Global Energy Storage Program (GESP)

Indicative Pipeline and Monitoring and Reporting Approach

Table of Contents

1. Starting the Global Energy Storage Program

The Global Energy Storage Program (GESP), as decided in the June 2019 CTF Trust Fund Committee (CTF/TFC.22/7) meeting, was established to make concessional climate finance available for all CIF countries, working through partner MDBs, to support them in accelerating the deployment of a range of energy storage solutions to scale up renewable energy development.

GESP was established as a separate thematic window under the CTF, along the lines of the Dedicated Private Sector Program (DPSP). GESP focuses on energy storage, which likely will play a critical role in moving the world toward a clean energy transformation by smoothly integrating renewable energy into existing and developing power grids, increasing the penetration of renewable energy into power systems, creating a more flexible and reliable grid system, improving energy access, and promoting the electrification of different economic sectors. Deployment of storage technology is a logical next step to further accelerate decarbonization efforts in developing countries where other non-carbon flexible energy resources are unavailable, prohibitively expensive, or otherwise not viable.

While the initial proposal for the program was narrowly focused on battery storage, the decision adopted by the CTF TRUST FUND COMMITTEE explicitly asks for a more expansive consideration of energy storage solutions that can lead to the type of transformational change that the CTF aims to foment. Catalysts to such change include a range of energy storage technologies that could be economic for short, medium, and long-duration storage across the breadth of CIF countries. Additionally, the TRUST FUND COMMITTEE decision calls for special attention to be paid to issues of sustainable sourcing, supply chain risks, and end-of-life disposal or reuse/recycling of storage components.

This document presents the indicative pipeline for GESP as of October 2020 and the monitoring and reporting arrangements that have been developed. Once this document is approved by the Trust Fund Committee by decision-by-mail, programming can commence.

2. Pipeline

2.1 Pipeline management and timeline for implementation

The MDBs, in coordination with the CIF Administrative Unit, have generated an indicative list of 26 pipeline projects worth about $910 million in potential programming. This list will be actively maintained, and the Trust Fund Committee will be periodically updated with any major developments. MDBs may replace projects in their own pipelines if more fruitful opportunities arise and there are sufficient resources. If more resources become available, we anticipate a much more ambitious program could spur the pipeline to grow substantially and could easily amount to several billion dollars in operations. Such ambition would drive the program closer to transformational change in VRE uptake across a wide range of countries while also complimenting efforts in other CIF programs.

MDBs will submit project and program proposals to the Trust Fund Committee for funding approval following the approval of this document. The large amount of financing requested in the indicative pipeline means that the program will be oversubscribed in the first phase of its execution. The CIF AU will work with the MDBs to prioritize projects based on readiness, innovation, and scalability, considering contributor preferences. Possible complementarity

between the GESP pipeline and the future Renewable Energy Grid Integration, Accelerating Coal Transition, and Industrial Decarbonization programs may be addressed at a later date. Similarly, the phase out date of GESP will be determined after programming has been underway for at least 12 months.

While guidelines that have been approved by the Trust Fund Committee under the CTF Pipeline Management and Cancellation Policy (from August 2016) currently apply, GESP will be subject to future changes to pipeline management policies approved by the Trust Fund Committee.

Table 1. Indicative Project Pipeline for GESP

Countries	Public/ Private	Project Title	Type of Technology	MDB	CTF funding (USD M)
Bangladesh	Public/ Private	Electricity Distribution Modernization Program	Battery	WB	20
Benin	Public/ Private	Battery Storage Systems and Synchronization	Battery	WB	50
Cambodia	Public	Cambodia Battery Storage Project	Battery	ADB	20
Colombia	Public/ Private	Promoting the Energy Transition from Hydrocarbons to Green Hydrogen for Power Generation and Storage	Green hydrogen	IDB	14.96
Global	Public/ Private	IFC Global Energy Storage Program	Battery	IFC	101
Haiti	Public	Energy Storage to Support the Supply of Renewable Energy to the Northern Region, Haiti	Battery	IDB	3.15
Honduras	Public	Energy Storage to Support Innovative Solutions for Health Service Delivery	Battery	IDB	0.53
India	Public	Battery Storage at distribution substations	Battery	ADB	40
India	Public/ Private	Program for Transformative Mobility and Battery Storage	Battery	WB	65
Indonesia	Public/ Private	Sustainable Least-Cost Electrification Project	Battery	WB	100
Maldives	Public	Additional Financing for Preparing of Outer Islands for Sustainable Energy Development (POISED)	Battery	ADB	15
Mali	Public/ Private	Regional Hybrid Solar PV and Storage Park	Battery	WB	30
Multinational	Public/ Private	Africa Green Baseload Program	Multiple	AfDB	50
Multinational	Public/ Private	Facility for Energy Inclusion – Distributed Energy Storage	Battery	AfDB	10
Multinational	Public	Hydropower Improvement Facility for Southern Africa	Hydropower	AfDB	30

Multinational	Public/ Private	Pumped Energy Storage Facility	Pumped storage hydro	AfDB	43.50
Regional	Public	Regional Challenges for Local Start-ups focused on Providing Energy Storage Solutions for LAC	Multiple	IDB	4.8
Regional	Public	EBRD-CTF energy storage framework	Multiple	EBRD	83
Regional	Public/ Private	Large-scale Battery Energy Storage Systems to increase the penetration of variable renewable energy in Central America	Battery	IDB	16.05
Regional	Public/ Private	Energy Storage Policy Support Program	Multiple	IDB	2.99
Regional	Public	Pacific Battery Storage Program	Battery	ADB	20
Tunisia	Private	Dispatchable Solar Power	Multiple	WB	50
Ukraine	Public	Facilitating Power System Integration with Europe	Battery	WB	35
Vietnam	Public/ Private	EVN's Battery Energy Storage System for Primary Frequency Control and Regulation	Battery	ADB	25
Vietnam	Public/ Private	Renewable Energy Accelerating Change Project	Battery	WB	40
Vietnam	Private	Pumped-Storage for Renewable Integration Project	Battery	ADB	40
	TOTAL				**909.97**

3. Monitoring and Reporting

The monitoring and reporting framework for GESP was finalized in close collaboration with CIF's donors and partner MDBs, including a detailed consultative process for deciding the underlying indicators through which project performance will be tracked. This was concluded via an iterative process, including discussions on both the applicability of indicators and their definitions as relate to GESP. Sections 3.1-3.6 below delineate the overall approach and objectives of the Montioring and Reporting (M&R) system, along with the mandatory and optional indicators as decided in consort with CIF's partners. Given that GESP sits within the CTF, the list of indicators for annual reporting includes three of the CTF core indicators that remain applicable for GESP (section 3.3), and three GESP-specific indicators (section 3.4), alongside a list of possible optional project-specific and co-benefit indicators (sections 3.5 and 3.6).

The CIF will be issuing a GESP M&R toolkit that provides detailed definitions and measurement methodologies of the indicators, and guidance on reporting processes. Reporting of results will be conducted via the CIF Collaboration Hub (CCH), with related guidelines also provided within the M&R toolkit. Alongside usual annual reporting processes, the CIF will also undertake real-time monitoring of the GESP portfolio, such that it allows on-going, mid-course learning that aids project implementation, and informs course-corrections where necessary. Under CIF's

learning stream on the Social and Economic Development Impacts of Climate Investments, economic modeling tools and mixed methods evaluations may be utilized to estimate and analyze the broader social and economic development outcomes of program once sufficient portfolio data becomes available.

3.1 Rationale

The reason for developing a M&R system for GESP is to be able to measure progress made and to determine whether and to what extent the GESP interventions achieve its main objective, which is the 'accelerated deployment of energy storage systems'. GESP projects/programs are also expected to contribute to CTF's objectives, and the M&R system will also assess progress against the expected CTF program outcomes:

(a) Avoided greenhouse gas (GHG) emissions[1]

(b) Increased finance for low carbon development mobilized

(c) Increased supply of renewable energy (RE)

The overall country-level impact objective of CTF programs like GESP, which is measured by these outcomes, is a transformed national low carbon economy. GESP, along with other CTF projects/programs implemented in target countries, will contribute to these results through programs and projects that build infrastructure, develop capacity, and provide financing. These programs and projects will produce significant co-benefits, such as improved opportunities for women, improved health and enhanced energy access. Investments in renewable energy and energy storage systems will increase countries' energy capacity in general and diversify their national energy mix, thereby reducing the costs of renewable energy and storage systems and increasing energy security.

It is also assumed that the activities under the GESP, along with other CTF projects and programs, will result in stronger consideration in national planning of the impact of decisions (especially in the energy sector) on GHG emissions. Furthermore, the combined effects of the increase in renewable energy, and energy storage systems are expected to increase access to energy. Finally, it is expected that CTF and GESP investments will have positive employment effects and thereby contribute to reduced poverty. CTF and GESP's theory of change is shown in Annex 1 of this document.

3.2 M&R Approach

As the delivery of climate financing evolves, so does the impetus to capture, analyze and learn from real-time and empirically robust data. Real-time monitoring will be done for GESP, based on a more active results data monitoring system. This is relevant to ensure that the program stays committed and accountable to its core objectives, informs decision-making and demonstrates progress toward national, regional, and international goals. It is also relevant to ensure that the activities pursued under this program are able to take pulse, course-correct, and maximize impacts for the most urgent issues of energy storage.

The CIF Admin Unit will monitor and report on CTF and GESP's contributions to the expected results, as outlined in the program's Theory of Change. Implementing MDBs will collect, aggregate, and report data annually on these indicators for all approved projects or programs.

[1] Measured in $MtCO_2e$

Over time, actual results—annual and cumulative—will reflect CTF and GESP's true impact on the ground.

At the two-year mark, a stocktaking will take place to ensure that learning and uptake is progressing as planned, as well as to assess the quality of the M&R framework under implementation.

MDBs should continue to provide information on the relevant indicators for all GESP projects/programs or sub-projects for private sector programs that are being implemented as is done for CTF. Each project and program, once under implementation, should also report on other relevant progress and achievements on an annual basis[2].

As explained in this section, the CIF Admin Unit will collect additional information, in order to prepare case studies, evaluations, research publications, or in-depth analysis on particular issues of interest. For example, one of the subjects that may be the main theme of a case study is the carbon footprint of an Energy Storage System. CIF remains committed to serving as a learning laboratory for scaled-up climate finance through its new action areas. To maximize synergies and ensure cost-efficiency, these activities and any information gathered will, wherever possible, be used as a basis for/or build on and be integrated with the CIF Evaluation and Learning (E&L) initiative, including studies implemented through the CIF E&L initiative as per its recently-approved FY20-22 Business Plan and annual work plans. These additional studies or analyses will complement the results reporting described here with additional breadth and depth of evidence for learning. The GESP M&R and E&L activities will also be underpinned and supported by strong knowledge management and communications, and will ensure that results are tracked, and lessons are learned to inform future decisions and investments in these areas, to the benefit of both CIF and the wider climate finance architecture.

The transformational change aspect of the GESP will be assessed through qualitative co-benefit indicators as well as reviews and studies conducted by the CIF M&R team. In addition, the E&L workstream will include the GESP in its regular evaluation program once implementation has advanced sufficiently to undertake meaningful evaluations.

The proposed list of indicators for the GESP is presented below. The table in Annex 1 shows how indicators are linked to each expected result in the GESP Theory of Change.

3.3 CTF Core Indicators

The M&R system for the GESP will be applied as per the current CTF Results Framework and M&R Toolkit[3]. MDBs should provide information on the core indicators shown below for all projects/programs or sub-projects that are being implemented.

- *B1. Tons of GHG emissions reduced or avoided*[4]

[2] Using when possible material and reports from the MDBs' own internal systems in place, such as project logframes with targets and actuals, supervision mission reports, progress reports, mid-term reviews etc.
[3] The CTF has five core indicators: B1. Tons of GHG emissions reduced or avoided; B2. Volume of direct finance leveraged through CTF funding ; B3. Installed capacity (MW) as a result of CTF interventions; B4. Number of additional passengers using low carbon public transport as a result of CIF intervention; and B5. Annual energy savings as a result of CTF interventions (GWh). However, in the GESP program only the first three (B1, B2 and B3) are applicable. Indicators on transportation and energy savings are not included, as they are not relevant for the GESP scope.
[4] Measured in tons of CO_2e

- *B2. Volume of direct finance leveraged through CTF funding- disaggregated by public and private finance*
- *B3. Installed capacity (MW) as a result of CTF interventions*[5]

As compared to investments in renewable energy or energy efficiency, the connection between investments in storage and GHG emission reductions (as well as with additional renewable energy capacity) is more indirect. Energy storage systems enable a higher integration of renewable energy in the grid (often in the future) and this in turn leads to GHG emission reductions, compared to a scenario without energy storage. MDBs will calculate the expected GHG emissions reductions using modeling tools and additional expected renewable energy capacity, disclose any key underlying assumptions, and report on these indirect outcomes.

MDBs will work with the CIF AU to develop a dedicated M&R toolkit for this program.

3.4 GESP specific indicators

In addition, GESP projects/programs are required to report on the following storage- specific indicators, as outlined in the project template:

GESP1. Energy rating (MWh)

The *energy rating, or energy storage capacity,* of the energy storage system indicates the amount of energy that can be stored. The energy rating is the measure of *how much* electricity the system can deliver or absorb.

GESP2. Power capacity (MW)

The power capacity indicates how much power can flow into or out of the energy storage system in any given instant.

GESP3. Regulations, codes or standards for energy storage solutions issued

Number of policies and regulations related/relevant to energy storage that are adopted and implemented by client countries. Information reported under this indicator helps illustrate whether an enabling environment at the regulatory level has been supported through GESP interventions. Not all GESP projects will include indicators directly measuring regulations, codes or standards for energy storage adopted; hence, this indicator should only be reported on if and when relevant.

The CIF Admin Unit will aggregate results from GESP-specific indicators and will report them in the annual results report.

3.5 Project-specific indicators

Also, the GESP will include additional optional indicators, specifically tailored to the corresponding projects. Some examples include:

- *Number of Innovative Energy Storage and Renewable Energy Subprojects Implemented.* This indicator refers to the number of GESP subprojects including energy storage and

[5] It must be noted that for this CTF Indicator, the projects would have to report the RE installed capacity directly associated with the energy storage investments. For indirect RE installed capacity enabled, system studies results must be referred to provide the enabling RE capacity through the energy storage investments, compared to a scenario without storage.

renewable energy systems, which represent an innovation to the context where they are being implemented.

- *Number of Types of Innovative Energy Storage and Renewable Energy Solutions Demonstrated.* This indicator refers to the number of energy storage and renewable energy systems, which represent an innovation to the context where they are being implemented, that have been tested and demonstrated its effectiveness.
- *Increase in RE from innovative applications (kilowatt-hour per year (kWh/year)).* This indicator refers to the additional consumption of renewable energy, thanks to energy storage systems.
- *Improved enabling environment suitable for scaling up innovative solutions.* This refers to how GESP interventions have supported the development of favorable conditions for energy storage solutions to continue to grow in the country where the project/program is being implemented. This qualitative indicator is linked to the establishment of a regulatory environment, and to the adoption of energy storage policies (GESP3).
- *Number of knowledge products/technical studies prepared.* This indicator refers to publications and communication materials prepared on energy storage systems.
- *Capacity of mini-grids installed (MW).* This indicator refers to the installed capacity through mini-grids based on renewable generation that the program is supporting, measured from the generation side.
- *Capacity of distributed storage applications (MW).* This indicator refers to the installed capacity of storage systems installed in end-user facilities, such as public services, industries, households, or businesses.

The CIF Admin Unit will aggregate results from project-specific indicators and will report on these in the CIF annual results reporting. The MDBs will supply the CIF Admin Unit with the full and detailed log frames of the individual projects, as well as with progress reports or implementation status reports from each of the projects on a rolling basis as these are produced as part of the MDBs' internal systems.

3.6 Co-benefit indicators

Co-benefit indicators will help demonstrate wider benefits of energy storage projects. In line with the overall CTF monitoring and reporting toolkit, it is required that one or more co-benefit indicator is identified during the design of a project and integrated into the results-based log frame for each project/program financed under the GESP. Co-benefits provided by the GESP will be measured through quantitative and qualitative indicators.

Reporting on development co-benefits should be done when appropriate, preferably annually, and is a formal reporting requirement. Input data for co-benefit indicators will come from MDBs and the CIF AU. For quantitative indicators, data will be drawn from MDBs at the project level. Qualitative indicators will be mainly assessed through research and stakeholder engagement conducted by the CIF AU.

