

# Energy Productivity as a New Growth Model for GCC Countries

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## **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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## **Acknowledgement**

This paper has been prepared as part of the joint KAPSARC-UNESCWA project 'Energy Productivity in the GCC' and we would like to thank our UNESCWA Colleagues for much helpful input and advice. It is a paper which will be used as input to a joint report on improving energy productivity in the GCC region.

# Key Points

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**F**ollowing the collapse in oil prices, Gulf Cooperation Council (GCC) countries have intensified efforts to find a new growth model which increases the welfare of their citizens, while reducing exposure to volatile energy markets. This paper argues that placing energy productivity at the heart of such a new growth paradigm offers a compelling path forward to strengthen economic diversification, energy efficiency and innovation efforts. Key findings of this paper include:

Setting national energy productivity targets would provide a powerful signal on the future direction of government policies and increase transparency to monitor and evaluate progress. Clear, shared goals can also act as a helpful coordinating instrument between different stakeholders.

Evidence suggests that greater economic value and per capita income is possible along a high-energy productivity growth pathway. Higher energy productivity can help address the Gulf's "energy paradox" of the current growth model driving higher energy consumption as a proportion of energy production, while relying on energy export revenues for public investment and spending to support growth.

Many advanced economies show strong evidence of having successfully decoupled economic growth from energy consumption along a high-energy productivity pathway. GCC countries exhibit this trait only weakly, if at all.

Setting energy productivity goals could constitute a regionally appropriate form of "green growth" and also strengthen GCC engagement with various international processes such as the UNFCCC and G-20 initiatives on energy and the environment.

# Summary

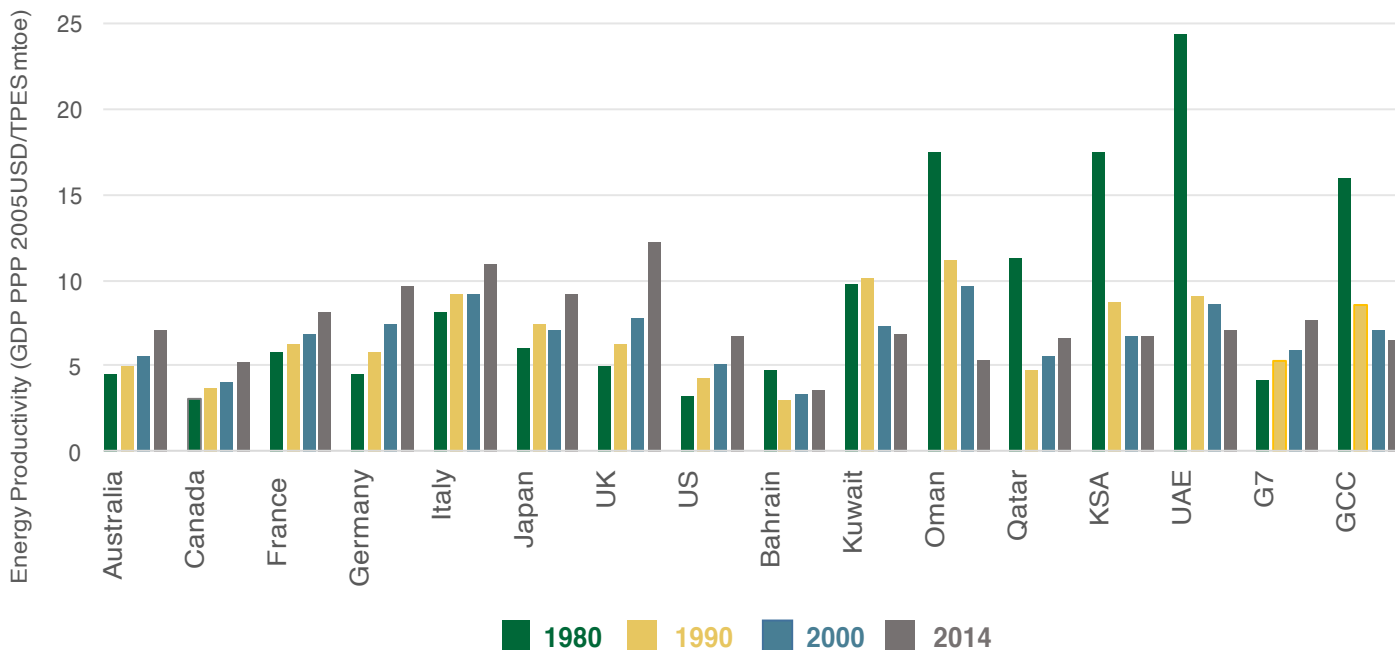
The first decade of the 21st century was a time of unprecedented economic growth. The world got richer, and the countries that make up the GCC raced ahead off the back of a commodities super-cycle and booming government revenues.

With the financial crisis of 2008 came the fall. Today, with China slowing, low energy prices and weak economic demand, governments around the world are confronting the reality that the growth models of the past were built on shaky, and in many cases, debt laden foundations.

