THE GLOBAL ESCO NETWORK

COPENHAGEN CENTRE ON ENERGY EFFICIENCY
SEforALL EE HUB

Incorporating Energy Service Companies in Nationally Determined Contributions

The potential of ESCOs for meeting the climate goals in the Paris Agreement

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Editors

Søren Lütken
Xianli Zhu

December 2020

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NASA. The International Space Station continues its orbit around the Earth as Expedition 50 astronauts captured this night image of sparkling cities and a sliver of daylight framing the northern hemisphere.

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Foreword

Brian Dean
Head of Energy Efficiency and Cooling

Energy efficiency is central to efforts to make the transition to clean energy, achieve net-zero carbon emissions by 2050 and limit the average global temperature increase to 1.5˚C by the turn of the century. Energy efficiency is a cost-effective means of reducing 40% of the carbon emissions required to meet the objectives of the Paris Agreement. As of 2018, there are 789 million people without access to electricity, 2.8 billion without access to clean cooking and more than a billion at high risk due to a lack of access to cooling. As we enter the decade of action, achieving universal access to energy by 2030 and making progress with the energy efficiency that is needed to achieve Sustainable Development Goal 7 (SDG 7) remain uphill tasks. Countries need to ramp up finance, technology and policy commitments to close these gaps.

Energy efficiency is the "first fuel" that countries should utilize in moving towards their sustainable development targets. The global effort to double the rate of improvements to energy efficiency from an average of 1.3% to 2.6% by 2030 has been slow and now requires average improvements of 3% a year to achieve the SDG 7 targets. The Three Percent Club has come together to support global progress to put the world on a path to 3% in efficiency improvements annually. The benefits of making progress with energy efficiency are numerous and not confined to savings in energy, costs and emissions. Energy efficiency policies and investments have demonstrated benefits in respect of creating new manufacturing value chains, increasing employment, increased household incomes, and making businesses competitive and resilient. Efforts to transition to clean energy cannot be effective without energy efficiency measures that make renewable energy integration and grid management more feasible.

COVID-19 has highlighted the vulnerabilities that countries face due to global economic contraction and falling revenues, in addition the global health crisis. The importance of energy efficiency in building back resilient economies has been recognized in the stimulus packages of some of the major economies. Stimulus packages based on interventions in energy efficiency are viewed as investments that can create jobs and economies that are sustainable and less exposed to global externalities.

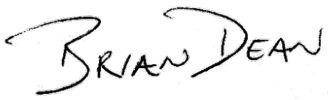
This is an important moment for energy efficiency, particularly the ESCO business. ESCOs have played a critical role in devising business models to overcome the barriers of high upfront capital costs, technology selection, and ensuring energy savings for the stakeholders that invest in energy efficiency. The success of ESCOs is intrinsic to achieving the SDG 7 targets relating to progress with energy efficiency by 2030. Furthermore, ESCOs can play a vital role in reviving economies, creating jobs and building back better.

The Copenhagen Centre for Energy Efficiency (C2E2) was initiated as the energy efficiency hub for Sustainable Energy for All (SEforALL). Recognizing the importance of ESCOs

in accelerating the uptake of energy efficiency to meet the SDG 7 targets by 2030, C2E2 established the Global ESCO Network to promote the role that the sector is playing in combating climate change, creating competitive businesses and developing resilient economies. The Global ESCO Network brings the global ESCO community together to share knowledge, best practices and advocate energy efficiency. The Global ESCO Network is evolving, with the Efficiency Valuation Organization (EVO) becoming an implementation partner supporting the next steps for the ESCO community.

This is a unique moment for the ESCO community and for countries to develop enabling policies and market mechanisms able to capitalize on opportunities and meet development needs. As more governments include energy efficiency in their recovery packages, it is important that they are accompanied by policies, institutional frameworks and capacity-building efforts to remove the structural barriers and unlock finance for energy efficiency. Only then will the full potential of the ESCO community yield the progress needed to achieve the sustainable development goals.

SEforALL congratulates C2E2 and its partners for publishing this latest *Perspective* series and bringing forward the key voices from the ESCO community around the world. SEforALL remains committed to the cause of the Global ESCO Network and is looking forward to continuing its support to C2E2 and EVO so that the potential of energy efficiency can be brought to the attention of national governments and best practices can be promoted through the activities of the Global ESCO network. We invite all partners to join hands in growing this network and championing its cause in support of SDG 7 and the Three Percent Club goals on energy efficiency.



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EDITORIAL

Incorporating Energy Service Companies into Nationally Determined Contributions

The potential of ESCOs for meeting the climate goals of the Paris Agreement

Introduction

This year's edition of *Perspectives*, issued by the Copenhagen Centre on Energy Efficiency (C2E2), is devoted to the opportunities presented by the Energy Service Company (ESCO). In particular, it focuses on the potential role of ESCOs in developing ambitious Nationally Determined Contributions (NDC) as part of the Paris Agreement, thus not only underpinning the energy efficiency agenda itself, but also creating a perspective from which to influence entire NDCs, thus integrating the energy efficiency agenda with financial and operational clout that reaches far into other spheres of the energy and emissions reduction agenda.

The 2020 issue of *Perspectives on ESCOs in NDCs* consists of ten invited articles from leading experts and practitioners around the world, including regional and national ESCO associations.

In recognition of the important role of ESCOs in making improvements to energy efficiency and mitigating GHG emissions, in 2019 C2E2, together with the UN's SEforALL initiative, established a Global ESCO Network. In 2020, a partnership with EVO, the Efficiency Valuation Organization, was created to reinforce these efforts. This edition of *Perspectives* is one of the results and can be considered one of the activities under the Global ESCO Network.

The Paris Agreement is based on voluntary Nationally Determined Contributions (NDCs) drawn up by the participating countries or Parties. After the submission of initial NDCs in 2015-2016 and several years of their implementation, the Parties are preparing a second round of enhanced NDCs with the aim of submitting them before the next international climate negotiations. The Paris Agreement has also introduced a Global Stocktake to conduct a periodic

review of the Parties' collective progress towards achieving the global climate change goals; the first such Stocktake will take place in 2023.

Despite the high benefits and low cost of energy efficiency as a major solution for mitigating climate change, a large number of energy efficiency opportunities remain untapped due to multiple barriers. ESCOs, which combine technical expertise and financing, are businesses that can play an important role in boosting private investments in energy efficiency and its implementation. The development of ESCOs varies from country to country, and it is necessary to spread the experiences and best practices of ESCO development policies in order to help countries improve their frameworks for ESCO development.

Raising awareness among national policymakers about using ESCOs as a practical tool for implementing energy efficiency projects is an important starting point for unlocking the potential to improve energy efficiency and increase the ambition in the updated NDCs. This year's *Perspectives* shares experiences and best practices on how to make ESCOs work and engage businesses to leverage the implementation of energy efficiency projects.

By doing so, it is hoped to inspire countries in their policymaking and planning of climate change mitigation action.

The Articles

The subjects explored in the 2020 issue of *Perspectives* are discrete elements of the overall energy efficiency agenda. The ESCO business model may be seen as one such discrete element, but the ten articles further explore different aspects of the ESCO agenda. The issue is not intended to be a full-scale guide to the development of ESCO policies and strategies, nor to how ESCOs operate and ensure the financial basis for their success. Instead, it aims to provide a comprehensive guide on issues to consider when opting to include energy efficiency in the revision of NDCs. It therefore highlights the challenges while particularly emphasizing the wide-ranging potential involved in embarking on dedicated ESCO strategies that yield a profit to all stakeholders.

The following is a brief introduction to these topics. However, all the authors in this issue approach their topics based on their own experience and expertise.

The first article by Søren Lütken looks at the role that energy efficiency has played in climate initiatives since these began in earnest after the Kyoto Protocol was agreed in 1997. The article shows that, while energy efficiency is acknowledged as an essential element in national responses to the climate change challenge, project implementation is falling behind. Compared to renewable energy, which is based on a few technologies, energy efficiency is fragmented into the adoption of more efficient technologies in every sector of the economy, leaving most of the opportunities unexploited.

The Energy Service Company, or ESCO, dates back to before the climate change negotiations. The concept became prominent in the USA in the 1980s and has spread, with differing degrees of success, to other parts of the world. Pierre Langlois writes about how the ESCO concept developed with the help of both public- and private-sector actors and how different models of its implementation emerged, culminating in the development of public-sector Super ESCOs over the last ten years.

Even though energy efficiency should be the 'first fuel' of energy policy-makers and governments worldwide, it has to face regulatory and policy barriers. Dilip Limaye and Jas Singh take a look at the most typical barriers, explain how the ESCO business model works, describe how ESCOs navigate these barriers, describe different ESCO models based on international experience, and finally offer a road map for ESCO development that could be adopted by any country.

In the fourth article, the importance of accrediting ESCOs is highlighted by Pierre Langlois and Timothy Unruh. The lack of trust in the energy performance contract or EPC and promises regarding energy savings have been central obstacles to ESCO development. ESCO accreditation is presented as an efficient tool both to overcome uncertainty and to professionalize the sector so as to improve both supply and demand. In the fifth article, Alexander Ablaza explores one of the most frequently mentioned of such barriers and examines different models for securing financing for ESCOs and their investments in energy-efficient equipment. In many instances, particularly in developing countries, multilateral financing institutions are one of the initiatives that are kick-starting the ESCO sector.

In the sixth article, Stephane le Gentil picks up the threads left by Pierre Langlois and Alexander Ablaza in his exploration of the growing trend to create Super ESCOs, where

the public sector is blazing the trail for setting up ESCOs through a dedicated financial and implementation structure for public-sector retrofits.

The last four articles explore ESCOs and ESCO development on four different continents: Latin America, North America, Africa and Asia. Monica Gazmuri and Juan F. Richards describe the many obstacles that the ESCO sector faced in its development in Chile, and particularly how the establishment of a national ESCO association was instrumental in its ultimate success. Timothy Unruh and Donald Gilligan describe the development of an ESCO market in the United States, how it was born through lighting retrofits, but more importantly how ESCOs have been able to ride different waves of technology and to thrive by adopting best practices and avoiding the 'cherry-picking' of technologies while also incorporating systems approaches and adapting to customers' needs. In Africa, where ESCOs are yet to become mainstream, Fenwicks Musonye describes how Kenya could benefit from learning about the ESCO experience from countries in similar situations. Finally Xianli Zhu closes the market-specific presentations with a study of China's experiences in utilizing ESCOs and in the process becoming by far the largest market for energy performance contracting or EPCs.

The Global ESCO Network

The Global ESCO Network was established in 2019 as a collaboration between a number of key experts and organizations with stakes in ESCO development and the Copenhagen Centre on Energy Efficiency as the energy efficiency programme of the United Nations' Sustainable Energy for All initiative. The Global ESCO Network adds to and reinforces existing efforts to promote increased activities by the ESCO Sector on a global scale by:

- Working for formal recognition of the ESCO sector as a pathway for countries to strengthen and achieve energy efficiency ambitions in their Nationally Determined Contributions (NDCs) under the Paris Agreement on Climate Change.

- Supporting a better understanding within the finance sector of the value and validity of energy performance contracting or EPCs, thus enabling investors to engage in the provision of financial resources to facilitate a decisive scaling-up of the reach and depth of ESCO activities.

- Documenting the benefits of applying ESCO principles in business and policy development through the international mapping and benchmarking of framework conditions for the successful operation of ESCOs and their achieving material energy savings.

- Actively promoting the establishment of ESCO associations and ESCO-related policies in countries where ESCOs are yet to establish a market foothold.

- Widely disseminating knowledge related to best practices in policy and business development related to ESCOs, and raising policy-makers' awareness of financially attractive models of improvements to energy efficiency.

- Acting as a platform for exchanges of knowledge and experience between national and regional ESCO associations on all aspects of ESCO operations, with the aim of distilling the central issues in order to inform any of the above-mentioned activities.

- Convening experts and operating a repository of authoritative literature and other sources of information in order to establish the Global ESCO Network as the go-to resource for any issue pertaining to ESCOs and their promotion as the central concept for implementing investments in energy efficiency.

Søren E. Lütken — *Editor*

Xianli Zhu — *Co-editor*

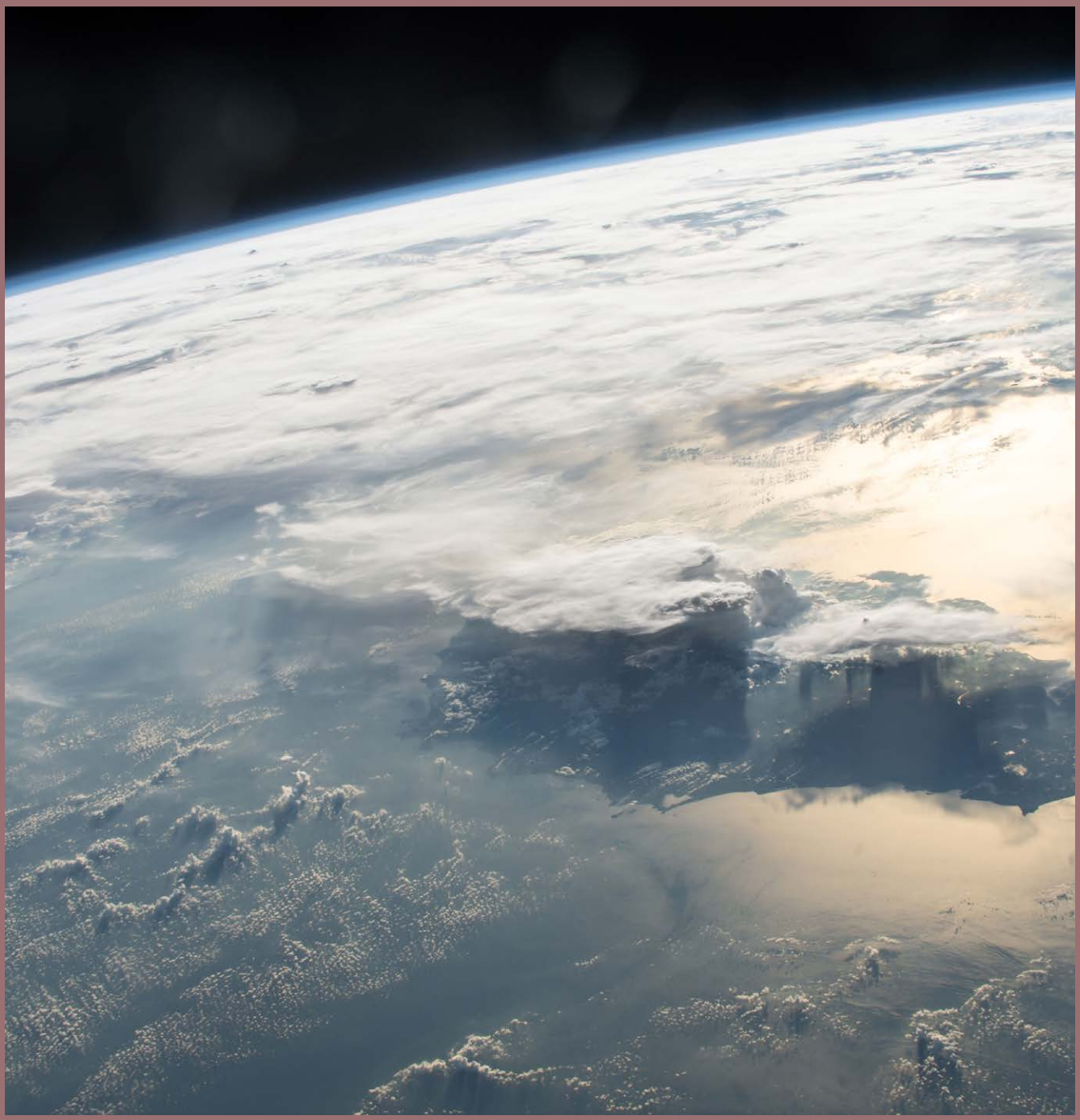


Photo credit: NASA

Søren Lütken
Senior economist,
Global ESCO Network

Energy efficiency in international climate change policies, past and present

How the absence of practical approaches to achieving efficiency potentials keeps energy efficiency off the nationally determined responses to the climate change challenge – and how ESCOs may assist

Abstract

Since the global climate change agenda first dawned, energy efficiency has held out the promise of cost-efficient options to make emissions reductions. It practice, it has delivered poorly on that promise, as recorded evidence from practically all frameworks emerging from the climate change negotiations have shown. The Nationally Determined Contributions (NDC) launched under the Paris Agreement are a new opportunity, this time rooted not in national ministries of environment but in governments. However, as shown by the first submissions in 2016, the risk yet again is that, although energy efficiency may be on the radar, it is just a blip on the horizon that doesn't seem to be coming any nearer. The technologies and methodologies for their implementation represent a multitude of approaches that leave energy efficiency at a disadvantage when it should be given a priority for its profitability alone. The so-called 'energy service company' (ESCO), with its combination of technical expertise and financial solutions, is an effective instrument capable of turning promise into reality by offering a concrete value to host governments in accelerating the implementation of energy efficiency projects. In that regard, the promotion of ESCOs in the context of climate change may ultimately require more active engagement by national ministries of finance with a vision not only of the efficient deployment of fiscal incentives for investments in energy efficiency, but also of the profits from energy efficiency investments being shared with those that are responsible for responses to climate change and will ultimately bankroll them.

Introduction

The global production of energy continues to be the prime source of greenhouse gas emissions. Immense amounts of capital are being ploughed into the sector every year, especially in emissions-free technologies. It is years since investments in the generating capacity of renewables overtook similar investments in hydrocarbons.

The dominant position of the energy sector as GHG emitter No. 1 has not changed since 1992, when the Earth Summit in Rio de Janeiro put climate change on the global agenda, where is has remained ever since. When countries around the world got to work, the range of viable alternatives to fossil fuels were limited. Wind turbines and solar panels were available, but the commonest wind turbine was a 225-kW Vestas machine manufactured in Denmark[1] requiring up to 50% government support to be commercially viable, while the cost of solar PV panels was about 8 USD per watt (Bloomberg New Energy Finance & pv.energytrend.com), more than fifty times the current cost. Renewables, except for hydropower, hardly figured at all in any energy statistics. Hence, even though China was yet to develop into a major energy consumer, and global energy consumption was about 40% less than it is currently, the challenge was still daunting.

No wonder, then, that when looking at ways to reduce the global economy's carbon footprint – at that time an issue mainly for the developed economies – the option of simply using less energy seemed not only obvious and straightforward, it was also one of the very few solutions available. At the same time, it was a strategy that the oil crisis of 1973 had already helped onto the agenda, especially because of the demand for heating. Energy efficiency had already become a term, and its potential seemed promising, so much so in fact that a new type of company emerged during the 1980s, the Energy Service Company or ESCO. The following article by Pierre Langlois briefly outlines its history. The ESCO model preceded the climate change agenda by a decade, a period in which it not only managed to boom, it also almost went bust due to the greatly fluctuating energy prices during those years.

Therefore, even though the ESCO is a business model that directly responds to the global challenge to reduce greenhouse gas emissions, the arrival of the climate change agenda, coinciding with the downturn in ESCO business, unfortunately failed to become a serious driver of ESCO business development worldwide. The linkage remains weak.

Hence, despite being the first obvious technological line of defence against rising greenhouse gas emissions by the energy sector from consumption as well as production, and despite demonstrating some of the best returns from energy-related investments, energy efficiency still mainly counts as no more than a general ambition in national plans to combat climate change.

Nationally Determined Contributions under the Paris Agreement

The Paris Agreement of 2015 on the one hand raised the bar for the global goal of climate change mitigation while on the other hand somehow lowering the bar for national contributions to achieve it. This conundrum is a result of the bottom-up process of Nationally Determined Contributions to the global effort to limit the average increase in temperature to less than 2°C. The annual Emission Gap Reports published by the United Nations' Environment Programme (UNEP) shows how far these national pledges are from what is required. In anticipation of ever-increasing national ambitions to be submitted as updated NDCs every five years, the hope is that the gap will narrow as countries submit their updates. The first round of updating is expected prior to COP26 in the UK in 2021.

How are energy efficiency and particularly ESCOs faring in the existing NDCs? The first observation is that ESCOs are not faring there at all. Not even the US and China, the two largest markets for ESCOs, mention ESCOs in their first NDCs. This may not be surprising, as NDCs tend to be high-level objectives rather than detailed implementation plans. On the other hand, nothing prevents countries from mentioning implementation instruments, which they all do to differing degrees and in different sectors.

One of the most frequently mentioned sectors in the 187 submitted NDCs is the buildings sector. As many as 53 countries mention energy efficiency in buildings, and 38 specifically reference building energy codes as an example of concrete instrumentation for implementation. The countries that reference building energy efficiency in their NDCs represent 63 percent of global energy consumption

[1] https://mst.dk/media/90030/vindmoeller-i-danmark_ens.pdf

by buildings (NDC Partnership[2]). The share of countries that mention energy efficiency as a focus area is about a third, regardless of whether they are low-, medium- or high-income countries.

The building sector is among the most relevant sectors for ESCOs. Countries describe several strategies in their NDCs for exploiting and leveraging their energy efficiency potential in buildings, not only through building energy codes for new and existing stock, but also through appliance standards, energy efficiency resource standards, rating systems, renovation targets and energy consumption goals. However, energy efficiency is relevant in any sector where energy is either produced or consumed. From that perspective, it is remarkable that energy efficiency is only mentioned as a focus by a third of countries.

Lost lessons from the past?

The lack of realistic approaches to reducing GHG emissions decisively at the beginning of the 1990s, except for an acknowledgement that a more efficient use of energy offered tremendous potential, produced a modest emissions reduction target under the 1997 Kyoto Protocol. Developed countries would undertake to reduce their emissions by 5.2% below 1990 levels by 2012. Developing countries would not reduce emissions at all. In hindsight these targets were tremendously inadequate, and global emissions have skyrocketed since then, even though the Kyoto targets were actually met.

Energy efficiency did play a role, and continues to do so. The energy intensity of the global economy (total energy consumption per unit of GDP) is falling. This, however, is attributable to a plethora of trends and causes that go well beyond the dedicated energy efficiency improvement policies and strategies of national governments. Nor is there a uniform picture across countries. Developed economies generally fare better, due particularly to one important factor, which is the outsourcing of energy-intensive industries to less developed countries. But even in developing countries the figures are improving. According to Enerdata, since 2000 the EU has cut its energy intensity by more than 30% thanks to energy efficiency efforts, leaving its energy intensity at 33% below the global average. China, always the exception, has reduced energy intensity by 44% in the same period, but remains 17% above the global average.

While these numbers are positive, and the global improvement in energy intensity seems to be accelerating (-2.1% in 2019 compared to its historical trend of -1.6%/year between 2000 and 2018), they remain far from the -3.5%/year decrease required to achieve the 2°C scenario.[3] See Figure 1.

In order to support countries in their efforts to reduce emissions in accordance with targets established by the Kyoto Protocol, 'flexible mechanisms' were established. These would allow emissions reduction projects in developing countries to generate 'carbon credits' that developed countries could buy to offset their continued emissions. Highlighted as a necessary precondition to make the targets for developed countries acceptable, the mechanisms have become a unique laboratory for research into the range of emissions reduction opportunities that countries are presented with in considering such reductions, for example, when formulating NDCs. The methodologies that underpin these project-based activities can at the same time provide insights into which energy efficiency technologies have been adopted by which countries, with the caveat that the great majority of these project-based activities have been undertaken through the Clean Development Mechanism (CDM) in developing countries, with only few in developed countries following the Joint Implementation (JI) mechanism.

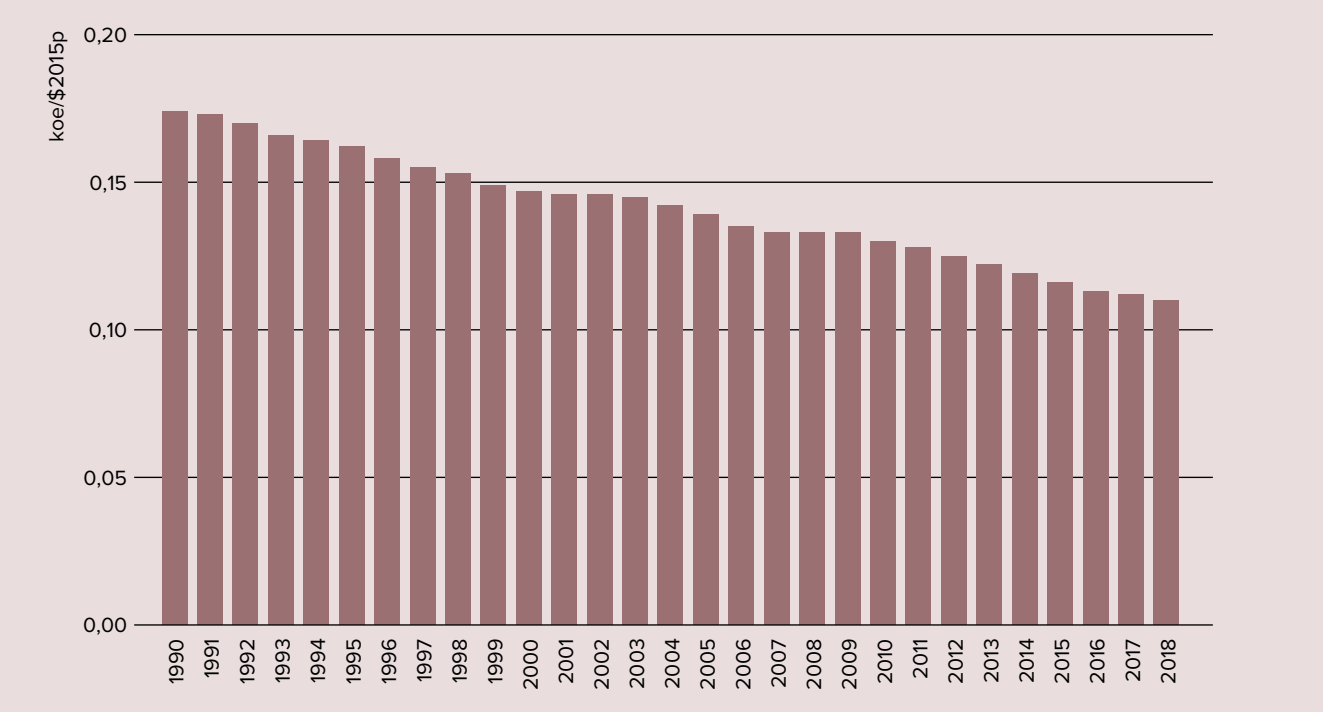
From a methodological perspective, energy efficiency was well represented, and professionals have developed methodologies for a multitude of different energy efficiency applications based on both demand- and supply-side technologies. This has been so much the case that energy efficiency technologies covered 30% of all approved methodologies, representing a very diverse set of focus areas, from forestry through transport to industrial gasses and different sources of methane. In comparison, renewable energy sources are only covered by thirteen methodologies (5%), but total 8129 projects or 64.6%, energy efficiency amounting to only 10.9% of projects.

At the same time, the mantra behind the flexible mechanisms was that they were intended to exploit cheap emissions reduction options in developing countries. The aver-

[2] https://ndcpartnership.org/building-energy-efficiency-and-nationally-determined-contributions

[3] https://yearbook.enerdata.net/total-energy/world-energy-intensity-gdp-data.html

Figure 1. **Energy intensity trend 1990-2019**



Source: Enerdata

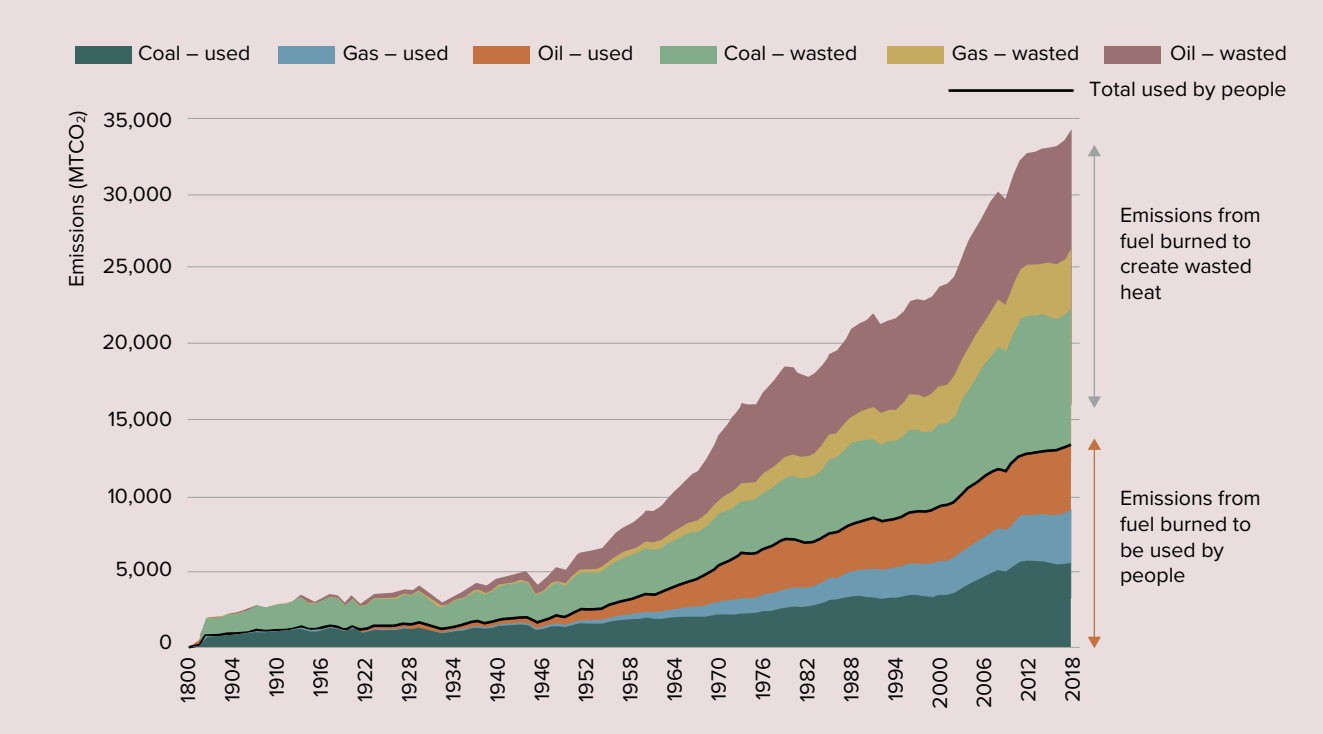
Table 1. **Methodologies and projects under the CDM and JI as of 2019**

Type of energy efficiency project	Number of methodologies	Total number of CDM projects	Total number of JI projects
Households	17	5	1
Industry	21	342	83
Own generation	6	557	7
Service	13	228	12
Supply side	18	152	22
Total	**75 (share of total: 30%)**	**1284 (share of total: 10%)**	**125 (21.5%)**

Source: The CDM Pipeline, http://www.cdmpipeline.org/

age IRR of all of more than 1500 proposed energy efficiency projects – according to submitted documentation, and excluding the value of the prospective income from carbon credits – was 8.5%, compared to the average for all other submitted technologies of 7.0%, thus to some extent countering this claim. These figures must be interpreted with caution, however. The flexible mechanisms laid down so called additionality rules both for calculations and approvals, including limitations for acceptable IRRs in awarding the right to earn Certified Emissions Reductions. Therefore, the calculations are likely to be influenced by these eligibility rules towards suppressing the projected returns. Statistically, however, energy efficiency remained over-represented in methodologies and under-utilized in application.

Figure 2. Emissions from wasted energy



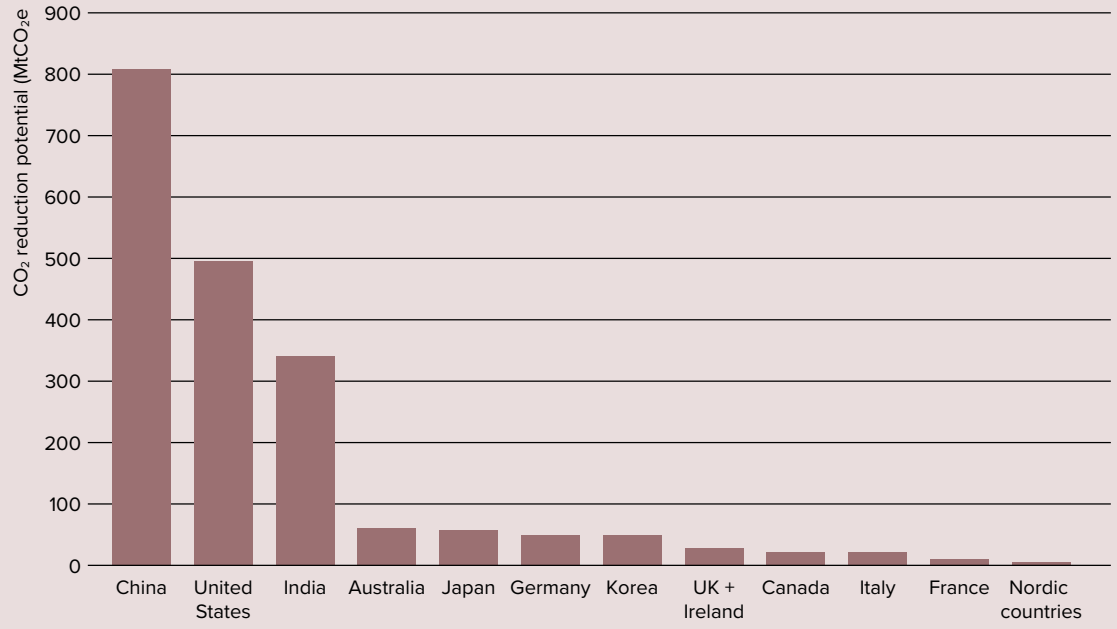
Source: Ketan Joshi (https://ketanjoshi.co/blog)

Notwithstanding, a few energy efficiency technologies experienced a boom. Waste heat recovery in industry alone was mentioned in 401 projects (Methodology ACM12) and energy efficiency combined with fuel-switching in industry in just over 200 projects ((AMS-II.D). These 600 projects were hosted by only fifteen countries, and it comes as no surprise that China and India were the most prominent users, representing 80% of the activity combined. In comparison, the demand side in services, where ESCOs currently have their largest market presence, was predominantly an Indian activity (65% of the registered projects, 40% of which were HVAC and lighting), the remaining projects attempted, particularly in Brazil, failing to materialize. In fact, the failure to materialize was a fate shared by 59% of all energy efficiency projects, while the average figure for all other project types was 31%.

Is it fair to say that energy efficiency missed the train? It probably is. Figure 2 shows the development in emissions from energy production and transport based on fossil fuels as growing from about 22,000 million tCO_2e in 1992 to 34,000 million tCO_2e by 2018. It also shows the share of those emissions that are attributable to waste energy from burning fuel. More than half of the energy consumed for power generation becomes actual usable energy. The supply-side energy efficiency projects registered in developing countries over a ten-year period through the CDM account for just about fifty projects, with untypically low representation by China, with only fifteen projects. At the same time, developing countries have some of the least efficient power plants, represented in Figure 3 by China and India. Many of these plants are run on imported coal, oil or gas and ultimately supply energy subsidized by cash- and capital-constrained governments, representing further co-benefits from supply-side energy efficiency, in addition to the emissions reduction potential.

While it may not be realistic to use all waste heat from power production, there are large untapped potentials, including cost-efficient technologies that could bring emissions closer to the black line in Figure 2. Yet, these potentials remain by and large untapped. Do they figure prominently in Nationally Determined Contributions? Unfortunately, they do not. Even if they represent relatively safe investments with pre-

Figure 3. Potential emissions reduction from power generation through energy efficiency measures by deploying the best available technology*



* Charlotte Hussy, Deutsche Gesellschaft für Internationale Zusammenarbeit: 'International comparison of fossil power efficiency and CO_2 intensity' – Update 2014 Technical Report, September 2014.

dominantly national energy utilities, they are not specifically targeted by, for example, boiler replacement programmes.

The explanation for this has been sought for as long as there has been a climate change mitigation agenda with its emphasis on the energy sector's overwhelming carbon footprint, and the potentials have repeatedly been identified.[4] These supply-side emissions and energy efficiencies are generally not pursued by ESCOs either, even though in most cases the prospective clients are creditworthy (at least they are familiar clients of the development banks). One explanation may be the capital-intensive nature of such investments, while another may be policy sensitivity, engaging third parties for critical supply infrastructure. Interestingly, however, according to the discussions regarding Super ESCOs elsewhere in this *Perspectives* publication, these supply-side options are not the target of such public sector-supported or initiated ESCOs either.

Of course, the CDM registries do not capture everything. Billions of investments have been undertaken without considering climate change, let alone the CDM or JI. The efficiencies of power plants generally increased from 1990 to 2009[5] without figuring prominently in the statistics for climate change-related projects. After all, emissions reduction has not been high on the agenda of ESCOs either. Here, the prime motivation remains the return on investment in saved energy, the emissions reduction being simply a co-benefit that arises out of the power plant's reduced supply.

If the climate change agenda fosters no particular drive to resolve the immense energy waste on the supply side – above the black line in Figure 2 – then there is at least some focus on the demand-side energy efficiency below the black line, as illustrated in the previous section, which documents the inclusion of the building sector's energy efficiency in about a third of the NDCs. This is also where the ESCOs generally operate, even when the potential on the demand side is less and the interventions are more diverse and too complicated

[4] See e.g. Ecofys (2007) - International comparison of fossil power efficiency, Ecofys, August 2007.

[5] See e.g. https://www.eea.europa.eu/data-and-maps/indicators/efficiency-of-conventional-thermal-electricity-generation-4/assessment-2

for many clients (see the case studies from Chile and Kenya in this issue of *Perspectives).*

The demand-side options did not thrive under the flexible mechanisms either, but they did do better. Also, even though the activity level was much less (but the targeted countries were also fewer and smaller), energy efficiency was more popular in Eastern Europe than in developing countries as a whole. The overall picture, however, is that the great opportunities offered by energy efficiency investments as a prime response to demands for GHG emissions reduction remained largely untapped, except for a few targeted technologies. The bottom line is that, for all emissions reduction actions undertaken under the flexible mechanisms, energy efficiency makes up only 10.5% of the issued carbon credits. In developing countries under the CDM, of which 75-80% of activity was registered in China and India, only 5.3% of the issued CERs stem from energy efficiency. In (predominantly) Eastern Europe, this number reached 20.5%. Although a frontrunner in the early days of climate change negotiations, it was left far behind when investments started to flow.

Other climate change contexts

There are other concepts and processes supporting the climate change agenda where energy efficiency could have made headway. From the end of the first decade of this century, the Global Environment facility initiated a process, on a mandate from the UNFCCC, to perform 'Technology Needs Assessments' of non-Annex-I signatories (predominantly developing countries) to the Convention. In an assisted bottom-up process, countries were to identify and prioritize preferred technologies in support of national responses to climate change. In reality these are both adaptation and mitigation technologies, though energy efficiency obviously belongs to the latter.

As of 2020, almost a hundred developing countries have made these assessments, and energy efficiency technologies are being considered by many of them in many different contexts, from energy-efficient irrigation and efficient cooking stoves to power-plant efficiency. A total of seventy different energy efficiency-related actions have been suggested by 36 countries. Also in the TNA context, however, energy efficiency in buildings is the most popular, with twelve countries considering this a priority out of about one third of countries that are considering energy efficiency at all. Co-generation on the supply side is prioritized by ten countries.

The challenge of the TNA process is that there is no link to implementation. Compared to the flexible mechanisms, these national considerations are at a very early stage and are led by national ministries of environment that often have little influence over policies in building and construction or energy sectors or in other sectors in which improvements to energy efficiency might be made. Even if they are followed by Technology Action Plans, they depend on-line ministries to push investments or programmes forward.

This could happen through other initiatives and concepts that have emerged from the climate change negotiations, but is by no means certain to do so. In 2007, Nationally Appropriate Mitigation Action (NAMAs) was launched as a new instrument that was intended to bring developing countries closer to actual commitments to make emissions reductions. If the shelf life of the flexible mechanisms was short – from 1997 to 2012 under the Kyoto Protocol – that of the NAMA was even shorter. In practice it was replaced, at least conceptually, by the NDCs under the Paris Agreement, though the underlying principles remain the same. Hence, NAMAs are still being developed and supported.

The NAMAs are closer to implementation, and programmes dedicated to obtaining implementation finance exist, first and foremost the NAMA Facility[6] championed by Germany and the UK, which so far has ploughed more than EUR 400 million into 34 projects since 2012, eight of which are energy efficiency-focused. Two of these NAMAs, in Mongolia and Morocco, correspond to priorities expressed in their respective national TNAs. Another supported programme in Colombia is for the replacement of refrigerators, while in Thailand a programme for the replacement of air-conditioners is being supported.

More generally, the UNFCCC operates a NAMA Registry[7] to which about 200 NAMAs have been submitted seeking investors, though they rarely find any.

Finally, the Green Climate Fund, founded in 2009 but only operational since 2016 (in the sense that financing has been flowing since then), has so far committed USD 7.2 billion (and disbursed 1.4)[8] to more than 150 projects. As the fund supports adaptation as well as mitigation, and as adaptation

[6] https://www.nama-facility.org/projects/
[7] https://unfccc.int/topics/mitigation/workstreams/nationally-appropriate-mitigation-actions/nama-registry
[8] Figures from the GCF, https://www.greenclimate.fund/projects/dashboard, accessed November 2020.

projects have a harder time raising finance elsewhere, there is a bias in that direction. Nevertheless the GCF has committed itself to financing 52 mitigation projects, eight of which are energy efficiency-related, and only two of which can be traced to similar priorities under the TNA, namely Armenia's focus on energy management and energy efficiency in housing, and a programme for the replacement of heating appliances in Mongolia.

The general picture when approaching energy efficiency actions through the lens of climate change is that ultimately actions are few and far between, coordination between different signature programmes stemming from the international climate change agenda is limited, and energy efficiency is overshadowed by a multitude of other priorities, even though the profits from investing in energy efficiency could help finance other, more expensive interventions.

Although this has been a cursory overview of the performance of energy efficiency activities supported by structures that have been developed under the climate change agenda, it seems obvious that the more efficient use of our energy resources has not delivered on its original promise, nor has it managed to compete with several other technologies, despite having a considerable head start in the 1990s in terms of both technological and financial feasibility. Whereas improvements to the energy performance of technologies are in most cases able to pay for themselves – the main justification for EPC and ESCOs – other technologies, particularly renewable energy resources, have needed subsidies. Regardless, energy efficiency seems to have taken a back seat.

One explanation might be an assumption that energy efficiency will diffuse itself through the ever-improving performance of appliances. The latest proof of this is the plan to recalibrate Europe's energy labelling by 2021. Circumstantial evidence for the overall effect this may have can be seen in Figure 1. It is more difficult to make that assumption for technologies that require subsidies. Particularly on the demand side, however, and especially for those technologies that are consumer-focused, the acceleration of energy efficient technologies beyond the pace of normal diffusion requires two essential decisions: 1) to discard perfectly functioning technologies; and 2) to require the consumer to understand the lifetime cost of technology rather than only the cost of purchase. The two issues require different choices, including politically.

Discarding functioning equipment and replacing it with more efficient alternatives (point 1) is where ESCOs come in. The assumption is that the scrap value of the replaced units will be zero. Alternatively, such units may come to service in other installations, but that is exactly what the ESCO concept is meant to avoid. In a world where Life Cycle Assessments (LCAs) are becoming increasingly prominent as an instrument to underpin sustainability decisions, a simple zero scrap value approach may in itself not be sustainable. Thus, attention must be paid to the fate of the discarded units. In the example from the NAMA Facility for refrigerators in Colombia, mentioned above, the programme includes a recycling facility for scrapped refrigerators specifically focused on the destruction of CFC coolants. But even in the larger picture, a single focus on energy performance without considering the resource question is objectively skewed. However, in the shorter term, from a policy perspective this may not be the prime concern. It is rather that having to offer a 'scrap premium' for people to get rid of their energy-inefficient appliances and purchase an efficient one instead is generally a very expensive policy, not only because of the grants that have to be paid out, but particularly because all the profits from saved energy accrue to the consumer. This is why, citing guidance from the TNA programme, 'if the ambition is limited to small-scale implementation of technology, then the measures could include procuring equipment and providing it to the end users at a subsidised cost. These measures are directly linked to technology and are potentially one-time efforts. The budgetary allocation therefore is high upfront. However, if the ambition is a wide scale diffusion of the technology then the nature of measures will be different. This is because now the focus will be to facilitate players in the market value chain to operate efficiently [through] measures such as changing the policies' structures to have the right incentives for stakeholders.'

For example, in the US, investment in consumer-funded EE programs increased to nearly $6 billion in 2012, leading to incremental electricity savings reported by the states of 22 million MWh. Compared to a levelized cost of wind energy (LCOE) at the time of about 50 USD/MWh[9] these numbers are good, but not outstanding, requiring six years to compete with unsubsidized wind energy. However, the main difference is that the $6 billion are out of pocket costs, while the 50 USD/MWh LCOE for wind is a business propo-

[9] The Past and Future Cost of Wind Energy, Preprint. E. Lantz and M. Hand, National Renewable Energy Laboratory, 2012.

sition. While the overall social economy of energy efficiency may be superior, government finances suffer significantly from such support programmes, unless, as was the case in the US, these programmes are consumer-funded (through cross-subsidization). However, such consumer funding, particularly in developing-country contexts, may not be politically feasible. This leads us to the second point.

The rational consumer would replace outdated technology with new and more efficient technology that would pay for itself over a reasonable payback period. Rational consumers would also purchase high capital-cost appliances if they are cheaper to operate, provided the savings pay for the increased capital cost. But consumers are not rational, and even the rational ones might not have sufficient access to capital to make the rational choice. Putting policies in place simply to deprive the consumer of the irrational choice by setting minimum standards, is often considered politically incorrect, contentious or at least unpopular. But it might also have more rational motivations, such as protecting national industry. Such issues are captured in barrier analyses, and guidance on how to perform such analyses through stakeholder consultations and other means are legion. However, there is no specific guide for how to overcome the fundamental barriers to large-scale energy efficiency deployment through a well-organized ESCO sector, the establishment of which is crafted by a conducive policy environment that ensures that efficiency gains are actually recorded, not only in a profitable ESCO sector, but also as a short-term surplus in government coffers.

In the larger picture of things, energy efficiency investments, being demonstrably profitable, should be made to pay for the other less profitable or net-cost emissions reduction options. Does the advice usually provided through the climate change window fail to address this sufficiently? It probably does. It is an acknowledged shortcoming of the entire climate change negotiation platform that it is anchored in national ministries of environment. And it is a standing regret of programme developers and implementers that the host countries' ministries of finance are largely absent from donor-funded climate change-related actions. If such policy action packages were readily available promising to make profitable emissions reduction tangible through ESCOs and directed at finance ministries and their interest in revenue preservation and cost savings, the climate change window might assist in raising awareness of the ESCO as a viable implementation mechanism.

The ESCO: a step too far, or a step that needs to be taken?

As already pointed out, the NDCs so far submitted under the Paris Agreement do not mention ESCOs, even though energy efficiency, particularly in the ESCO-relevant building sector, is mentioned in a third of NDCs. It would not be far-fetched to consider implementation modalities, just as renewable energy may be implemented through independent power producers through a feed-in tariff programme. NDCs do go into that level of detail. Further, for the NDCs, these are not confined to communication through national ministries of environment and thus should not be subject to either a shortage of sector knowledge or sector priority, nor indeed to the attention of national ministries of finance.

What does seem to be a general challenge, and not only in the context of climate change, is that comprehensive energy efficiency actions may not be straightforward. Elsewhere in this publication, the argument is made that cherry-picking single technology options forfeits the larger potentials, yet most of the guidance given out in climate change contexts relates to single technologies.

