CARBON UTILIZATION RESEARCH COUNCIL
ADVANCING FOSSIL ENERGY SOLUTIONS

INTERNATIONAL COLLABORATION ON FOSSIL FUELED CCS (LARGE PILOT) PROJECTS

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Analysis of Options to Overcome Barriers to Unilateral and Multilateral Large-Pilot Projects for Fossil Fuel Based Power Plants Equipped with CCS

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Can Multilateral Collaboration be an Effective Means to Support Large-Scale Pilot Projects?

Many technologies under development can result in more cost-effective and efficient fossil fuel-based electric power systems with CCS.

Large pilot projects are a necessary scale-up step but project funding is a challenge.

Without scale-up, technologies cannot achieve commercial deployment.

TRL 2-4

Laboratory and Bench Scale Testing

TRL 5-6

Pilot-Scale Field Testing

TRL 7-9

Demonstration-Scale Testing followed by Commercial Deployment

WE NEED TO FIND INNOVATIVE FINANCING METHODS TO MOVE BEYOND LABORATORY AND BENCH SCALE

Why Are Large Pilots Challenging?

- They are necessary, but from a project funding perspective they present unique circumstances:
  - They may cost in the range $100-500 million depending on technology and level of integration.
  - They typically are subcommercial and do not generate sufficient revenue to support project based financing.
  - The current business case for advanced fossil-based power and CCS technologies is highly uncertain - which discourages high levels of private sector investment.
  - And, individual governments do not have the resources to adequately fund all of the projects that need to be funded.
- Without creative financing approaches, promising technologies will be blocked at laboratory and bench scale.

Barriers to Large-Scale Pilots

- **Large-pilots face significant barriers**:
  - perception of a limited near-term market for the commercialized technology
  - relatively high cost of CCS
  - difficulties securing financing, and
  - inadequate or counter-productive government policies
    - Burdensome regulation
    - Lack of commitment to CCS
    - Absence of policy parity
- **A portfolio of policies and incentives will be necessary to advance large-pilot projects.**

Key Findings on How to Overcome Barriers

- **Measures to reduce CCS costs** will reduce financial barriers to pilots. These may include more bench-scale R&D, modular technologies, and reusable large-pilot scale test platforms.
- **Needed policy initiatives** center on a genuine commitment by governments to the development of CCS-based technologies.
  - Funding and policy commitment for CCS and dedicated to funding for large-pilot scale projects:
  - Regulatory incentives that have flexibility
  - Government sponsored projects or programs, i.e. to store CO2 captured at initial pilot and demonstration projects would overcome barriers to CO2 storage for those units

Key Findings on How to Overcome Barriers (Cont'd)

- **Measures to address market barriers**:
  - Repower or replace aging fleet of coal fired generation with CCS
  - Policies that implement CCS on all sources
- **Measures to overcome financial barriers**:
  - Public funding and incentives provided through tax credits, grants, and loan assistance.
  - Incentives should be viable across the full range of electric generation business structures.
  - Sources of funding vary by country, if necessary to fund CCS:
    - general tax revenues
    - fees from climate programs
    - fees levied on electricity users and fossil producers.
  - Financial participation from non-traditional supporters of new technologies:
    - environmentally purposed foundations
    - export credit agencies,
    - corporate collaboratives like the Oil & Gas Climate Initiative
    - "green" banks or purpose-based public finance institutions

International Collaboration – Key Findings

1. Large pilot projects present unique risks and challenges that could be mitigated by multilateral financial collaboration.
2. The need for substantial domestic involvement in return for a country's contribution may be compelling, may complicate framework development, and would impact project structure.
3. National and regional viewpoints differ on CCS technology development. Targeted collaboration and framework development by like-minded countries may be most effective.
4. Framework development is a complex undertaking. Compromises between the perfect and the achievable must be considered.
5. Sustained and consistent political support is necessary for success.
6. Concurrent award of government support and flexibility in managing use of funds for project expenditures will facilitate project development and implementation.

