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October 30, 2023

Hydrofluorocarbon Reduction Program  
Research Division  
California Air Resources Board  
1001 I Street, Sacramento, California 95814  
Submitted via Public Comment Docket

**Re: Request for Information for Senate Bill 1206 Assessment Report**

To Whom It May Concern:

Rheem appreciates the opportunity to respond to the California Air Resources Board (CARB) request for information (RFI) on the development of an assessment report in response to California Senate Bill (SB) 1206.

Headquartered in Atlanta, Georgia, Rheem operates multiple U.S. facilities for the manufacture and support of a comprehensive line of residential and commercial air conditioners and heat pumps, with nationwide distribution through various channels. Through its water heating division, Rheem manufactures heat pump water heaters, heat pump pool heaters, and hydronic heat pump space heaters, including those marketed under the Raypak brand. Rheem designs, manufactures, and markets energy-efficient commercial refrigeration equipment and system solutions through its Heat Transfer Products Group (HTPG), and through Friedrich Air Conditioning, is the sole manufacturer of room air conditioners in North America, offering premium room conditioning and other home environment solutions for residential, lodging, and multifamily properties.

Rheem has ambitious sustainability goals in both its own operations and its product offering<sup>1</sup>, and strives to be a market leader in decarbonizing the heating, ventilation, air conditioning, and refrigeration (HVAC&R) sector. Rheem's sustainability efforts encompass all business units across the world and Rheem has already demonstrated its commitment by introducing efficient and affordable products with a lower carbon footprint than comparable products.<sup>2</sup>

**Section 1: Commercial and Industrial Stationary Refrigeration (Retail Food, Cold Storage, Industrial Process Refrigeration, and Ice Rinks)**

**2. What incentives are needed to transition existing refrigeration facilities and what GWP limit should be set for technologies supported through incentives?**

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<sup>1</sup> Rheem Manufacturing Company. (n.d.). *Sustainability*. Retrieved October 27, 2023, from <https://www.rheem.com/about/sustainability/>

<sup>2</sup> Rheem Manufacturing Company. (2022, July 18). *Rheem® introduces 120 volt PROTERRA® plug-in heat pump water heaters*. PR Newswire. Retrieved October 27, 2023, from <https://www.prnewswire.com/news-releases/rheem-introduces-120-volt-proterra-plug-in-heat-pump-water-heaters-301587523.html>



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Incentive programs should be focused on spurring the replacement of high-GWP systems to low-GWP replacements as required by the regulation promulgated on December 29, 2021<sup>3</sup> for California. Given the lag in safety standard readiness for refrigeration systems to use flammable refrigerants and recognizing the technical challenges of using R-744 (CO<sub>2</sub>) as a refrigerant, the market is only just beginning to deploy low-GWP equipment on a broad scale. Rheem recommends the use of incentives to encourage proactive system replacement over repair of equipment past its useful life.

#### **4. What barriers exist in bringing technologies such as ejectors, CO<sub>2</sub> condensing units and others, to the California market, particularly for smaller refrigeration systems such as those found in convenience stores?**

Rheem supports research to advance technology and remove barriers to adoption, believing that a greater number of solutions is crucial to achieving climate goals. Rheem would caution that any mandate for the use of a particular technology or a particular refrigerant in any end use would restrict innovation and consumer choice and would ultimately be counter-productive to CARB's overarching climate goals.

### **Section 2: Stationary Air Conditioning & Space Conditioning Heat Pumps**

#### **5. There are limited ultra-low-GWP and/or no-GWP technologies for this sector. How can technological innovation be encouraged?**

Product development cycles for HVAC&R equipment are on the order of years, and the use of low-GWP substitutes bearing an ASHRAE safety classification<sup>4</sup> other than group A1 means equipment manufacturers (OEMs) are re-designing equipment to meet both performance and safety objectives. The market must first bring about the requirements of the California HFC regulation of December 2021 in addition to national HFC regulations administered by EPA. Manufacturer resources are fully consumed with the design, optimization, testing, and launch of products for regulations with upcoming compliance dates for low-GWP policy. Rheem would suggest grant programs for research and development into further reductions in GWP for this sector.

#### **6. What types of ultra-low GWP technologies for this sector are available in other markets globally, but not in the US? What do you see as the primary market barriers to the adoption of these technologies in the US?**

In the preamble to this section, CARB asserts that "ultra-low-GWP and/or no-GWP alternatives in this sector" are available elsewhere globally. Rheem finds this statement to be overly broad and would like to caution CARB against adopting a one-size-fits-all approach or assuming a niche offering is broadly applicable to the U.S. market.

#### **7. How can centralized ducted AC systems be transitioned to ultra-low GWP or no-GWP technologies?**

Rheem again suggests grant programs for research and development into further reductions in GWP for this sector.

