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King Abdullah Petroleum Studies and Research Center

Commentary

Building Back Better in Saudi Arabia With Energy Efficiency

September 2021

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Introduction

The first priority for governments in managing the COVID-19 crisis is the health of their citizens. However, the implementation of restrictions on activity necessary for limiting the spread of the disease has caused the greatest global recession since the Great Depression. Many governments are considering how to support citizens' livelihoods and stimulate economies hit hard by the disease.

According to Bloomberg, real gross domestic product (GDP) in Saudi Arabia is expected to fall by around 4.8% in 2020 as part of a global recession due to COVID-19 restrictions. Global energy demand is expected to fall by 6% in 2020, the largest relative decline in 70 years, reducing oil demand and public revenue in the Kingdom (IEA 2020a). Economic stimulus is urgently needed to address this economic damage and bring about an inclusive recovery with employment opportunities.

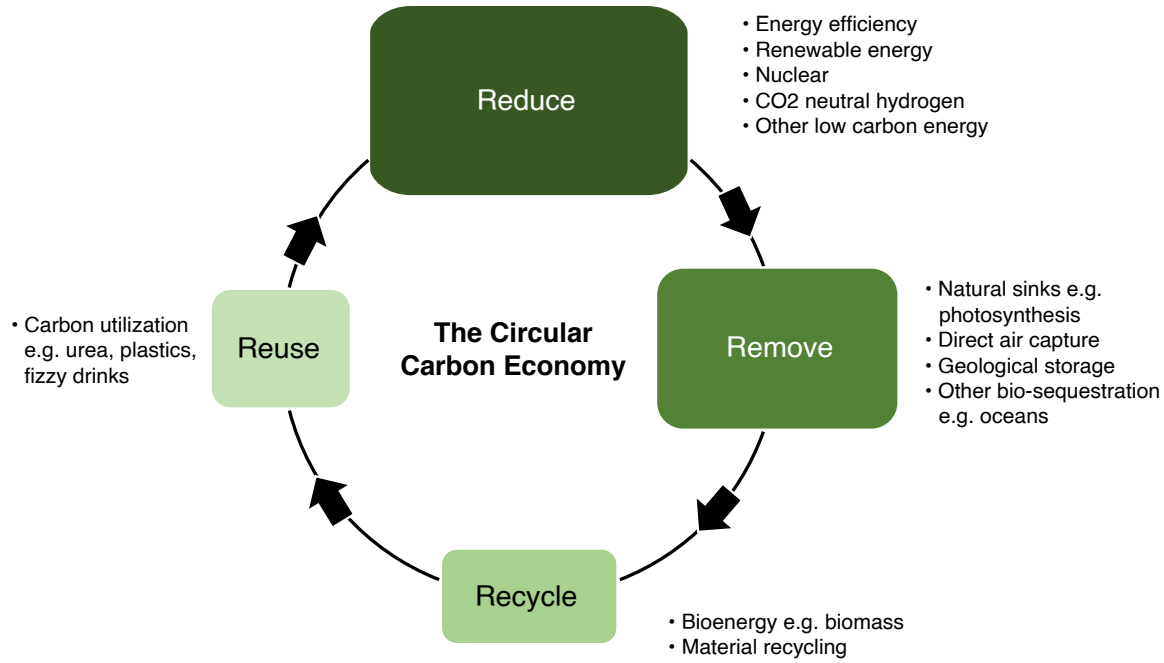
Energy efficiency actions can have a major impact by lifting business activity in the existing workforce and creating new jobs in labor-intensive sectors such as construction, digital technology and retail. Energy efficiency also drives longer-term economic productivity by reducing energy bills and increasing the competitiveness of industry. Energy efficiency also lowers greenhouse gas emissions. The International Energy Agency (IEA) estimates that energy efficiency could deliver up to 40% of the emissions reductions under the Paris Agreement on climate change by 2040 cost effectively and provide between 10-15 jobs for every million dollars of capital investment (IEA 2020a).

