ESMAP | THE WORLD BANK IBRD • IDA

ESMAP 2023

RENEWABLE ENERGY & STORAGE

Powering the energy transition

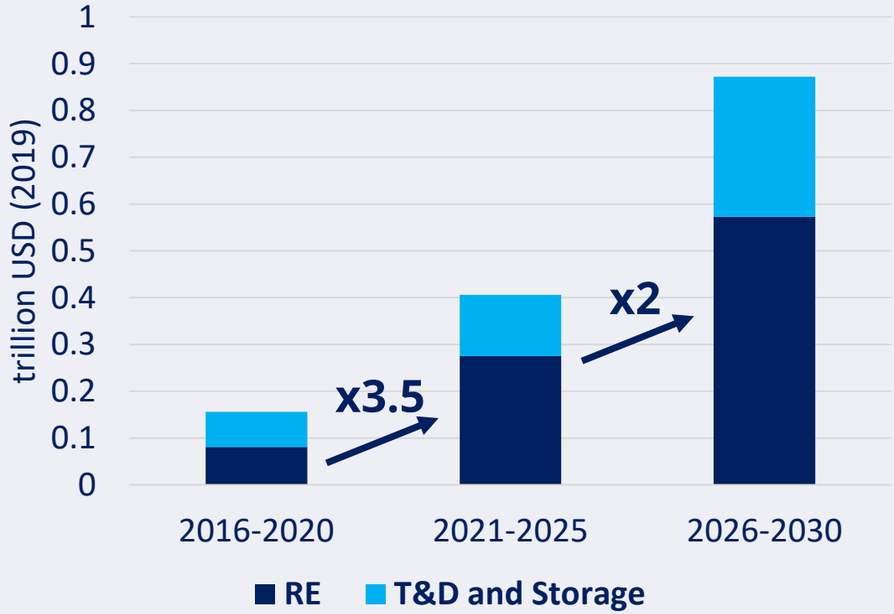
Multiple crises create challenges and opportunities for RE

- **The polycrisis has impacted RE deployment in developing countries combining:**
  - Higher capex due to commodity prices jump, supply chain disruptions with COVID-19 (which is improving) and polysilicon competing use
  - Increased indebtedness of the utilities in developing countries because of COVID-19 and fossil fuel price increase
  - Leading to increased investment risks which, coupled with inflation, heavily impact cost of capital
- **But it is also a real opportunity to increase RE deployment:**
  - Energy security has become a priority, the fiscal crisis has stressed the need for RE acceleration
  - Growing pipeline for green hydrogen

Energy Transition: the RE challenge

- **RE deployment needs to accelerate drastically**
- **Private sector mobilization will be key** to meet the RE investment challenge ahead of us
- Private sector participation is contingent on the power sector ***Foundations*** and suitable power grid
- **We cannot wait** for all the *Foundations* to be in place
- The RE team aims to support clients accelerate RE deployment by creating a tailored, **enabling environment** for private sector participation and sustainable energy transition

Average annual power system investment in the Net Zero 2050 Scenario



Note: Emerging market and developing economies excluding China

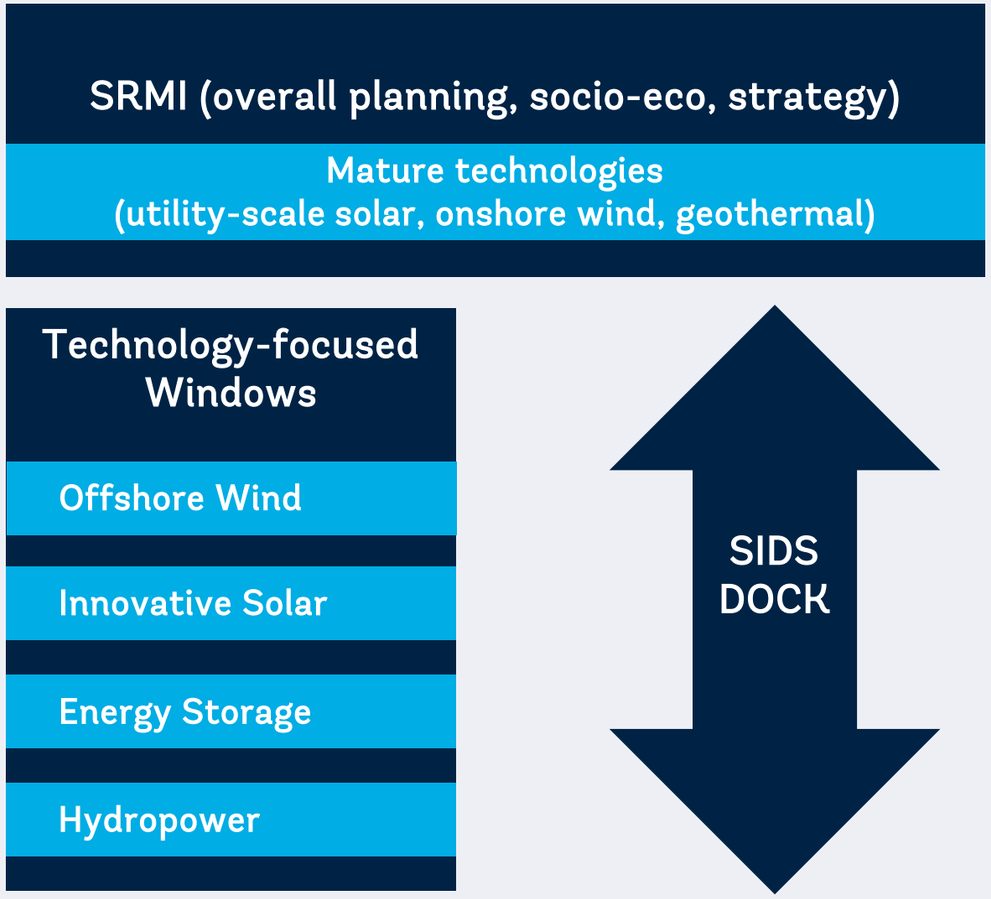
Sources: IEA – WEO 2022

Our approach

- Integrated solution under the SRMI approach from planning and socio-economic development, to privately-financed RE on the ground. Incorporating ESMAP grants, climate finance and innovative risk mitigation instruments

- Technology-focused windows to deepen resources provided for less mature technology or multi sectorial ones like hydropower

- Country-focused window for small islands development states (SIDS) looking at innovative approaches for further VRE penetration



Recent achievements

Knowledge products in FY23

- A Sure Path to Sustainable Solar, Wind and Geothermal
- Maximizing Socioeconomic Benefits Triggered by Renewables
- “From Sun to Roof to Grid: Grid Operation and Planning with Distributed PV” and When Sun meets Water” Series

o Power with full force, getting to gender equality in hydropower (June 2023)

Study tours & Capacity building in FY23

o Offshore wind: **Study tour** in 2022 with over 50 delegates from 15 countries. New e-learning course on WBG OLC.

- **Capacity** building on SRMI methodology in 3 countries
- **Gender** workshop for SRMI in Turkiye
- **Study tours** under the **ESP** Meetings in Korea and UK

$$ Climate finance fundraising

o SRMI supported the mobilization of $440 m GCF funds ; of which **$160 m under GCF SRMI-2** for 9 countries approved in March 2023

- **“SRMI + Energy Storage”** mobilized over **$500 m** for energy storage projects

GREEN CLIMATE FUND

Cumulative impact in 70+ countries

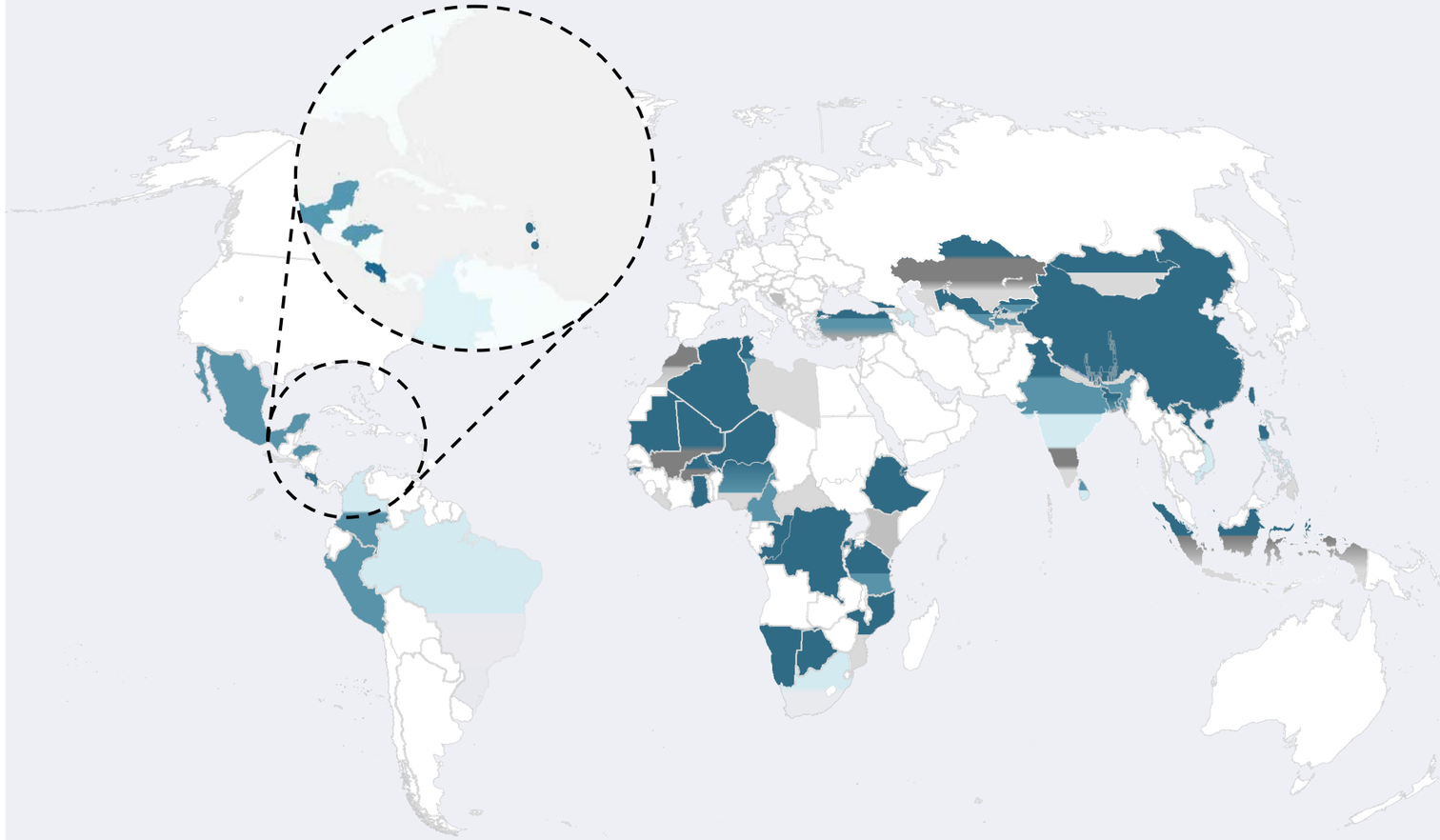
- 4 offshore wind roadmaps published, 5 others in draft

o 4.9 GW of RE committed under financed projects

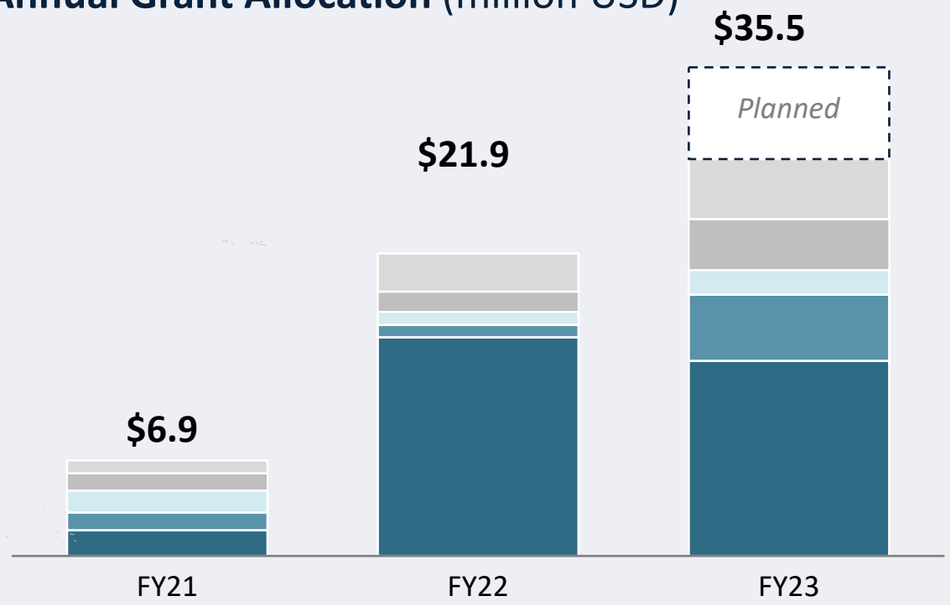
- 2.6 GWh of BESS committed and additional 3.7 GWh of BESS capacity in the pipeline
- $5.2 bn in WB finance leveraged
- $5.8 bn in private investments leveraged

Demand for regional and country grants has been growing

Global Footprint (Countries where the Renewable Energy has provided grants, FY21-23)



Annual Grant Allocation (million USD)



US$ 57.7 million grants already allocated in **70+ countries** directly/indirectly **over FY21-23**

The allocation for **FY23** amounts to **US$ 28.8 million**, with anticipated requests by June amounts to $35.5 million

Legend:
- HDF
- Energy Storage
- Offshore Wind
- Innovative Solar
- SRMI

Where next?

