Evolving Energy Service Companies in China

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Abstract

Energy service companies (ESCOs) deliver energy efficiency projects that are financed through the resulting energy cost savings. ESCOs can thus unlock energy efficiency action by addressing barriers related to funding and technical expertise. Despite their potential, many governments still struggle to stimulate development of a market for ESCOs. Evolving Energy Service Companies in People's Republic of China, ("China" hereafter) provides an overview of how China has built the world's largest and fastest growing ESCO market over the past decades. This report highlights how the government's strategic measures to set up key agencies for ESCOs, engage the State-Owned Enterprises, and encourage market play by bringing in commercial players, in line with China's socio-economic transition, have been critical to making the Chinese ESCO model a success. Looking ahead, ESCOs in China continue to evolve, for example by using digital technologies to make their businesses more sustainable and lucrative. Based on the insights gained from a survey of major ESCOs in China, the report highlights the challenges and opportunities of digitalisation and provides some policy insights.

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Executive summary

China has the world's largest and fastest growing ESCO market

Energy service companies (ESCOs) deliver energy efficiency projects that are financed by energy savings gained throughout the life-time of investments. The model is of increasing interest as governments and businesses seek to grasp the many benefits of energy efficiency. Despite the important role they can play, the full potential of ESCOs remains untapped in many economies.

The success of ESCOs in the People's Republic of China (hereafter China), now home to the world's largest and fastest growing ESCO market, can provide many policy insights for governments looking to build or promote a robust ESCO market. Since the roll-out of the first pilot projects in the late 1990s, ESCOs have flourished across the country. In 2020, China's total investment in ESCO projects grew 12.3% to USD 19.2 billion, making up 59% of the global ESCO market. This is a significant achievement considering that many other ESCO markets grew slowly or even contracted in 2020[1].

ESCOs bring multiple benefits that support China's clean energy transitions

Improving energy efficiency delivers multiple benefits to society. IEA analysis shows that without energy efficiency gains since 2000, China would have used nearly 25% more energy in 2018. Energy efficiency has also delivered around 2.1 Gt CO_2-eq of emissions reductions over the same period, equivalent to almost two-thirds of the annual emissions of the European Union (EU-28). This has also avoided around 14% additional fossil fuel imports.

While driving energy efficiency, ESCOs also bring multiple benefits to society. In 2019, ESCO driven energy savings reached over 1.1 EJ[2] per year – more than the final energy consumption of Austria – equivalent to reductions in CO_2 emissions of around 103 Mt CO_2. In 2020, ESCO projects saved 1.2 EJ. Despite the outbreak of Covid-19 in 2020, the number of ESCOs operating in China increased by 500 to about 7 000, hiring a total of 770 000 employees.

[1] IEA annual ESCO survey 2021.
[2] 38 million tonnes of coal equivalent (Mtce).

Joint government and international organisation support helped scale up ESCOs in China

During the 1990s, as China transitioned from a planned economy to an open market economy, ESCOs emerged as a promising business model for driving energy efficiency. The State Economic and Trade Commission, with support from the World Bank and funding from the Global Environment Facility established the China Energy Conservation Project, which launched the first domestic ESCOs in 1998. Building on theseinitial pilots, the World Bank provided additional funding to set up the China Second Energy Conservation Project from 2002 to 2010. While the first phase tested the feasibility of Energy Performance Contracts in China, the second phase aimed to resolve the primary barrier encountered, namely limited access to capital, by establishing a loan guarantee programme for ESCOs. From 2004 to 2009, 42 ESCOs obtained loans through the guarantee programme to roll out 148 projects. It is estimated that these projects saved around 17.3 PJ[3] per year, reducing CO_2 emissions by around 377 000 tonnes.. At the same time, the *Energy Management Companies (EMC) Development and Service Group* was established in 2001, becoming the Energy Management Companies Association (EMCA) in 2003 under the China Energy Conservation Association. Since that time, EMCA has played a critical role promoting ESCOs in China through knowledge sharing, research, and capacity building.

Strategic partnerships enabled ESCOs to flourish in the industry sector

In early stages, ESCOs that were either founded by or affiliated with State-Owned Enterprises (SOEs), such as Baosteel, an iron and steel conglomerate, or power companies, like State Grid, showed the strongest growth. These ESCOs had easier access to clients through their parent SOEs' existing networks, and benefitted from additional capital that could cover significant upfront costs. Association with large state-owned companies also provided enhanced financing credibility. The most successful example is the state-owned power generator Guodian, which in 2004 established a subsidiary group specialising in energy conservation: Guodian Technology & Environment Group Corp, listed on the Hong Kong Stock Exchange. On the technical side, ESCOs were primarily focused on saving energy through equipment upgrades. This straightforward, easily replicable business model facilitated rapid escalation of ESCOs in the industrial sector, which was the China Energy Conversation Project's primary objective.

[3] 589 000 tonnes of coal equivalent.

As ESCOs flourished, government focus turned to maturing the market

The 12th Five-Year Plan (2010-2015) saw drivers that accelerated ESCO market development. The government introduced a set of fiscal incentives, including business tax exemptions, Value Added Taxes (VATs) and tax reductions for energy savings-related expenses for ESCO clients. The government also promoted ESCOs as a profitable business opportunity and encouraged provincial and local governments to proactively make use of the expanding ESCO market. This comprehensive policy support helped position ESCOs as a driver for both economic development and environmental protection. In 2011, at the start of the 12th Five-Year Plan, there were about 1 400 ESCOs with projects worth approximately USD 5.9 billion; in 2016, there were 5 800 ESCOs with projects worth approximately USD 15 billion.

Towards the end of the 12th Five-Year Plan period, the Chinese government began phasing-out subsidies and other energy savings incentives that had rewarded ESCOs and started strengthening energy efficiency and environmental targets.. For instance, the 13th Five-Year Plan (2016-2020) introduced a 'double limitation' approach that restricted both energy intensity and total energy consumption levels. The TOP 10 000 programme that imposed mandatory energy efficiency targets on the country's top 10 000 most energy-intensive enterprises was upgraded to the TOP 100, 1000, 10 000 programme under the 13th Five Year Plan, boosting demand for ESCO services in the industry sector.

The government encouraged private sector engagement, particularly commercial banks, to overcome their financing challenges. In 2015, under China's G20 Presidency, G20 nations adopted a new long-term strategy to catalyse energy efficiency financing. Five Chinese banks: Industrial Bank, Industrial and Commercial Bank of China (ICBC), Bank of Jiangsu, Agricultural Development Bank of China and Huaxia Bank joined a global mobilisation of over 115 banks promoted by the G20 Energy Efficiency Finance Task Group. Other financial institutions, such as State-owned Leasing, followed and launched special green finance products that support ESCOs. Due to the government's multi-pronged policy approach and promotion of a market for sustainable growth, ESCOs continued to thrive.

Challenges and opportunities for ESCOs in China

ESCOs in China grew at an unprecedented pace over the past 20 years. However, there are still barriers that could compromise their sustainable development.

Primary barriers include: a low demand for energy efficiency services from end-users; a lack of ESCO technical capacity, particularly in small- and medium enterprises (SMEs), to take on the advanced demand-side management projects that are required; and persistent financing difficulties. These challenges fundamentally stem from the difficulty in placing a value on the invisible fuel that is energy efficiency, which can make investing in such projects appear risky and unattractive.

Digitalisation, the application of digital tools and technologies, presents an enormous opportunity for ESCOs to overcome their various challenges. A joint survey carried out by the IEA and EMCA on the largest ESCOs in China showed that digital tools were already in use, albeit in varying ways and degrees, for both project operation and business management. An increased use of digital tools and technologies, such as smart sensors and big data, allows for more transparent and systematic energy savings monitoring and verification (M&V), which in turn helps gain trust from investors and clients, and opens up opportunities for broader energy system benefits and facilitates project financing. The companies surveyed also highlighted how digitalisation could stimulate more innovative business models and greater diversification of their business portfolios. Some innovative business models, such as cooling-as-a-service or pay-as-you-go models, have already been piloted.

Digitalisation can help ESCOs transform into integrated energy service providers

Simple equipment upgrades that were common in the early years of the ESCO market formation are no longer as attractive to customers. However, the demand for more comprehensive, intelligent services that can optimise the energy system is growing. The term "integrated energy service" refers broadly to a comprehensive set of solutions that cover the full energy value chain in an integrated way through a range of services optimised for cost efficiency, including:

- integrated energy transmission and distribution service
- power market trading service
- distributed energy development and supply service
- integrated energy system construction and operation service
- energy efficiency service
- environmental energy service
- integrated energy storage service
- integrated smart energy service

ESCOs are well-positioned to transform into integrated energy service providers and lead the growing market. ESCOs can leverage their existing partnerships with energy companies and utilities to consolidate their position through providing energy efficiency services, which is the most mature market segment within the integrated energy service sector. ESCOs could also enter other promising market segments, such as integrated smart energy or energy system construction and operation. ESCOs that become more experienced and versatile with digital tools and technologies are more likely able to expand their business horizons and gain prominence as integrated energy service providers.

