

Enhancing private sector engagement in energy efficiency in Peru

A project funded by the Climate and Development Knowledge Network and delivered by the Carbon Trust with the support of Südesco Energy and Perú 2021



1. Project overview: objectives, approach and methodology

In Peru, the private sector is responsible for 65% of energy consumption and 60% of carbon emissions in the country. Energy represents a substantial cost to Peruvian companies, which spend more than \$9 billion on electricity and fuel each year¹. Energy efficiency (EE) can generate economic growth, increase productivity and improve competitiveness, along with delivering a substantial reduction in emissions of greenhouse gases (GHGs).

The business community in Peru is in the early stages of energy management and the implementation of cost effective energy efficiency measures. This project worked with six leading companies in Peru, each representing a key sector in the country, in terms of their economic importance, their environmental impacts and their importance in international supply chains.

The project aimed to support the delivery of climate compatible development² in Peru, through the identification and assessment of private sector energy efficiency opportunities, and through building capacity to support the implementation of energy efficiency practices in the country.

The project set out to achieve this objective through four key work streams:

- **The identification and assessment of energy efficiency opportunities** by carrying out reviews of the operations and procedures, and developing strategies to implement change. We followed these reports with regular support to enable the development of business cases and implementation plans for cost effective opportunities
- **Engaging with specialist energy consultants and helping to build their capacity.** We worked with specialised energy consultancies in Peru through workshops and direct collaboration to help build capabilities in carrying out energy audits and developing business cases around energy saving opportunities
- **Piloting an energy efficiency workshop** for groups of SMEs to help them manage their energy demands and identify savings. This pilot was designed to be replicable in the future and has, for example, been targeted at groups of SMEs that are either suppliers or customers of larger corporates.
- **Disseminating project results** through a detailed report ahead of COP21, and a knowledge sharing event using the case studies from the seven corporates and sustainability activities in their sectors in Peru. The case studies will be used to demonstrate the opportunities in the field and examples of early pioneering activities that will begin the move to a sustainable Peruvian private sector.

Participating organisations



The Carbon Trust is a non-profit company whose mission is to accelerate the move to a sustainable, low carbon economy. **The Carbon Trust** has developed, with funding from CDKN, this energy efficiency project in Peru in accordance with the philosophy of CDKN and has acted as a catalyst to maximize the impact achieved.

The Carbon Trust aims to contribute to the key objectives of emission reduction, development of low carbon business and increased energy security. Through its work, the Carbon Trust has helped its customers to attain energy savings of \$7 billion and reduce their emissions by 47 million tCO₂e.



Peru 2021 is a private non-profit organization which has been a local counterpart to the project. Peru 2021's mission to train and mobilize business leaders to incorporate social responsibility in to the management of their companies.



Südesco Energy has been responsible for developing and measuring the carbon footprint of the participating companies and identifying cost effective opportunities for energy improvements. Südesco Energy are a leading company in the development and implementation of energy management projects, energy conservation and sustainability. Their projects offer all types of solutions related to the optimal use of energy such as efficient lighting, air conditioning, waste heat recovery, prevention of waste heat, optimization of steam and compressed air systems, cogeneration and mini-renewables.

1.1 Project approach and key activities

Project timeline and key activities

Phase I: Recruitment of companies

Led by Perú 2021, we engaged with a wide range of large corporates to promote the project and evaluate the appetite for participation. We received a very positive response to the project with almost every corporate wanting to be involved. The project was so well received by organisations, we had to limit participation to seven places and turn some interested parties away.

Phase II: Consultancy recruitment

In the initial project design, we had anticipated delivering local technical support through only one local consultancy. However, it was quickly recognised that the project would need more capacity and a greater range of sector experiences to successfully deliver the engagements to the wide range of industrial and commercial organisations participating. Therefore, an additional technical consultancy was engaged due to their expertise in the mining and manufacturing sectors.

Phase III: Local consultancy engagement, training and briefing

Following the recruitment of the local technical consultancy teams, the Carbon Trust provided briefings on the energy audit approach, foot-printing guidance and technical training to the local consultancy teams. This enabled a consistent approach to audit and report preparation across the seven sectors. These training sessions were also valuable for the engineers from the UK and Peru to share local experiences and address challenges faced in the local market.

Phase IV: Site visits and reports

Each local consultancy was then commissioned to support 3-4 corporates. They engaged with the participating companies to understand their key sites of interest to be audited and the scope of the analysis. A number of site visits were made to each company and one draft report was produced per organisation.

Phase V: Quality assurance of reports and audits

The Carbon Trust carried out a review of each draft report, following which the reports were finalised and submitted to the client organisations for review and comment.

The project experienced significant delays with one set of reports at this stage, which led to the need to re-commission audit studies and visits for a small number of the corporates.

Phase VI: Dissemination of the project at COP 20³ and the World Climate Summit

The project was fortunate to coincide with the COP 20 event in December 2014, hosted in Lima. The opportunity was taken to showcase some of the early outputs from the project as well as promote the sustainability lead being taken by some of the corporates involved in the project.

