# NET ZERO NEWS

Resource Data Management

## ANALYSIS
An Uncertain Year Ahead for Cold Chain Businesses

## SOLUTIONS
Introducing an Innovative Solution to Increase Refrigeration Efficiency

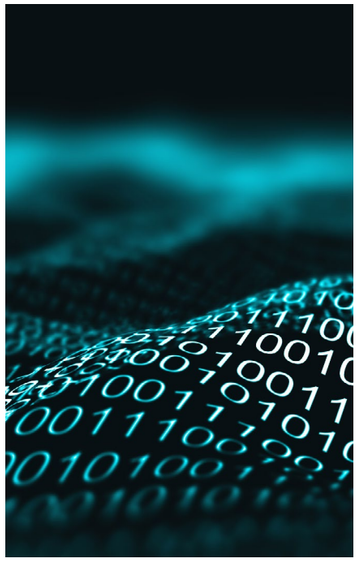
## INTERVIEW
Creating Efficient Refrigeration Systems

MARCH

# FOREWORD

Following a year of record-breaking temperatures, we are all under more pressure than before to limit our impact on the planet. Businesses are still facing challenges brought about by the last few years of economic and geopolitical changes, new policies, and changing labour markets. But at the same time, research into new technologies continues and there are new ways of helping businesses in the cold chain decrease their carbon footprint to reach net zero goals.

In this new edition of Net Zero News, we include industry news such as how leveraging AI can help businesses improve supply chain logistics, an interview with RDM's Research & Development Manager about creating efficient refrigeration systems, and new research on heat-driven cooling technologies.



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Resource Data Management

# NEWS

## AI PREDICTED TO IMPROVE SUPPLY CHAIN LOGISTICS

Creating resilient supply chains ready to deal with uncertainties and sudden market changes is predicted to become easier in the coming years thanks to AI. The authors of a recent article at The Global Treasurer claim that AI's ability to learn from experience and its capability to factor in market trend forecasts will produce solutions that help businesses through economic or geopolitical uncertainties better than human intelligence could. Its integration into business processes is predicted to enhance visibility, risk management, and decision-making.

Providing data-driven solutions, AI can be used for forecasting, adaptations, and proactive risk mitigation. Considering inventory management, AI's ability to predict demand using historical data while taking market trends into account can help businesses meet demand without overstocking. In the cold chain, this has the potential to reduce food waste, one of the contributors to climate change.

While the necessary technology might not be accessible to everyone at the moment, AI is predicted to become more readily available for large and small businesses.

*Source:* ***https://tinyurl.com/7zyzfyaw***

## ZERO GWP ULTRA-LOW TEMPERATURE CHILLER

Researchers working on a new ultra-low temperature Turbo-Brayton cooling system that will run with zero GWP refrigerants ran a successful trial where the system provided 10kW cooling capacity at -100°C. The team at the Korea Institute of Machinery and Materials (KIMM) will develop the system further into industrial chillers in the next three years.

KIMM's research team successfully developed a centrifugal compressor and turbo expander which form the core components of the system. The newly developed Turbo-Brayton cooling system can deliver ultra-low temperatures, provide large capacities, and is highly efficient as required by many industries while helping organisations lower their carbon footprint.

*Sources:* ***https://tinyurl.com/3uzpmpw6***



## RENEWABLES PRICES IN ASIA REACH ALL-TIME LOW

Cold chain businesses in the Asia Pacific (APAC) region will be able to benefit from low prices for renewable energy which are expected to be 32% cheaper than conventional coal by 2030. The lower prices will help businesses not only reduce costs but work towards their net zero goals at the same time.

