



Wind Power Generation in Vietnam

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**Vietnam Wind Power
In the Global Wind
Energy Market Place
after RE 1.0**

**Tariff Expiry in Oct 2021
COD with 3980 MW Wind**

2

**Challenges faced by the
Grid with the current
VRE Capacity**

**Transmission and
Generation Intensity
required for VRE**

3

**The next phase of
growth in Vietnam -
RE 2.0
2023 to 2030**

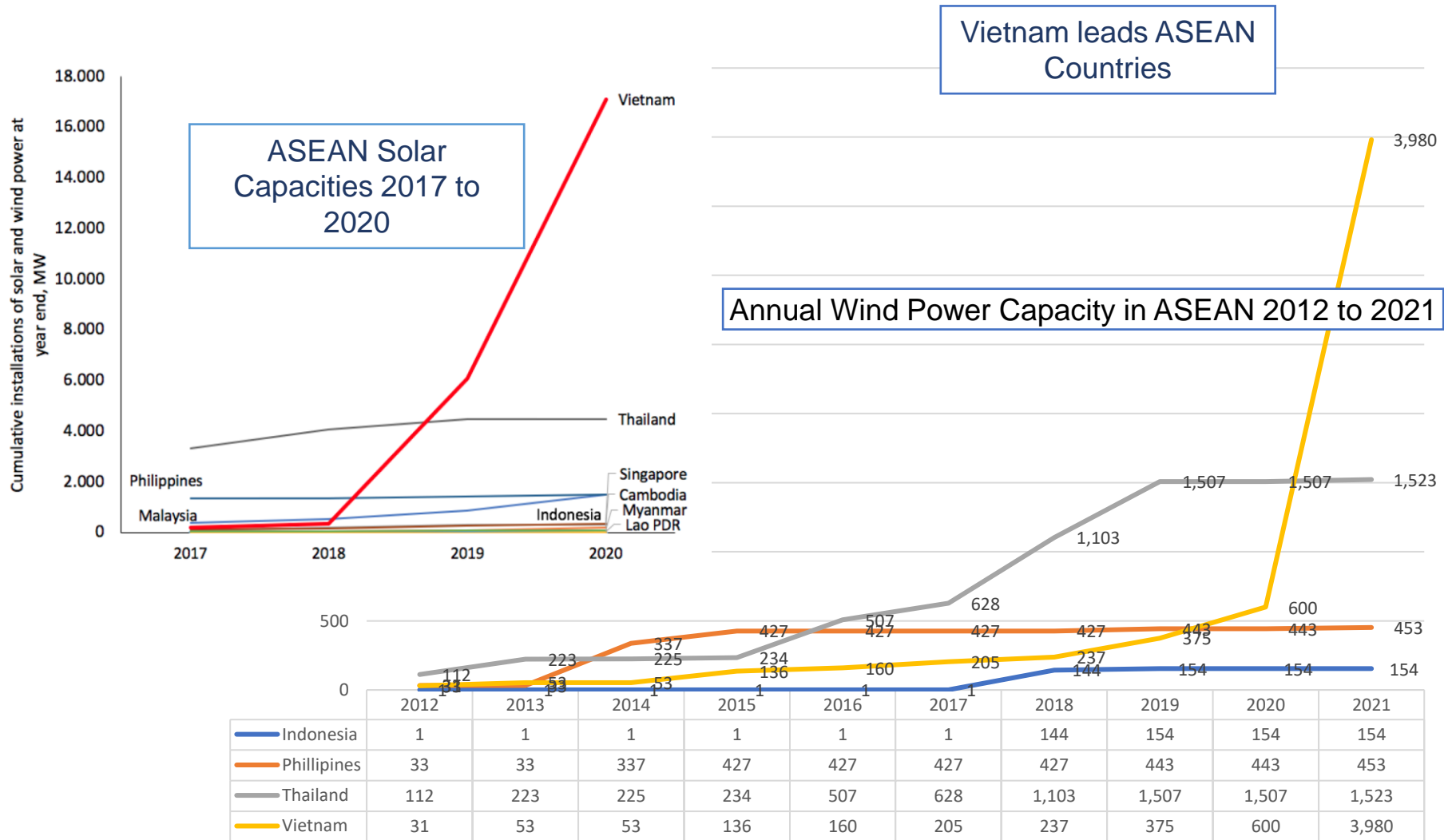
**PDP8 Targets
COP26 & JETP
Jumpstarting Offshore
Wind**

4

**Vietnam Wind Power
Accelerating Growth
from 2030 towards Net
Zero by 2050 - RE 3.0**

**Decarbonization
Phase out of Fossil Fuels
All Electricity from Carbon
Free Sources
Hydrogen
Electrification**

Vietnam leads Solar & Wind Capacities in ASEAN



Global Onshore Wind Project Installations - 2022

Rank as per 2022 Total Installations	MW, onshore	New installations 2021	Total installations 2021	New installations 2022	Total installations 2022	% as per 2022 Total Installations
Rank	Total onshore	72,499	773,818	68,816	841,898	%
1	China	30,670	301,419	32,579	333,998	39.67%
2	USA	12,747	135,848	8,612	144,184	17.13%
3	Germany	1,925	56,814	2,403	58,951	7.00%
4	India	1,459	40,083	1,847	41,930	4.98%
5	Spain	750	28,134	1,659	29,793	3.54%
6	Brazil	3,830	21,567	4,065	25,632	3.04%
7	France	1,192	19,079	1,590	20,653	2.45%
8	Canada	677	14,255	1,006	15,261	1.81%
9	United Kingdom	328	14,074	502	14,575	1.73%
10	Sweden	2,104	11,952	2,441	14,393	1.71%
11	Turkey	1,400	11,102	867	11,969	1.42%
12	Australia	1,746	9,125	1,412	10,537	1.25%
13	Mexico	473	7,159	158	7,317	0.87%
14	Netherlands	952	5,370	933	6,223	0.74%
15	Finland	671	3,186	2,430	5,607	0.67%
16	Japan	211	4,523	149	4,668	0.55%
17	Chile	615	3,444	824	4,268	0.51%
18	South Africa	668	3,442	-	3,442	0.41%
19	Argentina	669	3,291	18	3,309	0.39%
20	Vietnam	2,717	3,102	-	3,102	0.37%

Vietnam is ranked No. 20 in Global Onshore Wind Project Installations cumulative till 2022

(Source: GWEC Global report 2023)

Global Onshore Wind Project Installations

– ranked as per 2021 installations

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16	South Africa	668	3,442	-	3,442	1%
17	Chile	615	3,444	824	4,268	1%
18	Mexico	473	7,159	158	7,317	1%
19	Saudi Arabia	416	422	-	422	1%
20	United Kingdom	328	14,074	502	14,575	0%

During 2021 Vietnam was ranked No 4 in annual onshore wind project installations (Source: GWEC)

Global Offshore Wind Project Installations - 2022

Rank as per 2022 Total Installations	MW, offshore	New installations 2021	Total installations 2021	New installations 2022	Total installations 2022	% as per 2022 Total Installations
Rank	Total offshore	21,106	55,549	8,771	64,320	%
1	China	16,900	26,390	5,052	31,442	48.9%
2	United Kingdom	2,317	12,739	1,179	13,918	21.6%
3	Germany	-	7,713	342	8,055	12.5%
4	Netherlands	392	2,460	369	2,829	4.4%
5	Denmark	605	2,308	-	2,308	3.6%
6	Belgium	-	2,262	-	2,262	3.5%
7	Taiwan	109	237	1,175	1,412	2.2%
8	Vietnam	779	874	-	874	1.4%
9	France	-	2	480	482	0.7%
10	South Korea	-	142	-	142	0.2%
11	Japan	-	52	84	136	0.2%
12	USA	-	42	-	42	0.1%

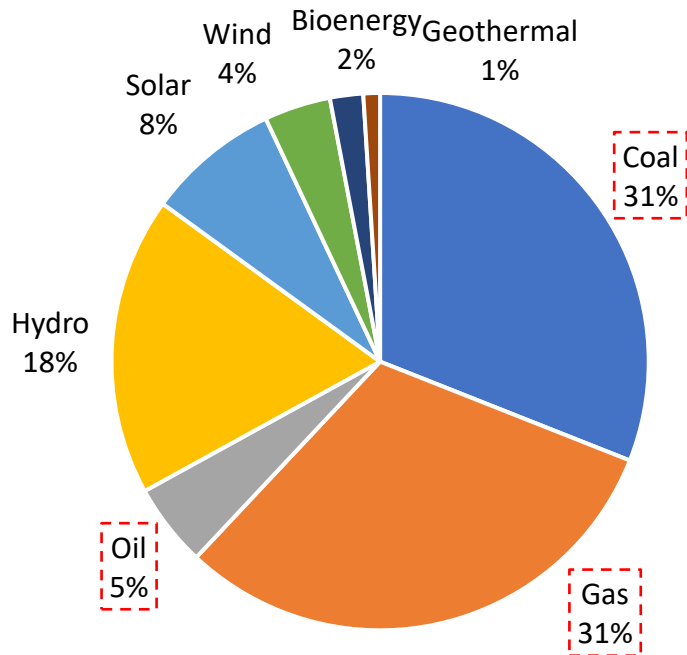
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3	Vietnam	779	874	-	874	3.7%
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5	Netherlands	392	2,460	369	2,829	1.9%
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With 779 MW of Near shore wind projects commissioned in 2021, Vietnam emerged on the Global Offshore Wind Market in the 3rd place in 2021 installations and 8th in 2022 total installations (*Source GWEC Global report 2023*)

