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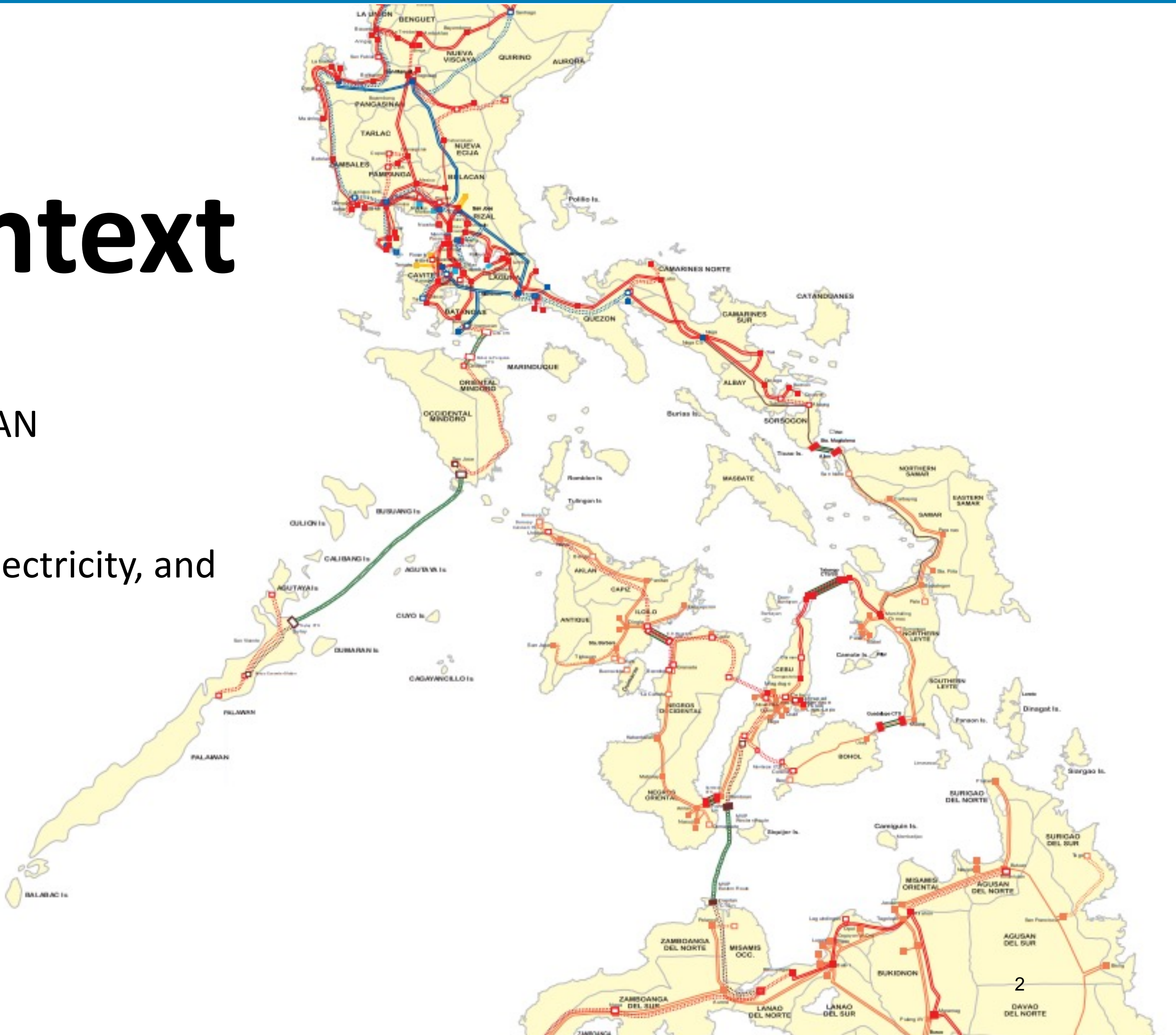
Seeking Balance – Offshore Wind, Essential Grid Services, and Good Things to Come in the Philippines

Philippines Context

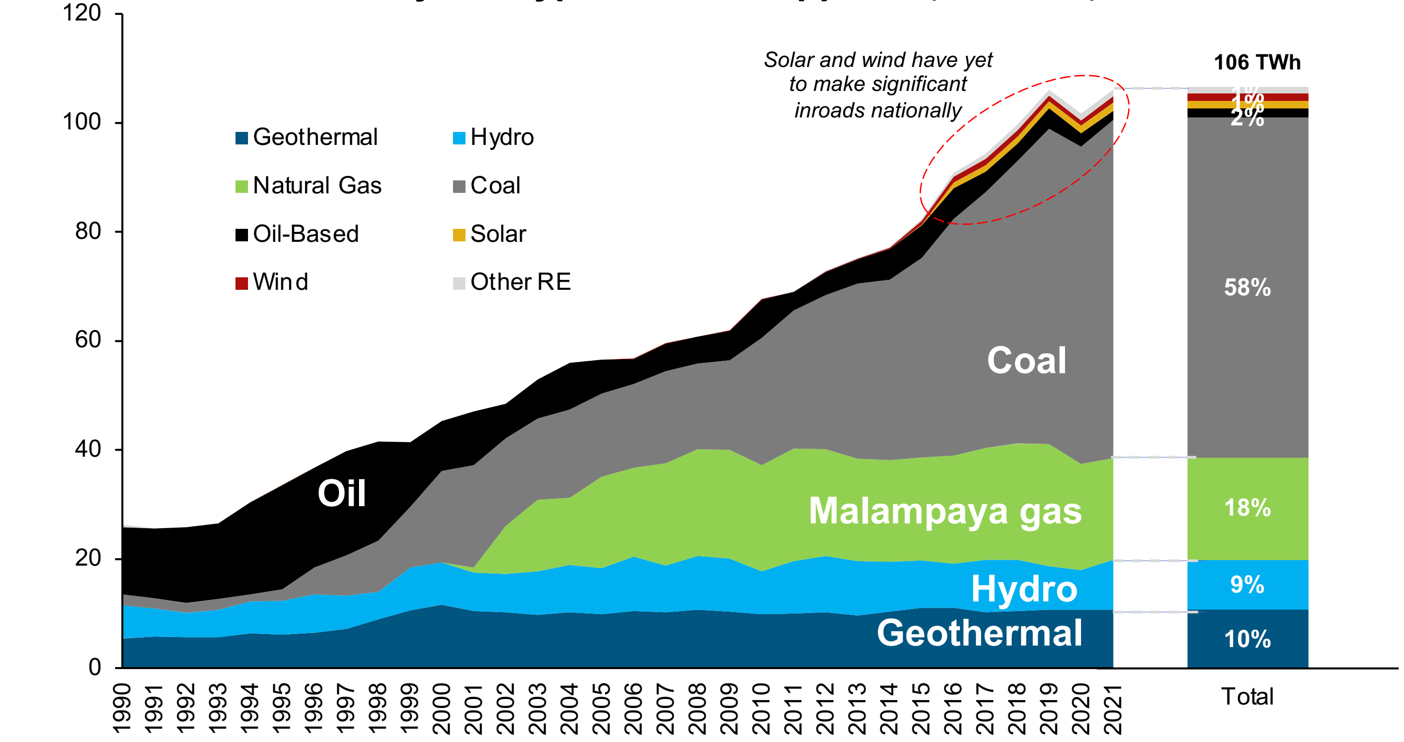
We are in an **energy emergency**

- Highest retail electricity prices in ASEAN
- Declining Malampaya gas field
- 5 million Filipinos have *no access* to electricity, and many lack *reliable* electricity

