

# **REFERENCE SCENARIO IN THE 8TH APEC ENERGY DEMAND AND SUPPLY OUTLOOK**

Mathew Horne, APERC, +81 80 8855 1863, mathew.horne@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 60% of global GDP. APEC is reliant on immense levels of energy supply, with a large trade component, required to enable continued strong economic growth in the region. The forum's purpose is to promote regional economic integration and trade. Understanding long-term energy market trends is fundamental to achieving this and has become increasingly important in the context of the global push toward decarbonisation.

For the 8<sup>th</sup> edition of the *APEC Energy Demand and Supply Outlook* (8<sup>th</sup> Outlook), the Asia Pacific Energy Research Centre has constructed two potential energy futures out to 2050. The Reference scenario analyses recent trends in APEC energy consumption, production, and trade, to deliver one potential energy future. The Reference scenario explores recent market and political trends for each of the 21 APEC economies and does not constrain development via implicit or explicit carbon prices, nor does it assume market interventions unless they have already been legislatively committed to by member economies.

The spate of recent decarbonisation announcements by APEC member economies means that the Reference scenario is unlikely to come to fruition. However, there is value in understanding the trajectory of energy demand and supply in the APEC region based on currently enacted policies and programs, recent trends in energy intensity, and less ambitious deployment of renewable technologies. The Reference scenario is a useful benchmark against which to measure the effectiveness of future decarbonisation policies and may ultimately be a better estimate of future energy demand and supply if achieving carbon neutrality turns out to be more difficult and expensive than currently assumed.

## **Methods**

The 8<sup>th</sup> 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.

Characteristics that distinguish the Reference scenario results from the Carbon Neutrality scenario are energy efficiency rates that follow historic trends; gradual rates of fuel switching; and relatively slow diffusion of new technologies in demand and power sectors. Assumed output and activity is close to the same in both 8<sup>th</sup> Outlook scenarios.

## **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.

Petroleum products remains the largest end-use fuel in APEC, reaching a peak in the late 2030s, before gradually beginning to decline out to 2050, supplanted by electricity in an increasing number of end-use applications. Electricity consumption increases from 23% of the APEC energy mix before the pandemic to 29% in 2050. Gas is the only fossil fuel to expand its share, although only by a small amount.

Electricity generation increases by almost half over the projection period to 2050, with all this additional generation attributable to solar, wind, and nuclear. Both solar and wind generation increase by almost 3,000 terawatt hours, and nuclear generation increases by over 2,000 terawatt hours. In contrast, coal-fired generation falls by almost half, with gas supplanting coal as the most prominent fuel in the generation mix in the late 2030s. Nevertheless, coal remains as an important source of baseload power generation, with much of this role locked in due to the many coal-fired power plants in APEC Asian economies that have been built relatively recently.

APEC continues to account for a significant portion of global fuel production in the Reference scenario. Coal production is assumed to peak in the early-2020s and slowly declines through the rest of the projection period to 2050. In contrast, natural gas production continues to increase significantly until the mid-2030s, at which point it maintains a high plateau for the remainder of the projection. APEC's net imports position across all energy commodities initially falls due to surging natural gas exports out to 2030, but then increases due to natural gas import requirements becoming more prominent than natural gas exports. A large portion of the trade position is due to a reliance by APEC Asian economies on crude oil imports to supply their domestic refineries. It is only in the late-2040s that crude oil imports begin to gradually decline. Imports of gas more than double and continue to increase through the entire projection period. Gas exports also increase significantly, though reach a peak, and begin to decline from the early-2030s.

## Conclusions

The Reference scenario provides a touchstone for the level of energy required for APEC to continue to prosper out to 2050. It is a scenario that assumes that improvements in energy intensity, and fuel switching to more economic and efficient fuel sources, continues at a modest pace. However, these incremental improvements that have been compounding over decades, deliver a level of energy consumption that is no longer so closely coupled to economic activity. The scale of energy consumption, and the supply sources required to deliver this consumption, remains vast, but the APEC region is increasingly able to do more with less, in an energy sense.

While energy demand and supply growth continues to slow out to 2050, there is a disparity in trends of fuel sources beneath the surface. Electricity use becomes more and more prominent in all sectors of the economy, with this prominence displacing demand for direct fossil fuel consumption. The sources that deliver this electricity are increasingly renewable, and this renewable take-up, which is primarily wind and solar, is driven largely by economics. The economics of renewables in the generation mix is clear, but there are limits to just how prominent renewables become. Natural gas and nuclear are also relied upon, and coal continues to provide an important level of baseload generation for many economies.

The power sector becomes noticeably less carbon intensive even with significant growth in electricity consumption. In contrast, end-use sectors of energy continue to rely on significant levels of fossil fuel consumption. The continually improving intensity of energy use is the most important factor in seeing energy supply moderate and begin to reach a plateau near to 2050. Even without aggressive decarbonisation efforts, this has important implications for medium- to long-term fossil fuel production and exploration activities.

While there is a continued slow transition away from fossil fuels, fossil fuels still account for almost three-quarters of APEC energy supply, albeit with a marked movement away from coal to gas. The modelled pace of change for the Reference scenario means that emissions are only marginally lower in 2050, and are not consistent with international climate commitments such as the Paris Accord.

## References

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