Technical Assistance Report

PUBLIC

Project Number: 55170-002
Knowledge and Support Technical Assistance (KSTA)
December 2021

Islamic Republic of Pakistan: Gas Storage Development Systems

Asian Development Bank

CURRENCY EQUIVALENTS
(as of 7 December 2021)

Currency unit	–	Pakistan rupee/s (PRe/PRs)
PRe1.00	=	$0.0056
$1.00	=	PRs176.552

ABBREVIATIONS

ADB	–	Asian Development Bank
cfd	–	cubic feet per day
LNG	–	liquefied natural gas
MOE	–	Ministry of Energy
TA	–	technical assistance

NOTES

(i) The fiscal year (FY) of the Government of Pakistan ends on 30 June. "FY" before a calendar year denotes the year in which the fiscal year ends, e.g., FY2020 ends on 30 June 2020.

(ii) In this report, "$" refers to United States dollars.

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[a] Outposted to the Pakistan Resident Mission.

CONTENTS

KNOWLEDGE AND SUPPORT TECHNICAL ASSISTANCE AT A GLANCE

1. Basic Data — **Project Number:** 55170-002

Project Name	Gas Storage Development Systems	**Department/Division**	CWRD/CWEN
Nature of Activity	Policy Advice	**Executing Agency**	Asian Development Bank
Modality	Regular		
Country	Pakistan		

2. Sector

	Sector	Subsector(s)	ADB Financing ($ million)
✓	Energy	Energy sector development and institutional reform	0.60
		Total	**0.60**

3. Operational Priorities

- ✓ Addressing remaining poverty and reducing inequalities
- ✓ Accelerating progress in gender equality
- ✓ Tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability
- ✓ Strengthening governance and institutional capacity
- ✓ Fostering regional cooperation and integration

Climate Change Information[1]

GHG Reductions (tons per annum)	0.000
Climate Change impact on the Project	Low
ADB Financing	
Adaptation ($ million)	0.00
Mitigation ($ million)	0.00
Cofinancing	
Adaptation ($ million)	0.00
Mitigation ($ million)	0.00

Sustainable Development Goals

SDG 1.a
SDG 5.c
SDG 7.a
SDG 10.4
SDG 12.2

Gender Equity and Mainstreaming

Some gender elements (SGE) ✓

Poverty Targeting

Household Targeting ✓

4. Risk Categorization Low

5. Safeguard Categorization Safeguard Policy Statement does not apply

6. Financing

Modality and Sources	Amount ($ million)
ADB	**0.60**
Knowledge and Support technical assistance: Technical Assistance Special Fund	0.60
Cofinancing	**0.00**
None	0.00
Counterpart	**0.00**
None	0.00
Total	**0.60**

Currency of ADB Financing: US Dollar

[1] The project reduces greenhouse gas emissions. However, it does not fall under the eligibility criteria for climate mitigation finance as defined by the joint multilateral development bank methodology on tracking climate finance, which notes that not all activities that reduce greenhouse gases in the short term are eligible to be counted towards climate mitigation finance. Accordingly, greenfield fossil fuel projects are excluded, and climate mitigation finance is considered zero.

I. INTRODUCTION

1. The knowledge and support technical assistance (TA) will (i) analyze and recommend gas storage modalities and options across Pakistan based on the safety, reliability, cost, and effect on amenities as prime considerations; (ii) propose a policy, legal, and regulatory framework to develop, operate, and maintain gas storage facilities following international best practice; and (iii) provide advisory services on a transaction model, financial structure, and development road map for the first gas storage facility in the country. The findings will assist the Government of Pakistan to design and approve optimal storage options (underground or overground) across multiple locations, a capital and ownership structure and road map for each option, and adjustments to the hydrocarbon legal and regulatory framework.[1]

2. The Asian Development Bank (ADB) is the government's key development partner in the energy sector, with an ongoing portfolio of $2.4 billion in physical investments, sector reforms, and technical assistance. The TA is consistent with the ADB country partnership strategy for Pakistan, 2021–2025;[2] and is included in the country operations business plan for Pakistan, 2021–2023.[3]

