



Technical Assistance Report

PUBLIC

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Knowledge and Support Technical Assistance (KSTA)
December 2022

South Asia Subregional Economic Cooperation Green Fuel Development Initiative

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Asian Development Bank

ABBREVIATIONS

ADB	–	Asian Development Bank
JFPR	–	Japan Fund for Prosperous and Resilient Asia and the Pacific
SASEC	–	South Asia Subregional Economic Cooperation
TA	–	technical assistance

NOTE

In this report, “\$” refers to United States dollars.

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CONTENTS

	Page
KNOWLEDGE AND SUPPORT TECHNICAL ASSISTANCE AT A GLANCE	
I. INTRODUCTION	1
II. ISSUES	1
III. THE TECHNICAL ASSISTANCE	3
A. Impact and Outcome	3
B. Outputs, Methods, and Activities	3
C. Cost and Financing	4
D. Implementation Arrangements	4
IV. THE PRESIDENT'S DECISION	5
APPENDIXES	
1. Design and Monitoring Framework	6
2. Cost Estimates and Financing Plan	9
3. List of Linked Documents	10

KNOWLEDGE AND SUPPORT TECHNICAL ASSISTANCE AT A GLANCE

1. Basic Data		Project Number: 56096-001	
Project Name	South Asia Subregional Economic Cooperation Green Fuel Development Initiative	Department/Division	SARD/SAEN
Nature of Activity	Capacity Development, Policy Advice, Research and Development	Executing Agency	Asian Development Bank
Modality	Regular		
Country	REG (All DMCs)		
2. Sector	Subsector(s)	ADB Financing (\$ million)	
		Total	0.00
3. Operational Priorities		Climate Change Information	
✓ OP3: Tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability		GHG Reductions (tons per annum)	0
✓ OP7: Fostering regional cooperation and integration		Climate Change impact on the Project	Low
		ADB Financing	
		Adaptation (\$ million)	0.00
		Mitigation (\$ million)	0.00
		Cofinancing	
		Adaptation (\$ million)	0.00
		Mitigation (\$ million)	2.00
Sustainable Development Goals		Gender Equity and Mainstreaming	
SDG 1.b		Some gender elements (SGE)	✓
SDG 5.4			
SDG 7.2			
SDG 9.1, 9.4			
SDG 10.1			
SDG 13.a			
4. Risk Categorization		Poverty Targeting	
	Complex	General Intervention on Poverty	✓
5. Safeguard Categorization		Safeguard Policy Statement does not apply	
6. Financing			
Modality and Sources		Amount (\$ million)	
ADB		0.00	
None		0.00	
Cofinancing		2.00	
Japan Fund for Prosperous and Resilient Asia and the Pacific (Full ADB Administration)		2.00	
Counterpart		0.00	
None		0.00	
Total		2.00	
Currency of Financing: US Dollar			

I. INTRODUCTION

1. The regional knowledge and support technical assistance (TA) aims to support the South Asia region in transitioning from fossil fuels to carbon-free “green fuels” such as advanced biofuels, e-fuels, green hydrogen, and green ammonia. Supported by the South Asia Subregional Economic Cooperation (SASEC) program, the TA will launch the Green Fuel Development Initiative as the energy sector’s platform for regional cooperation and integration.¹ The initiative’s frameworks were endorsed by the SASEC energy working group and nodal officers meeting in June 2022.² The TA will assess the market potential of various types of green fuels in multiple sectors and industries—e.g., energy, transport, manufacturing, and agriculture—in the region. Based on the studies, the TA will identify immediate ways of deploying green fuels and will design pilot projects for demonstration purposes in selected countries. It will also analyze transnational supply and value chains to inform development strategies and road maps in a regional context. Finally, various knowledge sharing activities will help increase the awareness of stakeholders of the importance of promoting green fuel development in South Asian countries.

II. ISSUES

2. **Energy security.** All the South Asian countries are net oil importers and are expanding the use of natural gas and liquefied petroleum gas. Since the Russian invasion of Ukraine, global fuel prices have been soaring, which drastically skewed the local demand–supply situation. The fundamental change in the commodity’s market quickly triggered inflationary effects across South Asia’s economies. It also raised energy security concerns in the face of looming fuel price volatility, trade deficits in fuel imports, shortage of fuel supplies, and interruption of fuel supply chains. As long as the countries continue to rely largely on fossil fuels, they remain vulnerable to these issues. While the ongoing pandemic had already highlighted the need to improve the domestic and regional self-sufficiency of supply chain systems, the recent economic shocks triggered by high-priced fuels reinforced the importance of independent energy supplies. This suggests that it would be strategically crucial to develop and promote alternative clean fuels that can be produced from domestic resources. It would also be impactful if the countries were to increase their domestic or regional production of green fuels by developing or applying novel technologies. This could mean producing (i) advanced biofuels from agricultural and municipal wastes, (ii) green hydrogen from water electrolysis with renewable power, (iii) green ammonia similarly with further conversion processing, and (iv) e-fuels (synthetic fuels) by synthesizing hydrogen and carbon.