All participating organisations on the project (including Peru 2021, the Carbon Trust and the corporates) were used to support this workshop which was delivered as part of World Climate Summit (a business led regular event co-located with each COP). Three of the companies were able to present their sustainability objectives, strategies and drivers to the business focused audience.

Phase VII: Corporate debrief

Following the finalisation of each corporate's sustainability report, a debrief workshop was held to review the report findings and support their development of an achievable implementation plan. These debrief workshops were a great opportunity to engage with a wider range of stakeholders in each company (typically including site managers, production engineers, sustainability and energy managers). By combining local and UK based engineers in these workshops, we were able to build confidence in the viability of the recommendations and problem solve the implementation plans for each opportunity.

Following the debrief workshops we conducted further site visits with a number of the corporates (during one of the team's visits to Peru). This was helpful in assessing progress made in each organisation and to broaden the scope of the studies. This again helped build confidence with the companies on the potential impact and viability of energy saving opportunities.

Phase VIII: Delivery of pilot SME Energy Management event

A key element of the project was to pilot an approach for engaging with communities of Small and Medium Size Enterprises (SMEs). Support for SMEs is an important element of any scalable programme in Peru since they represent an important contribution to many of the economy's key sectors.

The Carbon Trust developed and piloted an SME Energy Management event. This was delivered to a group of around 20 SMEs as well as representatives from a number of influential public organisations. The objective was to help them quantify and manage their energy demands and identify savings through low cost measures. This approach is adaptable to groups of SMEs brought together through a geographical, sectorial or supply chain similarities.

Phase IX : Dissemination event and project end workshop

At the end of the project, a stakeholder learning workshop was organised with representatives of the organisations to understand the successes and barriers encountered during the project.

Following this, a dissemination event was held with representatives from government ministries, private sector organisations and financial institutions to:

- a) share the key findings and lessons from the project
- b) discuss the key barriers to the identification and implementation of energy efficiency measures across the economy in Peru, and
- c) create a space for dialogue among the private and public sectors about ways in which the sustainability agenda and carbon reduction targets can be achieved.

1.2 Methodology: identification and assessment of energy efficiency opportunities

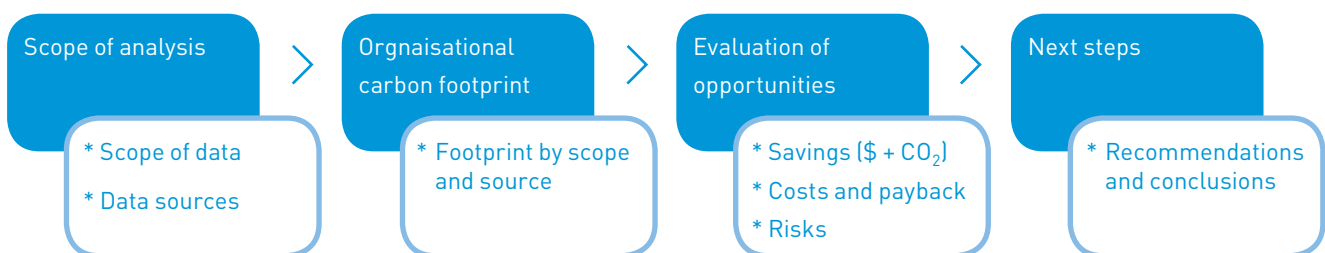
Energy audits are a critical step in taking companies on a journey from knowing little or nothing about their energy usage to a point where they can implement beneficial changes to processes and procedures and make smart 'invest to save' decisions. In our experience, the vast majority of companies have not had an energy audit conducted on their buildings or industrial processes. Consequently, most companies do not know how much energy is being used and when, which systems are the most energy intensive, or where the opportunities lie to make cost effective improvements to the energy intensity of the business operations.

A sustainability and energy efficiency report provides a company with a comprehensive, independent and evidence based understanding of the key areas for energy efficiency gains, their carbon footprint, and to establish specific, prioritised recommendations for making energy savings. To build confidence in these recommendations, it is crucial they include potential savings in energy and carbon emissions, estimated cost of the recommendation and payback period.

The reports include a range of energy saving opportunities focused on improving energy performance by:

- a) implementing an energy policy and strategy;
- b) raising staff awareness and engagement training;
- c) process/system optimisation;
- d) upgrading to more efficient/effective equipment;
- e) deploying cost-effective renewable energy technologies.

Figure 1 Scope of the advice provided



2. Overview of the companies and their associated sectors

2.1 Context

Companies face a growing pressure to improve their environmental performance from shareholders, regulators and civil society. The efficient use of energy and broader resources can lead to a positive impact in their bottom line, competitiveness in their sectors, and benefit their reputation – particularly for those organisations working in globalised markets. This is already being felt in some Peruvian sectors (such as food manufacturers).

As an added incentive, improvements to resource efficiency has a beneficial impact on costs and competitiveness. Making the right decisions in this area can deliver significant energy cost savings, and reduce the company's environmental impacts.