In that regard, the Achilles heel of energy efficiency might be exactly what the initially demonstrated diversity of the methodologies under the Kyoto Protocol's flexible mechanisms documents, even though overly profitable emissions reduction options may also face the challenge of additionality. While it takes 30% of the methodologies to deliver only 11% of the projects, renewable energy is simple in comparison, with 5% of the methodologies covering 64% of the projects. The fragmentation of energy efficiency technology options is immediately apparent, and if the approach is technological, energy efficiency is bound to be at a disadvantage. If, at the same time, the overwhelming focus is the building sector – where, admittedly, there is significant potential, but where, at least judging from the experience of the flexible mechanisms, the market does not venture to obtain a carbon credit and where split incentives traditionally hamper interventions – there is little to suggest that energy efficiency is finally looking to catch up with its original promise to deliver significantly on the climate change agenda unless decisive action is taken.

There is an obvious window of opportunity for the ESCO in the climate change context. First of all, it has largely been ignored, despite holding out the promise of a practical implementation modality for the multitude of energy efficiency

technologies available. Secondly, as documented throughout this *Perspectives* publication, it comes with substantial experience of implementation in both developed and developing markets, as well as from four decades of tangible action. Thirdly, it comes with a built-in monitoring and verification framework because that is the essence of its business concept. Finally it adopts known and tested technologies, despite in principle being agnostic about technology.

The ESCO is essentially a financing instrument. Its main challenge is not technological, it is regulatory and financial. Why, then, consider it from a technology perspective? Why make technology-focused programmes like those described above (the NAMA Facility and GCF and the technology focus of the TNA processes) if the real trigger is the implementation modality? If ultimately the technological choices made are those that also find their way into the finance bill, why not consider this the starting point and bring the finance ministries on board as powerful allies? In that context, energy efficiency in general is at a clear advantage with its promise of profitable emissions reduction opportunities. And the ESCO may be the instrument that turns such theory into practice.

Throughout this publication, and in the literature on ESCOs in general, there is immense evidence of the obstacles that ESCOs are facing in bringing their services to the market. This literature is ESCO-centric in the sense that it is focused on how to remove barriers and allow ESCOs to turn a market opportunity into realization. It is rarely focused on how regulators might benefit and how to make sure that governments get their share of the cake. In many developing countries this almost goes without saying (although it certainly needs to be spelled out anyway) that there are immense budget savings to be made from energy subsidies not paid out. In developed countries, where energy taxes are rather the norm, there are in fact immediate losses to be made, although this is rarely a significant concern, as the losses may be minimal, and climate change mitigation is, after all, becoming a priority. Whichever it is, it is not the focus of either ESCO promotion or the guidance that is emerging from the climate change agenda.

The Nationally Determined Contributions are by nature very conservative exercises. Countries are generally reluctant to commit to anything they are not absolutely sure they can deliver, not only technically and politically, but also financially. And certainty is in short supply. Adopting the ESCO as an innovative financial approach to realize some of the most certain emissions reduction options around should be both the objective of the ESCO community and a strategy for decisively placing the ESCO on the climate change agenda.

Conclusion

As the process of increasing the level of ambition in Nationally Determined Contributions picks up pace in government offices and support organizations throughout the world, energy efficiency is slated for its usual mention or consideration, though there are still few concrete actions aimed at a real transformation of the market. At the same time, however, given that almost a hundred countries have set out long-term goals to achieve climate and carbon neutrality, they can hardly afford to overlook the potential linked with large-scale rollouts of energy efficiency projects or neglect to reap the benefits of cost-efficient emissions reductions.

This issue of *Perspectives* is devoted to the opportunities that exist in the ESCO model to optimize the use and maximize the ambitions not only of the energy efficiency agenda itself, but of the entire NDC system, infusing the efficiency agenda with financial and operational clout that reaches far into other spheres of the energy and emissions reduction agenda. But even this collection of articles may not go far enough in spelling out how exactly the ESCO enters decisively into national responses to climate change. The recently established Global ESCO Network[10] has set out specifically to pursue this objective.

[10] www.globalesconetwork.org

Photo credit: Shutterstock

Pierre Langlois,
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Esco history Approaches and cases The role of private and public sectors[1]

Abstract

The ESCO market has evolved greatly over the more than forty years since it appeared on the energy efficiency scene. From the early 1980s until now, ESCOs have evolved in the ways they operate and the markets they target. Initially launched as a shared savings vehicle offering both technical and financial solutions, the ESCO evolved into offering more diversified approaches, including the guaranteed savings and the energy supply approaches (often referred as *chauffage*). The market also diversified from only focusing on the public sector to extending into the private sector as well. These diversifications have been quite varied, depending on the country and the development of its Energy Performance Contracting (EPC) market.

Governments have played a large role in the introduction, development and expansion of the use of ESCOs to achieve their goals related to energy efficiency (EE) and carbon emission reductions. Making their own building stock available to be retrofitted has been one of the ways they have helped introduce the concept in their respective national markets. The adoption of the relevant legislation and regulations has also enabled the use of EPC schemes.

The private sector has played a big role in the development of a market for EPC, partly through the creation of ESCOs, but to a greater extent in the development of diverse approaches that have contributed to making the concept work in different national environments.

Innovation has been another important factor in the growth of the ESCO market. The development of public-sector Super ESCOs over the last ten years to address both public- and private-sector opportunities for ESCOs have also helped foster the ESCO industry.

[1] A part of this document has been inspired by a previous publication of the author's entitled "World ESCO Outlook" – see https://www.riverpublishers.com/book_details.php?book_id=862 Langlois and Hansen, 2012.

1. Introduction

From its beginning in the 1980s, the ESCO concept has spread from being a private-sector approach to embracing much more diversity. This article explores how the original private sector to private sector dealings, which used a basic shared savings concept, have evolved to include practically all four potential constellations of deal partners: private-private, private-public, public-public and public-private. Indeed, today ESCOs themselves can be either private or public entities, as can their clients.

This article presents the evolution of ESCOs and the diversity of ESCO concepts and market structures over the years, as well as giving some examples of such diversity in different countries.

2. Context of the beginnings of the ESCO business

The basic concept of EPC as used today by ESCOs originated in France over a hundred years ago. The Compagnie Générale de Chauffe (CGC) is credited with developing a guaranteed savings approach while working with national district-heating firms that then had quite a large presence in the country. Scallop Thermal, a division of Royal Dutch Shell, found inspiration in CGC's idea and modified it to fit the demand side of the meter and their specific needs. Then Scallop introduced the model to the UK and US. At about the same time, Canada developed its own approach with the first public private partnership related to EPC and the country's first ESCO in the form of the creation of a subsidiary (Econoler) of the Hydro Quebec public utility. Based on its success, by the mid-1980s Econoler had introduced the EPC concept in Europe (Belgium, France, Spain and Portugal) and South Asia (Singapore and South Asia) using a franchise system. In an era of climbing energy prices, the idea that a firm could identify energy conservation opportunities for a client, implement the measures it had identified and be remunerated out of a share of the cost savings found a market niche.

Historical research into the development of the ESCO concept reveals that governments were perceived to be having a major impact on the acceptance of EPC in their respective national markets. Some governments have been instrumental in enabling EPC, while others have vehemently opposed it and held back its acceptance, and yet others have simply done nothing to help develop it. Governments that have remained silent on the issue have tended to create uncertainties and therefore made potential ESCOs reluctant to enter into an unknown field.

After the price of oil dropped in the late 1980s and most EPC agreements in North America changed from "shared savings" to "guaranteed savings," the financing picture evolved dramatically. The ESCO was no longer the principal borrower, and the customer secured finance by themselves, with the ESCO's secondary backing. With the surety of the ESCOs, which often belonged to the larger companies, or security insurance offered to smaller ESCOs, financiers began to see energy efficiency as an attractive investment.

Without a doubt, the biggest challenge ESCOs faced during the 1980s and early 1990s was the variations in the energy price. The basic shared-savings concept that has been the backbone of the industry worked very well as long as the price of energy stayed the same or went up. When it dropped abruptly, however, the payback periods became much longer, sometimes even longer than the contract periods themselves. ESCOs went out of business, and owners were left with the bill for the subcontractors. The whole idea of shared savings acquired a very bad name, and the industry nearly died.

By the start of the 1990s a new concept had emerged: guaranteeing the amount of energy saved. The new model not only issued such guarantees, it secondarily guaranteed that the value of that energy would pay the customer's debt service obligation, provided the price of energy did not go below a certain floor. In this new model, the customer would obtain the finance, and the ESCO would no longer have to carry the credit risk as well as the performance risk. Dropping the huge risk that had been tied to guessing the future price of energy, together with new strategies for sharing other risks, made for a more feasible package. During this time of transition, customers frequently asked for two quotes, one with shared savings and one with guaranteed savings. Backing out the numbers through careful analysis revealed that financing costs with shared savings were much greater than the same project would have to bear with guaranteed savings. In the new model, the customer would receive more services and savings for the same level of investment.

In its efforts to establish roots and grow, the industry has experienced many of the same problems in other countries. Each country and its respective culture are unique, but around the world the industry has experienced very similar

problems, leading to some very valuable lessons learned. Indeed, assessing the development of EPC in any environment revealed the following major concerns:

- A working legal system and cultural constraints
- Government leadership
- Lack of customer awareness
- Access to adapted financing mechanisms
- Measurement and verification (M&V).
- Importance of O&M

These all remain important barriers today for most countries and are limiting ESCO market development reaching its full potential. Indeed, outside Europe and North America, shared savings are still frequently used as an EPC model. The popularity of shared savings is based on its clear advantages when a new concept is introduced in an area without asking the customers to incur any debt obligations. In addition, shared savings appeal to customers who are having difficulties in establishing their creditworthiness in a transitional or developing economy. Finally, some large companies promote shared savings, as they have a market advantage over small ESCOs, which cannot establish a significant market presence without becoming too highly leveraged. Nonetheless, the shared savings approach has shown its limits in emerging economies, where most local ESCOs have to use their own equity to finance projects, seriously limiting their growth in increasingly demanding markets.

3. Types of ECO structure

ESCOs have become sophisticated energy efficiency (EE) project developers responsible for an unusually wide spectrum of tasks. Typically they can identify, design and help secure project financing; install and supervise the maintenance of equipment; measure and verify project energy savings; and assume the risk that the project will reduce the customer's energy and operating costs to a level sufficient to repay the investment. The model is therefore one in which risk is transferred from the client to the ESCO, mainly relating to the project's technical success.

ESCOs are generally classified grouped into the following five categories based on their composition and ownership:

- Private sector
- Independent ESCOs, or ESCOs not owned by a private or public electric or gas utility, equipment manufacturer or energy supply company. Many "independent" ESCOs concentrate on a few geographical markets and/or target specific market segments.
- Equipment manufacturers, who have parent companies with an extensive network of branch offices, providing them with a national and possibly international footprint.
- ESCOs owned by regulated or non-regulated electric or gas utilities (public of privately owned).
- ESCOs owned by international oil companies, non-regulated energy suppliers or large engineering firms.
- Public sector
- Internal ESCO structure to enable the realization of EE projects for different public-sector organizations
- Super ESCOs, which facilitate the development and implementation of EE projects (including the financing) but subcontract implementation to private-sector ESCOs

The nature of an ESCO's ownership and structure does not necessarily dictate what it offers. For example, ESCOs affiliated to an equipment manufacturer might supply equipment from competing companies. Secondly, utility and energy supply firms are not limited by territory or supply source.

On a limited scale, ESCOs can be differentiated on the basis of their marketing structure or approach, which focuses on:

- technologies (boilers, controls, lighting, etc.);
- vertical markets (schools, hospitals or steel plants, etc.); and/or
- utility /energy suppliers (electricity, heating/cooling or compressed air, etc.).

However, ESCOs rarely limit themselves to a narrow market in any country because they try to make the most of their presence to tap into a market. ESCOs are more liable to be regionally focused than market-focused.

4. Types of ESCO clients

While the vast majority of the EPC agreements in OECD countries are currently structured for offering guaranteed savings to public-sector facilities, the "chauffage"[2] contract is an increasingly popular model for both private- and public-sector clients, mainly in Europe. Interestingly, Asia, and specially the Chinese and South Korean markets, have focused a lot more on private-sector clients, standing out more as an exception than a norm.

[2] The French word is often used to define an energy supply arrangement where achieving a level of performance is included in the payment mechanism.

The guaranteed savings model has mainly been adopted in countries where there is:

- a high degree of familiarity with project financing
- sufficient technical expertise within a banking sector that understands EE projects and the associated risks; and
- a well-functioning banking structure.

Shared savings is still the favored approach in countries where ESCO markets are emerging, and are also preferred by Super ESCOs, being the basis of their business model. It relies as heavily on the client's long-term financial credit risk as on the ESCO's borrowing capacities and may create serious difficulties for small and even large ESCOs that lack access to financial resources. By incurring debts on even a limited number of projects, an ESCO may find itself too highly leveraged to obtain the finance to implement any additional projects, potentially constituting a key barrier to the industry's growth.

Consequently, it is easy to understand why the public sector is largely the favored target of EPC projects and why only a little share of the market has been going to the private sector so far, despite its significant potential for EPC projects.

5. Specific aspects of each model of contractual relations

As both ESCOs and their clients may by their nature come from either the private or public sectors, there are many different potential types of contractual relationships between them. In all cases, they involve a certain amount of risk transfer from the energy user (client) to the ESCO. Each of them is analyzed below with examples from different countries:

a. Private ESCO, public client

This is the most common way that ESCOs have been operating in OECD countries. Many countries have developed national and regional programs to enable public-sector facilities to benefit from EPC programs and reduce their energy operation costs. This model has proved quite interesting but also challenging, since each program needs to develop its own public procurement mechanisms, which need either to adapt to the current legal framework or work in parallel to change it, as needed.

The public procurement process has proved a challenge when it comes to interesting ESCOs, as the cost of submitting proposals is usually high, and the evaluation process is not always focused on selecting the best-value proposal. Indeed it is often based on other elements given public procurement rules (such as the lowest cost), which are not outcome-based and limit both the ability of the private sector to make innovations as well as the particular technical knowledge and expertise of the public-sector procurement team.

There are as many models here as there are countries that have developed them. Here a few examples illustrating this diversity.

Austria

In early 2000, a ministerial order laid the foundations for a "Federal Contracting Campaign" involving around 300 federal buildings. It became the largest EPC program in the country and evolved rapidly, affecting approximately 550 buildings bundled into 17 pools, which have only been outsourced to ESCOs in the 2000s. By the early 2010s the Austrian Energy Agency had almost entirely left the ESCO market facilitator arena.

As far as the business models that have been used in the market are concerned, they have mostly been labeled "energy-contracting", two basic business models being distinguishable in the national market:

- ESC, performance-based supply of useful energy, and EPC, a performance-based energy savings business model:
- The IEC model, combining supply (preferably from renewable energy carriers) with energy conservation measures in the entire facility, while simplifying M&V procedures through quality assurance instruments.

Canada

The Federal Buildings Initiative (FBI), an energy sector initiative of the federal department of Natural Resources Canada, was officially launched in 1991. Two years later, the first project using an EPC shared savings approach was implemented, recruiting private-sector ESCOs for their technical and financial strengths in order to benefit the government sector. Efforts were indeed made to overcome different ministries' budget constraints in the federal government by promoting the use of private, third-party financing by ESCOs. The Federal Contracting Policy was amended to allow federal departments to enter into such service contracts and

acquire energy services with an energy management firm with a view to implementing EE improvements.

In 20 years (1993-2011) the FBI program has attracted CAD 320 million (USD 250 million) in private-sector investments and generated over CAD 43 million (USD 34 million) in annual energy savings and annual GHG emissions reductions of 285 Kt. This was achieved through 87 projects in over 7,000 buildings, or by retrofitting about one-third of all federal buildings

b. Private ESCO, private client

This approach is the one that could prove to be the easiest to develop, as normally the legal framework does not prove limiting in most countries. Nevertheless, outside a few exceptions, like China and South Korea, most markets on the private sector side have been quite limited, essentially because of the risk to the client's financial viability involved in implementing longer term projects in private-sector facilities.

Below are some examples of how such markets have developed in different countries.

Brazil

The Public Benefit Fund for Energy Efficiency (PEE/ANEEL), which mandated utility investments in EE, was opened in 2000 for EPC-type contractual arrangements between utilities and consumers. Many private- (and public-) sector utilities soon opted to contract private-sector ESCOs to execute these projects. This segment rapidly became the biggest single market for ESCOs in Brazil. The market focus consisted essentially of clients of interest to utilities for strategic reasons. However, while this produced interesting revenue generation, instead of just using mandatory funding through grants, it did little to transform the market as far as EE development was concerned. Private-sector ESCOs were contracted by the utilities (often privately owned themselves) as installers using standard cost-plus engineering service contracts, not performance contracts. Not a single project used commercial bank credit to complement the PEE resources of the utilities, which essentially relied their obligations to use part of their revenues to invest in EE projects. At some point, the utilities greatly reduced their use of this kind of project for various reasons related to the regulatory framework of the PEE/ANEEL. This nevertheless proved an interesting market development involving private-sector entities using EPC.

China

EPC transactions in China were essentially concluded between private-sector ESCOs and private-sector clients. The market started to develop in the early 2000s after the launch of a demonstration project supported by the World Bank, and it developed into the world's largest ESCO market. The transactions are generally classified into three main schemes that are sometimes quite specifically adapted to the Chinese market:

- Shared Savings Contracts, where ESCOs provide the bulk of project financing and are compensated for their investment and services by their client from a portion of the energy cost savings resulting from the project. The assets created by the project are owned by the ESCO until contract completion, when they are transferred to the client, usually for no charge. Any additional savings are usually 'given' to the client. As long as the project is implemented with the basic results originally expected, these contracts typically result in a predictable payment stream. Hence, most Chinese shared savings contracts are actually not the same as the traditional 'shared savings' contracts as defined in North America. They are probably closer in principle to the "ESCO-financed guaranteed energy savings contracts" typically used in western countries.

- Guaranteed Energy Savings Contracts, where the clients provide the bulk of project financing themselves.

- Outsourcing Contracts, where the ESCO finances and develops energy savings assets within the client's facilities and operates them for an extended period for agreed compensation, which is linked in one way or another to the energy savings achieved.

South Korea

In one of the most unique cases in the world, the South Korean ESCO market developed through the private industry sector, which became the most valuable for ESCOs in terms of business opportunities. The majority of ESCO projects have traditionally been within this sector, with the commercial building sector still a rather distant secondary market. ESCO projects appear to be well spread out across different sub-sectors within industry, but they are always concluded between private-sector ESCOs and private-sector industrial clients. Although both traditional types of ESCO contract have been used (shared savings and guaranteed savings), South Korea was formerly dominated by

shared savings contracts. However, they had declined by the early 2010s, matched by clients' increased willingness, and even preference, to enter into performance guarantees as opposed to shared savings contracts.

Mexico

The ESCO concept initially emerged in Mexico in the 1990s. At that time FIDE (Trust Fund for Electric Energy Savings), supported by a loan from the Inter-American Development Bank (IADB), promoted projects aimed at making electricity savings. A strategy was then developed to support and promote the development of a private-sector offer from consulting companies, manufacturers and distributors in order to address the different market barriers related to the implementation of EE projects. Additionally, FIDE engaged the interest of finance organizations in order to secure such projects and in parallel established a link with the newly developed private-sector ESCOs. This early effort led to different alliances among equipment suppliers, international ESCOs and other stakeholders. These alliances resulted in (i) the development of the first model contracts; (ii) the design of financing options; and (iii) the preparation and implementation of demonstration projects. These efforts helped demonstrate the viability of the concept. The new market essentially focused on private-sector clients, as no national program for government facilities was proposed by the public sector.

As the newly formed ESCOs developed their capacities in project evaluation, development and implementation, they worked with an association called "Camara Nacional de Empresas Consultoras" (CNEC), which was to certify the consulting firms and increase their exposure and credibility in the market. Unfortunately, access to financing limited the growth of the EPC market at that time.

Over time, most Mexican ESCOs have focused on specific sectors where their expertise has a significant effect on reducing energy and/or water consumption. For example, some ESCOs have successfully developed projects for the commercial sector, especially in hotels, as well as in hospitals. Others have focused their activities on specific technologies such as heat-recovery systems, seawater for cooling systems, lighting, peak generation and power factor. The size of projects in Mexico usually ranges from USD 100,000 to USD 5 million, or from low to medium. This presents a problem, since these projects are too big for micro-finance programs and too small to attract market financing, given the typical transaction costs.

Over time, the most typical sources of finance for performance-based projects in Mexico have been (i) the end-users' own money; (ii) the participation of private trust funds, development banks or commercial banks; and (iii) the ESCOs' own equity. Accessing project financing by project developers and ESCOs has been particularly difficult.

c. Public ESCO, public client

A public-sector ESCO is not a structure one finds everywhere around the world. Such a structure would essentially have an added value in either unblocking the public sector market by eliminating the need to have a public procurement process, or concentrating the necessary expertise in one location, instead of spreading it around many different government organizations (ministries, agencies etc.). One of the mechanisms to have been used was the use of Super ESCO's owned by the public sector and targeting only, mainly or mostly public sector facilities.

There have been only a few examples of public-sector ESCOs serving public-sector energy consumers, some of which are presented below.

Belgium

Set up by the Belgium federal government, FEDESCO was created as a public ESCO with a focus on the implementation of EE projects in federal public buildings. FEDESCO, a limited liability company under public law, was structured as a subsidiary of the Federal Participation and Investment Company, a government-owned financial holding. It was started with capital of EUR 1.5 million (USD 1.8 million) from the Kyoto Fund, increased to EUR 6.5 million (USD 8.0 million) in 2007.

Starting in January 2007, FEDESCO obtained the exclusive right to apply EPC to federal buildings and to manage turnkey EPC projects on behalf of building occupants, in collaboration with the Federal Building Agency. The objective of FEDESCO's proposal was to apply the EPC shared savings model and to use public-sector financing to address the needs of at least half of all federal buildings, thus creating a potential market at the federal level ranging from 500 to 800 buildings in the following years. Unfortunately, by 2015 FEDESCO's development was facing a number of difficulties

and was merged with the Régie des bâtiments at the Federal level, thus ending its EPC activities.

Croatia

Croatia launched an ESCO approach in 2003 under an initiative of the World Bank and the Global Environment Facility through a first ESCO company. HEP ESCO Ltd, a subsidiary of HEP, a utility-based, state-owned company 100 percent owned by the Croatian national electricity company, was launched as the first ESCO in the country, in the form of a public-based facility. The aim was to create an EE market and increase awareness of its benefits through the use of EPC. The other objective was to create an ESCO company to demonstrate that the ESCO business could survive on the market while being profitable and leading the way to the development of a private-sector ESCO market.

HEP ESCO developed its market mainly in the public sector since, as a public-sector entity, it did not have to go through public procurement procedures and was therefore in a privileged position in being able to negotiate contractual agreements on a sole-source basis. Public-sector facilities became the main source of clientele for HEP ESCO in its first five years of operations. Unfortunately, in 2009, a new budget law entered into force in the country, which allowed budget users (government facilities) and municipalities to go into debt by taking out credits and loans. The Ministry of Finance issued an opinion that contracts signed with ESCOs, either public or private, were commodity loans and should be treated as debt. Consequently, in HEP ESCO's experience this change had an important negative influence on the ESCO market, bringing ESCO projects into competition with the real investments budget users and municipalities needed to make, for example, in the civil construction of new schools, hospitals, roads, public lighting systems or extensions of the latter. With such investments, EE was not regarded as a high enough priority in countries such as Croatia, where the need for new facilities and institutions is crucial for normal life.

HEP ESCO invested USD 24 million in EE projects between 2003 and 2010. From this amount, 83 percent was invested in the public sector and 17 percent in the private sector. From the total amount invested USD 11 million (47%) was invested in the building sector, which mostly includes hospitals and schools, along with USD 9 million in public lighting (37%) and USD 4 million in industry with cogeneration projects (16%) (Figure 9-8).

Germany

The first large statewide public EPC program, the "Energy Saving Partnership (Energiesparpartnerschaft)", to be launched in Germany was initiated by the Federal State of Berlin by grouping more than a hundred public buildings into two building pools. This idea was successful, and in the subsequent fifteen years, more than twenty large EPC tenders were launched. The most prominent example of a facilitator has been BEA (Berlin Energy Agency), but a number of other regional energy agencies (EA-Northrine-Westphalia, KEA – Klimaschutz – und Energieagentur Baden-Württemberg, Bremer Energiekonsens, the State of Hessen and as well as the German Energy Agency and many others), all public-sector entities, also became involved. They all developed adapted model contracts for their initiatives, which laid the basis for EPC contracts in federal, state and municipal buildings in many regions. In this context, the EPC market was mostly developed through large projects in public buildings (pools), hospitals, leisure facilities and the like, making the public ESCO-public sector arrangement the backbone of the market. On the other hand, many of these programs also relied on the use of private-sector ESCOs going through public procurement processes to select them.

Saudi Arabia

In October 2017, Saudi Arabia's Public Investment Fund (PIF) created the National Energy Services Company (NESCO), also known as "Tarshid". This new Super ESCO was created with an initial capitalization of over USD 500 million with the objective of increasing the energy efficiency of government and public buildings, public street lighting, etc., and stimulate the growth of the country's EE industry, in line with the objectives of the Government's Vision 2030 to diversify the economy and drive environmental sustainability.

All government entities are mandated to contract with Tarshid on an exclusive basis in accordance with a royal decree. Tarshid covers at least 70 percent of all projects in the country's EE sector, estimated to be a market of around USD 11 billion.

Tarshid has set up a framework for competitively procuring the services of private-sector ESCOs through EPCs to deliver EE equipment and solutions in public buildings across the country. In this process, Tarshid is also helping build the capacity of local private-sector ESCOs and preparing transaction tools and EPC templates, as well as develop-

ing guidance for the M&V of energy savings in accordance with international benchmarks. Since early 2018, Tarshid has started the process of developing and implementing energy retrofit projects in hundreds of public office buildings, schools, and mosques, and has also started a street lighting program to replace 2.5 million existing streetlights with LEDs.

This Super ESCO model has proved to be a very interesting example of public ESCO-public sector end-user relations, while still relying on the use of private-sector ESCOs for project implementation.

Uruguay

Uruguay defined its energy policy in the early 2000 with EE as one of its key strategies. Actions have been implemented in this regard in order to stimulate the development of a sustainable ESCO market. To support this trend, the Energy Efficiency Act addressed procurement and contracting mechanisms for public institutions, introduced tax exemptions, and supported the implementation of adapted financing mechanisms for energy efficiency projects. The Act was quite supportive of the introduction of the EPC and has good prospects for local and regional business.

At the time, engineering firms in Uruguay were offering energy consultancy services and charging for their services from a portion of the savings generated after the proposed measures had been implemented. Still, no one spoke of ESCOs at the time, as there was no finance available for project implementation, whether from the ESCOs themselves or from the financial market. There was therefore no talk of EPC and little understanding of what the concept meant.

In the public sector, the Uruguayan Energy Efficiency Act introduced changes in public-sector procurement procedures, thereby enabling the direct hiring of ESCOs. Before this modification, the public sector had no legal procedure in place to hire a company to perform energy efficiency services and be renumerated on the basis of the energy savings achieved.

In 2004, the Uruguay Energy Efficiency Project (UEEP) was developed by the World Bank with the support of a Global Environmental Facility grant. As investments in EE projects were very limited in the country, it was proposed to use this project to address the market barriers through the development of a public utility-based ESCO (USCO). The national and publicly owned Uruguay Electricity Company (UTE) developed an ESCO operation within its rank, and the EPC concept was launched. Under this initiative, UTE-USCO would develop, implement and finance investments in energy savings using the EPC shared savings concept. The program was designed for USCO to act as a public Super ESCO, meaning that it would support the development of local private-sector ESCOs and provide them with the finance to implement their own projects. It initially focused its market on public-sector facilities, given the favorable legal framework and the reduced client risk associated with the project.

The components of the UEEP program that were linked to the development of the EPC concept included the following:

- support for the creation and development of USCO, as mentioned above;
- support for the development of private-sector ESCOs through training, operation, support and financing mechanisms; and
- creation of the Uruguay Energy Efficiency Fund (FUEE) to support private-sector ESCOs implement EE projects.

On the financing side, a dedicated guaranteed fund (FUEE) was created to work through financial intermediation institutions. FUEE was managed by the National Development Corporation (NDC), an entity dependent upon the central government. So far, two commercial banks (BROU and BANDES) have signed agreements to participate in this financing system for energy efficiency projects.

d. Public ESCO, private client

This structure, although possible, has not developed a dedicated market due to the reasonable perception that the public sector would take the place of any private-sector ESCOs that were already present in the market or had yet to be developed. The concept of the Super ESCO presents a possible mechanism for using the strength of the public sector as a way to attract private-sector end-users while relying on the expertise of private-sector ESCOs to carry out the work. This would require both shared savings and guaranteed savings schemes to make it fully workable. Etihad ESCO in Dubai, discussed below, is a good example of such a structure.

United Arab Emirates

Etihad ESCO is the official Super ESCO organization under the leadership of the Dubai Supreme Council of Energy. It was established in 2013 as an initiative of the Dubai Electricity and Water Authority (DEWA) to help foster an EPC market in Dubai so that building owners from both the public and private sectors could improve EE in their buildings.

As a public Super ESCO, Etihad ESCO aimed to jump-start the creation of a viable EPC market for ESCOs by performing building retrofits in both public- and private-sector facilities, thus increasing the penetration of district cooling, building the capacities of local ESCOs in the private sector, and facilitating access to project financing. When created, the Dubai ESCO market was expected to provide new business opportunities for joint ventures and international partnerships, as well as engage UAE national entrepreneurs in a diversified supply chain made up of financial institutions, technology providers, equipment manufacturers and service providers throughout the project development, management and reporting stages.

Etihad ESCO was transferred to the Dubai Buildings Retrofit Program as part of the DSM Strategy and had clear goals and objectives. An estimate was made as part of the DSM Strategy study revealing that of the more than 120,000 buildings in Dubai, 30,000 would qualify for an energy retrofit and potentially benefit from the Etihad ESCO initiative. These 30,000 buildings come in all shapes and sizes, consisting of residential and non-residential buildings, as well as government and other privately owned facilities; they became the main target of Etihad ESCO.

The business model that Etihad ESCO has been deploying in Dubai since its creation was for itself to be the middleman between private and public facility owners, ESCOs and financial institutions in order to act as an effective facilitator to remove market barriers so that energy retrofits happen effectively.

As a Super ESCO, Etihad ESCO made sure it did not compete with private-sector ESCOS: quite on the contrary, it was focused on organizing and establishing a market for ESCOs. On this basis, Etihad ESCO encouraged private-sector ESCOs to participate in the calls for tenders that are published regularly on its website. ESCOs need to be accredited through the ESCO Accreditation Scheme of the Dubai Regulatory and Supervisory Bureau (RSB) in order to participate more easily in the projects being launched.

6. Conclusion

The ESCO market has developed greatly over the last forty years in multiple and different ways. The notion of transferring the risks of energy efficiency projects to another party has been an attractive way of addressing the risks, real or perceived, related to such projects by energy end-users. Both public-and private-sectors energy-users have used the model to implement their energy efficiency projects and to benefit from their advantages, including the long-term financial benefits.

The business models used in each country were quite varied, given the need to adapt to the legal and regulatory frameworks where they evolved. They also adapted themselves to the nature of the actors involved (public- or private-sector ESCOs or public- or private-sector involvement).

Unfortunately, many countries have not experienced development of the concept, and there is a significant lack of actors' presence in the market (ESCOs). Nevertheless, in a lot of other cases significant market development has taken place, alongside an impressive increase in ESCO developments, both national and international.

Given the need to address climate change mitigation and the recognized role of EE in achieving such goals, combined with the significant financial crisis that will emerge out of the COVID-19 crisis, interest in the use of EPC will grow, and ESCOs will play an increasing market role in many countries in the years to come.

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Overcoming Regulatory and Policy Barriers To Catalyzing ESCO Development Globally[1]

Abstract

International experience demonstrates that energy service companies (ESCOs), that specialize in EE project development and implementation, can contribute substantially to scaling up implementation of EE projects, particularly in the public sector, which in turn can lead to the growth and development of the energy services markets. However, it is widely recognized that the role and contributions of ESCOs are severely limited because of a number of regulatory and policy barriers. Governments can facilitate and promote the establishment and growth of ESCOs through legislative, regulatory and policy initiatives to overcome the barriers. This paper highlights some of the regulatory and policy barriers to ESCO development and defines actions that governments can take to overcome these barriers and offers a road map for ESCO development applicable in any country. Much of the material draws from the business models and experiences from Western countries but also how describes how such models can be simplified and adapted to developing countries where the enabling environment may not be as strong.

[1] This paper draws upon and updates World Bank reports prepared by the authors (World Bank 2014a and Hofer, Limaye and Singh, 2016).

Introduction

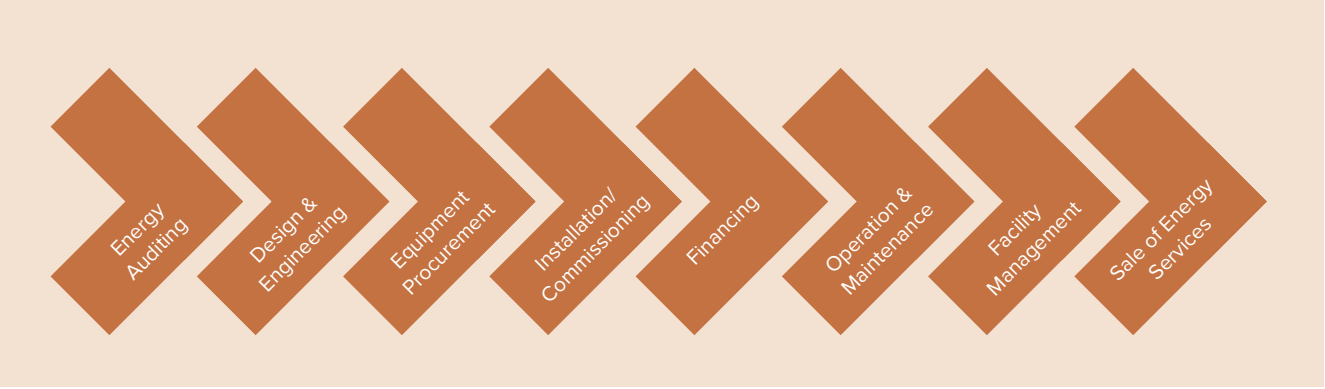
Energy efficiency should be the "first fuel" of energy policy-makers and governments worldwide. Energy efficiency (EE) is among the least-cost and cleanest options for meeting increased energy demand. The International Energy Agency (IEA) notes that of all single energy resources, EE made the greatest contribution to meeting energy demands between 1974 and 2010. Harnessing EE can facilitate more efficient allocations of resources across the global economy, potentially boosting economic output by USD 18 trillion by 2035. Energy efficiency can also help foster job creation (a critical benefit for countries needing to restore their economies after the devastating COVID-19 pandemic), while improving the environment, productivity and comfort levels (IEA 2014). A 2020 IEA and IMF Global Survey found that investing USD 1 million in EE in buildings can create 25 jobs; a similar investment in industrial EE can create an additional ten jobs (IEA 2020).

The aim of the 2015 Paris Agreement, signed by 196 Parties, is to transform development trajectories in order to set the world on a course towards sustainable development, aiming at limiting warming to 1.5 to 2 degrees Celsius above pre-industrial levels (UNFCCC 2015). The Parties also agreed to increase the ability to adapt to the adverse impacts of climate change, foster climate resilience and reduce greenhouse gas emissions. Nationally determined contributions (NDCs) are at the heart of the Paris Agreement and represent the achievement of these long-term goals. NDCs set out each country's efforts to reduce national emissions and adapt to the impacts of climate change. A key element of the NDCs is the implementation of energy efficiency projects (Copenhagen Centre 2019).

The development of private-sector energy service companies (ESCOs), which specialize in EE project development and implementation, can contribute substantially to scaling up the implementation of EE projects, particularly in the public sector (IEA 2018). ESCOs can provide the technical skills and resources needed to identify and implement EE opportunities. They can also provide their services through use of performance-based contracts, thereby reducing the risks to the energy user, facilitate access to financing from commercial lenders, and enable energy users to pay for the ESCO's services from the cost savings achieved (World Bank). However, it is widely recognized that the role and contributions of ESCOs in developing countries is severely limited because of the existence of regulatory and other barriers.

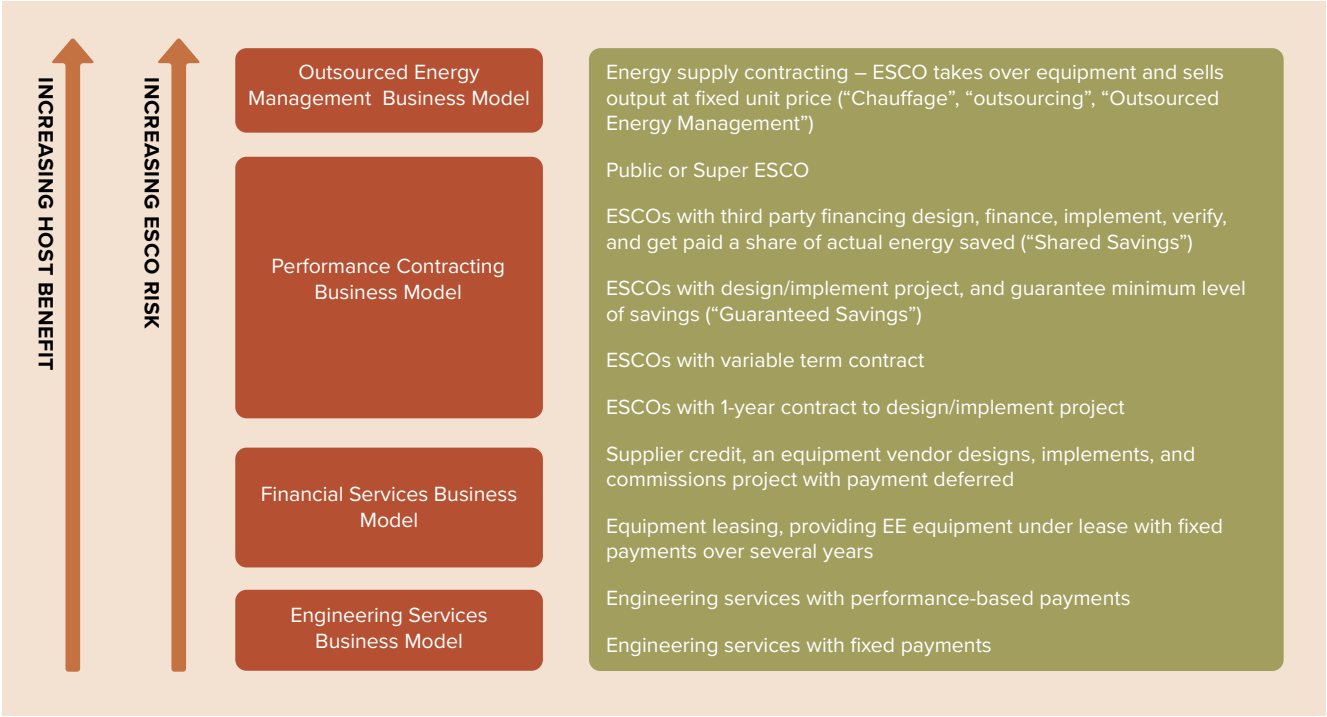
International experience demonstrates that governments can facilitate and promote the establishment and growth of ESCOs through legislative, regulatory and policy initiatives in order to overcome such barriers (Hofer, Limaye and Singh, 2016). This paper explains how the ESCO business model works, describes typical policy and regulatory barriers to the development of EE and ESCOs, sets out different ESCO models based on international experience, and offers a road map for ESCO development that would be applicable in any country. Much of the material in the paper draws on the experiences of ESCO markets in Western countries, as well as how such models can be simplified and adapted to developing countries where the enabling environment may not be as strong.

Figure 1. The Energy Services Value Chain



Source: Limaye 2013.

Figure 2. ESCO Business Models



Source: Adapted by authors from Limaye 2014.

The Energy Services Value Chain

ESCOs provide services spanning the entire energy services value chain, namely energy auditing, design and engineering, equipment procurement, installation and commissioning, financing, operations and maintenance, facility management, and the sale of energy services (Figure 1). While some companies that perform just one or some of these services can count as ESCOs, typically the hallmark of an ESCO is the ability to integrate these services into a single contract, thereby simplifying the project cycle for the client while ensuring greater accountability regarding the results.

ESCOs have drawn on a wide range of business models to offer some or all of the services and products in the energy services value chain identified above. Figure 2 shows the main types of ESCO business model.

The key characteristics of ESCO services are summarized below:

- The ESCO offers a package of energy services related to the design and implementation of EE projects in order to reduce energy use and costs
- Payment for the ESCO's services and repaying any loans are made by the energy user (also referred to as project host) from the cost savings resulting from the projects
- These payments are generally contingent upon certain energy-saving performance guarantees provided by the ESCO being satisfied
- The ESCO assumes most of the technical, financial, and performance risks.

It is important to note that, while ESCOs can provide finance, in most markets they do not. In developed markets, commercial financiers typically provide access to ample finance, which is facilitated by the ESCO's track record and performance guarantees. However, in developing countries, many start-up ESCOs lack a sufficient balance sheet to mobilize such finance on their own. As a result, they must rely on strong, creditworthy clients able to access finance on their own, which ultimately creates one of the more formidable barriers in these markets at the present day.

Barriers to ESCO Development

In the US and Europe various government initiatives have resulted in the successful development of ESCO Markets (Goldman et al., 2005 and Boza-Kiss et al., 2019). Facili-

tating ESCO projects in the public sector can provide an important impetus to the development of a robust ESCO market, as exemplified by the US and Europe. However, even in these developed markets, barriers, confusing ESCO business models, and competing priorities persist. In developing countries, these barriers can be even more pronounced.

The barriers to the large-scale implementation of energy efficiency projects in the public sector include the following:

- Budgeting procedures pose a major challenge because budgets are generally prepared annually, and each year's budget allocation is based on the previous year's expenditure. Therefore, the reduction in budgetary spending on energy costs resulting from an EE project can lead to a decrease in budget allocations in the next budget cycle. These procedures preclude the option of paying for energy services out of the project's cost savings (Switch Asia 2015).[2] Also, reductions in operating costs are typically unable to cover capital expenditure. Government decision-makers are therefore reluctant to undertake EE projects that could lead to future budget cuts or would be prevented under typical public-accounting regulations.

- In many countries, budgeting procedures also preclude public agencies from entering into multi-year contracts. Since ESCO projects generally require payments from energy savings over considerable periods of time, this precludes their ability to sign performance contracts. The inclusion of performance-based payments can also be problematic if the total value of the contract is not known upfront, as public agencies cannot commit to release more funding than they have.

- In many countries, there are significant restrictions on borrowing by public agencies, and payments owed under ESCO contracts are treated in the public agency accounting system as debt. Such accounting practices can limit the ability of public agencies to engage with ESCOs.[3, 4]

- In many countries a typical ESCO performance contract, which entails repaying cost savings over many years, may be treated as debt. There are often limits to debt financing by public agencies. In some countries, public agencies are not allowed to incur any debt, while in others there are limits to the amount of debt they can incur (and in many cases, public agencies such as municipalities are already at their debt limits).

- Public-sector contracting and procurement rules are often rather restrictive; for example, they may require the project to be predefined (i.e., with a final design and bill of quantities) and insist on selection of the lowest bidder, making it difficult to adopt a performance contracting approach that allow for alternative solutions and maximizing the best value for the client. In energy services, the EE measures may not be fixed, and the lowest-cost supplier is not necessarily the "best" provider of energy services, particularly for projects involving varying levels of energy savings.

- Responsibilities for capital and operating budgets in public agencies may be dispersed, making it difficult to deploy funds from capital budgets to reduce operating costs. This is often referred to as the principal-agent problem, where one entity has to make the investment, but another accrues the benefits.

- Energy pricing can also be a challenge when energy prices are low or bills are not consistently collected, or are not directly based on consumption. For example, some public buildings connected to district heating (DH) networks are billed on the basis of heated floor area rather than energy consumed. There may then be no incentive for the public building administrators to reduce energy use and no generated cost savings from which to repay debt.

- Many public buildings, such as kindergartens and schools (particularly kindergartens and schools), do not have adequate comfort or lighting levels and need significant structural rehabilitation (for example, see USAID, 2016) to comply with existing building codes (structural integrity, fire and seismic safety). In such situations, an ESCO project to improve energy efficiency that also needs to bring buildings to adequate comfort levels requires large investments that may not generate cost savings, thereby limiting the project's cost-effectiveness.

[2] One exception to this is Hungary, where local authorities can keep their operating costs constant if they have a signed contract with an ESCO (Central European University, 2007).

[3] For example, the existing legal framework in the Republic of Georgia does not permit central government agencies to undertake loans. The creditworthiness and borrowing capacity of municipalities are both limited, and municipalities need approval from the Ministry of Finance to borrow funds (World Bank 2016a).

[4] In Kosovo (World Bank 2016b), existing regulations limit municipal debt in conformity with the rules regulating deficit limits (Government of Kosovo, Procedures for Issuance and Management of State Debts, State Guarantees, and Municipal Debts, Article 9).

Table 2. Government Actions to Foster ESCOs

Create a Stable Demand for EE Services	Remove Barriers to Public Procurement of EE Services	Facilitate Financing of ESCO Projects
• Increase public agency knowledge and awareness of ESCOs • Increase public agency capacity to identify ESCO opportunities • Require EE targets and action plans • Develop standard, templates, benchmarks and M&V schemes • Organize workshops with public agencies and ESCOs • Aggregate similar projects across public agencies • Accredit or certify ESCOs	• Allow public agencies to sign multiple-year contracts • Allow retention of energy cost savings to pay ESCOs • Change procurement rules to select most value, not least cost • Exclude ESCO payment commitments from public debt • Require consumption-based billing for district heating • Establish "Facilitators" to help public agencies • Encourage public agencies to use simple ESCO business models • Develop model M&V protocols and other standards	• Establish EE revolving fund with loan facility, energy services agreements (ESAs) or other suitable financing schemes • Provide budgetary grants to improve comfort levels and address structural aspects • Provide risk-sharing facility • Facilitate forfeiting of ESCO contracts • Establish public or super ESCO

Note: PA = public agency; PPP = public-private partnership; M&V = measurement and verification.
Source: Adapted by authors from World Bank 2014a.

- Commercial banks are generally unwilling to provide project financing to ESCOs when the project host is a public agency. Most public agencies do not have sufficient internal funds (budgetary resources) to make the capital investments needed for EE projects. Therefore the ESCO needs to either arrange finance for the public agency from commercial sources or obtain finance directly from such sources. Both options face several barriers. Many public agencies are not creditworthy from the perspective of commercial lenders, and even creditworthy agencies are often already at their borrowing limits. Also, commercial banks and financial institutions are generally reluctant to lend to public agencies because they cannot provide adequate collateral for debt financing.[5]

- Many public agencies lack the capacity to evaluate ESCO proposals, negotiate ESCO contracts, review measurement and verification reports, or manage and supervise ESCOs (World Bank 2010).

