



Climate & Development
Knowledge Network

INSIDE STORIES

on climate compatible development

July 2017

Key messages

- Peru's national commitment to the United Nations – its Nationally Determined Contribution – and its climate change mitigation plan (PlanCC) recognise the importance of energy efficiency and identify a range of specific energy efficiency options at national level.
- In Peru, 99.5% of all registered companies are small and medium-sized enterprises (SMEs) – and energy costs are likely to be proportionately higher for SMEs than for larger companies.
- A project to encourage greater energy efficiency and sustainability in Peruvian SMEs worked with 12 SMEs in Lima to identify priority sectors, to quantify the opportunities for businesses in implementing appropriate energy efficiency measures and optimising energy management, and to explore tailored financing solutions.
- Barriers to SME energy efficiency include information and capacity challenges; standardisation issues; lack of economic incentives; and a lack of financial mechanisms dedicated to investment in energy efficiency.
- Recommendations include detailed market analysis on SME energy use; improved coordination between government and the private sector; improved standards for energy efficiency audits; partnerships between finance providers, consultants and equipment providers; support for external assurance systems; and reform in the regulatory environment.

Authors:

Paul Wedgwood with Ana Munoz and David Tobin, Carbon Trust and Susannah Fitzherbert-Brockholes and Daphne Amevenu, CDKN

Catalysing energy efficiency in small and medium-sized enterprises in priority sectors in Peru

Energy demand in Peru is expected to continue to increase over the coming decades, largely fuelled by industrial expansion and increasing economic prosperity. The Peruvian Government has, however, recognised the importance of energy efficiency as a key element in climate change mitigation strategy and action, with energy efficiency featuring among the climate change mitigation actions in Peru's Nationally Determined Contribution (NDC) under the Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC), and also in Peru's Planning for Climate Change project, known as 'PlanCC'.

The engagement and active participation of the private sector is a key component for delivering PlanCC and NDC objectives for energy efficiency, climate change mitigation and low-carbon development. Despite the high potential for energy cost savings across the private sector, a number of barriers prevent businesses in Peru from identifying and implementing energy efficiency opportunities in their premises and operations. This project focused on the small and medium-sized enterprise (SME) market, aiming to develop a broader understanding of the key actors, structure and dynamics of the current market, and carried out a pilot study with a sample of 12 larger SMEs in Lima operating in more energy-intensive sectors to identify the energy conservation and financial opportunities available to them.¹

The challenge

Peru has been one of the fastest growing economies in Latin America, with an average annual growth rate of 5.9% over the past decade (World Bank, 2016)² and the 59th largest export economy in the world. Its economy is dominated by the exploitation and production of primary natural resources such as copper, silver and gold, as well as fishing and agricultural activities.

In recent decades, rapid economic growth and large investments in infrastructure and the mining sector have increased energy demand in the country. Without a strong focus on addressing energy efficiency this pattern can be expected to continue. If high economic growth is sustained, growing energy needs and the expectations that typically accompany economic development and increased prosperity are likely to drive increases in the country's

energy consumption and carbon emissions.

In July 2016, the Peruvian Government ratified its NDC under the Paris Agreement on climate change. The NDC commits Peru to a range of climate change mitigation actions, several of which relate to energy efficiency across the Peruvian economy. In a complementary process, over the past five years the Peruvian Government has also been developing its Planning for Climate Change (PlanCC), with support from CDKN and others. The PlanCC project also recognised the importance of energy efficiency and it has identified a range of specific energy efficiency options at national level, many of which now feature in the NDC.

The Peruvian economy is largely made up of heterogeneous micro-, small- and medium-scale enterprises (SMEs), with businesses of this type representing 99.5% of all the registered companies in the country.³ Although difficult to estimate accurately, given the huge diversity of sectors and activities, it has been suggested that energy costs for SMEs are likely to be higher proportionately than for larger companies. This would be likely to be particularly the case in the unregulated market for electricity supply through which most businesses in Peru are supplied. Large users (i.e. larger businesses) have more opportunity to leverage their buying power and are more likely to be able to devote human resources to understanding their options and negotiating better tariffs from electricity suppliers. Larger businesses may also be more likely to plan forward and invest more regularly in modern energy-efficient equipment.

