APEC Sustainable Energy Center

Policy dialogue: Renewable Energy Transition for Sustainable Growth

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Outline

- Sustainable energy development and climate changer targets
- Renewable and energy transitions
- Selected policy areas to facilitate renewable energy transition
- Energy transition and growth
- Proposed APSEC research in relation to energy transition

Energy Systems and Transition

- **Energy systems are facing various challenges:** energy security, economic efficiency, environment and energy access, as well as urgently tackling key global issues, such as climate change, resource efficiency, sustainable consumption and production and environmental pollution.

- **Energy transition:** toward sustainable and clean energy systems, which are represented by the processes of decarbonisation, decentralisation and digitalisation of energy systems, including energy efficiency, re-electrification processes at end-user level, and introducing possible new energy carriers.

- **Renewable energy:** Renewable energy is among the key drivers of clean energy transitions. Energy transition can be enabled by innovation, deployment and operation of renewable energy technologies.

Renewable Energy and Climate Change Goals

- **SDG7:** Ensure access to affordable, reliable, sustainable and clean energy for all
- **SDG13:** Take urgent action to combat climate change and its impacts

  The Paris Agreement at COP21

  Keeping a global temperature rise in this century well below 2 ^{o}C above preindustrial levels and to pursue efforts to limit the temperature increase further to 1.5 ^{o}C.