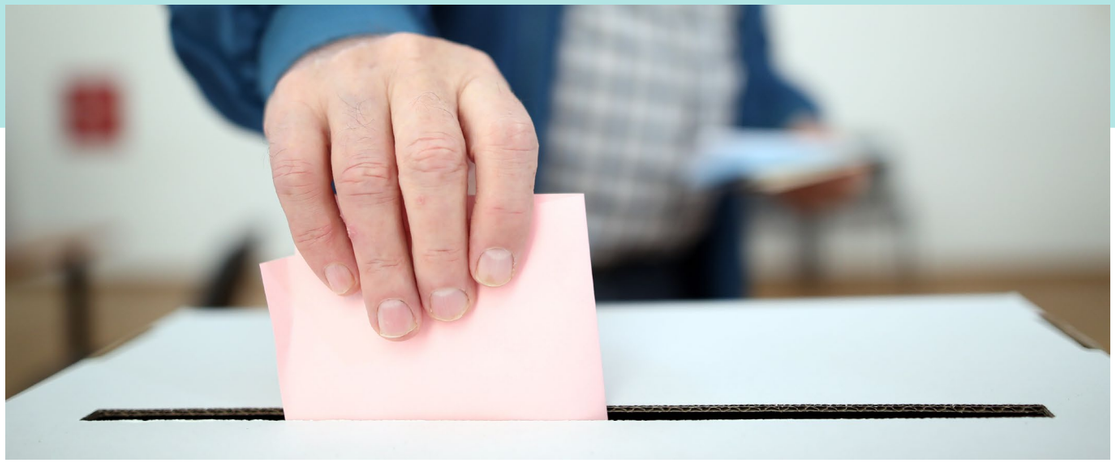
According to Wood Mackenzie's analysis, the price drop of renewable energy was due to falling costs of Utility PV solar after supply chain disruptions and inflation came to an end in the region. Falling module prices and increasing oversupply from China are expected to drop prices by another 20% by 2030.

Onshore wind costs were still more expensive than solar in 2023, but a 30% price drop is expected by 2030 due to cheaper turbines from China gaining market shares. At the same time, coal and gas generation costs have increased by 12% since 2020 and are projected to rise until 2050 due to carbon pricing mechanisms.

*Sources:* ***https://tinyurl.com/3bvfsafr***

# AN UNCERTAIN YEAR AHEAD FOR COLD CHAIN BUSINESSES

Will 2024 be another year of cutting changes? World politics, COP28, and an ever-warming planet are poised to increase the pressure on cold chain businesses. Following recent years of drastic changes and uncertainties, 2024 might again disrupt the cold chain industry and demand adjustments to operating procedures to keep costs low and reduce carbon emissions on the road to net zero. But new scientific research about frozen food safety also points towards a potential solution for reducing energy use.



### WORLDWIDE ELECTIONS COULD IMPACT POLICIES AND FUNDING

Global elections have the potential to impact climate change policies on the largest scale to date. In 2024, over 4 billion people are voting for new governments in over 70 countries. This includes elections in the US, UK, India, and Turkey, as well as for the EU parliament. Combined, these countries are responsible for over a quarter (27%) of total global greenhouse gas (GHG) emissions. If considered by capita, that figure rises to almost half at 43%.

Climate change is on the agenda in all elections, but the question of how the potentially new or remaining governments will prioritise climate change remains to be seen. Will funding for businesses to transition to net zero be cut or will more be made available? Will any laws and regulations become stricter that will force businesses to make potentially costly operational changes?

### FURTHER REGULATIONS FOLLOWING GLOBAL COOLING PLEDGE AT COP28

At 2023's COP28 in Dubai, over 60 countries signed the Global Cooling Pledge which states the goal to quickly phase down climate-warming hydrofluorocarbon (HFC) refrigerants. The Global Cooling Pledge includes commitments to reduce cooling-related emissions across all sectors by at least 68% from 2022 levels by 2050, with specific measures to address refrigerants with high global warming potential.

Clare Perry, EIA UK Climate Campaign Leader, called for a "robust and transparent governance structure to ensure accountability and early implementation." Exactly which changes will be implemented on a national policy level remains to be seen which means that the impact on cold chain businesses across the world is still uncertain.

### UNCERTAINTY OF FUNDING AVAILABILITY

For cold chain businesses in the UK, the Climate Change Agreement Scheme targets will be set during 2024. Under the Climate Change Agreement Scheme, participating businesses receive funding if they reduce their energy use according to a set benchmark. In 2022, that target was collectively surpassed, but until the 2024 target is set, businesses will not be able to decide which measures they have to implement to reach it.

Energy prices are still high in many countries and their future is still uncertain. Rising energy prices in recent years have already put an additional strain on businesses. On average, businesses experienced a 63% increase in electricity prices and a 124% increase in gas prices between Q3 2021 and Q3 2022.

### NEW RESEARCH SUGGESTS SOLUTION FOR REDUCED ENERGY USE

Positive news for the cold chain industry and the planet came from an international team of scientists who published a study in November 2023. The study found that changing frozen food storage temperatures from -18°C to -15°C, a mere 3°C change, could save as much as 17.7 million metric tonnes of $CO_2$ globally per year while still ensuring food safety.

