

Beyond Refrigeration – an IOR template for the steps to Net Zero cooling

Climate Change is an issue that everyone in all sectors needs to address. The purpose of *Beyond Refrigeration* is to develop guidance on how we can begin to address these issues in the refrigeration, air conditioning and heat pump sectors working back from what net zero in 2050 would look like. This document is a draft – inviting reflection, comment and discussion.

Why is this important? If we do nothing today the cost to business is that we might not be in business by 2050. Net zero isn't just about using renewable energy – you need to make informed decisions about your future or risk being left with stranded assets – equipment you have to get rid of because it isn't compliant with government net zero policies and legislation or is costing you too much to run. A changing environment with more extremes of heat will put more demand on cooling processes. We need to reduce the climate impact of cooling activities whilst meeting the increasing demand for cooling services. All this, at the same time as improving safety, reliability and cost effectiveness. Businesses large and small, manufacturers or users of cooling need expert, independent guidance on how to address these challenges. They need to have a shared purpose and framework to work together in order to plan for their business' future based on understanding the total cost of ownership of their cooling equipment – financial and environmental.

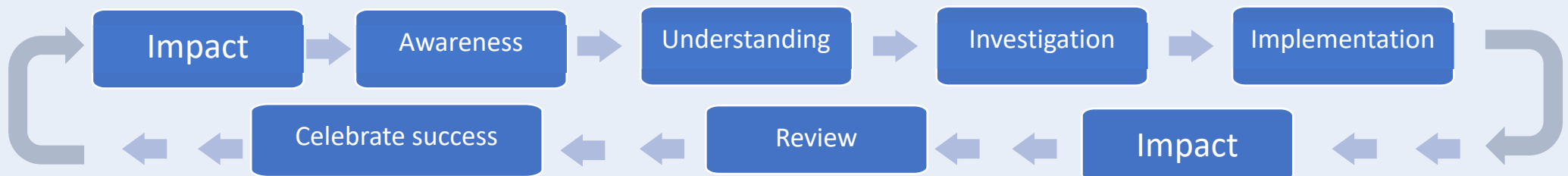
What does net zero mean? Put simply, net zero refers to the balance between the amount of greenhouse gas produced and the amount removed from the atmosphere. We reach net zero when the amount we add is no more than the amount taken away. A gross-zero target would mean reducing all emissions to zero - this is not realistic, so instead the net-zero target recognises that there will be some emissions but that these need to be fully offset. The UK is the world's first major economy to set the challenging target of being a net zero economy by 2050. The RACHP sector as a major user of energy (indirect emissions) and global warming gases (direct emissions) has an important part to play in this. You can read more about UK government net zero plans from the links at the end of this document.

How to use this template. The IOR as a charity has the remit to support the development of technology for the public benefit. It has developed the Beyond Refrigeration Net Zero template to help users of cooling to plan and take action starting with the end in mind. It identifies seven key areas that they need to address and provides suggested Steps on how they can begin to work towards net zero in each of them. The Steps begin by looking at what is a good starting point today and then provide a series of graded actions to take to that will help them move along a pathway towards an ideal end goal of net zero for that area.

The template is deliberately generic and not technology specific. In this way it can be adapted for use by any company or sector to help them to plan and review their strategies for working towards achieving net zero over the next 30 years. It was developed by a range of users and designers of cooling systems and will be regularly revised and updated as an evolving dynamic strategy as we move towards our shared goals. You will need more business specific advice and guidance on how to achieve these steps and there are plenty of resources already available or being developed on a sector by sector basis – we have included a list of resources at the end and these are useful for both larger businesses wanting an industry-standard comparison and smaller businesses who need help to get started. In addition Government schemes such as Climate Change Agreements, Enhanced Capital Allowances and Energy Technology Lists provide financial incentives that can support your choices.

How to get more involved. If you want to help this process to evolve and share steps you are taking towards net zero you can signpost additional resources and contribute to this work by signing up to our *Beyond Refrigeration* Working Groups at www.ior.org.uk/beyondrefrigeration

The process...



Net zero - Beyond Refrigeration Template for Success

1. Reducing the Need for Mechanical Cooling and Heating

2050 – What is our ambition? Mechanical refrigeration technology as a last resort and widespread adoption of net zero alternatives

Starting point – Where you are now?	The starting point for a net zero strategy is minimizing mechanical cooling and heating demand requirements. Knowledge of simple techniques to reduce cooling demand/load and their effectiveness Knowing who to ask for specialist advice on how to reduce cooling demand.
Step 1 - What are the generic issues?	Cooling needs review and procurement strategies start with the need for the business to reduce demand. Identifying quick and easy wins for your business such as efficiency, reducing the connected load. Building in flexibility to respond to changing customer demand patterns and opportunities. Measuring, monitoring and reviewing processes in place.
Step 2 - What is the incentive? How do we make it simple?	Total business net zero ROI and return on environmental impact approach to documenting and measuring changing cooling needs Implementing long term investment to address larger system-based energy demands Sharing business case approaches for measures to reduce demand.
Step 3 - What do we need to consider to get there?	Demand reduction as an industry standard for designers, consultants and purchasers. Reporting measured reductions in cooling demands (benchmarking data) Dynamic systems approach as part of intelligent energy system management to address increasing cooling demands.