The Carbon Trust has estimated that low cost energy efficiency measures have the potential to save Peruvian businesses 3.2 billion soles (12% of energy costs) and reduce carbon emissions by 4.5M tCO₂ (14% of businesses' total emissions) per year.⁴

In addition to these energy cost and emission reductions, successful implementation of good quality energy efficiency measures across the Peruvian economy can bring other important benefits:

- Strengthening of the industries' regional and global competitiveness
- Increasing productivity through use of modern, more reliable equipment
- Improving trade relationships and export growth
- Reducing the demands on the local energy supply infrastructure
- Creation of a "green product marketplace"
- Indirect job creation through the growth in energy efficiency equipment supply and installer sectors
- Mitigation against the impact of future regulation
- Supporting Peru in meeting its carbon reduction obligations

Below we provide a brief description of the relevance of energy and sustainability pressures for the economic sectors that are associated with the companies chosen to participate in this study. Additionally there is a short reflection on the progress that the participating organisations have achieved during the project and the key factors that encourage companies to focus on energy efficiency.

The mining sector in Peru

Peru has a large mining sector, representing the most significant contribution to the economy, as well as being responsible for a large labour force. In 2014, the mining sector accounted for 14.4% of GDP and 56% of all exports. The investment driven by this activity provides around 2.2 million direct and indirect jobs, and generates tax revenues of over 5,500 S/ million annually⁵.

Sustainability drivers and potential growing pressures

The mining sector is energy intensive. Therefore, optimising the use of energy is crucial for the sector if it is to maintain its global competitiveness as well as survive fluctuations in commodity and energy prices. The sector faces specific challenges due to the high capital cost of its infrastructure and equipment, as well as the typically remote location of its operational sites.

Energy use

In a recent study by the Carbon Trust on the mining sector, 40% of the total energy consumption was used for heating, melting and cooling processes. This could be reduced by 10% through the optimisation of product inputs and by improving heat recovery process.

Motors and drives are estimated to consume 60% of the total electrical power consumption. The selection of efficient motors, correctly sizing of motors and the use of variable speed drives, all lead to efficient use of this equipment. Operational costs of operating motors are often overlooked despite these costs being up to ten times greater than the capital cost of purchasing a new motor.

Case study from participating company



Poderosa is a mining company in Peru, who operate some of the largest gold mines in the country. The company currently operates an underground mine and two production plants.

What has been Poderosa's progress during the duration of this project?

Poderosa has measured the carbon footprint of one of its sites using an internationally recognised methodology, ISO 14064. The energy audits have also helped identify the key direct and indirect impacts of the operation and potential savings. Over the past few years, Poderosa has been focusing on optimising active power demands of motors and transformers in the Santa Maria production plant. Poderosa is currently working on upgrading the connection to the grid, reducing its use of fuel and will seek to improve its motors in the near future.

What do you think are the main factors that encourage companies in your sector to carry out their activities in more sustainable ways?

'The main factors that promote sustainability in the mining sector are the finite nature of the mines, the difficulties created by the distance of the operations, socioeconomic impacts and energy consumption. In the heavy industry with high energy consumption, there is an awareness of the importance of energy efficiency due to the cost it represents. It is however difficult for this culture to be extended upwards and horizontally across the organisation. In this sense, the smaller industry or wider public may be less aware of their energy consumption.'

The fishing sector in Peru

The fishing sector is key to the Peruvian economy as well as for the global fish supply chain. The sector has contributed between 0.5 - 0.7% to the GDP nationally per year in recent decades, and has been the second largest generator of foreign currency, following the mining sector - contributing 2,432 million US dollars in exports in 2008⁶. Internationally, the Peruvian anchovy fishery is the world largest single species fishery and provides a third of global fish meal.

Sustainability drivers and potential growing pressures

Peruvian waters are part of the anticyclonic movement of the eastern South Pacific Ocean, known as “El Niño”, which occur mainly during abnormally hot periods, causing major changes in oceanic and atmospheric system, which has a direct impact on fish resources. The sector is highly regulated, with production levels depending on the quotas set by government agencies due to the impact on marine resources and the risk of over-exploitation.

Energy use

The fishing sector in Peru includes fishing fleets as well as processing plants for fish products (for human consumption) as well as the production of fishmeal. Looking at the end-to-end impact of these products, refrigeration and the operation of production lines represent the most energy intensive processes.

Case study from participating company



Austral is a fish product company which is part of Austevoll Seafood ASA that has operations in Chile, Norway, UK and Ireland. The company is one of the largest producers of canned salmon products, omega 3 concentrate and marine products. Austral’s operations and assets include fishing vessels, fish meal and oil processing plants, and several canneries.

What has been Austral’s progress during the duration of this project?

The project has enabled Austral to identify new opportunities to improve energy efficiency and incorporate more accurate measurements in their management objectives. Austral has, as a result, decided to include the implementation of ISO 50001 as part of its corporate strategic plan, which will allow the organisation to streamline their future sustainable energy efficiency projects.

What do you think are the main factors that encourage companies in your sector to carry out their activities in more sustainable ways?

‘The main factor for our business is the sustainability of fishery resources, it is essential to ensure responsible fishing. Due to global warming, the severity of some climatic events such as El Niño, could intensify or become more frequent’. (El Niño is a climatic effect that can negatively impact fish populations and inland agriculture).’

