King Abdullah Petroleum Studies and Research Center

Investing for Energy Productivity in the GCC: Financing the Transition

Kankana Dubey, Steven Fawkes, Nicholas Howarth, Moncef Krarti and Padu S. Padmanabhan

September 2016/ KS-1647-DP042A

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.

Legal Notice

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 their helpful input and advice.The paper will be used as input to a joint report on improving energy productivity in the GCC region.

Key Points

An unprecedented infrastructure investment boom occurred in the Gulf Cooperation Council (GCC) in the first part of the 21st century. Strong public capital spending supported by high energy prices provided governments with an opportunity to accelerate economic diversification and infrastructure investment, lifting economic growth and per capita incomes. The 2014 collapse in oil prices created an added impetus for a transition to a more sustainable growth model less dependent on volatile energy markets. Here we make the case for a greater focus on energy productive investment to drive this transition.

Although evidence suggests that some GCC countries are beginning the transition to a more energy productive investment paradigm, in other countries capital investment is not lifting energy productivity. Particular progress has been made in recent years in the UAE, Saudi Arabia and Kuwait. Qatar has experienced the strongest growth in infrastructure investment (in percentage terms), but in recent years its energy productivity has declined significantly. In Bahrain, a decline in capital investment has also been accompanied by stagnation in its once-improving energy productivity. Oman remains strongly on a low energy productivity growth path.

Given that GCC governments face a constrained fiscal environment and low domestic energy prices remain for consumers, we suggest that policymakers consider a market-based 'negabarrel' program to stimulate energy productivity investment. Such a program would commoditize the value of avoided energy consumption and could provide social benefits in terms of extra energy available to export and avoided capital expenditure on new electricity generation capacity. This value is currently not available to the private sector and low prices provide weak incentives for the private sector to invest in energy productivity.

A 'negabarrel' program on the scale of around USD 100 billion across the GCC implemented over 10 years could incentivize private sector investment, generate around 800,000 to 1.2 million new jobs and increase government revenue, if a robust energy service company (ESCO) market can be established. Implementation programs, such as super ESCOs, need careful planning, but can deliver substantial economic benefits and employment opportunities for GCC citizens in the area of energy auditing and management.

Even in a low oil price environment there are significant opportunities to improve energy productivity in a cost-effective way across the GCC economies and the potential national benefits should make this an investment priority. Within Saudi Arabia improving energy productivity can sit well within the 2030 vision direction. Recent increases in end-user energy prices across the GCC, have shifted the balance of benefits more towards the energy user but joint public-private sector actions will still be required to catalyze the required actions

Other financing options to support the transition to higher energy productivity include incorporating energy productivity criteria into existing public capital spending; establishing a new public financing vehicle specifically for energy productivity investment; and issuing energy productivity 'green' bonds, including Green Sukuk.

As for all investments, the risks of energy productivity investment are real, but so too are the benefits for citizens, businesses and governments.

The GCC's Energy Productivity Investment Challenge

Over the first part of the 21st century, investment boomed in the GCC countries (Figure 1). Driven by national strategic plans and high oil prices, governments embarked upon a massive program of economic modernization and the development of transport, health and education infrastructure. Building on a competitive advantage of access to low-cost energy, investment also flowed strongly into the power and oil and gas sectors as well as industries based on natural resources, particularly petrochemicals.

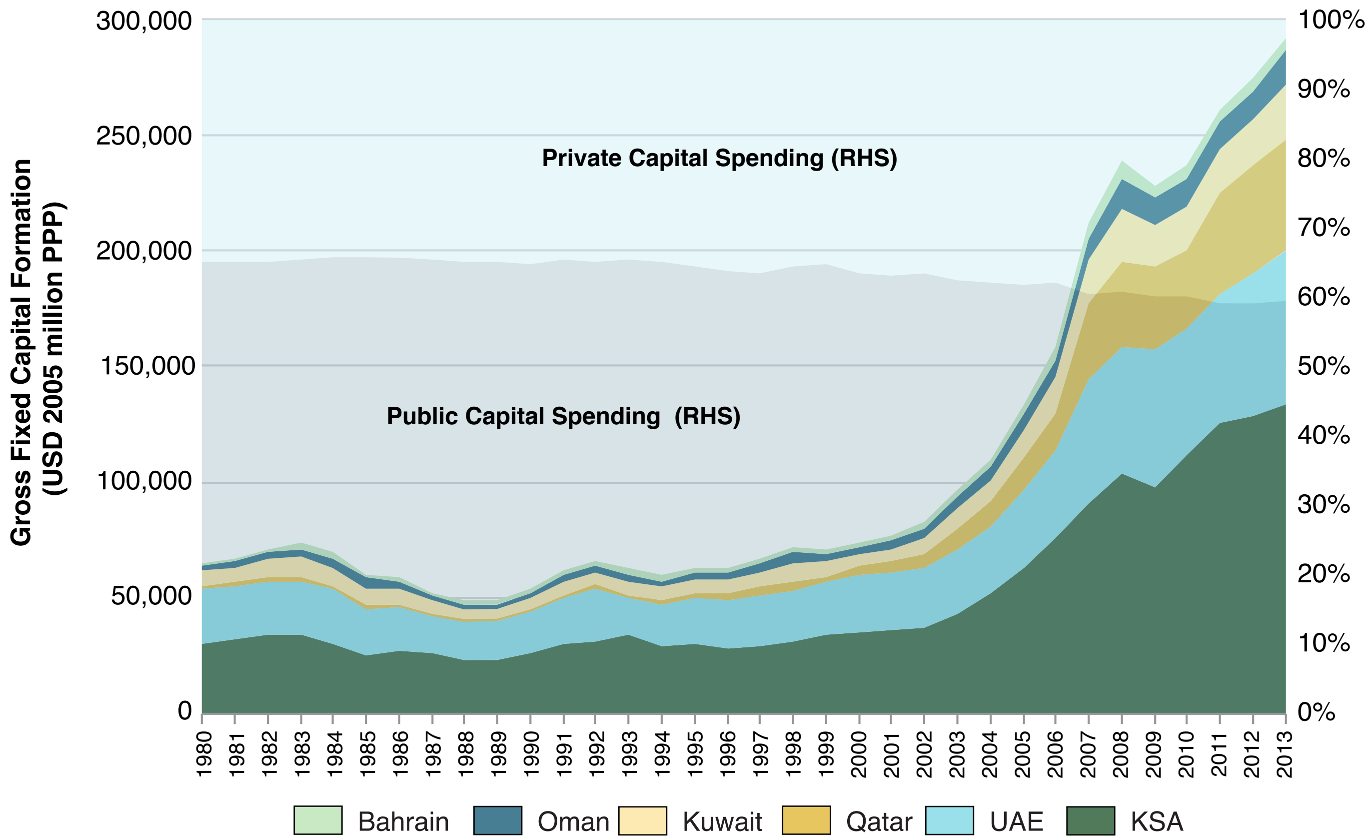

Figure 1. Capital investment trends in the GCC.

Source: UNSTAT, IMF.

Notes: Gross capital formation comprises the investments made in additions or improvements to, or the replacement of, existing fixed assets. These assets include land improvements; industrial plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings.

Policymakers established these modernization programs to improve standards of living and employment opportunities for GCC citizens, especially the young. Although great advances have been made for GCC citizens in these years of plenty, the recent collapse in oil prices highlighted the unsustainability of this growth model (Figure 2). First, growth is based primarily on oil and gas revenues. Second, investment may be locking in an infrastructure of ever-growing energy consumption that is slowly eroding government revenues from oil and gas exports — a potential energy policy paradox.

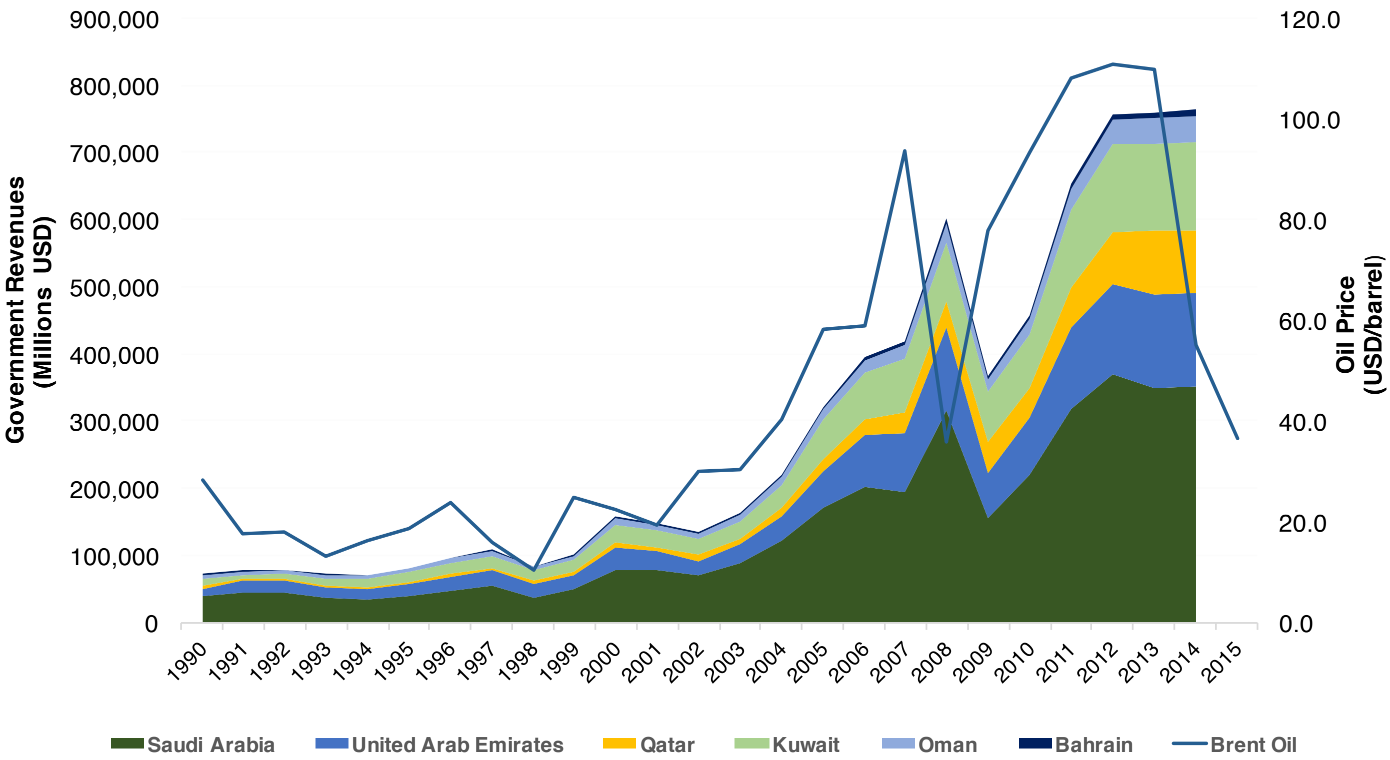

Figure 2. Government revenue trends in the GCC.

Source: IMF; Oxford Economics.

This potential paradox is evident in the Intended Nationally Determined Contribution (INDC) that Saudi Arabia made at the 21st Conference of the Parties to the UNFCCC in Paris in December 2015. The INDC describes two visions for future economic growth:

> A growth model involving accelerated industrialization in energy intensive sectors, such as petrochemicals, steel, aluminum and cement, based on Saudi Arabia's competitive advantage in low-cost energy. This would bring about rising domestic energy consumption and declining oil exports.

> A growth model involving substantial diversification into non-energy sectors, such as financial services, medical services, tourism, education, renewable energy and energy efficiency. With this model, the Kingdom would continue to export significant amounts of oil and channel export revenues into these high value-added sectors.

Saudi Arabia's 2030 Vision is aimed at reorganizing the capital investment landscape in the Kingdom to reduce reliance on oil. The investment plan tabled at the G20 Summit in Brisbane in 2014 also indicates the government's capital investment approach and provides valuable sectoral vision on public capital spending plans (Figure 3).

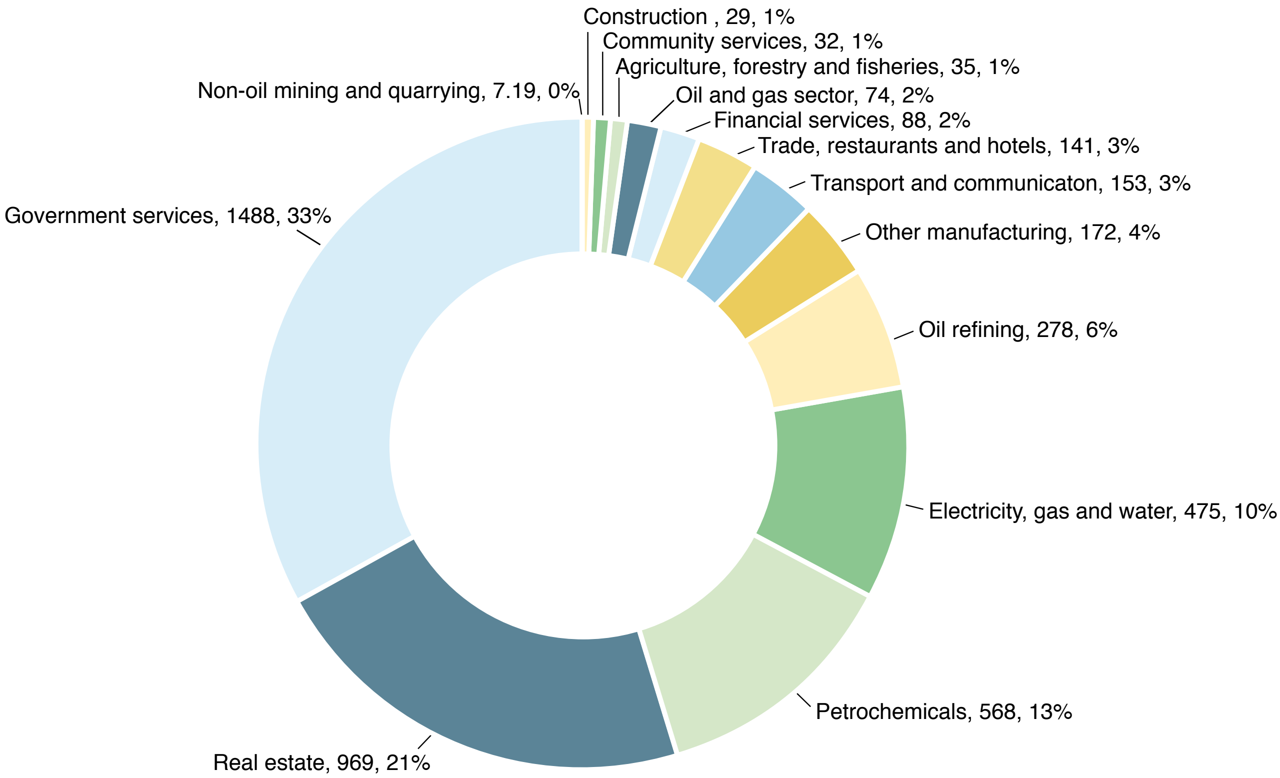

Figure 3. Public capital spending plans for Saudi Arabia (Billion SAR, 2015-2019).