II. ISSUES

3. Pakistan has been reforming its domestic natural gas market since 2005, but has not developed any storage systems. As natural gas accounts for an increasing proportion of the country's total energy consumption because of the goal of carbon neutrality, large-scale gas storage is necessary to satisfy the need for gas peak shaving and national strategic security. Additionally, domestic gas production in Pakistan cannot meet the consumption demand, and imports will play a significant role on the supply side. Pakistan's primary energy supply mix consists of oil, natural gas (including imported liquefied natural gas [LNG]), coal, liquefied petroleum gas, hydropower, renewable energy (solar and wind), and nuclear electricity.[4] Natural gas, including imported LNG, has the highest share (47%) of the country's energy supply mix. Gas consumption totals 1,453 billion cubic feet per day (cfd), mainly from the power (511 billion cfd), the domestic (311 billion cfd), and the industry (290 billion cfd) sectors respectively.[5] In addition to electricity generation, natural gas is used in industry, particularly fertilizer production; for domestic heating and cooking needs; and as compressed natural gas in the transport sector. Since 2000, gas consumption has increased substantially, at 4.8% per annum, but local gas production is almost stagnant at about 4.0 billion cfd. Since FY2015, the country has imported LNG under long-term gas sales and purchase agreements as well as through spot market contracts. LNG imports accounted for 23% of gas supplies in FY2020, and are expected to increase because of diminished local production. The supply deficit is estimated to be about 1,820 billion cfd (20%).[6]

4. Pakistan's heavy dependence on oil and gas imports constitutes a macroeconomic challenge and an energy security risk. The demand for natural gas is growing, particularly in the

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[1] Underground storage options include depleted fields, salt formations, and depleted aquifers. Overground storage options could include conventional above-ground, double-skinned metal tanks and pre-stressed concrete tanks.

[2] ADB. 2020. *Country Partnership Strategy: Pakistan, 2021–2025—Lifting Growth, Building Resilience, Increasing Competitiveness.* Manila.

[3] ADB. 2021. *Country Operations Business Plan: Pakistan, 2021–2023.* Manila.

[4] LNG is natural gas that is cooled and converted to a liquid at a temperature of –162°C and at atmospheric pressure. Liquefaction reduces the fuel volume by about 600 times and allows it to be stored and transported in specially designed vessels.

[5] In FY2020, oil accounted for 26%, coal 16%, and electricity 11%.

[6] Petroleum Institute of Pakistan. 2020. *Pakistan Energy Outlook*. Islamabad.

residential and industrial sectors, creating a greater need for increased gas storage. In the absence of storage, Pakistan has relied more on short-term and spot LNG to meet its natural gas demand. This exposes the country to spot price premium and market price volatility risks, which increase consumer gas tariffs. Natural gas plays an important role in decarbonizing Pakistan's electricity system, as it enables the displacement of carbon-intensive furnace oil and diesel power plants that emit twice as much carbon dioxide.[7] Private sector participation in the midstream gas sector is negligible, with no effective regulation providing a legal foundation for gas storage infrastructure. In the broader context of energy market development in Pakistan, including both private and public interventions, storage is critical to fulfil the country's energy security needs. In parallel, primary energy sources are increasing through the deployment of renewable energy (from 5% in 2020 to 30% in 2030) and incentive packages for oil and gas exploration companies.

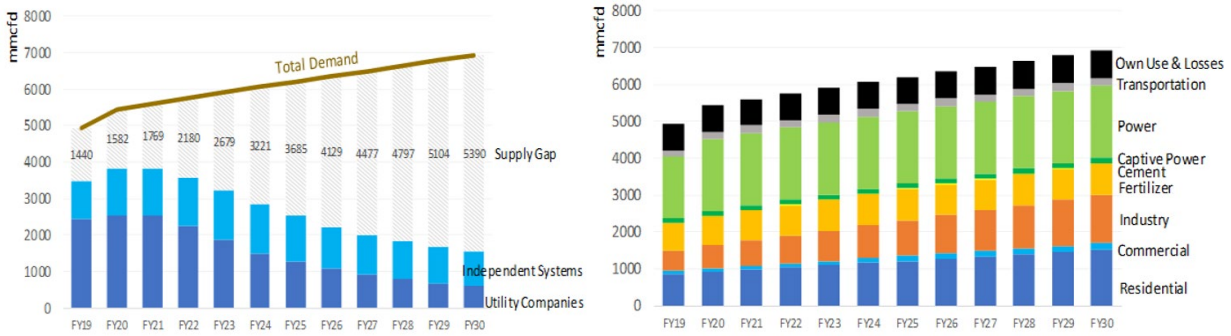
5. Pakistan is the 19th largest consumer of natural gas globally, with nearly 10 million customers. It has a well-established network of gas pipelines, comprising nearly 200,000 kilometers of transmission and distribution network for the transportation and distribution of natural gas to the domestic, industrial, commercial, and transport sectors. However, the country has not developed a public or private gas storage facility to (i) serve as a buffer between transportation and distribution; (ii) provide a safety stock and buffer inventory; (iii) ensure that adequate gas supplies are in place for seasonal demand shifts and unexpected demand surges; (iv) manage tariffs and pricing by storing gas when prices are low and withdrawing when prices are high; (v) meet obligations under take-or-pay contracts for gas imports, reduce capacity payments, and capitalize on cheaper lock-in contracts in the spot market; (vi) balance supplies, as multiple importers procure gas at various times and the supply–demand equation cannot often be matched; (vii) improve flexibility, resilience, energy security, and affordability; and (viii) serve as insurance against unforeseen accidents and disasters triggered by natural hazards.