- The demand for the technical and financial support from the RE team has grown drastically, reaching a critical milestone where most client countries have worked on their enabling environment for RE and BESS deployment.

- **Next frontier challenges the RE team are tackling :**
  - Planning and integration
  - Risk mitigation instruments for private sector
  - Resilience and sustainability

Planning:
Challenges & Solutions

Challenges:

- Lack of planning culture and capacity in the utilities
- Lack of complete or reliable data
- Weak grids and dispatch capacities increases the reluctance of utilities to deploy VRE

RE team solution:

- Holistic approach to planning to limit technical and financial risk by identifying investment and reform needs
- Technical analysis, capacity building/training, procurement support and leveraging ESMAPs data tools (Solar & Wind Atlas, ReZoning tool for site selection, Energy Storage Sizing App 2.0)

Planning: Vietnam

Challenges

- Major curtailment of existing VRE (+25%)
- Legal challenges for private investments
- Limited safeguards/marine planning for offshore wind

RE team's response

- Grid integration analysis with planning work (used in CCDR)
- Procurement strategy and legal support for any RE (incl. offshore)
- Offshore wind roadmap (2021) and offshore wind sectoral planning underway incorporating technical, E&S, and grid issues

Results

- Government's draft target in offshore wind of 7GW by 2030 and +83 GW by 2050 as part of net zero plan
- Investment project for grid reinforcement and offshore wind integration under preparation

Planning: Bangladesh

Challenges

- Sites for renewables are prone to flooding
- Few local developers with relevant experience

RE team's response

- Mapping and analysis solar rooftop potential in Dhaka and industrial zones, analysis of floating PV on canals
- Roadmap of renewables integration
- Support design of regulatory framework for solar rooftop
- Design and piloting of a RESCO-based business model, template tender documents and a first bidding process
- Decarbonization analysis for the CCDR

The Results

- Established a Renewable Energy Financing Facility (REFF)
- Three investment projects informed: $1.2bn IDA+SGCF financing, >500MW rooftop potential

Planning: Botswana

Challenges

- System mostly coal based
- Lack of flexibility to integrate VRE
- Limited experience with IPPs

RE team's response

- Full planning/VRE integration analysis with BPC
- RE roadmap including socio-eco benefits maximization
- SRMI comprehensive and integrated support: TA + lending operation (leveraging GCF funding) to unlock 100MW solar and 100MW wind to be deployed under IPP scheme

Results

- Project under development including BESS, STATCOM, SCADA upgrade to enable the integration of 200 MW of RE

Risk Mitigation:
Challenges & Solutions

Challenges:

- Uncreditworthy utilities
- Existing instruments are inadequate or hard to access for IPPs
- High risks increase cost of capital or prevent investment
- Complex offshore wind and geothermal exploration

RE team solution:

- Structuring analysis on a case-by-case basis
- Offshore wind and geothermal exploration risk mitigation instruments
- Collaboration with other entities (WBG and outside)
- SRMI Risk Mitigation Facility
- Innovative pilots to enable market creation for new technologies

Risk Mitigation: Maldives

Challenges

- Technical constraints with limited land availability, weak grid
- Limited bankability of PPPs due to uncreditworthy utility

RE team's response

- Technical analysis (feasibility studies, power sector planning including e-mobility, BESS deployment, offshore floating PV)
- Private sector strategies including innovative risk mitigation instruments (tariff buy-down, liquidity and FX)
- Additional financing to support client's Net-Zero commitment

Results

- Large increase in number of IPP participants (from 4 to 63)
- Lowest SIDS tariff US$ 9.82 cents/MWh

Risk Mitigation: DRC

Challenges

- Limited bankability of PPPs due to uncreditworthy utility
- Challenging electrification due to geographical constraints
- Limited economic development

RE team's response

- Extensive work with access team on private sector strategy for mini-grid PPs including innovative risk mitigation instruments (demand risk)
- Development of socio-economic roadmap to maximize benefits of mini grids

Results

- First tender to be launched with Scaling Mini-Grid for large scale PV/BESS

Risk Mitigation: St Lucia

Challenges

- High electricity prices
- Limited interest from the private sector

RE team's response

- Identification of the main risk factors for private sector engagement incl. resource risk and legal framework
- Provide technical support
- Analysis of potential for geothermal direct use

Results

- Investment project for exploration drilling to demonstrate adequate resource for 30 MW geothermal power plant
- Competitive selection of private sector to Build Own Transfer (BOT) once resource has been demonstrated

Resilience and Sustainability:
Challenges & Solutions

Challenges:

- Climate change can lead to increased variability in hydrological flow including magnitude of low/high flow
- Grid and power infrastructure not prepared for climate hazard increase
- High climate vulnerability of SIDS

RE team proposal:

- Promotion of innovative technologies in SIDS
- Energy mix with resilient planning incl. impact on hydrology and optimization of hydropower and energy storage
- Promotion of technical standards incl. country specific climate hazard analysis
- Reliable electrification to increase the population resilience

Resilience : Malawi

Challenges

- Weak/underdeveloped grid and severe energy access deficit and poor reliability
- RE projects planned but the technical constraints are inhibiting developers

RE team's response

- Support the country with BESS strategy to solve the short-term constraints inhibiting RE scale-up and increase reliability
- Capacity expansion analysis to find suitable alternatives to coal deployment and conducive strategy towards sustainable RE and energy access scale-up, and improve energy security

Results

- BESS and grid upgrade project under preparation

Resilience: Kyrgyz Republic

Challenges

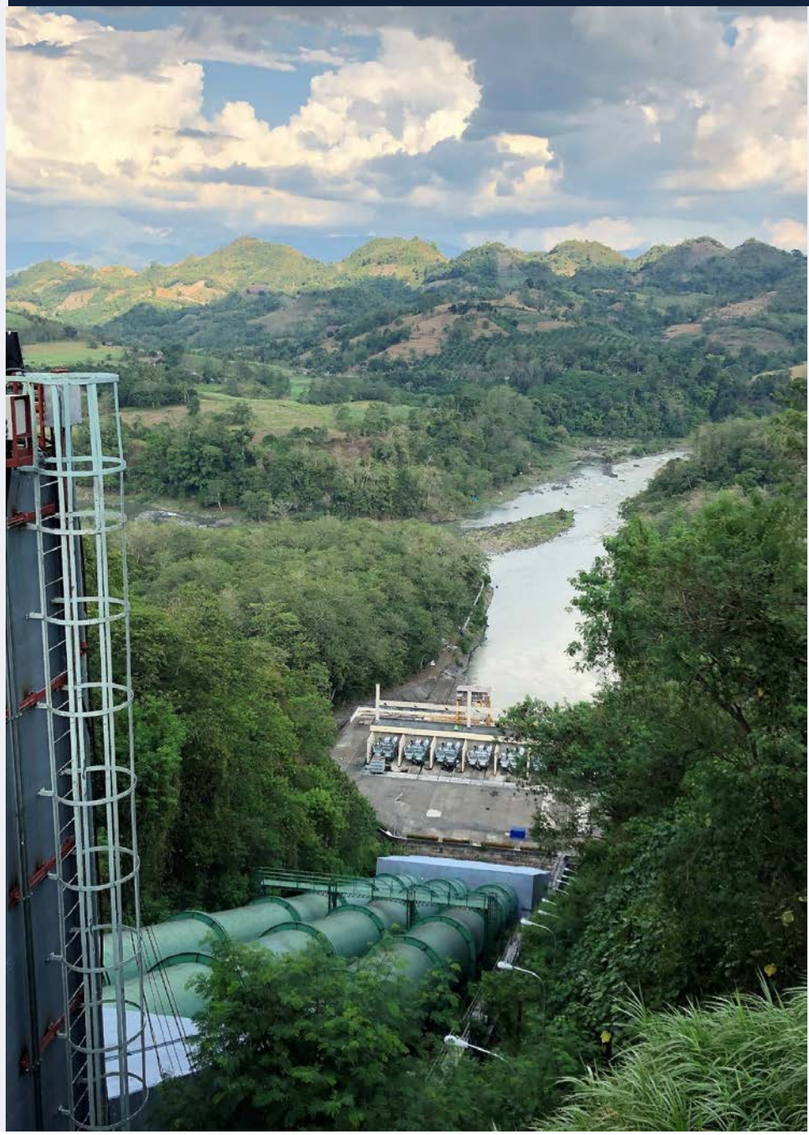
- Climate change can increase variability in hydrological flow incl. magnitude of low/high flow
- Hydropower fleet is aging and in need of modernization
- Planned coal projects to answer the hydro perceived limitations
- Uncreditworthy utility

RE team's response

- Strategy on attracting IPPs
- Roadmap for hydropower rehabilitation and modernization

Results

- Investment project (June 2023) financing sustainable small hydro and grid upgrades for VRE integration
- Feasibility study for Kambarata Hydropower Plant 1.9 GW, 5.6 TWh
- Innovative SRMI CAPEX-buy down instrument with PRG to be attached to the first solar tender for 130MWp



Resilience: Brazil

Challenges

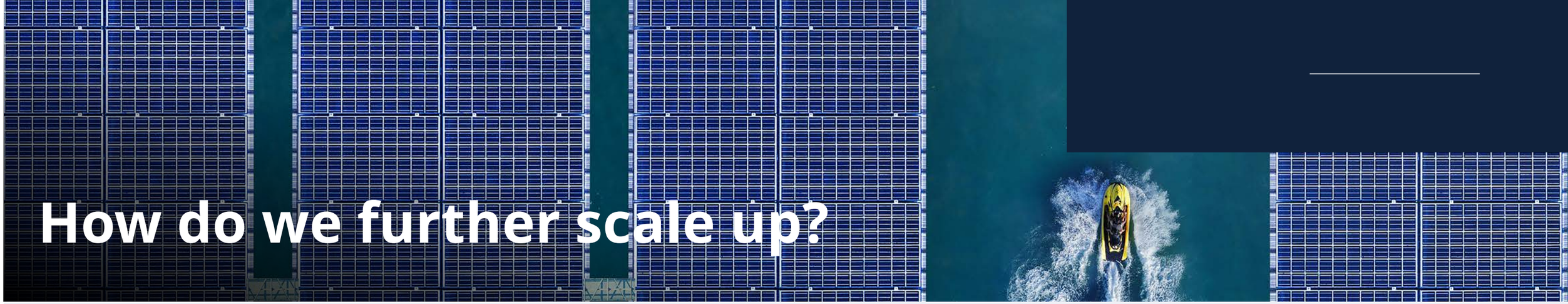
- Existing hydropower fleet vital, but aging
- Missing market for domestic hydrogen but high potential
- Insufficient policies and regulations for offshore wind development

RE team's response

- Technical workshops on the development of new offshore wind regulation and roadmap to inform policy and strategy
- Business model development, expertise on socio-economic benefits, and request for climate finance for green hydrogen hub
- Assessment of two hydropower plants to identify barriers (e.g. financial, technical, regulatory) for rehabilitation.

Results

- Offshore wind Decree and Ordinance published in 2022. +183 GW across 74 projects proposed by industry so far



How do we further scale up?

Mainstreaming Competitive Tender Framework for RE Auctions	Tenders launched in **offshore wind** and SRMI (including geothermal) Mainstreaming the **RE + storage hybrid PPA** approach through pilots
Innovation & Promotion of Frontier Technologies	**Innovation:** SRMI Risk Mitigation to reflect **innovative PPA approaches**; Innovative pilots for further RE scale-up (e.g. battery swapping pilot for EV 2-wheeler batteries, etc.) **Frontier technologies:** Long duration energy storage, flexible power and energy generation with hydropower, **RE deployment for GH**
Knowledge Products & Capacity Building	Scaling-up the mapping of **rooftop solar potential** with new generation mapping tool **SIDS guidelines under SRMI**, Energy Storage Sizing App 2.0, Hybrid hydro Institutionalization of **capacity building/training programs for energy storage**

Partnership and collaborations

Energy Storage Partnership

A partnership to help accelerate tailored energy storage solutions in developing countries

Partners:

A total of 49 ESP partners

+ stakeholders:
IFC, ADB, AfDB, Engie, India Energy Storage Association, Energy Storage technology providers, WB clients

Co-financiers: CTF, GCF, CCEFCF

Offshore Wind Development Program

Accelerate adoption of offshore wind in emerging markets and provide support to build pipeline of bankable & sustainable projects

Partnership with: IFC International Finance Corporation WORLD BANK GROUP — *Creating Markets, Creating Opportunities*

Collaboration with: GWEC GLOBAL WIND ENERGY COUNCIL

Member of Global Offshore Wind Alliance

Collaboration with Bilateral Donor Programs, including:

Danish Energy Agency

Netherlands Enterprise Agency

Foreign, Commonwealth & Development Office

SRMI Sustainable Renewables Risk Mitigation Initiative

A partnership to accelerate sustainable investments in renewables.