Source: G20 'Comprehensive Growth Strategy: Kingdom of Saudi Arabia' (2014).

For example, in USD at current market exchange rates, the public capital spending expected in the buildings sector was USD 258 billion, followed by USD 151 billion in petrochemicals, USD 129 on electricity gas and water, USD 74 billion on oil refining, USD 45 billion on other manufacturing and USD 40 billion on transport and communications.

Various studies have estimated the percentage of capital investment that goes to energy efficiency. Estimates range from 5% to 15% (Ehrhardt-Martinez and Laitner, 2008). An energy productivity perspective requires that we consider a broad range of investments across the capital stock, including direct investments in energy efficiency and capital additions that move the economy towards less energy intensive development.

From an investment perspective, policy makers may be concerned about the degree to which current institutions and economic incentives reinforce a low energy productivity paradigm and how they can aid the transition to a high energy productivity pathway. Figure 4 conceptually illustrates this concept.

Figure 5 provides a detailed picture of changes in capital spending and energy productivity across the GCC. Evidence suggests a nascent shift towards a higher energy productivity pathway in recent years. In particular, the region's two largest economies, Saudi Arabia and the UAE, as well as Kuwait, have moved their economies from decades of declining energy productivity into positive territory. In these three countries, the cumulative average growth rate (CAGR) of new capital investment has been more than 5% per annum.

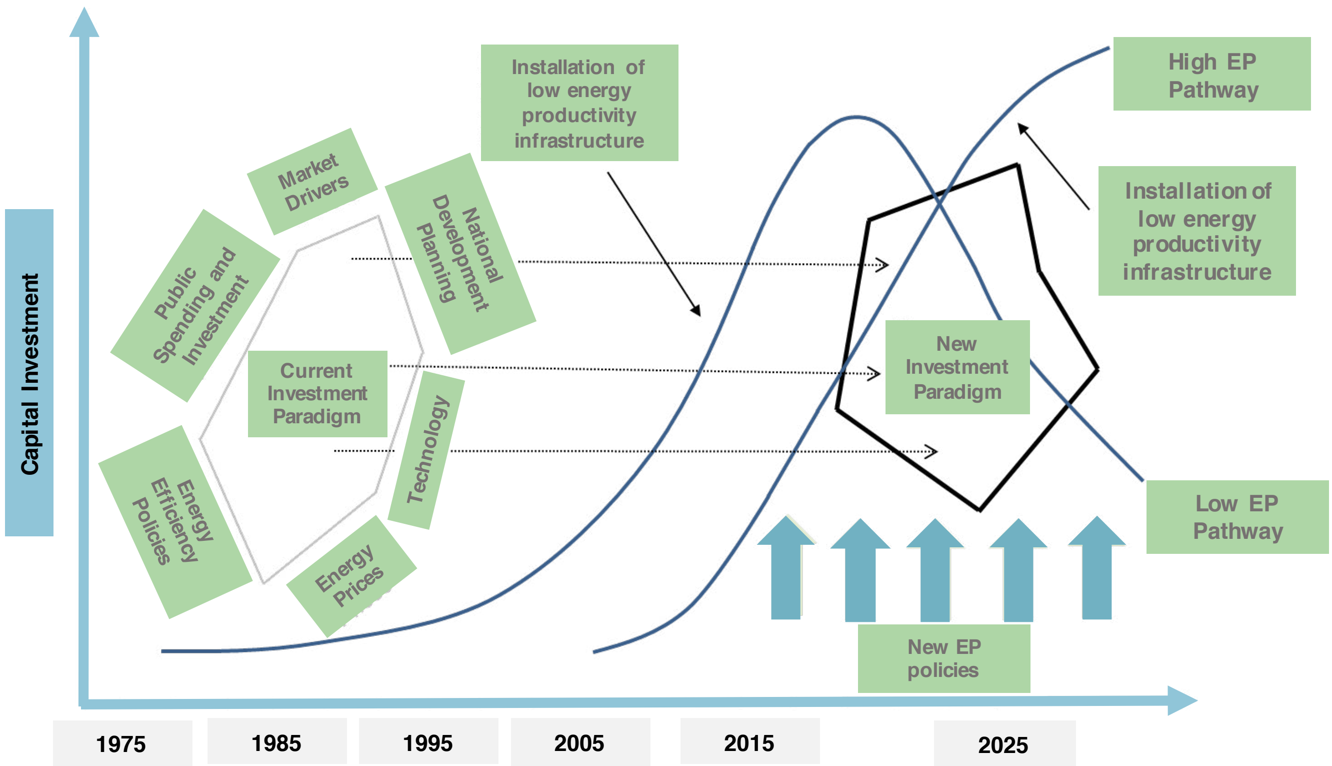

Figure 4. A transition framework for understanding energy productivity investment.

Source: KAPSARC based on Geels and Kemp, 2006; Howarth, 2012; and OECD 2014.

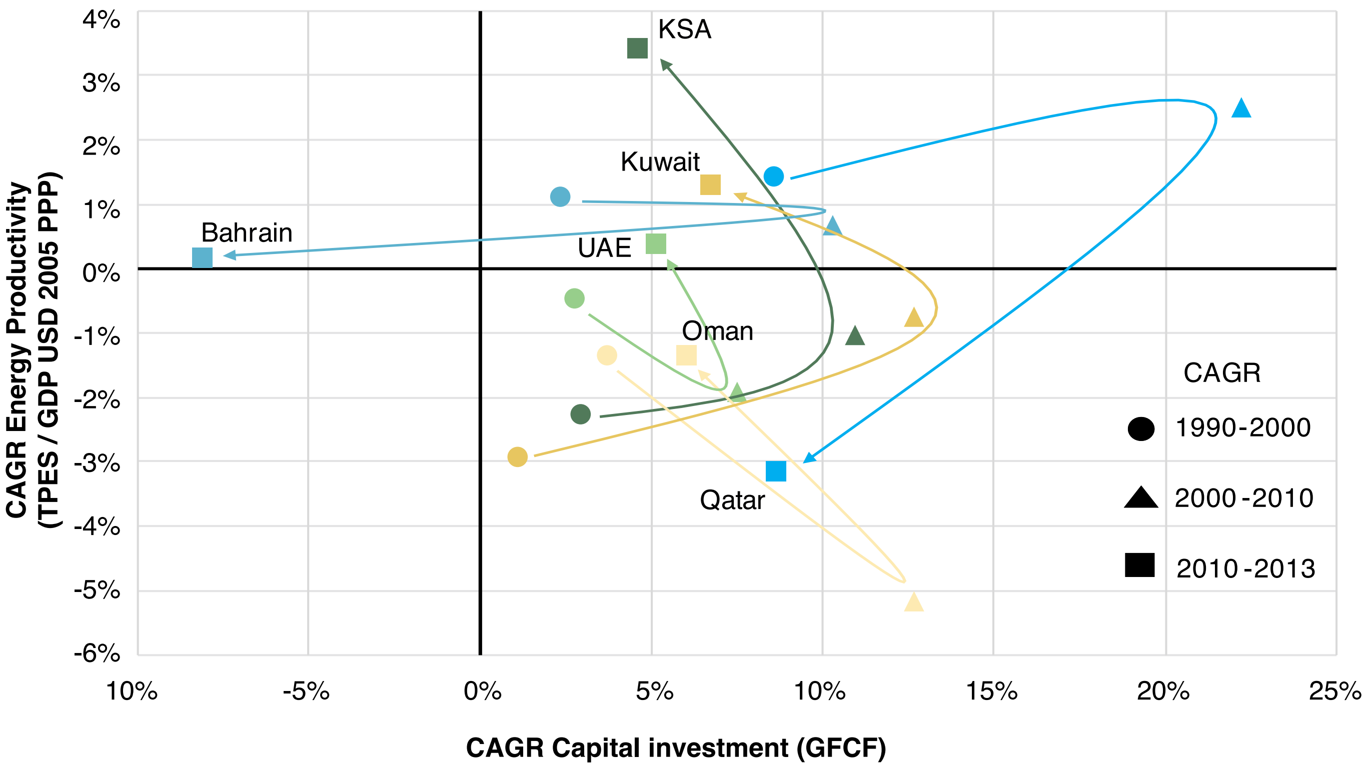

Figure 5. Changes in capital investment and energy productivity.

Source: IEA, Enerdata, UNSTAT.

In the case of Bahrain, the CAGR of capital spending from 2010 to 2013 crashed in response to the collapse in oil prices and the CAGR of energy productivity fell from around a 1% per annum improvement to stabilization. For Qatar, energy productivity rose strongly in the 2000s along with a massive increase in capital spending. However, since 2010 both the scale of capital spending and the direction of energy productivity have reversed. Oman is on a low energy productivity growth pathway, despite high capital spending, suggesting that diversification efforts there are focusing on structural change into energy intensive sectors.

This analysis suggests that strong capital spending may be a necessary condition for significant improvements in energy productivity, but it is not sufficient. A financial sector aligned with the goal of developing high energy productivity infrastructure is also necessary.

Energy Productivity Investment Categories

Two main factors affect energy productivity: the underlying energy efficiency of the economy and its structure. Improving the economy's energy efficiency without any change in its structure will improve energy productivity. Diversifying away from energy intensive (low energy productivity) industries to less energy intensive (higher energy productivity) sectors will also improve energy productivity. Programs to improve productivity should target both aspects: energy efficiency and diversification.

Table 1 presents a typology of four investment categories that improve energy productivity. Within the first three investment categories, investment is focused on refurbishing existing assets and replacing old assets with new ones, but leaving the structure of the economy largely unchanged. This includes improving energy productivity in energy intensive industries.

Energy efficiency driven retrofits: This category includes retrofitting existing buildings, industrial processes, transport systems or energy systems, with the primary purpose of improving energy efficiency. The expenditure in these cases is mainly on energy efficiency equipment and systems.

Modernization of existing assets: This category includes refurbishing existing buildings, industrial processes, transport systems or energy systems where the primary purpose is not energy efficiency but other factors, such as the need to bring an old building up to modern standards or improve reliability. In these cases, opportunities to maximize energy efficiency should be exploited to avoid locking in high energy use for the life of the project.

New assets: This category includes investments in new buildings, industrial processes, transport systems or energy systems for the existing structure of the economy. In this case the primary purpose is not energy efficiency, but the value or outputs that come from the new building, process or system. New buildings or processes are typically more efficient than older ones, but there are still opportunities to maximize efficiency.

Structural change: This category includes investments that change the structure of the economy. In industry this would involve a shift towards non-energy intensive industries and the services sector and away from energy intensive industries.

Improving end-use energy efficiency can bring direct and valuable benefits within the energy supply system. This is particularly clear in the electricity supply system, but also applies to fuel supply. Energy efficiency and demand response programs can reduce power demand, particularly at times of peak demand, and also increase system reliability.

Table 1. An energy productivity investment typology.

		Buildings & the built environment	Transport	Industry	Utilities
Energy efficiency investments	**Energy efficiency driven retrofit**	Retrofit building structure, systems and controls. Retrofit street lights to LED lamps.	Retrofit vehicles (e.g. aerodynamics, drive train).	Retrofit processes & buildings for energy efficiency reasons, e.g. variable speed drives.	Retrofit power plant, transmission & distribution systems for energy efficiency reasons.
Mainstream investments	**Modernization: existing assets**	Refurbishment of a building to make it fit for modern working environment.	Refurbishment of existing vehicles for non-energy reasons, e.g. refurbishment of buses or trains.	Retrofit/ refurbishment of industrial processes for non-energy efficiency reasons, e.g. quality, production output (incorporating some efficiency improvement).	Retrofit/refurbishment of power plant, transmission & distribution systems for non-energy efficiency reasons, e.g. reliability (incorporating some efficiency improvement).
	Modernization: new assets within existing industrial structure	New high efficiency buildings, near zero energy buildings or net energy positive buildings. New street lighting installations.	New high efficiency vehicles.	New high efficiency production plant using same process. New plant using new process for existing industries.	New high efficiency generation, transmission & distribution plant.
	Modernization: new assets driving structural change	Changes in urban planning. Use of buildings as part of the power grid, i.e. smart buildings and smart cities.	New vehicle types, e.g. electric cars, buses and trucks. Modal shifts, e.g. high speed rail links to reduce air transport.	New, less energy intensive industries.	New technologies, e.g. renewables, nuclear, distributed generation, district heating and cooling.

Source: KAPSARC.

Reducing power demand through energy efficiency can also reduce or defer the need for capital expenditure on new energy supply infrastructure, such as in generation, transmission and distribution. In addition, energy efficiency can also reduce the need for hot standby power plants that consume fuel without being connected to the system. Energy efficiency has the potential to become a resource within the electricity system that can be utilized in the same way that power stations are.

These benefits occur at the level of the individual or organization undertaking the investment at the utility level, and for energy exporting countries at the national level in terms of increasing the availability of energy production available to export. Table 2 summarizes these benefits.