3. **Climate change.** In many SASEC countries, electricity is still mostly generated by thermal power plants with conventional fossil fuels—petroleum, natural gas, and coal. Transport, industry, and agriculture also largely rely on energy from fossil fuels. The emissions from these sectors are increasing along with economic growth, and fossil fuels account for most of the greenhouse gas emissions in the region. The countries have ratified the Paris Agreement to commit to nationally determined contributions that specify their plans to reduce national greenhouse gas emissions and adapt to the impacts of climate change. To achieve that goal, each country needs to adopt low-emission technologies that can reduce the emissions across the sectors. Apart from crop-based

¹ SASEC covers seven countries: Bangladesh, Bhutan, India, Maldives, Myanmar, Nepal, and Sri Lanka. The Asian Development Bank (ADB) has placed a hold on sovereign project disbursements and new contracts in Myanmar since 1 February 2021. Country-specific studies in Myanmar will be carried out as required pursuant to the ADB Management guidance effective at that point in time.

² The TA first appeared in the business opportunities section of ADB website on 2 September 2022. It is expected to contribute to ADB’s Strategy 2030 and two of its seven operational priorities (OP1–OP7): OP3—tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability; and OP7—fostering regional cooperation and integration.

biofuels that may create a conflict with food security, advanced biofuels are identified as the second-generation technology and treated as renewable energy sourced from organic matter, agricultural waste, and municipal solid waste. Green hydrogen is decarbonized with zero emissions in water electrolysis using renewable energy such as solar and wind power as well as hydropower. Green ammonia can be produced from green hydrogen and used to produce carbon-neutral fertilizers, which will decarbonize the food value chain (while conventional chemical fertilizers are produced from fossil fuel-based ammonia with a lot of carbon dioxide emissions).

4. **Green recovery.** Green fuel development is expected to have a transformational effect on the national and regional economies since it will create a new market. In the long run, it will contribute to green industry and local job creation. This is because these alternative fuels can be used extensively. For example, advanced biofuels can serve multiple energy, transport, and manufacturing purposes in the form of bioethanol, biogas, and biodiesel. Bioethanol can be used for industrial chemicals, beverages, and medical activities, and biogas also for cooking. Any forms of biofuels can broadly be blended with low-carbon fuels for vehicles and treated as a key transitional tool for green transportation. Green hydrogen can also be applied to more wide-ranging and multisector activities for energy, transportation, industry, and agriculture. Hydrogen is widely used by petrochemical and manufacturing industries to produce plastics, glasses, electronics, solvents, methanol, and ammonia, which can be further used to produce chemical fertilizers. It is also extensively used in oil refinery and steel production processes. Green hydrogen will be of further service when blended with pipelined gas, power generation, industrial heat, aviation fuels, and heavy-duty transport (with fuel cells). It can also be considered as an effective tool for renewable energy storage. Green ammonia is useful for agricultural fertilizer production, thermal power generation, and as fuel for vessels.

5. **Development barriers (knowledge needs).** Despite the advantages for development described in para. 4, several constraints make it difficult to introduce green fuels to the market. These include (i) lack of comprehensive policy frameworks, or national and regional strategies and road maps to support the uptake of green fuels; (ii) limited technological standards and high-cost structures as well as the resultant financial viability concerns; (iii) no incentive mechanisms to alleviate risks of investments and drive economies of scale; (iv) uncertainties along the entire value chain of green fuel application; and (v) inadequate awareness, community concerns, and weak coordination between stakeholders. The Asian Development Bank (ADB) has initiated TA programs to support the use of advanced biofuels and green hydrogen and ammonia in India.³ These aim to help prepare development plans based on policy frameworks and to pilot innovative project designs in coordination with development partners from Japan and the Republic of Korea.⁴ To scale up green fuel development through regional market and supply chain systems with technological standardization across the countries beyond India, a regional approach in parallel with India's programs will be highly effective and impactful. It will allow the SASEC countries to explore synergies and to learn from India's experiences.