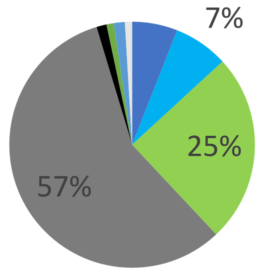


Power supply dominated by Coal

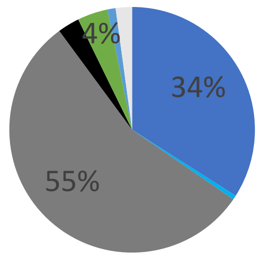
Generation by fuel type in the Philippines (1990-2021)



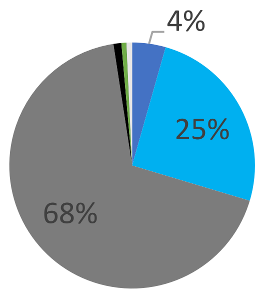
Generation mix in the Philippines 2021



Luzon
Predominantly coal & gas
75.2 TWh (2021)



Visayas
Predominantly coal & geothermal
16.3 TWh (2021)

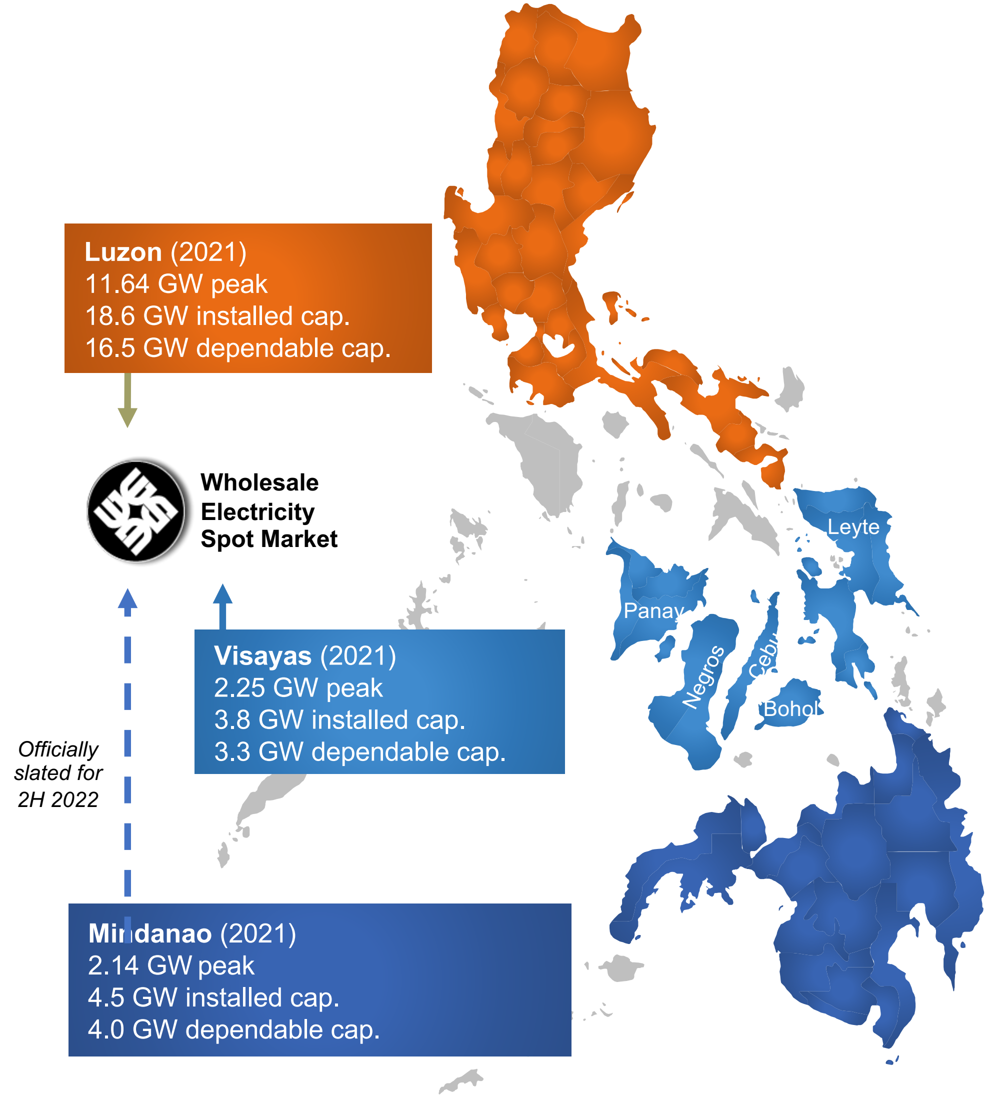


Mindanao
Predominantly coal & hydro
14.6 TWh (2021)

- While coal is now the mainstay of the generation mix, gas still accounts for around a quarter of grid-connected supply, and nearly a third of supply in Luzon
- Malampaya gas is used to fuel over 3.2 GW of gas-fired generation, of which 2.7 GW of capacity falls under gas supply purchase agreements featuring high Take-or-Pay contract quantities

Source: DOE

A versatile market for renewables and storage



- A restructured, commercially active, private-sector-driven, **electricity industry in a competitive market**
- **Sophisticated market environment** with a wholesale electricity spot market ("WESM")
- **Multiple routes-to-market for generation projects**, with direct PPAs, retail electricity contracts, spot market sales, and (anticipated) regular auctions.
- **Solar/storage and wind are economically competitive against other technologies.** Strong policy support and incentives for renewables, whilst increasing deregulation of the retail sector is spurring new offtake opportunities.
- Relatively liquid financing available at competitive rates (for those with access)
- A consolidating industry, as **several strong local players increase their market positions**.