New policies are needed to support the next generation of ESCOs

Digitalisation can open a new phase of modernised energy efficiency and transform ESCOs. In practice, however, many ESCOs, particularly those of small and medium size, either cannot afford or lack the capacity to use digital tools to their best advantage. There is also a lack of clear guidance and legal protection related to data use and security, which could discourage innovative applications of digital technologies. There is an opportunity for the Chinese government to step in and fill the policy gaps necessary to support digitalisation of the ESCO market.

The government could also work directly with ESCOs, particularly SMEs, to implement pilot projects. Leading by example is an effective way to test the feasibility of various digital business models, highlighting those policies that minimise risks and promote best practice. Since many Chinese companies, such as Baidu and Tencent, invest heavily in developing digital technologies and their business applications, sharing knowledge can help those ESCOs looking for practical advice and guidance.

Market history and developments

Key policy insights

- The successful development of Chinese Energy Service Companies (ESCOs), particularly their achievements in the industrial sector, can largely be attributed to a combination of three factors:
- Financial and policy support from the Chinese government and international financial institutions provided a foundation for ESCOs to flourish in China, demonstrating the feasibility of Energy Performance Contracting (EPC) models in the country.
- Strategic engagement with large, State-Owned Enterprises (SOEs) responsible for China's major industries, such as iron and steel, helped ESCOs to gain public trust and grow in scale.
- ESCOs concentrated on simple equipment replacement through shared savings contracts. This easily replicable business model facilitated a rapid escalation of ESCO activities in the industry sector, resulting in significant energy savings.

History of ESCO development in China

In the 1990s, China embarked on a profound socio-economic transition from a planned economy to an open market economy. This changed China's approach to energy conservation, which had become one of China's top priorities. Chinese policy makers turned to Energy Performance Contracting (EPC) through Energy Service Companies (ESCOs) – referred to as Energy Management Companies (EMCs) in China – as a way to both create a commercial market for energy conservation and to attract private investment.

ESCOs and EPCs in China began to emerge amid this economic transition. The State Economic and Trade Commission, supported by the World Bank and funded by the Global Environment Facility, established the China Energy Conservation Project and introduced the first domestic ESCOs in 1998. This USD 78 million project helped establish China's first three ESCOs in three different regions: Shandong Rongshihua Leasing Company Ltd., Beijing Yuanshen Energy Saving Technology Co. Ltd. and Liaoning Nengfa Weiye Energy Technology Co. Ltd. These initial projects targeted the most energy-intensive industries, such as cement and iron and steel, to maximise their energy-saving benefits. As more

projects were introduced, some State-Owned Enterprises, provincial investment and power companies and the European Commission provided additional funding and technical assistance. With this additional support and effective national and local coordination, ESCOs thrived across the country between 1998 and 2006, completing 475 projects and yielding a net profit of CNY 402 million (USD 50 million).

Building on the project's initial success, the World Bank provided an additional USD 26million to continue the project from 2002 to 2010 under the China Second Energy Conservation Project. While the first phase tested the feasibility of EPCs in China, the second phase established an ESCO loan guarantee programme, operated by China National Investment and Guarantee Company (I&G) with support from the Global Environment Facility (GEF) and the government, that aimed to resolve the project's core obstacle, namely limited access to capital. An important function of I&G was to cover the risks of EPC contract defaults. From 2004 to 09, 42 ESCOs obtained loans through the guarantee programme to implement 148 projects. Of the total CNY 909 million (USD 114million) invested in these projects, more than half came from guaranteed loans. It is estimated that these projects saved around 590 000 tonnes of coal-equivalent of energy per year, reducing CO_2 emissions by approximately 380 000 tonnes.

Another achievement in the second phase was the establishment of the *Energy Management Companies (EMC) Development and Service Group* in 2001, which became the Energy Management Companies Association (EMCA) in 2003, a sub-association of China Energy Conservation Association. Since then, EMCA has been critical to promoting ESCOs in China.

Box 1.1 Energy Management Companies Association (EMCA)'s role in facilitating the growth of China's ESCO industry

EMCA supported the growth of China's ESCO industry and guided its development throughout the various phases of the government's ESCO support policies. EMCA membership has grown from 59 members in 2004 to 1 300 in 2020. EMCA's initial role was to support ESCO industry growth by promoting the uptake of government subsidies for ESCOs and EPCs. when these subsidies were reduced in the 12th Five-Year Plan, EMCA set out the following as its focus areas:

- **Facilitate self-regulation** through standardised appraisal and rating of ESCOs, assist in the evaluation of ESCO credit ratings and certification of their services. These standardised assessment mechanisms and processes have become

well-respected and trusted voluntary standards across the industry and are widely used by all stakeholders, including local government authorities, potential ESCO clients and financial institutions.

- **Provide capacity-building services and a networking platform** for members, including legal, communications and financial advice. An illustration of EMCA's role as a platform is the annual ESCO Summit, which in 2019 convened over 800 participants. The Summit creates matchmaking opportunities among ESCOs, technology providers, financial institutions and other stakeholders. EMCA continues to advise the industry on how to navigate the changing policy landscape.
- **Promote collaborative business opportunities** among ESCOs. This includes sharing knowledge such as industry trends and demand patterns from ESCO clients as well as tracking emerging technologies, such as the Internet of Things (IoT) and big data.

Source: EMCA (2019), ESCO Committee of China Energy Conservation Association, https://www.emca.cn/site/term/105.html .

Government support played a central role in scaling-up ESCOs

Steady and strategic government support is essential for enabling energy efficiency financing, and it requires much more than providing public funding. The Chinese government's multi-pronged policy approach, including institutional development, provision of policy guidance and incentives throughout the 2000s, was vital for ESCO industry development. The start of the 12th Five-Year Plan (2010-2015) saw increased momentum for ESCOs with the State Council's *Guidance to Promote Energy Performance Contracting and Enhance the Development of the ESCO Industry*, which was complemented with substantive policy and financial support from the National Development and Reform Commission (NDRC), the Ministry of Finance, and the State Taxation Administration. In 2010, the government introduced a set of fiscal incentives to further accelerate the development of ESCOs, including business tax exemptions, Value Added Taxes (VATs) and tax reductions on energy savings-related expenses for ESCO clients. The government also promoted ESCOs as a profitable business model within the private sector and encouraged provincial and local governments to proactively use the booming ESCO market. This comprehensive policy support for ESCOs throughout the 2000s positioned ESCOs as an important driver for both economic development and environmental protection. At this time the later was starting to become a national priority.

Strategic partnerships enabled ESCOs to flourish in the industry sector.

The most successful ESCOs were those either founded by, or affiliated with, State-Owned Enterprises (SOEs). These were primarily SOEs leading energy-intensive industrial sectors, such as the iron and steel conglomerate Baosteel, or power and grid companies, like Guangdong Nuclear Power Group and State Grid. ESCOs affiliated with these SOEs had easier access to clients and business opportunities through their parent SOE's existing networks, as well as access to capital to cover project costs. Proven associations with large state-owned companies also came with enhanced credibility for financing. The most successful example is the state-owned power generator Guodian that in 2004 established a subsidiary group specialising in energy conservation: Guodian Technology & Environment Group Corp that was listed on the Hong Kong Stock Exchange.

New energy saving requirements in the power sector also helped increase ESCO business opportunities. For instance, energy efficiency obligations (EEOs), which required grid companies to meet a minimum of 0.3% energy savings in sales volumes and demand load on an annual basis from 2011, led to more large grid companies establishing ESCOs as subsidiaries. At this early development stage, ESCO businesses centred primarily on simple equipment replacements through shared saving contracts. This straightforward, easily replicable business model facilitated a rapid escalation of ESCOs in the industry sector.

The emergence of a robust ESCO market

Key policy insights

- As ESCOs flourished, the government's focus turned to maturing the ESCO industry by enabling markets and moving away from subsidies.
- Strengthened national energy efficiency targets and regulations boosted demand for ESCO services.
- The government engaged the private sector to expand the market and overcome financing challenges.
- The government's multi-pronged policy approach and focus on promoting an enabling market drove the sustainable growth of ESCOs in China.

The emergence of diverse, market driven ESCOs

In 2011, at the beginning of the 12th Five-Year Plan, there were approximately 1 400 ESCOs with projects worth around USD 5.9 billion, and around 0.5 EJ[4] of potential energy savings. In 2016, after the 12th Five-Year Plan had ended, there were 5 800 ESCOs operating in the country with projects worth up to USD 15 billion. Roughly 70% of these projects were in the industry sector, 21% in buildings and the remaining 9% in transport.