When end-users create value in the electricity system by investing in energy efficiency, there is an argument for appropriate market mechanisms that return some of this value to the end user. This payment could be in several forms, including grants, access to lower-cost capital or on-going payments for delivered energy efficiency (an efficiency feed-in tariff or e-FiT).

Table 2. Energy productivity benefits: organizational, utility and national value.

Recipient of benefits	Type of benefits	
	Energy saved	**Economic value**
Host organization	Energy cost saving. Reduced exposure to energy price volatility.	Reduced need to expand energy supply infrastructureImproved productivity through removing bottlenecks, etc. Improved employee satisfaction through better working environment and sense of social responsibility. Better market positioning through being seen as environmentally conscious. Increased sales through increased foot traffic, natural lighting etc.
Energy supply system	Reduced primary energy input.	Reduced (or delayed) need to invest in new supply infrastructure (generation, transmission and distribution).
National	Reduced need to import fuel or electricity (reduced domestic fuel use in the case of oil producing countries). Reduced need for energy subsidies where these are present.	Job creation. Reduced local pollution. Reduced GHG emissions. Creation of new industries/sectors with higher value added or lower energy consumption.

Source: KAPSARC.

A Business Model for Energy Productivity Investment in the GCC

Low energy prices lead to low levels of energy productivity in the economy. Low energy prices encourage energy intensive practices and low-value energy uses — the antithesis of encouraging energy productivity.

The transition to higher energy productivity in the GCC will require economic incentives to encourage higher value uses of energy. Energy price reform has received much attention. Regulations and standards will also play an important role, but they require substantial bureaucratic organization and strong implementation capacity.

The distribution of energy efficiency benefits among end users, the energy system and the national governments are very different in the GCC from many other countries. Low domestic energy prices mean that energy efficiency measures are not economic at the organizational level. However, a barrel of oil consumed domestically could otherwise be sold internationally, creating a large potential benefit from such investments at the system and national level. Reducing electricity demand through energy efficiency also has a significant benefit at the utility system level in terms of lower capital expenditure requirements.

To correct for the imbalance in value, the government could provide a financial payment to individuals and organizations that undertake energy efficiency investments. A unit of energy saved produces economic value for the government in three main ways:

- Increased income through exporting the saved unit of energy.
- Reduced need for energy subsidy payments (where these are present).
- Reduced need for new electricity generation capacity investments, as utilities in the GCC are mainly publically owned and operated.

These benefits establish the potential value of a 'negabarrel', a unit of energy saved through investments that enhance energy efficiency or energy productivity. Governments could offer this value to projects that produce 'negabarrels' against a defined baseline. Auctions could be implemented to achieve price discovery and best value for money.

While energy efficiency investments offer the most obvious and immediately feasible sources of investment for 'negabarrels', this approach could also be extended to areas such as renewable energy or investments that promote structural change. The key is that protocols would need to be defined and the investments would need to be monitored, verified and certified by accredited energy auditors.

The 'negabarrel' approach would require creation of a government-funded market in reduced energy demand, taking into account the overall value that greater energy productivity creates for society. Although negawatts (more properly negawatt hours for energy) have been discussed for many years in energy efficiency circles, a proper market has not yet been established. However, measurement and verification technology coupled with smart metering now allow energy efficiency measurement, making such programs more feasible.

Figure 6 highlights the results from a KAPSARC study (Krarti & Dubey, in progress) on energy productivity investment demand for the GCC buildings sector. Results from three levels of energy efficiency building retrofit are shown. Level 1 is a basic retrofit, including very basic measures such as installing LED lighting and weatherization of the building shell to limit air leakage. Level 3 is a deep retrofit, which in addition to basic measures requires a detailed energy audit and stronger measures such as window and cooling system replacement and the installation of daylight control systems.

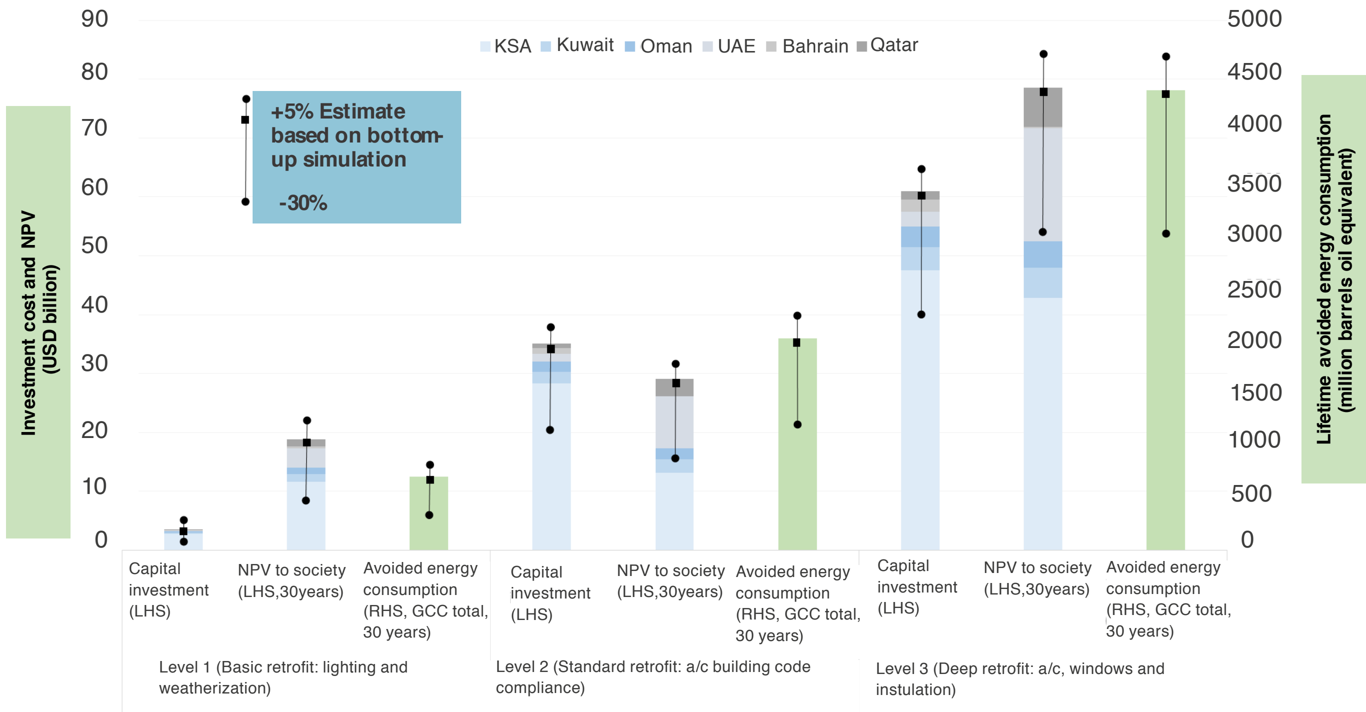

Figure 6. Estimated energy productivity investment and simulated benefits in the GCC residential buildings.

Source: KAPSARC (Analysis assumes 10-year investment implementation period and 30-year project period, 3% discount rate. Benefits to society include the full value of avoided oil equivalent being exported at USD 35/barrel, and avoided electrical generation capacity of 3787MW (Level 1), 10889MW (Level 2), 23673MW (Level 3) valued using USD 1,700 for reduced electricity (CAPEX per KW).

A key assumption that supports this analysis is the price at which the saved energy could be sold on international markets, and indeed whether such barrels would be sold, left in the ground or used elsewhere in the economy.

In this analysis, we assumed an international oil price of USD 35 barrel and that all barrels of oil-equivalent from avoided energy consumption could be sold at this price without affecting international prices. An important caveat to this analysis is that it only gives an indication of the order of magnitude of value created from the enhanced energy productivity investment. The design of a 'negabarrel' program would need to incorporate flexibility mechanisms that would be responsive to the international price of oil, which largely determines the upper bound on the opportunity cost of consumption (and value of avoided-consumption) of energy domestically. Additionally, countries might not export the saved energy, but put it to other uses or simply leave it in the ground.

The first takeaway from this analysis is that the energy productivity investment potential across the GCC is likely to be very large. Figure 6 shows that for the residential component of the buildings sector, implementing deep retrofits could involve around USD 61 billion in capital spending, compared to around USD 300 billion for the entire building stock.

The second takeaway is that the payoff to government from implementing energy efficiency investments in the residential sector is also large, even for very basic retrofits. Over the lifetime of its implementation, a level 1 retrofit program costing around USD 4 billion could deliver avoided energy consumption of approximately 700 million barrels of oil equivalent (MBOE) over a 30-year period. Valued at the export oil price of USD 35 per barrel, the benefit to government would be the equivalent of an annual increase in oil revenue of around USD 1 billion. In terms of avoided electricity capacity, a Level 1 retrofit equates to around 3,800MW that does not need to be built.

For a level 1 retrofit in the residential sector, the net present value (NPV) for the government (across the GCC) is USD 19 billion compared with a USD 4 billion initial investment cost, incorporating the avoided energy consumption now available for sale on international markets and the capital cost of avoided electrical generation capacity. For a level 3 retrofit the NPV is around USD 78 billion, relative to a USD 61 billion investment cost.

If each GCC country initiated a 'negabarrel' program, we suggest a total budget of USD 100 billion over a ten-year period focused first on the buildings sector (one of the largest areas of public capital spending), but ideally extending into the industry, transport and utilities sectors. Such a program would provide a strong incentive to private agents to undertake investments to substantially boost energy productivity. A 'negabarrel' program could also be used to help finance renewable energy projects.

Even after the current round of energy price reforms, the GCC’s energy prices remain very low and unlikely to provide an incentive for significantly higher energy productivity. Providing extra cash flow in recognition of the 'negabarrels' produced by investors in energy productivity and renewable energy could be a politically palatable and effective market-based tool to stimulate private sector investment in these areas.

Sources of Finance for Energy Productivity Investment in the GCC

Transitioning from a low energy productivity to a high energy productivity economy will require a substantial reallocation of capital towards energy efficiency and higher value energy uses. However, policy, market and technology uncertainties and risks constrain capital deployment for infrastructure investments. Furthermore, investors are reluctant to take a long-term view in financing relatively illiquid infrastructure assets.

In the GCC, governments have historically funded the majority of infrastructure. However, as the impact of volatile oil prices puts pressure on public budgets, governments are increasingly looking to private sources of capital for infrastructure financing. Public corporations operating in a ‘quasi-public sector’ in the mining, power, petrochemical, cement, steel, banking and transport industries also play a leading role in financing and implementing infrastructure investment.

In this paper we suggest that energy productivity investments can be considered a form of green investment, as they contribute directly to reducing carbon emissions through increasing energy efficiency and facilitating structural change in the economy. In this section we outline some of the main sources of finance that can be harnessed to improve energy productivity in the economy.

Energy productivity and 'green' investments

There is no universally agreed definition of 'green investment' among investors (Inderst, Kaminker and Stewart 2012). However, a commonly accepted understanding is that green investment refers broadly to low-carbon and climate-resilient investments made through companies, projects and financial instruments that operate in renewable energy, clean and environmental technology markets as well as those that are climate change specific or screened by environmental, social or governance criteria (Kaminker, et al. 2013). This includes investments in energy efficiency, carbon capture and storage, nuclear power, smart grids and electricity demand side technologies such as electric vehicles, floodplain defenses, as well as sustainable agriculture and water infrastructure.

Aligning existing public funds to support energy productivity

Energy productivity in the economy could be advanced by instigating energy productivity criteria for projects funded by existing government funding facilities. For example, government could set a criterion of achieving top decile levels of global energy productivity when funding a new process or industrial facility. This would ensure that all new plants and buildings financed achieve high levels of energy productivity.

For example, the following funds exist in KSA:

- Public Investment Fund.
- Real Estate Development Fund.
- Saudi Industrial Development Fund.
- Agricultural Development Fund.
- Domestic Loan Program.
- Saudi Arabia General Investment Fund.

The scale of investments being made and planned by these funds is very significant and similar development focused funds exist in other GCC countries. At the regional/international level, funding can also come from the Islamic Development Bank and other multi-lateral development institutions.

The European Bank for Reconstruction and Development financing model

The EBRD was established in 1991 to finance reconstruction and development in the former Soviet Union. Due to the former Soviet Union's extremely low energy productivity, which was around one-quarter of that of Western Europe at the time, improving energy efficiency and productivity was always a major priority for the EBRD. The EBRD established a specialized energy efficiency unit early on and has financed energy efficiency projects in the power and gas sectors (including reduction of gas flaring) as well as in industry, buildings and transport. In 2012 more than 26% of the EUR 8.8 billion lent was for energy efficiency and renewable energy projects or energy efficiency and renewable energy components of larger projects. In addition to lending for specialized efficiency projects, the EBRD checks all industrial or commercial loan applications to assess potential for energy efficiency improvements. The bank then works with the client organization to develop the priority projects and incorporate them into the loan application. This process ensures that all commercially and financially viable improvements are incorporated, improves the client's cash flow (which reduces the lending risk) and increases the capital deployed (figure 7).