³ There will be no duplication of scope and work between this regional TA and the TA programs for India. The regional TA will provide a pilot scheme to a new entity and summarize India's strategies and road maps as a reference for other countries. India's advanced experience will facilitate synergies and knowledge sharing among the countries.

⁴ The development partners are Japan's New Energy and Industrial Technology Development Organization and the Korea Energy Agency.

III. THE TECHNICAL ASSISTANCE

A. Impact and Outcome

6. The TA is aligned with the following impact: usage of green fuels promoted in multiple sectors across the SASEC countries.⁵ The TA will have the following outcome: readiness for pilot project investments in green fuel development and business enhanced.⁶

B. Outputs, Methods, and Activities

7. **Output 1: SASEC country-specific and regional market studies on green fuel development prepared.** The TA will assess (i) each SASEC country's resource potential to produce advanced biofuels, e-fuels, green hydrogen, and green ammonia; and (ii) the regional market's economic opportunities for, and constraints to, green fuel development by focusing on supply and demand curves in the production and consumption of different industrial segments. The regional market assessment will cover transnational supply chains and possible trading systems for alternative green fuels through fuel transportation and storage options. The studies will also assess the possibilities of competition and coexistence with electric vehicles as well as conventional fuel and power generation options.

8. **Output 2: Green fuel development solutions designed.** The TA will identify immediate ways of developing and using green fuels in selected sectors based on the country-specific and regional market studies under output 1. The TA will also design pilot projects for demonstration purposes in selected countries.⁷ In preparing these projects, comprehensive studies and activities will be provided to assess business models, technological assurance, safety standards, safeguard impact, financial and economic viability, and risk control and management.

9. **Output 3: Regional development strategies and road maps for green fuel supply chain systems developed.** Along with the findings from resource studies and pilot projects, the TA will support the SASEC countries and the region in formulating or updating sector strategies and phased development road maps for medium- and long-term green fuel deployment. This will include the preparation of shared and individual policy and regulatory frameworks and recommendations for green fuel development based on the conditions and requirements in each country, as well as assessments of technological benchmarking, pricing frameworks, safeguards, and financial incentive mechanisms for investments with private participation.⁸ The TA will also look into climate change impacts and value addition in each segment of the entire fuel supply chains with a bilateral and/or regional scope.⁹

10. **Output 4: Awareness of and knowledge sharing on green fuel development improved.** Various knowledge enhancement activities will serve to make stakeholders aware of the merits and usability of green fuels. These can include opportunities to learn about foreign and domestic green fuel technologies, markets, stakeholder coordination, value chain systems, policies, and regulations. The TA may organize workshops and/or a physical site visit to share

⁵ ADB. 2017. *SASEC: Powering Asia in the 21st Century*. Manila.

⁶ The design and monitoring framework is in Appendix 1.

⁷ The selection criteria may include degree of project viability, assessment of resources, site availability, and safeguard impacts, but will be considered based on ADB guidelines and practices, as well as further studies.

⁸ The mechanisms may include viability gap funding, fuel purchase obligation, and feed-in pricing with a lock-in period.

⁹ The climate change impacts will be assessed in relation to the overall environmental life cycle of each activity in the value chains, and in relation to climate mitigation and adaptation measures. All types of greenhouse gas emissions will be assessed.

lessons from TA findings and applications, build stakeholders' knowledge, and explore how to implement and scale up innovative schemes. The TA will also prepare corresponding knowledge products.

11. ADB's value addition is in its contribution to regional cooperation frameworks on green fuel development through an integrated approach to resource mapping, technological and safety standardization, transnational supply chain systems, policy coordination, pilot projects, and knowledge sharing between the SASEC countries. The TA will support SASEC in formulating regional blueprints in its common direction and approach.

C. Cost and Financing

12. The TA financing amount is \$2,000,000, which will be financed on a grant basis by the Japan Fund for Prosperous and Resilient Asia and the Pacific (JFPR) and administered by ADB. The key expenditure items are listed in Appendix 2.

D. Implementation Arrangements

13. ADB will administer the TA. It will execute the TA in accordance with ADB rules and procedures. The Energy Division of its South Asia Department will select, supervise, and evaluate consultants, organize workshops, and provide staff to act as resource persons in the workshops.

