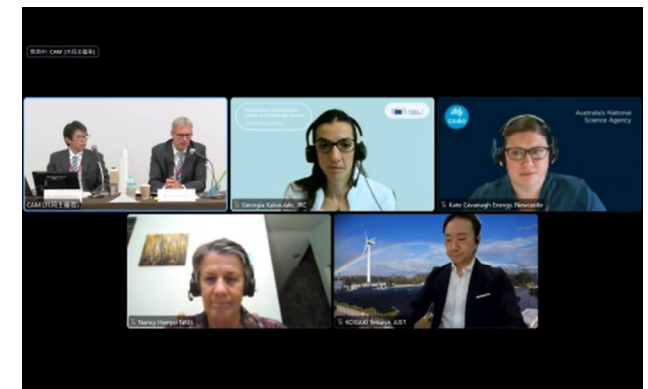


Reports of Technical Session and Workshop

Dr. Haruhiko Obara
Executive Officer

National Institute of Advanced Industrial Science and Technology (AIST)



Program Chairs



Dr. Haruhiko Obara
(AIST, Japan)



Dr. William Tumas
(NREL, US)

Moderators/ Chairs

Theme 1



Dr. Florence Lefebvre-Joud
(CEA-Liten, France)

Theme 2



Dr. Christian Thiel
(JRC, EU)

Theme 3



Dr. David Harris
(CSIRO, Australia)

Number of registrations: 936 (as of Oct. 2, 2022)

Maximum number of viewers: 372

- Held on October 4th, 2022
- General plenary session in the morning
- Three parallel sessions in the afternoon
 - ✓ Theme 1: Hydrogen Life Cycle Assessment (LCA) and Techno Economic Analysis (TEA)
 - ✓ Theme 2: Renewable Energy Generation and Integration
 - ✓ Theme 3: Carbon Management

Co-Chairs

Plenary: Dr. Koji Matsubara (AIST, Japan)

Theme 1: Dr. Masaharu Motoshita (AIST, Japan) - Group 1

Dr. Kouji Sakaki (AIST, Japan) - Group 2

Theme 2: Dr. Jun Hashimoto (AIST, Japan)

Theme 3: Dr. Kinya Sakanishi (AIST, Japan)



Dr. Akira Yabe (NEDO, Japan)

Talk 1: Research and Development Tasks Towards Carbon Neutrality of 2050 - NEDO's Challenges -

The importance of the establishment of innovative technologies to reduce largely the total abatement cost was stated. The author also stated that the importance to challenge many innovative technologies from various aspects of energy technology and contribute to the accumulation of the reduction amount of CO2 emission.



Prof. Dr. Christopher Hebling (Fraunhofer ISE, Germany)

Talk 2: Green molecules for a sustainable global energy system

The author stated that "80% of energy is provided by molecules in gaseous, liquid or solid state form and it is required to produce these molecules in a climate-neutral way and to use the established transport chains".



Dr. Abdelilah Slaoui (CNRS, France)

Talk 3: Research perspectives towards carbon-neutrality in France

The author presented about research perspectives toward carbon-neutrality in France. He introduced France 2030' Initiative and the French low carbon hydrogen plan 2020-2030. He also pointed out the importance of circular economy and 7R's (Reduce, Reuse, Redesign, Repair, Renovate, Recycle, and Recover).



Dr. Nawshad Haque (CSIRO, Australia)

Talk 1: Techno-Economic Analysis of Renewable Hydrogen and Ammonia supply chains



Dr. Myriam Merad (CNRS-Paris Dauphine, France)

Talk 2: Sustainability of territorial transitions toward Decarbonated Hydrogen: a multidisciplinary, multi-actors and multi-criteria approach”



Dr. Amgad Elgowainy (ANL, US)

Talk 3: Life Cycle Analysis (LCA) and Techno Economic Analysis (TEA) of Hydrogen Production Pathways and End Use Applications



Dr. Yuki Kudoh (AIST, Japan)

Talk 4: Contribution of Capital Goods on the Life Cycle CO₂ Emissions of Hydrogen Technology – A Case of Ammonia Power Generation –



Mr. Thomas Roos (CSIR, South Africa)