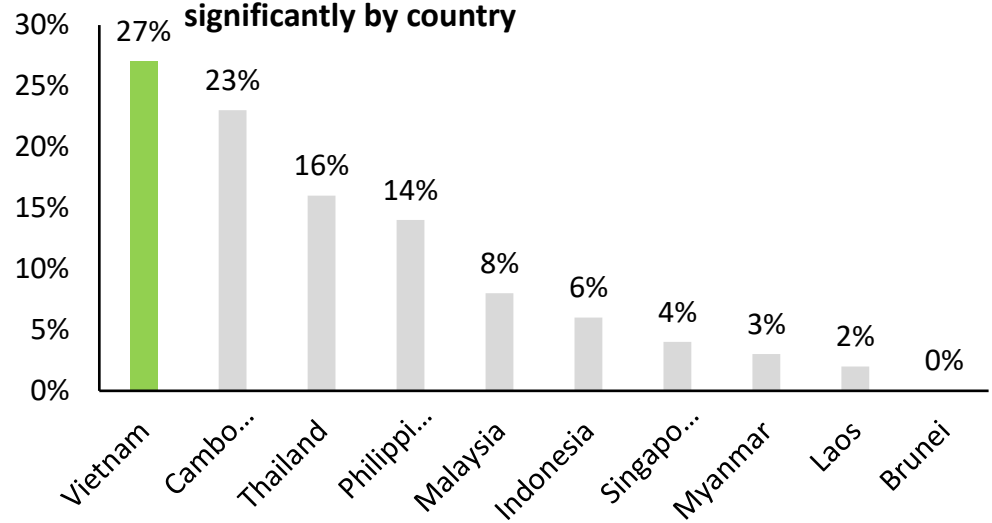
The power landscape across ASEAN shows variance

GW	ASEAN	Vietnam	Philippines	Thailand	Malaysia	Indonesia	Singapore	Laos	Myanmar	Cambodia	Brunei
Total Demand (Consumption)	119	20	11	21	20	30	7	1	2	1	1
Total Supply (Generation)	141	24	13	27	23	36	7	5	3	1	1
Total Production Capacity (Installed)	298	77	27	52	34	74	17	9	7	2	1
Fossil fuels	68%	45%	72%	77%	74%	85%	96%	6%	48%	18%	100%
Hydro	18%	28%	14%	7%	18%	9%	0%	92%	49%	59%	0%
Renewable (Wind, Solar, Biomass, Geothermal)	14%	27%	14%	16%	8%	6%	4%	2%	3%	23%	0%

Fossil fuels account for 68% of ASEAN's 300GW capacity



Overall ASEAN RE mix is 14%, but mix varies significantly by country

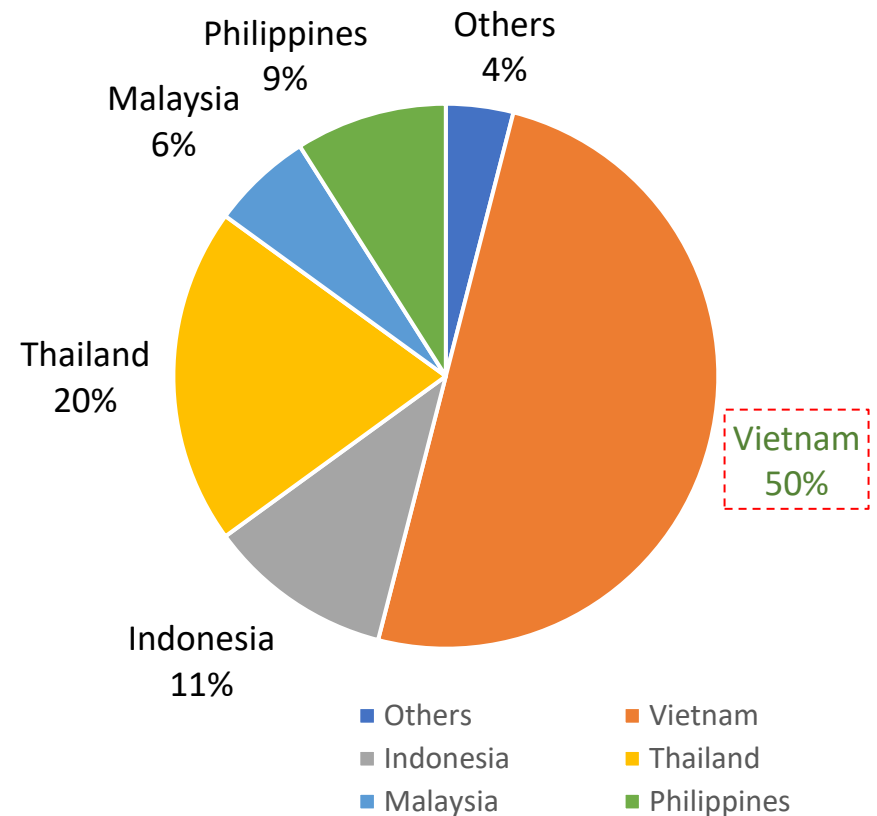
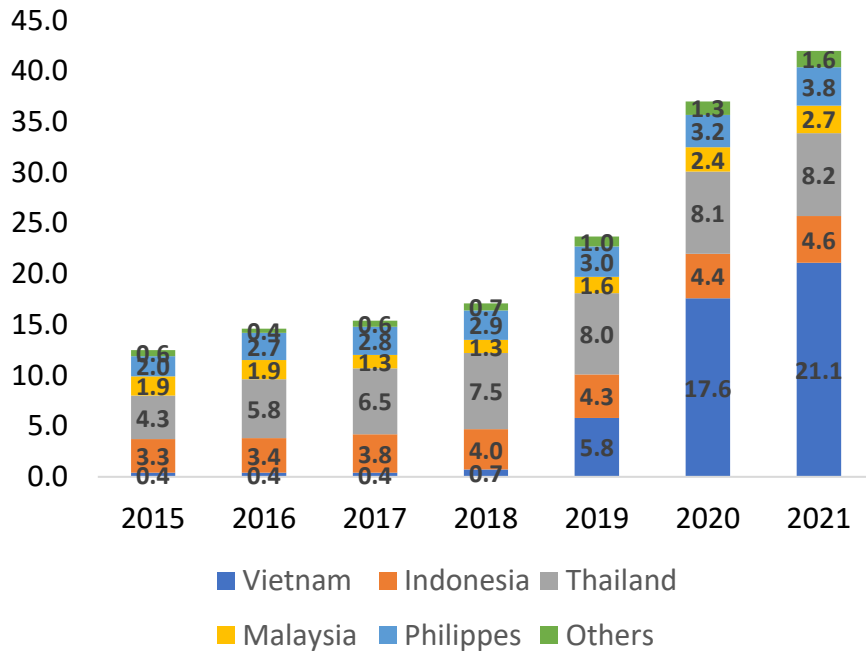


Key 3 trends in Asean RE

Vietnam is the key driver of growing RE

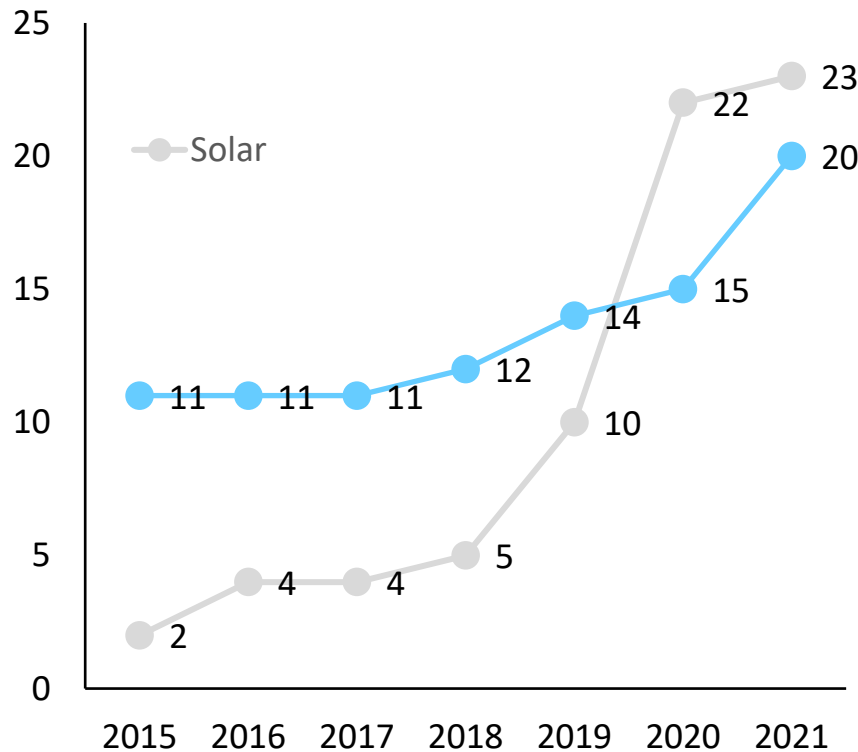
Vietnam has 50% share in ASEAN's 300GW capacity