As ESCOs grew in scale, the government's focus turned to maturing the ESCO industry by enabling the market to grow while cutting subsidies. The transition towards creating a more market-driven environment brought notable changes to existing ESCOs.

[4] 11.6 million tonnes of oil equivalent (Mtoe).

Market forces became an important driver for ESCOs in China

In 2015, towards the end of the 12th Five-Year Plan, the government phased out five different subsidies and financial schemes that had rewarded ESCOs for energy savings. The withdrawal of these subsidies did not cause significant disruptions, as many ESCOs had developed business strategies to address the forthcoming changes. Provincial and municipal governments continued to provide tax rebates and financial support, which softened the overall impact of the policy changes. However, companies that had previously relied primarily on government subsidies without competitive business strategies did not survive these reforms.

The government did not suspend support for energy efficiency altogether. Instead, they created an enabling environment for ESCOs to thrive by strengthening energy efficiency and relevant environmental targets in the 13th Five-Year Plan (2016-2020). For instance, the 13th Plan introduced a 'double limitation' approach that put restrictions on both energy intensity and total energy consumption levels, driving enhanced energy demand-side management. The existing TOP 10 000 programme, that had imposed mandatory energy efficiency targets on the country's top 10 000 most energy-intensive enterprises, promoting a deployment of energy management systems, became the TOP 100, 1 000, 10 000 programme under the 13th Five Year Plan. The Plan also included a specific target for ESCOs – doubling the ESCO sector's gross outputs by 2020 from 2015 levels, thereby boosting confidence in the ESCO market.

Structural reforms to develop the market in key areas, such as public institutions like hospitals and municipalities as well as critical infrastructure, also helped increase business opportunities for ESCOs. In 2002, the State Council announced reforms in the energy sector, particularly the power sector, and promoted rationalising the price system and fair market competition. Energy-intensive industries received increasing pressure to reduce their operating costs as well as their energy intensity, providing new business opportunities for ESCOs. Similarly, as the State Council enacted a policy demanding divestments of SOEs in 2016, the servicing of public buildings became a new market for ESCOs.

The Chinese ESCO market is maturing

Scale and duration of projects

A key indicator to assess the maturity of the Chinese ESCO market is the size and duration of projects. Among the 708 projects documented in the EMCA annual

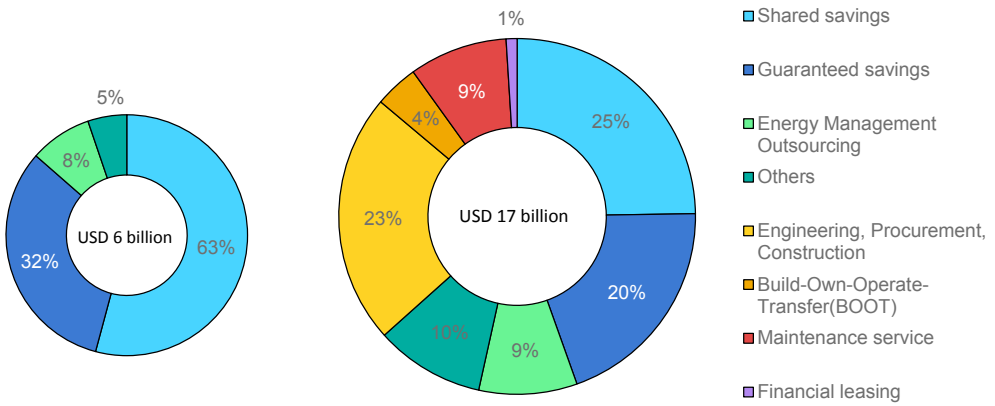
market survey in 2018, the average investment amount for industrial projects was about CNY 34 million (USD 5.1 million), 70% higher than the average at CNY 20 million (USD 3.0 million) during the 12th Five-Year Plan. The average size of investments in commercial building projects has also increased substantially reaching around CNY 20 million (USD 3.0 million) in 2018. This was a major development given the market's previous, almost exclusive, focus on industrial projects.

The average duration of projects has also increased over time. In 2018, shared savings model-based EPCs were on average seven years long, compared to 4.5 years during the 12th Five-Year Plan (EMCA, 2018). Longer project durations meant a longer repayment period, reflecting that EPCs were increasingly recognised as a reliable mechanism for contracting companies. Increased project duration also coincided with the shift from previous simple equipment replacement projects to comprehensive system operation and maintenance service projects. These long-term, service-oriented projects helped unlock deeper energy savings, which could not be easily achieved by quick-fix projects with shorter payback periods.

Contracts and business models

Conventionally, EPCs based on shared savings models have been predominant in China. In 2011, over 60% of all contracts were based on shared savings, followed by emerging guaranteed savings and energy management outsourcing models. Over time, various business models were introduced, and in 2019, while shared savings remained the dominant model, the share of new models, including Engineering, Procurement, Construction, maintenance service and Build-Own-Operate-Transfer (BOOT), increased substantially. A rapid increase in maintenance service contracts indicates a growing demand for 'updated services' from existing customers in recent years.

Figure 2.1 ESCO business models in China, 2011 vs 2019



Source: Adapted from International Finance Corporation (IFC) (2012), China Energy Service Company (ESCO) Market Study and ESCO Committee of China Energy Conservation Association (EMCA) (2020).

The emergence of innovative business models reflects how the ESCO market in China has matured enough to attract a diverse array of private players. It also illustrates the increased demand for more comprehensive, high-quality services that can result in long-term energy system optimisation.

Hybrids of different models are becoming more prominent as more clients demand more tailored contracts. The combination of the guaranteed savings and shared savings models has become more popular, as has the hybrid of the guaranteed savings model and the outsourcing model.[5]

Financing

Access to finance and the types of finance available to ESCOs have both evolved. In 1998, the World Bank and the Chinese government provided direct financial support to ESCOs in the form of grants, guarantee funds, and other public financing mechanisms. In 2006, the Industrial Bank of China became one of the first banks to offer energy efficiency loans as part of the International Finance Corporation (IFC)'s China Utility Energy Efficiency Finance program. The IFC provided a risk-sharing facility of up to USD 25 million for the Industrial Bank's 'green loans'. In return, the bank financed 46 energy efficiency and greenhouse gas emission reduction projects, for a total loan amount of CNY 900 million (USD 126 million). Small and medium sized enterprises delivering relatively

[5] ESCO Committee of China Energy Conservation Association (EMCA) (2020).

simple energy efficiency projects such as industrial boiler retrofitting, waste heat recovery and district heating were the main beneficiaries.

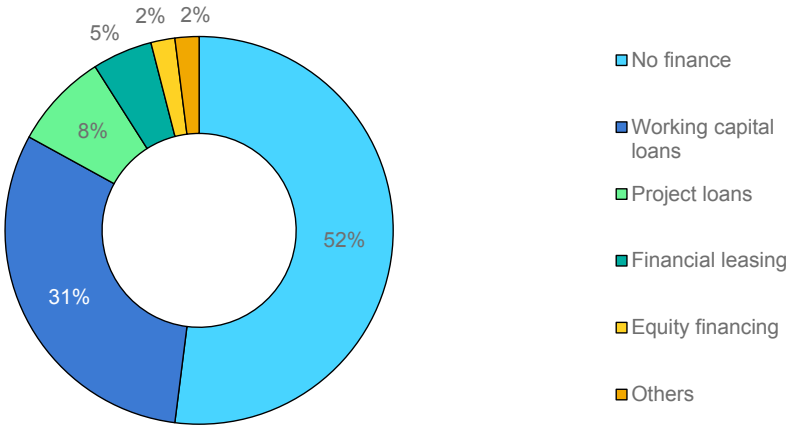
Table 2.1 Evolving financing mechanisms for ESCOs in China

Stage	Main financing mechanisms	Institutions
Inception and wide-scale demonstration (1998-2010)	Public finance (grants, World Bank guarantee fund, concessional loans)	Multilateral Development Banks (MDBs), Bilateral funds, the Chinese government
Mainstreaming (2010-2015)	Commercial financing (project and working capital loans, financial leasing, and equity finance) + supplementary risk guarantees and insurance products	Commercial banks (Bank of Beijing, IMEX Bank of China, SPD Bank, the Industrial Bank of China, Ping An Bank), MDBs, the Chinese government
Market development (2015)	Commercial financing + international/domestic clean energy financing (green bonds)	Commercial banks, MDBs, the Chinese government

Due to the accumulated experience gained from international cooperation projects, domestic financial institutions' capacity to evaluate energy efficiency projects and develop special financing solutions for ESCOs has improved. In 2015, under China's G20 Presidency, G20 nations adopted a new, long-term strategy to catalyse energy efficiency financing. Five Chinese banks: the Industrial Bank, the Industrial and Commercial Bank of China (ICBC), the Bank of Jiangsu, the Agricultural Development Bank of China and Huaxia Bank joined the global mobilisation of over 115 banks promoted by the G20 Energy Efficiency Finance Task Group. Other financial institutions such as State-owned Leasing have followed and launched special green finance products to support ESCOs.