Asia-Pacific Economic Cooperation

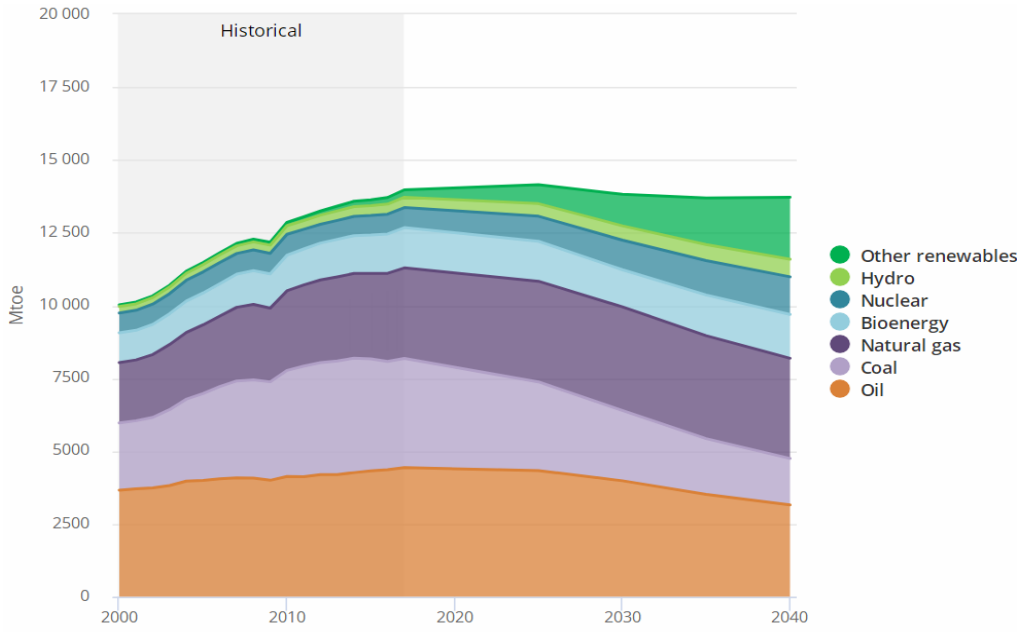
2014 APEC Energy Ministerial Meeting

Beijing Declaration

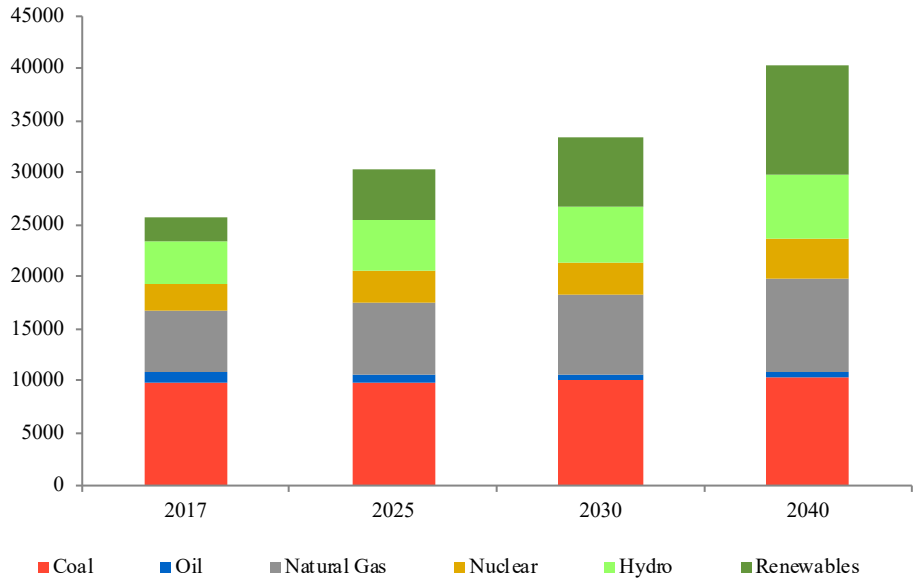
- **APEC RE Doubling Goal:** doubling the share of renewables in the APEC energy mix, including in power generation, from 2010 levels by 2030

Evolvement of Global Energy Mix

- Effective energy transition has become the strategic choice and action to be taken for sustainable energy development.
- One of main trends in the part decade of the global energy system is to shift to clean and renewable energy resources for energy supply.



World total primary energy demand in Sustainable Development Scenario



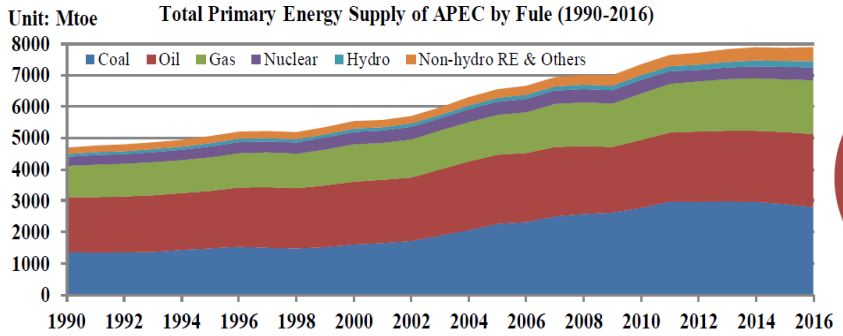
Global electricity demand and its structure

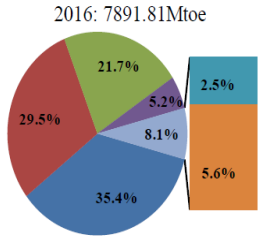
Source: IEA

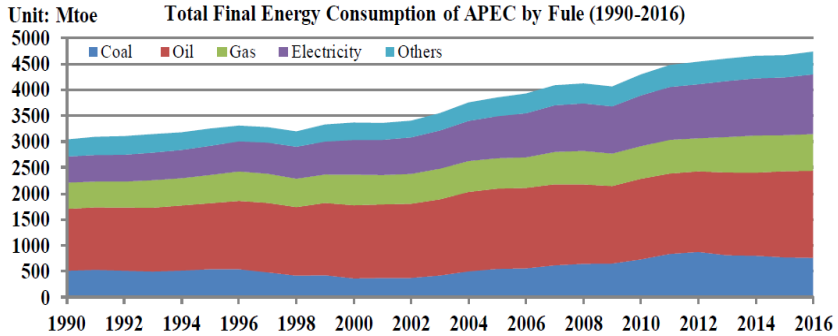
Asia Pacific Energy Mix

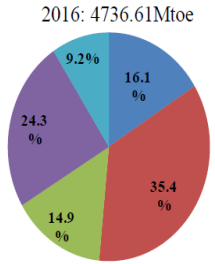
- APEC region is the world's largest producers and consumers of energy, accounting for 60.3% in primary energy supply, 50.0% in final energy consumption, respectively.