In the context of what Saudi Arabia has been calling the 'circular carbon economy' (CCE), energy efficiency falls under the 'reduce' category of the 4Rs: reduce, reuse, recycle, and remove. Reduce represents options that reduce the amount of carbon that is produced and must be managed. Among the CCE initiatives underway or planned in Saudi Arabia, well over half fall into the reduce column, and energy efficiency is one of the most advanced areas (Figure 1).

Energy efficiency can play a strong role in boosting jobs and economic growth in Saudi Arabia as part of COVID-19-related economic stimulus measures

In this commentary, we highlight the strong role that energy efficiency can play in boosting jobs and economic growth in Saudi Arabia as part of COVID-19-related economic stimulus measures. We describe in detail where to invest in energy efficiency in the building and construction, transportation and industrial sectors. This is followed by a summary of key policy priorities that can be implemented as part of short-term stimulus plans and suggestions for scaling up the ambition of longer-term energy efficiency policies and actions. Finally, we identify the benefits for Saudi Arabia from enhanced international cooperation on energy efficiency and the opportunities for joint leadership on strategic issues, such as on cooling, with international partners.

Figure 1. Energy efficiency is a major contributor to the 4Rs in the circular carbon economy.



Source: Authors, based on Williams (2019).

Where to invest in energy efficiency?

The Kingdom has over 35 energy efficiency initiatives, supported by 13 teams targeting Saudi Arabia's primary energy-consuming sectors (SEEC 2020). The Saudi Energy Efficiency Center (SEEC) and its implementation of the Saudi Energy Efficiency Program (SEEP) have facilitated these initiatives. SEEP has focused on the three leading energy-intensive sectors: buildings, transportation and industry, which together account for over 90% of the country's energy consumption.

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Buildings and construction

Energy efficiency opportunities in new and existing buildings and the construction sector often have significant macroeconomic impacts because of their connection to local value chains (IEA 2020b). In Saudi Arabia, there is a large need for new buildings and renovations of existing ones, including investment in housing, schools, hospitals and municipal facilities. Opportunities for energy efficiency improvements include insulation and building fabric, air conditioning (AC), hot water, lighting systems, rooftop solar thermal and photovoltaic systems and district cooling systems, which also provide grid-balancing cold storage.

According to Enerdata, the Kingdom's 2018 total final electricity consumption was 285 terrawatthours (TWh), comprising 41 TWh used for industry (14%), 144 TWh used for residential buildings (51%) and 100 TWh used in the services sector (35%). In an analysis of this data, KAPSARC found that around 85% of

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A full roll out of the SEEC's High-Efficiency AC Program could result in around 33 TWh per year of energy saving and a reduction of 24 million tonnes of CO2 each year

Digitization represents a large opportunity for more efficient energy systems, with the potential to reduce demand from the global buildings sector by 10% by 2040

total final electrical demand (electricity used after transmission and distribution losses) comes from buildings and that the Kingdom also has the world's highest share of air conditioning (AC) in total household electricity consumption at 70% (Howarth, Odnoletkova et al. 2020; Howarth, Al Saud et al. 2020b). Cooling is necessary to ensure quality of life and development in the Kingdom, and it deserves to be a strategically and significantly high priority for the government.

Since 2007, SEEC has increased the minimum energy efficiency rating (EER) for split-type AC units from 7.5 to 11.8, and the EER for window type units from 7.5 to 9.8. This difference in minimum energy performance standard (MEPS) is due to the fact that window units are more inefficient than split systems. Despite being effectively banned in most countries, window units are the most popular residential AC unit sold in Saudi Arabia due to their cheaper upfront costs compared with split units. In 2018, 772,000 window units and 455,000 split systems were sold in the Kingdom, with 63% of the window units used in the residential market (Howarth, Odnoletkova et al. 2020). While sales of split systems have been increasing relative to window units in recent years, accelerating this trend by phasing down new window unit sales through increasing MEPS is one of the highest-impact policies that the Kingdom could take to enhance energy efficiency. Local AC producers such as Zamil could be given support to shift their production lines to more efficient units, and the Saudi Industrial Development Fund could be a useful source of low-interest capital to help finance this shift. This could provide new investment stimulus for the sector in the short term with strong policy coordination.