Based on EMCA's latest market survey, loans from commercial banks, primarily in the form of working capital loans, have become the dominant source for financing. While still minor, leasing companies are increasingly interested in collaborating with equipment manufacturers to provide operating leases for energy-saving equipment based on their expertise in industry. For large-scale equipment, such as central air-conditioning systems and high-efficiency motors which have high upfront costs, this leasing model allows ESCOs to improve their cash flow management. Nevertheless, over half of the ESCOs surveyed could not obtain external financing and the recent economic downturn added to that challenge. The need for more support to ease this financing difficulty is evident.

Figure 2.2 Financing types for Chinese ESCOs, 2018



Source: ESCO Committee of China Energy Conservation Association (EMCA) (2018).

Box 2.1 Green finance and energy efficiency

Green banks have become a growing source of private finance for energy efficiency projects globally. From 2012 to 2017, the share of energy efficiency and low-emissions transport in total green bank investment grew over 50%. In 2017, bonds issued for energy efficiency rose from 18% to 29% of the total green bond market of USD 161 billion, equalling the issuance of bonds dedicated to renewable energy for the first time.

The green finance market emerged in China in 2007 and has grown at an exponential rate since 2016. In 2016-2019 alone, the Chinese domestic green bond market quadrupled to nearly USD 120 billion, making it the second-largest in the world. Unlike many developed economies, the growth of China's green finance market was driven by the central government in a strict, top-down approach. In 2015, the State Council and CPC Central Committee published *the Integrated Reform Plan for Promoting Ecological Progress,* which signalled the country's intent to address pollution and other environmental problems. The founding policies for green finance in China were established in the following year, including the *Guidelines for Establishing the Green Financial System* jointly issued by seven Chinese ministries[6]. This guideline served as a milestone to promote China's national green finance system, which became one of the world's most comprehensive systems. More support in the form of financial incentives,

[6] People's Bank of China, Ministry of Finance, National Development and Reform Commission, Ministry of Environment (predecessor of the current Ministry of Ecology and Environment), China Banking Regulatory Commission, China Securities Regulatory Commission and China Insurance Regulatory Commission, which later merged with the Banking commission and became the current China Banking and Insurance Regulatory Commission.

enhanced disclosure requirements and regulatory standards have been imposed subsequently to facilitate market expansion.

The growing green bond market in China is good news for clean energy transition drivers, including energy efficiency and renewable energy. Energy saving projects, which broadly include industrial energy saving, sustainable buildings, energy management centres and energy efficient urban and rural infrastructure construction, are the most trackable energy efficiency projects in the bond market. Among the six categories of the green bond catalogue[7], energy saving projects accounted for 12% of all green bonds issued in 2016-19, third largest after clean energy (36%) and clean transport (25%). In practice, the energy efficiency share exceeds 12%, as other categories, such as resource conservation and recycling, also incorporate numerous energy efficiency measures.

Despite energy efficiency's potential for promoting a green economy, it has failed to obtain a fair share of the expanding green finance package. Renewable energy projects, which investors consider to be more tangible and easier to label as credible green projects, benefitted greatly from the package. This seems largely due to unclear standards for what constitutes an energy efficiency project and the difficulty of rigorous monitoring, reporting and verification for those projects. For a long time, there was no clear definition of energy efficiency investment, and the term was only officially introduced in 2019 in the *Guidance for taxonomy and assessment of energy savings financing projects*. This prompted the introduction of an 'energy efficiency improvement' criterion in the new *Green Bond Endorsed Project Catalogue*, issued in 2020 for public consultation. 'Energy efficiency improvement' serves as a sub-criterion applicable to various sectoral categories, including Energy Saving and Environmental Protection Industry, Clean energy and others. Clear guidance can encourage energy efficiency investment and facilitate systematic tracking and evaluation, creating useful benchmarks.

Source: IIGF (2020), IIGF Green Bond Database, http://iigf.cufe.edu.cn/info/1028/1521.htm.

The world's largest and fastest growing ESCO market

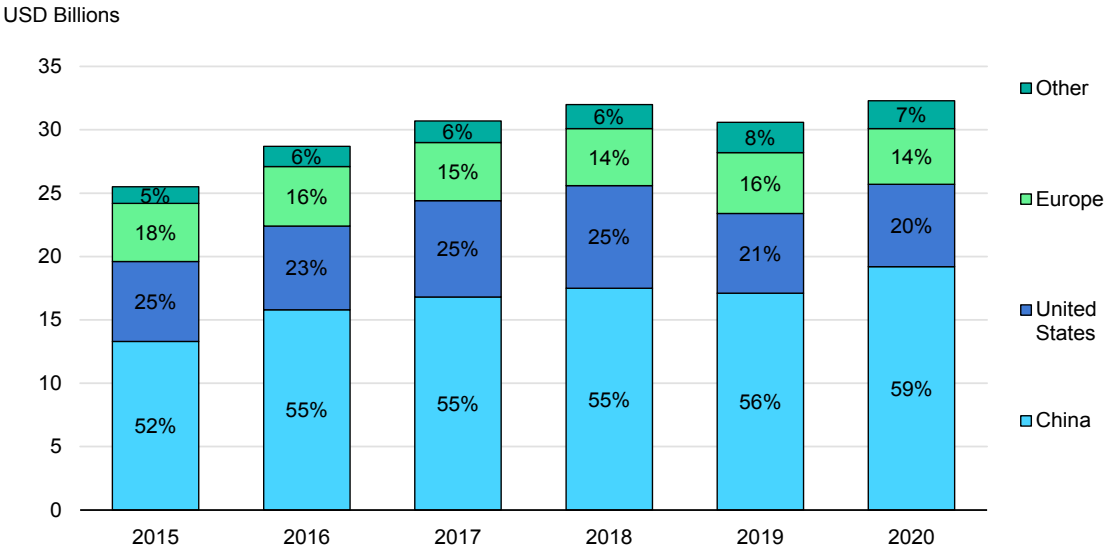
During the 12th Five-Year Plan, total investments in ESCO projects grew from USD 6.1 billion in 2011 to over USD 15.8 billion in 2016. Since then, the growth rate has slowed and 2019 saw the first-ever decline since the introduction of ESCOs in China. Major industry sectors, including manufacturing, non-ferrous metal and light industry, have all been affected by the recent economic downturn,

[7] Six categories include: energy saving, pollution prevention and control, resource conservation and recycling, clean transportation, clean energy, ecological protection and climate change adaptation.

squeezing out business opportunities for ESCOs. The market for the simple equipment replacements that allowed the ESCO business to flourish in prior years, has become saturated and businesses have become more knowledgeable about adopting energy efficient technologies themselves, and are hence less reliant on ESCOs, both factors added to the recent slowdown in ESCO activities. This trend has parallels with China's energy intensity improvements that have been slowing notably since 2015.

Despite this worrisome trend, and the outbreak of Covid-19 in 2020, China's ESCOs demonstrated how resilient the market could be with the right policy actions. The total investment in ESCOs increased by USD 2.1 billion to USD 19.2 billion in 2020, a remarkable achievement considering that many other ESCO markets showed less growth or even contractions. The gross output value of ESCOs in China reached USD 91.0 billion in 2020, up 17% from 2019. Despite the decline in ESCO investment in 2019, the gross outputs have continued to increase over the last five years.

Figure 2.3 Global ESCO market growth, 2015-2020



Source. IEA annual ESCO survey 2021.

