

CoolingEU World Café – Sustainable Cooling for Europe

A conference report

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1. Summary

On 6 June 2018 coolingEU hosted a discussion event at this year's edition of the EU Sustainable Energy Week (EUSEW). Contrary to most other events, the coolingEU event was organised as World Café to ensure participants' involvement and highlight cross-sectorial contribution. Since the coolingEU forum brings together stakeholders from a broad range of industrial sectors using or supplying cooling, the variety of topics was broad and discussions likewise. More than 30 stakeholders from entities inside and outside coolingEU came together to discuss the importance of cooling and possible ways forward in the EU and beyond. The proceedings of this event are summarised in this report.

2. Detailed report

General Information

On 6 June 2018 coolingEU hosted its third public event. Following the success of the coolingEU launch event at EUSEW 2017, the involved stakeholders decided to invite the broader public to yet another EUSEW workshop. The workshop took place in the morning of the second day of EUSEW at the premises of Fundación Galicia Europa in Rue de la Loi 38. It took place in the form of a World Café, i.e. in small discussion groups. Following a general introduction and a note by Cooling4All, the participants were asked to split in four groups. In these groups they visited four tables where they had interesting discussions about four core cooling topics : space cooling, cooling in the food supply chain, cooling for the digital era and cooling in industrial processes. At the end of the event, the various discussions were summarised and outlooks on the future of cooling were presented by industrial and academic stakeholders.

Rationale

Events are plenty in this sphere but most of them follow the same one or two modes. Either they focus on traditional presentations or they are organised around panel debates with longer or shorter presentations from panellists followed by a debate among these. Both modes which focus on activities happening 'in the front' and often offers little possibility for participants to engage or contribute. Even well-organised events in these formats leave limited room for discussion between the front and the audience. Since coolingEU is a forum for exchange, the stakeholders did not want to limit the interaction to questions and answers. Rather they wished to ensure that all participants had the possibility to engage in the debate, present ideas and discuss them with the forum stakeholders. The World Café format allows for this sort of participants' engagement. Moreover, discussing a variety of topics in a big group usually lead to only a few people speaking up – often the experts. Discussions on small World café tables ensure that there is room for everyone's contribution and the chance to gather input from experts in other/neighbouring fields on the broad number of topics covered by the forum.

Proceedings

More than 30 participants gathered for the World Café on sustainable cooling on 6 June 2018 as of 09h30. Participants were welcomed by **Ingo Wagner** (Euroheat & Power, coordinator coolingEU) and introduced to the topic: Human history is the story of taming fire and discovering electricity. Thanks to fire humanity could heat caves and prepare warm food. Heat, steam and electricity have driven our industries while electricity is paving the way for the digital future. But barely any of this can be done without cooling. Cooling is key for a healthy indoor climate and a productive work environment, food needs to be delivered and kept cool before heated for consumption, steel needs to be chilled in a specific manner to have the features to bridge our rivers, and no data centre can provide any information without cooled processors. Despite its indispensable role in our society, cooling is not broadly discussed. The matter as such and sustainable cooling solutions now and in the future deserve more attention – and an integrated perspective. This is why coolingEU was founded and why this event takes place.

Keynote

The introduction was followed by a keynote by **Ben Hartley** (UNEP Cooling4All). He confronted the audience with the key role sustainable cooling and access to cooling services plays for reaching the UN' sustainable development goals. The cooling discussion goes beyond the impacts on climate change . It' as much a matter of health and well-being, fighting hunger, as well as of creating decent work spaces, economic growth, and sustainable cities and communities. Globally, 3bn people lack access to reliable energy supply and over 3.4bn lack access to cooling services or are at risk to make poor choices for cooling equipment due to limited financial means. The lack of access to cooling for the poorest results in spoiled food and vaccines or a lack of possibilities to bring local produce to the market. Limited financial means often means that cold consumers buy low-efficiency cooling units that increase energy consumption and climate impacts. With these consumers at risk, actions taken for more access to cooling as well as the roll-out of sustainable cooling options will have a major impact on societies in many countries, mostly in the developing world. Cooling must be sustainable and affordable . It is not just a matter of luxury - it is a matter of equity.