Now would also be a good time to scale up SEEC's popular High-Efficiency AC Program (HEAC), which offers up to 900 Saudi riyals (SAR) or US$240 for new split systems for up to six units or a total of 5,400 SAR or US$1,440 per household. This program is applied as an instant discount at the point of sale on AC unit prices, increasing the program's appeal for consumers. Scaling up the HEAC program would help stimulate the retail sector, provide construction jobs for AC installation professionals, and reduce electricity bills for consumers. KAPSARC research suggests that if fully rolled out across the entire household stock, this could result in around 33 TWh per year of energy savings and a reduction of 24 million tonnes of carbon dioxide (CO2) each year (Krarti and Howarth 2020). This effort would cost the government approximately US$6 billion but could result in an extra annual income of US$3 billion per year from avoided oil consumption associated with reduced electricity generation due to lower AC energy use.

Digitization also represents a large opportunity for more efficient energy systems, with the potential to reduce demand from the global buildings sector by 10% by 2040 (IEA 2020a). Digitization supports system-wide efficiency by leveraging real-time data and advanced analytical and data processing capabilities to identify efficiency opportunities and capture value. Energy efficiency actions are realized through automation or human intervention. This includes the use of digital systems such as smart thermostats, smart windows, smart appliances, and intelligent and adaptive controls that not only allow the efficient use of energy but increase the grid's flexibility in responding to demand under various conditions, including extreme events such as heatwaves (IEA 2019). The rollout of 5G

technology over the next five to 10 years will reduce the upfront and operational costs of such digital-based solutions.

The focus of the Saudi Electricity Company (SEC) is already shifting from the supply side of generation, transmission and distribution toward demand-side management. For example, the SEC's Smart Metering Project is a core element of the Kingdom's Digital Transformation Strategy and aims to install 10 million smart meters, 35% of which are to be made in Saudi Arabia (SEC 2020).

Digitization also provides opportunities for consumers to better understand their own energy use and improve household or facility efficiency, thus reducing waste and saving energy costs – an especially important factor during an economic recovery (IEA 2020a). For example, KAPSARC research has shown that smart thermostats, when applied to the existing housing stock, have the potential to save 40 TWh per year from buildings and 10 GW of peak demand in electricity use in Saudi Arabia (Krarti et al. 2017; Krarti et al. 2020; Krarti 2020). Creating a smart thermostat program by providing a consumer rebate or the bulk procurement of new systems could help accelerate the digital transformation of energy use.

Implementing building retrofits and smart systems will need an appropriately skilled and trained workforce in construction, information technology, and energy systems management. Demonstration projects can build local capacity and consumer awareness while providing an evidence base for policymaking decisions to scale-up implementation. Mainstreaming energy efficiency in the national housing scheme for first-time homebuyers, Sakani ("my home"), provides such an opportunity to promote a range of energy-efficient design solutions, including district cooling and green spaces.[1]

The construction sector is one of the Kingdom's largest employers, with around 594,691 non-Saudis and 95,138 Saudis working in the sector, according to the 2017 Economic Survey of Institutions. There is considerable potential for employment opportunities for locals in roles such as builders and AC technicians and installers. For example, KAPSARC estimates that the deployment of basic retrofit measures, such as replacing AC units and installing smart thermostats, could create 12,000 new jobs, and over 247,000 jobs could be created annually if a full range of cost-effective deep retrofit measures is implemented (Krarti et al. 2017; Krarti et al. 2020).

