

Outlook for Energy Demand and Supply in APEC

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With 21 economies individually and collectively facing the energy challenges of the early 21st century, the Asia-Pacific Economic Cooperation (APEC) has an opportunity to influence global trends. Three overriding challenges stand out: i) the need to affordably meet growing energy demand associated with population growth and rising incomes; ii) the need to reduce energy-related carbon dioxide (CO₂) emissions in an effort to reduce the environmental impacts of energy production and consumption; and iii) the need to develop and deploy new technologies for energy production and use them to support the first two challenges.

In its sixth edition of the *APEC Energy Demand and Supply Outlook*, the Asia Pacific Energy Research Centre (APEREC) first assesses a Business-as-Usual (BAU) Scenario, examining the potential to meet these challenges if current energy-related trends continue unchanged to the year 2040 (the Outlook period). The results fall far short of the above objectives as well as APEC's energy goals. To address this gap, APEREC modelled three alternative pathways: the Improved Efficiency Scenario to support APEC's energy intensity reduction goal of 45% between 2005 and 2035; the High Renewables Scenario to outline a pathway to double the share of renewables in APEC between 2010 and 2030; and the Alternative Power Mix Scenario which evaluates trade-offs among the use of cleaner coal, gas and nuclear energy in the electricity sector.

Energy demand dominated by growth in China and South East Asia with energy efficiency being the most attractive option to improve energy security and address climate change

Total final energy demand (TFED) in APEC reaches 7 000 million tonnes of oil equivalent (Mtoe) in 2040, rising 32% compared with 2013 levels, with China and South-East Asia being the main drivers of growth. China accounts for more than half of the demand growth, due to its sheer size and continued economic growth. Aggressive, strategic efforts to control energy demand growth over the next decade, however, prove effective and demand flattens after 2030.

Over the Outlook period, energy demand decouples from economic growth as a result of efforts to reduce energy intensity by strengthening energy efficiency policies, implementing conservation measures and shifting economic development. Overall energy demand growth in APEC consequently slows considerably during the Outlook period, with the annual average growth rate (AAGR) falling to 1%—i.e. nearly half the 1990-2013 rate of 1.8%. While promising efforts are made to improve energy efficiency under the BAU Scenario, energy efficiency policies currently in

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place are insufficient to meet the goal of reducing energy intensity by 45% by 2035; this target is achieved in 2037.

The Improved Efficiency Scenario shows that additional measures to implement cost-effective energy efficiency strategies can cause APEC energy demand to peak by 2029 and fall 13% by 2040 (compared with the BAU). These savings reduce overall demand by 921 Mtoe, equal to the combined 2013 consumption of Russia, Japan and Korea. This scenario also demonstrates that the energy intensity target can be achieved earlier—in 2032—suggesting that opportunity exists to push for further reductions. Early actions and concerted efforts on the part of both governments and industry in APEC are vital to this process.

While most APEC economies have introduced policies to advance energy efficiency, the strength of these policies varies greatly, as does the capacity to develop comprehensive programs, enforce regulations and monitor impacts. As a result, the energy efficiency gains achieved through policy intervention also vary greatly across economies. Implementing cost effective energy efficiency options lead to the lowest emissions and highest improvements in energy security.

Despite being the fastest growing energy source, renewables will need further policy support if APEC is to achieve its renewables doubling goal

Renewables represent the fastest-growing energy source over the Outlook period, rising at an AAGR of 2.5%. Their absolute contribution to TFED nearly doubles from 251 Mtoe in 2010 to 457 Mtoe in 2030, but the share only increases from 5.2% in 2010 to 6.7% in 2030, falling short of the doubling target under the BAU. APEC economies will need to intensify the development and deployment of renewables, with governments providing additional incentives and measures to achieve the doubling goal.

The High Renewables Scenario sets out a least-cost pathway to achieve the APEC goal of doubling the share of renewables by 2030, and even surpass these levels by 2040. For successful renewables development in APEC, policy makers will need to provide strong policy direction within a supportive framework. This includes clear near- and long-term targets and strategies, R&D support for promising renewable technologies and strategic public-private co-funding of pilot projects.

Installation of an estimated 1 692 GW of additional renewable generation capacity (i.e. an average of 100 GW per year) is needed to achieve the doubling goal in renewable electricity generation by 2030. While a formidable task, compared with APEC 2015 renewable capacity additions of just over 100 GW, this interim target is in line with current rates of renewable investment in the region. Wind and solar photovoltaic (PV) increase the most, with average annual capacity additions of 62 GW to 2040 providing over 75% of all new renewable capacity.

In transport, improved cultivation practices and use of unutilised agricultural land would lead to an APEC biofuels supply potential of 144 Mtoe by 2040, while biofuels demand rises from 29 Mtoe in 2010 to 87 Mtoe in 2030 and 95 Mtoe by 2040. This achieves the doubling goal, but a mismatch between biofuels supply potential and demand in individual economies becomes evident; thus, APEC policy makers should encourage biofuels trade among APEC economies.