<sup>3</sup> Prohibitions on Use of Certain Hydrofluorocarbons in Stationary Refrigeration, Stationary Air-conditioning, and Other End-Use (2021), 17 C.C.R. §95371 *et seq.*

<sup>4</sup> American Society of Heating, Refrigerating and Air-Conditioning Engineers. (2022). *Designation and Safety Classification of Refrigerants* (ANSI/ASHRAE Standard 34–2022). Atlanta, GA.



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**10. What are the benefits of and potential for expanding the use of integrated heat pump technology (units that prove space conditioning and water heating and/or other uses) in California?**

Rheem encourages CARB to allow consumers the choice to select the technology that best fulfills their needs in their climate region. Flexibility to OEMs when designing equipment and flexibility to consumers when selecting the kind of equipment they would like to install in their home or building will provide the necessary impetus for the adoption of technologies that reduce the *Total Equivalent Warming Impact* (TEWI) of the HVAC&R equipment.

**11. What mechanisms, policies, and or incentives can be used to increase recovery and reuse of high-GWP HFCs from existing AC or HP systems, particularly in the residential sector?**

Rheem agrees with CARB on the need to increase recovery, reuse, and reclamation of high-GWP refrigerants. California Senate Bill (SB) 1206<sup>5</sup> prohibits the sale of virgin refrigerant with a GWP-value exceeding a pre-defined limit with the first prohibition coming into effect in 2025. This prohibition would have the effect of requiring reclaimed refrigerant for the service and maintenance of installed equipment. A substantial increase in the demand for reclaimed refrigerant should encourage the recovery of refrigerant. Assessing the impact of this prohibition on both the recovery rates for high-GWP refrigerants and availability of reclaimed refrigerant can inform future action in this area.

**12. What type of safety testing and safety standard updates are needed for the transition to ultra-low GWP (such as hydrocarbons) and/or no-GWP alternatives?**

Rheem notes that many low and ultra-low GWP solutions are A3 refrigerants (high flammability), which (per safety standard UL 60335-2-40) are currently only allowed for with very limited charge amounts, making it challenging to use them in a broad variety of applications. More study is needed to determine safe charge levels for the use of A3 (high flammability) refrigerants for use in residential and commercial ducted AC systems.

**Section 3: Non-Space Conditioning Heat Pumps (Water Heaters, Clothes Dryers, Pool and Spa Heaters)**

**13. There are limited ultra-low-GWP and/or no-GWP technologies for these equipment types. What can be done to spur technological innovation?**

Rheem is confident that a low-GWP future for water heating is achievable and is necessary given the anticipated growth of heat pumps in this application. Although the development of technology to support a transition to low-GWP substitutes for heat pump water heaters (HPWH) is well underway, more time is needed to enable large-scale deployment of a broad portfolio that ensures uninterrupted supply of affordable solutions to consumers. This time would be used to address the necessary modifications to building codes to permit flammable refrigerant substitutes. Leveraging our expertise in heat pumps for space heating, Rheem has conducted study of low-GWP alternatives in water heating applications and provided input to EPA on market readiness for a broad HFC phase down. Thorough technical evaluation and testing has been conducted to identify tradeoffs associated with various refrigerant alternatives. Due to the

<sup>5</sup> Skinner. Hydrofluorocarbon gases: sale or distribution, Cal. Health and Safety Code §39735 *et seq.*



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wide-ranging installation and design configurations (such as integrated system, split system and high temperature), and multiple incumbent refrigerants, many alternatives may be necessary. Rheem encourages CARB to allow the development and deployment of heat pumps in applications where they are used in a minority of instances today. Restricting the technology and/or refrigerants used in these end uses, in the near term, will reduce the availability of heat pumps available in these applications and slow down their adoption. Rheem would like to caution CARB against restrictions in these emerging end uses, which would ultimately counter the California Energy Commission's (CEC) and CARB's building decarbonization goals.

#### **14. What technological, financial, or building code barriers exist in adopting non-space conditioning heat pumps?**

With many of the low-GWP substitutes classified as ASHRAE safety group A2L, building codes to support installation in water heating applications are still lacking specific references to HPWH, which is a subsector not referenced in the EPA Significant New Alternatives Policy (SNAP) rules. Additionally, the significant changes resulting from NAECA-4 should be considered so as to implement a refrigerant transition in a manner that minimizes redesigns and overall market disruption. Rheem would like to caution CARB against rushing to ultra-low GWP-limits prior to the readiness of relevant safety standards and building codes, thereby limiting available alternatives to a very short list of low-GWP substitutes. Such an outcome would adversely impact equipment size, operability, costs, and applicability to many installation configurations. Certain alternatives with high flammability are limited to inadequate charge sizes and warrant further safety evaluation through the entire supply chain.

