Regulatory Approaches to Industry Emissions Mitigation in the US: Output Based Emissions Standards in the Boiler MACT

Nate Aden
World Resources Institute

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Today's Presentation

- Questions and background
- Affected boilers
- Rule compliance and OBES
- Assessment of impacts
- Conclusions & future research

Questions

This project considers three questions:

- What are Boiler MACT and output-based emissions standards?
- How does this rule affect U.S. industry energy use and GHG emissions?
- What type of regulatory approach is most effective for reducing industry emissions through fuel switching and efficiency improvements?

Boiler Maximum Achievable Control Technology (MACT) rule development

1990

Sept 13, 2004

2007

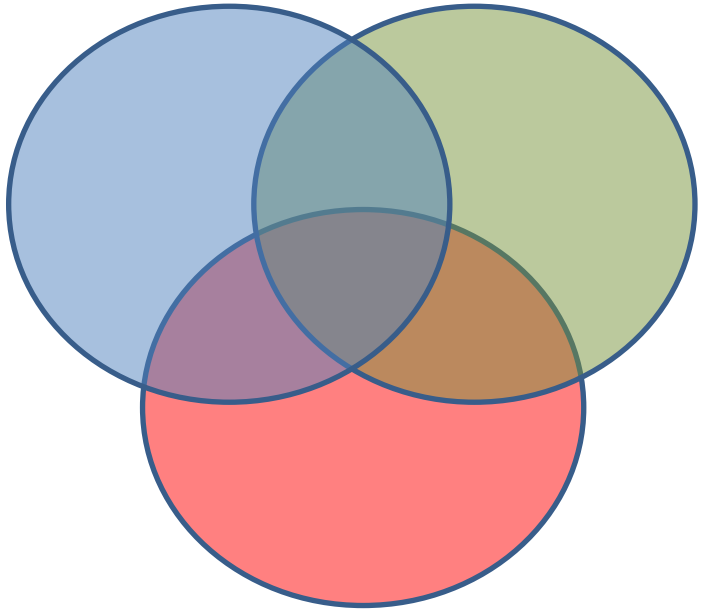
June 2010

Dec 23, 2011

May 17, 2012

Major source criteria and regulations

All boilers that emit at least **10 tons/yr** of a single hazardous air pollutant (HAP) or **25 tons/yr** total HAPs are considered **Major Sources.**
(est. 14,000 ICI MSB/1.5 million total)



Three criteria for Major Source Boilers to be subject to **emissions limits**:

1. Capacity > 10 MBtu/hr
2. Used > 10% of the year
3. Burn fuels other than natural gas or refinery gas

EPA estimates that 12% of Major Source boilers will be subject to emissions limits.