2. Achieving Best System Performance

2050 – What is our ambition? Public benefit achieved by reduced energy use and increased reliability - Highest temperature possible of cooling, lowest of heating achieved.

Starting point – Where you are now?	Designing for efficiency as a key objective including reliability, safety, skills and reuse/ remanufacture or recycle of system and components regardless of choice of refrigerant. Commitment to system-based approaches to cooling Appreciation of the need for measuring, monitoring and benchmarking.
Step 1 – Best practice - What needs to change?	Best practice standards in installation, (re)commissioning, service and maintenance regimes to ensure safe, reliable, efficient operation throughout the life of the system selected. Adoption of best management processes e.g. auditing, reviewing, reporting, data schedules and priorities Adoption of best monitoring and control strategies to maximise efficient operation.
Step 2 – Where does the whole sector need to be?	Sharing of results of real system efficiency improvements achieved. Sharing of tools to enable evaluation of performance over time. Technology hubs that share best solutions.
Step 3 – What else needs to happen to embed practices?	Recognising and rewarding best achievement. Financial and legislative drivers and incentives support system efficiency improvement. Transparent reporting on energy use and savings achieved. External validation against agreed standards and metrics

3. Balancing heating and cooling

2050 – What is our ambition? Maximum heat recovery, sharing and storage in achieved across all business activities using cooling

Starting point – Where you are now?	Awareness of the drivers for balancing heating and cooling Availability of guidance on to how map your business's heating and cooling needs
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Step 1 - What are the generic issues?	<p>Commitment to a plan for exploiting the opportunities</p> <p>You understand your business's current and proposed future heating and cooling needs</p> <p>You have the resources allocated to your business plan</p> <p>You are committed to timescale for taking action.</p>
Step 2 - What is the incentive? How do we make it simple?	<p>Investigating technical options and limitations for heat recovery, distribution and storage.</p> <p>Begin working with others to collaborate on shared heating and cooling initiatives outside of commercial boundaries.</p> <p>Multi-business agreements in place so that implementation can begin.</p>
Step 3 - What do we need to consider to get there?	<p>Solutions are being implemented</p> <p>Results are being measured and maximised.</p> <p>Ongoing review of results and process of identifying more opportunities across businesses to validate future investment in environmental solutions.</p>

4. Making use of Best Available Technology

2050 – What is our ambition? Best available, closest to net zero heating and cooling as dominant technologies in use

Starting point – Where you are now?	<p>Evaluate cooling assets and activities in terms of carbon impact and anticipated future life span of equipment.</p> <p>Measuring business whole impact including energy use, embodied and direct emissions such as global warming gases.</p> <p>Agree business policies and practices that support net zero investment and payback for purchasing.</p>
Step 1 - What are the generic issues?	<p>Asset management, renewal and replacement plans focus on carbon reduction.</p> <p>Strategies in place to evaluate new technologies against carbon reduction objectives including intelligent energy use and balancing heating and cooling</p> <p>Simple practices on which procurement policies can be based to reflect return on investment in energy, whole life cycle analysis and awareness circular economy.</p>
Step 2 - What is the incentive? How do we make it simple?	<p>Regular programme of equipment audits that identify opportunities to improve or replace cooling assets to best available standard.</p> <p>Commitment to environmental business case based ongoing investment in best available technology using business case templates and independent technology evaluation methodologies.</p> <p>Low risk / cost pathways to trialing of new technologies and fast track route to identifying and wider adoption of best net zero design.</p>
Step 3 - What do we need to consider to get there?	<p>Widespread availability of safe and reliable net zero solutions driven by purchasing market</p> <p>Measuring, monitoring, evaluating and continuous improvement of technologies with results shared to market.</p> <p>Net Zero approach to asset viability embedded in the business.</p>

5. Using Energy Intelligently

2050 – What is our ambition? Aiming towards 100% renewable energy and zero carbon energy systems providing maximised efficiency, flexibility and support grid stability.