Following the keynote, participants were grouped around four tables where different topics in the field of cooling were discussed. The four tables were managed by topic hosts from the coolingEU forum who introduced the topic, provided examples and questions, and guided through the discussion. The groups switched tables every 20 minutes so that all participants discussed all four topics. Discussions were paused for a 20 minute coffee break after the second table. After the last discussions the topic hosts summarised the results briefly. The following summaries were provided in writing afterwards and are more detailed than the oral ones gives during the event.

Living and working (hosts: **Andrea Voigt, EPEE, Thomas Garabetian, EGEC**)

The discussion of the living and working roundtables started with a short overview of the challenges of space cooling by the topic hosts and participants. The weight of the building sector in the energy consumption was notably highlighted, as well as the growing demand for space cooling. As we spend about 90% of our time indoors the importance of indoor air quality highlighting its impact on health and well-being but also on productivity of professionals working indoors was also noted.

In order to meet the future demand of space cooling in Europe, it is crucial to start considering the technical solutions that can be integrated in the built environment and how to most cost-efficiently meet the often very decentralised cooling needs.

In Europe, space cooling has mainly been used in the southern and eastern regions. Large part of the built environment in Europe has furthermore been installed before space cooling became as affordable as it is today. In the coming decades, the European economy will need to focus on integrating cooling solutions into existing buildings, taking into account compliance with EU's climate and energy objectives. Participants of the roundtables emphasised the role of energy efficient solutions for space cooling and the importance of a system approach – in line with trends in other segments of energy policy – as a corner stone to meet Europe's future cooling needs. In that respect, the idea of minimising thermal losses, for instance by exploiting waste heat from cooling applications was highlighted.

In addition, some concrete technology solutions were mentioned such as heat pumps (all energy sources), solar thermal (high deployment potential but only limited application today) and geothermal solutions, again with a strong focus on the necessity of these solutions to be energy efficient. Extensive attention was also given to the design and performance of buildings. Beyond the notion of thermal insulation, solutions for free-cooling such as natural ventilation and geo-cooling were also quoted, next to cultural habits such as dress codes that could be adapted to temperature.

In order to allow for the scaling of the aforementioned technology and policy solutions for meeting future cooling needs, it is also necessary to identify the barriers that remain to be tackled. The

discussion in that regard highlighted the challenges that remain for the development of sustainable cooling in Europe. These notably include the lack of skilled installers; the lack of awareness and understanding of sustainable solutions among users, installers and financial institutions (for instance in view of granting loans); the lack of incentives for companies and users to invest in sustainable solutions (for example due to non-adapted business models, ignoring a life-cycle approach).

Food chain (hosts: Christine Weiker, ECSLA, David Irvine, EVA)

The discussions on cooling in the food supply chain started with an overview of the different methods and requirements for cooling in the sector. The cooling demands were outlined systematically all the way from cold storage, through the refrigerated transportation of food, to the end supply of chilled products directly and the final consumers in vending.

In order for the consumer to be able to buy and safely consume fresh products all year round, perishable goods and frozen food have to be sourced, transported, stored and distributed along the temperature controlled food supply chain. It is essential that the temperature controlled supply chain (or cold chain) is uninterrupted from farm to fork. This way it is possible to preserve and to extend and ensure the shelf life of e.g. fresh agricultural produce, seafood, meat and meat products, frozen food, fruits and vegetables, dairy products, ice-cream and pharmaceutical drugs. The temperature controlled logistics sector with its temperature controlled (refrigerated) warehouses and temperature controlled (refrigerated) transport modes provides essential links for the frictionless functioning of the food supply chain from farm to fork and therefore contributes significantly to the prevention of food waste and food loss.

The final link in the chain is for consumers to purchase directly these chilled foods. Vending, for instance, with 1.5 million chilled vending machines in Europe – falling into 4 different cooling categories ranging from -20°C to +12°C – in meeting growing consumer trends for snacking and more convenience foods. The cooling needs in the industry and the wider food supply chain are hence expected to grow in the coming years.

The discussions embraced all participants and considered the challenges the sector faces in the next years in order to meet demand and adapt to various legislative constraints. Extensive conversations on the implementation of the F Gas Regulation took place, and how each industry and subsector are trying to determine and apply alternative refrigerants. It was clear that each industry certainly has its own issues, whether it be cost, availability or technical solutions to overcome. Indeed, participants acknowledged that recent drastic price increases were adding to the pressure in the food supply chain to find appropriate solutions as soon as possible.

