ADB

Technical Assistance Report

Project Number: 47277-001
Capacity Development Technical Assistance (CDTA)
May 2014

Islamic Republic of Pakistan: Determining the Potential for Carbon Capture and Storage

(Financed by the Carbon Capture and Storage Fund under the Clean Energy Financing Partnership Facility)

Asian Development Bank

CURRENCY EQUIVALENTS
(as of 1 May 2014)

Currency unit – Pakistan rupee/s (PRe/PRs)
PRe1.00 = $0.0101
$1.00 = PRs98.65

ABBREVIATIONS

CCD	–	Climate Change Division
CCS	–	carbon capture and storage
CO_2	–	carbon dioxide
GHG	–	greenhouse gas
TA	–	technical assistance

TECHNICAL ASSISTANCE CLASSIFICATION

Type	–	Capacity development technical assistance (CDTA)
Targeting classification	–	General intervention
Sector (subsectors)	–	Energy (energy efficiency and conservation, energy sector development); industry and trade (larger industries)
Themes (subthemes)	–	Environmental sustainability (global and regional transboundary environmental concerns); capacity development (institutional development)
Climate change	–	Climate change mitigation
Location (impact)	–	National (high)
Partnerships	–	Global Carbon Capture and Storage Institute and the Government of the United Kingdom through the Carbon Capture and Storage Fund under the Clean Energy Financing Partnership Facility

NOTE

In this report, "$" refers to US dollars.

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I. INTRODUCTION

1. Pakistan's carbon emissions have doubled since 1990 largely due to the country's growing energy demand. The Government of Pakistan is committed to lowering its current emissions and has requested the assistance of the Asian Development Bank (ADB) to support the implementation of its national climate change policy, particularly in mitigating climate change through development of technologies that help reduce greenhouse gas (GHG) emissions. The capacity development technical assistance (TA) is not included in the country operations business plan, 2014–2016 for Pakistan. The concept paper was approved on 21 February 2014.

2. Reconnaissance and fact-finding missions were fielded in June and September 2013, where the government and the ADB mission agreed on the scope, implementation arrangements, cost, financing arrangements, and the consultants' terms of reference for the TA.[1] The government requested ADB's assistance as indicated in its letter of 29 January 2014. The design and monitoring framework is in Appendix 1.

II. ISSUES

3. Carbon emissions in Pakistan grew by 105% from 152.79 million tons in 1990 to 313.48 million tons in 2010.[2] The significant increase in GHG emissions, particularly carbon dioxide (CO_2), is mainly attributed to the burning of fossil fuels for electricity, transport, and manufacturing. In the manufacturing sector, production of fertilizers (ammonia), cement, alternative fuels (methane and ethanol), iron, and steel contributed to more than 45% of CO_2 emissions. The clearing of land for agriculture, industry, and other human activities also boosted GHG concentrations. GHG emissions will increase further with the anticipated diversification to coal-fired power generation to reduce the power shortfall and cost of generation.[3] Meeting Pakistan's energy needs for economic growth and poverty reduction makes the task of mitigating its GHG emissions all the more challenging.

4. In February 2013, Pakistan launched its first National Climate Change Policy, which underscores the need to develop low-carbon technologies—including carbon capture and storage (CCS)—to reduce carbon footprints in agriculture, transport, and industry. In the energy sector, Pakistan is endowed with vast renewable energy resources such as hydropower, solar, and wind. The government is promoting hydropower, wind, solar, and natural gas project development and other low-GHG technologies for power generation. However, for a reliable, affordable, and secure electricity supply system, it needs a significant portion of power supply from fossil fuel power generation. The challenge of reducing emissions and simultaneously increasing energy supply is daunting. Hydropower's contribution to the energy mix has declined from 72% in 1980 to 32% in 2012, whereas fossil power has increased from 28% to 61% during the same period. Diversifying away from expensive fuel oil generation to coal will increase carbon emissions further despite an increase in renewable energy in the medium term. CCS will be a critical technology for meeting the country's goal of reducing carbon emissions.

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[1] The TA first appeared in the business opportunities section of ADB's website on 1 April 2014.
[2] World Resources Institute. Climate Analysis Tool 2.0. http://cait2.wri.org/wri/Country (accessed 28 February 2014).
[3] Government of Pakistan, Ministry of Water and Power. 2013. *National Power Policy 2013.* Islamabad.