- RE share in primary energy increased 1.49% from 2010 to 2016, 31% of the way to the goal. RE share in final energy increased 1.62% from 2010 to 2016, about 26% of the way to the goal.









Source: APEC Energy Database

2010-2017 Period:

- China's coal consumption fallen by 9%, the share of renewable energy increased by 5%;
- China's coal-fired electricity generation fallen by 15%.

Progresses on Energy and Climate Change

- **UN Climate Action Summit:** "The climate emergency is a race we are losing, but it is race that we can win."

  If Sustainable Development Goals 7, 13 and related Goals are to be met, much higher levels of ambition are required with regard to renewable energy, including transportation and heating. A global energy transition is urgently needed to meet the objectives.

- **APEC Renewable Energy Goals:** APEC is unable to achieve the Renewable Energy Doubling Goal on time according to current projection. (EWG57, Manila)

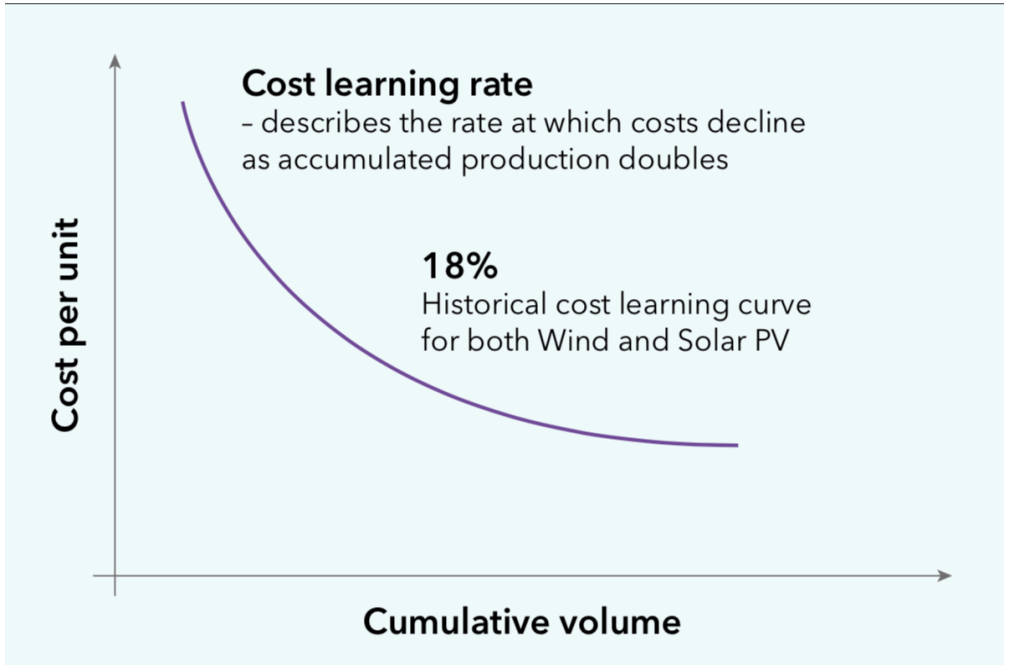
Facilitating and accelerating energy transitions:

- Decarbonisation, decentralisation and digitalisation of the energy systems
- Energy use efficiency, electrification of transportation, sector coupling
- Innovation and deployment of energy technologies

Support Innovation and Technology Development

Energy technology and innovation:

- Green electricity generation: renewables
- Energy storage and carbon capture and storage
- Electricity transmission and distribution: flexible power system, smart grid, inter-grid connection, microgrid
- Low carbon transportation: fuel efficiency technologies, biofuels, electric, hybrid and fuel cells vehicles
- Energy efficiency: building, industrial processes
- Sector coupling: power, heating and cooling
- Adaptation to climate change



Supporting technologies:

- Artificial intelligence, Internet of Things, blockchain

Cost reduction of Renewable Technologies

- Significant reduction in costs of solar and wind technologies
- Solar PV and wind power are moving to compete with conventional power generation

The global weighted-average electricity cost and installed cost of renewable power in 2018

Renewable Power	Electricity Cost (USD/kWh) 2018	Change of Electricity Cost 2017-2018	Installed Cost (USD/kW) 2018	Change of installed Cost 2017-2018
Bioenergy	0.062	−14%	--	--
Geothermal	0.072	−1%	--	--
Hydro	0.047	−11%	--	--
Solar PV	0.085	−13%	1210	−13%
CSP	0.185	−26%	5204	−28%
Offshore wind	0.127	−1%	4353	−6%
Onshore wind	0.056	−13%	1497	−6%

Source: IRENA

Support Renewable Energy Penetration

Power generation and power network

- **Power Generation:** continue to be the most important sector for bulk of RE usage with the costs decline, reaching of grid-parity of RE technologies;
- Development of energy storage capacity;
- **Power network:** grid integration, enhancing transmission capability, flexible power system; active distribution network.

Renewable energy-friendly power systems to promote RE:

- UHV, Flexible DC and Smart Grid
- Integrated Energy Services and Green Dispatch

Power system becomes the foundation and core of energy transition:

- Non-fossil energy is mostly electricity
- Modern energy demand is mainly electricity
- Electricity utilization is an important symbol of industrialization and modernization

Grid Integration and Inter-grid Connection

Renewable grid integration:

- **Development of long-term plan of power system**, in which the design of power grids and electricity markets fully takes account of the shifting landscape of power generation
- Maintain system operation and reliability
- Localized grid congestion, frequency control and supply/demand imbalance
- Ancillary services

Inter-grid connection:

Reduce the relative variability of both load and generation; smooth out the variability of the variable RE resources; larger balancing areas for cost savings on spinning reserve.

