Asia-Pacific Economic Cooperation

APERC Asia Pacific Energy Research Centre

APEC Energy Demand and Supply Outlook 8th Edition

Market update on renewable energy development and progress on the new edition of the Outlook

The 54th Meeting of APEC Expert Group on Renewable Energy and New Technologies
November 10, 2020

Dr. Victor MARTINEZ, Researcher

A year with the biggest pledges to achieve carbon neutrality

Major Asian economies has a commitment to reach a net-zero economy

Can we tackle both climate change and Covid-19 recovery? |

China pledges to be 'carbon-neutral' by 2060

Surprise move at UN by world's biggest emitter increases pressure on US over climate commitments

Japan to be carbon neutral by 2050, insists prime minister

Yoshihide Suga says 'next-generation' solar panels will help break reliance on fossil fuels

South Korea follows Japan and China in carbon neutral pledge

Moon Jae-in promises green transition as part of coronavirus recovery package

Biden shift on climate change welcomed by world leaders

President-elect pledges to rejoin Paris accord on day one and launch $2tn green stimulus package

Google pledges to be carbon free as fires engulf California

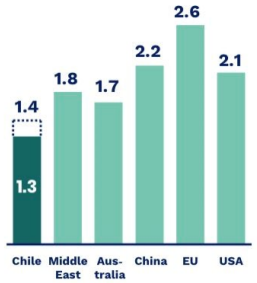
Big Tech groups respond to pressure from employees concerned about climate change

Carbon trading: the 'one-way' bet for hedge funds

South Australia (October 2020):

~100% solar powered and ~100% wind powered at the same week

Rooftop solar is installed on one-in-three homes in South Australia, with 2,500 systems installed monthly this year alone.

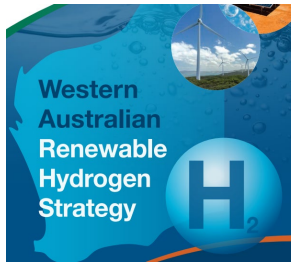


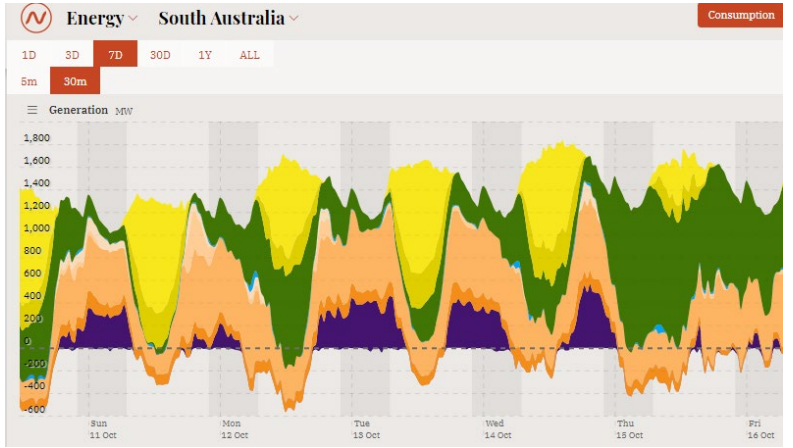
Green hydrogen produced in the Atacama Desert and in the Magallanes Region will achieve the lowest levelized cost of production* on the planet by 2030. **The quality and abundance of the renewable resources found in these regions will enable a large-scale competitive production.**

**Does not consider compression, transport, and distribution costs, which vary according to the end-use of hydrogen.*

Source: McKinsey & Company.

New Zealand Prime Minister Pledges to Reach 100% Renewable Energy Across Nation by 2030





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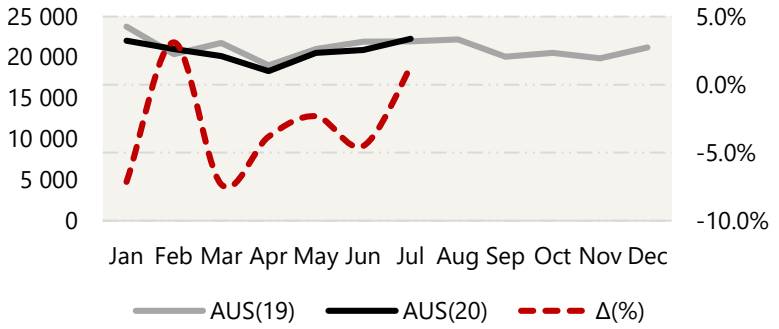
2020 Electricity generation in a Snapshot (selected economies)