Quantitative indicators will be added to the annual report that MDBs fill out and share with the CIF Admin Unit on an annual basis. Some examples of quantitative co-benefit indicators include:

- *Gender:* Percentage of women in total workforce of company implementing energy storage systems. Percentage of women in technical departments of company implementing energy storage systems.
- *Employment:* Number of jobs created (disaggregated by sex).
- *Energy access:* Number of people who gain access to energy through a new system with energy storage or an increase in electricity supply through energy storage (directly and indirectly).

The CIF Admin Unit will aggregate data from all GESP projects/programs and will report at the portfolio level in the annual results report. In addition, this information will also be used to develop theme-specific reports, such as on gender or health aspects of energy storage projects.

Alongside real-time monitoring, the CIF Admin Unit will also utilize economic modeling tools to estimate larger impacts of the portfolio, building on work currently being done within the CIF learning stream on the Social and Economic Development Impacts of Climate Investments. Analysis has thus far been conducted on the CTF and SREP portfolios, and lessons learnt there will feed the commensurate analysis of the GESP portfolio, when such data is available. The overall objective of the learning stream, utilizing economic modeling and mixed method evaluations where suitable, is to understand the social and economic development outcomes linked to CIF-provided climate finance.

Qualitative indicators will be measured mainly through desk and field research, case studies, evaluations and stakeholder engagement, conducted by the CIF AU. These will assess progress on the qualitative co-benefit indicators at the portfolio level. These indicators will be used to report more descriptive types of results in the GESP Theory of Change (See CTF and GESP Theory of Change in Annex 1), and help 'tell a story' about the transformational change promoted through GESP interventions. Most of these indicators help assess progress at the transformational impact level of GESP's results chain. The GESP qualitative co-benefit indicators include:

- Contribution of GESP to catalyzing deployment of renewable technologies;
- Degree to which GESP is contributing to improved system flexibility;
- Degree to which GESP is contributing to an increase in national energy security and a reduction in generation capacity requirements;
- Degree of demonstration and replication effects for investors in energy storage systems, including through the establishment of a regulatory and enabling environment.

Progress on these will help the CIF Admin Unit determine how likely GESP outcomes are to be achieved. With this body of evidence, the CIF Admin Unit will prepare one or two case studies per year, reviews or assessments, and communication products, such as blog posts and other digital communication materials.

Figure 1 below summarizes the four groups of indicators required for GESP reporting. Parties responsible for providing the data input for each indicator group – MDBs through their annual reports and CIF Admin Unit through desktop and field research and stakeholder engagement are shown too. The figure shows the result products and deliverables that will be prepared with the collected data – Annual Results Report and Theme-specific reports, case studies, reviews or assessments – and communication products.

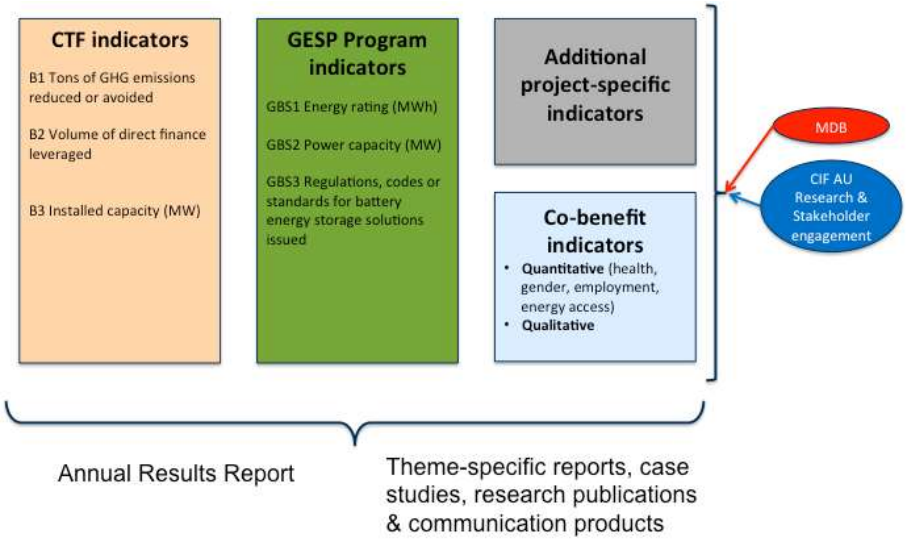

Figure 1. Indicators required for GESP

GESP's expected impacts, outcomes and outputs and their corresponding indicators are aligned with ESMAP's Energy Storage Program[6].

[6] https://www.esmap.org/energystorage

Annex 1: Theory of Change for CTF and GESP Results Framework

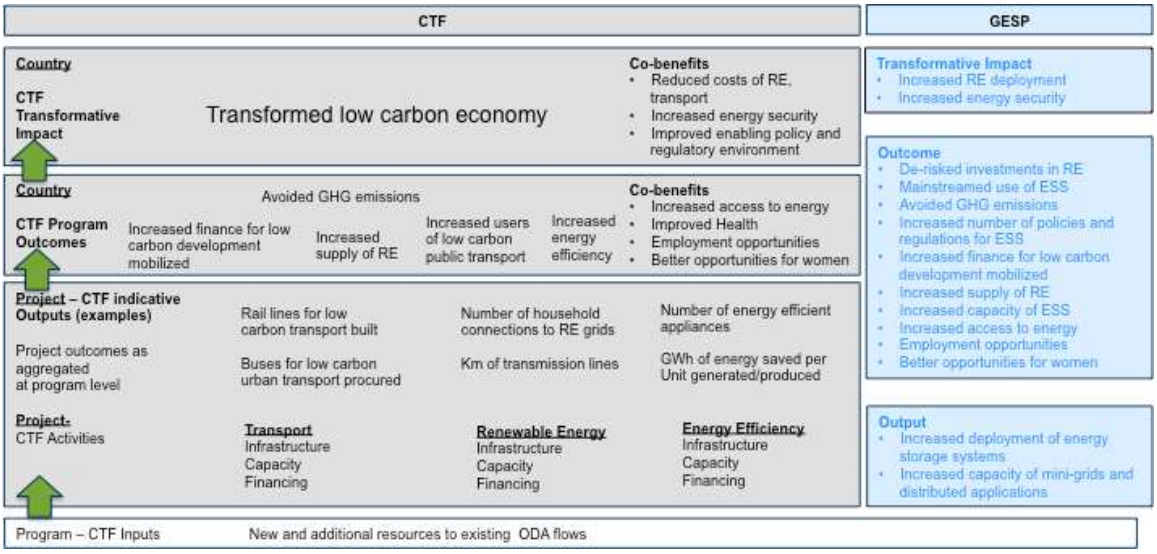

Table of Proposed Indicators for GESP Projects

GESP Transformative impact	**GESP Indicators**
Increased RE integration in the power system	Co-benefit indicator: • Contribution of GESP to catalyzing deployment of renewable technologies; • Degree to which GESP is contributing to improved system flexibility
Increased energy security *(also CTF)*	Co-benefit indicator: • Degree to which GESP is contributing to improved system flexibility; • Degree to which GESP is contributing to an increase in national energy security and a reduction in generation capacity requirements;
GESP Outcomes	**GESP Indicators**
De-risked investments in RE	Co-benefit indicator: • Degree of demonstration and replication effects for investors in energy storage systems, including through the

	establishment of a regulatory and enabling environment.
Mainstreamed use of energy storage systems	Project specific indicators: • *Increase in RE from innovative applications (kilowatt-hour per year (kWh/year)).* Number of knowledge products/technical studies prepared.
Avoided GHG emissions	B1. Tons of GHG emissions reduced or avoided
Increased finance for low carbon development mobilized	B2 Volume of direct finance leveraged (disaggregated between private and public)
Improved enabling policy and regulatory environment *(also CTF)*	Project-specific indicators: • Improved enabling environment suitable for scaling up innovative solutions. GESP3. Regulations, codes or standards for energy storage solutions issued
Increased supply of RE	B3 Installed capacity (MW) as a result of CTF interventions
Increased capacity of energy storage systems	GESP1 Energy rating (MWh) GESP2 Power capacity (MW)
Increased access to energy *(if/when relevant)*	Co-benefit indicator: • Number of people who gain access to energy through a new system with energy storage
Employment opportunities *(if/when relevant)*	Co-benefit indicator: • Number of jobs created for men and women
Better opportunities for women *(also CTF) (if/when relevant)*	Co-benefit indicators: • Percentage of women in total workforce of company implementing energy storage systems

	• Percentage of women in technical departments of company implementing energy storage systems.
GESP Outputs	**GESP Indicators**
Increased deployment of energy storage systems	Project specific indicators: •Number of Innovative Energy Storage and Renewable Energy Subprojects Implemented •Number of Types of Innovative Energy Storage and Renewable Energy Solutions Demonstrated.
Increased capacity of mini-grids and distributed applications	Project specific indicators: • Capacity of mini-grids installed (MW) • Capacity of distributed applications (MW) • Number of mini-grids (DAs) implemented

Annex 2: Indicative pipeline by MDB

African Development Bank

Multinational: Africa Green Baseload Program

Project title	Africa Green Baseload Program – Phase I
Country or region	Multinational (CIF pilot-countries only)
Type of storage asset	Various energy storage technologies
Implementing MDB	AfDB
Brief description (including project objectives and innovation aspects)	Energy services in many parts of Africa are unreliable and of poor quality. Despite high tariffs, most utilities and off-takers struggle to even recover operating costs and very often post financial losses. As a result, networks suffer from weak management and under-investments in critical areas and are unable to provide sufficient generation to meet current and future demand. Service providers and utilities are struggling to establish reliable energy services to meet growing demands from industry and commercial sectors critical for economic growth while at the same time contribute to their countries' commitments under their Nationally Determined Contributions. While variable renewable energy (VRE) sources can be utilized for the delivery of reliable energy services, they are by definition not firm and dispatchable. However, with a correct use of the resources available in a given location and an optimal combination with storage solutions (thermal, battery, hydro, etc.), VRE technologies can deliver the same level of service generally afforded by fossil fuel generation technologies (i.e. power that is available for dispatch round the clock to meet the baseload needs of the system). The objective of the Green Baseload Program (GBL) is to support the scale-up of renewable energy and maximize the use of VRE technologies to meet baseload needs, including through storage solutions. The overarching concept of increasing penetration of renewable power in the African grids, through a combination of interventions encompassing generation, transmission, distribution and storage. Where the use of VRE technologies does not result in an economically viable solution as part of a least economic cost plan study, then appropriate strategic intervention will be required from the governments, with support and reinforcement from development partners. The GBL program will be organized around the following 5 core areas: (i) Supporting national power system planning and optimization of VRE solutions**,** (ii) Upstream policy advisory and capacity-development for VRE and supply-side storage integration, (iii) Design and structuring of generation (IPP) and storage procurement programs, (iv) project preparation to pave the way for follow-on investments from AfDB and others, and (v) deployment of concessional climate finance capital to close viability gaps.

	The GBL Program is being spearheaded by the Sustainable Energy Fund for Africa (SEFA) – AfDBs' flagship concessional finance facility for catalyzing private investments in renewable energy and energy access. SEFA will pledge around USD 50 million to address both the technical assistance needs (areas 1-4 above). In addition, SEFA may also consider the provision concessional resources (area 5) in project finance structures, matching the same amount and terms of SEFA, and duly calibrated to unlock significant contribution from AfDB (and other investors). The CTF contribution will be set-up as a parallel financing facility alongside SEFA and focus on area 5 only. The GBL programme will be implemented in coordination with other flagship initiatives at the AfDB that are relevant to the CTF DPSP IV including the Desert-to-Power initiative aiming at deploying solar power across the Sahel countries, while strengthening their power systems to absorb more renewable inputs. The combined contributions of SEFA/CTF should support the delivery of up to 5 projects representing around 250 MW of storage capacity. AfDB will strive to build a diverse portfolio across energy storage technologies and regions to maximize the demonstration potential of concessional investments.		
Expected CTF financing	**Financial instrument**		**Amount (USD M)**
	Senior Debt, Subordinated Debt, Guarantees and Equity		50.0
Expected leveraging and co-financing by source	**Source**		**Amount (USD M)**
	SEFA		50
	AfDB		150
	Private Sector		150
	Total		**350**
Expected results	**Indicator**	**Storage input**	**Storage output**
	Energy rating (MWh)	TBC	TBC
	Power capacity (MW)	250	250
Expected dates of milestones	Submission to CTF Trust Fund Committee		March 2021
	MDB Approval		March to December 2021
Project status	Pipeline efforts are currently on-going with projects already identified in CTF-eligible countries such as Malawi, Kenya, Mozambique, Uganda, Zambia, Lesotho and Niger. This intervention is expected to open up a new business line for AfDB and pave the way for gigawatt-scale investments across the entire continent and increase the share of renewable energy penetration in African power markets.		

Multinational: Facility for Energy Inclusion – Distributed Energy Storage

Project title	Facility for Energy Inclusion – Distributed Energy Storage under the Off-Grid Fund	
Country or region	Multinational (CIF pilot countries only)	
Type of storage asset	Typical energy systems in off-grid areas entail solar home systems with individual energy storage that allow for 4-8 hours of daily use from batteries, mini-grids and other innovative systems that allow for village level power generation and storage, and/or renewable energy recharge stations for portable or vehicle batteries. These storage components are typically lead acid, nickel and lithium-based batteries with a range of sizes and states. Some mini-grids, for example, utilize decommissioned bus batteries with a 10-year warranty.	
Implementing MDB	African Development Bank (AfDB)	
Brief description (including project objectives and innovation aspects)	The Facility for Energy Inclusion (FEI) Off-Grid Energy Access fund (OGEF) is a USD 95 million debt fund supporting companies that provide or support the provision of distributed household and community access to renewable energy across sub-Saharan Africa. The objective of the OGEF is to increase local capital market engagement with the energy access sector through: (i) innovative and scalable financing mechanisms, (ii) preference for local currency lending (unlike most peer funders), and (iii) preference for co-investment by local financial institution. From a storage perspective, the OGEF innovates by promoting off-grid, near-grid and weak-grid distributed storage solutions, promoting renewable energy exclusively and oriented energy storage to appliances and productive use for households and Small and Medium Enterprises. CTF long term concessional debt for OGEF will focus the orientation of the fund to include targets on innovative energy storage technologies explicitly within the investment pipeline, allow for greater flexibility on local currency lending to companies deploying distributed energy storage products and reduce pressures on asset and liability management and therefore increase scope for long dated, higher risk investments.	
Expected CTF financing	**Financial instrument**	**Amount (USD M)**
	Senior Debt	10.00
	Total	**10.00**
Expected leveraging and co-financing by source	**Source**	**Amount (USD M)**
	AFDB –Ordinary Equity and Debt	30.00
	NDF – Ordinary and Junior Equity and Technical Assistance	7.52
	GEF – Ordinary Equity	8.50
	All On – Junior Equity and Debt	2.00
	EC – Junior Equity and Technical Assistance	16.72
	KfW – Junior Equity	16.65
	Calvert Impact Capital -Senior Debt	10.00

	Prudential Insurance Company – Senior Debt		5.00
	Lion's Head – Junior Equity		0.58
	Additional senior debt		20.00
	Total		**116.97**
Expected results	**Indicator**	**OGEF Internal**	**With 3rd Party**
	Energy rating (MWh)	40MWh storage capacity	74MWh
	Power capacity (MW)	16 MW installed capacity	37 MW
Expected dates of milestones	Submission to CTF Trust Fund Committee		December 2020
	MDB Approval		March 2021
Project status	FEI OGEF reached a second close in November 2019 and to date has deployed a total of USD 20 million to three projects (BBOXX Rwanda, SunCulture Kenya, d.Light Kenya).		