6. The key advantages of developing gas storage are (i) to reduce the volume of rationing and curtailments until these are eliminated, an indicator for energy reliability; (ii) to provide energy security, as Pakistan continues to rely on LNG purchased from the expensive spot market with a longer lead time and high global demand in winter, driving prices up when demand in Pakistan is at its peak; (iii) to secure LNG supply and accelerate fuel switching to reduce coal consumption and carbon dioxide emissions; (iv) to facilitate clean cooking and improve people's living conditions; and (v) to add storage volume through private sector participation, leading the way to foreign direct investment and technology transfer.

7. To bridge the growing demand–supply gap, the government is incentivizing local production, the importation of natural gas and LNG, the development of cross-country and import pipelines, and the construction and operation of two LNG handling terminals. The government has solicited expressions of interest for the construction of two additional LNG terminals with storage infrastructure and two new cross-country gas transmission pipelines. The share of LNG in the overall gas supply during FY2020 increased to 29% of the total natural gas availability, while the total supply of natural gas in Pakistan, including imported LNG, reached 4,052 million cfd. These upstream and downstream developments in the gas supply chain reinforce the need for midstream storage facilities. With the government's liberalization reforms in the natural gas market, investment in private storage facilities is expected to follow. The government is contemplating granting import and storage licenses but further analysis is required, which this TA will support. The figure shows the gas demand–supply balance projections up to FY2030.

[7] By 2024, the Ministry of Energy will replace 3,700 megawatts of inefficient, carbon-intensive thermal plants with gas-powered and renewable energy generation systems.

Gas Demand–Supply Balance Projections



mmcfd = million cubic feet per day.
Source: Government of Pakistan, Oil and Gas Regulatory Authority. 2019. *State of the Regulated Petroleum Industry, 2018–19*. Islamabad.

8. The TA supports the recommendation of the government's integrated energy plan to deregulate the gas value chain and encourage private sector participation. The government does not intend to offer any sovereign guarantees, capacity charges, or offtake commitments for future LNG terminals and storage; hence, operators would arrange their own buyers, as well as third-party access to pipeline capacity. The TA is linked to the operational priorities of ADB's Strategy 2030: (i) addressing remaining poverty and reducing inequalities by cutting energy poverty and lowering gas tariffs; (ii) accelerating progress in gender equality through access to year-round energy for rural areas for cleaner cooking and cottage industries; (iii) tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability by reducing carbon footprints through the replacement of furnace oil and diesel-powered plants with gas-powered plants that are available year-round; (iv) strengthening governance and institutional capacity; and (v) fostering regional cooperation and integration through gas pipeline interconnections with neighboring countries (Turkmenistan and Iran), with options to store gas.[8] The TA is aligned with ADB's energy policy, supporting the low-carbon transition, and TA outputs will include necessary due diligence to ensure compliance with the three conditions of ADB's Energy Policy for any subsequent ADB-assisted projects involving natural gas. [9] Further, ongoing ADB analytical work will supplement and underpin this TA to support early retirement of coal- and furnace oil-powered power plants in Pakistan under the Energy Transition Mechanism, and the formulation and implementation of a government alternative and renewable energy policy will increase the share of the renewable energy capacity mix from 5% in 2021 to 30% in 2030.[10]

9. **Role of ADB and value addition.** The TA will build on the outcomes of two earlier TA projects: (i) in 2005, the improvement of gas infrastructure in Pakistan to strengthen regional energy trade; and (ii) in 2019, an overview of the gas storage environment and framework in

[8] ADB. 2018. *Strategy 2030: Achieving a Prosperous, Inclusive, Resilient, and Sustainable Asia and the Pacific*. Manila. The TA will also contribute to achieving Sustainable Development Goals 1.a, 5.c, 7.a, 10.4, and 12.2.