Clear signals of recovery in most economies

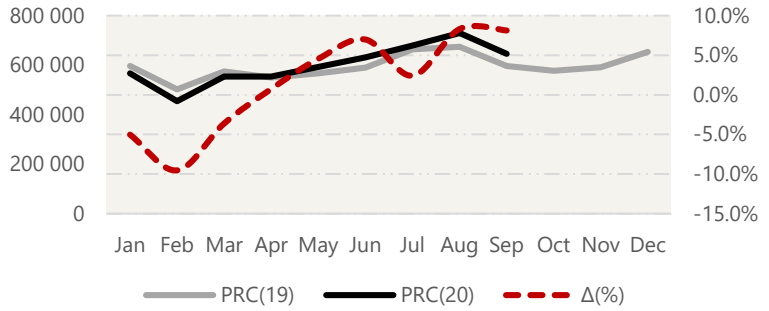
Unit: TWh

Source: APERC, 2020

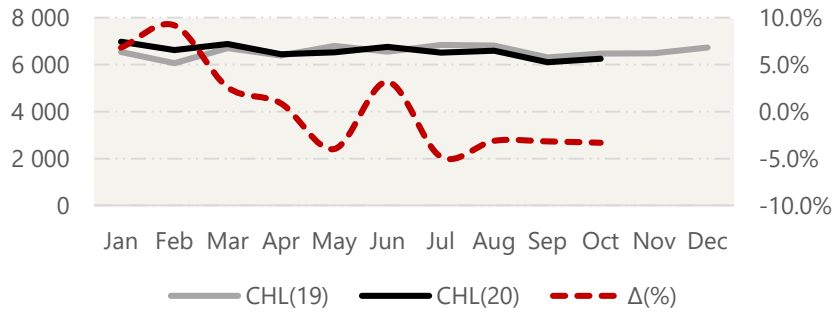
AUSTRALIA



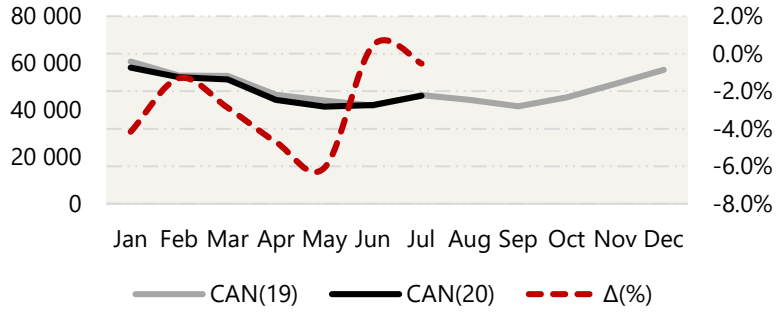
CHINA



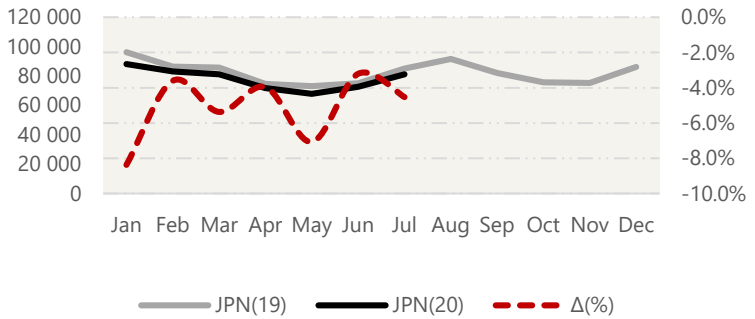
CHILE



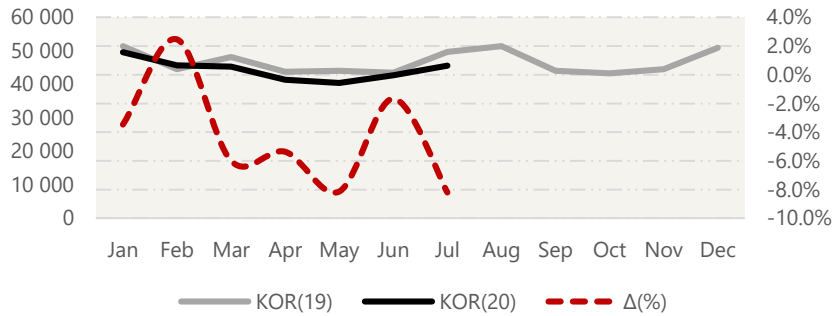
CANADA



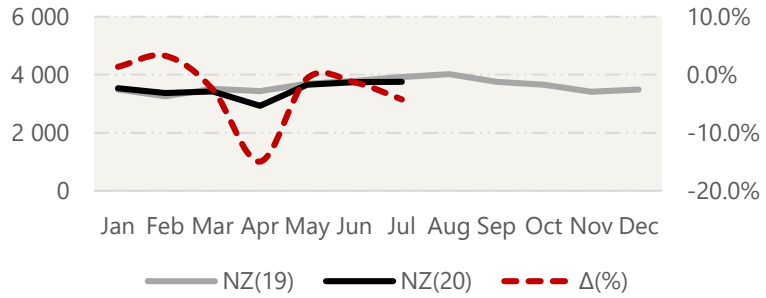
JAPAN



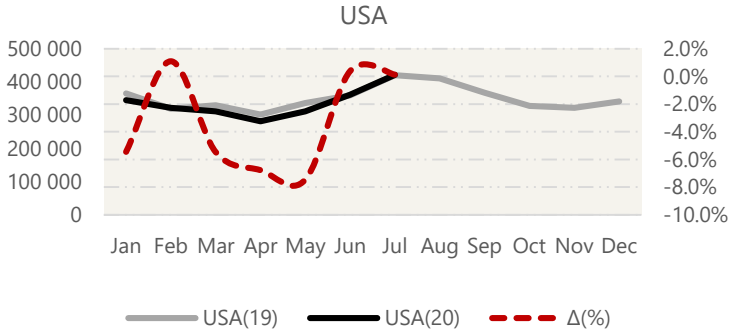
KOREA



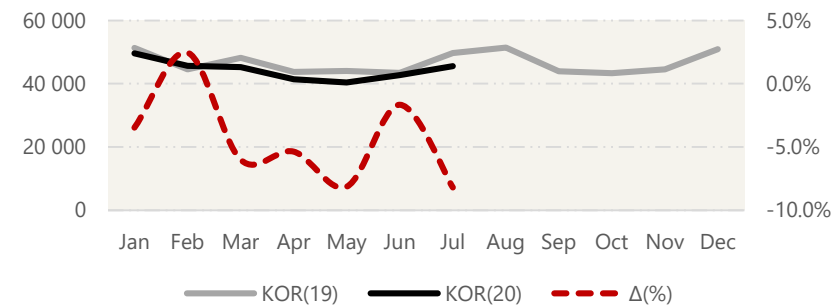
NEW ZEALAND



USA

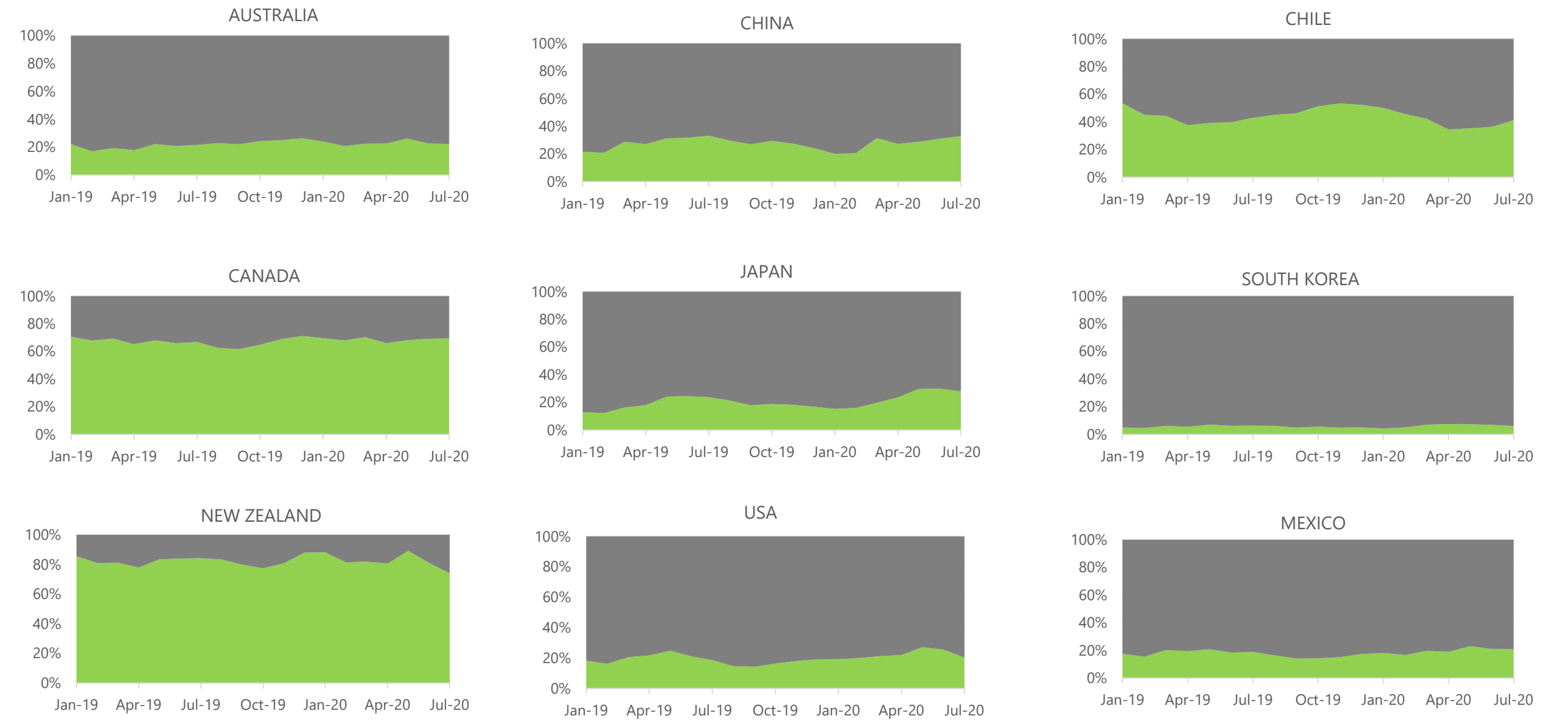


MEXICO



2020 Electricity generation produced by renewables (selected economies)