Multinational: Pumped Energy Storage Facility

Project title	Pumped-Energy Storage Facility
Country or region	Lesotho, South Africa and a third CIF Pilot Country in the SAPP region
Type of storage asset	Pumped-storage hydro power
Implementing MDB	African Development Bank (AfDB)
Brief description (including project objectives and innovation aspects)	The proposed Pumped-Energy Storage Facility (PESF) will target the development of a new solar PV pumped-storage facility linked to a new hydro power plant in Lesotho and support the preparation of three energy storage projects in Lesotho, South Africa and a third CIF pilot country in the Southern Africa Region. The objective of the generation asset is to improve system efficiency by using electricity produced at night (or when there is less demand to fill a hydroelectric reservoir) that can provide electricity during peak hours or when the system requires. The project will not only provide gains in terms of grid management but will also support the integration of variable renewable energy (VRE). The project will also extend financing to support the development phase of three future energy storage projects. As such, it will cover the costs of required studies (encompassing technical and financial viability, ESIA, and economic impact) and thus help these transactions become investor ready. The studies will help prepare the ground for developing additional capacity in the region for providing system stability and balancing power, which will be increasingly important as the region moves to higher penetration of VREs. Despite having significant potential for solar and wind energy, the Southern Africa region faces a current shortage of power due to ongoing financial issues hindering Eskom and a severe drought. The cheapest and fastest technologies for expanding supply of power are solar PV and wind but real and perceived problems with integration of these technologies acts as a brake on accelerating deployment. The hybrid project will include a 175 MW solar PV project and a 200 MW of hydropower generation using reversible pump turbines. In 2014, as part of the Lesotho Electricity Supply Project funded by the AfDB, a pre-feasibility study of a 2000 MW pump-storage hydropower was undertaken by the Government of Lesotho. Since the size of the proposed scheme was far in excess of the needs of Lesotho, a follow-on market study funded by the World Bank was undertaken to assess the long-term demand for peaking power within the Southern Africa Power Pool market, including the assessment of the fit of the 2000 MW pump hydro scheme. The conclusion was that the proposed 2000 MW scheme would be too large even within the SAPP power market context, and, therefore would be uneconomic to develop. The current concept is for a smaller scheme that meets the needs of Lesotho for peaking power and allows the country to export the excess into the SAPP power market.

<table>
<tr><td></td><td colspan="3">The project would involve the updating of existing studies, structuring of competitive selection process to establish a Public-Private Partnership (PPP), lead and develop the financing package for the project and to support project implementation and monitoring.
The current envisaged structure for the project is that the solar PV plant would be privately owned while the HPP would be developed as a PPP with the Government owning a stake in the project company.

The Facility will also target studies associated with the development of the following project ideas: (i) South Africa has several abandoned mines that could potentially be turned into pumped storage hydro power plants. This idea is being explored in Australia and the USA and the facility would support a pre-feasibility study of the technical and financial viability as well as possible ESIA issues developing such a project, and (iii) develop pre-feasibility and feasibility studies for two additional pumped storage facilities in South Africa and one other SAPP country.</td></tr>
<tr><td rowspan="4">Expected CTF financing</td><td colspan="2">Financial instrument</td><td>Amount (USD M)</td></tr>
<tr><td colspan="2">Concessional Loan</td><td>40.0</td></tr>
<tr><td colspan="2">Preparation Grant</td><td>3.5</td></tr>
<tr><td colspan="2">Total</td><td>43.50</td></tr>
<tr><td rowspan="6">Expected leveraging and co-financing by source</td><td colspan="2">Source</td><td>Amount (USD M)</td></tr>
<tr><td colspan="2">Equity</td><td>195.0</td></tr>
<tr><td colspan="2">AfDB sovereign loan</td><td>100.0</td></tr>
<tr><td colspan="2">AfDB non-sovereign loans</td><td>100.0</td></tr>
<tr><td colspan="2">Other Financiers including private sector</td><td>405.0</td></tr>
<tr><td colspan="2">Total</td><td>800.0</td></tr>
<tr><td rowspan="3">Expected results</td><td>Indicator</td><td>OGEF Internal</td><td>With 3rd Party</td></tr>
<tr><td>Component A: Energy rating (MWh)</td><td>312,000 MWh/Yr</td><td>219,000 [7]MWh/Yr</td></tr>
<tr><td>Component A: Power capacity (MW)</td><td>175[8] MW</td><td>200 MW</td></tr>
<tr><td rowspan="2">Expected dates of milestones</td><td colspan="2">Submission to CTF Trust Fund Committee</td><td>July 2021</td></tr>
<tr><td colspan="2">MDB Approval</td><td>Semptember, 2021</td></tr>
</table>

[7] The assumption is that the 200 MW HPP will run for 3 hours every evening. At 70 % turn-around efficiency 312 GW of solar PV electricity need to be produced.

[8] Sizing has been done with the help of the Global Solar Atlas. A generic location in Lesotho has been modelled. The solar PV installation is oversized by 8 %. Excess power would be sold directly to the grid.

Project status	Several valuable studies were already undertaken in the context of the proposed Solar PV Pumped Energy Storage project and implementation will benefit from the fact that the Solar PV component could be frontloaded to ensure faster project implementation. AfDB is also in advancing discussions with other CIF pilot-countries in the SAPP region that could be benefit from the proposed feasibility studies.FEI OGEF reached a second close in November 2019 and to date has deployed a total of USD 20 million to three projects (BBOXX Rwanda, SunCulture Kenya, d.Light Kenya).

Multinational: Hydropower Improvement Facility for Southern Africa Facility

Project title	Hydropower Improvement Facility for Southern Africa Facility	
Country or region	Lesotho, Zambia, South Africa, Mozambique, Madagascar and Malawi	
Type of storage asset	Improvements to existing hydropower to provide energy storage and better overall system support with a view to enhance integration of Variable Renewable Energy	
Implementing MDB	African Development Bank (AfDB)	
Brief description (including project objectives and innovation aspects)	The Hydropower Improvement Facility for Southern Africa (Facility) will work with up to two existing hydro-power plants (HPP). The Southern Africa region is water stressed and existing hydro power stations are periodically running significantly below rated capacity (e.g. the Kariba dam). This, in itself, is a large problem, but the challenge will become more acute in the future as HPPs will increasingly be expected to balance VRE sources such as wind and solar. Co-location of floating solar PV on HPP dams helps decrease evaporation, but the big potential for having more dispatchable water comes from being able to throttle back release of water during the day as a result of the auxiliary production of power from floating solar PV systems. Using HPPs to balance Variable Renewable Energy (VRE) sources puts more mechanical stress on installations and performance increases (availability and responsiveness) can often be improved through upgrades to the SCADA systems. With the expansion of VRE sources, rebuilding and modifying smaller and larger existing HPPs to provide peaking power and faster response to changes in demand and supply (from other sources of power) could add significant value to power systems in the region. The AfDB is engaging with governments and private developers looking to refurbish some of their existing HPPs. While opportunities have been identified across the entire region, the proposed facility will focus on two of the following countries: (i) Mozambique, (ii) South Africa, (iii) Zambia, (iv) Malawi, (v) Lesotho, and (vi) Madagascar. This will contribute to a more focused implementation seeking to develop internal market over time so that long-lasting transformation can occur. Introducing and scaling-up the use of floating solar PV in southern Africa will lead to increased capacity and respond to a greater need for quick response and peaking. The facility will also consider supporting innovations such as virtual peaking and quick response (e.g. run-of-the river HPPs in combination with solar PV and battery storage). In essence, floating solar PV systems become enablers of deploying more VRE sources, including solar PV.	
Expected CTF financing	**Financial instrument**	**Amount (USD M)**
	Concessional Loan	30.0
	Total	**30.0**
Expected leveraging and	**Source**	**Amount (USD M)**
	Equity	10
	Shareholders loan	35

co-financing by source	Debt (sovereign and non-sovereign debt provided by AfDB) + other partners		200.0
	Total		**245.0**
Expected results	**Indicator**	**OGEF Internal**	**With 3rd Party**
	Energy rating (MWh)[9]	390,000 MWh/Yr	390,000 MWh/Yr
	Power capacity (MW)[10]	250 MW	250 MW
Expected dates of milestones	Submission to CTF Trust Fund Committee		July 2021
	MDB Approval		September 2021
Project status	The AfDB is engaging with several existing HPP stations in several CIF pilot-countries in Southern Africa.		

[9] The location used is the Cahorra Bassa dam in Tete, Mozambique. The preliminary calculated result is using the global solar Atlas and assuming that all floating solar PV capacity is installed on one dam. The linear relationship (storage in and out) depends on several factors such as despatch and operating strategy and availability of water.

[10] There are several assumptions. Floating solar PV capacity is being used to save water that can be dispatched later. The solar PV capacity factor will be very high as the cooling effect of closeness to water and reflection from the water make this achievable. Conservatively, a price of 1 USD per watt is assumed for floating solar.

Asian Development Bank

Cambodia Battery Storage Project

Project title	Cambodia Battery Storage Project
Country or region	CAMBODIA
Type of storage asset	Battery Energy Storage System (BESS)
Implementing MDB	Asian Development Bank
Brief description (including project objectives and innovation aspects)	A massive solar power generation expansion is underway in Cambodia. While as recently as 2016 no solar capacity existed in the country; currently committed projects of over 400 MW, are expected to account for approx. 17% of total generation capacity by 2022. The strong uptake of solar PV has been driven by declining technology costs, economies of scale, as well as successful piloting and demonstration experiences. This includes the ADB supported Cambodia's National Solar Park project (100 MW), whose auction in 2019 resulted in a record low procurement price for solar energy in the ASEAN region. This project deployed climate finance from the Scaling up Renewable Energy Fund (SREP) within the Climate Investment Funds (CIF) family, to finance the public infrastructure components. This project also includes a pilot battery energy storage system with a storage capacity of approximately 15 MWh of storage capacity, which will be financed through SREP. It is expected that by 2030, approximately 2 GW of utility-scale solar PV will be commissioned, as per projections of the country's Power Development Master Plan, that is currently under development with ADB's assistance. As solar generation is expected to play an increasingly important role in Cambodia's future power generation mix, there is a need to strengthen the capacity of the power system to accommodate this intermittent source of energy. Energy storage can provide a range of benefits to the power system, including ramp rate control (i.e. smoothing, firming of intermittent generation, etc.), time shifting (energy arbitrage, capacity management, supply-demand matching, etc.), peak shaving (grid congestion management, deferment of grid reinforcement etc.), and power quality related applications (voltage regulation, frequency regulation, etc.). It is in this context that a nationwide project on energy storage linked to solar PV is being proposed for Cambodia. Specific objectives of the proposed project are:

<table>
<tr><td></td><td colspan="3">To finance utility-scale energy storage systems at several substations across Cambodia and position the country as a regional leader in the deployment of these systems.
To build technical capacities of national stakeholders on energy storage systems and grid integration.
The project will aim to deploy 50 MW of storage capacity – to be finalized upon due diligence – in various locations across Cambodia. Total financing requirement is 50 million USD (assuming 1 million USD per MW installed).</td></tr>
<tr><td rowspan="3">Expected CTF financing</td><td colspan="2">Financial instrument</td><td>Amount (USD M)</td></tr>
<tr><td colspan="2">Concessional loan</td><td>20</td></tr>
<tr><td colspan="2">Total</td><td>20</td></tr>
<tr><td rowspan="3">Expected leveraging and co-financing by source</td><td colspan="2">Source</td><td>Amount (USD M)</td></tr>
<tr><td colspan="2">ADB</td><td>30</td></tr>
<tr><td colspan="2">Total</td><td>30</td></tr>
<tr><td rowspan="3">Expected results</td><td>Indicator</td><td>Storage input</td><td>Storage output</td></tr>
<tr><td>Energy rating (MWh)</td><td>TBC</td><td></td></tr>
<tr><td>Power capacity (MW)</td><td>50</td><td></td></tr>
<tr><td rowspan="2">Expected dates of milestones</td><td colspan="2">Submission to CTF Trust Fund Committee</td><td>Q1 2022</td></tr>
<tr><td colspan="2">MDB Approval</td><td>Q3 2022</td></tr>
<tr><td>Project status</td><td colspan="3">The first pilot battery energy storage system in Cambodia is currently being supported through additional financing under the ADB’s National Solar Park Project. This is being grant-funded by SREP/CIF.

In addition, ADB is supporting the Government of Cambodia to develop the Power Development Master Plan (PDP) (2020-2040). As part of this process, key government stakeholders – namely Electricite du Cambodge (EDC), the Ministry of Mines and Energy and the Ministry of Economy and Finance – recognize the benefits of deploying energy storage alongside solar PV systems. The PDP will also include estimates of storage capacity needs and possible locations for these systems. The PDP is expected to be approved in Q4/2020.</td></tr>
</table>

India: Battery Storage at distribution substations

Project title	Battery Storage at distribution substations
Country or region	India
Type of storage asset	Battery Energy Storage System (BESS)
Implementing MDB	Asian Development Bank
Brief description (including project objectives and innovation aspects)	With Government of India's impetus for the development of renewable energy projects, especially solar and promotion of low-carbon economy, Energy Efficiency Services Limited (EESL) has identified an interesting opportunity to utilize increasingly reducing cost of energy storage (battery) systems and couple that with the solar energy in the available land in different states of India. EESL is a joint venture of the state-owned corporation including NTPC Limited, Power Finance Corporation, Rural Electrification Corporation and POWERGRID Corporation under the Ministry of Power. EESL has initiated a first of its kind large scale program wherein existing agricultural feeders are being solarized using the vacant/un-used lands at distribution substations or wastelands nearby the substations. The project is currently being implemented in Maharashtra where Power Purchase Agreement (PPA) for 500 MW has already been signed and another 300 MW is in the pipeline. The potential in Maharashtra alone is to the tune of 8,500 MW. Similar project of 113 MW has been awarded to EESL in Rajasthan. In total, EESL plans to install about 5,000 MW in the next 4-5 years requiring investment of about $3 billion. These solar power plants, between 0.5 MW to 10 MW capacity, are installed at unused distribution company lands or local government land and the power is fed directly to the 11 kV feeder in the substation. The main objective of this project is to install battery energy storage system in each of these substations along with solar power so that the excess energy not utilized for agriculture purposes can be stored and utilized during peak demand or for public lighting using efficient LED streetlights in nearby rural areas not having access to proper public lighting. In the case of Maharashtra alone, the number of local government units called gram panchayats are 27,920 and if 100 24W LED streetlights are installed in each local government unit, the requirement of energy for 10-hour operation for around 2.8 million streetlights will be 245 m kWh annually. The energy consumption of the agriculture sector in Maharashtra is around 30 b kWh, which roughly translates to 700 kW of solar installed capacity in each

	panchayat. If the solar plant is to be used for public lighting as well, the capacity will need to be increased to 720 kW along with provision of battery energy storage system (BES) of around 50 kWh at each solar plant for 20 hours of storage. This model will complement the earlier support from CTF for the distributed solar which now with energy storage system can be scaled up and replicated in other parts of India not only to provide clean source of energy and reduce GHG emissions but also contribute to making the energy storage system a viable business case.		
Expected CTF financing	Financial instrument		Amount (USD M)
	Loan+grant		40
	Total		40
Expected leveraging and co-financing by source	Source		Amount (USD M)
	ADB		200
	Energy Efficiency Services Limited (EESL)		240
	Total		440
Expected results	Indicator	Storage input	Storage output
	Energy rating (MWh)	3600	
	Power capacity (MW)	140	
Expected dates of milestones	Submission to CTF Trust Fund Committee		October 2020
	MDB Approval		June 2021

Project status	The request from Government of India for the financing to EESL has already been received by ADB where this will be a component. EESL has already signed PPA with distribution company in Maharashtra for 500 MW and others are in the pipeline. The identification of the land, prefeasibility study etc. have been completed and preparation of the tender document is in the process. No major social and environment safeguards related impacts are expected which makes the project readiness very high. There are also a very strong gender benefits of the project from this first of its kind in India.

Maldives: Additional Financing for Preparing of Outer Islands for Sustainable Energy Development (POISED)

Project title	Additional Financing for Preparing of Outer Islands for Sustainable Energy Development (POISED)	
Country or region	Maldives	
Type of storage asset	Battery Energy Storage System (BESS)	
Implementing MDB	Asian Development Bank	
Brief description (including project objectives and innovation aspects)	Ongoing Project: The POISED project replaces inefficient diesel-based power generation grids in 160 outer islands of the Maldives with hybrid Solar PV-Battery-Diesel generation, support supply side energy efficiency and upgraded distribution grids. These interventions will contribute in reducing the cost of electricity, the subsidy burden on the government budget, and emissions. CIF Financing: The CIF funds will be used to design and install Battery Energy Storage Systems (BESS) with energy management system in outer islands to allow higher renewable penetration with private sector participation and introducing net metering/gross metering. The CIF financing to battery systems will improve the reliability of mini-grids and help to address the difficulties in integrating more renewable based generation due to its intermittent generation. This will bring up the confidence of private sector to invest in more renewable in Outer Islands. Further, support MEA and MEE to, (a) draw out an updated roadmap for higher RE penetration and publicize this as part of pre-tender exercise to get private sector interested in a larger number of islands; and (b) discussion on prioritization of different renewable sources (net metering versus larger private sector) for the island grids that could be used as a template beyond just POISED islands in the additional financing.	
Expected CTF financing	Financial instrument	Amount (USD M)
	Grant funds to support BESS (high cost component in the hybrid system)	15
	Total	15
	Source	Amount (USD M)

Expected leveraging and co-financing by source	ADB		15.5
	EU		6.0
	Total		21.5
Expected results	Indicator	Storage input	Storage output
	Energy rating (MWh)	480MWh/yr	
	Power capacity (MW)	15	
Expected dates of milestones	Submission to CTF Trust Fund Committee		Apr 2021
	MDB Approval		May 2021
Project status	Support Government's target in meeting 70% of peak demand by renewable energy. This was discussed in detail with Ministry of Environment and Ministry of Finance. The Government has agreed to this proposal and requested ADB to prepare the project quickly.		