Partners:

Stakeholders:
IFC, MIGA, Proparco, ADB, IADB, AfDB, EIB, EBRD, FCDO, Canada, GIZ, KfW, ENS Denmark, French Ministry of Foreign Affairs/Treasury, Norway

Co-financiers: CTF, GCF, CCEFCF

Annexes

SRMI

SRMI: Tackling risks to create a pipeline of bankable RE programs

Upstream Technical Assistance

(generation and transmission planning, Variable RE integration analysis, regulatory and strategic support, resilience analysis, socio-economic analysis)

Downstream Technical Assistance

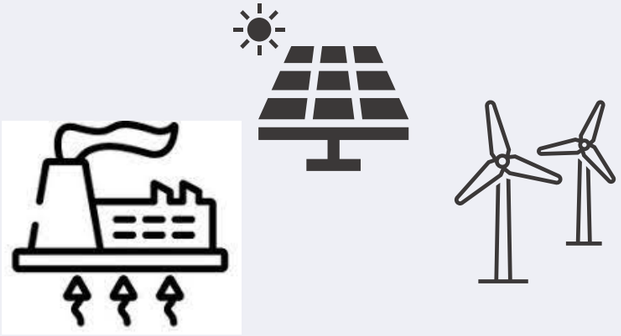
(tender transaction advisory support, feasibility studies, safeguards instruments, resource assessments)

Risk Mitigation Instruments

(Guarantee/insurance for private investors for grid-connected and off-grid RE, geothermal resource de-risking, viability gap funding)

Critical Public Investments

(grid reinforcements, RE park infrastructure, geothermal drilling, and Public-Private-Partnership [PPP] mini-grids, implementation of socio-economic/gender action plans)

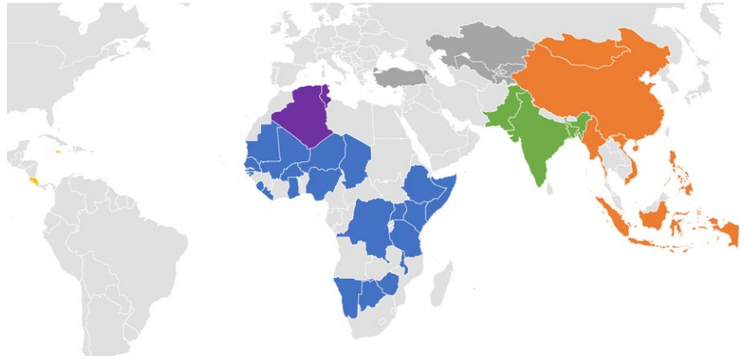


Deployment of 20 GW of RE and mobilization of US$20bl of private investments by 2030 under bankable & sustainable RE projects while maximizing socio-economic benefits

Results to date: Setting the sector fundamentals & enabling environment

Upstream Technical Assistance

55 countries



Main result: 25 GW of RE added to government's generation plans

Approved Downstream Technical Assistance & Public Investments

19 country investments

US$ 4bl of WB financing blended with US$ 700ml of climate finance informing:

- 4.4 GW of expected RE
- US$ 5.5bl of private investments
- 1.6 GWh of battery storage

The second phase of the SRMI implementation is starting: most of our client countries are working on the fundamentals and moving towards tenders

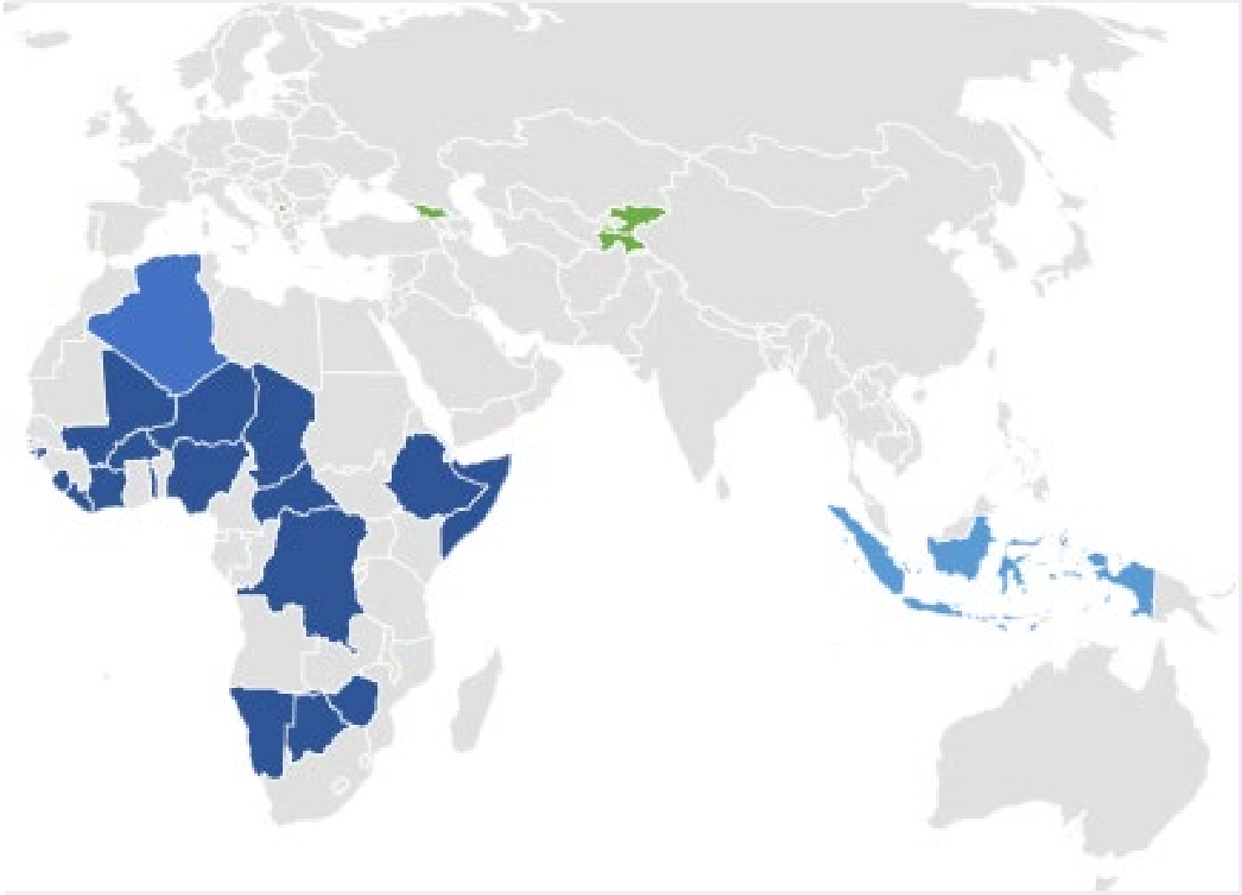
Risk Mitigation Instruments

7 instruments approved and 2 successful tenders

Maldives (US$c 10.2 per kWh) and Uzbekistan (US$c 1.8 per kWh) have completed successful tenders for which guarantees were needed to achieve:

- 150 MW of solar PV
- US$ 250ml of private investments
- 50 MWh of battery storage

1.7 GW of RE tenders to be launched within 24 months



- **2023-2024: 1.7GW of wind and solar with 675MWh of battery storage**: Burkina Faso, Cote d'Ivoire, Guinea Bissau, Gambia, Liberia, Mali, Niger, Sao Tome, Togo (Africa), Tajikistan, Kyrgyzstan, Georgia (ECA), Indonesia (EAP), Palestine/West Bank (MENA)

- **2025-2026: 4GW of wind and solar with 390MWh of battery storage**: Botswana, Burkina Faso, CAR, Chad, Ethiopia, Liberia, Namibia, Mali, Zimbabwe (Africa), Palestine/West Bank, Algeria (MENA), Indonesia (EAP), Kyrgyzstan, Kosovo (ECA)

- **And IPP-owned mini-grids programs:** in DRC, Niger, Nigeria, Haiti, Sierra Leone, and Somalia.

While SRMI's upstream TA work has helped de-risk these programs, additional hands-on support is required for implementation, and risk mitigation instruments will still be needed for tenders to be successful*

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- * Indonesia will likely be able to move ahead without a guarantee as the off-taker (PLN) is credit-worthy

SRMI Risk Mitigation Facility

- **Objective:** Unlocking renewable energy investments in countries where existing risk mitigation instruments are limited, inadequate or unavailable by ensuring timely deployment of tailored, innovative instruments to tenders.

- **Solution:** Establish a new US$ 250ml Programmatic Risk Mitigation Facility to deploy innovative risk mitigation structures, provided in parallel to existing instruments and technical assistance

SRMI Programmatic Risk Mitigation Facility – solutions to close the gaps

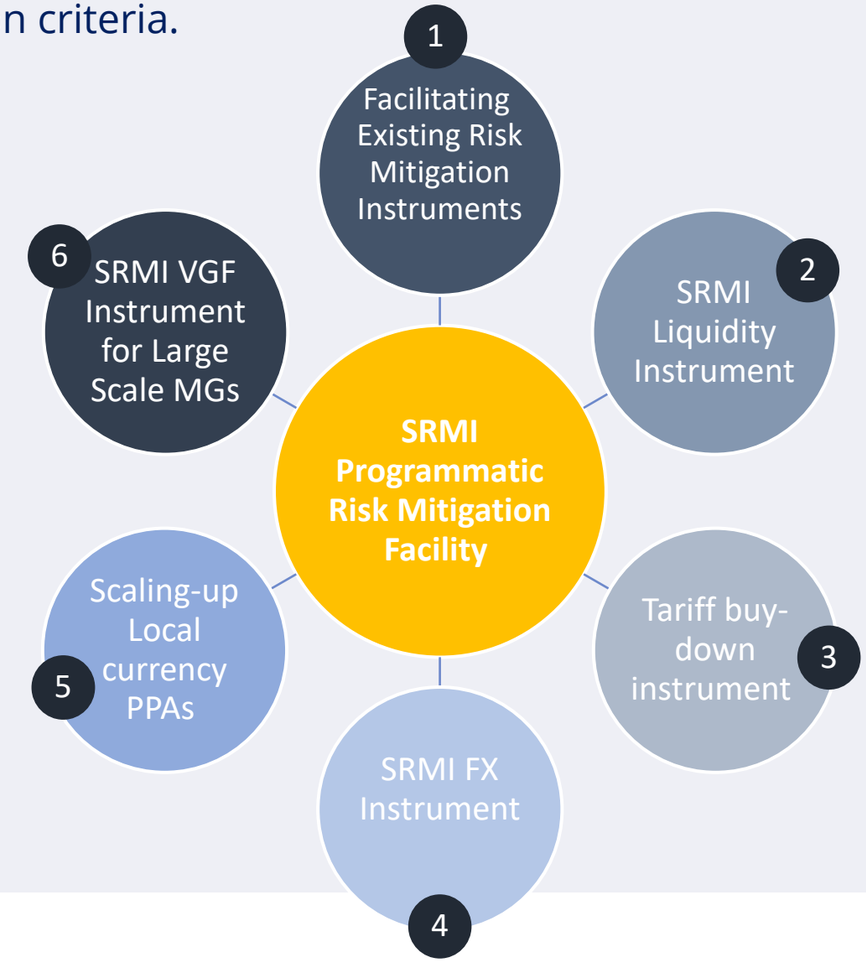
- **Residual risk coverage is needed for successful tenders**

- **Bankability of the off taker:** Off-taker credit risk leads to real/perceived non-payment and/or termination risks, impacting IPP financial viability and/or inability to reach financial close.

- **Foreign exchange:** Particularly high risk in countries lacking a developed local debt market and limitations concerning currency availability and convertibility at Central Bank level.

- **Demand for large scale mini grids:** A key risk is the uncertainty of revenues during the first years of operation, given the time needed for demand ramp-up.

- **Solution:** Hosted at ESMAP and implemented in partnership with the WB Guarantees team, a programmatic approach will give the flexibility to allocate the funding based on readiness & agreed-upon criteria.