[9] ADB. 2021. *Energy Policy: Supporting Low-Carbon Transition in Asia and the Pacific*. Manila (para. 76). The three conditions are: (i) No other low-carbon or zero-carbon technology, or combination thereof, can provide the same service at an equivalent or lower cost at a comparable scale; (ii) The project's operating lifetime is consistent with the carbon stabilization trajectory aiming to achieve carbon neutrality by about 2050, and by a time set by developing member countries that is consistent with their nationally determined contributions (the project also avoids long-term lock-in into carbon infrastructure and the associated risk of creating stranded assets); and (iii) The project is economically viable considering the social cost of carbon and an operating lifetime consistent with condition (ii). The policy allows ADB's engagement in midstream and downstream gas activities including the gas storage systems.

[10] ADB. 2019. *Technical Assistance to Islamic Republic of Pakistan for Preparing Sustainable Energy Projects*. Manila.

Pakistan.[11] Both TA projects recommended diversifying supplies and developing strategic reserves to reduce prices and balance the supply–demand framework. The TA will explore investment opportunities under the One ADB approach through private and public–private partnerships. To improve access to knowledge and information for capacity support of developing member countries on gas storage infrastructure, a plan will be prepared to disseminate to a wider range of stakeholders all knowledge products completed under the TA.

III. THE TECHNICAL ASSISTANCE

A. Impact and Outcome

10. The TA is aligned with the following impact: gas market equilibrium established.[12] The TA will have the following outcome: gas supply chain strengthened, and strategic reserves requirements met.[13]

B. Outputs, Methods, and Activities

11. **Output 1: Gas storage infrastructure across Pakistan based on safety, reliability, cost, and effect on amenities as primary considerations assessed**. The TA will undertake a master study to assess potential gas storage infrastructure development sites in Pakistan in terms of cost, modality (underground or overground), geology and location (proximity to transmission network and load centers), market parameters, ownership, and operation and maintenance, among other factors. The TA will screen and rank these storage locations following international best practice and local conditions, and recommend an adequate risk and mitigation strategy. This component will entail almost 20% of the TA resources.

12. **Output 2: Legal, policy, and regulatory framework to build, operate, and maintain gas storage facilities developed**. The TA will review the existing legal and regulatory regime for gas storage development and propose changes in line with international best practice. The study, through consultative dialogue, will recommend an efficient legal, contractual, and governing structure and advise on licensing conditions, concession agreements, and related factors to be adopted by the government. This component will entail nearly 30% of the TA resources.

13. **Output 3: Transaction advisory services for an optimal project capital structure and road map for financial closure developed.** The TA will undertake financial and economic due diligence; identify project financing options for private and public–private participation; devise a strategy to raise finance; and showcase selected projects to potential investors including negotiations on term sheets, lenders' requirements for financial closure, and contract awards. This component will entail almost 50% of the TA resources.

14. The TA will benefit from multiple pre-feasibility studies prepared by the regulator and the Ministry of Energy (MOE) on gas supply and demand scenarios, the dynamics of Pakistan's future energy requirements, progressing gas import projects, and techno-economic considerations. It will also obtain input from a 2021 technical study for underground storage covering reservoir aspects, injection and extraction facilities, interconnection, and cost estimates.[14]

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[11] ADB. 2003. *Technical Assistance for the Turkmenistan–Afghanistan–Pakistan Natural Gas Pipeline Project (Phase II)*. Manila (TA 6153-REG); and ADB. 2019. *Technical Assistance to the Islamic Republic of Pakistan for Preparing Sustainable Energy Projects*. Manila.

[12] Government of Pakistan, MOE. 2020. *Development Plan for Pakistan Oil and Gas Industry 2020*. Islamabad.

[13] The design and monitoring framework is in Appendix 1.

[14] Government of Pakistan. 2021. *Underground Gas Storage*. Islamabad.