Transport

In the transport sector, SEEC has set Corporate Average Fuel Economy (CAFE) standards to improve average fuel efficiency by 3% to 4% annually. Energy efficiency in the transport sector can play an enhanced role as part of stimulus measures to generate new business activity while saving energy. For example, one policy currently under consideration in Saudi Arabia is a 'cash-for-clunkers' program to help incentivize people to exchange old, inefficient cars and trucks for new more efficient models. One of the largest contributors to passenger

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[1] See: https://www.housing.gov.sa/en/initiative/763
https://www.mostadam.sa/home
https://sakani.housing.sa

vehicle fuel efficiency improvements globally has been diesel vehicles (IEA 2020a). In Saudi Arabia diesel is only used for heavy vehicles, so allowing an increase in diesel light duty vehicle imports (LDV), currently around 8% of LDV imports, could promote fuel switching and substantial energy savings. The Kingdom has been working on clean fuel regulations and infrastructure to ensure that any such shift does not come at the cost of declining air quality. Taken together and prioritized in economic stimulus measures, such policies can make a significant contribution to economic recovery and circular carbon economy efforts.

The impact of energy efficiency is much broader than saving energy and money, as it embodies productivity-enhancing technologies and innovation

Industry

One of the significant benefits of energy efficiency is its ability to reduce energy costs. This, in turn, contributes to enhancing resiliency in a crisis and strengthening economic competitiveness when economies emerge from crises. However, the impact of energy efficiency is much broader than saving energy and money, as it embodies productivity-enhancing technologies and innovation, such as digitization.

KAPSARC's research on energy productivity highlights the economic productivity and increasing revenues from energy efficiency as additional benefits to its more widely studied energy and cost savings (KAPSARC-UNESCWA 2017). During Saudi Arabia's 2020 Presidency of the G20 Group of Nations, references to energy productivity were included for the first time in the G20 Energy Minister's Communiqué, reflecting the impact of this work (G20 Saudi Arabia 2020).

For example, upgrading a steel or petrochemical plant will improve its energy efficiency. It will also open up the prospect of producing new, higher-quality materials like more robust steel and better plastics, which are the building blocks of more advanced manufacturing. Energy efficiency goes hand-in-glove with modernization and usually results in increased competitiveness, product value-added and overall revenue.

What is done with the extra revenue that energy efficiency produces is an important consideration. For example, it is likely this increase will lead to more energy-consuming activities – the so-called 'rebound effect' or Jevon's paradox. This is where energy efficiency delivers energy savings and thereby lifts disposable income or profits. Part of this may be spent on activities that result in more energy consumption, which counterbalances the original energy savings. For example, with a more competitive business, the output may increase as firms sell more products, increasing overall energy use.

Understanding this paradox is critical to the question of which policies and technological innovations can drive growth without having a negative environmental impact. It also highlights the importance of low-carbon energy sources such as renewable energy in delivering future energy supply and imposes some qualifications on energy efficiency's role in reducing CO2 emissions while lifting economic growth.

Summary of the key energy efficiency stimulus priority areas for policymakers

As discussed above, significantly scaling up the Kingdom's energy efficiency initiatives and introducing some new ones would support economic activity and give householders a boost to their quality of life and disposable incomes by lowering their energy bills. Leveraging existing program administration, contracts, guidelines and service providers where possible can also give fast scalability (IEA 2020b). In summary, key priority policy mechanisms that can be pursued as part of economic stimulus plans include:

Scaling up the current energy efficiency initiatives and introducing new ones would support economic activity and give householders a boost to their quality of life

- **Scaling up grants and rebates** for energy efficiency actions such as the successful High-Efficiency Air Conditioning Program (HEAC), which provides an instant discount upon purchase for high-efficiency split systems. This could be extended to other appliances, including smart sensors in homes and businesses. Even encouraging the replacement of old tires on cars could improve fuel efficiency.

- **Government auctions** of new projects in the construction sector, which provide builders, developers and utilities with additional revenue streams for enhancing energy efficiency actions at scale. Examples include companies partnering with the National Housing Program Delivery Plan.

- **Introducing 'cash-for-clunkers' programs,** such as grants for efficient cars. These programs can be pursued quickly and at scale and have a strong economic impact. Extending the HEAC program with a provision to decommission old, inefficient window units could also have a large and fast impact. This could be expanded to other appliances such as refrigerators. It is important old technology is taken out of the market as part of modernization efforts, in addition to the purchase of new, more efficient equipment.

