Creating A Cleaner Energy Future For the Commonwealth

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Massachusetts Department of Energy Resources

Heat Pumps in the Massachusetts Alternative Portfolio Standard

American Energy Engineers Technical Roundtable
November 17, 2014, Westborough, MA

Heat Pumps & Renewable Thermal

- Heat pumps are among a portfolio of renewable thermal technologies offering opportunities
  - Energy bill savings, greenhouse gas reductions, air quality improvement, local job creation
  - Includes single family, multi-family as well as commercial building applications
  - Best when offsetting fuel oil, electric heat
    - Natural gas depends on cooling option

Existing Residential Incentives

Heat Pump	Air Source	Ground Source	Water Heater
Mass Save® rebate	Up to $500		$750
Mass Save HEAT Loan	0% interest loan up to $25,000		
Residential Renewable Energy Tax Credit	30%		
Renewable Energy Equipment Sales Tax Exemption	100%		

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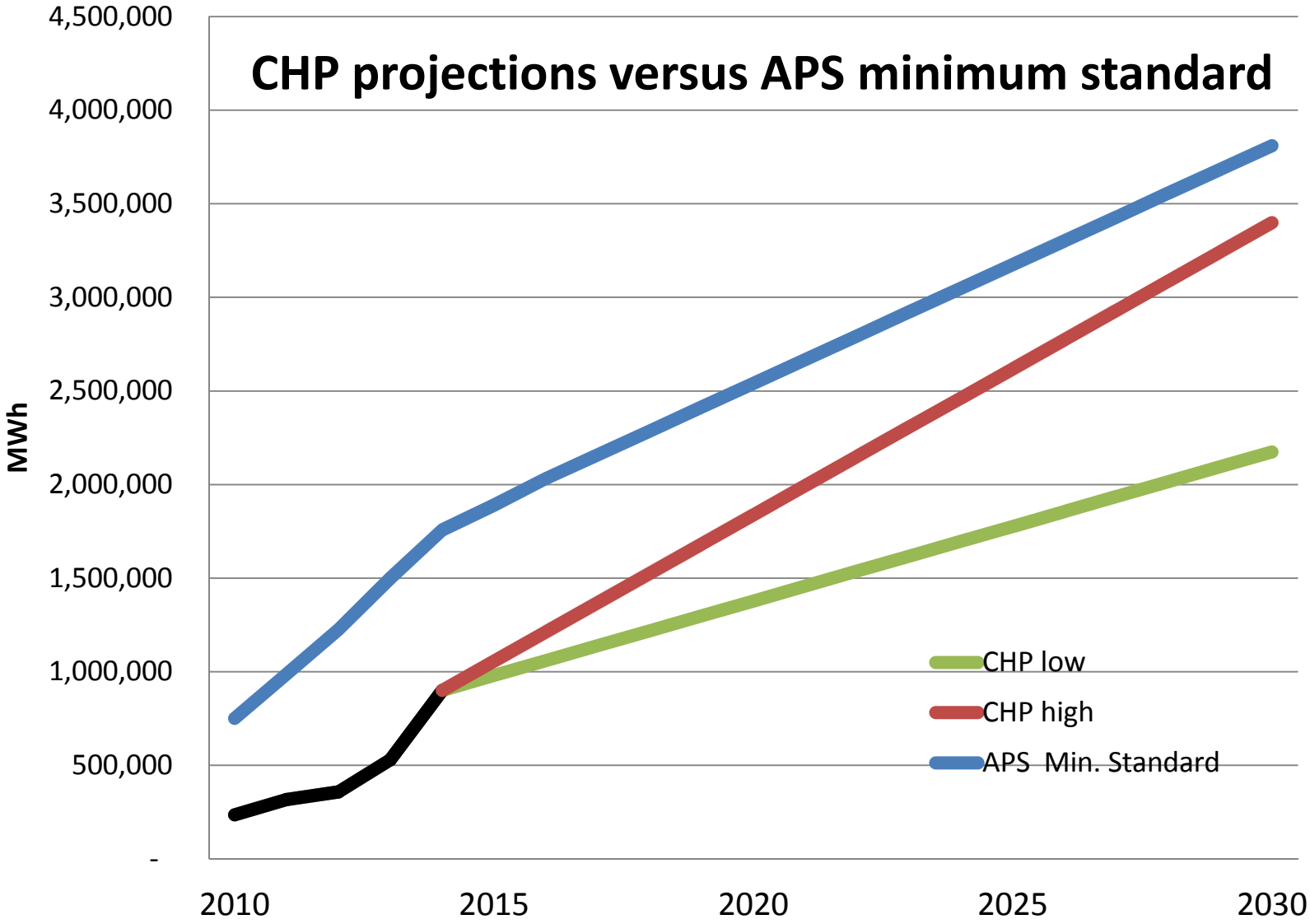
MA Alternative Portfolio Standard

