FAST Report

Project Number: 50227
September 2016

Equity Investment
Fluidic
Distributed Energy Storage Solutions Project (Regional)

This is the abbreviated version of the document that excludes commercially sensitive and confidential business information that is subject to exceptions to disclosure set forth in ADB's Public Communications Policy 2011.

Asian Development Bank

CURRENCY EQUIVALENTS

(as of 16 August 2016)

Currency unit	–	rupiah (Rp)
Rp1.00	=	$0.0001
$1.00	=	Rp13,115

ABBREVIATIONS

ACP	–	Asia Climate Partners
ADB	–	Asian Development Bank
DMC	–	developing member country
FAST	–	Faster Approach to Small Nonsovereign Transactions
MPA	–	master purchase agreement

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PROJECT AT A GLANCE

1. Basic Data — **Project Number:** 50227-001

Project Name	Distributed Energy Storage Solutions Project
Country	REG
Department /Division	PSOD/PSIF2

2. Sector	**Subsector(s)**	**ADB Financing ($ million)**
✓ Energy	Energy utility services	5.00
	Total	**5.00**

3. Strategic Agenda	**Subcomponents**	**Climate Change Information**	
Inclusive economic growth (IEG)	Pillar 1: Economic opportunities, including jobs, created and expanded	Mitigation ($ million)	5.00
Environmentally sustainable growth (ESG)	Global and regional transboundary environmental concerns	CO_2 reduction (tons per annum)	30,000
		Climate Change impact on the Project	Low

4. Drivers of Change	**Components**	**Gender Equity and Mainstreaming**	
Private sector development (PSD)	Promotion of private sector investment	No gender elements (NGE)	✓

5. Poverty Targeting		**Location Impact**	
Project directly targets poverty	No	Regional	High

6. Nonsovereign Operation Risk Rating - NA

7. Safeguard Categorization **Environment:** B **Involuntary Resettlement:** C **Indigenous Peoples:** C

8. Financing

Modality and Sources	**Amount ($ million)**
ADB	**5.00**
Nonsovereign Direct Investment: Ordinary capital resources	5.00
B-Loans	**0.00**
None	0.00
Official Cofinancing [a]	**0.00**
None	0.00
Others [b]	**0.00**
Total	**5.00**

[a] Concessional financing from external sources.
[b] Derived by deducting ADB financing, B Loans and Official Cofinancing from Project Total Cost.

I. INTRODUCTION

1. This is an eligible transaction under the Faster Approach to Small Nonsovereign Transactions (FAST) framework.[1] The transaction involves an equity investment of up to $5,000,000 in Fluidic (Fluidic) for the Distributed Energy Storage Solutions Project.

II. THE PROJECT

A. Project Identification and Description

2. **Project identification.** Affordable, reliable, and safe energy storage[2] is the untapped catalyst of distributed clean energy deployment throughout the developing world. The ability of energy storage to load shift, or move blocks of power generation across different periods, can help overcome the intermittency challenges associated with wind and solar power generation in remote areas, and reduce the power-on-demand advantage of diesel generation. As such, it is a key enabling factor for renewable energy integration, minimization of diesel power generation, and the resulting decarbonization of global energy.

3. Asia represents one of the largest opportunities to apply frontier energy storage technology to promote clean energy access. Developing Asia accounts for nearly half of the 1.2 billion people in the world who lack access to electricity.[3] However, universal electrification efforts are often hindered by the uneconomic and technically complex realities of connecting isolated rural areas to the grid, leading to significant proportions of installed power capacity being sourced from diesel generators, as they are in Indonesia (14%),[4] the Philippines (20%),[5] and India (over 20%).[6] Though diesel-fired generation requires a lower up-front investment than grid connection or other alternatives, it presents ongoing variable expenses and causes pollution. Considered together with its operational inefficiency and vulnerability to supply disruption, these issues demonstrate how diesel generation only provides a partial solution and curtails related progress in other areas like public health and telecommunications.

