



Cleantech Innovation Festival
by Future Cleantech Architects

FCA Future
Cleantech
Architects

Key takeaways



Innovation



LDES

Long Duration
Energy Storage



Cement



Aviation

co-hosted by



United Nations
Climate Change



UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION



INVESTMENT AND TECHNOLOGY
PROMOTION OFFICE
BONN, GERMANY



InnoEnergy

Co-funded by the
European Union





THE ARC 23 – EUROPE’S MOST AMBITIOUS CLEANTECH INNOVATION FESTIVAL – HOSTED OVER 250 PARTICIPANTS FROM MORE THAN 25 COUNTRIES TO DISCUSS HOW TO REMOVE ROADBLOCKS AND BRIDGE THE INNOVATION GAPS TO REACH NET ZERO BY 2050.

The ARC 23 looked towards a net-zero 2050, zooming in on the innovation processes in some of the hardest- to-abate industry sectors, such as cement, aviation, and long duration energy storage. Our Future Cleantech Festival aimed to identify specific steps that will remove roadblocks and bridge the innovation gaps to reach net zero by 2050. The ARC 23 brought together private industries, policy makers, and research institutes to discuss and collaborate.



Key takeaways

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Cleantech innovation

Key takeaways

Promoting global climate change mitigation, economic growth, enhanced international competitiveness, and the eradication of energy poverty relies heavily on embracing social and technological innovation.

While national governments play a pivotal role in driving the global energy transition, it's crucial to recognize that fostering cleantech advancements requires more than just public investment in clean energy research, development, and demonstration. The global innovation system encompasses an intricate network of actors, institutions, and resources that must collaborate in synergy. To achieve optimal effectiveness, this system must fulfill a diverse array of functions, such as mobilizing resources, cultivating and disseminating new knowledge, facilitating entrepreneurial experimentation and the emergence of new markets, establishing social acceptance for novel technologies, guiding the pursuit of knowledge in specific directions, and facilitating knowledge transfer to interconnected industries.

1

Improve cleantech financing

Financing volumes in Europe are still too low. Focus should be placed on attracting more private capital (e.g. institutional investors) and targeting it effectively in order to close the significant climate funding gap. Public money and mechanisms such as quotas and guarantees can be used to de-risk private capital. This is especially critical for early-stage research as well as demonstration projects.

2

Balance intellectual property protection and knowledge dissemination

The current regulatory framework makes university spin-offs complicated and impedes the further development and commercialization of ideas. We need to streamline the regulatory framework to facilitate knowledge commercialization and to simplify the transfer of intellectual property rights from universities to spin-off companies while ensuring fair compensation.

3

Support green alternatives in initial market entrance

Green alternatives still come at a premium during market ramp-up. We need to establish more mechanisms, such as Carbon Contracts for Difference or Offtake Agreements, to facilitate the adoption of green alternatives. Subsidies must be clearly limited in scope and time to avoid market distortions.

4

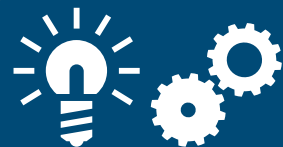
Imperfect regulations are better than no regulations

Innovations are often blocked by missing or outdated regulation. Agile regulatory approaches that give companies and investors planning security and allow for iterative improvements should be promoted. It is necessary to engage with innovators, think tanks, and industry to ensure comprehensive and practical regulations.

5

Public sector impact

The public sector has a central role to play in driving the global energy transition and needs innovative and committed talents just as much as the private sector does. Smart policy making can set the direction for cleantech innovation.



Aviation

Key takeaways

Aviation is responsible for 2-3% of global annual CO₂-emissions and is the fastest-growing emitter in the transport sector. However, CO₂ alone does not tell the full story of aviation's impact on the planet. CO₂ represents only 1/3 of the sector's emissions, with 2/3 coming from non-CO₂ effects.

The largest contributor to aviation's warming impact on the planet are contrails (>50%). Airplanes are built to last; the average lifespan of an aircraft is over 25 years. Therefore, what is happening in the industry (as well as the type of aircraft leaving the production line) today have far-reaching implications when looking towards a net-zero 2050. Additionally, safety, testing, and verification are lengthy procedures. Such procedures need to be sped up and simplified to accelerate the entry of new technology onto the market, from new aircraft designs to new engine technologies, and help the sector decarbonize. One of the key solutions to help decarbonize the sector until 2050 are Sustainable Aviation Fuels (SAFs). However, in 2022 SAFs still made up less than 0.1% of the market share of jet fuel. Policy measures such as ReFuelEU, the EU Emissions Trading System (ETS), the UK SAFs mandate, as well as other similar initiatives are key drivers to decarbonize the sector.