Source: DOE Power Statistics 2021; NGCP Operations Data; TLG analysis

Entrenched challenges and new opportunities

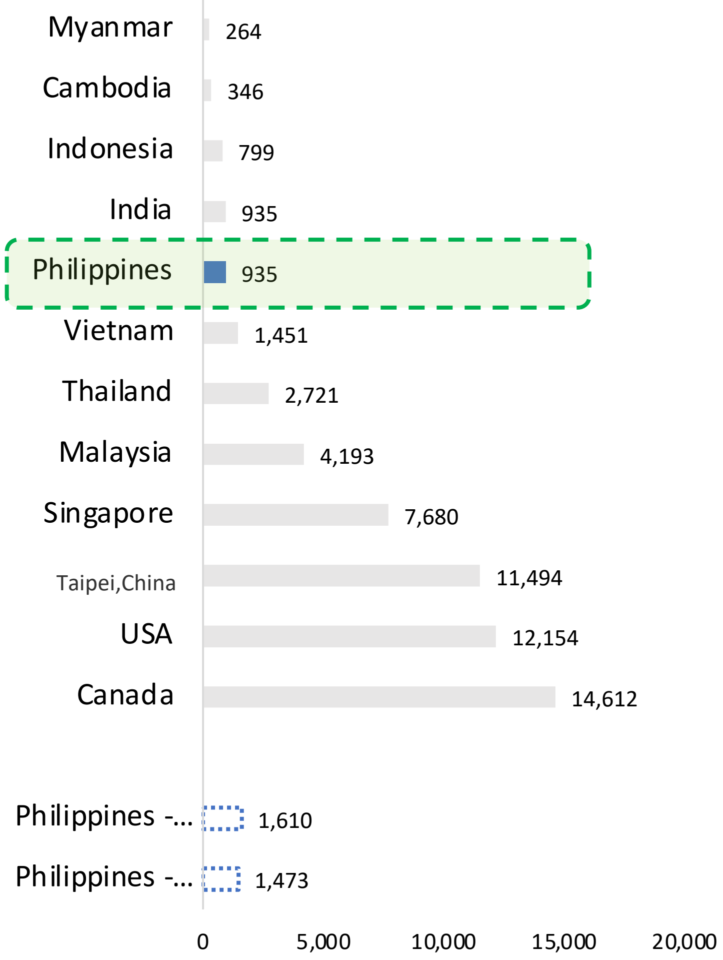
- **Low electricity use per capita and limited access** –
  - Constrained access to reliable electricity, esp outside of Luzon
  - → Opportunities for significant growth

- **High prices -** Among the most expensive electricity in the region
  - Makes energy efficiency and renewable energy highly competitive

- **Constrained transmission**
  - Three major grids, with Luzon representing ~73% of demand
  - Lack of build-out has stranded new generation assets and increases costs to build generation, which include transmission/ interconnection in project costs
  - → New performance-tied approaches can improve connection and affordability

- **Lack of Essential Grid Service**
  - Under procurement of essential grid services leads to increasing black- and brown-outs
  - → New transparent and competitive procurement approaches can allow for generation value-stacking, especially for storage technologies

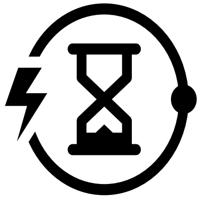
Low Electricity Consumption per Capita **(kWh)** *(2020)*



Government support to reach 35% RE share of generation by 2030, and to >50% by 2040

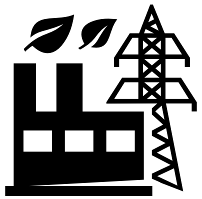
- **Renewable Portfolio Standards (RPS)** require grid-connected distribution utilities and retailers to procure a defined share of energy from renewable sources – 2.5% from 2023
- **Green Energy Auction Program** to drive large-scale renewable capacity additions – inaugural auction in 2022 was expanded in 2023 and expected to give be conducted annually
- **Green Energy Option (GEOP)** allows larger end-users (>100 kW) to contract directly with renewables suppliers
- **Moratorium on new coal** was implemented in late 2020
- **Preferential dispatch and tax incentives** for RE technologies
- **Competitive Renewable Energy Zones** to encourage renewables development via proactive transmission planning
- **Nationally Determined Contribution** underlines ambition energy transition targets

Additional New Capacity Targeted under Philippine Energy Plan 2020-2040 Clean Energy Scenario (CES)



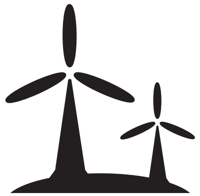
Geothermal
+480 MW

Hydro
+16,397 MW

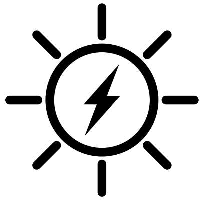


Biomass
+447 MW

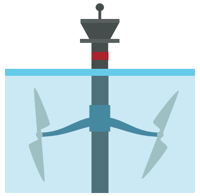
NOTE: Targets don't yet include emerging opportunities in:
- Offshore wind
- Floating solar PV
- New approaches for geothermal