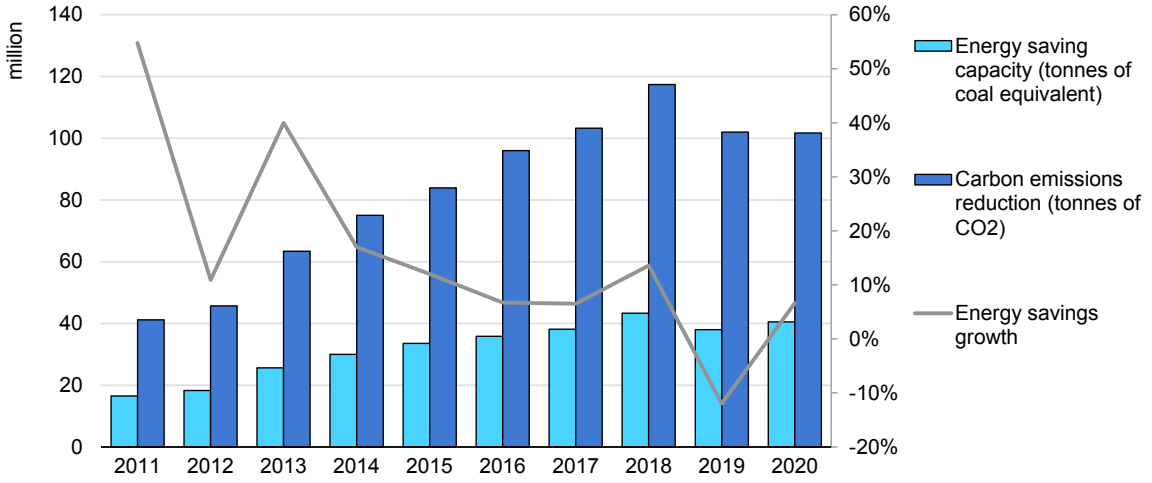
ESCOs provide multiple benefits to China's sustainable economic growth

Improving energy efficiency delivers multiple benefits to society. IEA analysis shows that without energy efficiency gains since 2000, China would have used nearly 25% more energy in 2018. Energy efficiency has therefore made a major contribution to China's energy security without constraining economic growth.

Energy efficiency has also provided around 2.1 Gt CO_2-eq of emissions reductions over the same period, equivalent to almost two-thirds of the annual emissions of the European Union (EU-28). This has also avoided around 14% (91 mtoe) additional fossil fuel imports. In addition, energy efficiency creates local jobs. For example the Shanxi Energy Efficiency and Environmental Improvement Project, implemented in 2016 to improve the energy efficiency of the province's space heating, created 25 000 additional jobs, provided heating to 6.34 million m^2 of floor space and provided 224 000 residents with reliable heating services.

As a successful driver of energy efficiency improvements, ESCOs have contributed to these societal benefits. At their peak in 2018, the annual energy savings potential from ESCOs was over 43 million tonnes of coal equivalent (1.3 EJ) per year - more than the final energy consumption of Austria - resulting in emissions reductions of around 117 Mt CO_2.[8] In 2020, the annual energy savings potential from ESCOs was still as high as 41 million tonnes of coal equivalent while markets in other parts of the world were contracting.

Figure 2.4 Energy saved and related carbon emissions avoided by ESCOs, 2011-2020



Source. ESCO Committee of China Energy Conservation Association (EMCA) (2020).

In terms of jobs, ESCOs have become an important driver of green jobs in China. In 2020, the number of ESCOs operating in China increased by 500 to 7 000, employing a total of 770 000 employees. Investment in ESCOs supported existing jobs, created new ones and helped green key labour-intensive sectors such as construction and manufacturing.

[8] ESCO Committee of China Energy Conservation Association (EMCA) database 2020.

Challenges and opportunities for next generation of ESCOs

Key policy insights

- The demand for more integrated, intelligent energy services is growing in China.
- Using digital technologies for projects and business management can help ESCOs overcome the existing barriers to market growth and evolve as integrated energy providers.
- Transformative policies would be needed to facilitate the further development of the integrated energy services sector and transformation of ESCOs.
- China's vision for a green, digital economy presents massive opportunities for growth in ESCOs.

Barriers to sustainable development for the ESCO industry

ESCOs in China have grown strongly over the last 20 years, creating the world's largest ESCO market. However, there are several barriers to overcome in order to promote continued development. These include a low level of demand for energy efficiency, financing difficulties and high perceived risks, low levels of trust and public awareness and inadequateskills to deploy new technologies.

Low demand for energy efficiency

This is partly due to the regulated energy price and partly due to the difficulty of measuring the full benefits of energy efficiency, making investments for energy efficiency seem unattractive and risky. In parallel to accelerating energy market reforms, the government could further strengthen regulations and policy measures to stimulate market demand for energy efficiency.

China's national emissions trading scheme (ETS), which began operation in February 2021, should be an effective way to put a price on the negative externalities of inefficient energy consumption. Enhanced monitoring, reporting, and verification systems, which underpin smooth ETS operation, also open up the

possibility of applying trading mechanisms to China's current command and control type of energy efficiency programmes, much as India does with its Perform, Achieve, Trade (PAT) scheme. Expanding China's ETS, which is currently limited to coal and gas-fired power plants, should open up more opportunities to stimulate synergies between energy savings and emission reductions in hard to abate sectors.

Low technical capacity to deploy new technologies

According to a survey conducted by the Energy Research Institute of the National Development and Reform Commission on 1 300 key energy-consuming companies in 2016, around 600 companies pointed to ESCOs' insufficient technical capacity as the main reason for avoiding their services[9]. Industrial businesses demand more holistic and lasting services that can support their increasingly automated and advanced operation systems, and ESCOs in China, particularly the SMEs, still largely lack such technical capacity. The majority of these ESCOs either provide technical upgrades or capital financing; those capable of providing a complete package of service are still rather uncommon.

Against this background, ESCOs with differing areas of expertise have begun to collaborate on projects in the form of joint ventures, or joint EPC contracting. Cultivating a transparent market environment based on concrete contractual frameworks is essential for these emerging collaborations to succeed. An open online platform that connects and supports parties interested in joint ventures, facilitates cooperation and provides guidance on effective implementation is a possible solution.

Financing difficulties and high perceived risks

According to EMCA's 2018 survey, more than 90% of ESCOs pointed to financing difficulties as the most severe constraint. As in other markets, the 'invisibility' of energy savings, due to the difficulty of tracking and verifying them, makes access to financing a fundamental challenge. Long-term financing for large-scale industrial projects is even more difficult to secure, with limited specialised venture capital and/or private equity sources available in the market. Promoting a simpler and more standardised financing protocol, enhancing the understanding of energy efficiency within commercial banks could help to reduce these financing

[9] ESCO Committee of China Energy Conservation Association (EMCA) (2020).

challenges. Tapping into innovative financing vehicles, such as blended finance that leverages public funds to catalyse private investments, could also help increase the financing pool.

Low level of trust and public awareness

Social acceptance and trust is an indispensable element for market growth. The Chinese government has set up regulatory authorities and self-regulating industry associations to promote healthy competition and remove those ESCOs that deliver poor quality services or are in breach of industry codes and regulations from the market. While the regulatory authorities and associations contributed to raising the profile of ESCOs in China, the overall level of public awareness and financial credit rating remains low. Scaling-up good business cases for ESCOs is needed more than anything else to convince both potential clients and financiers.

Inadequate skills

A shortage of qualified technical experts, particularly skilled IT engineers and technicians, data analysts and project managers, who can support increasingly advanced and cross-cutting ESCO services has become a critical barrier. EMCA has supported the capacity building of ESCOs through training and knowledge sharing. ESCOs themselves also need to invest more in capacity building to cultivate necessary talents, increase the overall digital literacy of employees, and attract a diverse pool of specialists.

Opportunities from digitalisation: ESCOs to become integrated energy services providers

Growing demand for more integrated, intelligent energy services

Simple equipment upgrade projects that were common in the early years of the ESCO market in China are no longer as attractive for consumers. The demand for more intelligent and integrated services that cover the entire value chain is growing.

The term 'integrated energy service' broadly refers to a comprehensive set of solutions that cover the full energy value chain in an integrated way through different services optimised for cost efficiency. The Energy Research Institute of the National Development and Reform Commission (NDRC ERI) has categorised the integrated energy services sector into eight market segments:

- integrated energy transmission and distribution service
- power market trading service
- distributed energy development and supply service
- integrated energy system construction and operation service
- energy efficiency service
- environmental energy service
- integrated energy storage service
- integrated smart energy service.

According to ERI, major energy companies like State Grid, China Southern Power Grid, and ESCOs are well-positioned to become integrated energy service providers.

There are mainly two ways for ESCOs to lead the growing integrated energy service sector. One is to leverage existing partnerships with energy companies and utilities, consolidating ESCO's role as energy efficiency service providers. As energy efficiency services are the most mature market segment within the integrated energy service sector, with an estimated annual market demand of hundreds of millions of dollars in the next 3-5 years, this approach should provide a relatively safe return on investment. Further, many energy companies and utilities in China are unfamiliar with demand-side management, and ESCOs can fill this gap using their existing expertise.

The other strategy requires ESCOs to venture into other segments of the integrated energy service sector such as smart energy, integrated energy system construction and operation, and power market trading, which have become very promising in recent years.. Although progress thus far has been rather slow, the government's willingness to further expand market reforms – in parallel with promoting carbon trading, digital economy and smart cities – open up huge opportunities for ESCOs to expand their businesses.