If this change is adopted to regulations, cold chain businesses can instantly benefit from it and will have more capital available to make further investments towards becoming a net zero operation.

*Sources:*
*Global Cooling Pledge:*
*https://tinyurl.com/wscu77sr*
*COP28 HFCOs:*
*https://tinyurl.com/3d9zuzwd*
*Emissions:*
*https://tinyurl.com/t9zuz44s*
*Energy Prices:*
*https://tinyurl.com/yjkw48sf*

# INTERVIEW

**Stephen McCulloch**
RDM's Research and Development Manager
Stephen McCulloch has decades of experience creating efficient refrigeration systems.

# CREATING EFFICIENT REFRIGERATION SYSTEMS

Refrigeration systems use between 60% and 85% of energy in the temperature-controlled areas of the cold chain[1]. When working towards net zero and reducing emissions, it is essential that refrigeration systems are set up as efficiently as possible. We spoke to refrigeration expert Stephen McCulloch – Research & Development Manager at Resource Data Management (RDM) – who has years of experience designing and improving refrigeration systems and asked for his advice on creating efficient refrigeration systems. He bases his recommendations on data analysis and considers all angles of a problem to develop new solutions.

*Source*
*1: https://tinyurl.com/mryvas9v*



**Data availability is crucial to make informed decisions. But depending on the industry, some data is especially important to have. What kind of data is essential for businesses in the cold chain to make the best decisions?**
There are three key areas relating to data within the cold chain. The first is legislative temperature monitoring, ensuring that products are stored at the correct temperatures throughout the cold chain process. Businesses can gather temperature data using a range of product probes and temperature-calculating algorithms. Storing all data centrally in a control and monitoring system front-end allows all data to be accessible when needed for compliance purposes.

The second is asset maintenance. It is essential to maintain all HVAC and refrigeration assets to ensure trading availability and eliminate stock loss which are key to any business. Traditional alarms generated by faulty equipment or surpassed thresholds encourage reactive maintenance after a breakdown has occurred. Several data sources assist proactive and preventative maintenance to catch issues early before severe faults disrupt trading or cause costly repairs. Software is available to provide the necessary data that highlights problem assets which allows users to act on developing problems before failures reach critical points. Site performance analysis software can be used to identify problem sites.

The third is energy monitoring. Key equipment can be electrically sub-metered and can then be monitored at enterprise level. Specific areas such as suction pressure or whether night blinds were deployed can also be monitored. Our new Refrigeration Performance Indicator (RPI) feature can measure cabinet and cold room evaporator performance, along with electrical energy input and heat reclaim energy output generating an overall system Coefficient of Performance (COP). Not only can this feature guide the selection of equipment and system designs, but it is also a useful tool in highlighting problem assets and driving proactive maintenance.

**What part of a refrigeration system might run inefficiently without businesses being aware of it?**
If only standard temperature or equipment failure alarms are utilised, various equipment can run inefficiently without businesses being aware of it. For example, cabinets can run colder than needed if settings are not correctly reviewed. Refrigeration plant might run lower pressures than needed. Blocked condensers can cause fans to run more than necessary whilst not reaching critical alarm levels. Also, external environmental impacts such as ventilation ducts blowing into open cabinets can cause increases in refrigeration energy use whilst the cabinet is still maintaining temperature and not generating alarms. When cabinet night blinds are not being used it can generate significant and unnecessary energy consumption, whilst again the cabinet will not generate over-temperature alarms.

**What could be set up inefficiently?**
Equipment should always be configured to the manufacturer's recommended settings. However, often these also require some fine-tuning to suit individual sites and systems. There should be an acceptable range of settings stated by manufacturers against specific settings to allow this site-specific commissioning. Following commissioning, it's important to control settings to ensure these do not deviate resulting in poor performance or inefficiencies. This could include general cabinet or coldroom settings and refrigeration plant settings, but can also include such things as electric defrost timing and cabinet lighting timing that can impact energy costs. Some system sensors also need to be correctly commissioned to ensure both performance and efficiency such as pressure transducers having the correct offsets set.

Another area that may be affected by incorrect operations is site level control initiatives. Specific equipment may be configured to switch set points at specific times such as peak energy periods or overnight. These set points and timings could be incorrect, either to suit site operations or to maximise energy savings. PLC software can be utilised to implement control-based energy initiatives and monitoring strategies can provide visibility, management and control of these operations.