Regional: Pacific Clean Energy Mobility Program

Project title	**Pacific Clean Energy Mobility Program**	
Country or region	Regional	
Type of storage asset	Battery Energy Storage System (BESS)	
Implementing MDB	Asian Development Bank	
Brief description (including project objectives and innovation aspects)	Pacific Island countries have a significant import of petroleum products (20% of all imports, similar or greater than food imports). Petroleum product usage is typically 1:2 or 1:3 for electricity: transport end use. While there are variations depending on the country context, costs to power and transport sector are high and there is a consequent impact on the cost of electricity and transport to deliver goods and services in an island economy. ADB is currently engaged on initiatives to support renewable energy and battery storage for the electricity sector in the Pacific through its Pacific Renewable Energy Investment Facility that covers 11 countries. It is considering scaling up support for clean energy including to reduce emissions in the transport sector through upstream renewable energy generation investments and end use investments through energy efficiency and a transition to electric mobility (either through retrofits or replacements) based on commercially proven technology. Concessional CTF financing (loans and grants) for battery storage to support the transition to clean mobility would support the program. The potential for leveraging through MDB financing and private sector participation through upstream investments in renewables, leasing of equipment and potential for co-financing would be assessed. The program would be beneficial to demonstrate utilization of energy storage for mobility and to introduce a pathway to reduce emissions in the energy and transport sectors through replacing petroleum product imports with clean energy sources.	
Expected CTF financing	**Financial instrument**	**Amount (USD M)**
	Loan+grant	20
	Total	**20**
Expected leveraging and co-financing by source	**Source**	**Amount (USD M)**
	MDB financing (under PREIF as loans, grants for RE)	20
	Equity	TBD
	Total	

Expected results	Indicator	Storage input	Storage output
	Energy rating (MWh)		TBD
	Power capacity (MW)		TBD
Expected dates of milestones	Submission to CTF Trust Fund Committee		Q1 2021
	MDB Approval		Q2 2021
Project status			

Vietnam: BES System for Primary Frequency Control and Regulation

Project title	EVN's BES System for Primary Frequency Control and Regulation		
Country or region	Viet Nam		
Type of storage asset	Battery Energy Storage System (BESS)		
Implementing MDB	Asian Development Bank		
Brief description (including project objectives and innovation aspects)	The proposed project is to install a pilot Battery Energy Storage System in the Vietnam high-voltage grid system for primary frequency control and regulation, to reduce the spinning reserve requirement in conventional power plants and therefore saving fuel costs, and also to reduce system frequency fluctuations due to intermittency of renewable energy plants power output. Energy savings (MWh; specify total or annual): Annual fuel energy to maintain 60MW/60MWh spinning reserve in thermal power plants.		
Expected CTF financing	Financial instrument		Amount (USD M)
	Loan+grant		25
	Total		
Expected leveraging and co-financing by source	Source		Amount (USDM)
	Equity and other loans		31.7
	Total		
Expected results	Indicator	Storage input	Storage output
	Energy rating (MWh)	TBC	
	Power capacity (MW)	60	
Expected dates of milestones	Submission to CTF Trust Fund Committee		Jan 2021
	MDB Approval		
Project status	The feasibility study for BESS with EVN and MOIT is underway. Interim mission scheduled in April 2020.		

Vietnam: Pumped-Storage for Renewable Integration Project

Project title	Pumped-Storage for Renewable Integration Project		
Country or region	Viet Nam		
Type of storage asset	Pumped-hydropower energy storage		
Implementing MDB	Asian Development Bank		
Brief description (including project objectives and innovation aspects)	The proposed project involves the construction and operation of a pumped hydropower energy storage facility in Viet Nam. This project will be one of the first pumped-storage hydropower projects in Viet Nam and will help to reduce curtailment currently affecting solar and wind projects in Ninh Thuan and allow for the continued expansion of zero emissions energy sources in Viet Nam. The project will be equipped with advanced reversible pumps/turbines and motors/generator.		
Expected CTF financing	Financial instrument		Amount (USD M)
	Loan+grant		40
	Total		
Expected leveraging and co-financing by source	Source		Amount (USDM)
	Equity and other loans		630
	Total		
Expected results	Indicator	Storage input	Storage output
	Energy rating (MWh)	TBC	TBC
	Power capacity (MW)	1200	1200
Expected dates of milestones	Submission to CTF Trust Fund Committee		TBC
	MDB Approval		TBC
Project status	Construction of main pumped storage facilities expected to commence in 2022		

European Bank for Reconstruction and Development

EBRD-CTF energy storage framework

Project title	EBRD-CTF energy storage framework	
Country or region	Regional (Egypt, Jordan, Morocco, Tunisia, Turkey, Ukraine, Kazakhstan, Armenia, Mongolia)	
Type of storage asset	Various technologies (compressed air, advanced lead acid, sodium sulfur, sodium metal halide, lithium ion, flow (zinc bromine), flow (vanadium redox), green hydrogen) and associated infrastructure.	
Implementing MDB	EBRD	
Brief description (including project objectives and innovation aspects)	The EBRD energy storage framework will support developers of energy storage projects, electric vehicle charging infrastructure, developers of co-located renewable energy and energy storage projects, and projects involving the generation and use of green hydrogen in a variety of applications, to address the barriers to investment that currently prevent such projects from reaching financial close. Energy storage (both stationary and vehicle) is an essential element of national low carbon development planning, to manage the increase in intermittent renewable energy generation on grids, unlock additional renewable energy investment, and accelerate the electrification of transport. While this is increasingly being deployed in the form of lithium ion batteries, other technologies such as green hydrogen production and use are also emerging at utility scale. CTF funding is needed to accelerate the deployment of proven technologies which cannot yet attract finance on commercial terms. The rapidly-evolving market for energy storage globally requires a flexible framework, that can support one or more first mover projects that emerge in EBRD countries of operations. This framework builds on the Accelerating Innovation in Renewable Energy programme that was recently approved by the CTF TFC. In particular, it provides funding to catalyse the energy storage market, in countries and projects which have not benefited from funding under the AIRE programme.	
Expected CTF financing	Financial instrument	Amount (USD M)

	To be determined		[83][11]
	Total		[83]
Expected leveraging and co-financing by source	Source		Amount (USD M)
	EBRD		150
	Other sources of finance (other lenders, project sponsors, etc)		165
	Total		315[12]
Expected results	Indicator	Storage input	Storage output
	Energy rating (MWh)	800[13]	730[14]
	Power capacity (MW)	365	365[15]
Expected dates of milestones	Submission to CTF Trust Fund Committee		March 2021
	MDB Approval		Expected for first sub-project in 2021

[11] Any further funding under DPSP IV that is made available to MDBs shall be added to the total funding request under this programme, up to the aggregate total of the indicative pipeline.
[12] Aggregate based on a portfolio average of 21% CTF, 38% EBRD and the remainder from other sources of finance.
[13] Assumes 10% round trip losses.
[14] Assuming total investments of USD 136 million, lithium-ion technology, and benchmark LCOE for lithium ion batteries of USD 187 / MWh (source: Bloomberg New Energy Finance March 2019)
[15] Assumes two hour discharge period at full capacity.

Project status

The following table sets out an indicative pipeline of sub-projects to be financed under the facility, and their status:

Country	Project description	Capacity (MW/MWh)	CTF funding need (USDm)
Jordan	Utility scale stand-alone storage	30/60	5
Egypt	Renewables co-located batteries	36/72	8
Morocco	Storage project	Tbd	Tbd
Tunisia	Renewables co-located batteries	30/60	15
Kazakhstan	Co-located battery storage pilot	50/100	25
Ukraine	Utility scale battery storage	Tbd	Tbd
Mongolia	Storage project	50/100	15
Each eligible country	Electric vehicle charge point infrastructure at existing fuel stations rolled-out by the fuel stations operators	tbd	15
		TOTAL	>83

International Finance Corporation

Global Energy Storage Program

Project title	**IFC Energy Storage Platform**
Country or region	**Preliminary focus on 11 CIF countries across 5 regions:** • SSA: Burkina Faso, Mali, South Africa, Nigeria • EAP: Philippines, Indonesia, Vietnam • ECA: Ukraine • LAC: Brazil, Mexico • MENA: Egypt
Type of energy storage asset	• Electrochemical batteries (grid or mini-grid scale) • Other GESP-eligible technologies will also be considered
Implementing MDB	International Finance Corporation (IFC)
Brief description (including project objectives and innovation aspects)	IFC's energy storage platform will utilize CTF funds under the DPSP IV Global Energy Storage Program to catalyze impact on the energy storage market and ecosystem in developing countries. Storage is a key component of IFC's power strategy, which is based on country-level approaches that focus on supporting client countries' energy needs, energy security, and climate transition through universal access to affordable, reliable, and cleanest energy available. Energy storage is a crucial tool for enabling the effective integration of RE, as well as unlocking the benefits of local generation and a clean, resilient energy supply. Energy storage solutions are needed most in developing countries, where power grids are weak and cannot take full advantage of their solar and wind potential, as well as in emerging economies that experience a rapid increase in energy needs, especially during peak hours. Despite falling costs, energy storage systems (ESSs) remain expensive – with a small market primarily in developed countries. The significant upfront investment required for ESSs is difficult to overcome without government support and/or low-cost financing. The IFC energy storage platform seeks to accelerate and/or kick-start transformative investments and private finance in energy storage and RE in low and middle-income countries. To this end, IFC will develop private sector programs and projects aimed at increasing RE integration, improving grid reliability, stability and power quality, while reducing carbon emissions. IFC's energy storage programs and projects will primarily be focused on 11 CIF countries, where IFC already has a growing pipeline. IFC will leverage its Upstream practice and InfraVentures, where appropriate, and in doing so, seek to partner with credible sponsors and other private sector players to make early investments into projects that advance the nascent energy storage market in developing countries. In addition to investment activities, the platform will support IFC's ongoing upstream initiatives aimed at (i) addressing market barriers that prevent the scale up of energy storage lending activities; (ii) accelerating stable policy frameworks for storage projects; (iii) developing viable business models, and (iv) conducting grid analyses to determine the potential role for energy storage. The platform will, therefore, help to create additional investment

	opportunities through the successful implementation of these upstream initiatives.	
Expected CTF financing by financial instrument (USD M)	Subordinated Loans, Equity and Quasi-Equity. Final selection of financing instruments will be done at the project level, reflecting specific project risks, macroeconomic conditions, sectoral dynamics, etc.	90
	Viability Gap Financing (Grants)	10
	Advisory Services Grant Funding	1
	Total	**101**
Expected leveraging and co-financing by source (USD M)	IFC	30
	Other lenders	70
	Total	**100**
Expected results (if available)	GHG emissions reduced or avoided (Tons CO_2e)[a][16,17]	8,315,515
	Installed capacity of RE as a result of CTF interventions (MW)[a]	270
	Energy rating (MWh)	TBD
	Power capacity (MW)	TBD
	Regulations, codes or standards for energy storage solutions issued (number)	TBD
Expected dates of milestones[18]	Submission to CTF Trust Fund Committee	November 2020
	MDB Approval	June 2021

[16] Expectations based on performance of solar PV + electrochemical battery storage plants and diesel/heavy fuel oil displacement shifting part of the energy produced during daylight to evening peak use.

[17] The IFC GHG accounting methodology provides guidance on calculation of the GHG emission reductions on the basis of one representative year. To assess the amount of the lifetime GHG savings, an indicative average life of physical assets is assumed to be around 20 years. Actual values of lifetime for individual assets and sub-projects may vary and are likely to be different from the lifetime of the financial instruments.

[18] Individual projects will follow IFC's business cycle and will be expected to reach Board approvals within timeframes consistent with experience of the current blended climate finance portfolio and the CTF Pipeline Management and Cancellation Policy.

Project status	IFC is gearing up to operationalize its storage strategy in key markets and has several ongoing upstream initiatives and investment leads. IFC's advanced upstream initiatives include the following: • Mexico: Non-wire solution for transmission congestion to help with the integration of RE on isolated grid; exploring private-sector investment opportunity • Ukraine: Grid analysis to determine potential role for storage (focus frequency regulation), development of business models , and regulatory review • Burkina Faso: Evaluating the need for Battery Energy Storage Systems, defining Private-Public Partnership structure options, sounding the market, and proposing an investment roadmap that IFC could support IFC's early investment leads include the following: • South Africa: Program envisioned to support several sub-projects; > USD 35 Mn CTF funds needed • Mexico: Program/Project focused on supporting inclusion of storage technology on planned RE projects; USD 25 Mn CTF funds needed IFC will continue pursuing and expanding the pipeline of projects, and will submit individual Program Proposals/Funding requests for TFC review as the projects mature and meet readiness criteria. IFC will seek to frame the submissions to maximize synergies between individual projects.

InterAmerican Development Bank

Colombia: Promoting the Energy Transition from Hydrocarbons to Green Hydrogen for Power Generation and Storage

Project title	**Promoting the Energy Transition from Hydrocarbons to Green Hydrogen for Power Generation and Storage**
Country or region	Colombia
Type of energy storage asset	Green hydrogen production, storage and hydrogen-based power generation
Implementing MDB	IDB Group
Brief description (including project objectives and innovation aspects)	The general objective of the project is to support the energy transition and decarbonization of the hydrocarbon sector in Colombia by the integration of green hydrogen-fueled electricity generation and storage. To this end, the specific objectives are: ▪ Assess and pilot the production of green hydrogen (H_2) from geothermal generation and other renewable sources in Colombia, leveraging existing knowledge and infrastructure of the hydrocarbon industry ▪ Design and pilot hydrogen-based electricity generation to facilitate the integration of renewable sources into the energy supply for hydrocarbon operations and transformation. Recent research into hydrogen's applications as a carbon emissions-free source of energy has catapulted it to the forefront of the discussion on the energy sector transition towards cleaner and more sustainable matrices. The production of hydrogen is categorized into three: grey, blue, and green hydrogen. The first, and by far largest category, refers to H_2 that is produced from natural gas processing, accounts for 75% of global H_2 supply.[19] Blue hydrogen refers to a production process that uses fossil fuels but where all consequent emissions are captured and sequestered. Green hydrogen is obtained by electrolysis processes with renewable power generation. Interest in the use of H_2 in the energy industry – as a source and as a mean of energy storage – is currently enjoying high levels of economic and political interest for the first time in decades. These wider applications have attracted the attention of major international Oil and Gas (O&G) companies interested in varying the uses of hydrogen beyond its more traditional uses in refining and ammonia production. The national oil company of Colombia, Ecopetrol (ECP), updated its energy transition strategy in 2020 to embrace the energy transition with focus on three areas: (i) optimization of its upstream portfolio, (ii) decarbonization, and (iii) assessment of new sustainable business opportunities. To that end, Ecopetrol set a 20% companywide greenhouse gas (GHG) emissions reduction target by 2030 and the incorporation of, at least, 300 MW of renewable energy capacity by 2022.[20] The company has estimated potential renewable

