

ENERGY SECURITY AND RESILIENCE IN THE APEC REGION

Glen E. Sweetnam, Asia Pacific Energy Research Centre, +1-240-599-6672, glen.sweetnam@aperc.or.jp
Emily Medina, Asia Pacific Energy Research Centre, +52-1-999-968-1568, emily.medina@aperc.or.jp

Overview

The 21 economies that comprise the Asia Pacific Economic Cooperation (APEC) forum are home to almost three billion people and account for approximately 60% of global GDP and energy consumption. The region is also expected to account for a disproportionate share of future increases in global energy demand. In several rapidly growing economies, increased energy demand causes increased dependence on energy imports, which raised issues of energy security and resilience. This paper utilizes the energy growth, import dependence, and energy mix projections from the 8th edition of the *APEC Energy Demand and Supply Outlook* (8th Outlook) to quantify the energy security and grid reliability risks associated with increased energy consumption in rapidly growing economies.

The 8th Outlook includes two scenarios, a Reference (REF) case and a Carbon Neutrality (CN) case. In Asia, oil import dependence and energy security risks grow in REF but not in CN. On the other hand, dependence on liquefied natural gas (LNG) imports and associated security risks grows substantially in Asia in both cases. In addition, reliance on non-dispatchable renewable energy sources grows in both cases but especially in CN. As recent experience in the U.S. and Europe demonstrates, this increase in the share of intermittent renewable energy sources has the potential to raise consumer costs and grid reliability risks in Asia.

Methods

The 8th Outlook modelling involves decomposing the APEC energy system into multiple subcomponents spanning demand sectors (such as industry, transport, and buildings), transformation (power, heat, and refining), and supply (production and trade). Demand sector modelling relies on estimates of output, energy efficiency, fuel switching rates, activity rates, technology diffusion, and multiple other variables. Calibration occurs via knowledge-based iteration, particularly with economy-level experts. When demand is finalised, the power, heat, refining and supply, sector models deliver the required energy based on assumptions about fuel cost trajectories, and policy/market intervention. In the case of the power sector, a least cost model is deployed. However, cost-based decisions and assumptions are overridden if there is political backing for certain technologies or fuels that enhances their relative economic viability. There is frequent iteration of results, with extensive review and input from economy and energy experts to arrive at final energy demand, transformation, and supply results.

The Reference (REF) scenario is based on recent trends in APEC energy consumption, production, and trade, and assumes continuation of currently enacted policies. The Carbon Neutrality (CN) scenario explores hypothetical pathways for each of the 21 APEC member economies to reach carbon neutral energy sectors. The Carbon Neutrality scenario (CN) explores additional energy sector transformations such as increased levels of energy efficiency, behavioural changes, fuel switching, and CCS deployment. The pathways are constructed based on the unique characteristics, policy objectives, and starting points of each economy. The CN scenario does not consider CO₂ emission sinks, such as land-use or technologies like direct air capture.

Results

The APEC region is comprised of a diverse group of economies. Economic development is assumed to continue at a rapid pace in APEC Southeast Asia and South America economies, as well as in China, with GDP more than doubling out to 2050 for the entire APEC region. However, this rapid growth in economic output leads to energy demand that is only 12% higher in 2050 relative to just prior to the pandemic. China's industrial might transitions to a more service-based economy, with energy demand slowly peaking by the early-2030s. Many other APEC economies continue to grow their economies without needing significantly more energy to do so. In fact, almost three-quarters of the growth in final energy demand out to 2050 is from the group of APEC economies in Southeast Asia. Energy demand from these economies almost doubles out to 2050, though for that same time period, their GDP more than triples.

In REF, oil consumption for the APEC region peaks in 2035 and declines moderately from that peak by 2050. Within that overall pattern, oil consumption increases substantially in Southeast Asia, while Russia sees a

moderate oil consumption increase. In contrast, all other regions see a decline in oil consumption. From 2035-50, China drives oil consumption declines, followed by the USA, which experiences a smaller consumption decline.

The increased consumption of oil in Southeast Asia increases the region's dependence on oil imports. In both REF and CN, oil import dependence rises in the near term, and continues to increase in REF but declines in CN. In 2050, oil import dependence in CN is less than half that in REF.

In both REF and CN, China drives natural gas net import growth through 2050. While Southeast Asia is the region with the second largest natural gas net import growth. In REF, China's gas net imports increase by two-thirds through 2050, due increased gas demand from fuel switching from coal and limited indigenous gas production due primarily to challenging geologic conditions. Investments in new LNG and gas pipeline infrastructure projects increase import capacity substantially in China, and the economy becomes the largest LNG importer in APEC.

In REF, starting in the mid-2020s, Southeast Asia's gas imports exceed its exports. The region goes from a net gas exporter to a substantial gas importer with associated energy security risks. Even in CN, net gas imports in Southeast Asia follow an upward trajectory throughout 2050.

Maintaining reliable and affordable access to electricity requires balancing demand, supply, costs, weather, climate, and unforeseen factors. In recent years, APEC has experienced several notable reliability issues in Australia (2016) and in the United States (2021 California and Texas). In economies that are ramping up non-dispatchable sources, grid reliability is declining for a variety of reasons.

In 2018, wind and solar each represented 7% of total power generation capacity in APEC. The 8th Outlook projects large increases in both solar and wind generation in both scenarios, although the capacity increase in CN is approximately 50% higher than the increase observed in REF.

Conclusions

In Asia, oil import dependence and energy security risks grow in REF but not in CN. On the other hand, dependence on liquefied natural gas (LNG) imports and associated security risks grows substantially in Asia in both cases. Throughout the APEC region, insufficient investment in new oil and gas upstream and midstream projects could increase oil and gas import dependence and energy security risks if oil consumption does not decline as projected.

In addition, reliance on non-dispatchable renewable energy sources grows in both cases but especially in CN. As recent experience in the U.S. and Australia demonstrates, this increase in the share of intermittent renewable energy sources has the potential to raise consumer costs and grid reliability risks in Asia.

References

Asia Pacific Energy Research Centre (2022), APEC Energy Demand and Supply Outlook 8th Edition [scheduled to be published in June 2022]