**How can businesses assess if they chose the right equipment?**
With such emphasis on energy consumption presently there are many varying equipment, plant and system designs being tried and tested. It can be difficult to assess which equipment or system designs offer good performance and energy efficiency. This can result in not achieving the full efficiency potential, and can impact significant numbers of sites when equipment or systems become specified or are rolled out across an estate.

There can then also be site or system design elements that can impact both performance and efficiency such as undersized or oversized condensers, condenser location or system design criteria. Other non-refrigeration system site design elements such as airflows from external doors or ventilation

# INTERVIEW

systems can also impact on open display cabinet performance and efficiency.

Another area, often difficult to assess is energy-saving initiatives such as retrofitting energy-saving equipment to existing assets or recommissioning settings. Without the correct analysis significant costs can be incurred without gaining the expected efficiency savings, or system performance can be impacted.

It has always been recommended that any initiatives should be fully monitored to capture all relevant data points to allow analysis of both energy and system performance. Should any initiative be impacted by external factors such as ambient, trading hours or other system operations, then regression analysis is vital to normalise results. Since RPI now offers the ability to provide individual asset energy reports along with overall system performance, RPI significantly improves assessment and also allows conversion from refrigeration energy use to the financial impact on the business. This helps businesses to select the correct equipment or initiatives.

**Some businesses have data available but are unsure how to use it to make changes. For those who are overwhelmed with data, what might be a good starting point to develop a new energy-efficient strategy and put action in place?**

**Get the settings right first.**
Utilising recommended settings along with site specific fine tuning, ensure things are set to maximise both performance and efficiency. Then ensuring the system is locked down to prevent ongoing unwanted changes.

**Ensure equipment is operating correctly.**
Equipment and systems must be maintained correctly to ensure both system performance and efficiency, but also to allow the correct settings to work. Often settings are tweaked to overcome failures resulting is poor performance or efficiency.

**Ensure the right people can see the right data.**
Whether it is site staff, maintenance contractors or client management, it is important that people have easy access to the relevant data and only the relevant data. On site this can be achieved by hiding unwanted items within the available software, setting up discipline specific assets or items and setting up data exports for specifically required data. At enterprise level, automated scheduled email reports of specific data sent to the relevant people can support analysis.

**Analyse the data.**
Businesses can use all the relevant data to identify good and inefficient performing equipment. Available data includes alarms, temperatures, pressures, refrigeration performance, system COP, valve performance, optimisation performance, asset availability, night blind warnings, and energy consumption data.

**Target specific inefficient equipment.**
It is likely that there are limited resources to allow acting on all possible areas. Picking a specific metric to target, gathering the relevant data, and rectifying the issues of the worst performers first helps businesses to make consistent, impactful changes.

**Learn from good performers.**
As well as targeting inefficient sites or equipment it is also important to assess good performers. This information can be utilised to select and specify the best equipment, system design, and settings.

**Specify, roll out, and control.**
Considering the above actions, it is vital that controlled processes are in place to assess, specify, and roll out equipment, commissioning, or initiatives to ensure improvements are realised and importantly that the benefits continue to be realised. Therefore, systems, settings and operations must be locked down, monitored, maintained, and controlled on an ongoing basis.

# SOLUTIONS

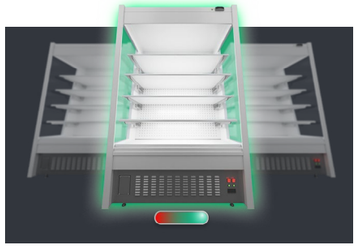
# REFRIGERATION PERFORMANCE INDICATOR

## INTRODUCING A NEW SOLUTION TO INCREASE REFRIGERATION EFFICIENCY

The latest innovative technology gives businesses the power to choose the refrigeration system that is the most efficient for their premises, taking environmental conditions into account. The new tool Refrigeration Performance Indicator (RPI) was developed to help businesses increase energy efficiency, reduce operational costs, and take another step towards net zero.

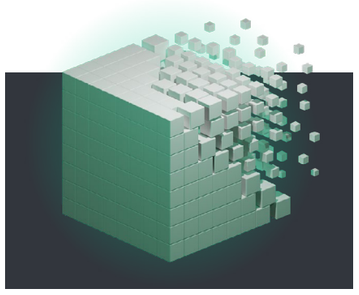
This newly developed analytical software allows users to compare sites like for like, considering a host of environmental factors to create situationally adjusted efficiency data. RPI analyses the performance of entire refrigeration systems and refrigeration system components using granular data. This includes data that was not considered in any other solution prior to this development.