- Alternative Portfolio Standard established by the 2008 Green Communities Act, in addition to Renewable Portfolio Standard
  - Retail electric suppliers have annual obligation to meet increasing share of load with generation from eligible alternative energy sources
    - List of eligible technologies
    - In practice only Combined Heat and Power
  - Undersupply of Alternative Energy Credits lead to high reliance on Alternative Compliance Payments
    - Current ACP rate is $21/MWh

Technology changes – per the Statute
(Acts 2014, Chapter 251)

- Add any facility that generates useful thermal energy using:
  - Sunlight, biomass, biogas, liquid biofuel or **naturally occurring temperature differences in ground, air or water**
- Strike carbon capture and storage, gasification, paper derived fuel
- Additionally exclude construction & demolition debris



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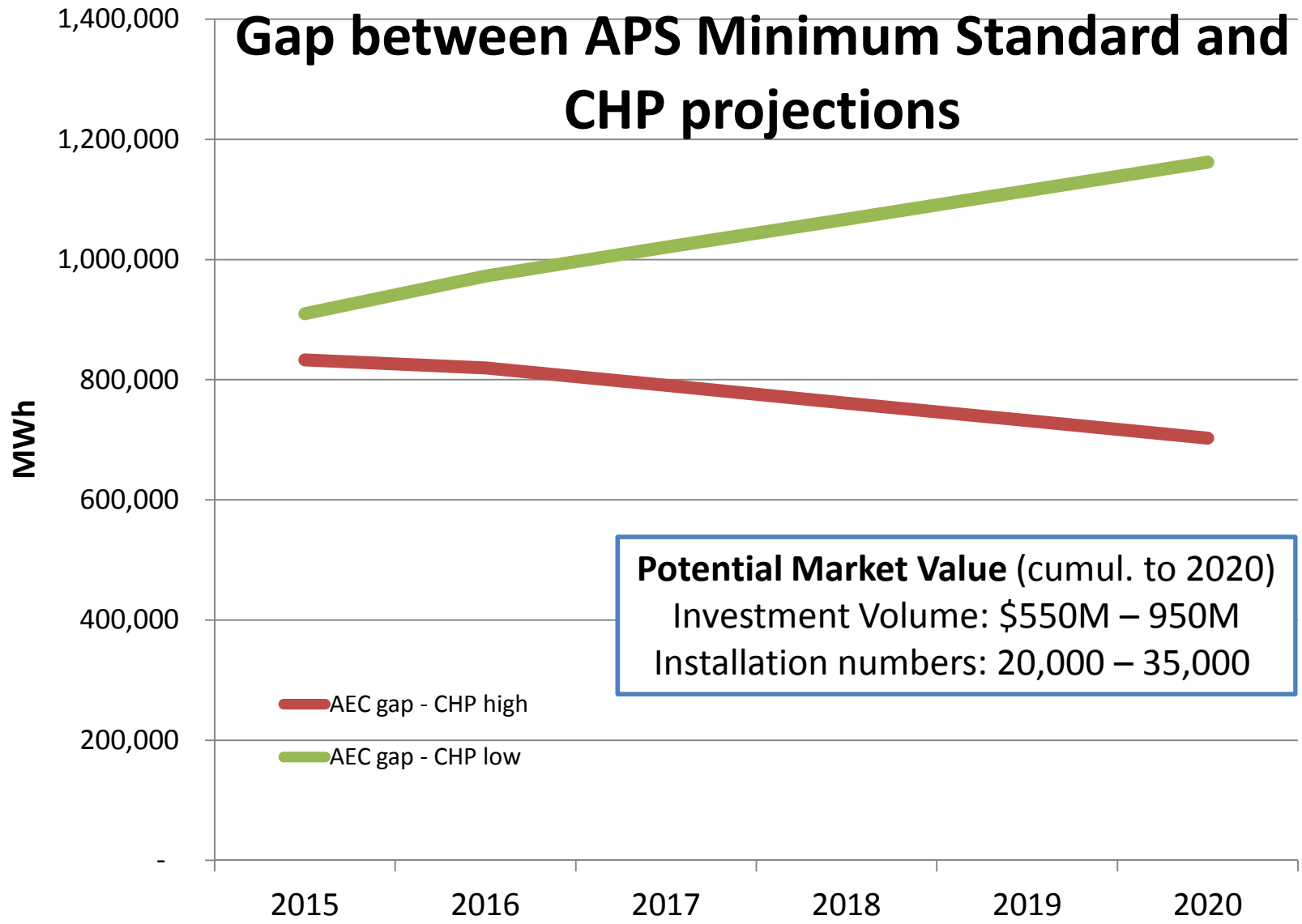