Country-wise breakup of ASEAN total RE capacity

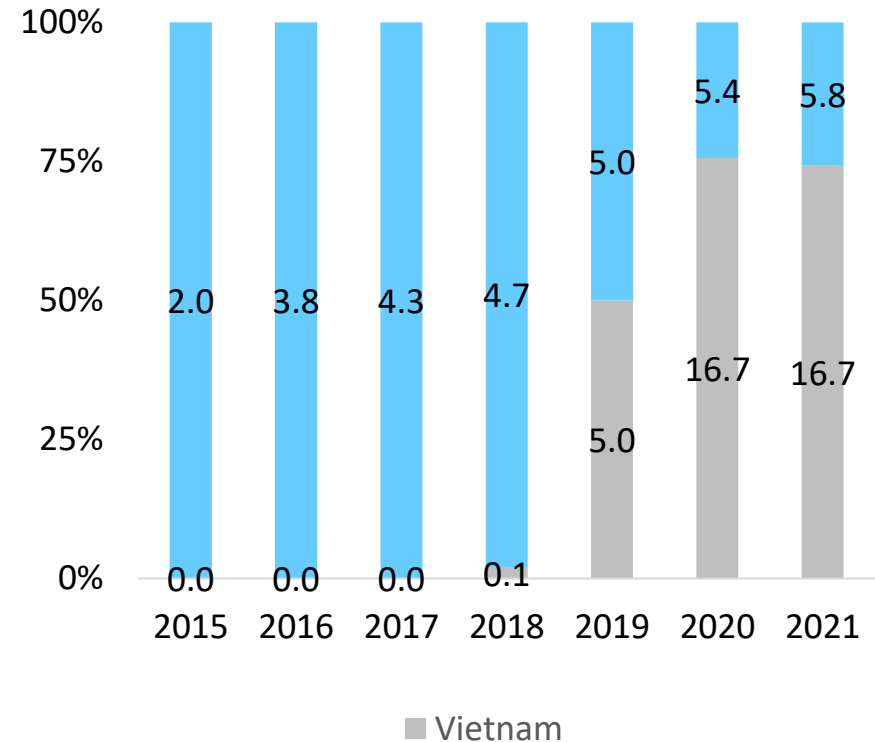


Key 3 trends in Asean RE

Solar projects multiplied ~5x over the past 3 years



Bulk of ASEAN's solar capacity comes from Vietnam



Key 3 trends in Asean RE

Inflection happened during the pandemic; Likely to continue this decade

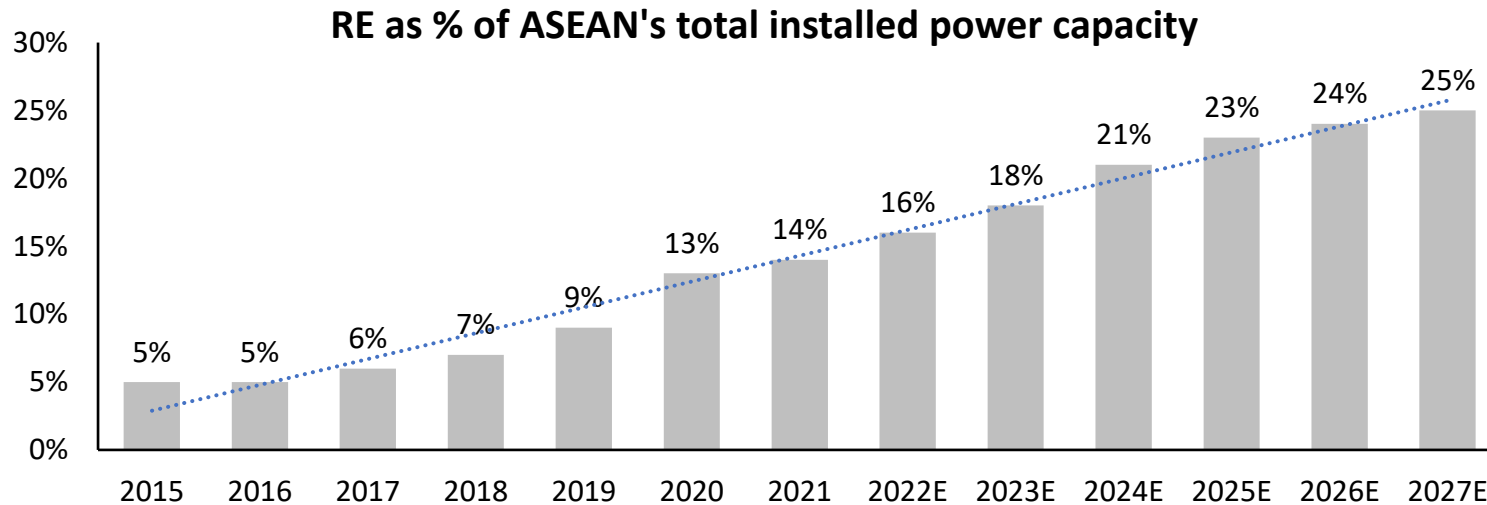
- RE mix doubled to 14% between 2018-21
- ASEAN added 25GW RE capacity between 2018-21
- ASEAN targets RE mix of 23% by 2025 and 35% by 2035

Vietnam has led the RE surge; Philippines & Thailand look most likely to join

- Vietnam contributed 82% of the RE capacity additions between 2018-21
- Vietnam now has 50% share in ASEAN's RE capacity
- Higher intent & policy direction now witnessed in Philippines and Thailand

Solar is now the leading RE fuel

- Solar capacity in ASEAN grew c.5x fold between 2018-21
- 71% of new RE capacity came from new solar projects between 2018-21
- Solar installation costs are down a significant 88% in the last 10 years

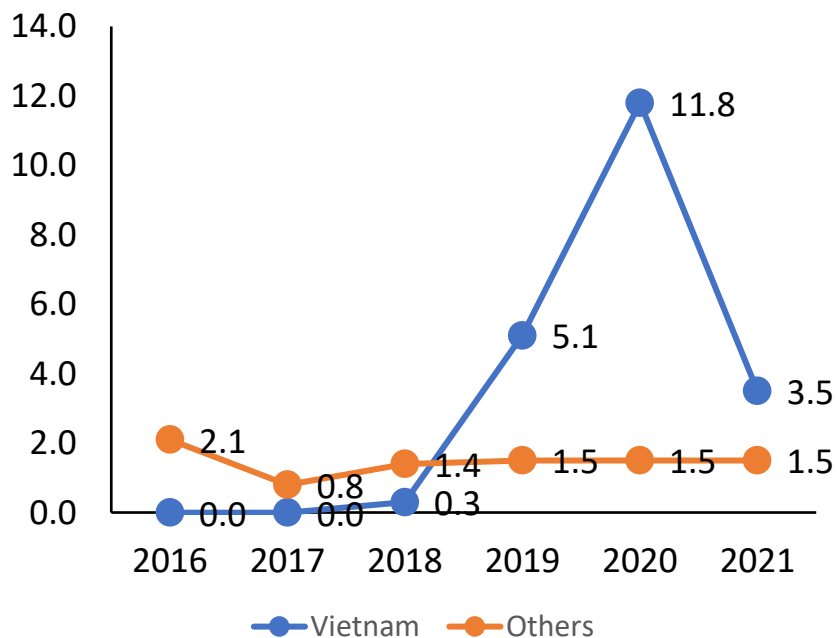


Vietnam

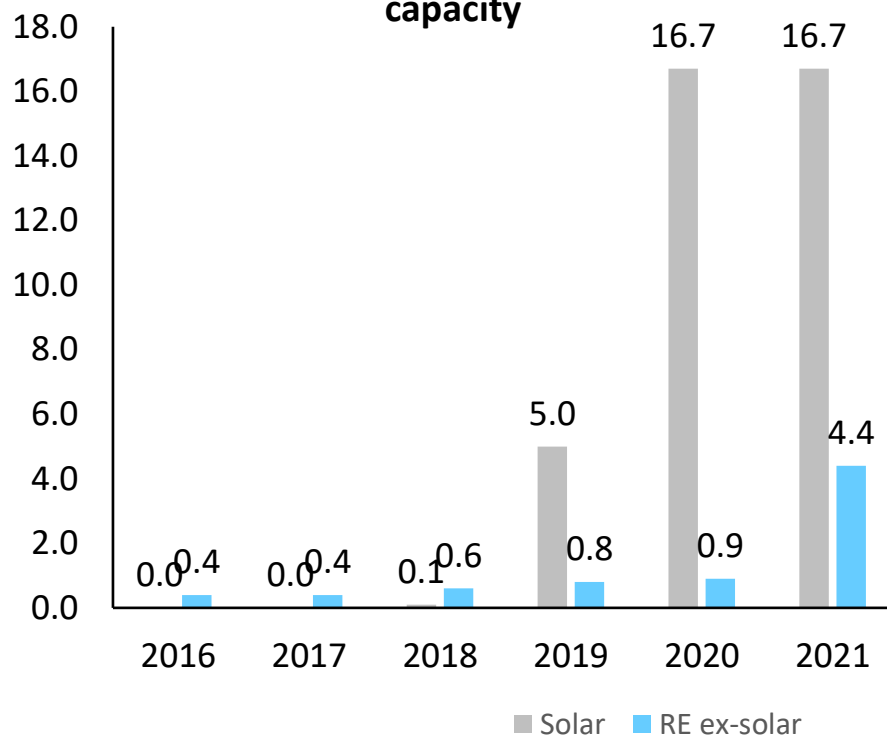
Rest of ASEAN has lagged Vietnam in new RE capacity additions since 2019