Government Actions to Overcome the Barriers

Experience in the US has demonstrated the successful role of ESCOs in scaling up EE project implementation. The vast majority of ESCO activities in the US (about 85% of total ESCO revenues) have been in the public sector (Stewart et al., 2016). In Europe substantial ESCO activities have also been in these sectors (Boza-Kiss, et al, 2019). Such public and institutional projects can be very beneficial to the development of ESCOs because (i) government actions in these sectors provide "leadership by example"; (ii) successful project implementation provides useful case studies that help establish the credibility of the ESCO market; and (iii) these projects help build the capacity of the ESCO industry. Because the public sector is often the largest single user of energy in a country, this market can provide stable and predictable demand for ESCOs, bundle smaller buildings together to achieve economies of scale, offer homogeneous clients (e.g., schools, hospitals, office buildings) for easier replication, and are generally creditworthy. Governments can overcome the barriers outlined above and support the establishment and growth of ESCOs by undertaking a set of legislative, regulatory, and policy initiatives targeted at:

- Creating a large and stable demand for energy efficiency services projects in the public sector.
- Removing barriers to the public procurement of EE services and establish clear regulations.
- Facilitating adequate and affordable financing of ESCO projects.

[5] In Macedonia, the US Agency for International Development attempted to use its partial credit guarantee through the Development Credit Authority (DCA) to increase the interest of commercial banks in lending to municipalities for EE, but this did not lead to a significant number of projects (Meyer and Limaye, 2012)

Some of the policy and regulatory initiatives that can be undertaken by governments are summarized in Table 2.

Creating a Demand for Energy Services in the Public Sector

The public sector is a very large energy user in most developing countries. However, the efficiency of energy use in public buildings and facilities is generally low due to (i) use of old, outdated equipment; (ii) inadequate maintenance; (iii) limited budgets for purchasing efficient equipment; and (iv) lack of knowledge of EE improvements and incentives to make them. Public agencies generally lack the capacity to identify, finance, or implement EE projects, and ESCOs can provide them with useful and valuable services. However, for ESCOs to enter the market, they need to be assured that there is a large and stable demand for their services.[6]

Governments can take a wide range of actions to create such a demand:[7]

- **Increase public agency knowledge and awareness** of the need for EE and the role that ESCOs can play in implementing EE projects.
- **Improve public agency capacity** to identify and assess EE opportunities, including developing training programs, tools, and case studies.
- **Establish binding targets for EE improvements** in public agencies and provide incentives to agency staff to meet or exceed these targets.
- **Require public agencies to develop EE action plans** to meet the binding targets.
- **Develop standardized documents** such as audit templates, benefit-cost assessment tools, request-for-proposals (RFP), bidding documents, and energy services contracts and agreements.
- **Establish facilitators** who can provide technical assistance to public agencies in identifying EE project opportunities, developing RFPs and bidding documents, procuring ESCO services, and monitoring their performance.
- **Develop** simple but effective **measurement and verification (M&V) protocols**.
- **Organize workshops** involving public agencies and ESCOs to publicize ESCO models, facilitate interaction between public agencies and ESCOs, and give ESCOs an indication of the forthcoming procurements from public agencies.
- **Bundle similar projects across multiple public agencies**, creating larger projects with relatively lower transaction costs that will be more attractive to ESCOs.
- **Accredit and/or certify ESCOs**, thereby giving public agencies greater confidence to enter into contracts with them.

Removing Barriers to Public Procurement of EE Services

Legislation, Regulations, Procedures

Governments have a number of options in removing the barriers that currently prevent ESCOs from successfully providing EE services to public agencies, as follows:

- **Revise legislation** to allow public agencies to sign multiple-year contracts. Such contracts are usually needed if the agency is to pay for the energy services from the energy cost reductions the project achieves. In some countries, EE repayments can be categorized similar to utility payments, which are implicitly multi-year contracts.
- **Change public budgeting regulations and procedures** to allow public agency budgets to retain energy savings from EE projects in order to pay ESCOs. This is critical if public agencies are to make EE repayments from the savings. A recent example is the recent modification of budgeting procedures for water utilities in Uzbekistan.[8] Some governments are moving to performance-based budgeting (e.g., $/student, $/patient) to allow for greater accountability by public agencies and promote additional operational efficiency gains.
- **Modify government procurement rules,** many of which currently require projects to be predefined and that the lowest bidder be selected. Instead, the rules should allow bidders to propose a wider range of EE solutions,[9] and the government should select ESCOs based on the proposal offering the best value, such as the highest net present value or NPV.
- **Enact legislation or regulations** to allow public agencies to participate in public-private partnerships (PPP) to

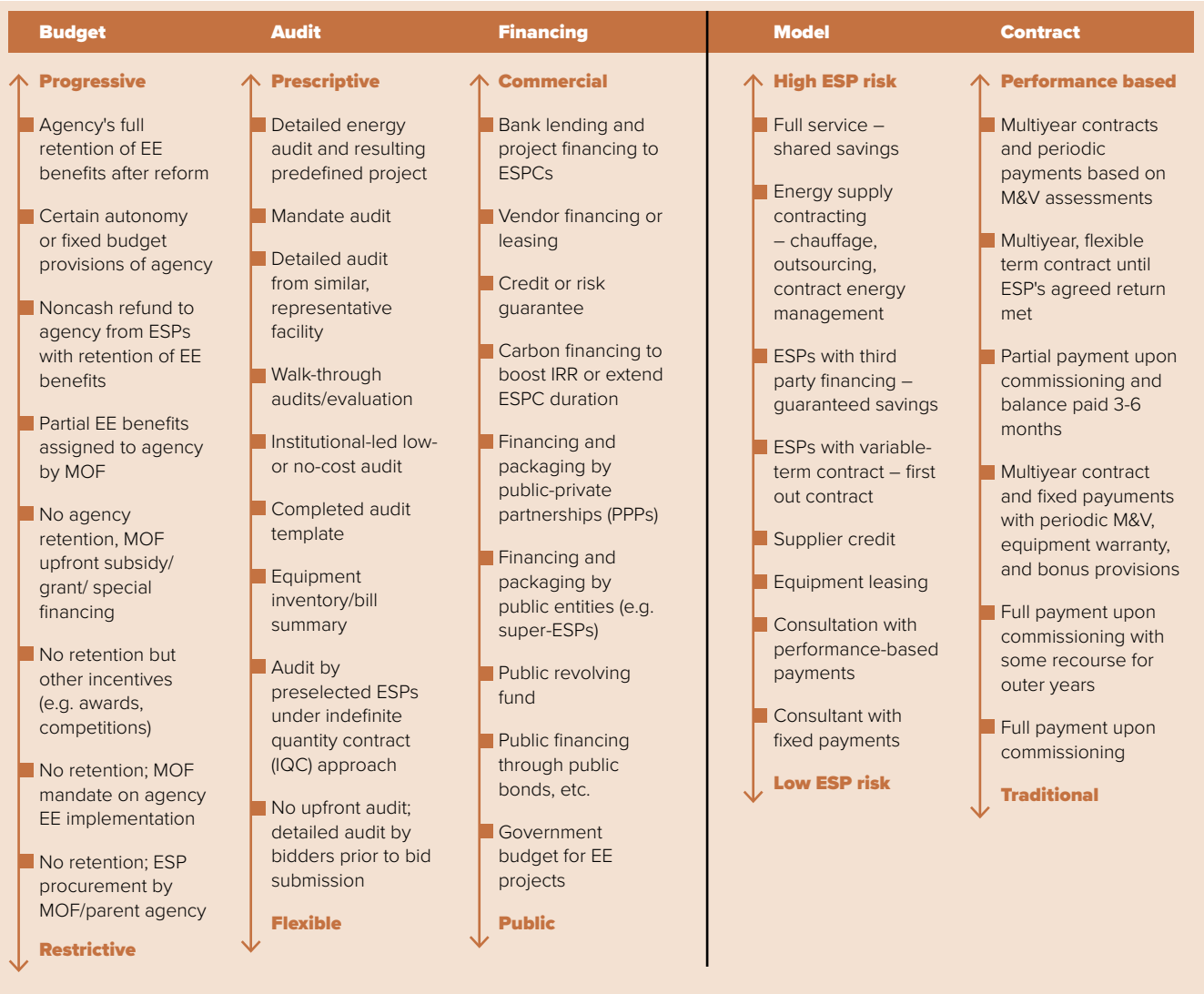
[6] Personal communications and interviews conducted by the authors in several counties in the western Balkan countries and in India, Philippines, Ukraine and Kazakhstan have identified the interest of domestic and international ESCOs in entering local markets provided they can be assured of a sizable and stable demand for their services.

[7] Information adapted from World Bank 2014a.

[8] The World Bank, in cooperation with the Ministry of Housing and Communal Services and the Ministry of Finance, developed a revised tariff structure that allows the water utilities to capture and retain any efficiency gains (World Bank 2020).

[9] The recently enacted Energy Efficiency Law in Kosovo requires an assessment of the possibility of concluding long-term energy performance contracts that provide long-term energy savings (Government of Kosovo, 2018).

Figure 3. Range of ESCO Approaches



Source: World Bank 2010b.

implement EE projects, which can help particularly with the outsourced energy management model.

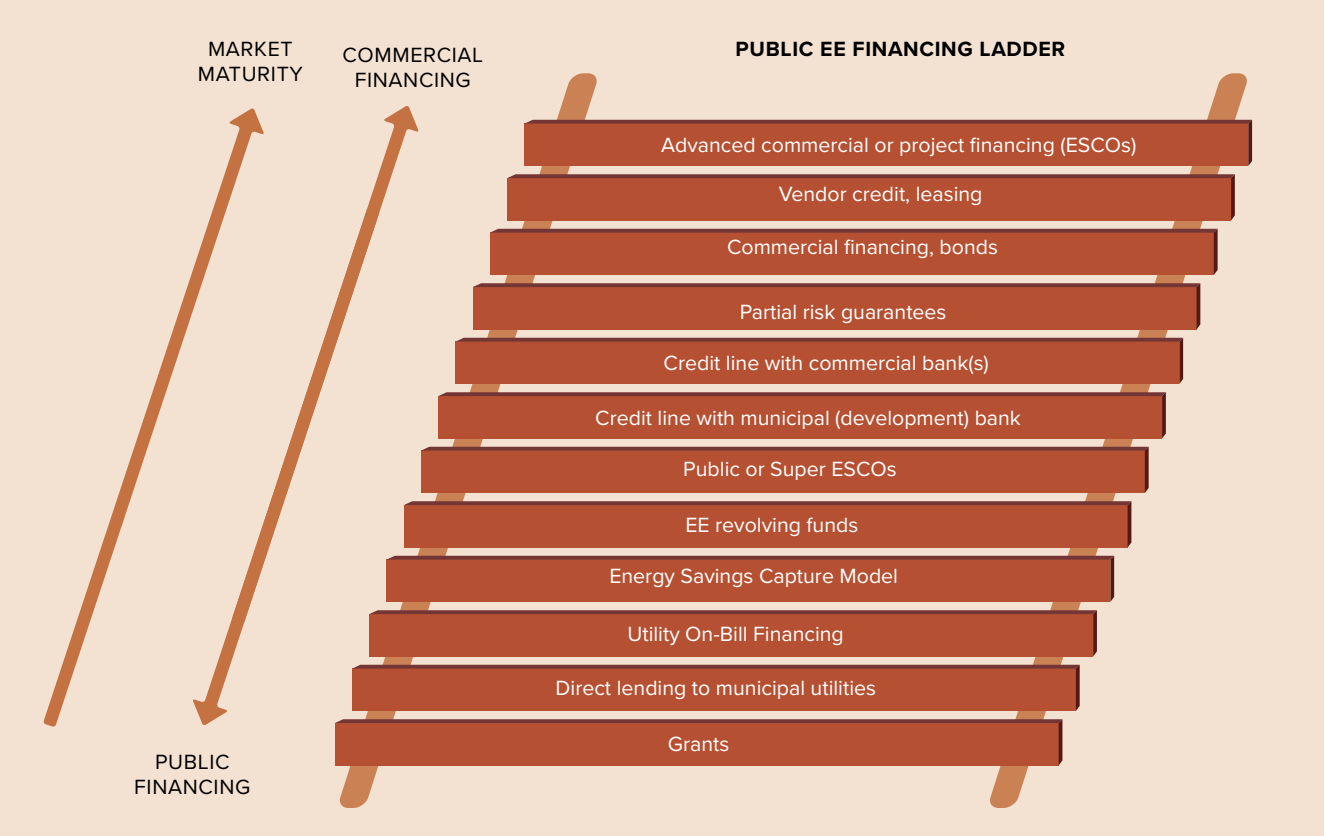
- **Amend procurement regulations or procedures** to facilitate public agencies leasing energy efficient equipment.
- **Change public accounting and budgeting regulations/procedures** to exclude ESCO investments from public agency debt.[10] Given the limited public debt capacity in the Western Balkans region and numerous competing priorities, this change would help motivate public agencies to work with ESCOs, since they would be able to retain their debt capacity for their other investments.
- **Require a transition to cost-reflective, consumption-based energy metering and billing** for all public agencies.

Procurement of ESCO Services

ESCOs can greatly assist EE implementation and help mobilize commercial financing to the public sector. However, procuring ESCO services can be a complex business, since they (i) blend goods, works, services, and sometimes financing (World Bank 2010b); (ii) use an output-based rather than input-based approach to defining the scope of projects; (iii) rely on a variety of cost factors and various public benefits

[10] In Germany, for example, ESPCs are viewed as an alternative to credit financing and are thus not counted against public debt as long as the cost savings are greater than the repayment obligations.

Figure 4. Public Energy Efficiency Financing Options Ladder



Source: Adapted from Limaye, 2019

for evaluation; and (iv) demand payments based on performance, which requires credible baseline and post-project energy-use data (World Bank 2013). While these issues are complex, governments should build upon existing procurement procedures in other sectors that can serve as reference points.

In some procurement laws dealing with PPPs, standard contract models have been developed to deal with similar issues; these include management services contracts, output-based and performance-based infrastructure contracts, and cost-plus contracts (OECD 2013). Based on these precedents, efforts should then be undertaken to develop tailored bidding documents for simplified ESCO contracts that seek to (i) use simplified design construction contracts; (ii) specify a minimum level of performance improvement (e.g., energy savings, emissions reductions, meeting of all national lighting/comfort standards) that must be achieved, rather than prescribing the specific EE measures to be installed; (iii) base selection on the highest NPV; (iv) link at least a part of the ESCO payment to a commissioning test (comparing post-project outcomes with promised results); and (v) include at least one deferred payment. Figure 3 illustrates a range of approaches that allow and promote public procurement of ESCOs.

Governments can also facilitate procurement of ESCO services through the use of simplified business models, such as:

- **Supplier credit**: an equipment vendor designs, implements, and commissions the project with a one -time deferred payment to the supplier;
- **Equipment leasing**: similar to supplier credit, except payments are generally made over an extended time period;
- **ESCOs with 1-year contracts**: to design/implement project, receive 60–70 percent of payment; or
- **ESCOs with variable-term contracts**: similar to full service ESCOs, but the contract term varies based on the verified energy savings, to help ensure the ESCO is able to receive its full payment.

Such models can help create a basis which the ESCOs can build upon and evolve over time.

Facilitating the Financing of ESCO Projects

International experience around the world show that there are a number of financing options for ESCO projects in public buildings that can help address some of the barriers to EE implementation. These options can be represented as a "financing ladder" (Figure 4) to help guide policy-makers in selecting one or more options that can then be designed to provide accessible financing products.

The "steps" in the ladder show the progression from strictly public financing to market-based commercial financing. Moving up the ladder requires the increasing participation of commercial financing and financial markets with improved maturity. Unfortunately, in most developing countries, commercial finance is generally not available for public agencies (including water utilities), so governments have to rely on the lower steps in the financing ladder.

The following discussion focuses on the three options circled in Figure 4: (i) Energy Savings Capture Model, (ii) EE revolving funds, and (iii) public, or "super," ESCOs.

Energy Savings Capture Model

The Energy Savings Capture mechanism is based on recovering or "capturing" the cost savings from an EE project to fund additional project investment without requiring additional capital infusion or increasing the public debt. The cost savings will generally reduce the budget for energy costs in subsequent years. This approach involves keeping the energy budget constant, paying the reduced energy bills from the energy budget, and placing the cost savings in a separate budget account[11] annually for a specified period of time. The funds can then be used for investments in new EE projects. The amount of energy cost savings captured and set aside in the account is determined by appropriate measurement and verification (M&V) of project results.

This approach is being adapted in Montenegro (World Bank, 2018), Uzbekistan (World Bank, 2019) and Belarus.

EE Revolving Funds

EE revolving funds offer viable options for governments to stimulate ESCO projects in the public sector.[12] Such funds have been successfully deployed by national or state governments, with assistance from the World Bank and GEF, in Armenia, Bulgaria, and Romania (World Bank 2014a) and are now being replicated in Mexico, Kosovo and elsewhere.[13] They offer a range of long-term financing options for public-sector EE projects, such as:

- *Loans to (i) public agencies that are creditworthy and have borrowing capacity or (ii) to ESCOs that provide services to these public agencies*, such as those offered by the Bulgarian Energy Efficiency Fund.

- *Energy services agreements (ESAs) with public agencies that have little or no borrowing capacity and/or do not have the capacity to contract with or manage ESCOs*. Under an ESA, the fund offers a full package of services to identify, finance, implement, and monitor EE projects. The public agency is usually required to pay to the fund all, or a portion, of its baseline energy bill to cover the investment cost and associated fees during the contract period. The fund can then engage ESCOs to provide some or all of the implementation services using performance-based agreements.

- *Risk-sharing facilities, designed to refute lenders' perceptions that EE projects are inherently riskier than their traditional investments*. These provide partial coverage of the risk involved in issuing loans for EE projects.

- *Forfeiting or sale of ESCO receivables*. Forfeiting is useful in situations where an ESCO is providing its own equity for project financing. It is a form of transfer of future receivables from one party (the seller—an ESCO) to another (the buyer—a financial institution).[14]

[11] Such an account may be established by a line ministry or the Ministry of Finance.

[12] A more detailed discussion is provided in a separate guidance note on EE revolving funds (World Bank 2014b).

[13] See, for example, *Kosovo Launches Energy Efficiency Fund*, https://fkee-rks.net/en/kosovo-launches-energy-efficiency- fund/#:~:text=Kosovo%20becomes%20the%20first%20country,Bank%20and%20the%20European%20Union

[14] The original creditor (the ESP) cedes his claim to future revenues from the project, and the new creditor (the FI) gains the right to claim these future receivables from the debtor (the client). The ESP receives a discounted one-time payment from the FI that then allows it to invest in new ESPC projects.

Table 3. Illustrative Government Actions to Foster ESCOs

Government Action	Country	Summary Description
Procurement Agent	Germany	The Berlin Energy Agency helps public agencies, on a fee-for-service basis, to identify EE opportunities; it also provide standard templates for audits, RFPs, bid evaluation, contracts, etc. and as well as guidance throughout ESP procurement process
Facilitating public procurement	Czech Republic	The government reformed public procurement procedures to facilitate ESP contracts; uses multiple criteria in ESP bid evaluation; and certifies "energy experts"
Project bundling	Hungary	The Ministry of Education issued single procurement for all schools and competitively selected an ESP consortium to provide EE services to all schools under a master contract
Forfeiting	Bulgaria	The Bulgaria ESCO Fund used financing from EBRD to purchase the cash flows from an ESP project; this allowed the ESP to free up funding for additional projects.
EE revolving fund with loan facility	U.K.	Salix Finance was established by U.K. DECC to provide loan financing exclusively for public sector projects; it has worked with 138 public agencies and financed over 11,000 projects, many of which are implemented by ESPs
EE revolving fund with ESAs	Armenia	The Armenia R2E2 Fund offers public agencies ESAs under which it designs the project, hires ESPs, oversees construction, and monitors the project under a fixed-price, long-term agreement
Public ESCO	Croatia	A public ESCO was established in the national utility, HEP, to (i) develop, finance, and implement EE projects using local businesses as key delivery agents and (ii) provide opportunities for ESPs to tap into new energy efficiency business opportunities
Super ESCO	India	A public sector entity (EESL) was established to develop, finance, and implement EE projects in the public sector using private ESCOs as subcontractors or partners

Source: prepared by authors based on World Bank 2014a

Public or Super ESCOs

Another option for financing ESCO projects in the public sector is the creation of a *public*, or "super," ESCO.[15] Examples of public ESCOs include the HEP ESCO in Croatia (HEP 2013), the Krakow ESCO in Poland,[16] and UkrESCO in Ukraine (World Bank 2010a). Recent *super* ESCOs include Fedesco in Belgium (Madam 2013), Fakai Super ESCO in China (ECO-Asia 2009), and EESL in India (EESL 2013). Public and super ESCOs facilitate contracting with other public agencies, help reduce the transaction costs associated with complex public-sector procurements, allow performance contracts to be financed by international donor agencies, and help develop ESCOs by engaging them as subcontractors in the implementation process. They can thus serve as incubators for local ESCOs, while allowing the concept of ESCOCs to win acceptance and providing the local ESCOs with experience and track records for purposes of future marketing.

Illustrative Government Initiatives to Promote ESCOs

Many governments have taken action to foster the energy services market and help establish and grow ESCOs in their countries. Some examples are provided in Table 3.

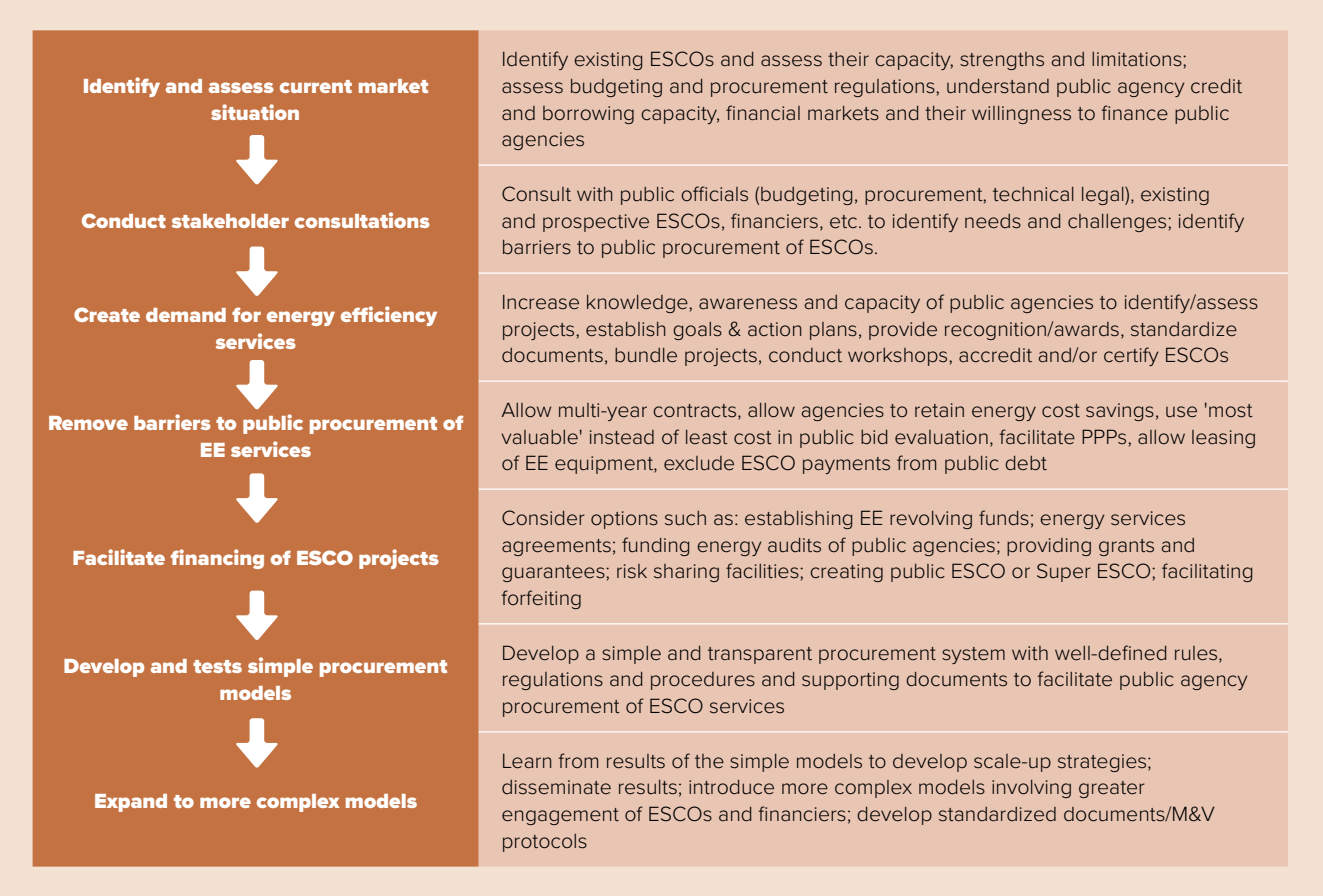
Another important initiative is the guidance on the recording of Energy Performance Contracts (EPCs) in government accounts provided by Eurostat, which is designed to ensure adequate accounting treatment of EPCs and homogenous statistical treatment across countries (Eurostat 2017).

Road Map for Establishing an Energy Services Market

ESCOs are a useful option for scaling up the implementation of EE projects. However, most developing countries face substantial challenges in developing energy services markets. Governments can foster the establishment and growth of ESCOs through initiatives that have been successfully implemented internationally. While there is no specific formula that can be prescribed to governments regarding how to develop an energy services market, the "road map" in

[15] Additional information on public and super ESCOs is provided in World Bank 2013a.
[16] http://www.esco.krakow.pl/about_us/about_us/english.

Figure 5. A Road Map for Developing the Energy Services Market



Source: Prepared by Authors based on World Bank 2014a.

Figure 5 provides some them with guidance on the various initiatives that may help them do so in their own countries.

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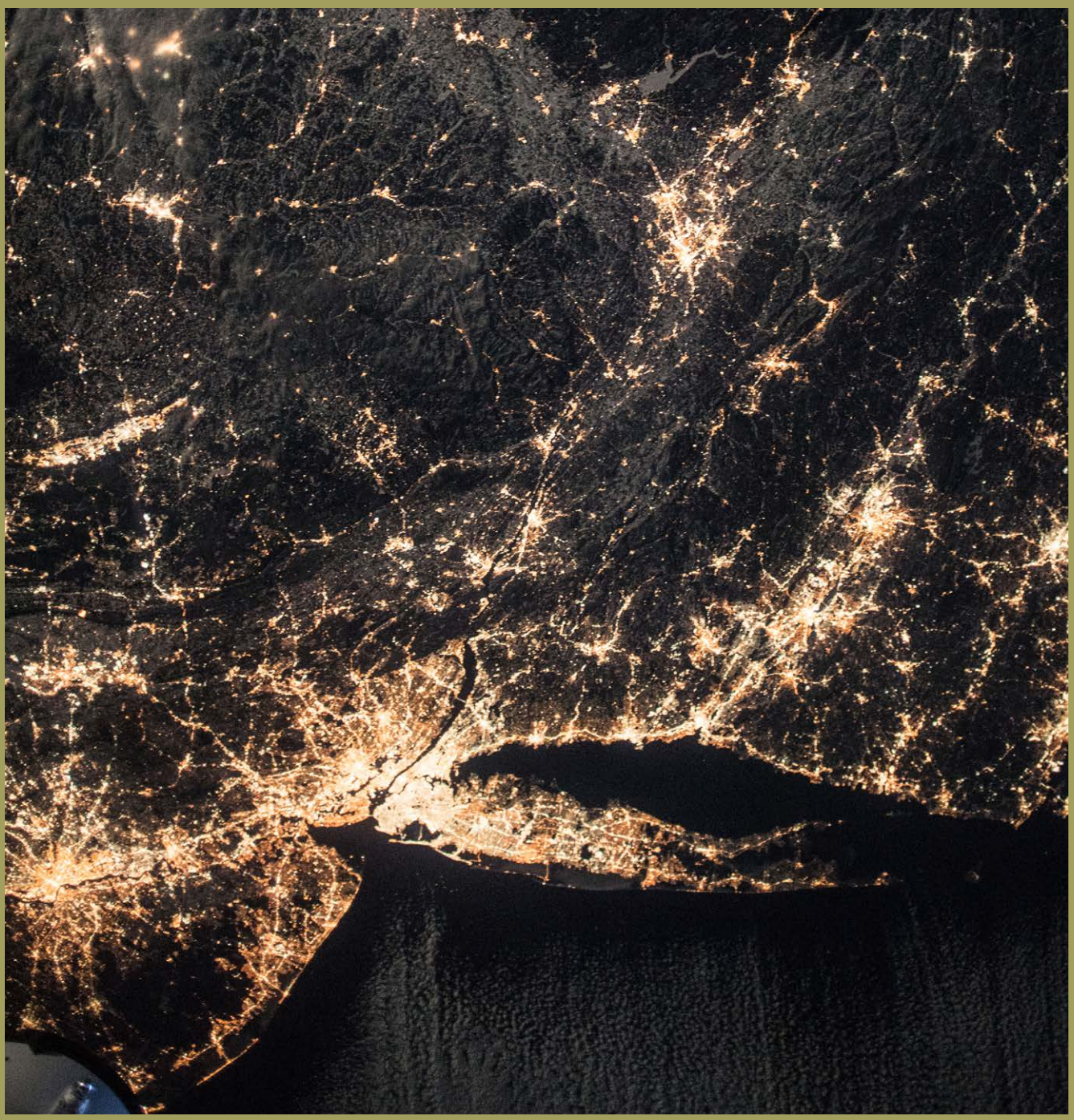

Photo credit: NASA

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How Super ESCOs can circumvent regulatory restrictions in engaging with the private sector and be mandated to adopt system approaches

Abstract

So-called Super ESCOs, which are initiated and generally financed by the public sector to serve other public-sector entities, are a growing phenomenon with particular advantages in dealing with other public entities, partly because by their very nature they may escape the restrictions that otherwise pertain to private entities and may be better placed to secure access to the public clients' cash flows that are to finance the ESCO contracts. But even Super ESCOs may find that the private sector is easier to work with and may venture into competition with private ESCOs, leading to potential market conflicts. A level playing field is necessary. At the same time, Super ESCOs are ideal carriers of best practices due to their often superior access to concessional financing through multilateral channels.

1. Introduction

In the quest to improve the energy efficiency of existing buildings, Energy Service Companies (ESCOs) are a very powerful tool. ESCOs are specialized providers of turnkey energy efficiency services, often offering outcome guarantees as well. The services that ESCOs provide include auditing buildings, baselining energy consumption, identifying all sources of energy waste, defining Energy Savings Measures (ESMs) that can be put in place to generate savings, installing the defined ESMs, keeping these ESMs operational for a number of years, and finally measuring, verifying and guaranteeing the savings to their clients.

ESCOs can also complement their technical activities with financial tools in order to bring fully financed project options to clients. They can either arrange the appropriate funding for their clients, who can then reimburse over time as the energy savings are realized, or can finance the work themselves and get their money back by having their clients share the savings with them over a number of years.

ESCOs are mostly private-sector companies with both private- and public-sector clients. Dealing with the private sector is rather simple for ESCOs, as it only involves direct negotiations, but dealing with the public sector can be complex in many cases due to a number of barriers, including:

- public procurement policies not allowing selection of the best economic value but focusing on the lowest cost,
- borrowing restrictions of public entities and lack of finance or a budget for such activities
- separation of capital and operating budgets, making it difficult to repay ESCOs based on savings in the operating budget

In overcoming these barriers, a Super ESCO can act as a very specialized organization to manage and finance the procurement of energy efficiency services from ESCOs for public-sector buildings.

2. What is a Super ESCO, and why create one?

As governments develop strategies to better manage and rationalize the demand for energy, they often create Demand Side Management (DSM) strategies[1] to streamline existing energy practices across entities in order to optimize synergy and energy efficiency. DSM strategies cover multiple aspects of energy consumption at the regional or country level and draw up tactical plans to deliver the strategy. Existing buildings often play an important role in these DSM strategies, given the large amount of energy they consume, which can sometimes reach 40% of total energy and 70% of total electricity.[2] It is then very common to identify a building retrofit programme within a DSM strategy to address the energy consumption of existing buildings, which often calls for the use of ESCO services.

A Super ESCO is a specific dedicated organization (often set up as an independent company) created and funded by a government (local or federal) in order to manage part or all of a building retrofit programme for its public-sector buildings. A Super ESCO has specific goals and KPIs that are often directly linked to the savings objectives of the DSM strategy. It defines its own strategies to improve the energy efficiency of public-sector buildings and can also contribute to improving efficiency of the private-sector buildings.

The Super ESCO can be funded for its OPEX and CAPEX directly by the government, or it can operate independently and cover its OPEX through its operations and raise CAPEX through third-party financing.

The main roles of a Super ESCO can be listed as follows:

- Elaborate a strategic plan to address the DSM target it was given
- Realise energy audits of public buildings to identify energy savings opportunities
- Organize the procurement for retrofitting public buildings, either as turnkey projects through ESCOs (system approach), or by cherry-picking specific energy-efficient equipment and procuring it for the government (e.g. LED lights, fans, AC splits, etc.)
- Optionally finance the procurement of these projects or equipment
- Manage the execution of the ESCO's projects or installation of the energy-efficient equipment
- Verify the energy savings realized and ensure that the ESCOs are fulfilling their promises

[1] See, for example, the DSM strategy from Dubai in the United Arab Emirates: https://www.dubaisce.gov.ae/en/about-dsce/about-us/get-to-know-us/dsce-demand-side

[2] https://www.ase.org/initiatives/buildings

Table 1. Summary of Super ESCO examples

Name	Country	Establishment Year	Shareholder	Funding sources	Initial funding
Fedesco	Belgium	2005	Belgium Federal State	Belgium State	5 m€
EESL	India	2009	India government as a JV between NTPC Limited, Power Finance Corporation, REC Limited and POWERGRID	India government and international banks (ADB, World Bank, etc.)	Third-party funding
Etihad ESCO	UAE	2013	Dubai Government through the Dubai Electricity and Water Authority	Dubai Green Fund and National Bonds	Third-party funding
Tarshid	Saudi Arabia	2017	Public Investment Fund	Public Investment Fund	500 m$
ADES	UAE	2020	Abu Dhabi Government through TAQA	TAQA	unknown

3. Examples of Super ESCOs

The following examples in table 1 are Super ESCOs operating differently from each other to reach the goal of saving energy, with the exception of the Middle-Eastern Super ESCOs, which have similar operating models.

3.1 Fedesco in Belgium

Fedesco was created in 2005 as a public ESCO to study and implement energy efficiency projects in 1,800 Belgian federal public buildings, of which about two thirds are owned by the Belgian federal state and the remaining third rented from private building owners. The company started with capital of 1.5 million €, later extended to 6.5 million €. At its creation, Fedesco had a financing capacity as a third-party investor of 5 million €, which quickly increased to 10 million € and (in 2009) 100 million €. From 2007, Fedesco was granted the exclusive right to work for the federal administration. Close collaboration was initiated with the federal Building Agency, which acts as the building owner and manager.

In 2007, Fedesco first implemented a "separate contractor"-based model, implementing so-called "transversal measures" with a strong focus on HVAC (mainly boiler replacement and boiler-room renovation), HVAC regulation, re-lamping and re-lighting, co-generation, and roof insulation. Fedesco thus acted as an "integrator" to become one of the first public ESCOs in Europe. In 2008, the government gave Fedesco a secondary mission to install PV solar panels on the roofs of certain buildings and to negotiate concessions with private installers of PV solar panels on other buildings for a budget of 1.5 million €.

From 2011, Fedesco started implementing an alternative parallel model involving energy performance contracting (EPC), using an innovative methodology called smartEPC. A SmartEPC is effectively a model for Maintenance, Energy and Comfort Performance Contracting. The difference between smartEPCs and more traditional EPCs is the fact that the contract also covers the full performance-based maintenance of all the technical installations in the building.

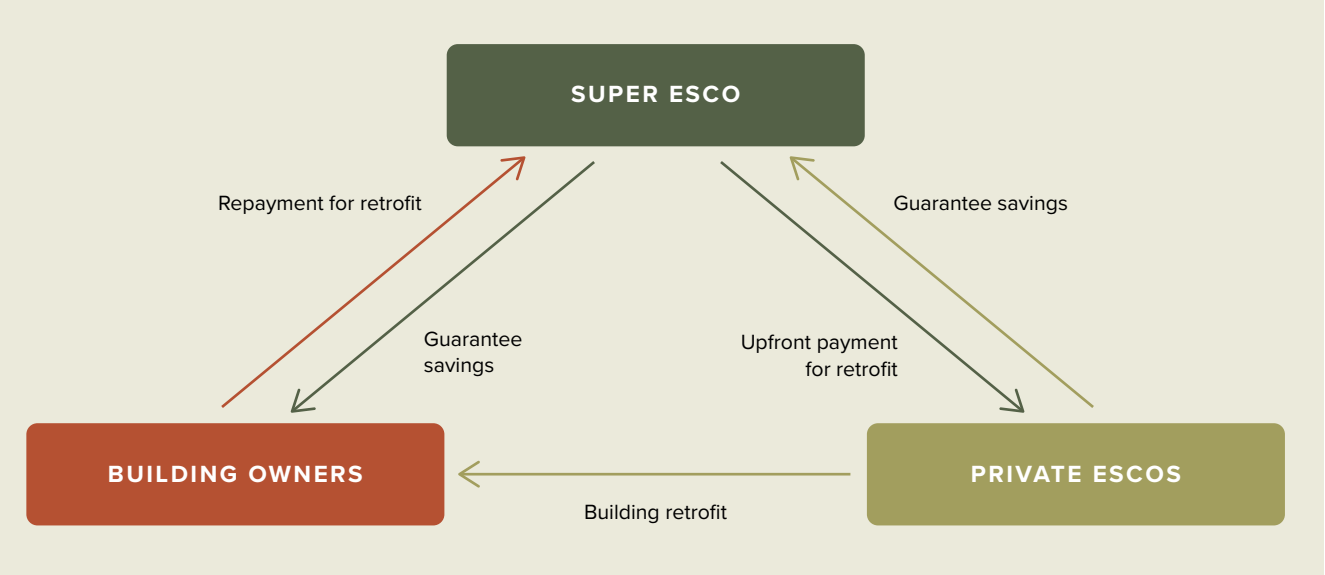
In 2011, Fedesco created a "Knowledge centre" department to provide EPC facilitation services to non-federal public authorities, i.e. regions, provinces, cities and municipalities. Fedesco tendered for several consecutive framework contracts, to be assisted by a private EPC facilitator. Several EPC projects were initiated (e.g. Province of Walloon Brabant, GRE Liège…).

In 2015, Fedesco was integrated into the Building Agency.

3.2 EESL in India – https://www.eeslindia.org/

Energy Efficiency Services Limited (EESL) is a Super ESCO, which enables consumers, industries and governments to manage their energy needs effectively by using energy-efficient technologies.

Figure 1. Etihad ESCO model



Founded in 2009, EESL is promoted by the Ministry of Power, Government of India, as a joint venture between four reputed public-sector undertakings: NTPC Limited, Power Finance Corporation Limited, REC Limited, and POWERGRID Corporation of India Limited. EESL focuses on solution-driven innovation with no subsidy or capital expenditure (CAPEX) for the client. It is able to do this by using its Pay-As-You-Save (PAYS) model, which obviates the need for any upfront capital investment by the client.

EESL has designed a business model that is transparent, scalable, and flexible, and that can seamlessly embrace different emerging technologies in a manner that incentivizes all stakeholders. By deploying this business model, EESL can drive large-scale initiatives, creating a market for transformative, future-ready solutions.

EESL is a Super ESCO that has not used ESCOs to develop its model and should therefore rather be called a public ESCO. It is cherry-picking specific energy-efficient equipment procured on a massive scale for the Indian government. It therefore acts as a super procurement organization for energy-efficient equipment for the government of India. It has developed specific procurement programs for LED lights, efficient fans, streetlights, efficient pumps for agriculture, smart meters, solar PV equipment, electric vehicles, charging infrastructure, etc.

While EESL has delivered massive electricity savings for the government of India, it has not contributed to developing a market for private ESCOs in India, which remains very small and scattered. Thanks to its government backing, EESL has been able to get hundreds of millions of USD in funding from the World Bank and ADB for Energy Efficiency actions. This also helps address the financing barrier commonly faced by small and private ESCOs.

3.3 Etihad ESCO in Dubai – https://etihadesco.ae/

Etihad Energy Services Company LLC (Etihad ESCO) is a Dubai Electricity and Water Authority subsidiary that was established in 2013 to retrofit Dubai's existing building stock.

As a Super ESCO, it is establishing a market for energy performance contracting in Dubai by developing energy efficiency projects targeting more than 30,000 buildings. Etihad ESCO was given targets to save 1.7TWh of electricity and 5.6 billion imperial gallons of water by 2030. Etihad ESCO carries out building retrofits, is increasing the penetration of district cooling and the building capacity of local ESCOs for the private sector, and facilitating access to project finance. Etihad ESCO does not have its own funds for its projects but relies on third-party financing from the Dubai Green

Fund,[3] as well as developing a model using Islamic financing in partnership with the National Bonds Corporation.[4]

In 2016, Etihad ESCO was granted the project management of the whole DSM strategy for Dubai, creating a specific division named Taqati to handle this activity.[5] Taqati has also contributed to developing the market by devising a thorough energy-training program for individuals.[6]

The same year, it was also given the responsibility for stimulating Dubai's solar rooftop programme[7] and started to install photovoltaic panels on public and private buildings in Dubai.

As of September 2020, Etihad ESCO has carried out 22 projects, resulting in the retrofitting of 7,763 buildings and generating savings of 307GWh of electricity and 289 million imperial gallons of water.

Etihad ESCO has benefited from Dubai government entities being encouraged to work with it, thanks to a Directive from the Dubai Supreme Council of Energy, but the Dubai government did not mandate government entities to work with Etihad ESCO, nor did it mandate the retrofits. This has naturally reduced the speed at which Etihad ESCO has been able develop, given that it had to convince each entity separately to save energy and to work with it.

3.4 Tarshid in Saudi Arabia – https://www.tarshid.com.sa/

Saudi Arabia's Public Investment Fund (PIF)[8] created the National Energy Services Company (NESCO), also known as "Tarshid", in October 2017, with an initial capitalization of over USD 500 million, to increase the energy efficiency of government and public buildings, public street lighting, etc., and stimulate growth of the country's energy efficiency industry. This is in line with the objectives of the Government's Vision 2030 to diversify the economy and drive environmental sustainability.

All government entities are mandated to contract with Tarshid on an exclusive basis in accordance with a royal decree. Tarshid covers at least 70 percent of all projects in the country's energy efficiency sector, a market estimated to be worth around USD 11 billion.

Tarshid has set up a framework for competitively procuring the services of private-sector ESCOs through ESPCs to deliver energy efficiency equipment and solutions in public buildings across the country. In this process, Tarshid is also helping to build the capacities of local ESCOs and preparing transaction tools and ESPC templates, as well as developing guidance in the measurement and verification of energy savings in accordance with international benchmarks. Since early 2018, Tarshid has started the process of developing and implementing energy-retrofit projects in hundreds of public office buildings, schools, and mosques, and has also started a street-lighting program to replace 2.5 million existing streetlights by LEDs.

Thanks to the Royal Decree mandating government organizations to retrofit and to work exclusively with Tarshid, the Super ESCO rapidly became very successful by developing numerous projects for ESCOs. In mid-2020, it announced having achieved its first terawatt-hour reduction in energy consumption in the Kingdom[9] and having created 1200 jobs directly and indirectly.[10]

3.5 ADES in Abu Dhabi – http://www.ades.ae

Abu Dhabi Energy Services LLC (ADES) is the Abu Dhabi Super ESCO created in January 2020 as a subsidiary of the Abu Dhabi National Energy Company, TAQA.[11] It is initially relying on project funding from its shareholder, TAQA, and is responsible for retrofitting buildings in the private and public sectors by identifying, sourcing and funding solutions that deliver tangible reductions in water and electricity consumption. ADES is driving the growth of the Abu Dhabi energy services market and helping to meet the increasing need for energy-efficient solutions in the Emirate and beyond. ADES operates under a similar business model to Tarshid in Saudi Arabia in having its own funding to retrofit public buildings by commissioning private ESCOs. ADES signed an initial agreement with the UAE Ministry of Education for the retrofitting of more than two hundred public schools in the emirate of Abu Dhabi.[12]

[3] See https://www.dgf.ae/
[4] See https://www.nationalbonds.ae/
[5] See https://etihadesco.ae/taqati/
[6] See https://etihadesco.ae/taqati/trainings/
[7] See https://www.dewa.gov.ae/en/consumer/solar-community/shams-dubai
[8] https://www.pif.gov.sa/en/
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[11] See https://www.taqa.com/
[12] See https://www.wam.ae/en/details/1395302817885

Table 2. Operating models of Super ESCO examples

Super ESCO	Operating and Contractual Model	Domains	Examples of projects
Fedesco	Energy Performance contracts & transversal measures (cherry-picking)	Federal buildings	Thirteen federal public buildings occupied by the FPS Finance, FPS Justice, Federal Agency for the Safety of the Food Chain, Beliris and the Belgian Buildings Agency
EESL	Transversal measures only (cherry-picking)	LED lights, fans, street-lighting, agricultural pumps, electric cars, etc.	UJALA LED bulbs, UJALA efficient fans
Etihad ESCO	Energy Performance Contracts & Rooftop solar projects	Dubai government and semi-government buildings, residential buildings	Dubai Airport, Dubai Golf, Mohammed bin Rashid Housing Establishment
Tarshid	Energy Performance contracts	Street-lighting and public buildings	Multiple projects in education and medical sectors
ADES	Energy Performance contracts	Abu Dhabi public and semi-public buildings	Schools under UAE Ministry of Education

4. Regulations ensuring the success of Super ESCOs

Following observation of the progress of the various existing Super ESCOs, a few necessary regulations can be identified to make ensure the Super ESCO's success. These regulations should ideally be established at the same time as the Super ESCO itself.

4.1 Mandating use of Super ESCO by public entities

Creating a Super ESCO to retrofit public buildings but not mandating public entities to retrofit their buildings and to work with the Super ESCO will make it difficult for the latter to succeed. Any such situation will require the Super ESCO to have a specific team of "Sales" or "Business Development" executives tasked with convincing each public entity separately of their interest in working with them in saving energy use in their buildings. In other words, creating a public Super ESCO without legislative element to direct work to it will make it harder, slower and more expensive for the Super ESCO to succeed.

There are two examples in the Middle East that illustrate this problem very clearly. Etihad ESCO was created in Dubai in 2013 without the supporting legislation mandating government entities to work with them. A soft law was passed a few years afterwards to "encourage" but not "mandate" public entities to retrofit and work with the Super ESCO. As a result, by 2020, the problem in government buildings had only partially been addressed, and the Super ESCO was having difficulties in launching significant new projects. On the other hand, Tarshid, the Super ESCO for Saudi Arabia, was created in 2017, and a Royal Decree was issued at roughly the same time to mandate public entities to retrofit their buildings and to work exclusively with Tarshid. As a result, by 2020 Tarshid had been moving very fast and had already launched around a hundred ESCO projects.

4.2 Exclusivity for the Super ESCO

In addition to problems in mandating the use of the Super ESCO by government entities, it is absolutely key for the government to avoid the public Super ESCO having to compete with another Super ESCO in the same market in order to avoid generating confusion in the market for the public entities, as they would need to organize a tendering process to select which Super ESCO to work with. This would unnecessarily create complexities and delay the retrofitting of public buildings. It is nevertheless possible, and may be even desirable for reasons of speed and efficiency, to have several public Super ESCOs address different distinct markets, for example, geographically, to optimize the speed of delivery or to ensure proximity to the local government. As an example, the UAE has two official Super ESCOs, Etihad ESCO in Dubai and ADES in Abu Dhabi, and one in-house organization acting as a Super ESCO within the Municipality of Ras-Al-Khaimah. These three organizations deal with

the local governments' public buildings in parallel and do not compete against each other.

4.3 The ESCO framework

In addition to creating a public Super ESCO, drawing up a regulatory framework to accompany, simplify and strengthen its development and to make private ESCOs more confident about the markets they are working in would be another powerful move.