Of the three main growth tools available to policymakers – monetary policy, fiscal policy and structural reform – cash-strapped governments have

over relied on their central banks. While productivity has long been recognized as the foundation of economic growth, we have heard a lot less about the structural reform needed to drive it than perhaps we should.

This paper makes the case for placing energy productivity at the center of economic development strategy in GCC countries. With energy such a vital resource in the region, energy productivity provides a natural measure of how well an economy is doing at utilizing the energy it consumes, focusing on gross domestic product (GDP) growth, economic diversification, innovation and energy efficiency. It thus captures a significant part of the economic reform agenda in the GCC.



**Figure 1.** Energy productivity in the GCC compared with selected advanced economies.

Source: KAPSARC analysis based on IEA and Enerdata.

At the macroeconomic level, energy productivity describes how much value (generally measured in GDP) can be produced using an amount of energy (generally measured in tons of oil equivalent (toe)). It is thus a reflection of both what activities are undertaken in the economy (degree of structural diversification) as well as how energy is used (energy efficiency). It thus goes beyond energy efficiency to focus on the optimization of energy use in generating income and economic value.

A simple comparison of energy productivity in the GCC with a selection of advanced economies shows several important trends and features. First, over recent decades the energy productivity of advanced economies has improved, whereas in the GCC it has been on a falling trend, except in Bahrain and Qatar where it has risen. In 1980 energy productivity was high in the GCC, reflecting the high level of GDP (consistent with the strong oil revenues of the era) and low domestic energy consumption reflecting the relatively immature stage of economic development at the time.

Following the collapse in oil prices of the 1980s, government revenue and GDP fell, bringing down energy productivity from these high levels. In the 1990s, the region slowly recovered through a program of economic development, which sought to improve its resilience to swings in the oil market through economic diversification. In the first part of this century, the resurgence in oil prices and government revenue allowed for ambitious spending programs and brought great advancements in infrastructure and human development.

Following the recent volatility in oil prices, concerns have once again resurfaced about

the region's over reliance on oil and gas for its economic development. Diversification and energy efficiency policies have assumed a new urgency, as governments carefully evaluate the fiscal sustainability of existing growth models.

The evidence from an international Kuznets curve analysis conducted for this paper suggests that greater economic value and per capita income is possible along a high-energy productivity growth pathway. While many advanced economies show strong evidence of having successfully decoupled economic growth from energy consumption along a high-energy productivity pathway, GCC countries exhibit this trait only weakly, if at all.

This paper argues that setting national energy productivity targets would offer a powerful political narrative to amplify and extend existing efforts in the policy arenas of economic diversification, energy efficiency and innovation. Setting targets would also provide greater transparency around monitoring and evaluating progress against such goals. National targets can also be used as a coordinating instrument for institutions with shared goals.

A focus on energy productivity could also strengthen GCC engagement with various international processes. For example, a focused strategy on energy productivity could constitute a regionally appropriate direction for “Green Growth” and “Green Investment.” It would also align naturally with goals in GCC countries Intended Nationally Determined Contributions under the Paris Accord on climate change, as well as initiatives within the G-20 Energy Working Group process.

# Energy Productivity as a New Growth Model for the GCC

Over the last 40 years, the dominant economic model in GCC countries was to rely on the region's great endowment of oil and gas resources. A low cost of production has provided an abundant and cheap source of energy to fuel the domestic economy. Oil and gas production is also the main source of export and fiscal revenues for GCC countries. These revenues have facilitated government-led growth strategies making the GCC one of the fastest growing regions in the world.

Development strategies centered on ambitious public investments in infrastructure and real estate, as well as on education and health. Income from the region's oil wealth was distributed to citizens through many channels including very low domestic energy prices for electricity, transport fuel and feedstock to industry, through an expansion of public sector employment and direct transfers. Any leftovers were invested in either Sovereign Wealth Funds (SWFs) or held by central banks.

This strategy has been successful in transferring nations' wealth from natural capital (oil under the ground) into human (increasing levels of education), physical (infrastructure) and financial (money in the bank) capital. Unambiguously, oil has been a great blessing for the region and the welfare of its citizens has risen considerably from its development and use. For example, the region has exhibited substantial improvements in per capita income as well as improved measures for the prevention of infant mortality, education and life expectancy among other indicators of human progress.

However, the recent collapse in oil prices has exposed long-held concerns with this growth model. Much of the recent expansion in GDP was driven by high oil prices and the boost this gave to

government revenues. The underlying structural concern has been weak or declining productivity growth in the economy, with only Saudi Arabia experiencing slightly positive total factor productivity (TFP) growth in the non-oil sector (IMF, 2014a).