The table also discussed challenges related to the wider public, such as the lack of consumer awareness and knowledge about food supply chain in general, and the sustainable cooling technologies required to keep their foods hygienic and safe for consumption in particular. It was concluded that while the general public may be aware of initiatives such as supermarkets adding doors to their fridges to improve energy efficiency, cooling does not constitute a concern as long as the food is accessible on demand. Suggestions on awareness raising included e.g. adding branding on fridges or machines could increase consumer interest in the efforts being made in the sector. One suggestion was “this fridge runs on natural refrigerants saving substantial amounts of harmful global warming gases.” One project discussed has the objective of introducing an ecolabel to supermarkets, which can help consumer understanding of how particular retailers are becoming more environmentally friendly with regarding to cooling.

More specifically, the roundtable debated whether additional funding specifically targeting sustainable refrigeration, complementing more general funding programmes e.g. Horizon 2020, could enhance the development of more sustainable technological solutions and the exploitation of solutions which have not been fully explored commercially yet. Additional R&D funding could also

help companies reach targets with upcoming ecodesign/energy labelling measures for commercial refrigeration.

Cooling for the digital era (host: Vincenzo Belletti, EHPA)

The roundtable on Digital Future started with an introduction on both opportunities and barriers to digitalisation of energy. Digital technologies are set to play a crucial role in making energy systems smarter, more efficient and reliable.

Great potential lays in the building sector where according to the IEA the use of real-time data to improve operational efficiency alone could cut the energy use by 10%. The potential is especially notable when it comes to heating, cooling and sanitary hot water. Smart demand response can furthermore provide sufficient flexibility to avoid further investment in new infrastructure. Further standardisation (based on national characteristics) will also be crucial for improving inter-operability across technologies and for improving user-friendliness.

In the industry, digitalisation could enhance energy savings (especially for cooling equipment and machinery) in many sectors including ICT. Google has for example reduced its energy demand for cooling by 40% using a self-learning machine. In Mäntsälä (FI), the smart cooperation between a DHC operator, heat pump company and data centre operator reduced the data centre's energy consumption for cooling by 30%. Additionally the cooperation between the three also supplies useful heat recovered from the data centre to more than 2000 households saving 70% of CO₂ emission. Such best practice, in order to be replicated around Europe, need a regulation which facilitates the use of waste heat from data centres. New business models could ease the digital transition of the residential sector. "All inclusive packages" or cooling as a service business model are already a possibility in markets where the electricity price is not too high and can help consumers with the choice of technologies and initial investment.

Digitalisation plays a crucial role also in food and medicine quality control. Better use of sensors monitoring the status and temperature of the products could improve the functioning of the cold chain. Labels which show the energy used (since day 1) to deliver the product to the end customer could improve the consumers' awareness on important issues such as energy consumption and sustainability. Many of these best practices can already be found in the supermarkets which in many cases have a digital infrastructure in place to control the cold chain and to improve the overall energy efficiency of the building.

Furthermore, the application of smart devices will improve the reaction to system failure, anticipating problems and reacting in the fastest and most efficient way to prevent major issues (e.g. quick re-action to a problem occurred to a truck which is transporting cooled goods).

Some of the major barriers to a deeper and faster penetration of digital technologies in the cooling and more in general in the energy sector are:

- Lack of skills among professionals dealing with cooling
- Lack of awareness of benefits among customers
- Data ownership and digital privacy

The growing number of smart devices available on the market will require a skilled workforce (engineers, technicians, installers etc) to ease the transition and installation of smart devices (especially in the residential sector), making the most of these. Policymakers could help speed up the process by improving certification systems and make access to public funding subject to appropriate conditions.

Customers will need to be properly informed about the benefits of the new appliances for their businesses or homes, and the use of their data in order to consider and accept these solutions and this way give incentive to wider use and development of digital technologies

Privacy and data ownership have become a major concern, especially as the data collected become more detailed and includes a growing number of digital devices and appliances. Especially in the residential sector, many consumers will want to protect their anonymity. Companies will need to sharpen their data collection methodology in order to be transparent and protect their customers' data from possible cyber-attack. Policymakers should better regulate data collection in order to balance privacy concerns with promotion of innovation (e.g. in demand response) and the operational needs of utilities.