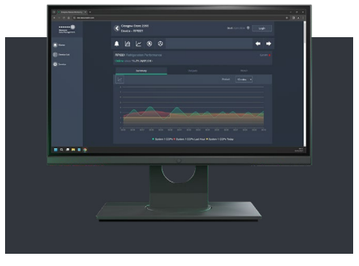


**Like-for-Like Comparisons: Choosing the Most Efficient Refrigeration System**
As an industry-first, businesses and system designers can now compare the efficiency of various refrigeration system designs like-for-like. Using RPI, businesses can analyse the impact of factors such as energy use, heat reclaim, asset size, different manufacturers' equipment, and environmental conditions on their system's efficiency. Using electrical energy input and heat reclaim energy output RPI also calculates an electrical coefficient of performance (COPe) enabling businesses to assess which system will work best on their premises.


**Like-for-Like Comparisons: Comparing Individual System Components**
RPI offers performance data for individual refrigeration system components, including display cases and coldroom evaporators. By doing so, RPI diverts from the industry standard of using only energy submetering for the whole refrigeration system to determine energy use. With performance data of individual components at their disposal, businesses and system designers can create the most efficient system depending on the environmental conditions of their sites.



**Access to Granular Data**
Businesses can access granular data about refrigeration system components through RPI. RPI calculates evaporator duty and breaks it down into a live value, last hour average, running daily total and previous 24 hour total. Display case duty is split into total device duty and duty/m length to allow comparing efficiency adjusted for length. Total system electrical energy input, heat reclaim output, and COPe, are also broken down further to provide detailed energy data.



**Energy Management & Predictive Maintenance**
Using RPI's situationally adjusted performance data for individual system components, users can identify equipment with unusually high energy use. Identifying which component uses too much energy helps businesses carry out corrective action and predictive maintenance. This, in turn, keeps maintenance and operational costs low while reducing the carbon footprint and maintaining the system's efficiency.

# RDM'S NET ZERO JOURNEY

**Resource Data Management (RDM) was founded on the principle of sustainability. Minimal use of resources and maximum efficiency in all aspects of the business have always driven our operating practices and product development.**

Over the years, we have taken many steps towards reducing our emissions including free air cooling, LED lighting, insulated roofs, and occupancy detectors. We are now implementing more initiatives across the business to reach net zero. As part of these initiatives, our head office in Glasgow is taking part in Glasgow's Step Up to Net Zero (SUTNZ) scheme.

The recently launched programme supports local SMEs in their efforts to achieve net zero. As part of Glasgow's strategy to reach net zero by 2030, the Chamber of Commerce matches net zero advisers with local businesses to support their transition. Through this programme, Tanya Goyal joined us earlier this year as our Net Zero Coordinator to help advise on any future steps that can be taken to ensure the business is on the right track.

## INTRODUCING RDM'S NET ZERO COORDINATOR

**Tanya Goyal**
Tanya Goyal recently joined RDM as our Net Zero Coordinator to advise on any steps that can be taken to ensure RDM reaches net zero targets.

**Can you tell us a bit about yourself and your background relating to net zero?**
My journey towards environmental sustainability began long before I started working at Resource Data Management (RDM). While studying at university, I had the opportunity to work on Net Zero policies and data sets. Urgent environmental and sustainability actions have always been central to my academic pursuits and principles.

My background and passion for environmental science gave me a solid foundation to understand the complexities of climate change mitigation strategies. Through SUTNZ, I can apply my theoretical knowledge by actively engaging with real-world challenges.

Joining RDM has given me the opportunity to be involved in crafting strategies, analysing data, and implementing initiatives aimed at reducing RDM's carbon footprint and fostering a culture of sustainability.

**What had RDM done before net zero targets were established by the government?**
We had already implemented energy-saving measures at our offices, including free air cooling for the IT and data suite, LED lighting, newly insulated roofs, and occupancy detectors. In 2008, we were also the first company in Glasgow to install wind turbines at our office to supply clean energy.
We also integrated our environmental standards into our manufacturing processes. As part of that we ethically source components and recycle the water used to flush away flux from PCBs.
When it comes to packaging for our products, we use recycled cardboard and paper instead of polystyrene foam and plastic.