III. THE TECHNICAL ASSISTANCE

A. Impact and Outcome

5. The TA will support the implementation of the first national climate change policy of Pakistan, particularly mitigation of climate change impacts through development of technologies that help reduce GHG emissions. The TA will explore the potential of CCS by devising demonstration road maps, engaging in dialogue with the public and private sectors, and drafting relevant policy statements. It will specifically look into CO_2-emitting sectors such as energy, agriculture, transport, and industry for the purpose of determining the best type of demonstration road maps.

6. The impact will be a CCS road map implementation in Pakistan that will boost CCS-installed capacity to 600 megawatts, and CCS-ready facilities to three by 2025. The outcome will be improved capacity in planning and managing demonstration projects in Pakistan through at least one large-scale CCS demonstration plant committed for development by 2015.

B. Methodology and Key Activities

7. The outcome will be achieved by conducting an assessment and evaluation of CCS potential in the country, developing a CCS knowledge dissemination program to ascertain key requirements of CCS readiness, and training staff who will be involved in the planning, financing or implementing of CCS projects, and ultimately in formulating a road map identifying priority demonstration projects during 2014 through preparation of up to three prefeasibility study reports, including Clean Development Mechanism and other carbon-financing projects.

8. It is a major assumption that the government will uphold its commitment to CCS development and that interest from development partners to assist in CCS implementation remains high. Major risks include poor coordination between CCS-relevant agencies and development partners, slow development of the technology in Pakistan, exorbitant cost of the technology, and the equivalent energy penalty and related impacts on tariffs becoming too impractical.

C. Cost and Financing

9. The TA is estimated to cost $1.2 million equivalent, of which $1.0 million equivalent will be financed on a grant basis by the Carbon Capture and Storage Fund[4] under the Clean Energy Financing Partnership Facility and administered by ADB. The government will provide counterpart support in the form of security, office space, counterpart staff, and other in-kind contributions. The cost estimates and financing plan are in Appendix 2.

D. Implementation Arrangements

10. The Climate Change Division (CCD) reporting under the cabinet secretariat will be the executing agency. The CCD will be responsible for providing technical and policy support on the development and implementation of CCS projects, and advising the government in technical matters related to CCS in Pakistan. The implementation of the TA will be supervised by ADB and will not be delegated to the executing agency. The CCD will be supported by a working group comprising the Planning Commission, Ministry of Industries, Ministry of Petroleum and

[4] Financing partners: Global Carbon Capture Storage Institute and the Government of the United Kingdom.

Natural Resources, and Ministry of Water and Power. The working group will provide overall strategic direction and review the outputs of the consultants. Periodic meetings will be organized for the working group to discuss the progress of the TA.

11. The TA will be implemented over 12 months from September 2014 to August 2015. It will require 15 person-months (five experts) of international and 34 person-months (eight experts) of national consultants. Required positions include CCS experts (team leader and deputy team leader), CCS experts on CO_2 capture, CCS experts on CO_2 storage, financial analyst, legal and regulatory expert, CCS strategy analyst, energy economist and policy analyst, technology policy issues specialist, environment and climate change policy analyst, and coordinator. The team will coordinate the periodic meetings, engage with all stakeholders, lead technical group meetings, and prepare documentation as required. Consultants are expected to prepare and submit documents such as the CCS road map, prefeasibility study reports, and workshop proceedings. The terms of reference for consultants are in Appendix 3. ADB will engage consultants according to its Guidelines on the Use of Consultants (2013, as amended from time to time). Because of the highly specialized nature of the assignments and the limited number of experts in the field, the TA will be implemented by a team of international and national consultants, and individual experts.[5]

12. The TA will organize knowledge dissemination workshops for policymakers, power generators, regulators, and private sector and other national stakeholders to feed in lessons from projects in Australia, the People's Republic of China, India, Indonesia, the Republic of Korea, and Malaysia, which will ensure ownership and allow participation from potential donors and investors. Resource persons will be recruited to assist in organizing the conduct of trainings, workshops, and study tours. The TA will be monitored through assessment of quality and timely delivery of outputs. Overall results of the TA are expected to be disseminated through regional energy and climate forums, ADB's energy and climate change communities of practice, and countrywide workshops. All disbursements under the TA will be in accordance with ADB's *Technical Assistance Disbursement Handbook* (2010, as amended from time to time). Equipment under the TA will be procured in accordance with ADB's Procurement Guidelines (2013, as amended from time to time).

