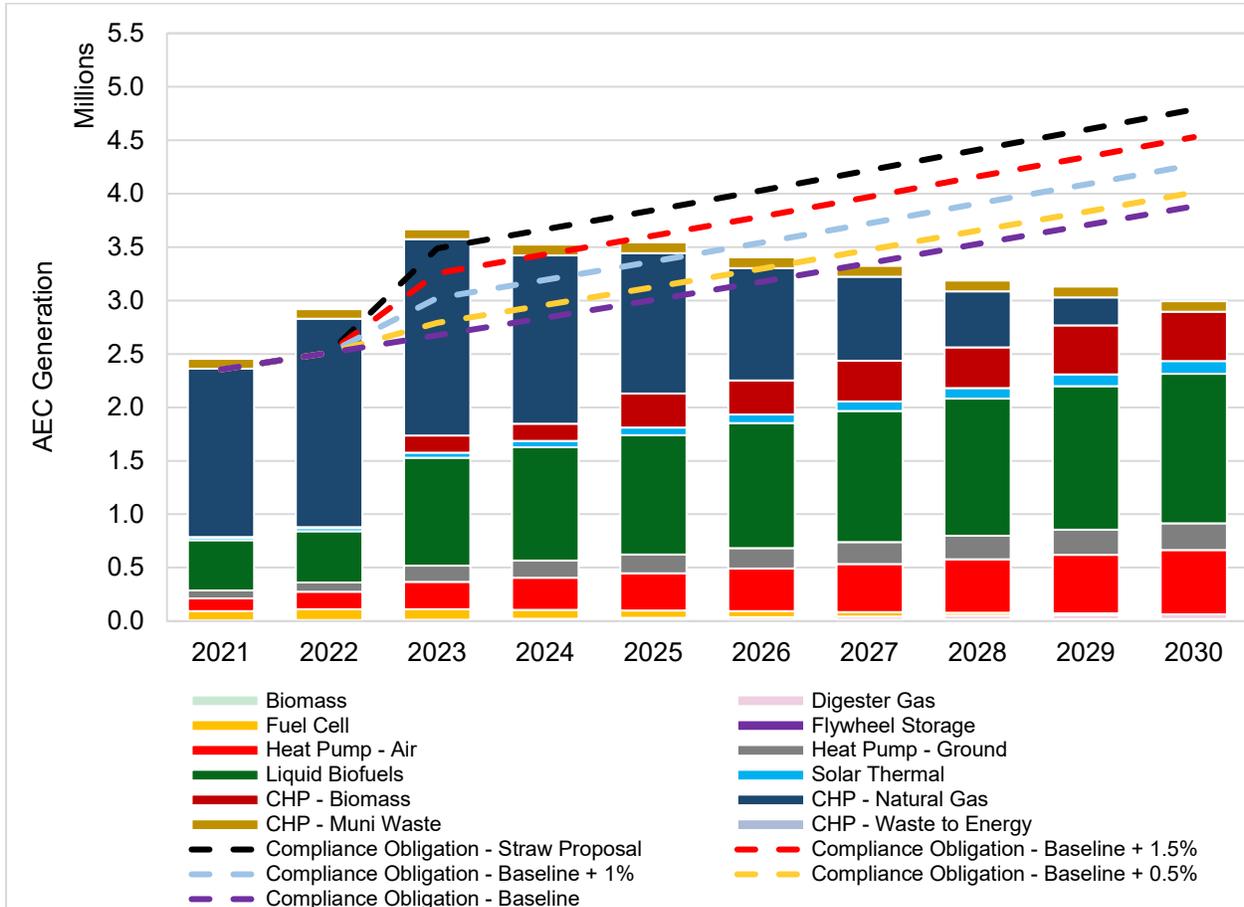
**Scenario 8: Straw Proposal with biofuel cap at 30% in 2023, phasing down 2% per year and natural gas phase out .125 per year starting in 2023**

**Projected AEC Generation by Technology vs. Compliance Obligation (2021-2030P)**



**Scenario 9: Straw Proposal with biofuel cap at 30% in 2023-2030 and natural gas phase out .125 per year starting in 2023**

**Projected AEC Generation by Technology vs. Compliance Obligation (2021-2030P)**



### C. Findings and Recommendations

One of the goals of the 2021 APS review stated by the DOER is to “support a balanced market to facilitate a stable incentive and drive technology adoption and market development”. Increasing the minimum standard or reducing the generation of AECs would have helped the market get back to equilibrium. The straw proposal proposed both of those measures, increasing the minimum standard by 2%, and increasing the ACP. All those measures together would not support a balanced market. The market would be undersupplied for years, resulting in a high cost of the program to ratepayers and reducing greenhouse gas emissions at a lower rate than the APS has historically.

The Straw Proposal is relying on growth from intermediate and large air and ground source heat pump systems, which consumer behavior has proven will not be adopted voluntarily, regardless of the incentive given. In the three and a half years that intermediate and large air and ground source heat pump generation units have been eligible, only a few generation units have come online due to the significant capital investment required. The assumption that any change to the price of an AEC or supply in the market would change that consumer behavior is not supported by case studies or historical APS data. The Massachusetts Clean Energy Center is running a Whole-Home Heat Pump Pilot Program and provided an update<sup>5</sup> on the programs progress. 53 homes retrofitted a whole-home heat pump system at an average cost of \$21,479 per installation. The average square footage of the homes was 1,590, which is significantly smaller than the average sized home in Massachusetts. Scaling projects this expensive to commercial and industrial buildings, which would qualify as intermediate and large-scale generation units in the APS program, is not realistic.

