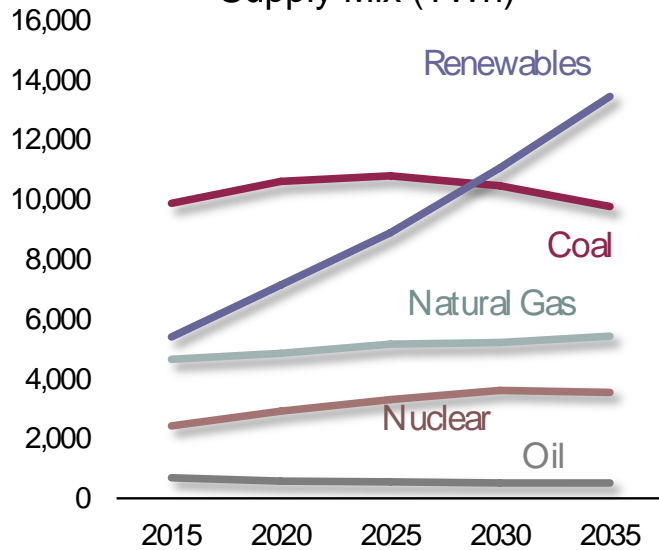


Outlook for Renewable Energy from an Asian Perspective

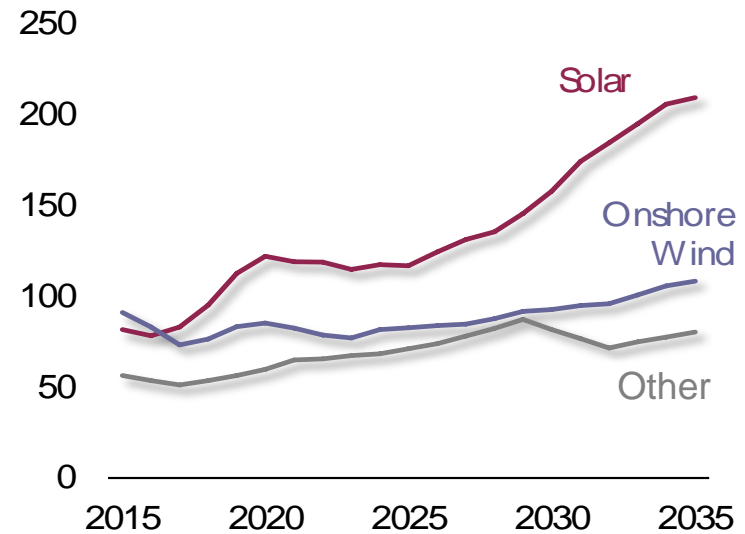
Douglas-Westwood Singapore
Jason Waldie, Assoc Director

Asia Clean Energy Forum 2016
ADB, Manila, 9 June 2016

Global Power Generation Supply Mix (TWh)