Potential Barriers to International Collaboration

- Domestic source policies and practices
- Different national or regional CCS goals and strategies
- Differences in planning, selection and funding processes
- Impact of changing national policies and priorities on long term projects
- Management of intellectual property rights

Collaborative Models Covered in Study

The Study considers five models for effectiveness. Recommended features that should be weighed when evaluating models include:

- Concurrent award of financial support
- Ability to accommodate national requirements
- Early resolution of conflicting requirements
- Time required for framework development
- Ability to limit project impact from changing national priorities
- Acceptability to industry stakeholders

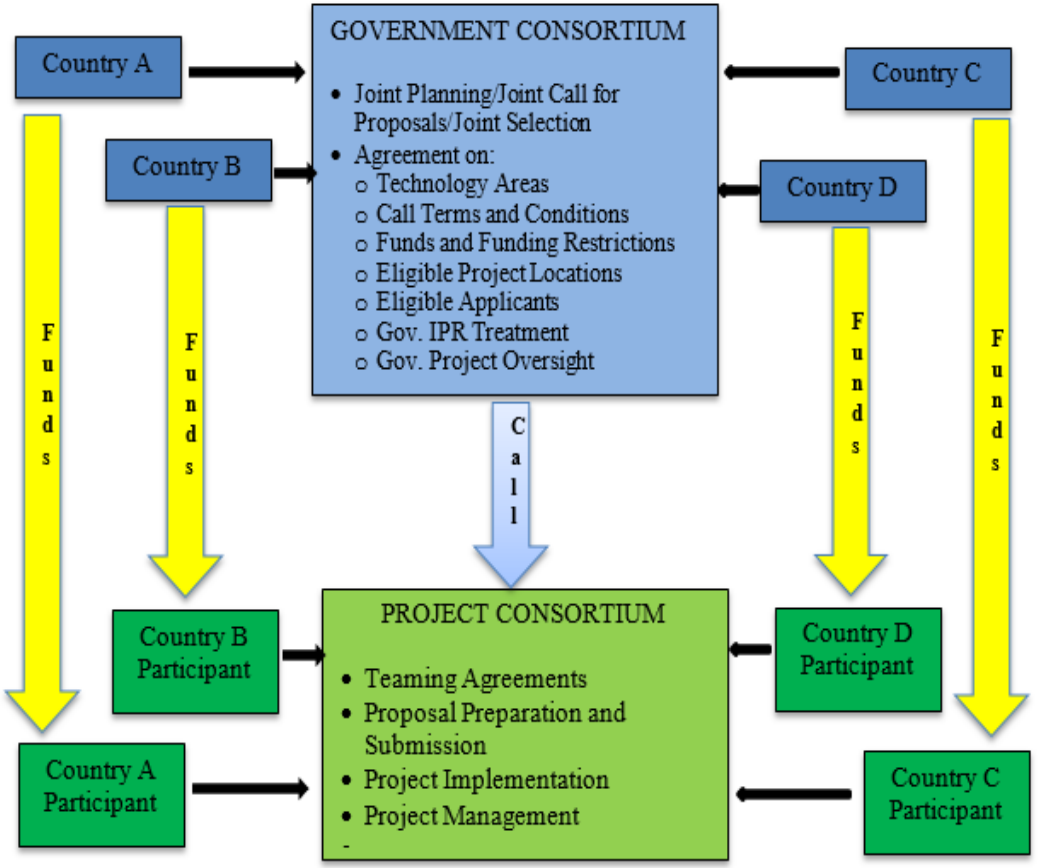
Model A: Joint Planning, Combined Call for Proposals

Advantages

- Concurrent funding
- Early conflict resolution
- Can accommodate national funding restrictions
- Greater financial certainty
- Shorter time to Project FID

Disadvantages

- Complexity
- Deviations from normal grant or procurement practices
- Time required for framework development