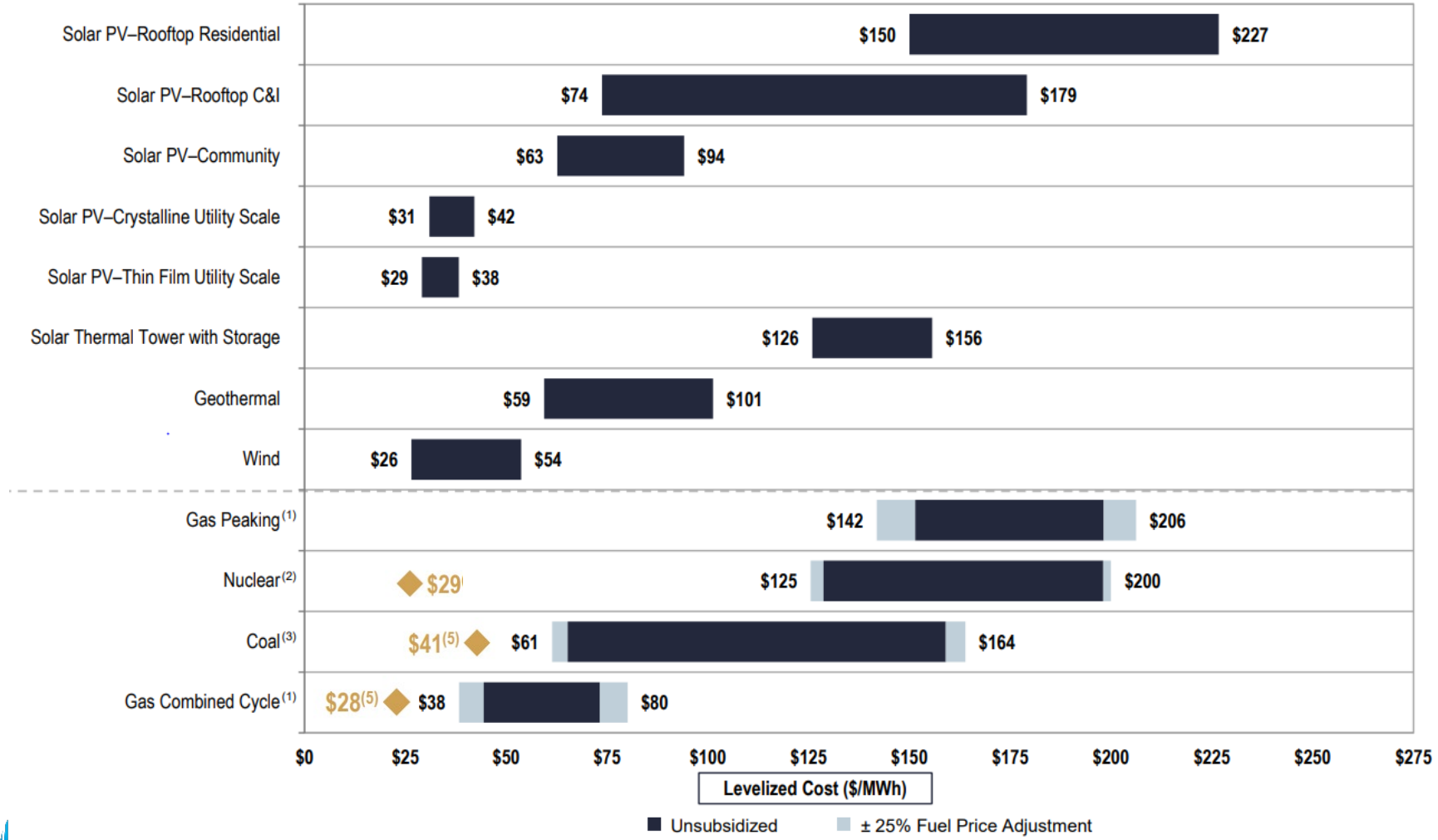
Despite COVID-19 a steady or growing trends is observed in most of the APEC economies



Source: APERC, 2020

Renewable technologies are fully competitive with conventional generation
unsubsidized analysis with prices adjustments

Levelized cost of selected generation technologies (Oct-2020) – [US$/MWh]



Variations in fuel prices can materially affect the LCOE of conventional generation technologies. (indirect and cross subsidies)

Direct comparisons to "competing" renewable energy generation technologies must consider issues such as dispatch characteristics:

- baseload vs. peaking
- Market structure

Source: Lazard, Oct 2020

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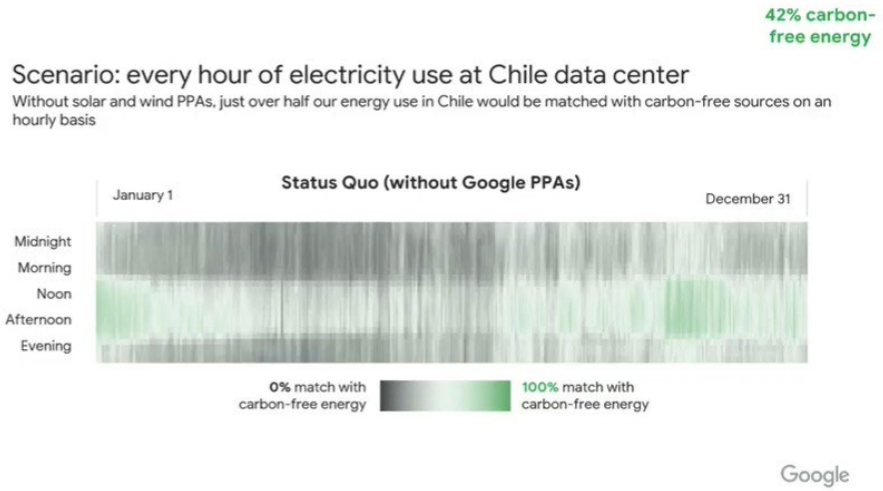
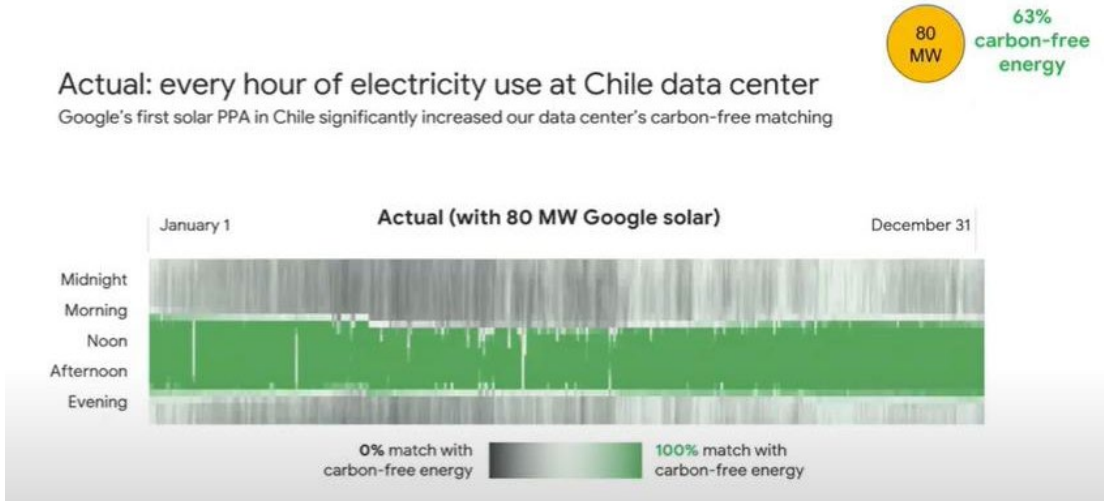
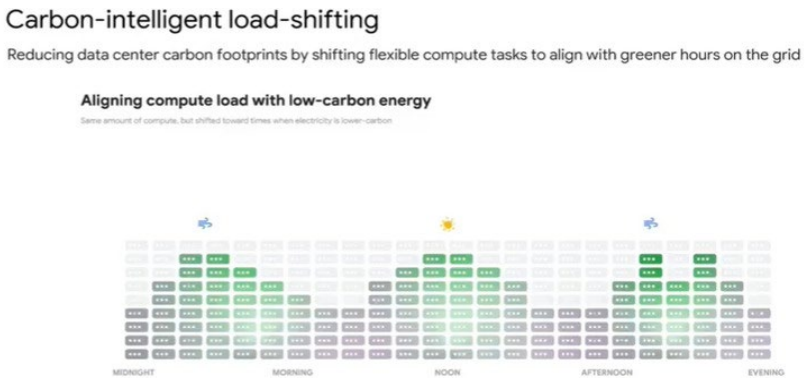
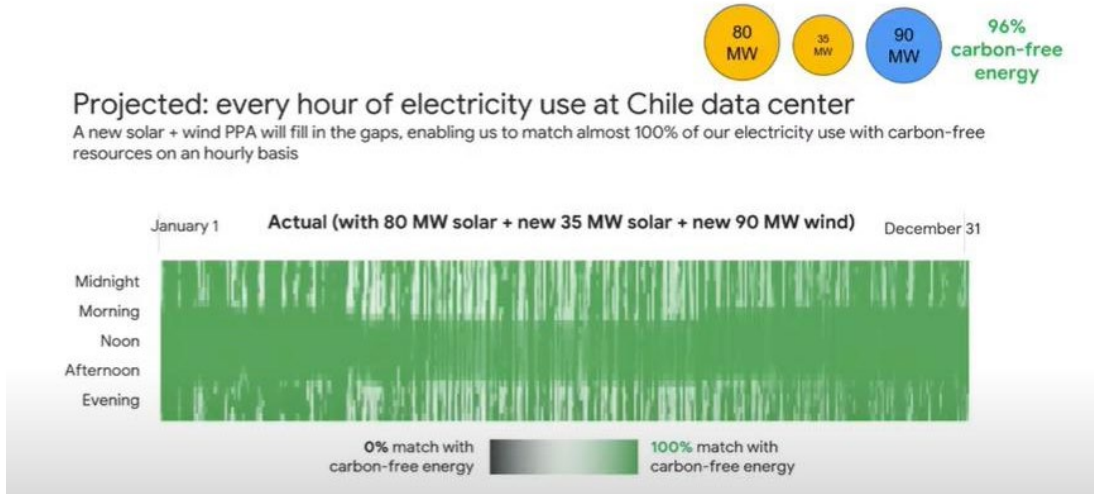
New ways of structure corporate PPAs
24/7 carbon-free guarantee (hourly and intra-hourly basis)









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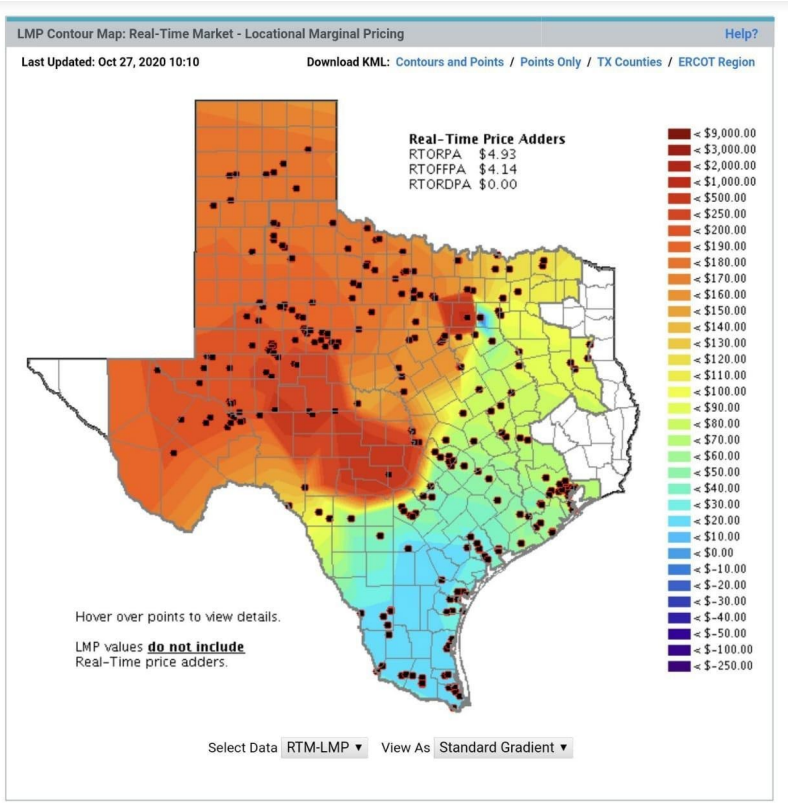
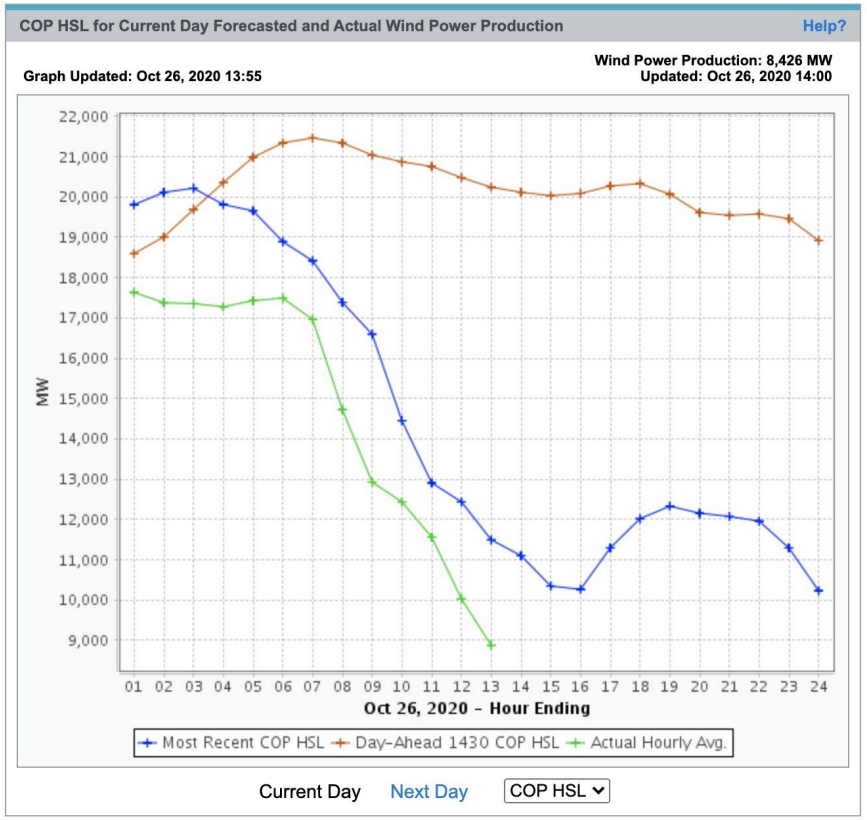
Transitioning to a low carbon grid with high penetration of VRE brings operational challenges