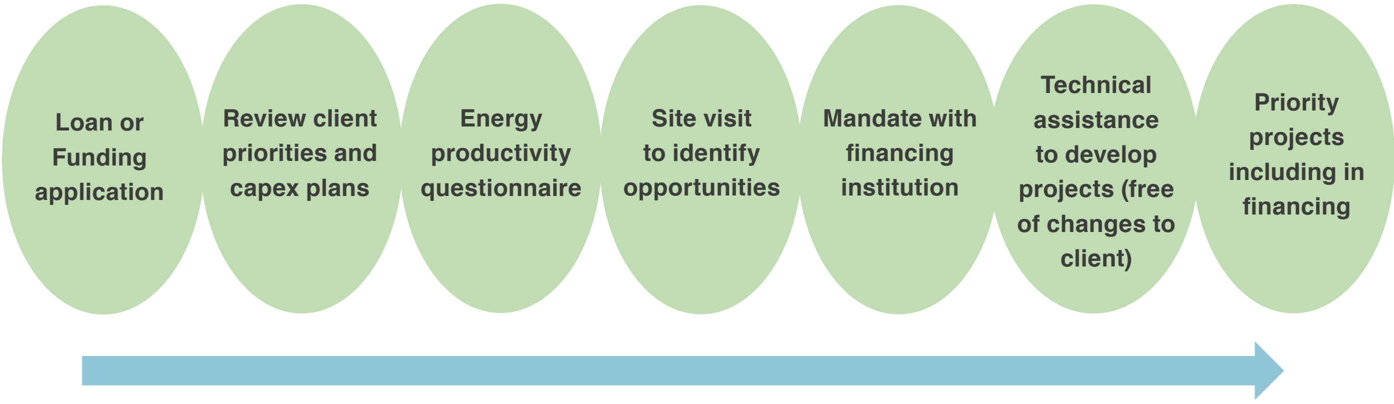

Figure 7. Aligning energy productivity within mainstream investment criteria.

Source: Based on EBRD.

Establishing new public financing vehicles to finance energy productivity

An alternative to adapting an existing public investment fund would be to create a new specialized financial vehicle, such as an energy productivity investment bank, which would have energy productivity as its central mission. This would be analogous to the formation of green investment banks in many countries to finance renewable energy investments. The advantages and disadvantages of such an approach are outlined in Table 3 below.

Green bonds

Countries such as KSA have started issuing bonds to fund infrastructure projects. The emergence of green bonds is an important development in capital markets. Green bonds are defined as “any type of bond instrument where the proceeds will be used to finance or re-finance in part or in full any new/ and or existing eligible Green Projects and which follows the four Green Bond Principles” (Green Bonds Principles, International Capital Markets Association). A range of standards are emerging for defining 'green'. Issuance of green bonds rose from less than USD 1 billion in 2007 to USD 40 billion in 2015. Although the total issuance of green bonds is still small compared to the total bond market of USD 80 trillion, the market is growing rapidly and most green bond issues have been over-subscribed as institutional investors seek to deploy capital into environmentally-friendly assets. Many large institutions have made commitments to buy more green bonds. In 2015 Zurich Insurance, Deutsche Bank treasury, KfW, Barclays treasury and ACTIAM made public pledges to build EUR 1 billion green bond portfolios. From the issuer’s perspective, green bonds can open up a wider range of investors.

There are close links between how the proceeds of green bonds can be used and the energy productivity agenda, as shown in Table 4. This suggests that green bonds could be a good source of finance for projects that can demonstrably improve energy productivity. The rise of standards within the green bond market means that projects should achieve higher levels of energy efficiency (productivity) than a business as usual (BAU) scenario.

Table 3. Creating specific energy productivity financing vehicles.

Advantage	Disadvantage
Gives energy productivity higher visibility; sends a signal to developers and financial markets.	New vehicle requires design and set-up time.
Specific energy productivity targets and processes can be built in from day 1.	Requires new fund allocation within existing budgets and/or fund raising process.
Could attract new investors, e.g. through green bonds or green Sukuk.	Requires new structure and organization.
Changing the investment rules of existing funds may be difficult depending on constitution and institutional appetite.	Possible confusion of roles with existing development banks.

Source: KAPSARC.

Table 4. Green bond financing and the energy productivity agenda

Eligible project types that can be financed by green bonds	Relationship to energy productivity agenda
Renewable energy	High
Energy efficiency	High
Sustainable waste management	Possible links depending on specific project
Sustainable land use including agriculture and forestry	Possible links depending on specific project
Biodiversity conservation	None
Clean transportation	High
Clean water and/or drinking water	Possible links depending on specific project

Source: KAPSARC.

For instance, the market would not regard new factories or buildings built to existing legal design codes as genuinely green, even though they would be more efficient than the factories they replace. To satisfy investors in green bonds, projects should achieve a significant improvement over and above BAU.

In addition to labelled green bonds, there is a growing market for unlabeled 'climate-aligned' bonds. In 2015 over USD 597 billion of climate-aligned bonds existed, made up of 2,796 bonds from 407 issuers and covering similar areas to the labelled green bonds. Approximately 70% of the unlabeled climate-aligned bonds (USD 419 billion) were used for transport projects and 20% (USD 118 billion) were used for energy projects. As with green bonds, the climate-aligned bond universe overlaps significantly with the energy productivity agenda and the market offers real opportunities to finance projects that improve energy productivity.

Green Sukuk

Sukuk are Sharia-compliant securities backed by a specific pool of assets. The Sukuk market is growing, with global issuance in 2014 estimated at USD 130 billion. A growing pool of under-utilized Islamic capital could be invested in Sukuk. The market is increasingly attractive to global investors and there is now a diverse and growing range of issuers and arrangers, as well as longer tenors and a growing secondary market. The benefits and drawbacks to both issuers and investors are shown in Table 5.

Table 5. Benefits and drawbacks of Sukuk to issuers and investors.

	Issuers	Investors
Benefits	Access to additional capital	Access to unique markets
	Absorb under-utilized Islamic capital	Deploy under-utilized Islamic capital
	Can fit national Islamic finance agenda	Consistent with Islamic mandate (where applicable)
	Requires minimal regulatory reform	Comfort of specific assets
Drawbacks	Needs identifiable assets	Unfamiliarity
	Requires additional documentation	Confidence of rating
	Potential perception issues	Varying consistency of Sharia standards
		Limited legal precedence

Source: Fajr Capital.

As with green bonds, the nature of Sukuk overlaps well with projects that improve energy productivity. Sukuk investments must be based on real assets. They have long (and increasing) tenors which is important as banks are having increasing difficulties making long-term loans due to tightened international capital requirements. Sukuk is also well suited to infrastructure projects that are orientated towards social benefit. There is a shortage of product for Sukuk and energy productivity projects fit the need well.

As well as conventional Sukuk, there is growing interest in green Sukuk which parallels the growing interest in green bonds and environmental finance in general. The Green Sukuk Working Party (GSWP) has been established by the Energy Business Council (MENA), the Climate Bonds Initiative and the Gulf Bond and Sukuk Association to promote and develop Sharia-complaint financial products to invest in climate change solutions. GSWP is a collaboration of experts in project development, environmental standards, capital markets, actuarial compliance and Islamic finance. According to the Climate Bonds Initiative, the GSWP will:

1. Design green Sukuk architecture, so that product issuers can offer, and investors can access, products with confidence about their compliance with Shariah law and ethical standards.

2. Promote the concept of green Sukuk and other green Islamic finance products to governments, investors, product originators and other interested parties.

3. Engage with governments and development banks about supporting appropriate project development and the growth of a green Sukuk market.

4. Inform the market by promoting best practice, convening industry forums and developing template models.

One option to create a specialized energy productivity finance vehicle is a Sukuk Umbrella Energy Productivity Fund. This concept is based on a United Nations Economic and Social Commission for West Asia (UNECSWA) proposal for a Sukuk umbrella green fund. The concept is to establish an umbrella Sukuk energy productivity fund and have different compartments within the fund for different types of productivity investments, as shown in Figure 8.

The energy productivity fund could be split into different compartments according to sector, including buildings, industry, transport and energy/ water. Within each compartment, allocations could be made for energy efficiency retrofits ('energy efficiency investments' as defined here), additional energy efficiency incorporated into refurbishments, new buildings or facilities and new industries. A number of design decisions would need to be made, including:

> What criteria distinguishes an energy productivity investment from a 'normal investment', especially as this fund would not replace existing funds for new buildings, industrial facilities, transport and energy systems.

> This fund could itself be part of larger funds, such as sovereign wealth funds.

The fund should learn lessons from specialized energy efficiency funds and the EBRD and provide limited development funds and technical assistance to assure a robust pipeline of projects.

The fund may provide some form of credit enhancement through guarantees in order to leverage public funds with private funds.

Establishing a separate Sukuk Energy Productivity Fund has a number of benefits and drawbacks. Primary amongst the drawbacks is potential confusion and over-lapping with existing development funds. Such a fund would need a clear mandate and clear direction for working with existing funds.

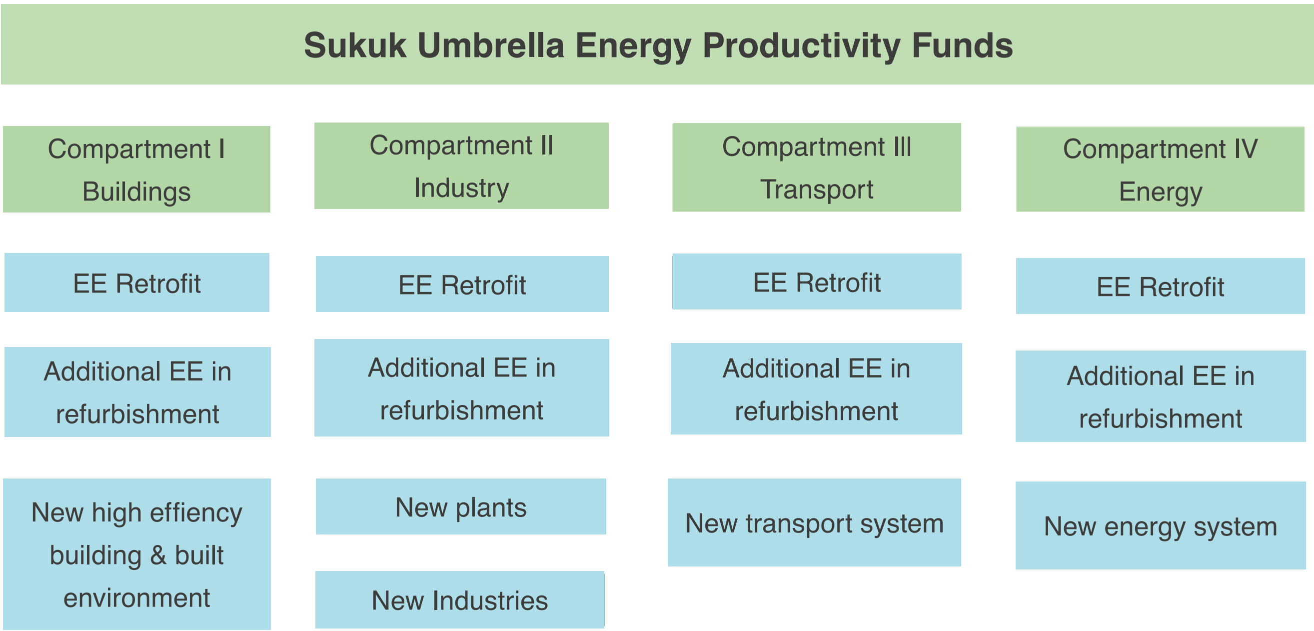

Figure 8. Sukuk Umbrella Energy Productivity Fund concept.

Source: Based on proposal to UNESCWA by Walik Grais for a Sukuk umbrella green fund.

Implementation

Employment and market capacity considerations

Countries with a history of high domestic energy prices and energy efficiency programs have built up a strong network of market institutions capable of delivering energy productivity investments. Developing this institutional capacity in the GCC will be critical to achieving higher energy productivity. In the short term, institutional capability is likely to constrain capital deployment towards energy productivity. However, in the longer term energy productivity investment represents a significant opportunity to create high-skilled private sector jobs that add to the value society gets from its energy resources. For example, energy evaluation centers have been established in many GCC countries, with the objective of training energy auditors and managers for a range of industrial and household clients. Appendix 4 contains a sample job description for such positions. A simple heuristic that has been used in the buildings sector estimates that between 8 and 12 jobs can be created for every USD 1 million spent on energy efficiency programs (Krarti, Evaluation of large scale building energy efficiency retrofit program in Kuwait 2015).

Energy performance contracting is one of the foundations for the development of a private sector energy productivity market. Energy performance contracting has been widely used in the U.S. and Europe, but is relatively new in GCC countries. Under such schemes, an end user seeking to improve energy efficiency contracts with an energy service company (ESCO) will provide energy efficiency actions and financing. The energy cost savings can be turned into incremental cash flows paid to the lender or ESCO. ESCOs are differentiated from other actors in the energy efficiency market because they offer access to finance and guaranteed levels of performance through Energy Performance Contracts (EPCs). In an EPC the ESCO identifies, develops and builds an agreed-upon set of energy efficiency projects and guarantees a minimum level of energy performance or savings. The client usually borrows the funds for the capital project and the deal is arranged such that the financial savings exceed the repayment costs, thus giving the client positive cash flow from the first day of operation. The basic ESCO-Energy Performance Contracting model is shown in (Figure 9).

EPCs address two of the most important barriers to energy efficiency investment: availability of capital and mitigation of risks. EPCs minimize or eliminate the end user's up-front cash outlay and the end user makes payments over time as the energy savings are realized. Performance contracting through an ESCO transfers the technology and management risks away from the end-user to the ESCO. For energy users reluctant to invest in energy efficiency, a performance contract with an ESCO can be a powerful incentive to implement a project.