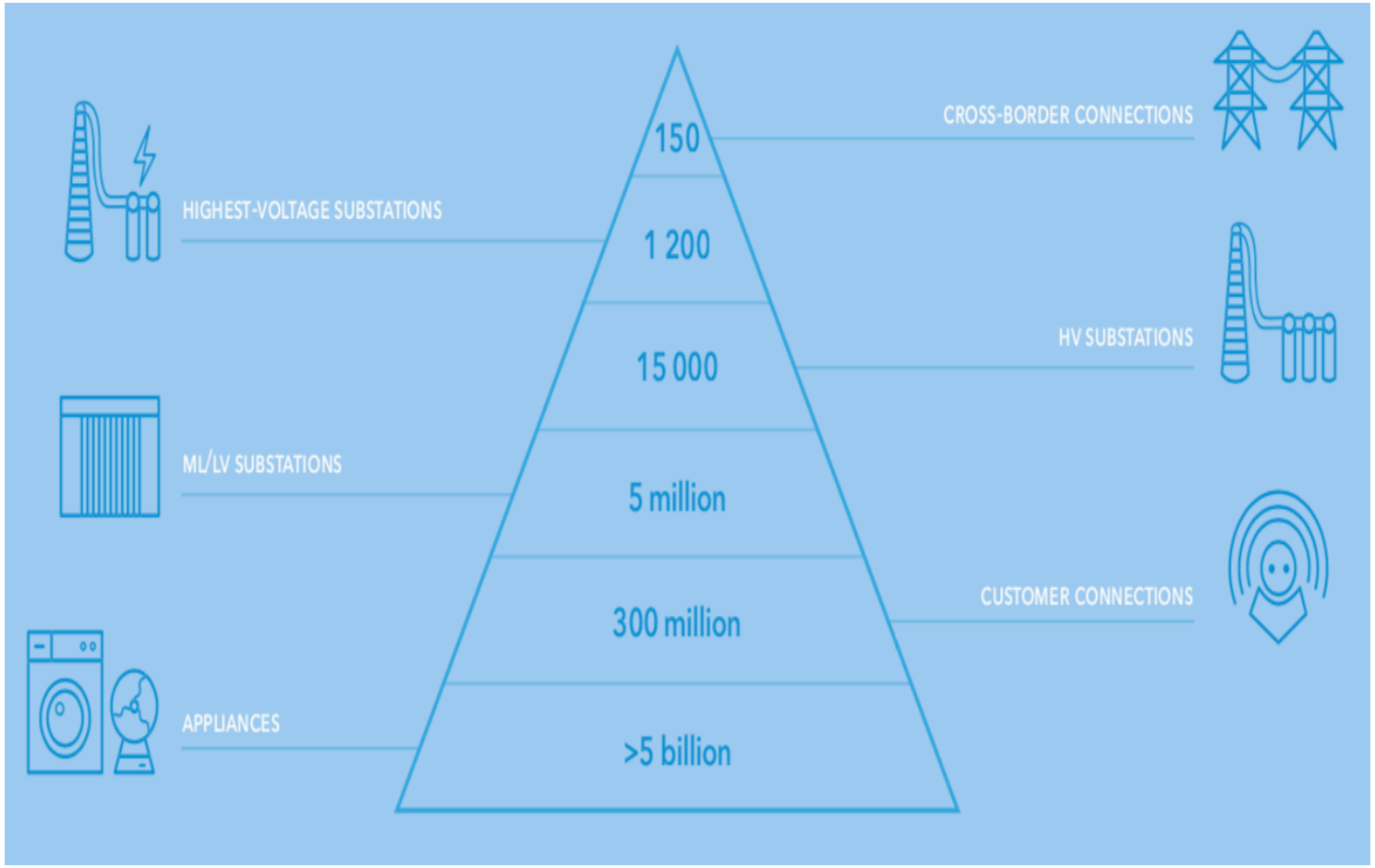
- Grid codes and technical standard harmonisation
- Coordinated operation of the power grids
- Development of connection agreements
- Electricity market integration

Consumers Participation in Energy Transition

- **Consumer electricity market participation**
  - PPA purchasing renewable electricity
  - Demand management and demand response
  - Virtual power plant
- **Costumers to prosumers**
  - Consumers transforming into prosumers actively participating in capacity, energy and ancillary services markets
  - Prosumers may range from householders to business entities
  - The vehicle fleet operators will become major energy consumers with substantial ability to managing charging demand and location
- **Redefined role for utility and regulator**
  - Regulation framework

Data Intensive Energy Systems

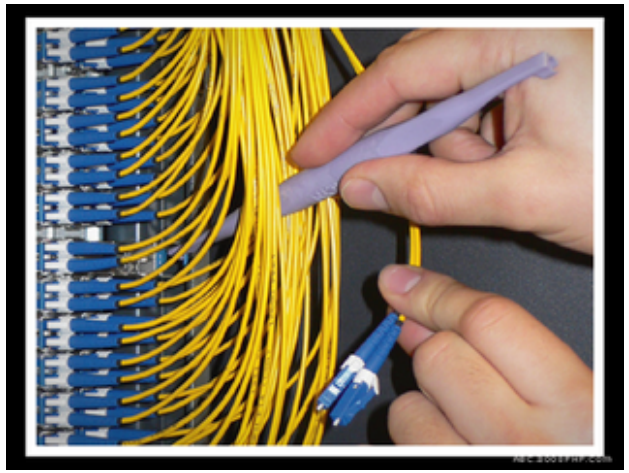
- **Quantity and complexity of the energy system**
  - The **quantity** and complexity of equipment and components of the energy system
  - The increased **complexity** involved will increased monitoring and control and data management.