IV. THE PRESIDENT'S DECISION

13. The President, acting under the authority delegated by the Board, has approved ADB administering technical assistance not exceeding the equivalent of $1,000,000 to the Government of Pakistan to be financed on a grant basis by the Carbon Capture and Storage Fund under the Clean Energy Financing Partnership Facility for Determining the Potential for Carbon Capture and Storage, and hereby reports this action to the Board.

[5] The preferred recruitment method would be through a firm using quality-based selection. If it cannot be done due to the limited number of firms with the required expertise, consultants will be hired individually.

DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
Impact CCS road map implemented	Installed capacity of carbon capture and storage grows to 600 MW by 2025 (2013 baseline: none) GHG emissions reduced due to installed CCS capacity of 600 MW by 2025 amounting to 3.13 million tCO_2e (or 10% of Pakistan's GHG emissions baseline as of 2012) Number of CCS-ready facilities grows to 3 by 2025 (2013 baseline: none)	Mention of CCS plans in strategic documents on energy, industry sectors, and climate change mitigation Draft policy statements and regulatory directives	**Assumptions** Government maintains interest in CCS development and seeks concessional financing Development partners assist implementation of the road map by funding feasibility studies, capacity development, and knowledge dissemination **Risks** Fragmented implementation and poor coordination between agencies and development partners Technology suitable for Pakistan is not developed in time
Outcome Improved capacity in planning and management of demonstration projects	At least one large-scale CCS demonstration plant committed for development by 2015 (2013 baseline: none) Government staff trained to plan and manage demonstration projects increases by 15 in 2015 (none as year 2013)	Draft government policies Consultants' reports, technical assistance reports, and materials for dissemination	**Assumptions** Road map is cascaded down to CCS-relevant agencies Government is committed to implementing the recommended regulatory, policy, technical, and financial measures Government is committed to factoring in geological and storage options in making siting decisions for new sources **Risks** Cost of technology, and the equivalent energy penalty and related impacts on tariffs become too impractical Results of the prefeasibility study

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
			reports show that no CCS project is viable
Outputs 1. Scoping analysis on the potential for CCS undertaken	A CCS road map endorsed by the cabinet by 2015	Government website Second National Communication to UNFCCC	**Assumptions** Timely access to data, relevant personnel, and locations within Pakistan
2. Knowledge dissemination program for CCS undertaken	A knowledge product describing key requirements of CCS readiness developed and disseminated to key stakeholders by 2015 20 government staff knowledgeable on CCS through workshops and study tours by 2015	Prefeasibility study reports produced by consultants, and government's acceptance during final workshops	Effective participation and collaboration between stakeholders **Risk** Staff reallocation within key agencies could lead to loss of support within agencies
3. Road map for CCS demonstration with priority demonstration projects identified	Up to three prefeasibility study reports, including analysis of possible financing mechanisms such as CDM and other carbon financing prepared in 2014	Consultants' reports	

Activities with Milestones	Inputs
1. Scoping analysis on the potential for CCS 1.1 Discuss outline and timeline for scoping study (Sep 2014) 1.2 Conduct data analysis on sources of emissions, and technical options for capture, and establish cost elements and benchmark for storage options (Sep–Nov 2014) 1.3 Conduct data analysis on storage potential and technical options for storage, and establish cost elements and benchmark for storage options (Sep–Nov 2014) 1.4 Define an appropriate, fully integrated demonstration-scale CCS project, including capture, transport and storage aspects (Sep–Nov 2014) 1.5 Midterm and final review of scoping study (Jan–Mar 2015) 1.6 Preparation of prefeasibility study reports (Apr–May 2015) **2. Knowledge dissemination program** 2.1 Send sector representatives to leading international CCS events (Apr–Jun 2015) 2.2 Organize trainings and seminars on CCS (Apr–Jun 2015) 2.3 Conduct study tour to pilot projects (Apr–Jun 2015) 2.4 Organize workshops to disseminate TA outputs and lessons (Apr–Jun 2015) **3. Road map for CCS demonstration** 3.1 Review policy, technical, geological, regulatory and financial	Carbon Capture and Storage Fund under the Clean Energy Financing Partnership Facility: $1,000,000 Note: The government will provide counterpart support in the form of security, office space, counterpart staff, and other in-kind contributions.