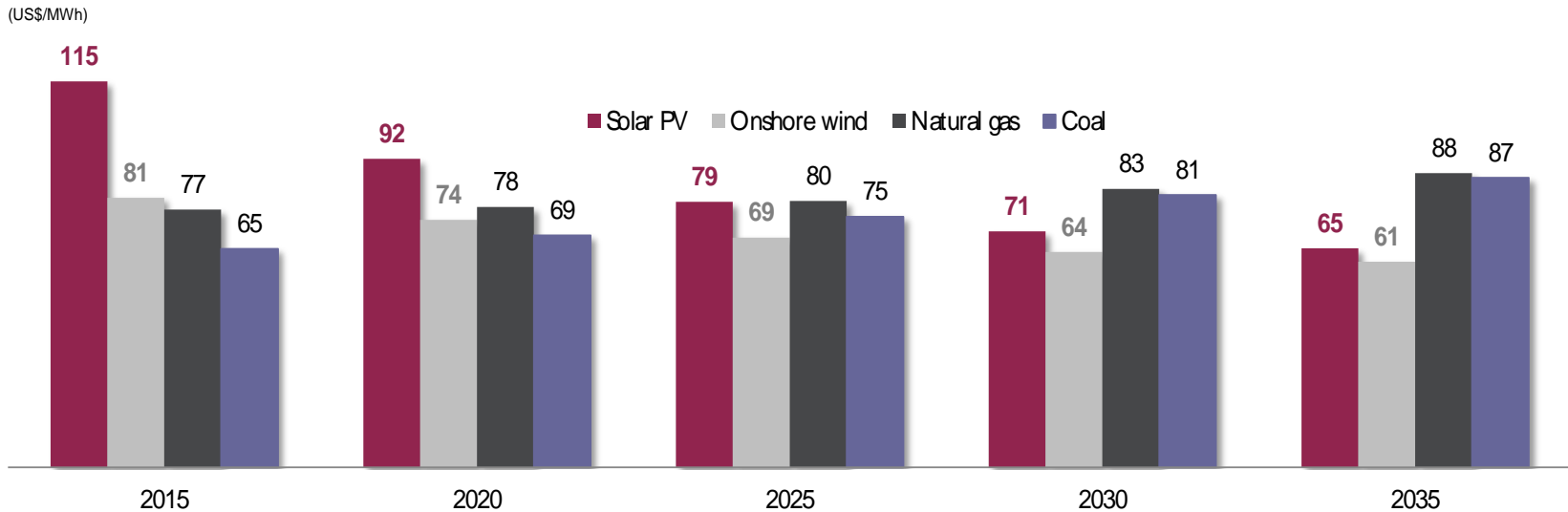


Global Investment on Renewable Capacity (\$Billion)



- 2015 was a peak year to date for investment in renewable energy generation with over \$2.3 billion investment globally on new capacity additions - outpacing conventional fossil fuel and nuclear.
- Over the next twenty years, an anticipated \$6.1 billion will be spent at a Compound Annual Growth Rate (CAGR) of 2.8% as the global industry adds an additional 4,200GW of renewable capacity.

Reducing Levelized Cost of Electricity (LCOE) for Solar and Onshore Wind



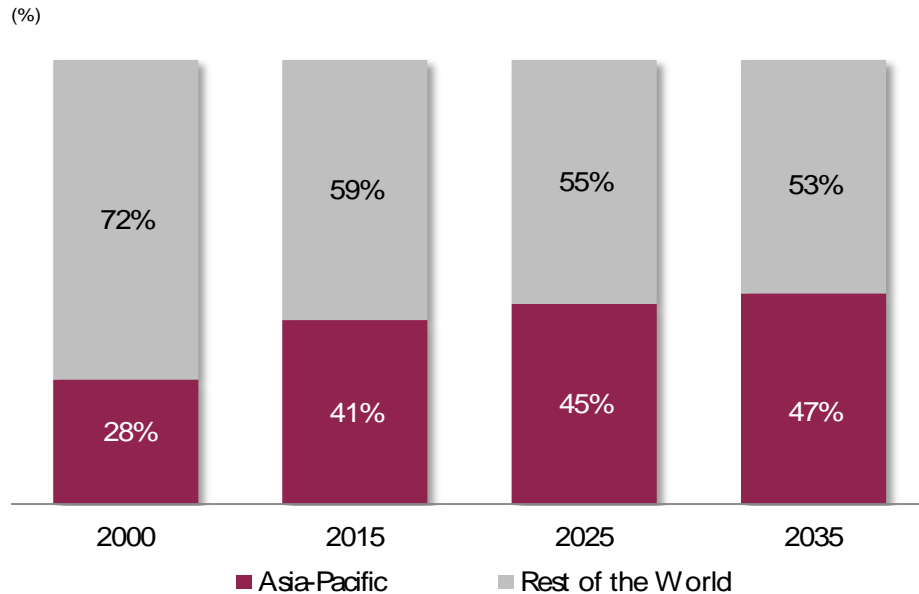
Solar – LCOE has fallen by 50% over the past 5 years

- Improved economies of scale in the manufacturing industry
- Falling price of polysilicon which is a primary component of solar panels
- Improved solar panel performance

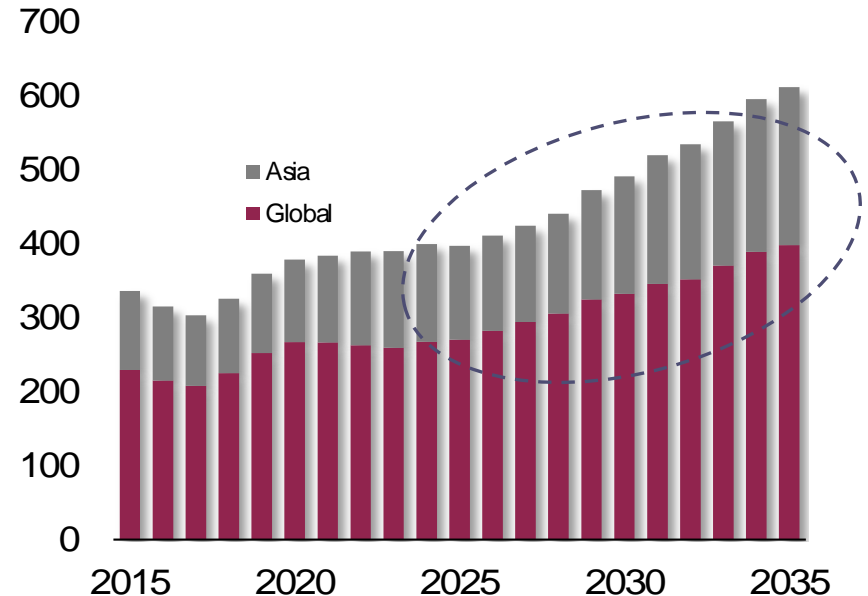
Onshore wind - LCOE has fallen by 13% over the past 5 years