The telecommunications sector in Peru

The telecommunications sector in Peru has seen a high annual growth rate driven by an increasing demand for communication solutions and data transmission. This sector in Peru has had a lower penetration rate than in the rest of the region, and a different evolution when compared with European and North American markets. Mobile communication is by far the most popular sub-sector - for every 100 people in Peru there are 116 mobile lines but just 13 fixed telephone lines⁷.

Sustainability drivers and energy

The sector growth has driven significant growth in the energy demand of its products during their design, manufacture and operation – therefore impacting on the energy consumption of suppliers, operators and consumers. The build and use phases of the products are associated with serious environmental impacts related to the materials used in their production and disposal, and the difficulty posed for recycling.

The telecommunications sector can, however, have a positive impact on the carbon footprint and energy use of its customers, as its products and services enable efficient economies.

Looking at the direct operations of organisations in the telecommunications sector, the most energy intensive spaces are data centres through direct energy demand and cooling.

Case study from participating company



TGestiona is a company specialising in business process outsourcing and communications. It is part of Telefónica Group, which has operations worldwide. TGestiona has operations across Peru - primarily offices and distribution centres.

What has been TGestiona's progress during the duration of this project?

As a result of the participation in this project TGestiona has evaluated the energy savings opportunities identified, prioritised these and developed budgets for the implementation of these. These recommendations will also be communicated to, the business' other sites and be monitored internally.

What do you think are the main factors that encourage companies in your sector to carry out their activities in more sustainable ways?

'In Peru, many organizations are beginning to realize that sustainability is a market requirement. That is to say, if these large corporations adopt management models and extend their supply chains, this will encourage compliance with these standards at all levels.'

'Additionally, we understand that future legislation will be a key factor that will contribute to sustainable development.'

The finance and insurance sector

The finance and insurance industries in Peru have experienced significant growth over the last few years, reaching a 12% growth rate in 2014⁸ – directly linked to GDP growth. The high degree of informality in the Peruvian economy represents a major barrier to the growth of the insurance industry.

Sustainability drivers and potential growing pressures

Internationally, the insurance sector has incorporated sustainability in an exemplary fashion, developing the Principles of Sustainable Insurance or UN Principles for Sustainable Insurance -PSI as an initiative by the sustainability of the sector and through investment principles responsible or PRI - Principles for Responsible Investment, which incorporate environmental sustainability in its risk management for both customers and investments.

Energy use

Most of the energy used in the sector is based on the office space it occupies and the data centres it operates. The two key energy consuming technologies, and the areas where the greatest opportunities for significant energy savings, are ventilation/air conditioning and lighting.

Case study from participating company



SURA is a Colombian insurance group with more than 141 billion soles in managed assets and more than 34 million customers. SURA is present in Peru with a company structure that specializes in insurance and finance. SURA has conducted several evaluations of its corporate carbon footprint, and estimates a reduction of more than 29% last year. Some major initiatives over the last few years have included the creation of a system of pool cars that allow employees to share vehicles, improving facilities at its offices, LED lighting automation, and optimization of the air conditioning system.

In 2014, SURA held the launch of the Responsible Investment Program that seeks to implement the principles of UN PRI to manage environmental, social and governance issues. This initiative was developed in partnership with the Financial Cooperation Development (COFIDE), Lima Stock Exchange and Association of Banks (ASBANC) with the support of the Inter-American Development Bank (IDB), Driving Sustainable Economies (CDP), Principles of Investment Head of the United Nations (UN PRI), and Sustainable Stock Exchange (SSEA).

The initiatives undertaken by SURA in recent years extend beyond its direct operations, having a large number of awareness raising campaigns, funding programs in rural areas and other environmental projects.

The food retail sector

The supermarket business in Peru grew 9% in 2014 mainly due to the increased use of credit card purchases and a growing middle class in the country. This has aided the penetration of the big chains within the country, although the market is still largely dominated by smaller sized firms. In 2011, sales in large supermarkets totalled 3,100 million dollars, while sales in traditional stores were 16,800 million dollars⁸.

Sustainability drivers and potential growing pressures

Due to the reliance on their value chains, the food sector has the challenge to improve the efficiency and transparency of its suppliers, to meet the expectations and demands of its stakeholders.

Energy use

Energy use in the food retail and distribution sector is focused in lighting, ventilation, and air conditioning processes, with refrigeration responsible for the largest energy consumption. Refrigeration in supermarkets can consume between 30% and 60% of total energy, whilst lighting uses between 15% and 25%. It is particularly important in areas like Lima with high air pollution to maintain the air conditioning systems in a good and clean condition to ensure that cooling losses are minimised.

Case study from participating company



Supermercados Peruanos S.A. is the second largest supermarket and hypermarket chain in Peru. Supermercados Peruanos has operations in the largest cities with a higher concentration of stores, distribution centres and megastores in Lima.

What has been Supermercados Peruanos's progress during the duration of this project?

Supermercados Peruanos' footprint has lowered as a result of different initiatives identified in this project, such as the installation of LED lighting and a better energy management and staff training. Supermercados Peruanos has developed timetables for switching on and off store lights and an efficiency check-list for its environmental leaders.