19 EIA. The future of Hydrogen. June 2019. https://www.iea.org/reports/the-future-of-hydrogen

20 Ecopetrol. Business Plan Update 2020 – 2022. March 2020.

	energy capacity of 184 MW solar, 84 MW wind, plus yet-to-determine geothermal energy and hydrogen capacity. Ecopetrol is the largest player in the Colombian hydrocarbon industry and consumes 1,038 MW for its operations, which represents 10% of the national power demand. The company self-generates around 70% of its power demand (mostly from natural gas and liquid fuels) and purchases the remaining 30% from the national grid.[21] The IDB has been discussing with Ecopetrol areas of support for the execution of this energy transition strategy, including the assessment of geothermal energy potential from abandoned wells, the construction of a geothermal generation pilot project, and the production of green hydrogen from clean geothermal energy or other renewable resources. The funding of the **Global Energy Storage Program** will support the following components: 1. **Component 1. Development of pre-feasibility studies:** The focus of this component is to conduct technical, economic, and regulatory feasibility studies for green hydrogen production, storage, and integration into power generation assets and industrial processes. 2. **Component 2. Pilot project for green hydrogen production from geothermal energy and hydrogen-based power generation in Colombia:** The objective of this component is to run a pilot project to validate the feasibility of green hydrogen production from geothermal or other renewable sources and build a hydrogen-based power generation plant. The results of this pilot will demonstrate the feasibility of hydrogen-based power generation and measure the impact on the decarbonization of the hydrocarbon sector in Colombia. 3. **Component 3. Assessment of scalability and replicability:** This component will evaluate options to scale up the production and storage of green hydrogen for power generation enabling the integration of renewable intermittent sources not only in Ecopetrol operations but also in the national power grid. For the execution of this project, the IDB will establish a facility to open the access of CTF funding to private or state-owned O&G companies interested in transitioning towards carbon free fuels such as geothermal energy and green hydrogen for power generation in Colombia. To this end, Bancoldex will be the executing agency for the project. Bancóldex is a well-reputed Colombian credit institution with ample experience in finance structuring and fiduciary management in renewable energy projects. It has experience in implementing programs financed by the IDB and the CTF. The expected **transformational impact** on this project could be reflected in two aspects: (i) Boost the energy transition of Colombian hydrocarbon sector leveraging its infrastructure and capabilities to produce green hydrogen and geothermal energy, and (ii) Validation of hydrogen-based power generation as an option to produce cleaner energy in Colombia and facilitate the integration on intermittent renewable energies into the network.	
Expected CTF financing by	Grant	3.1
	Concessional Loans	11.7

[21] Estrategia de energía grupo Ecopetrol. Ecopetrol 2019

financial instrument (USD M)	**Total**	**14.8**
Expected leveraging and co-financing by source (USD M)	IDB Group	30
	Private & public sector equity	35
	Total	**65**
Expected results	GHG emissions reduced or avoided (Tons CO_2e)[a]	TBD
	Installed capacity of RE as a result of CTF interventions (MW)[a]	TBD
	Storage energy rating (MWh)	70MWh
	Storage power capacity (MW)	2 MW
	Regulations, codes or standards for energy storage solutions issued (number)	3
	Energy storage from H2 on annual basis (MWh/year)	12,775
Expected dates of milestones	Submission to CTF Trust Fund Committee	1Q 2021
	MDB Approval	4Q 2021
Project status	IDB maintains an open dialogue with Ecopetrol and other hydrocarbon producers in Colombia to assess the potential geothermal generation from non-operational wells in Colombia. Ecopetrol is conducting preliminary studies to identify opportunities of green hydrogen production in Colombia	

[a] In most cases the calculation of GHG emission reductions and RE capacity will need to be estimated through a modeling exercise.
Version 5. 2020-03-05

Haiti: Energy Storage to Support the Supply of Renewable Energy to the Northern Region, Haiti

Project title	**Energy Storage to Support the Supply of Renewable Energy to the Northern Region, Haiti**
Country or region	Haiti
Type of ES asset	Battery storage for a small grid
Implementing MDB	IDB Group
Brief description (including project objectives and innovation aspects)	Haiti has an estimated population of 10.9 million inhabitants, of whom 1.8 million live in the Northern region, the fastest-growing region in the country (2015 figures). Haiti is the poorest country in the Western Hemisphere, with a Gross Domestic Product (GDP) per capita of USD 870 in 2018 and a Human Development Index ranking of 168 out of 189 countries in 2018. Over 6 million Haitians live below the poverty line on less than USD 2.41 per day, and more than 2.5 million people fall below the extreme poverty line of USD 1.23 per day. About 65% of the population has not access to electricity, the majority located in rural areas. The Government of Haiti has defined the development of the northern region as one of its top priorities. To promote economic growth, generate local jobs, and increase overall productivity in the region, the Bank's strategy is to provide favorable operational conditions to attract and retain private investment and increase the region's manufacturing base and export capacity. The growth pole strategy for the northern region focuses on the establishment of industrial parks and key infrastructure projects. The *Parc Industriel de Caracol (PIC)* is the result of an agreement, signed in September 2008 between the Government of Haiti, the United States Department of State (US-DOS), and the IDB, to establish an industrial park at the core of the Northern region. The PIC opened in 2012 and today is the largest employer in Northern Haiti with over 14,000 people (62% women), and with the potential to employ over 20,000 more, mainly in the apparel industry. PIC exports and domestic sales have continuously increased from 2012 and are valued at USD 21.5 million for 2019. Total payroll for the first three quarters of 2019 was USD 19.9 million. Additional demands for new buildings were confirmed during 2019, coming from current tenants and new firms. The Bank and the Government are working in the preparation of new financing to expand the capacity of the PIC with new buildings for industrial proposes. The PIC is located in the northeast region of Haiti. The electricity for PIC is supplied by a 10MW Thermal Plant (TEP), consisting of 6 units of 1.675 MW each operating with heavy fuel oil. The electricity consumption of PIC Customers is mostly from Monday to Friday from 7:00 AM to 5:00 PM with a peak demand of about 4.5MW that will increase to 5.5MW in the next few years. The TEP also supplies energy to residential and commercial customers from communities outside the PIC (non-PIC customers): Caracol, Limonade, Trou du Nord, Terrier Rouge and Sainte Suzanne. To reduce the electricity costs and achieve the tariff requested by the industrial customers from 0.30 to 0.16 USD/kWh, thereby improving

	economic competitiveness and sustainability of the industries at the PIC, and to provide a more affordable and sustainable electricity service to surrounding communities, the Government of Haiti with IDB and USAID support will finance the design, supply, installation, commissioning, operation & maintenance (O&M) of two solar photovoltaic plants: One 8-MWp (IDB funded), and one 4-MWp (USAID funded). The 8MWp PV plant will supply about 60% of the PIC demand during the day and will produce an excess of energy during noon and on weekend when the operation of the PIC is reduced. The 8MWp capacity was optimized to respond to the industrial demand and the need to reach a lower tariff of USD 0.16/kWh. An excess of energy is observed during the first years of operations of the solar plant. The excess of energy is estimated in about 4,500 MWh per year. During the first years of operation only 25% of the surplus will be utilized during daytime, by the residential users outside the PIC. **Project proposal:** CTF resources would be used to install a 6MWh battery energy storage system that would facilitate electricity consumption during nighttime when the demand is higher in the communities located in the vicinity of the PIC. The storage of the excess of energy produced by the solar plant would allow the supply of clean energy to about 3,000 additional households. The optimal size of the storage is calculated in about 6 MWh (1 MW), equivalent to USD 3.0 million in a battery bank.	
Expected CTF financing by financial instrument (USD M)	Grant resources	3.0
	Total	**3.0**
Expected leveraging and co-financing by source (USD M)	IDB *(approved in Nov. 2019)*	16.5
	USAID *(approved in Sep. 2020)*	6.5
	Total	**23.0**
Expected results	GHG emissions reduced or avoided (Tons CO_2e)	TBD
	Installed capacity of RE as a result of CTF interventions (MW)[a]	TBD
	Battery energy rating (MWh)[22]	6 MWh
	Battery power capacity (MW)	1 MW
	Regulations, codes or standards for energy storage solutions issued (number)	--
	Energy access (households)	3,000
	Reduction in thermal generation (MWh/year)	1,300
Expected dates of milestones	Submission to CTF Trust Fund Committee	Oct 2020
	MDB Approval	Feb 2021

[22] A model was developed in SimSEE to optimize the size of the battery.

Project status	The financing for the construction of the two solar plants was approved by IDB in November 2019 and by USAID in Sept 2020. The Executing Agency is the Unité Technique d'Execution of the Ministry of Economy and Finance (UTE/MEF) with technical support from the Autorité Nationale de Régulation du Secteur de l'Energie (ANARSE) and the Ministry of Public Works, Transport and Communication (MTPTC). An RFP for both Solar Power Plants was lunched in Sep 2020; contract award is expected by the first quarter of 2021 and the commissioning of both solar photovoltaic plants by the end of 2021. The project expects additional grant contribution from a new donor to secure a better use of the excess of energy from the 8MWp in favor of supplying cleaner and cheaper energy to the residential users of the Northeast of Haiti.

Version 5. 2020-03-05

Honduras: Energy storage to support innovative solutions for health service delivery in Honduras

Project title	**Energy storage to support innovative solutions for health service delivery in Honduras**
Country or region	Honduras
Type of energy storage asset	Grid-connected and off-grid batteries
Implementing MDB	IDB Group
Brief description (including project objectives and innovation aspects)	The COVID-19 pandemic has severely affected our society, and Honduras is not the exception. One important lesson of this pandemic is the importance of having reliable health systems, including quality human resources and resilient infrastructure. As a response to the emergency situation, the Government of Honduras is seeking to strengthen the capacity of existing health centers and to open new ones. Energy supply is a critical factor to guarantee the normal operation of such health centers. This project has been conceived as a self-autonomous energy, climatically smart and sustainable contained solution to ease the pressure exerted by the COVID-19 pandemic upon the health system in Honduras. In support of the central hospitals, which are to experience saturation within months due to the pandemic, the project will deploy mobile Solar Power Peripheral Health Units (SHU) equipped with power generation systems with solar photovoltaic modules supported by battery storage stations. The systems will be installed in specific suburban areas, including the Central District and San Pedro Sula (two of the locations most affected by COVID-19) but it will also include Departments such as Colon (the third most affected in the country with low electricity access) and without electricity[23] (Lempira department). In coordination with the Public Health Ministry, these units will deliver medical services to people with COVID-19-related symptoms, via direct consultation, medical treatment and via telemedicine. The project will finance both on-grid and off-grid health units, and the CTF resources will be destined to the acquisition of storage systems for the health units connected to the grid. The climatic innovativeness consists in the utilization of shipping containers as infrastructure for the clinics, a solution that is being used in Italy, the UK and elsewhere,[24] and in the use of solar energy in the container roofs as well as containerized solar systems integrated with energy storage systems (ESS) / grid connection transfer systems and meter. It will also include telemedicine. The grid connection transfer system will be used to feed solar energy surplus to the grid. On the other hand, for places with poor quality services the solution will include ESS, which will avoid the greenhouse gas emissions associated with traditional infrastructure. The SPCs will be equipped with appropriate medical arrangements and personnel to facilitate its functioning as standard health units, and will also include COVID-19-treatment devices. The containers will include at least the following equipment: photovoltaic panels, energy storage systems (the most expensive components), water pump and purification systems, lightning, refrigeration and cooling systems of high efficiency, and telecommunication equipment. One advantage of the containers is that they are

[24] World Economic Forum, *Hospitals made from shipping containers could help tackle COVID-19*, 2020.

	modular, which means depending on the necessities more than one SPC could be installed. Project execution will last two years. The proposed investment grant in Honduras will complement the efforts that the national government and international organizations are conducting to provide a fast response to the pandemic. It is a clean energy solution for the hospitals with a concept of modularity and flexibility, which with the strategic support of CTF will provide innovative services that in business as usual would have involved fossil fuel systems. It will represent a contribution of energy storage not only to the protection of the environment but also of human lives. **Expected transformational impact.** The implementation of the project with resources to procure the most expensive component in the energy supply system (the storage batteries) will contribute to overcoming the barrier of providing a clean energy solution for hospitals under emergency conditions. The implementation of clean energy will also contribute to improve the financial sustainability of the health system because electricity has an important participation in the operational costs, and clean energy will release resources to be used to pay salaries to health employees, and to buy the drugs and equipment that are needed to address the pandemic. The project will have a positive impact in the environment and human lives.	
Expected CTF financing by financial instrument (USD M)	Grant	0.5
	Total	**0.5**
Expected leveraging and co-financing by source (USD M)	Government of Honduras	N/A
	IDB	N/A
	SREP / CIF	1.4
	IDB Lab	0.15
	Private sector	0.15
	Total	**1.7**
Expected results (if available)	GHG emissions reduced or avoided (Tons CO_2e)[a] per year	500
	Installed capacity of RE as a result of CTF interventions (MW)[a]	0.5
	Storage energy rating (MWh)	TBD
	Storage power capacity (MW)	TBD
	Regulations, codes or standards for energy storage solutions issued (number)	N/A
Expected dates of milestones	Submission to CTF Trust Fund Committee	Oct 2020
	MDB Approval	Nov 2020
Project status	In preparation	

[a] The calculation of GHG emission reductions and RE capacity will need to be estimated through a modeling exercise during preparation.

Regional: Large-scale Energy Storage to increase the penetration of variable renewable energy in Central America

Project title	**Large-scale battery energy storage systems to increase the penetration of variable renewable energy in Central America**
Country or region	**Central America (Honduras, El Salvador, Guatemala)**
Type of energy storage asset	Grid-connected battery storage
Implementing MDB	IDB Group
Brief description (including project objectives and innovation aspects)	Central American countries have opted for greater integration of variable renewable energy (VRE), i.e. wind and solar photovoltaic energy, to supply the region's energy needs. This implies significant operational challenges in managing these variable output sources. Energy storage systems (ESS) are increasingly being integrated in conjunction with VREs to maintain secure network operation and to balance generation and demand. ESS can increase reserves to manage uncertainty in the production of VREs, allowing greater penetration of these technologies by storing wind or solar photovoltaic energy when it is available, in order to avoid dispatch limitations due to network restrictions and provide firmness to the VREs during certain hours. Therefore, ESS have a huge potential in modern electrical networks by performing the essential task of storing the excess energy generated and making it available to the grid during periods of peak demand or when the system requires it, for example, for frequency regulation. In addition, ESS can provide numerous benefits to electric power industry chain through the provision of ancillary services. With the current VREs penetration levels and the ones that are forecasted to be integrated in the near future due to decarbonization goals, it becomes necessary to adequately assess the national transmission system and SIEPAC response capacity to contingencies. Despite its potential benefits, energy storage is an untapped market in the region, with only a few small-scale projects operating. This project seeks to demonstrate the benefits of energy storage for assuring system stability through the provision of ancillary services, including frequency regulation/control to increase the penetration of VRE sources in the region throughout a programmatic approach consisting of assessment, design and implementation projects for BESS in the national and regional transmission systems. It will also support dynamic studies and a feasibility study of the alternatives that can guarantee the frequency stability of the grid, particularly considering modern technologies such as BESS. The initiative seeks to address some of the main barriers for investments in BESS in the region including, technical and financial barriers such as lack of understanding of the services that BESS provides for large scale applications, lack of adequate cost recovery mechanisms, high upfront costs, financial viability of transmission utilities as well as the lack of familiarity with BESS among stakeholders. The Program will also seek to address with technical, legal, policy and regulatory issues through technical cooperation. In this sense the Program will be structured through two main complementary areas of work: 1. **Finance BESS demonstration projects**:

	The program will consist of a loan from IDB to the Central American Bank for Economic Integration (CABEI) for the provision of medium- and long-term credit and guarantees to cover high CAPEX and long payback periods related to energy storage associated to renewable energy. The Program will also consider a regional facility for supporting the investment of large-scale grid connected BESS. Potential beneficiaries include (i) state owned transmission utilities; (ii) private companies that will invest in transmission projects; and (iii) utility owners of the regional grid. The specific financial instrument will be developed through technical cooperation that will include (i) support for the identification and assessment of the appropriate place and size of large scale BESS to be installed throughout the national and regional transmission system based on stability criteria and expansion plans, (ii) facilitating the establishment of alliances among key stakeholders (national and regional transmission utilities, private players, battery manufacturers, energy-storage integrators, and financial institutions); and (iii) analysis and definition of the proper financial instruments (e.g.: concessional loans, grants, credit guarantees, etc.) for specific projects. 2. **Technical, legal, regulatory, and environmental support**. The Program will provide technical cooperation support to update the national and regional power generation expansion plans to integrate BESS, and stability assessment in the national and regional grids. It will provide legal support to conduct competitive international bidding process to install, operate and transfer/ own (depending the local conditions) BESS. The regulatory support will review best international practices and standards to integrate standards/ regulations in the national regulatory frameworks. In the operational regulatory framework for the regional electricity market, it will integrate compensation schemes of investments and operation and maintenance costs (including battery replacement and final disposal). It will also contribute to the preparation of environmental guidelines and/or regulatory assessment for BESS aiming to promote the use of environmentally friendly battery technologies, recycling and disposal programs, and end-user buy-in strategies. **Expected transformational impact**. It is expected that the results provide the support for the development of new greenfield VRE projects enabling the countries to increase the participation of RE in their energy mix and reach their NDCs and decarbonization targets. It will also demonstrate the uses of large-scale BESS for the supply of ancillary services to strength the system stability at high levels of penetration of VRE. The financial scheme will serve as successful case studies and models for scaling up future private investments in BESS in the region and building the confidence in financial institutions on the robustness and profitability of those investments.	
Expected CTF financing by financial instrument (USD M)	Loan	15
	Grant	1
	Total	**16**
Expected leveraging and co-financing by source (USD M)	IDB Group	15
	Local NDBs	TBD
	Private Financing	5
	Total	**20**

Expected results	GHG emissions reduced or avoided (Tons CO_2e)[a]	TBD
	Installed capacity of RE as a result of CTF interventions (MW)[a]	TBD
	Energy rating (MWh)	116-MWh
	Power capacity (MW)	29 MW[25]
	Regulations, codes or standards for energy storage solutions issued (number)	3
Expected dates of milestones	Submission to CTF Trust Fund Committee	TBD
	MDB Approval	TBD
Project status	IDB has a strong track record in developing and executing public private financial intermediation programs to scale up private investments in renewable energy and energy efficiency with national development banks, including in Central America. Further it has a strong presence and experience in support the development and implementation of renewable energy solution in all the 3 proposed Central American countries. CABEI also has local presence and capillarity with both governments, financial institutions and private sector and strong track record in working with renewable energy investments. IDB and CABEI have a firm agenda of collaboration and if this proposal would be approved, IDB would be able to co-finance the CTF resources with at least a USD 15 million Program to finance renewable energy investments associated to the storage investments.	