While the DOER hopes to see growth from APS technologies that weren’t capped or phased out, liquid biofuels is the obvious choice to fill the large undersupply. While natural gas is phased out, biofuels will displace heating oil at a much higher rate than previously incentivized and help the APS program succeed with the necessary greenhouse gas emissions reductions. Biofuels reduces greenhouse gas emissions at the largest scale and the lowest cost.

The Straw Proposal as is would provide less greenhouse gas emissions reductions to the ratepayer for years, while tripling the cost of the program for ratepayers and negatively impacting environmental justice populations.

Scenario 9, with a 1% increase to the minimum standard in 2023 provides the best option for the future of the APS program. Scenario 9 phases out CHP and fuel cell technology that utilizes natural gas in a more reasonable and equal manner, while filling the large undersupply in the market with liquid biofuels. The cap on liquid biofuels will be increased from the current level of 20% to 30% in 2023. From 2023-2030, liquid biofuels will have the ability to scale and will reduce greenhouse gas emissions that the DOER can claim. Those immediate emissions reductions

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<sup>5</sup> <https://www.masscec.com/blog/2020/09/29/september-whole-home-heat-pump-pilot-update-still-time-apply>

would justify the higher cost to ratepayers by providing the greenhouse gas emissions reductions that the APS program was created to incentivize.

Scenario 9 is the best option for the APS program for the ratepayers. They will pay a lower cost for the APS program than the straw proposal, while receiving far more greenhouse gas reductions.

Scenario 9 is the best option for the DOER because the Straw Proposal would have reduced the least greenhouse gas emissions short-term while adding significant cost to the ratepayers. Biofuels will fill that void of the undersupply 2023-2030 and reduce emissions at the lowest cost of any technology. Biofuels will displace the largest amount of fossil fuels of any other technology in the program.

Scenario 9 provides the end result that the DOER intended in the Straw Proposal, but reduces more greenhouse gas emissions at a lower cost to the ratepayer, while displacing heating oil and phasing out natural gas.

The ACP should remain at its current levels and not increase to \$40.00 in 2023, further devaluing the reduction in greenhouse gas emissions in other sectors.

## V. Recommendations

Diversified Energy Specialists recommends that the DOER reconsider the Straw Proposal and implement the following changes to the APS.

### A. Minimum Standard Increase

**A one-time increase of 1% to the minimum standard in 2023.** An increase of 1% to make the minimum standard 6.5% in 2023. The Straw Proposal’s suggested minimum standard increase of 2% will undersupply the market for many years and will increase the ratepayer cost of the program at a level too high to justify, given the greenhouse gas emissions reductions achieved in the APS program. The increase in ratepayer cost from a 2% increase to the minimum standard will have a disproportionate impact on environmental justice populations. **The minimum standard increase each year should remain at 0.25%.**

### B. Alternative Compliance Payment

**Allow the ACP to remain at its current level and to continue increasing with inflation each year.** The Straw Proposal’s suggestion of increasing the ACP to \$40.00 in 2023 is not based on the federally accepted societal cost of carbon and doesn’t align with the greenhouse gas emissions reductions provided in the APS program compared to the RPS program. Reducing emissions 50% or more versus the alternative is simply not as valuable as reducing emissions by 100%, and should not be financially incentivized at an equal rate. In addition, increasing the minimum standard will increase the cost of the program and the cost of electricity for every ratepayer, disproportionately impacting environmental justice populations.

### C. Natural Gas Phase Down

**Phase down CHP and Fuel Cell generation units utilizing natural gas by the following factors:**

Compliance Year	AEC per MWh Generated
<b>2023</b>	0.875
<b>2024</b>	0.750
<b>2025</b>	0.625
<b>2026</b>	0.500
<b>2027</b>	0.375
<b>2028</b>	0.250
<b>2029</b>	0.125
<b>2030</b>	0.000

Diversified Energy Specialists supports phasing out thermal technologies that utilize natural gas in the APS by 2030. The Straw Proposal's phase down is too rapid, starting with 0.7 AEC per MWh generated in 2023. Many CHP generation units utilizing natural gas have come online recently or will come online soon. They anticipated receiving an APS incentive for the life of their generation unit and made large capital investments based on current regulations. Some of the CHP generation units utilizing natural gas are universities and hospitals. Diversified Energy Specialists supports a complete phase out of CHP and fuel cell generation units utilizing natural gas by 2030 but would encourage the DOER to implement a slower phase out.

#### **D. Increase the Liquid Biofuels Cap**

**The cap on liquid biofuels should be increased to 30% of the retail electric load from two years prior multiplied by the current year's minimum standard in 2023. The cap should remain at 30% through 2030.** Biofuels can scale quicker than any other technology and can reduce greenhouse gas emissions immediately. This will help fill part of the undersupply in 2023-2030, while also sending a market signal that will facilitate capital investment in other renewable thermal technologies that take years to come online. Biofuels will lower the cost of the program for ratepayers, while also providing significant greenhouse gas emissions reductions that the DOER can claim. Biofuels will also reduce greenhouse gas emissions in environmental justice communities at no cost to the end user. This will alleviate the grid load, lowering the cost of electricity for all ratepayers, lower the energy affordability gap in Massachusetts and provide health benefits in environmental justice communities.

#### **E. Increase Biodiesel Feedstock Eligibility**

**Feedstock eligibility for liquid biofuel generation units should be expanded to the Federal RFS definition of advanced feedstocks.** These feedstocks generate RINs in the Federal RFS and reduce greenhouse gas emissions by greater than 50% versus heating oil.

#### **F. Biofuel Minimum Blend Percentage**

**Increase the liquid biofuel minimum blend percentage in the APS program to 20% in 2023, 30% in 2025, and 50% in 2030.**

#### **G. Small Air and Ground Source Heat Pump Eligibility**

**Small Air and ground source heat pump generation units must provide full displacement, only receive an incentive from either MassSave or the APS and must remove the legacy heat source.**