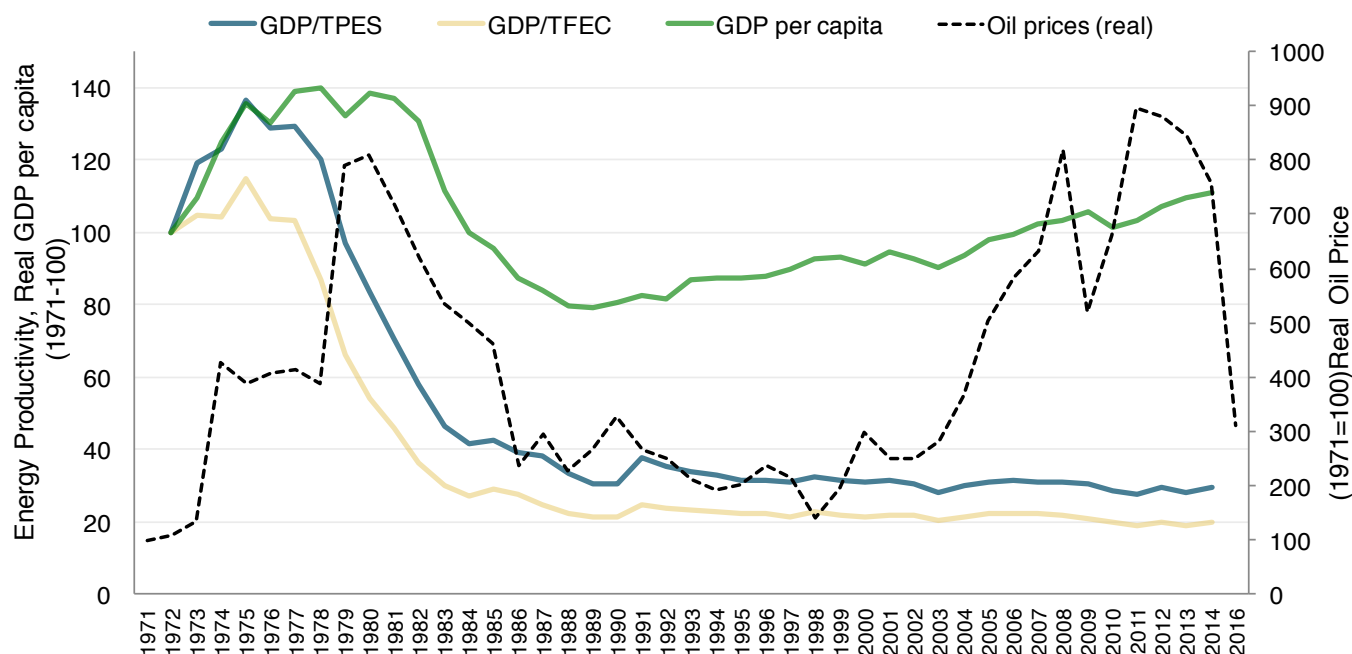
Memories were triggered of the long decline in per capita incomes associated with the collapse in oil prices in the 1980s (Figure 2). During this period, declining fiscal spending and increasing public debt contributed to per capita income falling on average by more than 30 percent from its early 1980s peak, returning only to this level in the late 2000s as oil prices recovered

Now in the face of falling government revenues, attention is again shifting to productivity as the main strategy to achieve sustainable higher incomes for GCC citizens for the long term. With energy playing such an important role in the economy, it is only natural that energy productivity assumes a key part of this general focus on economic productivity.

Indeed, since 2013 there have been significant policy moves to look "beyond barrels" for a source of growth and to decouple energy consumption from per capita income growth.

For example, in a landmark speech on this issue at the 2015 UAE Government Summit, His Highness Sheikh Mohamed bin Zayed of the United Arab Emirates posed the question: "In 50 years when we might have the last barrel of oil, the question is: when it is shipped abroad, will we be sad? If we are investing today in the right sectors, I can tell you, we will celebrate that moment."

To take another example from the region's largest economy, Saudi Arabia, plans are under discussion to bring energy intensity (the inverse of energy productivity) in line with G7 nations by 2020.



**Figure 2.** Energy Productivity and Real Per Capita GDP Index 1971-2014 – GCC Countries.

Source: IEA, Enerdata, UNSTAT (TPES = Total Primary Energy Consumption, TFEC = Total Final Energy Consumption, GDP = 2005USDPPP).

As part of this, the aspiration is to make energy efficiency savings that are equivalent to 37GW of new capacity by 2032 (BMI Research 2016).

Such visions of the future are also reflected in Saudi Arabia’s Intended Nationally Determined Contribution made at the 21st Conference of the Parties to the UNFCCC in Paris in December 2015. In this, two visions for the future of economic growth are given:

An economic growth model involving accelerated industrialization to energy intensive sectors such as petrochemicals, steel, aluminum and cement based on Saudi Arabia’s competitive advantage in low cost energy. This would see a rising share of domestic energy consumption in total energy production and declining oil exports.

A growth model that sees substantial diversification into non-energy related sectors such as financial services, medical services, tourism, education, renewable energy and energy efficiency to drive economic growth. This model has the Kingdom continuing to export significant amounts of oil, with export revenues channeled into these high value-added sectors.

These two visions of growth clearly exemplify the energy productivity choice that policymakers in the region confront. On the one hand, exploiting the region’s substantial comparative advantage from access to low cost energy resources and the movement up the value-chain into higher value-added, albeit energy intensive industry; and on the other hand, moving toward a stronger form of diversification into lower energy intensive service sectors and renewable energy.