Typically, the regulatory framework can control the Accreditation or Licensing of ESCOs that will work in the market, as well as the use of standard ESCO contracts, which will be balanced and have a clear dispute-resolution mechanism to reassure market actors that the conditions and rules are clear and fair. It can also draw up a standard Measurement & Verification (M&V) protocol, introduce specific rules to facilitate the commercial feasibility of projects if energy tariffs are subsidized, and simplify the execution of Government-to-Government (GtoG) contracts, allowing direct negotiation of a service provided by a public entity to another public entity if that service is unique and exclusive.

4.3.1 ESCO accreditation or licensing scheme

Creating a Super ESCO and announcing that it will generate multiple opportunities for ESCOs may create an opportunistic attitude in the sense of many companies then claiming to be "ESCOs". This enthusiasm can be seen positively, but the regulators have to take care that the aim is to obtain real energy savings and that they need to ensure companies working in that sector are highly competent. Therefore to ensure that a professional market with experienced companies is being promoted and developed, it may be worthwhile to set up an ESCO accreditation or licensing scheme. This scheme should cater to companies that are already experienced, as well as to those that are beginners and want to learn and become an ESCO. It could therefore distinguish experienced ESCOs from learning ESCOs. One example is two schemes that officially operate in the Middle East. The first, in Dubai, is managed by the Dubai Regulatory and Supervisory Bureau for Energy and Water (Dubai RSB),[13] which accredits companies as either provisional or full ESCOs. The second, in Saudi Arabia, is managed by the Saudi Energy Efficiency Center (SEEC),[14] which licenses ESCOs as provisional or full, depending on a number of criteria.

The official status of the ESCO accreditations or licenses should be made available to anyone, for example, through a website, and the rules for becoming accredited or licensed should be made very clear so that the ESCOs know what they have to do to obtain such credentials.

Additionally, to make the scheme powerful, the Super ESCO should only work with ESCOs that have an accreditation or a license. This is the case for the two examples above, where Etihad ESCO only works with ESCOs accredited by the Dubai RSB, and Tarshid only works with ESCOs licensed by the SEEC.

4.3.2 Standard ESCO contracts and dispute resolution

To secure ESCOs further and serve as a reference for asset owners that are willing to work with ESCOs, the regulator may develop and publish standard ESCO contract models that are equitable, balanced and fair in terms of the responsibilities and risks they set out. Ideally, these standard contracts should cater to both the guaranteed savings model, where the client is financing the project, and the shared savings model, where the ESCO is doing so. These standard contracts will establish a contractual baseline that will become a reference, given that they have been issued by an official authority. These contracts should also define a clear and fair dispute-resolution mechanism, so the parties are clear on how to proceed in the case of problem during an ESCO project. The regulator can also offer to be an independent party in order to facilitate the resolution of either minor or stronger cases before they go to arbitration or court. The regulator can call on international or local ESCO experts to expedite the resolution of cases.

As an alternative to the regulator publishing standard contracts, this role can be given to the Super ESCO that will be developing and using a model contract to be openly provided to ESCOs that are willing to participate in the projects tendered by the Super ESCO. In cases where the Super ESCO is a party to the ESCO contract, it obviously cannot have the role of facilitating the resolution of disputes. If, however, the Super ESCO acts as a consultant between the ESCO and the asset owner, it can then also act as a facilitator in dispute resolution.

[13] https://www.rsbdubai.gov.ae/accreditation-system.html
[14] https://esco.seec.gov.sa/Home/EnergyLicenses

4.3.3 Measurement & Verification protocol

As when standardizing ESCO contracts, it is important for the regulator to standardize a Measurement & Verification (M&V) protocol in order to define the official rules for calculating the savings that are the basis of ESCO contracts. In many cases, regulators will refer to the International Performance Measurement and Verification Protocol (IPMVP), which defines standard terms and suggests best practices for quantifying the results of energy efficiency investments and increased investments in energy and water efficiency, demand management and renewable energy projects. IPMVP has existed in various forms since 1995, when a version of the protocol, the North American Energy Measurement and Verification Protocol, was published. This has been updated and expanded several times since then and in 2001, IPMVP Inc. was formed as an independent non-profit corporation in order to include the international community. In 2004, IPMVP Inc. changed its name to Efficiency Valuation Organization (EVO).[15]

It may be appropriate for the local regulators to slightly adapt the best practices and examples provided by the IPMVP protocol to the specifics of the local country or region. For example, it is unnecessary to provide examples of space-heating savings calculations in hot climate countries where only air-conditioning is used.

Also, regulators can provide additional rules that are not in the IPMVP but that might be recognized locally for specific cases. We can mention, for example, the use of the so-called "Option E", which is not covered by the IPMVP and not regarded as an M&V option in all of the literature. With Option E, savings are determined on the basis of engineering calculations using typical equipment characteristics and operating schedules without field-testing or metering. Instead, verification may consist of checking units installed and verifying the proper operation of the equipment or measure. Given the absence of direct verification of energy savings, the risks related to the ECM are placed virtually entirely with the client.

4.3.4 Energy subsidies and tariffs

In countries or regions where the energy used as reference for ESCO projects (often electricity and sometimes water) is highly subsidized by the government, thus favouring end-users through a lower tariff than its real cost, it will be difficult to execute commercially viable ESCO projects, This is because the decisions on these are often taken on the basis of a payback calculation (i.e. how much does the asset owner have to invest versus how much will the energy savings bring back to him). This unfortunately does not help the government, which has an interest in developing a healthy ESCO market for energy savings to happen so that fewer subsidies are paid out. Reducing subsidies to facilitate ESCO projects is something that most governments will consider doing, but this can be a very sensitive topic creating very negative reactions from energy users because this implies increasing tariffs. While normally reductions of subsidies are planned to be gradual over many years, governments can nevertheless define specific reverse-subsidy mechanisms to facilitate asset-owners' decisions regarding ESCO projects.

The possible mechanisms for reversing subsidies are not described here in detail. They can be developed in several forms, such as artificially higher tariffs used in Super ESCO contracts where the saved electricity kWh or water m3 price difference from official tariffs is directly paid to the Super ESCO by the government. Other reverse-subsidy mechanisms could take the form of financial grants provided to the Super ESCO to finance projects only partially, or zero-interest loans provided to the Super ESCO by the government, or any combination of such measures. These mechanisms need to be carefully planned on the basis of the existing level of subsidies, but they will be extremely powerful and possibly indispensable tools in accelerating the adoption of an ESCO programme in an energy-subsidized market.

4.3.5 Government to government contracts

The Super ESCO, as a government entity, will act as a procurement body to source ESCOs for the other government entities that need to retrofit their facilities. In order to do so, the Super ESCO will have to formalize its intervention through the signature of a contract between the Super ESCO and the government entities in control of the conditions of the retrofits. Unfortunately, in many countries, public procurement rules do not allow direct negotiation of government-to-government contracts without a regular procurement and tendering process. This will be a major setback to the Super ESCO's activities, as then government entities will need to organize a procurement exercise, usually through a public tender, to procure the services of the Super ESCO. It would be highly desirable to set up regulations or exceptions to allow the Super ESCO to contract directly with government entities without the need for a procurement

[15] https://evo-world.org/en/

exercise. This topic will not be developed further here, but it can usually be solved through either an executive decree or a similar action in cases where government-to-government contracts are not included in public procurement laws.

Thanks to their superior access to the market for public buildings, Super ESCOs can quickly create a retrofit market for private ESCOs.

4.3.6 Funding

Funding for the Super ESCO is one of the most important elements that needs to be sorted out when setting it up. If the Super ESCO is financing ESCO projects, then its work will be an easy sell to public-sector entities, as they will not have the excuse of not having a budget to do the retrofit. Conversely, if the Super ESCO is relying on public-sector entities to pay for the retrofit, then it will have major difficulties and delays in executing its projects, as public-sector entities will have problems in allocating a budget for these projects. This may oblige entities to request a budget for the next year, but even if they are successful, the launch of retrofit projects may be delayed by a year to two years before anything can be done.

In setting up a Super ESCO, the government must therefore arrange funding for it. And it needs to be carefully set up. If the funding relies on high interest rates, that will give the Super ESCO an additional problem in doing deep retrofits. The cost of the finance will tend to cancel out the savings that can be generated. The only possibility to keep the same level of savings with costly finance rather than cheaper finance would then be to extend the life of the project contract. However, that also has a limit. In some regions, such as Europe or the USA, it is very common to accept 15 to 25 years retrofit contracts, but in some developing-country markets, going above seven years would be a problem. Thus, combining expensive financing with short contract periods will not allow ESCO contracts to reach the deep retrofits.

Thanks to their strong government backing, Super ESCOs are able to source funding at very affordable cost from government and from multiple third-party sources, including multilateral banks, while providing minimum collateral guarantees. They therefore simplify greatly the access to finance for private ESCOs by removing the financing barrier.

4.3.7 Mandating the System Approach

One commonly discussed topic in the Super ESCO world is whether Super ESCOs should be mandated to go for the "system" approach or merely the "cherry-picking" approach.

The "cherry-picking" approach typically applies when the Super ESCO decides to focus on one technology at a time only and to deploy it massively across multiple public-sector facilities. For example, a Super ESCO could decide to purchase millions of LED light bulbs to replace old incandescent or CFL lights across multiple public-sector buildings, thus generating massive savings. Once the LED project is done, the Super ESCO could then move on to another equipment or technology and could decide to replace it across the board, and so on. In this approach, the Super ESCO acts as a simple procurement entity for the government by bulking up the purchasing volumes and negotiating prices aggressively. The Super ESCO could then simply resell the products to the public-sector entities with a small mark-up. The amount of energy saved in this approach can be massive, but that will not help to develop a market in the private sector through the development of an ESCO market. On the contrary, this approach will only benefit the public sector and will totally ignore the energy savings that could have been generated in the private sector by developing an healthy ESCO market. The cherry-picking approach will not treat all aspects of the facilities and might leave inefficient systems continuing to operate if they are not among the technologies that have been cherry-picked.

The "system" approach, conversely, consists of approaching a number of facilities with comprehensive solutions touching all possible technologies that are applicable to these facilities in order to save energy. This is usually done by using ESCOs. The role of the Super ESCO in the system approach is to produce a unique solution dedicated to a number of facilities it has given to ESCOs to evaluate. The system approach will allow the facilities to be dealt with entirely within one project, and these facilities will not need to be touched again when other technologies are considered, as is the case with the cherry-picking approach. The system approach allows the full responsibilities for the energy savings to be given to an ESCO that will have to guarantee the outcome. This allows the project to secure the finance. All interactive effects between technologies within the same facility will be considered, which is not the case with the cherry-picking approach. For example, there is an interactive effect between the HVAC system of a facility and

its lighting system. Replacing a lighting system based on incandescent lights with LEDs will reduce the heat load of the building, which may then require additional heating in winter or less cooling in summer. Only replacing the lights without taking the HVAC system into account means ignoring the side effects on energy savings in the facility, which could optimize the energy savings.

The cherry-picking approach is a good approach for certain unique cases, but it should not be the only strategy the Super ESCO follows, as that would mean ignoring the multiple benefits that ESCOs could bring to maximizing the savings. A combination of the cherry-picking approach with the system approach should then be used. Cherry-picking could be used for assets that are independent of others and exist in large volumes. For example, streetlights could be an excellent candidate for cherry-picking, given that they are not reliant on any other technology.

An example of a Super ESCO that has fully mastered the combination of the two approaches is Tarshid in Saudi Arabia. It has a programme targeting streetlights only, but it also runs a parallel programme dedicated to buildings through the use of ESCOs. As a result, they are able to maximize energy savings.

Mandating the Super ESCO to adopt the system approach is probably not necessary if the Super ESCO deploys the right strategy. Thus, it is probably a question not of regulation, but of doing the right things to maximize energy savings by having properly assessed the market and chosen the right strategy.

Note that there is a multiplication effect in creating an ESCO market in a country that does not have one. Stimulating an ESCO market by tendering ESCO projects for public buildings will quite rapidly create a market in the commercial and industrial private sectors. ESCOs are private companies that will develop competencies allowing them to address any type of facility, whether publicly or privately owned. Private owners of buildings will more easily be willing to retrofit their facilities through ESCOs if they see the public sector embracing that methodology. It is therefore important to stimulate an ESCO market through the system approach, rather than just focusing on buying energy-efficient products by cherry-picking.

5. How can a Super ESCO ensure that legal contracts are signed quickly?

A Super ESCO can create tremendous savings for its cooperating government, but it needs to act fast and optimally to ensure market success. Being situated between the ESCOs and public-sector entities, the Super ESCO can optimize processes on both sides by standardizing its actions. ESCO contracts are in general complex and new to public-sector entities that are not familiar with them. To ensure that projects are not delayed due to endless legal negotiations with ESCOs and public-sector clients, the Super ESCO can optimize its contractual processes.

5.2 Optimizing contracts with ESCOs

The Super ESCO should create a robust and fair tendering process using standard ESCO contracts that should be balanced and not often modified to ensure the trust of the ESCOs. Once a contract has been signed with one ESCO for a project, the same model contract should be signed with the same ESCO for another project. In that way, both the Super ESCO and the ESCO will speed up the awarding process, thereby focusing more rapidly on execution of the project.

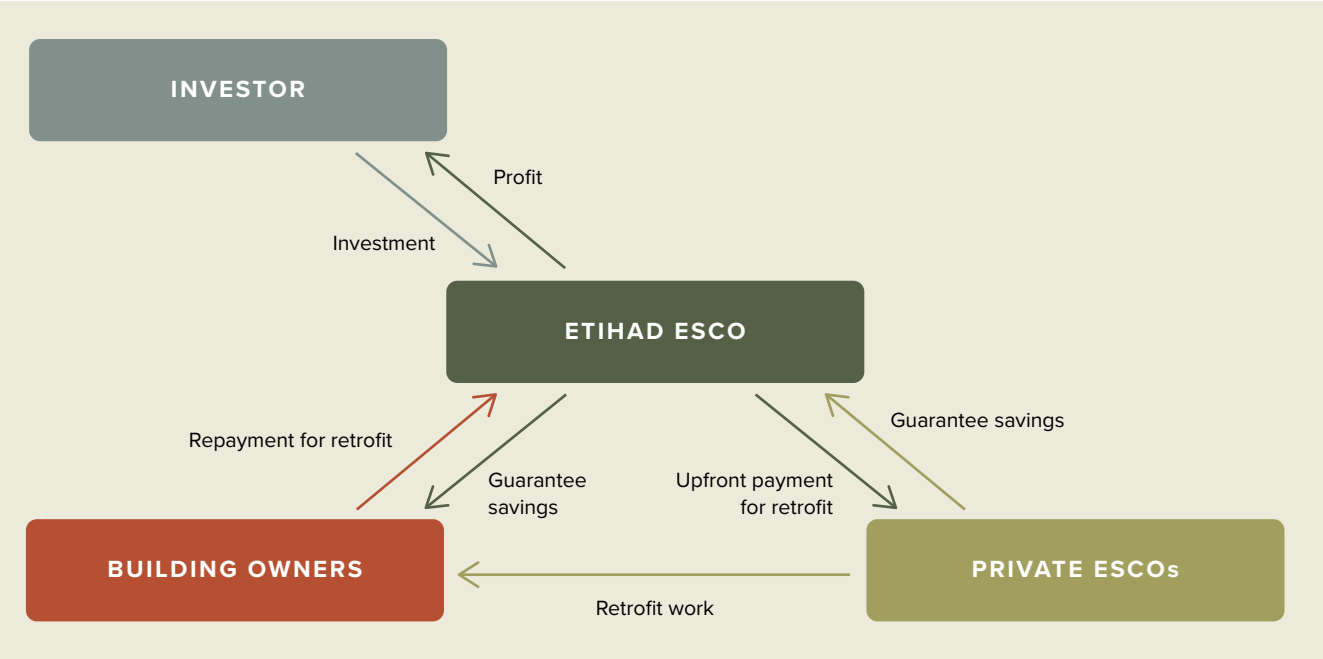
5.3 Optimizing contracts with public-sector entities

Public-sector entities are generally not familiar with ESCOs or their specific energy performance contracts. It may take a very long time for the Super ESCO to negotiate such a contract if it wants to have a back-to-back model with the contract it signs with the ESCO. Two specific actions may be required to optimize this part of the Super ESCO process, namely creating a high-level framework agreement and getting it endorsed by the government authority regulating public procurement contracts as the model to use between the public-sector entities and the Super ESCO. If this is done properly, the Super ESCO will be able to "impose" its contract on public-sector entities and minimize the legal negotiations, allowing it to be signed quickly.

6. Risks related to a Super ESCO becoming an ESCO

After completing a few projects, the Super ESCO will have learned a lot from the ESCOs it is working with. At some point in time, given the close relationships and detailed knowledge it has developed concerning the ESCOs and their activities, it could become tempting for the Super ESCO to replace the ESCO in doing the necessary work and thus optimizing the project's profitability by removing the ESCO's financial margin. It could also happen that the

Figure 2. Typical Super ESCO model



Super ESCO does not find satisfactory solutions to a project by the ESCOs. If it has enough knowledge and experience, the Super ESCO could then decide to replace the ESCO and carry out the project itself.

If the Super ESCO were to do this, however, it would have an immediate, dramatic impact on the active ESCOs in the market, which will see the Super ESCO directly competing against them. The confidence of the ESCOs in working with the Super ESCO will be reduced, and trust may be lost.

A second important aspect is the risks to the project. By sub-contracting a project to an ESCO and ensuring that the legal contract signed with the ESCO provides guarantees concerning outcomes that are backed by bank guarantees, the Super ESCO takes very little financial risk in terms of project results. Indeed, if there is a savings shortfall from the contracted guaranteed savings, the ESCO will cover the difference to the Super ESCO, thus limiting the risk to the latter. Conversely, if the Super ESCO decides to carry out the work itself, thus bypassing the ESCO, then there is no more outcome guarantee and the Super ESCO has to take on the project risk directly and in its entirety.

Some attempts have been made by Super ESCOs to establish themselves as an ESCO in markets that do not fall with their Super ESCO remit. Two recent cases can be mentioned. Etihad ESCO, the Super ESCO of Dubai has established an ESCO under the name of Etihad Energy International in Saudi Arabia and it is responding to ESCO tenders launched by the Saudi Super ESCO Tarshid. Similarly, EESL, India's Super ESCO, has partnered with an ESCO in the UAE to establish itself as an ESCO and to be able to respond to market tenders.

While these attempts have not yet proved very successful, they are clearly not welcome to the ESCOs. Some ESCOs may be present in both markets where the Super ESCO is acting as both Super ESCO and ESCO, and they will fear becoming subject to the Super ESCO's possible attempts to influence not to compete against them in the market where it is acting as a ESCO in exchange for winning projects in their local market. Currently there is no sign of this happening, but it is a genuine risk. Ultimately, it may discourage ESCOs from working with a Super ESCO they see as "stealing" their knowledge to be able to compete against them more effectively.

The government authority that has decided to establish a Super ESCO will have to monitor these actions closely to avoid market distortions or even destruction of the ESCO market, as well as a loss of focus on the part of the Super

ESCO on its primary market and mission. A simple way of monitoring this is to determine the success of ESCO participation in projects launched by the Super ESCO. If some experienced ESCOs decide no longer to participate in any of the Super ESCO's projects, it will create a problem requiring further investigation.

7. Should a Super ESCO be for profit?

The primary reason for a government setting up a Super ESCO is generally not to create a new source of income for itself but to implement a programme to significantly reduce energy consumption in public-sector buildings, leading to cost reductions and a positive environmental impact. The priority for the Super ESCO should therefore be to maximize the energy savings that it can contribute to generating but that should not be impacted negatively by the need to make a profit. Otherwise the impact of the programme will be less.

8. Concluding remarks

The Super ESCO model is an extremely powerful tool for a government seeking to improve the efficiency of its properties in a fast and focused manner. To be successful, the Super ESCO will have to ensure it uses the right strategy, prioritizing the system approach and only resorting to cherry-picking for specific cases. It will also need to be accompanied by a number of precise regulations designed to ensure its success. The regulator will have to ensure that the Super ESCO maintains its focus, resists the temptation of competing against the ESCOs, and developing a harmonious market for the ESCOs to provide their services to the private sector, thus ensuring maximum effectiveness of the Super ESCO programme.

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Unshackling ESCO Potential: Public Financial Mechanisms that Enhance the Viability of ESCO Projects

Abstract

In order to reduce the annual growth in global energy demand through 2040 from 1.0% to 0.3%, an estimated USD 24.5 trillion in energy efficiency (EE) investments will be needed. Across developed energy service markets around the world, the public sector can potentially mobilize bulk of the requisite EE capital by creating a demand for ESCO services. Beyond serving as a feeder of scalable EE projects to ESCOs, the public sector can also accelerate ESCO market growth through policies and financial mechanisms that will enhance project viability. An examination of various ESCO markets across the regions reveal how such financial mechanisms can be used to expand ESCO project pipelines. The use of energy performance contracting in public procurement processes could open up access of less-creditworthy public end users to EE services through efficient distribution of project risks and reduction in upfront costs. EE service providers wholly owned by the government, such as Super ESCOs, could act as a developmental pillar of local ESCO markets through the efficient large-scale delivery of technical and financial resources. Government agencies can also arrange long-term concessional financing with development partners to attain sub-commercial lending terms to enable ESCO implementation of EE projects. Another type of EE financing facility worth considering is the energy efficiency revolving fund, which uses seed capital to stimulate participation of local financial institutions in EE investments and pave the way to sustainable financing markets for ESCOs. Experiences in other developed markets also show the potential effectivity of other fiscal tools such as budget-based financing for public end users or incentive frameworks to improve financial viability of EE projects. Finally, public utilities capable of providing ESCO services could also ease customers' cost burden and lessen their credit risk by bundling EE service payments with utility bills.

Introduction

The IEA estimates that cumulative global investment in energy efficiency (EE) through to 2040 will amount to USD 24.5 trillion (IEA 2018). This conclusion results from two energy scenarios drafted by the IEA in its 2018 Energy Efficiency Report. The first, the "New Policy Scenario" (NPS), forecasts the annual growth in energy demand through to 2040 with respect to expected trends in global economic activity. It only accounts for the strategies and policies set out by countries' national governments in response to commitments made under the Paris Agreement on Climate Change. In contrast, the "Efficient World Scenario" (EWS) claims that a twofold increase in the global economy is possible despite "only a marginal increase in energy demand" under the critical condition that all "cost-effective energy efficiency opportunities between now and 2040" will be implemented. The USD 24.5 trillion of estimated investment in EE mentioned above is expected to spell the difference between 0.3% and 1.0% annual growth in net energy demand through to 2040 for the EWS and NPS respectively. This multi-year investment target is both challenging and promising to energy service companies (ESCOs) worldwide, which in recent years have been at the center of a rapidly evolving energy services industry. As carbon-reduction commitments by national governments identify energy efficiency as a key component in achieving these goals, the relationship between public sectors and ESCOs is likely to be of strategic importance.

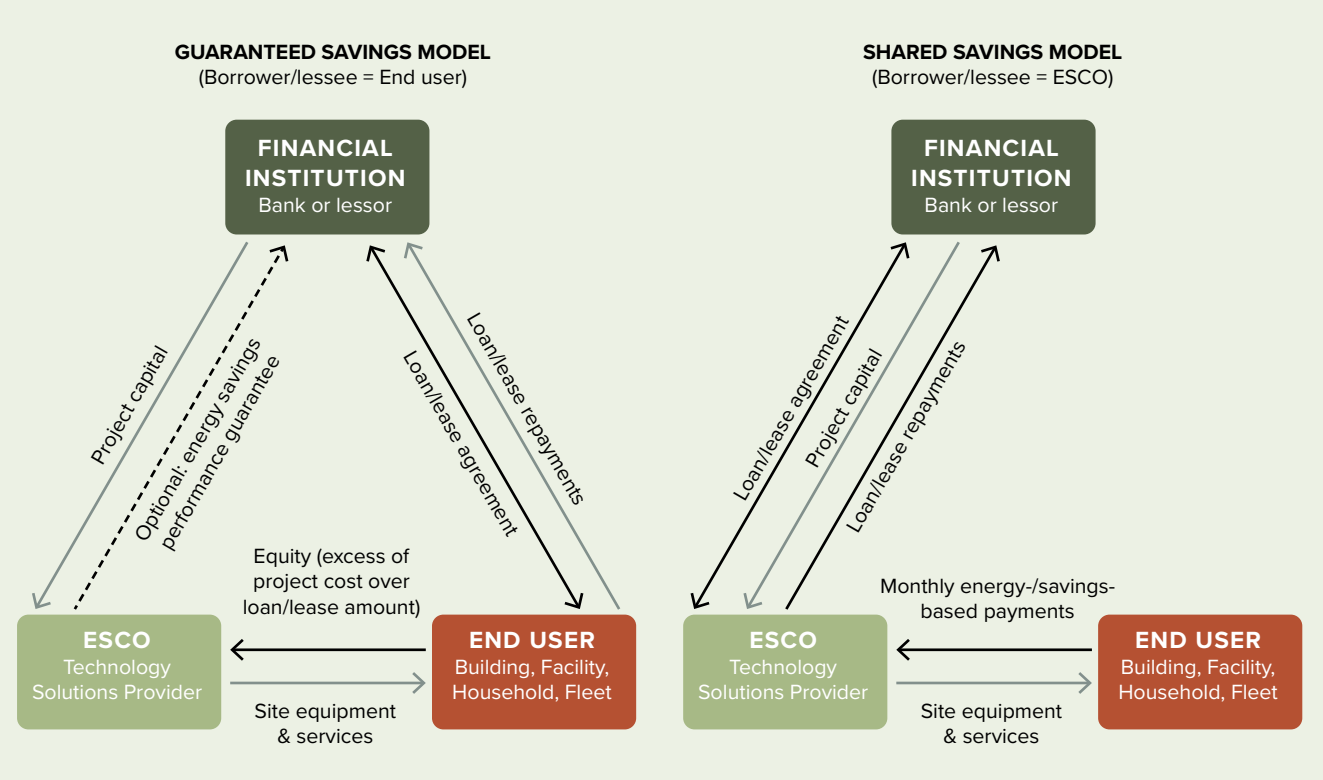
Close examination of some of the most successful energy-efficiency markets in the world reveal the catalytic role that public sectors are playing in the industry's aggressive growth. With GDP contributions ranging from 10% to 20% (World Bank 2020), the public sector is one of the largest consumers of energy in most countries. From office buildings, schools, and municipalities, to hospitals, airports, and other special-purpose facilities, the potential market for EE applications is both wide and deep. Because public administrators operate under mandates issued by the law or the national government, the potential for EE scalability is high. The Federal Energy Management Program (FEMP) of the US Department of Energy is one of the oldest government energy-management programs in the world. The energy intensity of federal government buildings (measured in British thermal units per square feet or Btu/sq ft) declined massively from over 150,000 Btu/sqft in 1992 to just above 100,000 Btu/sqft in 2012 (USAID 2015). A similar program in Canada, the Federal Buildings Initiative, saw the launch of eighty ESCO projects by 2013, most covering portfolios of buildings. These two countries are home to the some of the largest ESCO markets globally, with the public sector accounting for at least 80% of ESCO activity by 2017 (IEA 2018). Clearly, the public sector represents a huge amount of potential demand for EE services that, if tapped extensively, will spur the acceleration of ESCO markets.

As well as being a feeder of scalable EE projects, the public sector is also a catalyst of ESCO development because of financial mechanisms that could materially improve the viability of ESCO projects. The policies, reach, and influence of governments can be used to attract sources of funding or create financial structures that normally would not be available to ESCOs through private or commercial channels. More importantly, public financial mechanisms could bridge the gap between ESCOs and public end-users that has long been characterized by risk aversion and a lack of funding. In this chapter, such mechanisms and their potential impact on ESCO project viability will be discussed, along with their merits and the experience of the governments and markets that have utilized them.

Performance Contracting for Public End-Users

Energy performance contracting (EPC) is a financial structure that has become integral to the growth of ESCOs and EE industries across the world. EE end-users compensate ESCOs based on energy savings resulting from implemented EE interventions. By spreading what would have been a significant upfront cost over a long period of time and tying these cash outlays to project performance, end-users are more likely to undertake EE improvements. For projects in which energy reduction patterns are more predictable, ESCOs may provide guarantees over expected energy savings (the "guaranteed savings" model, in contrast to the more typical "shared savings" model, as depicted in Figure 1), thus further reducing uncertainties in project economics faced by end-users. The EPC model has been widely used or is steadily growing in the public sectors of several developed economies, such as the United States and Canada. Rapid growth in ESCO markets has also been observed in several member states of the European Union, particularly Belgium, Croatia, Denmark, Italy, and Slovenia (EU JRC Science Hub 2019). However, public agencies in other countries, particularly those in developing markets, still employ "business-as-usual" means such as upfront equity or debt issues to finance their EE projects. EPC is yet to become a primary mode of

Figure 1. Two common ESCO business models showing the sourcing of debt finance



Source: Ablaza A., Liu Y. and Llado M.F. 2020.

EE public procurement in these markets for a number of reasons. Some consider EPC to be a hybrid between being a "good" and a "service," thus excluding procurement systems that accommodate only pure forms of one or the other. In the Philippines, this hybrid treatment of EPC prevents it from being considered in public procurement. Other barriers include but are not limited to a reluctance to engage ESCOs through multi-year contracts, the supposed complexities of their business models (and thus the non-existence of template contracts and guidelines), and perceived financial risks. Revamping procurement policies, implementing scalable EPC pilot projects, and capacity-building for EPC tenders are necessary to grow ESCO industries in these markets, particularly those in which the public sector makes up a significant proportion of the potential market.

In essence, energy performance contracting is a form of public-private partnership (PPP) in which a government uses private-sector resources, in this case, a private ESCO's services or equipment using a structure similar to a lease. Another common PPP approach is one where the public agency or entity makes outright payments to the private energy service provider to operate or manage an energy system, such as municipal streetlighting. PPPs enable a more efficient or appropriate allocation of various project risks across the parties, the private counterparty being rewarded with a sufficient return on its investment in exchange for taking on these risks. For collaborations in which the public entity is also the ESCO, the private sector can be tapped for technical or financial resources that the ESCO might lack. In 2017, the state of Melaka in Malaysia initiated preparations for a large-scale LED streetlighting project involving the upgrading of around 100,000 high-pressure sodium luminaires to LED. These replacements were expected to reduce electricity and maintenance costs (Ablaza 2017). The state-owned Melaka Green Technology signed an agreement with the Asian Development Bank (ADB) for the latter to handle project scoping, transaction structuring, and tendering. In this PPP, ADB's advisory support team provided technical specifications, developed the business case model, and conducted legal due diligence with respect to local rules and regulations.

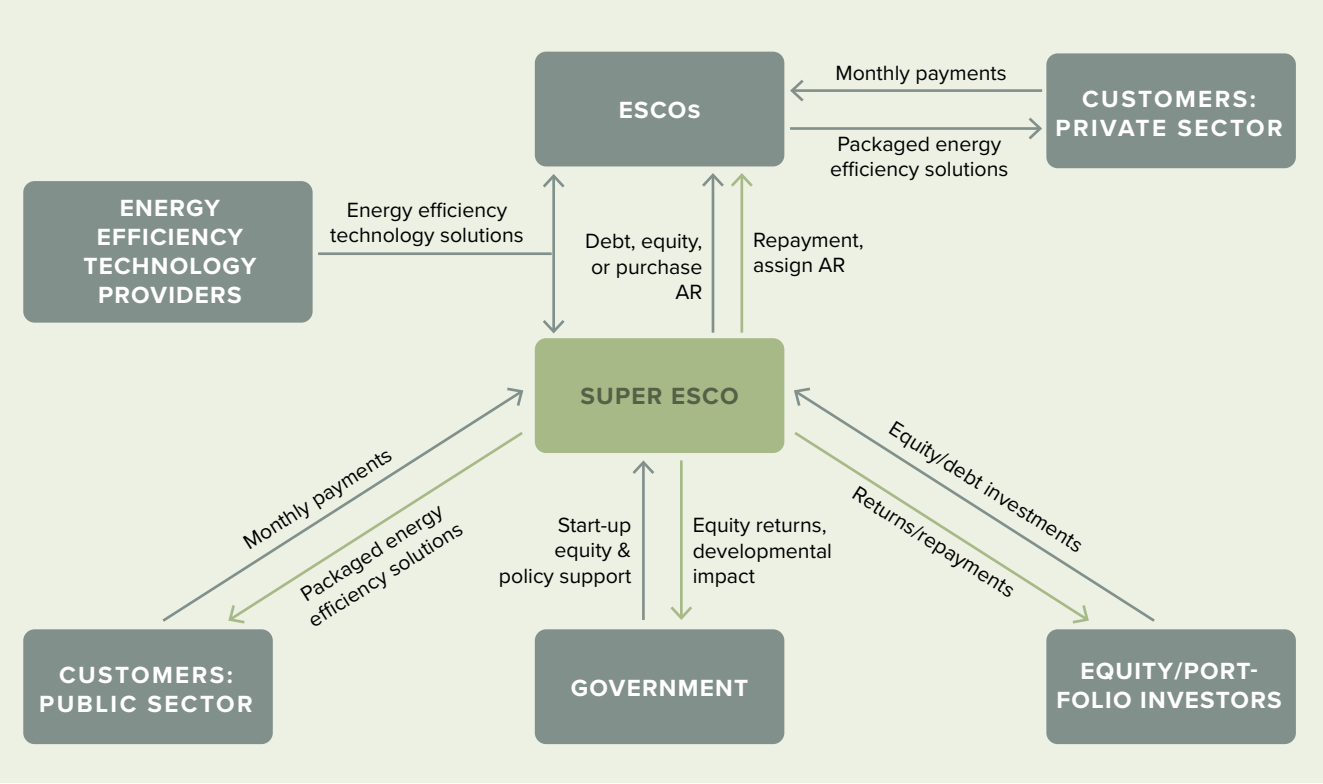
Energy performance contracting is considered an accelerator of ESCO industries because it is mutually beneficial to both public end-users and ESCOs. Rather than depleting already-limited public budgets, these customers gain access to private sources of financing and transfer both the technical and the financial risk to the EPC provider. The model also enhances the viability of ESCOs' projects, particularly those with large scopes and longer-term horizons. Credit risk is also often minimized when ESCOs have governments as contract counterparties. As such, performance contracting has established its place in well-developed ESCO markets. Germany presents a case of stable EPC utilization with further growth potential in the energy services market. While EPC accounts for only 15% (or around EUR 150 million) of energy service contracts, Germany's EPC market as a whole is still among the largest in Europe (EU JRC Science Hub 2017). With only a small proportion of the 500+ ESCOs employing EPCs, there is still the potential to further scale up performance contracting within the German public sector (BFEE 2015). While the majority of EPCs are signed with agencies of central and local governments, the number of such projects has seen a decline recently resulting from larger ESCOs exiting the market. EPC activity in the public sector concentrated on public buildings (offices, education establishments, hospitals) and streetlighting. To qualify for performance contracting, projects must have a minimum energy-cost baseline of EUR 200,000, which becomes an issue for smaller public buildings unless they are bundled together into a portfolio. Since some public administrators deem EPCs too complex, there has been an active rollout of guidelines for EPC procurement, for example, for municipal facilities and public buildings. The Berlin Energy Agency and other associations of energy service providers (ESPs) also aggressively promote the merits of EPC through training programs and workshops. While the German EPC market is expected to grow by 7% annually, this is expected to be driven by a 10% growth in the public sector (EU JRC Science Hub 2017).

Government-Owned EE Service Providers

ESCOs capitalized by the government and run as public entities that take advantage of economies of scale are called "Super ESCOs." Super ESCOs' unique capabilities, as opposed to those of typical private ESCOs, include but are not limited to securing competitive lending terms from financial institutions, managing a large pipeline of EPCs, and diversifying risk across a portfolio of projects. Among currently existing super ESCOs are the R2E2 Fund of Armenia, FEDESCO of Belgium, HEP ESCO of Croatia, and Tarshid of Saudi Arabia. Super ESCOs tend to emerge in markets where the private ESCO industry is still at its early stages but where there is clearly a growing demand for their services. They are considerably valuable to public-sector energy efficiency, as public agencies are typically incapable of conducting energy audits on their own, and procurement rules in some countries limit the use of performance contracting. In these situations, Super ESCOs can catalyze EE activity by investing resources such as audit and design expertise. Doing so removes the risks from projects and facilitates the generation of ESCO project pipelines that increasingly include public-sector clients, not just commercial and industrial facilities. Super ESCOs themselves can take on large-scale public-sector projects such as municipal streetlighting and public building retrofits. A key attribute of Super ESCOs is that they are capitalized and controlled by the government, potentially allowing them to circumvent procurement issues against performance contracting. Financing and contracting structures available only to public-to-public transactions could be used to implement publicsector EE projects. The scale and asset base of Super ESCOs also create a source of third-party financing for the greenfield or brownfield EPCs of private ESCOs, which could prove valuable in cases where commercial financiers are unable to provide competitive or acceptable lending terms due to their lack of understanding of EE or EPCs. Super ESCOs can also address such risk aversion by providing technical advisory services so that financial products can be created to support the growing demand for EE projects. These can be complemented by risk-management and credit-enhancement products offered by Super ESCOs, further stimulating the participation of commercial financial institutions in EE credit markets. Finally, since Super ESCOs are likely to operate as one of the largest energy service providers in a given market, they are capable of having a developmental impact on the ESCO industry by facilitating information exchange, creating activities that promote best practices, and being a hub for contracting templates and standards. Rather than public agencies such as ministries of energy, Super ESCOs can take the lead in the national government's efforts to promote and market the merits of energy efficiency and the ESCO business model. See Figure 2.

Under RA Government Decision N 799-N, the Armenia Renewable Resources and Energy Efficiency Fund (R2E2) was established in 2005 as the country's first and only Super

Figure 2. A variant of the super ESCO structure directly supporting public-sector projects while supporting ESCOs for private-sector projects



Source: Ablaza A., Liu Y. and Llado M.F. 2020.

ESCO. R2E2 acts as an autonomous, non-trade, legal entity mandated with the following objectives:

- Promote energy efficiency and renewable energy sector development
- Foster market development and stimulate investments in the sector
- Develop mechanisms aimed at increasing the level of energy security and energy system reliability
- Organize and implement loan, grant and other projects, promoting the sector's development on behalf of the state
- Facilitate the reduction of anthropogenic impacts on the environment and human health. (R2E2 2020)

In 2019, this Armenian Super ESCO invested nearly AMD 2 billion (around USD 4 million) in EE projects across 64 public facilities. Among such projects is scaling an EE building retrofit initiative of the United Nations Development Program, in which R2E2 is to secure financing from local financial institutions and procure energy saving measures, conduct an energy audit, and undertake installation and technical supervision. Another key focus of this Super ESCO is implementing public awareness campaigns that raise the need for EE improvements. These include public discussions with local community stakeholders of EE projects, an "energy efficiency festival" in partnership with national government agencies, and training programs on technical solutions and procurement processes.

Governments may also choose to organize a state-owned enterprise to deliver EE services under the supervision of the department or ministry of energy/power, and such an entity would function as a competitive player in the local energy services industry. Because of its scale and government-backed financing, these state-owned ESPs can provide a wide range of EE services (vertically and across varying technology types) and have the capability to take over large project pipelines, especially from the public sector. Given their deep expertise, such ESPs could also take on international ventures to support overseas ESCO markets as a form of capacity- and relationship-building. One such entity is Energy Efficiency Services Limited (EESL) of India, established in 2009 as a joint venture between four public-sector undertakings under the Ministry of Power: NTPC Limited,

Power Finance Corporation Limited, REC Limited, and Powergrid Corporation of India Limited (EESL 2020). As the world's largest public ESP, EESL boasts an EE/RE technology portfolio encompassing streetlighting, HVAC, green buildings, distributed generation, and smart meters. In addition to its significant contribution to the local energy-services industry, EESL has signed partnerships with public and private clients in thirteen countries, focusing on procurement of and retrofitting with energy-efficient equipment. Leveraging its extensive pool of expertise and experience, EESL also provides consultancy services for implementing EE projects or achieving sustainability goals.

Long-Term Concessional Financing for ESCOs

Business-as-usual financing, in which equity- and debt-based funds are sourced to fund EE projects, is common among ESCOs. While some financial institutions, especially international financial institutions or IFIs, initially extended equity investments, over time they have shifted to investing in EE projects using debt in order to better manage risk. In emerging economies, multilateral development banks (MDBs) have established funds that help finance private-led infrastructure, such as ADB's Leading Asia's Private Infrastructure (LEAP) Fund. Other facilities, such as the Green Climate Fund (GCF), are designed specifically to support pipelines of energy efficiency projects financially. Typically, investment horizons range over a decade in order to exceed the average contract durations of projects and to facilitate rollovers and the reinvestment of repayments. This is a common characteristic of official development assistance (ODA) funds, which are received by government agencies that then direct them into large-scale public EE programs or the project aggregators that directly manage EE pipelines. Unlike most commercial debt financing, ODA lending terms are provided at near- (or even sub-) wholesale interest rates. Low financing costs can also be bundled together with guarantees that further ease the financial burden on ESCOs, particularly those with asset bases that are considered insufficient to qualify for commercial loans. Of course, securing such affordable financing is subject to satisfying criteria that are predetermined by the ODA or MDB.

Another common approach is to blend these concessional sources of finance with other private or public funds to structure larger lending facilities. These can be then used to support rapidly growing ESCO markets that are weighed down by a risk-averse commercial financing environment. IFI investments can been infused into multilateral climate funds and capital raised from multiple private investors. Haiti was one of the emerging markets that benefitted from these co-financing structures. Funds from the GCF, the International Finance Corporation (IFC), and the Haitian government were used to put together a loan facility for a 2020 solar/microgrid project (GCF 2020). At the senior tranche of the debt portion of the facility, the IFC provided USD 23.6 million at 7% interest and a twelve-year tenor. Concessional financing was blended in via the GCF, which covered the junior tranche with USD 8.4 million at 2% interest and a twenty-year tenor. As a result, the debt facility's effective cost of funds is 5.7%, or 130 bps cheaper than the senior tranche rate.

The Shandong Green Development Fund (SGDF) illustrates how public administrators can organize a long-term lending facility to achieve local EE objectives. Considered an economic center, the province of Shandong is located on the eastern coast of the People's Republic of China. The SGDF is a USD 1.5-billion, twenty-year catalytic fund targeted at climate change mitigation and adaptation measures for the province, including energy efficiency interventions (ADB 2020). Investments will be made on a revolving basis to sub-funds at an initial ratio of 55% and 45% from public (Qingdao Municipal Government) and IFI finance (Asian Development Bank, Agence Française de Développement, Kreditanstalt für Wiederaufbau, and Green Climate Fund) respectively. The revolving structure of the SGDF is potentially attractive for Chinese ESCOs with several projects already in their pipelines. In the context of Shandong's climate finance environment, the SGDF would function as an anchor investor which could potentially attract further investment, such as private paid-in capital and concessional sources of financing. Although the SGDF's effective cost of funds may not match the sub-commercial rates offered to developing countries by some climate finance programs, it would still represent a discount relative to that offered by commercial banks, particularly those still risk-averse towards EE financing.

Another variant of multi-party co-financing is the use of risk-sharing facilities (RSFs). In these structures, the credit risk arising from EE debt-financing is shared between a financial institution and the government (Ablaza 2019). The RSF financiers can elect to have a single tranche or multiple tranches in place, depending on each other's risk management needs. Under a single-tranche structure, the majority of the risk can be assumed by the government in

order to attract private-sector participation. If the government wants to temper its risk exposure but still entice private investment, a two-tranche RSF can be used in which the first wave of credit losses is more evenly split between the parties, but majority of the risk balance is still taken by the government. This risk allocation protects the government from small underpayments by ESCOs, which could add up to a large sum across an entire lending portfolio, but still incentivize private financial institutions to participate in EE lending. RSFs are feasible in markets where commercial banks are liquid and risk-tolerant of energy efficiency projects, and there is enough ESCO activity to generate a pipeline for the RSF to fund.

Fiscal Tools and Policies

When sourcing adequate funding from financial institutions is difficult, governments employ fiscal tools to support or enable public agencies to take on EE projects. One such tool is budget financing with capital recovery, in which sponsoring agencies such as the department or minister of budget or finance provide allocations to implementing agencies or municipalities for their EE projects (World Bank 2018). The sponsoring agencies are repaid through budget reductions across implementing agencies based on energy savings (for example, lower budgets for energy expenses). Typically, the reductions are set lower than the expected energy savings, allowing the implementing agencies to retain a portion of the economic value resulting from their EE projects. This in turn would incentivize them to continue identifying energy-saving opportunities. ESCOs also gain from this mechanism because projects for previously non-creditworthy or undercapitalized public agencies now become financially viable, and pipelines of future projects with them become more likely. Small municipalities are among those that would benefit the most from budget financing, as it would address the following limitations regarding municipal funding: 1) insufficient municipal revenues, 2) restrictions on borrowing capacity, and 3) restrictions on the use of funds. In addition to financial support, sponsoring agencies may include technical assistance to help EE end-users identify opportunities and properly assess project risk. Risk aversion towards implementing profitable EE projects would lessen, thus increasing the demand for ESCO services. A budget financing structure was used in the Municipality Services Improvement Project (MSIP) of the Macedonian government. In 2010, the World Bank provided funds to Macedonia's Ministry of Finance, which the latter then lent on to public agencies and municipalities that met the creditworthiness criteria (Gassner 2018). Qualified use of the funds were municipal services projects, such as those on energy efficiency, that either generated revenue or reduced costs. In cases in which borrowers lacked the technical capacity to conduct in-house project procurement or design, a special implementation unit within the Ministry of Finance would supplement the client with technical advisory financing to outsource these processes. Loans issued by the Ministry of Finance were paid with the net cash flows generated by the projects. Failure to do this resulted in the Ministry of Finance exercising its right to reduce the future annual budgets of these public agencies or municipalities.

Programs are also developed at the municipal or local government level. In some markets, loans made for energy efficiency projects can be repaid over time via property taxes. Upon meeting the qualification requirements, residential and commercial buildings receive funding from the state or local government to implement energy efficiency improvements, which could even include hurricane proofing, seismic retrofitting, and renewable energy systems. Financing mechanisms may vary based on national and local government regulations. One of the most successful property-based repayment schemes in the US is the Property-Assessed Clean Energy (PACE) program. In the US investments are categorized into commercial (C-PACE) and residential (R-PACE) (IEA 2018), and cash-flow streams from property tax payments are securitized for trading in financial markets (US DOE 2020). A key feature that makes this program even more attractive is that repayment obligations are tied to the property rather than the home or building owner. As a result, even if the repayment stream spans decades, owners are still incentivized to make improvements in energy efficiency. Should they sell the property in the future, the balance of the payment stream is transferred to the new owner. Altogether, the PACE program reduces energy expenditure while increasing property values. At the time of writing, 33 US states and the District of Columbia have passed legislation enabling PACE. Nineteen of these states plus the District of Columbia currently have operational PACE programs.

A more common fiscal approach to stimulating EE investments is legislation regarding financial incentives and energy audit requirements. In some countries, frameworks for these are largely based on existing policies on renewable energy investments. Designed to improve EE project economics and bankability, fiscal incentives come in different forms,

such as tax reductions and credits, income tax holidays (ITH), zero-rating of value-added taxes (VAT) or goods and services taxes (GST) for qualified equipment, and tax rebates. Legislative frameworks for these incentives could also include requirements for public and private entities that would ultimately raise the demand for ESCO services. The Philippines recently joined its Asian peers in incentivizing EE projects financially after lawmakers passed the Energy Efficiency and Conservation Law in 2019. Qualified enterprises are entitled to ITH, duty-free importation of capital equipment, and additional deductions from taxable income. A database on nationwide energy consumption and the application of EE and RE technologies will be established, and minimum energy performance standards (MEPS) will be set for energy-consuming products. More importantly, business establishments that depend on annual energy consumption are now required to 1) undergo an energy audit every three years by a certified energy auditor, 2) submit an annual energy consumption report, and 3) reduce energy consumption based on pre-determined annual targets. The legislation is expected to accelerate ESCO activity in the Philippines, as the need for energy audit services increases and the identification of energy-saving opportunities becomes a business priority. The new law is also expected to broaden government procurement regulations and financing modalities for ESCO contracts targeted at public buildings or municipal services such as streetlighting, water utilities and irrigation.