What do you think are the main factors that encourage companies in your sector to carry out their activities in more sustainable ways?

'It is necessary to develop a sustainability culture through raised awareness and education. An improvement in energy management would immediately result in a reduction of energy consumption.'

'Technologies at accessible prices for the companies, especially for the SMEs, may result in a massive reduction of energy consumption.'

'Legislation that promotes the use of clean technologies and sanctions the indiscriminate use of resources.'

Sustainability drivers and potential growing pressures

Sustainability in the beverage bottling sector is important, due to the average life cycle of the products it trades, which go beyond its direct operations. Usually, this sector has an important hydrological impact, since water is the base material of its products, and also an important impact through its packaging once the products have been consumed.

For bottling companies, the efficiency of processing and distribution of its food and beverages, is an operational priority. Additionally, the end of life impacts of their packaging materials and the sourcing of raw materials, are both key concerns for the value chain. Waste can also be an added problem in countries like Peru, where recycling of certain products is limited.

Energy use

Energy use is concentrated in the processing plant and transport of the products sold. There are energy efficiency opportunities across heat recovery systems, conveyor belts, flue gas recovery and lighting.

Case study from participating company



Corporación Lindley specialises in the manufacturing, distribution and marketing of non-alcoholic beverages, including all Coca-Cola products in Peru. The company operates across the country.

What has been Lindley's progress during the duration of this project?

During this project, Corporacion Lindley has installed a real time energy control program for natural gas, electricity and LPG consumption. Further to this, the installation of new technology to optimise the use of pumps and the improvement of chilled water and steam pipes insulation has also been implemented.

Corporación Lindley has an energy saving management system in place where energy consumption is monitored and project implementation is tracked.

What do you think are the main factors that encourage companies in your sector to carry out their activities in more sustainable ways?

'Training: Employees and citizens, must become aware of the efficient use of resources. We should analyse the relationship between energy consumption and environmental impact, either of an organization or of an individual, so that we all become aware that with good practice in the use of the resources we can reduce the carbon footprint. Financing: Although new technologies are developed, financing is a limiting aspect. Peru is a country where the energy cost is low, the introduction of new technologies in an organizations is difficult. However, the continuous innovation and desire for improvement encourages Lindley to incorporate new technologies along our value chain and within our production process. Likewise, we are aware that over time the cost of energy will increase and that the cost of new technologies will decrease while technological progress continue.'

3. Project findings and opportunities

This project has focused on the **identification and assessment of energy efficiency opportunities across seven sectors** in Peru. Working with local consultancy support, we have reviewed the operations and procedures to identify areas of key energy savings and develop strategies to implement change. These key opportunities identified in the individual company reports are grouped in two categories; energy management and new capital investment opportunities. Whilst these opportunities were identified for each company, there are broader lessons and recommendations that can be more widely applied.

4.1 Energy management opportunities

During this project the Carbon Trust has found some key areas of improvement around energy management. A good energy management strategy and high quality processes facilitate the identification of energy savings and the incorporation of best energy practices into day-to-day management.

Operational energy management opportunities



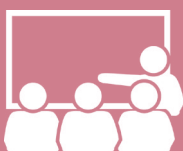
Energy management



Data availability



Operational maintenance



Staff engagement and awareness

Energy management resourcing

The disconnection between energy and sustainability responsibilities within an organisations complicates the effective management of energy consumption and the success of energy efficiency projects.

Throughout the duration of the project, the Carbon Trust found that energy and sustainability responsibilities are not usually grouped into one single function. Rather, energy related matters can be part of the day-to-day responsibilities of site and plant managers and are not passed up any further in the responsibility structure. Sustainability on the other hand, is grouped with wider tasks such as corporate social responsibility (CSR) and communications, and is managed centrally without direct reporting on energy consumption or matters.

The responsibility framework for energy management often does not extend to upper management levels, making any issues or requests for resources difficult to escalate. It also makes it difficult for senior executive leadership or sustainability commitments to be communicated to lower management levels and staff with direct day to day responsibility over energy related matters.

The lack of human resources can lead to situations where resources are allocated based on what's urgent vs. what's important.

Priority is usually given to what is urgent, whereas what is important, such as longer term programmes, is delayed or postponed.

As responsibility over energy matters is often not centralised or eventually escalated to senior leadership, the amount of resources – both human and financial – assigned to it tends to be low. The lack of human resources can become a key impediment to the incorporation of energy efficiency practices to day to day practices as well as the progress of specific projects, as it limits the engagement of the key staff.

Project examples

One of the participating organisations found that the most effective way to manage energy and sustainability matters within the organisation was through the setting up of an environmental team, with representation from senior management and energy managers. The environmental team would meet up regularly to discuss new projects, employee engagement and energy site performance.

Staff engagement and awareness raising

Employee engagement in energy efficiency and carbon reduction can help change behaviour in the workplace and reduce unnecessary energy consumption. Ideally energy awareness and cultural change should complement other elements of good practice as part of an integrated approach to energy management. Some organisations have found that creating sustainability committees can help distribute the work burden, facilitate collaboration across various departments and improve internal reporting mechanisms. A well implemented employee engagement scheme can lead to energy savings of approximately 5%.