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DOER Regulatory Process

- Stakeholder/industry engagement
  - Meeting preceding formal regulatory process
  - Formal public hearing and comment period
  - Subgroups on metering, biofuels and biomass
- Regulatory proceeding: 225 CMR 16.00
  - Draft regulations before end 2014
  - Final regulations by summer 2015?
- Use guidelines according to RPS/APS custom

Eligible Technologies

- Active solar heating
  - Space heating, domestic & process hot water
- Automatically fed biomass boilers and furnaces
  - Wood pellets, chips
- Blended or pure biogas and biofuels
- **Heat pumps**
  - **Air source, ground source, water source**
  - **Not: fossil pre-heating heat pumps**

Net Energy Generation

$$E_{net} = E_{thermal,\ out} - E_{non\text{-}renewable,\ in}$$

- Energy calculated as primary energy
  - Taking into account average heat rate and transmission/distribution losses for electricity (ISO-NE)
- 1 Alternative Energy Credit (AEC)

  = 1 MWh = 3.412 MMBtu

Example Residential Installation

Building characteristics		
Heat Load	MMBtu/y	100
Cool Load	MMBtu/y	40
Domestic Hot Water Load	MMBtu/y	15

Illustrative example – actual calculation will depend on final regulations

		ccASHP	GSHP
Efficiency/COP		3	4
Load served (heating & cooling)	%	80%	100%
Thermal energy	MMBtu/y	112	140
Net useful thermal energy	MMBtu/y	20	54

Electric Conversion Rate used for net energy calculation = 41%

Metering Approach

- Large systems: continuous accurate **metering** and automatic reporting
- Small systems: **calculate** projected output
  - Cut-off large/small = 400 kBtu/h (total system capacity)
    - Meant to cover residential, small multi-family and small commercial
    - Based on assessment of cost of metering compared to AEC revenue
  - Verification of ongoing operation through spot checks and run-time monitoring

Large System Metering

- **Air/Ground Source Heat Pumps**: quantify the consumption of the site grid electricity and the supply of renewable heat energy terms by combining
  - Directly metered values (ΔT, runtime)
    - ΔT across loop (ground wells, working fluid)
  - Nominally rated system performance
    - Original equipment manufacturer certified: AHRI
    - Need standardized performance data at different temperatures (incl. 5°F)

Upfront Minting of AECs

- Upfront minting will be default for non-metered (small) systems
  - In lieu of lifetime AECs, systems will receive a one-time strip of AECs, equivalent to 10 years projected output
    - AECs will be year of APS qualification vintage
    - Upfront minting allowed as far as APS minimum standard can accommodate
  - DOER contracts with Third Party (Agent)
    - Default AEC aggregator
    - System verification
  - DOER is considering market options to enable purchase of pre-minted AECs to provide up-front project capital