- **Programs delivered by energy utilities** can be enhanced by supporting providers such as the Saudi Electricity Company that already have direct roles in delivering energy efficiency upgrades. Such programs include implementing the Kingdom's Smart Grid Strategy and efficient street lighting program.

- **Bulk procurement** from government through the public super energy service company (ESCO) or buyer clubs in private business could increase retail activity and bring down the cost of new equipment.

Scaling up the ambition of energy efficiency policies

The future is almost certainly going to be one where more, not less, energy is consumed. For example, under current policies the IEA expects global final energy consumption to increase from 10 billion tonnes of oil equivalent (Btoe) in 2018 to 12.7 Btoe by 2040, an increase of around 1.1% per year. Global energy intensity improves at a rate of 2.3% per year under this scenario, while the global population increases by around 20% to 9.1 billion, total building floor area increases by around 50%, the ownership of ACs triples, industrial value added increases by 70%, and around 66% more passenger car kilometers are driven and freight increases by 80%.

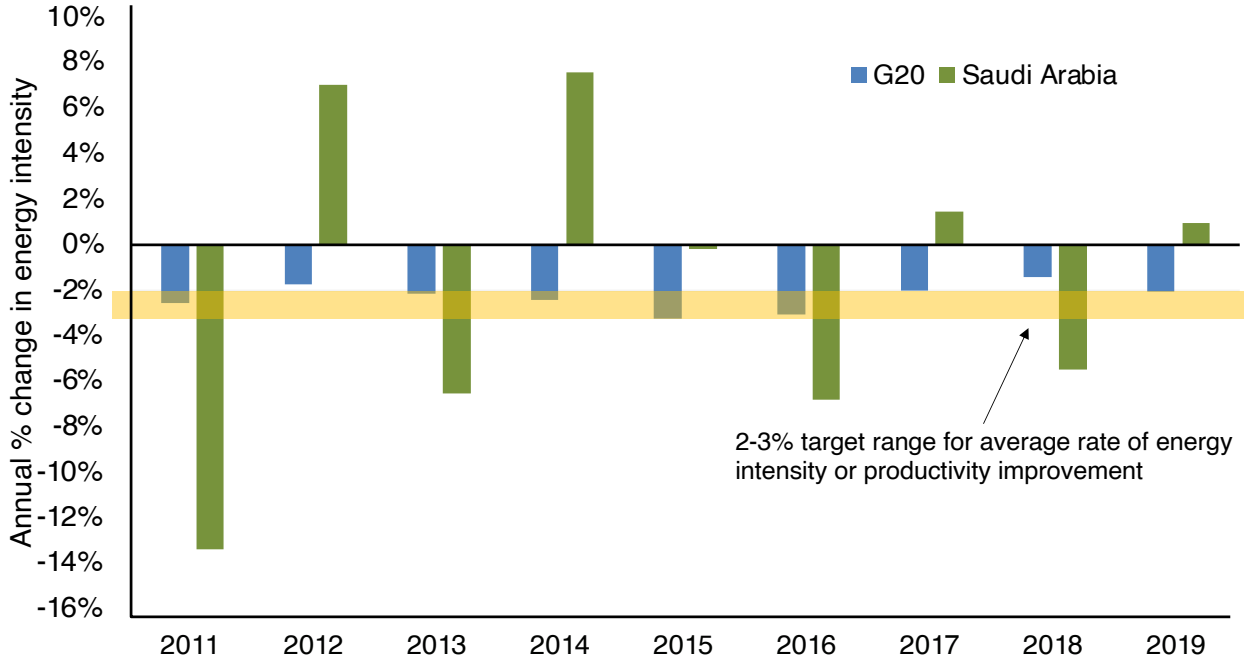
The Kingdom does not have a national energy intensity or productivity target despite having a large number of other public economic and energy targets

The challenge is how to make this sustainable from a climate change and resource perspective. Increasing the annual rate of improvement in energy intensity, or its inverse, energy productivity, is one of the most important factors. This is driven by the level of energy efficiency of the economy and the relative size of energy-intensive industry versus higher-value, less energy-intensive services.