Digitalisation can help ESCOs transform into integrated energy service providers

The potential synergy between digitalisation and energy efficiency is increasingly noted and studied by the global community. The IEA's Energy Efficiency 2019 market report has elaborated how digitalisation can provide opportunities to accelerate and modernise energy efficiency in this critical time of global clean energy transition.

Digitalisation can also serve as an important tool for ESCOs. While end-use energy efficiency has always delivered energy system benefits, digitalisation allows these benefits to be more easily and accurately measured. This element of digitalisation – more accurate data collection for more advanced analytics – is important for ESCOs as it can remove the fundamental challenge of validating project benefits.

Furthermore, the use of digital technologies and tools, such as big data with cloud computing, Internet of Things (IoT) and even artificial intelligence (AI), can promote more efficient and smarter connectivity between people, devices, and machines. Such wider and more in-depth interconnectivity can not only allow for optimisation of business operation and management but also stimulate innovative business models such as Energy-as-a-Service (EaaS)[10], which provides bundled energy services propelled by technological and financial developments. It is estimated that commercial and industrial sectors will be the early adopters in this market, estimated to be worth USD 221 billion by 2026 globally.

Increased business case for digitalising ESCO services in China

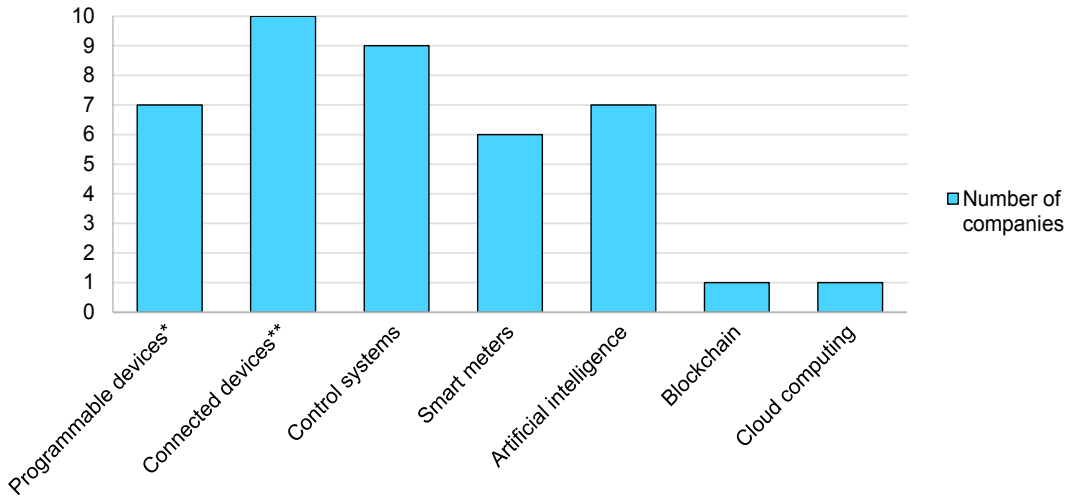
To understand how ESCOs in China incorporate digital tools into their businesses, the IEA and EMCA conducted an in-depth survey with ten Chinese ESCOs in 2019, hereafter referred to as 'IEA-EMCA survey'. The results of this survey provide indications of emerging trends.

Technology deployment trends

Early applications of digital technologies primarily consisted of installing devices such as smart meters to monitor energy consumption and use the results as evidence for energy savings. Rapid development of various digital technologies allowed for many more advanced functions beyond monitoring, and many ESCOs have started using more connected devices and digital control systems, with some adding an extra layer of artificial intelligence to that process. However, the use of more advanced technologies such as block chain and cloud computing remains in their early stages.

[10] The EaaS market builds on ESCO services, but includes a wider range of energy supply options, and integrates and manages them across multiple sites through digital technologies (Deloitte, 2019).

Figure 3.1 Adoption of digital technologies, 2019



*Programmable devices refer to the device without dependence on internet connection such as programmable thermostats.
**Connected devices include devices that apply data analytics to improve performance and customer experience, often referred to as the Internet of Things (IoT).
Note: 10 Chinese ESCOs participated in the joint IEA-EMCA survey in 2019.
Source. IEA and EMCA (2020), Survey on impacts of digitalisation on ESCOs.

Hanpu Intelligent, one of the participants of the IEA-EMCA survey, began as a company specialising in energy savings in hydraulic systems. Over time, they have expanded their business and gained a foothold as a service provider of smart energy solutions, for which adoption of various digital technologies has played a critical role. In the IEA-EMCA survey, eight companies out of ten answered that all of their projects rely on digital technologies.

Sectoral trends and market potential

The application of digital technologies in the industrial sector has proven more challenging due to the range of production processes, production scenarios, and energy sources. Another obstacle is the absence of a concrete legal framework defining the ownership and user rights of available data, adding to the increasing concerns around data security and theft of proprietary information. If ESCOs are to optimise the entire industrial supply chain, securing core operational data is essential, but many companies are not willing to disclose sufficiently disaggregated data. Despite this challenge, the majority of surveyed companies still considered the industry sector to hold the largest potential for using digital tools.

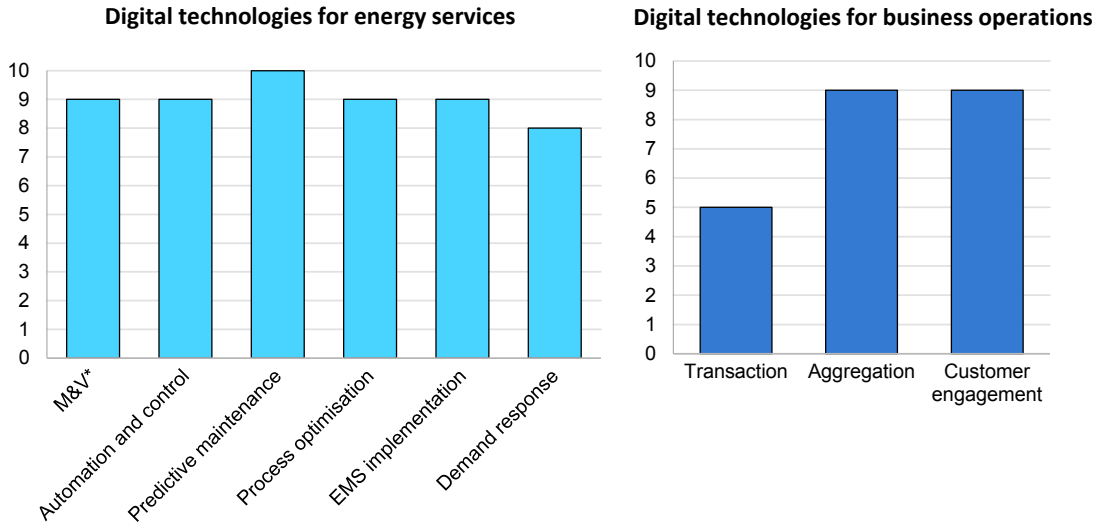
ESCOs found it easier to upscale and replicate digital solutions in the buildings sector. The basic structure and functions of buildings are simpler than industrial

facilities, and their range of energy sources and energy consumption patterns are also more consistent. Nine out of ten companies from the IEA-EMCA survey were active in the buildings sector, predominantly commercial buildings. The first national energy efficiency standards on energy-intensive data centres in China provide more opportunities for ESCOs to deploy their digital services in the buildings sector. Surveyed ESCOs were also operating actively in the municipal services sector, mostly for projects in public buildings. With climate change expected to intensify over the next decades, EMCA also noted cooling demand will increase, creating even more business opportunities.

Advanced applications of digital technologies

All companies from the IEA-EMCA survey used digital technologies for both projects and for their own business operations.

Figure 3.2 Applications of digital technologies for projects and business management, 2019



* M&V = monitoring and verification.
Note: Ten Chinese ESCOs participated in the joint IEA-EMCA survey in 2019.
Source. IEA and EMCA (2020), Survey on impacts of digitalisation on ESCOs.

Digital technologies were most commonly used for predictive maintenance (PdM) diagnostics – and least often for demand response services – but the average application rate of digital technologies for projects was high. Use of big data and cloud computing allowed for more transparent and systematic monitoring and verification (M&V) of energy savings, which helped gain trust of investors and clients, opened up opportunities for broader energy system benefits and eased project financing.

A qualitative discussion with the surveyed companies regarding how they apply digital technologies for their own business operations revealed that one of the greatest benefits of digitalisation is not technical improvements but improved communications and client engagement. This is primarily because more coherent aggregation of data helps the client's understanding of a project and its benefits; and more extensive application of digital tools allows ESCOs to take on more advanced, long-term projects, giving them the opportunity to promote their businesses, build up their reputations as integrated service providers and consolidate customer loyalty.