This project aimed to achieve the following objectives:

- develop further insights about the structure and actors in the energy market in Peru
- identify key energy-intensive sectors with a high representation of SMEs
- through a pilot working with 12 SMEs in Lima, quantify the opportunity for businesses of implementing appropriate energy efficiency measures and opportunities to optimise energy management
- establish ways in which finance providers could support investment in energy efficiency measures by SMEs through tailored financing solutions.

Barriers to SME energy efficiency

Efforts to increase energy efficiency among SMEs face a range of challenges, some that typically constrain engagement and investment by individual businesses, and others that limit the deployment of energy efficiency measures more widely across the market. These challenges are not exclusive to businesses in Peru, or to SMEs in particular, although they are often more relevant for SMEs due to their size, business structure and financial constraints, especially so in a developing or transition economy such as Peru. The following key barriers have been identified in Peru:

- **Information and capacity challenges.** There are low levels of interest in energy efficiency due to lack of awareness of the possibilities, exacerbated by scepticism, misunderstanding

and underestimation of the benefits and, consequently, insufficient motivation versus other business priorities. Energy consumption data are often not interpreted properly (with little or no use of benchmarking, for example). Support from external expertise and/or staff training is needed, but is not widely available or prioritised. The informal status of many SMEs in Peru is a considerable barrier, making it more difficult even to contact them to raise awareness of energy efficiency as an opportunity.

- **Standardisation barriers.**

With a lack of clear and stringent energy efficiency and environmental standards, and no accredited lists of technologies, suppliers or installers, there are perceived to be increased commercial risks, consumer uncertainty and even, ultimately, disincentives for businesses to invest time, effort and money in identifying appropriate energy-efficient technologies and equipment and reliable suppliers/installers.

- **Lack of economic incentives for energy efficiency projects.**

Energy prices in Peru are relatively low (some of the lowest in Latin America), in some cases artificially so due to subsidies. This makes investment in energy efficiency less attractive for individual companies and for finance providers such as banks. There are no market mechanisms or fiscal incentives in place to encourage businesses to upgrade equipment. Government funds to support SMEs have priorities other than energy efficiency, such as encouraging the formalisation of informal companies.

- Economic and financial barriers.** A lack of financial mechanisms dedicated to investment in energy efficiency, and low levels of awareness and technical expertise within financial institutions, invariably results in the perception of financing risks and the related problem of high transaction costs. SMEs are in any case typically seen as a high-risk investment for finance providers, and often struggle to access appropriate financial services for any kind of investment. Finance providers are generally not experienced or motivated to assess and acknowledge energy savings as a valid and predictable source of funds for businesses to repay loans or other financing.

Recommendations for enhancing SME energy efficiency

The barriers identified are present and relevant not only in Peru, but to a lesser or greater extent in many markets around the globe. Efforts to enhance energy efficiency in Peru's SMEs will nonetheless need to consider specific market conditions. Energy efficiency among SMEs can be influenced by supporting market actors/functions such as finance, equipment providers, energy distributors, and national and regional government, alongside efforts targeted directly at the SMEs themselves. It is the functioning and interaction of all these aspects together that will ultimately determine enduring levels of energy efficiency among SMEs in Peru. Different actors can provide different interventions, services and goods relevant to energy efficiency either directly to SMEs or indirectly to other parts of the market system, which

in turn can affect SMEs' ability and inclination to improve their energy efficiency.