Starting point – Where you are now?	<p>Awareness of the concept of intelligent energy use.</p> <p>Investigation of business benefits of systematic energy management</p> <p>Guidance on practices that will help you use energy intelligently such as smart metering, energy generation, renewable energies, peak demand, energy storage and load shifting</p>
Step 1 - What are the generic issues?	<p>You have systems in place to measure your whole energy use (not just cooling) patterns and future forecast demands and supplies.</p> <p>You have identified how and where you want to change or reduce your energy use and what technological solutions are available to you.</p> <p>Your business is committed to collaborative activity such as benchmarking to maximise learning from best practices in other similar businesses.</p>

Step 2 - What is the incentive? How do we make it simple?	<p>Whole energy system strategies are being implemented taking into account equipment, systems, sites, estates and grid.</p> <p>A continuous improvement system is in place to ensure results are measured, evaluated and contribute to future energy policy both internally and across the sector.</p> <p>Energy use as ROI - where energy use is the investment.</p>
Step 3 - What do we need to consider to get there?	<p>Smart energy use as a core business KPI</p> <p>Roll out of industry wide best practice solutions as standard</p> <p>Cooling users as a key component of future energy systems and networks</p>

6. Developing the Best people and skills

2050 – What is our ambition? Everyone involved in cooling and heating systems to have adequate technical understanding and responsibility for championing net zero.

Starting point – Where you are now?	<p>Identification of professional skills and qualifications essential for understanding and implementing net zero strategies.</p> <p>Implementing a skills strategy to ensure the right people with appropriate skills are being employed.</p> <p>Identifying key players in your multidisciplinary net zero team. Skills audits and identification of personnel available for developing resources and mentoring.</p>
Step 1 - What are the generic issues?	<p>People skills audits and training needs analysis. Does the company have the right skills to help it make the transition?</p> <p>Commitment to training and development of appropriate existing staff.</p> <p>Developing personal responsibility - KPI targets for individuals aligned with business and environment targets.</p>
Step 2 - What is the incentive? How do we make it simple?	<p>Having the right people with the right skills will make the journey to net zero quicker and more rewarding for the individuals.</p> <p>Leadership on engagement with your staff, suppliers, and clients.</p> <p>Training and recruitment with an eye to future needs - apprenticeships at all levels.</p> <p>Input to and use of National Policies to support and encourage training and net zero skills development.</p>
Step 3 - What do we need to consider to get there?	<p>A business CSR Program & ESG Objectives (environmental and social governance) commitment to securing and rewarding the best people and skills across the sector - with clear linkage to CSR / ESG objectives.</p> <p>Wide take up of tailored development programmes with energy reduction focus across business functions.</p> <p>Monitoring tools to measure added value of qualified and skilled staff</p>

7. Working Together

2050 – What is our ambition? Systemic approach to collaboration across Beyond Refrigeration themes with all relevant stakeholders with a robust framework in place for effective policy and decision making, involving Government, industry and other experts.

Starting point – Where you are now?	<p>Identifying who needs to work together to achieve the aims of Beyond Refrigeration.</p> <p>Determining the key milestones and decision points between now and 2050.</p> <p>Deciding on a stakeholder plan for how all parties will work together.</p>
Step 1 - What are the generic issues?	<p>Risk of a fragmented approach to Net Zero Cooling with different groups (industry and Government) looking at the issue independently. Risk of fragmented policy and duplication of effort.</p> <p>Difficulty identifying currently available sources of good practice information and make use of them.</p> <p>Requirement for a single voice, or at least consistent messages from the various industry groups on the interventions required to support Net Zero refrigeration, to support policy development and confidence in the sector.</p>
Step 2 - What is the incentive? How do we make it simple?	<p>Businesses in the refrigeration industry would benefit hugely from understanding the future policy, infrastructure and innovation requirements which will be required for net zero.</p> <p>Individual organisations can achieve more for their members by working together and presenting a united front on this issue.</p>

<p>Step 3 - What do we need to consider to get there?</p>	<p>This approach can support and make clearer the government interventions which will govern the transition to net zero. Working together on Beyond Refrigeration could support businesses making public commitments on achieving Net Zero.</p> <p>Development of joint strategies across organisations, related sectors and functions.</p> <p>Overcoming competitiveness issues relating to working together and sharing information.</p> <p>Larger companies mentoring and providing people to support to smaller ones.</p> <p>Sharing transparently what has been achieved and what more is still to be done. Including corporate ESG reporting.</p> <p>Working with communities to offer and understand cooling needs matters.</p> <p>Working with external organisations such as climate change activists, consumer groups, Environmental NGOs to reframe issues and scrutinise CSR.</p>
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8. What else? There are other challenges and opportunities related to this topic that are not covered in the seven main points above. Acknowledging this we ask those using this template the question - “What else do you need to take into account?”. **What broader environmental matters need to be addressed in your sector? What specific areas need to be tackled by your business operations? What national legislative, policy or government incentives might influence your path to net zero? Net zero emissions is only a subset of sustainability – we also need to address other issues such as LCA, circular economy.**