- Improved efficiency
- Increasing turbine size

Growth of Energy Demand



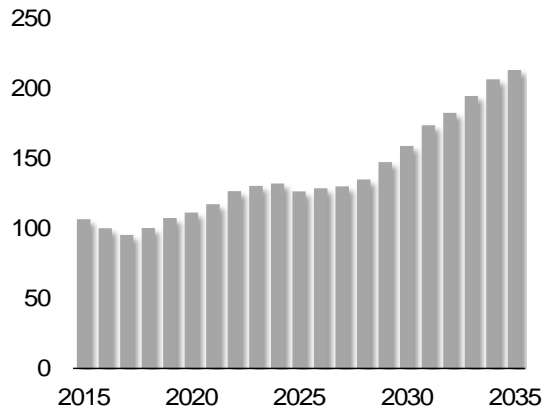
Primary Energy Demand by Region



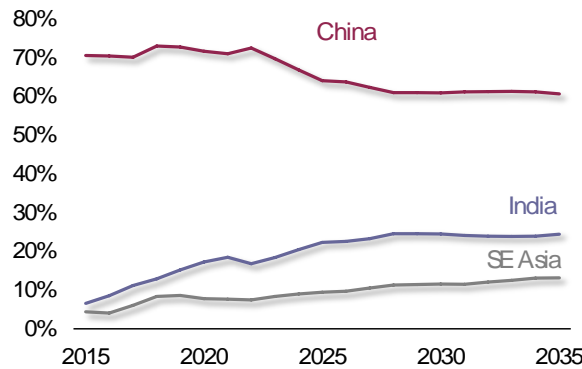
Global Vs Asia Investment on Renewable Capacity (\$Billion)

- Principal drivers for increased adoption of renewable energy at a global level are the increasing focus of governments on mitigating “security of supply” risk associated with fossil fuels

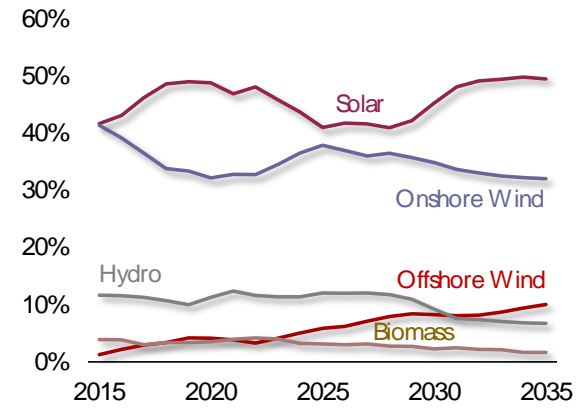
The Asian market currently accounts for 41% of global energy demand and 45% of global power generation



Asian Renewable Spend (\$Billion)