Cooling for Europe's industry (host: Ingo Wagner, Euroheat & Power)

The discussions on cooling in industrial processes started with an introduction on the substantial industrial energy demands, the need for cooling and existing examples for sustainable cooling approaches. If for example the whole chemical industry in Europe would switch to renewable electricity, this would have a major impact on the energy system as a whole. In such case the amount of electricity needed would equal 4times the current electricity demand of Germany. A lot of this energy is used for heating purposes, i.e. creating cooling demands, or cooling purposes. Accordingly, there is a big potential for sustainable cooling options. In industrial processes heat is often dispersed to the environment and at the same time causes huge demands for fresh water used in the process. However, plenty of positive examples turning this around does exist. Dispersing heat to the environment and wasting fresh water can be avoided by cascading thermal energy to other parts of the process where it is then later reused, or delivered to external customers, e.g. buildings. Another example is to replace current cooling technologies with more sustainable options. One example is the use of waste cold from other processes. This saves energy and cuts emissions and costs. Participants were asked what they found the main barriers and solutions for an increase in the use of top-sustainable solutions is.

A core problem when it comes to sustainable cooling solutions in the industrial sector seems to be awareness. Whereas cascading, balancing and sustainable solutions seem to be quite common in some subsectors such as in the metallurgical ones, they are largely unknown and/or unused in others. While it is already challenging to reach bigger sectors with larger players, it is even more difficult to reach smaller actors. Another part of the issue might be related to the possibility to change a process once it is put in place, which often proves to be limited or a direct blind spot. Also, since it is not part of the core business the interest especially for out-of-the-box solutions is often low. If top decision making processes furthermore are complex or hampered by uncertainty regarding the economic future or the regulatory framework, change is complicated further. Moreover, participants outlined that there is a lack of communicated business cases which further hampers the much needed cooperation between the variety of actors that are involved in such projects.

To solve these issues interested actors need to work on actual case studies and, even more important, distribute them through the right channels directly to the relevant actors. A platform for sustainable cooling in industries and/or thermal cascading of heat and cold can play a central roles in these efforts. These case studies should among other issues focus on investment and business cases (a focus provided by calls under the last H2020 work programme), and identify momentary opportunities but also look for step-by-step approaches to market development. In addition further research in cascading, synergies and sustainable cooling options in the sector should be promoted. A platform could also help improving the link between legislators and investors to ensure that the framework actually promotes the roll-out of these solutions. To increase capacities energy consultants and solution providers need to be trained and educated in the right direction. Moreover, industrial consultants and planners of industrial facilities and parks need to be further equipped to take synergies into account when setting up new parks and clusters. Last but not least participants

highlighted that there must be proper incentives to realise projects like these, e.g. investment support, or the other way round maybe even a tax on wasted energy that actually could be used in an technologically and economically viable manner.

Closure

Following these summaries, Julia Panzer (Danfoss, who kindly supported this event), took the floor. She highlighted the key importance of sustainable cooling for a successful energy transition. Taking the examples of supermarkets: By connecting all European supermarkets to the energy system, a huge demand response capacity could be built up and theoretically replace 10 coal-fired power plants. But there is much more to it. Technologies such as heat pumps or district cooling are nothing new. As future-proof technologies, they are the key for a sustainable cooling sector. Beyond these individual technologies, a system approach is needed – not an approach just looking at the systems but one which connects them. When connecting systems the individual technologies of course play a role but on top three connecting solutions which are key, are: Thermal networks (and especially linked with vapor compression), linking all energy demands and sources, and intelligent controls. When using the best available technologies today, focussing on a system approach as well as on a lifecycle approach, and using the advantages of a dynamic electricity price, we can drive the change right away, as of today.

As last speaker, Kostadin Fikiin (Member of the Academic Mirror Group, TU Sofia) took the floor for an academic closure. He highlighted once more how important cooling is and also provided a sound overview of sustainable technologies and solutions. Important to keep in mind is the fact that cold as such, can be a pleasure but it can also be a threat (e.g. in the form of a blizzard) but in most cases it is a simple must. Representing 17% of the world's electricity consumption and 12 million jobs, the sector is an important player – and covers a colourful bouquet of different and often combinable technologies. Alone in the food sector cold accounts for a cost factor above three times the US military budget. To face the challenges of an increased need for food mirroring the further growth of the world population efficient existing solutions must be supplied, further innovations supported, renewable energy made available for cooling in a dedicated way. This can be all supported by intelligent and smart concepts but in the end it is driven by smart people who deserve our support.

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