Target setting is an important tool that can be used to foster enhanced energy efficiency. For example, between 2015 and 2020 the SEEC set the industrial sector a target to improve energy intensity by around 1% each year. The second cycle of this program runs from 2020 to 2025 and has scheduled energy intensity improvement targets of 3.2% for steel, 4.7% for cement and 7% for petrochemicals, compared with a 2018 baseline.

Outside of the industrial sector, the Kingdom does not have a national energy intensity or productivity target despite having a large number of other public economic and energy targets. KAPSARC research has reviewed the use of such national energy intensity or productivity targets globally. An achievable but strong annual improvement target of 2% to 3% for the Kingdom would send a strong signal regarding the government's commitment (Figure 2) (KAPSARC-UNESCWA, 2017).

Figure 2. Annual improvement in energy intensity in G20 countries and Saudi Arabia.



Source: Enerdata Global Energy and CO2 database.

Note: energy intensity = total primary energy demand divided by GDP in constant 2015 purchasing power parity terms. Negative numbers denote an improvement. Date accessed: June 11, 2020.

Two primary drivers work together to bring about improvements in energy efficiency: strong energy efficiency regulations and energy prices. Saudi Arabia has supported these policies by making equally important changes in policy governance via a more consultative and whole-of-government approach to energy efficiency.

Two primary drivers work together to bring about improvements in energy efficiency: strong energy efficiency regulations and energy prices

Improving regulations in Saudi Arabia have seen Minimum Energy Performance Standards lifted for most appliances. Moving forward, the government could consider stronger actions, including phasing out the most inefficient technologies while accelerating the adoption of the best available technologies (BAT). For example, SEEP is currently working on developing the Seasonal Energy Efficiency Ratio (SEER) standard for small capacity ACs (split and window ACs). After a full-implementation period of the SEER standard, MEPS will gradually be raised, partially phasing out inefficient technologies. Regulations based on BAT, regularly updated based on each product's innovation cycle, could help close the gap between what is technically possible and what is actually achieved on energy efficiency.

Regulations governing the digital transition in the energy sector, such as the interoperability of communication protocols, cybersecurity and data privacy, can also have a major impact on enabling energy efficiency. For instance, the use of open interoperability protocols such as ISO/IEC 21823 is essential to ensure that smart devices, such as thermostats, can be deployed in any country. Cybersecurity safeguards are also necessary elements of energy security in the digital age.

The development of energy efficiency markets also requires more to be done to facilitate the availability of accurate and transparent data for energy demand and supply. This requirement includes hourly power generation data and energy efficiency metrics such as specific fuel consumption from major industrial processes. Such data allows energy service companies (ESCOs) to better assess market opportunities for energy efficiency, demand responses and demand-side management. Associated with this, opening up the vertically integrated and administered electricity market could enable small and medium firms to come forward with innovative solutions.

The development of energy efficiency markets requires more to be done to facilitate the availability of accurate and transparent data for energy demand and supply

The super ESCO model, where the government acts as a bulk purchaser of energy-efficient solutions such as lighting and air-conditioning, has proven to lower the costs of energy efficiency. For example, public procurement strategies have been successfully deployed in India through the government agency Energy Efficiency Services Limited. This approach was initiated with the promotion of LED bulbs, which helped lower the price of an LED bulb from US$5 to 60 cents in only two years and made LED bulbs the preferred lighting option in India (Kamat et al. 2020).

In 2017 India issued its first public procurement of super-efficient air conditioners for a US$68 million bulk purchase, with a 30% price reduction for the most energy-efficient room AC available. In 2019 a bulk procurement for room ACs resulted in equipment that was 40% more efficient and 30% cheaper (Howarth, Al Saud et al. 2020b). With the support of the World Bank, such

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approaches are now underway in Saudi Arabia and could be further scaled up as part of a COVID-19 recovery package.