Most of Vietnam's new RE capacity addition was Solar in 2019-20, though Wind made progress in 2021

New capacity addition in ASEAN RE over the last 6 years

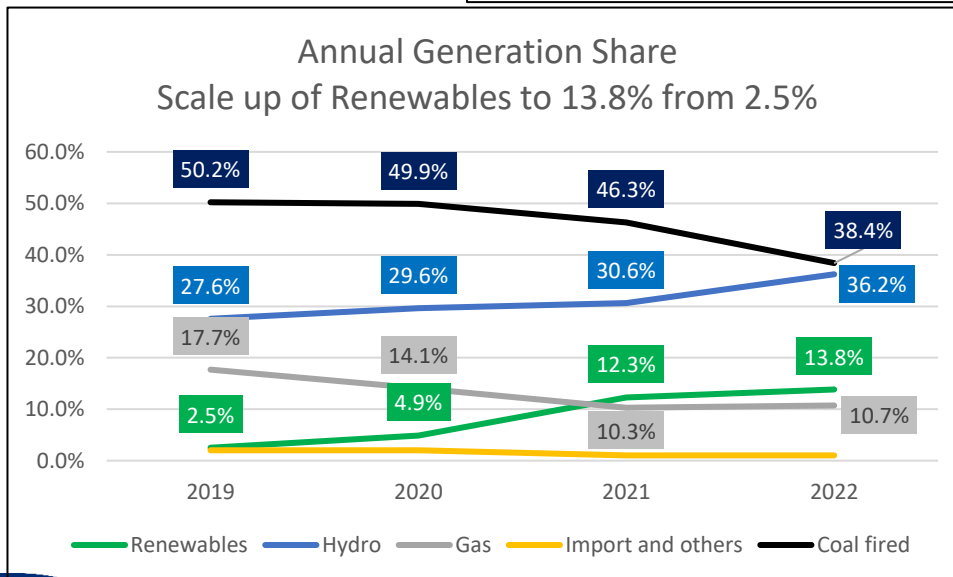
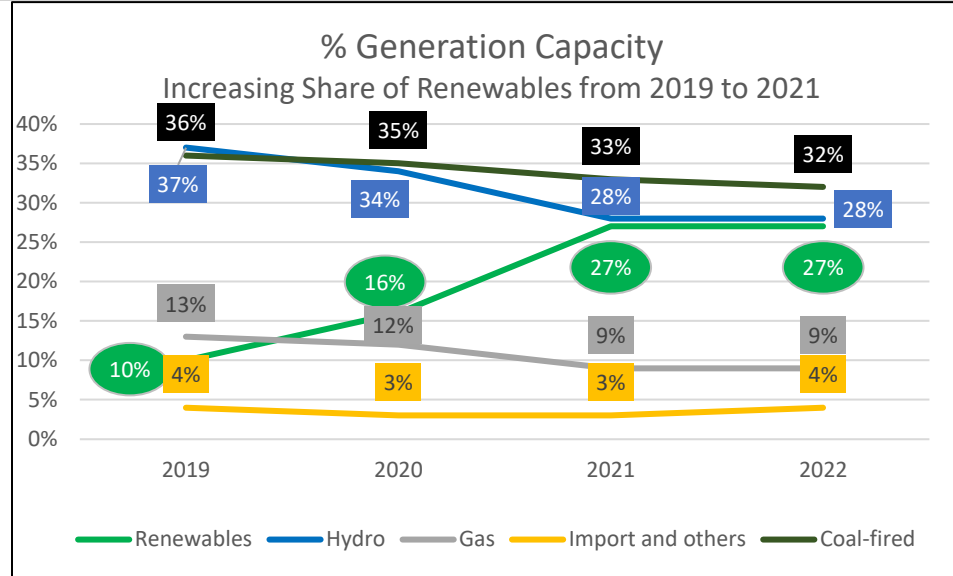


Break up of Vietnam's total installed RE capacity



Increasing share of VRE in Vietnam Energy Mix

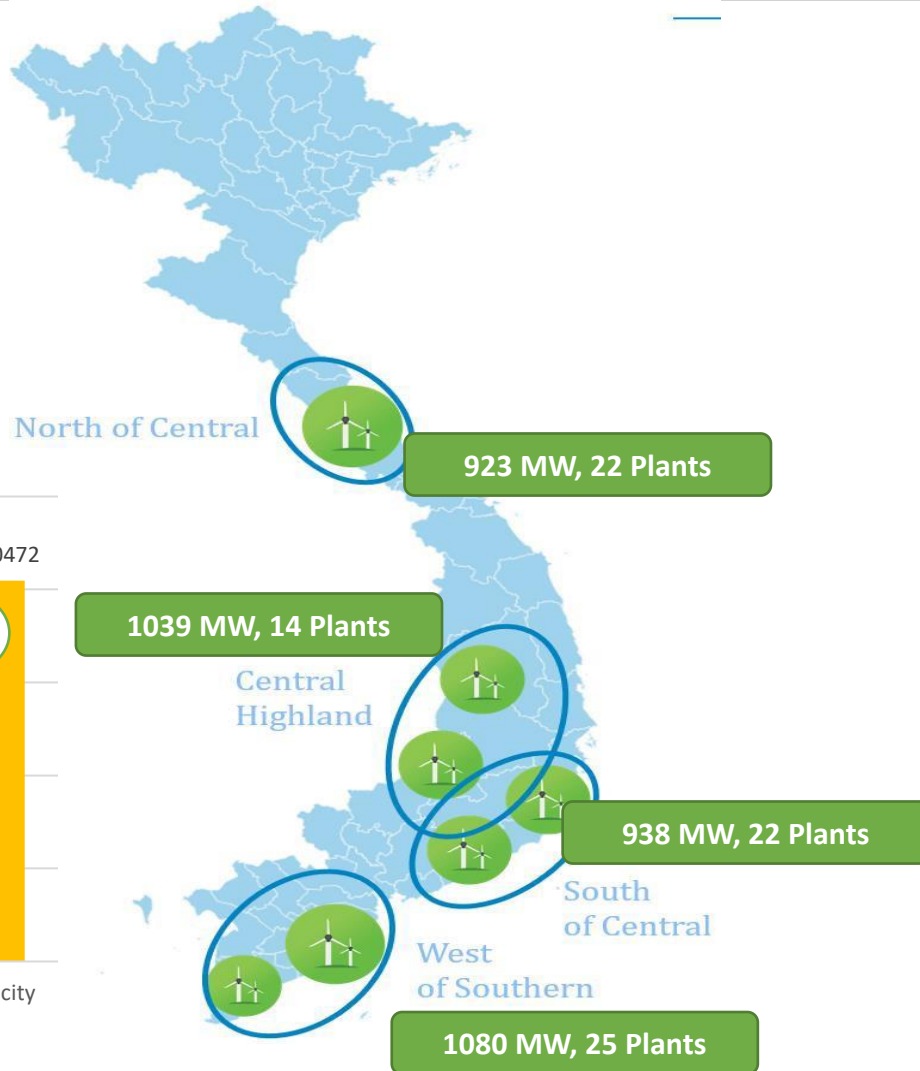
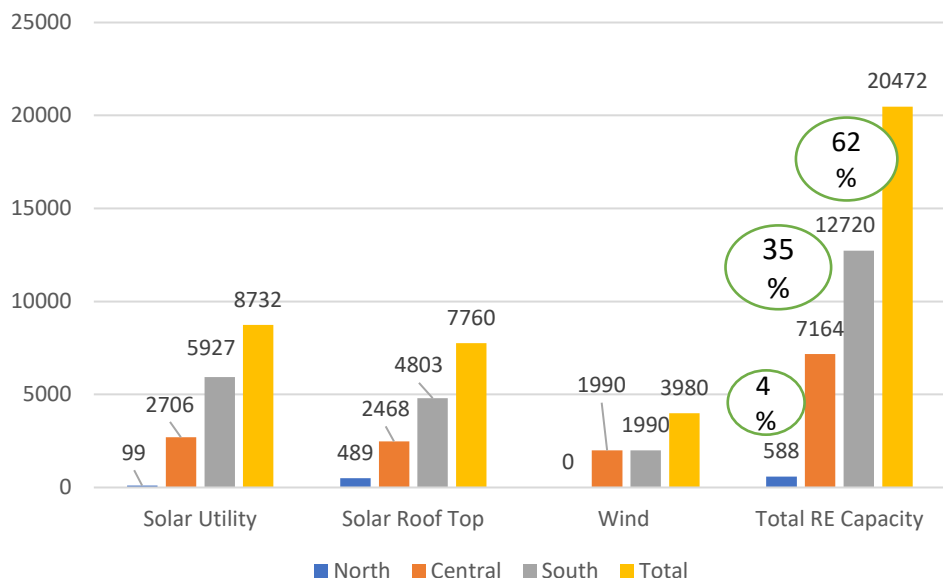
- ✓ VRE – Solar & Wind Projects leap to 27% of total generation capacity in 2021 from 10% in 2019 with a corresponding drop in thermal and Gas.