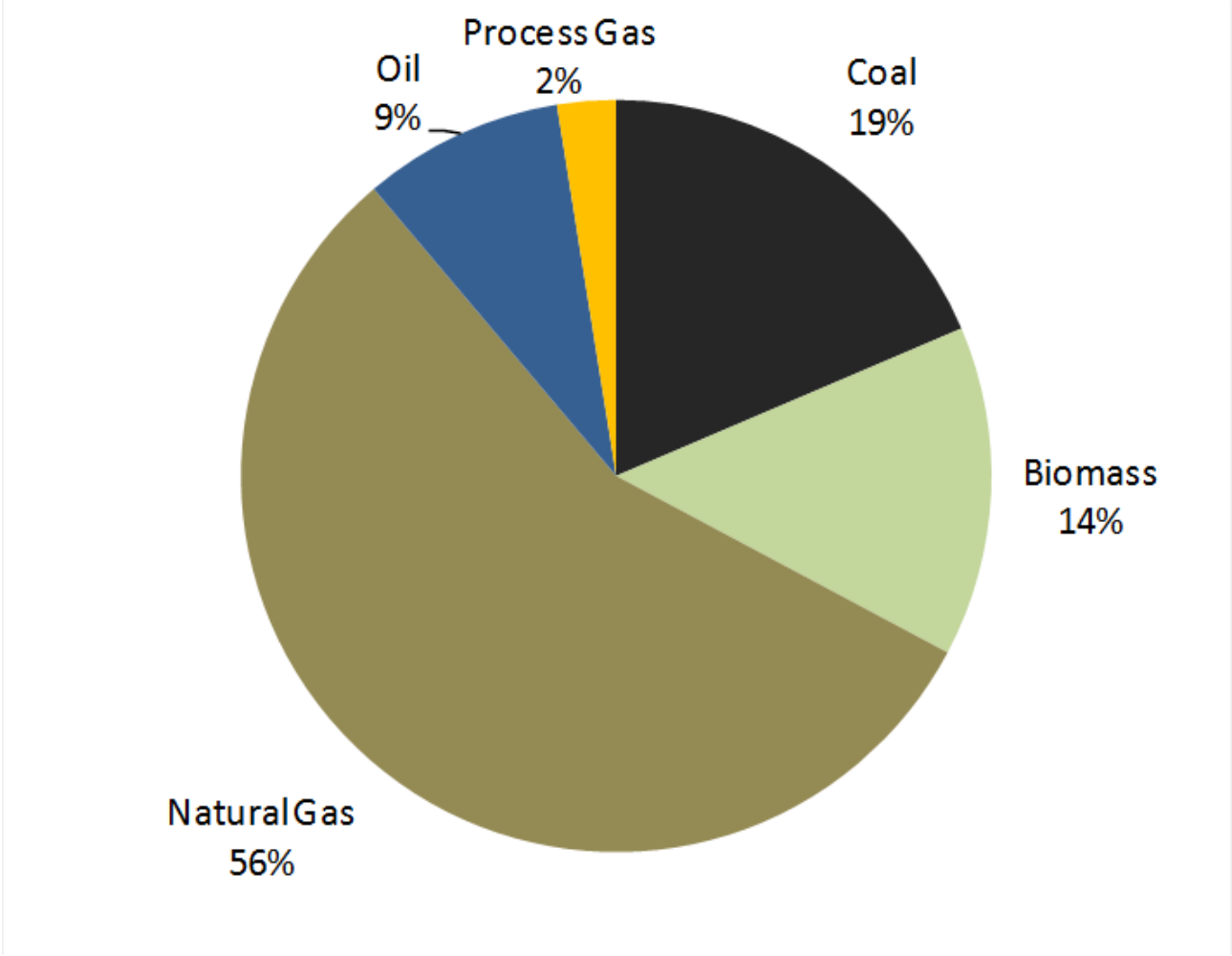
All Major Source Boilers are required to perform a one-time energy assessment. Boilers not meeting the three criteria above are subject to **work practice standards**.

Most Major Source Boilers are used for manufacturing

	NAICS Code	Subsector Description	Number of Major Source Boilers	Aggregate Capacity (mmBtu/hr)
1	324	Petroleum & coal product mfg	2,099	246,070
2	325	Chemicals mfg	1,250	146,944
3	336	Transportation equipment mfg	558	28,661
4	322	Paper mfg	533	160,789
5	221	Utilities	445	84,176
6	331	Primary metal mfg	437	47,092
7	311	Food mfg	435	59,036
8	928	National security & international	414	13,309
9	321	Wood product mfg	382	28,287
10	326	Plastics & rubber products mfg	278	13,816
Total for all subsectors			8,300	1,718,779