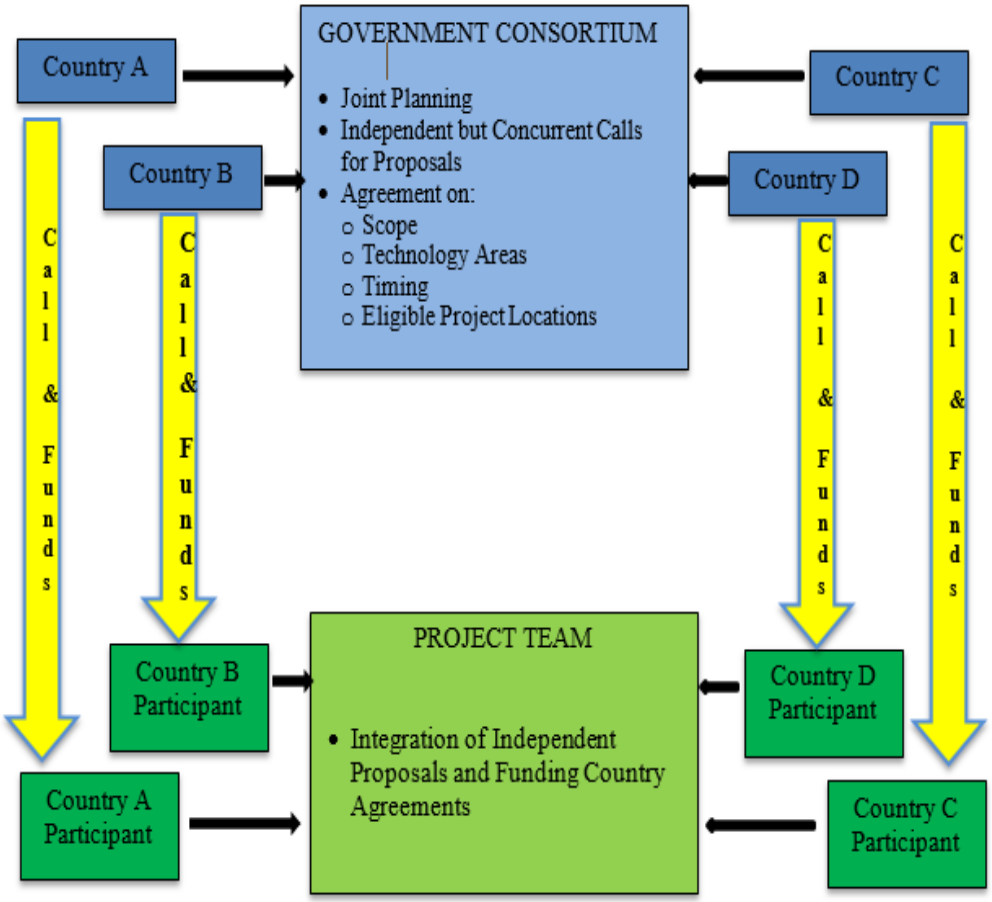
Model B: Joint Planning, Independent Calls for Proposals

Advantages

- Important issues of scope, technology, timing and project location resolved in framework
- Potentially fastest to implement since many contentious issues deferred
- Less deviation from grant or procurement processes

Disadvantages

- Many issues left to individual country discretion
- Projects must be successful in multiple venues
- Less certainty and greater risk of project financial viability



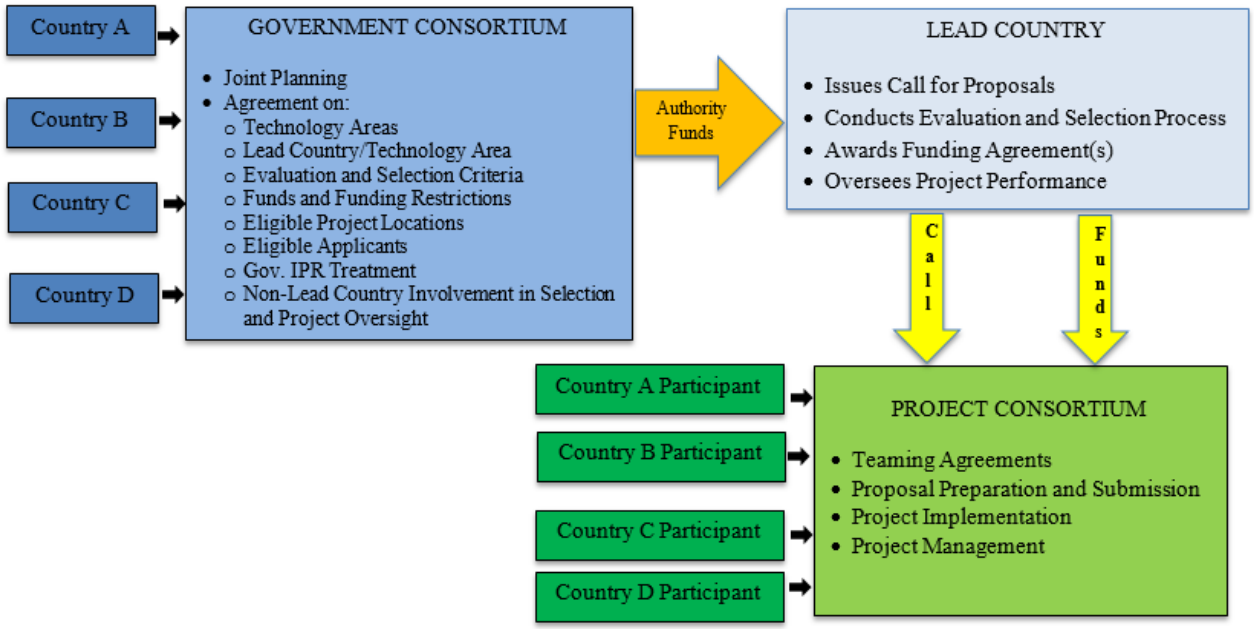
Model C: Pooled Funding in Lead Government