Climate is changing making more harder predict weather conditions adding more complexity to the forecast





ISO and TSO needs to work mostly in

- Assessing ability of the resources fleet and import to meet the demand in all periods
- In near and mid-term ensuring sufficient peak resources (gas) or overbuilding renewables to meet high demand periods
- Time of Use rates and demand response strategies
- Incentivize renewable resource to provide controllability and essential reliability resources traditional provided by conventional resources

Source: ERCOT, 2020

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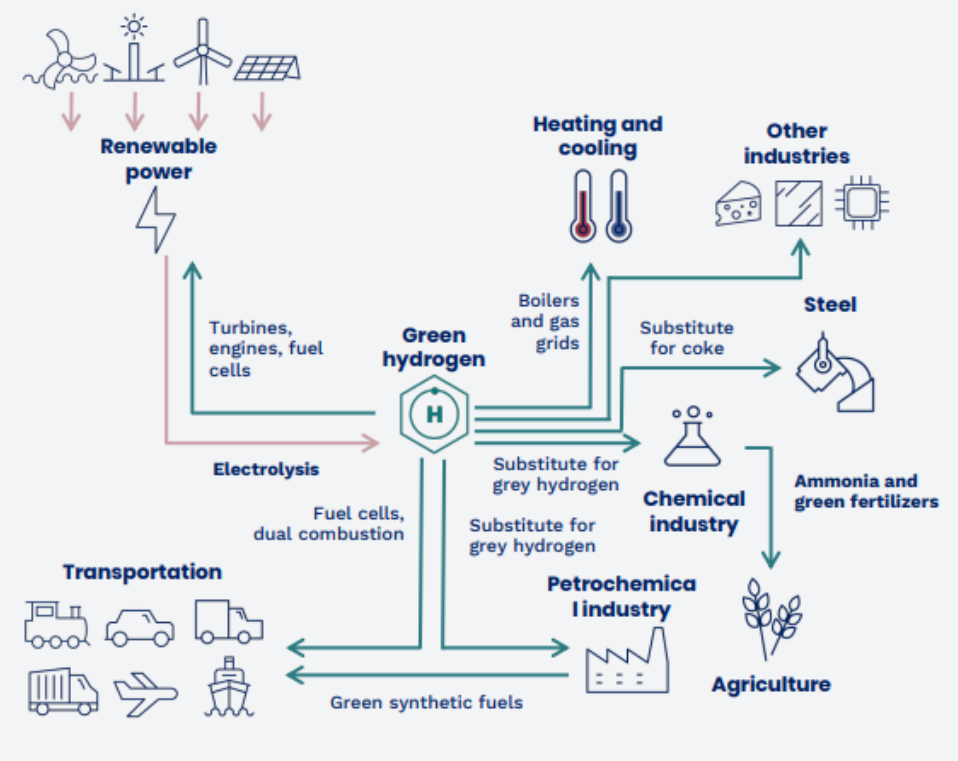
APEC economies has ambitions renewable energy targets by 2030 and some relevant economies has pledge to reach carbon neutrality by 2050-60 (~80% renewables by 2050)

New technologies are critical for the energy transition: electricity cannot decarbonize entire economies alone

Achieving net-zero emissions requires a radical transformation in the way we supply, transform and use energy



Source: Siemens, Power to X, Hydrogen Strategy Chile

Hydrogen forms a bridge between the power sector and industries where the direct use of electricity would be challenging, such as in the production of steel from iron ore or fueling large ships (IEA,2020).

- Green hydrogen will be cost-competitive with blue hydrogen in around a decade and competitive with gray hydrogen at around $1/kg by 2050 (BNEF, 2020).

- Japan, Singapore, Australia and Chile has released ambitions Hydrogen strategies which combined includes more than 30 GW by 2030. Saudi Arabia, Russia and Canada has a relevant role to play too.

A secure and sustainable energy system with net-zero emissions results in a new generation of major fuels: Electricity, hydrogen, synthetic fuels and bioenergy

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Renewables are on track despite the pandemic and the sustainable recovery has accelerated the energy transition, but the key challenges remains as harder than usual

From the **policymakers**' side, increasing renewable deployment requires:

- A strong institutional framework to support policies and specific energy targets: i.e., carbon neutrality policy.
- New financial and market mechanisms for low-carbon technologies. i.e., novel tender process (auctions) to support the entrance and uptake of renewables.
- Easy access and priority for small-scale renewables developers
- Utility obligations/quotas (share) for modern renewables.
- Net-metering/ Net-billing implementation for end users.
- Gradually incorporation of carbon-tax and associated environmental policies to boost competitiveness.
- Reliability and adequacy in the power system need to be addressed: Flexibility is required to maximize the efficient integration of VRE.

Reaching net-zero emissions in 2050 would require a much more rapid deployment of low-carbon power generation

The energy transition is an opportunity to increase the role of renewables in the energy mix but there is not a single recipe.

- Electricity generation would be about 2.5 – 3.0 times higher in 2050 than it is today, requiring a rate of growth equivalent to adding the entire US power sector **every three years.**
- Annual additions of renewable electricity capacity, would need to average around **four times the current record,** which was reached in 2019.
- New trends and technological advances are critical to reach the current energy aspirational targets and new net zero pledges.
- **Improved technical-economics modeling of energy systems**
- Working with local communities and strength education in energy, economy and related subjects.
- Economical alternatives to carbon-intensive technologies and potential phase-out of inefficient power plants i.e., subcritical coal power plants.
- Direct and indirect effects of decarbonization policies on jobs local communities in the short and mid-term.

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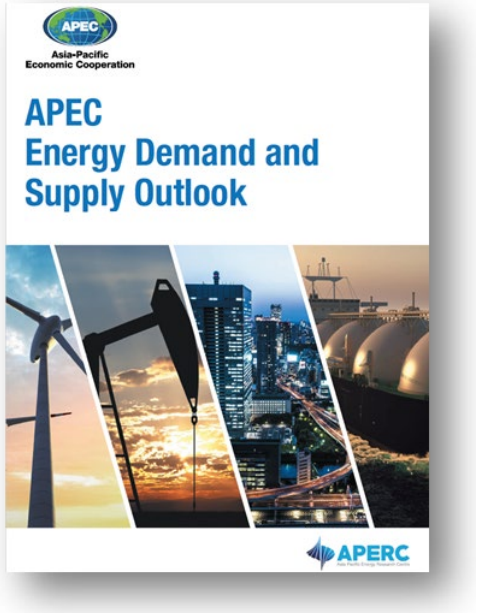
Part 2: APEC Energy Demand and Supply Outlook 8th Edition

Redesigned analysis adding new values and creating new tools for the economies

APEC Energy Demand & Supply Outlook
8th edition scenarios



Current Policies	Announced Policies	Climate Change
This scenario shows a continuation of **current trends and policies in effect** without any additional policy interventions. It serves as a **reference** for the two alternative scenarios.	This scenario includes current and **announced** policies that have not been implemented, and **targets and goals**.	This scenario presents a decarbonization pathway consistent with a **2DC** future under the Paris Agreement. It identifies the **additional level of ambition and policy packages** to transition to a low-carbon energy system.