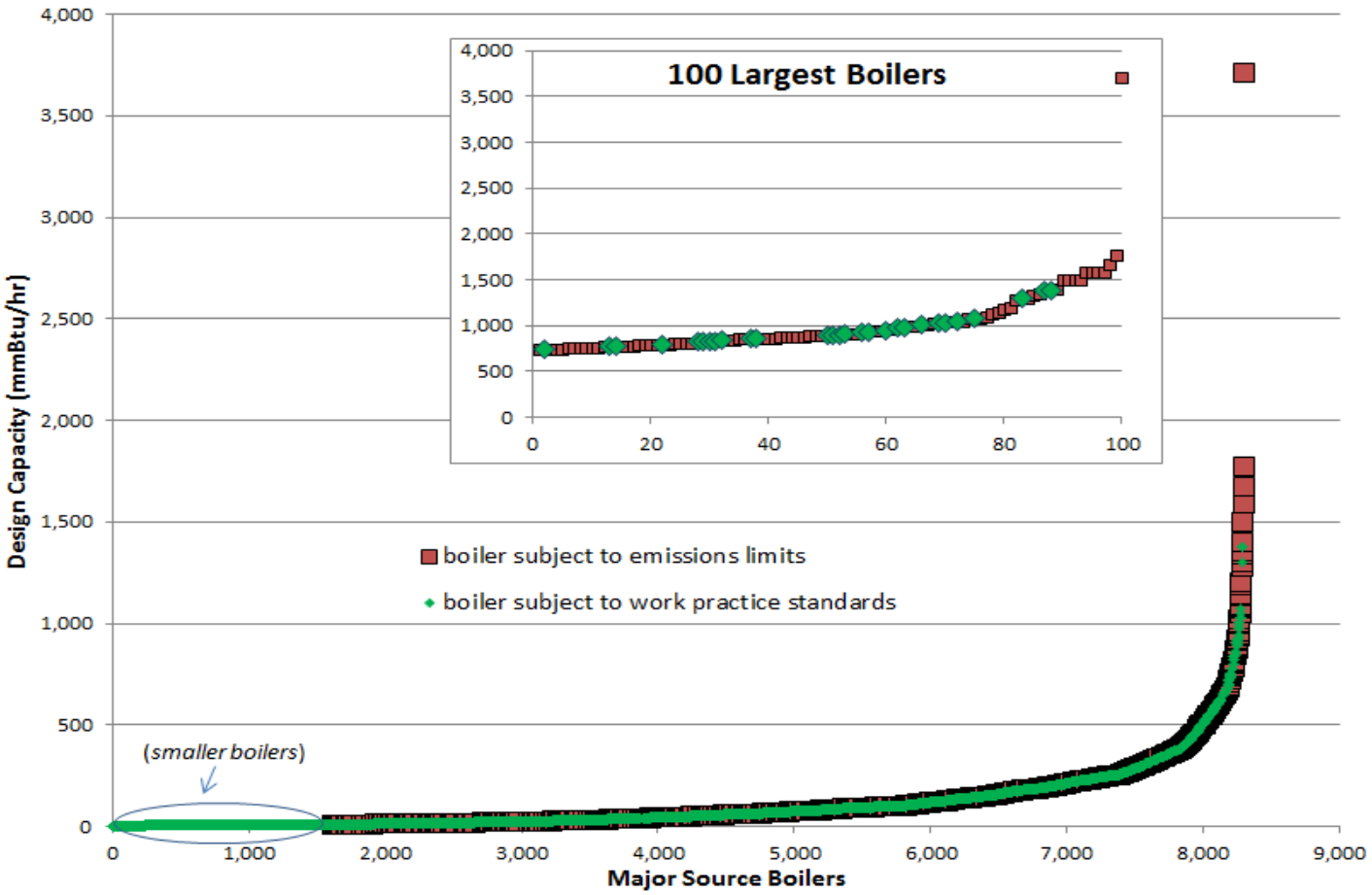
Source: EPA ICR database- "Boiler Emissions Database (version 7).mdb", (U.S. EPA, 2011).