Wind
+11,387 MW



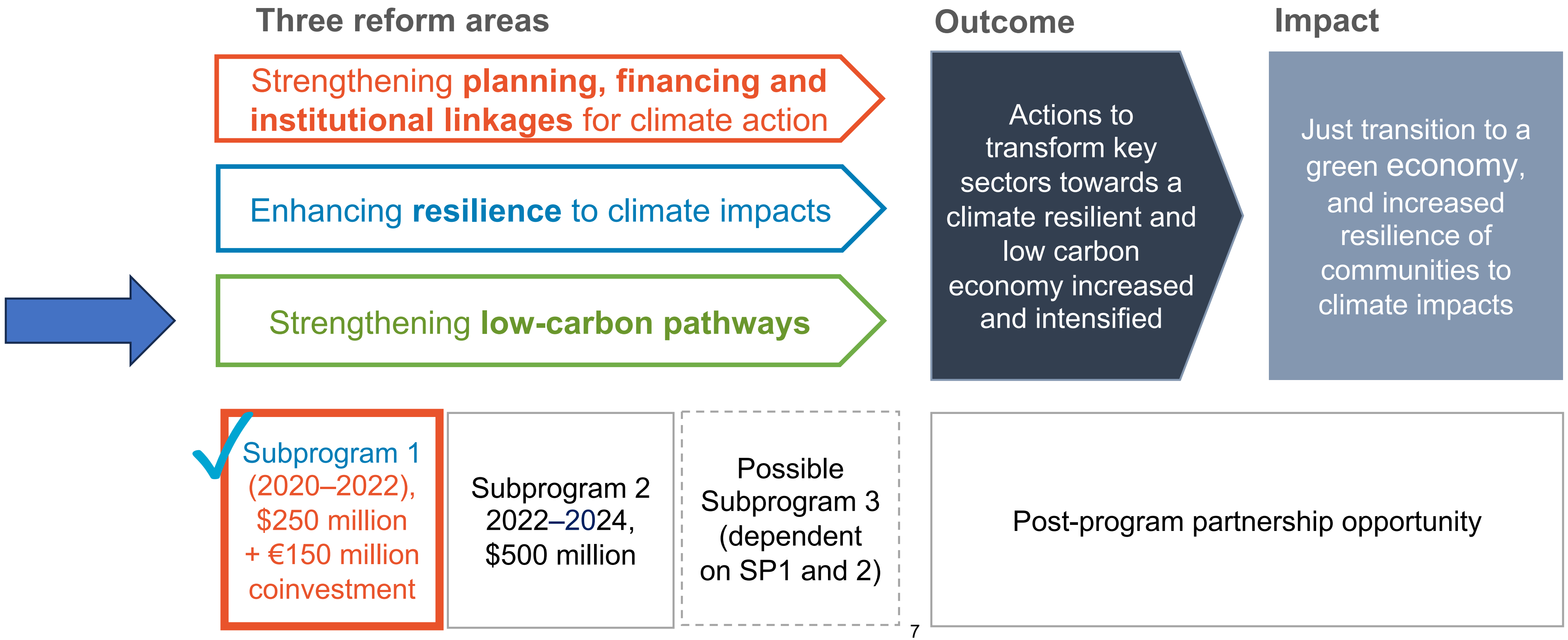
Solar
+45,118 MW



Ocean
Pilot Program

The Philippine Climate Change Action Program

ADB's First Climate Change Policy Based Loan



ADB's *current* Philippine Energy Transition Program

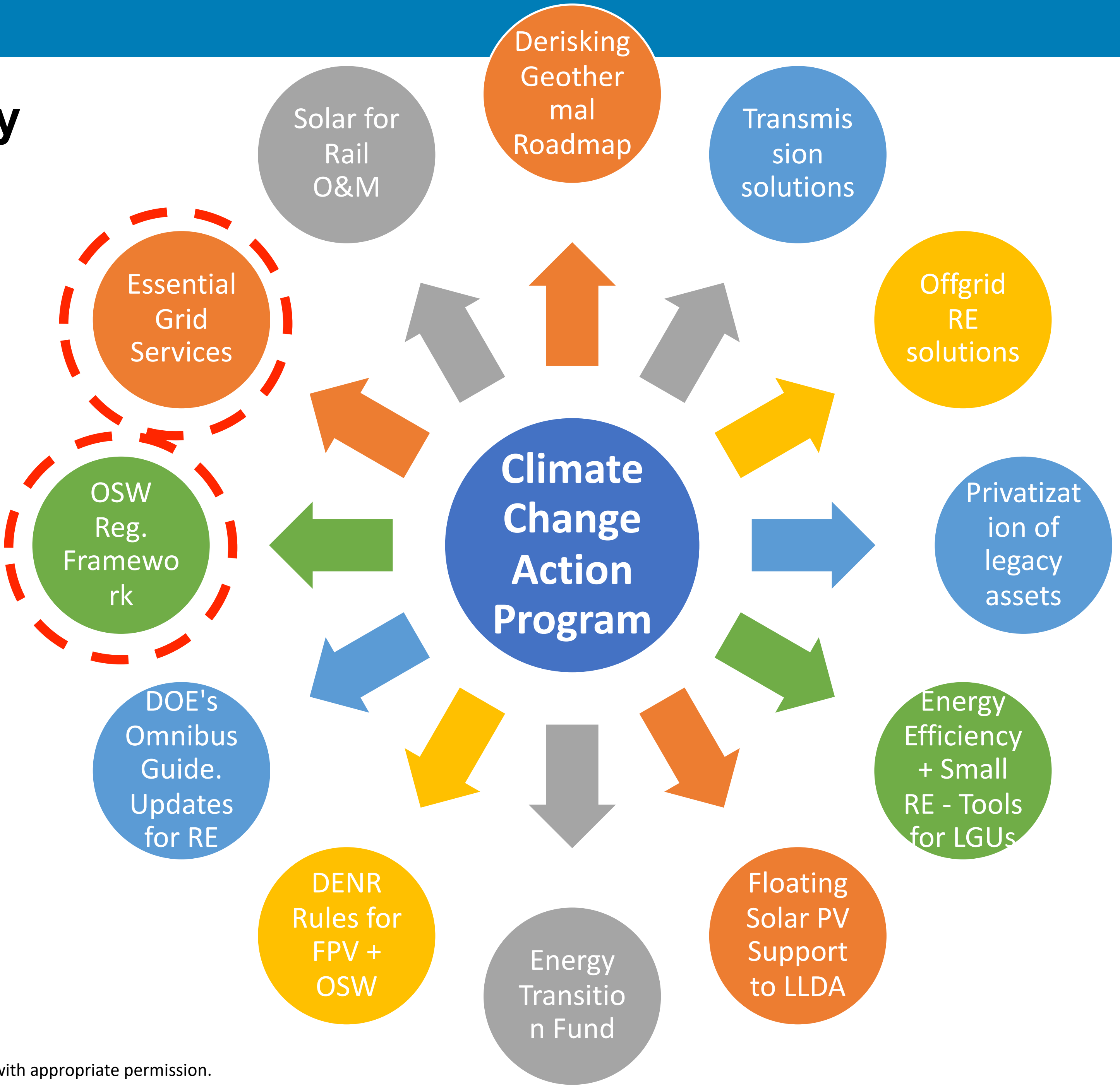
There are no silver bullets on the path to affordable, reliable, sustainable, and secure energy for *ALL*, but there are two **game-changers** on the horizon:

1. **Improved definitions and procurement of essential grid services**

This can reduce black- and brown- outs and allow more RE to come online

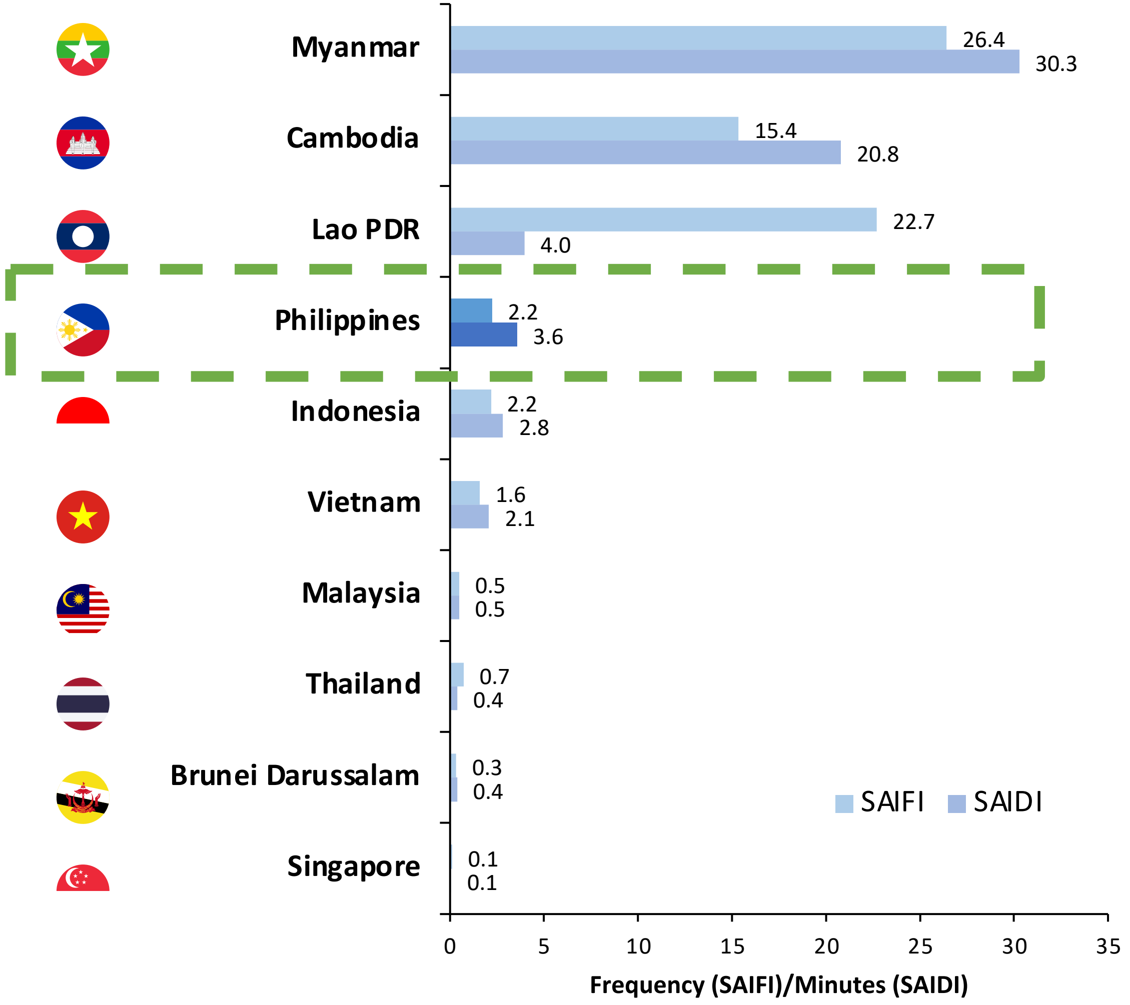
2. **Offshore wind development**

This can bring *gigawatts* of clean energy online if the enabling environment is ready



Grid reliability problems cost consumers and businesses

National Reliability Indicators (Not Disaggregated) **(2020)**



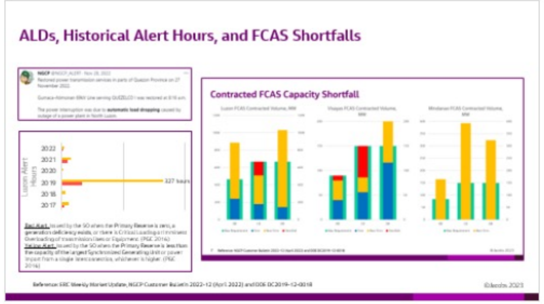
- The Philippines has seen gradual improvement in system losses over the past decade, however, grid reliability issues persist – most recently in the Luzon red alerts in the summers of 2021, 2022, and now in 2023.
- Compared to its regional peers, the Philippines' grid reliability still lags behind its economic counterparts – partially hindered by the geographic need for inter-island interconnections.
- As more intermittent renewables come online, system balance will become only more difficult.

Grid reliability problems are caused by:

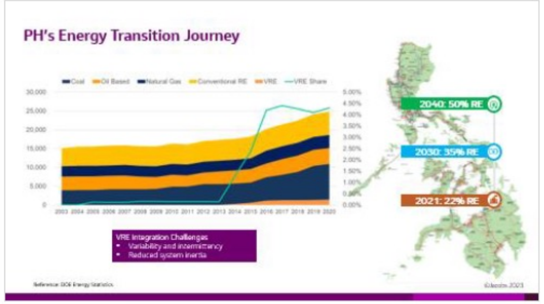
- Unplanned outages at large generation facilities / lack insufficient penalties and accountability to prevent then
- Lack of transmission and interconnection / Disconnect between mandate and incentives
- Insufficient ancillary services (essential grid services) – definitions and procurement approaches per service
- Insufficient data and grid controls

Step 1: Update definitions in line with system needs

Why review FCAS technical requirements?



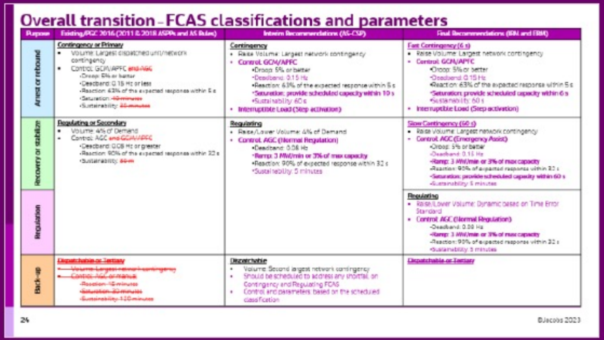
Improve system reliability/performance



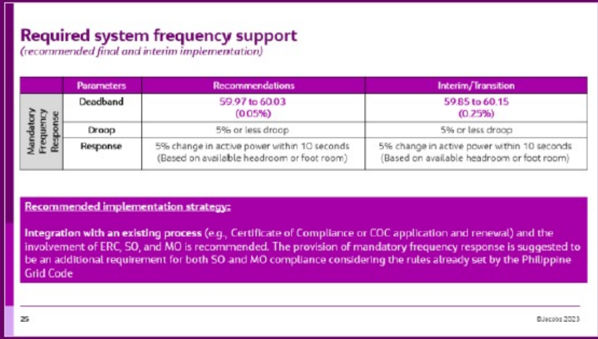
Prepare the Grid for the energy transition

Task Outputs:

- FCAS Technical Requirements and Strategy
  - Enhanced parameters
  - Transitional definitions



- Mandatory Frequency Response Requirements and Strategy



Required system frequency support
(recommended final and interim implementation)

	Parameters	Recommendations	Interim/Transition
Mandatory Frequency Response	Deadband	59.97 to 60.03 (0.05%)	59.85 to 60.15 (0.25%)
	Droop	5% or less droop	5% or less droop
	Response	5% change in active power within 10 seconds (Based on available headroom or foot room)	5% change in active power within 10 seconds (Based on available headroom or foot room)

Recommended implementation strategy:

Integration with an existing process (e.g., Certificate of Compliance or COC application and renewal) and the involvement of ERC, SO, and MO is recommended. The provision of mandatory frequency response is suggested to be an additional requirement for both SO and MO compliance considering the rules already set by the Philippine Grid Code

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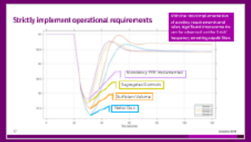
New classifications under development