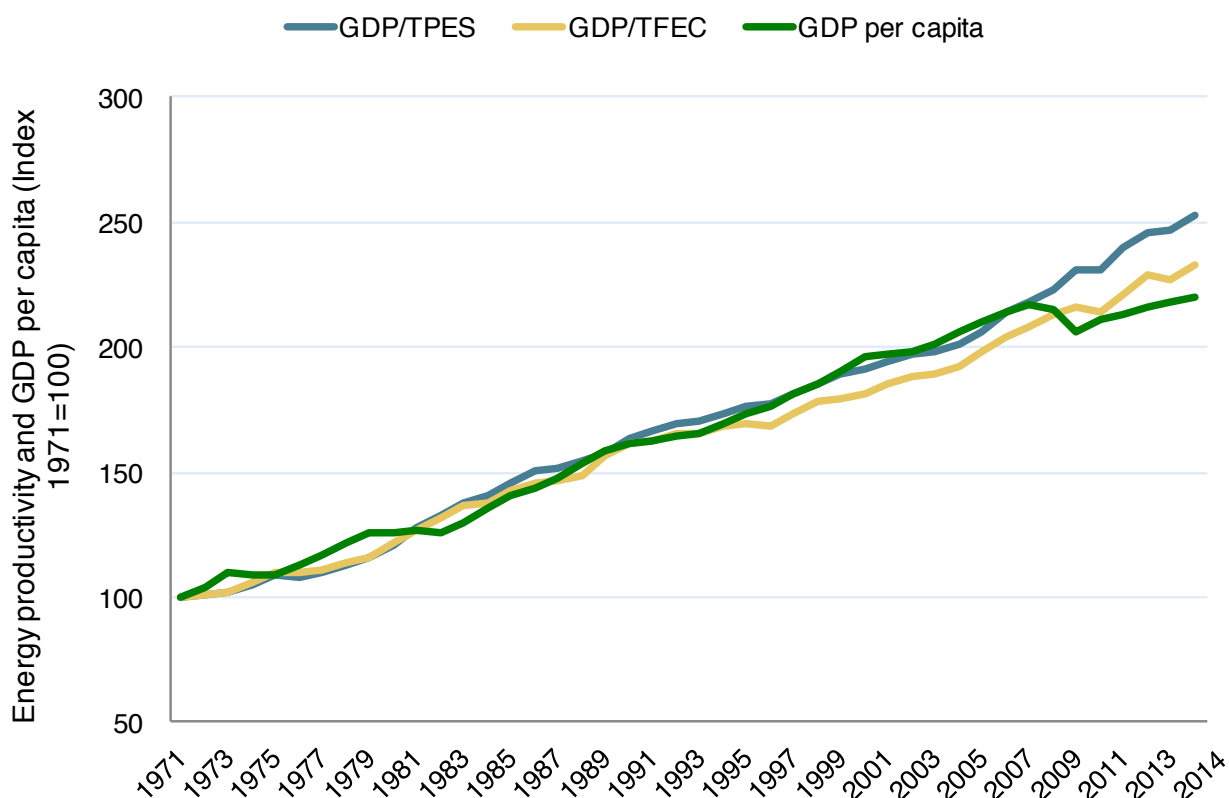
## Energy Productivity as a New Growth Model for the GCC

In the former, oil production is diverted to domestic consumption; and in the later, government revenues from oil production are maintained. The assumption in the INDC is that growth from the latter strategy will be higher than by following an energy intensive development path. This issue was explored by KAPSARC, and is supported by findings from the development and application of an overlapping generations general equilibrium model of the economy in the context of increased domestic energy efficiency at the macroeconomic level (Gonand, in progress). This work highlights the contribution that raising energy efficiency can play in avoiding domestic energy consumption, thus lifting the amount of oil available for export, for alternative

domestic uses, or to be kept in the ground for future use. If sold internationally, this extra oil can earn the government significant extra revenues and be used to support investment and economic growth.

In Figure 3, we show a selection of advanced economies including Australia, Canada, France, Germany, Italy, Japan, U.K. and U.S. as a useful counterpoint to evaluate the type of growth experienced in the GCC and illustrated in Figure 2.

For advanced economies, in almost all years, per capita incomes and energy productivity are rising at almost the same rate. This compares with the relationship in the GCC where GDP per capita rises



**Figure 3.** Energy Productivity and Real Per Capita GDP Index 1971-2014 – Selected Advanced Countries.

Source: IEA, Enerdata, UNSTAT (TPES = Total Primary Energy Consumption, TFEC = Total Final Energy Consumption, GDP = 2005USDPPP).



independently of energy productivity, suggesting growth is being achieved, but at an expensive rate in terms of energy.