Advantages

- Concurrent funding
- Single interface point
- Greater financial certainty
- Shorter time to Project FID
- Eliminates procurement redundancy

Disadvantages

- Time required for framework development
- Individual country authority to transfer or receive funds
- Project developer concerns



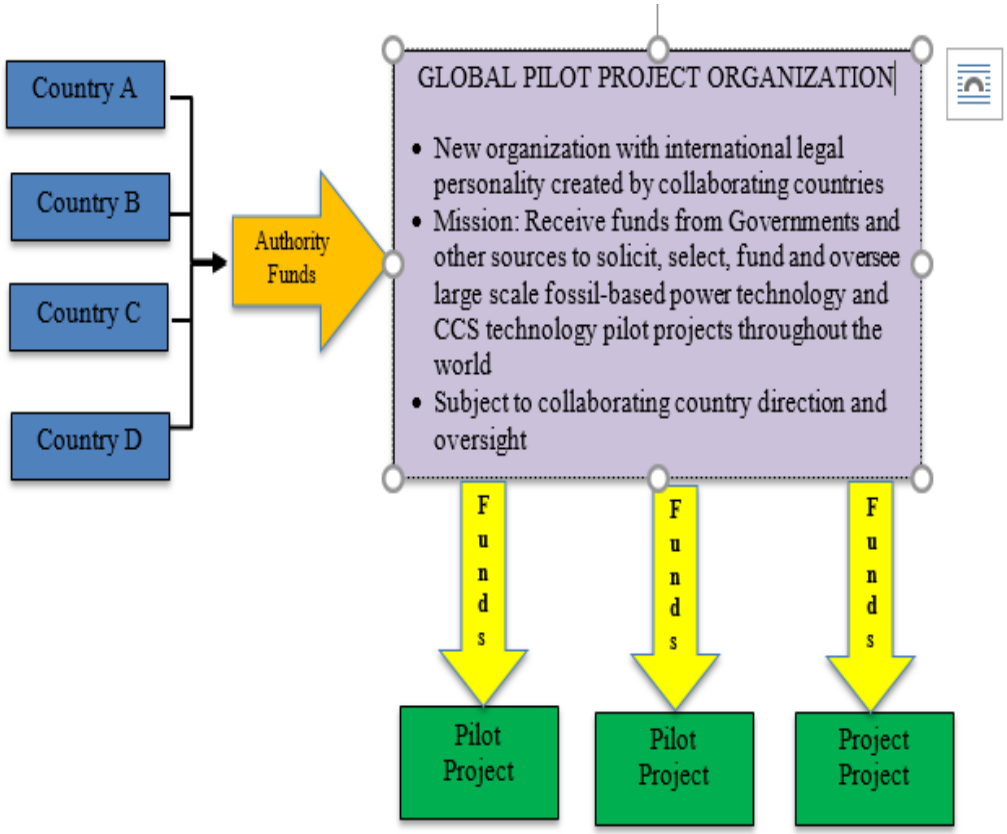
Model D: Global Pilot Project Organization