Purpose	Existing/PGC 2016 (2011 & 2018 ASPPs and AS Rules)
Arrest or rebound	<u>Contingency or Primary</u> ▪ Volume: Largest dispatched unit/network contingency ▪ Control: GCM/APFC ~~and AGC~~ •Droop: 5% or better •Deadband: 0.15 Hz or less •Reaction: 63% of the expected response within 5 s •Saturation: ~~10 minutes~~ •Sustainability: ~~30 minutes~~
Recovery or stabilize	<u>Regulating or Secondary</u> ▪ Volume: 4% of Demand ▪ Control: AGC ~~and GCM/APFC~~ •Deadband: 0.08 Hz or greater •Reaction: 90% of the expected response within 32 s •Sustainability: ~~30 m~~
Regulation	
Back-up	~~Dispatchable or Tertiary~~ ~~▪ Volume: Largest network contingency~~ ~~▪ Control: AGC or manual~~ ~~•Reaction: 15 minutes~~ ~~•Saturation: 30 minutes~~ ~~•Sustainability: 120 minutes~~

Strictly implement operational requirements



- Schedule and dispatch required AS volumes
- Segregate control for optimization
- Implement Mandatory Frequency Control

Introduction of appropriate technical requirements/parameters

- Saturation or Response time for frequency arrest
- Volume for frequency recovery
- Sustain requirements based on existing market structure

AS reclassification and consider new AS resource

- Separate FCAS for frequency recovery and regulation
- Inverter-based resources (batteries, VREs, etc.)
- Interruptible Loads

Step 2: Improve transparency and competition in Procurement

Current approach

- Opaque bilateral contracts
- Insufficient procurement
- First competitive selection procurement process in April 2023, but excluded new suppliers

1. Updated approach
2. Consultations
3. Document revisions

Improved approach

- Transparent, competitively procured bankable contracts for *new* suppliers
- Forward market to ensure sufficient supply volumes for market mechanism
- Co-optimization with spot market for contingencies
- Improved review procedures for qualified providers, including storage

Step 3: Improve affordability and accountability

Cost Recovery

Current approach

- 100% of costs passed directly to consumers

Improved approach

- Implement causers-pay approach, where efficient and possible

Cost recovery principles

Approach	Description
Causer pays	Adopted in various forms to reduce costs of Frequency Control Ancillary Services (FCAS) by allocating cost to party who is able to control the cost • Causers of the service should be self-evident. • Measure of causer contribution (or billing determinant) is correlated to the amount of the service procured and can be measured. • The methodology is transparent so that causers can infer behavior changes required to modify their costs.
Beneficiary (or user) pays	Adopted for Ancillary Services (AS) cost recovery when causers-pays is not appropriate as need for service is not caused by specific parties or where causer attribution is challenging • The beneficiaries or users of the service should be easily identifiable • The allocation of cost should be fair and linked to ○ The beneficiary's use of the service or ○ The beneficiary's use of the power system or other service driver if use of service cannot be measured

Management and incentives

Current approach

- Approx. 1-2% of Transmission System Operator's compensation is tied to performance, including for ancillary services provision

Improved approach

- Tie compensation to agreed performance metrics to improve ancillary services delivery quality, quantity, and timelines

Essential Grid Service Improvements

Implementation Strategy

FCAS Classifications and Technical Requirements

Status Quo

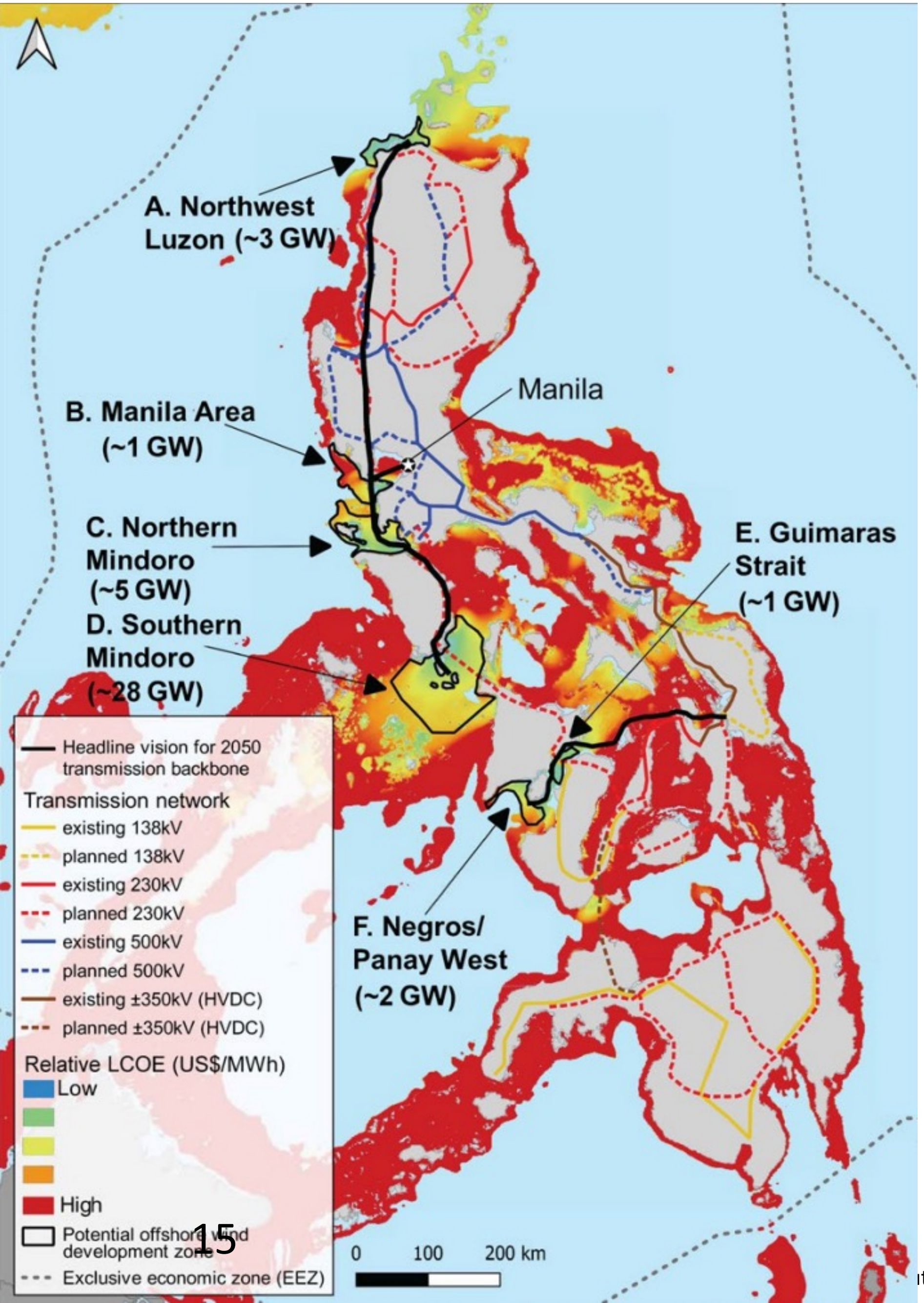
- Existing FCAS Classifications and Technical Requirements