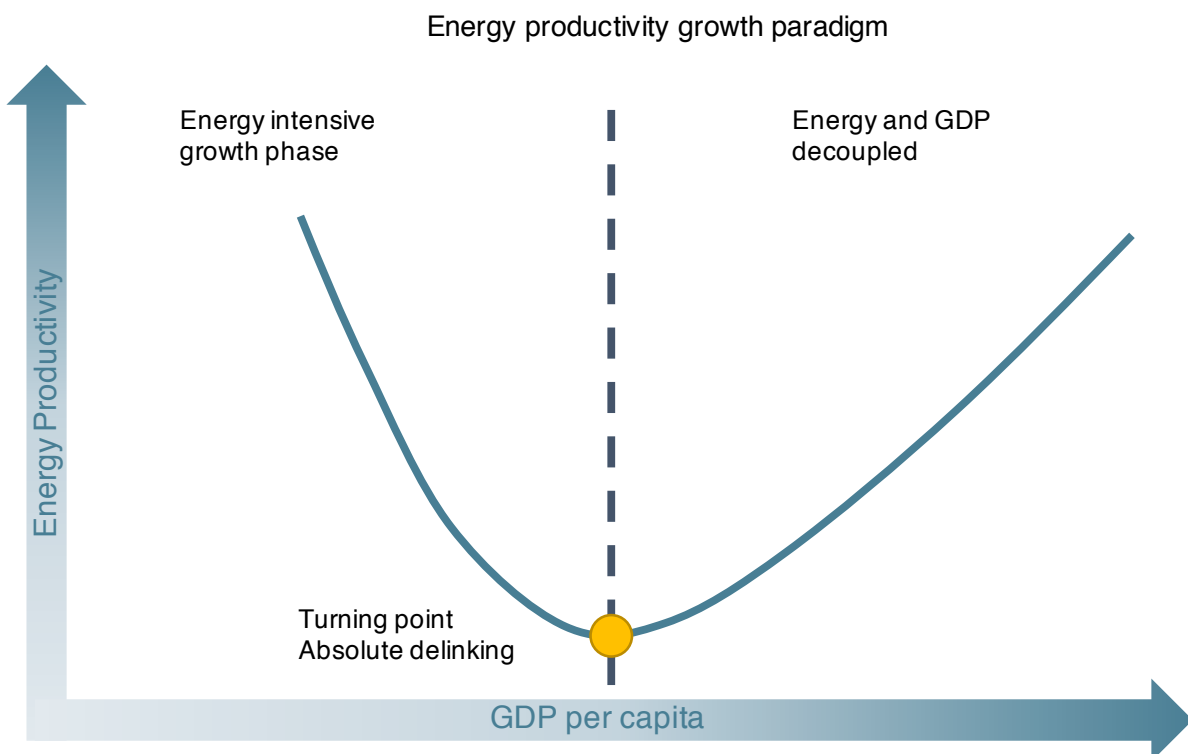
In the later years, the effect of the 2008 economic crisis is clearly visible on per capita income. This shows that, while briefly slowed, the upward trend in energy productivity has continued, while per capita GDP growth has taken longer to recover to 2008 levels.

KAPSARC analysis has explored these trends in greater depth through an empirical assessment of the theory of energy productivity Kuznets curves (Figure 4).

The hypothesis is that at early stages of economic development, energy productivity may be very high reflecting the fact that while the economy may be small, energy consumption is also very low due to low levels of income and industrialization.

As the economy grows, per capita energy consumption increases along with the installation of new infrastructure and industrialization. This is an energy intensive process and our theory suggests that we should expect energy productivity to decline during this period.

As the economy matures and diversifies, moving up the value chain of production into a wider range



**Figure 4.** Energy productivity Kuznets curve.

Source: KAPSARC.

of sectors including advanced manufacturing and services, we expect the level of energy consumption per unit of GDP to start to decline as per capita incomes go up and energy productivity enters a phase where it rises with per capita incomes.

Policy is also an important driver of this hypothetical Kuznets curve behavior. As incomes rise, we can expect the quality of economic governance to improve as a wider range of social services are demanded by citizens. These could include education, health and environmental considerations. Such concerns are also likely to lead to stronger policies around energy efficiency, which boost energy productivity as well as a range of other socio-economic indicators of progress.

Empirically, higher GDP per capita and lower economic volatility have been shown to be strongly and positively associated with diversification of output and exports in low and middle income countries (Papageorgiou and Spatafora 2012). Diversification in output and exports make up the structural transformation of the economy in a dynamic reallocation of resources from less productive to more productive sectors and activities (IMF 2014).

