

July 7th, 2023

Ms. Abigail Daken
Manager, ENERGY STAR HVAC Program
United States Environmental Protection Agency

Robert Bosch LLC
50 Wentworth Avenue
Londonderry NH, 03053
Tel +1 603-552-1100
Fax +1 603-584-1681
www.bosch.us

Residential Boiler Energy Star Program Sunset Proposal

Dear Ms. Abigail Daken,

1. Introduction

Bosch Home Comfort submits the following comments on the Environmental Protection Agency's (EPA) Energy Star Residential Boiler Discussion Guide released in June 2023. In North America, Bosch Home Comfort is a leading source of high-quality heating, cooling, and hot water products. The company offers Bosch tankless water heaters, Bosch and Buderus floor-standing and wall-hung boilers, Bosch and FHP water-source, geothermal and air-source heat pump systems, as well as controls and accessories for every product line. Bosch Home Comfort is committed to reinventing energy efficiency by offering smart products that work together as integrated systems that enhance quality of life in an ultra-efficient and environmentally friendly manner.

2. General Remarks

Bosch Home Comfort commends Energy Star's efforts to promote high-efficiency technology, reduce greenhouse gas (GHG) emissions, and improve consumer safety and comfort through its various programs. Bosch firmly believes these programs support consumers in making well-informed decisions on their product purchases. However, we strongly suggest that Energy Star reconsider sunsetting its Residential Boiler Program for three significant reasons:

- A. **Minimal Retrofit Applicability:** There are a lack of retrofit options available for consumers with 160-180°F hydronic baseboard systems, which represents the majority of the hydronic installed base in the United States.
- B. **Product Attainability:** The air-to-water heat pump market has remarkably low market penetration which means there are less cost-effective solutions for consumers and fewer trained workers available to install or service the equipment.
- C. **Avoid Backsliding:** Bosch believes there are potential opportunities to further reduce GHG emissions by maintaining the Residential Boiler Energy Star Program.

While Bosch supports the development and creation of a new air-to-water heat pump program, it is crucial that the highest efficiency gas & oil technologies that are available and known today by consumers and contractors are promoted.

July 07, 2023
Page 2 of 6

2.A Minimal Retrofit Applicability

Most homes in the US with hydronic heating are designed and sized with baseboard, which are generally based on a boiler supply temperature of 180°F to properly heat the home. Because of this, it is an industry standard for residential boilers to reach 180°F. However, most residential air-to-water heat pump products cannot reach temperatures above 150°F without using a backup system, and thus are more suited for radiant heating that uses lower supply temperatures. Therefore, when someone with baseboard needs to replace their boiler, an air-to-water heat pump is not currently a realistic option for them without a major and expensive renovation project to install radiant heating. By removing the Residential Boiler Program, Energy Star is eliminating consumer education and indirectly, depending on local utility programs, financial incentivization for high-efficiency products for the majority of hydronic heated homes. This would disenfranchise hundreds of thousands of consumers and increase the likelihood of them installing the cheapest possible option, which is likely to be an inefficient non-condensing gas system. Further, air-to-water heat pumps still have a place in homes with radiant heating, and so a new Energy Star program for these products will be useful for educating consumers. However, until the housing stock transitions to radiant heating and/or air-to-water heat pumps can reach high temperatures for baseboard at an affordable price, it is crucial to maintain the existing Residential Boiler Energy Star Program.

2.B Product Attainability

Of the ~450,000 hydronic heating products sold per year, only ~2,300 are air-to-water heat pump products or 0.5% of the total hydronic market. This means that air-to-water heat pumps are not installed in significant numbers in the US, which creates pricing and workforce issues for consumers if they are the only hydronic heating product that is promoted by the Energy Star program. The cost of most air-to-water products on the market are, on average, double gas or oil products, with installation costs also being higher. This price difference is created by systematic issues for air-to-water heat pumps that keep the cost higher than condensing gas boilers. This is because an air-to-water heat pump requires two processes for transferring heat to the hydronic system. The first process is to transfer heat from ambient air to the refrigerant and the second is to

transfer heat from the refrigerant to the hydronic system. On the other hand, conventional boilers only have one heat transfer process from the burner directly to the hydronic system. This inherent difference, which will remain even as the market grows, is one reason the cost is higher as more material and parts are needed for the air-to-water heat pump. In removing the Residential Boiler Program, Energy Star would only be promoting technologies with a higher cost that's attainable only by affluent households. This isn't to say an air-to-water program shouldn't exist, but considering Energy Star's purpose is to promote efficient and safe products for all consumers, it's important to include products that are financially and technically realistic for all consumers as well.

In addition, low market penetration means many installers do not know how to properly size, design, or install an air-to-water heat pump system. Although there is a renewed focus on workforce development for heat pump installers through passage of the Inflation Reduction Act (IRA) and other state and local programs, these technicians would still need to learn hydronic systems, which could be difficult due to a current lack of knowledge. This is because heat pumps are installed by HVAC technicians who have separate certifications and expertise compared to plumbers, which generally install boilers. This can lead to a scenario where a consumer needs to hire multiple trade companies to have an air-to-water heat pump system installed or serviced, which increases consumer burden. Even if some larger contracting companies have all the needed tradespeople on staff, small businesses would suffer, as they rarely service multiple trades. This hurdle will likely be overcome in the future, but it will take several years for this transition, and in the meantime, the Residential Boiler Energy Star program and an air-to-water heat pump program can complement each other to promote hydronic heating systems while the air-to-water heat pump market matures.