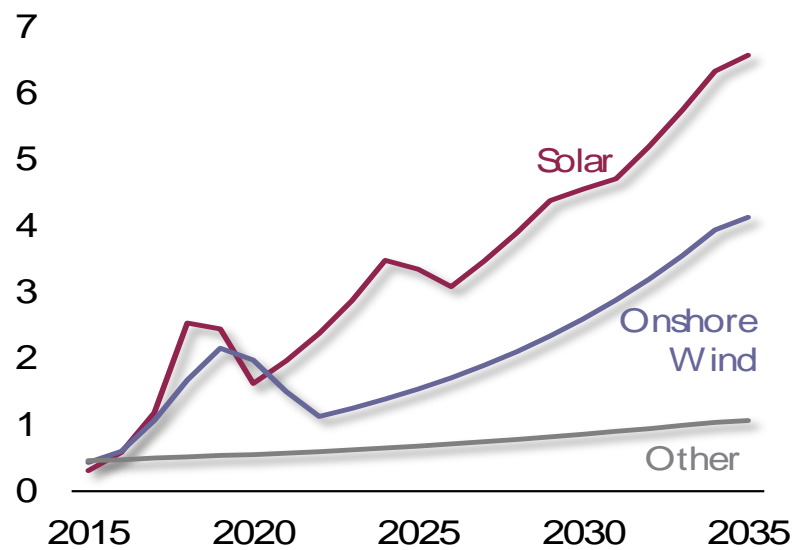
Asian Renewable Spend by Geography



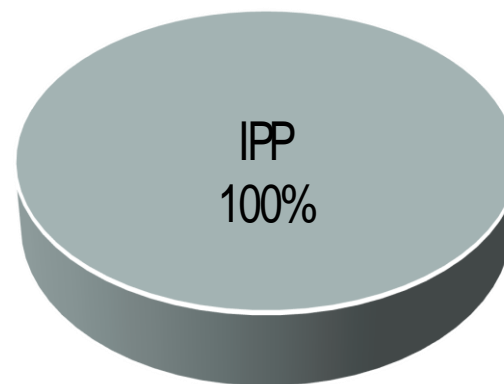
Asian Renewable Spend by Sector

- Renewable sources account for 8% of regional energy consumption with this share expected to increase to 14% by 2035

Highly embryonic renewables market, current installed capacity stands at 4.5GW



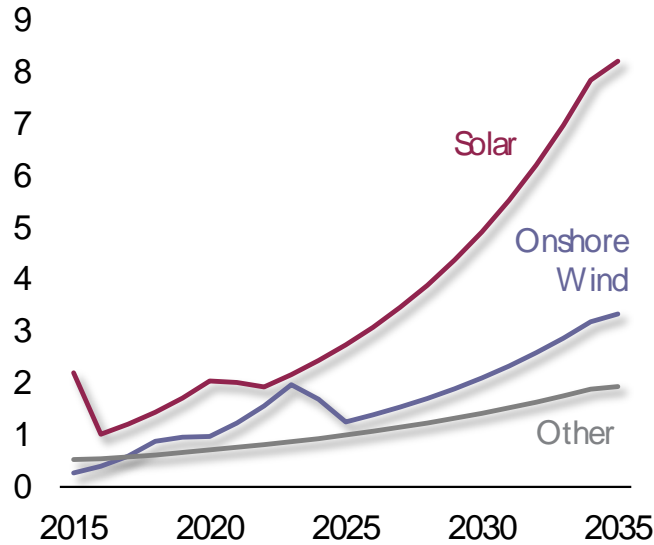
Philippines Investment on Renewable Capacity (\$Billion)



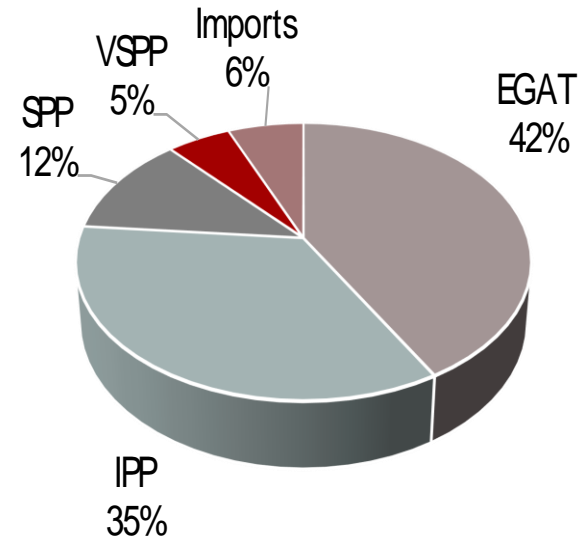
Current Philippines Generating Capacity Breakout- *Independent Power Producer

- Geothermal and hydro already feature prominently in the country's energy supply mix. However, significant future investment in solar PV and onshore wind is expected to be announced when the government releases its Philippine Energy Plan (PEP) later this year.