Talk 5: Economics of Green Hydrogen production in South Africa



Dr. Monika Bosilj (Fraunhofer ISE, Germany)

Talk 6: Catalysis for Power-to-X Processes



Dr. Jennifer Kurtz (NREL, US)

Talk 7: Reducing the Risk of Deploying Hydrogen Technologies through Large-Scale R&D

Mr. Souvik Bhattacharjya (TERI, India)

Dr. Trinayana Kaushik (TERI, India)

Talk 8: Environmental Sustainability Assessment of Different Beverage Packaging Substrates in India Using LCA



Prof. Dr. Mario Ragwitz (Fraunhofer IEG, Germany)

Talk 9: Hydrogen infrastructures in an integrated European energy system – determinants and modelling options



Dr. Farid Bensebaa (NRC, Canada)

Talk 10: Integrated and bottom-up LCA /TEA framework and its use to support research and policy – Hydrogen Case Study

Common expression of current needs :

- For common metrics and harmonized methodologies to evaluate Carbon Content of H₂ or H₂ based molecules and also for evaluating risks/benefits other than economics,
- For sharing assumptions and boundary conditions that determine the analysis
- For **sharing data** to increase LCA inventory

Additional consensual remarks:

- Incorporate sustainability and social acceptance,
- Consider local specificities and environmental justice
- Coordination with IPHE running task force (focused on C Content of H₂ produced/transported) as well as other initiatives, and possibly expand their approaches to H₂ based molecules & e-fuels
- Analyze any scenario or solution that could help, not only “ideal” cases

These slide materials are provided by Dr. Florence Lefebvre-Joud and Dr. Abdelilah Slaoui.

Theme 1: Conclusions of the discussions and ideas for further cooperation

Based on these analysis RD20 will have the ability to :

- propose priorities at international level for R&D&I, demonstration or experimentation at large scale
- provide sound advice, with a common voice, to G20 countries

→ Consensus to form a **task force on broad area of LCSA**

Participants:

Chair: **Dr. Amgad Elgowainy**
Argonne National Lab, US
Co-chair: **Dr. Nawshad Haque**
CSIRO, Australia

Dr. Myriam Merad - CNRS-Paris Dauphine, France
Dr. Yuki Kudoh - GZR, AIST, Japan
Mr. Thomas Roos - CSIR, South Africa
Dr. Souvik Bhattacharjya - TERI, India
Dr. Eniya Listiani Dewi – BRIN, Indonesia
Dr. Monica Bosilj – Fraunhofer ISE – Germany
And ?

These slide materials are provided by Dr. Florence Lefebvre-Joud and Dr. Abdelilah Slaoui.



Dr. Nancy M. Haegel (NREL, US)

Talk 1: PV at Multi-Terawatt Scale: Today's Choices, Tomorrow's Role"



Mr. Shirish S Garud (TERI, India)

Talk 5: Making India's Renewable Energy Targets a reality



Dr. Tetsuya Kogaki (AIST, Japan)

Talk 2: Recent R&D activities in AIST for Japan's offshore wind power deployment



Marcos Politi, Eng. (INTI, Argentina)

Talk 6: IOT for Integration of Renewable Energy



Dr. Gareth Erfort (CSIR, South Africa)

Talk 3: Offshore wind opportunities for South Africa



Dr. Kenji Otani (AIST, Japan)

Talk 7: Advanced R&D Platform for Decarbonized Power Grid with Inverter-based Distributed Energy Resources



Ms. Kate Cavanagh (CSIRO, Australia)

Talk 4: Accelerating the transformation of the Australian energy grid



Dr. Georgia Kakoulaki (Joint Research Centre, EU)

Talk 8: Floating photovoltaics, a solution to combine hydro- and solar power

Theme 2: Conclusions of the discussions and ideas for further cooperation

- Continue further knowledge sharing on the topics to identify synergies, differences and gaps so that possible avenues for cooperation can be identified
- Multi- Terawatt Workshop, interested RD20 members can join and contribute, contact point Nancy Haegel, NREL
- Smart grids, interoperability, and artificial intelligence, exchange further on ongoing activities in various regions
- Offshore Wind power, methods for wind power estimation (for example through LiDAR) and comparison with field data
- Floating PV, interest to study situation for India and details for South Africa, contact point Georgia Kakoulaki, JRC.