Initial Reserve Market

- Interim – Existing FCAS Classifications with adjusted Technical Requirements

Enhanced Reserve Market

- Final – Recommended FCAS Classifications and Technical Requirements



Offshore Wind – big opportunities need big preparations

- DOE's Offshore Wind Roadmap sees offshore wind build-out in 2028 at the earliest
- The roadmap identifies technical potential for **20.5 GW by 2040 and 40.5 GW by 2050**. The **total Philippine grid capacity was only 26 GW total in 2021**
- OSW requires extensive government coordination and preparation. Priorities include:
  - **DATA!**
  - Transmission planning and new solutions
  - New approaches for Marine Spatial Planning
  - New approaches for offshore permitting
  - Port infrastructure expansion and improvements
  - Bankable PPA contracts through the GEAP
  - Regulatory framework for OSW, including GEAR pricing and interconnect
  - Targets and incentives based on comparative LCOE fit into the Philippine generation mix

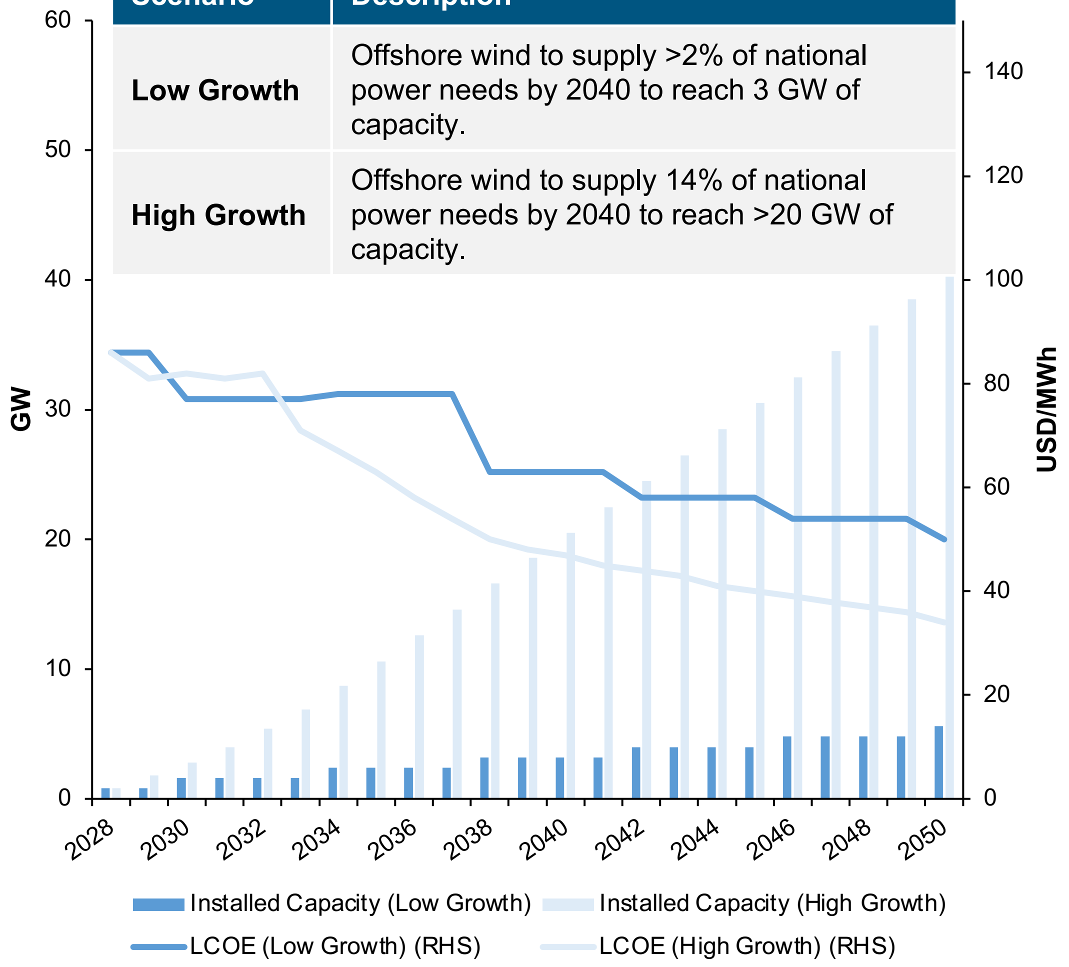
Development Partner Coordination is key to meeting the government's needs at this scale

Scope under development

- **Cost Methodology, Assumptions, and Estimates**
  - Bottom-up costing to identify reasonable cost estimates to inform ERC's tariff structures as well as national policy.
- **Least-Cost of Integration in the Philippines Energy Mix Study**
  - Optimization scenario recommendations for OSW integration with other forms of energy to meet Philippine load growth over the next two+ decades based on bottom-up costing and local contexts.
- **Potential Regulatory Supporting Schemes Evaluation**
  - Recommend options for potential OSW support mechanisms, including advantages and disadvantages, examples/benchmarks from PHI and relevant markets, and prioritization
- **Grid Connection Procedures and Cost Allocation Recommendations**
  - Procedural requirements for interconnection, evidence-based assessment for cost allocations
- **Grid Operations Recommendations**
- **Key Contract/ Agreement Template**
  - To improve transparency and efficiency for industry development
- **Knowledge Gaps and Next Steps**