1

Reducing emissions starts today

SAFs (Sustainable Aviation Fuels) and efficiency gains will be the biggest contributors to decarbonizing the sector. The industry should start utilizing available biofuels while focusing on ramping up synthetic fuels. Smaller contributions are to be expected from alternative technologies such as hydrogen and electric aircrafts.

2

Reducing non-CO₂ effects, mitigating contrails

The fastest way to mitigate contrails are avoidance measures. According to Breakthrough Energy, rerouting 5% of flights will lead to an 80% reduction in contrails and a marginal added cost of ~\$5/flight for an airlines.

3

Reducing the green premium

With SAFs being 2-5 times more expensive than conventional jet fuel, they could double ticket prices. Efficiency gains could then counter increasing fuel prices and minimize the impact on the end consumer. Until the impact is minimized, the cost needs to be spread to those consumers who can afford it, as 1% of the global population is responsible for half of the industry's emissions.

4

Prioritizing a three-step approach to reducing emissions

First, avoiding emissions through more sustainable practices, such as using alternative modes of travel. Second, reducing emissions through efficiency and cleaner technologies. Finally, offsetting remaining unavoidable emissions via Direct Air Capture (DAC).

5

Addressing international flight emissions

International flights are responsible for approximately half of the sector's overall emissions. Meaningful carbon-pricing mechanisms and phasing out of fossil fuel subsidies should be established to encourage both CO₂ and non-CO₂ emissions reductions worldwide. Carbon prices need to rise to adequately reflect the environmental damage that fossil fuel flights are causing. Global cooperation and coordination are needed to maintain a level playing field between countries.

LDES Long Duration Energy Storage

Key takeaways

Electricity generation is responsible for over 25% of global greenhouse gas emissions. The vast majority of these currently come from coal and gas-fired power plants.

Decarbonizing electricity will require large amounts of solar and wind energy. Solar and wind are already the cheapest and fastest-growing energy sources globally; however, they fluctuate over time. Long Duration Energy Storage (LDES) enables the integration of large shares of solar and wind into the power grid, storing clean electricity when there is a surplus and supplying it back when needed. There are a diverse range of LDES technologies, divided into four families: electrochemical, thermal, mechanical, and chemical. Together, they can provide energy security from daily up to seasonal timescales. Pumped hydro storage (PHS) is the most mature and widely implemented LDES technology, with over 90% of global installed capacity. Several other LDES technologies are also ready for deployment; the priority now is scaling up.



1

Establish long-term deployment goals and market incentives

Ambitious, long-term deployment targets for energy storage, both at national and EU levels, are necessary to ensure regulatory stability, encourage developers, and create an attractive investment environment. Deployment targets should be coupled with incentives to ensure stable revenue streams.

2

Support full-scale demonstration projects and boost targeted R&D

For LDES technologies with medium-to-high technological readiness levels (TRLs), public grants are needed to support their demonstration at full scale. These first demonstrators are crucial to de-risk future projects, reduce costs, attract investment, and speed up deployment. R&D funding programs should target LDES technologies with low-to-medium TRLs that show high potential.

3

Streamline approval processes and grid connection

Standardized permitting procedures for storage assets are needed to accelerate deployment and connection to the grid. Storage facilities should be treated separately from consumption and generation assets in order to avoid double taxation.

4

Transform fossil-fired thermal power plants into energy storage plants

Repurposed plants can use thermal stores to run on off-peak clean electricity, becoming electricity storage plants. The transformation process reuses existing infrastructure (avoiding decommission), reduces the footprint and cost of new LDES systems, speeds up the deployment of grid-scale storage, and allows keeping the associated workforce.

5

Decarbonize heat with electrification and thermal storage

Coupling heat electrification with thermal storage provides further flexibility to the power grid. Clean electricity can be consumed in large volumes when available at low cost, transformed into heat, and stored in thermal tanks to be used when the electricity supply is low.

Cement

Key takeaways

The state of the sector today: not on track for net zero.

Between growing demand, stagnating emissions intensity, and a conservative industry that isn't given strong incentives to decarbonize, construction is not on track for net zero and relatively neglected by public policy (which focuses much more on operational emissions i.e. energy consumption during the usage phase of infrastructure). To understand the challenge of decarbonizing cement production (the main source of emissions in concrete production), it is important to consider that about 30% of the emissions come from energy use (high-temperature heat), while 60% (the process emissions) come from the core chemical reaction of turning limestone into cement.