- ✓ In actual generation VRE – Solar & Wind Projects account for 13.8%.
- ✓ Hydro and RE accounted for 50% of total generation in 2022, a leap from 30% in 2019.
- ✓ Leads to significant savings in EVNs Coal and Gas fuel costs at elevated prices since 2022

VRE projects are largely located in the South and Central leading to challenges in Grid Management

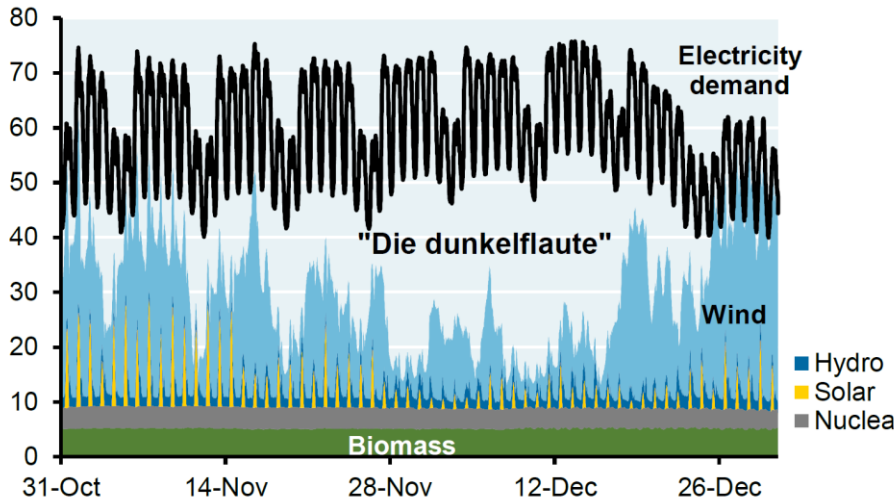
RE Capacities in MW
Region wise
Solar Utility, Rooftop and wind Projects



International Experience – Electricity Grids at High VRE High Transmission Intensity and Generation Intensity – built in redundancy

Germany generation by source, Nov - Dec 2022

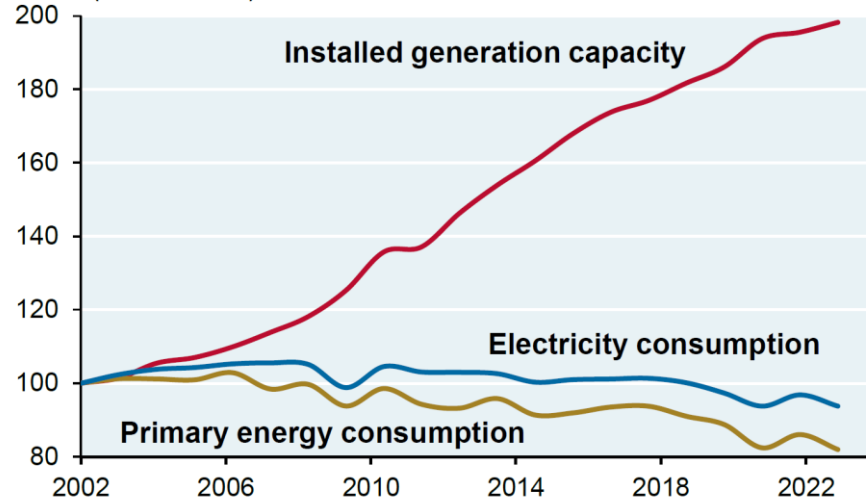
MW per 15 minute interval, thousands



Source: Fraunhofer ISE, JPMAM. 2022.

Germany generation capacity and energy use

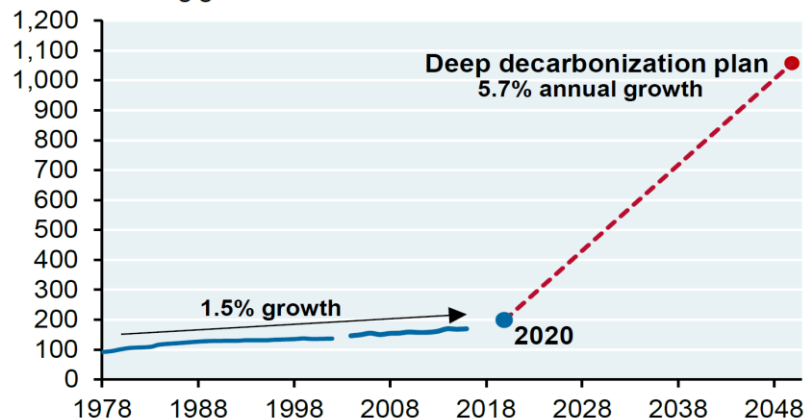
Index (100 = 2002)



Source: Bundesverband BDEW, Fraunhofer Institute, JPMAM. 2023.

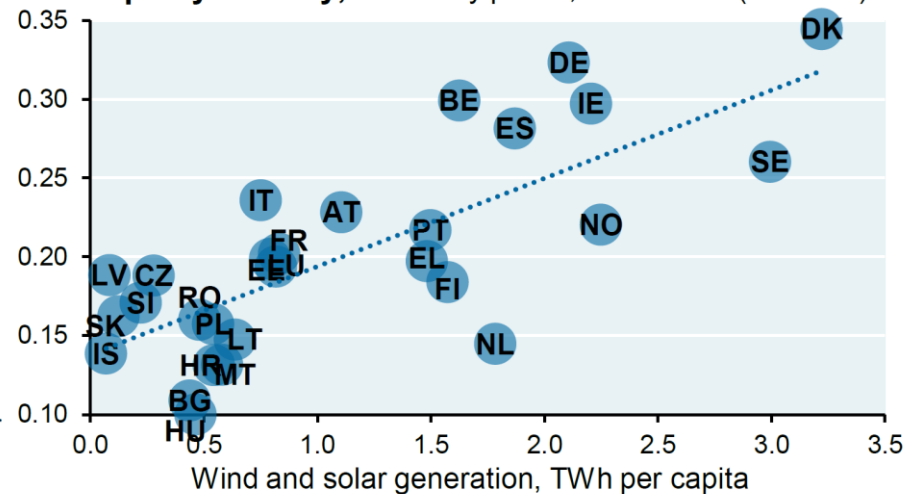
US transmission growth, history vs targets

Thousands of gigawatt-miles



Source: DOE, UT Austin, Larson et al (Princeton), JPMAM. 2022.

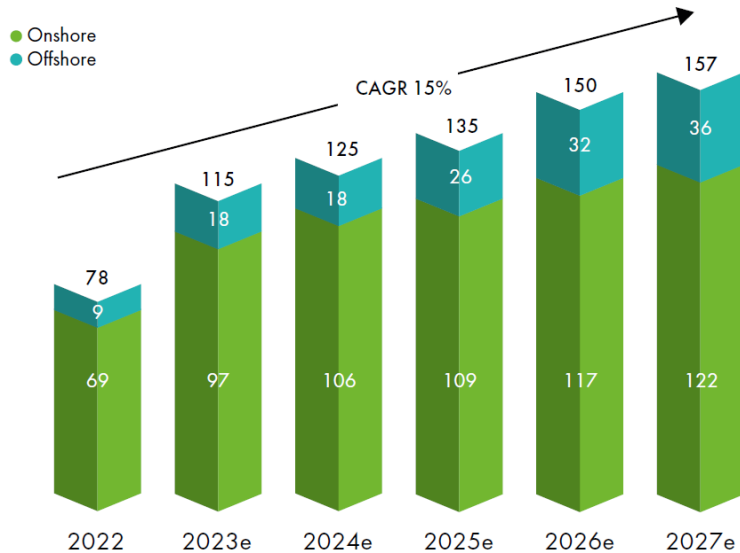
Household electricity prices vs wind and solar penetration in Europe by country, Electricity prices, EUR / kWh (H2 2021)



Source: Eurostat, JPMAM. 2022.