2.C Avoid Backsliding

As discussed previously, there is still potential to reduce GHG emissions and increase the number of installations of high-efficiency products with the Residential Boiler Program by promoting condensing gas products. Although 57% of gas boiler products in the market meet Energy Star criteria, [per the 2020 Unit Shipment Annual Summary Report](#), if the program ended many retrofit installations would revert to the most cost-effective, and likely least efficient, systems. These products not only produce more GHG emissions and consume more energy, but they likely do not have low NOx certifications or other mechanisms to promote cleaner combustion. Therefore, it is important to maintain the Energy Star Residential Boiler

program to ensure more homes are retrofitted with condensing boilers.

July 07, 2023
Page 4 of 6

3. Energy Star Question Responses

The following are Bosch Home Comfort's recommendations to Energy Star's established questions on air-to-water heat pump systems:

- **Question 2:** Are there broadly accepted industry definitions of air-to-water heat pumps or heat pump boilers?
 - There is not an established or broadly accepted industry definition for an air-to-water heat pump. As mentioned in the guide, this technology is quite new for the United States, and due to its limited applicability in the retrofit hydronic market, there are not many units in the field. Because of this, each manufacturer has their own definition of an air-to-water heat pump, and an industry norm does not currently exist. Bosch Home Comfort recommends “air-to-water heat pump” as a name that would avoid the most confusion.
- **Question 3:** Is there any need to distinguish boilers that are used with hydronic coils in a forced-air distribution system from those used with hydronic distribution? Are the same products used in both situations?
 - There is no need to distinguish the two applications as the same product is used. Additionally, the general operation of the system is the same, where both applications will run for consistent periods of time (in a properly sized application) to provide heating. However, hydronic coils in forced-air distribution require lower temperatures from the boiler outlet compared to boilers in a baseboard application, which could potentially be a good application of air-to-water heat pumps. Further, because both systems transfer heat to water for heating, the same products are used.
- **Question 4:** EPA believes that products that can serve as domestic water heaters or as air-to-water heat pumps for space heating could simply be tested and rated for each use. Is there any need for a definitional distinction between heat pump water heaters and air-to-water heat pumps for space heating? If so, what would the distinction be?
 - It is critical to establish a definitional distinction between the two products as their operation conditions and use is very different. A vast majority of storage water heaters are located in a conditioned or semi-conditioned space such as a basement or garage. Therefore, the inlet air temperatures are relatively stable throughout the course of a year. On the other hand, air-to-water heat pumps that can supply domestic water will



always have an outdoor unit, which obviously creates variable inlet air temperatures to the unit, which subsequently affects performance. These differences will therefore require different test methods. Additionally, a heat pump water heater generally does not have the capacity to provide sufficient space heating, but an air-to-water heat pump can do both. This means there is a different control logic and prioritization for an air-to-water system, as it must “pick” to provide space or water heating. So, although the two products are using a refrigerant to heat water, due to the different air inlet temperatures and control logic, the two product types need to be defined and categorized differently. Note that this is a similar distinction between a boiler and a gas instantaneous water heater, which are the same product from a heat transfer perspective, but their test standards and definitions are quite different.

- **Question 13:** This test defines performance with 110 °F leaving water temperature. This will not provide sufficient heat when used in legacy heat exchangers, typically designed for 160-180 °F water. Do manufacturers recommend using these products in retrofit situations? If so, is there anything special they recommend making sure residents have enough heat?
 - Due to technological limitations of current refrigerant technology, most air-to-water heat pumps for residential applications cannot reach the 180°F temperatures needed to be applied in retrofit baseboard applications. Some two cycle products exist that can reach high temperatures, but these products are incredibly expensive and not realistic for consumers to purchase. Because most retrofit applications are for baseboard rather than radiant floor, which would require lower temperatures, the air-to-water heat pump market is essentially isolated to properly designed new construction applications.

- **Question 16:** What is the cost of air-to-water heat pump systems? Does this provide the same service (e.g., covers full heating load, provides cooling, etc.) as competing systems? What are the design and installation costs for these systems in new construction and in a replacement scenario?
 - Air-to-water heat pump systems are significantly more expensive than conventional boilers and even air-to-air heat pump systems. Depending on the specific system, air-to-water heat pumps can be up to 3 times as expensive as conventional gas or oil boilers and on average, they are double the price. In addition, these more expensive systems would need either a back-up system for baseboard applications (i.e a back-up boiler to reach 180°F to adequately heat the home) or require the homeowner to upgrade their home to a higher R-value, which

will require more costs to the homeowner to be achieved. Because of this, air-to-water heat pump systems are mostly installed in either new construction high-end luxury homes where price is not an issue or where radiant heating is already installed and an air-to-water heat pump can be used due to the low temperature application.

July 07, 2023
Page 6 of 6

4. Conclusion

Bosch Home Comfort supports Energy Star's efforts to enhance its program to promote the most efficient equipment for consumers. We strongly believe that given the short-term technological outlook of air-to-water heat pumps, their main applications will be in new construction luxury homes with minimal applicability to retrofit consumers. While the new air-to-water specification will be impactful, and we plan to be a contributing member of the program development, there are still many consumers with homes designed for high temperature boiler supply temperatures that need guidance from Energy Star on what products are most efficient. Therefore, to reach the shared interest of reducing GHG emissions as much as possible, we believe it would be premature to completely halt the Residential Boiler specification given the types of hydronic systems currently installed and the status of technological capabilities for air-to-water heat pumps. We thank Energy Star for considering these comments, and we look forward to future engagements with the Energy Star on this subject. Additionally, we would be happy to meet to discuss these points further and address any questions or clarifications.

Best Regards,



Dan Moffroid
Director of Product Management