Delivering significant improvements in SME energy efficiency is possible, yet it is challenging given the significant barriers outlined, many of which are not easily overcome. Experience from elsewhere in the world suggests that the first priority is for the national government to take ownership of the overall challenge and prioritise energy efficiency at the senior level as a strategic priority for the country. A first tangible step from this would be for future work to be led by government to carry out further in-depth research, in particular on the potential demand for energy efficiency services and products among SMEs across Peru, and to identify and publish a directory of active consultancies and equipment providers for energy efficiency, and what they offer.

Government also has a potential role to encourage reliable equipment providers to promote their energy-efficient products to SMEs as part of more sophisticated packages, for example including upfront energy audits, by providing guarantees of energy saving from installing new equipment, and by allowing payments by instalment funded from energy savings. Data from several of the energy audits carried out for SMEs in our pilot study suggest potential savings averaging 16% of annual energy costs, supported by a clear business case for SMEs to invest in energy efficiency, with return on investment calculated at less than two years, on average. This provides tangible evidence of the potential market opportunity if other barriers can be overcome (although it should be noted that this is based only on

the small sample of 12 SMEs in certain industry sectors that participated in the pilot study).

A number of subsequent recommendations have been identified to enhance the wider market system that could support the achievement of sustainable improvements in SME energy efficiency at scale across Peru, including the following:

- Market insight.** A detailed market analysis on SME energy use is needed to determine priority sectors to target, assessing the potential size and constitution of demand for different energy efficiency services and products. Publishing this information will help inform market actors (energy consultants, equipment providers) on where to direct their sales efforts.
- Enhanced business networks focused on energy efficiency.** There are currently few spaces for key market actors to come together to develop partnerships, and through which it would be possible to make use of economies of scale to develop research on the sector, advocate to the government, channel communications and/or provide training opportunities.
- Improve communication and coordination between government and private sector.** Linked to the previous point, channels and networks need to be developed through which key actors can hold dialogue to address some of the major constraints. This could assist in engaging senior government buy-in to energy efficiency as a practical priority for business competitiveness and sustainability, and in tackling climate change.

Box 1. Findings from the pilot study

The current project has carried out 12 energy audits across different individual larger SME businesses from relevant more energy-intensive sectors in the Peruvian economy, the majority of which were manufacturing companies of different types (e.g. metal processing, component engineering and production, glass manufacture, textiles and clothing). Commonly identified opportunities across most businesses were:

- **improving energy management** – through better day-to-day practices, including measuring and monitoring procedures for energy consumption; improved ongoing analysis of energy use; and raising staff awareness of energy use and how to make savings through simple operational steps
- **reducing energy use in lighting** – moving from old inefficient fluorescent and incandescent lighting to light-emitting diodes (LEDs), which offer significantly lower electricity consumption as well as longer operational life and lower maintenance, so delivering significant savings
- **compressed air technology**, in particular in ongoing detection and fixing of leaks in compressed air systems, along with better regulation of pressure levels (i.e. not using more than is needed)
- **use of heat recovery** applications within production processes, capturing heat energy that is currently emitted as ‘waste heat’ and recycling it back into heat-intensive processes.

Most savings identified in this pilot study do not require large capital outlay on new equipment, and many simply involve better management of existing equipment and processes. This can require significant staff time, so there are costs involved, although this finding suggests that access to credit to achieve energy efficiency benefits may be less of a priority concern for SMEs than would otherwise be assumed.

In the pilot programme, energy audits were able to identify the following potential outcomes for the 12 participating businesses:



The above findings demonstrate the potential environmental benefits of targeted energy efficiency audits, with an average payback on investment of around two years. These energy audits present a strong financial business case for SMEs to invest in energy efficiency. Many of the recommendations will continue to save energy throughout the life of the energy-efficient technologies recommended, which means the potential saving could exceed \$8.9 million in total cumulatively over the next 10 years for the 12 businesses collectively.