4. The need to couple energy access with clean energy development is implicit in the Sustainable Development Goals adopted in 2015, which target universal access to affordable, reliable, and modern energy, as well as an increased share of renewable energy in the global energy mix and improved realization of energy efficiency by 2030.[7] Renewable energy sources, like wind or solar, are increasingly becoming economically viable options for distributed generation systems given the decreasing costs of panels and turbines and the high baseline cost of electricity supply in diesel-reliant off-grid or weak-grid locations.[8] However, wind and solar intermittency limits total associated generation capacity to less than 10% of decentralized systems globally. Diesel gensets or gas engines provide the requisite balance of supply, cycling

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1 Asian Development Bank (ADB). 2015. *Faster Approach to Small Nonsovereign Transactions*. Manila.
2 Energy storage facilitates power demand and supply management by collecting energy for later discharge.
3 International Energy Agency. World Energy Outlook 2015 Electricity Access Database. http://www.worldenergyoutlook.org/resources/energydevelopment/ (accessed 16 August 2016).
4 State Electricity Company (PLN). 2015. *Statistik PLN 2014*. Jakarta (Table 21, diésel or dual-fuel rental gensets).
5 R.B. Aguilos. 2015. Investment Opportunities in the Philippine Energy Sector (presentation). 5th Asia–Singapore Infrastructure Roundtable. 21 October.
6 International Energy Agency. 2015. *India Energy Outlook 2015*. Paris.
7 United Nations. Sustainable Development Goals. http://www.un.org/sustainabledevelopment/energy/
8 International Renewable Energy Agency. 2015. Off-Grid Renewable Energy Systems: Status and Methodological Issues. Abu Dhabi. p. 3.

up and down to stabilize power output in calm weather or at night.[9] Stationary energy storage, like batteries, could facilitate the increased penetration of renewable energy in distributed systems by providing an alternative source for stabilization, thereby minimizing diesel genset or gas engine use. However, few energy storage solutions have demonstrated the combined long-duration performance, life-cycle cost, and safety to advance beyond proof of concept in off-grid and weak-grid applications.[10]

5. Formed in 2006, Fluidic is a privately owned, vertically integrated provider of distributed energy storage solutions that use proven rechargeable zinc-air battery technology with integrated smart-grid intelligence.[11] The company's mission is to develop lower cost, sustainable battery solutions to enable broad implementation of distributed clean energy systems. Fluidic was the first company to combine proprietary designs, chemistries, and smart electronic controls successfully to commercialize the first rechargeable zinc-air battery in 2011, prompting a step-change in affordability, safety, and application reach for energy storage.[12]

6. Fluidic is headquartered in Scottsdale, Arizona, United States, and launched commercial operations in 2011 after establishing manufacturing and assembly facilities in Bogor, Indonesia. Fluidic has since deployed over 100,000 batteries across remote sites in Southeast Asia and Latin America. The batteries demonstrated commercial and technological success even in the most rugged, warm, and pilferage-prone areas identified by telecom tower operators and micro-grid energy systems operators. On track to achieve operational profitability in 2017, the early-stage company is entering a growth phase backed by a large client book, a master purchase agreement (MPA) with Caterpillar (a world leader in the manufacturing of diesel and gas engines), as well as contracts and memoranda of understanding targeting the provision of energy storage for some of the largest rural electrification opportunities in Asia and the Pacific.[13] Fluidic approached the Asian Development Bank (ADB) through Asia Climate Partners (ACP)[14] to obtain financial support and benefit from ADB's knowledge and experience in the energy sector. The proposed ADB investment will provide institutional capital to secure Fluidic's execution capability as it makes critical inroads to the Asian telecom, micro-grid, and rural electrification markets.