Natural gas is already the predominant US major source boiler fuel



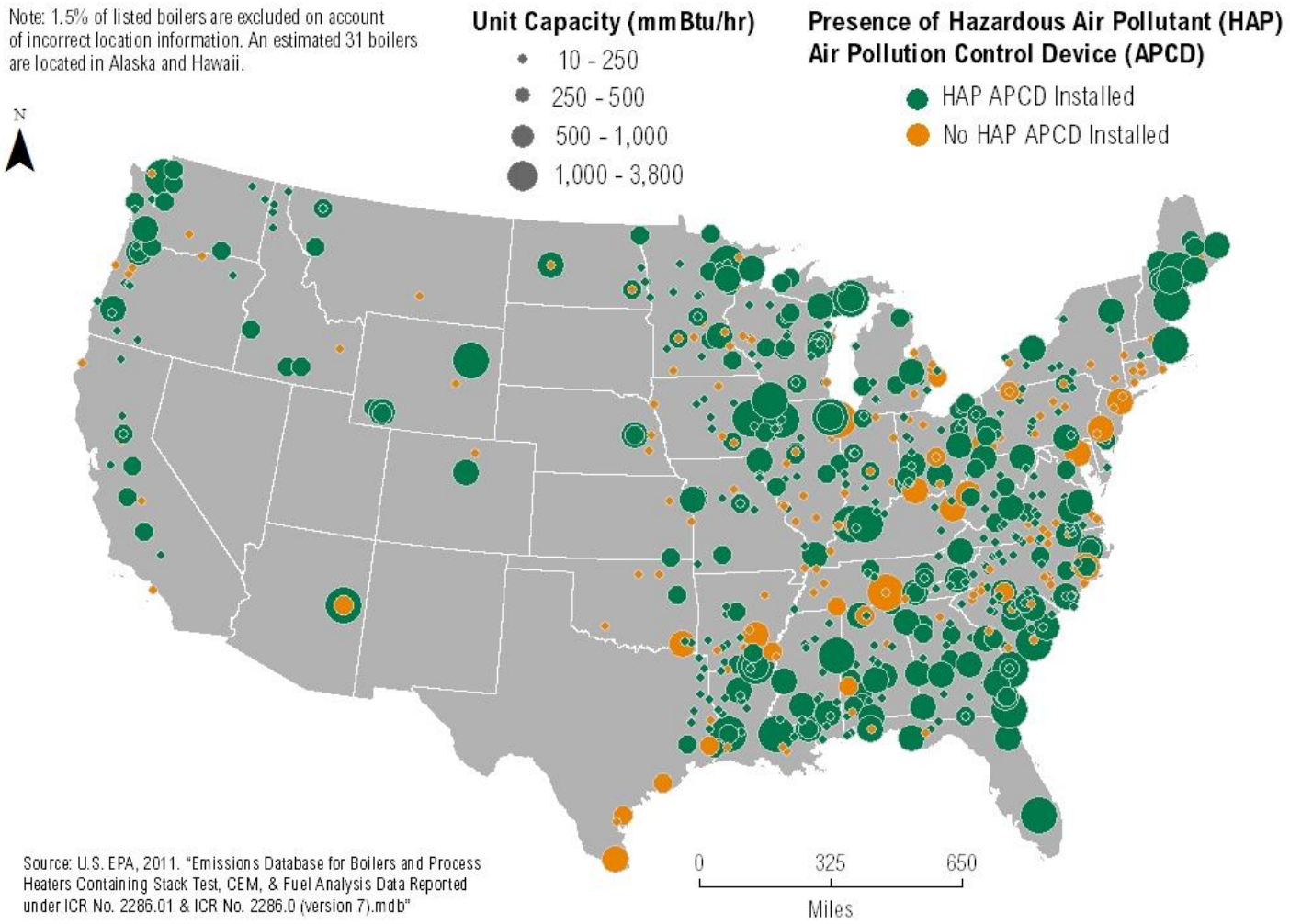
Source: EPA ICR database- "Boiler Emissions Database (version 7).mdb", (U.S. EPA, 2011).

Boilers subject to emissions limits are generally larger than those that comply with work practice standards



Source: EPA ICR database- "Boiler Emissions Database (version 7).mdb", (U.S. EPA, 2011).

Major source boilers subject to emissions limits unevenly distributed across the U.S.



Impacts depend on compliance path

Major source boilers **subject to emissions limits** have three basic compliance options for continuing use:

- **Switch input fuels** to natural gas or refinery gas,
- **Retrofit** existing affected boilers with pollution control equipment, or
- **Improve boiler efficiency** enough to comply with alternate output-based emissions standards.

Output-based emissions standards credit efficiency improvements

In contrast with commonly-used input based emissions standards, OBES relate emissions to the **productive output** of a given process including electrical, thermal, and mechanical energy.