Cleaner coal technologies, higher shares of natural gas and expanded nuclear energy needed to decarbonise power

Despite the rising uptake of renewables, coal remains the leading source of power (41% in 2040) due to rapid growth in electricity demand, particularly in China and South-East Asia. The Alternative Power Mix Scenario evaluates trade-offs among the use of clean coal technologies, higher shares of natural gas and expansion of nuclear energy in APEC's electricity generation mix.

Continued coal use can only be sustained through the uptake of cleaner coal technologies coupled with widespread adoption of carbon capture and storage (CCS), the latter being particularly critical. CCS deployment on all new coal facilities from 2030 could reduce CO₂ emissions by 12% compared with the BAU by 2040, while the use of more efficient coal generation technologies reduces emissions by barely 3%. Economies should focus on improving the economics of CCS projects by coordinating and aligning policies that provide more economic incentives, and by promoting private investment in CCS projects to strengthen their commercial viability.

Substituting all new coal-fired capacity with natural gas (as modelled in the High Gas Cases) would lead to the lowest power sector emissions in 2040 (14% below the BAU). For many APEC economies, however, this would lead to the highest generation costs and result in rising dependence on gas imports. While gas offers an attractive option to support decarbonisation, it should be viewed strictly as a transitional fuel; over the longer term, the CO₂ emissions intensity of gas generation means its emissions would exceed those of cleaner coal with CCS and nuclear.

Expanded use of nuclear energy in APEC results in the lowest generation costs, a decrease of 4% compared with the BAU, while also reducing CO₂ emissions by 10%. The main challenges are in building the additional nuclear capacity required by 2040 and in using this source of energy with sufficiently high safety standards to support economic growth while mitigating the physical hazards to society.

Investment in energy supply required to address energy security concerns

Energy supply production grows across all fuel types (except nuclear) in APEC over the Outlook period. High energy-demand projections, however, result in a regional supply gap of more than 10%, meaning dependence on imports will increase. The continued dependency on fossil fuels in the region poses energy security concerns and raises the question about if and when APEC economies will establish more ambitious policy interventions to pursue a sharp reduction in fossil fuel dependency.

As energy demand in APEC continues to increase, concern grows regarding the need to balance energy supply security and the environmental effects of the chosen energy mix. Even if APEC member economies trade all surplus energy production among themselves, APEC would still need to import 1 140 Mtoe (over 10% of total supply) from outside the region. Thus, in addition to enhancing trade, APEC should pursue further collaboration to expand existing production and transport infrastructure, and to accelerate deployment of renewable and other

low-carbon energy technologies.

Investing in energy supply to meet future demand should also be prioritised across APEC. A total investment of USD 17 trillion to USD 35 trillion is needed for the additional energy system capacity requirements to meet the region's growing demand. Bridging the gap between the investment required and funding available is a huge challenge for most economies, especially developing economies with limited access to affordable capital.

APEC energy targets need to be intensified to meet global climate objectives

Energy-related CO₂ emissions under the BAU reach 25.3 gigatonnes of CO₂ (GtCO₂) in 2040, an increase of 24% over 2013 levels, the result of high energy demand and growing reliance on coal-fired power in many APEC economies. Urgent action is needed to support decarbonisation of the APEC power sector, particularly in Asia where abundant low-cost coal makes it the preferred source. Early transition away from coal will have long-term benefits, particularly in avoiding the 'lock-in' associated with the long (40+ years) lifespan of coal-fired plants.

Technology development continues to play a major role in shaping the energy sector. Dramatically declining costs are making wind and solar PV increasingly competitive with fossil fuels in power generation, while more efficient end-use technologies are helping to lower energy demand.

The APEC targets to reduce energy intensity and double renewables can help curb the growth of energy-related emissions. Neither the Improved Efficiency nor the High Renewables Scenario, however, leads to an overall reduction from current levels. This highlights the need to pursue a combined strategy of energy efficiency improvements and measures to decarbonise the energy supply. Combining both scenarios delivers a 27% reduction in emissions in 2040 (compared with the BAU), at which time total emissions of 18.5 GtCO₂ are actually 9% lower than in 2013. While encouraging, this level of emissions remains more than double the estimated 8 GtCO₂ to 9 GtCO₂ needed in 2050 to achieve the global 2°C goal.

APEC should consider increasing the level of ambition of its existing energy targets and potentially introducing additional targets that could support a more dramatic transformation of the energy sector. Individual APEC economies should monitor and re-evaluate their INDCs, strengthening when possible commitments that will lead to faster decarbonisation of the energy sector.

Writer's Profile

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Joined APERC in 2015. She leads the development of the APEC Energy Demand and Supply Outlook. Prior to joining APERC, she was Head of the Energy Demand Technology Unit at IEA, where she led the IEA's Energy Technology Roadmaps Programme. Joined IEA in 2006, her work has covered technology roadmaps, finance, deployment and innovation, industry and energy efficiency.