Assessment of the economic impacts of potential new industries and businesses resulting from the implementation of Response Measures

Activity 5 of the KCI's 2022 Work Plan

Mandate for Technical Paper

- Under Decision 4/CP.25 Parties adopted the detailed workplan for the KCI.
- Annex 2 of 4/CP. 25, KCI was mandated to prepare technical paper on the assessment of the economic impacts of potential new industries and businesses resulting from the implementation of Response Measures.
- With the aim to build awareness and understanding of Parties and other stakeholders.
- The technical paper is structured in response to the mandate to the KCI.

Objectives

- Define what constitutes new/emerging industries and businesses.
- Enhance the awareness and understanding of stakeholders on new/emerging industries and businesses.
- Understand the social, economic, and environmental impacts of these new/emerging industries and businesses.
- Explore ways to maximize the positive and minimize the negative impacts of these new/emerging industries and businesses

Methodological Approaches

- Desktop reviews
- Systematic literature search
- Shortlisting
- Qualitative assessment of impacts
- Reviews and feedback

Desktop review

- Reviewing and gleaning pieces of views from
  - Party submissions to UNFCCC on new/emerging industries and businesses,
  - Works by constituted on technology development and transfer, and
  - Grey publications
- To understand and synthesize the findings inform the criteria and justification for the shortlisting.

Systematic literature search

- Comprehensive review of publications in peer review journals to obtain a broad list of new/emerging industries/businesses
- Choice of journals depend on its relevance to the subject, recent publications, geographic focus and scope of assessment.
- Journals – E.g. Science Direct, Web of Science, International Journal of Emerging Technology in learning, Scopus, Google Scholar,, and Taylor and Francis).
- Constraint by Years of Publication – Twenty-two years (2000 to 2022).
- Search strings/key words. E.g. “New+emerging industries+businesses, New Technology Trends for 2022, Emerging industries, Climate change, new risks and opportunities for businesses

Short-listing of new/emerging businesses

- Desktop review and the systematic literature searches produced a list of 52 new/emerging industries and businesses from implementation of climate mitigation policies.
- A set of qualitative criteria was used to create a shortlist of new/emerging industries/businesses selected from the literature search in excel spreadsheet.
- **Criteria for shorting**: (a) Decarbonization potential; (b) Allied industries/ businesses; (c) Sector applicability ; (d) Geographical application; (d) Replication potential; (e) Technology maturity ; (f) Methods for impacts assessment; (g) Societal impacts; (h) Technology cost and (g) Risk management.
- **The shortlisting produced** - Hydrogen (H_2), Carbon Capture, Use and Storage (CCUS) and Artificial Intelligence (AI) as new industries/businesses to focus the impact assessment in the next stage

Qualitative assessment of economic, social and environmental impacts

- assessment of literature on economic, social and environmental impacts of shortlisted new/emerging industries/businesses,

- Technical paper presents synthesis of the major economic, social, and environmental impacts and tools used for the assessment.

Review and feedback

- Views from UNFCCC secretariat and KIC members reflected in the technical paper.
- Draft technical paper was shared with the KIC members during the SB56 for their feedback and incorporation

Preliminary impacts for CCUS (Technology Information)

- CCUS is a greenhouse gas mitigation technology that is critical to the transition to a net zero emissions economy.
- Without CCUS at scale, the cost for meeting the long-term climate target would be prohibitively high
- It may be impossible to achieve net zero in hard-to-abate heavy industries without CCUS.
- CCUS technology consist:
  - capturing carbon dioxide (CO_2) produced by industrial plants, natural gas-fired power plants, and oil refineries
  - compressing the captured CO_2 for transportation to storage site.
  - use for in allied industrial application or
  - injected into at least 800 meters below the surface for a long-time rather being emitted

Summary of impacts assessment of CCUS

- **Integrated Assessment Models (IAMs)/Scenario models)** - explore interactions between climate and socio-economic systems and present pathway options to meeting climate goals.
- **Numerical simulation** - Carbon Capture Simulation Initiative (CCSI) used in the assessment of CCUS impact on water and sub-surface transport over multiple phases (STOMP-CO2).
- **Life cycle assessment (LCA)** – LCA has been used in several studies to assess the environmental impact of CCUS system.
- Economic impact assessment using Computable General Equilibrium (CGE) modelling - EYGEM model
- Qualitative assessment of the potential social and environmental benefits.
- Dynamic recursive Global Trade Analysis Project (GTAP) model and the Input-output method used to assess socio-economic effects of CCUS.

