Department of BioTechnology, Government of India

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Mission Innovation Challenge IC# 3: Carbon Capture and Utilization

Report on Meeting of MI-India Workshop on "Carbon Capture and Utilization" Challenge held on 13th September, 2017 at ICGEB, New Delhi INDIA

Recommendations of First MI workshop on Carbon Capture and utilization, IC#3.

IC#3 workshop was held on 13th Sept, 2017 at Magnolia Hall, India Habitat Centre. The agenda of the workshop is enclosed. Inaugural lecture in the Workshop was delivered by Prof K. VijyaRagvan, Secretary DBT (Department of Biotechnology) and participants were addressed by Dr Renu Swarup, Senior Adviser, DBT.

After 3 main talks which were helpful in setting the context, the participants were divided into 2 groups to discuss about the topic with the following deliverables:

1. What is the current status of Technology in India?

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2. What are the R&D gap areas?
3. What type of R&D projects should be taken?
4. Need for National/International collaborations.
5. Short, Mid and Long term strategies.
6. Which other stakeholders/groups to be included in future?

The first group discussed CO_2 Capture, Separation and storage. The second group discussed CO_2 value addition to chemicals and value added products. The recommendations from the two groups are as follows:

<u>Recommendations of Group A on CO_2 capture, separation and storage.</u>

Current status of Technology: There are four major separation technologies for CO_2 capture as absorption, adsorption, membrane based and cryogenic.

R&D gap areas/suggestions:

Absorption

- For a solvent based absorption: Development of efficient absorbants, their regeneration, life and capacity.
- In real life CO_2 capture, there is no industrial scale pilot experience.

- There is a requirement for a cost economics evaluation.
- This technology has been demonstrated at TRL 9 by Clean Carbon Solutions. However, for regeneration of absorbant material the energy consumption is high, thus the process has to energy efficient.
- Enzyme (biomimetic) assisted solvent mediated CO_2 capture to reduce CAPEX & OPEX.
- In order to increase the efficiency of absorption, there is a requirement for Hybrid model of two technologies.

Adsorption

- This technology has achieved a TRL 5/6 level, however Industry validation still needs to be done.
- Facilities to manufacture the adsorbant in India are available; however the cost economics has to be assessed.

Cryogenic

- Not viable and not being pursued anywhere else and therefore presently not relevant.

Membrane Technology

- TRL level 5, Industry evaluation not done.
- International collaboration for new material development, lowering of cost, high selectivity and high temperature operation is desirable for achieving quantum jump.
- Membrane which can separate CO_2 and water vapour should be explored.

Sequestration (EOR) done by Oil industry on limited scale; though it is being adopted abroad on a larger scale.

Some ideas of algal based CO_2 capture were discussed but it was decided to take this subject in IC#5 workshop.

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Recommendations of Group B on CO_2 value addition

- Globally, advances have been made in this area and some large scale activity is reported.
- In India, carbonates synthesis and dry reforming of CO_2 has been done on lab scale.
- Low TRL level of this technology.
- No industry involvement.
- IOCL has done bench scale carbonates for fuel/grease additives and is planning a scale up soon.
- NCL is working on CO_2 to polymers but TRL is presently low.
- Biggest gap area is lack of industry-academia interaction.
- Utilization of CO_2 must be for value addition in terms of LCA and energy balance.
- Industry validation is required for every claimed development for economics.
- Short term (3 years): fuel additives.
- Med term (3-6 years): CO_2 dry reforming, CO_2 to methanol, polymer.
- Long term (> 6 years): biological and photochemical processes.