Utility Programs

Public utilities are capable of implementing financing mechanisms that can support ESCO project viability. On-bill financing has been utilized in some markets as a means of supporting the large-scale implementation of relatively small EE projects across a portfolio of existing customers. The utility provides project capital to customers pursuing EE projects for their households or business establishments. A share of the energy savings is then repaid to the utility by being bundled into existing utility bills. This bundling feature significantly reduces the credit risks posed by end-users, thus justifying a lower cost of financing than that offered by commercial financial institutions. Customers applying for this type of financing are still screened by the utility, but utility bill payment histories can be used as proxies for the creditworthiness of traditional measures. In some cases, investor capital outside the utility can be pooled with the funds from the on-bill repayments, particularly when there is an established demand for EE projects or when the utility's available funds are limited. Because repayments are pooled from multiple customers or ratepayers, ESCOs implementing a portfolio of projects (for example, LED upgrades for households) gain from investment diversification and reduced credit risks. The benefits for project viability are magnified even further when the public utility itself functions as the ESCO providing the EE services, since its technological offerings can be tailored to its understanding of ratepayer behavior. On-bill financing gives ESCOs the opportunity to offer services to customers that would have been too small to create a bankable project or to aggregate into a project portfolio without the assistance of a utility. Although on-bill financing presents a convenient way to scale-up EE initiatives and manage risk, several conditions must be met to allow its implementation. Utilities need a sizeable balance sheet and robust cash-flow management to provide capital for projects across a multi-year horizon. In addition, billing infrastructure should be capable of accommodating such bundling of project repayments. The most critical condition, the non-fulfillment of which has precluded on-bill financing in several countries for the time being, is that legislation must allow public utilities to conduct and profit from such mechanisms.

In Brazil, the Contribuição para Custeio do Serviço de Iluminação Pública (meaning "Contribution for the Cost of Public Lighting") or COSIP is a municipal-legislated, on-bill charge or tax that is added to the energy costs that must be paid by utility customers. The funds resulting from COSIP revenues can be used solely for the modernization of public lighting. Municipalities can also allow excess COSIP funds to be used for PPP energy efficiency projects. Because these utility collections are committed to streetlighting projects, ESCOs involved in streetlight modernization programs enjoy lower credit risks when contracting with such municipalities. However, surveys indicate that at least 31% of municipalities deem COSIP revenues insufficient to cover streetlighting costs (Meyer et al. 2017). Nonetheless, this form of on-bill financing is seen as an effective means of de-risking and making attractive EE investments in a specific sector. LED conversion resulting from COSIP funding, if implemented nationwide, could result in a energy savings rate of close to 50% in the public streetlighting sector, or a 2% gain in national efficiency (Meyer et al. 2017).

Demand-side management (DSM) is a means for utilities to reduce energy costs on a large scale, primarily by reducing consumption during peak hours. Utilities assess the elec-

tricity usage patterns of their customers and provide rebates to them to reshape their consumption behavior. Flattening the load curve, combined with employing energy storage resources, helps avoid the higher per-kWh generating costs from either "peak power plants" or the peak prices resulting from imbalances caused by variable renewable-energy sources such as solar and wind. Off-balance sheet investments may also be made by utilities by providing more energy-efficient technologies to customers to replace their existing equipment. On-bill recovery mechanisms combined with energy savings from shaved peak loads allow utilities to recoup their investment and earn a return on it.

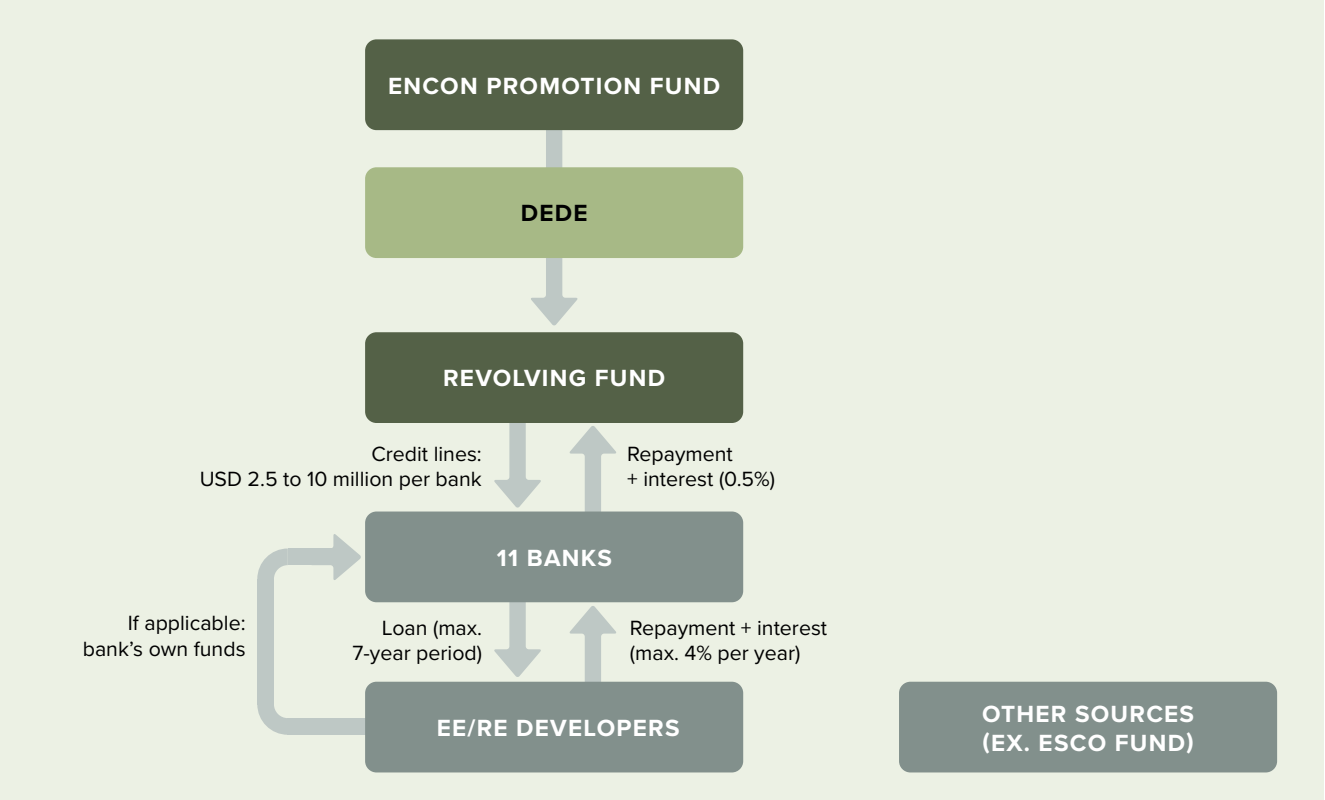
Emerging applications can also be seen in the "smart grid," where customers can potentially provide utilities with access to their smart (i.e. internet-connected) appliances and equipment. The assets can be remotely turned off or switched to low-consumption settings during peak hours, and customers are compensated with a share of the energy savings. Utility-led DSM effectively serves as a portfolio of small-scale energy efficiency projects with relatively lower capital intensities, depending on the type of DSM employed, and governed by a shared savings model. Utility-led DSM can still be promoted in vertically integrated electricity markets, particularly because the economic and financial benefits of energy savings achieved at the level of the utility customers can directly flow up to the generation side of the utility business. Electricity markets that have been restructured to unbundle generation from transmission and distribution, as well as accommodating retail competition and open access, now face challenges in crafting a role as energy efficiency financing channels for distribution utilities.

Energy Efficiency Revolving Funds

Energy efficiency revolving funds (EERFs) are long-term financing facilities that can be set up by governments (national, state, or local) to support EE investments in the public sector. IFIs, such as the World Bank and KfW, have also helped establish them in certain countries. EERFs are designed to provide initial investments in public EE projects. In return, a proportion of the monetized energy savings flow back into the fund to be used for other EE projects. Unlike one-time concessional funding or grant programs, which eventually taper off as the market approaches maturity, EERFs are considered more sustainable, since well-performing projects help fund future ones. Such a structure is especially advantageous for lower-budget, less creditworthy public agencies, since financing is generally cheaper and comes with a longer tenor than those that would have been provided by the commercial banks (World Bank 2018). The presence of EERFs in a market is also beneficial to ESCOs, particularly those looking to make the public sector a larger share of their project pipelines. Undercapitalized public clients that would have initially required ESCOs to take over most of the financing responsibilities would then be able to take on a larger share of that burden. This could cascade into more EE projects in the future for the same public agencies, as cash is freed up by realized energy savings.

Under its Energy Conservation Program, in 2003 the government of Thailand created the Thai Energy Efficiency Revolving Fund to address the financial barriers to the country's EE industry and to heighten participation by commercial financial institutions (Wang et al. 2013). Serving as the primary legislative framework for Thailand's EE policy, the Energy Conservation Promotion Act (ENCON) established the ENCON fund to provide financial support for energy conservation programs. The Department of Alternative Energy Development and Efficiency (DEDE), an agency under the Ministry of Energy, manages the ENCON fund and used its proceeds as initial funding for the EERF, covering a ten-year investment horizon (UNIDO 2015). Originally, the EERF was launched for a pilot period of only three years, with supplemental investments provided by six participating banks. This was subsequently extended by seven years in five phases, after which the EERF will cease to receive a budgetary allocation from the government and will be sustained instead by the banks' own capital. In course of time, the DEDE signed agreements with eleven participating banks (Grüning et al. 2012). The EERF is structured to lend to participating banks at 0.5% (reflecting administrative costs and the banks' credit risk), the latter flowing the funds to the EE programs with a THB 50 million cap per project at 4% per annum defaults (Energy Futures Australia 2005). Project costs in excess of the cap are then covered by the banks. The EERF disbursed USD 210 million to fund 335 EE and RE projects between 2003 and 2010, or 46% of the USD 453 million total project cost. This resulted in USD 154 million of annual energy savings by 2009 and a three-year average payback period (Wang et al. 2013). The value of the EERF was limited not just to its actual investment outlay, but also in its ability to stimulate investments in EE by other stakeholders. Because the EERF passed on below-market interest rates, the commercial banks were able to mobilize more of its capital. As their risk perceptions of EE projects improved, the banks increased their capital exposure, rather than sim-

Figure 3. Thailand energy efficiency revolving fund structure



Source: Grüning C., Menzel C., Panofen T., Shuford L.S. 2012.

ply matching the EERF's outlays. Because of its key role back then in Thai EE financing, the facility also paved the way to streamlined lending procedures, reduced loan-approval times, and decentralized responsibilities for implementing EE financing (Energy Futures Australia 2005). See Figure 3.

Recommendations

Broadly speaking, the public financial mechanisms discussed here enhance ESCO project viability in at least one of two ways: 1) improving project economics by raising after-tax returns and managing key risks; and 2) expanding the sphere of potential customers it is financially feasible to contract with. Governments drive policies, which in turn shape the economic feasibility of energy efficiency projects. However, the depth and effectiveness of policies developed for energy efficiency purposes are functions of the maturity and sophistication of any given country's energy services industry. As such, the availability of public financial mechanisms discussed here varies widely across the world. Examination of the more developed ESCO markets reveal that governments must take certain steps before pursuing these financial structures. Furthermore, the existence of certain market barriers or gaps precede the use of certain mechanisms. Below are recommendations that would help identify which public financial mechanisms to implement in maximizing their impact on ESCO project viability:

- Conduct EE market-mapping analyses and estimate the market potential of public-sector and less-creditworthy customer segments relative to the entire country
- Allocate funding to the preparation of public-sector EE projects, including budgets for investment-grade energy audits, PPP transaction support and the design of large-scale ESCO procurement programs
- Assess the existing ESCO industry and identify bottlenecks to the growth of project pipelines, and the accreditation and technical capacities of new ESCOs
- Assess the current environment for private-sector and government lending to ESCOs, and estimate the financial intervention needed from IFIs, MDBs, and the government to achieve EE market potential

- Review public procurement rules and how the policies of governments that allow public-sector EPCs can be adapted
- Create innovative financial vehicles and structures (e.g. equity and guarantee funds, Super ESCOs, PPP, joint venture transactions) that can enable public funding and private-sector capital flows into ESCO-led EE retrofits in public facilities
- Create a road map for gradually removing subsidies in energy prices in order to improve EE project economics and the viability of ESCO financing
- Implement an incentives framework to improve after-tax returns for a wide range of EE technologies and services, and require establishments meeting a given energy-consumption threshold to create energy-use reduction plans
- Identify technical competency gaps across the EE value chain and establish training and international partnerships
- Conduct technical training and marketing campaigns to raise stakeholders' confidence in EE projects and ESCO business models

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ESCO Accreditation Experience Around the World

Abstract

An Energy Service Company (ESCO) accreditation process can be implemented in an Energy Efficiency (EE) market to assess and accredit all companies wishing to operate as ESCOs and implement contracts that include performance conditions. Accreditation provides recognition of a firm's competence in fulfilling certain standards of performance and is based on a review of certain of its activities but not all. Indeed, accreditation is quite different from certification guaranteeing the an organization's qualifications. Accreditation helps create a trusting environment that supports both the development of an Energy Performance Contracting (EPC) market and the ESCO selection process, thus providing owners with the ability to make an informed selection.

The development and implementation of a well-structured ESCO accreditation process aims at creating a fertile and predictable market environment for energy services. The availability of such a process can help address some of the barriers to EE market growth and identify EE projects that are eligible for financing by commercial banks. The accreditation process should be open to any company established or operating in a region that wishes to be accredited as an ESCO. Applicants that can demonstrate a high level of full-service project development and implementation of energy-efficiency projects should be allowed to apply and obtain such accreditation.

Many countries have established several country-based accreditation programs. While each program is unique, and each provides certain attributes that may be desirable to an organization establishing an accreditation program, it is recommended that accreditation program developers select criteria that are most appropriate for their particular ESCO markets.

1. Introduction

Most countries do not have a legal or regulatory framework for Energy Performance Contracts (EPCs) or the operation of Energy Service Companies (ESCOs) in the private sector. Hence, any EPC contract established under an EPC scheme is usually governed by existing commercial laws.

In many countries as well, the role of ESCOs is not well known or understood, in itself creating a barrier to their development. We believe that the current legal framework does not help address this, since it creates confusion in the private-sector market. Furthermore, based on our own experience, this lack of knowledge often leads to the formation of opinions about the ESCO market and its companies, that often present an inaccurate picture of the performance ability of ESCOs.

An accreditation process can be implemented in an ESCO market to assess and accredit all companies wishing to operate as ESCOs and to implement EPCs. Accreditation provides recognition of competence in certain standards of performance. Furthermore, accreditation is based on a review of certain activities of an ESCO, but it does not assess all its activities. In that sense, accreditation is quite different from certification guaranteeing an organization's qualifications. Accreditation helps create a trusting environment that can support both the development of an EPC market the ESCO selection process, thus providing owners with the ability to make an informed selection.

ESCO accreditation was initiated to build market confidence and support the development of the market. Having an accredited ESCO program helps to sustain and legitimize the ESCO industry.

Over the years, different countries have put together accreditation processes that have facilitated the development of ESCOs in their respective markets.

2. Rationale for an ESCO accreditation process

Overall, international experience demonstrates that the ESCO business model is an effective way of facilitating EE investments. The aim of the development and implementation of a well-structured ESCO accreditation process is to create a fertile and predictable environment for an energy services market. The availability of such a process can help address some of the barriers to EE market growth (lack of knowledge, lack of trust, rumors of bad project, lack of confidence in the promised savings) and identify EE projects that are eligible for financing by commercial banks. Since the lack of trust and confidence among market stakeholders are major barriers, information about ESCOs needs to be complemented by measures to confirm and increase their reliability for potential end-users. One measure that should increase trust and reliability is the development of a robust ESCO accreditation process.

The authors believe that the introduction of such a process will have a beneficial impact on the market and will:

- Promote and expand ESCO business in the local market.
- Reduce transaction costs for both customers and ESCOs by identifying a limited pool of qualified providers.
- Build the necessary market confidence and make it easier for end-users (facility owners) to identify a competent ESCO partner.
- Create an industrial environment that has integrity.
- Contribute to the country's economic development by creating more jobs in a stable ESCO business sector.

Accreditation should not be viewed as an onerous obligation, but rather as a market development catalyst that will create a more mature, transparent and fairer EPC market environment. Below is a list of the incentives and benefits that ESCOs can be expected to receive if accreditation is achieved:

- Protection for technically and financially sound companies against unfair competition from unqualified companies.
- Recognition by clients, especially those in the public sector. By requiring ESCO accreditation, public-sector clients can reduce the risks related to project fulfillment.
- Easier access to financing: an accreditation process will generally increase the credibility of the companies from the sector and counter banks' perceptions that ESCO projects are risky.
- Greater awareness of the impact of poorly performing projects. By having to periodically re-qualify, an ESCO has an incentive to produce high-quality projects.

Accreditation has been widely used by public-sector clients in many countries, including the United States and Canada, which have some of the longest standing accreditation programs in existence. While the markets in these countries are heavily tilted towards the public sector, other countries with accreditation programs have a market that includes

Table 1. Requirements for national ESCO recognition

Business Financial Technical		China	Canada	Dubai	India	Singa-pore	United States
B	Longevity Requirement	x	x	x	x	x	
B	Project Completion Investment Amount	x					
B	Demonstrate Staff*	x	x	x	x	x	x
B	Insurance Verification (General Liability)		x				
B	Reference from Clients			x		x	x
B	Membership in Accreditation Organization						x
B	Ethic Agreement						x
B	Legal Action Description						x
F	Financial Strength	x	x	x	x		x
F	Financial Statements for 2 years		x				
T	Number of Projects	x	x	x	x		x
T	Demonstrate Ability**	x	x	x	x	x	
T	Auditing Equipment Ownership			x		x	
T	Safety Requirements			x		x	
T	M&V Demonstration						x

* Staff refers to the ability to field competent staff to fulfill ability
**Ability refers to the ability to perform energy audits, project design, construction, and performance services

both public- and private-sector clients. Public-sector clients have greeted the inclusion of accreditation requirements in solicitation documents with favour, but evidence of private-sector clients favoring accreditation is not as abundant due to the shorter time period since these markets adopted accreditation.

3. Type of esco accreditation

Over the years, different countries have put together accreditation processes that have facilitated the development of ESCOs in their respective markets.

Table 1 presents a list of common generic requirements for all the national ESCO recognition criteria we reviewed that could serve as good examples for the development of an ESCO accreditation process in any country. It also provides some examples of countries that are using them. These criteria are broken down into three major groups – technical, financial and business.

3.1 Business Criteria

Business criteria involve the aspects of operating a business. These are important considerations, since ESCO contracts are often of long duration, justifying the importance given to sound business .

3.1.1. Longevity Requirement

Longevity refers to the length of time that a business has been in operation. ESCO contracts have complex financial and technical aspects that often require a level of maturity in business processes to be able to manage financials and agreements that span many years. Longevity is often evaluated from the perspective of a specific number of years of continuous business operations. For example, in China at least one year of operations is required, while in Dubai companies must have been operating for at least three years. For contracts in the United States, although no longevity requirement is stated, one is implied by the requirement for projects to be submitted with at least one year's worth of performance measurements, which indirectly would mean over one year of continuous business operations.

3.1.2 Project Completion Investment Amount

This label refers to the total number of projects in monetary terms that an ESCO has completed. This requirement is not typical of those countries listed in Section 6, but China requires a level of project investment prior to accreditation.

In making a requirement of this nature, it is important clarify the amount it is desired to examine. When the statement "project investment" is used, for example, this typically means the implementation portion of the contract, but it does not include the value of ongoing or other services being provided.

3.1.3 Staffing

An ESCO is usually required to demonstrate some level of staff competence and to present its organizational structure. For the staff responsible for the mechanism to fulfil a project, this can be an important requirement for accreditation. Section 6 shows that all countries discussed there require some demonstration of staff competence. High professional standards and technical and organizational skills on the part of the staff are considered of crucial importance in all the jurisdictions we reviewed. To guarantee successful performance, ESCOs may be required to demonstrate that their employees meet some of the following criteria:

Staff Experience

Staff experience can range from certain degree requirements to number of years in the profession to requirements to provide certain personal certifications. In Canada, staff must have at least five years' experience.

Staff Competence

Staff competence means the ability of staff to perform the work required to fulfil an ESCO contract. This type of demonstration might include such things as completed audits or qualifications achieved. In Dubai, ESCOs applying for full certification must prove employment of at least two staff members with an engineering degree, including one Certified Energy Procurement Professional (CEP) and one Certified Measurement and Verification Professional (CMVP). In Singapore, certified ESCOs must have at least one Qualified Energy Services Specialist in full-time employment with them.

Staff Capacity

Staff capacity refers to the ability of an ESCO to have sufficient staff availability to perform the level of work expected of the ESCO. Staff capacity may be represented by in-house staff or contract staff. However, if contract staff are used to augment the in-house staff, an evaluation of the former's experience and competence is still required.

3.1.4 Insurance Verification

In many areas insurance is a requirement for embarking on any type of construction, and in most areas, just to maintain a business, insurance may be required. Insurance provides an indicator of a company's business viability, as many insurance claims may be challenged to sustain an insurance policy. Insurance is generally mostly necessary to protect the stakeholders in an ESCO contract.

3.1.5 References from Clients

References from clients provide an avenue for the accrediting body to evaluate perceptions of an ESCO's performance by clients and building owners. References can be provided in multiple formats (written affidavits, purchasing system database of projects, in-person discussion), each providing different levels of evaluation. In the United States, project references are used in conducting in-person reviews of project performance, and the discussion includes staffing, development, construction and post-project performance. Project references are required in Singapore and Dubai as well.

3.1.6 Membership in Accrediting Association

Some accreditation bodies require that, to maintain accreditation, the ESCO must remain a member in good standing of the organization providing the accreditation. This requirement can add to the overall cost of accreditation, but it does provide some additional ongoing interaction with the ESCO through events and training.

Ethics Agreement

In the United States, accredited ESCOs are required to have a senior officer of the company acknowledge and sign the ESCO Code of Ethics of the accrediting organization. The code of ethics includes topics like accreditation evaluation and has the goal of ensuring ongoing satisfaction of the accreditation requirements between accreditation cycles. Furthermore, the ethics document has items that restrict an ESCO's ability to make claims about its own abilities as well as those of its competitors, and above all it aims to enforce good business practices.

3.1.7 Legal Action Description

Legal action can be a monitoring point for the ESCO's performance and issues with project fulfillment. By providing a list of all legal actions over a specific period, the accreditation committee can determine whether there has been any pattern of problematic performance resulting in litiga-

tion penalties. It is important to note that not all litigation is viewed as negative, but any instance of litigation should nonetheless be disclosed to allow the accreditation committee to understand the impact of the ESCO on its clients.

3.2 Financial Criteria

The business criteria in the last section focused on how a company is run: the financial criteria concern the results of that operation. A company with sound business practices should be profitable and thus have a solid financial history.

3.2.1 Financial Strength

Financial strength is best understood by examining the company's profitability, but it should also include an evaluation of its debts, timely payments (lack of late fees), capital availability and general good bookkeeping practices. Most countries mentioned in Section 6 require some evaluation of the company's financial strength, most of which are subjective. China, however, has a specific measure it applies to the company's capital.

3.2.2 Financial Statements

Some countries require one year of financial statements, some more. Canada, for example, requires two years of financial statements. When requiring financial statements, priority should be given to audited financial statements. However, in some cases, when an ESCO is a subdivision of another larger entity, the overall audited financial statements may not provide sufficient understanding of the ESCO's specific finances. In those cases, unaudited details may be used to augment the audited financial statements.

Technical Criteria

While the business and financial criteria are important in evaluating an ESCO, ESCO projects are inherently technical in nature. Since the project has an impact on the building that could endanger life, indoor air quality and other personnel issues, competently delivering a technical project is a necessity. Thus, ESCO accreditation must evaluate the ESCO's ability to deliver the technical aspects of a project.

3.2.3 Number of Projects

The number of projects that an ESCO has completed can help an accreditation committee understand its ability to deliver projects. If only a few projects have been delivered or are provided as examples, it can be unclear whether the ESCO has a repeatable process for project delivery. In the United States, ESCOs are required to list all projects completed over a five-year period, but only a select portion are provided with substantial details. In China, at least one project is required, and in Dubai, six projects are required.

3.2.4 Demonstrating Ability

The ability of an ESCO to deliver projects is closely related to the ability of its staff to perform certain aspects of project delivery. While its staff may have their own performance histories as individuals, the ESCO must show that it too has delivered audits, constructions and post-project performance. This shows that the company seeking accreditation has the ability to ensure all the components work together to deliver a full project. In Canada, this is assessed by requiring full delivery information for two projects, as well as documentation of the ability to deliver projects, with schedules, project tracking tools, etc. In India, the number and nature of all audits is required, as well as a listing of the different industries served and any certification and quality systems the company has in place.

Audit Equipment Ownership

For an ESCO to perform energy audits and develop projects, certain equipment should be available for the staff to use in making these developments. A sample of such equipment is shown below, which is not claimed to be comprehensive or all-inclusive:

- Energy meter
- Power transducer
- Data logger
- Ultrasonic flowmeter
- Power quality analyzer
- Current/voltage clamp meter
- Pressure indicator/probe/sensor
- Temperature indicator/probe/sensor

The equipment may be owned by the ESCO or may be made available through other means. Dubai and Singapore, for example, require ownership of energy-auditing equipment.

3.2.5 Safety Requirements

In many countries, governments have introduced certain safety requirements for workers. The ESCO accreditation process seeks to validate and understand how the ESCO handles safety issues. The work of an ESCO is broad and covers standard office-based work, but also involves building mechanical systems and possibly more complex construction activities. Thus, safety is an important consider-

ation. An ESCO should provide safety plans, policies and procedures to demonstrate that it has an active program. Dubai, for example, requires ESCOs to provide safety policies and keep records of safety-related incidents.

3.2.6 Demonstration of Measurement and Verification Capabilities

What makes an ESCO project unique is its guarantee that the systems it installs will perform at the levels predicted in the detailed audit. Many contracts include a guarantee of performance that requires a measurement and verification process and reporting that validates the claim that cost savings have been achieved. Some accreditation organizations require annual reports and evaluations to be provided for consideration. In the United States, projects with at least one year of savings measurements must be submitted.

4. ESCO accreditation process Requirement recommendations

The purpose of accreditation is to enhance the professionalism and quality of the services offered by ESCOs. A reliable and transparent accreditation process increases confidence in the energy services sector and helps promote the growth of the industry. To foster the development of a viable energy services market, any scheme should develop its ESCO accreditation process by establishing a set of criteria to serve as its basis.

4.1 Accreditation Requirements

The accreditation process should be made open to any company established or operating in a region that wishes to be accredited as an ESCO. Applicants that can demonstrate a high level of full-service project development and implementation for energy-efficiency projects should be allowed to apply for and obtain accreditation. Below are some key features that all accreditation programs should include:

4.1.1 Business Criteria

- Applicants should be registered companies under national legislation.
- A minimum of two years of continuous operation.
- A positive review of all outstanding legal actions over a defined period.
- A statement of compliance with the accreditation organization's ethical guidelines.
- A demonstrated ability to acquire construction bonding of a certain capacity.

4.1.2 Financial Criteria

- A positive net working-capital ratio for the last two financial years.
- A positive net assets ratio for the last two financial years.
- An acceptable explanation by the applicant explaining any financial anomalies found by the accreditation body in the financial statements.

4.1.3 Technical Criteria

- A demonstration of staff competence through resumés and organizational charts.
- Project profiles that describe the project's EE measures, their construction and ultimate performance.
- A listing of all projects completed over a defined duration.
- A demonstration of the fulfillment of a broad range of energy conservation measures.
- A safety program and documentation.

4.2 Alternate Accreditation Requirements

In some markets and countries, ESCOs may be just starting to provide services and therefore have only a limited ability to provide extensive project details as required by the accreditation process. Furthermore, new market entrants may emerge that likewise have only a limited project portfolio. Several countries listed in Section 6 have introduced a "provisional" accreditation process that allows ESCOs to seek accreditation on the basis of a reduced set of documentation. Provisional accreditation is an acceptable process for developing markets and new market entrants, but it should only be offered for a short period of time, such as two to three years. Furthermore, provisional accreditation should only be offered once, and only under special circumstances should provisional renewal be allowed. As the designation "provisional" is designed to allow a new market entrant to gain some project experience, it should only be renewed under special circumstances. As during the provisional period, success should be assessed with reference to the development of some projects that can be used for full accreditation.

In the provisional accreditation process, the areas to be relaxed should involve those items that a company with less longevity might experience, including:

- Number of years in operation
- Projects available for reference
- References from clients

However, other criteria apart from those found in Section 3 should be evaluated normally. The role of an accreditation program is not to enable an ESCO to enter the market but to qualify those ESCOs that meet the accreditation requirements at a higher level of performance expectation. As such, it is important that even with provisional accreditation the ESCO can demonstrate the ability to fulfil the functions of an ESCO as outlined in Section 3.

It is also important to acknowledge the dynamics of the market where the accreditation program is being established. If accreditation imposes legal or policy requirements on any company wishing to provide ESCO work, to facilitate new market entrants provisional accreditation should be more relaxed, as the ability to do any ESCO work is limited to accredited companies. It is vital that the accreditation program has a path allowing new markets and new market entrants to grow and prosper.

4.3 The Process of Accreditation

A dedicated ESCO Accreditation Board must be created and vested by a specific entity (government ministry, national EE agency, private-sector association) to manage the process and carry out the accreditation. The Board often includes prominent professionals with various backgrounds and expertise to cover the different aspects of the ESCO business, for example:

- Government experts
- Academics
- Representative(s) of the accrediting body
- Professionals from the financial sector
- Professionals from the legal sector
- Other experts as may deemed necessary

The Board should meet, review and assess ESCO accreditation applications submitted by potential candidates. The Board may convene and make decisions virtually by means of video conferences or audio calls. Applications will be evaluated against the stipulated criteria of the accreditation program. It is recommended that the accreditation process be conducted at specific times during the year to allow the accreditation board to process applicants in groups, rather than continuously during the year.

4.3.1 Application Submission

When submitting an application for ESCO accreditation, the applicant will have to complete and submit a set of necessary documents and information, including at least the following:

- A completed application form.
- All the relevant information needed to prove that the company meets the requirements of the accreditation program.
- Payment of the application fee.

The completed application form and all accompanying documents should be sent, using a valid electronic signature, to the Board's designated e-mail address.

4.3.2 Issuing a Certificate

Upon successful accreditation, an Accreditation Certificate is issued. The accredited ESCO is then registered on a list of accredited companies posted on the accreditation body's website. The successful applicants will be expected to conduct their business in a professional and ethical manner according to the applicable national laws and regulations, otherwise accreditation may be withdrawn or suspended.

5. Using accreditation

Once an accreditation process has been established and a group of energy service companies has been accredited, it becomes important to determine how the accreditation is being used and represented by those involved in the accreditation program.

5.1 Energy Service Companies

ESCOs are the organizations that receive accreditation. The accrediting body may provide a certificate, logo and letter indicating the organization's accreditation status. Furthermore, the accrediting body may provide guidance in using the accreditation and how it should be represented. It is recommended that the following criteria be applied in using the accreditation designation:

- Accredited organizations may list their accreditation status on their official documentation, including their websites and printed materials.
- An accredited organization may not represent or imply any level of warranty or validation that is attributable to the accreditation body.
- An accredited organization agrees not to comment on the validity of or offer opinions about the accreditation

status of other organizations and must refer any issues that arise to the accrediting body.
- An accredited organization cannot extend its accreditation status to any other entity or any division within its own company that was not a part of the accreditation process.

5.2 ESCO market stakeholders

Any market stakeholders in government or private organizations may need to refer to an ESCO's accreditation status. The most common application of this use is through the creation of qualified or exclusive lists of organizations that provide energy services. Policy-makers should feel comfortable that the accreditation process was done with integrity, and without any conflict of interest. Policy-makers should review the information about accreditation to satisfy themselves that these requirements have been met.

5.2.1 Creation of Pre-selection Lists

It is recommended that a policy-maker refer to the accreditation in making selections for lists to reduce the field of organizations that are competing for certain projects. Using accreditation from an unbiased and uncompromised source assures the policy-maker that there is a high-integrity group of organizations offering to supply services to those using the list.

5.2.2 Using Accreditation in Specific Project Selection

In some cases, accreditation is included in the process to evaluate the organization that will eventually be selected to carry out a particular project. In most cases, one of two circumstances can arise: responses are exclusive to accredited organizations, or organizations are favored in the selection process for their accreditation status. In the former, the solicitation documents will state that only accredited organizations can apply, and they will also specify the allowable accreditation levels and accrediting bodies. In the case of the latter, the solicitation documents will state what weighting will be granted in the evaluation structure for accredited organizations.

5.3 Accrediting Bodies

Accrediting bodies are often trade associations or non-profit entities that operate on a membership basis. These bodies too must make proper use of the accreditation process. They need to be aware that they should avoid taking on project liability by making statements, either in print or verbally, indicating that accreditation status conveys any assurance or guarantee of an accredited organization's performance.

6. Examples: ESCO accreditation requirements in selected countries

This section provides more details of several country-based accreditation programs. While each program is unique and each provides certain attributes that may be desirable to an organization establishing an accreditation program, it is recommended that developers of accreditation programs select the criteria that are most appropriate for their own ESCO market.

6.1 China

To be considered an ESCO by the Energy Management Company Association (EMCA), the association of ESCOs in China, a company needs to demonstrate compliance with the following criteria:

Business/Financial Requirements
- Registered capital exceeding CNY 5 (approximately USD 750,000).
- At least one year of continuous operation.
- Accumulated investment in EPC projects of no less than CNY 1 (approximately USD 150,000).

Technical Requirements
- Implementation of at least one EPC project.
- Competent technical professionals and personnel to implement EPC projects.
- Business core covering energy audits, diagnosis, design, retrofit and operation.

6.2 Canada

Companies wishing to qualify under the Federal Buildings Initiative must meet the following criteria:

Business/Financial Requirements

ESCOs must possess the full financial capacity necessary for the provision of energy management services. Financial capacity must be demonstrated through recent financial performance, a high level of working capital, and/or proven access to multi-year sources of finance. To meet these criteria, ESCOs must present the following documents to the certification commission:

- Audited financial statements, or if these are not available, unaudited financial statements for the past three fiscal

years. If the ESCO has been in operation for less than three years, it must provide financial statements for the entire time period in question (including as a minimum: balance sheet; statement of retained earnings; income statement; and any notes to these statements).
- A signed certificate from the Chief Financial Officer (CFO) or an authorized signing officer of the company stipulating that the financial information provided is complete and accurate.
- A year-to-date financial statement for the current fiscal year with comparative in-house statements for the same period of the prior year.
- A parental guarantee signed by the parent company (if applicable and requested by the certification commission).
- Evidence of sufficient insurance coverage with respect to comprehensive general liability, errors and omissions.

Technical Requirements
- Have implemented at least two energy-improvement projects, with completion dates within the last five years, using the EPC model.
- Provide details that clearly demonstrate experience in project management and the commissioning of energy improvements.
- Provide details of past experience of energy audits, energy analyses and feasibility studies, energy monitoring, energy-system maintenance and repair, and the training of building managers and operators.
- Demonstrate that it employs personnel with at least five years' experience in managing the design and implementation of energy improvements.
- Provide the names and qualifications of key personnel, supported by detailed resumés outlining relevant project experience. ESCOs should also identify the employment status of each individual (e.g., partner; full-time employee; part-time employee; etc.).

6.3 **Dubai**

The UAE has established an ESCO certification process consisting of two levels that is valid for three years. Companies that wish to be certified need to demonstrate the following qualifications:

Business/Financial Requirements for Full Certification
- At least three years' operating experience.
- A minimum of six project references demonstrating a wide array of ECMs.
- Financial strength, based on an assessment of audited financial statements for last two years.
- A minimum of two years' operating experience in Dubai.

Technical Requirements for Full Certification
- Employment of at least two members of staff with engineering degrees, including one Certified Energy Procurement Professional (CEP) and one Certified Measurement and Verification Professional (CMVP).
- Energy audit equipment in place.

Business/Financial Requirements for Provisional Certification
- Financial strength based on positive net assets, at least 25% equity finance and forecast solvency during the provisional certification period.

Technical Requirements for Provisional Certification
- Employment of at least one staff member with an engineering degree or CEP.
- Energy audit equipment in place.

Evaluation of companies that wish to be certified is based on the submission and review of documents proving that the applicant meets high standards in the following areas:

- Performance records for: audits; energy measurement; verification protocols; installation; project management; post-implementation reports; energy savings achieved.
- Safety policies and records.
- A detailed company profile.
- An acceptable legal and organizational structure.
- Financial solvency, a reputable sponsor, and/or established parent company organization.
- Reference letters from three or more clients.

6.4 Singapore

Certification is open to any company established in Singapore that wishes to be certified in the provision of energy-auditing services and the implementation of EE and conservation projects for buildings and facilities. Certification varies according to the experience level of the ESCO and the systems expertise it possesses.

Certification criteria differ according to whether the company has been operating for less or more than three years. There are two levels of certification according to:

- The number of years of experience the company possesses.
- The capacity to complete a Level 3 energy audit.
- The capacity to complete implementation of an EE project.

Business/Financial Requirements for Full Certification

- Industrial and workplace occupational safety policies and records.
- An acceptable legal and organizational structure.
- A range of additional service capabilities, e.g. facilities management.
- Reference letters from three or more clients.

Technical Requirements for Full Certification

- Completion of a minimum of nine Level III audits and three implementation projects in the previous three years.
- At least one Qualified Energy Services Specialist under full-time employment.
- Calibrated measuring equipment and instrumentation to carry out audits.

Business/Financial Requirements for Provisional Certification

- Industrial and workplace occupational safety policies and records.
- An acceptable legal and organizational structure.
- A range of additional service capabilities, e.g. facilities management.
- Reference letters from three or more clients.

Technical Requirements for Provisional Certification

- At least one Qualified Energy Services Specialist under full-time employment.
- Calibrated measuring equipment and instrumentation to carry out audits.

6.5 India

In order to create a sense of credibility among prospective clients that are likely to want the services of an ESCO, as well as among financial institutions, the Indian Bureau of EE has undertaken a process of rating ESCOs in terms of their success in implementing EE projects based on performance contracting, the availability of technical manpower, financial strength, etc. The rating exercise was carried out by the Security and Exchange Board of India's accredited agencies, CRISIL and ICRA. These two agencies developed an accreditation methodology which involved an assessment of the business risk (track record and market position), organizational arrangements and financial capacity of the organization and accrediting the ESCOs on a five-point scale. The grading was designed to aid ESCOs in their ability to bid successfully for energy services projects and to arrange the finance for their implementation.

The parameters for assessment include a mixture of business/financial and technical capability criteria:

- Years in the ESCO/energy management business.
- Number and nature of energy audits carried out to date.
- Number of different industries served.
- Order-book strength as measured by ratio of current order book to previous years' turnover.
- Number of energy management projects completed.
- Certification and quality systems in place.
- Technology tie-ups.
- Patents held by the company.
- R&D facilities.
- Constitution, ownership structure and parentage.
- Management evaluation and quality of organizational structure, internal control and systems.
- Employee strength in terms of numbers, qualification and experience.
- Number of certified energy auditors employed by the company.
- Annual turnover of the ESCO/energy management business.
- Profit margins of the ESCO business.

Overall financial strength as reflected by the capital structure and debt servicing.

6.6 United States

ESCO's accreditation in the United States is managed by the National Association of Energy Service Companies (NAESCO). NAESCO maintains accreditation as an Energy Service Provider, an ESCO or an Energy Efficiency Contractor. To become accredited, an applicant must:

- Be a member of NAESCO
- Agree to NAESCO's ethical guidelines
- Receive a recommendation from the accreditation committee
- Be approved as accredited by the NAESCO Board of Directors

The accreditation committee receives a file of information from the applicant, which forms the basis of evaluation of the applicant. The submission for ESP and ESCO applicants is through an online database known as eProject Builder, run by the Lawrence Berkeley National Laboratory (LBNL). Project data submitted by applicants is held in confidence by LBNL and the accreditation committee. The submission must include:

A business description, including the name of the legal entity for which accreditation is being sought, plus:

- Resumés of reference project engineers and project managers.
- Financial-offer documentation – two reference projects.
- Measurement & Verification (M&V) narrative.
- M&V documentation – two reference projects.
- Commissioning/O&M documentation – two reference projects (including evidence of customer acceptance).
- Contracts executed for two reference projects.
- One full year of savings data for reference projects.
- At least ten reference projects.
- Audited financial statements.
- Signed NAESCO Ethical Guidelines document.
- Summary of legal action.
- Customer Reference Contact Form for reference projects.
- Submittal of all projects (list) in the last five years.
- Detailed company description.

7. Conclusion

In many countries, the role of ESCOs is not well known or understood, which in itself creates a barrier to their development. Furthermore, most countries do not have a legal or regulatory framework that addresses the use of EPCs or the operation of ESCOs in the private sector. Hence, any EPC contract established under an EPC scheme is usually governed by existing commercial laws.

Based on the experience of the authors, this lack of knowledge often leads to opinions being formed about the ESCO market and its companies that often give an inaccurate picture of the performance ability of ESCOs.

An accreditation process can be implemented in an ESCO market to assess and accredit all companies wishing to operate as ESCOs and implement EPCs. Accreditation provides recognition of the ESCO's competence regarding certain standards of performance. Furthermore, accreditation is based on a review of certain of the ESCO's activities but not all of them. In that sense, accreditation is quite different from certification guaranteeing the qualifications of an organization. Accreditation helps create a trusting environment that supports the development of an EPC market and that can also support the ESCO selection process, providing owners with the ability to make an informed selection.

The authors therefore believe that the introduction of an adequate accreditation process will have a beneficial impact on the ESCO market and will:

- Promote and expand ESCO business in local markets.
- Reduce transaction costs for both customers and ESCOs by identifying a limited pool of qualified providers.
- Build the necessary market confidence and make it easy for end-users (facility owners) to identify a competent ESCO partner.
- Create an industry environment that has integrity.
- Contribute to a country's economic development by creating more jobs in a stable ESCO business sector.

The accreditation process should not be viewed as an onerous obligation, but rather as a market development catalyst that will create a more mature, transparent and fairer EPC market environment.

Over the years, some countries have put together accreditation processes that have facilitated the development of ESCOs in their respective markets. Such processes are unique and adapted to their markets, as they provide certain attributes that can be considered desirable to an organization establishing an accreditation program.

Photo credit: NASA

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Motivating both supply and demand for energy services: the Chilean case

Abstract

Since its beginning in 2007 in the "Clean Energies" program of the Interamerican Development Bank and its formation as an association in 2012 till today, the National Energy Efficiency Association of Chile (ANESCO Chile A.G.) has been in the front of the promotion of Energy Efficiency and the ESCO model in Chile. ANESCO has been dealing with the barrier and myths against EE in the public and private sector. The growth of the companies that provide EE services, the disseminations of its benefits and visible achievements has been essential for the EE market in the private sector. In the case of State facilities, a public-private round table was needed to show that the adoption of ESCO model was compatible with the rules of the sector. All this effort has been accompanied with public policies, the inclusion of EE as a pillar in long term energy policy and the creation of the public-private Energy Efficiency Agency, now the Sustainable Energy Agency. At the end of 2020, Chile still doesn't have an EE legal framework, but EE is seen as essential for the fulfillment of the National Determined Contribution, the sustainable recovery after Covid-19 and the Carbon Neutrality in 2050. ANESCO believes that EE and ESCOs, with the support of a legal framework and the development of Green financing and banking, will play an essential role in these goals.

Introduction

How can energy efficiency (EE) and sustainable development become a reality in a country like Chile? With multiple barriers, it is clear that the road has not been easy and therefore that every tool or instrument created, as well as their promotion, must manage to provide several benefits if it is to be developed in the different production sectors.

In recent years, a fundamental milestone in Chile was the formation of a specialized association, ANESCO, and the incorporation of the Energy Services Company (ESCO) model into public auctions for state facilities and between private companies, not just as a financial tool, but also as a design, implementation and operational solution.

A summary of the history of its main processes and progress is presented below, along with an overview of the present and future challenges of energy efficiency in Chile.

The first impulse to the energy efficiency market in the country

In Chile, energy efficiency represents a complete innovation implying a new way of working. Some milestones marked the beginning. In 2007, a program called *Clean Energies* started, developed by the Interamerican Development Bank and Fundación Chile as the implementing body. This established the need to develop a supply of energy efficiency solutions and a way of financing their implementation.

The companies invited to take part in this program were different in nature, but in some respects they were similar, consisting of engineering and maintenance services from different production sectors. These companies were of different sizes, but mainly small (nine small and only one multinational).

While this was being prepared, the production sector, encouraged by a strong economy and great perspectives at the time, had simply not considered the option of engaging in energy efficiency. Their arguments were based on Chile's solid economic performance: a high GDP[1], a good copper price[2] and a competitive dollar value[3] at the time, but with a focus on producing more rather than better.

[1] Gross Domestic Product 2007, 126,646M.€.
[2] Ending the year 2007 with an average of USD 3.23.
[3] Value of almost $500.

However, innovation, technology and the environment were not priorities in the country. Environmental ambitions and compliance considerations were restricted to the legal requirements, and regulation imposed a ceiling on the industry's environmental performance.

It was only at the end of 2010 when this group of companies, already experienced in EE, began to distribute the benefits offered by focusing on improving the efficient use of energy. This was a time when energy bills were just paid. In many industries, cash was plentiful and if there were losses, they weren't "noticed". But the commercial efforts by the front-runners working with Fundación Chile were tireless and much was learned, including a variety of proposals incorporating a lot of feedback from different types of clients. Big and small, grouped or individually, they had gone through many of the same experiences of relations between developers of energy efficiency projects and consumers.

Some energy efficiency solutions had to be combined with auditing, investment or financing, safeguards, and demonstrations, among others. It had to be proved that energy efficiency worked, that the service provider was reliable, that the technology had been tested, that the promised savings would be real, and that it was worth dedicating time to this type of project rather than others within the same company. This last point was particularly difficult to compete with. Dedicating capital to non-core business was considered a deviation of attention. Therefore, as a minimum, clients wanted quick and high profit returns.

This is why ANESCO Chile A.G., formed as an association in 2012 with more than twenty member companies, began an action and demonstration process in those production sectors that had the highest levels of energy consumption and where energy costs were an important percentage of their total production costs. Seminars were held, a greater Business-to-Business commercial initiative was launched, performance contract models were developed and adapted to the local market, and promotion of the ESCO model, which had been developed over several decades in North America and Europe, began.

The problem was how to encourage clients to consider and adopt energy efficiency as a worthwhile investment. According to ANESCO Chile's members, who were the trend-setters in this experience, , the starting point was to identify the most attractive cost-efficient technologies, start-

ing with small projects that were easy to replicate. In this way, for example, a series of efficient lighting projects began in chains of stores, then scaling up and heading into the retail or mining sectors, while others were linked to boiler conversion and fuel changes or solar panel installation. Part of the support generated for this task was the creation of a standard registry of cases, their economic and environmental impacts being measured and their publications placed on the web and in catalogs.