Digital technologies have had a limited impact on streamlining the transaction process and reducing its cost. EMCA noted that transaction costs remain a major challenge, particularly for Small and Medium Enterprises (SMEs), for which going back to the basics – capacity building for SMEs – to become competent in the transaction process and enable the ESCOs to take more ownership is key.

Box 3.1 Digitalising the Shanghai Haichang Ocean Park energy system.

The Shanghai Haichang Ocean Park is a theme park that opened in November 2018. The park consists of rides and performance shows, an aquarium and an on-site hotel. In order to optimise the park's energy consumption, Haichang Ocean Park Holdings invested around CNY 30 million (USD 4.6 million) to install an integrated smart building management system through an Engineering, Procurement and Construction contract with Beijing Hexingunder Technology Co. Ltd.

Hexingunder Technology used its buildings energy efficiency operation system, called Hysine, to combine building automation, intelligent lighting, energy consumption monitoring, hotel management control, aquarium management and environmental monitoring systems under an integrated control platform. In practice, the project meant building a system that covers a total area of 150 000 square metres with more than 3 000 facilities and 65 000 monitoring stations. By connecting all facilities into one smart digital management system, Haichang Ocean Park was able to optimise its energy use with easier control and management of its properties.

Source: Z-Park Modern Energy and Environment Service Industry Alliance (EESIA) (2020), Intelligent Shanghai Haichang Ocean Park http://eesia.cn/news/details/id/807.html.

The impacts of digitalisation depend on individual corporate capacity and strategies

The majority of the surveyed companies also highlighted how digitalisation could stimulate more innovative business models and greater diversification of business portfolios. Already, some innovative business models, such as cooling-as-a-service or pay-as-you-go models, have been piloted. In practice, however, many ESCOs, particularly those of small and medium size, still lack the capacity to harness digitalisation to spur business innovations.

While more than 50% of respondents to the survey highlighted that automation and remote controls helped reduce the need for human interventions and the associated risks, whether they found the use of digital technologies cost-effective varied. Some companies mentioned that digitalisation helped cut labour costs, others pointed to high upfront costs when using advanced technologies and recruiting the required expertise. Similarly, companies answered that the average payback period of digital projects is not significantly shorter than conventional projects and varies case by case.

Transformative policies are needed to support the evolution of ESCOs

All companies from the IEA-EMCA survey, save one, answered that the government's commitment to digitalisation played a critical role in catalysing their uptake of digital tools and technology. In addition to the 13th Five-Year Plan[11], a series of national action plans including *Made in China 2025*, *Guidance on the Promotion of Internet of Things*, and the *Three Year Action Plan to promote the Development of a New Generation of Artificial Intelligence (AI) Industry 2018-2020* contributed to addressing the State Council's ambition to make 'new-generation information technology' a strategic industry that would account for 15% of gross domestic product by 2020. Two companies from the survey particularly praised the smart city initiative that led to an increase in the demand for smart energy services.

There were also calls for more progressive policy support. For instance, current procurement and tendering requirements are not conducive to innovative ESCO projects. A lack of clear guidance and legal protection around data use, security

[11] In its 13th Five-Year Plan timeframe (2016-2020), China aims to transform itself into a science and technology leader, with 16 "Science and Technology Innovation 2030 Megaprojects", including "AI 2.0". This plan has provided impetus for action in the public sector (OECD, 2020) https://www.oecd-ilibrary.org/sites/cf3f3be0-en/index.html?itemId=/content/component/cf3f3be0-en.

and privacy could also discourage innovative applications and hinder ESCOs seeking to embrace smart digital technologies. The government could work directly with ESCOs, particularly SMEs, to carry out pilot projects. Leading by example can be an effective way to test the feasibility of various digital business models, identify which policies are needed to minimise the risks and drive best practice. Knowledge sharing from leading Chinese companies such as Baidu and Tencent that invest heavily in developing digital technologies and their business applications can greatly help ESCOs looking for practical advice and guidance.

Special Focus: ESCOs for green, digital recovery

With Covid-19 creating an unprecedented global health and economic crisis, the energy sector, an essential backbone of modern life, is also greatly affected. At the same time, the energy sector, particularly energy efficiency, can bring many long-term socio-economic benefits. These include greater competitiveness, reduced greenhouse gas emissions and improved energy affordability.

China has already shown that it is possible to build back better following the 2008-2009 global financial crisis. At that time the government allocated around 5% of the national stimulus package worth CNY 4 trillion (USD 585 billion) to *energy conservation, pollutant emissions reduction and environmental* projects. More than CNY 40 billion (USD 6.2 billion) of this was spent on energy efficiency, mainly supporting the Top Ten Energy Saving Projects [12]. This package is estimated to have reduced coal consumption by 19 million tonnes per year, roughly 14% of China's total energy savings in 2010.

The increased investment in energy efficiency projects provided many long-term socio-economic benefits. It spurred growth in the domestic market for energy efficiency services and equipment such as highly efficient boilers, electric motors and lighting. With financial institutions such as the Huaxia Bank, Industrial and Commercial Bank of China increasing their investment in energy-saving programmes, the roll-out of similar stimulus funds boosted the credibility of investing in companies devoted to energy services. The government's ambition to reduce China's energy intensity by 20% between 2006 and 2010, achieved as part of the 11th Five-Year Plan, also fostered a rapid development of Energy Service Companies in China reinforcing China's position as a major player in the global ESCO market.

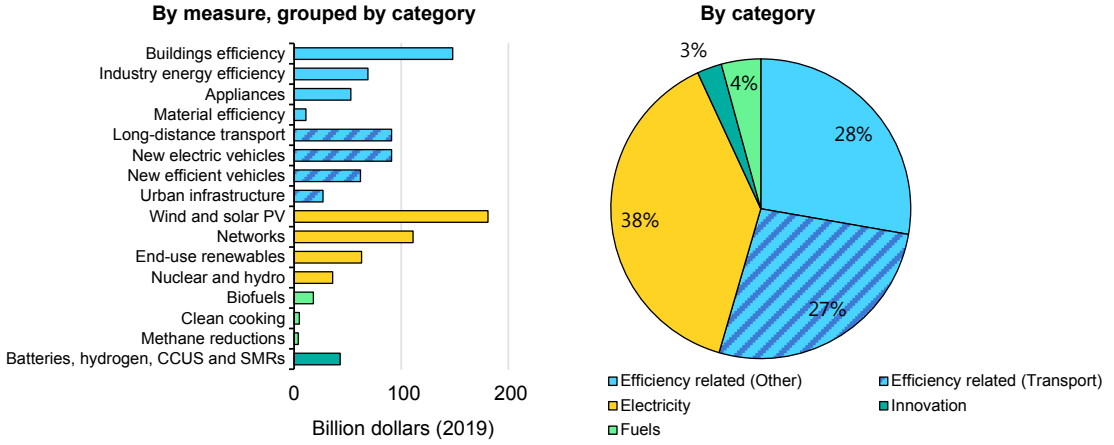
[12] Initiated as part of the 11th Five-Year Plan (2006–2010), the projects included: upgrading inefficient coal-fired industrial boilers and furnaces, the regional cogeneration project, utilisation of residual heat and pressure, petroleum conservation and substitution engineering, energy conservation in motor systems, optimisation of energy systems (system conservation), energy-efficient buildings, green lighting project, energy conservation projects of government agencies, and energy-saving monitoring and technology service system construction.

ESCOs can reinforce energy efficiency's role in building back better and greener

In a critical time like this, China's concept of crisis – 'Wei-ji (危机)', which combines the ideograms for danger (危) and opportunity (机), could not be more apt. Governments have the opportunity to reboot their economies and create a wave of green jobs while accelerating the shift to a more resilient and cleaner energy future. To help governments realise this ambition, the IEA published a Sustainable Recovery Plan in June 2020 – an energy sector roadmap for governments to stimulate economic growth and employment, and to put global emissions into structural decline.

Achieving the suggested sustainable recovery requires a global investment of around USD 1 trillion annually (public and private), about 0.7% of global GDP, which would save or create around 9 million jobs over the next three years. Energy efficiency accounts for around 40% of this USD 1 trillion sustainable recovery investment.