7. **Project design.** Fluidic sells proprietary battery hardware and system controls, as well as monitoring, installation, maintenance, and financing services for pure zinc-air energy storage systems as well as hybrid systems (zinc-air batteries used in combination with third-party, lithium-ion batteries). Fluidic offers several standard business models and pricing structures that are aligned to its customers' needs. The most common model is a traditional capital expenditure sale, where the customer pays the full cost of the system up front and owns the equipment (Table 4 shows other variations). System sales are based on Fluidic's Generation 6 energy

[9] A. Dehamna and P. Asumus. 2014. Energy Storage for Micro-grids: Advanced Flow, Advanced Lead-Acid, Advanced Lithium Ion, and Sodium Metal Halide Batteries and Flywheels for Grid-Tied and Remote Micro-grid Applications. *Navigant Research*. p. 7.

[10] ADB. 2015. *Achieving Universal Electricity Access in Indonesia*. Consultant's report. Manila (TA 8287-INO). p. xiii.

[11] Rechargeable zinc-air batteries use a reversible chemical reaction between zinc and oxygen (from ambient air).

[12] While zinc-air batteries have been in use for over 100 years in marine and railway signaling devices and as batteries for cameras and hearing aids, the technical hurdles of recharging the batteries limited widespread deployment. Source: Sargent & Lundy. 2015. *Final Energy Due Diligence*. Technical advisor's report. Chicago.

[13] Fluidic battery systems will be integrated into (i) Indonesia's Bright Indonesia Rural Electrification Program (under development), and (ii) three village electrification contracts with Indonesia's Ministry of Energy and Mineral Resources (already contracted). The company is looking to develop similar opportunities in Bangladesh and the Philippines.

[14] ACP is a joint initiative of ADB, ORIX, and Robeco to make private equity investments in the clean energy, resource efficiency, and environment sectors in Asia.

module, which can store 6 kilowatt-hours of energy and deliver 750 watts power for 8 hours. The module is made up of several rechargeable zinc-air battery cells, each of which represents average energy capacity of 0.575 kilowatt-hour. A zinc-air cell comprises (i) two air cathodes separated by a zinc anode in between, (ii) casing for the battery cell with a lid, (iii) an electrical board over the lid that provides remote control and monitoring capabilities, and (iv) an aqueous and alkaline electrolyte. Each system comprises multiple modules stacked on shelves in a steel cabinet. Fluidic also combines the benefits of its zinc-air technology with the strengths of other batteries. Applications that require both high energy capacity and high power capacity will typically use a hybrid solution with two technologies: (i) Fluidic's zinc-air battery cells (for reliable long duration discharge); and (ii) power modules consisting of third-party, lithium-ion cells that enable short-term high-power draws (e.g., to smooth intermittencies from renewable power generation).

[CONFIDENTIAL INFORMATION DELETED]

8. **Ancillary services.** Fluidic's proprietary electric control system (FluidicIQ) enables the batteries to adjust to site energy requirements automatically, deliver optimal energy savings, and prompt targeted cell-level maintenance. FluidicIQ also provides monthly performance summary reports detailing items like power availability, uptime, and grid outage profiles to clients—a service that clients identify as a key differentiating factor in Fluidic's value proposition. FluidicIQ monitoring also bolsters the company's capacity to offer long-term performance guarantees, with various options for limited and extended warranties. Extensions require Fluidic involvement or affiliation in operation and maintenance. Fluidic also enters into service level agreements that guarantee the delivery of auxiliary power during an outage (system availability).

9. **Manufacturing and product evolution.** Fluidic manufactures air cathode screens in Scottsdale, United States, and produces and assembles the zinc anodes in Bogor, Indonesia.[15] The company operates a single production line in Indonesia, with two shifts per day, to produce its requirements. [CONFIDENTIAL INFORMATION DELETED].