Data and Information Management

- **Date and information management**

- Data quality assessment
- Organizational maturity assessment
- Data usage risk assessment
- Data management advisory services



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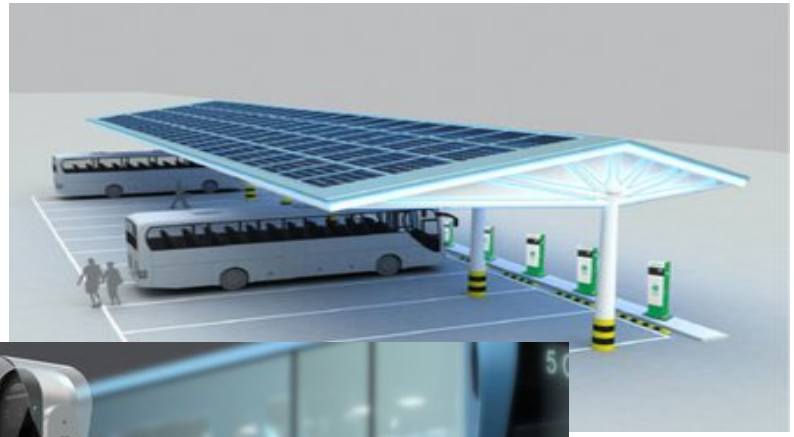
Sectoral Renewable Energy Penetrations

- **Transport sector:** improve fuel economy, biofuel for transportation, EV and charging infrastructure;



- **Commercial and residential sectors:** distributed renewable energy generation, supported by microgrid technologies; implementation of energy management system; sector coupling;

- **Industrial sectors:** shifting to greener iron and steel making, chemicals and petrochemicals, and pulp-and-paper and other energy intensive industrial sub-sectors.

Fiscal and Financial Measures

Fiscal measure:

- Capital subsidy for renewable energy
- Feed-in-tariff
- RE auction for large RE projects
- Reduced corporate income tax, corporate tax holiday, import duty exemption for eligible technologies and equipment, and exemption from value-added tax for clean energy technologies
- Phasing out fossil fuel subsidies will narrow the investment gap for renewable energy technologies

Internalise external costs of fossil fuels:

- Fossil fuel levy, carbon tax
- Carbon trading

Financing and investment:

- Grants, concessional financing
- Support for financial intermediaries
- Risk-mitigation to help mobilize private sector investment
- Green and climate funds

Regional Collaborations

- **Knowledge sharing:** collaboration and information exchange with other relevant international organisations such as IEA and IRENA; sharing the experience from the economies with effective and successful renewable energy policies and development programs;