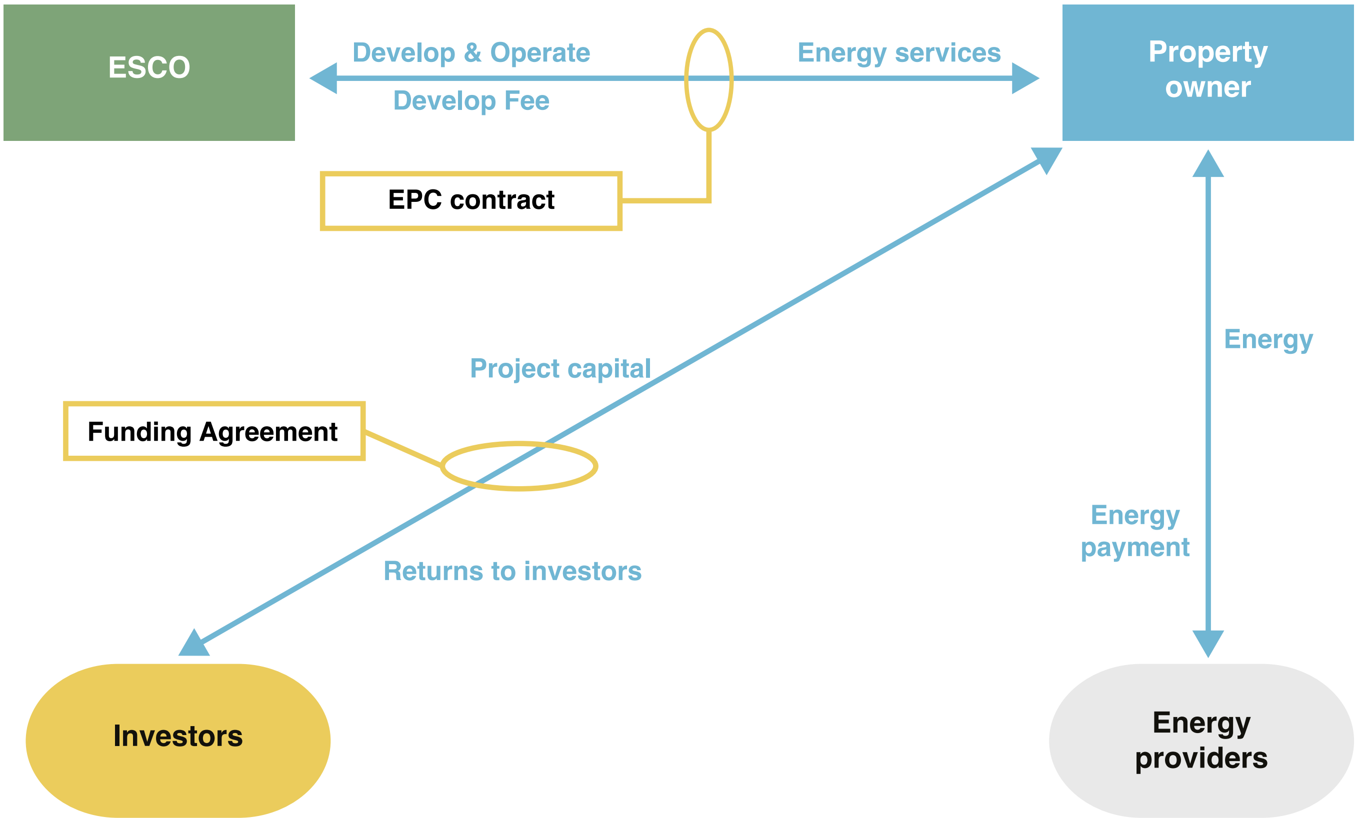

Figure 9. The ESCO-Energy Performance Contracting model.

Source: KAPSARC.

Despite EPC's conceptual appeal, a number of implementation challenges must be managed:

- They can be complex, hard-to-understand contracts.
- Measuring energy savings and the effect of various endogenous variables such as change of usage patterns in a building can be difficult. These challenges can lead to disputes, although the introduction of measurement and verification (M&V) protocols and independent M&V contractors has improved this situation.
- Development times are long. It sometimes takes one to two years to develop projects and the risk of abortive development work is high.
- Contract terms are long – up to 25 years – which can be a disincentive to many organizations.
- The client ultimately pays for the guarantee, even though they will not see that as a separate line item.
- Financing is on the client's balance sheet. Although off-balance sheet solutions can be created, this is becoming more difficult due to new accounting regulations.
- The ESCO guarantee does not act as a credit enhancement.

To back up the guarantee, ESCOs tend to be large companies with significant balance sheet strength. Ameresco is a good example of an independent ESCO and manufacturers such as Honeywell or Johnson Controls are also active in the ESCO market.

In the U.S., the EPC market has grown to an estimated USD 6.3 billion, but is still largely (85%) confined to the public sector, particularly the federal market and the municipal, universities, schools and hospitals market, with most of the investment coming from municipal bonds or federal government budgets. ESCO/EPCs have also been successful in other specialized markets, such as the U.K. National Health Service, where large hospitals have used them to reduce energy consumption and operation and maintenance costs. In Germany, EPC-type contracts have been used successfully in Berlin and other markets. Despite these successes, the EPC-ESCO market has not grown to the scale that it could, even within the public sector.

To help overcome the complexity and lack of capacity on the client's side, two main tools have been developed: ESCO facilitation and Super ESCOs.

ESCO-Energy Performance Contract facilitation programs

The complexity of EPCs presents difficulties for clients and suppliers alike. ESCO facilitation, which has been practiced successfully in markets like Berlin and London, is one method of addressing this complexity. The ESCO facilitator works with clients to develop project opportunities. It carries out a preliminary technical and economic assessment, prepares tender documents, assists in the evaluation and negotiation of proposals and provides assistance in M&V of project results. Selected ESCOs carry out investment-grade audits and are responsible for installation of energy efficiency measures, service delivery and operations and maintenance, as well as providing a performance guarantee. Typical facilitation costs are 3% of the total project cost. Examples of ESCO-facilitation programs are shown in Appendix 3.

Super ESCOs

Super ESCOs are another approach to EPC-ESCO facilitation. The Super ESCO concept has been around since at least 2010, but applications are still limited. The Super ESCO aggregates demand, provides assistance and possibly funding for project development work and arranges project financing. The Etihad Super ESCO is a good example of how this concept is being applied in the GCC (figure 10).

The Etihad Super ESCO was established in 2013 as wholly-owned subsidiary of the Dubai Electricity and Water Authority (DEWA). It is a commercial organization with the mission of creating a market for energy performance contracting in Dubai. It has the following targets to be achieved by 2030:

- Retrofitting 30,000 buildings.
- Reducing energy consumption by 1.7 TWh.
- Reducing CO2 emissions by 1 million tonnes.

The Etihad Super ESCO aims to catalyze USD 540 million of capital deployment by 2030. The business model is to develop projects, bundle these projects, and contract with Energy Service Companies to undertake the work on a guaranteed performance contract as well as to source and arrange the capital. It targets government and other organizations with large property portfolios.

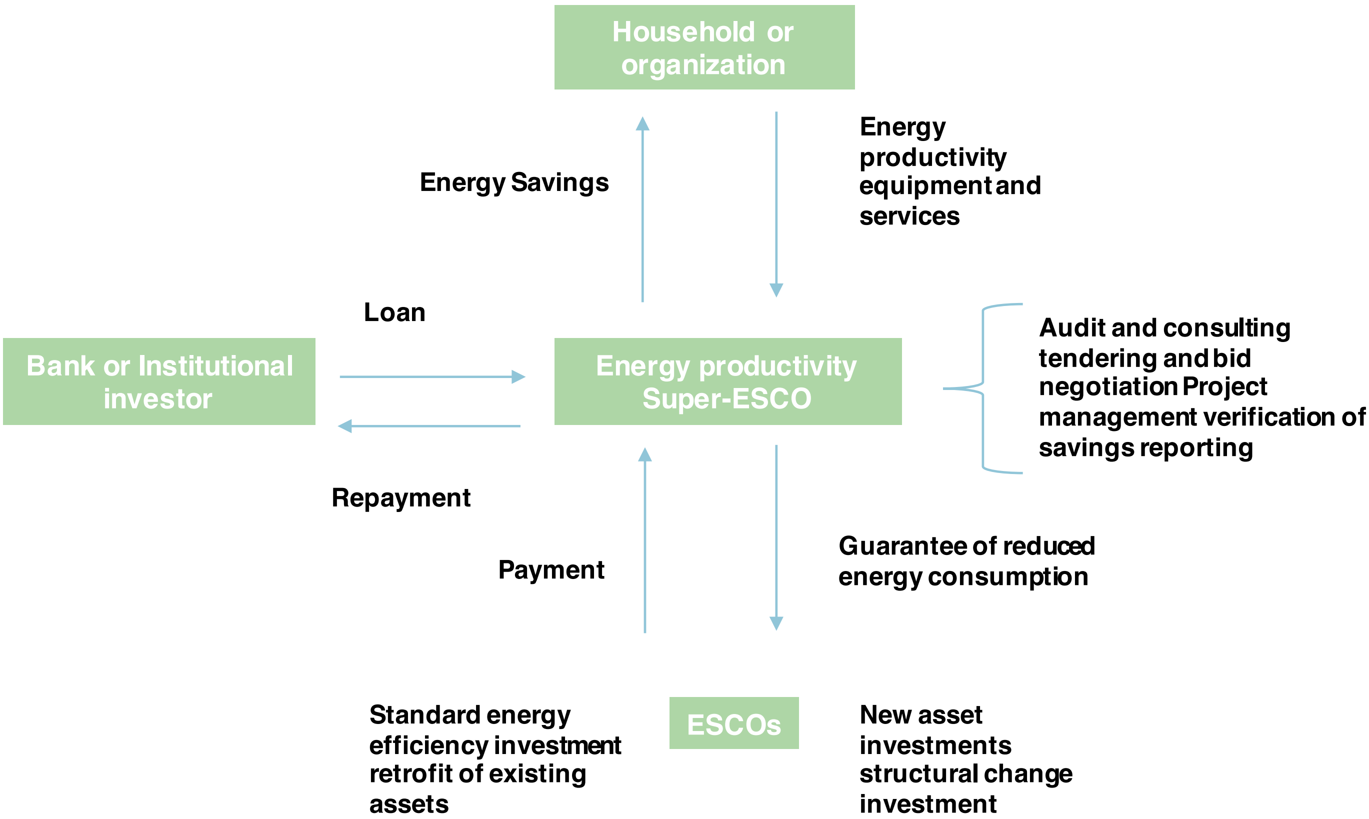

Figure 10. Super-ESCO business model.

Source: KAPSARC based on Etihad Super-ESCO model.

To date, the Etihad Super ESCO has undertaken several projects including:

> An AED 16 million project for DEWA in seven buildings, including 55 energy efficiency measures in lighting, cooling and ventilation. The project has achieved a 31% reduction in energy consumption, or 5 gigawatt-hours (GWh) per year with a saving of AED 2.6 million. The project also achieved a significant improvement in building comfort. Contract length is six years and project execution is by MAF Dalkia Middle East.

> An AED 21 million project to replace lighting in power stations with LED lighting. The project achieved a 68% reduction in energy consumption for lighting, with savings of AED 21 million a year. The new lighting also produced better working conditions. Implementation was by Philips Lighting.

Several memoranda of understanding have also been signed, including with the Dubai International Finance Centre, the Dubai Airport Free Zone Authority and Wasl Asset Management Group. These should lead to further projects being implemented.

In November 2015, Etihad Super ESCO announced a significant first: the world's first building retrofit project funded through a Sharia-compliant structure. The project in the Jebel Ali Free Zone is the largest retrofit to date in the Middle East, covering 157 buildings. It is projected to save 26 GWh of electricity a year and 200 million imperial gallons of water resulting in an AED 22 million saving. Capital cost is AED 64 million. The funding came from the National Bonds Corporation.

Although still in its early days, the Etihad Super ESCO is a world-class demonstration of how to create a functioning Energy Performance Contract market. It addresses the issues of financing efficiency by:

- Taking on the development of large multi-building or facility projects rather than single buildings.
- Using a 'captive' portfolio to achieve scale (in this case DEWA buildings, power plants and government buildings).
- Building capacity among customers and users.
- Arranging finance at scale.
- Providing standardized measurement of results.

Institutional infrastructure to support energy productivity investments

To accelerate energy productivity investment, a number of pieces of 'infrastructure' need to be put in place, including:

- Standardization of project development and documentation processes.
- Standardization of contracts.
- Standardization of M&V protocols.
- Building evidence that energy efficiency is a sound investment.
- Building capacity, particularly in the financial sector.
- Building a skilled workforce which can develop and evaluate energy efficiency projects, particularly in the financial sector.

Building capacity, particularly in the financial sector

Several analyses of the problems of increasing investment into energy efficiency have identified the lack of standardization of project development and documentation of energy efficiency projects as a major barrier. Compared to energy supply projects, efficiency projects are heterogeneous but, even allowing for that, there is lack of standardization in the way that projects are developed and documented. This leads to several problems:

- Increased performance risk.
- Transaction costs – especially technical due diligence costs – are increased.
- Aggregation of projects is more difficult.
- It is hard for financial institutions to build human capacity around ad hoc processes.

The Energy Efficiency Financial Institutions Group (EEFIG), the International Energy Agency, Citi Group and The European Commission's Joint Research Centre have highlighted the lack of standardization (European Commission 1995-2016). For example, Michael Eckhart, Managing Director & Global Head of Sustainable Finance at Citi Bank has said:

> **"Energy efficiency is in a category by itself … Energy efficiency projects do not yet meet the requirements of the capital markets … No two projects or contracts are alike."**

An international response to this problem is the Investor Confidence Project (ICP), which was initiated in the USA by the Environmental Defense Fund and has expanded to Europe with financial support from the European Commission (Investor Confidence Project 2012). The Investor Confidence Project is an open source project that has developed protocols for ensuring that energy efficiency projects are developed, documented, implemented and measured using standard best practice. In addition, the ICP has developed a system of accreditation for project developers, software developers and quality assurance agencies called Investor Ready Energy Efficiency (IREE™). The use of IREE™ is now growing in the USA and Europe and there are plans to expand the system to other regions. A GCC ICP linked to the global ICP initiative would assist in increasing the flow of private finance into energy efficiency in the region as well as be useful for public funds targeting efficiency.

The ICP covers the entire project development, implementation and operation period and includes guidance on how to standardize the measurement of energy savings through internationally accepted tools such as the International Performance Measurement and Verification Protocol.

Standardization of contracts

EPCs can be complex and costly to develop and execute. Contract standardization is one tool that can be employed to reduce the complexity.

There have been several efforts to do this in different regions and jurisdictions, including:

> The U.S. Department of Energy Federal Energy Management Program (FEMP) aims to improve energy efficiency within the U.S. Federal government's portfolios of more than 350,000 buildings and 600,00 road vehicles. FEMP has facilitated the use of Energy Savings Performance Contracts (similar to EPCs) within the Federal estate by developing standardized contracts utilizing indefinite-delivery, indefinite-quantity contracts which allow call-offs by various federal agencies.