Vietnam PDP Targets vs estimated global growth for in New Wind installations – RE 2.0

New installations outlook 2022–2026 (GW)



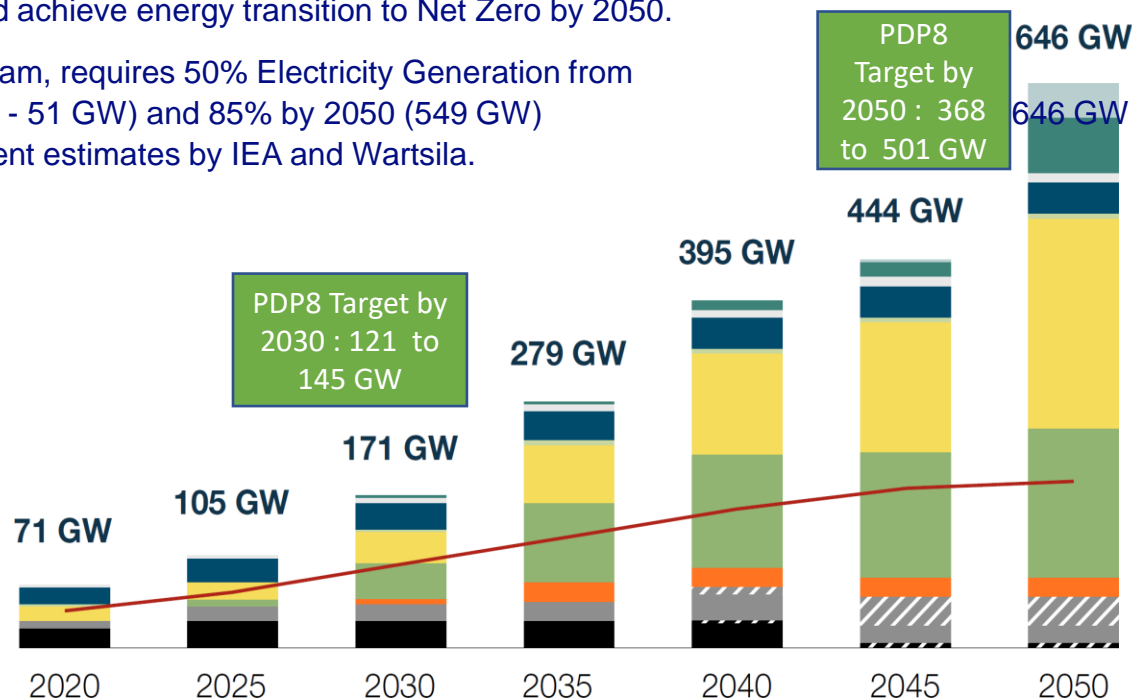
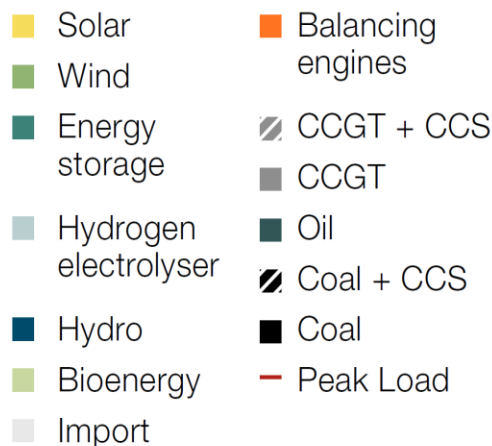
Source: GWEC, 2023

PDP 8 Targets (Dec 2022 Draft)	2030	2050	CAGR 2022 to 2030
Onshore Wind	21480	66050	23.46%
Offshore Wind	7000	87000	
Offshore + Onshore	28480	153050	27.89%

- ✓ Vietnam set to outpace global growth in New Installations in the near future based on PDP8 Estimates at a CAGR of 27.89% till 2030.
- ✓ Realization of PDP8 Estimates will depend on resolving the Grid and Policy Challenges to enable new capacity, particularly in Offshore Wind

Vietnam Net Zero Targets & JETP

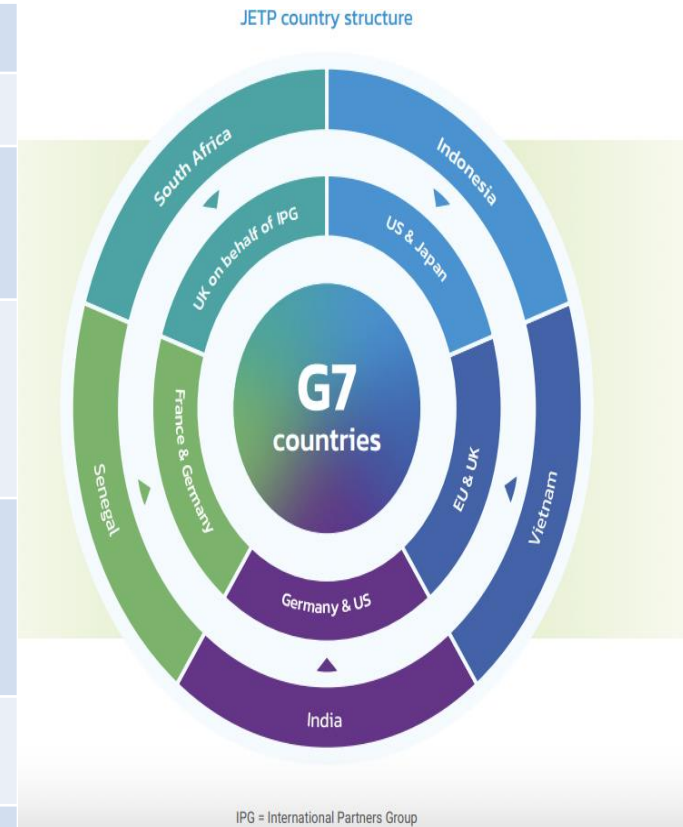
- Vietnam pledged Net Zero by 2050 during COP26 in Glasgow. (in comparison China & India pledged Net Zero by 2060 & 2070 respectively). Following COP26 Vietnam revised its power development plan to scale up Renewables significantly in the energy Mix, introduce Green Hydrogen & low carbon fuels and phase out coal power plants from 2030.
- JETP : Vietnam signed the *Just Energy Transition Partnerships (JETP)* in December 2022 with IPG countries and GFANG – Private financial Institutions for a total commitment of US\$ 15.5 Bn, aimed to bring forward the peak emissions from 2035 (240 MtCO₂e) to 2030 (170 MtCO₂e) and achieve energy transition to Net Zero by 2050.
- A Net Zero Power System Model for Vietnam, requires 50% Electricity Generation from Renewables by 2030 (Wind + Solar : 30% - 51 GW) and 85% by 2050 (549 GW) Power Capacity by 2050 as per independent estimates by IEA and Wartsila.



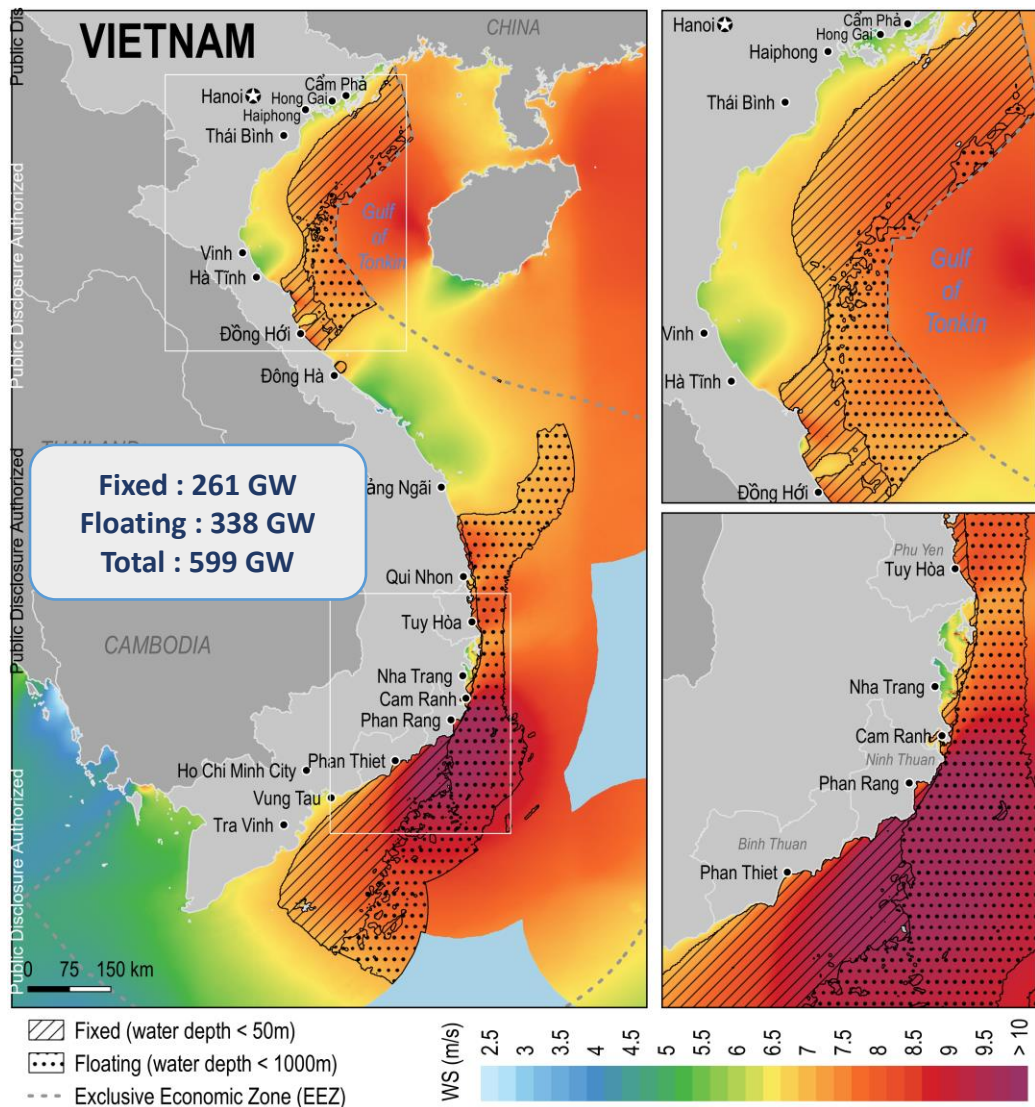
- The Net Zero Power System of 646 GW by 2050 will comprise of 239 GW of Solar, 171 GW of Wind, with 52 GW of Hydrogen production with Renewables.
- Green hydrogen as a sustainable fuel will displace natural gas, allow balancing engines to run using carbon neutral fuels. Locally produced green hydrogen will ensure long-term sustainability, security and decarbonize energy-intensive sectors, such as mobility and heavy industry