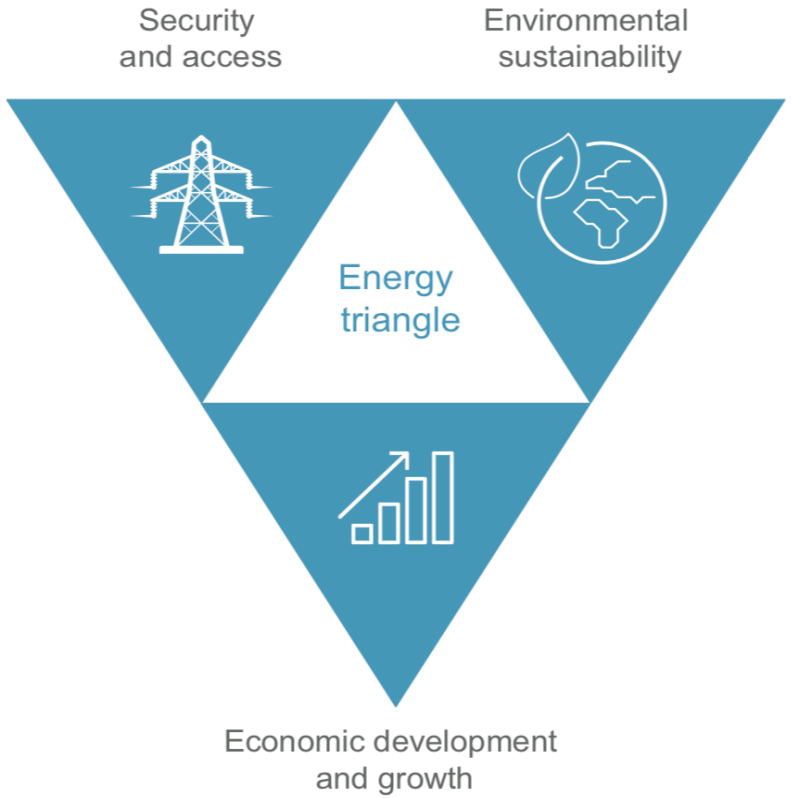
- **Capacity building:** work with multilateral institutions, and relevant international initiatives such as One Belt and One Road (OBOR) Initiative, building up the capacity for renewable energy development across the APEC region;

- **Support energy connectivity/interconnected grid:** energy connectivity, relying on both technical and financial viability and political trust, could build upon the existing regional economic cooperation frameworks, such as ASEAN;

- **Formulation of energy transition roadmaps:** the selection of energy technologies, technical pathways and energy transition trajectories will be subject to the status of social and economic development, resources availability, and the existing energy infrastructure of each member economy;

Regional Collaborations

- **Monitoring, measuring and assessment:**
  The progress of energy transition in member economies and across the Asia Pacific region



Source: WEF

Energy Transitions and Growth

Energy transitions offer a path of high-quality growth, potentially turning the economy growth from grey to green growth: direct and indirect contribution. Policies need to address the challenges:

- **Skills shortage:** New technologies require new skills to enable the technologies to be developed and diffused, and new infrastructure to be deployed;
- **Innovation capacity:** not only the training of researchers, but also to develop a well-functioning innovation ecosystem;
- **Financing:** investors lack the knowledge necessary to accurately evaluate the risk-return profiles of new technologies. Lack of adequate financing along the clean and renewable energy chains;
- **Dynamic business environment:** organising knowledge sharing and necessary capacity development programs, fostering public-private partnerships for dissemination of innovative technologies, and development of infrastructure projects, products, and services.

Proposed APSEC Research Programs: ETS

- APSEC proposed to implement **“APEC Energy Transition Solutions (ETS) Program”** from 2020 and formulated the implementation plan in line with China's energy development strategy and task framework of APEC Energy Working Group.

- Proposed research areas:
  - Innovative approaches of scaling-up of renewable energy applications
  - End-user energy management and energy efficiency improvement
  - Road-map of urban energy system transition toward 2050

APSEC Research Program: ETS

APEC Sustainable Energy Center

- **Focus on the theme of Energy Transition Solutions**
  - **Supply side:** innovative modes of renewable energy development
  - **Demand side:** end-user energy management and energy efficiency improvement
  - **City as a carrier:** urban energy transition plan

- Provide recommendation on technology choice and technology scale considering the different characteristics of the economies;
- Examine business models to facilitate the development of renewable energy projects;
- Explore innovative approaches to support the large-scale and marketization of renewable energy;

- Analyze the penetration of smart energy use and the process of electrification process at end-use level;
- Development of comprehensive energy management systems and relevant business models that can accelerate energy transition at the end-use level.

- Urban energy transition up to 2050: energy supply and usage in cities is an integrated sustainable development process;
- Holistic and dynamic analysis of urban energy transition: urban energy systems and technology choices under carbon emissions constraints, renewable energy development goals and energy intensity targets.

THANK YOU!