10. **Business plan.** Fluidic's strategy targets two market segments: (i) telecom tower operators, and (ii) micro-grids and rural electrification. [CONFIDENTIAL INFORMATION DELETED] About half of the orders came from telecom customers, and most of the remaining amount is attributable to a tender awarded by Indonesia's Ministry of Energy and Mineral Resources for rural electrification. [CONFIDENTIAL INFORMATION DELETED]

11. Based on repeat orders from existing customers, as well as new orders placed in the first half of 2016 and anticipated for 2017, Fluidic projects sales to increase and then grow thereafter until 2019. [CONFIDENTIAL INFORMATION DELETED] Independent market assessments have confirmed the sizeable nature and growth trajectory of the target segments. The assessments have also validated Fluidic's capacity to establish market share given its existing commercial traction and technology development plans. The energy storage market for telecom towers located in off-grid or weak-grid locations is expected to be $6.0 billion or $1.5 billion per annum until 2020. The micro-grid and rural electrification markets are expected to grow significantly as well, especially in Asia, averaging $2.5 billion annually until 2020. In the medium term, Fluidic could also enter other segments with similar profiles (i.e., residential, commercial, and industrial energy storage), doubling the potential market for applications.

[15] The air cathode manufacturing remains in Scottsdale to secure proprietary materials and processes.

12. **Demonstrated advantage.** After 5 years of commercial operation, the company demonstrates a record of high performance and strong customer retention, with a proven advantage over competing solutions (e.g., lead-acid battery and diesel generation) for target applications. Based on more than 750,000 recorded cycles of charging and discharging for all its batteries as of May 2015, Fluidic reports high uptime reliability exceeding 99.9%. [CONFIDENTIAL INFORMATION DELETED]

13. Fluidic's patent-protected technology offers the most cost-competitive and reliable solution for remote power applications that require long duration discharge and up to 72 hours of autonomy. [CONFIDENTIAL INFORMATION DELETED] Rechargeable zinc-air batteries can offer higher storage capacity at lower cost because they use (i) oxygen from ambient air; and (ii) zinc, a cheaper and more abundant commodity than alternatives like lithium, manganese, or lead. As such, the unit cost of zinc-air batteries ($/kWh) decline continuously with 4–24 hours of discharge, while lead-acid and lithium-ion batteries become significantly more expensive as energy storage needs exceed 4 hours.[16] In addition, Fluidic zinc-air battery life is independent of temperature (0-50ºC), humidity, number of cycles (charging and discharging), or nature of discharge (i.e., battery continues to operate at high efficiency even when repeatedly fully discharged).[17] Theft or safety are not issues, as the main element (zinc) is nontoxic, easily recyclable, has limited resale value. Other energy storage solutions represent: (i) frequent or complex maintenance or replacement (such as lead-acid and sodium-sulfur batteries), (ii) expensive or energy-intensive auxiliary systems (like cooling or humidity control for lithium-ion), (iii) safety risks (e.g., lithium-ion, sodium-sulfur), (iv) use of toxic materials (lead-acid), and (v) high likelihood of theft (e.g., lead-acid, diesel). As such, these solutions are less suited for off-grid and rural deployment.

14. **The sponsor.** Fluidic was formed in 2006 by Cody Friesen, a professor of materials science at Arizona State University, who led the initial technology development with early investments from True North 2 and Madrone Capital Partners, experienced clean technology investors. The current shareholders include the founders, senior management, several family offices, the International Finance Corporation, and strategic partners, Caterpillar and Flextronics. [CONFIDENTIAL INFORMATION DELETED]

15. Fluidic is an established company with over 200 employees and a management team and board that have been in the clean energy sector since the late 1990s. Steve Scharnhorst was appointed as chief executive officer in 2015 and is supported by a strengthened management team with experience across a variety of fields including clean technology, global manufacturing, supply chain management, and remote power generation. [CONFIDENTIAL INFORMATION DELETED]

16. **Incorporation.** Fluidic is a Delaware corporation established on 16 October 2008 and has a 90% ownership interest in Fluidic Indonesia. [CONFIDENTIAL INFORMATION DELETED] The ADB review of the entity does not give ADB cause to believe that such entity has been established, or is being used for cross-border tax evasion, money laundering, or terrorism financing in the jurisdictions involved in the project.