Some ways in which this can be done include:

- Staff awareness campaigns
- Workshops to capture staff suggestions on energy improvements
- Technical training for relevant staff
- Development of online based induction training
- Development of a staff committee to look at how best to implement suggestions

Data availability

The availability of energy data enables organisations to measure and monitor their current consumption and plays a vital role in calculating the potential saving from energy efficiency projects. However, in a large proportion of the audited sites, energy data was scarce and did not have sufficient level of granularity to enable the identification of potential energy inefficiencies.

One purpose of monitoring and targeting (M&T) is to relate energy consumption data to the weather and floor area (for buildings) or production volumes (for industrial or manufacturing sites) in such a way that companies can have a better understanding of how energy is being used. In particular, it will identify if there are signs of avoidable waste or other opportunities to reduce consumption.

In relatively simple systems, it is advised that an automated meter is installed. This enables the organisation to track the electricity consumption with a 30 min interval, showing the energy consumption at times of no occupancy/activity, during peak activity period, or at times when certain systems are running, such as air conditioning or cooling systems.

Project examples

One of the participating organisations had recently upgraded their energy management system to include automatic meter readings for its main energy consumption as well as sub meters for energy intensive machinery in the production line. With this data, they were better able to identify areas where demand was too high, indicating a maintenance check was needed, or that the control systems had to be adjusted.

Operational efficiency and maintenance

For equipment to run efficiently, regular inspection and maintenance is required. In areas such as Lima, this is particularly relevant for air conditioned systems. During the audits conducted, a large proportion of the air conditioning systems showed signs of running below their capacity due to a number of easily solved situations, primarily dust obstruction in the filters and poorly insulated systems.

Project examples

Due to the high pollution levels in Lima, air conditioning filters and condensers can get clogged, which lowers the performance of the equipment. The filters should be cleaned twice a year in Lima to ensure proper functioning. The savings from having a well-functioning systems easily pay for two cleaning services a year. There are also specialised treatments that can be applied to filters and condensers that prevent dust building up.

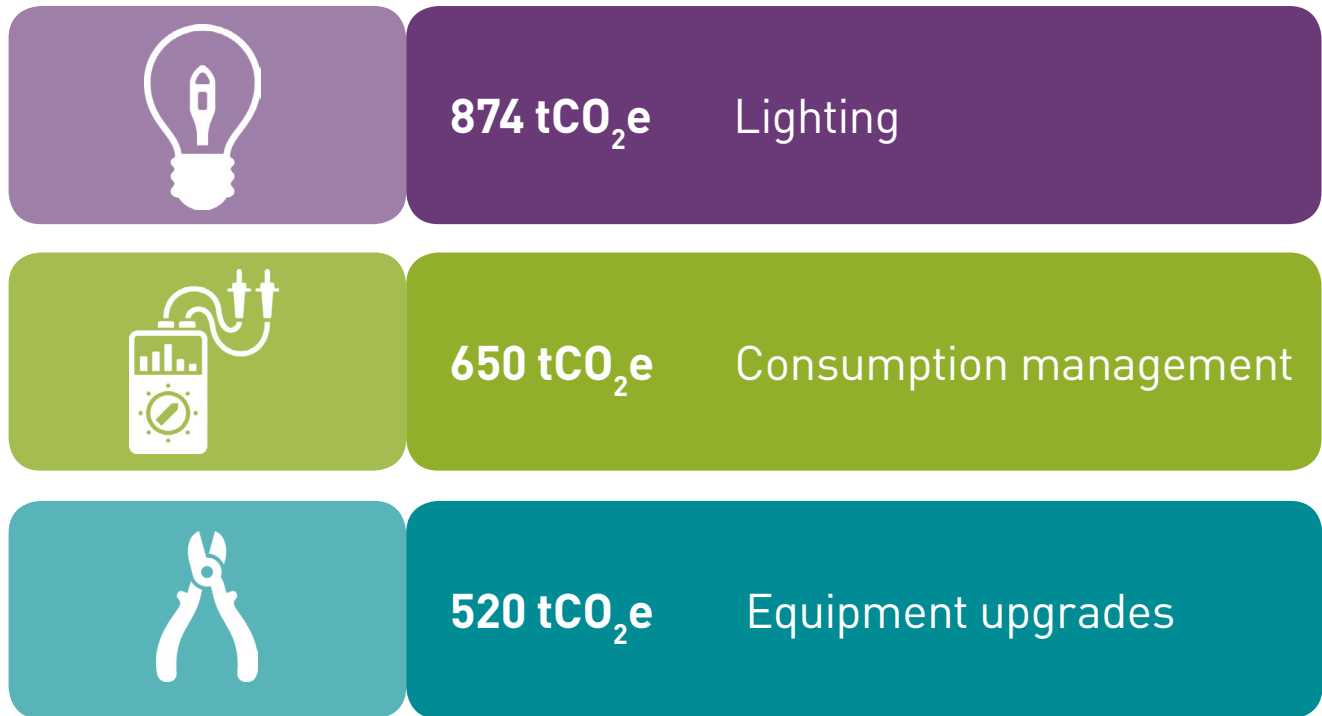


Condensation around pipe insulation indicates that the insulation needs replacement. Inefficiencies in the insulation system will have negative impacts on the energy consumption of the cooling system.