> The Dubai Regulatory and Supervisory Bureau for Electricity and Water has launched a regulatory framework for ESCOs that will standardize methods of reporting savings, provide standards for energy performance contracts and provide a clear and transparent method of settling disputes.

> The ESCO facilitation frameworks described above and the Etihad Super ESCO are also standardizing contracts.

Building evidence bases on the performance of energy efficiency investments

Another common barrier to increasing the flow of capital into energy efficiency is the lack of evidence on the performance, both technical and financial, of energy efficiency investments. Although the energy efficiency industry would argue that it has a lot of experience in producing energy and monetary savings, this statement is hard to back up with the level of data that financial institutions demand.

This lack of data is due to:

- The costs of data collection (now falling rapidly).
- Lack of agreement on measurement and verification, now addressed by the International Performance Measurement and Verification Protocol.
- A general lack of post-investment monitoring of energy efficiency projects.

This lack of data and evidence makes it more difficult for financial institutions who would like to invest in energy efficiency to do so. This barrier is being addressed in several ways in different regions. In the EU, DG Energy is funding a project to build an evidence base that records project performance. This project is linked to the EEFIG group, which identified the lack of evidence on project performance as a barrier in its 2015 report.

In the U.S., a number of related initiatives have been put in place. First, the U.S. Department of Energy developed the Building Energy Data Exchange Specification (BEDES). BEDES is not a database itself, but rather a common language or dictionary that allows building performance data held by many market actors in many different forms to be stored and compared. Developing BEDES as a dictionary of terms has allowed the collection and comparison of the energy performance of over 850,000 buildings across the USA. BEDES is open source and therefore different users or software vendors can produce applications relevant to their own needs.

One application built upon BEDES is the SEED (Standard Energy Efficiency Data) platform, which allows large building portfolio owners to import data from multiple sources, translate the data to a common format, search the data and use it to identify energy efficiency project opportunities.

Capacity building in the financial sector

The lack of capacity within banks and financial institutions is another barrier to increasing energy efficiency investment flow. Even when the institution wants to lend or invest, it is difficult if there is insufficient human capital to identify projects, appraise them and execute on their financing. The European Investment Bank (EIB) is addressing this issue through its Private Finance for Energy Efficiency (PF4EE) instrument. This instrument is a joint agreement between the EIB and the European Commission that aims to address the limited access to adequate and affordable commercial financing for energy efficiency investments. The instrument targets projects that support the implementation of National Energy Efficiency Action Plans or other energy efficiency programs of EU member states. PF4EE lends money to financial intermediaries within the 28 countries of the EU. To support capacity building within these institutions, EIB issued a contract for support and training in energy efficiency project development and evaluation.

Managing Energy Productivity Investment Risk and Barriers

Energy efficiency projects are usually presented as being low risk (or even 'no risk'), but in reality every investment involves risk. The main types of risk within energy efficiency projects are:

Capital cost risk. The risk that the actual capital cost will be greater than estimated at the time of the investment decision. The financial case would have been made on the basis of estimates or quotations from vendors, suppliers and/or contractors. This risk can be mitigated by securing fixed price contracts.

Performance risk. The overall risk that the annual savings will be less than estimated. This risk can be broken down into two elements.

- **Technology risk.** The risk that the energy efficiency measures installed (e.g. lighting, insulation, improved controls etc.) do not perform at the level predicted due to a technical issue. Therefore the actual units of energy saved are less than expected. This can occur through over-selling of performance or simple technical failure. The under-performance can manifest itself immediately after installation, or over a period of time due to technical failure, over-selling of performance, performance dropping off due to wear and tear, lack of maintenance or other factors.

- **Design risk** arises because the predictive models that engineers use to estimate energy savings have varying degrees of complexity and accuracy. Simple models may be spreadsheet-based using engineering design principles and codes, while complex models may involve whole building simulation. The difficulties of predicting energy savings are made more complex because some energy efficiency measures interact with existing systems and other efficiency measures. For example, installing LED lighting reduces the heat given off by the lights, which reduces the air conditioning load. In a hot climate this is an example of a positive interaction. In colder climates the same effect can increase heating loads, thus having a negative effect. If the design engineers do not properly assess and model these effects, the financial performance of the energy efficiency investment will differ from what is expected.

Energy price risk. The risk that the price of energy used in the investment appraisal varies from the assumed level. Predicting the energy price over the lifetime of a typical energy efficiency measure is not possible unless the customer making the investment is on a long-term fixed energy price contract. This is not possible in all jurisdictions and many energy markets experience considerable energy price volatility.

Operations & Maintenance risk arises because many energy efficiency projects include equipment that requires ongoing operations and maintenance (O&M). The cost of any additional O&M that the energy efficiency measure requires should be included in the investment appraisal. Therefore O&M risk is the risk that the O&M costs will be higher than estimated.

Production level risk. For a production process energy efficiency investment, the energy savings resulting from the project will likely be dependent on production levels. If production declines below the level anticipated in the business case for the energy efficiency project, the financial savings will decrease.

Change of use risk. The risk that the building or facility may change use in some way that renders the energy efficiency measure less effective or obsolete. For example, a business could invest in efficiency measures in a production process that is later closed or replaced by a new process. In buildings, the predicted energy savings will be affected by the number of building occupants or changing hours of use.

In appraising any proposed energy efficiency investment, these risk factors and their interactions need to be considered alongside normal financing risks, such as credit risk. In the case of investments into energy supply projects, either fossil fuel or renewables, financial institutions' capacity to understand and evaluate these risks has been built up over many years (or decades). Many institutions have specialized teams. Additionally, industry-wide standardized approaches have been developed in many sectors. For example, in the case of oil and gas, reserves are valued according to the Petroleum Resources Management System, while the wind power sector has developed a process of wind monitoring and evaluation of the P90 output (the P90 projected output has a 90% probability of occurring in practice). In contrast, financial institutions have not built up such capacity and expertise in energy efficiency and standardized approaches are only now emerging.

Energy efficiency financing faces a number of difficulties and constraints. In designing policies or financing programs, whether they be publicly or privately funded, one must understand these constraints. They include:

The small average size of energy efficiency investments, particularly compared to the needs of the institutional investors who invest in quanta of millions, tens of millions or even hundreds of millions of dollars, euros or pounds. Individual efficiency investments can be as small as thousands or even hundreds of dollars.

High transaction costs, including due diligence costs, development costs and legal costs – especially relative to the average size of investment.

Lack of standardization. There is no standardized way of developing, documenting and under-writing energy efficiency projects. This increases transaction costs, increases performance risk, makes aggregation of projects difficult and prevents financial institutions from building up human capacity around standardized processes.

The outcome is difficult to measure, unlike investments into energy supply projects that have meters attached and sell into established energy markets. Additionally, investors lack confidence in the results of energy efficiency investments, due to their limited experience base and the lack of an independent evidence base of financial performance.

Energy efficiency is not strategic. Within most organizations energy efficiency investments are not seen as strategic compared to investments in production or marketing. For this reason, energy efficiency investments receive lower priority than would seem appropriate considering their potential financial returns. Consideration of the non-energy benefits of efficiency investments, such as increased sales or increased productivity, is important as these are often far more strategic than energy savings or cost.

Lack of cutting the ribbon opportunities. The energy savings that energy efficiency investments produce and the actual technology involved (control system software or air handling equipment in a plant room) are generally invisible.

Sunk costs. The equipment installed can be difficult (or impossible) to recover in the event of non-payment of debt because it is embedded into a process or building.

An immature market. Financial institutions have very little knowledge about or capacity to process energy efficiency investments. Unlike conventional oil or gas, or even renewables, banks and investors do not have teams of specialists who understand energy efficiency investing. This immaturity can also lead to higher costs of capital due to lack of confidence.

Energy efficiency is not a recognizable asset class, unlike real estate or renewables. This makes it difficult for financial institutions to allocate capital to it.

Limited secondary market. The secondary market for energy efficiency investments, through securitization and forfaiting funds, is limited in scale and only just beginning to emerge, mainly in the USA.

Conclusions

This paper has explored ways to increase the flow of funds into energy efficiency investments and maximize the energy productivity improvements that can result from investments in new facilities and refurbishment of older facilities. We have also identified a number of important tools that can assist in financing energy productivity improvements, summarized in Table 6.

We have rated these tools on two criteria: the potential impact on energy productivity and the ease of implementation. The relative ranking is shown in Figure 11.

Changing the investment criteria of existing development funds is undoubtedly the policy tool with the greatest potential impact and ease of introduction. Each investment that these funds make is an opportunity to maximize future energy productivity. Nonetheless, these opportunities are being missed in many cases, locking in higher-than-necessary energy consumption for many years.

Creating a market for energy productivity, or 'negabarrels', would have a high impact. Such a policy is difficult to introduce, but is worth considering as a target to move towards. Implementing this kind of measure in the GCC would effectively leap-frog the productivity policies of other countries and establish GCC leadership in this area.

Table 6. Summary of tools for financing investment into energy productivity improvement.

Investment type	Tool
Energy efficiency investments	Specialized energy efficiency funds
	ESCO-EPC facilitation
	Super-ESCO
	Support development of market infrastructure
Mainstream investments	Write energy productivity into investment criteria of existing development funds
	Utilize green bonds
	Mobilize Sharia compliant funding
	Sukuk Umbrella Energy Productivity Fund
	'Negabarrel' proposal: create a market for energy productivity

Source: KAPSARC.

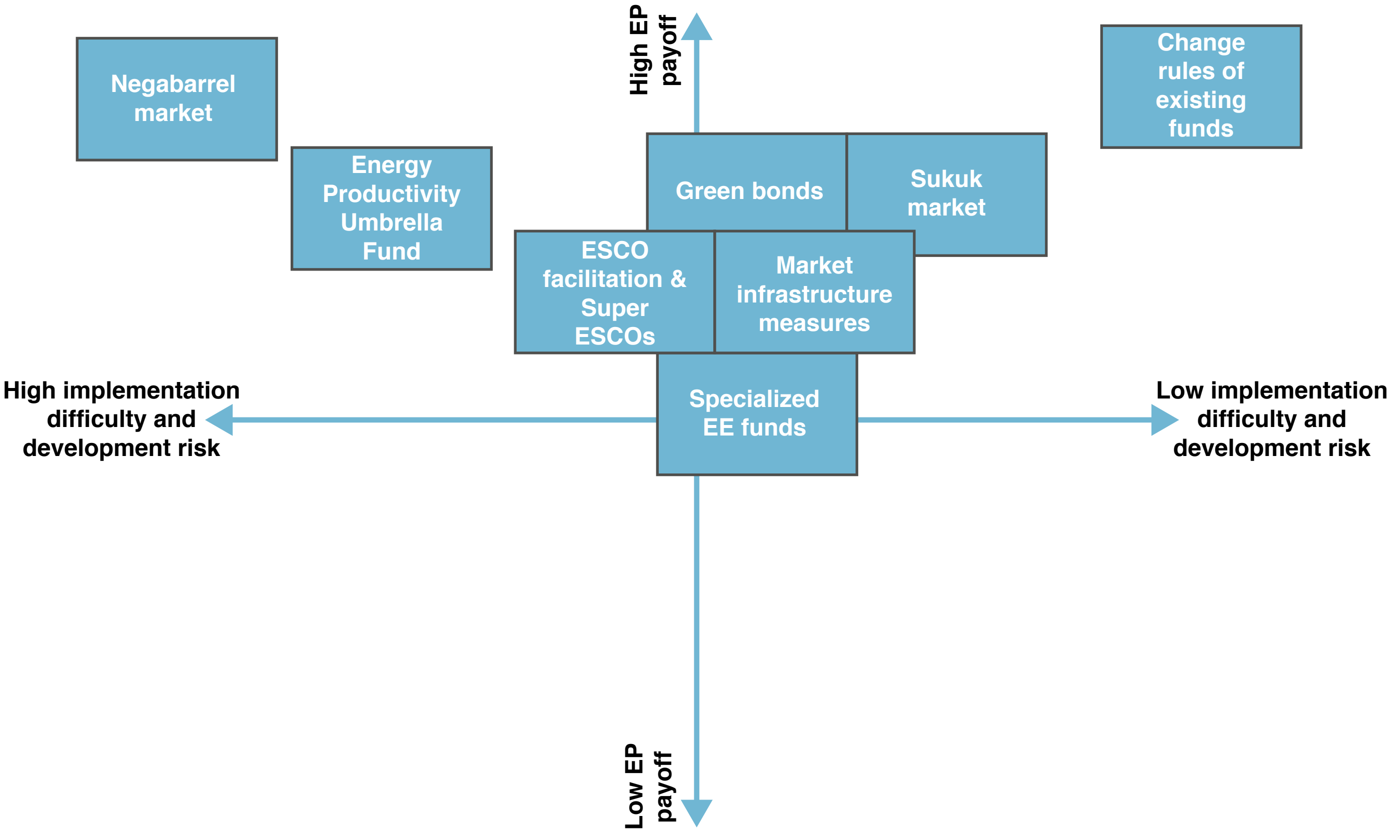

Figure 11. Ranking the potential impact and implementation risk of policy tools.

Source: KAPSARC.

Utilizing the green bond market and the Sukuk market would have medium impact on energy productivity. There are strong overlaps between the nature of energy productivity investments and the requirements of both green bonds and Sukuk. These overlaps should be exploited.

Specialized energy efficiency funds are likely to have smaller impacts than the measures described above. They are, however, relatively easy to establish and considerable global experience can be brought to bear to ensure productivity. Any such fund also needs to address the issues of building a robust investment pipeline, standardization and capacity building.

Any policies and programmes to enhance energy productivity in the GCC countries must address financing mechanisms as well as simply technologies or policies. Significant improvements in energy productivity will only come about through a) increasing the flows of capital dedicated to this objective and b) increasing the energy productivity impact of existing investment flows.

Reference

1995-2016. European Commission. Accessed May 2016. https://ec.europa.eu/energy/en/news/new-report-boosting-finance-energy-efficiency-investments-buildings-industry-and-smes.

