Grid Resilience in Developing Countries

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ADB Energy Overview

- **Prioritizes sustainable energy and low-carbon development:**
  - Promoting energy efficiency and renewable energy
  - Maximizing access to energy
  - Promoting energy sector reform, capacity building and good governance
- **Comprehensive and accommodates global developments in climate and energy sectors, notably:**
  - Paris Agreement on Climate Change
  - UN Sustainable Development Goals
- **Total approvals in the Energy Sector in 2017 amounted to $6.3 billion** with an additional $4.6 billion in co-financing
- **Total climate mitigation finance approved in the sector in 2017 amounted $2.04 billion** including $0.84 billion from PSOD (or 41% of the total climate investments)
- **Energy Access approvals in 2017 amounted to $1.29 billion** ($8.47 billion impacting 24.35 million households 2008-2017)

Examples of resilience issues in DMCs

India Power Outage 2012

- The blackout on 31 July is the largest power outage in history.
- Extreme heat had caused power use to reach record levels in New Delhi combined with late monsoons resulting in increased grid power for irrigation lower hydropower
- The outage affected more than 620 million people, but Wall Street Journal article highlighted only 320 million initially had power, while the rest lacked direct access.

Portions of Philippine Infrastructure:

High-level Challenges and response

Power Investment needs

- ADB estimates the region will need to invest $14.7 trillion in power infrastructure between 2016 and 2030 to meet demand.

Energy Access

- 439 million people without access to electricity in Asia - 70% of this population are in remote areas and islands

Climate and Environment

- Countries have NDC's but generally not on track, air quality a good entry point
- Climate change mitigation and air pollution control requires:
  - multi sectoral intervention (energy, urban, transport, water, agriculture, etc.)
  - energy efficiency improvement at the consumers' demand side (number of different clients, instead of single SOEs)

ADB Energy needs to change and adapt in terms of:

- New skills/knowledge on advanced technologies
- Innovative approaches/financing instruments
- Methods of work that allows for more cross-sectoral investments

Electricity Infrastructure Challenges

Overall trends:

- Most countries exhibiting high demand growth and just need to build generation and T&D
- But….some are already experiencing some pains of over capacity (Pakistan)…but for how long?
- Most countries are pursuing both RE and thermal infrastructure

Challenges:

- Bias to large scale solutions creating risk of under performing assets, especially for coal.
- Uncertain electricity system development plans and short term thinking
- Grid electrification and rural off grid electrification are not aligned
- Some extremely low tariffs
- Very different situations across countries

Supportive Approaches:

- Strong support to T&D – needed for conventional power and RE
- Differentiated approach across countries, while looking for commonalities and lessons learned
- PBL (policy based loans) to support overarch policy development
- Ongoing search for applicable examples to deploy in DMCs
- Include access to electricity plans in all power projects

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Rural Electrification through Mini-grids

Overall status:

- Perceived high risk of projects due to low affordability and unpredictable demand (too high and too low)
- Lack of Operation & Maintenance (O&M) experience and standardized solutions
- Lack of conducive frameworks & regulatory barriers
- Dispersed settlements in remote areas with small investment volumes leading to high transaction cost
- Tedious permitting processes & lack of smart subsidies

Challenges:

- All of the above
- Transaction size
- Developer sophistication
- Uncertain electricity system development plans from large grids

Supportive Approaches:

- Aggregation/ bundling of smaller projects
- Technical innovation: pre-paid models, remote monitoring
- Business model & Financial innovation: rent-to-own models, co-ownership community/ private sector, building of local capacity for O&M, risk-mitigating tools to create bankable projects, e.g. credit guarantees

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PHI: Cobrador Island Solar Hybrid Pilot Project

Funded by TA 7512 (REG) under the Energy for All Program (ADB share - $100,000 for the battery unit)

- **Issues:** Cobrador Island in Romblon Province, the Philippines is home to 1,000 people whose economic opportunities, lifestyle and well-being are curtailed by the limited supply of diesel-fueled electricity available only for 8 hours a day.

- **Approach:** The pilot project demonstrates viability of solar-diesel hybrid power plants with energy storage for remote island systems.

- **Design/Specifications:** The project installed a hybrid system consisting of a 30 kW rooftop solar PV capacity to generate immediate use during the day, and 180 kWh lithium-ion batteries to store excess energy for use at night. This is combined with a 15 kW diesel generator and control system to allow for switching to diesel when solar power runs out. The project was implemented by ADB in collaboration with Korea Energy Agency, the Philippine's National Electrification Administration, Romblon Electric Cooperative. BJ Power, Republic of Korea carried out the design, installation and commissioning of the system.
- Similar pilots were also done in Bangladesh, Myanmar and Nepal.

REG: Pacific Renewable Energy Facility

(Approved in 2017, ADB loan is up to $200 million financing across 11 Pacific member countries (PIC-11))

- **Issue:** The PIC-11, with a combined population of less than 1.5 million, face unique challenges transitioning to a renewable energy (RE) future.