Opening new paths: the development of opportunities in the public and private sector

In 2010, coinciding with plans to establish ANESCO, , the Ministry of Energy and the Energy Efficiency Agency (Agencia Chilena de Eficiciencia Energética, AChEE) were created. As a result, energy savings began to be a subject of public policy and attracted the attention of the media, exacerbated by an energy emergency caused by cuts in the gas supply from neighboring Argentina.

Another notable event was the successful launch of the first National Energy Policy (Energía 2050), of which energy efficiency was pillar no. 1. Although this looked like great news for the energy efficiency business, sadly it was not applied in practice and never achieved consistency with its number one position, being overtaken by other issues. It could only be promoted by ANESCO again once it became able to position itself strongly in front of the authorities following its recent update, almost ten years later. This process is currently in full development and has a large number of subscribers who acknowledge energy efficiency and its role in sustainable development.

But back in the days of formation, a second step was necessary. The Ministry of Energy had to be part of this work. This is why ANESCO promoted the creation of a public-private roundtable for the development of energy efficiency and the ESCO model in 2014. This roundtable managed to bring together other players that specifically promotes ESCOs internationally, like IDB, GIZ (part of the Ministry of Environment in Germany), and domestic production promotion agencies like Corfo (Chilean economic development agency), CER (Renewal Energies promotion Agency in Chile), Fundación Chile, among others. The roundtable would also promote success stories and it would facilitate the exchange of information among members as well as potential beneficiaries and decision-makers.

The roundtable proposed to test whether it was possible to develop energy efficiency and the ESCO model administratively and legally in Chile without altering or influencing the national budget. From the perspective of ANESCO, the government had to be the natural promoter and lead by example. But there was both the fear and the need to demystify the idea that using energy efficiency could affect the budgets of the government-affiliated services that would implement it negatively.

The way to put the concerns to rest was a full-scale demonstration. A working alliance with the CER resulted in a first public competition that awarded the incorporation of energy efficiency and NCRE (Non-Conventional Renewable Energy) under the ESCO concept in the industry, one of which projects still stands out to this day (see text box).

Synthesis of the Project "ESCO in Universidad Nacional Andrés Bello"

The 80 kWp photovoltaic solar project, implemented in Universidad Andrés Bello, was a milestone in the Chilean market. It was implemented in 2014 and was the largest project in the Metropolitan Region until 2016. It was conceived under the ESCO model with a specially designed contract to attend to the client's needs and shorten payback time to a period of no more than ten years.

Considered as one of the first ESCO photovoltaic solar system contracts, it allowed myths to be broken down and prepared the path to developing the technology in Chile, while still positioning the University as a benchmark in terms of sustainability.

The project's total investment was 50% co-financed by Corfo, the other 50% being provided by a private contribution from the company Punto Solar.
The solar system cost $80 million pesos. It generates emissions reductions of 57.5 tCO_2/year and provides 139.5 MWh/year of energy.

These contracts would be tremendously important in demonstrating the initial success of the ESCO model to the authorities, the business world and society more broadly. In 2015, an international seminar was held with the Ministry of Energy and the support of the Canadian Embassy showing how the country's energy service companies made ESCO contracts with private companies and the state.

After almost two years of investigation involving attorneys specialized in the public sector, the final report provided to the public-private roundtable revealed there was nothing to prevent these improvements being made, that flexibility of

Figure 1. **Budget breakdown in a public building (goods and services/maintenance and repair of buildings).**

CLASIFICADOR DE INGRESOS Y GASTOS

APRUÉBASE el siguiente Clasificador de Ingresos y Gastos, que para los efectos de presupuestaria e información mensual pertinente, deberán utilizar todos los organismos del se a que se refiere el decreto ley Nº 1.263, de 1975.

Subt.	Ítem	Asig.	BIENES Y SERVICIOS DE CONSUMO
22	05		Servicios Básicos
		001	Electricidad
		002	Agua
		003	Gas
		004	Correo
		005	Telefonía Fija
		006	Telefonía Celular
		007	Acceso a Internet
		008	Enlaces de Telecomunicaciones
		999	Otros
	06		Mantenimiento y Reparaciones
		001	Mantenimiento y Reparación de Edificaciones
		002	Mantenimiento y Reparación de Vehículos
		003	Mantenimiento y Reparación Mobiliarios y Otros
		004	Mantenimiento y Reparación de Máquinas y Equipos de Oficina

the schemes to contract goods, equipment and operation/maintenance was in place, and that it was possible to conclude an ESCO contract in state facilities. In order to provide transparency regarding the use of resources, the budget[4] lines these services belong to has been clarified for public services wishing to engage in ESCO activities (see Figure 1).

This positive conclusion was accompanied by a joint effort by the Ministry of Energy together with the roundtable to promote the ESCO model in all regions of the country. In 2016 the Minister of Energy, Máximo Pacheco, issued instructions that all public services should appoint an Energy Leader (Energy Manager) and then undertake training in order first of all to extract reliable information in a process to seek solutions. This was the most concrete starting point in the direction of generating public tenders in the main state buildings with the highest energy consumption and making significant use of fossil fuels, like coal or diesel.

The State spent USD 228M in 2016 just on electricity.

This opened two paths for both the private and public sectors, the common and primary goal being to reduce their energy costs. However, despite the need and the available solutions, the motivation to adopt the ESCO model quickly and on a widespread basis still seemed very limited.

Nevertheless, the efforts made during these years did lead to the tendering of more than thirty projects in public buildings and hospitals between 2010 and 2017 as part of the energy efficiency agency's so-called PEEP program, with more than 80% of them being developed by ANESCO's members. Among these project were high-complexity hospitals and public buildings belonging to the police force, the armed forces, and the National Statistics Institute, among others, all under the guaranteed savings modality.

The need for a legal framework

In the roundtable, conversations had been held since 2014 about the need for an energy efficiency law that would compel improvements to energy efficiency to be made on an industrial scale. The overall goal of these conversations was to uncouple energy consumption from GDP growth. At this time, the experience was that there were few projects and that these would obviously be voluntary as long as there

[4] https://anesco.cl/casos/. http://transparencia.munistgo.cl/web2/file/tei/PORTAL/PRESUPUESTO/PPTO%20VIGENTE/2016/PPV%20JUNIO%20IMS.pdf

were no regulation in place. The large companies and mines lobbied for no goal to be established or enforced, nor any regulation to be adopted that would allow a third party, like an ESCO, to have access to their facilities and interfere with them. The lobbying was successful in that the draft bills that were developed would restrict their focus of action to the regulated energy industry, while more generally promoting projects and conditioning the development of a freer and more innovative market.

Regardless of the limitation of scope, however, in these legal trials a false antagonism flourished between promoting development and protecting the environment, which influenced the larger consumers. As a result, the negotiations led to proposals that were ever less demanding and that finally they ended up failing.

Quantifiable visible achievements and crises as opportunities

By 2017, after ANESCO kept insisting on its mission to promote ESCOs and document its cases, there were signs of progress: more members, more sales, more success stories to show. The ESCOs' sales had already shown remarkable growth from 2014: USD 8 million, 2015: USD 12 million, to 2016: USD 60 million, and in 2017 they jumped to close to USD 150 million, bringing the accumulated market value up to a quarter of a billion USD[5]. Also, some ESCO projects were increasingly being recognized, for example, Energy Tracking, a founding member of ANESCO, received the main recognition in Chile for its innovations in a successful case of EE, the Avonni Prize for Innovation in Energy.

Also in 2017,with a grant of funding from the Public Goods Fund, ANESCO undertook a study of the national energy efficiency market to take stock of its still embryonic situation. Apart from documenting the prominent position of ANESCO's members in the market (between 2014 and 2017, more than 90% of the contracts under the ESCO model were concluded by ANESCO members), all projects had been developed using one of four different modalities: energy sales, shared savings, fast out (all the savings go to the ESCO, but for a shorter time) and guaranteed savings, and among these mainly the two latter ones. Another observation was that projects had mainly been implemented by small and medium-sized companies.

That same year, ANESCO accompanied the Ministry of Environment in launching a dedicated initiative to 'decontaminate' the central-southern part of the country, which has the lowest temperatures and uses wood-based heating. A tour of the main cities in the region was initiated to demonstrate energy efficiency solutions and the ESCO model, including changing fossil fuels to other less contaminating and more sustainable fuels and thus contributing to emissions reductions from fuel switching and energy efficiency at the same time - not to mention the reductions of local air pollution thus improving living conditions in these areas.

On the project side, a number of ESCO EE contracts with public-sector partners were closed , including high-complexity hospitals, where an integrated project particularly highlighted the environmental benefits linked to energy efficiency through the combination of a fuel switch from coal to gas, boiler changes, and efficient lighting, among others. Co-benefits included better working conditions and improved air quality. The project was implemented at Valdivia's public hospital, which until 2017 was considered to be operating the most polluting chimney in the entire XIV Region in the south of Chile, one of the most polluted urban areas in the country.

Despite all these positive developments, in 2017, another study of energy efficiency in national industry, carried out by the University of Chile, evidenced the general apathy of the industry when presented with the ESCO model as a possible solution to climate action. Only 25% of the industry throughout the country, from Arica in the north to Punta Arenas in the south, had made investments in energy efficiency. The journey had only just begun.

In 2018 and 2019, the economy began to slow down, and companies that had been seeking solutions were suddenly also seeking zero-cost implementation or third-party investments. In that way, many of the inquiries that reached either ANESCO or the Energy Sustainability Agency (the former AChEE) concerned the ESCO model. Coinciding with this shift in attention and interest, the environmental and climate change aspects of energy efficiency gained relevance in light of COP25, the role that Chile would play in its organization and the potential to showcase the country before a world audience.

[5] Energy efficiency market study made as part of the Corfo Public Goods project, including ANESCO Chile members and nine additional efficient equipment sales companies (not members).

Thus, presentation of the benefits of energy efficiency and ESCO resurged, but now not only with a focus on saving money and energy, but also presenting it as a concrete tool for climate action, a key to the transition to a low-carbon economy.

ANESCO played a key role in presenting these advantages and the actions of all the energy efficiency projects linked to the ESCO model. A special web page was created to present the step-by-step methodology for the implementation of an energy efficiency project using the ESCO model. Regional capitals and the public and private sectors were called upon to help demonstrate the benefits of the ESCO activities they had been involved in.

This turn of events meant that ANESCO became strongly involved in climate change discussions, the evaluation of Chile's nationally Determined Contributions (NDCs), the energy transition, and decarbonization and carbon neutrality plans, giving it an active role as well in the preparation of COP25 up to and including representation, at international meetings and exhibitions at the COP, which was ultimately moved to Madrid.

At the end of 2019, due to a new crisis, this time social, the companies became unsettled and postponed many decisions relating to the implementation of EE. To counter the negative effects of this situation on the energy efficiency market; ANESCO approached the Ministry of Energy, Corfo, Banco Estado and the Sustainability Agency to start an energy efficiency stimulus program and accordingly cooperate so that the production sectors could manage to recover productivity, but now with a vision towards sustainability. ANESCO's approach led to the launch of several reactivation or co-financing programs with a focus on renewable energy and energy efficiency. Unfortunately, they ultimately ended up focusing on individuals or small companies doing simple installations of photovoltaic panels, but without improving the systems into which equipment was being installed. Hence, ultimately, it was not necessarily the ESCO companies that benefitted from these programs.

Experience 2020, COVID-19 and other elements

Updated NDC: an opportunity

In April 2020, the Ministry of Environment presented an update to Chile's NDCs, which was presented as a new opportunity. Chile adopted a national emissions budget covering the period 2020-30. The mitigation commitment was measured in absolute values, without the forestry sector. Four central criteria were introduced:

- Absolute emissions: reaching 95 $MTCO_2eq$ by 2030
- Carbon budget 2020 to 2030: 1,100 $MtCO_2eq$
- Peak emissions: 2025
- Reduction: at least 25% of the total black carbon emissions by 2030, base 2016

In addition, the Ministry proposed the introduction of a circular economy with initially three milestones:

- In 2020, a National Organic Waste Strategy
- In 2020, a Circular Economy Roadmap (2020 to 2040)
- In 2022, generating and implementing circularity indicators and metrics to monitor the country's progress.

These elements of Chile's NDCs are not just an opportunity to establish more energy efficiency projects through ESCOs: their implementation will also require cross-sectional support.

Alongside this, following a parliamentary motion in 2018, a bill has progressed from the Presidency that looks to instill an energy efficiency culture in the country with six initiatives: institutionalizing energy efficiency in the framework of the inter-ministerial council for sustainability; installing Energy Management Systems in companies that consume more than 100 Tera calories per year; certification of new housing; promoting energy management systems in the public service; incentives to import electric vehicles; and facilitating the installation of chargers.

ANESCO took part in these initiatives by providing suggestions for improving the law and making presentations to Congress on more than one occasion, achieving, among other things, widening the spectrum of companies allowed to install an Energy Management System (EMS).

The goal of this bill is summarized as promoting the rational and efficient use of energy resources through the creation of economic and regulatory instruments to speed up cultural change. The expected impacts are 5.5% less energy consumption by 2030 and 7% by 2035, saving 2.4 and 3.5 billion dollars, respectively. With this, the energy efficiency market should be on track to reach around 300 million dollars in the short term.

However, these figures were those projected by ANESCO several years earlier, provided Chile made just 5% of energy efficiency savings in production sectors. Added to this, and following the logic that every company that starts out on the road to EE continues along it, making continuous improvements, this alone should double the market. Moreover, in spite of it already being at its third constitutional stage, the energy efficiency bill has not yet been passed due to reasons related to COVID-19. Before that, it was not being passed for reasons related to the economic and social unrest that the country was experiencing at the end of 2019, it being left on the table and therefore effectively postponed. In this process, it must be remembered that the discussion of energy efficiency and the cost to the government of promotional programs continues to weigh on the political desire for a swift implementation.

The lack of implementation perseveres despite ANESCO's widely disseminated claims and numerous support letters from scientists, academics and politicians documenting the economic value of the energy efficiency law in itself. This value comes from the generation of economic activity and thus directly underpins the production drive that is required in these circumstances, as well as protecting jobs.

Green financing and banking

As an association, ANESCO believes that the limited development of energy efficiency and the ESCO model, as well as the lack of knowledge of these in the market, is related to the limited support from the banking sector either in investing in energy efficiency or in financing ESCO businesses. ESCOs in Chile only manage to offer a comprehensive solution by using their own funds or through traditional consumer credits, similar to a mortgage: without preferential interest rates or being backed by a contract, they face a lot of requirements where they must use their private assets or even those of their partners or spouses as collateral.

The UN has been promoting green financing, with some local results. It is trying to open up a path and instill confidence in energy efficiency and ESCO concepts both for the banking association and for the councils of ministries for sustainability. It has carried out many webinars to increase awareness and promote responsible banking principles aligned to the SDGs and the Paris Agreement. International banks are trying to reduce their commitments from their head office and transfer responsibility to their national branches, which may support projects like, for example, Banco Santander's support of projects related to the circular economy or recycling.

Banco Estado has opened a small door to energy efficiency in the financial sector, developing "green" products, but again with a focus on SMEs and natural persons, which, according to the above, have apparently been the government's preference in the past. This has not been without its problems, as there are no internal experts to assess projects, and they must be approved by an external third party. On the other hand, until now the traditional banking logic has not managed to incorporate the ESCO win-win logic, for which reason Chile's ESCO companies are not being accepted under Banco Estado's program.

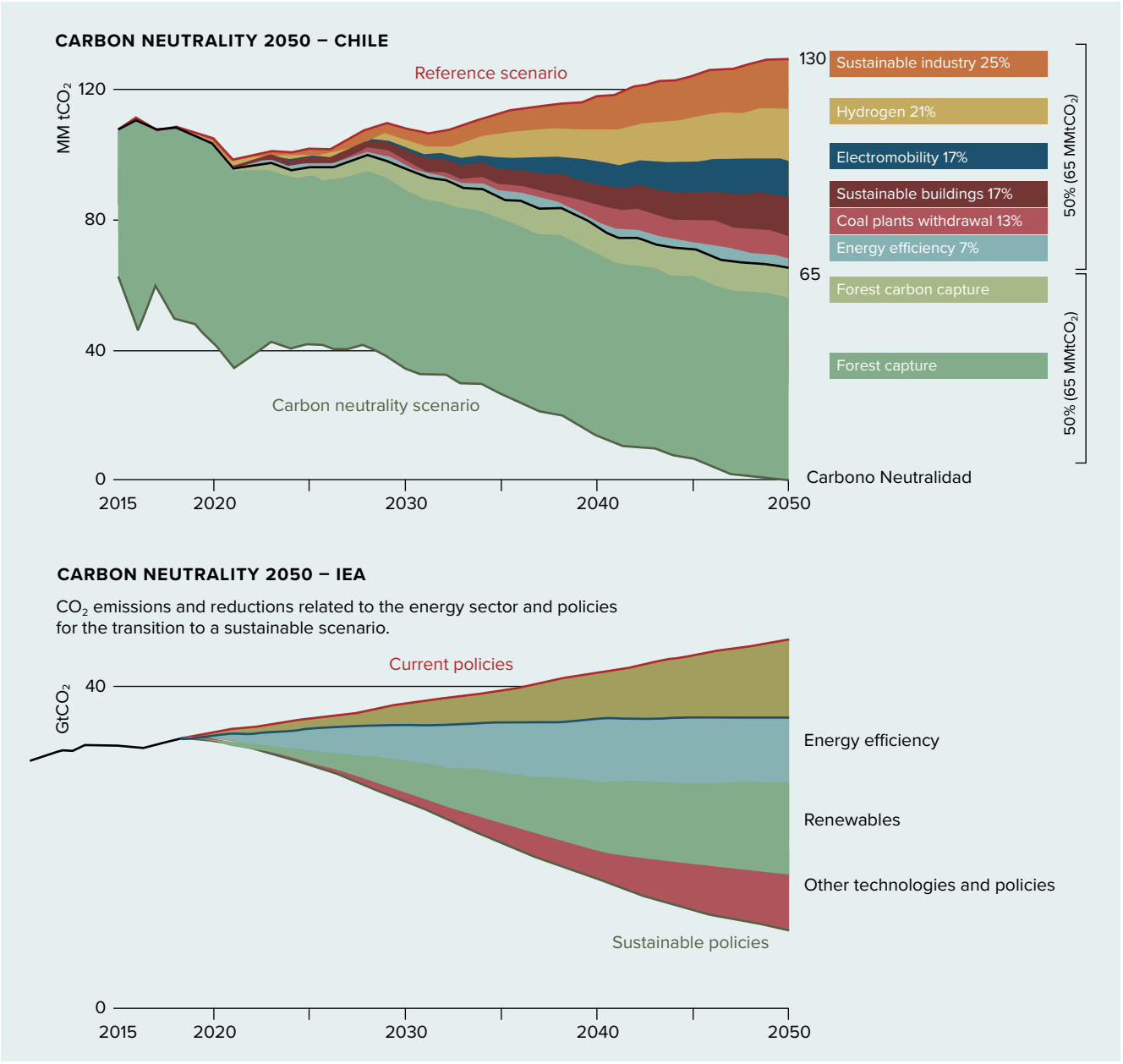
"Bank ethics" have also appeared, but likewise with limited funds and only for minor projects that do not incorporate the ESCO logic.

Facing these obstacles, ANESCO is working on the creation of a platform that will guide banking regarding the ESCO model and will provide banks with information about projects and benchmarks. ANESCO is also involved in conversations about Green and White Certificates, in the context of a new public-private roundtable that began a couple of years ago with the Ministry of Energy, the Ministry of Foreign Affairs, and associations from the energy sector and other entities. These certificates will provide the owner, investors or any other stakeholder with clear information about the project´s contributions to renewable energies (Green Certificates) and/or Energy Efficiency (White Certificates). The roundtable is also engaged in discussions related to the use of Article 6 of the Paris Agreement, and generally to devising financial instruments that stimulate emissions reductions.

Current actions and new challenges

Facing the constant changes in political priorities, DIPRES (the Budget Directorate) does not seem to be prepared to acknowledge the ESCO model easily. Today, it is erecting some additional barriers to it and it expects to approve each project in each public service. It does not operate with a standard contract, so time and money are lost in contract studies. The same happens with local councils. ANESCO now sees itself as focused on recovering existing achievements and progress and on reestablishing this line of work. Its objective is to create a real system that allows public services to have a quick and secure standard, and that facilitates tender processes for energy efficiency and the ESCO model.

Figure 2. Comparison of Ministry of Energy of Chile v/s IEA (2019)



Regarding information campaigns and economic reactivation, without enough support from the Energy Ministry to drive EE, and competing with other issues on the agenda that have been given a greater priority, as hydrogen has recently done, ANESCO Chile has had to double its efforts. It has held webinars focused on each production sector showcasing projects and their impact, as well as demanding rapid approval of the energy efficiency bill that is still stuck in Congress.

In early October 2020, through the persistence of ANESCO and suggestions for highlighting energy efficiency and the ESCO model, the Ministry of Energy held a joint seminar with IEA in which, for the first time after nearly ten years, the national responsible authority publicly acknowledged EE, with all its potential, relevance and its role in carbon neutrality, comparing the 7% the Ministry assigned to the emissions reduction potential to the figure of more than 40% that the IEA had set out.

Although Chile is in a dramatic situation regarding contamination (7 out of 10 Chileans live below the contamination standards, especially in respect of particulate matter), one that is almost entirely caused by its own energy use, decontamination plans continue to be based on restricting operations and changing energy. However, we believe that the involvement of the Ministry of Environment, which is in charge of decontamination plans, in the fight against climate change and the preparation of the NDCs has been helpful in changing the Ministries' attitude to the potential of energy efficiency.

ANESCO maintains a significant presence in the different roundtable discussions related to citizen participation, climate change, evaluation of the National Energy Policy, and other laws like electricity distribution, which are slowly but surely permeating more and more of the more hardline sectors. ANESCO, through its persistent work, has become part of the system, but one that actively promotes a culture of better energy use and information for the user and prosumer. However, without enough political collaboration, the energy efficiency and the ESCO market will not prosper. Some shortfalls only require willingness and the alignment of criteria to clear the way for energy efficiency and ESCOs, including greater competition and transparency.

Chile needs to make progress with EE. The extreme positions of the past against the energy efficiency bill have only caused a loss of time and created false antagonisms between sustainability and development. Energy efficiency meets both goals, and ESCOs are well placed to ensure implementation. The companies that consume the most energy could make the most EE, which is why today's discussions and the political focus on the small scale must be dismissed as a senseless paradox if the energy efficiency potential is to be exploited at scale.

Lessons learnt

In respect of energy efficiency services, to match supply and demand involves a constant struggle to convince the demand side, to sensitize the finance sector to the needs of the supply side, and to promote and help understanding by the government, which is traditionally under pressure from interest groups that promote the status quo. The ESCO model takes the relationship in respect of energy consumption outside the known and comfort zone of most stakeholders. The goalposts have to be moved gradually and simultaneously. Barriers keep rising, competition from other 'hot' agenda items is unpredictable, and there is a constant risk of backsliding.

ANESCO has learnt all this the hard way, but it has also managed to establish itself as a serious counterpart to all the stakeholders involved. This is an objective in itself that is able to influence conditions in the sector and ultimately to ensure that energy efficiency and ESCOs play their own important roles in the national efforts to reduce GHG emissions, thus ensuring everyone both a non-polluted environment and economic growth.

Photo credit: Colourbox

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Keys to US ESCO Growth: Government Mandates and Risk Management

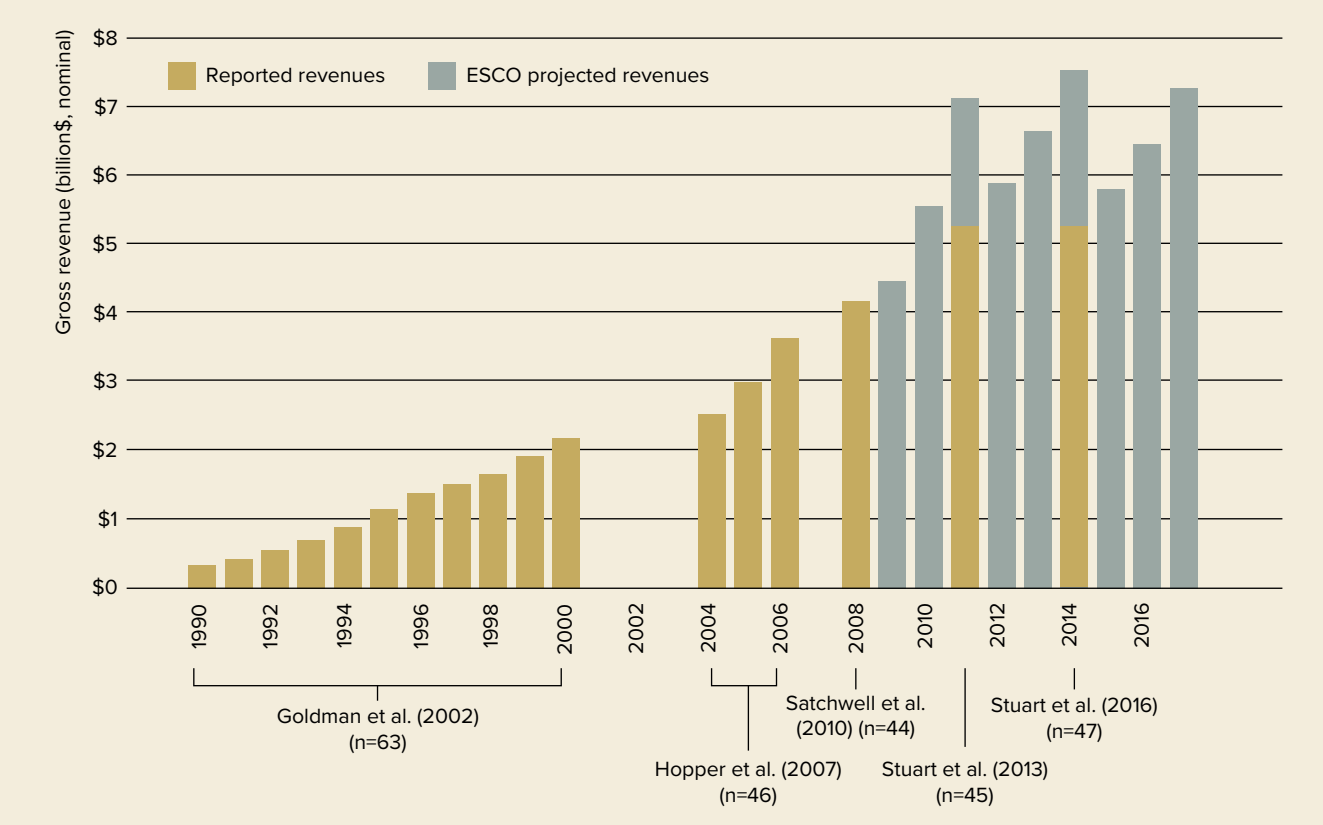
Abstract

The ESCO Industry in the United States has grown from its original existence into a large market. Studies conducted with the Lawrence Berkeley National Laboratory have shown year upon year of growth, resulting in a market size in 2017 of about $7 Billion US Dollars. During this growth, ESCOs have grown in all market segments, but in the United States, predominantly serve the public building market such that in 2014, roughly 92% of all work was with public buildings. As the market has grown, the project sizes have grown as well, with projects for the Federal Government averaging $0.8 Million in the 1990's to $5.5 Million in the latest studies. Growth is not the only way that the ESCO industry has changed since its beginning, as projects have become more diverse. While lighting measures are nearly always included, projects now include retrofits to every building system, and have extended to water conservation and non-energy benefits as well. Certain markets, such as the elementary through high-school public buildings, non-energy benefits have grown to be a large portion of the market, often driven by high levels of deferred maintenance.

These changes in the ESCO market in the United States occurred over time, and gradually as ESCOs adopted to various market drivers. Two drivers in particular have dominated the ESCO market: Government mandates and deferred maintenance. Government mandates have arising due to a desire to reduce greenhouse gas emissions related to energy use. When these mandates are issued, often with no money attached for achievement, ESCOs have used savings to fund the implementation to achieve these mandates. Furthermore, as budgets tighten, governments have reduced funding which often reduces the ongoing maintenance and repair budgets in a large amount, creating a pathway for ESCOs to use savings to fund the replacement of old, poorly operating and high inefficient equipment. These market drivers have helped public buildings become a lucrative market in which ESCOs can thrive.

Finally, ESCOs have shown the ability to adapt to market changes. The ESCO market in the United States was born through lighting retrofits. However, as competition arose in lighting, ESCOs learned to adapt and bundle their projects with more diverse energy measures. These changes in the market help from the ESCO industry into one that provides a comprehensive project fulfillment that involves targeted marketing and sales management combined with expertise in project development and delivery. Through being adaptable to market conditions, ESCOs will continue to thrive in the energy services marketplace, and likely continue to expand its ability to provide energy-related solutions for its clients.

Figure 1. US ESCO industry revenues (nominal $): 1990-2017*



*Recent Market Trends, op. cit.

1. Introduction

This chapter provides an overview of the US ESCO industry: its history and growth, market segments served, retrofit measures implemented, project economics, and lessons learned from three decades of experience. The data presented in this chapter is drawn from reports published by the Lawrence Berkeley National Laboratory (LBNL), which has had a long-term partnership with the North American ESCO association (NAESCO) to gather project data from US ESCOs. Data on individual projects (about 6,300 as of 2018) have been submitted by ESCOs pursuant to their applications for NAESCO accreditation and are housed in two LBNL databases. Data on ESCO market trends has been submitted by ESCOs in response to periodic surveys conducted by LBNL. The data-collection reporting has been supported by the US Department of Energy through a series of contracts with LBNL and subcontracts with NAESCO over the past twenty years.

2. Overview of the US ESCO Industry[1]

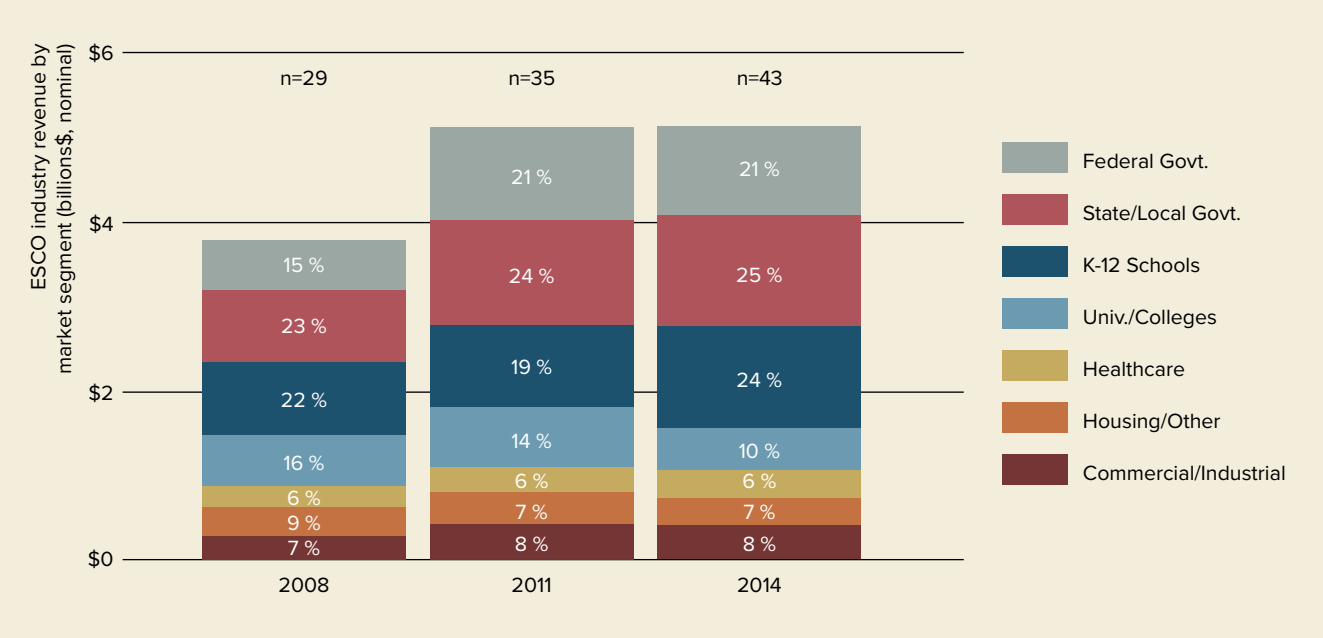
The US ESCO industry has grown steadily over the past three decades to reach an annual revenue of about $7 billion in 2017, as shown in figure 1.

Market segments served

The US ESCO industry primarily serves the public sector (see Figure 2), that is, federal, state and local government agencies, as well as institutional markets. Less than 10% of US ESCO revenues are derived from private commercial and industrial customers. The segment labeled "Housing/Other" mostly consists of multi-million-dollar projects for municipal public-housing authorities.

[1] Much of the data in this section has been extracted from a 2016 LBNL U.S. Energy Service Company (ESCO) Industry: Recent Market Trends report (See: https://emp.lbl.gov/publications/us-energy-service-company-esco#:~:text=Based%20on%20ESCOs'%203%2Dyear,13%25%20between%202015%20and%202017). This is being updated with new data collected during the past year. A new report will be published early in 2021.

Figure 2. **ESCO industry revenue share and absolute revenue by market segment***



*Recent Market Trends, op. cit.

Table 1. **Median project investments by market segment and vintage ($2016 Million)***

Market segment	1990 to 1997	1998 to 2003	2004 to 2007	2008 to 2011	2012 to 2017	Growth between first and last vintage (%)
Federal government	$0.8	$2.9	$3.3	$5.3	$5.5	588%
Healthcare	$0.5	$1.2	$2.5	$2.7	$3.0	500%
K-12 Schools	$1.6	$1.4	$2.0	$2.1	$4.9	206%
Private	$0.4	$0.6	$1.8	$1.0	$2.9	625%
State/Local government	$0.6	$1.5	$2.1	$2.0	$6.2	933%
University/Colleges	$2.5	$1.7	$2.6	$3.4	$7.3	192%

* State of the US ESCO Industry, Market Characteristics and Project Performance: 1990-2017, P. Larsen et. al., Lawrence Berkeley National Laboratory, 2019.

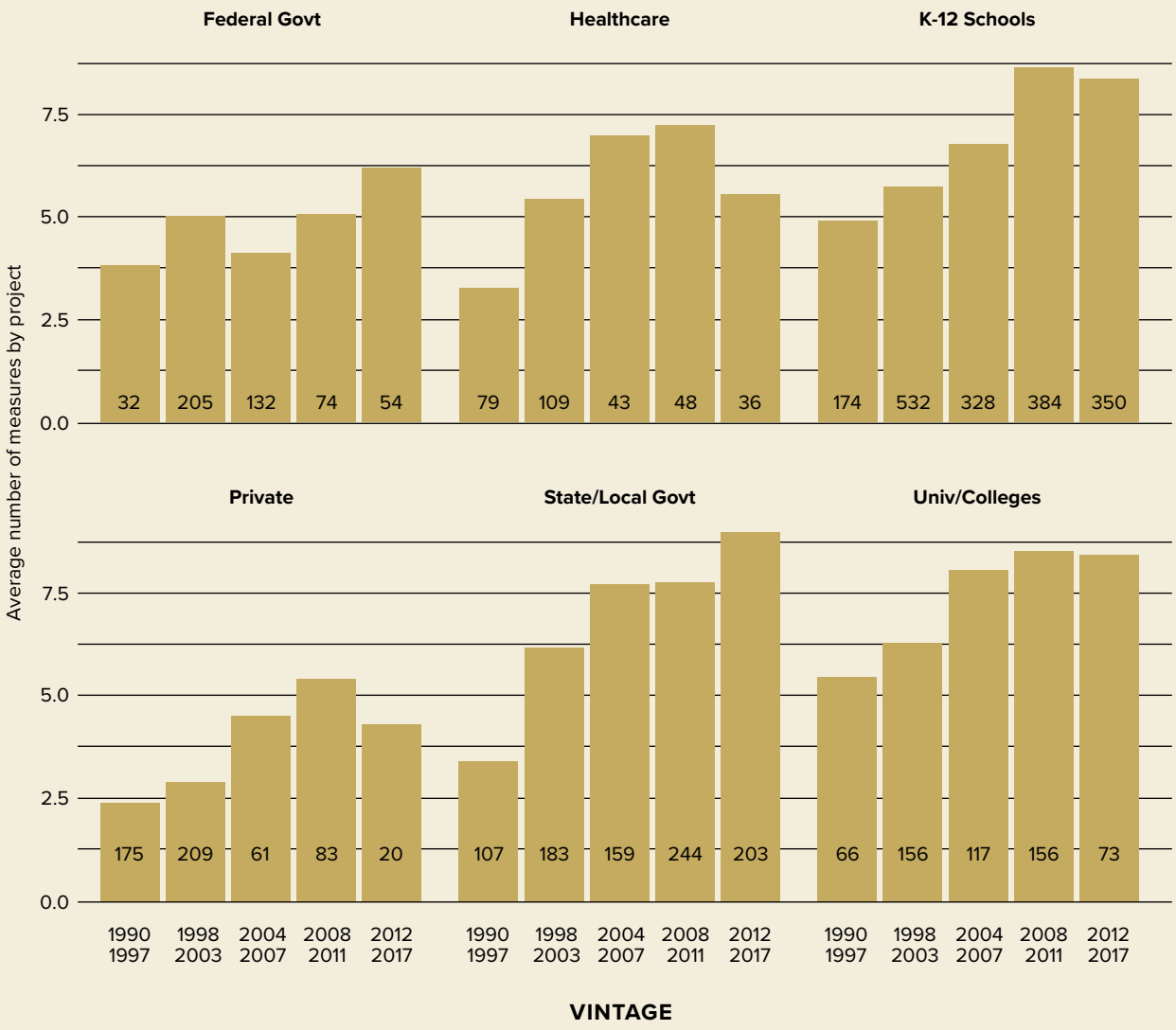
Average project sizes by market segment

US ESCOs implement large projects, project sizes continuing to grow in all market segments, as shown in Table 1 below.

Measures installed in ESCO projects

US ESCO projects have always included multiple measures, and the average number of measures in each project has increased in each project vintage. Figure 3.

Figure 3. Changes in number of measures per project, 1990-2017*



*State of the US ESCO Industry, op. cit.

Table 2. Dominant Retrofit Strategies*

LBNL dominant retrofit strategy (DRS)	Criteria	Example of ECM and/or NEM included in this category
Lighting-only	Projects include only this type of measure.	Technologies installed include only various lighting efficiency measures and controls.
Minor HVAC	Normalized project investment of $5/ft2 or less.	Technologies installed include only less capital-intensive HVAC measures and controls (and exclude major HVAC equipment) and may include lighting and other measures.
Major HVAC	Normalized project investment of $5/ft2 or more.	Technologies installed include major HVAC equipment replacements (e.g., boilers, chillers, cooling towers, HVAC distribution system improvements) and may include other HVAC control, high-efficiency lighting, and motors measures.
Onsite generation	Projects include onsite generation technology.	Technologies include installation of onsite generation equipment and may include other energy-efficiency measures (e.g., lighting, HVAC equipment and controls, motor efficiency measures). Onsite generation includes diesel backup generators, distributed PV systems, and biomass gasifiers, among others.
Motors and drives	Normalized project investment of 5 $/ft2 or less.	Technologies installed include industrial process equipment not directly related to HVAC, such as variable speed drives, pumps and priming systems, and electric motors.
Water conservation	Majority of dollar savings are from water savings.	Technologies installed include an array of water conservation measures that include low-flow showers, faucets (taps), urinals, and toilets, as well as meters and leak detection equipment.
Non-energy	Normalized project investment of $7/ft2 or more. Majority of dollar savings are non-energy savings.	Technologies installed include roof or ceiling replacement and asbestos abatement (i.e., measures that are not installed primarily for their energy savings, but may have other types of savings), and projects may include other efficiency measures (e.g., lighting or HVAC upgrades).
Other	Projects include only these types of measures.	Technologies installed include installation of energy-efficient equipment such as vending machines, laundry or office equipment, high-efficiency refrigeration, staff training, and utility tariff negotiation. These individual measures may also be included in other retrofit strategies (except lighting-only); projects categorized as "Other" retrofit strategy only installed these types of measures.

* State of the US ESCO Industry, op. cit.

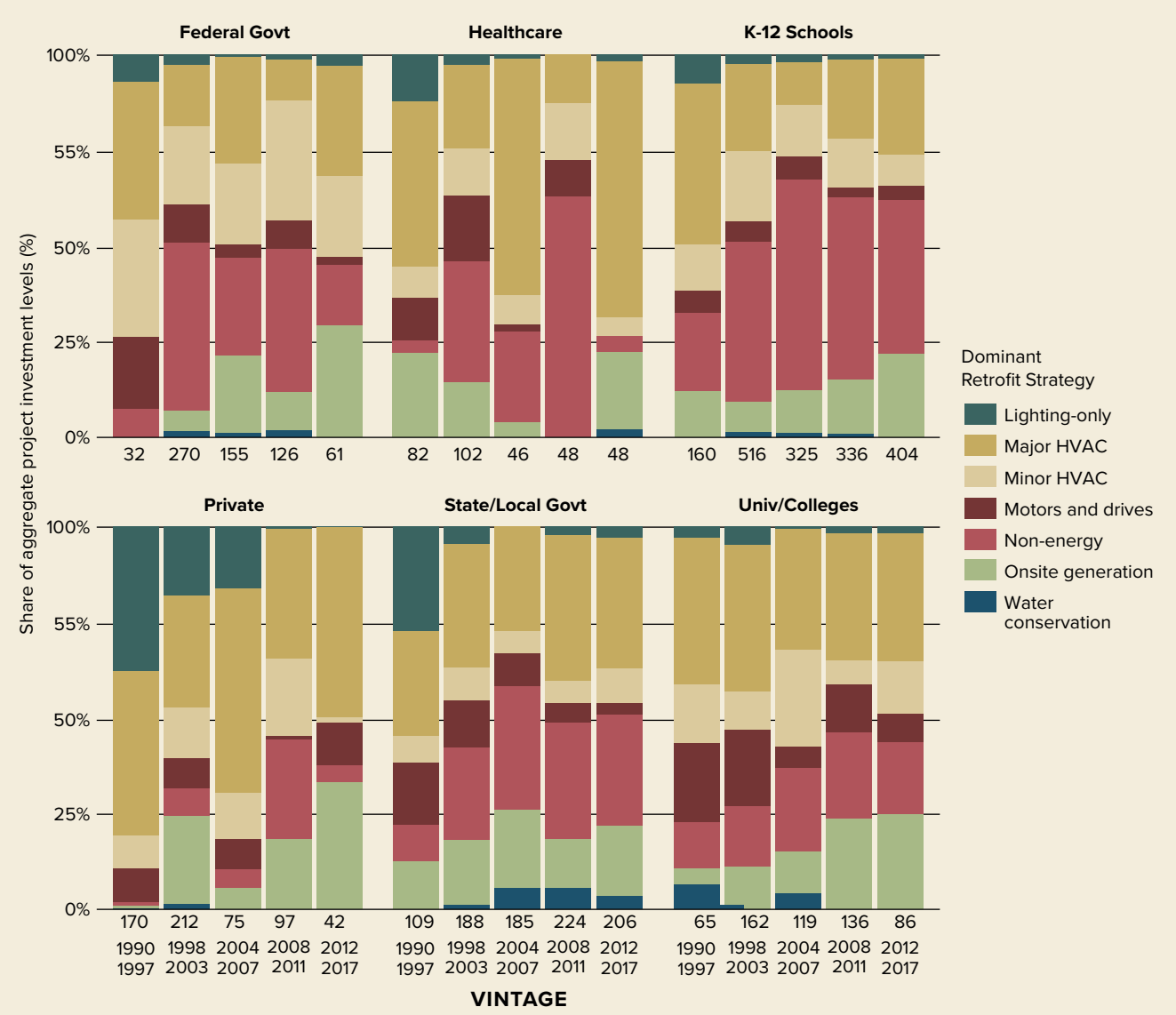
Dominant Retrofit Strategy classification system used by LBNL

The LBNL databases include about 120 measures that have been installed in ESCO Projects, so LBNL has developed a system that classifies ESCO projects in terms of what it calls the Dominant Retrofit Strategy (DRS), as described in Table 2.

Changes in Dominant Retrofit Strategies, 1990-2017

As shown in Figure 4, only the earliest vintage (1990-97) has a substantial number of single-component (i.e. lighting) projects. The long-term trend is for ESCO projects to focus on a more complex mix of measures, as shown in figure 4.

Figure 4. Changes to Dominant Retrofit Strategies, 1990-2017*



* State of the US ESCO Industry, op. cit.

3. Do Components or Systems Drive US ESCO Projects?

Projects are comprehensive, some including more than 120 different measures, according to the Lawrence Berkeley database of more than 6,300 projects: energy efficiency, customer-sited renewable energy, demand response, and resilience (cybersecurity and microgrids). Almost all of the customers for US ESCO projects are government agencies, ranging from the largest military bases and state university campuses to small rural school districts. Average project size varies by market segment but is quite large in comparison to projects in other countries. Most projects are based on performance contracts, which means that ESCOs guarantee that the cost of the project will be paid from savings over periods of from ten to 25 years. This is relatively long by international standards, but necessary to achieve the energy savings mandates and facility modernization needs described below. Financing comes from a very competitive private market place, which includes everything from local banks to major institutions like insurance companies and pension funds.

3.1 Market Drivers

There are probably two main drivers in the US market: 1) government mandates, and 2) the desperate need for capital to address an estimated $1 trillion in deferred maintenance and equipment-replacement needs in public facilities.

3.1.1 Government Energy Savings and GHG Reduction Mandates

The federal government and most state governments have enacted legislative and administrative energy-savings mandates, which are often accompanied by aggressive, aspirational targets for greenhouse gas reductions[2] and require significant improvements in energy efficiency. The mandates, however, usually have no funding attached. Rather, the federal government and a number of states have taken a variety of administrative actions to promote performance contracting, such as the following:

- Competitive solicitations to create lists of ESCOs that are qualified to compete for public agency projects, and conducting educational programs to promote performance contracting with state and local government agencies.
- Development and promulgation of standardized project development and implementation processes, such as the US DOE Energy Savings Performance Contracting Toolkit.[3]
- Requirements that public agencies either implement all cost-effective projects using performance contracts (Colorado) or demonstrate to state budget officials that capital projects for which they have requested funding could not be done with performance contracts (Kansas and Pennsylvania).
- The federal government, under the Obama Administration, mandated federal agencies to complete $4 billion of performance contracting projects from 2011 to 2016.

3.1.2 Deferred Maintenance and Capital Improvement Deficiencies

At the same time, many public facilities in the US have been starved of maintenance and capital improvement funds for decades, and the meager appropriations that are made are eliminated by periodic recessions and other government fiscal crises. School facilities today need tens of billions, maybe hundreds of billions, of dollars' worth of capital improvements. For example, an analysis by the Illinois State Board of Education estimates that Illinois public schools have accrued about $7.65 billion in accumulated deferred maintenance.[4] Since this analysis was carried out, i.e. before the COVID crisis, more capital improvements will be needed to provide the increased ventilation required to make schools safe for students, faculty and staff. Another example is a recent report from the federal Government Accounting Office (GAO) that says that a majority of public schools need substantial improvements to their HVAC systems.[5] However, most school systems have no obvious way of finding the capital appropriations they need.

Performance contracting offers a lifeline to government facility and financial managers because it simply re-purposes money that the facility is currently spending on wasted energy and the maintenance of decrepit equipment into a payment stream for energy-saving replacement equipment.