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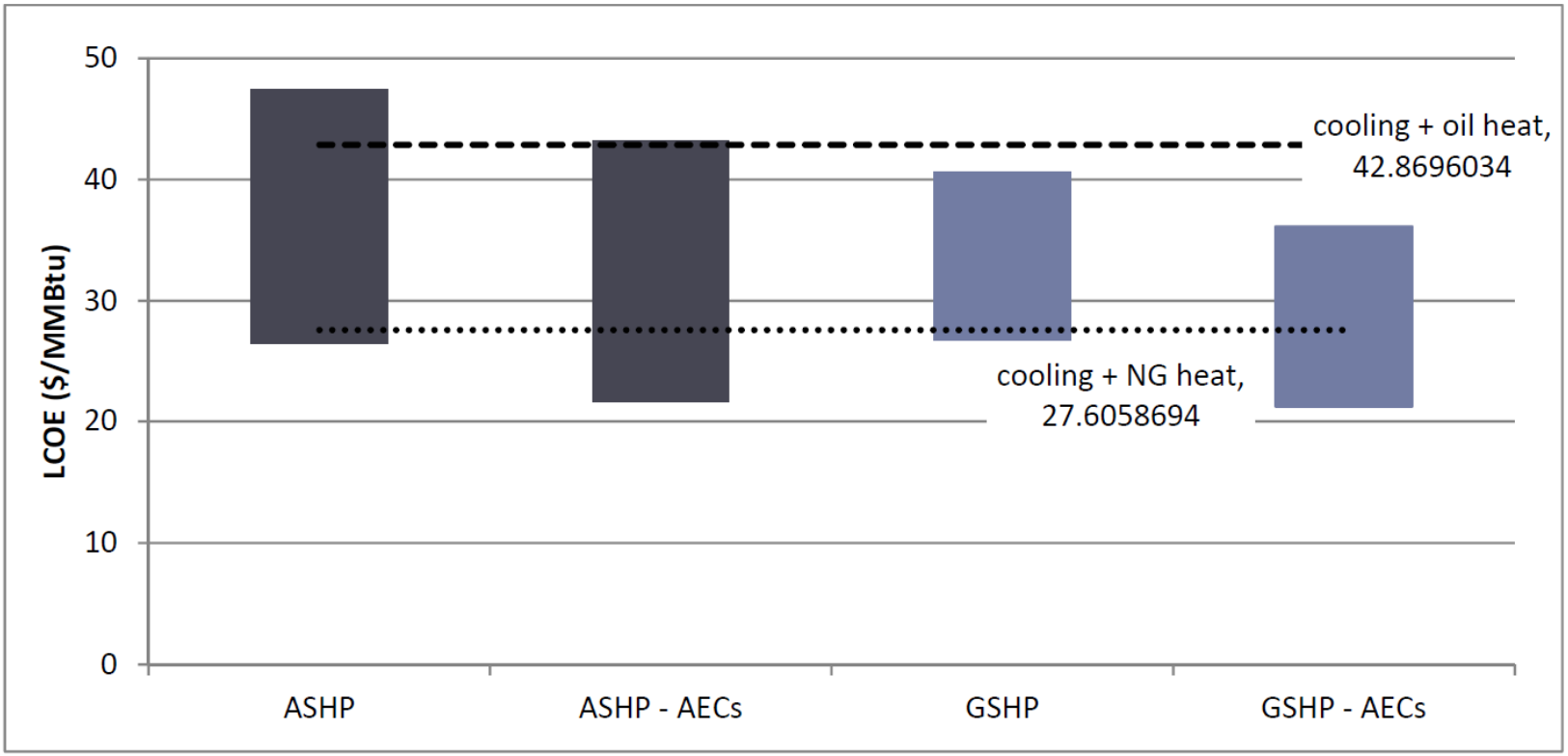
Illustrative example – actual calculation will depend on final regulations

		ccASHP	GSHP
Efficiency/COP		3	4
Load served (Heating & Cooling)	%	80%	100%
AEC/year		6	16
Pre-minted AEC value	$	$886	$2,370

Calculation assumes 10 years pre-minted AECs are sold at $15/AEC

Inclusion in APS impacts LCOE

Figure 5 - Financial analysis, total thermal load scenario, commercial size heat pump systems



Source: Useful thermal in the APS, Report to the Legislature, EEA/DOER, December 2012

Stakeholder Comments

- Stakeholders invited to provide written feedback
  - Comments, suggestions, information resources
  - E-mail before 11/26/2014 to bram.claeys@state.ma.us

Thank you!