Aims at establishing an Energy-Sufficient Society and promoting Renewables Growth



Thailand Investment on Renewable Capacity (\$Billion)

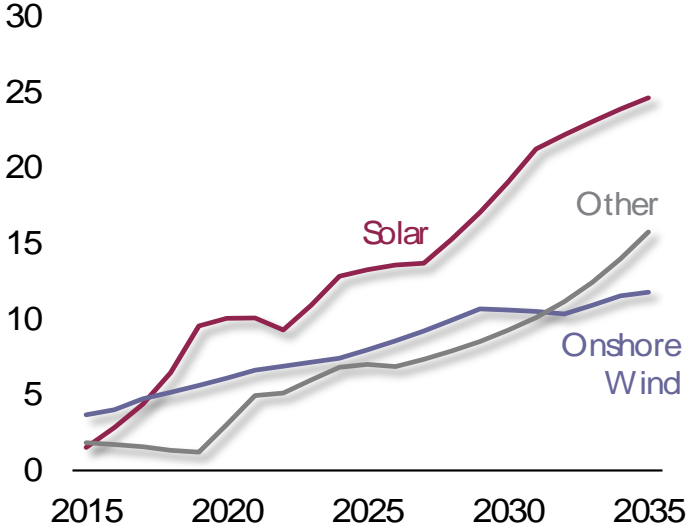


Current Thailand Generating Capacity Breakout * EGAT - State Utility

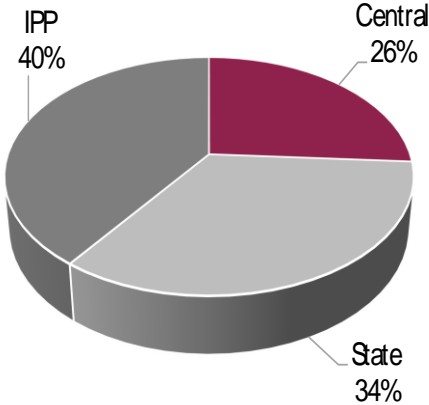
- Thailand’s most recent Power Development Plan (PDP) calls on an increase in renewable contribution to the nation’s power generation mix from 15% to a range between 30% and 40% by 2036. Solar PV and wind are expected to account for the majority of incremental renewable capacity.

Independent Power Producer (IPP); Small Power Producer (SPP); Very Small Power Producer (VSPP);

Recent years have increased focus on renewables as part of the future energy supply



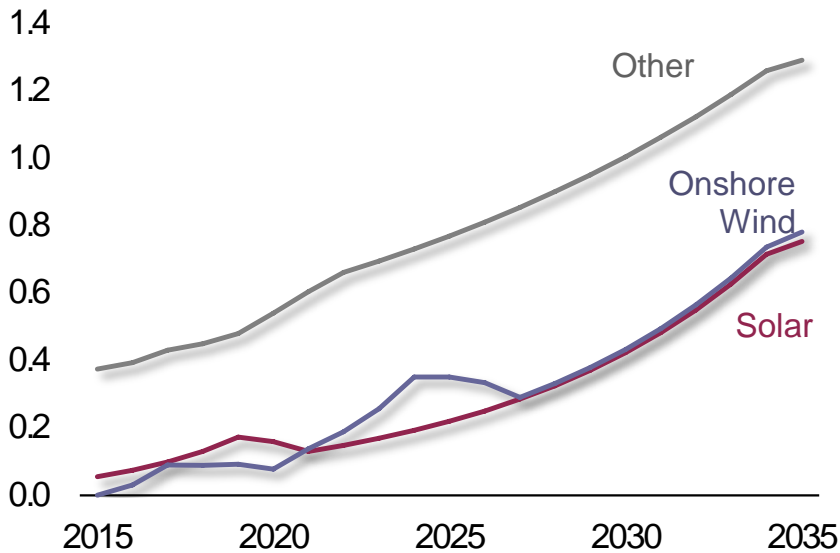
India Investment on Renewable Capacity (\$Billion)



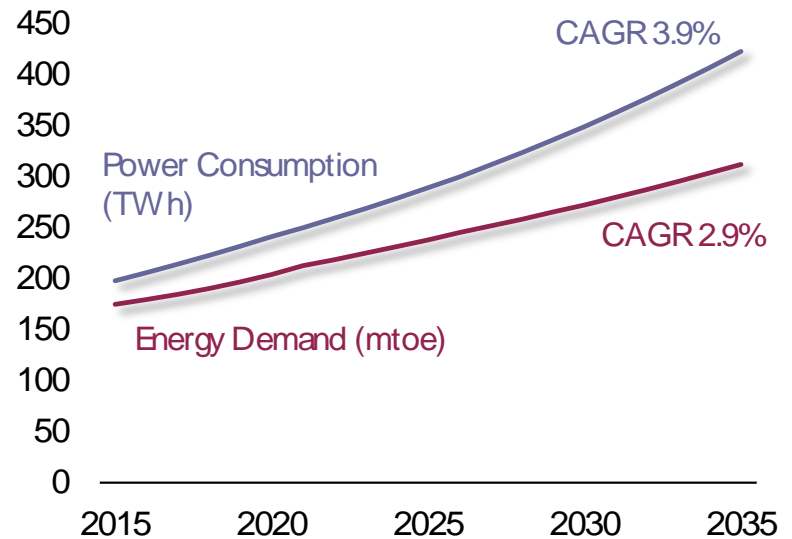
Current India Generating Capacity Breakout