SRMI: Socio-Economic Benefits

Delivering a comprehensive approach to skills development, domestic firm participation, local development, and gender inclusion. For example:

- **Central Africa Republic:** Socio-economic roadmap developed with ENERCA on RE skills, jobs and gender. Recommendations to strengthen vocational training centers and promote engagement by formal and informal domestic firms.

- **Uzbekistan:** Socio-economic roadmap planned with focus on skills development, domestic participation and industrialization.

- **Tunisia:** Development of Renewable Energy Center of Excellence, which will support domestic firm, develop curriculum for the educational sector, and pilot vocational training courses.

SRMI: Climate Finance

SRMI has supported the mobilization of over $460ml of CTF climate funds (11 projects + one regional program); **$280ml under GCF SRMI-1 (7 projects), $160ml under GCF SRMI-2 (9 projects) and over $347.8 ml** from other donors including the Canada Facility for solar, wind and geothermal. For a total of **$1.2bl.**

The 16 projects that receive GCF co-financing is expected to generate a total number of **144 million tCO2e emission reductions** (SRMI-1: 88,978,000 tCO2e and SRMI-2: 55,007,000 tCO2e)

Together, the projects blended with the climate funds aim to support the deployment of 14.5 GW of RE and mobilize $17.5bl in private capital.

Energy Storage

Energy Storage

The purpose of the Energy Storage window is to:

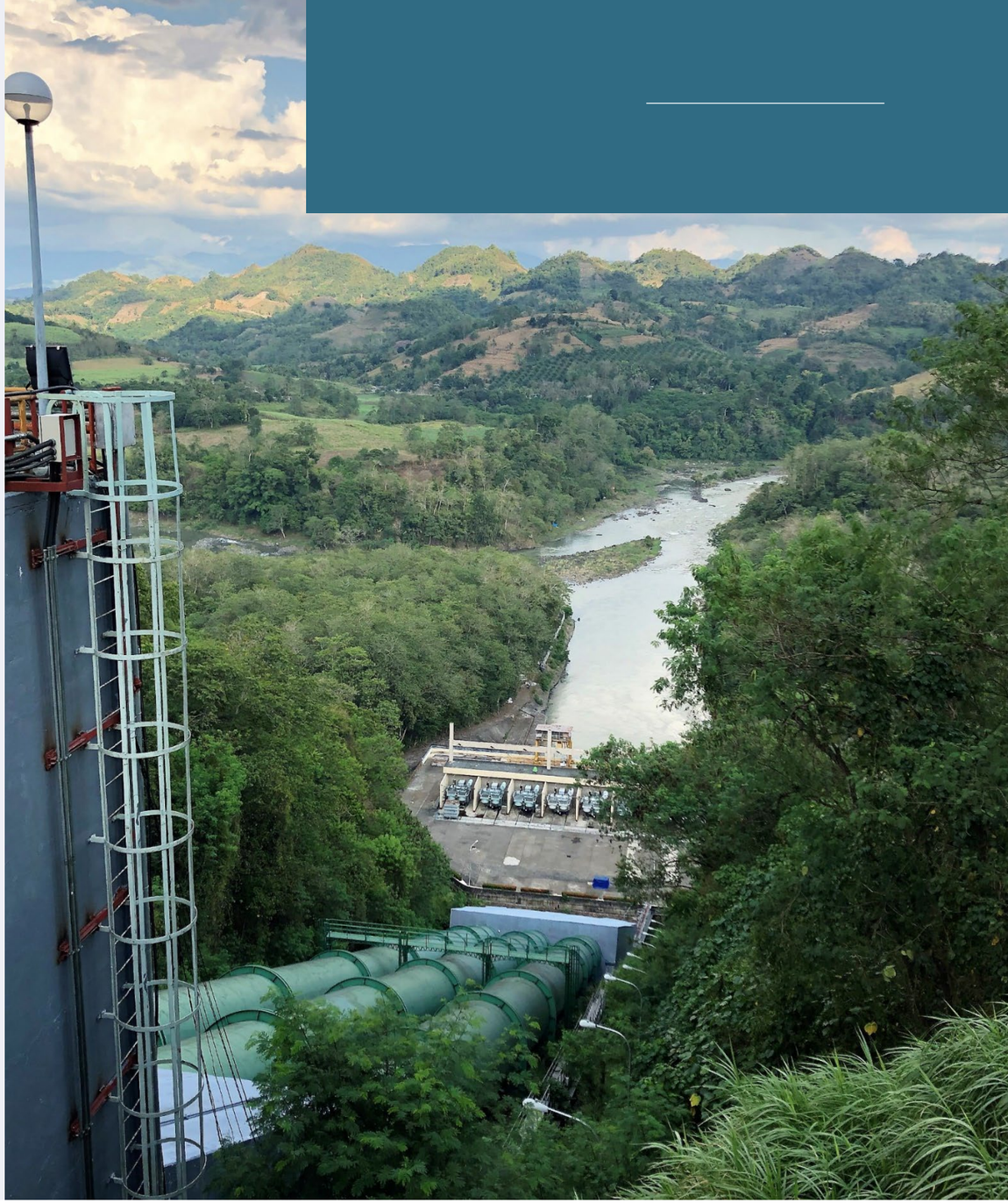
- Provide a **three-tier approach of knowledge, capacity building, and investment support** to WB task teams and clients on tailored solutions for energy storage in developing countries through providing access to concessional finance, technical assistance, and addressing key knowledge gaps

The support includes:

- **Knowledge development and dissemination** through the Energy Storage Partnership by establishing guidelines and technical standards on energy storage and develop the platform for sustainable energy storage solutions in developing countries.
- **Institutionalization of the capacity building/training for energy storage** to develop the technical and institutional capacity to implement energy storage projects.
- **Technical and operational support to task teams and clients** in designing and implementing energy storage projects.

Achievements:

- The window has provided technical and operational support to upstream activities in energy storage and engaged in 2**2 countries/regions** in FY22 with **10 new engagements** to help clients identify strategies to deploy energy storage
- In the last four years, ESP has mobilized **$790 million concessional funding** for battery storage projects
- Mobilization of **5.5 GWh (IBRD: 2.7 GWh; IDA: 2.8 GWh)** battery storage capacity commitments in active projects (including mini grids) and **3.7 GWh (IBRD: 1.7 GWh; IDA: 2 GWh)** of identified capacity in our future pipeline



Energy Storage Partnership

The purpose of the Energy Storage Partnership is to foster international cooperation to help develop and **adapt energy storage solutions tailored to the needs of developing countries**

The support includes:

- **Convene international cooperation** to increase **knowledge base in energy storage solutions** for developing countries
- **Build capacities** by following a global public goods approach to increase **design and implementation capabilities** of **energy storage projects**
- Opportunities to **promote innovation** and to **inform investments** and **policy dialogue** with countries

Achievements:

- Over **48 ESP Partners** in 7 working groups and **750 Stakeholders**
- **Bi-annual meetings in Seoul and Leicestershire (UK):** ESP Stakeholder Forum, Partners Meetings, study tour/site visits
- **Knowledge Development Products:** Business Model Innovations in Deploying Storge for Power Systems in Developing Countries, Comprehensive List of Flexible Sector Coupling Initiatives
- **Knowledge Dissemination:** Energy Storage Webinar Series (PHS, TES, non-Li-ion BESS), conference participations (e.g. EASE and CEM), workshop for WB clients (energy storage sizing app; hybrid PPA framework)
- **Women in Energy Storage** Mentoring Program (ongoing second cohort)
- **Upcoming reports:** BESS Safety Operation Guidelines, VGI in Islands, Global Status of Mini Grids with Storage, Hybrid PPA Framework, Circular Economy in Africa

Energy Storage Program in Numbers

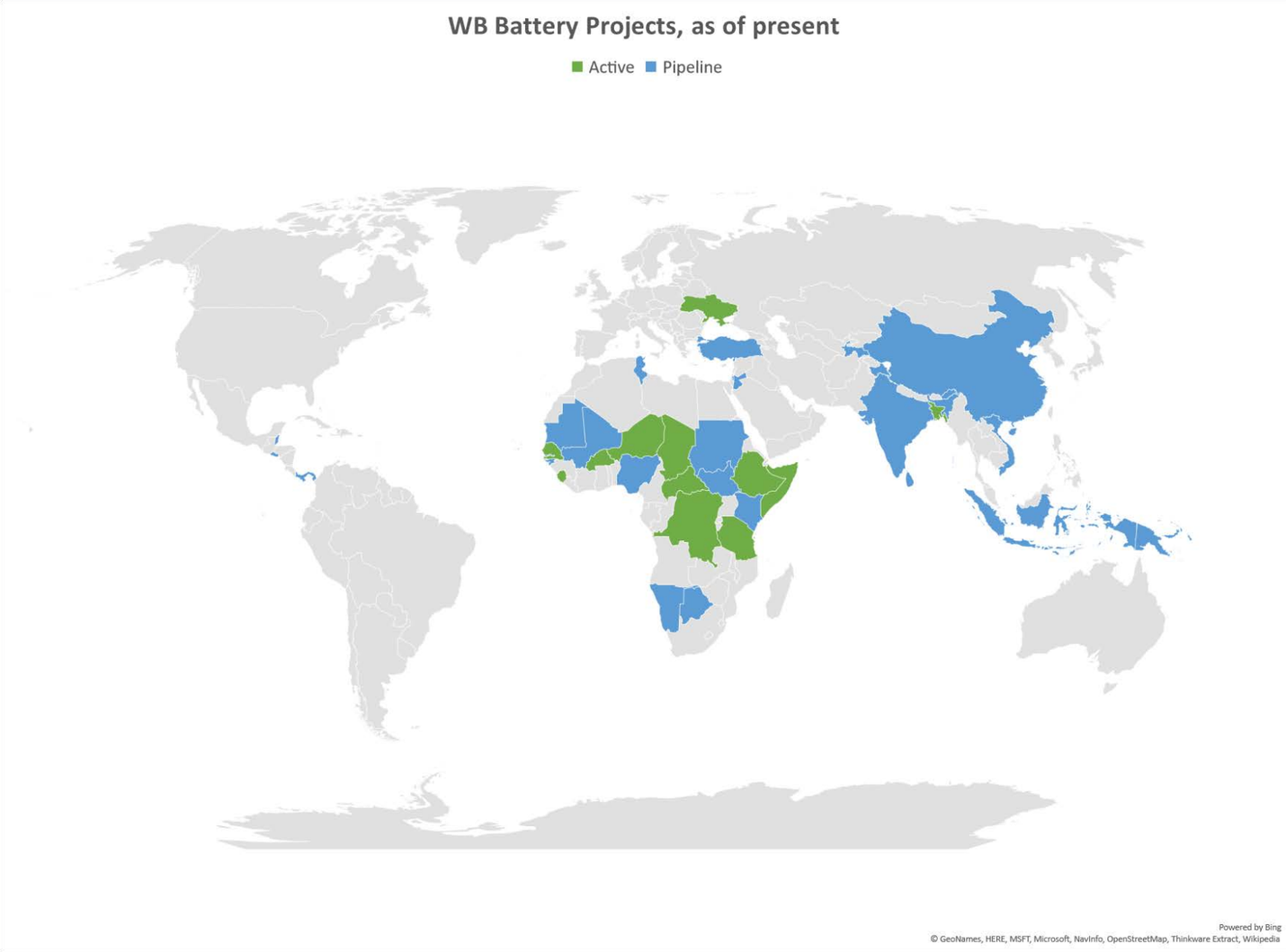
- **US$ 850 million** concessional funding mobilized for battery storage projects, channeled through the CIFs, Canada Climate Finance Facility and other climate funds
- Through WB financed projects, ESP has mobilized **5.5 GWh** battery storage capacity commitments in active projects (including mini grids) and **3.7 GWh** of identified capacity in our future pipeline
- **Projects already awarded:** India (120 MWh), South Africa (833 MWh), CAR (25 MWh), Marshall Islands, Tuvalu

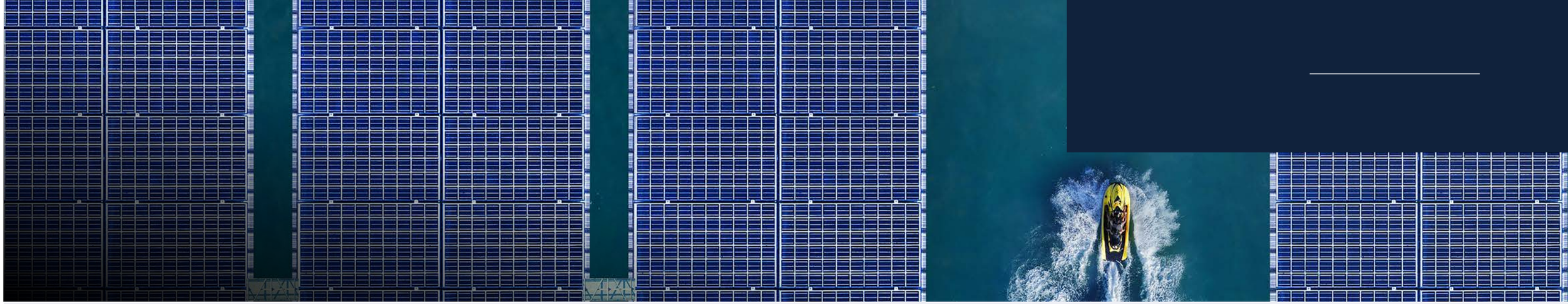
Countries/regions supported by the Energy Storage Program:

Active Projects - Bangladesh, Burkina Faso, CAR, Chad, DRC, ECOWAS, Ethiopia, India, Maldives, Niger, Senegal, Sierra Leone, Somalia, Tanzania, Tuvalu, Ukraine, Cabo Verde, West Africa

Pipeline Projects- Gambia, Guinea-Bissau, Horn of Africa, India, Indonesia, Papua New Guinea, Sahel Countries, Sudan, Sri Lanka, Vietnam, Tunisia, Turkey, Kenya, Mali, Namibia, Botswana, Tajikistan, Maldives, Sao Tome & Principe, China, Nigeria, Jordan, Caribbean, Belize, Mauritania, South Sudan

ASA - El Salvador, Panama, Kazakhstan, West Bank and Gaza





Innovative Solar

Innovative Solar

The purpose of the Innovative Solar window is to:

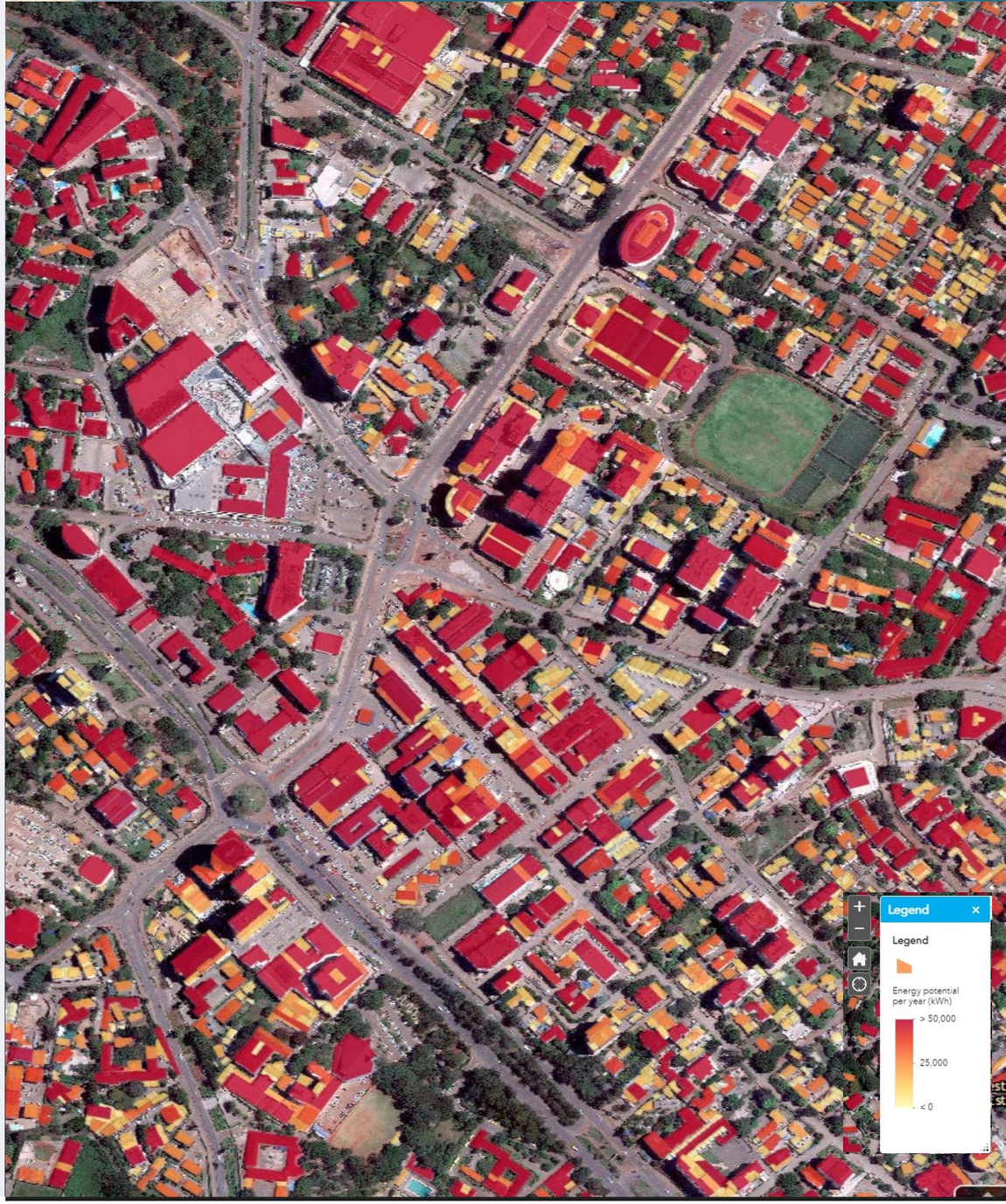
- Improve awareness on benefits of innovative solar technologies (Solar rooftops, Floating PV, Agrivoltaics) for grids and land use
- Unveil potential with user-friendly, data analytics and assessment tools
- Demonstrate value of hybridization of solar with other sources for dispatchability
- Develop Business models , policy and regulatory framework for distributed PV

The support includes:

- **Technical assistance** for conducting technical and economic assessments based on data analytics and tools, pilot business models and provide capacity building for policy and regulatory framework.
- **Mobilize financing,** including World Bank and IFC lending, investment and concessional climate finance where appropriate
- **Generate comprehensive global knowledge** on innovative solar technologies and their applicability in diverse contexts of developing economies, in an environmental and socially sustainable way.

Achievements:

- The window **has supported upstream work to develop the use of innovative solar technologies** in 20+ countries with significant results already achieved
  - 500 MW of committed under financed projects
  - $1.3 bl of WB finance
  - $0.3 bl of private investments leveraged

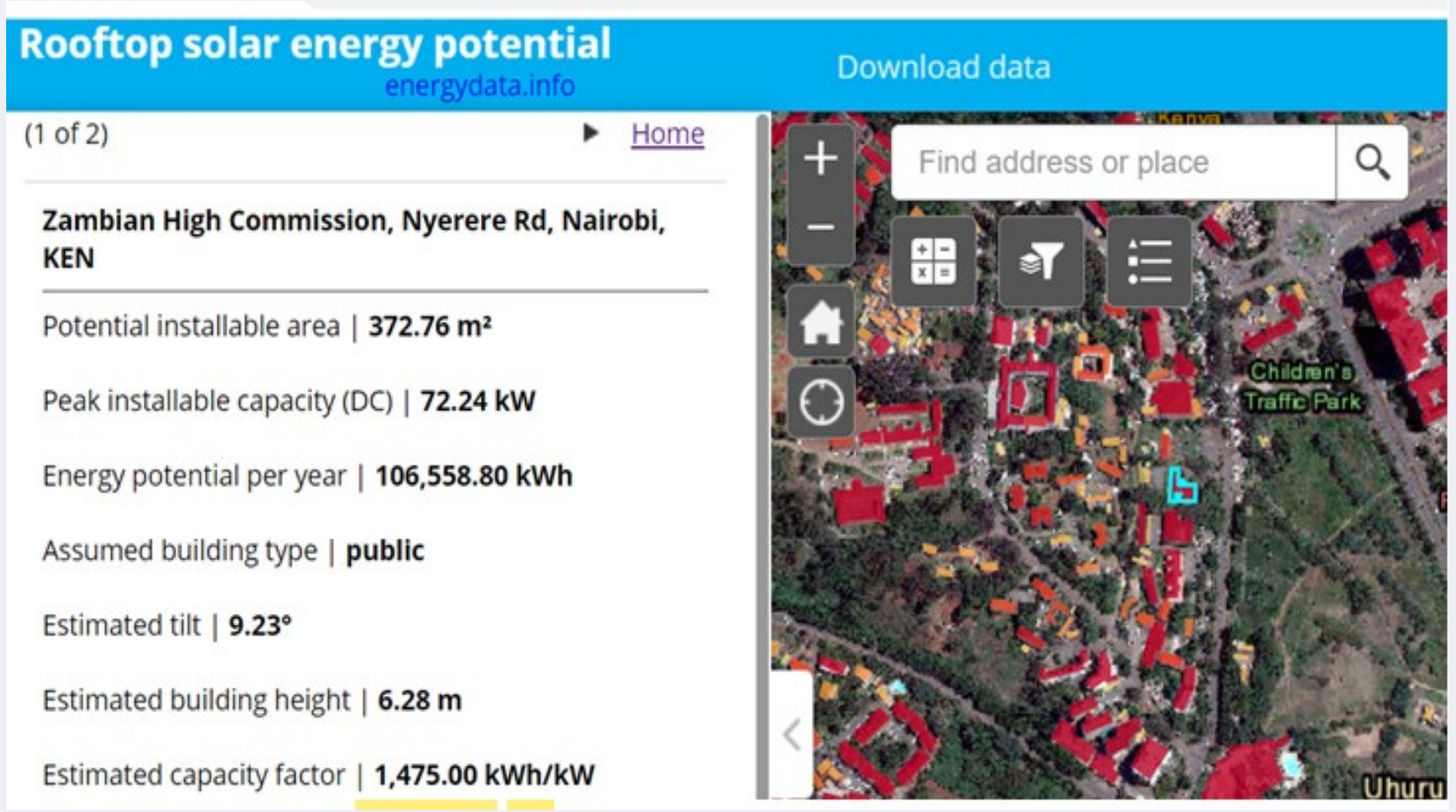


Rooftop Solar PV

Geospatial tool for rooftop solar potential

- **Pilot** covered 14 cities, 5 Caribbean islands added since the pilot was completed

- **Expansion Phase:** Scale-up number of country- and city-wide rooftop potential mappings :
  - Nigeria: currently mapping entire state of Lagos in support of upcoming multi-phase WB lending operation for energy sector
  - Turkiye: mapping of Izmir to be complemented with other cities requested for two upcoming WB lending operations focused on residential and public/municipal rooftop PV
  - Armenia: mapping request for selected areas for upcoming WB lending operation focused on rooftop PV in public and university buildings
  - LAC: 12 additional Caribbean islands requested to be mapped by WB counterparts
  - Bangladesh : mapping of selected industrial areas in Greater Dhaka Region

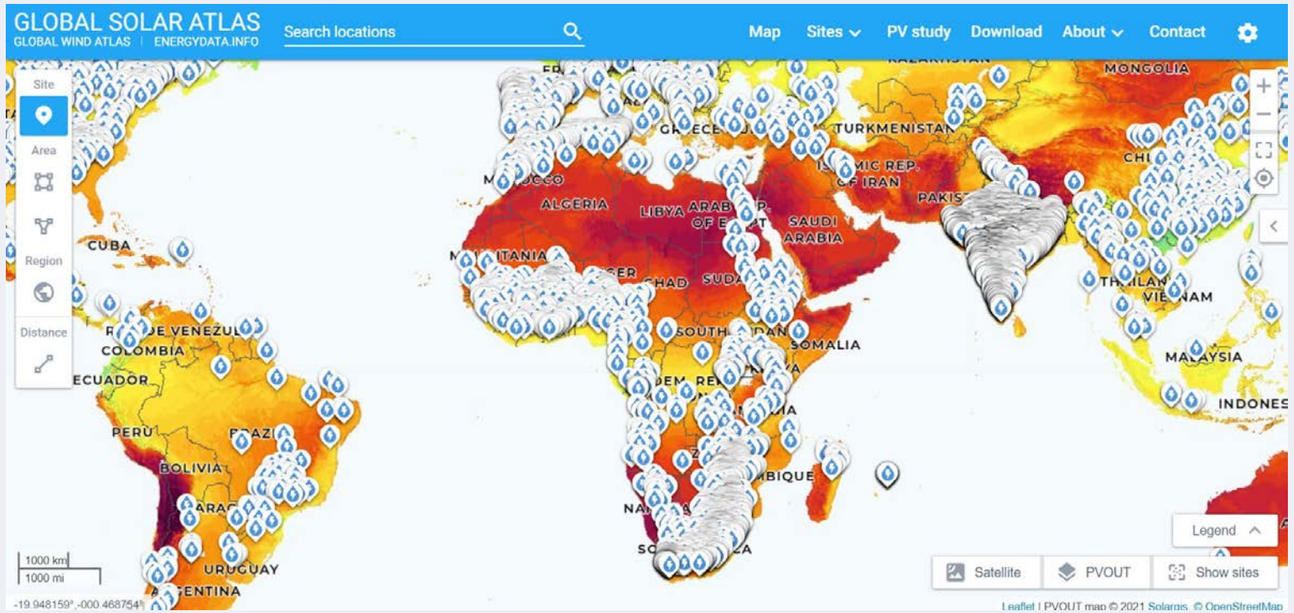


Example from Nairobi

Hydro + Solar Hybrids

- Combining solar with hydropower plants and hybridizing their outputs is of interest in many countries, especially in small and weak grids in SSA or Asia, in places with big differences in water availability between dry and wet season
- Hybrid “hydro + solar PV” plant can behave as a PV+battery plant but can be more affordable and safer while bringing benefits also for hydropower (higher water availability in dry season)