[a] In most cases the calculation of GHG emission reductions and RE capacity will need to be estimated through a modeling exercise.

Version 5. 2020-03-05

[25] Based on an average cost of $1,200/MW installed, with 4 hours of energy storage. Cost projections for utility-scale battery storage, NREL, 2019.

Regional: Regional Challenges for Local Startups Focused on Providing Energy Storage Solutions for LAC

Project title	**Regional Challenge for Local Startups Focused on Providing Energy Storage solutions for LAC**
Country or region	Regional (CIF LAC countries)
Type of energy storage asset	All
Implementing MDB	IDB Group
Brief description (including project objectives and innovation aspects)	According to a study commissioned by the IDB,[26] "…Using Energy Storage (ES) in combination with renewable energy (RE) in the Latin America and the Caribbean (LAC) region can enable a larger scale deployment of cost-saving intermittent RE, with which the region is highly endowed, without threatening grid stability or the ability to meet electricity demand. (…) ES technologies can increase the share of intermittent RE in total generation by: (i) providing backup power at times when intermittent RE technologies cannot generate power (to maintain grid stability); and/or (ii) providing energy management services that allow system operators to forecast when they will be able to use electricity from intermittent RE (to maintain the ability to meet electricity demand at all times)." Until recently, the average penetration of RE in national grids within the region was approximately 20%, whereas with efficient ES systems this penetration can go up to 50% in some cases.[27] Some LAC countries have already adopted an ES regulation (i.e. Chile, Mexico, Dominican Republic) that incentivizes generators to invest in good quality storage systems to avoid intermittent transmission. The development of ES technologies also benefits low-income populations living in remote areas. More and affordable energy technologies ought to be deployed so the current ES prices can make ES available for more people in the region. There are various ES technologies to be explored. Lithium ion batteries seem to be the most promising now because they are small, light and contain a good amount of storage – which makes it easier to deploy it in remote/distant areas to be used for small appliances. However, their lifespan is not significant among other issues. In addition, the price of lithium has decreased significantly in the past years. Other more advanced ES technologies include the ReDOX battery and the V-Flow battery that uses vanadium (as opposed to lithium) and the WattJoule batteries that also uses vanadium. This last one seems to be promising in the long term.

26 "Potential for Energy Storage in Combination with Renewable Energy in Latin America and the Caribbean." Inter-American Development Bank. Balza, Lenin; Gischler, Christiaan; Janson, Nils; Miller, Sebastián J.; Servetti, Gianmarco, January 2014.

27 Source: Greenpower, Spain. http://www.greenpower.es/en/corporation/references/real-case/Energy-Storage-A-case-of-success-in-Latin-America/

	Other software technologies – that go beyond hardware technologies – such as the use of Artificial Intelligence, Blockchain and/or IoT may also add value and efficiency gains to current ES Battery technologies available. There are various new applications of these software technologies being developed in the LAC region for the energy sector. **IDB Lab and the innovation ecosystem in LAC.** IDB Lab has played a decisive role in the initial building and consolidation of the Latin American and Caribbean Venture Capital (VC) and startups support ecosystem since the late 90s. Today, the active VC portfolio of IDB Lab in the region funds has approximately 50 active VC funds plus few operations with local accelerators and incubators. Currently all IDB Lab supported VC funds, accelerators and incubators have approximately 50 invested energy sector startups in their portfolio. IDB Lab's operations focus on supporting startups with high development impact and cutting-edge models, testing these models to, later, replicate them in other countries and less developed ecosystems. While still far from more developed ecosystems – such as the United States where VC-backed startups have transformed the landscape of most of the industrial and service sectors and represent today 57% of the market capitalization of public companies founded since 1979, 38% of employment, and 82% of research and development (R&D) expenditures[28] – the VC industry has gained important traction in LAC over the last two decades with ever growing figures. In 2019, annual VC investments in the region surpassed two billion (BI) dollars for the first time in history. Moreover, per IDB Lab's experience in the region, there is an emerging and growing generation of dynamic entrepreneurs that focus on solving pressing environmental and clean energy issues[29] by leveraging the power of technology, pursuing both financial and environmental returns[30]. This trend follows the growing awareness from private sector actors in the region to align their operational strategies with the United Nations Sustainable Development Goals (SDGs). Various energy sector stakeholders such as ENGIE, Schneider Electric, General Electric have tried to boost their corporate venturing/innovation programs by promoting challenges and match making with LAC's startups. Engie, for example launched in 2014 an initiative called ENGIE new ventures, that supports the development of new energy technologies by startups. General Electric also adopted the same approach back in 2013 route, by creating its own startups funds called GE ventures (that has supported over 100 startups worldwide). Startups can be especially interesting for the development of technologies that support less mature but technically viable long-duration battery technologies and/or mini-grid solutions in rural areas to improve clean energy access. One great example that has received continuous support from IDB Lab is Kingo Energy (that started at IDB Lab as a startup and its now reaching its third financing round, also known as Series C).

28 "How Much Does Venture Capital Drive the U.S. Economy?", Stanford Business, October 2015.

29 Driving startups also known as cleantechs. Cleantech startups deliver performance, productivity and efficiency by reducing negative environmental outputs.

30 "Innovation: the new Latin American entrepreneurial brand" Susana García-Robles, May 2017.

	The IDB Group proposal. IDB Lab proposes to launch a regional Challenge for LAC-based startups that may develop solutions for: 1) deployment of dedicated Battery Energy Storage Systems (BESS); 2) demonstration-effect technologies that support for large-scale BEES connection to grids; 3) ES solutions that support mini-grid solutions in rural areas to improve clean energy access. The Challenge would be commissioned by IDB Lab and publicized by the IDB Group's social media and communications teams. The selection criteria would follow CTF's BESS program and IDB Lab's guidelines. The judges would be composed by IDB Group specialists. The goal will be to select and support business models for up to 3 solutions that can receive financing from CTF and IDB Lab (preferably loans but quasi-equity instruments can be considered) within the next four years (2020-2023). Companies to be supported by the challenge need to be based in LAC and with a revenues stream already established. Potential financing will have an average ticket size of US$ 1.5M. Priority will be given to potential projects in the Caribbean region. The IDB lab has commissioned several other Challenges in the recent past, including the BlueTech Challenge (see: https://www.iadb.org/en/news/idb-announces-selected-proposals-its-blue-tech-challenge-caribbean). It has been an effective selection tool to democratize the access to IDBG and partners funding to innovative companies from the LAC Region. It has also helped IDBG specialists to get to know new relevant stakeholders.	
Expected CTF financing by financial instrument (USD M)	Quasi-equity	4.5
	Total	**4.5**
Expected leveraging and co-financing by source (USD M)	IDB Group	3M
	Companies counterpart and other co-financing sources	1.5M
	Total	**4.5M**
Expected results (if available)	GHG emissions reduced or avoided (Tons CO_2e)[a]	TBD
	Installed capacity of RE as a result of CTF interventions (MW)[a]	TBD
	Energy rating (MWh)	TBD
	Power capacity (MW)	TBD
	Regulations, codes or standards for energy storage solutions issued (number)	
Expected dates of milestones	Submission to CTF Trust Fund Committee	Feb 2021
	MDB Approval	Jun 2021
Project status	Early stage concept	

[a] In most cases the calculation of GHG emission reductions and RE capacity will need to be estimated through a modeling exercise.

Energy Storage Policy Support Program

Project title	**Energy Storage Policy Support Program**
Country or region	Regional (Bolivia, Brazil, Colombia, Ecuador, Honduras, Mexico, Peru).
Type of energy storage asset	Policy and regulatory support related to various energy storage and management technologies, including li-ion batteries, hydrogen, and pumped storage.
Implementing MDB	IDB Group
Brief description (including project objectives and innovation aspects)	Stabilizing climate change below 2°C and as close to 1.5°C as possible, the objective set in the Paris Agreement, requires getting to net-zero carbon emissions by around 2050 (IPCC, 2018). Decarbonizing the economy could achieve annual savings for the Latin America Region (LAC) of $621 billion by 2050 if its energy and transport sectors reach net-zero emissions. This would also create 7.7 million new permanent jobs. With solar and wind power now cheaper than fossil fuel in many countries, it is time to abandon fossil fuels—which carry $90 billion worth of stranded assets risk in the region's power sector alone.[31] While renewable energy is key to achieving this, some of the most important renewable energy technologies are variable and many tools will be required to bridge the gap in time between energy production and energy consumption in order to keep system balance and ensure resiliency, energy storage being one of the key tools. The share of renewable energy in the electricity sector is growing continually in LAC with record low prices thanks to innovations such as the pioneering designs of electricity auctions. Yet, other sectors, such as transport, buildings, and industry still largely depend on fossil fuel energy supply and represent the next frontier for deep decarbonization in LAC. To decarbonize these sectors, they need to be electrified or to reach other energy sources such as hydrogen or renewable liquid fuels. The objective of this project is to support countries to strengthen policies and regulations to facilitate energy storage integration and participation in electricity markets to manage supply and demand across the region. This project will also evaluate different energy storage technologies that will facilitate the increase in participation of renewable power generation and the use of green electricity to decarbonize the transport, industry, and buildings sectors. Policy development, institutional frameworks, and the development of the physical infrastructure for li-ion batteries recycling will also be considered. GESP contribution will play a critical role in moving the LAC region toward a clean energy transformation by smoothly integrating renewable energy into existing and developing power grids, increasing the overall system efficiency, creating a more flexible and reliable grid system, improving energy access, and promoting the electrification of different economic sectors. The project will be divided into four main components: **Component 1 (USD$0.6M): Green hydrogen production and commercialization assessment in Honduras.** This component aims to assess the viability of producing, storing, transporting, and utilizing hydrogen for

[31] IDB (2020). Long-term decarbonization strategies can guide Latin America's sustainable recovery.

	energy activities in Honduras. It will also strengthen the capacities of the Energy Ministry to facilitate the legal, regulatory, and institutional framework for the use of energy storage. Furthermore, technical, financial, and environmental analysis of the different commercially available large-scale storage technologies will be included. **Component 2 (USD$0.25M): Pumped storage deployment in LAC.** Given in particular the existence of a large hydropower fleet with reservoirs that allow energy storage and the lack of adequate regulation for energy storage, this component will support the development of hydro pumped storage plants (HPS) projects across the region. Activities will include (i) the analysis of the regulatory frameworks of countries with hydropower plants and growth of VRE to identify the existence of standards and incentives for the installation of HPS, and (ii) analysis of case studies. **Component 3: Enabling energy storage markets in LAC for a low-carbon multisector coupling (USD$1.0M):** This component is aligned with the IDB's USD$600M e-mobility fund (co-financed by the GCF) that will enable the uptake of EVs by tackling the barriers of high CAPEX, performance risks and low profitability.[32] The component will focus on enabling countries' policy and regulatory frameworks to foster the creation of energy storage markets needed for the adequate functioning sector coupling, not just reducing barriers but also taking advantage of the storage flexibilities that end-use sectors may represent, thus promoting the electrification of different economic sectors. **Component 4: Circular lithium (USD$1.0M).** This component aims to accelerate the shift towards circular economies in the region and create awareness of the untapped business opportunities of circular systems. Its objective is to identify and assess sustainable business models for recycling used li-ion batteries, both by reusing its material components or by finding a second life for the battery. Activities will include (i) the identification of recycling business model for lithium-based batteries, (ii) financing the piloting of the most cost-effective technology option previously identified, including the design of its logistic structure for the gathering of the disposed batteries in selected countries, and (iii) regulatory assessments about battery waste disposal and logistics, workshops and capacity building activities, dissemination activities and raising awareness campaigns.	
Expected CTF financing by financial instrument (USD M)	Grant	2.85
	Total	**2.85**
Expected leveraging and co-financing by source (USD M)	IDB Group (additional co-financing TBD)	0.15
	Total	**0.15**
	GHG emissions reduced or avoided (Tons CO_2e)	N/A

[32] The fund investment focus is on urban public transport, electric micro-mobility linked to low-carbon urban development, institutional fleets, charging infrastructure, H2 pilots including trucks and Vehicle-to-Grid (V2G) pilot projects with the aim to speed up decarbonization of the grid by exploiting multi sector coupling opportunities with are key to achieve a more flexible zero carbon power grid.

Expected results	Installed capacity of RE as a result of CTF interventions (MW)[a]	N/A
	Energy rating (MWh)	N/A
	Power capacity (MW)	N/A
	Increased renewable energy integration in the power system, increased energy security, improved enabling policy and regulatory environment, increased deployment of energy storage systems.	TBC
Expected dates of milestones	Submission to CTF Trust Fund Committee	Nov 2020
	MDB Approval	Feb 2021
Project status	The IDB has experience working with battery storage systems to improve access to electricity installing mini-grids and evaluating the potential of the storage systems in the grids through pilot projects, examples include Argentina, Barbados, Bolivia, Honduras and Uruguay. Furthermore, the Bank is already mobilizing human and financial resources to strengthen regional strategic management capacity for the development of the lithium industry, through the project Development of lithium: Regional Platform for Sustainable Growth, which is part of the Regional Public Goods (RPG) initiative. The IDB is also performing an analysis of the regulatory framework in 6 countries (Panama, Colombia, Peru, Chile, Argentina and Brazil), which will identify the suitability and barriers for the development of HPS, as well as propose next steps.	