- Policy mechanisms introduced in 2009 were highly successful in kickstarting the solar PV and wind industries and the country is now transitioning to a more standard FiT scheme providing potential investors with longer-term stability at the expense of short term profitability

Recent years have increased focus on renewables as part of the future energy supply



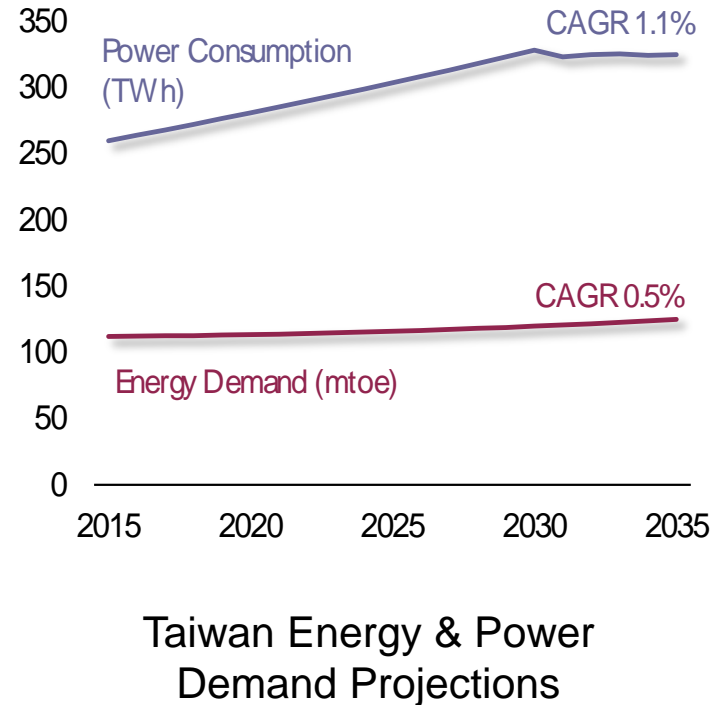
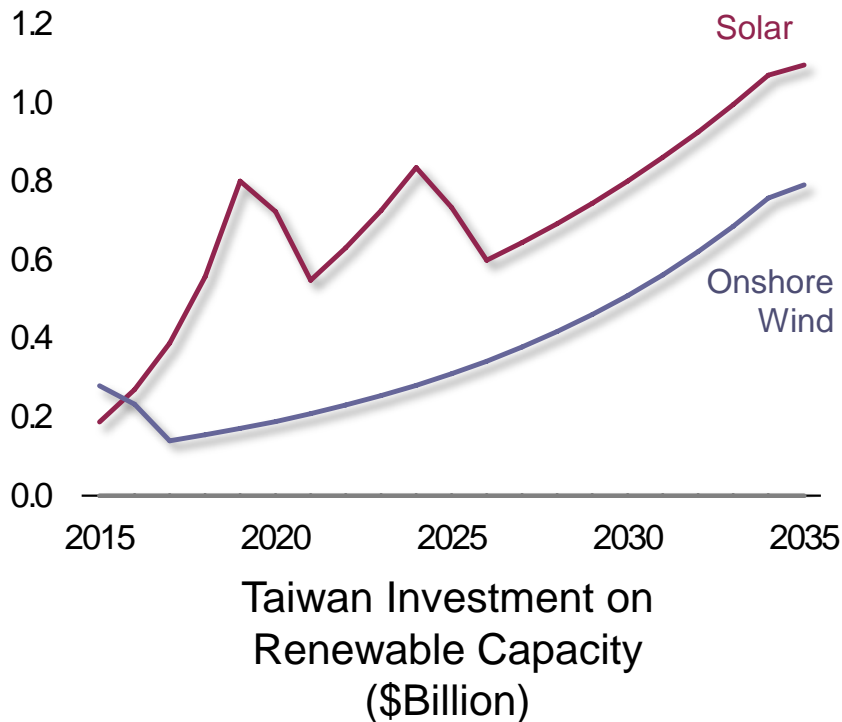
Indonesia Investment on Renewable Capacity (\$Billion)