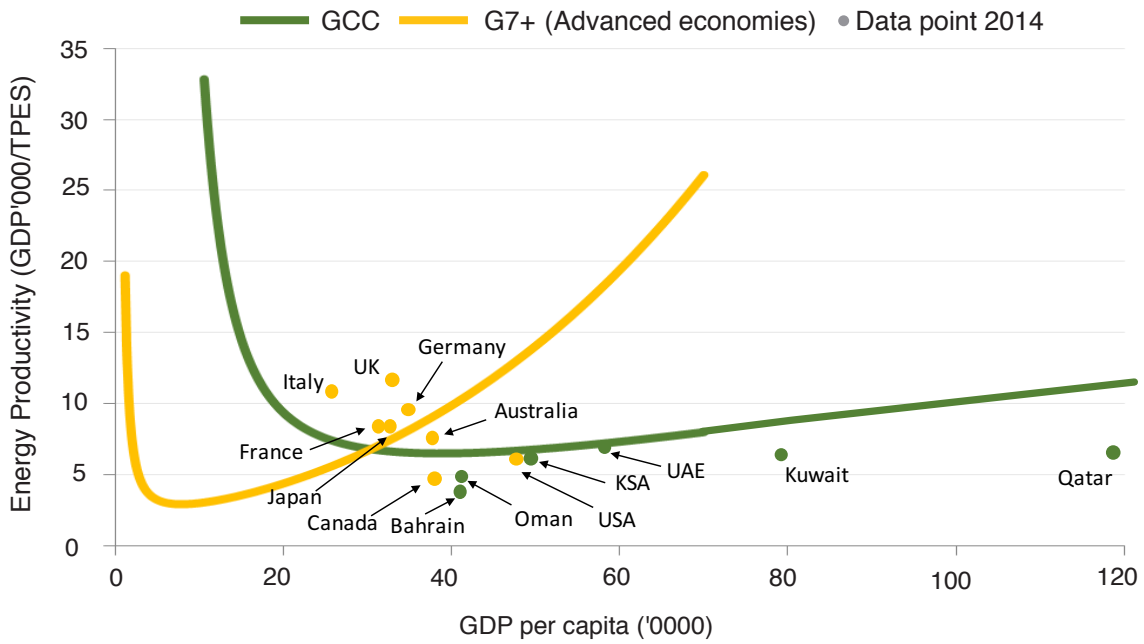
Typically, this transformation first involves a reallocation from agriculture and natural resources toward higher value-added manufacturing. The latter has more potential for improvements in productivity and the upgrading of quality, which drives the increasing value of output. As countries become wealthier and reach advanced economy status their level of diversification may also decline as they become specialized in high value-added products and services (Cadot, Carrere and Strass-Kahn 2011). Thus the contribution of diversification to rising energy productivity may have a limit and can be seen to evolve along with the increasing sophistication of the economy.

Exports are also often seen as a key channel for achieving productivity improvements by helping drive producers up the value chain and into new, more efficient, technologies and the application of knowledge in order to compete in global markets (Lall 2000, Santos-Paullino 2010). This suggests that energy productivity strategies should also be outward looking, building on key competitive advantages to foster a robust export sector.

KAPSARC research has empirically tested the energy productivity Kuznets curve hypothesis through an international comparison of GCC and selected advanced countries (Galeotti, Howarth and Lanza, in progress). The estimated energy productivity Kuznets curves from this work are shown in Figures 5, 6 and 7. The group of advanced economies show strong evidence of having successfully decoupled economic growth from energy consumption (increasing energy productivity) – even as per capita incomes rose. GCC countries, by contrast, exhibit this trait only weakly, if at all. This result implies that while the advanced group of countries have achieved a high-energy productivity growth path, this is yet to emerge in GCC countries.

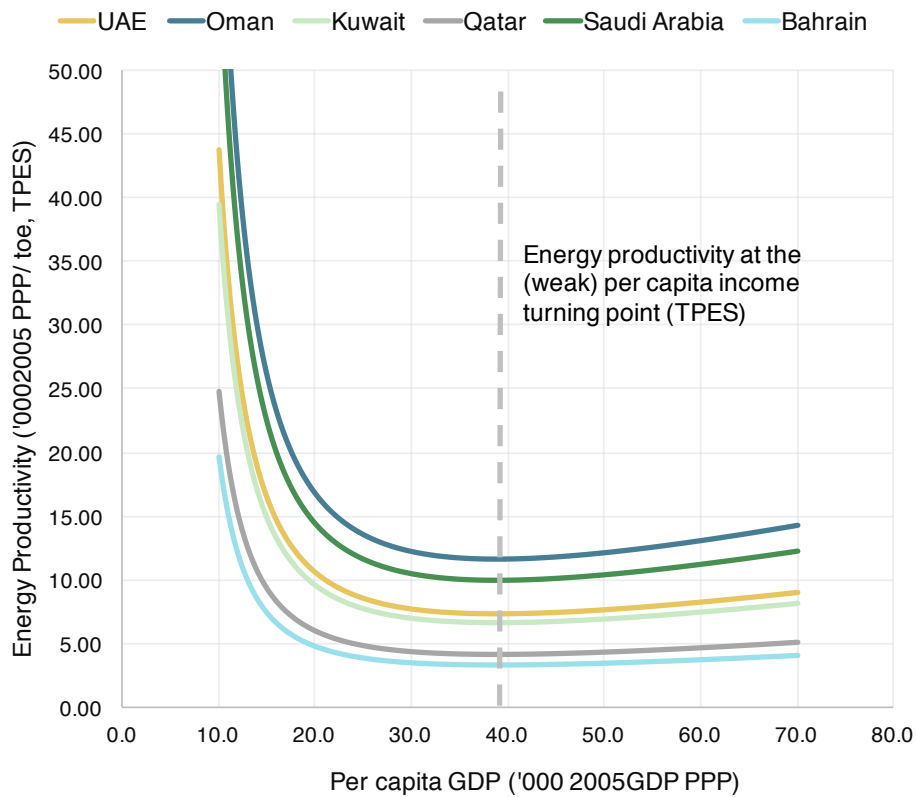
This analysis also shows the heterogeneity between countries, with Oman, Saudi Arabia and the UAE the leaders in terms of stabilizing energy productivity at higher levels of GDP per capita relative to Kuwait, Qatar and Bahrain.