Activities with Milestones	Inputs
issues (Sep–Nov 2014) 3.2 Evaluate ongoing efforts on CCS by donors, countries, and research institutes (Sep–Nov 2014) 3.3 Examine international experience and identify opportunities for public and private sector investments (Oct–Dec 2014) 3.4 Develop modalities of collaborative research and project development based on PPPs to deploy new CCS technologies that are adapted to local condition in Pakistan (Sep–Nov 2014) 3.5 Complete draft and final country road map identifying key sectors, project types, and key barriers (Oct–Dec 2014)	

CCS = carbon capture and storage, CDM = Clean Development Mechanism, GHG = greenhouse gas, MW = megawatt, PPP = public–private partnership, TA = technical assistance, tCO_2e = ton of carbon dioxide equivalent, UNFCCC = United Nations Framework Convention on Climate Change.
Source: Asian Development Bank.

COST ESTIMATES AND FINANCING PLAN

($'000)

Item	Amount
Carbon Capture and Storage Fund[a] under the Clean Energy Financing Partnership Facility	
1. Consultants[b]	
a. Remuneration and per diem	
i. International consultants (15 person-months)	415.00
ii. National consultants (34 person-months)	247.85
b. International and local travel	48.00
c. Reports and communications	5.72
2. Equipment[c]	20.00
3. Workshops, trainings, and study tours	
a. Resources persons, facilitators	20.00
b. Workshop and training	125.00
c. Study tours[d]	60.00
4. Miscellaneous administration and support costs[e]	25.00
5. Contingencies	33.43
Total	**1,000.00**

Note: The technical assistance (TA) is estimated to cost $1.2 million, of which contribution from the Carbon Capture and Storage Fund under the Clean Energy Financing Partnership Facility is presented in the table above. The government will provide counterpart support in the form of security, office space, counterpart staff, and other in-kind contributions. The value of government contribution is estimated to account for 17% of the total TA cost.

[a] Financing partners: Global Carbon Capture and Storage Institute and the Government of the United Kingdom. Administered by the Asian Development Bank (ADB).

[b] May include individual consultants or consulting companies.

[c] Includes the cost of computers and geographic information system software for mapping purposes. These assets will be turned over to the executing agency upon completion of the project.

[d] Includes travel expenses of up to 10 staff from relevant agencies to participate in overseas study tours to pilot carbon capture and storage installations in ADB member countries such as Australia, the People's Republic of China, India, Indonesia, the Republic of Korea, and Malaysia. Participants will be drawn from utilities, regulatory and policy-making agencies, and industrial sectors.

[e] The government will provide office space and at least two counterpart staff to assist the consultants during TA implementation.

Source: Asian Development Bank estimates.

OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

1. The Central and West Asia Department, in coordination with the Regional and Sustainable Development Department, will implement the technical assistance (TA). A consultant team consisting of five international consultants (total of 15 person-months) will coordinate its work with the eight national consultants (34 person-months). The international consultants will have expertise in (i) carbon capture and storage (CCS) strategy development; (ii) technical areas across the whole CCS chain, especially capture and storage; (iii) policy, legal, and regulatory issues; and (iv) financial modeling and analysis. The national consultants will have expertise similar to that of the international experts, as well as in-depth knowledge and expertise in Pakistan. The international CCS expert will be the team leader, and a national CCS technical expert in capture technology will be the co-team leader. Together, they will coordinate the activities of all the consultants. In addition, there will be a national coordinator with extensive experience in coordinating and managing a team of consultants and administering TA from the Asian Development Bank (ADB).

A. International Consultants

2. **Carbon capture and storage expert—team leader** (5 person-months). The team leader will be responsible for pulling together outputs from other international and national experts in a coherent report covering all areas of the TA. A national coordinator will assist the team leader in these tasks and in ensuring proper coordination between all experts. The team leader will also undertake the following tasks:

(i) Review and assess CCS development activities worldwide, and the activities being carried out in Pakistan.

(ii) Capture and map out these national and international activities and their relevance to the TA activities; establish an information and knowledge network with other CCS initiatives in Pakistan. National experts will assist in quickly familiarizing the team leader with ongoing CCS activities in Pakistan and in establishing a stakeholder network.

(iii) Review and summarize results of previous studies and initiatives; and capture lessons learned internationally in formulating policies, regulations, programs, and targeted initiatives to promote CCS activities.

(iv) In conjunction with national consultants, critically examine the strategic importance of CCS in the national energy mix and long-term energy security, especially comparing and contrasting with other supply-side options. Evaluate the impacts of the CCS deployment on electricity pricing, society, and environment among others.

(v) Analyze the strengths, weaknesses, opportunities, and constraints of CCS development, its demonstration, and potential future deployment in Pakistan.