**What other steps has RDM taken recently to reduce emissions?**
We want to establish ourselves as a 100% circular business and have already taken necessary steps towards that goal. We switched to renewable energy and now have a fully electric car fleet. In addition, we are reducing scope 3 emissions by conducting virtual meetings whenever possible to reduce business travel. The business is making additional progress towards waste recycling, space conservation, and internal sustainable practices.

**What options are you looking into to help RDM reduce emissions in the future?**
Reducing emissions is a team effort which is why we are focusing on increasing employee engagement. We are currently developing internal communications on how employees can reduce the business's carbon footprint.

Switching to more renewable manufacturing sources and tools, in the long run, is certainly on the checklist. This change will mainly affect our manufacturing hub in Taiwan.
And lastly, we will bring all our subsidiaries in line with our head office's environmental goals and policies to achieve net zero on a group level.

All of the steps we have taken so far and are looking to take in the future will help RDM align with Glasgow's net zero targets and the EU Taxonomy Goals.

**How do you use data/what kind of data are you using to generate your recommendations?**
We are using software to record our emissions, company portfolio, and other aspects quarterly. The data recorded is automatically displayed as bar graphs, comparison charts, or tables, which we analyse as needed.
We are also looking to use more analytical tools to read the datasets and have useful analyses available to work with and form recommendations for the future.

**Generally speaking, what do you think are some easy steps businesses can take to reduce their emissions?**
There are a few basic steps that a company can incorporate as actionable tips that can help them reduce their emissions:

> In my opinion, the very first step for any business is to know and understand their current emission and set reasonable carbon reduction targets.

> The next useful step could be reducing energy use. This can be done by various methods such as purchasing more efficient equipment certified as efficient, sustainable, or environmentally-friendly products.

> Lastly, unplugging equipment at the end of each day, and taking advantage of natural sunlight for lighting are easy steps that will have an impact in the long run.

Other options are regulating business travel, using sustainable suppliers, eliminating waste where possible, and engaging employees to follow sustainable practices.

# RESEARCH

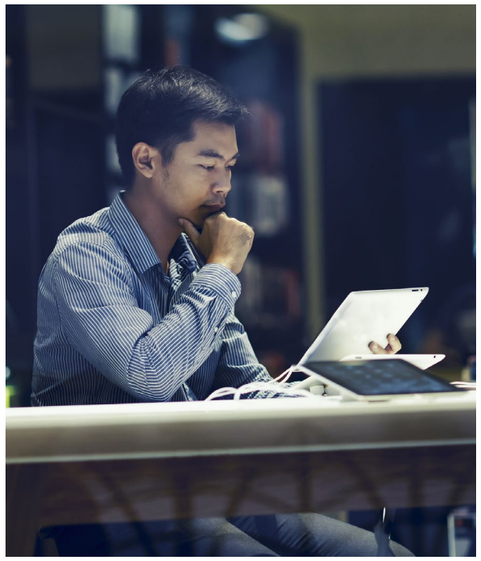
## RESEARCHERS DEVELOP HEAT-DRIVEN COOLING TECHNOLOGY

Researchers from the Technical Institute of Physics and Chemistry (TIPC) of the Chinese Academy of Sciences have achieved a major scientific breakthrough. A new, innovative engineering solution increased the coefficient of performance (COP) of heat-driven thermoacoustic refrigerators (HDTRs). The research team anticipates that the new technology will exceed double-effect absorption refrigerators in the near future.

HDTRs are considered a promising environmentally-friendly cooling technology because of their use of eco-friendly substances such as helium and nitrogen but have so far been unsuitable for commercial applications due to their low efficiency.

The new invention features a bypass configuration that allows part of the acoustic power to be bypassed. This configuration achieves efficient acoustic power matching between the engine unit and the cooler unit at high heating temperatures. The resulting energy flow field synergy significantly increases efficiency

*Sources:*
*https://tinyurl.com/4yjsj7wm*

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# CONTACT US

**RDM Head Office**
Glasgow UK
+44 (0) 141 810 2828
sales@resourcedm.com

**RDM Asia**
Subang Jaya, Malaysia
+603 5022 3188
asiasales@resourcedm.com

**RDM USA**
New Hope, MN, USA
+1 612 354 3923
usasales@resourcedm.com

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