

Welcome to the 5th newsletter for IC7: Affordable Heating and Cooling of Buildings

We hope that you are safe and well at this challenging time. Whilst there is strong focus on finding a vaccine and minimising the impact of COVID-19, the importance of cooling (and heating) as an enabling technology must not be underestimated. Some examples of the essential contribution of cooling at this challenging time include:-

- the use of cooling and air flow management is keeping our hospitals and medical facilities functioning and safe,
- the essential role in preservation of medical supplies,
- in maintaining our food and drink supplies minimizing waste and
- keeping our data centres running essential for the many virtual meetings taking place!

The objective of Innovation Challenge 7 (IC7) is to make low-carbon heating and cooling affordable for everyone. In total, there are 20 MI countries following IC7 activities, and 14 countries plus the European Commission actively involved in project leadership, formation or delivery. As MI enters its fifth year, this presents a pivotal moment to look back on impact and progress to date, to discuss future trends and challenges in the global innovation landscape and to explore options for the future of MI Beyond 2020. This newsletter documents some of the projects from across IC7 and the impact that is being achieved.

The items highlighted in the newsletter are just a small sample of what is going on. We hope you are already involved in some of the activities, but if not, please consider getting in touch with us to find out how you might be able to get involved.

Your IC7 Co-Leads



Amal Hamadeh



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Global cooling prize update

The [Global Cooling Prize](#) — initiated by the Rocky Mountain Institute; Mission Innovation; Department of Science and Technology, Government of India, and supported by a broad-based coalition of partners — is an international innovation competition launched in November 2018 to identify a super-efficient, climate-friendly, and affordable residential cooling solution.



After receiving 139 technical applications from 31 countries, the Prize coalition announced [eight Finalist teams](#) in November 2019 and awarded each team \$200K to support prototype development. Over the coming months, the Finalists' prototypes will be tested in both laboratory and real-world conditions in India. The prototypes were originally set to be tested from May through September 2020; however, due to

the global escalation and increased measures to contain COVID-19, Prize Administrators announced in March a three-month Prize extension. Therefore, testing will now take place from September 2020 to January 2021 and based upon the performance of the prototypes, the Prize coalition will award the Grand Prize Winner(s) up to US\$1 million in March 2021. An updated Prize timeline can be found below.



In order to continue to build an ecosystem of support for sustainable cooling technologies, the Global Cooling Prize has established an Investment Committee, which includes the Carrier

Corporation, Danfoss, and Trane Technologies as the founding members. Prize Organizers are helping to connect consenting Prize applicants to the market makers and investors within the Investment Committee in support of the commercialization and scaling goals for sustainable cooling technologies.

Additionally, to shine a spotlight on the eight finalist teams and their innovative cooling solutions, the Prize Coalition has developed highlight videos on each team, released monthly in alphabetical order. Watch the three episodes released to date on the Prize's [Youtube channel](#).

To learn more about the Global Cooling Prize, please visit globalcoolingprize.org, and to subscribe to the Prize newsletter, [click here](#).

Report on Key findings from Delhi Thermal Comfort Workshop in Delhi

One of the six priority areas for IC7, Thermal Comfort was progressed at a workshop at the Indian Institute of Technology in Delhi on the 6th November 2019. The purpose of the meeting was to forge international collaboration in Thermal Comfort and other complementary Priority Areas of IC7. The meeting was hosted by the Indian Government's Department of Science and Technology (DST).

The main output of the workshop is a strategic roadmap to accelerate research and development in thermal comfort innovation and identify cross cutting issues and future research needs. This identified three areas of focus in thermal comfort including thermal physiology, systems and technology and operational controls.

A copy of the strategic roadmap can be downloaded from <http://mission-innovation.net/our-work/innovation-challenges/affordable-heating-and-cooling-of-buildings/>

The next steps agreed are for DST to establish three working groups one each on Thermal Physiology, Systems and Technologies and Operational Controls. DST will also map the current research in the respective areas, market status, international status and potential for future research. Based on this a research project/programme with research sprints will be developed.