### **Section 6: Recovery and Reclamation**

#### **27. Are there emerging reclamation technologies that show promise in addressing potential barriers, such as reclaiming contaminated or blended HFCs, or cost-effective reclamation on a small scale?**

A proposed research consortium at the University of Kansas aims to investigate separation techniques to promote the recycling and reclamation of refrigerants and their blends.<sup>6</sup> The consortium is a collaboration between several universities. Participants from industry including equipment manufacturers and refrigerant producers support the establishment of this research consortium and hope that the studies conducted at this consortium improve recovery and reclamation rates in the US—especially as the use of refrigerant blends with more than two components rises.

#### **28. When is it appropriate to destroy HFCs?**

A study suggests that on a life cycle assessment basis, reclamation of refrigerants is better than destruction.<sup>7</sup> Based on circular economy principles, recycling and reclamation of HFCs may be better than destruction.<sup>8</sup>

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<sup>6</sup> The University of Kansas. (n.d.). *Goals*. Environmentally Applied Refrigerant Technology Hub (EARTH). Retrieved October 28, 2023, from <https://erc-earth.ku.edu/goals>

<sup>7</sup> Yasaka, Y., Karkour, S., Shobatake, K., Itsubo, N., & Yakushiji, F. (2022). Life-cycle assessment of refrigerants for air conditioners considering reclamation and destruction. *Sustainability*, 15(1), 473. <https://doi.org/10.3390/su15010473>

<sup>8</sup> Castro, P. J., Araújo, J. M., Martinho, G., & Pereira, A. B. (2021). Waste management strategies to mitigate the effects of fluorinated greenhouse gases on climate change. *Applied Sciences*, 11(10), 4367. <https://doi.org/10.3390/app11104367>



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Rheem urges CARB to engage with experts among all stakeholders before concluding on the relative merits of HFC reclamation and destruction.

**29. How can the State enable financial and/or regulatory mechanisms, like extended producer responsibility schemes or other fees, to improve the recovery and reclamation of HFC refrigerants? Are there successful examples from international markets that can be applied in California?**

A report summarizes practices around the regarding refrigerant management, including extended producer responsibility schemes in a few countries.<sup>9</sup> But some also caution against schemes that serve as contrary incentives and result in outcomes diametrically opposite to those desired by the scheme.<sup>10</sup> Based on this observation, Rheem urges CARB to be thoughtful and engage with all stakeholders throughout the supply chain before mandating schemes or fees to improve refrigerant recovery rates.

**Section 9: Not-In-Kind and Passive Cooling Technologies**

**36. Which not-in-kind technologies are nearest to commercialization? What barriers exist for commercializing them and how can those barriers be addressed?**

Research is still needed on not-in-kind technologies for them to be competitive with vapor compression-based systems. Pezzutto *et al.* concluded that there were no alternative cooling technologies whose efficiency and cost were advantageous compared to vapor compression.<sup>11</sup> Qian *et al.*'s assessment shows that solid-state not-in-kind technologies are only practical in small temperature lift applications. Similarly, Lu *et al.* point out drawbacks of not-in-kind technologies in relation to scalability (capacity), maturity, durability, and initial cost when compared to vapor compression.<sup>12</sup> In light of these studies published a few years after the study referenced by CARB in the RFI, it is clear that not-in-kind technologies are still not competitive with vapor compression, and vapor compression will likely remain the dominant technology in the market in the near future. As CARB considers not-in-kind technologies, Rheem cautions CARB against assuming that not-in-kind technologies can replace vapor compression across the multitude of applications in the HVAC&R market.

**37. How can incentives or other mechanisms drive the commercialization of not-in-kind technologies and the broader adoption of passive cooling technologies?**

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<sup>9</sup> Garg, A., Kumar, S., Bhasin, S., & Asphjell, T. (2023). *Global best practices on lifecycle refrigerant management*. Council on Energy, Environment and Water. <https://www.ceew.in/publications/global-best-practices-in-lifecycle-refrigerant-management-for-sustainable-cooling>

<sup>10</sup> Andersen, S. O., & Sarma, K. M. (2010). *Making climate change and ozone treaties work together to curb HFC-23 and other "Super Greenhouse Gases"*. Natural Resources Defense Council. <https://www.nrdc.org/resources/making-climate-change-and-ozone-treaties-work-together- curb-hfc-23-and-other-super>

<sup>11</sup> Pezzutto, S., Quaglini, G., Riviere, P., Kranzl, L., Novelli, A., Zambito, A., & Wilczynski, E. (2022). Screening of cooling technologies in Europe: Alternatives to vapour compression and possible market developments. *Sustainability*, 14(5), 2971. <https://doi.org/10.3390/su14052971>

<sup>12</sup> Lu, Z., Kim, J., Braun, J. E., & Ziviani, D. (2021). A quantitative review of the state-of-the-art of conventional and alternative HVAC&R technologies. *ASHRAE Transactions*, 127(2).