Currently modeling

Notes: all scenarios will use a base year of 2019. Projections are annual through 2050. Macro-economic assumptions are constant across scenarios.

Current policies are those that are active in law, regulation, and/or implementation. Current policies do not include targets, goals, or other policy proposals that may have been announced but not implemented.

Announced policies include targets and goals, and policies that are not yet under implementation. NDCs are included.

Additional measures for the *Climate Change scenario* are bottom-up in nature. Planning for this scenario will commence later this year, followed by modeling in early 2021.

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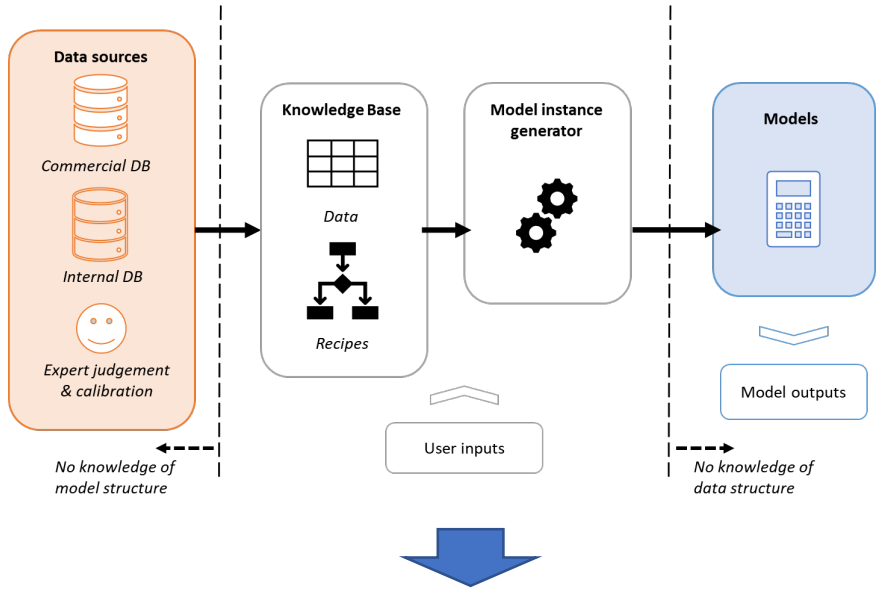
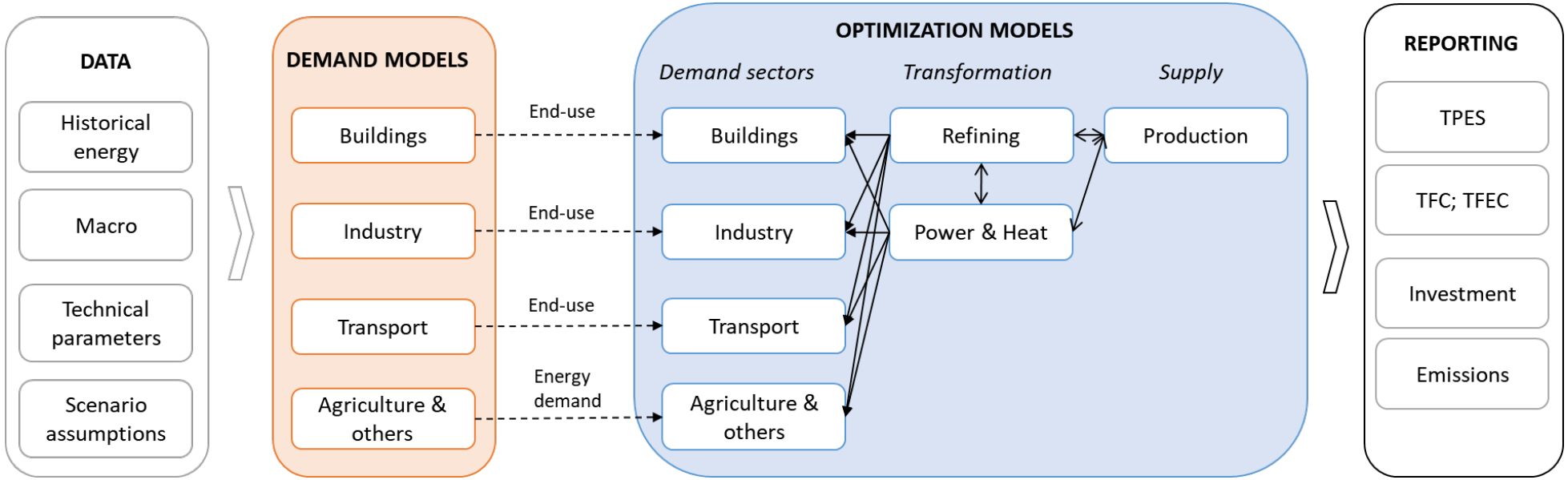
Analysis guiding principles & Knowledge Based Modeling

- Consistency in methodology
- Increased focus on economics
- Improved accessibility and usability
- Open source whenever possible
- Transparency





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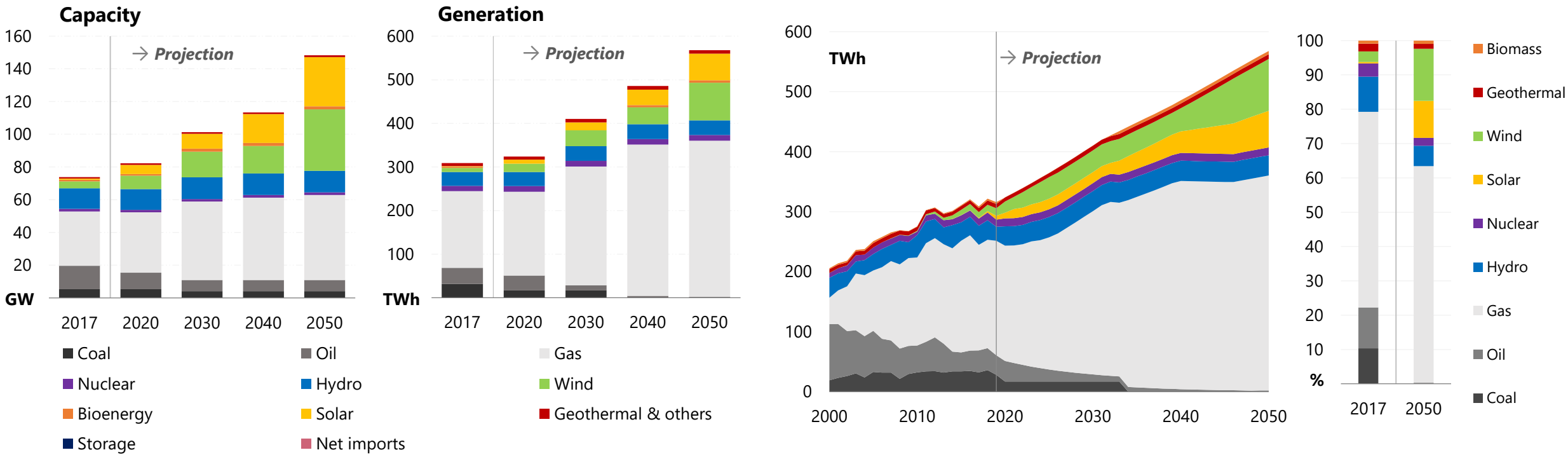
Data science tools