JETP Funding Comparison : Vietnam and Indonesia

JETP Funding Features	Vietnam	Indonesia
Committed Funding	\$15.5 billion	\$20 billion
Targets Set	Net Zero 2050	Net Zero 2060
Peak Power Sector Emissions	170 megatons by 2030 a reduction of 30% from 240 MT.	300 megatons by 2030
Increase Renewable energy in the Power Mix	47 percent of electricity generation by 2030 from a prior target of 36%	34 percent of Power generation compared to a prior target of 31% by 2050
Peak Coal Capacity	Limit Peak coal capacity to 30.2 GW a steep reduction from 37 GW	Expect to retain 50 GW coal-fired power plants in 2030.
Projected Peak GHG Emissions Date	2030 from 2035	By 2030
Emissions saved with JETP Funding	500 Mega Tons by 2035	

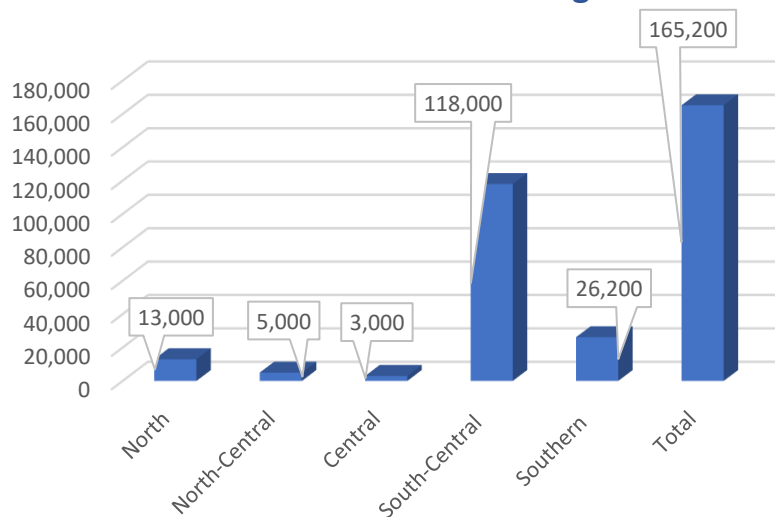


Vietnam's long coastline offers excellent potential for offshore wind for H2 Production for the region

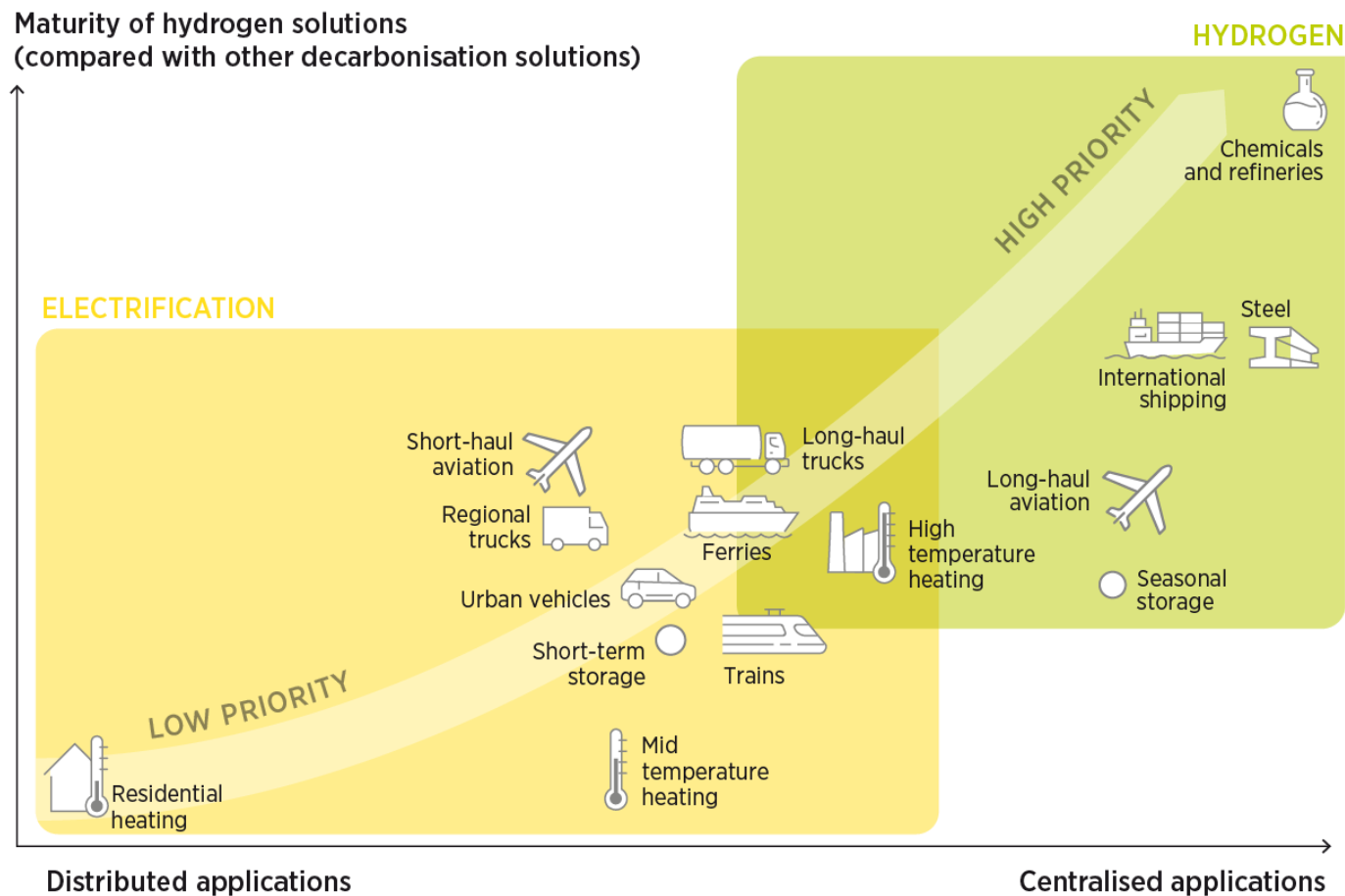


Technical Potential of Offshore Wind along the Vietnam coast is 599 GW
 (World Bank estimates - criteria Wind speed > 7m/s and seabed depth ≤ 1000m)