C. Cost and Financing

15. The TA amounts to $600,000, which will be financed on a grant basis by ADB's Technical Assistance Special Fund ($300,000 TASF 7 and $300,000 TASF-other sources[15]). The key expenditure items are listed in Appendix 2. The government will provide counterpart support in the form of counterpart staff, office accommodation, access to data, hosting stakeholder meetings, and other in-kind contributions.

D. Implementation Arrangements

16. ADB will administer the TA through the Energy Division of its Central and West Asia Department, in close collaboration and with guidance from ADB's Procurement, Portfolio and Financial Management Department and the MOE (Petroleum Division) of the Government of Pakistan. ADB will select, supervise, and evaluate the consultants; organize workshops; and provide staff to act as resource persons in the workshops. It is estimated that 4 person-months (national) of individual consultants, including a resource person to coordinate and engage with the office of the Prime Minister, the Cabinet Committee (Energy), and the provincial governments, will be required. A consulting firm will be recruited using the fixed budget selection method.

17. Implementation arrangements are summarized in the table.

Implementation Arrangements

Aspects	Arrangements		
Indicative implementation period	December 2021–December 2023		
Executing agency	ADB		
Implementing agencies	CWEN, in collaboration with the Ministry of Energy (Petroleum Division)		
Consultants	To be selected and engaged by ADB		
	Firm: FBS	International expertise (14 person-months) National expertise (36 person-months)	$580,000
	Individual: individual selection	National expertise (4 person-months)	$20,000
Disbursement	Disbursement of TA resources will follow ADB's *Technical Assistance Disbursement Handbook* (2020, as amended from time to time).		

ADB = Asian Development Bank; CWEN = ADB's Energy Division, Central and West Asia Department; FBS = fixed budget selection; TA = technical assistance.
Source: Asian Development Bank.

18. **Consulting services**. ADB will engage the consultants following the ADB Procurement Policy (2017, as amended from time to time) and its associated project administration instructions and/or staff instructions. The consultants will primarily consist of energy sector specialists, while financial, economic, legal, social, and other specialists will be recruited as necessary. An international consulting firm will be recruited using the fixed budget selection method. For the remaining expertise required, individual consultants will be engaged through an individual consultant selection process.[16]

IV. THE PRESIDENT'S DECISION

19. The President, acting under the authority delegated by the Board, has approved the provision of technical assistance not exceeding the equivalent of $600,000 on a grant basis to the Government of Pakistan for the Gas Storage Development Systems, and hereby reports this action to the Board.

[15] From TASF savings.
[16] Terms of Reference for Consultants (accessible from the list of linked documents in Appendix 3).

DESIGN AND MONITORING FRAMEWORK

Impact the TA is Aligned with
Gas market equilibrium established[a]

Results Chain	Performance Indicators	Data Sources and Reporting Mechanisms	Risks and Critical Assumptions
Outcome Gas supply chain strengthened, and strategic reserves requirements met	Annual gas demand–supply deficit reduced to 25% by 2030 (2020 baseline: 60%) (OP1.2,1.3, 2.4, 3.1, 7.1)	Annual State of Industry Report by Oil and Gas Regulatory Authority	R: Political and macroeconomic instability, including debt and protracted recovery from COVID-19 pandemic
Outputs 1. Gas storage infrastructure across Pakistan based on safety, reliability, cost, and effect on amenities as primary considerations assessed	1. At least two underground and two overground gas storage facilities ranked by 31 December 2023, with the requisite preliminary due diligence through stakeholders' analysis, including social safeguards and environmental analysis and considerations (2021 baseline: 0) (OP3.1,7.1)	1. Quarterly TA progress reports and annual progress reports of MOE	R: Long lead times in issuing and approving legal and regulatory frameworks for private sector participation A: International gas prices remain competitive A: Interest of international investors in foreign direct investment in Pakistan remains positive
2. Legal, policy, and regulatory framework to build, operate, and maintain gas storage facilities developed	2a. Draft legal framework developed, linking upstream, midstream, and downstream infrastructure parameters by 31 December 2023, in consultation with stakeholders and public consultations initiated (2021 baseline: none) (OP3.1, 6.1)	2a. Quarterly TA progress reports	R. Opposition by key stakeholder and community organizations
	2b. Draft policy framework, including private sector participation, developed and approved by the Cabinet Committee on Energy by 31 December 2023 (2021 baseline: none) (OP3.1, 6.1)	2b. Quarterly TA progress reports	