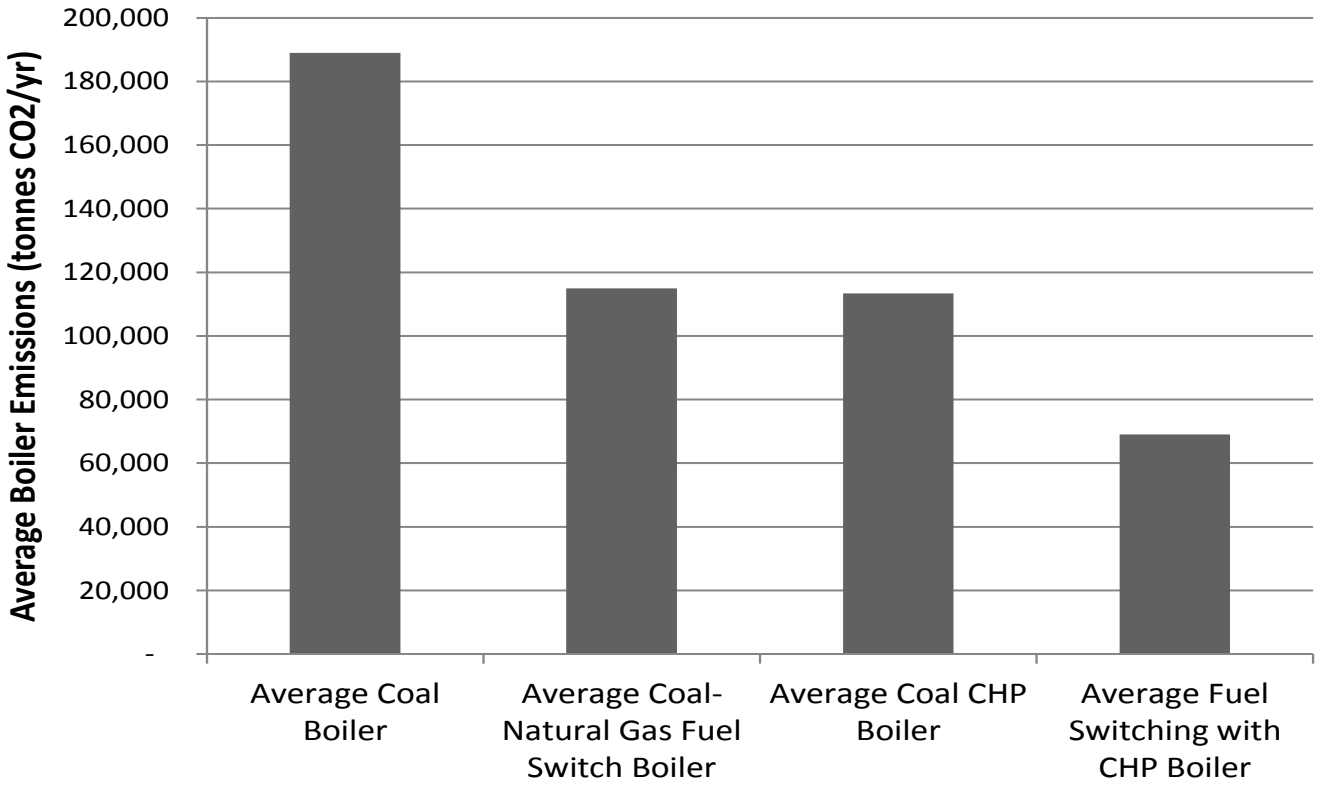
$$OBES\ (\frac{kg}{MJ}\ heat\ output) = \frac{(\text{input based emissions limit}(\frac{\text{kg}}{\text{MJ}}\ \text{heat input}))}{(\text{benchmark steam generator efficiency}(\%))}$$

OBES benefits:

- incentive for pollution prevention,
- multi-pollutant emissions reductions,
- reduced fuel use,
- avoidance of upstream environmental impacts of fuel production and delivery, and
- lower compliance costs.