14. Implementation arrangements are summarized below.

Implementation Arrangements

Aspects	Arrangements		
Indicative implementation period	January 2023–December 2025		
Executing agency	ADB		
Implementing agencies	ADB South Asia Department, Energy Division		
Consultants	To be selected and engaged by ADB		
	Firm: quality- and cost-based selection (90:10)	International expertise (43 person-months)	\$1.63 million
Disbursement	Disbursement of technical assistance resources will follow ADB's <i>Technical Assistance Disbursement Handbook</i> (2020, as amended from time to time).		

ADB = Asian Development Bank.
Source: Asian Development Bank.

15. **Consulting services.** ADB will engage consultants following the ADB Procurement Policy (2017, as amended from time to time) and its associated project administration instructions and/or staff instructions. The TA will require 43 person-months of international consulting services under one consultancy contract,¹⁰ recruited through a full technical proposal and quality- and cost-based selection with a quality–cost ratio of 90:10. An output-based contract will be considered. Advance contracting will be used for the firm.

¹⁰ Terms of Reference for Consultants (accessible from the list of linked documents in Appendix 3).

16. **Cofinancier requirements.** The JFPR implementation guidelines define ineligible and/or eligible expenditure items, the TA's monitoring and reporting requirements, and any change in implementation arrangements.¹¹

IV. THE PRESIDENT'S DECISION

17. The President, acting under the authority delegated by the Board, has approved the Asian Development Bank administering technical assistance not exceeding the equivalent of \$2,000,000 to be financed on a grant basis by the Japan Fund for Prosperous and Resilient Asia and the Pacific for the South Asia Subregional Economic Cooperation Green Fuel Development Initiative, and hereby reports this action to the Board.

¹¹ All changes in the TA scope and objectives, if any, will be discussed with the JFPR team. The TA completion report will eventually be shared with the Government of Japan.

DESIGN AND MONITORING FRAMEWORK

Impacts the TA is Aligned with			
Usage of green fuels promoted in multiple sectors across the SASEC countries ^a			
Results Chain	Performance Indicators	Data Sources and Reporting Mechanisms	Risks and Critical Assumptions
Outcome Readiness for pilot project investments in green fuel development and business enhanced	By 2025: a. SASEC regionwide business cooperation framework on green fuel development formulated (2022 baseline: NA) (OP 7.1.4) b. At least 6 green-fuel-related project schemes ready for financing consideration (2022 baseline: 0) (OP 3.1.5)	a–b. TA progress and completion reports	R: Economic slowdown and market decline affect energy demand and prices, acting against green fuel development. R: Technological changes lead to adverse shift to other energy types.
Outputs 1. SASEC country-specific and regional market studies on green fuel development prepared	By 2025: 1a. Country-specific market assessment on biofuels, green hydrogen, and green ammonia prepared for each SASEC country (2022 baseline: NA) (OP 3.1.5) 1b. SASEC's regionwide market assessment on biofuels, green hydrogen, and green ammonia prepared (2022 baseline: NA) (OP 7.2.1)	1a–1b. TA consultant reports	R: Prolonged consensus building among stakeholders may delay finalization of project direction and design. R: Due diligence studies may assess the pilot projects as unfeasible and unviable for investments because of exogenous factors (e.g., sharp cost reduction in an alternative energy source).
2. Green fuel development solutions designed	By 2025: 2a. Technological assessments for at least 6 country-specific green fuel pilot projects prepared (2022 baseline: 0) (OP 3.1.5) 2b. Green fuel projects' business modeling, safety standards, safeguard impact, financial and economic viability, and risk control and management assessed (2020 baseline: NA) (OP 3.1.5)	2a–2b. TA consultant reports	