- Hydro-connected solar tool now in Global Solar Atlas with separate bookmark on the app showing statistics for large reservoirs
- Support to pre-feasibilities (grants and staff time) in Cameroon, Myanmar, Tajikistan, and Sri Lanka (+Armenia and Burkina Faso going through review process)

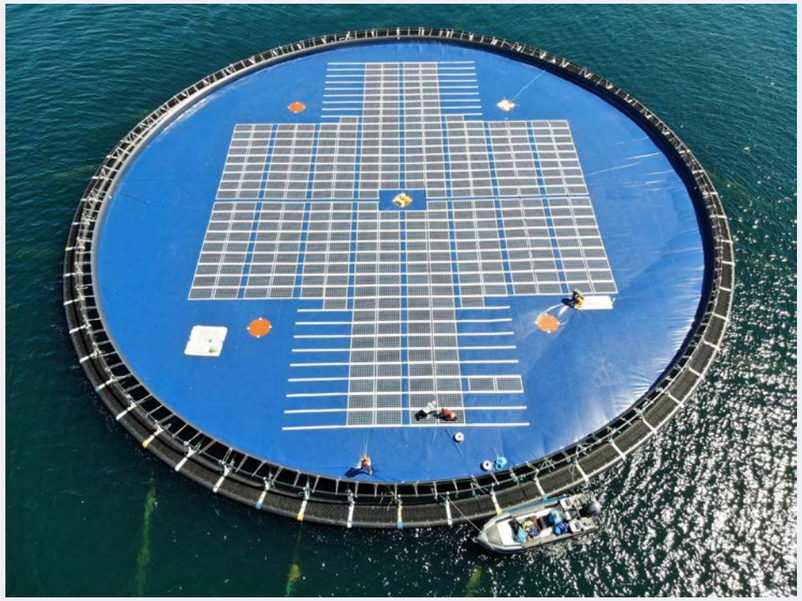


Near-shore floating solar

- Support to FPV marine framework, pre-feasibilities + enviro prep work (grant and staff time) in Maldives which informed a tender for 10 MW marine floating solar installation under WB lending operation
- Expected demand from other island states (due to limited space for ground-mounted and rooftop solar)

Priorities:

- Marine spatial plans for near-shore floating solar
- Environmental and social considerations (similar work ongoing for offshore wind so can build on that for consistency of approaches)
- Framework for marine FPV deployment (building on the work of consultants under Maldives' grant)



Planned team: Amit, Zuzana, Daron, and smaller consulting contract

Innovative Solar : Country Highlights

- **Bangladesh:** creation of renewable energy service companies (RESCOs) and technical assistance to design net metering policy. Aggregation model for public building PV projects as part of ongoing WB lending operation implemented by RESCOs
- **Maldives:** technical support for rooftop and floating solar informed the country's first solar procurement auctions as part of two ongoing WB lending operations
- **Tajikistan:** ESMAP funded first ever floating solar assessments in the country on selected hydro power plant sites, to inform WB and AsDB lending operations
- **Tunisia:** technical support on regulatory design for distributed PV, results and recommendations were basis for government's new contractual framework for self-generation in industrial and commercial sectors
- **Turkiye:** ESMAP-supported PV market assessments and municipal PV project implementation mechanism informing two upcoming WB lending operations, including first Program for Results (P4R) solar project in Turkiye expected to result in over 1 GW of PV installations
- **Uzbekistan:** technical support for regulatory framework for distributed PV and energy efficiency investments, informed subsequent GEF funding and expected WB loan request from counterpart

Innovative Solar : Global Knowledge Products

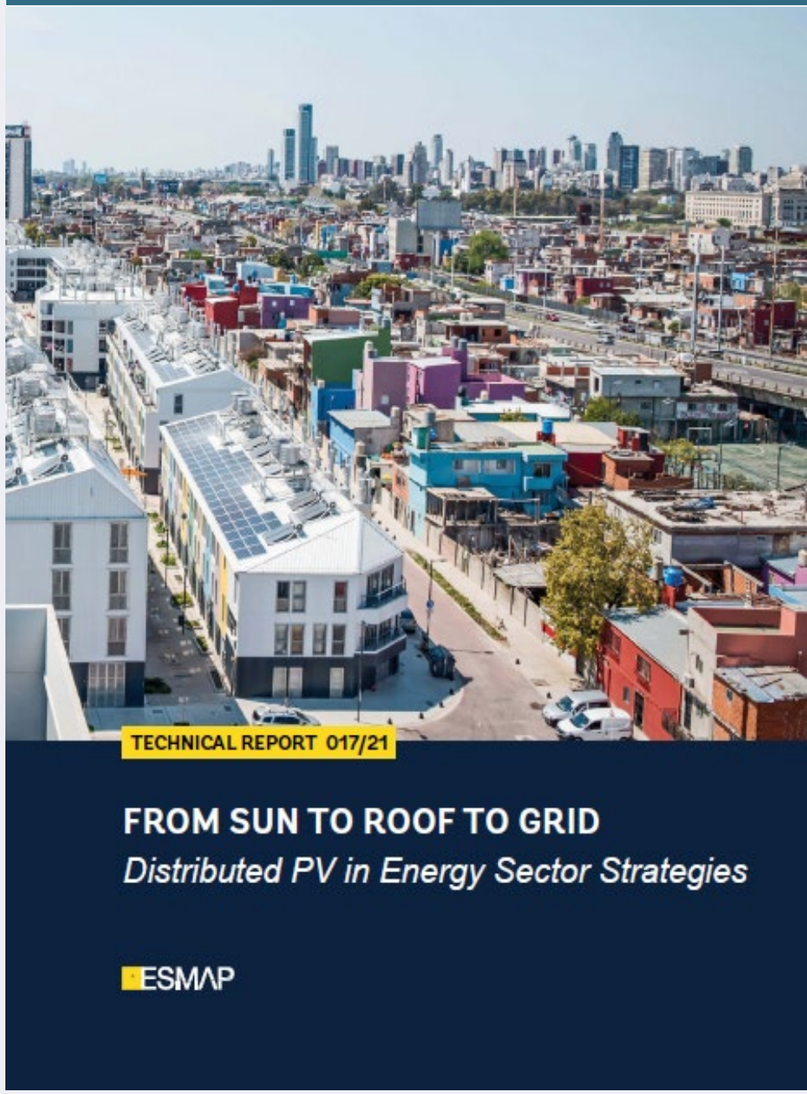
“From Sun to Roof to Grid” Series of Reports

1. DPV in Energy Sector Strategies
2. Grid Operation & Planning with DPV
3. DPV Economics and Policy

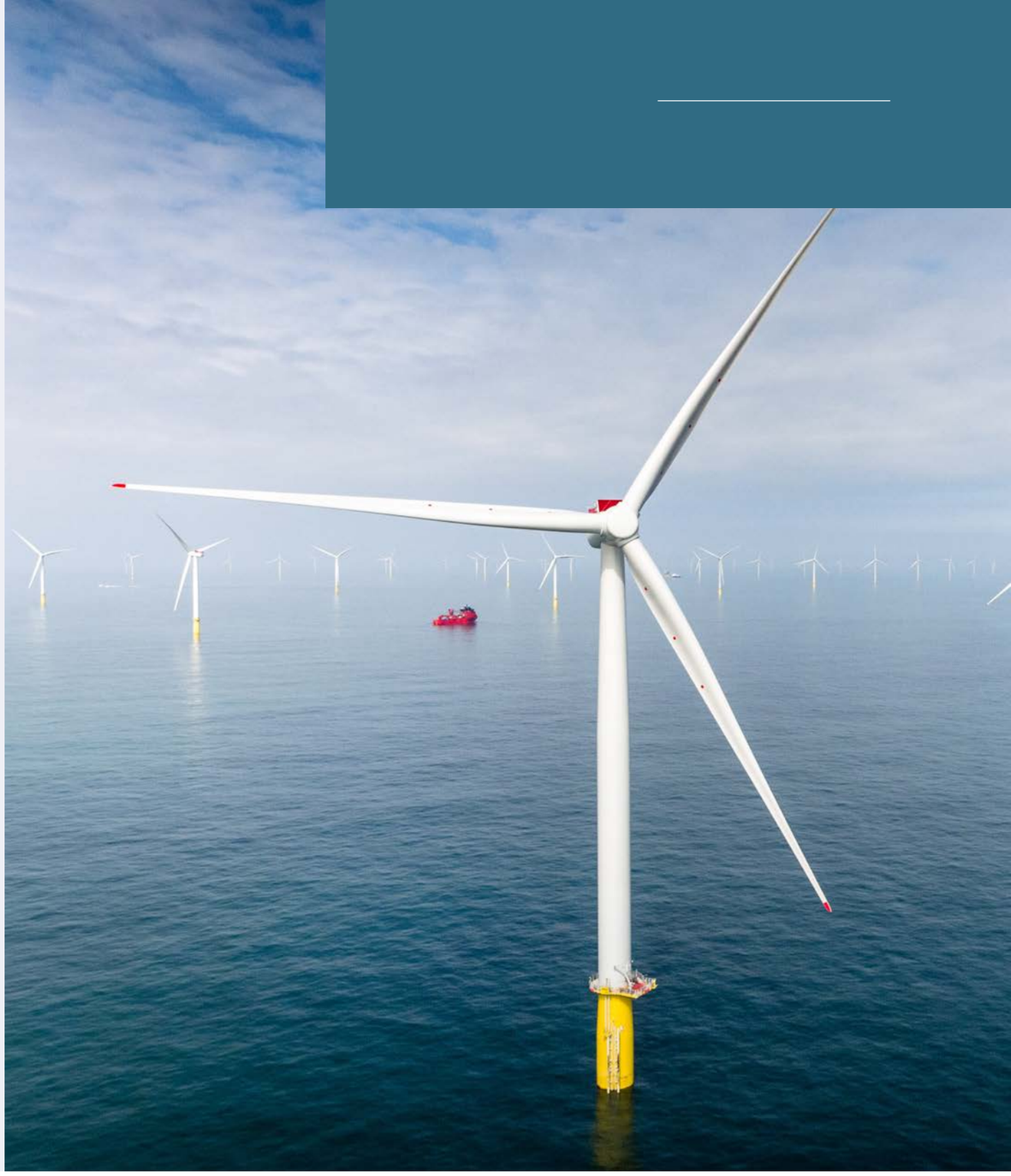
“When Sun meets Water” Series of Reports

1. Floating Solar Handbook for Practitioners
2. Floating Solar Market Report
3. Near-shore Floating PV Report

Next Series considered:
“Agrivoltaics for Development”



Offshore Wind



Offshore Wind

In partnership with IFC

IFC International Finance Corporation WORLD BANK GROUP

The purpose of the Offshore Wind Development Program is to:

- Accelerate deployment of offshore wind in emerging markets and provide support to build pipeline of bankable & sustainable projects

Target outcomes:

- Inform 20 GW of government policy commitments
- 5 GW of capacity under project preparation

Our work:

- Program is led by ESMAP in partnership with IFC. Over 75 staff engaged across WB and IFC
- Supported 21 countries since 2019
- Almost all countries supported had no offshore wind policies, targets, or regulations when we started
- Our assistance began with resource analysis, capacity building, and strategic roadmaps
- Now moving into detailed studies, following roadmap recommendations, and site/tender preparation

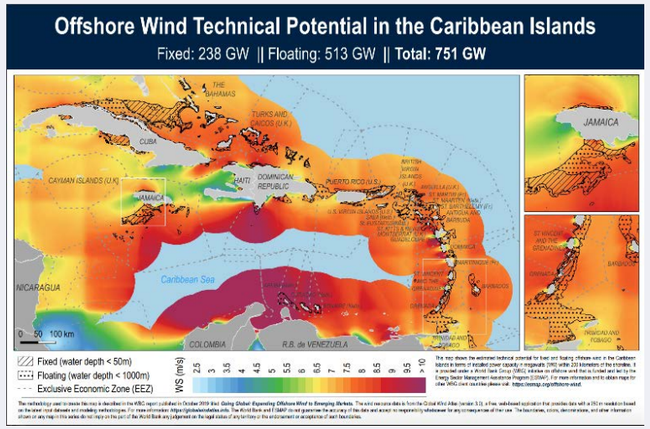
The support includes:

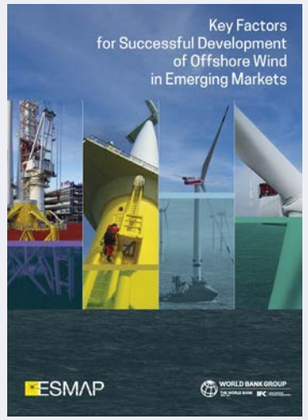
- Global knowledge and best practice reports, guides, and technical notes
- Capacity building through study tours, webinars, and training
- Country-level support including; roadmaps, advice on tender design, technical analysis (wind, grid, environmental, social), spatial planning guidance, regulatory and procurement advice.