[16] Diesel power generation, another alternative, often constitutes up to 60% of annual operating expenses for telecom tower companies because of the high costs of diesel purchase and transport to remote areas.
[17] [CONFIDENTIAL INFORMATION DELETED]

B. Development Impact, Outcome, and Output

17. **Impact.** The project will contribute to regional progress in achieving Sustainable Development Goal 7: Expanding universal access to affordable, reliable, and modern energy services by 2030 (see footnote 7). If more service providers (e.g., telecom operators) use clean energy and more modern rural electrification projects are implemented, sustainable, distributed energy solutions will enhance quality of life and drive increased economic activity across the region. The project will play a pioneering role in demonstrating the commercial viability of distributed energy storage in Asia and the Pacific—encouraging more investment in energy storage and renewable energy across ADB's developing member countries (DMCs).

18. **Outcome and output.** The outcome will be the provision of long-duration battery storage solutions through the private sector. The project will contribute to increased avoidance of carbon dioxide equivalent emissions of at least 30,000 metric tons annually from energy storage installation alone and provide at least 280 jobs in zinc anode production and energy storage system assembly in Indonesia by 2020. The output will be the installation of distributed energy storage systems.

C. Alignment with ADB Strategy and Operations

19. **Consistency with ADB strategy and country strategy.** The project is closely aligned with ADB's Strategy 2020 and Strategy 2020 Midterm Review, both of which underscore ADB's aim to reduce poverty and improve living conditions and quality of life by expanding private sector development and promoting environmentally sustainable models through projects that address climate change challenges.[18] ADB's country partnership strategies for various ADB DMCs (e.g., target DMC, Indonesia) echo the themes of the energy policy, including the promotion of energy security and environmentally sustainable economic development.[19]

20. **Consistency with sector strategy and relevant ADB operations.** The project is consistent with ADB's Energy Policy, which supports wider access to energy through investments in energy efficiency and renewable energy projects.[20] The project will contribute to ADB's new internal goal of $6 billion in annual financing for climate mitigation and adaptation by 2020, as well as catalyze further private sector resources in the clean energy sector.[21]

[CONFIDENTIAL INFORMATION DELETED]

D. Implementation Arrangements

21. Table 4 summarizes the implementation arrangements.

Table 4: Summary of Implementation Arrangements

Aspects	Arrangements
Regulatory framework	As Fluidic does not seek government subsidies for its products and can sell to private or public entities, off-grid energy policy and regulatory changes have had a limited impact on the business.
Management	With more operational expertise in global supply chain management and sales and distribution,

[18] ADB. 2008. *Strategy 2020: The Long-Term Strategic Framework of the Asian Development Bank, 2008–2020*. Manila; and ADB. 2014. *Midterm Review of Strategy 2020: Meeting the Challenges of a Transforming Asia and Pacific*. Manila.
[19] ADB. 2014. *Interim Country Partnership Strategy: Indonesia, 2015.* Manila.
[20] ADB. 2009. *Energy Policy.* Manila.
[21] Of the $2.5 billion in clean energy financing ADB approved in 2015, 48% ($1.2 billion) was through ADB's Private Sector Operations Department.

Aspects	Arrangements
	Fluidic's strengthened management team is more secure in its path to profitability as it transitions its focus from research and technology to marketing and business development.
Implementation period	[CONFIDENTIAL INFORMATION DELETED]
Revenue structure	[CONFIDENTIAL INFORMATION DELETED]
Major cost structure	[CONFIDENTIAL INFORMATION DELETED]
Key customers and partners	[CONFIDENTIAL INFORMATION DELETED]
Performance monitoring	Fluidic will monitor the project's financial performance, development impacts (output and outcome indicators), and safeguards compliance; and will report to the Asian Development Bank at least on an annual basis.

Sources: Fluidic and Asia Climate Partners.