- **Raise awareness among SMEs on energy consumption and its financial implications.** This can be done by encouraging and supporting business networks to focus on energy efficiency as a key topic related to business competitiveness and sustainability. Government could lead this, ensuring that, wherever possible, their communications campaigns targeting SMEs (either directly or via industry leadership bodies and networks) prominently feature information and practical guidance on energy efficiency. There is particular relevance to topics such as competitiveness, sustainability, climate change or environmental management.
- **Improved standards for energy efficiency audits.** Interventions to raise the standards, suitability and consistency of energy

efficiency audits delivered in Peru could have a beneficial impact. For SMEs in particular (and other market segments more widely) it is important to ensure that practitioners providing energy audits can do so in ways that are highly cost-effective, appropriately proportioned, and adapted to the circumstances and opportunities. This includes optimising the time spent on site, strengthening information presented on the potential for financial savings, and providing accurate costings for investments in new equipment. Government could lead work in this area, focusing on training and standards for energy consultants. Free basic training could also be provided for SME businesses to enable them to upskill key operational management to carry out their own basic assessments of energy efficiency.

- **Development of the energy efficiency consultancy sector.**

As well as setting standards for cost-effective energy auditing, there are opportunities in encouraging consultancies to develop and provide more embedded services, for example in partnership with providers of energy-efficient equipment and/or finance providers. There is likely to be a need for capacity-building in business management skills, and in fostering connections between consultancies, equipment providers and finance providers.

- **Partnerships between finance providers, consultants and equipment providers.**

As an extension of the previous point, consultants and equipment providers could offer training and in-house services to finance providers (e.g. advising on investments). This could be

developed further, with the most proactive finance providers working to develop specific financing products/services relevant for energy efficiency investments by SMEs.

- **Supporting external assurance systems.** In order to increase confidence among SMEs (and also finance providers) in recommendations made by consultants and equipment providers, it could be beneficial to strengthen the visibility in Peru of international accreditation schemes for energy efficiency. Other possibilities include the development of a third-party assurance mechanism for investments in energy efficiency equipment, as has been supported in other markets by the Inter-American Development Bank.
- **Reform in the regulatory environment.** The introduction of regulation around the energy efficiency of products and services has been shown to drive change in other markets. Regulation in energy markets can also be used to encourage suppliers, in competition with each other, to manage their relationships with energy buyers differently. In some markets this has included the regulator setting requirements around the provision of energy efficiency advice and related services by energy suppliers.

The actions identified above are those that could potentially commence in the short term, given the right backing from government and key actors in industry and commerce. It is recognised that commitment is required to support such initiatives and changes over the longer term, requiring close public-private coordination to develop successful

approaches and apply interventions with impact and with minimal unintended consequences. Such actions are likely to involve the national government working in close partnership with Peru's business representative associations and networks, suppliers in the Peruvian market of energy-efficient consultancy and equipment, and finance providers. There may also potentially be a role for international suppliers/providers that are not yet established but would consider entering the market in Peru.

Lessons from the project

In delivering this project, insights were gained and lessons learned, not only about the opportunities and barriers for energy efficiency in the SME market in Peru, but also around the operational implementation of a project such as this. It is worth reflecting on these lessons learned and sharing our experiences with others who may be designing and/or implementing similar and related projects for energy efficiency, whether in Peru or in other developing markets.

Challenges

The original project design had to be adapted in practice, in response to various challenges experienced once working on the ground, including the following:

- **Limited engagement by finance providers.** With hindsight, this is a reflection of the lack of appreciation among financial providers of the nature of energy efficiency measures and technologies, and of the potential attractiveness of energy efficiency investment with SMEs. As noted above, there is minimal technical

expertise relating to energy efficiency within financial institutions in Peru (in common with the financial services sector in many countries). This increases the perception of risk in financing equipment for energy efficiency, reducing appetite among financial institutions for engaging in what is perceived to be a small, specialist and uncertain market segment. This is particularly true in connection with SMEs, which are already typically seen as a high-risk market for finance providers. There is a need for focused activity with the financial services sector to educate them about energy efficiency investment opportunities, illustrated as far as possible with real case studies showing how predicted energy savings are achieved and make cash available for businesses to repay the financing on new equipment. Stakeholders including government, development banks, international donor financiers, non-governmental organisations and financial services trade associations all have a future role to play to engage the finance provider community more deeply in the opportunities around energy efficiency investment.