- **Approach:** The Facility will upscale ADB support to RE financing and sector reform as well as streamline project processing through financing a series of individual small-value RE projects in the PIC-11.

- **Design/Specifications:** The facility is designed to support: increased co-financing, innovative financing modalities, systematic support for sector reform, private sector development and capacity building as well as streamlining ADB processing procedures that significantly hastens project processing and reduces transactions costs. The Facility is being supported by (i) $5 million TA for sector reforms and capacity building; and, (ii) $6.2 million for project preparation. Two projects have been approved in 2017 with 3 more in the pipeline for 2018.

INO: Sustainable Energy Access in Eastern Indonesia – Electricity Grid Development Program

(Approved in 2017, ADB results-based loan - $600 million)

- **Issues:** Eastern Indonesia suffers from fragmented island grids and low electrification rates compared with Java and Sumatra.

- **Approach:** The program funds results on distribution network buildout while introducing design and technology suited for small grids to increase efficiency and enable a higher mix of renewable energy into the local grids.

- **Design/Specifications:** System design aimed at reducing technical losses, and introduce advanced metering, smart grid pilot projects, and improvement of waste management practices. Co-financing in the amount of $300 million is expected from KfW that will be confirmed in Q2 2018. Project team provided all due diligence material to support KfW to expedite their management and government approval. Independent verification arrangement will be shared by ADB and KfW.

REG: Floating Solar Energy Development
(Proposed Regional TA for approval in 2018, $3 million from CEFPF)

- **Issues**: CWRD countries are heavily reliant on fossil fuels, hydropower, or imported fuels and power, solar potential is untapped due to lack of technical skills and knowledge on new technologies, costs, benefits and financing options.

- **Approach and Rationale**: Pilot testing and scaling up of emerging 'floating' solar photovoltaic technology; business models formulation to encourage private sector participation; institutional capacity building

- **Design and Specifications:** Selected pilot project sites have huge potential for scale up, replication and showcasing various configurations, uses and benefits of FPV:
  - Qargha reservoir in AFG: Qargha lake could fit at least 10 MW, and Naghlu reservoir could theoretically fit at least 200 MW
  - Lake Boyukshor in AZE. The lake could theoretically fit 500 MW and there are 8 more such lakes in Baku.
  - The 1,200 MW Toktogul HPP and reservoir in KGZ could theoretically fit over 20 GW

MON: Upscaling Renewable Energy Sector Project

Proposed project planned for approval in 2018, ADB Loan - $ 40 million

- **Issues:** There is increasing power demand in the remote grid systems in western Mongolia with heavy reliance on high carbon electricity import from Russia; and 30% transmission losses on account of about 2,000 km of long stretched 110 kV transmission line to supply electricity in the western Mongolia.

- **Approach:** The project aims to reduce high carbon electricity imports and transmission losses through a distributed renewable energy system supplying clean electricity in scattered load centers.

- **Design/Specifications:** The project will install a total of 41 MW renewable energy generation capacity in 6 load demand centers in western Mongolia comprising: solar PV (25 MW), wind power (15.5 MW), shallow-ground heat pump (500 kW), and battery storage. Grant financing in the amount of $20.6 million is being sought from Climate Investment Fund ($14.6 million) and Japan Fund for Joint Crediting Mechanism ($6.0 million).

CAM: National Solar Park Project

(Proposed for approval in 2018/2019, ADB loan - $20 million + $14 million in trust funds)

- **Issues:** Cambodia is beset with low electrification rates, high electricity costs, an over reliance on fossil energy and large hydropower. The country also is wanting of affordable and sustainable renewable energy generation options.

- **Approach:** The project will develop and finance a large solar park, the first of its kind in Cambodia under a public-private partnership modality. It will also install a 100 MW solar power generation capacity that will represent 4% of the country's energy mix.

- **Design/Specifications:** The common infrastructure and transmission line will be funded through a public sector loan while the solar photovoltaic (PV) plant will be financed by the private sector. The solar park will be constructed near the demand center of Phnom Penh and will include advanced features such as solar resource forecasting system and short-term energy storage for output smoothing.
- Currently supporting the preparation of a National Solar PV Masterplan which will identify future solar parks and technical consideration for scaling up solar PV generation.
- Will also provide technical review into the energy storage technology for the proposed solar park.

Conclusions

Resilience challenges

- Most vulnerable are typically the most impacted – especially due to weather
- Lesser developed electricity systems can manage less RE
- Lowest cost and conventional approaches are the most commonly utilized to system development, despite mitigation or resilience concerns.
- Apparent or sometimes conflict between adaptation and mitigation approaches.
  - Resilient approaches can be more carbon intensive
  - Mitigation approaches may be less resilient (or may be perceived that way)

Response to resilience concerns:

- Hardening of infrastructure is an important approach, but cost is a key concern
- Trying to develop “Ad-Mit” projects (adaptation and mitigation)
- “Quality” infrastructure is emphasized

Questions:

- How do you make hydro resilient?
- How do we better encourage energy efficiency and demand side utilization?

Thank you

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