<p>2050 – What is our ambition?</p>	<p>Whole systems thinking is used across the sector to identify optimum solutions.</p> <p>Life cycle sustainability (LCSA) assessments on the refrigeration industry (all sectors including industrial, retail, professional, domestic) are being carried out, and results implemented and used throughout the entire development process to produce optimised products, systems and services.</p> <p>Circular economy of the refrigeration industry, i.e. systems and products (food waste) is safely achieved</p> <p>Refrigeration storage has been optimised to assist in reducing food wastage</p> <p>Food excluded, but this has a very large environmental impact on emissions (e.g. WRAP), including behaviours of wastage and that people value food more (requires culture), and labelling.</p>
<p>Starting point – Where you are now?</p>	<p>There is already established recycling infrastructure for some (common) metals, and refrigerants are reclaimed.</p> <p>The design and assembly of commercial refrigeration equipment lends itself to refurbishment which is a developing market as retailers recognise the economic and environmental benefits of second life products.</p> <p>High costs of spare parts</p> <p>Social Corporate Responsibilities (SCR) reports are not technically challenged by independent parties.</p> <p>Unnecessary transport of food associated with buying culture of anywhere round the world</p>
<p>Step 1 - What are the generic issues?</p>	<p>Recycling infrastructure not in place for electronics and plastic insulation, which is stuck to metal, etc. Plastics downgrade when recycled and cannot necessarily be used to remake the same product so other applications for the recyclates have to be sought</p> <p>Although air conditioning is used in commercial applications, there is a growing demand in the domestic / residential market; reuse of commercial and retail properties (which are often single façade and located in urban heat islands) may also encourage use of AC.</p> <p>Availability of raw materials will decrease and costs will increase if recycling and reclamation rates do not increase.</p>
<p>Step 2 - What is the incentive? How do we make it simple?</p>	<p>LCSA is embedded into all the design and development activities (printed circuit boards, refrigerants, insulation, etc, etc)</p> <p>Recycled materials become cheaper than raw materials.</p> <p>Labelling on embodied impact of materials, equipment and systems, put side to side with energy labelling.</p> <p>Upgrades are technically simple, economically viable and spares parts are available and not overcharged during the overall life of equipment.</p> <p>National legislative, policy or government incentives to kick start circular economies until they become self-sustaining.</p> <p>Internet of things (IoT) enables appliances monitoring of components, equipment and systems to enable energy optimisation (defrost cycles, etc)</p>
<p>Step 3 - What do we need to consider to get there?</p>	<p>Whole systems integration of use of materials, equipment and systems that considers embodied and operational impact.</p> <p>Integration of supply chains to improve circular economies</p> <p>Legislation to avoid manufacturers ring fencing their own components to allow interchanging for repair and upgrades.</p> <p>Consider different business models such as leasing of equipment and systems and selling services.</p>

Notes In the Refrigeration, Air Conditioning and Heat Pump sectors the Institute of Refrigeration is an independent scientific and professional body that offers technical expertise to help designers, manufacturers and users of cooling equipment and heat pumps improve the science and practice of technology.

Useful resources available to provide more depth of information

Net zero and sustainability

What does net zero mean? <https://www.instituteforgovernment.org.uk/explainers/net-zero-target>

UK action on climate change <https://www.theccc.org.uk/uk-action-on-climate-change/reaching-net-zero-in-the-uk/>

Scottish Parliament Net Zero Plan <https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/>

Welsh Path to Net Zero <https://www.theccc.org.uk/publication/the-path-to-net-zero-and-progress-reducing-emissions-in-wales/>

Northern Ireland Net Zero <http://www.niassembly.gov.uk/globalassets/documents/raise/publications/2017-2022/2021/aera/1421.pdf>

International commitments to net zero <https://coolcoalition.org/>

Ethics of sustainability for professional engineers from the Engineering Council www.engc.org.uk/sustainability

European partnership for energy and environment policy briefs <https://countoncooling.eu/index.php/about-eppe/>

How refrigeration contributes to UN sustainability goals <https://iifiir.org/en/news/iir-activity-report>

Sector specific guidance

Retail sector roadmap <https://brc.org.uk/climate-roadmap/>

Building services sector advice <https://www.actuateuk.org.uk/policy-areas/>

Cold storage and distribution sector advice <https://www.coldchainfederation.org.uk/energy/>

Heat pump sector advice https://www.heatpumps.org.uk/wp-content/uploads/2020/06/Building-the-Installer-Base-for-Net-Zero-Heating_02.06.pdf

Case studies of success

IOR Conference papers <https://ior.org.uk/index.php?cID=199&cType=html>

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