1997-2016. Global Information. Accessed May 2016. https://www.giiresearch.com/report/pike230699-us-energy-service-company-market-energy.html.

Inderst, Georg, Christopher Kaminker, and Fiona Stewart. 2012. Defining and Measuring Green Investments: Implications for Institutional Investors' Asset Allocations. OECD Working Papers on Finance, Paris: OECD Publishing.

2012. Investor Confidence Project. Accessed April 2016. http://www.eeperformance.org/.

Kaminker, Christopher, Osamu Kawanishi, Fiona Stewart, Ben Caldecott, and Nicholas Howarth. 2013. Institutional Investors and Green Infrastructure Investments. OECD Working Papers on Finance, Paris: OECD Publishing.

Krarti, Moncef. 2015. "Evaluation of large scale building energy efficiency retrofit program in Kuwait." Renewable and Sustainable Energy Reviews, 1069-1080.

Krarti, Moncef, and Kankana Dubey. (in progress). "Energy productivity of the GCC buildings sector." KAPSARC Discussion Paper. KAPSARC.

2013. Qassim University. Accessed May 2016. http://www.qec.qu.edu.sa/en/Departments/ME-Dept/Laboratories/IEAL/Pages/default.aspx.

UNDP. 2016. United Nations Development Program. Accessed May 2016. http://www.sa.undp.org/content/saudi_arabia/en/home/operations/projects/environment_and_energy/national-energy-efficiency-programme--phase-2-.html.

Geels, F. and Kemp, R. (2006) Transitions, transformations and reproductions: dynamics in sociotechnical systems, in McKelvery, M. and Holmén, H. eds. (2006) Flexibility and stability in the innovating economy, Ch. 1, Oxford University Press.

Howarth, N.A.A. (2012) ‘Clean energy technology and the role of non-price based policy: an evolutionary economics perspective’ European Planning Studies, 20 (5) 871-891.

Appendix 1: Energy Productivity Investment Potential for Buildings

Three levels of energy efficiency building retrofit programs are typically considered to improve the energy efficiency of existing buildings.

Level 1 – energy efficiency retrofit: in this case, the buildings are required to undergo basic or level 1 energy audit followed by implementation of low-cost energy efficiency measures, such as programmable thermostats, LED lighting and weatherization of building shell to reduce air leakage. The estimated savings from a level 1 retrofit program are 8% for all building types, based on documented studies and case studies reported for residential, commercial and governmental buildings in the GCC region.

Level 2 – energy efficiency retrofit: a standard or level 2 energy audit is required for this program. Building envelope components must be improved to meet at least the current energy efficiency code and energy efficient cooling systems and appliances must be used. Based on the existing literature on GCC region, average savings of 23% can be achieved for level 2 retrofits for all building types.

Level 3 – energy efficiency retrofit: for this program, a detailed or level 3 energy audit is required to perform deep retrofits of existing buildings. A wide range of energy efficiency measures can be considered in this type of program, including window replacement, cooling system replacement, use of variable speed drives and installation of daylighting control systems. Although deep retrofits are typically costly, they are linked with architectural refits to minimize costs and can provide energy use savings exceeding 50%.

Table A1. Operating costs of oil production.

Countries	USD/bbl
Bahrain	8.4
Kuwait	4.4
Oman	5.3
Qatar	6.8
UAE	5.9
KSA	5.0

Source: Knoema, http://knoema.com/vyronoe/cost-of-oil-production-by-country.

Appendix 2: Increased Interest in Energy Efficiency Projects

A number of factors have brought about a significant increase in financial institutions' interest in energy efficiency. The scale of potential investment and tightening energy efficiency policies and regulations are important factors. Additionally, investors are increasingly interested in environmental, socially responsible and impact investing and some have taken decisions to divest from fossil fuels. Changes to renewable energy support mechanisms (feed-in tariffs) in some markets have also accelerated the financial sector's interest in energy efficiency. These changes have reduced the attractiveness of renewable energy to some investors that have raised funds tied to renewable investments. These investors are now looking at energy efficiency as an alternative home for their funds.

Individual financial institutions are demonstrating their increased interest in energy efficiency investing by allocating capital to energy efficiency investments and loans, either directly or through specialized funds. Several groups of investors have also made public commitments to invest in efficiency.

The Alliance of Energy Efficiency Financing Institutions

Thirty nine asset managers with assets under management exceeding USD 4 trillion in association with more than 100 banks and leasing companies signed a commitment (around the G20 process) stating that they will actively contribute to scaling up energy efficiency financing; will recognize the need to further embed energy efficiency investment principles into the way in which they engage with clients; and have a special interest in guiding their clients towards best practice financing decisions, including on modernization and competitiveness strategies that instill enhanced energy efficiency.

The Energy Efficiency Financial Institutions Group (EEFIG)

The European Commission and the UNEP Finance Initiative convened the EEFIG, which was created in 2014 and was charged with writing a report on how to increase the flow of investment into energy efficiency. EEFIG is a voluntary group that comprises representatives from more than 100 financial institutions within the EU with an interest in developing the energy efficiency market. Its report in February 2015 was widely regarded as a significant advance in understanding of the issues around energy efficiency financing and it contributed directly to the G20 actions that led to the Alliance of Energy Efficiency Financing Institutions. The European Commission supports the work of EEFIG through building a database of evidence on the performance of energy efficiency investments, and developing, in conjunction with the financial industry, a common framework and language for underwriting of energy efficiency projects.

Appendix 3: Examples of Specialized Energy Efficiency Funds

Specialized energy efficiency funds have been established in several jurisdictions and several examples are described below. These funds have largely been created using a mixture of private and public funds and have an investment remit that targets certain levels of energy use reduction. They can use a variety of financial instruments, including equity and various types of debt (senior, mezzanine and leasing), guarantees and first loss reserves and various structures (direct investment, special purpose vehicle etc.). Investments into the funds can come from a mixture of international and national public and private finance. Most often the public sector catalyzes the creation of these funds as a response to policy drivers and to address the perceived lack of finance for energy efficiency. The funds target a range of sub-sectors, public and private, but many focus on larger projects due to the high transaction costs of small projects.

European Energy Efficiency Fund (EEEF)

EEEF was established in 2010 by the European Investment Bank (EIB) and Cassa Depositi e Prestiti SpA (CDP) (a joint-stock company under public control, with the Italian government holding 70% and a broad group of bank foundations holding the remaining 30%). The initial capital was EUR 200 million. Deutsche Bank is the fund manager and invested EUR 5 million. To date the EEEF has deployed EUR 58.5 million as shown in Table A2.

Table A2. EEEEF investments to date.

Country	Project	EEEF Commitment	Technologies
Netherlands	City of Venlo	EUR 8.5m senior debt	Public lighting
France	City of Orléans	EUR 5.1m junior debt	CHP/biomass
	City of Rennes	EUR 7.3m junior funding	CHP/biomass district heating
	Boloré	EUR 30m senior funding	Clean urban transport – electric cars
	Région Rhône-Alpes	EUR 5m senior construction facility	EE building retrofit of schools
Germany	Museum Berlin	EUR 0.9m forfeiting loan via ESCO of Johnson Controls	EE building retrofit
	University of Applied Sciences Munich	EUR 0.6m forfeiting loan via ESCO of Johnson Controls	EE building retrofit & combined heat & power
Italy	University Hospital S. Orsola Malpighi, Bologna	EUR 32m project bond facility to project entity	EE retrofit to heat production and distribution system
Romania	Banca Transilvania	EUR 25m sub-debt to financial intermediary	EE, RE & clean urban transport

Notes: EE = energy efficiency, RE = renewable energy.

UK Green Investment Bank energy efficiency funds

In 2012, the UK Green Investment Bank (GIB) appointed two fund managers to establish specialized energy efficiency funds. Each fund received GBP 50 million in capital, which matched GBP 50 million from other investors, resulting in two GBP 100 million funds. The funds have a flexible mandate that allows debt and equity transactions across the public and private sectors. The two funds have struggled to deploy capital for several reasons, including the low demand for financed energy efficiency projects and the lack of well-developed, bankable projects at scale — themes that have been repeated in most other markets. The GIB has also invested GBP 30 million alongside Aviva (a UK-based multi-national insurance company with GBP 43 billion revenue) in the REaLM Energy Centres Fund, which invests in building and operating new energy centers for large building owners, such as hospitals. The REaLM fund's first investment was a GBP 36 million energy center at Cambridge University National Health Service Trust. The boiler house incorporated combined heat and power, biomass boilers, high efficiency dual fuel boilers and heat recovery from incineration of medical waste. The installation was built and operated on a 25-year contract. The GIB is now working with a development company to improve the flow of bankable projects.

The London Energy Efficiency Fund (LEEF)

The London Energy Efficiency Fund (LEEF) was established in 2011. Its mandate is to invest in energy efficiency retrofits to public, private and voluntary sector buildings and infrastructure in the Greater London area in order to improve their energy efficiency. LEEF is one of three Urban Development Funds procured by the EIB on behalf of the London Green Fund. The London Green Fund was established by the Greater London Authority with the assistance of the EIB and the London Waste and Recycling Board under the European Commission's Joint European Support for Sustainable Investment in City Areas (JESSICA) initiative. LEEF was capitalized with GBP 100 million, GBP 50 million from the EIB and GBP 50 million from the Royal Bank of Scotland. The fund manager, Amber Green Sustainable Capital, was procured by open competition. Arup are retained as technical consultants.

LEEF funds projects between GBP 1 million and GBP 20 million and due to EIB support it can provide funding at interest rates from 1.65%. Projects must be able to demonstrate energy savings of at least 20% compared to the conditions prior to investment and achieve an annual carbon reduction cost of less than GBP 5,000 per tonne of CO_2. Funded projects can use a wide range of technologies, including demand-side energy efficiency measures, combined heat and power and district heating. There are no maximum or minimum terms on the LEEF funds or maximum payback period. LEEF is able to offer sculpted drawdown and repayment profiles to match expenditure and revenue savings, thus providing a revenue neutral or cash positive situation for the borrower.

Up until February 2016, LEEF had invested over GBP 65 million in over 76 buildings across London. The initial LEEF funding round was completed 18 months ahead of schedule in August 2014, which released a further GBP 11.5 million of investment, all of which has now been invested. In total LEEF's investments have enabled GBP 470 million of projects throughout London, delivering a 6x leverage effect from public seed capital.

Investments made to date by LEEF are shown in Table A3.

Table A3. Investments made to date by the London Energy Efficiency Fund.

Project	Capital Cost	Energy savings (%)	Tonnes carbon saved	Main technologies
Greenwich Peninsula ESCO	GBP 14.5 million	50%	20,000	Heat network for new development of 15,000 dwellings and 35,000m2 of commercial space.
St. George's NHS Trust (Hospital)	GBP 12 million	25%	6,300	Installation of CHP, remodeling of an energy center and various energy efficiency technologies.
Tate art galleries	GBP 20 million	26%	2,500	Heating and cooling technologies across Tate Modern, Tate Britain and storage facilities including innovative transformer waste heat recovery, River Thames bore hole cooling, passive measures to fabric plus lighting and lighting controls.
London Borough of Enfield	GBP 6 million	50%	3,000	Seed capital for District Heating network covering 6,800 homes incorporating first ever carbon-capture power facility in London and first match-funding of JESSICA funds alongside an EIB loan.
Salters Livery Company	GBP 4.7 million	39%	592	Upgrades to lighting, building fabric, space/water heating across two buildings – reached BREEAM Excellent standard.
London Borough of Hackney	GBP 4.6 million	—	—	Communal heating across 10 blocks (1,500 dwellings) leading to 56% reduction in heating costs.
London Borough of Croydon	GBP 3.6 million	17%	—	50 buildings being retrofitted including schools, social housing and civic buildings.

Source:KAPSARC.

China Utility-Based Energy Efficiency Finance program (CHUEE)

CHUEE was established in 2006 with the support of the International Finance Corporation (IFC) and the Global Environment Facility (GEF). It has three main components:

- Partial risk guarantees.
- Technical assistance.
- Market outreach through information dissemination.

The initial funding of the program involved a USD 15 million fund from the GEF to guarantee the first loss under the loan facilities and to provide technical training. The IFC then extended guarantee facilities for over USD 215 million to three main Chinese banks: the Industrial and Commercial Bank of China (ICBC), the Shanghai Pudong Development Bank (SPDB) and the Bank of Beijing (BoB). The IFC covered 75% of the risk for the first 10% of the loss (i.e. first loss), the remaining 25% of the first loss was borne by the commercial banks. For the remaining 90% of any loss, the IFC covered 40% of the risk and the commercial banks the remaining 60%. This structure mitigates the risk to the commercial banks, which is considered important, especially in the early phases of what is essentially a new market for banks — energy efficiency financing.

The program also provides technical assistance to both banks and local ESCOs. The technical assistance helped the three banks to become more familiar with energy efficiency finance and to introduce new products including project finance, lending to ESCOs and savings-based lending. In addition, technical consultants reviewed projects on behalf of the participating banks.

Through market outreach and dissemination activities, the IFC sought to increase awareness of energy efficiency opportunities and financing options amongst target audiences of industry and banks. As of the end of 2013, the participating banks in CHUEE had provided loans of over USD 700 million and financed 226 energy efficiency and renewable energy projects.

Argentina's Energy Efficiency Fund

The Argentinean Energy Efficiency Fund (Fondo Argentino de Eficiencia Energetica) was brought into force by the Ministry of Energy in 2009 and was developed under a World Bank Energy Efficiency Project. It is aimed at industry, various sub-sectors and small and medium enterprises (SMEs) with funding of USD 2.18 million. The objective of this six-year project is to increase energy efficiency through the promotion and sustainable growth of energy efficiency services and to reduce greenhouse gas emissions by eliminating regulatory, financing and information-related barriers that limit activities and investment in energy efficiency and energy conservation. The funds cover the development of energy audits and implementation of feasibility studies for investment in energy efficiency as well as the development of the energy efficiency fund itself. Currently the fund provides low interest loans for energy efficiency projects in SMEs and is operated under the scope of the national fund for development of micro-, small- and medium-sized companies.