Indonesia Energy & Power Demand Projections

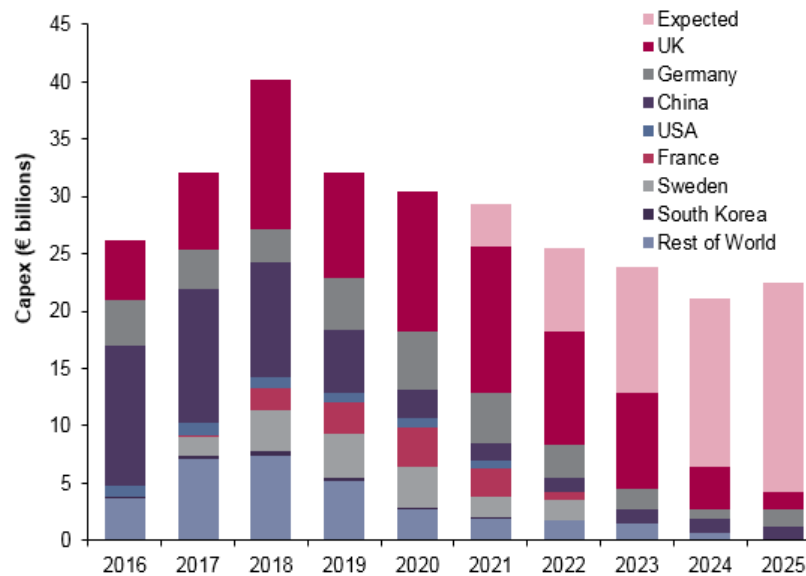
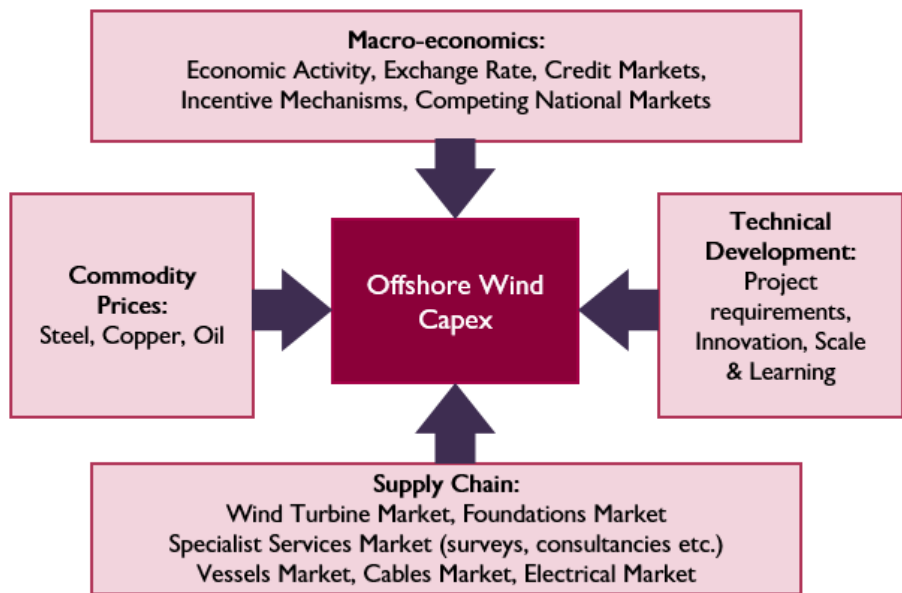
- The majority of renewable investment is expected to come from biomass and hydro with onshore wind and solar PV expected to account for 21% and 23% respectively.

Taiwanese energy sector is expected to undergo a significant transformation - reduce coal and nuclear power



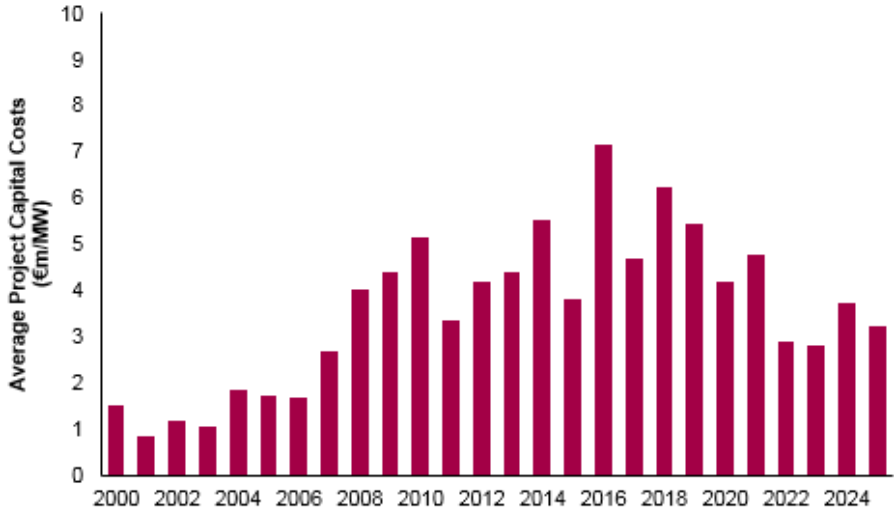
- Government plans to make Taiwan nuclear free by 2025 is expected to see significant investment in new renewable capacity over the next 20 years