Offshore Wind

Highlights of the Program's global work include:

- **Study tour** in 2022 took over 50 delegates from 15 countries to the Netherlands, Germany, and Denmark
- **Key Factors** for offshore wind is viewed as essential reading for civil servants – Originally published as a reference handbook, it was also recently published as an online training course
- Publications on **Concessional Finance** and **Spatial Planning** will soon be published.
- Further knowledge work planned on **Environmental and Social Impact Assessment (ESIA)** and **Small Island Developing States (SIDS)**





WBG Offshore Wind Study Tour 2022 at Anholt Offshore Wind Farm, Denmark

Offshore Wind

Country impact and achievements:

Azerbaijan: Roadmap drove developer interest, with more than 10 GW of MOUs signed with the government. Supporting preparation of pathfinder project

Brazil: Advised the drafting of an offshore wind Decree and Ordinance which led to +184GW of project applications. Developing a Roadmap to investigate role of offshore wind and inform policy.

Colombia: Roadmap informed country's first offshore wind Resolution. Recent $1billion policy lending included offshore wind prior actions. Work ongoing to support tender design.

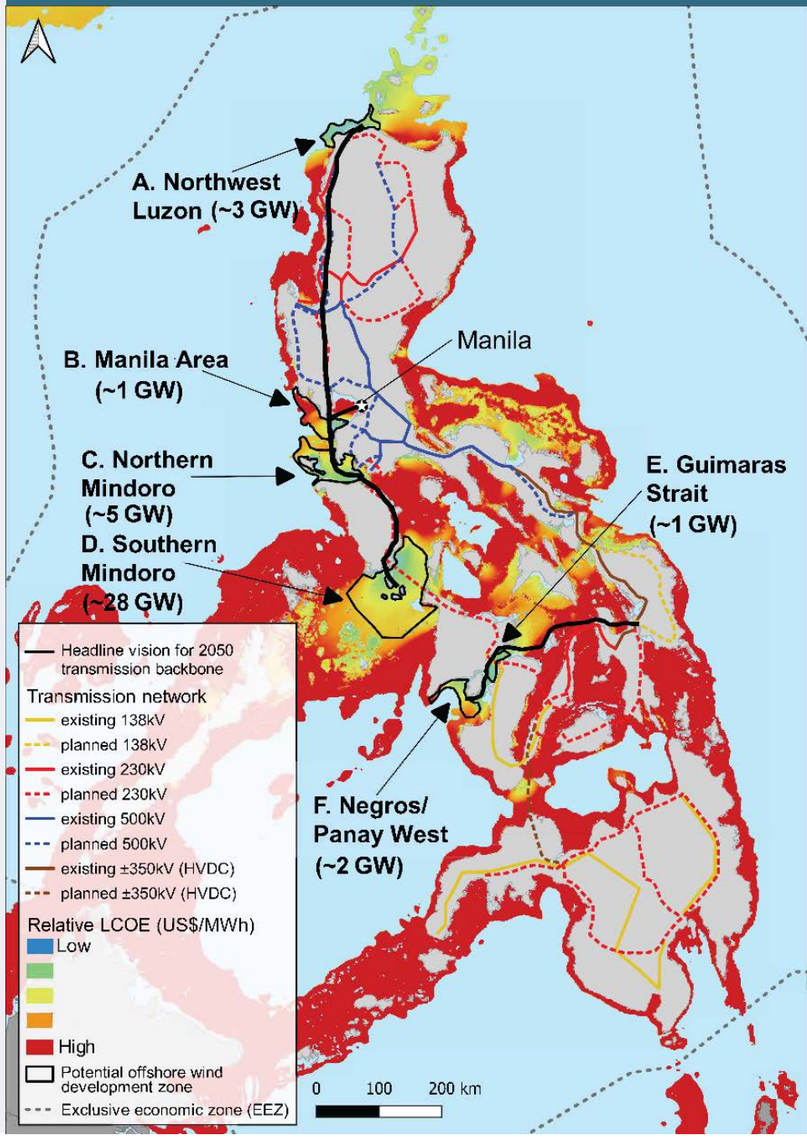
India: Program has helped develop the country's first seabed leasing competition for 4 GW, due to commence this year. Roadmap will focus on priority actions for different government entities.

Philippines: No consideration of offshore wind resource until ESMAP's analysis. Roadmap helped initiate the industry, with over +42 GW of marine area awarded. Work on grid planning ongoing.

Sri Lanka: Internal govt target of 1GW by 2030, informed by the Roadmap. Work ongoing to help prepare the country's first projects.

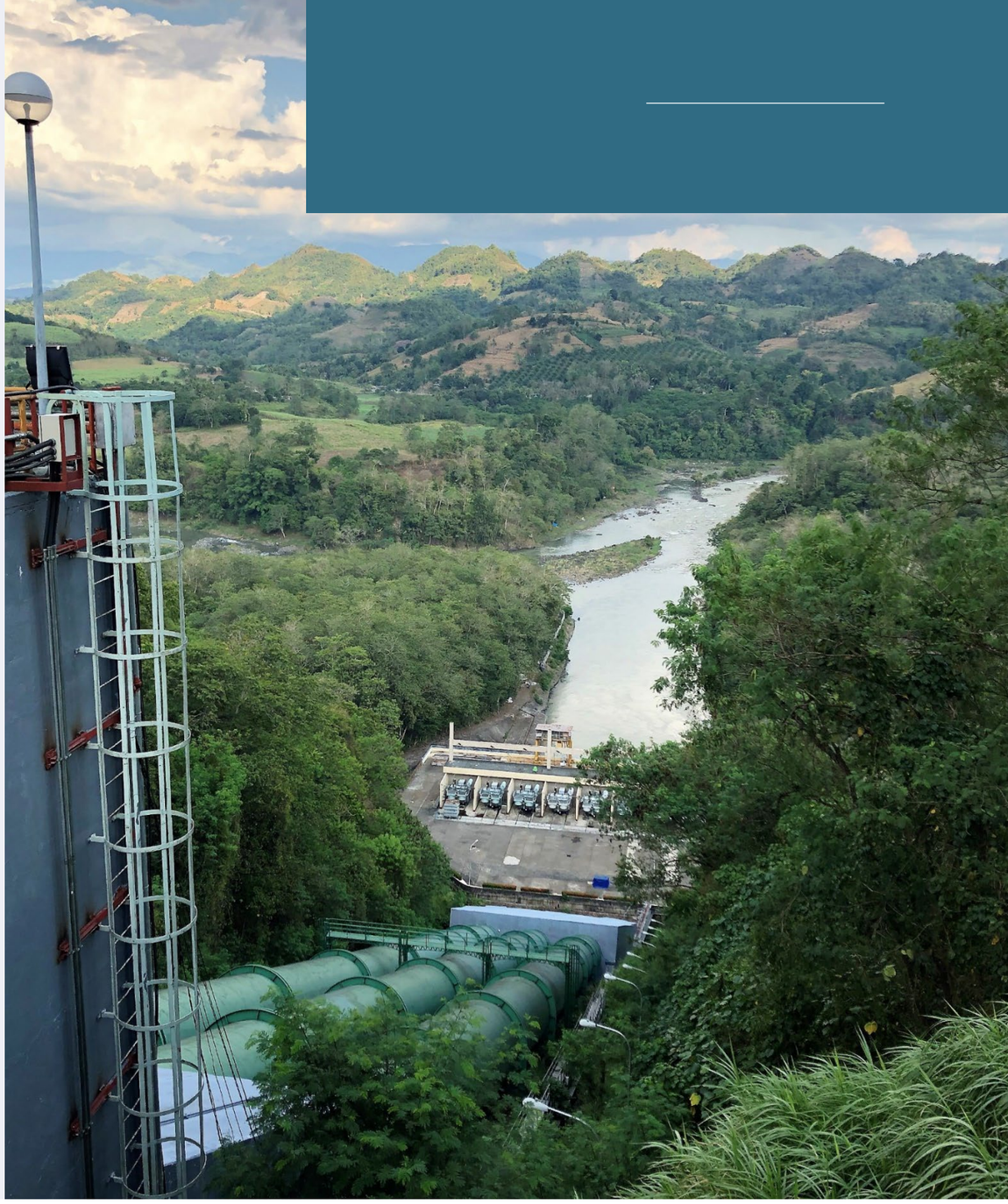
Turkiye: Roadmap advised government on establishing a target of 5GW by 2035. Recipient executed work about to commence to deliver offshore site surveys, feasibility studies, and tender design.

Vietnam: Roadmap helped establish a national offshore wind target of 8 GW by 2030. Work ongoing to inform marine spatial planning and procurement framework to allocate sites and capacity.



Offshore wind and transmission planning from Philippines Roadmap

Hydropower Development Facility



ABOUT HDF

The purpose of the Hydropower Development Facility window is to:

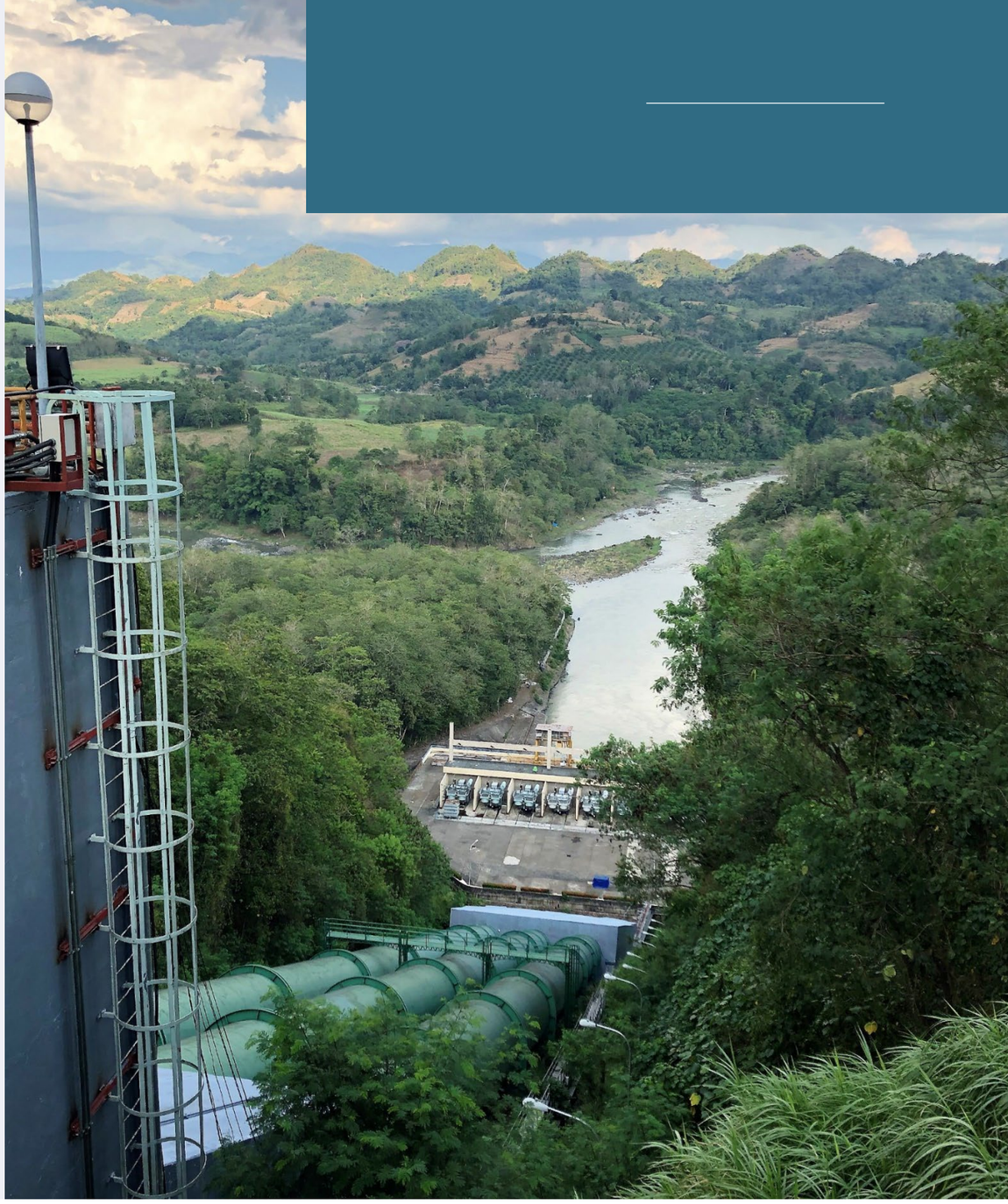
- **Hydropower provides energy and enables power systems to deliver secure, affordable, and clean electricity.** It allows river systems to provide multipurpose water, ecosystem services, and adaptation to climate change.