E. Projected Financial and Economic Performance

[CONFIDENTIAL INFORMATION DELETED]

III. THE ADB ASSISTANCE

[CONFIDENTIAL INFORMATION DELETED]

IV. POLICY COMPLIANCE

A. Safeguards and Social Dimensions

22. In compliance with ADB's Safeguard Policy Statement (2009), the project is classified as category B for environment, and category C for both involuntary resettlement and indigenous peoples. As ADB funds will be used to support the production and deployment of energy storage, but are not earmarked for financing specific subprojects, this transaction is considered to be general corporate finance. An environmental and social compliance audit was conducted on the two existing manufacturing facilities to identify potential environmental and social impacts of current facility operations. The audit findings and recommendations form the basis of the corrective action plan to avoid, minimize, mitigate, and compensate for any adverse impacts. Fluidic has committed to corrective action plan implementation through the establishment of an environmental and social management system to improve its environmental and social practices and procedures and strengthen its institutional capacity to manage its social and environmental impacts. Fluidic will comply with national labor laws and, pursuant to ADB's Social Protection Strategy (2001), will take measures to comply with the internationally recognized core labor standards.[22] Fluidic will report regularly to ADB on (i) its compliance with such laws, and (ii) the measures taken. Information disclosure and consultation with affected people will be conducted in accordance with ADB requirements.

B. Anticorruption Policy

34. Fluidic was advised of ADB's policy of implementing best international practice relating to combating corruption, money laundering, and the financing of terrorism. ADB will ensure that the investment documentation includes appropriate provisions prohibiting corruption, money laundering, and the financing of terrorism, and remedies for ADB in the event of noncompliance.

[22] ADB. 2003. *Social Protection*. Manila (adopted in 2001).

C. Investment Limitations

35. The proposed equity investment is within the medium-term, country, industry, group, and single-project exposure limits for nonsovereign investments.

D. Assurances

36. Consistent with the Agreement Establishing the Asian Development Bank (the Charter),[23] ADB will proceed with the assistance upon establishing that the Government of Indonesia has no objection to the assistance to Fluidic, ADB will enter into suitable investment documentation, in form and substance satisfactory to ADB.

V. THE PRESIDENT'S DECISION

37. The President, acting under the authority delegated by the Board, has approved the equity investment of up to $5,000,000 from ADB's ordinary capital resources in Fluidic, Inc. for the Distributed Energy Storage Solutions Project, and hereby reports this action to the Board.

13 September 2016

[23] ADB. 1966. *Agreement Establishing the Asian Development Bank.* Manila.

DESIGN AND MONITORING FRAMEWORK

Impact the Project is Aligned With
Sustainable Development Goal 7.1: Universal access to affordable, reliable, and modern energy services ensured[a]

Results Chain	Performance Indicators with Targets and Baselines	Data Sources and Reporting Mechanisms	Risks
Outcome Long-duration battery storage solutions through the private sector provided	By 2020: a. Annual amount of emissions reductions achieved at least 30,000 metric tons of carbon dioxide equivalent (2015 baseline: 0) b. Number of local full-time equivalent jobs provided during operation in Indonesia amount to at least 280 (2015 baseline: 168) c. Total payments provided to government during operation at least $4 million (2015 baseline: Not applicable)	a.–c. Company's annual financial statements a.–c. ADB's annual monitoring report	Supplier disruption or unplanned plant maintenance causes less-than-planned battery production Caterpillar Master Purchase Agreement terminated
Output 1. Distributed energy storage systems installed	By 2019 1a. Minimum of 500 megawatt-hours of energy storage solutions contracted (2015 baseline: Not applicable)	1a. Company's annual financial statements 1a. ADB's annual monitoring report	Weak battery demand resulting from adverse macroeconomic shock
Key Activities with Milestones 1. Distributed energy storage systems installed 1.1 Complete execution of legal documentation by 31 September 2016. 1.2 Prepare and adopt environmental and social management system in accordance with ADB's Safeguard Policy Statement (2009) requirements for General Corporate Finance by 31 September 2016. 1.3 Fulfill conditions precedent for first disbursement by 31 September 2016.			
Inputs [CONFIDENTIAL INFORMATION DELETED]			
Assumptions for Partner Financing Not applicable			

ADB = Asian Development Bank.
[a] United Nations. Sustainable Development Goals. http://www.un.org/sustainabledevelopment/energy/
Source: Asian Development Bank.