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https://itcn-global.org/
ITCN 2019

- Increase the value of public and private CCS research and technology investments through increased sharing of lessons learned and results from parallel activities
- Identify one technical focus area per year and publish summary report
- Continue emphasis on technical and non-technical collaboration
  - Determine more technical areas for collaboration
    - Testing beyond advanced solvents
    - Comparing baselines and campaign results
    - Promoting technology certification and standardization through lessons learned
- Collaborate on partnerships for scale-up of technology and responses to funding opportunities
Summary Recommendations

- C2ES and RITE offer a number of recommendations for consideration at the energy and environment Ministerial meeting on June 15-16, 2019, in Karuizawa, Japan, and at the G20 Summit on June 28-29, 2019, in Osaka, Japan. It includes:

  - Pledging stronger support for collaborative efforts highlighted in the 2017 Roadmap of the Carbon Sequestration Leadership Forum, including the **International Test Centre Network (ITCN)** and the CO₂ Storage Data Consortium.

  - Organizing side events at the G20 Summit to highlight recent CCUS successes, build stronger understanding of these technologies and their multiple benefits, and identify opportunities for their advancement.

G20 presents an important opportunity to strengthen awareness of the climate and other benefits of CCUS technologies and to initiate new actions by the G20 and by Member countries, building on existing initiatives and partnerships, to advance the development and deployment of these critical technologies.
Challenges that need to be addressed for specific CO$_2$ capture technologies

**Current Technologies**

- **Solvent Based Capture Technology**
  - Solvent PCC is the only technology that is past TRL 9
  - Challenge is raising the Commercial Readiness Index – to follow

- **Oxy-fuel**
  - Atmospheric pressure technically feasible but appears to be awaiting commercial driver

- **Membranes**
  - Proprietary developments progressing e.g. MTR

- **Solids**
  - Proprietary developments progressing e.g. Inventys
Challenges that need to be addressed for specific CO$_2$ capture technologies

Next Generation Technologies

- **Supercritical Carbon Dioxide Power Cycle for Stationary Power Generation (s-CO$_2$)**
  - Heat Exchanger
    - Durability: high temperature metal alloys, advanced materials
    - Thermal Management: high temperature, high pressure, high efficiency and super-compact
  - Fundamental Knowledge Gap on Combustion
    - Chemical Kinetics for combustor development
    - Emission prediction
    - Impact of impurities

- **MCFC-CCUS (Combustion Alternatives)**
  - Possibility to be a game changer: Exxon
    - To increase CO$_2$ capture rate / module
Commercial Readiness Index (CRI) for PCC needs to be increased by driving sub-systems through the TRLs, based on learning by doing

- Government funded R&D and innovation can help to evolve the CRI of PCC technologies
- But requires good knowledge transfer between large scale plants and R, D & I communities.

Four stages of energy innovation

**Creating Options**
- ‘Idea’
- Laboratory research
- Development
- Proof of concept testing
- Prototyping
- Pilot-scale

**Demonstrating Viability**
- Market testing
- Debugging
- System integration
- Demonstration at commercial scale
- Complementary technologies
- Risk reduction

**Early Adoption**
- Cost reductions
- Learning-by-doing
- Learning-by-using
- Market development
- Regulatory development
- Manufacturing
- Infrastructure development

**Improvements-in-use**
- Large-scale take-up
- Continued cost reductions
- Incremental improvements
- Learning-by-doing
- Learning-by-using
- Scale economies

Scale:
- Creating Options: $100K-100M
- Demonstrating Viability: $10M-$1B
- Early Adoption: Up to $10s of billions
- Improvements-in-use: Up to $100s of billions

Basic research is important at **every** stage of the innovation process (as is the take-up of knowledge from other sectors).
Open-technology / open-access post-combustion capture is a key enabler for international partnership

- Open-technology – owner has full control of the technology, including multiple solvents
- Open-access – uses generic, non-proprietary solvent
- Enables international knowledge exchange and strong commercial competition to reduce costs at all stages – feasibility, FEED, EPC, commissioning and operation
- Enhanced value for government expenditure on deployment and RD&I
- Increases rate at which the field of solvent PCC technologies will improve:
  - OT / OA PCC hardware is a fast track to deploy multiple innovations, including through in-service upgrading
  - Can try out new solvents etc. without building a new plant for every one!
  - Plus critical information exchange, in both directions, with Mission Innovation and pilot testing e.g. ITCN, ACT - Accelerating CCS Technologies*

- Relative costs for OT / OA indicated by World Bank+ study
- Proprietary PCC technologies gave similar cost, only marginally better than 1st generation generic 30% w/w MEA.

International CCUS Collaboration - Knowledge exchange for CCS deployment

Open technology/open access activities, with feedback to ITCN, include:

• CO2CRC, Bechtel and UKCCSRC open access retrofit study to a full 2GW brown coal power station site, 2017-2018

• ITCN workshop on 2nd generation open access solvents in Hong Kong, June 2018

• Workshop on open access solvents at GHGT14 in Melbourne

• Workshop on practical aspects of PCC retrofit to coal and gas plants based on open access information, April 2019 in Sheffield; practitioners from China, Ireland, South Africa, Thailand, US, Norway, NL, UK

• Collaboration with Guangdong CCUS Centre in 2019-2020 on 50t/day pilot testing plus their open technology deployment plans.

International post-combustion capture retrofit workshop held in Sheffield, 9-12 April 2019

PACT / University of Sheffield (UK)
Bechtel (US)
TNO (NL)
Test Centre Mongstad (Norway)
Universities of Edinburgh and Leeds (UK)
GDCCUS (China)
Ervia (Ireland)
SANEDI (South Africa)
CMU & EGAT (Thailand)
Gassnova – OA FEED study

https://ukccsrc.ac.uk/news-events/news/international-post-combustion-capture-retrofit-workshop
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ITCN-2018-2020

• Expansion of international membership
• Partnership and collaboration
• New data archive ([www.itcn-global.org](http://www.itcn-global.org)) and Open Access Data
• Facilities expansion including, sCO2 reactor, BECCS + WtE, next generation capture technology and CCUS as a part of integrated smart energy system (TRL 3-6)
For additional information: Please download our factsheets for the description of ITCN facilities.

https://itcn-global.org/itcn-factsheets/