Vietnam PDP Power potential of 165 GW from Offshore Wind Region wise



Green hydrogen to grow from niche to mainstream by 2030 & beyond

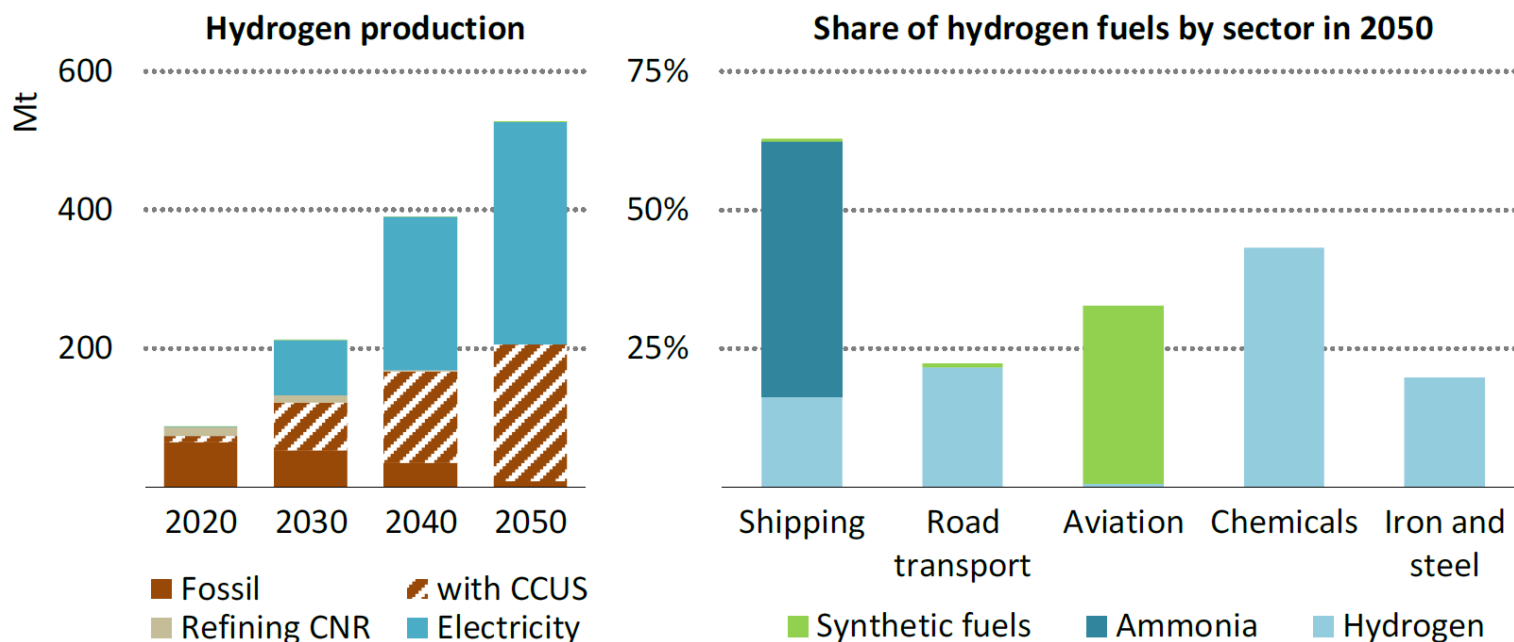


Policymakers should identify priorities for indirect electrification using green hydrogen with a focus on hard-to-abate sectors and devise strategies for its deployment.

Source : Irena

Green Hydrogen – a Key Pillar of Energy Transition

Global production of hydrogen by fuel and hydrogen demand by sector



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Hydrogen production jumps sixfold by 2050, driven by water electrolysis and natural gas with CCUS, to meet rising demand in shipping, road transport and heavy industry

Note: Refining CNR = hydrogen by-product from catalytic naphtha reforming at refineries.

Source : Irena, IEA

Global hydrogen trade in a 1.5 deg scenario

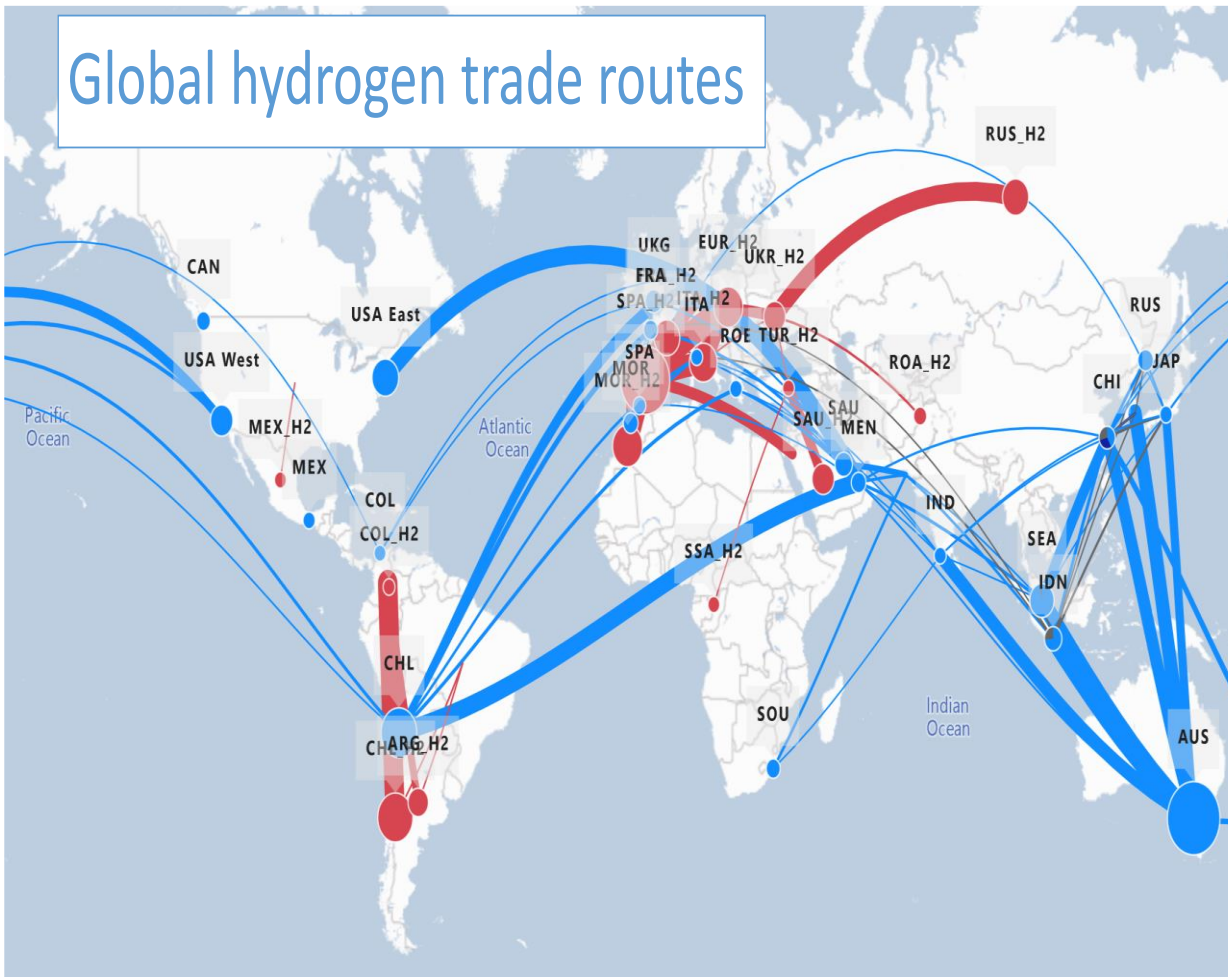


Table 7: Shipping distances port-to-port

Country	Distance to the EU (Port of Rotterdam)	Distance to South Korea (Port of Daesan)	Distance to Japan (Port of Tokyo)
Morocco (Casablanca)	1.682nm	11.287nm	11.648nm
South Africa (Cape Town)	7.323nm	10.047nm	10.430nm
Chile (Chacabuco)	10.044nm	15.971nm	16.342nm
Australia (Perth)	11.511nm	5.063nm	5.298nm
Viet Nam (Saigon)	10.082nm	2.727nm	3.088nm

Source: (Ports, 2022)

Source : Irena, GIZ, IEA

Summary & Conclusions



Vietnam in the Global Wind Market Place :

- ✓ Vietnam emerged as the clear leader in new installations of Wind and Solar Installations among ASEAN countries in recent years and is ranked among the global majors in Wind Power installations following the successful tariff regime in Oct 2021.
- ✓ Significant grid connection challenges have arisen since the expiry of Oct 2021 Tariff, in commissioning Transitional projects .



PDP8 Targets

- ✓ Aggressive PDP8 targets, a result of Vietnam's COP26 Net Zero Pledge and the JETP agreements provides the next phase of growth opportunity for Vietnam by 2030 and beyond, with funding gaps bridged by international finance on soft financing terms.
- ✓ Vietnam's Net Zero pledge by 2050 will require even more ambitious targets to electrify the energy system, scale up Renewables and implement a Hydrogen based economy.



Significant Challenges :

- ✓ Investments in Grid Development remains a challenge to absorb Variable Renewable Energy which will require both high transmission intensity as well as generation intensity with a built-in redundancy.
- ✓ Success of Offshore wind will depend on appropriate policies in place for for bankability, grid and port infrastructure.



Future Opportunities :

- ✓ Hydrogen for export may provide another opportunity for utilizing the vast Offshore wind resource in Vietnam to power electrolyzers for international trade in Ammonia & liquid hydrogen



Vietnam Wind Power Generation
a compelling Opportunity
to meet Net Zero targets



THANK YOU

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Source: unsplash.com



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