3.2 Component Technologies Build the Market in Waves

The beneficial effect of new component technologies in the US ESCO market seems to have come in waves. Each successive wave of technology builds, crests and breaks, as single-technology, low-overhead vendors effectively compete with ESCOs. But the ESCO market keeps growing rather than fading, because ESCOs have learned that their competitive advantage lies in building their business skills, as well as their ability to understand and integrate the best features of their competition to deliver what their customers want. Here are some examples.

3.2.1 Lighting

A major technology in the first wave of the US ESCO market was the replacement of T-12 fluorescent lamps and magnetic ballasts (many of which contained PCBs) with electronic ballasts and T-8 bulbs. This retrofit cut lighting energy use by half, delivered better quality lighting, and produced cash flow from short paybacks that amortized the longer payback measures. In the mid-1980s, ESCOs were virtually the only companies that knew about the technology, which seemed like wizardry to customer facility managers. But ESCOs had to buy equipment directly from manufacturers and stock it in their own warehouses because electrical distributors would not do so. Moreover, ESCOs financed projects from

[2] https://www.c2es.org/content/state-climate-policy/
[3] https://betterbuildingssolutioncenter.energy.gov/energy-savings-performance-contracting-espc-toolkit
[4] *Passing The Buck: An Assessment Of Capital Funding Needs In Illinois*, Craighead, Illinois Economic Policy Institute, 2018.
[5] *K-12 EDUCATION School Districts Frequently Identified Multiple Building Systems Needing Updates or Replacement*, US Government Accountability Office, GAO-20-494, 2020.

their own funds, with effective interest rates of near 20%, again because no one else would do it. The US ESCO industry was hence small but very profitable. That could not last. ESCO profits attracted competitors like a honeypot attracts bees.

By the early 1990s, the lighting wave had broken. First distributors, then big box stores began to stock electronic ballasts and T-8 lamps. Electrical contractors learned how to install them. ESCOs, especially the business units of large companies like Honeywell or Johnson Controls, found it harder to compete for single-technology projects. Banks and other financiers offered much cheaper financing, so that profit centers also shriveled up.

But the tide kept rising because ESCOs learned to integrate the strengths of their competitors into their projects. ESCOs found that they could grow their businesses faster without expanding their staffs and overheads by partnering with lighting contractors as subcontractors and exploiting their superior auditing, materials-ordering and job site-management skills. ESCOs also recognized that the low interest rates offered by the competitive financing market enabled them to offer larger projects to their customers, with bigger profits that offset the loss of earnings from interest. Project-savings guarantees, substantiated by a credible M&V system following the international Performance Measurement and Verification Protocol (IPMVP®[6] - NAESCO partnered in the development of the IPMVP), gave them access to an almost unlimited pool of project capital. Moreover, ESCOs learned that the critical financial skill was the ability to package financing from various sources, showing their customers how government grants, tax incentives and utility rebates could be leveraged with private capital to get the comprehensive projects the customers really wanted.

3.2.2 HVAC and Controls

Another technology wave was HVAC upgrades: new boilers, chillers and ventilation systems, including variable speed drives and digital control systems. The larger ESCOs that are subsidiaries of international controls companies (e.g. Honeywell and Johnson Controls) expanded their substantial service businesses, while the smaller ESCOs run by entrepreneurial engineers exploited their expertise in market segments (e.g., the Hospital Efficiency Corporation). But, as with lighting contractors, established mechanical contractors with established relationships with the types of customers that ESCOs seek have learned that their lower overheads enables them to compete with ESCOs by offering their own performance contracts.

3.2.3 Solar PV

Solar PV is a more recent wave. ESCOs showed customers that a comprehensive project could cover the long paybacks of solar with the short paybacks of lighting and controls upgrades. This advantage, however, was eroded by federal and state government incentives for solar installations (e.g. federal tax credits for 30% of project costs). Moreover, ESCOs were at a disadvantage in trying to compete with the lower overhead costs and simpler PPA contract structures of standalone solar installation companies.

The technology waves are continuing with even shorter cycles. The new waves are the need for resilience and flexibility in public buildings, which are problems addressed by a number of technologies, e.g. microgrids, cybersecurity, indoor air-quality upgrades, and water management. Each of these technologies is offered by a mini-industry of specialized companies that arguably have more expertise and lower prices than ESCOs for their products or services.

3.3 Technologies – Components or Systems – Are Not the Key

ESCOs rode each wave of technology as it crested, but did not wind up on the rocks as the wave broke because they focused on the customer's needs, rather than the latest technology. ESCOs saw that the drivers for public-sector buildings were the need for capital improvements and a way to pay for them, while competitors (e.g. lighting companies, mechanical contractors, solar PV installers) were talking about their cheap prices. ESCOs integrated the best products and best vendors of each technology into packages customized to each customer's needs and offered customers the best value rather than the cheapest price.

4. Lessons Learned: Risk Management

In addition to the importance of government mandates and the promotion of the performance contracts described in Section 3.A.1, today successful US ESCOs embody a set of common characteristics that have enabled them to survive

[6] IPMVP defines standard terms and suggests best practice for quantifying the results of investments in energy efficiency and increasing investments in energy and water efficiency, demand management and renewable energy projects. The IPMVP was developed by a coalition of international organizations, including NAESCO (led by the United States Department of Energy), starting in 1994-1995. The Protocol has become the national measurement and verification standard in the United States and many other countries, and has been translated into ten languages.

and prosper. These characteristics revolve around the axis of risk management: identifying and eliminating the risks from each stage of their complex businesses. Successful ESCOs "stick to their knitting." They tend to be conservative in target market selection, the initial screening of potential customers, new technologies, contract terms, and the reliability of software and analytic methodologies used to verify long-term project energy savings. They do not take flyers.

Examples of this risk management are:

4.1 Targeted Marketing

ESCOs have learned to focus on segments of the public facilities market, even though the private commercial and industrial (C/I) market segments are at least an order of magnitude larger because they know that the ESCO offering – comprehensive projects with long paybacks – is attractive to public-sector customers. And they know that C/I customers are generally interested only in short-payback projects with a limited focus, and the customers are often much more difficult to finance.

4.2 Sales Management

US ESCOs have learned that the riskiest part of the business is the selling cycle because their projects typically take from twelve to thirty months to develop, and they can spend tens of thousands of dollars (hundreds of thousands for large federal projects) doing energy audits and engineering studies before they get a contract. Successful ESCOs are ruthless in ensuring that their sales forces identify customers who have an urgent need for a project and in addressing the prospective customer's business issues (e.g. don't like long-term debt) before investing in expensive engineering analyses.

4.3 Contract and Construction Management

Successful ESCOs use experts to write contracts and manage construction. US performance contracts are complex documents[7,8] compared to the contracts used in other countries, and the US is a litigious society, so large US ESCOs have in-house counsel, while small ESCOs retain specialized outside counsel. In addition to the normal base contract with terms, conditions and construction requirements, a performance contract contains schedules that may include topics such as:

- Savings Guarantee
- Baseline Energy Consumption and Methodology to Adjust Baseline
- Savings Mesurement and Verification Plan
- Project Costs and Cash Flow Analysis
- Financing Agreement
- Annual Services Fees
- Site Description
- Equipment to be installed
- Construction Schedule
- Commissioning Plan
- Standards of Comfort
- Training
- Maintenance

Even the smallest ESCOs have learned that a specialized construction manager is better than a design engineer at delivering a project on time and on budget.

4.4 Project Savings Monitoring and Verification (M&V)

A major risk element is the savings guarantee for the ten to 25-year life of performance contract. Almost all US ESCO projects use the IPMVP, but ESCOs have learned that they must go beyond the technical parameters of the IPMVP to carefully define what they are actually guaranteeing (units of energy reduction not dollars) in the project contracts, as well as the customer's responsibility for maintaining the project equipment and the agreed building operating parameters (e.g. hours of operation, indoor temperature, etc.). Successful ESCOs ensure that the customer understands the contract, approves the scope and format of the M&V reports in advance in accordance with the IPMVP, and follows up with the customer to answer questions about the reports and promptly solve any issues that surface in them.

5. Conclusion

The US market will continue to grow, and ESCOs will continue to thrive as long as they continue to deliver projects that fit the needs of each customer while managing their business risks. That is the core skill and experience of the U.S. ESCOs, and what the U.S. ESCO industry can offer as guidance to ESCOs in the rest of the world.

[7] Federal Energy Management Program, "Federal ESPC Process Phase 3: Project Development," https://www.energy.gov/eere/femp/federal-espc-process-phase-3-project-development.

[8] Energy Services Coalition, "Model Instruments for ESPC," http://www.energyservicescoalition.org/model-instruments.

Photo credit: Fenwicks Musonye

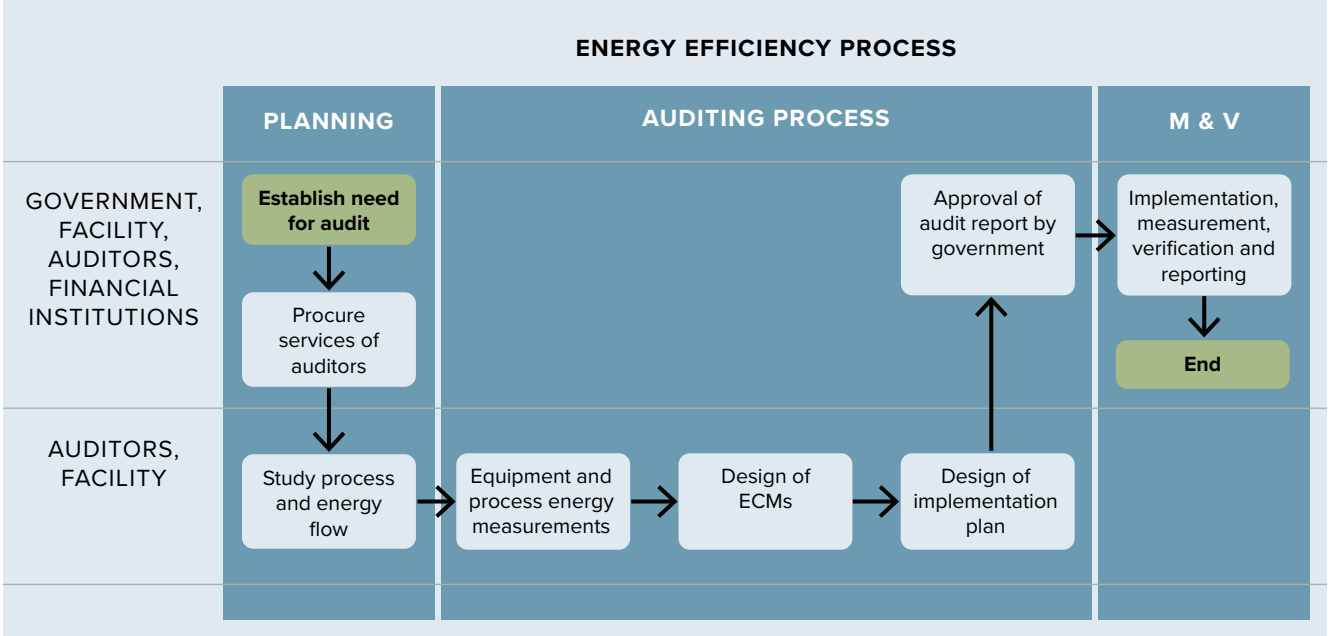
Fenwicks Musonye,
Energy & Petroleum Regulatory Authority, Kenya

Building trust in ESCOs in a developing country context: the case of Kenya

Abstract

To achieve their Nationally Determined Contributions (NDCs), developing countries need to enhance their efforts to make the energy efficiency improvements that require relatively less investment. Energy Service Companies (ESCOs) are recognized as potentially important contributors to such improvements, but the ESCO market is not yet well developed in developing countries. In this paper, the barriers and challenges faced by energy efficiency and ESCO markets in such countries are identified, leading to suggesting a framework for building trust by linking these challenges to specific solutions. The recommendations call for both government and private-sector interventions that include the formation of super ESCOs and associations of ESCOs, the implementation of favourable fiscal policies, the encouragement of public-sector facilities to participate in energy efficiency projects, and improvements to local capacity regarding knowledge and skills.

Figure 1. Stakeholders' interactions with energy efficiency



1. Introduction

Developing nations face the challenge of increases in energy demand due to their growing manufacturing, agricultural and service sectors. Most of this growing energy demand is currently being met from fossil fuels, which are associated with high greenhouse gas (GHG) emissions. Countries therefore have to balance between meeting their economic and social development goals and achieving their Nationally Determined Contributions (NDCs). Various possible solutions are available, including shifting the economy from manufacturing into services, switching forms of energy, and adopting efficient production and consumption practices.

Energy efficiency, as opposed to the two interventions just mentioned, is simple, uses tested technologies, and can be applied widely (Bukoski et al., 2016) in the domestic, manufacturing, agricultural and service sectors to meet the NDCs. However, simple, tested and universal though it may be, energy efficiency is a non-trivial process that has its hurdles, which range from the complexity of the skills required (Paramonova and Thollander, 2016) to its marginal allocations of financial resources and time (Fleiter et al., 2012). These problems are amplified in developing countries, and the existence of an energy efficiency gap in such countries is an emerging theme in the literature.[1] Apeaning and Thollander (2013) have noted this gap and the fact that little is being done to bridge it, showing the need to develop interventions to do so in order to meet the NDCs. Energy service companies (ESCOs) are considered the best candidates for solving the skills, time and financial resource challenges associated with energy efficiency.

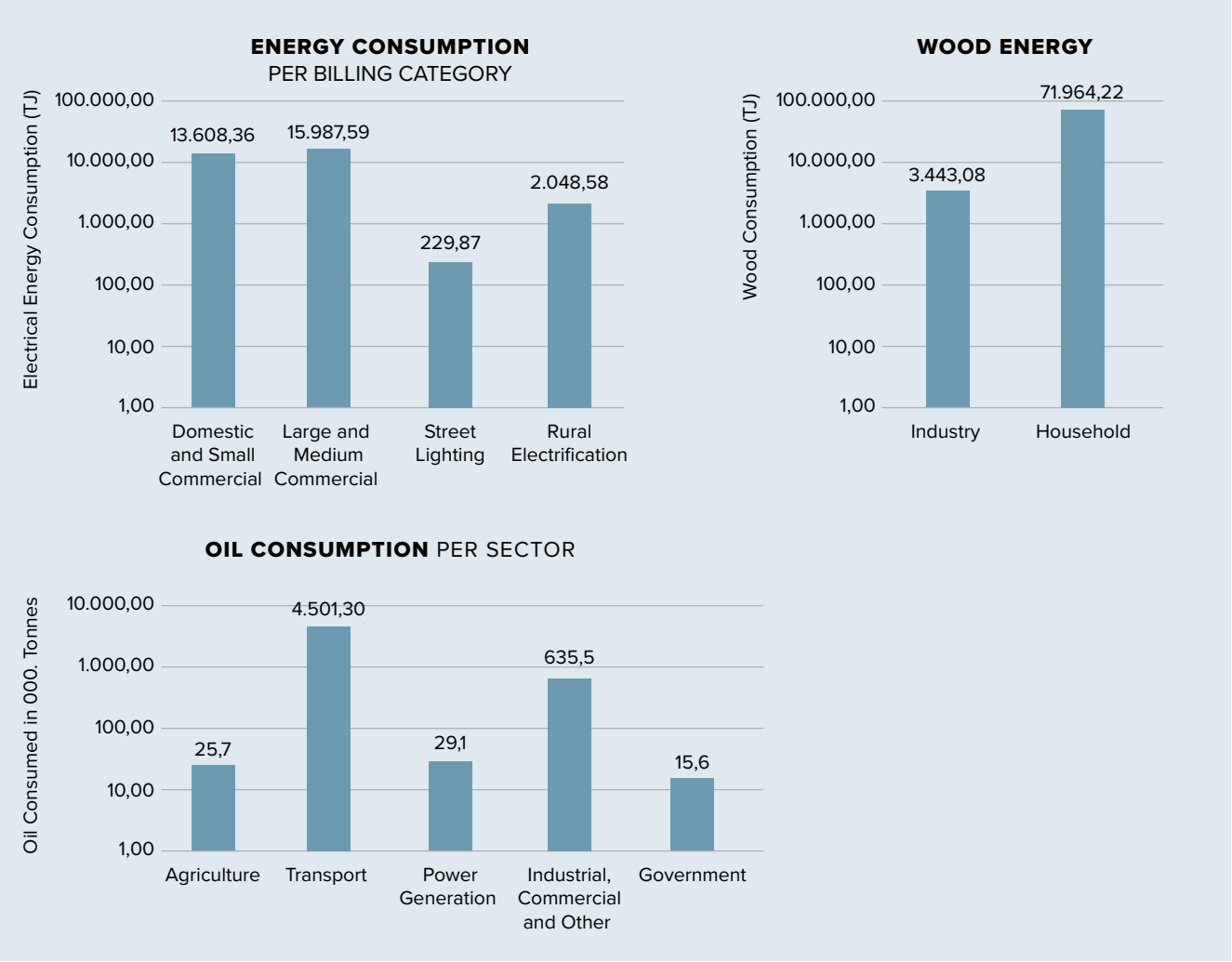
Developing countries should cultivate conducive environments for ESCOs as one way of improving efficiency and meeting their respective NDCs. In this article, a market framework is suggested for building trust in ESCO markets by delving into the contextual issues relating to energy efficiency and the growth of ESCOs. Secondly, the barriers to the adoption of energy efficiency practices in Kenya are examined and some case studies of other African countries that have already established ESCO markets. The third section discusses suggests solutions to the barriers identified that developing nations can implement in order to institutionalize trust in ESCO markets.

1.1 Understanding ESCOs and the Context of Energy Efficiency

Energy efficiency provides a pathway for reducing consumption to a unit of output in a process. This intervention has definite steps: analysis of process energy flows; investigation of energy performance at both the process and equipment levels; determination and design of the improvements required to optimize energy consumption; financial appraisal

[1] The energy efficiency gap is the difference between the energy saving potential in an economy, industry or sector and the actual savings realized.

Figure 2. Energy consumption in Kenya in 2019 (adapted from KNBS, 2020)



and planning the implementation of energy conservation measures (ECMs); and implementing the recommendations and measurement and verification (M&V) procedures of the implemented measures. These steps require resources, as shown in Figure 1.

The processes presented in Figure 1 can very well be carried out with the aid of support policies, financing, energy engineering, M&V knowledge and skills, expertise in making financial appraisals, procurement management and financial accounting. Scarcities of such support structures have been highlighted in studies by Shen et al. (2012) and Paramonova and Thollander (2016). Similarly, issues like restricted access to capital, the prohibitive capital costs of ECMs, high levels of uncertainty and a lack of in-house professionals like energy managers have also been noted (Turner and Doty, 2013). Such challenges are more pronounced in developing countries, and ESCOs can play a vital role in dealing with them.

Kenya is one developing country with an energy efficiency gap that requires intervention by the ESCO market to provide a solution. Two studies have been carried out in the hotel and manufacturing sectors, one in 2002, the other between 2003 and 2005. The former puts the EE gap at annual savings of 108,263 tonnes of oil equivalent (Toe), the latter at 115,447 Toe. These accounted for potential annual savings of $ 32 million and $ 28.5 million respectively (UNDP, 2006). The latest study by the Energy and Petroleum Regulatory Authority (EPRA) (2020) shows that only 1313 facilities, representing 43% of those that are supposed to comply with the country's energy efficiency laws, are on a path to compliance and have projected savings of 94,754

Toe. Some facilities have not fully implemented the ECMs that would help them meet these projected savings.

The gap can be bridged by focusing on the institutional, industrial and commercial sectors that consume energy in Kenya.[2] In 2019 these sectors consumed a total of 6.4 million tons of oil according to the Economic Survey Report of 2020 (KNBS, 2020). The same report indicates that total energy consumption from fuelwood, wood charcoal, coal, charcoal and waste was 75,407.31 TJ, while total consumed electricity was 31,874.40 TJ. A comparison of consumption by categories is useful, especially to understand where efforts to meet the NDC targets should be directed. Figure 2 compares the consumption of electricity, oil and fuelwood energy sources in Kenya.

In respect of oil consumption, the transport sector consumed the highest amount, at 86.4%, followed by the industrial, commercial and other category at 12.2%. Government, power-generating utilities and the agricultural sector consumed 1.4% of the oil. In respect of sources of electrical energy, industry falls into two categories: domestic and small commercial, and large and medium commercial. The former includes household consumption. Combined, this category consumed 92% of the electrical energy supplied in 2019. These statistics indicate the areas where energy efficiency should be focused. Even though industrial consumption is not necessarily the highest in oil and fuelwood sources, it is still the most viable candidate for energy efficiency interventions, particularly because of the relatively few players in the sector compared to transport, which has thousands, probably millions of entities each operating separately. The coordination of energy efficiency efforts in the former would therefore be easier. The industrial sector thus offers low hanging fruit in terms of meeting the NDCs compared to the transport sector.

The establishment of an ESCO market in developing countries like Kenya will be vital in relieving the industrial, commercial and institutional facilities of the risks involved in designing, financing, implementing and monitoring energy efficiency. In developing countries, ESCOs can take over all the steps shown in Figure 1 save for the first. In developed markets like the USA and Europe, ESCOs can take either just one step, like the performance assurance of a single energy-saving piece of equipment, or all of them (National Association of Energy Service Companies (NAESCO), 2020). Such arrangements can be adopted in future in developing countries, after the ESCO markets have matured. In the formative stages of these markets, ESCOs should offer seamless operations, from the design of ECMs to reporting. Among such arrangements should be confidence-building measures to deal with obstacles to market growth. Such obstacles are discussed in the next section.

1.2 Confidence-Building in ESCO Markets

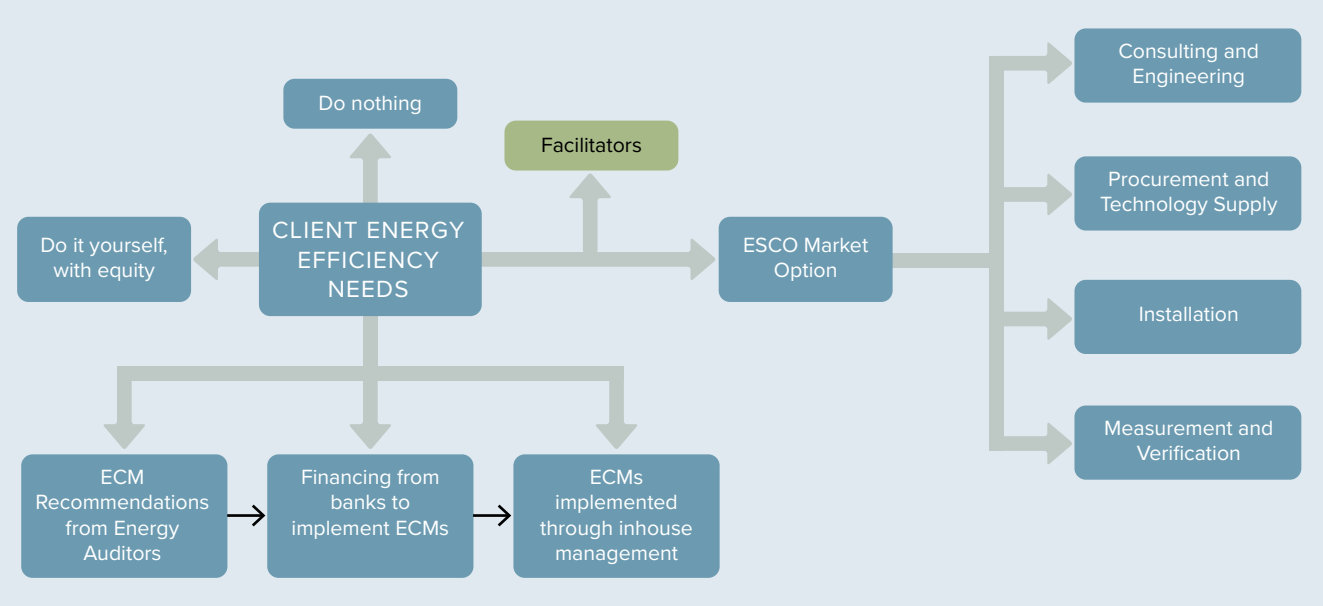
An ESCO market consists of ESCOs, their clients (the energy-consuming facilities), the transactions between the two and a regulatory or oversight body. To build up confidence in the market, the challenges and barriers that affect all the players respectively should be understood. This article discusses these confidence-building issues using a three-phase approach to the barriers and challenges: those for the ESCO, client and their transactions respectively. Some confidence-building issues are unique to just one of these sides, while others cut across the market, affecting both the facility owners and the ESCOs. Figure 3 gives a general overview of the interactions between a facility and an ESCO.

In developing countries, facilities faced with energy efficiency needs may take different paths to a solution, as shown in Figure 3. For them to take any of the pathways, however, existing barriers and challenges should be removed, with a bias towards promotion of the ESCO market option. The two in-house pathways are also viable, but they are affected by problems resulting from the uniqueness of energy efficiency projects compared to routine facility activities. For example, the procurement of energy efficiency services requires knowledge and experience, yet this is a non-core business of the facilities. Such experience may not be available.

The Kenyan government published its Energy (Energy Management) Regulations in 2012 requiring commercial, industrial and institution facilities to adopt an energy management system that allows them realize at least 50% of the projected savings out of ECMs identified through energy audits conducted once every three years. An assessment conducted in 2020 demonstrated low compliance with the regulations across the targeted facilities (those consuming more than 180,000 kWh of energy per year), only 45% of them having carried out energy audits. Of that 45%, only

[2] In Kenya, energy users are classified into three sectors. The industrial sector is made up of manufacturers and horticulture. The commercial sector combines transportation, hotel services, a banking sector, retail chains and utilities like power and water companies. The institutional sector includes schools, prisons, government buildings, warehouses, hospitals and similar entities.

Figure 3. Energy efficiency options for facilities in developing countries



43% have implemented the recommendations for meeting 50% of the projected energy savings (EPRA, 2020). Some of these barriers are summarized in Table 1.

As shown in Table 1, the barriers can be understood in the context of three categories: generation of a pipeline of projects in energy efficiency; financial barriers related to the costs and benefits of energy efficiency projects; and barriers related to the knowledge and skills of the players in energy efficiency markets. These barriers affect both the facilities and the ESCOs.

An ESCO market can grow if energy efficiency projects are generated continuously. The first port of call for energy efficiency projects should be government buildings, factories, sewerage facilities and energy utilities. Uptake of energy efficiency projects by public entities in Kenya has been slow. Efficiency improvements in public buildings represent quick gains in achieving the NDCs using the ESCO model. However, according to the EPRA (2020) report, few public buildings have complied with the Energy (Energy Management) Regulations 2012, especially local and central government offices, public schools and hospitals, correctional facilities and universities. With the government taking a back seat in complying with energy efficiency requirements, trust in the market is eroded, thus limiting the growth of ESCOs. This problem may be attributable to inherent bureaucratic procurement procedures.

Even though the private sector has performed relatively well in terms of energy efficiency compared to the public sector, there is still a problem in valuing energy efficiency proposition. Some facilities still do not appreciate energy efficiency as a form of investment. Anecdotal evidence shows that some facilities have yet to develop confidence in energy efficiency markets. The "what is in it for me" question has not been adequately answered by the stakeholders who are pushing for energy efficiency. Facilities are mostly concerned with improving other areas of production, and thus ignore energy efficiency. This is manifested in the question usually asked by the facilities: "I am paying my bills, so why should you bother me to conduct energy audits?"[3] Earlier studies by the Kenya Association of Manufacturers (GEF-KAM) (2005) pointed to the same lack of awareness among industry players as one of the reasons for the slow uptake of energy efficiency. The reluctance of such facilities to adopt energy efficiency measures may threaten the viability of the ESCO market in Kenya.

[3] This question has been evidenced by the author several times in some of his field awareness creation activities. This implies that efficiency is not their priority.

Table 1. Summary of barriers to energy efficiency and ESCO markets in Kenya

Category	Barriers
Pipeline of projects	Inadequate participation of government facilities in energy efficiency
	Facilities' failure to appreciate energy efficiency as an investment
	Insufficient awareness of energy efficiency regulatory requirements
Financial	High upfront costs of energy efficiency investments
	High transaction costs
	Energy price fluctuations
Knowledge and skills	Inadequacy of measurement and verification skills
	Inadequacy of energy efficiency knowledge and skills

Energy efficiency can be improved through the adoption of energy management systems. In Kenya these are covered by the Energy (Energy Management) Regulations 2012. However, most facilities are not fully aware of the provisions in the Regulations. The EPRA (2020) study revealed that only 74% of facilities were aware of their existence and that familiarity with the compliance process was even lower. Only 56% stated they were aware of the specific provisions of these regulatory requirements. This low level of awareness restricts ESCOs in creating project pipelines.

Investment costs for energy efficiency projects are considered high, especially when equipment retrofit is required. The available literature, from District (2003), alludes to these high initial costs for energy efficiency. The treasury briefly considered granting subsidies for light emitting diode imports, waiving import duties and VAT, but these have since been restored. Other equipment for energy efficiency projects has not been considered for such incentives. These high upfront costs make energy efficiency projects in Kenya less competitive, as financing institutions have other projects to consider too.

Transaction costs also affect the overall return on investments in energy efficiency projects. High consultancy fees have been identified as one of the reasons why facilities in Kenya do not implement such projects (EPRA, 2020). Energy audits are the first point of reference for ESCOs in devising projects to save energy, as facilities consider its cost prohibitive. Given these perceptions, facilities are reluctant to engage ESCOs. Using internal staff to carry out the audits is usually not tenable, given their lack skills regarding energy efficiency.

Investment appraisals of energy efficiency projects are pegged to energy prices, the returns being determined in the form of avoided energy costs. The stability of energy prices is therefore important for these projects to prevail, especially for financiers who associate energy savings with money. The costs of electricity prices in Kenya are fixed and are set once every three years. However, sometimes, through an executive order, they can be changed before the three years are up. In 2018, for example, electricity prices were reduced just a few months after the three-year tariff had been fixed. Similarly, the variable component of the electricity price is fixed every month. This is susceptible to foreign exchange fluctuations and a fuel cost component, which upsets the savings model. If energy prices are reduced within the project period, then the ESCOs may be disadvantaged, while increasing these prices negatively affects the facilities.

Capacity building for both the energy efficiency service-providers and the facilities is essential in implementing energy efficiency projects. The EPRA (2020) study found out that there are insufficient knowledge and skills related to energy auditing and M&V. This affects both the energy auditors and the facility's employees. Some energy efficiency recommendations have been found to fall short of quality standards, discouraging facilities from implementing them. For those that make meaningful recommendations, they still do not have any way of verifying the benefits. These challenges may lead to snap-back problems, where facilities scale down their

efficiency improvements and revert to business as usual. Establishing ESCOs requires a market in which both the facility and the ESCO have good levels of expertise regarding energy efficiency.

The barriers in the Kenyan market are not unique and have been faced by other developing countries, some of which have gone ahead to formalize the registration of ESCOs. Notable successes have been achieved, but there are still problems with market uptake. The challenges have been documented in the literature, and they are discussed as case studies in the next section.

2. Case studies of ESCO performance in developing countries

The South African ESCO market is a typical example of a program that has suffered a snap-back problem. The country's ESCO market was chiefly championed by the national power utility, ESKOM, which wanted to reduce the strain on the national energy-supply system. Between 2006 and 2013, ESKOM's Standard Offer Programme implemented 206 projects in energy efficiency (IEA, 2019). ESKOM adopted the ESCO performance contracting, standard product rebate and standard officer rebate programmes. The rebate programme involves three parties, namely ESKOM, an ESCO and an energy user, and targets users who have a peak demand of 200 kW.

To deal with the possible challenge of bias in measurement and verification, ESKOM set up a team from South African universities to conduct independent verification. The ESCO conducts an energy audit to identify potential energy-saving measures, based on which they submit a funding proposal to ESKOM. The ESCO was required to assume the ECM performance risk, but was penalized for non-performance. Following improvements in ESKOM's fortunes, especially in load management, ESCOs' activities slowed down in 2017, and not much success has been reported recently.[4] This led to the snap-back, when the utility became reluctant to pursue any further energy efficiency initiatives.

The previous success of the ESCO market in South Africa notwithstanding, issues of inadequate capacity-building have been cited as having affected the working of energy efficiency market. Studies by Volschenk (2007) revealed that there was a lack of trust in the market due to the energy efficiency industry's inadequate knowledge, skills and experience. Specifically, this problem affected the measurement and verification process. Public-sector involvement in energy efficiency programmes in South Africa is low. Singh et al. (2009) note that there is no clear mechanism for supporting contracts in energy efficiency services. The lack of such a framework may have contributed to the slowing down of the ESCO market, which had been left in ESKOM's hands.

In Morocco, as in South Africa, utility companies play a central role in ESCO markets. ESCOs in this country are utility firms that aid project implementation and the maintenance and management of lighting systems in public buildings. ESCOs have been limited to ten in number since 1992, but they serve both the private and public sectors. The market is regulated by the Agency for Renewable Energy and Energy Efficiency Development. Among the programmes implemented by this Agency are the initiation of international and national fiscal instruments to support energy efficiency. The Agency has a target of saving 25% to 30% of energy by 2030. To achieve this, it has identified 122 measures through energy efficiency studies. The government has set itself a target of reducing the public sector's primary energy consumption by 12% in 2020 and by 3% by 2030. It is not clear whether the 2020 target has been met, but ESCO activities have been directed at helping public-sector entities achieve these goals (Oxford Business Group, 2016).

The problem of the high upfront costs involved in producing energy efficiency is also significant in Morocco. Howson (2020) highlighted some of these challenges in interviews with the country's experts on energy efficiency. Public entities have difficulties in access finance to participate in energy efficiency programs. Whereas some banks are involved in financing projects in the manufacturing sector, the government has not taken a leading role in ensuring its entities generate a stream of projects. Ezziyyani et al. (2019) also point to the lack of economic viability in how subsidies are used in the Moroccan energy market, which gives inefficient practices a competitive edge against sustainable measures like energy efficiency. With the subsidies in place, the financial attractiveness of energy efficiency projects wanes. Moreover, Morocco has had issues with trust, mostly related to the use of baseline data to verify savings. This is attributed to the lack of a clear measurement and verification framework

[4] ESKOM's problems in demand management have resurged since 2019, and they may be required to spur the activities of the ESCOs once more. Many news outlets have reported on this problem, e.g. The Economist: https://www.economist.com/middle-east-and-africa/2019/12/12/eskom-is-turning-out-the-lights-in-south-africa

Table 2. Proposed framework of solutions to energy efficiency challenges in Kenya

Category	Suggested solutions
Pipeline of projects	Mandatory legal requirements for government facilities to adopt energy management systems in their operations
	Inclusion of energy efficiency as part of performance contracts for government agencies
	Establishment of energy facilitators to help facilities make investment decisions and understand the regulatory requirements
	Formation of super ESCOs
	Establishment of energy efficiency revolving fund for public facilities
Financial	Clarity in defining ESCOs to admininster financial incentives in the regulations
	Fiscal policies favorable to ESCO markets
	Formation of a super ESCO
	Formation of an ESCO association for lobbying purposes
	Development of energy efficiency consolidated fund for ESCOs
Knowledge and skills	Development of local curriculum for energy efficiency and measurement and verification
	Adoption of measurement and verification protocols
	Training programs by government and manufacturers' association

(Medener Network, 2014). Such a framework would be useful, since it clearly defines the type of data and measures to be used in case of any technical disputes between the ESCO and the facility.

3. Proposed framework for improving the ESCO market in Kenya

Solutions to the barriers identified earlier for Kenya should be formulated with a specific focus on the parties that are responsible for the action points. In this section, such a framework is described, with specific actions linked to the different categories of barriers identified earlier. The framework is illustrated in Table 2.

The solutions proposed in Table 2 have been devised so as to be suitable for reducing the barriers and challenges discussed in this paper. A better approach to implementing the solutions would be to divide them into ESCO-side, client-side and transaction-side interventions respectively, as discussed below.

3.1 ESCO-side interventions

For ESCOs to survive in an energy market, the government should establish laws or guidelines relating to the ESCO market. First, the laws should have provisions to make government-owned facilities comply with energy efficiency requirements. Although the Energy (Energy Management) Regulations 2012 do not have any specific provisions for these facilities, it would be essential to make energy efficiency part of performance-contracting for government agencies. This would ensure that they set aside funds for investments in the sector. For ESCOs to be viable, the Kenyan government should actively seek to adopt ESPC in all its facilities, including government manufacturing facilities, buildings, water and sewerage, and energy utilities.

Projects fronted by the government are easier to find financing for, especially at low rates, because the risks are lower. Reliance on government projects will therefore generate a pipeline of projects. In successful ESCO markets, governments have taken the lead in generating projects for the entities. In the Nordic countries, for example, the public

sector accounts for most of the projects, and in Sweden for 80% to 90%. In Denmark by 2015, 38 out of 98 municipalities were undertaking ESPC (Energy Savings Performance Contracting) projects. Norway's public sector has also led in ESPC, while Finland has a mixture of public- and private-sector participation rates.[5] These and many other examples demonstrate the important role of governments in generating projects in ESCO markets.

To stimulate the uptake of energy efficiency projects in the public sector further, the government can establish a revolving fund to cover the initial costs of investing in projects. The savings realized can then be used to pay back the loan, together with interest and a service charge. These repayments can then be used to finance projects in other government entities, reducing the problem of reluctance by government-owned facilities to participate in these projects. Such solutions have been working in the Balkan region (Limaye et al., 2014).

To solve the triple problem of capacity, financing and the generation of a pipeline of projects, the formation of a super ESCO will also be essential. This will help ESCOs access the financial services they require for projects, offer technical guidance through training, and seek out contracts on behalf of the ESCOs. Currently, there are plans to form a super ESCO, which will be housed by the national power utility company, the Kenya Power and Lighting Company.[6] This program hopes to obtain finance from the African Development Bank (AfDB) and to generate initial projects in government-owned buildings. Once established, the super ESCO has considerable potential. It should be able to wean itself off AfDB funding and find a stable foothold in the market by finding its own finance. However, it should also consider getting out of the government buildings sector and expand into other sectors.

For ESCOs to champion financial incentives, especially in the form of capital investments in energy efficiency projects, there should be order in the market. The regulations and guidelines governing ESCOs' activities should clearly distinguish their functions from those of other energy efficiency entities, like energy audit firms. However, defining ESCOs is potentially an operational minefield, especially when it comes to claiming financial incentives related to the ESCO market. Kenya has a number of companies carrying out ESPC-based interventions in energy efficiency. However, to ensure that the field is streamlined, the law should provide guidelines for the boundary conditions that define an ESCO. This will create a clear structure for implementing any financial benefits related to ESCOs should the government roll them out in future, as well as eliminating free-rider effects.

Fluctuations in energy costs, especially the introduction of energy subsidies, can lead not only to contractual problems, but also to losses on the part of the ESCO. Such risks can be mitigated through the establishment of a consolidated energy efficiency fund. Such a fund already exists under Kenyan law for the oil market. Whenever there is a price shock, the money from the fund is used to cushion consumers. On the ESCO side, if there is a dramatic reduction in energy prices, which might cut into the ESCO's profits, then money from the fund could be used to cushion them. Money for the fund can be sourced from all facilities designated under the Energy (Energy Management) Regulations 2012 and is administered by the Ministry of Energy.

The problem of inadequate capacity, especially in measurement and verification, as well as energy efficiency, can be solved through the creation of an ESCO lobbying group. Once officially registered, ESCOs in Kenya should form themselves into an association to take responsibility for the capacity-building of ESCOs, facility employees and other experts. Like a professional association, it can be useful in ensuring the professionalism of the services their members offer. Maybe, with the improved functioning of such an association, future ESCO registration by the government could make association membership a compulsory requirement. Such an association would also form a unified platform useful for lobbying for policy changes in government, mostly to obtain financial incentives promoting energy efficiency.

Developed countries have examples of ESCO associations. In Turkey, there is the Energy Efficiency and Management Association (EYODER), the Turkish Cogeneration and Clean Energy Technologies Association (TURKOTED) and the Energy Efficiency Association (ENVERDER). The USA has a National Association of Energy Service Companies (NAESCO), the United Kingdom an Energy Services and Technology Association (ESTA). Some of these associations

[5] This information is based on a report published in 2015, since when the figures may have changed. This report can be accessed at https://www.diva-portal.org/smash/get/diva2:900555/FULLTEXT02

[6] Using the national utility for super ESCOs is attractive, if the case of ESKOM is anything to go by. However, utility-based super ESCOs are only active when there is a demand problem on the national grid. In cases of excess supply, the utility may not see any short-term gains from energy efficiency.

have expanded the scope of their membership. The Kenyan market could copy this and include suppliers of energy efficiency equipment, independent M&V experts and even financiers.

3.2 Client-side intervention

As observed in this article, facilities may not have the expertise to deal in energy efficiency procurement. This problem is compounded by limited awareness of the facility in understanding the investment returns from energy efficiency. ESPC facilitators have proved useful in other markets in helping facilities make investment decisions, providing the facility with the necessary technical know-how and experience. This helps in the successful implementation of ESCO projects. This is realized through initial assessments of the potential savings of a project, initial technical analysis, client support during procurement, and providing advice during implementation and monitoring.

ESPC facilitators will have to be set up in the market. Facilitators in developed ESCO markets include the Berlin Energy Agency (Germany), SEVEn (Czech Republic) and the Graz Energy Agency (Austria). The Kenyan market should also have facilitators to help facilities interact with ESCOs from a basis of knowledge and experience. Facilitators should have a strong understanding of public administration. They should also help with the initial project set-up, make feasibility assessments and communicate the concept to those making investment decisions. They have a strong understanding of the procurement process, which includes contract formulation, baseline data collection, preparing tender documents and ESCO requirements.

The Kenya Association of Manufacturers (KAM) has been acting as a bridge between government and manufacturers, enjoying goodwill from both sides. This gives it a vantage point from which to become one of the country's ESPC facilitators. Its scope, however, will have to go beyond manufacturing entities to include commercial and institutional facilities.

It is essential for facilities to improve the skills and expertise of their employees in the fields of energy efficiency and measurement and verification. The current job-based form of energy efficiency training in Kenya is based on international curricula, which, although rich in content, may not be enough to cover the local characteristics of Kenya's energy efficiency sector. For example, while some part of the curricula focus on building envelope and district heating systems, the country's greatest consumption occurs in the manufacturing sector. Consumption in buildings is mostly for lighting. There is a need to develop local curricula, tailoring trainings to engineering and non-engineering professionals in energy efficiency. The government and the Kenya Association of Manufacturers should actively pursue the training of energy managers in facilities, using an appropriated curriculum.

The government should also come in to help reduce the high investment costs in energy efficiency by means of favourable fiscal policies. This will help incentivize the rapid changes that will realize achievement of the NDCs. These incentives should include investment tax credits, allowances for accelerated depreciation, tax holidays and duty exemptions on energy efficiency equipment. Investment tax credits allow an investor to deduct a given percentage of the investment cost from the tax due. Facilities may also be allowed to use accelerated methods of depreciation that are useful in allowing them to defer tax payments. This is essential for energy-consuming facilities that have cash-flow problems. To encourage purchases of energy efficient equipment, governments can declare tax holidays in which some taxes are temporarily removed from the cost of the equipment. Exemptions from excise and import duties can also reduce the price of locally manufactured or imported energy efficiency equipment. To reduce transaction costs, facilities can be allowed to report money paid to ESCOs as business costs, thus reducing their tax obligations.

Incentivized acceleration measures have been adopted in ESCO markets in developing countries like Tunisia, developed nations like the USA and middle-ranking powers like China. In Tunisia, customs duties for all imported energy efficiency equipment have been reduced from 18% to 10%. Value Added Tax (VAT) has been waived for such equipment too.[7] In the USA, states give investment tax credits for facilities that invest in energy efficiency projects. Transfers of fixed assets in EPC projects in China are exempt from VAT. Previously Kenya had exemptions on VAT and duty on some renewable energy and energy efficiency products, but these were removed in the 2020-2021 budget, probably

[7] Even though Tunisia has such schemes, ESCOs have not performed up to expectations. This probably shows the synergistic importance of a combination of measures to improve markets in the developing world. One measure alone is not enough. Information on these incentives was obtained from https://www.worldbank.org/en/results/2013/05/23/energy-efficiency-in-tunisia-promoting-industry-while-protecting-the-environment

as a response to the COVID-19 pandemic's effects on the economy. These exemptions should be reintroduced to help facilities improve their uptake of energy efficiency.

Access to financing can be enhanced, thus reducing the upfront costs of energy efficiency projects for clients, especially in models where the client has to provide the investment capital. The government should encourage investors to create investment funds focusing on industrial and commercial energy efficiency. Direct foreign investment could be targeted to investors creating mutual funds, hedge funds or even third-party financing to help the sector grow.

3.3 Interventions based on ESCO transactions

The issue of a lack of mutual trust has been raised in many countries where ESCO markets have already been established. These problems are bound to occur in the Kenyan market once ESCOs are established. It is essential to identify sources of conflicts that can erode trust between a facility and an ESCO. There are a number of risks associated with transactions between ESCO and facilities that can erode trust in the market, including design, technology, installation, financial, operation, measurement and verification risks. These risks can be addressed partly by developing contracts and measurement and verification protocols that forestall possible disputes between parties in the ESCO market. Developing standard contract templates, however, is not necessarily a duty of governments. ESPC facilitators, ESCOs and super ESCOs should therefore combine their efforts to come up with contract templates that are flexible enough to accommodate any energy efficiency project at hand, as well as robust enough to cater for all the risks.

Design and financial risks are associated with over- or under-designed energy efficiency solutions. In most cases, especially in developing countries, these are caused by poor-quality baseline data. Contract templates should address this by specifying the baseline data protocols to be followed when data are missing. The International Performance Measurement and Verification Protocol lists measures to be taken when data are missing. Contract templates should be clear on such options during the collection of baseline data for design purposes. Laws should also be strict with respect to data management by facilities. Kenya's existing Energy (Energy Management) Regulations 2012 have such a requirement, but they do not stipulate the quality of data management facilities should follow. The laws should clearly state that ESCO market transactions should adhere to established measurement and verification protocols. As in the case of the local curriculum, Kenya can appropriate the existing protocols to suit the local market.

Poor equipment selection creates technology, installation and operational risks. To mitigate these risks, appropriate system design and equipment should be purchased from verified suppliers. This actually demonstrates the importance of ESCO associations. A regulatory framework to register the suppliers of such equipment can be developed in Kenya. Measurement and verification risks can occur when there is a disagreement between the ESCO and the facility. Apart from the development of and adherence to measurement and verification protocols, the government can devise a framework where, in cases of conflict over savings verifications, an independent body can step in. Kenya could adopt the South African framework, in which university teams have been used to verify savings, thus reducing conflicts.

4. Conclusion

This paper has explored the adoption of ESCO markets in developing countries in the context of achieving their NDCs, showing how trust in these markets can be institutionalized. Using examples of the barriers and challenges that are evident in the Kenyan market, and fortified by studies from Morocco and South Africa, the paper has established the need to develop interventions to build trust in the energy efficiency and ESCO markets. The barriers concerned have been divided into three: barriers to the development of pipelines of projects in energy efficiency, barriers related to financing, and barriers related to knowledge and skills in the market. A framework of solutions has been suggested, based on these three broad barriers and challenges, and specific interventions have been allocated to the ESCO side, the client side and the transaction process in the market. All the parties involved, namely the government, investors, ESCOs and facilities, share the responsibility to improve trust in the ESCO market: these have been articulated in the paper.