The need to enhance international cooperation

International cooperation on energy efficiency is difficult due to its fragmented nature, spanning every sector of the energy economy, diverse technologies and a wide range of cross-cutting themes. Different geographies often have their energy efficiency initiatives facilitated by an international organization, a multilateral development bank, or a non-government organization. Energy efficiency also suffers from a lack of adequate baseline data, which is expensive to collect as it needs to be detailed and specific in order to inform policy.

The contrast of this with, say, the International Renewable Energy Agency based in Abu Dhabi, which has a clear scope and mandate, is obvious. There is no equivalent international energy efficiency agency, despite the fact energy efficiency could offer even more significant short-term benefits for CO2 mitigation and economic development than renewable energy. This situation needs to be addressed.

At the end of 2019, the energy efficiency industry's main body, the International Partnership for Energy Efficiency Cooperation (IPEEC), was disbanded and reborn as the Global Energy Efficiency Hub, hosted by the IEA. The Hub has 16 founding members: Argentina, Australia, Brazil, Canada, China, Denmark, European Commission, France, Germany, Japan, Korea, Luxembourg, Russia, Saudi Arabia, the United Kingdom, and the United States.

The Global Energy Efficiency Hub is supported by the Global Commission for Urgent Action on Energy Efficiency, formed in June 2019 and also hosted by the IEA. The Commission currently has 23 members and is composed of national leaders, current and former ministers, top business executives, and global thought leaders. Such initiatives are critically important if energy efficiency is to deliver on its potential.

Space cooling deserves special attention because it is the fastest-growing energy end use globally and represents 12% of the world's energy saving potential from energy efficiency (IEA 2020a). This issue and the need for enhanced international cooperation on cooling was highlighted as part of the Think 20 Saudi Arabia (Howarth, Al Saud et al. 2020b) and was incorporated into the recommendations for the G20 to consider in the G20 Circular Carbon Economy Guide (IEA 2020a). With Saudi Arabia being the third-largest consumer of electricity for AC in the G20 after the United States and China, despite representing only around 1% of the G20's population, cooling is an obvious area of strategic interest. There is significant scope to strengthen international cooperation on this issue, such as through the fast ratification of the Kigali Amendment to the Montreal Protocol. The Kingdom also has an opportunity to play a leading role on this topic at the G20 and UNFCCC levels, such as at COP26 in the United Kingdom in 2021.

COVID-19 is reshaping the world by increasing the awareness of the link between the natural world and our vulnerability to exogenous shocks. The world needs an institution, such as the Energy Efficiency Hub, supported by strong engagement from countries like Saudi Arabia, to lift its collective ambition on energy efficiency, support effective international cooperation, and help achieve policies that support genuinely sustainable growth.

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About the project

Energy productivity is a paradigm for evaluating energy policy increasingly being used by G20 governments and leading companies looking to maximize the value created from energy use. At the most basic level it involves using metrics, such as energy intensity, to measure and manage the relationship between economic growth and energy consumption. For Saudi Arabia, increasing the value created from each unit of energy consumed can help to achieve the Kingdom's Vision 2030 objectives. It can also help the country address climate change and make progress toward the United Nations' Sustainable Development Goals.

A common problem facing governments is that different elements of energy policy, such as conventional power, renewable energy, energy efficiency and industrial strategy, are often pursued in isolation or compete with one another for attention. Energy productivity can also be used as strategic policy framework to help integrate these issues for better whole-of-government decisions. It does this by focusing on minimizing the costs of providing energy services while maximizing the benefits of energy consumption.

About KAPSARC

The King Abdullah Petroleum Studies and Research Center (KAPSARC) is a non-profit global institution dedicated to independent research into energy economics, policy, technology and the environment, across all types of energy. KAPSARC's mandate is to advance the understanding of energy challenges and opportunities facing the world today and tomorrow, through unbiased, independent, and high-caliber research for the benefit of society. KAPSARC is located in Riyadh, Saudi Arabia.

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