- **Limited appetite among SMEs for financial assistance.** It was anticipated that SMEs would see finance as a fundamental barrier to the implementation of energy efficiency measures in their businesses. In the pilot project with 12 SMEs in Lima, this was not found to be the case. It is not clear whether this small sample

Box 2. Case study: Filtros LYS

Energy audits conducted with Filtros LYS identified annual energy savings of more than US\$33,000.

The project identified five energy-saving measures for the company with potential to generate annual savings of more than US\$33,000 with a rate of return of 1.6 years.

Filtros LYS is a company engaged in the manufacture of filters and filtration systems with automotive and industrial applications. The company is based in Lima and markets its products in South America, Central America and the Caribbean. It maintains proactive environmental and quality management, holding ISO 14001 and ISO 9001 certificates.

Energy experts from Carbon Trust and Efizity visited one of Filtros LYS's manufacturing plants as a result of the company's interest in participating in the SME energy efficiency project. The experts identified a series of key opportunities to save energy and reduce carbon emissions, the most important being:

- improving energy management
- changing the lighting in manufacturing plants and offices
- improvements in leak detection and reducing leaks in compressed air systems
- regulating the operating pressures of compressors.

In addition to a technical report on the opportunities to replace and/or improve equipment, an evaluation was conducted of the company's energy management practices, and a series of possible improvements was proposed to adapt it to the needs of their plant and equipment.

We've given priority to three of the opportunities identified and will be keeping an eye on the resulting savings in the coming months. This project has been vital for us to open our eyes to the possible savings and obtain the information we need to know about energy efficiency investment: invest this amount, recover it in a known number of months and then generate lasting savings.

Roger Omar Cedamanos, Maintenance Manager, Filtros LYS

is representative of the wider market, and finance may still be a key issue in the wider SME market. For the businesses participating in the pilot, however, other very valid barriers came to the fore. Businesses recognised that the energy efficiency opportunities identified were valuable, yet for

various reasons they were not expecting to implement changes (at least not in the short term). Common barriers included:

- lack of management prioritisation of energy efficiency – energy costs were often perceived as essentially fixed, unavoidable costs, and other business