Offshore Wind Roadmap Scenarios for Installed Capacity and LCOE *(2028-2050)*

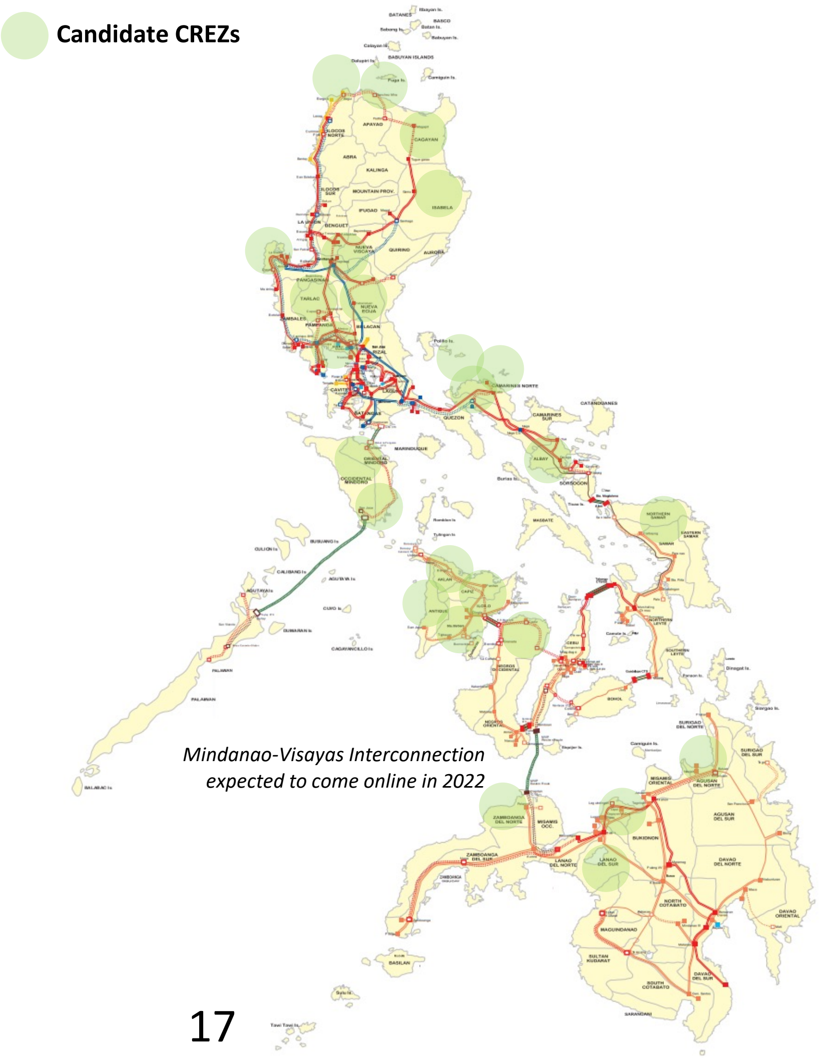
Scenario	Description
Low Growth	Offshore wind to supply >2% of national power needs by 2040 to reach 3 GW of capacity.
High Growth	Offshore wind to supply 14% of national power needs by 2040 to reach >20 GW of capacity.



Note: indicative estimates in ADB study, which is still underdevelopment

Agile transmission planning and build-out are critical

Map of Main Grid & Candidate CREZs
(as of May 2021)

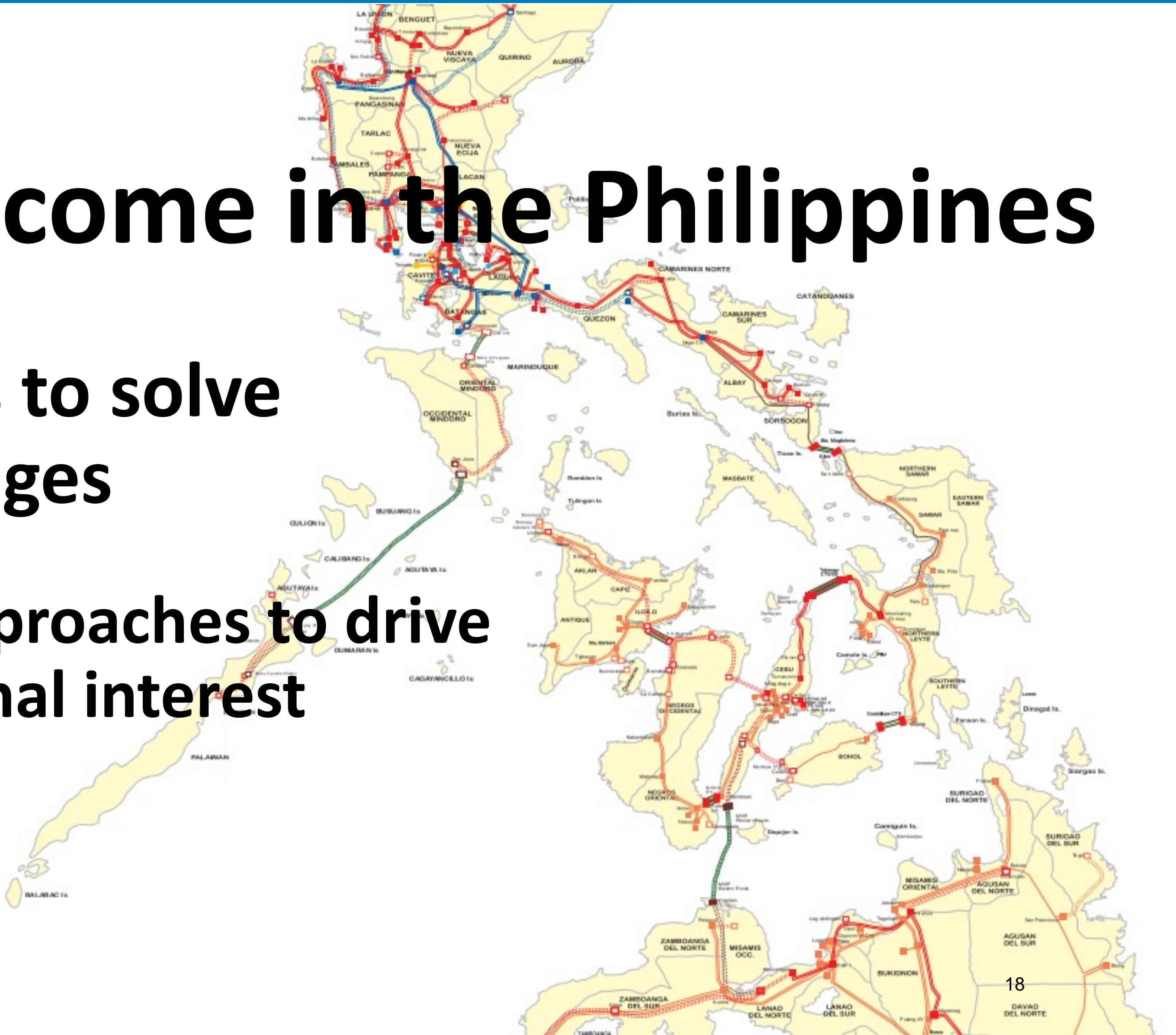


Key Grid Profile Facilities by Region
(as of August 2021)

	Luzon	Visayas	Mindanao	National
Substation Capacity (MVA)	29,976	5,574	6,141	41,871
Transmission Line Length (CKT-KM)	9,449	5,379	5,855	20,732
Capacitor (MVAR)	2,738	327	360	3,424
Shunt Reactor (MVAR)	965	565	93	1,603

- As the concessionaire transmission system operator (TSO), the privately-owned NGCP is in charge of grid development over the course of its 25-year tenure. NGCP's annual Transmission Development Plans (TDPs) have been subject to approval from the ERC and published in consultation with the DOE.
- New technologies, such as offshore wind, onshore wind, and floating solar PV highlight the need for agile and active interconnection capacities; however, in recent years, there have been major delays in key island interconnections, leaving regional grids weaker, creating pockets of over- and under- supply, and stranding new renewable assets without evacuation
- Implemented by the DOE in 2020, the Competitive Renewable Energy Zone (CREZ) policy is aimed to proactively direct transmission planning toward areas with highly potent and cost-effective new renewable energy resources, though further updates are needed.

Good things to come in the Philippines



⭐ New ambitions to solve entrenched challenges

⭐ New tools and approaches to drive solutions in the national interest