- Python: to automate workflows
- Pandas: to manipulate datasets
- scikit-learn: machine learning-based demand projections
- Pyomo: to generate linear programs
- OSeMOSYS: to generate linear program model instances
  - provides a consistent framework to organize the model elements
    - Input and output data
    - Supply-demand balances
    - Cost structure
    - Emissions accounting
- Microsoft Excel: data management and charts
  - Charts are created using Pandas XlsxWriter

Example:
Preliminary results – Transformation activities

Mexico - Power capacity and electricity generation by fuel, 2017-50



- Power sector represented by cost-minimizing capacity expansion model (OSeMOSYS), which meets exogenous electricity demand (from demand sectors)
- Refinery and Supply sector follows same approach

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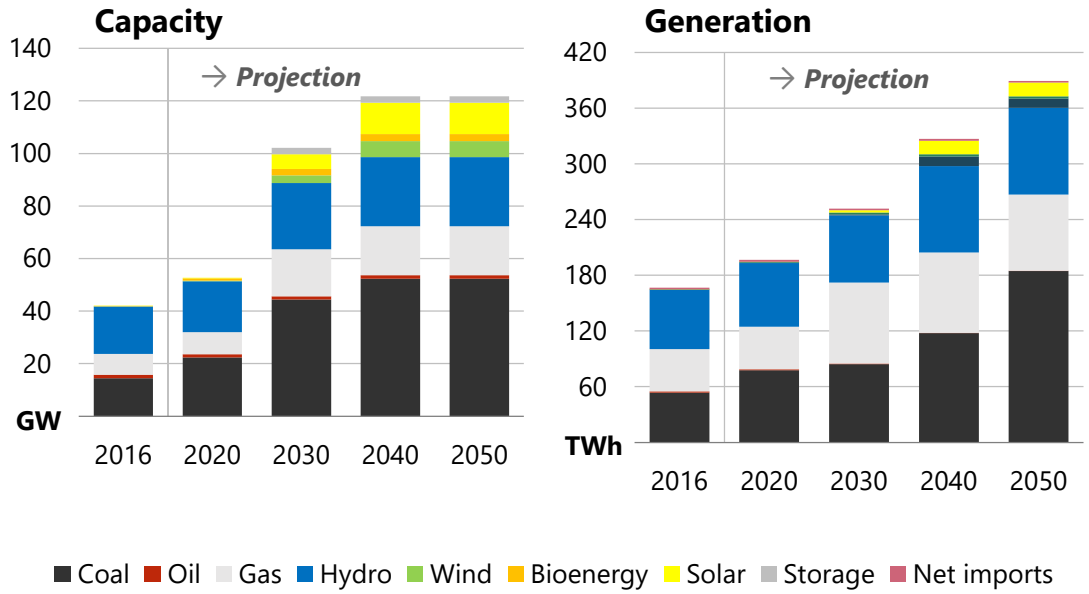
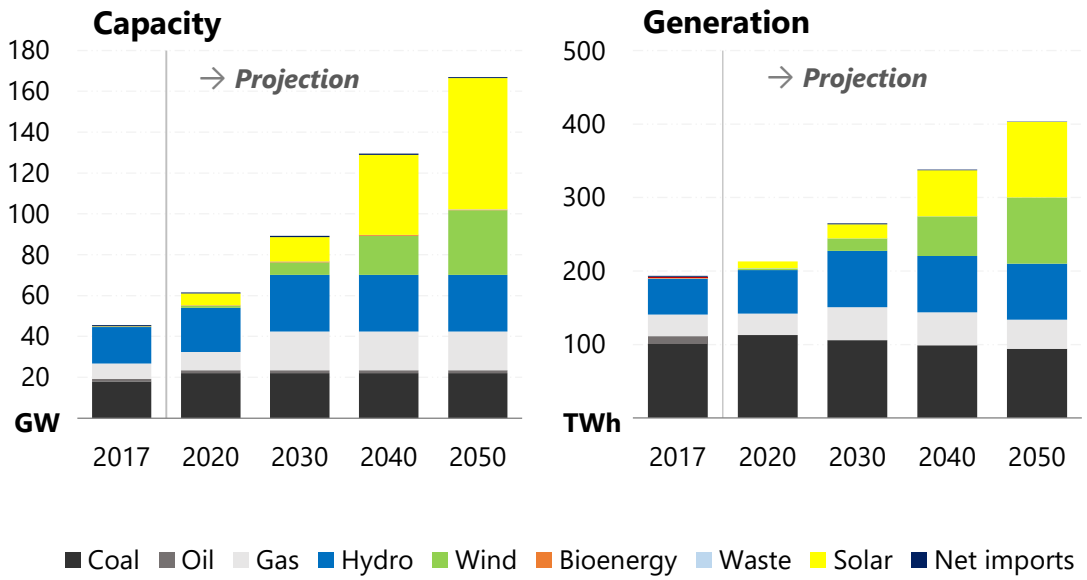
21_VN: Power Sector
Electricity generation and capacity by source – preliminary results under consistency review

APERC-7th Edition



APERC- 8th Edition



- Similar demand but a larger role of renewables this time
- more renewables → ~ compatibility with LNG Terminal expansion → lower LNG demand?
- Security of supply, margin reserve and peak demand

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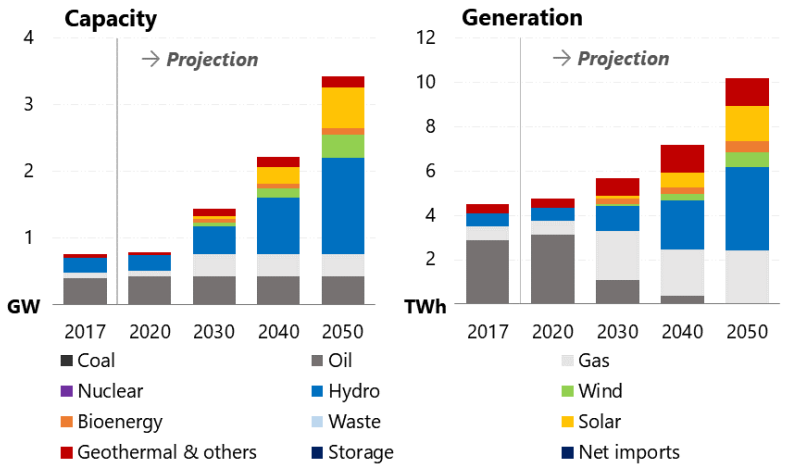
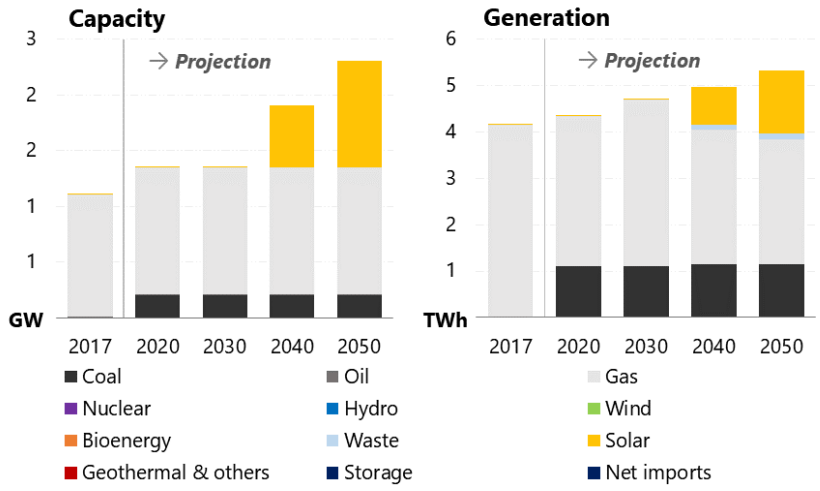
Source: APERC, 2020