- issues and opportunities take precedence for management and owners
- short-term mentality in how the business is run – this may prevent SMEs from considering investments, even those shown to pay back within 18–24 months
 - a preference for self-financing where possible – accessing external finance is perceived to be a lengthy, complex process that places constraints on the business.
 - **Constrained government resources to support energy efficiency.** The project commenced just as a new national government was coming to power in Peru (August 2016). This period of change for government officials, with uncertainty around roles and policies moving forward, highlighted a broader point concerning the need for greater coordination between relevant ministries of the national government: for the cause of energy efficiency in SMEs this particularly means between the Ministry for Energy and Mines (MINEM) and the Ministry of Production (PRODUCE). Government ministries have very limited resources for understanding and addressing the opportunities for energy efficiency in business, and for developing methods for engaging SMEs and driving and supporting action. With such resource limitations, it is particularly important for government officials to have senior backing to support projects such as this one and to explore and implement more innovative, flexible and cost-effective approaches,
- for example in encouraging or even mandating the use of appropriate methodologies for energy audits in SMEs and other less energy-intensive sites such as public sector buildings.
- Success factors**
- The project benefitted from being designed by and resourced with an experienced team which brought together specialist skills and knowledge from different perspectives, including local Peruvian resources blended with international expertise. Specific experience in working with SMEs was invaluable, and it was often noted how experience working on energy efficiency with SMEs in other countries, including the United Kingdom, bore considerable resemblance to what was found in working with SMEs in Peru. Particular factors that significantly benefitted the successful progress of the project included the following:
- **Support from key local stakeholders.** A number of key stakeholders were quickly engaged and were very willing to share their knowledge and experience, which helped adjust the project design and facilitate the initial stages of implementing the project, notably in identifying possible industry sectors on which to focus, and in assisting with communication with and selection of SMEs to participate in the pilot project. Particular thanks go to the Sociedad Nacional de Industrias (SNI). Its structure of working committees for different industrial sectors offered routes to connect with member companies, including several committees for manufacturing sectors such as metal-mechanical engineering and textiles. Engaging SME businesses on the topic of energy efficiency can be challenging, with management typically highly focused on existing core business activities. It is not common in SMEs for people to have dedicated responsibility for energy issues within the business. The ability to leverage existing business networks and trusted communication channels to reach SMEs is therefore vital for projects such as this.
 - **Willingness to learn among operational management and staff at the SMEs.** Once the 12 SMEs were signed up to the pilot project, we found that most were very interested to learn more and were very receptive to expert advice about improving energy management practices and opportunities for installing new energy-efficient technologies in their premises and operational processes. In different businesses there were sometimes different motivations: while making cost savings and improving competitiveness is universally attractive, other motivations can be at least as important, if not more powerful. These can include:
 - pressure from stakeholders in the value chain to demonstrate ongoing improvements in managing the environmental impact of the business and its products/services
 - personal commitment from owners or senior management to run the business more sustainably and/or take action in response to climate change
 - general desire by management/owners to run an efficient,

modern operation, with openness to exploring innovation and improvements to the business, including to enhance the reputation of the business.

- **Well-designed, streamlined approach to energy auditing.** The design of the energy audit methodology and reports which were provided to the 12 SMEs in the pilot project was found to be highly effective and proportionate

to the circumstances. Carbon Trust shared its extensive international experience in delivering SME energy audits with local Peruvian energy consultants Efizity. Working in close coordination, this achieved time- and cost-effective delivery of readily understood reports for each SME. Reports were well supported with evidence and made clear the quantification of costs, savings

and time involved for the businesses to take forward each specific recommended energy efficiency measure. The approach also made good use of information from local suppliers of energy-efficient equipment, such as LED lighting, so that costings and practicalities for the supply/installation of new equipment were properly informed and credible.

Endnotes

- 1 This document summarises work carried out under the project 'Encouraging greater energy efficiency and sustainability in Peruvian small and medium-sized enterprises (SMEs) in priority sectors in Peru, promoting UK expertise as energy efficiency solutions supplier', which was commissioned through the Climate and Development Knowledge

Network (CDKN), and funded by CDKN and the British Embassy in Lima (through the UK Prosperity Fund). The project was carried out between July 2016 and April 2017.

- 2 World Bank (2016) 'Peru: Overview'. Washington, DC: World Bank (www.worldbank.org/en/country/peru/overview).

- 3 Ministerio de la Producción (2015) *Las Mipyme en cifras 2014*. Lima: Ministerio de la Producción (www.scribd.com/doc/296846821/Mipyme-en-Cifras-2014).



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Funded by:



e: enquiries@cdkn.org

Ministry of Foreign Affairs of the Netherlands



t: +44 (0) 207 212 4111

This document is an output from a project commissioned through the Climate and Development Knowledge Network (CDKN), funded by CDKN and the UK Foreign and Commonwealth Office (FCO). CDKN is a programme funded by the UK Department for International Development (DFID) and the Netherlands Directorate-General for International Cooperation (DGIS) for the benefit of developing countries. The views expressed and information contained in it are not necessarily those of or endorsed by DFID, DGIS, FCO or the entities managing the delivery of CDKN, which can accept no responsibility or liability for such views, completeness or accuracy of the information or for any reliance placed on them.

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