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World Bank

Bangladesh: Electricity Distribution Modernization Program

Project title	**Bangladesh Electricity Distribution Modernization Program**
Country or region	Bangladesh / South Asia
Type of energy storage asset	Distribution-level Battery Energy Storage Systems
Implementing MDB	The World Bank
Brief description (including project objectives and innovation aspects)	**Background** Bangladesh has made considerable headway in increasing access to electricity and power generation capacity. Access to grid electricity increased from a third of the population in 2000 to 95 percent by 2019, and installed generation capacity quadrupled from 4.5 GW to 18 GW in the same period. Improvements in electricity supply have helped underpin economic growth rates of more than 6% in the last decade. Yet the country faces significant challenges in securing electricity to support its rapidly growing economy. Electricity demand in Bangladesh is projected to more than double to 32 GW by 2030 to meet its economic growth targets and per capita electricity consumption, which remain at just 1/7th the average for middle-income countries. Despite the growth in generating capacity, there has not been adequate investment in expansion and modernization of transmission and distribution networks, leaving them congested and prone to outages. The share of coal in the generation mix of Bangladesh is expected to grow substantially to meet the projected growth in demand, with 5.2 GW of coal power under construction, and a total of 19 GW under consideration by 2030. Bangladesh Rural Electrification Board (BREB) is planning to implement a US$3.2 billion distribution capacity enhancement and modernization program over 2021-2026 with the assistance of World Bank and other development partners. The Bank is expecting to provide US$500 million from the IDA19 Scale Up Window to support the proposed program. The Bank's technical assistance (TA) has shown that decentralized energy resources including rooftop solar and battery electricity storage systems (BESS) can improve the efficiency and resilience of the distribution system in Bangladesh and would help displace fossil fuel generation in the electricity mix. Ongoing analyses show that decentralized solar together with energy storage could reduce distribution losses by more than 40% and complement the efficiency benefits of other distributed technologies. Storage can integrate solar rooftop output without overloading distribution feeders, defer T&D augmentation, improve overall power quality, and improve the climate resilience of the distribution network. Ongoing TA work is underway focused on system level analysis of energy storage across

	distribution and transmission to understand the value of energy storage for enabling higher shares of VRE in system planning and accommodate the increasing needs for peaking power service without the additional diesel, gas or coal power plant capacity. Despite its growing economic competitiveness to improve power system flexibility, there are currently no grid-level battery storage systems deployed in Bangladesh. The technology is novel, perceived to be technically and financially high risk, and lacking a supportive regulatory framework. Initial demonstration of BESS in Bangladesh will create market and regulatory experience regarding use cases and benefits of BESS, which can leverage new investment to strengthen the Bangladesh transmission and distribution system while reducing reliance on coal. **Project objective**: The objective is to improve the operational efficiency and reliability of the electricity distribution in selected areas in Bangladesh. **Components**: - **Component 1** "BREB Distribution system capacity enhancement and modernization" will support the expansion and upgrade of the BREB distribution network including distribution lines and substations, SCADA, AMI and measures to improve climate resilience of the distribution system. - **Component 2** "Decentralized Energy Resources" will support BREB in integrating of decentralized renewable energy, battery energy storage systems and electric vehicles in distribution system to facilitate the energy transition including displacing fossil fuel generation and making the electricity more efficient. - **Component 3** "Technical assistance and capacity building" will support the capacity of electricity sector institutions to modernize electricity distribution and implement the energy transition, including digitalization, distribution network planning, decentralized renewable energy, battery energy storage systems, tariff reform, training, as well as human resource planning and strengthening. **Innovation aspects**: Energy storage cuts across the components of Project, however there is currently no BESS deployed in Bangladesh despite a wide range of applications where BESS could be well suited. This investment will be critical to quantify and demonstrate the value proposition of BESS within the distribution system.	
Expected CTF financing by financial instrument (USD M)	Softer concessional loan	15
	Capacity building grant	5
	Total	20

Expected leveraging and co-financing by source (USD M)	IDA Scale Up Window	500
	Private investments	50
	Development Partners	336
	Total	**886**
Expected results (if available)	GHG emissions reduced or avoided (Tons CO_2e)[a]	128,000[33]
	Installed capacity of RE as a result of CTF interventions (MW)[a]	15[34]
	Energy rating (MWh)	50
	Power capacity (MW)	25[35]
	Regulations, codes or standards for energy storage solutions issued (number)	1[36]
Expected dates of milestones	Submission to CTF Trust Fund Committee	May 2021
	MDB Approval	July 2021
Project status	The Bangladesh Distribution Modernization Project is at the identification stage (through August 2020) with anticipated Board Approval in July 2021. Related Technical Assistance is underway on assessment of distribution network resilience, acceleration of the energy transition in Bangladesh, with work already completed on financial sustainability plan for BREB's grid expansion planning and distributed solar potential.	

[33] Assuming daily cycling of several distribution-level storage systems collectively capable of displacing 50 MWh of daily diesel generation with a 0.7 kg/kWh emissions factor. Assumes 10 year investment lifetime at this level of BESS throughput.

[34] In this PV+BESS configuration, BESS would serve only to store solar power (average 1,400 kWh/kW annual generation and 86% round trip BESS efficiency) to displace diesel used during peak power periods, usually in the evening.

[35] Estimate assumes BESS development costs in the range of $300/kWh for lithium ion system, based on literature survey and bottom-up cost estimates of battery packs in 2020 for the Indian and U.S. markets from LBNL, adjusted to include balance of system, inverter, EPC, and soft costs.

[36] Inform policy dialogue to integrate energy storage in the grid code.

Benin: Battery Storage Systems and Synchronization

Project title	**Battery Energy Storage Systems and Synchronization (BE3S) Project**	
Country or region	Benin / Africa	
Type of energy storage asset	Battery Energy Storage System	
Implementing MDB	The World Bank	
Brief description (including project objectives and innovation aspects)	The objective of the project is to increase ECOWAS power system capability to secure synchronous operation and enable renewable energy penetration. The proposed project will finance the installation of Battery Energy Storage Systems (BESS) in substations of Benin and Cote d'Ivoire. Firstly, it aims at providing Ancillary Services supporting frequency and voltage control required for the synchronous operation of the West African Power Pool (WAPP) system that enables the environment for stable regional power exchange between the member countries. Secondly, it aims at providing the integration of variable renewable energy for future renewable penetration on the networks. Two components are currently under consideration on the project: **Component 1 Provision of ancillary services for the WAPP interconnected system** **Sub-component 1a. BESS equipment**: This component involves the supply and installation of approximately 120 MWh BESS to provide frequency control to the WAPP power system. It includes all the elements required to connect the system to the 225-kV busbar of the substation. The equipment will be installed in substations in Nigeria, Ghana and Cote d'Ivoire based on the technical studies under execution selected among all available integration techniques and flexibility options to reach the least-cost. This component will be co-financed by CTF. **Sub-component 1b. Synchronization Equipment**: This component involves the supply and installation of all the additional equipment (voltage control, control, communications, and Supervisory control and data acquisition) required to operate the power system in a synchronous manner. **Component 2 Technical Assistance to the regional implementation unit and national implementation units** This component will finance the technical assistance for the key entities in charge of the operation of the system, namely, the regional regulator (ERERA) and the system market operator (ICC). This component will also finance project Management and supports implementation teams as well as supervision engineer to oversee the works in each country. The expected completion time is between 36 to 48 months.	
Expected CTF financing by	Loan	40
	Grant	10

financial instrument (USD M)	**Total**	**50**
Expected leveraging and co-financing by source (USD M)	IDA	68
	Private sector	150
	Total	**218**
Expected results (if available)	GHG emissions reduced or avoided (Tons CO_2e/year) [a]	103,210
	Installed capacity of RE as a result of CTF interventions (MW)[a]	200
	Energy rating (MWh)	120
	Power capacity (MW)	To be determined
	Regulations, codes or standards for energy storage solutions issued (number)	Not applicable
Expected dates of milestones	Submission to CTF Trust Fund Committee	May 2020
	MDB Approval	October 2020
Project status	The project is under pre-appraisal.	

India: Program for Transformative Mobility and Battery Storage

Project title	**Program for Transformative Mobility and Battery Storage**
Country or region	India
Type of energy storage asset	Battery Energy Storage System
Implementing MDB	The World Bank
Brief description (including project objectives and innovation aspects)	India made substantial progress towards its renewable energy ambitions and installed 37.5 GW of wind power and 35.6 GW of solar power capacity by December 2019. Integrating a growing share of variable renewable energy into the existing power grid is becoming increasingly complex. If India meets its RE capacity addition targets, then during a typical day in 2022, solar power may meet up to 44 percent of the total power demand. However, this solar power is not only variable in nature but also will be generated during off-peak periods and will not be able to meet peak demand. Also, the variable nature of wind power means that wind capacity of 60 GW could bring about a variation in output to the power grid of up to 8 GW in as little as 5 hours. The variable nature of renewable energy supply will require a combination of fast responding, high capacity energy storage to support its integration into the power system, support ramping requirements, and to service peak demand. Increasing the capacity of renewable energy production in areas where resources are most abundant may lead to transmission capacity constraints, resulting in curtailment of renewable energy generation during peak production. For the successful integration of high volumes of renewable energy in the power system, energy storage will be essential. Recognizing the transformative potential of battery energy storage system (BESS) for RE integration, India launched a National Mission on Transformative Mobility and Battery Storage (NMTMBS) in 2019 to promote sustainable mobility initiatives and clean energy through BESS. This project will adopt Multiphase Programmatic Approach (MPA) to support NMTMBS. The MPA aims to catalyze early investments and mobilize private sector financing for the development of sustainable markets for BESS and e-mobility. The MPA activities include: (a) defining the value propositions for BESS, (b) developing bankable business models, (c) developing policy and regulatory structure, and (d) catalyzing early investments in BESS and supporting infrastructure and mobilizing private sector financing for the development of a BESS over the longer term. These activities will be implemented through a series of projects. Phase 1 project will catalyze early signaling investments and demonstrate the feasibility of BESS. Phase 2 will support scale-up through commercial investments. Phase 3 will support market consolidation to the extent of fully commercial and self-sustaining markets for battery energy storage across the power sector and e-mobility sectors. **This CTF funding will finance only Phase 1 of the MPA and the support will be limited to BESS development for power sector only.** The support includes the early investments and capacity development of key market intermediary government entities, regulators, transmission and distribution companies, generation companies, developers, and investors. Funding from other sources will support similar activities for the development of e-mobility.

Expected CTF financing by financial instrument (USD M)	Loan	60
	Grant	5
	Total	**65** (The expected CTF financing amounts by each instrument are indicative and subject to further adjustments toward the project submission to the Trust Fund Committee)
Expected leveraging and co-financing by source (USD M)	IBRD	185
	Commercial financing	107
	Total	**292**
Expected results (if available)	GHG emissions reduced or avoided (Tons CO_2e/year) [a]	350,000
	Installed capacity of RE as a result of CTF interventions (MW)[a]	170
	Energy rating (MWh)	1,200
	Power capacity (MW)	278
	Regulations, codes or standards for energy storage solutions issued (number)	To be determined
Expected dates of milestones	Submission to CTF Trust Fund Committee	April 2021
	MDB Approval	July 2021
Project status	The project concept has been reviewed by the World Bank management on March 16th, 2020. Analytical and Advisory work (ASA) (US$1.25 million) is currently being implemented in support of the proposed Program with support from ESMAP. This ASA aims to support the development of the required enabling environment for scaling up the deployment of battery storage across stationary storage and e-mobility sectors. The activities related to BESS for power sector focus on the following areas: Demand Assessment, Policy & Regulatory Environment and Standards and Testing Facilities for Battery Storage.	

Indonesia: Sustainable Least-Cost Electrification Project

Project title	**Indonesia Sustainable Least-cost Electrification (ISLE) project**
Country or region	Indonesia / East Asia and Pacific
Type of energy storage asset	Battery Energy Storage System
Implementing MDB	The World Bank
Brief description (including project objectives and innovation aspects)	**Background**: Indonesia has made it a priority to reach 100% electrification by 2024 through access to affordable and sustainable energy supply. Eastern Indonesia – which covers Kalimantan, Sulawesi, West Nusa Tenggara, East Nusa Tenggara and Papua Indonesia with around 50 small to medium size islands – is the region with the lowest electricity ratio but also the highest percentage of people living below the poverty line. The Eastern Islands are characterized by (i) small size grids (between 5 MW to 300 MW – with the exception of Sulawesi and Kalimantan) powered with diesel and coal, and (ii) the highest average cost of electricity in the country. The 2018 average generation cost in those islands was between USD 0.14 and 0.21 per kWh, compared to around USD 0.06 per kWh in the Java-Bali grid. Due to the fluctuation in diesel fuel cost, the average generation cost in those islands faced a 5-10% increase from 2017 which already faced a 15-20% increase from the year before. This cost increase is being covered by PLN (the State Utility) and the Ministry of Finance through its subsidies to PLN as by law PLN is required to offer a uniformed tariff across islands. Therefore, to support the development of a sustainable electrification plan and lessen PLN's financial burden, it is critical to reduce the cost of generation in this region as more customers will be connected to it once universal access is reached. The main solution proposed by PLN to reduce the cost of generation is to develop more small coal units. However, based on technical and financial assessments conducted under the technical assistance (TA) part of ISLE, solar energy is expected to be the least-cost solution. Under the TA, ten islands in the Maluku and Nusa Tenggara regions – with different characteristics to be representative of the 40 other islands – have been assessed to propose solutions to reduce losses, increase reliability and decrease cost of generation. According to the preliminary results, the deployment of 425 MWp by 2025 and 755 MWp by 2030 with over 250 MWh of storage for ancillary services and load shifting enables a reduction by USD 366 million compared to PLN's current generation plan (RUPTL 2019-2028). PLN limits the amount of solar energy to 5-10% of the installed generation capacity in each grid due to perceived technical and commercial constraints. It is critical to support PLN in successfully deploying the least-cost and easy to integrate solar generation in the smaller grids to enable the solar deployment

	in larger grids as a second step. Solar generation represents today less than 100 MW in a 60 GW system. **Project objective**: ISLE's objective is to pilot a sustainable deployment of grid-connected solar and battery storage to reduce cost of generation in the Eastern Islands of Indonesia and improve grid reliability. **Components**: - **Component 1** "Reliability enhancement and VRE integration" (USD 250 million) focusses on improving the Islands grid's strength by financing expansion and upgrade of transmission network (SCADA, new lines, grid upgrades, battery storage for ancillary services) and VRE integration (battery storage for load shifting in the larger grids). It will also pilot recently approved new World Bank guidelines on grid resilience. - **Component 2** "Hybridization of smaller grids" (USD 100 million) finances hybridization with solar and battery with existing dual fuel plants running on diesel in six islands. - **Component 3** "Technical Assistance for Integrated Planning Support and Capacity Building for Local Planning" (USD 25 million) finances the preparation of a second phase (about 30 islands) as the ISLE TA component financed the preparation of the first phase of 10 islands. **Innovation aspects**: ISLE will enable the piloting of large-scale solar penetration in Indonesia with the support of a sustainable methodology that evaluates the grid strength and its flexibility prior to deployment VRE. This investment will be critical to showcase positive development of solar generation in Indonesia.	
Expected CTF financing by financial instrument (USD M)	Softer concessional loan	98
	Capacity building grant	2
	Total	**100**
Expected leveraging and co-financing by source (USD M)	IBRD	200
	Private investments	310
	Bilateral	48
	Total	**558**
Expected results (if available)	GHG emissions reduced or avoided (Tons CO_2e)[a]	7.6 million tons (over 25 years)
	Installed capacity of RE as a result of CTF interventions (MW)[a]	755
	Energy rating (MWh)	250
	Power capacity (MW)	100
	Regulations, codes or standards for energy storage solutions issued (number)	Not applicable

Expected dates of milestones	Submission to CTF Trust Fund Committee	February 2021
	MDB Approval	November 2021
Project status	ISLE TA is under implementation. The concept review for the project is expected for November 2020. Analysis on battery storage needs, infrastructure upgrades, hybridization and land selection for solar projects was completed by September 2020. Pre-feasibility studies and environmental and social safeguard in instruments are under preparation. Consultations with the Government of Indonesia and PLN is ongoing.	

Mali: Regional Hybrid Solar PV and Storage Park

Project title	**Regional Hybrid Solar PV and Storage Park**
Country or region	Mali / Africa
Type of energy storage asset	Battery Energy Storage System
Implementing MDB	The World Bank
Brief description (including project objectives and innovation aspects)	**Background**: As a part of the USD 21 million Solar Development in Sub-Saharan Africa Project Phase 1 (Sahel) approved in July 2018, referred below as "SOP1", two 150MWp Regional Solar Parks with 50MW/200MWh of battery storage[37] are being developed in Mali. The Regional Parks are included in the West African Power Pool (WAPP) regional Master Plan. The current grid-tied installed capacity in Mali is around 310 MW and it is a mix of hydropower and diesel and heavy fuel oil (HFO) plants. The grid is weak with major bottlenecks along several lines, requiring very expensive rental generators additionally at certain points of the grid. Solar generation, which is variable, is expected to be difficult to integrated into the grid without significant generation curtailment if batteries are not part of the plant.[38] **Benefits of the Regional Solar Parks:** The Regional Solar Park will add local and partially dispatchable generation to the grid and enable the displacement of diesel/HFO-based generation during the day. Battery storage will enable the solar plants to deal with variability of its output during the day and partially answer the evening peak demand. The park will become a key asset in the local grid, delivering local green power and enabling a reduction in GHG emissions through partial displacements of mid-day fossil-based power production. Additionally, the park will bring to the power system additional much needed evening power. Finally, being connected to the high voltage regional grid overseen by the West African Power Pool, the Regional Solar Park aims to ultimately export solar electricity to the regional grid. **Objective**: The objective of the project is to leverage private sector investments to develop the least-cost sustainable solar PV electricity production in Mali as a lever for increasing access to electricity in the country and the WAPP region while reducing GHG emissions through the displacement of diesel/HFO-based generation. **Investments**: The first Regional Solar Park is expected to be financed as per the following[39]: - USD 71 million IDA lending which would encompass: (i) the solar park infrastructure (land, evacuation, safeguards etc.), (ii) an upgrade of the key transmission line Segou-Bamako and deployment of utility-owned battery

[37] The storage size is being refined by the consultants hired for the feasibility study.
[38] A grid integration analysis is currently being conducted during feasibility study.
[39] All investment numbers are under discussion with the Government and being refined through technical analysis

	storage to support the integration of the national solar PV plants under development, and (iii) technical assistance - USD 62 million IDA guarantee (liquidity and loan) made available to the private sector to reduce the national utility related risks and political risks perceived by the independent power producers (IPPs) - USD 201.5 million by IPPs and private lenders to finance the solar battery power plant - USD 30 million CTF, of which USD 18 million concessional loan to reduce the cost of publicly-owned storage and solar park infrastructures for bringing down power prices, USD 10 million guarantee to further leverage investments, and USD 2 million CTF grant for technical assistance	
Expected CTF financing by financial instrument (USD M)	Loan	18
	Grant	2
	Guarantee	10
	Total	**30**
Expected leveraging and co-financing by source (USD M)	IDA	133
	Private sector (equity and debt)	202
	Total	**335**
Expected results (if available)	GHG emissions reduced or avoided (Tons CO_2e)[a]	3 million (over 25 years)
	Installed capacity of RE as a result of CTF interventions (MW)[a]	150
	Energy rating (MWh)	200
	Power capacity (MW)	50
	Regulations, codes or standards for energy storage solutions issued (number)	Not applicable
Expected dates of milestones	Submission to CTF Trust Fund Committee	February 2021
	MDB Approval	May 2021
Project status	The Government has been extensively involved in the project development. Feasibility studies (FS) and grid integration studies are currently being conducted. Environmental and social impact assessments and the development of an auction mechanism to select the IPPs will start. The project will be ready for concept review after the preliminary technical and financial results of the FS.	