Results Chain	Performance Indicators	Data Sources and Reporting Mechanisms	Risks and Critical Assumptions
3. Transaction advisory services for an optimal project capital structure and road map for financial closure developed	3. Transaction structure for one short-listed and MOE-approved gas storage facility developed for private sector participation by 31 December 2023 (2021 baseline: none) (OP1.2, 6.2)	3. Quarterly TA progress reports and notification by the MOE	

Key Activities with Milestones

1. Gas storage infrastructure across Pakistan based on safety, reliability, cost, and effect on amenities as primary considerations assessed

1.1 Undertake a desk study from earlier reports and estimate gas demand growth centers across Pakistan (Q2 2022)

1.2 Align the transmission and distribution constraints and infrastructure requirements for augmentation and expansion (Q2 2022)

1.3 Recommend and rank two overground and two underground gas storage infrastructure options with locations, estimated cost, and reliability factors (Q4 2022)

1.4 Conduct technical workshop to arrive at a consensus on storage infrastructure through consultative dialogue (Q4 2022)

2. Legal, policy, and regulatory framework to build, operate, and maintain gas storage facilities developed

2.1 Review the existing and regional legal, policy, and regulatory framework to recommend changes to incentivize private sector participation, keeping in view the interest of consumers (Q2 2022)

2.2 Recommend provisions for the tariff regime, security of investments, and other requisite parameters to allow the development of gas storage infrastructure facilities (Q4 2022)

2.3 Organize a technical workshop to arrive at a consensus on the legal, policy, and regulatory framework through consultative dialogue (Q1 2023)

3. Transaction advisory services for an optimal project capital structure and road map for financial closure developed

3.1 Prepare financing options, including fully public, public–private partnerships, and fully private participation (Q1 2023)

3.2 Showcase the project to private investors (Q2 2023)

3.3 Recommend an appropriate capital structure in consultation with development partners, financial institutions, and oil and gas companies, with term sheets; and recommend a road map for financial closure (Q3 2023)

Inputs

ADB: $600,000 ($300,000 TASF 7 and $300,000 TASF-other sources)

Note: The government will provide counterpart support in the form of office space and counterpart staff, access to data, hosting stakeholder meetings, and other in-kind contributions.

A = assumption, ADB = Asian Development Bank, COVID-19 = coronavirus disease, MOE = Ministry of Energy, OP = operational priority, Q = quarter, R = risk, TA = technical assistance, TASF = Technical Assistance Special Fund.

[a] Government of Pakistan, Ministry of Energy. 2020. *Development Plan for Pakistan Oil and Gas Industry 2020*. Islamabad.

Contribution to Strategy 2030 Operational Priorities:

The expected values and methodological details for all OP indicators to which this TA will contribute results are detailed in Contribution to Strategy 2030 Operational Priorities (accessible from the list of linked documents in Appendix 3).

Source: Asian Development Bank.

COST ESTIMATES AND FINANCING PLAN
($'000)

Item	Amount
Asian Development Bank[a]	
1. Consultants	
a. Remuneration and per diem	
i. International consultants	335.0
ii. National consultants	180.0
b. Out-of-pocket expenditures	
i. International and local travel	50.0
ii. Reports and communications	3.0
iii. Printed external publications[b]	2.0
2. Miscellaneous technical assistance administration costs[c]	5.0
3. Contingencies	25.0
Total	**600.0**

Note: The technical assistance (TA) amounts to $612,000, of which contributions from the Asian Development Bank are presented in the table. The government will provide counterpart support in the form of staff support, office space, access to data, hosting stakeholder meetings, and other in-kind contributions. The value of the government contribution is estimated to account for 2% of the total TA cost.

[a] Financed by the Asian Development Bank's Technical Assistance Special Fund (TASF 7 and TASF-other sources).

[b] Some 500 printed external publications are needed for consideration and approval by the cabinet committees, government offices in the federal and provincial governments, and workshops.

[C] Hydrocarbon planning software with license fee.

Source: Asian Development Bank estimates.

LIST OF LINKED DOCUMENTS

http://www.adb.org/Documents/LinkedDocs/?id=55170-002-TAReport

1. Terms of Reference for Consultants
2. Contribution to Strategy 2030 Operational Priorities