Renewable Energy: Offshore wind

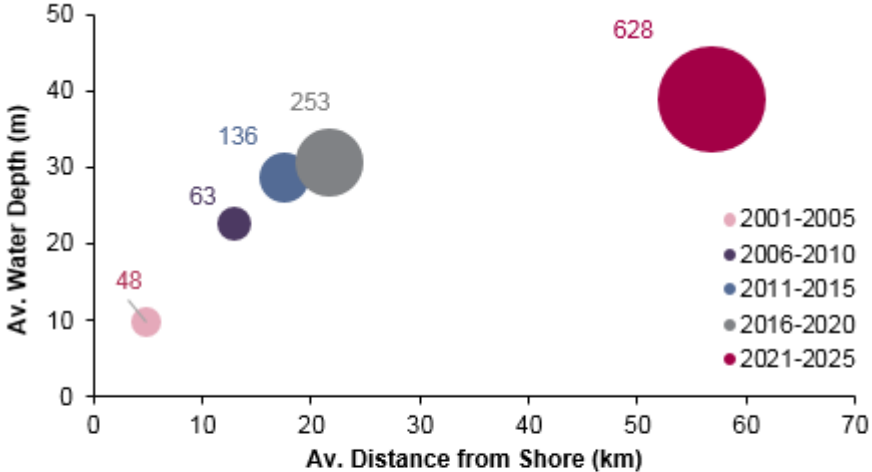


Capital Expenditure by Country, 2016-2025

Renewable Energy: Offshore wind



Offshore Wind Average Project Capex, 2000-2025



Average Project Capacity, Distance from Shore and Water Depth

Key Risks

- Regulatory & Policy Risk

Potential changes to energy policy and regulation at national levels.

- Intermittency & Resource Risk

Unexpected changes in weather can have a significant impact on outputs and subsequent revenues.

- Connectivity & Infrastructure

In most markets, suppliers must seek a grid connection permit as well as a generation license and may need to submit supply estimates to local regulators

- Off-Taker

Potential for counterparties to renege on PPA obligations due to bankruptcy or other force majeure still presents a threat.

- 2015 was a peak year to date for investment in renewable energy generation with over \$2,298 billion investment globally on new capacity additions - outpacing conventional fossil fuel and nuclear.
- Solar – LCOE has fallen by 50% over the past 5 years
- Onshore wind - LCOE has fallen by 13% over the past 5 years
- The Asian market currently accounts for 41% of global energy demand and 45% of global power generation
- Renewable sources account for 8% of regional energy consumption with this share expected to increase to 14% by 2035
- Key risks: Regulatory & Policy; Intermittency & Resource Risk; Connectivity & Infrastructure; Off-Taker
- Offshore wind: less of a focus in Asia in comparison to Europe but China and Korea are looking like the leaders in years to come

Our business: research and consulting



offshore



onshore



downstream

- Established 1990
- London, Aberdeen, Houston, Singapore

Activity & Service Lines

- Business strategy & advisory
- Commercial due-diligence
- Market research & analysis
- Published market studies

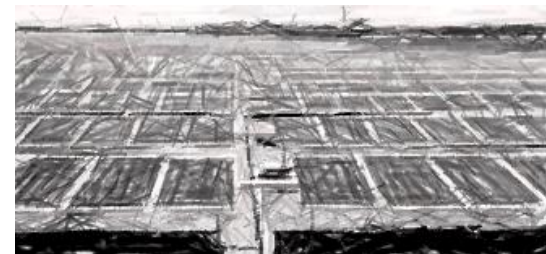
Large, Diversified Client Base

>1,020 projects, >450 clients
>72 countries, >230 sectors

- Clients include the top-10:
 - Oil & Gas Companies
 - Oilfield Services
 - Renewable energy investors and operators
 - Investment Banks
 - Private Equity firms
- Government Agencies



power



renewables



Thank you

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