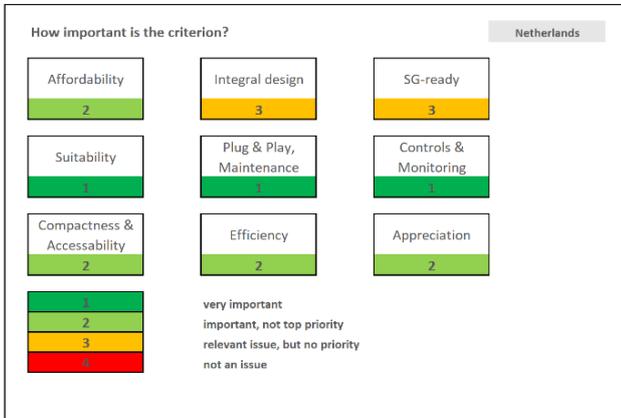
Comfort climate box – emerging outcomes

The “Comfort and Climate Box” (CCB) was initially conceptualized during the first IC7 workshop, in Abu Dhabi, in November 2017. The CCB concept provides integrated heating, cooling and energy storage at the same time as working with a smart energy grid. It was conceived to receive multiple inputs of energy sources and using these to meet heating, cooling and power demands in the most optimal way (be that lowest carbon, lowest cost or lowest impact on the electricity grid). The CCB fits well with IC7 objectives and the concept is being progressed in collaboration with the International Energy Agency (IEA), as part of the IEA's Technology Collaboration Programme (TCP).

The technical challenge is the smart combination of different technologies in one system. Specialists from various fields of technology are required and need to cooperate in order to accelerate product development and market introduction. The goal is to develop nearly market ready systems, including, as a minimum, a heat pump and a storage system.

13 Countries are involved in the CCB including 10 IC7 Members Countries. Cooperation between specialists from various technology areas is required, given the challenge of combining multiple technologies into one compact system.

Progress on this project has been good. A key focus has been the development and prioritisation of nine quality criteria that give focus to the CCB development. An example of the prioritisation for one partner is shown in the figure below:-



This output will be used to inform the development of CCB concepts and by policy makers to understand which trade-offs should be considered when CCBs are involved.

The next progress meeting is an online meeting on the 25 and 26 June. The team are planning an Autumn meeting on the 22 & 23 October in Vienna. If you would like to take part in the meetings and/or participate in the CCB please make contact:

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Predictive Maintenance and Optimisation Priority Area Update

The joint Mission Innovation/ International Energy Agency initiative on 'Data-Driven Smart Buildings' addresses the opportunity for emerging digital technologies to reduce costs and overcome barriers to energy efficiency, through advanced maintenance, control and operation of building HVAC systems. Emerging technologies and business models under investigation include the Internet of Things (IoT); Artificial Intelligence and advanced data analytics; and open 'sharing-economy' digital platforms.

A series of online video conferences were held in early April, bringing together over 80 experts to discuss research in the field, review plans for collaboration, identify key stakeholders, and form working groups to conduct the new research.

There was a good spread of attendees from across Europe, North America and Asia-Pacific (creating an interesting logistical task, requiring 5 video

conferences to be repeated – resulting in 10 one-hour sessions). Coupled with cloud document-sharing technology, the new online approach captured valuable inputs from the experts and allowed more people to attend than might otherwise have attended a face to face meeting!

The initiative is expected to commence its working-phase in June under the Auspices of the International Energy Agency 'Energy in Buildings and Communities' (EBC) TCP and IC7.

With 16 countries and over 30 organisations looking to contribute, the "Data-Driven Smart Buildings" project will provide an excellent platform for driving international innovation, commercialization and adoption of energy efficiency through digitalization.

For further information contact

Dr Stephen White (stephen.d.white@csiro.au)

Solar cooling in the sunbelt region

IC7 has endorsed a new IEA collaboration in the area of "Solar cooling for the sunbelt regions". The 2nd Task definition meeting took place online on the 18th March 2020. The meeting was led by Uli Jakob, Daniel Neyer, Salvatore Vasta and Wolfgang Weiss, and 27 organisations took part. It was agreed that:

- The task would focus on innovations for affordable, safe and reliable solar cooling systems for the sunbelt regions worldwide.
- The technologies investigated could utilize solar energy from either solar thermal (ST) or solar PV collectors, and
- Innovation should take place with industry and where possible with support of target countries like UAE through IC7.

The scope was agreed to target the market segment for cooling and air conditioning between 2 and 5,000 kW of cooling and the task duration was envisaged to run from July 2020 – June 2024. For more information or to get involved please liaise with:-

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Cities Roadmap for Sustainable Cooling

A joint initiative between the Cool Coalition, The Global Covenant of Mayors, the Rocky Mountain Institute and IC7 is initiating the development of a Roadmap for Sustainable Cooling in Cities.