(vi) In consultation with other national and international experts on the team, identify and design a framework for a CCS demonstration road map and seek stakeholders' acceptance of the framework. With contributions from other team members, prepare a draft road map for implementing demonstration project(s).

(vii) Identify institutional structures, skills, and resources needed to implement the proposed road map for the demonstration project(s). Review existing capacities and readiness of planners, research institutes, and relevant agencies, and point out critical gaps, if any.

(viii) Formulate, recommend, and implement a comprehensive capacity-strengthening program to bridge the capacity gaps. Define the knowledge and expert networks needed to support the CCS demonstration.
(ix) In detailed consultation with the executing agency and other key stakeholders, develop benchmark standards and criteria for selecting priority demonstration projects and setting performance indicators for demonstration projects.
(x) Seek stakeholders' acceptance of the set of criteria. Develop a short list of potential demonstration sites, and assess and rank them.
(xi) Coordinate tasks between team members and regularly coordinate with key stakeholders on TA implementation.
(xii) Along with the team, develop and submit up to three prefeasibility study reports for large-scale demonstration projects.

3. **Technical expert—carbon dioxide capture** (3 person-months). The expert will support the team leader in relevant tasks and will undertake the following specific activities:

(i) Describe viable technological options and applications for the capture process in Pakistan, including total capture capacity, capture rate, capital and operational costs, and closure arrangements.
(ii) Review existing and planned carbon dioxide (CO_2) capture approaches and undertake a comprehensive cost–benefit comparison of these capture approaches and their strategic relevance to Pakistan. Analyze the technical readiness in Pakistan for CCS demonstration and assist the team leader in devising a technical road map for CCS demonstration project(s). Analyze the concept of "capture-ready" for a future CCS retrofit, if necessary, its strategic merits, and relevance to Pakistan. Estimate additional investments needed for capture-ready plants.
(iii) Develop strategic choices and potential technical routes for CCS demonstration and deployment considering previous and ongoing studies and initiatives in this area internationally and in Pakistan. Summarize the results and analysis, and prepare a technical road map for CCS demonstration.
(iv) Undertake a desk analysis of the costs for projects with and without CCS, indicating the assumptions and basis for the CCS elements of the cost estimate.
(v) Undertake the capacity assessment in terms of technical skills in implementing CCS demonstration project(s) and identify critical gaps, if any. Propose a capacity-strengthening plan to overcome critical capacity gaps.
(vi) Develop technical benchmark standards and criteria for assessing and ranking demonstration sites. Identify additional in-depth technical analysis needed on selected demonstration sites and associated cost estimates.
(vii) Assist the team leader where required.

4. **Technical expert—carbon dioxide storage** (3 person-months). The expert will assist the team leader and other technical experts in a comprehensive analysis of the whole CCS chain. In particular, the expert will focus on the CO_2 storage element of CCS and undertake the following tasks:

(i) Describe viable technological options and applications for the storage process in Pakistan, including total storage capacity, capital and operational costs, transport performance, and closure arrangements.
(ii) Review existing and planned CO_2 storage mapping and related activities being carried out or planned in Pakistan.

(iii) Undertake extensive analysis of the quality of CO_2 storage data and the reliability needed for CCS projects, and evaluate available data and previous studies for their suitability for CCS demonstration.
(iv) Carry out initial geological investigations for the storage aspects of the identified pilot projects.
(v) Identify additional geological investigations required on a potential storage site and an indicative cost estimate for undertaking the studies. Prepare detailed terms of reference and identify suitable agencies to undertake such a study.
(vi) Identify measures and performance indicators to ensure the integrity of CO_2 storage for a CCS demonstration, and identify capacity strengthening measures.
(vii) Assist the team leader where required.

5. **Financial analyst** (2 person-months). The expert will assist the team leader in analyzing the cost barriers to CCS demonstration and in identifying innovative financing that may make CCS work in Pakistan. In particular, the expert will undertake the following tasks:

(i) Prepare an indicative cost structure for projects with and without CCS, including base cost and physical and price contingencies. Clearly spell out all assumptions in arriving at the indicative costs.
(ii) Analyze existing relevant financing mechanisms, such as the Clean Development Mechanism and Climate Investment Facility, and other emerging climate finance sources that can provide concessional financing or additional revenues to a CCS demonstration project.
(iii) Identify opportunities for public and private sector investment in CCS in Pakistan.
(iv) Prepare an indicative project cost and financing plan for the demonstration project(s), including proposed concessional financing, justifying its need for mitigating the higher incremental costs to an appropriate level and its potential source, and appropriate counterpart funds.
(v) Carry out an in-depth financial analysis for projects with and without CCS, including calculation of the financial internal rate of return and weighted average cost of capital, taking into account all the financial costs and benefits.
(vi) Check and compare the financial viability with and without CCS projects and the expected impact on electricity tariffs with CCS components. Analyze the impact of concessional funding on the electricity tariff and the financial viability.
(vii) Conduct a comprehensive analysis of all risks associated with project revenues and costs, and conduct relevant sensitivity analyses on the financial results.
(viii) In conjunction with the CCS technical experts on the team, identify incremental benchmark costs for making carbon capture-ready plants.
(ix) Assist the team leader where required.

6. **Legal and regulatory expert** (2 person-months). The expert will assist the team leader in analyzing the policy, legal, and regulatory barriers to CCS demonstration, and in identifying an appropriate enabling framework for CCS demonstration and future deployment. In particular, the expert will undertake the following tasks:

(i) Identify enabling policies, legal, and regulatory frameworks and discuss them with government line ministries and private sector stakeholders.
(ii) Review existing policies and recommend changes, if any, to the climate change policy, energy sector policy, other sector strategies and policies, and the national regulatory framework to enable CCS development and deployment.
(iii) Undertake a comprehensive analysis of the CCS chain in relation to legal and regulatory issues, and summarize unique challenges and risks posed by

demonstration project(s). Identify measures needed to strengthen safeguard and related issues to mitigate these risks.

(iv) Summarize results of specific legal and regulatory initiatives undertaken internationally to meet these challenges, including but not limited to the relevant European Union directive and Australian initiative. Evaluate the relevance of these international efforts to the situation in Pakistan.

(v) Review policies, programs, and initiatives that have been formulated internationally to promote, encourage, and accelerate CCS demonstration. Critically evaluate the roles that have been assumed by various stakeholders, including governments, in these initiatives.

(vi) Review the analysis being carried out on complementary projects in Pakistan. With extensive contributions from national consultants, identify legal and regulatory barriers, if any, that may affect the demonstration project(s). Recommend a critical set of policies that will be essential to providing the enabling legal and regulatory basis for demonstration project(s).

(vii) Identify benchmark standards for safeguard and long-term monitoring compliances needed for the demonstration project(s). Identify additional preparatory work, including enhanced environmental compliances and long-term storage monitoring that will be necessary.

(viii) Assist the team leader where required.

B. National Consultants

7. A team of national consultants will supplement and support the international consultants with similar expertise. The national team will comprise (i) one co-team leader and CCS technical expert—capture technologies (3 person-months), (ii) one CCS strategy analyst (3 person-months), (iii) one CCS technical expert on capture technologies (2 person-months), (iv) one CCS technical expert—CO_2 storage (2 person-months), (v) one energy economist and policy analyst (6 person-months), (vi) one specialist on technology policy issues—transfer of technology and intellectual property rights issue (5 person-months), (vii) one environment and climate change policy analyst (5 person-months), and (viii) one national consultant's coordinator (8 person-months). The co-team leader will provide the planning and project management leadership for the national consultants. Together with the team leader from the international consultants, the co-team leader will be the focal point for interacting with key stakeholders and ensuring the quality of the TA output reports. All national consultants will have extensive knowledge of CCS development issues in Pakistan. They will assist the respective international consultants in quickly becoming familiar with their tasks by reviewing relevant reports, analytical data, policies, regulations, and current strategic thinking and challenges in CCS.

8. The national consultants' terms of reference will be similar to those of the international consultants. The national CCS strategy analyst will work with the international team leader and co-team leader in examining the strategic importance of CCS in the national energy mix and long-term energy security, especially comparing and contrasting with other supply-side options; and evaluate the impacts of the CCS deployment on electricity pricing, society, the environment, among others. The national specialist on technology policy will also work with the international team leader and co-team leader on identifying creative policies for the transfer of technology and intellectual property rights issues. The national environment and climate change policy analyst will assist the team leader and co-team leader on the national climate change action plan and in identifying the strategic fit of CCS into similar national plans and activities.

9. The national coordinator will assist the project management office of the implementing agency and the team leader and co-team leader in all TA management and administration tasks throughout the TA implementation period. The national coordinator will ensure that the tasks of selected consultants can be coordinated and managed in a timely and cost-effective manner, enhancing the TA implementation.