Summary of potential economic impacts of CCUS

- **Boost clean economic growth** - stimulate substantial clean value-added growth
- **Substantial flow-on effects** - provide cascading economic benefits through agglomeration and clustering.
- **Source of high-value spill overs that can stimulate innovation-led growth.**
- **Extension of lifetime of existing infrastructure** - The lifetime of existing infrastructure can be extended, and the cost of decommissioning deferred if are retrofitted for CCUS.

Summary of social impacts of CCUS

- **Creation and sustenance of jobs -** create low-to-high skilled jobs at the construction, operation and maintenance of CCUS facilities.
- **Support to indirect jobs in the supply chain –** the employment multiplier effects of CCUS deployment.
- **Increase skills and knowledge** – The integrated CCUS deployment could enhance skills and unlock innovation capacity among the industry players as a strategy for preventing economic and social disruption.
- **Ensure just and sustainable transition** - Deployment of CCUS could provide employment opportunities at the time and place where they are most likely to be needed to support the just transition to a net-zero economy.

Summary of Environmental impacts of CCUS

- CCUS can help avoid CO_2 emissions at point sources which hitherto would have been emitted to atmosphere.
- CCUS can decrease at scale the stock of CO_2 emissions already in the atmosphere through carbon dioxide removal technologies.
- CCUS the improve air quality as it reduces air pollutants when used for hydrogen production.
- Could impose water stresses due to additional water requirements for chemical and physical processes to capture and separate CO_2 in CCUS-fitted fossil-fuel thermal plant.
- Groundwater contamination due to CO_2 leakage during geologic sequestration could affect in water quality.
- Leakage of CO_2 with CCUS system via boreholes overlaying rocks or natural fractures and faults may be local effect.
- Large scale hazard includes global climate effect due to low-level CO_2 leaked back into the atmosphere.

Technology information – hydrogen fuel

- Hydrogen fuel is a zero-carbon fuel depending on how it is sourced.
- As energy carrier, hydrogen can be produced from renewables or hydrocarbons such as natural gas or coal.
- Hydrogen is one of the keys to the energy transition and sector-coupled energy system.
- It has the potential to cut emissions from heavy industry and transport.
- Its deployment must be economically viable, socially acceptable, to maximize the decarbonisation impact and minimize its resource requirements.

Impacts assessment of hydrogen fuel

- Life Cycle Assessment (LCA)
- Integrated Process model (IPM)

Potential economic impact of hydrogen fuel

- **Integration with low-carbon alternative in energy, transport and industry** - Hydrogen can be linked with other low-carbon alternatives to enable a more cost-effective transition to de-carbonized and cleaner energy systems.
- Promotion of industries and revitalise regional economies through patents relating to hydrogen technology**.**
- **Reschedule the decommissioning of existing gas infrastructure** - Existing gas infrastructure can be used to transport the renewable energy in the form of hydrogen.
- Enable large-scale, efficient renewable electricity integration due to the intermittent character of solar and wind, the electricity system.
- **Stimulation of new businesses:** The technical and economic success of hydrogen-based distributed energy systems will stimulate new business ventures.

Potential environmental impacts of hydrogen fuel

- Long-term option for reducing CO_2 emissions.
- Ramp up efforts to achieving net zero targets pledged by governments and corporations in the wake of calls for climate action.
- Reduce environmental stress as when used to produce energy does not emit CO_2.
- Pollution in urban cities can be attributed to the use of fossil fuels by cars, buses and trucks for hauling goods among others.
- Hydrogen warming impact - Climate consequences of hydrogen application relative to fossil fuel strongly depend on time horizon and leakage rate

Technology information - Digitalization and Artificial Intelligence

- Enabler of CCUS and Hydrogen.
- Application of digital technologies (e.g., sensors, networked devices, cloud data storage, analytics) to physical equipment and systems to reducing energy use and carbon emissions.
- Collection of more and high-quality data about the physical world using sensors, analysing data with algorithms or Artificial Intelligence (AI), and turning the resulting information into actions that can help increase productivity and efficiency.
- Digital technologies can also help using digitalization to achieve decarbonisation.
- AI can help to develop new technologies, improve forecasts of demand and renewable energy, optimise grid management or enhance system monitoring.

Potential economic impacts of hydrogen fuel

- Digitalization/artificial intelligence can generate wide positive economic benefits.
- Economic returns are achieved through the employment creation, improve quality of life and enabling adoption of green technologies.
- Digitalization/artificial intelligence can also contribute to the duel of benefit of economic growth and reduction of greenhouse gas emissions.

Next steps

- Collect feedback from KCI members on draft technical paper.
- Address KCI members comments in the next iteration of the technical paper.
- Complete the conclusions and possible recommendations..
- Share the advance version with KCI members prior to COP27.

Thanks