Thailand ESCO fund

The ESCO Fund was established by Thailand's Department of Alternative Energy Development and Efficiency under the auspice of the Ministry of Energy. The ESCO Fund aims to address the issue of the lack of equity capital for SMEs that develop energy efficiency and renewable energy projects.

The ESCO Fund receives public grant support of THB 500 million (USD 14 million) per phase to fund up to 50% of qualifying energy efficiency and renewable energy projects, and then sells certified carbon reduction credits on the international carbon market.

SMEs can apply for support from the ESCO fund on their own or as part of the service offering by financial institutions, equity investors, energy service companies and product suppliers. A minimum threshold for energy efficiency and renewable energy projects is applicable:

> Equity investors are required to finance from 10% to 50% of the project costs, total project value has a maximum value of THB 50 million, and payback must be between 3 and 7 years.

> Venture capitalists are required to finance from 10% to 30% of registered capital, total project value has a maximum value of THB 50 million, and payback must be between 3 and 7 years.

> For equipment suppliers, total project value has a maximum value of THB 10 million and payback must be in less than 5 years.

> All applications need to guarantee the energy savings and carbon savings.

Owing to the need to guarantee energy and carbon savings, the equity investors and venture capitalists normally would carry out the energy audits and feasibility studies. The cost of these studies can be included in the ESCO fund application, subject to a maximum of THB 100,000 per project. If the project is subsequently cancelled, the approved fund for energy audits and feasibility studies is to be returned to the ESCO Fund.

The Energy Conservation of Thailand Foundation and Energy for Environment Foundation act as fund managers for the ESCO fund. The fund managers are responsible for appraisal of projects, financial due diligence, coordination with financial institutions, funds and other investors, signing contractual agreements, advice to project clients and portfolio and risk management.

The ESCO fund is currently in its fourth 2-year phase. Phase I ran from October 2008 through September 2010, Phase II ran from October 2010 to March 2013, and Phase III ran from April 2013 to May 2015. In each phase, THB 500 million was allocated and the fund accounts for 100% of Thailand's ESCO business.

Lessons learnt from experience with energy efficiency funds

Many of the specialized funds report challenges in finding enough bankable projects. This highlights the 'development gap' — the gap between economic potential to reduce energy costs and a solid pipeline of well developed, bankable projects. The most successful energy efficiency lenders and investors (notably EBRD and LEEF) have mitigated this problem by having development funds available. The EBRD uses Technical Assistance funds donated by the member countries as aid and the LEEF accesses European Union JESSICA funds. The European Union has made considerable development finance available through mechanisms such as JESSICA, the Horizon 2020 program and the Structural Funds. Any new fund needs to address the development gap and ensure that both development funds and development expertise are in place to ensure a robust pipeline of bankable projects.

Appendix 4: Sample Energy Auditor Job Description

ENERGY AUDITOR – SAMPLE POSITION DESCRIPTION

Summary:

Energy auditors facilitate the participation of building owners, home owners and developers in conservation programs and act as a liaison with the contracting community. Employees in this position conduct audits of residential, commercial or industrial facilities to identify energy conservation measures and their associated savings potential and determine clients' eligibility to participate. Energy auditors also inspect and approve installation of materials.

The size of the facilities being audited and the complexity of the energy-using systems in a facility distinguish levels of energy auditors. In addition, the energy auditor is expected to independently perform the full range of auditing activities and duties and may be involved in reviewing compliance with the local energy code. Auditors possess knowledge of HVAC, lighting and electrical systems and the interrelationships between such systems. Knowledge of procedures and requirements for program eligibility is required, as well as the ability to specify appropriate energy conservation measures and to calculate and quantify the impacts of such measures on facility energy use.

Examples of Work:

- Explains advantages of energy conservation to prospective participants regarding the cost effectiveness and savings potential in program participation.
- Gathers information to determine energy use, energy loss and potential energy savings in complex commercial/industrial facilities.
- Creates computer simulations of building systems; researches energy conservation opportunities for individual firms; determines cost-benefit elements of implementation plans; prepares written energy audit reports; presents findings and proposed energy management program to business executives.
- Reviews plans for new construction and recommends energy-efficient methods; conducts seminars on energy management practices and procedures for the business community; may serve as a technical resource to code committees or other technical working groups as appropriate.
- Reviews and negotiates cost estimates and cost proposals prepared by contractors and consulting engineering firms.

- Prepares specifications for installation of energy conservation measures.
- Inspects installation of energy conservation measures in complex commercial/industrial facilities for compliance with engineering standards, technical requirements and specifications.
- Determines eligibility to participate in conservation programs.
- Coaches less experienced energy staff in preparing energy auditing reports.
- Performs other related duties of a comparable level/type as assigned.

Work Environment/Physical Demands:

Most work is performed in a normal work or office environment. Work entails visiting residential, commercial and industrial customers and touring their facilities to identify energy conservation opportunities.

Minimum Qualifications:

Baccalaureate degree in energy management, engineering, architecture or a related discipline and two years of experience in professional commercial or industrial energy management analysis. (Other combinations of education, training and experience will be evaluated on an individual basis for comparability).

Licensing and Other Requirements:

Current driver's license or evidence of equivalent mobility.

Appendix 5: ESCO Facilitation Case Studies

Berlin Energy Agency ESCO facilitation

The Berlin Energy Agency's facilitation service has worked on 1,400 buildings since 1996 in 26 pools of buildings. The total investment to date has been EUR 53 million and guaranteed energy savings have reached EUR 11.9 million per annum. The ESCO procurement process is assisted by having standard EPC contracts, a standard tendering procedure and a standard proposal evaluation tool. The key parameters of one project are listed below.

London: RE:FIT

The Mayor of London established RE:FIT in 2008 to help make London's non-domestic public buildings and assets more energy efficient. The Mayor and the European Union Regional Development Fund jointly fund RE:FIT. Through the end of February 2016, RE:FIT had worked with over 200 organizations and supported the retrofit of over 600 of London's public buildings, resulting in GBP 92 million of investment, a reduction in energy bills of GBP 6 million and carbon savings of 103,000 tonnes of CO_2. The RE:FIT Programme Delivery Unit (PDU) provides free-of-charge support to public sector organizations seeking to implement energy efficiency retrofit projects and programs. The PDU provides tailored advice and support as required by the host organization. In addition to providing advice and assistance, RE:FIT has a procurement framework with a range of suppliers who are able to provide EPCs (Figure A1).

Case Study: Berlin Energy Agency ESCO Facilitation

Site: Wenckebach Hospital Berlin

Building: public owned hospital with 438 beds

Baseline energy spend: EUR 808,359/year

Guaranteed savings: 39.6% (EUR 320,000/year)

Investment: EUR 2.44 m

CO2 reduction: 1,789 tonnes/year

Duration of contract: 12 years (started 2011)

Energy efficiency measures: insulation of top storey ceilings, modernization of heat distribution, cooling and ventilation system, installation of combined heat and power (CHP), web-based energy management system and user training.

This significantly reduces the time and effort to procure a supplier, as only a mini-competition is required rather than the full EC compliant tender that is usually required for public sector bodies within the EU.

In 2014, with the support of the UK Department of Energy and Climate Change and Local Partnerships, a body providing advice to local authorities, a similar service to RE:FIT was launched nationally throughout the UK.

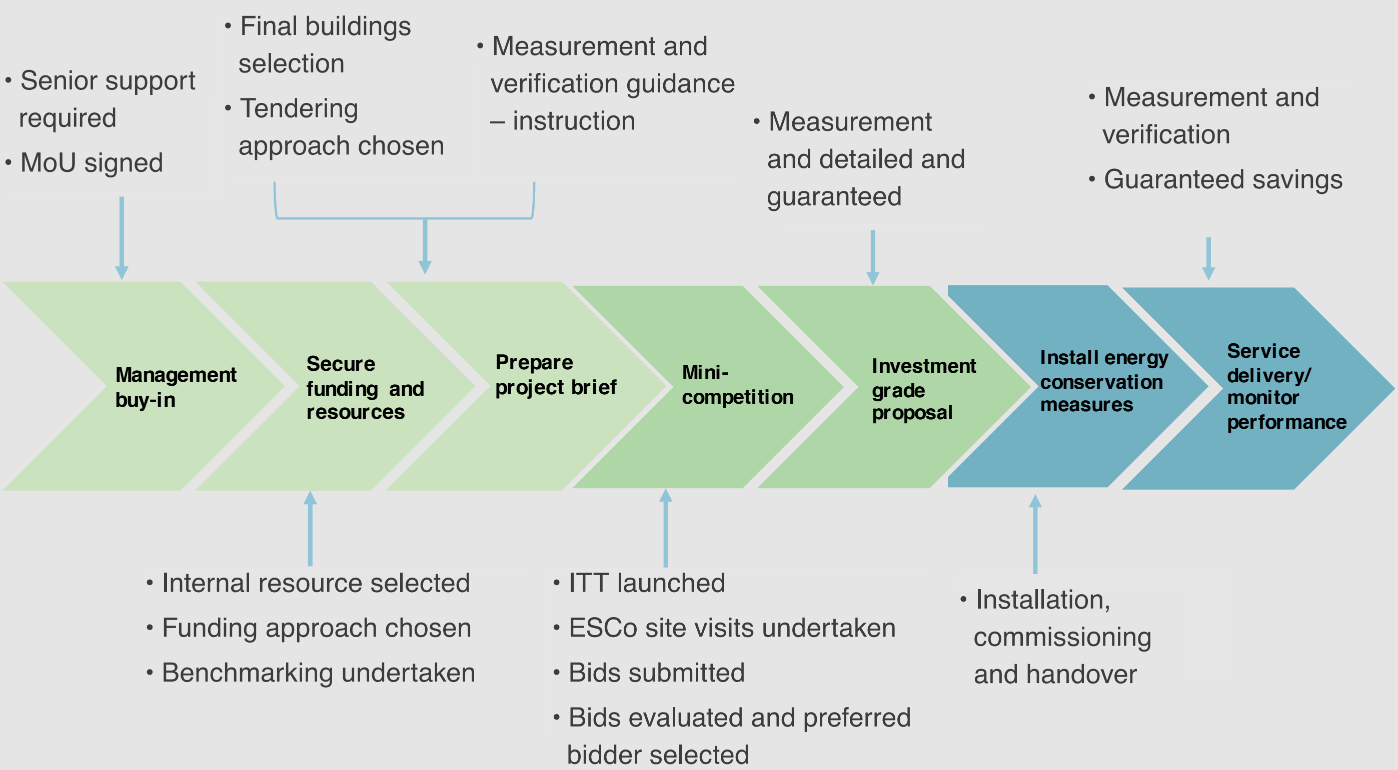

Figure A1. The RE:FIT process.

Source: KAPSARC.

UK: The Carbon and Energy Fund (CEF)

The Carbon and Energy Fund (CEF) is a framework (not a fund despite the name) for developing and procuring EPCs in the UK public sector, with a particular expertise within the National Health Service (NHS). NHS hospitals typically have high energy bills, strong pressure to reduce costs, pressure to increase energy system resilience and a significant backlog of maintenance. The CEF was co-created with the U.K. Department of Health. The CEF offers co-operating organizations ('members') the use of its assistance, framework and contract form. The contract is compliant with EU procurement requirements, which reduces procurement time and complexity. The CEF also provides on-going performance measurement and verification to ensure that the contractor delivers the projected savings. The CEF does not undertake technical development work, but is rather more of a quality assurance agent that provides a standardized approach and contracting framework. It also does not provide finance, but it does access a panel of three private sector lenders that are familiar with the framework and are able to lend to NHS hospitals. A case study from CEF is presented below.

CEF Case Study – Halton General Hospital

Capital expenditure of GBP 5 million

Guaranteed savings of GBP 1 million

15-year term

GBP 2.4 million of high risk backlog maintenance undertaken

55,000 tonne carbon reduction.

The ESCO, Cynergin, was selected after invitation to tender stage.

Capital cost and structure: GBP 4.6 million operating lease, GBP 576,00 grant from Department of Health’s Energy Efficiency Fund.

Energy efficiency measures: 850 kW combined heat & power, new controls and building energy management system, lighting retrofit, water saving measures (including flow regulators, dams, WC controls), variable speed drives on pumps and motors, thermal insulation on pipes and valves.

Prior to the measures being implemented the site was up to its maximum power capacity and without implementing energy efficiency measures the site would have had to invest in an increased power supply, entailing high capex and higher electricity service charges.

About the Authors

Kankana Dubey

Kankana is a senior research associate at KAPSARC working on energy productivity in the GCC. Her work focuses on energy efficiency and developing policy tool kits for government action.

Steven Fawkes

Steven has over 30 years experience in energy efficiency with particular expertise in financing. His main focus is financing energy efficiency. He has published extensively on energy efficiency including more than 250 papers and articles, three books and a regular blog: www.onlyelevenpercent.com

Nicholas Howarth

Nicholas is an applied economist with 20 years of experience working with governments, industry and in academia. A research fellow at KAPSARC he coordinates the center's work on energy productivity in cooperation with UNESCWA.

Moncef Krarti

Moncef is a visiting research fellow at KAPSARC, with over 30 years of experience in designing, testing, and assessing innovative energy efficiency and renewable energy technologies applied to buildings. He is a professor and cordinator of the Building Systems Program, Civil, Environment and Architectural Department at the University of Colorado.

Padu S. Padmanabhan

Padu is the former program director of the South Asia Regional Initiative for Energy Integration (SARI/EI) and senior energy advisor for USAID/India’s bilateral economic assistance program. He has worked with the World Bank in Washington DC, and is a visiting researcher at KAPSARC.

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 and later extending to other countries.

Aimed at policymakers, this project highlights the social gains from energy productivity investments, where countries are currently at, and pathways to achieving improved performance in this area.

KAPSARC

مركز الملك عبدالله للدراسات والبحوث البترولية

King Abdullah Petroleum Studies and Research Center

www.kapsarc.org