4.2 Capital investments

Capital investments in new equipment were largely focused on lighting upgrades, energy management and upgrade of pumps and motors. Payback for these systems ranged from a few months to 2 years, representing a sound business case for investment across all seven organisations.

Key CO₂ savings identified



Lighting opportunities were identified in most sites, typically the upgrading of the existing systems to LED systems that offer significantly lower electricity consumption as well as longer life and lower maintenance.

Key recommendations across the organisations:

- Installation of occupancy sensors: By dimming or switching off lighting when there is nobody in a room, occupancy sensors can reduce electricity use by 30%.
- Use of daylight sensors: Adjusting the artificial lighting according to the amount of natural light in a room using daylight sensors or photocells can reduce electricity use by up to 40%
- Upgrade of lighting systems to LED: LED lighting has been high on the wider energy efficiency agenda for several years, but right now no other technology change offers the same level of energy reduction, whilst maintaining or improving on operational performance.

Project examples

In a warehouse space a large number of light fittings were mounted in the ceiling, approximately 25 metres above floor level. The light was however only needed for members of staff working at ground level. The light fittings required enough voltage to provide good lighting at ground level, whilst illuminating a large area of unoccupied vertical space.

- *Recommendations:* Because this area did not require cranes to pass under them, lights could be fitted at a lower level, making maintenance easier and for the lights to be replaced with more efficient, lower voltage types.

A refrigerated space is lit with lighting systems that generate a lot of heat and are largely inefficient.

- **Recommendations:** The replacement with LED systems has a double impact: it doesn't heat up the space, thereby not increasing the cooling demand, and it is a more efficient lighting system.

Motors and drives

Running costs of a motor can be over ten times what it cost to buy in the first place. The efficiency of the motor and the correct sizing for its application is therefore of critical importance to minimise the lifetime costs and the environmental impact of the motor.

Key recommendations:

- Selection of high efficiency motors for new installations and replacements. Ensure the correct motor size is selected, avoiding the common mistake of oversizing motors
- Use of high efficiency hydraulic pumps

Other important factors:

- Installation of variable speed drives when there are variable loads such as fan systems or to control flow rates. A small speed reduction can result in relatively high reductions in energy use and therefore operational costs.
- Switch off. Turn off motors when they are not in use, even when hidden within machinery. This can happen during breaks, between batches or job changes, or out of normal working / production hours. This could be done with automatic switch-off controls or time switches, sensors or intelligent controls.
- Have a motor management policy that will structure the approach to repair and maintenance.

Project examples

A site, which requires constant use of motors as part of its production line. The motors used however, are old and inefficient and have required a number of repairs. Some of these motors are between 10 and 20 years old.

- **Recommendations:** Undergo a replacement for more efficient motors based on the expected load, with variable speed drives and easy switch off monitoring. The return on investment is less than a year

Heat recovery

Heat recovery is the collection and re-use of heat arising from any process that would otherwise be lost. Heat recovery can be applied in buildings (such as kitchen ventilation systems) or in many industrial processes such as ovens, furnaces, refrigeration or compressors. Heat recovery can help to reduce the overall energy consumption of the process itself, or provide useful heat for use in other purposes on site.

Project examples

The operational efficiency of a boiler is measured by the percentage of the fuel input energy delivered as useful heat output. Not all the heat released when the fuel is combusted can be used; so potential heat is never released due to incomplete combustion and some is lost. The majority of lost heat arises from flue losses at circa 18%.

- *Recommendations:* Installation of a boiler flue economiser to recover the heat. The installation of this technology could result in savings 4-6%¹⁰. These can be retro-fitted to most steam and high temperature hot water boilers. The water is fed from the economiser to the boiler at the boiler operating temperatures.

Renewable energy

Some organisations have looked that installing on site renewable energy sources to reduce their electricity cost and reliance on the grid. Renewable technologies can also enhance the organisation's green credentials and potentially allow a company to sell electricity back to the grid.

Any organisation considering the installation of renewable technologies should follow the next steps:

- Carry out pre-work assessment with the energy and facility managers to identify specific carbon-saving opportunities, risks and issues and maintenance opportunities.
- Conduct a feasibility study that provides a realistic estimate of the whole-life costs and benefits of all the potential renewable technologies.
- Implement a pilot project onsite that can provide data to support any renewable technology decisions.
- Explore funding sources that could help the upgrade to renewable technology
- Address issues such as operator training and staff awareness, and set up a maintenance schedule when installing a renewable technology.

Project examples

A participating organisation had been looking to install a hydroelectric plant in order to reduce its energy cost and reliance on the grid. The objective of the project was to generate up to 42.75 MW and be able to export some energy into the grid.

It is important to take into consideration the feasibility and cost of the investment as well as the environmental and energy permits that are sometimes required. However, decentralised energy generation technologies have a large potential in Peru, particularly in areas that are not connected to the grid or where the generation is mostly reliant on fossil fuels.