Advantages

- Single interface point
- Concurrent funding
- Greater financial certainty
- Eliminates procurement redundancy
- May afford a measure of insulation from policy and priority cycles

Disadvantages

- Complex and difficult to implement
- Time required for framework development
- Suitability for large applied research the purpose of which is to test, develop and ultimately deploy privately owned technology



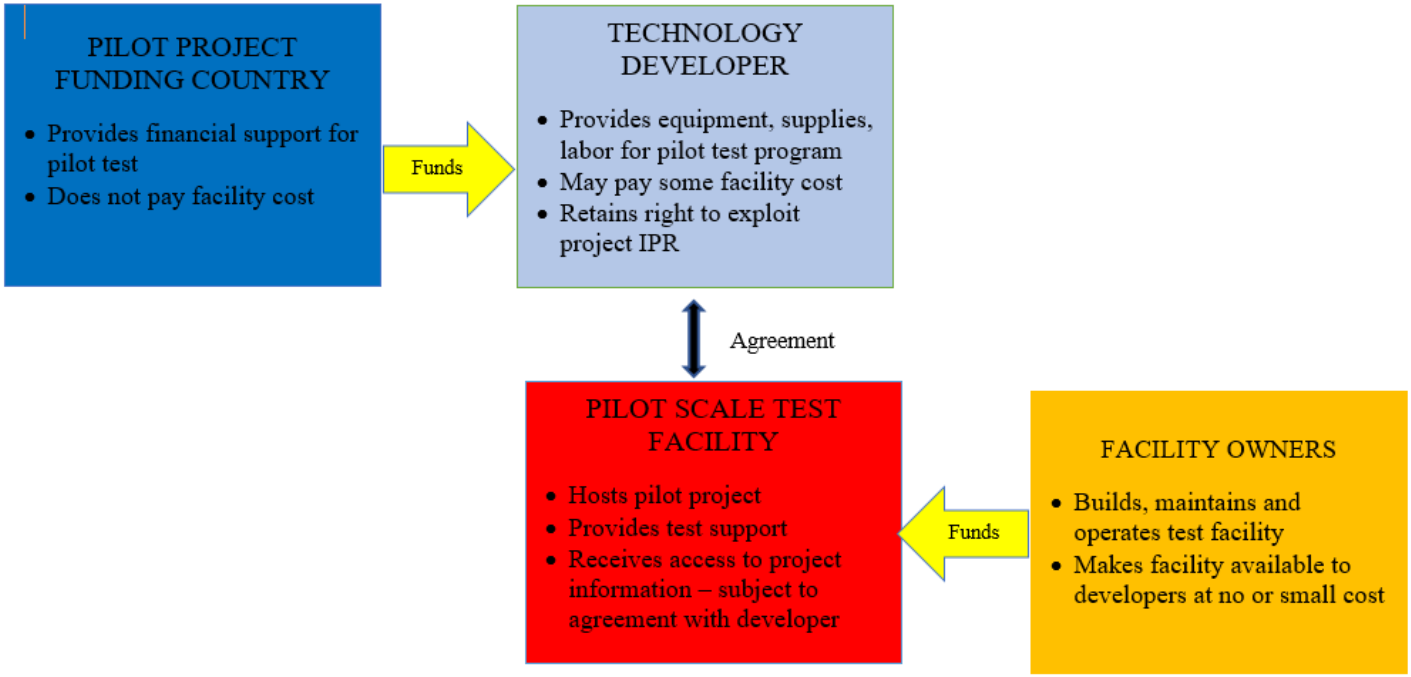
Model E: National Test Facilities

Advantages

- Cost-effective
- Time
- Potential to mitigate country funding issues

Disadvantages

- Questions of reusability for large larger power and CCS technology pilots in the 10-50 MWe range



Next Steps

A possible next step for governments may be to test the thesis of this Study by engaging each other, technology developers and technology users to assess whether:

1. There is sufficient common interest among country groups in fossil-based power and CCS technologies to warrant collaborative initiatives at the large-pilot scale;
2. There is a pathway to resolve potential framework barrier issues in a reasonable timeframe that will allow projects to contribute to desired deployment timeframes; and,
3. Technology developers and users have an interest in participating in collaboratively funded projects.

Thank you and Questions

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