The support includes:

- The ESMAP Hydropower Development Facility (HDF) is well placed to support client countries with the **development of sustainable, flexible hydropower projects that will enable the energy transition.** The HDF has the objective to:
  - Build a pipeline of sustainable hydropower projects in recognition of the critical role it plays in power system balancing and water resource management
  - Support developing countries to develop, build, operate and maintain next generation greenfield and rehabilitation/upgrade/modernization projects
  - Accelerate deployment of sustainable hydropower that is critical for integrating VRE onto the power system

Achievements:

- Since 2019, HDF has **supported upstream preparation of hydropower projects in 18+ countries** with significant results already achieved
  - 1.1 GW of committed under financed projects
  - $1.1 bl of WB finance
  - $0.2 bl of private investments leveraged
- In FY23
  - 1.1 GW under planning in Bhutan and feasibility study for 1.9 GW to be approved in June 2023.
  - $ 19 million of WB financing



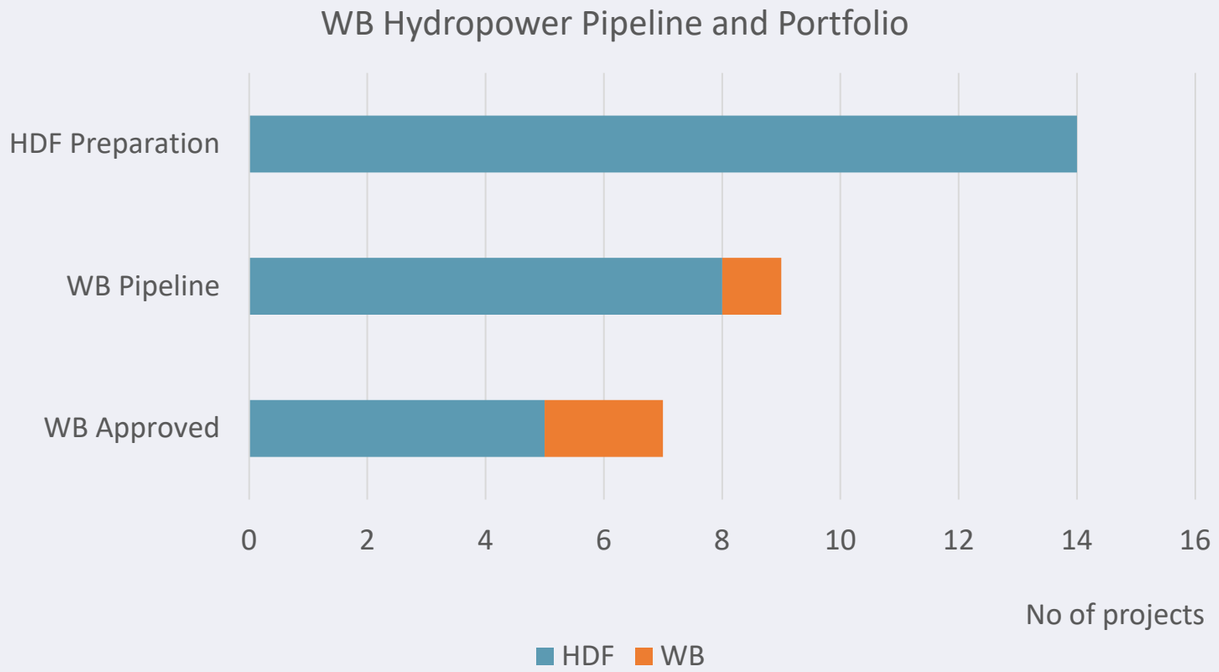
HDF is vital in developing the WB Pipeline and Portfolio

The ESMAP Hydropower Development Facility (HDF) is well placed to support client countries with the development of sustainable, flexible hydropower projects that will enable the energy transition.

The HDF is vital in developing the pipeline of sustainable hydropower projects. The graph presents an overview of projects approved by the WB and projects in the pipeline since the year the HDF program started. The graph also shows projects under preparation by the HDF

Key takeaways are;

- HDF is currently supporting 14 projects under preparation at various readiness levels.
- Project under preparation will need further funding to prepare for financial close
- HDF supports 81% of WB hydropower pipeline projects and approved projects (under implementation)



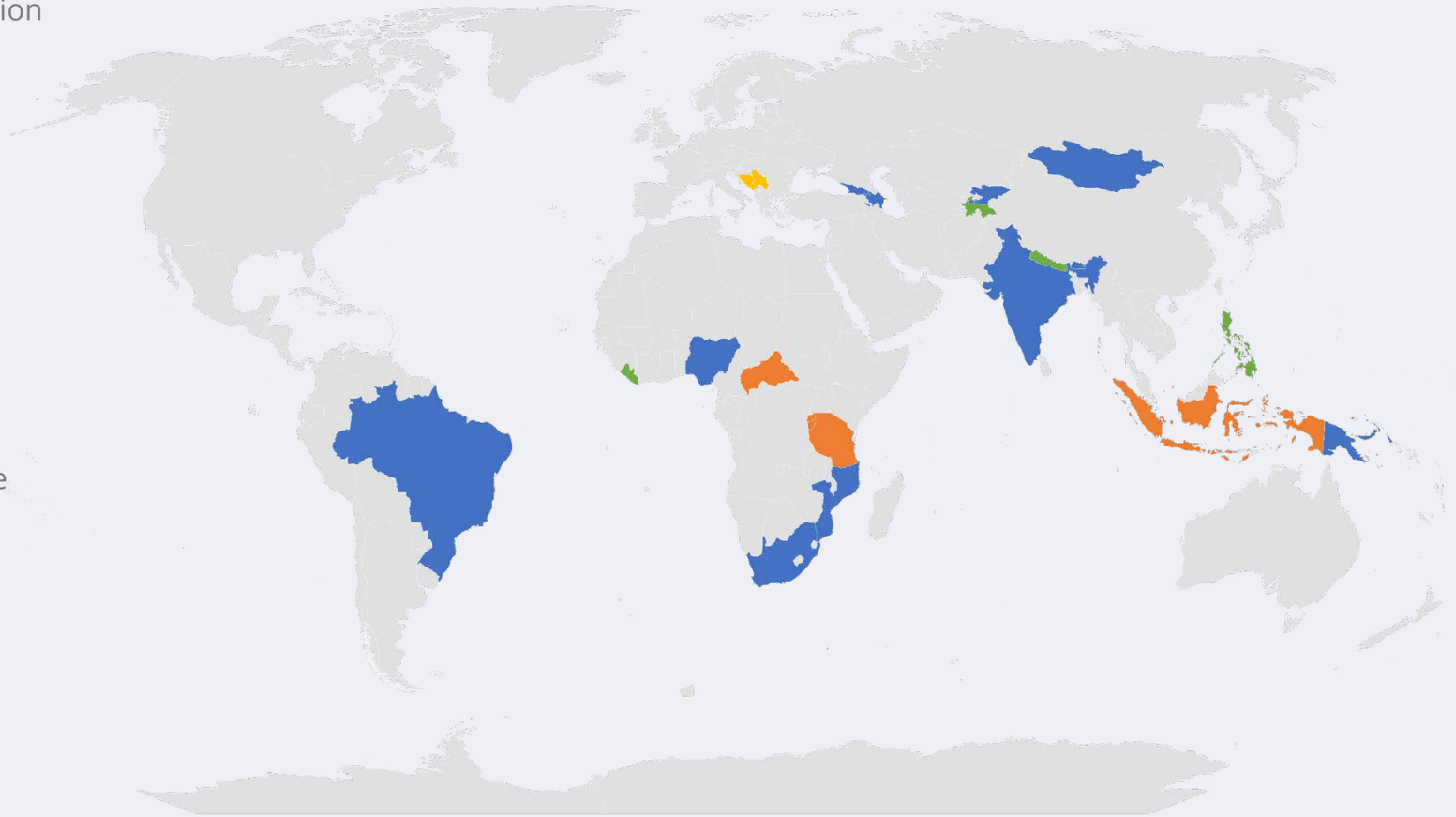
HDF By the numbers

- 5 approved WB projects with 1.12 GW
- 8 projects in the WB pipeline with 5.6 GW
- Preparation of 14 projects with 8.7 GW

The grants support projects that enables the energy transition

- 16 greenfield plants and rehabilitation of 10 plants including potential upgrade of capacity, performance, functionality and environmental and social conditions
- Both greenfield and rehabilitation projects focus on deploying high performance technology to enable integration of VRE
- In 6 grants intend to create an enabling environment to enhance the sustainability, bankability and macroeconomic environment of the projects
- In 8 projects focused on enhancing the technical, commercial and social and environmental foundations to reduce perceived risks and align with the framework of the World Bank´s and other investment institutions
- 11 grants include upstream work such as development masterplans, roadmaps for rehabilitation that are necessary to develop future pipeline projects

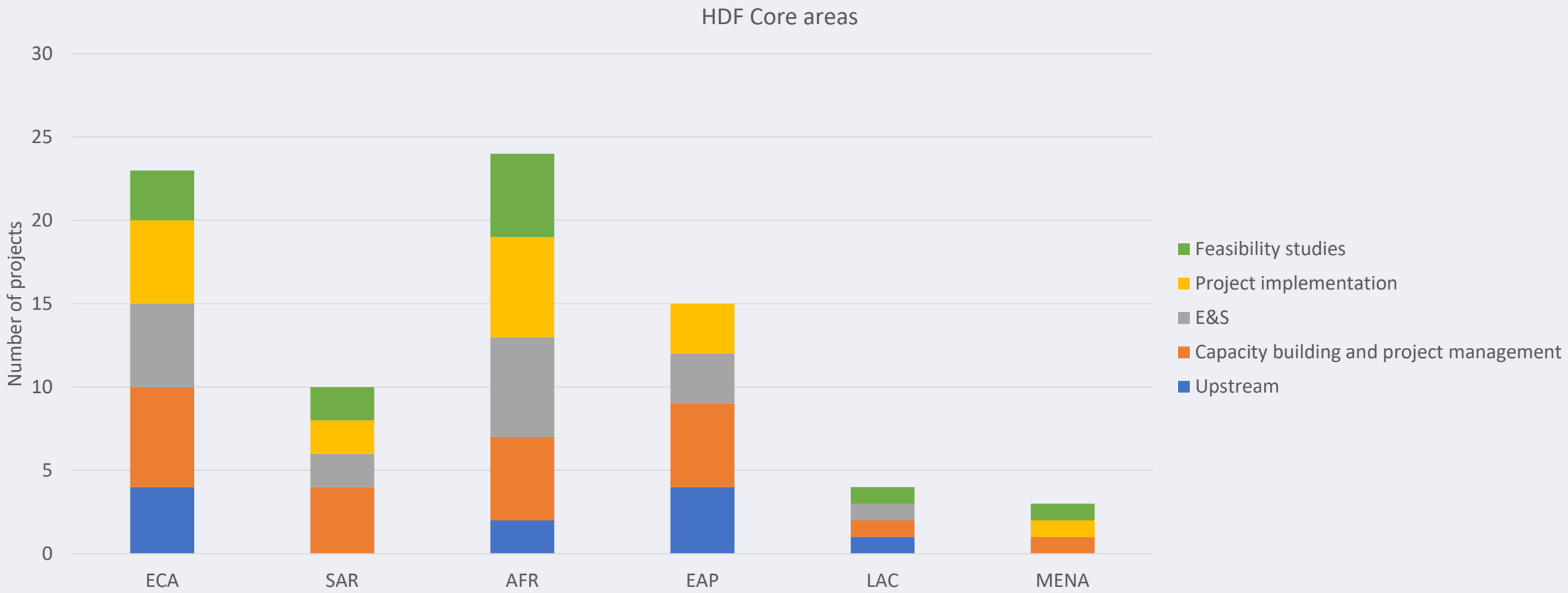
Note; The sum is not intended to equal the total number of projects since one project can cover multiple areas



HDF Core Areas to enhance project sustainability

Upstream	Capacity building & Project Management	Project implementation	Environmental and social impact assessments	Feasibility studies
Activities that leads to development of a pipeline of sustainable project as the project readiness matures	To ensure the lifetime sustainability of the projects through strengthening the Client´s capabilities	To enhance and tailor strategies for the project such as financing, identification of risks and establishment of risk sharing mechanisms etc.	to mitigate and improve conditions and to support Clients to align with and implement the Bank´s ESF	To ensure comprehensive assessments of the technical and commercial viability of the projects through developing new or additional studies

HDF Core Areas to enhance project sustainability



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