Tunisia: Dispatchable Solar Power

Project title	**Dispatchable Solar Power**
Country or region	Tunisia / Middle East and North Africa
Type of energy storage asset	Battery Energy Storage System associated with PV and/or Thermal Energy Storage System (TES) associated with Concentrating Solar Power (CSP)
Implementing MDB	The World Bank
Brief description (including project objectives and innovation aspects)	The project will support preparation for launch of a competitive tender in Tunisia of a dispatchable solar plant incorporating CSP generation with thermal energy storage(TES) and/or solar PV generation with battery energy storage systems (BESS) . Under the MENA CSP Knowledge and Innovation Program (P153959, a first phase of an in-depth technical assistance activity has been carried-out, analyzing the extent to which CSP can be part of a least-cost generation expansion plan, and how dispatchable CSP can contribute to supporting a higher penetration of variable renewables and to achieving 24/7 renewable supply. The study highlighted that dispatchable solar has interest for Tunisia, with a first plant to be commissioned before 2025. Following the completion of this program, the Government of Tunisia in December 2019 requested the World Bank to assist the development of a dispatchable solar project following a technology-neutral approach. This activity is an element of the ongoing Tunisia energy PASA (P167211) and contributes to its development objective by improving the performance of the Tunisian public energy company. The proposed project will enhance the performance and increase capabilities of the public energy sector by enabling it to procure competitively dispatchable renewable electricity that provides an optimal fit to the national grid's needs, including expected national demand profile, cost requirements, flexibility and other ancillary service needs and renewable energy targets, while avoiding additional burdens on public finances. The storage element of the project will enable the project to contribute to grid flexibility, which is crucial to absorb anticipated additions of PV and wind power to the grid, while avoiding the need for additional fossil generation. The following analysis are contemplated at this stage: A. **Variable renewable energy (VRE) integration studies.** These studies will estimate level of sound VRE penetration based on technical and commercial constraints and identify the grid upgrade measures needed to enable VRE integration. Additionally, a high-level locational study will clarify the optimal points of VRE injection into the grid, minimizing grid reinforcement costs. B. **Socio-economic benefits studies**. This component aims at maximizing the benefits of the project in terms of industrial development, local development and gender gap equality. C. **Development of a first-of-its-kind CSP-TES-PV-BESS hybrid design model**. This innovative tool will determine the optimal design to explore the techno-economic trade-offs between various energy storage system technologies used in conjunction with solar power technologies.

	D. **Enabling framework**. The objective of this component is to compare the possible contractual schemes under the Tunisian legislation including risk allocation analyses to reduce the risk premium and optimize the targeted tariff. Two related tasks are contemplated to be supported by a separate, recipient-executed activity. Those will be: E. **Feasibility studies of the solar park, such as those related to the power grid, ESIA, or civil works** F. **Transaction advisors for the competitive bidding process, including technical, legal and financial/tax.** The analytical work on variable renewable energy (VRE) deployment and on solar + storage technologies will enable Tunisia to scale-up renewables in the country in a sustainable manner and to implement the national solar energy plan. Preliminary work done has shown the limitations of the grid to absorb more VRE in a short to medium-term basis, which will limit the potential of the country to harness its domestic resources at scale while addressing the needs of its utility. The World Bank is supporting Tunisia to prepare a dispatchable solar project that will be procured competitively. The aforementioned activities will inform the design of this operation. At this stage, aligned with the SRMI[40] approach, the private sector is expected to finance the solar plant whereas the World Bank operation with the CTF support would finance the grid investment needed in particular from VRE integration perspective and/or a utility-owned battery energy storage systems (BESS). A liquidity guarantee may also be needed to provide comfort to the private sector to cover the delay payment risk by the utility. A market sounding will be carried out to inform the need of such instrument and its design. A coverage of the PPA off-taker liquidity risk (in combination with the other de-risking measures promoted) is expected to encourage other institutions to support or otherwise participate in the project and mobilize additional funding. In addition, discussions will take place within the World Bank Group to explore the possibility of complementary instruments to the ones sought from the CTF (e.g. coverage of termination payments by MIGA).	
Expected CTF financing by financial instrument (USD M)	Loan	38
	Grant	2
	Guarantee	10
	Total	**50**
Expected leveraging and co-financing by source (USD M)	IBRD	100
	Private Sector	250
	Total	**350**

[40] **SRMI** refers to the Sustainable Renewables Risk Mitigation Initiative launched by the World Bank to support governments design and implement sustainable renewable energy (RE) programs to (i) leverage private investments, (ii) reduce reliance on public finances (limited to critical public investments needed to unlock private investments such as for grid integration purposes) and (iii) maximize socio-economic development triggered by RE projects.

Expected results (if available)	GHG emissions reduced or avoided (Tons CO_2e/year)[a]	142,000
	Installed capacity of RE as a result of CTF interventions (MW)[a]	100MW with 4h of storage or 200MW PV with 800MWh BESS
	Energy rating (MWh)	330 GWh/year
	Power capacity (MW)	100MW with 4h of storage or 200MW PV with 400MWh BESS
	Regulations, codes or standards for energy storage solutions issued (number)	Tbd
Expected dates of milestones	Submission to CTF Trust Fund Committee	March 2022
	MDB Approval	September 2022
Project status	The project is under pre-appraisal.	

[a] We considered the US average electricity source emissions of 0.429 kgs CO2e per kWh for the capacity ranges and technologies specified below. Source: https://carbonfund.org/calculation-methods/

[b] Energy production for the capacity ranges and technologies specified below. **For the configuration of 100 MW CSP parabolic trough with 4h of storage**: 100MWx8760h/year*capacity factor of 37.89%=332 GWh. This average capacity factor corresponds to a parabolic trough CSP technology, with 4h of storage and was calculated specifically for the Tunisian solar resource, as part of a modeling exercise undertaken by the MENA CSP KIP Knowledge and Innovation Program P153959. **For the configuration of 200 MW of PV with 400 MWh BESS,** a modeling exercise under the same Program and also considering battery degradation estimates a yearly output of 333 GWh/year.

Ukraine: Facilitating Power System Integration with Europe

Project title	**Facilitating Power System Integration with Europe**
Country or region	Ukraine / Europe and Central Asia
Type of energy storage asset	Battery Energy Storage System
Implementing MDB	The World Bank
Brief description (including project objectives and innovation aspects)	Ukraine has gone through multiple stages of power sector reform that started with unbundling and partial privatizations in the 1990s. The country transitioned in 2019 to a new wholesale electricity market (WEM), facing various challenges in market concentration under the new heavily regulated market structure. WEM provides only 30-38 percent of total consumption, with the rest being supplied by SOEs that can't participate in the market due to public service obligation. The small market volume limits market liquidity and resource diversity. Ukraine is also planning to synchronize with the European Network of Transmission System Operators for Electricity (ENTSO-E) power system together with Moldova after disconnecting its system from the Russian power system. Facilitating Power System Integration with Europe Project (the Project) aims to support Ukraine towards the synchronization of its power system with Europe, through (i) establishing a cross border power interconnection between Ukraine and European Union (EU) and (ii) introducing battery storage facility into the power system. The first component of the Project is to support construction of 600 MW of Back to Back interconnection with Europe, which is expected to bring benefits, including enhanced reliability and security of electricity supply, increased liquidity in the WEM, improved grid resilience, and diversification of energy mix that is heavily dominated by nuclear and thermal generation. The proposed infrastructure will facilitate Ukraine's synchronization with ENTSO-E power system, through providing various technical benefits to stabilize the synchronized grid. The second component is to support installation of 197 MW of Battery Energy Storage System (BESS) to meet with the power system's requirement to provide sufficient amount and quality of flexibility in the system. The national transmission system operator (TSO), Ukrenergo, has identified that the Ukrainian power system needs to develop 220MW of BESS to provide Frequency Containment Reserve (FCR). Preparation of the required amount of FCR is a prerequisite for its synchronization with the European power system, as per the requirement from ENTSO-E. Currently, the Ukrainian power system lacks capability in the provision of a sufficient amount of the FCR from existing thermal power plants (TPPs) and hydropower plants (HPP) due to its high historical dependence for the fast reserve on the Russian power system and obsolete functionarities of the power plants. The BESS facilities will be installed within territories of four existing hydro power plants owned by the national hydropower company, UkrHydroenergo (UHE), combined with solar PVs on site. Given the unbundling constraint for the TSO to develop and operate BESS, the HPP company is well-positioned to provide the service given its experiences in ancillary service provision and the availability of the land and grid.

	The use of BESS for ancillary services will reduce the CO2 emissions from the system and increase the system capability to integrate renewable energy sources. By transferring part of the reserve requirement from the TPPs to BESS, the power system will avoid inefficient TPP operations, leading to the CO2 emission reduction. BESS would also add system flexibility needed to accommodate more renewable energy into the system. The World Bank's least-cost planning exercise tentatively identified that the introduction of BESS into the power system can reduce the CO2 grid emission by 263 tons per year and enable the integration of additional 70MW of variable renewable.	
Expected CTF financing by financial instrument (USD M)	Loan for BESS investment	35
	Total	**35**
Expected leveraging and co-financing by source (USD M)	IBRD Loan (of which BESS investment)	250 (56)
	EIB/EU (of which BESS investment)	260 (83)
	Total (of which BESS investment)	**510 (139)**
Expected results (if available)	GHG emissions reduced or avoided (Tons CO_2e/year)[a]	263
	Installed capacity of RE as a result of CTF interventions (MW)[a]	70
	Energy rating (MWh)	197
	Power capacity (MW)	197
	Regulations, codes or standards for energy storage solutions issued (number)	Not applicable
Expected dates of milestones	Submission to CTF Trust Fund Committee	Nov 2020
	MDB Approval	March 2021
Project status	The World Bank team has been closely working with UHE and USAID, to develop Feasibility Study (FS) of the proposed BESS project. The FS was completed in April 2020. The FS has identified four potential sites for the BESS combined with PV plants: Kiev HPP, Kaniv HPP, Kremenchuk HPP and Serednodniprovska HPP. The total capacity of the proposed BESS is 197 MW. The significant economic benefits is identified with a total NPV of 157 million USD while the total investment cost is 167 million USD including BESS, PV and Energy Management System, which is needed to operate the BESS, PV and HPP in an efficient manner as a comprehensive system. Other project preparatory activites are in progress including environmental and social assessments. The Bank team is planning to organize internal review meeting in October 2020, aiming the World Bank Board approval in March 2021.	

Vietnam: Renewable Energy Accelerating Change Project

Project title	**Renewable Energy Accelerating Change (REACH) project**
Country or region	Vietnam / East Asia and Pacific
Type of energy storage asset	Battery Energy Storage System
Implementing MDB	The World Bank
Brief description (including project objectives and innovation aspects)	**Background**: Vietnam is endowed with excellent solar and wind resources. Together, they can play a critical role with regards to energy security, climate change mitigation and answering the Vietnamese fast growing demand. Since 2017, the Government of Vietnam is promoting solar and wind through a feed-in-tariff (FIT) policy to mobilize private investments in renewable energy generation. Under the FIT policy, over 4.5 GW of solar generation and around 350 MW of wind generation have been developed. However, this fast deployment of variable renewable energy (VRE) has been sub-optimal. Indeed, as under the FIT, the Independent Power Producers (IPPs) had the liberty to decide where the solar projects will connect to the grid, Vietnam is now facing VRE integration issues, including important curtailment of the newly built solar projects. Plus, the FIT price is USD 0.09 per kWh when well-organized competitive bidding led to prices below USD 0.05 per kWh in countries such as in Tunisia, Ethiopia or the Philippines – especially when developed under a solar park scheme that provides land and key permits to the IPPs. Through the Vietnam Solar Transition Accelerator (VISTA) technical assistance, the World Bank is supporting the Government of Vietnam to pilot two different solar PV competitive bidding schemes, namely the solar parks and substation-based competitive bidding schemes. Under both schemes, when the Government and the national utility launch the tenders, the bidding packages include the information on the grid availability. This information enables a significant reduction in perceived curtailment risks. In addition, the solar park scheme further reduces development risks by providing the land and key permits to the IPPs. Along with the competitive bidding schemes, targeted public investments are crucial in unlocking the areas with the best solar and wind resources in the country. Public investments will support not only to mitigate the curtailment risk but also to ensure that a high penetration of VRE does not compromise the grid stability and reliability. To that effect, REACH supports the Government's decision to develop solar and wind parks with public infrastructure to reduce the development risk perceived by the IPPs. **Project objective**: REACH's objective is to sustainably increase VRE production in Vietnam mobilizing private investments. **Components**: - **Component 1** "Grid Expansion and Reinforcement" (USD 250 million) focusses on improving the Vietnamese grid's strength by financing expansion and upgrade of transmission network. It will also pilot new guidance on grid resilience. Although this component will not be financed by CTF funding, still it comprises an integral part of the project by improving the grid stability to achieve the objective of increasing the VRE production.

	- **Component 2** "VRE Integration and Battery Storage" (USD 125 million) finances voltage and frequency equipment such as capacitor banks, STATCOM and battery storage to integrate the 5.5 GW of installed VRE and support the integration of the other VRE prepared under REACH and VISTA. - **Component 3** "Solar and Wind Park Preparation and Infrastructure" (USD 75 million) finances ground-mounted solar and wind parks infrastructure for 3 GW of VRE generation, and the preparation for 2 GW of off-shore wind. **Innovation aspects**: Being one of the countries that will be the most impacted by climate change, Vietnam is aiming to become a leader in renewable energy deployment and prepare its infrastructure to the potential changes that will impact the country. Vietnam will be one of the first developing countries to explore its offshore wind potential and to finance utility-owned battery storage to increase VRE penetration. The development of solar/wind parks will also enable Vietnam to maximize its socio-economic benefits in regions where economic development is lessened. It will be the first time the Government is developing solar/wind parks, and a vital capacity building component will be needed.	
Expected CTF financing by financial instrument (USD M)	Loan	38
	Capacity building grant	2
	Total	**40**
Expected leveraging and co-financing by source (USD M)	IBRD	225
	Private Sector	975
	Bilateral	48
	Others (GCF + ESMAP)	90
	Total	**1,338**
Expected results (if available)	GHG emissions reduced or avoided (Tons CO_2e)[a]	63 million (over 25 years)
	Installed capacity of RE as a result of CTF interventions (MW)[a]	3 GW
	Energy rating (MWh)	85
	Power capacity (MW)	190
	Regulations, codes or standards for energy storage solutions issued (number)	Not applicable
Expected dates of milestones	Submission to CTF Trust Fund Committee	December 2020
	MDB Approval	July 2021
Project status	Concept review is expected for May 2020. Analyses on battery storage needs, infrastructure upgrades, and land selection for solar/wind parks are ongoing and will be completed by September 2020. Consultations with the Government is ongoing, and VISTA's implementation is going well.	