1

No silver bullet in terms of technology

There is no one technology that can take the sector all the way to net zero. The key is to combine multiple complementary approaches to decarbonize this emissions-intensive industry.

2

Improve regulations and standards

Non-compliance and certification are major barriers to innovative solutions. We need a rapid shift to more flexible, performance-based norms that open up the solution space.

3

Green public procurement

The public sector is a major client of the construction industry that could exert significant market demand for greener products and drive innovation. While there will likely be a green premium for low-carbon cement and concrete (and steel), its effect on the final cost of a building should be in the single-digit percentage and therefore manageable.

4

Decarbonizing high-temperature heat

Multiple pathways to decarbonize the heating of a cement plant exist, including biomass & waste, concentrated solar thermal, and electrification. While this would directly mitigate around 30% of emissions, non-combustion options would also enable easier Carbon Capture and Storage by avoiding the mix of gases resulting from the use of gas, coal, or oil in traditional cement production.

5

Local materials and supply chains

Leveraging the local bio-based materials, timber, and waste (circularity), for which regional specificities play an important role, is necessary. Therefore, establishing new supply chains to access and monitor these material flows is crucial.

6

Reduce concrete usage

» **Structural efficiency** – Current buildings use several times more material than strictly needed; with better design, we could use up to 10 times less material to meet the actual structural requirements.

» **Natural materials** – Just from using timber as a substitute, concrete use could be decreased by 30-40%.

» **Waste** – 1/3 of Europe's waste comes from construction. Integrating circularity and reusing is already needed in the design phase.

Impressions



“Discussions at The ARC helped me gain a deeper understanding of the different technological approaches to decarbonize cement and what regulatory hurdles stand in the way of innovators.”

Henning Rehbaum |
Member of German Parliament | CDU



“I had an exciting and inspiring exchange today about efficient and environmentally friendly energy supply at The ARC Cleantech Innovation Festival.”

Dr. Klaus Wiener |
Member of German Parliament | CDU



“At The ARC, cleantech stakeholders from all over the world came together to discuss solutions for a sustainable future. Many solutions are already technically and scientifically available - but the political framework is still lacking. That's why it was so important that FCA brought us together at this festival.”

Yazgülü Zeybek |
State Chairwoman NRW |
Bündnis 90/Die Grünen



“The focus here is very different than in Berlin (...) you see a very diverse field of players. That is a very, very interesting thing to see because everybody is oriented in getting further, in getting things done, not to preserve stuff, and that is innovative.”

Bengt Bergt |
Member of German Parliament | SPD



“I think you have done a great job at actually creating public conversations between people and not just business small talk. (...) There is a lot of momentum, a lot of great companies, a lot of accelerators, a lot of investment companies. Let's use this momentum, let's be positive, and make it work.”

Johanna Schiele |
Policy Officer EU Innovation Fund
(DG CLIMA) | European Commission



“It's bringing people together from politics, from innovators, from start-ups, a very wide variety, and focusing on the hard topics, not the ones which are done everywhere but like decarbonize aviation, decarbonize buildings - clean cement-, and long duration energy storage.”

Dr. Simon Brettschneider |
Technical Lead LDES Challenge |
SPRIND

Join us next year

Our Future Cleantech Festival, The ARC 24, will be back!

Our Future Cleantech Festival, The ARC24, will bring together leading innovators and policy-makers to discuss specific steps in developing and scaling cleantech solutions faster. We will be tackling some of the hardest-to-abate industry sectors, such as construction, transport, and the future energy system. Adopting a holistic, cross-sector approach, our Future Cleantech Festival aims to help set the agenda for key policy approaches and specific funding tools in Europe and beyond. Together with our co-hosts, we look forward to bringing together innovators, incumbent industry, and researchers with policymakers, who will set the future framework for cleantech development. Mark the date and make sure to join us!

FCA Future
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SAVE THE DATE THE ARC

FUTURE CLEANTECH FESTIVAL
REMSCHIED, GERMANY | **MAY 28-29, 2024**



About Future Cleantech Architects:

We are a climate innovation think tank.

We exist to close the remaining innovation gaps to reach net-zero emissions by 2050. To reach this objective, we accelerate innovation in critical industries – such as cement, aviation, or shipping – where sustainable solutions are still in very early stages.

We urge policy-makers to intensify and better prioritize their R&D activities. Moreover, we initiate and actively drive high-level research consortia on critical technologies for these neglected technological sectors.

Connect with us to join this mission or support our work.

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