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China's Remarkable Success in Developing ESCOs: Current Status, Policy Drivers, and Prospects

Abstract

China accounts for around 59% of the global ESCO market. The history of the Chinese ESCO market goes back to 1998, over a decade after the appearance of ESCOs in the US and other parts of the developed world. The rapid increases in the number of ESCOs in the market and their growth in market revenue make China a remarkable success story in using ESCO business models as an important instrument for improvements to energy efficiency in industry, commercial and public buildings, and public facilities. This article examines the status of the ESCO market in China, the policies that drive it and their evolution. China has set itself the ambitious target of peaking its energy consumption and GHG emissions by 2030 and achieving carbon neutrality by 2060. The national strategy to develop a green and circular economy promises enormous potential for the further development of ESCOs as effective market mechanisms in implementing energy efficiency projects. The article also offers an assessment of the remaining barriers to ESCO development in China and makes some recommendations for how to address them. China's approaches to developing an ESCO market and experiences with it can provide useful advice and examples to many other countries in their efforts for develop ESCO markets and devise the associated policies.

1. Introduction

The concepts of the energy performance contract (EPC) and the energy service company (ESCO) were introduced in China in 1998 by a World Bank/GEF "China Energy Conservation Project". A major achievement during Phase I of this project (1998-2006) was the establishment of three pilot ESCOs and a demonstration of their feasibility in China by means of multiple EPC projects. Phase II of the project (2002-2010) involved further support in the form of an "ESCO Loan Guarantee Programme", for which USD 22 million worth of guarantees were put into an account managed by the Ministry of Finance to underpin the commercial loans several Chinese banks made to EPC projects. The loan guarantees effectively reduced the risks for the commercial banks and expanded ESCOs' access to bank loans. Another outcome of Phase II was the establishment of the Chinese ESCO Industry Association (EMCA) in 2003, which plays an important role in promoting public awareness of ESCOs and EPC business models and in providing training for ESCOs.[1] Since then, thanks to government and international support, the ESCO market has developed quickly in China. In 2014, China became the largest ESCO market in the world, and its share of the global ESCO market has kept increasing since then.

This article will provide an overview of the status and history behind China's remarkable success in ESCO market development, the evolution of the country's general ESCO policies, and its policies in specific sectors. It assesses the barriers to further ESCO development in China and offers some solutions and policy recommendations.

2. Current status and trends of ESCOs development in China

According to the latest data from the IEA (2018),[2] China's ESCO market revenue was USD 16.8 billion in 2017, representing 59% of the global total.

2.1 Current status

According to China's ESCO Association, EMCA, the total size of China's ESCO market revenue increased by 9.4% to reach 522.2 bn RMB (or USD 75.9 bn) in 2019.[3] The number of enterprises engaged in energy conservation services reached 6547, with 761,000 employees in the sector. China's total investment in energy conservation and efficiency improvements is 114.1 billion RMB. The annual energy savings from ESCO projects in 2019 were 38.0 million tons of coal equivalent (MtCe), and the annual CO_2 savings capacity was 103.0 million tCO_2.

In terms of sectoral distribution, as can be seen in Figures 1a, 1b, and 1c, the Chinese ESCO market is mainly concentrated in four sectors: industry, public buildings, commercial and industrial buildings, and public facilities. Public facilities include street lighting and utilities. Figure 1a shows the distribution of ESCO projects in terms of the numbers of projects in each sector, while Figure 1b shows the distribution of investment, and Figure 1c the expected savings from these projects.

From the three figures, we can see that from project numbers to investment, and finally to energy-saving capacity generation, the degree of concentration of ESCO projects in industry increases, indicating that they are generally larger and generate more energy savings. ESCO projects in public facilities are the opposite: project size and each project's energy savings tend to be smaller.

2.2 Trends

The overall development trends in China's ESCO market are shown in Table 1. After the ESCO concept was introduced into China in 1998, the first few years constituted the initial stage of ESCO market development. The decade between 2005 and 2015 was a period of rapid development. Since then, although the market is still growing, the growth rate has slowed down in terms of both the number of ESCOs operating in the market and the number of employees. The actual energy savings capacity of ESCO activities in 2019 was the same as in 2017.

2.3 Sector distribution

According to the IEA, China's ESCO market is mainly focused on industry and non-residential buildings. As in Korea, India and Thailand, industry dominates the Chinese ESCO market due to government policies that provide incentives for industries to engage with ESCOs in implementing energy efficiency (see Table 2).

[1] EMCA and IFC, 2012. China Energy Service Company (ESCO) Market Study.
[2] IEA, 2018. *Energy Efficiency 2018 - Analysis and outlooks to 2040.*
[3] EMCA, 2020. ESCO Industry Development Report 2019. http://shoudian.bjx.com.cn/html/20200113/1035938.shtml. The big difference between the IEA data and the ECMA data indicate big differences in the scope of data.

Table 1. Development trends in China's ESCO market

	2005	2010	2015	2017	2019
Number of ESCOs	80+	782	5426	6137	6547
Employment (persons)	16,000	180,000	607,000	685,000	761,000
Revenue (bn RMB)	4.7	83.6	312.7	414.8	522.2
Investment (bn RMB)	1.3	28.8	104.0	111.3	114.1
Annual energy saving capacity (million tCe)	0.6	13	33.5	38.1	38.0
GHG emission reduction ($MtCO_2$)			84	103	103

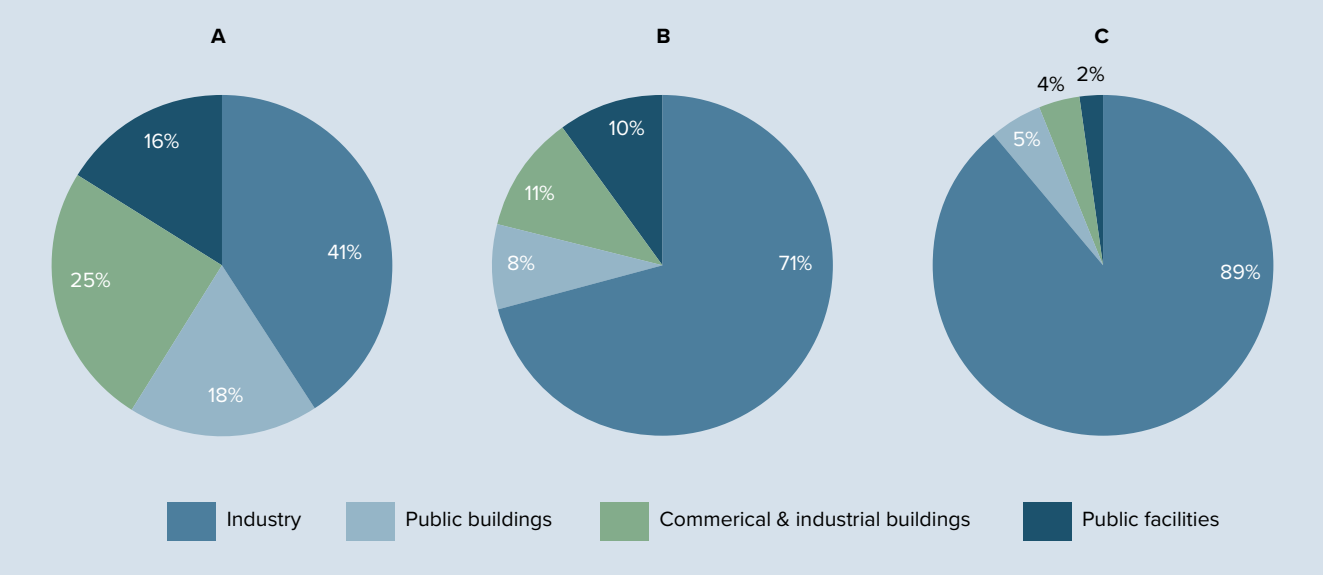
Source: 2005, 2010, and 2015 data from NDRC,[a,b] and 2017 and 2019 data from EMCA.[c]

[a] A Review of the Energy Saving Service Sector during the 12th Five-year Plan Period: https://www.ndrc.gov.cn/xwdt/gdzt/xyqqd/201707/t20170703_1197806.html;

[b] Rapid development of the energy-saving service sector - a review of the energy-saving during the 11th Five-year Period. http://www.gov.cn/gzdt/2011-10/08/content_1963940.htm

[c] EMCA, 2020. ESCO Industry Development Report 2019. http://shoudian.bjx.com.cn/html/20200113/1035938.shtml

Figur 1. a, b and c



Source: EMCA, 2020, ESCO Industry Development Report 2019. http://shoudian.bjx.com.cn/html/20200113/1035938.shtml. The big difference between the IEA data and the ECMA data indicate big differences in the scope of data.

Table 2. ESCO revenue based on end-use sectors

	Industry	Non-residential buildings	Residential buildings
China	55%	45%	
EU	20%	80%	
USA		90%	10%
Japan	30%	70%	
Canada		100%	
Korea	75%		25%
India	100%		
Thailand	60%	35%	5%
Mexico	70%	30%	

Source: IEA, 2018. *Energy Efficiency 2018 – Analysis and outlooks to 2040.*

Table 3. ESCO revenues, public vs private sector, 2017

	Private sector	Public sector
China	90%	10%
Canada	10%	90%
EU	20%	80%
US	15%	85%
Japan	62%	38%
Korea	85%	15%
Mexico	80%	20%

Source: IEA, 2018

In China, 90% of the ESCO market is in the private sector. This is different from the ESCO market in developed countries, but more similar to the situation in Asia and some developing countries. The concentration of ESCO market revenue in the private sector indicates more favourable policy settings for ESCO engagement in the private sector than in the public sector (IEA. 2018). As shown in Table 3, the majority of the Chinese ESCO market is in industry and commercial and industrial buildings. In contrast, public buildings and facilities only account for a small share of the market.

2.4 Business models

Globally, ESCOs typically engage in three types of contract in their operations: shared savings contracts, guaranteed savings contracts, and fee for service contracts. The first two types are also known as energy performance contracting (EPC) and are the main business models that distinguish ESCOs from other service companies in implementing energy efficiency. In shared savings contracts, an ESCO not only provides technical support to energy efficiency project design and implementation, it is also responsible for upfront project financing. Hence, it carries both the performance risk and the financial risk of the project.

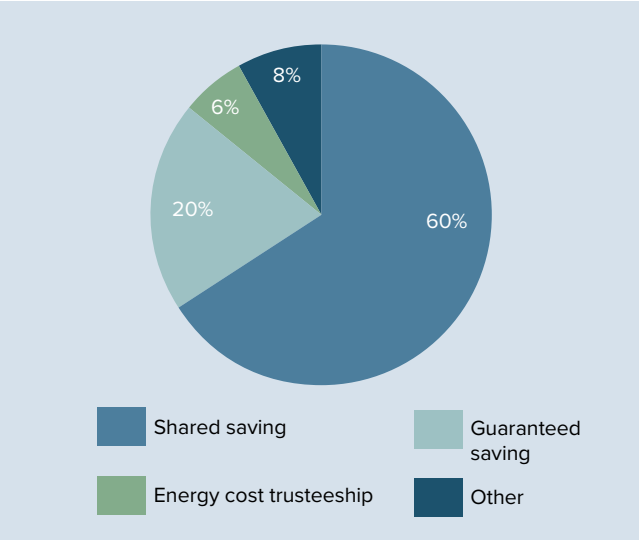
The guaranteed saving contract differs in that it is the facility owner, not the ESCO, that is responsible for financing the energy efficiency project. In such contracts, the ESCO guarantees the facility owner a certain percentage of the energy savings (see Figure 3).

In fee for service contracts, the ESCO provides specified energy efficiency services for an agreed fee. The facility owner is responsible for financing the energy efficiency project and receives all the cost savings. The ESCO does not have to guarantee a specified level of energy savings, but nor will it get a share of the savings from the energy efficiency project. Hence, this type of contract is not performance-based.

In the early periods of China's ESCO market development, the majority of the energy performance contracts (EPCs) were shared saving ones (see Figure 2). This was partly because facility owners were not familiar with EPC business models and lacked confidence in ESCOs, and partly because government policies limited some incentives to the shared saving EPCs. Moreover, government subsidies to EPCs were only applicable to the shared saving EPCs.

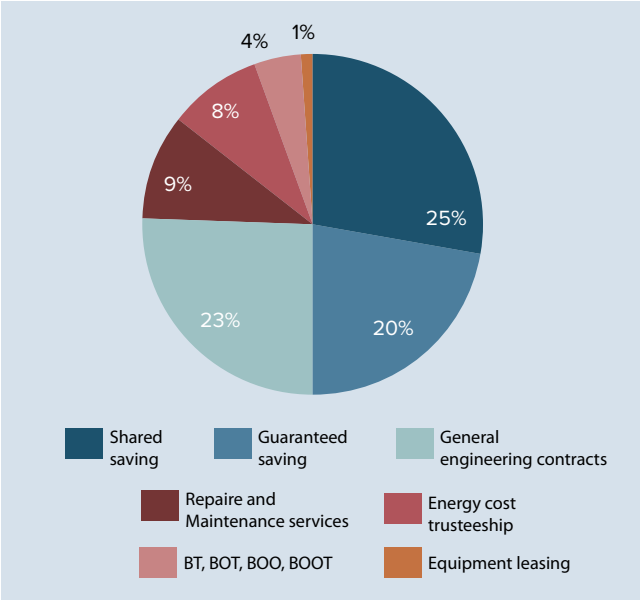
This situation has gradually changed. As the ESCO market has developed further, facility owners have increased their capacity to assess and fund energy efficiency opportunities. They are also more willing to fund energy efficiency actions and undertake the financial risks. The government's policies

Figure 2. Business models of ESCO market in China, 2010-2011



Source: IFC & EMCA, 2012. China Energy Service Company (ESCO) Market Study. https://www.ifc.org/wps/wcm/connect/5d1cfd04-36fc-4f80-9900-c419940bd69b/IFC+final+ESCO+report-EN+.pdf?MOD=AJPERES&CVID=jZVnBBO

Figure 3. Types of different energy performance service contracts by ESCOs, 2019



Source: EMCA, 2020. ESCO Industry Development Report 2019. PPT presentation. Available at http://shoudian.bjx.com.cn/html/20200113/1035938.shtml (accessed on 21 October 2020).
Note: BT- build-transfer; BOT: build-operate-transfer; BOO - build-own-operate; BOOT: Build-own-operate-transfer

have changed and now offer equal treatment to different business models of energy efficiency services. The Chinese ESCO market has witnessed some diversification and innovation of business models, and the proportion of sharedsavings contract has been declining (see Figure 3).

A very frequently used type of contract in Europe is the 'chauffage' contract, where an ESCO takes over complete responsibility for providing the client with an agreed set of energy services (e.g. space heat, lighting, motive power, etc.).[4]

2.5 ESCO size, ownership and types

The Chinese ESCO market consists of many small companies and a small number of large companies conducting the majority of the EPC projects. As can be seen in Table 4, the market has some tendencies towards concentration. While in 2010, small and micro-ESCOs received 78% of ESCO market revenues, in 2019 their combined share declined to 40%.

Table 4. Business revenue distribution among ESCOs of different sizes

Type of ESCOs	Share of ESCO market revenue	
	2010	2019
Micro-ESCOs (annual revenue ≤5 m RMB)	39%	16%
Small ESCOs (5 m RMB <annual revenue ≤ 20 m RMB)	39%	24%
Medium ESCOs (20 m RMB <annual revenue ≤ 100 m RMB)	18%	51%
Large ESCOs (100 m RMB <annual revenue)	4%	9%

Source of data: 2010 data from IFC & EMCA, 2012; 2019 data from EMCA.

[4] https://e3p.jrc.ec.europa.eu/articles/energy-performance-contracting#toc-1 Energy Performance Contracting

3. Evolving Policies

There are many factors behind the boom in the Chinese ESCO market. One is its national context, especially the increasingly strong and comprehensive national policies for energy conservation and GHG emissions reductions, as well as public awareness of the need for energy savings. The binding energy-saving and GHG emissions targets for the public sector and industry, as well as the high energy prices for small and medium industrial and commercial energy users, make up the demand for ESCO services. This article will focus on the policies that are directly related to ESCOs and EPCs. An overview of the relevant Chinese policies on ESCOs and EPCs is given in Table 5.

The 2007 Amendment to the Energy Conservation Law introduced a supportive overall framework for the energy service sector and relevant businesses. Over the years, China has introduced a whole set of supportive policies for ESCO and EPC development, from registration to operation via fiscal and taxation support to financing, as well as a long list of standards and rules for the measurement, monitoring and verification of EPCs. The 13th Five-Year Plan for National Development includes Energy Performance Contracting (EPC) as one of its key energy conservation projects and sets a target of doubling the ESCO sector's revenue by 2020 compared to the 2015 base.[5]

The targets for ESCO sector development in 2016-2020 are as follows:[6]

- Expanding and enhancing the energy conservation service sector's development innovations to the EPC business model, improving the benefit-sharing mechanism and promoting energy cost custody, guaranteed savings and equipment leasing services to meet the needs of the different energy-consuming enterprises.
- Support the provision of energy consultation, assessment, monitoring, testing and inspection, auditing and certification services. Encourage ESCOs to integrate upstream and downstream resources and provide one-stop EPC services, including diagnosis, designing, construction and operations.
- Encourage ESCOs to expand their services from single equipment and single content to energy system optimization and area energy efficiency improvements.
- The target is to increase the added value of ESCO services to 600 billion RMB by 2020.

3.1 Main policies on ESCOs and their evolution

In 2010, the State Council issued a document entitled *"Opinions on Accelerating Energy Performance Contracting (EPC) and Facilitating the Development of Energy Conservation Service Sector".* The document created a favourable policy environment for EPC dissemination in four respects.

First, the government increased its fiscal support. EPC projects are included in the scope of the national fiscal budget investment and the supporting scope of the National Special Fiscal Fund for Energy Conservation and Emission Reduction. The government also issued "Provisional Regulations on the Fiscal Rewards for EPC". In 2010, the central budget allocated 2 billion RMB to support ESCOs in implementing EPC projects for energy conservation.

Second, it set out preferential taxation policies. EPC projects are provisionally exempt from paying the business tax, as well as corporation tax for the first three years, the latter being halved for the next three years. When ESCOs transfer assets formed from EPC implementation to the facility's owners for free at the end of the energy performance contracts, they are exempt from paying VAT. All reasonable payments by facility owners to ESCOs under the EPC can be deducted from their current taxable income.

Third, the document improved the relevant accounting rules. When government agencies and public institutions use EPCs for energy conservation retrofitting, their payments to ESCOs should be treated as energy expenses in accountancy terms. When public institutions and enterprises use EPCs for energy conservation retrofitting, under the contract their payments to ESCOs should be treated as accounting expenses. The transfer of energy efficiency equipment to the host institution at the end of the EPC period is treated as a donation by the ESCO, which means they do not need to pay any tax on the asset transfer.

The fourth aspect was further improving financial services for ESCOs. Banks and other financial institutions are encouraged to introduce innovative credit products based on the financing needs of ESCOs, expand the scope of col-

[5] State Council, 2016. *Overall Plan for Energy Conservation and Emission Reduction during the 13th FYP*. Issued by the State Council

[6] The Development Plan for Energy Conservation and Environmental Protection Sector as part of the 13th FYP, jointly issued by the NDRC, MIIT, MOST, MOE.

Table 5. Overview of China's Main Policies on ESCOs and EPCs

Category	Sub-category	Specific measures	Policy Documents
Administration	Abolishing the ESCO registration system	It is forbidden to restrict the business operations of ESCOs based on their qualifications and registration.	*"State Council's Notice on the Overall Plan for Energy Conservation and Emission Reduction during the 13th Five-Year Period"* (2016)
	Establishing a blacklist system	Establishing a blacklist system of defaulting ESCOs, energy users, and third-party organizations, and list the defaulters on the national credit information sharing platform.	*"State Council's Overall Plan for Energy Saving and Emission Reduction during the 13th FYP"* (State Council, 2016) *The Action Plan for Energy Conservation by All during the 13th FYP* (NDRC, 2016)
	Establishing a registry and administration platform	The government establishes an online platform for an EPC registry and encourages energy users and ESCOs to register their EPCs in the registry.	The Action Plan for Energy Conservation by All during the 13th FYP (NDRC, 2016)
Legislation	*Energy Conservation Law* National People's Congress Original law: in 1997, amendments in 2007, 2016, and 2018	Contents on ESCOs: Article 22: "The state encourages the development of energy service organizations, supports them carry out consultation, designing, testing, auditing, and certification services on energy conservation." "The State supports energy conservation organizations to carry out awareness raising, technology training, piloting, and other public services regarding energy conservation." Content on EPC: Article 66: "The state shall use fiscal, taxation, and price policies to support demand-side management, **energy performance contracting**, and voluntary energy saving agreements."	The most important amendment was one in 2007 which extended the law from the original 50 articles to 87 articles. The other two amendments were minor.
Fiscal budget	Include in the national budget	EPC projects shall be included in the national investment budget and the support scope of the national budget for the special fund for energy conservation and emission reduction.	*"Notice on Speeding up EPC Implementation and Facilitating ESCO Development"* (General Office of the State Council, 2010)
Tax incentives	Corporate VAT exemption and reduction	The business revenue ESCOs receive from their EPC projects will be exempt from paying VAT, and the assets created from EPC implementation and transferred for free to project owners are expected from paying VAT.	*"Notice on Speeding up EPC Implementation and Facilitating ESCO Development"* (General Office of the State Council, 2010) *"Notice on the Policies Regarding the VAT, Business Tax, and Corporate Tax to Support the Development of Energy Conservation Services* (Ministry of Finance and State Taxation Administration, 2010)
	Tax exemption and reduction	ESCOs' income from EPC projects shall be exempted from paying corporate income tax during the first three years of receiving revenue. The tax rate is half the normal rates during the second three-year period.	*"Notice on Speeding up EPC Implementation and Facilitating ESCO Development"* (General Office of the State Council, 2010) *"Notice on the Policies Regarding the VAT, Revenue Tax, and Corporate Tax to Support the Development of Energy Conservation Services"* (Ministry of Finance and State Taxation Administration, 2010) *"Announcement on Preference Policies for the Corporate Income Tax for the EPC projects by ESCOs"* (NDRC, State Tax Administration, 2013)
Accounting rules	Accounting of equipment transfer	Upon expiration of energy performance contracts, the equipment transfer from ESCO to the facility owner is treated as donations.	*Notice from the General Office of the State Council on Facilitating the Development of Energy Service Sector* (2010)

Category	Sub-category	Specific measures	Policy Documents
Financial support	Using expected income as collateral	The state encourages banks and other financial institutions to accept the use of carbon emission right, pollution emission right, expected revenue from EPCs, and franchise revenue as collaterals for loans, and supports the leasing and other innovative financing services.	*13th FYP Plan on the Development of Energy Conservation and Environmental Protection Sector*
	Fixed asset collateral	ESCOs can use the fixed assets they invest in under EPCs as collaterals when applying for loans from banks.	*Notice from the General Office of the State Council on Facilitating the Development of Energy Service Sector* (2010)
	Risk-sharing	The government guides and supports various financial guarantee institutions to provide risk-sharing services.	*State Council's Overall Plan on Energy Conservation and Emission Reduction during the 12th FYP* (2011)
	Transaction platform	Establishing an asset transaction platform based on EPC assets	*State Council's Overall Plan on Energy Conservation and Emission Reduction during the 13th FYP* (2016)
	Investment fund	The government encourages social capital to set up investment funds targeting at energy conservation service sector.	*State Overall Plan on Energy Conservation and Emission Reduction during the 13th FYP* (2016) *Action Plan for Whole Society Participation in Energy Conservation during the 13th FYP* (NDRC, 2016)
	Green bonds, interest subsidies	The government supports ESCOs to issue green bonds and the combination of investment, bond issuance, and loans to facilitate the development of EPCs.	*State Council's Overall Plan on Energy Conservation and Emission Reduction during the 13th FYP* (2016)
	Insurance	Explore the development of green insurance and innovate insurance products targeting at EPCs and third-party involvement in environmental pollution reduction.	*13th FYP Plan on the Development of Energy Conservation and Environmental Protection Sector* (2016, NDRC, MIIT, MOST, MOEE)
Public institutions	Business model selection	Public institutions should prioritize EPCs during their energy efficiency retrofitting; the government actively supports public procurement of EPC services and explores the business model of energy use and cost custody.	*State Council's Notice on Energy Conservation and Emission Reduction during the 12th FYP* (2012) *State Council's Overall Plan for Energy Conservation and Emission Reduction* (2016)
	Payments to EPCs treated as energy expenses in public spending.	When government agencies engage EPC services for energy retrofitting, the payments to ESCOs under EPCs should be treated and reported as energy expenses in accounting.	*Guidance on Speeding up EPC Development and Promoting Development of the Energy Service Sector* (State Council, 2010) *Energy Conservation Plan for Public Institutions during the 13th FYP* (State Council, NDRC) *Notice on Improving the Energy Efficiency of Public Buildings and Key City Construction* (MOHURD and China Banking Regulatory Commission, 2017) *State Council's Overall Plan on Energy Conservation and Emission Reduction during the 13th FYP* (2016)
	Public institutions may seek EPCs in energy conservation.	Public Institutions may adopt **energy performance contracting** and commission energy service companies to conduct energy conservation diagnosis, designing, financing, retrofitting and operations management. During their energy efficiency retrofitting, public institutions should conduct an energy audit and cost-benefit analysis, specify the energy-saving targets, and check and assess whether the energy-savings targets are achieved through measurement and data collection.	*Bylaw on Energy Conservation for Public Institutions* (Standing Committee of the National People's Congress in July 2008)

Category	Sub-category	Specific measures	Policy Documents
	Public institutions can preserve part of their energy cost-savings and other incentives.	Improve the subsidy policies for EPCs of public institutions and the partial preservation of energy cost-savings, stimulate social investment in energy conservation projects in public institutions, and facilitate the development of the ESCO sector.	The Energy Conservation Plan for Public Institutions during the 12th FYP (Government Offices Administration, State Council, 2011)

Table 6. The ESCO certification system

Name	Criteria	Focus	Categories	Grading	Validity
ESCO Certification and Grading	*Instructions on Promoting Energy Performance Contracting and Energy Service Sector Development* (State Council, 2010); *Regulations on ESCO Certification and Grading* (amended in 2018)	*Overall competence*	Industry Building Public Facility	AAAAA AAAA AAA AA A	2 years
ESCO Credit certification and grading	*Provisional Regulations on Credit Evaluation and Grading for Energy Conservation Sector (Enterprises)* (China Energy Conservation Association, 20	Credit, operation	Production; Service	AAA, AA, A BBB, BB, B CCC, CC, C	3 years
Certification for the Qualification to Conduct EPC Services	Requirements for the Certification for Enterprises for Conducting EPC Services	Service quality, process control, service performance	Boilers (kilns), waste heat and waste pressure utilization, motor system energy saving, energy system optimization, building retrofitting, solar PV	AAAAA, AAAA, AAA, AA, A	3 years

laterals, simplify loan applications and approval procedures, and provide project financing and guarantee services to ESCOs. ESCOs should be allowed to use the fixed assets generated from their investments in EPCs as collateral when they apply for bank loans.

3.1.1 ESCO and EPC administration

At the beginning, all ESCOs were subject to government approval and registration. To seek registration by the National Development and Reform Commission (NDRC), they needed a recommendation from the Ministry of Industry and Information Technology (MIIT). This system has shifted to a system of voluntary registration, namely an ESCO certification system based on the ESCO's technical competence, economic capacity and credit record. Enterprises that default on their contracts and promises are blacklisted, and information about this is made publicly available. Table 6.

3.1.2 Tax incentives and government subsidies

The ESCOs that implement shared saving EPCs can enjoy the preferential policies of a "3-year exemption" and "3-year half rate" for corporate income tax payments based their income from such projects. If the contracting period is shorter than six years, then the actual preferential tax period is the duration of the shared saving EPC.[7]

3.1.3 Subsidies from national and local governments

EPC projects are included in the supporting scope of national budget investments and the national special budget fund for energy savings and emissions reductions. The energy retrofitting projects that ESCOs implement via EPCs can receive subsidies or rewards. Subsidies from local governments can be applied in advance and settled on the basis of actual

[7] State Taxation Administration and NDRC, 2013. Announcement on Preferential Policies on Corporate Income Tax for EPC Projects. http://www.chinatax.gov.cn/n810341/n810755/c1149419/content.html

energy savings and emissions reductions. *The Interim Measures for the Management of Financial Incentive Funds for EPC Projects* issued by the Ministry of Finance and NDRC in 2010 and more than 2 billion RMB from the national fiscal budget was allocated to the special fund. This also set the standards for central budgetary rewards of RMB 240/tCe, while the rewards from province-level fiscal budgets should be at least RMB 60/tCe.[8]

In 2015, the *Interim Measures for the Management of Fiscal Incentive Funds for EPC Projects* were replaced by the *Interim Measures on the Management of Subsidies for Energy Saving and Emission Reduction*. The 2015 Interim Measures stipulate that fiscal subsidies should be results-based rewards; EPC projects can receive some grants in advance, and then the subsidies should be settled on the basis of actual energy-saving effects.[9] In January 2020, the Ministry of Finance updated the 2015 version of the Interim Measures on the Management of Subsidies for Energy Saving and Emission Reduction and extended the duration of the financial rewards to 2022.[10] Upon expiry, the government may consider whether to continue offering the subsidies for longer.[11]

3.1.4 Financing

The financing policies for EPCs include encouraging banks and other financial institutions to accept the assets ESCOs invest in EPCs and their expected revenues from EPCs as collateral for bank loans, guarantees, insurance products for risk management and green bond issues. The Beijing Environmental Exchange has set up an investment and financing platform for EPC assets where ESCOs can sell their future revenue flows from EPC projects and raise funding for new EPC projects.[12] The government also encourages public-private partnerships in the funding of energy efficiency projects and ESCOs and green bond issues by ESCOs. It also supports the development of EPCs by innovatively combining investments, bonds and bank lending.[13]

From 2009 to 2017, another international project financed with World Bank loans and GEF grants was aimed at supporting innovation in energy conservation financing and policy improvements, as well as the NDRC and the National Energy Conservation Centre. These projects involved USD 350 million of loans from the World Bank and USD 13.5 million of grants from 2009 to 2017. The NDRC is the Chinese partner, while the China National Energy Conservation Centre was responsible for day to day project management. Three Chinese banks, China Import and Export Bank, Huaxia Bank and Minsheng Bank, were the local financial institutions that re-lent the World Bank loans to finance energy conservation, waste-heat utilization and coal substitution projects in such industries as iron and steel, electricity, chemicals, building materials and petrochemicals. The loans leveraged over RMB 20 billion of investment in energy conservation and generated an annual energy-saving capacity of 4.41 MtCe and an annual CO_2 generating capacity of 10.77 Mt. The USD 13.5 million was spent on policy study and capacity-building for energy conservation.[14]

Seeing lending to energy efficiency projects and opportunities as a new business opportunity, some commercial and local banks, such as the Beijing Bank, Industrial Bank and Shanghai Pudong Development Bank, offer loans for EPC projects. Financing has been a key area in the various efforts to boost ESCO market development in China.

3.2 Policy drivers of ESCO markets in different sectors

3.2.1 Industrial sector

As the world's factory, China has a large industrial sector. In 1990, industry accounted for 70% of China's primary energy consumption and 67% of its final energy consumption. Improving industrial energy efficiency has been a priority of the government's various policies and efforts to achieve improvements in energy efficiency and emissions reductions. The rapid boom in heavy industry and construction since the early 2000s makes slowing down the industrial sector's demand for energy a difficult task. After almost three decades of strong efforts to make energy efficiency improvements, industry still accounted for 66% of China's primary energy consumption and 65% of its final energy consumption.[15]

[8] Exchange rate of RMB: since 2008, the USD/RMB has been in the range between 6 and 7.
[9] http://www.gov.cn/gongbao/content/2015/content_2912375.htm
[10] http://www.gov.cn/zhengce/zhengceku/2020-02/21/content_5481719.htm
[11] Provisional Regulations on the Administration of the Energy Conservation and Emission Reduction Subsidies (MoF), 2020 version (Issued to replace the 2015 version).
[12] China Beijing Environment Exchange, https://www.cbeex.com.cn/article/ywzx/htnygl/
[13] State Council, 2016. Overall Plan for Energy Saving and Emission Reduction during the 13th FYP.
[14] Enhance energy-saving financing and support the thriving and expansion of energy saving sector – conclusion meeting of the China Energy Saving Financing Project is held in Beijing. 2017/06/06. https://www.ndrc.gov.cn/fggz/hjyzy/jnhnx/201706/t20170606_1134137.html
[15] NSBC, 2020. China Statistical Yearbook 2020.

Table 7. Energy efficiency targets for big energy consumers

	Key programs for big energy users	GDP decrease in energy intensity in the industrial sector	
	Big energy users	Target	Actual
11th FYP (2006-2010)	Top 1000 Programme	-20%	-19.1%
12th FYP (2011-2015)	Top 10,000 Programme	-16%	-18.4%
13th FYP (2016-2020)	Top 100, 1000, and 10,000 Programme	-15%	

The main policies for industry include energy-intensity targets for key industrial sectors, products and processes, energy efficiency targets for large industrial energy users (see Table 6), and using energy efficiency as a criterion before new investments in industrial projects can be approved. The enterprises on the list have to report their annual energy use and GHG emissions, subject themselves to government inspections, and release their energy and emission performance data to the general public. The government can require enterprises that are failing to meet their targets to take immediate corrective action or be forced to close down their polluting and inefficient industrial facilities. As a result, the industrial sector has been able to meet the energy-intensity targets through the rapid deployment of efficient technologies. Apart from subsidies and tax incentives for investments in energy efficiency, the government also uses energy prices as a tool to motivate energy efficiency actions. It is strong policies promoting energy efficiency in the industrial sector and the relatively high returns from energy efficiency investments that make industry the most important component of the ESCO market in China.

Moreover, the focus on motivating improvements to energy efficiency in energy-intensive sectors in the form of technology catalogues, standards and guidance on energy efficiency auditing, benchmarking, diagnosis, measurement, monitoring, verification and certification also support ESCO services in the industrial sector. The National Promotion Catalogues for Key Energy Saving Technologies are intended to stimulate energy savings and emissions reductions in all industrial facilities. The catalogue targets both equipment manufacturers and energy users. The first version of the catalogue was issued in 2008, and as of early 2020 it has been updated ten times. The NDRC makes the different versions of the catalogue available on its website, and various fiscal and taxation measures are linked to the adoption of the technologies featured in the catalogue.[16]

As the governing authority for the industrial sector, the MIIT has actively engaged in standard-setting in assessing and calculating energy savings in various industries, which can help avoid controversies over EPCs and other energy service contracts by ESCOs. For instance, in 2012, the MIIT published technology catalogues, technical guides and application case studies for energy savings and emissions reductions in eleven key industries.[17] In 2017, it launched an "Action Plan for Industrial Energy Saving and Green Development Standardization" (2017-2019), focusing on establishing a set of energy-saving standards for such industries as iron and steel, building materials, metallurgy and machinery manufacturing. In August 2020, it published guides for Industrial Energy Saving Diagnosis (IESD) services in six key industries: iron and steel, cement, electronics, textiles, food and paper, as part of an "Action Plan for Industrial Energy Saving Diagnosis (IESD)", facilitated the development of IESD services, and further enhanced the standards and quality of IESD services.[18]

3.2.2 Commercial buildings

Like other sectors, the commercial sector faces many mandatory requirements and financial incentives regarding energy savings, including using EPCs for energy renovation

[16] SEforALL Industrial Energy Accelerator, 2020. *China Energy Saving and Low-Carbon Technologies Catalogue and Financial Incentives to Promote Energy Efficiency Technologies*. Available at https://www.industrialenergyaccelerator.org/

[17] 2012. Technology Catalogue and Technical Guides Issued for 11 Key Industries. http://news.cncaa.org/17283.html

[18] MIIT Issued Guidance on Energy Saving Diagnosis for 6 Key Industries. http://www.solidwaste.com.cn/news/313673.html

purposes. Unlike many other countries, however, in China the electricity, natural gas and heating prices for industry and commercial consumers are higher than those for households, providing an additional motivation for businesses to take energy-saving actions.[19]

In China, energy prices are controlled by the government, and the Price Department at the NDRC sets the benchmark prices, while local DRCs decide their own local prices. The prices differ for different energy-user groups, including households, large industrial clients, ordinary industrial and commercial users, and agricultural users. Among them, the energy price for households is the lowest, while those for ordinary industrial and commercial users are the highest. Despite repeated government efforts to reduce the prices for industry and commercial users, they remain higher than those for other user groups. As energy prices vary from province to province, Tables 8, 9, and 10 use the prices for electricity, heating and natural gas in Beijing to illustrate the high energy prices that commercial consumers need to pay.

A price range is given because there is a progressive tier-based price structure for households, while for industrial and commercial consumers electricity prices depend on their voltage requirements and are divided into two parts, one based on installed capacity, the other on actual usage. In Table 7, the median levels are the level for the middle tier or middle capacity and consumption level.

3.2.3 Public buildings

In October 2008, the State Council enacted an *"Energy Conservation Bylaw for Public Institutions"*[20] setting out the various measures public institutions should adopt to save energy and improve energy efficiency. The measures include using energy efficiency as a criterion in deciding public procurements of products and services, establishing quotas for energy consumption and annual targets for energy conservation, carrying out energy audits and energy management, collecting data and reporting energy use. Public institutions' performances in respect of energy conservation will be evaluated on the basis of their total energy use in different years, per-capita energy use and per-floor area energy use. The government also regularly publishes a catalogue of energy efficiency products and services to support public procurement.

One barrier to energy conservation by public institutions was that public institutions used to fund their energy bills and fixed asset investments from different budget lines, making it impossible for them to engage ESCOs to undertake energy performance contracting.[21] This barrier was removed in 2010, and local public institutions can now include their payments to ESCOs for EPCs as part of their energy expenses and pay them from the government budget.

The government is calling for the implementation of preferential tax policies to ESCOs and encouraging governments at all levels to enhance their support to EPCs. Payments by government agencies and public institutions to ESCOs for EPCs are treated the same as energy expenses.[22]

To encourage energy savings in public buildings, the Chinese government has issued detailed technical guidance on energy consumption monitoring, data collection and transmission, as well as metering equipment installation, the building operations of hospitals, colleges and universities, government office buildings and large public buildings.[23] In 2016, the Ministry of Housing and Urban-Rural Development (MOHURD) issued Guidance for Energy Auditing for Public Buildings.[24]

3.3 Various standards for ESCO services

China has issued over two hundred standards and guidance documents related to energy savings. These standards and guidance provide a solid technical basis for various aspects of ESCO services. The most important one is the *General Technical Rules for Energy Performance Contracting*, issued in 2010 by the Administration of Quality Supervision, Inspection and Quarantine (AQSIQ) and the Standards Administration of China (SAC), which only recognizes the shared savings contract model. In 2020, the document was updated to include all three models of ESCO services: shared savings, guaranteed savings, and services not linked to the results of energy savings. Table 11 lists the most important national standards affecting ESCO services.

[19] Xianli Zhu, 2020. "A Review of China's Energy Efficiency Policies for the Industrial Sector Since 1990". Chapter 9 in Energy Efficiency in Developing Countries: Policies and Programmes, edited by Suzana Tavares da Silva and Gabriela Prata Dias. Routledge Talor & Francis Group, London and New York.

[20] Decree No. 531 of the State Council of People's Republic of China, *"Energy Conservation Bylaw for Public Institutions"*. The bylaw was amended in 2017, but the amendment is related more to changes in government approval procedures, not energy conservation requirements.

[21] IFC report mentioned this?

[22] State Council, 2016. Overall Plan for Energy Saving and Emission Reduction during the 13th FYP.

[23] http://ecpi.ggj.gov.cn/gather-news

[24] https://www.emca.cn/site/content/109387.html

Table 8. Energy prices in Beijing, 2020

	Households	Ordinary industrial and commercial clients	Large industrial clients	Agricultural electricity use
Electricity (RMB/KWh)	0.44-0.79 Median: 0.53	0.32-1.73 Median: 0.85	0.33-1.07 Median: 0.66	0.31-0.93 Median: 0.6

Source: Electricity sales price in Beijing. http://fgw.beijing.gov.cn/bmcx/djcx/jzldj/202003/P020200331428682714728.pdf

Table 9. Heating prices in Beijing, 2020

			6 downtown districts	Other
Residential	Based on floor area (RMB/m² per season)		16.5/24depending on fuels and suppliers	
	Based on metering	Basic price (RMB/m² per season)	7, 12, 18 depending on fuels and suppliers	
		Use (RMB/KWh)	0.16	
Non-Residential	Based on floor area (RMB/m² per season)		45	43
	Based on metering	Basic price (RMB/m² per season)	18	18
		Use (RMB/KWh)	0.36	0.33

Source: Beijing Municipal Government. http://csglw.beijing.gov.cn/csyxbz/fwxx/grfw/201912/t20191203_824589.html

Table 10. Natural gas prices in Beijing, 2019

Uses		Heating season	Non-heating season
Households	Tier 1: 2.61, Tier 2: 2.83, Tier 3: 4.23		
Gas for electricity generation		2.57	2.29
Gas for heating and cooling	Downtown	2.75	2.47
	Outskirts	2.51	2.23
Industrial and commercial use	Downtown	3.15	2.87
	Outskirts	2.91	2.63
Filling stations for compressed natural gas	Residential	2.12	2.10
	Non-residential	2.61	2.33

Source: Beijing Price, 2019. http://www.beijingprice.cn/c/2019-05-01/489008.shtml

Table 11. China's National Standards for ESCO Services

	Year of issue and amendment	Standard No.
General Technical Rules for Energy Performance Contracting	2010, 2020	GB/T 24915
General principles for the Energy Balance of Equipment Using Energy	1981,2009	GB/T/2587
General Principles for the Calculation of Overall Energy Consumption	1981, 1988, 2008	GB/T/2589
The General Principles for the Energy Balance of Enterprise	1993, 2009	GB/T/3484
Determination of Energy Savings in Organizations	2009, 2018	GB/T/13234
General Principles for Monitoring and Testing of Energy Savings	1994, 2009	GB/T/15316
Technical Guidance for Energy Auditing	1997, 2019	GB/T/17166
Requirements on Energy Management Systems	2009, 2012	GB/T23331
General Technical Rules for Measurement and Verification of Energy Saving	2012	GB/T 28750
Operation Guide for Energy Saving Measurement and Verification	2015	GB/T 30045

Source: prepared by the author.

4. Remaining barriers to ESCO development and solutions

4.1 General barriers to EPC development

One main barrier often mentioned to the deployment of EPCs is the lack of finance. Chinese ESCOs still mainly rely on their own equity funding as the main source, plus bank loans. Existing data indicate that in 2017, 65.2% of ESCO funding came from their own equity funds, 28.1% from bank loans. Many banks still find it risky and complicated to offer loans to EPC projects. A lack of finance delays project implementation and constrains the expansion of the ESCO market.[25]

Other barriers are limited technical capacity and irregular market competition. The Chinese ESCO market includes a large number of small ESCO companies that lack technical capacity and experience of doing projects. The fierce market competition sometimes leads to price wars and poor services, which damage clients' confidence in ESCO services.

Although China has established over two hundred standards for energy efficiency actions in different sectors, there remain some gaps in technical and commercial standards, as well as in rules for specific areas of EPC projects and implementation, for instance, in industries that are not energy-intensive. This makes it difficult to implement EPCs in specific areas.

Another issue is the continuity of subsidies and the coordination of different incentive systems. The existing policy indicates that the subsidies for EPC projects will last until 2022, at which point the future of the policy will be decided.

4.2 Barriers to ESCO services in the residential building sector

Globally, there is little ESCO presence in the residential building sector. Apart from the usual issues of difficult coordination with residential buildings, ESCOs face some additional barriers to operating in the residential buildings market in China. Residential buildings in Chinese cities are mainly high-rise apartment blocks, most of which were built after the housing reform of the late 1990s. According to the 2018 *China Urban and Rural Construction Yearbook*,[26] in 2018 China had 8.78 billion square meters of heated floor area, of which 72.9% are in residential buildings and the rest in public and commercial buildings. Traditionally, central heating is only available in the north of the country and is considered a kind of social benefit provided by municipal governments. Local governments are obliged to ensure that all households can achieve a minimum indoor temperature of 18°C during the heating season. The start and end dates of the heating season are fixed by the city. For instance, in Beijing, the heating season runs from 15 November to 15 March of the following year. However, the central heating service can start early if the daily average temperature falls below 5°C for five consecutive days.[27]

Local residents' heating bills depend on the size of their apartments and a fixed rate in RMB per square meter of floor area per heating season. Residents can neither adjust nor turn off the heating supply to their apartments. Often only around 80% of the heating charges can be collected. The heating price system means that any energy cost savings from their building retrofitting goes to the heat supply company instead of the household. This system prevents ESCOs from taking on projects in China's residential building sector. Despite the recent reform to introduce the metering of residential heating supplies, progress has so far been limited.

In summary, there are two key barriers to energy efficiency retrofitting based on EPC: 1) the majority of households pay for heating based on the size of their apartments, not on their metered usage of heating; and 2) the low energy prices for households mean a longer payback period for investments in energy efficiency. Moreover, the lack of properly enforced energy performance certification for buildings mean that even households with energy meters face the risk of being unable to recover their investment in energy efficiency retrofitting when they sell their apartments.

4.3 Barriers to EPCs in the transport sector

During the pilot stage of ESCO development under IFC support, there were two pilot EPC projects for the transport sector. However, as the energy efficiency retrofitting of transport infrastructure tends to have a long payback period and low returns, and because the majority of China's transport infrastructure is relatively new, as in most other parts of the world transport EPCs are rare and have a low potential for further development.

[25] http://www.cnseia.com/zixun/nyjy/jnrz/95193.html

[26] MOHURD, 2019. 2018 China Urban and Rural Construction Yearbook. Available at http://www.mohurd.gov.cn/xytj/tjzljsxytjgb/index.html, accessed on 9 November 2020.

[27] https://finance.sina.com.cn/china/dfjj/2020-10-09/doc-iivhuipp8716932.shtml

4.4 Possible solutions

In the residential sector in the last two decades, the government has been promoting energy, especially the metering of heating. However, progress is mainly visible in new buildings. Energy efficiency retrofitting in residential buildings needs effective enforcement of energy efficiency certification for buildings and large investments in heating pipe and meter retrofitting, as well as changes in social attitudes to heating, to the move from a public welfare service to market-based services and to energy prices, especially heating pricing reform for the residential sector.

The existence of a large number of small ESCOs with low capacities is a commercial phenomenon. This issue can be addressed through market competition, support policies for mergers and acquisitions, and further capacity-building, certification and accreditation. The existing accreditation system for ESCOs is voluntary, and only a small number have been accredited. Further technical qualification and financial capacity, as well as business performance accreditation, can develop the market further.

Regarding the financing barriers, the government needs to create innovative ways to increase the role of ESCOs further, like allowing large and successful ESCOs to raise funding by listing on the stock market and issuing a green bond, as well as increasing government guarantees and the national revolving fund for EPC projects.

Although launching a national emissions trading system may to some extent fill the gap in financial incentives for EPCs, the prevailing uncertainty is a barrier to investments in energy efficiency projects. The government needs to decide its subsidy policies as soon as possible to provide certainty for investments in EPC projects. It also needs to study the effects of its efforts to reduce energy prices for industries and commercial consumers on the profitability of energy efficiency projects and opportunities, as well as find ways to avoid them having negative impacts on energy efficiency actions.

5. Conclusion

Since the ESCO and EPC concepts were introduced into China in 1998, in less than three decades the country has become the largest ESCO market in the world. China's experience with these concepts offer a valuable model for other countries seeking to use ESCOs to achieve energy efficiency and emissions reductions. The country's strong policies for improving energy efficiency are playing an important role in this process. Other factors include effective international support and an industrial association that helps improve awareness and offers training.

China has pledged to peak its carbon emissions by 2030 and to achieve carbon neutrality by 2060. In the country's efforts to build a resource-efficient and circular economy and to improve its international competitiveness in green and efficient technologies, ESCOs have bright market prospects.

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