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Rheem supports research at universities in the US; some of the research focuses on not-in-kind technologies and passive cooling technologies to improve their efficiency, scalability, and make systems employing such technologies more robust. Rheem believes incentives can improve the maturity of such technologies; once mature, the market will adopt them. Rheem would like to point out that some of these technologies are only feasible in specific climate types; an assumption that passive cooling technologies can be deployed everywhere may be too broad.

## **Section 10: Overarching Questions**

### **38. What factors around PFAS (per- and polyfluoroalkyl substances) should be considered as California transitions to ultra-low- and/or no-GWP alternatives?**

Rheem is a strong proponent of a single federal policy on PFAS that employs a science-based approach to define and regulate the use of PFAS. The U.S. EPA has published a strategic roadmap on PFAS<sup>13</sup> with specific goals on research into PFAS, prevention of PFAS discharges, and remediation of PFAS contamination. Rheem supports such a comprehensive and deliberative approach towards PFAS that utilizes latest scientific techniques and both laboratory and environmental assessments to inform any regulation. Rheem encourages CARB to follow EPA's lead and avoid fragmentation of the regulatory landscape—a unified federal approach provides manufacturers certainty and reduces the regulatory burden, ultimately improving productivity and reducing cost to the consumer.

### **40. Are there additional control measures for refrigerant management, such as requirements for maintenance, servicing, and leak detection/repair, that could support California's climate goals?**

The US EPA has proposed to establish an *Emissions Reduction and Reclamation Program*<sup>14</sup> for hydrofluorocarbon-based refrigerants. Several aspects suggested by CARB such as requirements for leak detection and repair and reclamation are included in the proposed rule. Rheem suggests CARB to pause any further action as EPA conducts the notice and comment process and finalizes its rule. Assessing the impact of the EPA program would help CARB more accurately gauge the need for further state-level action and enable CARB to take measures to specifically address the issues that EPA's program does not.

### **41. Do you have any suggestions for legislative, or regulatory changes that are needed to transition away from HFCs and to ultra-low GWP and/or no-GWP alternatives?**

Rheem suggests CARB to gauge the impact of various provisions of the AIM Act<sup>15</sup> and regulations promulgated by the US EPA under the authority given to it by the statute before considering additional state-level legislative or regulatory actions. Overlapping or redundant state-level legislation or regulations may be inconsistent with or contradictory to federal law and/or regulations. This may cause confusion and

<sup>13</sup> United States Environmental Protection Agency. (2021). *PFAS Strategic Roadmap: EPA's Commitment to Action 2021–2024*. [https://www.epa.gov/system/files/documents/2021-10/pfas-roadmap\\_final-508.pdf](https://www.epa.gov/system/files/documents/2021-10/pfas-roadmap_final-508.pdf)

<sup>14</sup> Phasedown of Hydrofluorocarbons: Management of Certain Hydrofluorocarbons and Substitutes Under Subsection (h) of the American Innovation and Manufacturing Act of 2020, 88 Fed. Reg. 72216 (2023) (to be codified at 40 CFR parts 84, 261, 262, 266, 270, and 271).

<sup>15</sup> American innovation and manufacturing. 42 USC §7675 (2020).



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uncertainty in the market, impose unnecessary cost and burdens on both industry and consumers, and delay the outcomes desired by CARB.

**42. Do you have any other comments that would support the SB 1206 assessment report?**

Rheem encourages CARB to take a holistic view of the carbon footprint of refrigerant-bearing equipment that accounts for applied system efficiency and cost, system size and materials of construction, system reliability and service life including maintenance needs, and equipment end-of-life. A narrow focus on the GWP-value of refrigerant may inadvertently force sub-optimal choices in other aspects of refrigerant-bearing equipment ultimately leading to an increase in the TEWI of the system.

Rheem appreciates the consideration of this feedback and looks forward to collaborating with CARB and the state of California on reducing the contribution of the HVAC&R sector to climate change, decarbonizing the building sector, offering energy efficient and innovative products to California consumers, and encouraging best practices among HVAC&R technicians and contractors.

Sincerely,

A handwritten signature in black ink that reads "Allison J. Skidd".

Allison J. Skidd  
Director, Global Regulatory Affairs – Air.  
Rheem Manufacturing Company.

CC: Karen Meyers, Matthew Thornblad, Joe Boros, Ron Shughart, Harshad Inamdar



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