4. Lessons learned

This project has identified some areas where further support from government, funding agencies and solutions providers, would significantly advance the speed of identification and implementation of energy efficiency measures in Peru's industries, helping to support the transition needed to meet the country's unconditional INDC target of a reduction in the national footprint by 20% by 2030:

The energy efficiency sector is in its early stages

- **Solution:** To provide skills training for technical specialists, consultants and the equipment supply and installation industries.
- Providing an experienced team of experts in the marketplace to support industries to identify and appropriately evaluate opportunities for energy efficiency improvements is crucial to help overcome the skills gap within companies. Having these skills available to provide independent and trusted support to companies in Peru will help to accelerate the consideration of impactful measures as well as maximise the level of investment and implementation of these measures.
- One way to achieve this outcome would be to design and operate a training and accreditation scheme for energy-efficiency consultancies and consultants in Peru, in order to spread best practice and establish higher standards of performance. This in turn would lead to higher levels of trust and engagement in making investments in this area, and in more successful project outcomes in terms of saving money, energy and carbon emissions. It should be noted that based on our experience of such schemes elsewhere, funding is likely to be required as these schemes do not normally break even commercially while the market is being established.
- Finally, for future programmes involving corporates, consideration should be given to requiring participating corporates to explicitly commit resources to the project (ideally with a Board level sign-off as was secured for this project), though it is recognised that this stipulation could result in project delays at the outset.

Finding financial solutions to implement changes is still a challenge for companies

- **Solution:** Financing options to facilitate the implementation of technological improvements
- Cost effective energy saving measures should be, by their nature, attractive projects for finance institutions to engage with, since the energy savings generated can be used to fund the capital investments.
- Technical support for financial institutions to evaluate projects and energy saving technologies can support greater scale of deployment of finance in this area
- Innovative micro-financing solutions are needed to support projects in the SME market in Peru where traditional banking relationships may be immature.
- Further analysis of this area is recommended.

SMEs face specific challenges and consume most of the energy

- **Solution:** Engagement with SMEs, who have specific constraints and challenges through training and supply chain management solutions.
- There are a number of proven approaches to engage with SMEs across key sectors, for example groups of SMEs can be supported together through regular training events and follow up support as they work through a prioritised action plan for cost effective energy saving projects.
- SMEs can be identified and convened through their locality, their sector or through a common customer (such as farms and food processors working together within a retailer's supply chain).

Further integration between suppliers and energy advisors

- **Solution:** Engagement with equipment suppliers and installers in Peru to design better communication strategies that would make it easier for companies to make informed decisions on technology and supplier selection. This would maximise the likelihood of good quality energy efficiency solutions being the norm for equipment used in new build, replacement and retrofit.
- Furthermore, working with the energy consuming equipment supplier and installer markets to maximise their design and implementation of energy efficient solutions in Peru, demonstrating the whole life cost benefits of more efficient solutions. Promoting the procurement of more efficient equipment supports the supplier market for green technologies as well as locking efficiency in to buildings and industrial processes permanently.

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Footnotes

1. The Carbon Trust's calculations
2. Climate compatible development is "development that minimises the harm caused by climate impacts, while maximising the many human development opportunities presented by a low emissions, more resilient, future" – for more details see www.cdkn.org
3. The United Nations Climate Change Conference or COP20 was held in Lima in December 2014. This was the 20th yearly session of the COP. COP20 attracted over 15,000 official delegates, and negotiators concluded talks with the 'Lima Call For Climate Action', a draft document that lays the foundations for a new global climate deal.
4. The Carbon Trust developed a transformational energy efficiency programme for Peru's private sector. As part of this design, the Carbon Trust estimated potential energy savings across the private sector using its industry experience, Peru's Annual Energy Statistics, Statistical Database from Produce (Peru's Production Ministry), World Bank Data and Peruvian Industrial Database
5. Instituto Peruano de Economía 2012, Efecto de la Minería sobre el Empleo, el Producto y Recaudación en el Peru
6. Organización de las Naciones Unidas para la Agricultura y la Alimentación, 2010, Perfil de la Pesca y Acuicultura por Países, Perú
7. Ospitel, Statistics December 2015 available at <https://www.osiptel.gob.pe>
8. Pacific Credit Rating, Informe Sectorial Sector Seguros, Diciembre 2015, available from http://www.ratingspcr.com/uploads/2/5/8/5/25856651/sectorial_seguros_201512.pdf
9. Equilibrium, Analisis del sector Retail: Supermercados Tiendas por Departamento, y Mejoramiento del Hogar, Junio 2015. Available from <http://www.equilibrium.com.pe/sectorialretailmar15.pdf>
10. The Carbon Trust, Retail Sector Overview
11. The Carbon Trust, Publication CTG057 Heat Recovery

The Carbon Trust is an independent company with a mission to accelerate the move to a sustainable, low carbon economy.

The Carbon Trust:

- Advises businesses, governments and the public sector on opportunities in a sustainable, low carbon world.
- Measures and certifies the environmental footprint of organisations, products and services.
- Helps develop and deploy low carbon technologies and solutions, from energy efficiency to renewable power.

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