This slide is provided by Dr. Christian Thiel (JRC, EU).



Dr. William Tumas (NREL, US)

Talk 1: Challenges and Opportunities for Carbon Dioxide Capture and Utilization



Dr. Jennifer V. Littlejohns (NRC, Canada)

Talk 2: Opportunities in Bioenergy and Waste-to-Energy with Carbon Capture Utilization and Storage in Canada



Dr. Shinichirou Morimoto (AIST, Japan)

Talk 3: Current review and activities of LCA for carbon mineralization



Dr. Nicholas Musyoka (CSIR, South Africa)

Talk 4: Carbon Capture and Utilization (CCU) research activities at the South Africa's Council for Scientific and Industrial Research (CSIR)



Dr. Graeme Puxty (CSIRO, Australia)

Talk 5: Emerging CO2 capture technologies for DAC and 'hard to abate' industry Sectors



Dr. Atul Sharma (AIST, Japan)

Talk 6: Innovative application of chemical-looping technology for CO2 reduction, recycle and removal



Dr. Valérie Keller (CNRS/University of Strasbourg, France)

Talk 7: Different approaches for CO2 reduction and valorisation using Solar Energy within the French Solar Fuels Network



Prof. Dr. Eniya Listiani Dewi (BRIN, Indonesia)

Talk 8: Get Carbon Neutral and Economic Benefit in 2060

- **Covered the CO₂ ‘value’ chains and lifecycle systems**
 - CO₂ capture, utilisation and conversion, storage
 - Scale of decarbonisation issues and meaningful impacts need to be understood (*this is not a ‘cottage industry’*)
- **Decarbonisation of multiple industry sectors is complex and often highly interdependent across sectors.**
 - Integration is key
 - Power, manufacturing, agriculture, mineral processing, metallurgical processes, transport...
 - Carbon is integral to many industries – atmospheric CO₂ is the issue
- **Opportunities for industrial scale innovation**
 - Established industries – CO₂ capture, recycle, storage,
 - Integration in existing and new processes
 - Learning across sectors from scale-up in power and oil/gas sector
 - Sustainable fuels, fertilisers, products etc where fossil derived CO₂ can be replaced
- **New synthesis and decarbonisation pathways**
 - Power to X, biological processes...
- **Transparent Life-Cycle Analysis (LCA) is key to ensuring ‘sensible’ pathways are explored**
- **Discussion around effective collaboration opportunities and *First Steps for RD20***
 - Different perspectives and capabilities across the RD20 community enable entire energy and CO₂ value chains to be addressed
 - Renewable energy supply, storage, distribution and export, utilisation, CO₂ and environmental impact management
 - Collate and communicate major industrial and research scale initiatives across G20 countries (eg HyResource, HyResearch in Australia <https://research.csiro.au/hyresource> <https://research.csiro.au/hyresearch>)

These slide materials are provided by Dr. David Harris and Dr. William Tumas.

October 5, 2022 @AIST Tsukuba

Aims: To specify and prioritize technologies for international collaboration as Taskforce activity

- The same 3 themes as Technical Session were selected for discussion
- Report of corresponding Technical Session, Summary of Questionnaire, Presentation of practical example, discussion

Chair



Dr. William Tumas
(NREL, US))

Moderators

Theme 1



Dr. Florence Lefebvre-Joud
(CEA-Liten, France)

Theme 2



Dr. Michio Kondo
(AIST, Japan)

Theme 3



Dr. David Harris
(CSIRO, Australia)

Theme (1): H₂

- The result of Questionnaire in RD20 members was explained to specify research topics for international collaboration.
- It is necessary to work on common matrix to evaluate carbon intensity or content from many aspects, and the prioritize themes in the Taskforce Activity.

Theme (2): PV

- Taskgroup of PV characterization and capacity building has already been launched by AIST and JRC. Many institute show interests to join this activity.
- Status of environmental assessment of PV was also discussed.

Theme (3): Carbon Management

- Key themes and challenges were explained based upon the Technical Session discussion, including covering the CO₂ 'value' chains and lifecycle system
- There are a lot of aspects for integration, such as CCU, CO₂ reduction with downstream process, biomass for CO₂ capture.