Figure 4.1 Average annual spending by category and measure in IEA Sustainable Recovery Plan

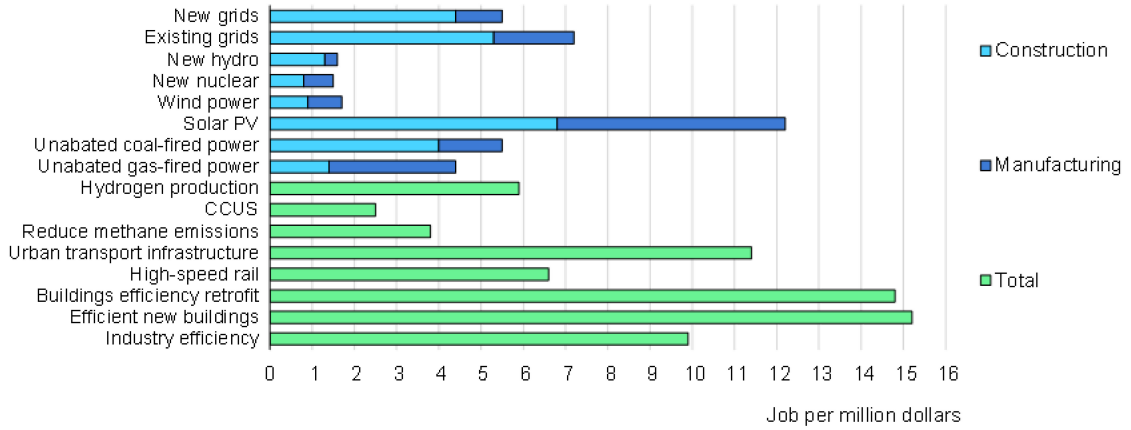


Source. IEA (2020), Sustainable Recovery Report.

A roll-out of energy efficiency programmes across end-use sectors could provide lasting benefits to the global economy with increased productivity. Energy efficiency is also a 'jobs machine'; the largest number of new jobs would be in buildings and other measures to improve energy efficiency; and in the electricity sector, particularly electricity networks and solar PV. The IEA Sustainable Recovery Plan would make 2019 the definitive peak in global emissions and

energy efficiency measures would contribute to the largest overall emissions reductions. ESCOs can act as a key enabler to realising the potential of energy efficiency.

Figure 4.2 Construction and manufacturing jobs created per USD 1 million of capital investment in the Sustainable Recovery Plan



Source. IEA (2020), Sustainable Recovery Report.

Box 4.1 How do China's economic recovery policy announcements compare with the IEA's Recommendations of the Commission for Urgent Action on Energy Efficiency?

In response to a global slowdown in energy efficiency improvement, the IEA convened an independent high-level Global Commission for Urgent Action on Energy Efficiency composed of current and former national leaders, ministers, chief executives and global thought leaders. Members of the commission worked together to produce a set of 10 recommendations to encourage governments to implement more ambitious energy efficiency actions.

China's new policy for supporting private energy conservation companies, announced in July 2020, focuses on scaling-up private sector efficiency investment through a range of financial instruments (Recommendations 3 and 4). Preferential tax incentives create opportunities for more efficient use of energy and water resources among businesses, while the policy strongly encourages financial institutions to incorporate efficiency criteria in their financial services. Sub-national governments are key to implementing and monitoring these measures (Recommendation 7).

In line with the government's New Infrastructure initiative and its goal to transition into a modernised and green economy, the government has approved a 4 600 km railway and urban rail infrastructure project worth USD 14.7 billion. The government's investment in more efficient transport infrastructure would bring many long-lasting socio-economic benefits. For one, it can help accelerate a shift from air to rail in the medium- to long-term.

Source. IEA (2020), Energy Efficiency 2020.

ESCOs have been resilient to the pandemic

According to the IEA's survey of the major ESCO players around the world in the third quarter of 2020, the pandemic has had varying impacts on ESCO businesses depending on the maturity of the market, the government support, and the main sectors they service. Based on anecdotal evidence, ESCO activities in the industry sector seem to have been hit the hardest while those in the public sector and residential sector have proven more resilient. Increased demand for bundled ESCO services with pandemic related measures, particularly enhanced ventilation and control upgrades, has been noted by some respondents. EMCA, for instance, noted that the outbreak of Covid-19 has raised public awareness of the importance of environmental sustainability and quality of life, helping boost the public's interest and appetite for energy efficiency.

Mature ESCO markets with stable revenue streams have proven resilient to the pandemic throughout 2020. Reduced face-to-face opportunities to sell new services and a restriction of on-site implementation were raised as the main barriers in the short term. Looking ahead to 2021 and beyond, the survey respondents pointed to the government's support and stimulus programmes as being key to their continued commercial viability and growth.

Box 4.2 Building resilient hospitals and other public institutions

The outbreak of Covid-19 and its persistence have tested the limits of healthcare systems in many countries, highlighting the need for further improvements. Retrofitting public facilities such as hospitals and schools, installing more efficient HVAC (Heating, Ventilation, and Air conditioning), can not only boost green jobs

and assist the re-opening of the economy in the short term but also lay a strong foundation for building a more sustainable economy.

Public buildings for municipalities, healthcare and education are becoming a new market for ESCOs in China. With the healthcare system reforms pushing the hospitals to adjust their financial portfolios, reducing energy bills, which were previously considered insignificant, has become an important management issue.

For example a hospital in Zhuhai has contracted an ESCO to apply big data and IoT technologies to manage the hospital's logistics service and power system. This upgrade of operation and maintenance supported through a Smart Building 4.0 system greatly improved the capacity and quality of the hospital's services, ensuring power safety and replacement of equipment when needed, facilitating logistics and resource savings. An added benefit was that this contract allowed the hospital to focus on its core business of saving lives and patient care while the ESCO manages the energy system.

Source. ESCO Committee of China Energy Conservation Association (EMCA) (2020).

China's New Infrastructure initiative and commitment to carbon neutrality by 2060 provide immense opportunities for ESCOs

China has introduced ambitious regeneration plans following the outbreak of Covid-19.. The New Infrastructure initiative, involves a shift from highly polluting, export-led manufacturing to a modernised, high-tech, service-driven economy. The key infrastructure that constitutes the Initiative includes large data centres, 5G networks and charging stations for new energy vehicles (battery electric, plug-in hybrid, and fuel cell). As of February, China Unicom announced a deployment of 250 000 5G base stations across the country by the third quarter of 2020. Thanks to these efforts, China became the first major economy to recover from Covid-19 pandemic and energy demand also saw a quick rebound. The new infrastructure that China intends to build is energy-intensive; with a supportive policy environment, ESCOs could roll out more innovative business models around smart energy management and control systems in the next 3-5 years, which in turn would help the government align the New Infrastructure initiative with its clean energy and climate goals.

Box 4.3 How does the New Infrastructure initiative link to China's clean energy transition?

The New Infrastructure initiative has different implications for different sectors. For the energy sector, the immediate focus is around linking the wave of industrial transformations with clean energy transition.

- **Data is the "new oil" of the 21st century**

The conventional wisdom in China, that stocks of fossil fuels are the only way to strengthen energy security, is being challenged in this era of clean energy. China is rich in renewable energy sources and the New Infrastructure policy is expected to accelerate, the move to a more decentralised and digitalised energy system. In this context, investing in technologies that can help secure both energy sustainability and security will become more important.

For instance, virtual power plants (VPPs) that harness big data and other information technologies to optimise the flexible use of intermittent distributed power generation can strengthen electricity security, improve the efficiency of the integrated energy system, and reduce transaction costs.

- **"New" infrastructure is not only about building more but optimising the energy structure**

Supply-oriented energy development comes at a price. Building big power plants, particularly coal-fired power plants, is not only expensive but assets are likely to become stranded as renewable energy becomes cheaper and cheaper to supply. New Infrastructure does not focus on building more power generators but on enhancing connectivity through efficient transmission and distribution lines and charging stations to foster an integrated, intelligent energy system. Good coordination and cooperation among public and private stakeholders are key to carrying out the initiative in the most sustainable and efficient way.

Source: China Energy News (2020), 4th Annual Conference on Chinese Energy Industry Development, http://paper.people.com.cn/zgnyb/html/2020-09/28/content_2011764.htm

In September 2020, President Xi surprised the global community by committing to carbon neutrality by 2060, increasing optimism for a global clean energy transition. The subsequent Guideline for Green and Circular Economy set out methods to set China on course to meet the 2060 target. The guideline highlighted the importance of energy efficiency and specific measures that can support ESCO industry, such as encouraging utilities to engage in energy management services, promoting energy performance contracts, and providing preferential tax incentives for ESCOs.

In March 2021, the government unveiled the draft outline of the 14th Five Year Plan (2021-2025), the first Plan since the country set a pathway to a modern, carbon-neutral economy. It set forth 20 indicators in five categories covering economic development, innovation, well-being, green development and security, including a 13.5% energy intensity reduction from 2021 to 2025. According to the IEA, a sharp increase in efficiency improvements is the single most important element that unifies the world towards the Sustainable Development Scenario. The pursuit of all economically viable opportunities for efficiency improvement can reduce global energy intensity by more than 3% each year. China already has a clear vision of where it wants to be in the next decades; the right investments today will help China get there and ESCOs have a clear role to play in realising this ambition.

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