It is important to compare these results with Figure 1, which shows the direction of recent change as well as the general level based on historical data. For Oman, the trend has been a movement from high-energy productivity toward lower energy productivity growth as they move strongly into energy intensive industry, whereas in the UAE and Saudi Arabia the recent trend has been toward higher energy productivity.



**Figure 5.** Energy productivity Kuznets curve for GCC and G7+ countries.

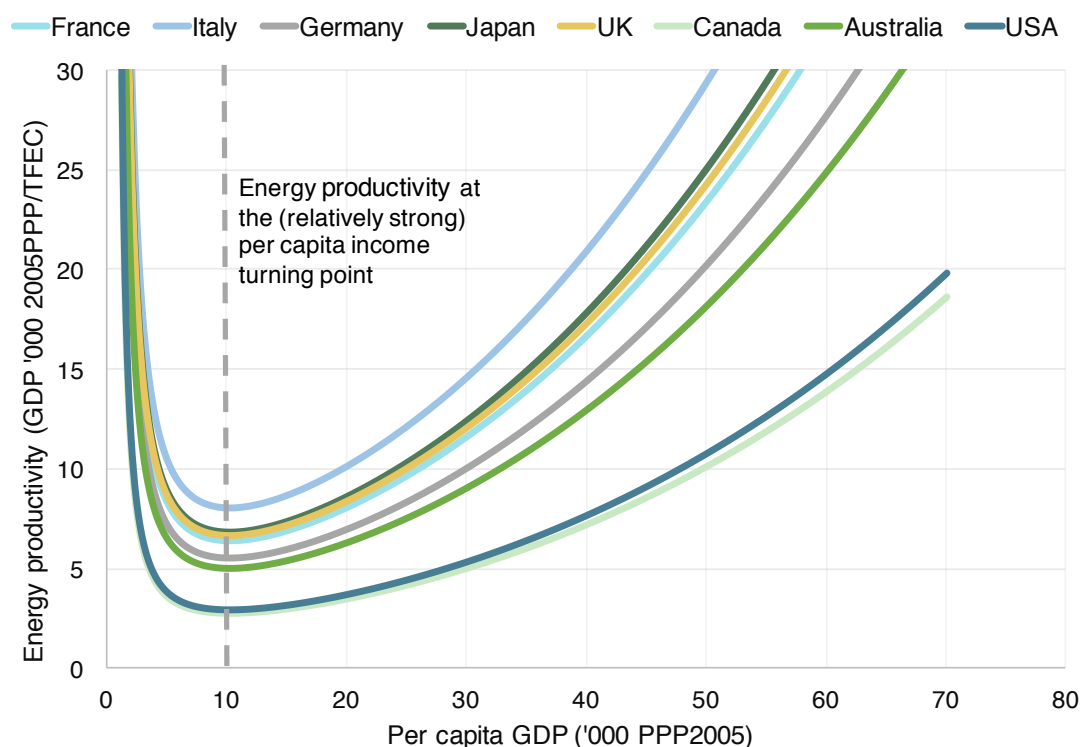
Source: Galeotti, Howarth and Lanza, in progress.



**Figure 6.** Energy productivity Kuznets curve for individual GCC countries (TPES).

Source: Galeotti, Howarth and Lanza, in progress.

## Energy productivity as a new growth model for the GCC



**Figure 7.** Energy productivity Kuznets individual curves for G7+ countries (TPES).

Source: Galeotti, Howarth and Lanza, in progress.

Within the advanced group of countries the leaders are Italy, Japan, U.K., France, Germany and Australia, while U.S. and Canada exhibit a lower energy productivity growth path.

It is interesting to note that both the U.S. and Australia have set national energy productivity goals:

- U.S. has an objective to double energy productivity by 2030 relative to 2010.
- Australia has a target to increase energy productivity by 40 percent relative to 2015.

This difference in target can be understood through the relative position of the Kuznets curves for each country. Those countries on a lower energy productivity growth trajectory are likely to find it easier to improve than those on a higher trajectory. This is because there is more scope to make energy productivity boosting structural changes, or make

large efficiency improvements through the adoption of new technologies. They are further from the “efficiency frontier.”

By applying a similar logic we argue that there is greater scope within the GCC to improve the trajectory of economic growth per capita and energy productivity through the setting of nationally appropriate energy productivity targets.

Of course, national energy productivity targets must be complemented by a suite of policies and economic reforms at the national, sector and sub-sector level. The development of such a strategy has been identified as a priority by the United Nations Economic and Social Commission for Western Asia (UNESCWA) and the King Abdullah Petroleum Studies and Research Center (KAPSARC). Indeed, this paper forms part of a wider project aimed at developing detailed sectoral tool kits for such a strategy.