Results Chain	Performance Indicators	Data Sources and Reporting Mechanisms	Risks and Critical Assumptions
3. Regional development strategies and road maps on green fuel supply chain systems developed	By 2025: 3a. Country-specific green fuel development strategy and development road map formulated or updated for each SASEC country (2022 baseline: NA) (OP 3.1.5) 3b. SASEC's regionwide green fuel development strategy and development road map formulated or updated (2022 baseline: NA) (OP 7.1.4)	3a–3b. TA consultant reports	
4. Awareness of and knowledge sharing on green fuel development improved	By 2025: 4a. At least 100 participants in 4 regional knowledge sharing workshops reported improved knowledge of green fuel development (2022 baseline: 0) (OP 7.3.1) 4b. At least 3 knowledge products on green fuel development published (i.e., TA consultant reports, project briefs, and brochures) (2022 baseline: 0)	4a–4b. TA consultant reports, including workshop program document, pre- and post-workshop assessments, and knowledge documents	
<p>Key Activities with Milestones</p> <p>1. SASEC country-specific and regional market studies on green fuel development prepared</p> <p>1.1 Assess global practices, policies, and strategies for green fuel deployment (Q2 2023)</p> <p>1.2 Set up an assessment process of green fuels' resource potential (Q2 2023)</p> <p>1.3 Develop each country's resource mapping for the production of biofuels, green hydrogen, and green ammonia, along with technological feasibility assessments (Q4 2023)</p> <p>1.4 Assess regional market's economic opportunities for and constraints to green fuel use in terms of value and supply chain systems across the countries and possible trading systems through transportation and storage options (Q2 2024)</p> <p>2. Green fuel development solutions designed</p> <p>2.1 Assess immediate ways to deploy green fuels in selected sectors across the countries (Q2 2024)</p> <p>2.2 Identify green fuel pilot projects in selected countries (Q3 2024)</p> <p>2.3 Assess the pilot projects in terms of technological assurance, locations, financial and economic impacts, risk control and management, and any safeguard-related mitigations (Q1 2025)</p> <p>2.4 Assess investment and financing options and risk mitigation plans (Q2 2025)</p> <p>2.5 Assess the pilot-project-related gender mainstreaming design (Q2 2025)</p> <p>2.6 Identify specifications and requirements for commercial scale-up based on the performance assessments of pilot projects (Q3 2025)</p>			

3. Regional development strategies and road maps for green fuel supply chain systems assessed

- 3.1 Review the current regulations and rules and propose possible changes for further improvements (Q3 2023)
- 3.2 Assess technological benchmarking, pricing, and financial incentive mechanisms (Q1 2024)
- 3.3 Conceptualize policy framework to develop cost-effective value chain and propose effective policy support measures (Q3 2024)
- 3.4 Assess climate impacts in relation to the overall environmental life cycle of each activity in the value chains, and in relation to climate mitigation and adaptation (Q1 2025)
- 3.5 Propose more adequate and sustainable business models for further scaling up green fuel investment with a view to private participation (Q2 2025)
- 3.6 Propose draft sector strategies and road maps, informed by assessments of market studies and pilot projects (Q3 2025)

4. Awareness of and knowledge sharing on green fuel development improved

- 4.1 Organize inception workshops (Q2 2023)
- 4.2 Thoroughly analyze and map stakeholders, including civil society (Q3 2023)
- 4.3 Develop a comprehensive stakeholder engagement plan, and facilitate early engagement with key stakeholders, including civil society organizations (Q1 2024)
- 4.4 Organize follow-up workshops to promote knowledge sharing and to discuss (i) the regional market's economic opportunities for, and constraints to, the use of green fuels; and (ii) immediate ways of deploying green fuels in selected sectors of each country (Q2 2024)
- 4.5 Organize a third round of workshops for knowledge sharing and/or site visits (Q4 2024)
- 4.6 Organize a fourth round of workshops to promote knowledge sharing and discuss proposed draft sector strategies and road maps (Q3 2025)

TA Management Activities

ADB, as the executing agency, administers the TA and manages the consulting contracts. The monitoring and review activities follow ADB requirements and fund guidelines.

Inputs

Japan Fund for Prosperous and Resilient Asia and the Pacific: \$2,000,000

ADB = Asian Development Bank, NA = not applicable, OP = operational priority, Q = quarter, R = risk, SASEC = South Asia Subregional Economic Cooperation, TA = technical assistance.

^a ADB. 2017. *SASEC: Powering Asia in the 21st Century*. Manila.

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
Japan Fund for Prosperous and Resilient Asia and the Pacific^a	
1. Consultants	1,572.5
a. Remuneration and per diem	
i. International consultants	1,354.5
ii. National consultants	0.0
b. Out-of-pocket expenditures	
i. International and local travel	215.0
ii. Reports and communications	3.0
2. Training, seminars, workshops, forum, and conferences	324.0
a. Travel cost of Asian Development Bank staff acting as resource persons	72.0
b. Venue rental and related facilities	28.0
c. Participants	224.0
3. Contingencies	103.5
Total (1+2+3)	2,000.0

^a Administered by the Asian Development Bank.
Source: Asian Development Bank estimates.

LIST OF LINKED DOCUMENTS

<http://www.adb.org/Documents/LinkedDocs/?id=56096-001-TAReport>

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