Example:
Preliminary results – Snapshot of selected economies (current policies scenario)

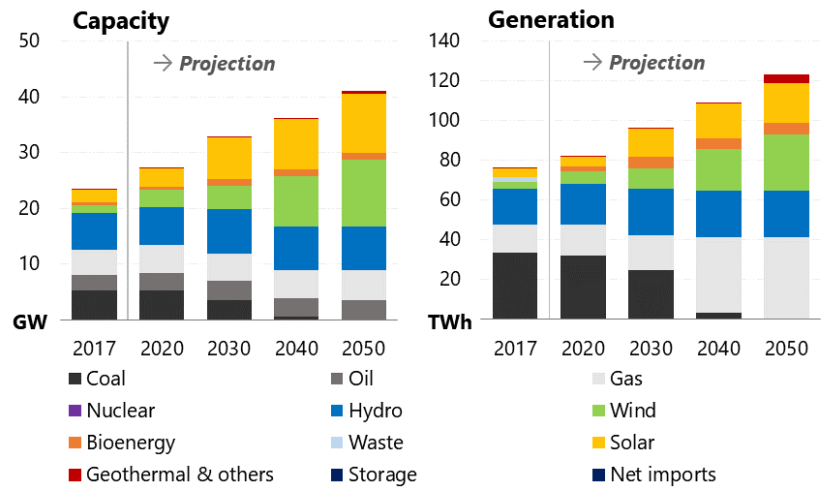
PNG



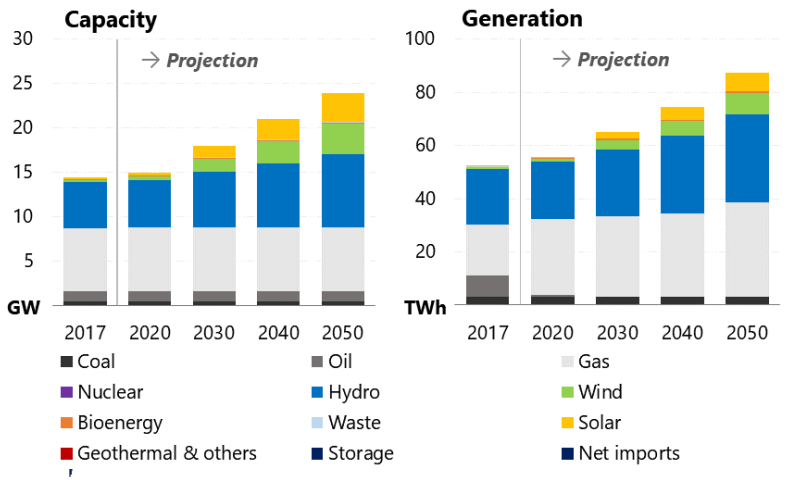
Brunei



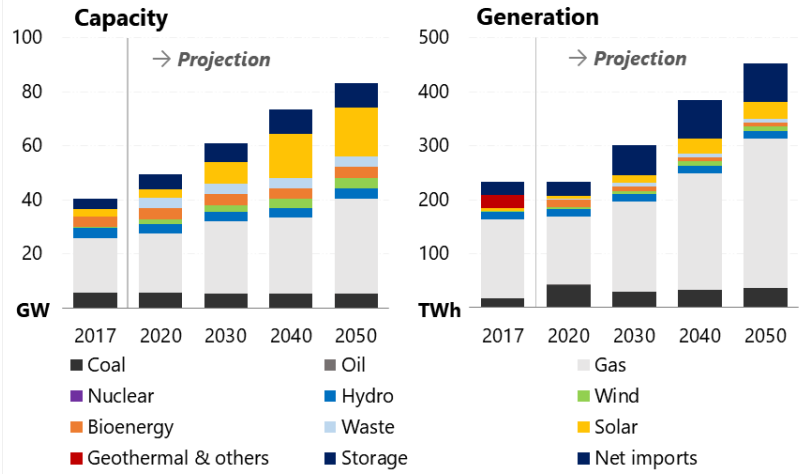
Chile



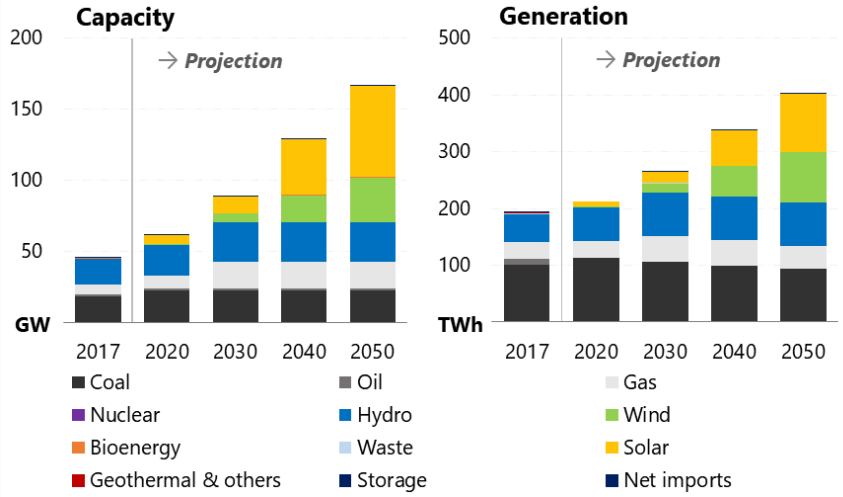
Peru



Thailand



Viet-Nam



Ongoing and future activities

- COVID-19 assumptions
  - We are incorporating short- and long-term impacts by adjusting GDP assumptions (applies to all three scenarios) and commodity prices
    - Short-term: GDP disruption and recovery projections from IMF
    - Long-term: return to previous GDP growth rates
  - **Question**: what other long-term structural and/or behavioral shifts should be considered?
- Climate Change Scenario
  - Will begin design late 2020/early 2021
  - **Question**: what new developments or trends should we explore? E.g., Circular Carbon Economy?
- Expert feedback
  - We are seeking reviewers for our results and chapters

Thank you for your kind attention!

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https://aperc.or.jp

https://github.com/asia-pacific-energy-research-centre