# Beyond the Gulf's Domestic Energy Demand Paradox

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**T**he conclusion we may take from this analysis is that a transition to higher energy productivity is possible in the GCC but, based on historical data, we do not yet see the emergence of such a transition.

Here we must draw attention to the fact that in recent years oil prices have fallen from well over \$100 per barrel and all GCC countries have brought in significant new policies involving energy efficiency, reforms to domestic retail energy and water prices, renewable and nuclear energy investment and policies on green growth.

While this new wave of policy reforms will no doubt help increase the energy efficiency of the economy and move incentives away from energy intensive development toward other sectors of growth, the collapse in oil price means it cannot be taken for granted that energy productivity will increase as a result of these shifts.

GDP and per capita income in the GCC are still linked to oil prices. Even though energy efficiency and diversification policies are putting upward pressure on energy productivity because GDP growth is weakened by lower government revenues, there will also be downward pressure on energy productivity.

What is different between current low energy prices compared with the 1980s is that instead of defending oil prices and reducing output, OPEC has opted to defend market share by maintaining and increasing output to push out higher cost producers. If this approach results in a smaller fall in government revenue then authorities will be in a much better position to maintain government spending. This may cushion the effect on per capita incomes relative to what was experienced in the 1980s.

That energy productivity has remained stable over the last two-and-a-half decades while per capita incomes rose, suggests that growth and improvements in living standards have been achieved at an expensive cost in terms of domestic energy utilization.

A potentially dangerous energy paradox exists within the low-energy productivity growth paradigm. Within this paradigm, increasing living standards have been reliant on government-led public spending and energy intensive industrial development. However, the continued rapid expansion of such developments is also cutting into the share of domestic energy production available for exports, and therefore the original source of government revenue used to drive growth.

The evolution to a higher energy productivity growth paradigm would address this paradox by decoupling economic growth from higher domestic energy consumption on one hand, and by increasing the sustainability of government finances on the other.

Evolving to a new energy productivity growth paradigm in the GCC offers a compelling, and perhaps imperative, case for policymakers to meet their domestic energy and economic goals by generating private sector jobs, supporting the competitiveness of existing industries, as well as encouraging new sectors to develop.

Building a coherent and strategic energy productivity strategy will require bold vision and leadership. It will require adaptive, forward looking policies that can capture the synergies among the respective economic sectors, while building on but not being beholden to the region's dominant competitive advantage in low-cost energy.

# References

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BMI Research. 2016. Saudi Arabia Power and Water Report Q1. Quarterly Report, BMI Research.

Cadot, Olivier, Celine Carrere, and Venessa Strauss-Kahn. 2014. "Export diversification: What's behind the hump?" *Review of Economics and Statistics* (The MIT Press) 93 (2): 590-605.

Galeotti, Marzio, Alessandro Lanza, and Francesco Pauli. 2006. "Reassessing the environmental Kuznets curve for CO2 emissions: A robustness exercise." *Ecological Economics* 152-163.

Galeotti, Marzio, Nicholas Howarth, and Alessandro Lanza. in progress. "Energy productivity in the GCC: Evidence from an international Kuznets curve analysis." KAPSARC Discussion Paper.

Gonand, Frederic. in progress. "The potential macroeconomic benefit of energy productivity for Saudi Arabia." KAPSARC Discussion Paper Series.

IMF. 2014. *Economic Diversification in the GCC: Past, Present and Future*. IMF staff Discussion Note, SDN/14/12, Washington: International Monetary Fund.

International Monetary Fund. 2013. *Labour Market Reforms to Boost Employment and Productivity in the GCC*. Policy Paper, Washington: IMF.

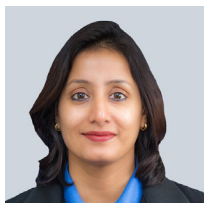
International Monetary Fund. 2014a. *Sustaining Long-run Growth and Macroeconomic Stability in Low Income Countries: The Role of Structural Transformation and Diversification – Background Notes*. Policy Paper, Washington: IMF.

Lall, Sanjaya. 2000. "The Technological Structure and Performance of Developing Country Manufactured Exports, 1985-98." *Oxford Development Studies* 337-369.

Papageorgiou, Chris, and Nikola Spatafora. 2012. *Economic Diversification in LICs: Stylized Facts and Macroeconomic Implications*. Staff Discussion Note SDN/12/13, Washington: IMF.

Santos-Paullino, Amelia. 2010. "Export Productivity and Specialization: A Disaggregated Analysis." *The World Economy* 11: 1095-1116.

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## About the Project

Increasing energy productivity holds some of the greatest possibilities for enhancing the welfare countries get out of their energy systems. It also recasts energy efficiency in terms of boosting competitiveness and wealth, more powerfully conveying its profound benefits to society.

KAPSARC and UNESCWA have initiated this project to explore the energy productivity potential of the Arab region, starting with the six GCC countries.

Aimed at policymakers, the project aims to highlight the social gains from energy productivity investments, where countries are currently at, and articulate options for achieving improved performance in this area.



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