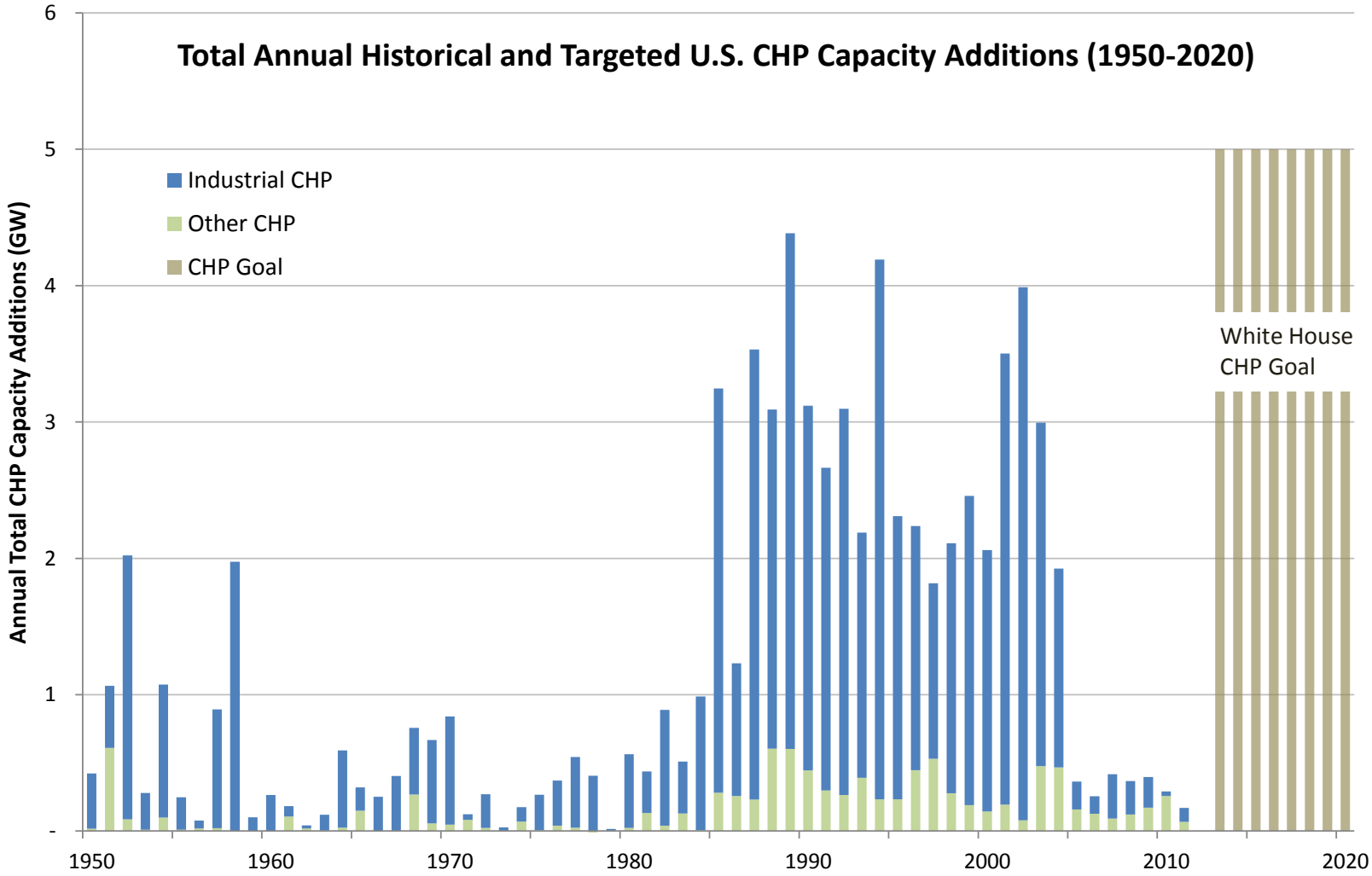
From a policy perspective, research has found that OBES are more cost-effective and result in more total carbon abatement than other U.S. industry programs including energy portfolio standards, the Superior Energy Performance Program, tax-lien financing, and industrial motor rebates (Brown et al., 2011).

Fuel switching and CHP installation have about the same emissions mitigation effect



The combined fuel-switching with CHP boiler type includes several benefits including reduced facility exposure to potential future gas price increases, HAP and GHG emissions reduction, improved overall efficiency, reliability, reduced electricity transmission congestion, and potential revenue related to surplus electricity sales.

Policy support is need to achieve new U.S. industry energy efficiency goals



Conclusions and further research

•While the OBES will not result in total CHP adoption, they will help to incentivize facility-specific consideration of CHP and other efficiency improvement measures.
•Within the framework of Boiler MACT standards, this analysis suggests that OBES can generate greater benefits than other compliance pathways.

Four related areas for further research:
•Interplay between efficiency and fuel switching in reducing industry GHG emissions.
•Ex-post assessment of the pathways used to achieve Boiler MACT compliance would assist in modeling expected impacts and guiding implementation.
•Assessment of measured impacts of OBES as deployed in Boiler MACT and other standards could validate the optimistic consensus between environmental groups, academics, and industry associations.
•Research on the comparative efficacy of a regulatory approaches (as, for example, pursued by the Clean Air Act in the U.S.) for achieving deep long-term emissions reductions.

THANKS!

Nate Aden

naden@wri.org

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