Cities are where the cooling challenge is felt most acutely. Depending on the climate zone, the urban heat island (UHI) effect can raise urban temperatures as much as 5°C compared with surrounding rural areas and the very nature of urban environments makes access to passive cooling approaches far more challenging. Urbanization and rising incomes also mean that demand for cooling is rising far more rapidly in cities with direct consequences for both city residents and the local electricity systems. (Even at relatively low penetration rates, cooling demand in hot cities can easily exceed 50% of peak electricity load.¹)

The problem is also highly concentrated; just 100 cities account for 18 percent of global emissions—with a disproportionate and growing share of those emissions related to cooling in dense, hot, fast-growing megacities.

A holistic approach to sustainable space cooling at a city level would most logically be structured around the accepted sequence of first working to reduce cooling loads, then using more sustainable technologies and solutions to serve residual cooling loads, and then optimizing, operation and maintenance practices to maximize the performance of the whole cooling system in the context of the overall energy system. There is no one-size-fits-all solution, with climate zone, land-use patterns, building typology, age of existing building stock, projected new construction, the nature of the local electricity grid, and current penetration of cooling all being major variables. But regardless of these characteristics, there are some general categories where interventions can be considered—and some city “archetypes” may emerge that offer lessons for other, similar cities.

Our aim is to develop guidance encompassed within a handbook that will enable city officials to develop a sustainable cooling roadmap specific to the needs and opportunities represented by the unique characteristics of their city environment.

If you would like to contribute to the development of the Roadmap, please contact us.

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MI2.0 – the next steps beyond 2020

Mission Innovation (MI) member representatives met in Riyadh, Saudi Arabia, from 1-3 February 2020. As MI comes towards the end of its first five-year mandate, the main focus of the meeting in Riyadh was to discuss the potential scope and priorities for a second phase of MI. Officials recognized MI’s invaluable role in building relationships between countries and enabling knowledge sharing on clean energy innovation. They agreed that the next phase of MI should shift towards delivering impact around specific innovation goals of global significance, with strengthened horizontal platforms for collaboration and knowledge sharing. This will build on and enhance the many current successful work streams and collaborations.

A more detailed proposal will be discussed later this year. We hope to represent the interests of IC7 so that innovation continues into affordable heating and cooling of buildings and impact is delivered. We plan an IC7 all members call shortly to explore.

Smart cooling and heating research in India

The Indian Ministry of Science and Technology is the main coordinator for Mission Innovation initiatives across the country, with the Department of Science & Technology (DST) the agency representing 4 mission innovation challenges. India has pledged a one-third reduction in the “emissions intensity” by 2030, compared to 2005 levels (INDC-UNFCCC, 2019). A recent study indicates that the primary energy demand for space cooling in buildings in India will be about 281 TWh by 2027. Realising the immense potential for energy efficiency and emissions reduction in the space conditioning segment, DST has been supporting R&D in cooling and heating.

DST’s clean energy research initiative has created multinational collaboration programmes in smart cooling and heating, smart energy storage, low energy cooling and heating of buildings with a funding over 31.3 million USD. DST has also initiated a national research programme with a funding of 4.87 million USD in the fields of smart cooling and heating systems, ICT and operational control, design integration and innovative building

¹ 1 IEA (2019), "Tracking Buildings", IEA, Paris
<https://www.iea.org/reports/tracking-buildings>

materials. Through this, DST has enabled the creation of over 20 state of art technology test-beds across India addressing different aspects of energy efficiency. Over 400 leading researchers from as many as 60 research centres across India are actively engaged in supporting this work. DST has also engaged industry stakeholders in its programmes to facilitate the market uptake of R&D outcomes. As many as 60 industries from Heating Ventilation and Air Conditioning to Renewable energy segment are currently associated with DST's programmes.



DST has been very active in pursuing the goals of Mission Innovation. A dedicated IC7 resource unit has been set up to coordinate the Mission Innovation initiatives. A roadmap for IC7 engagement was finalized during the IC7 international deep dive workshop on low carbon, affordable heating and cooling of buildings with a special focus on thermal comfort held at New Delhi, India. In the coming years DST is keen to foster international collaboration for R&D in the field of smart cooling and heating. For more information please contact: sbajpai@nic.in, jbvreddy@nic.in, jbvreddyic7@gmail.com.



Dr Sanjay Balpai



Dr JBV Reddy

How to get involved with IC7?

We welcome involvement with IC7 through any of our priority areas, as well as news items, announcements, etc for inclusion in future newsletters.

Graeme Maidment has been seconded into UK Government to support Innovation Challenge 7. If you would like to get more involved and find out more about IC7 activities, please contact Graeme.



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[IC7 Activities Website](http://mission-innovation.net/our-work/innovation-challenges/affordable-heating-and-cooling-of-buildings/) <http://mission-innovation.net/our-work/innovation-challenges/affordable-heating-and-cooling-of-buildings/>