



Identifying Energy Efficiency Opportunities in El Salvador

This report was developed by ICF under USAID's Energy Efficiency for Clean Development Program (EECDP), a Leader with Associates Award Cooperative Agreement. EECDP promotes sustained and achievable reductions in energy use and associated greenhouse gas (GHG) emissions through analysis and capacity building. Since 2011, EECDP has worked with USAID missions globally on projects addressing key questions and critical barriers around energy efficiency to enable strategies that can be expanded across countries and regions. Project locations include Bangladesh, El Salvador, Ghana, Indonesia, Kazakhstan, Mexico, Mozambique, South Africa, and Tanzania.

EXECUTIVE SUMMARY

Over the last several decades, energy efficiency and demand response have become essential cornerstones of clean energy strategies in mature markets. If deployed as a “first fuel” at a large scale, energy efficiency can keep demand growth manageable and allow clean energy sources to achieve rising market shares. Energy efficiency and its power-sector companion, demand response (curtailing or shifting peak periods of energy consumption), are also less expensive than most energy supply options. In the utility industry, efficiency and demand response are referred to as demand-side management (DSM) programs since

they displace the need to purchase more power or build new power plants, and thus can be considered along with supply side resources. DSM strategies can reduce customer bills, minimize total system costs (which leads to lower tariffs over time), lower total emissions, and improve system reliability and resiliency.

A fundamental barrier to wider adoption of DSM measures in developing countries is the difficulty of selecting high-impact measures and designing the corresponding implementation strategies, while addressing significant development-related market barriers. Using a data-driven approach, ICF developed a methodology for USAID to evaluate the viability of energy efficiency programs using information on country-specific indicators and fundamental building blocks for market readiness. Through discussions and reviews with local stakeholders, along with research and the construction of an extensive database of energy-efficient technologies specific to El Salvador, the ICF team profiled the potential of opportunities to scale up energy efficiency.

The most promising areas to invest in energy efficiency for El Salvador are listed in Exhibit 1 below. The energy efficiency programs for residential, commercial, and industrial lighting





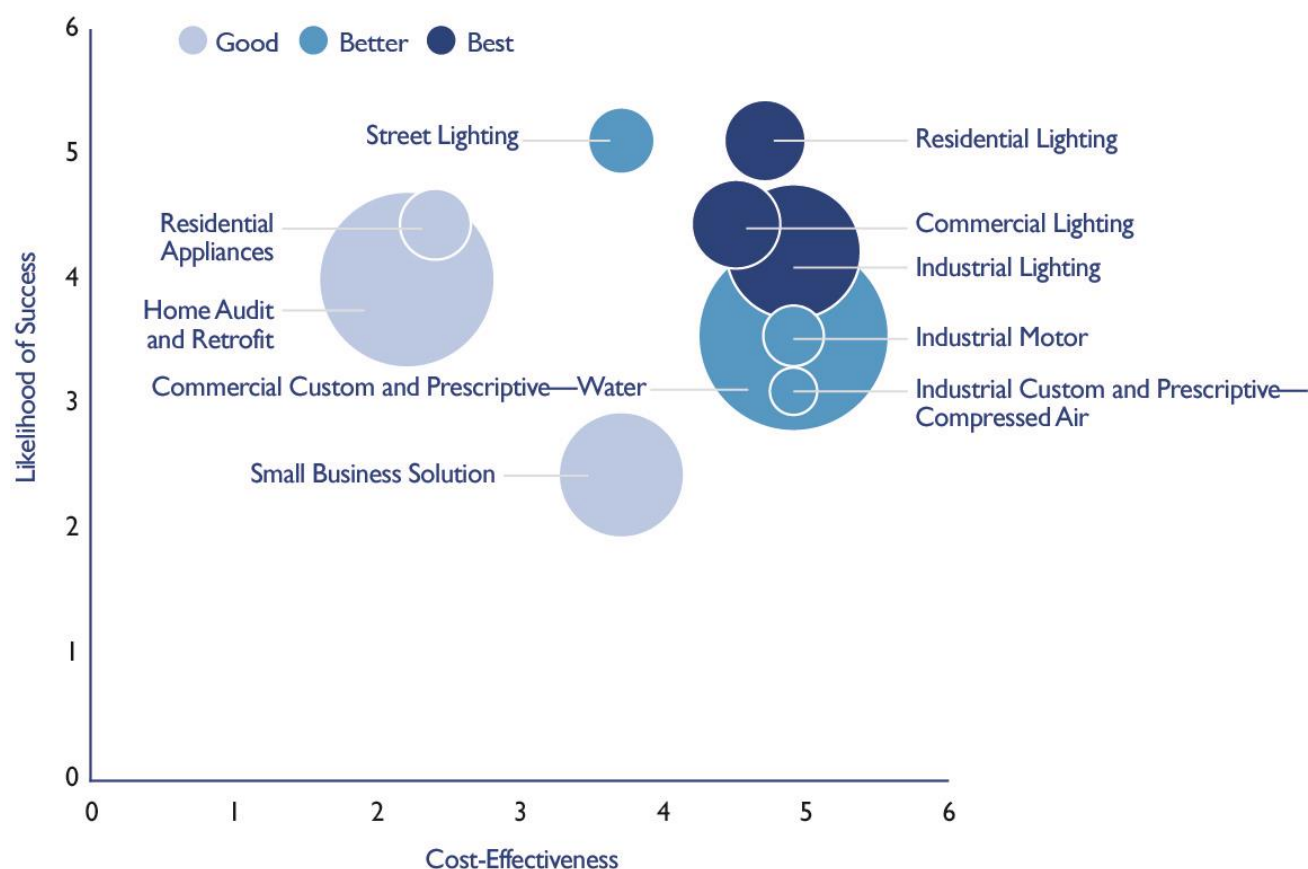
are the most cost-effective and have the highest likelihood of successful implementation (shown at the upper-right side of the chart). However, the study identifies ten programs in Exhibit 1 which all present strong investment opportunities to cost-effectively scale up energy efficiency. All of the programs listed in Exhibit 1 are included in the Top 10 and, therefore, would be worthwhile and cost-effective pursuits. These programs are identified using the following metrics:

- Likelihood of Success: A review of each energy efficiency opportunity across six country-level indicators assesses the associated risk. The

higher the score, the higher the likelihood of success of that individual energy efficiency opportunity.

- Cost-effectiveness: Product costs and energy savings potential based on locally available information is used to calculate the cost-effectiveness of each energy efficiency opportunity. The higher the score, the higher the cost-effectiveness of that individual opportunity.
- Size of Opportunity: The size of each circle indicates the energy savings potential of the individual energy efficiency opportunity.

EXHIBIT 1: TOP 10 ENERGY EFFICIENCY OPPORTUNITIES FOR EL SALVADOR





INTRODUCTION

Energy efficiency holds great potential to contribute to development objectives and key policy priorities in emerging markets. Policy priorities include expanding energy access and enabling low emission development. Strategies include promoting sustainable social and economic development while reducing greenhouse gas (GHG) emissions. The *Energy Efficiency Opportunity Study*, implemented under USAID's EECDP, demonstrates a rapid assessment methodology developed by ICF for identifying the programs and measures with the greatest likelihood of cost-effectively lowering energy demand through efficiency. The project was designed to provide policy makers with tools to make decisions on energy efficiency policy and program deployment. El Salvador was selected as one of seven locations to pilot the methodology. Results of this study will contribute to a robust, flexible framework that can be applied worldwide on a country-by-country basis.

In El Salvador, as in many developing economies, energy efficiency competes with a number of other priority issues, including clean water, poverty, natural disasters, sanitation, and education. USAID's support to El Salvador focuses on increasing the productivity of businesses, particularly those producing goods and services for international trade. While energy efficiency can support these goals, measures and programs in El Salvador, such as public awareness campaigns, rebate programs, and product standards, are nascent. To convince policymakers to pursue improved energy efficiency, it is critical to not only connect efficiency to advancing other priorities, but to also identify which energy efficiency programs and policies will have the greatest impact for the least cost.

The significant variability between countries in terms of energy tariffs, subsidies, energy intensity, and general market readiness, means that measures that work well in one setting at a particular point in time, may not work well in others. The uncertainty over what strategies to invest in

can cause efficiency to be deprioritized in favor of policy and program solutions that are better understood. For long-term growth, increased certainty on energy efficiency investments and improved understanding of the areas that build market readiness for scaling up energy efficiency is required.

METHODOLOGY

To understand how the market supports energy efficiency, and to identify programs that represent the best investments in El Salvador today, ICF developed an analytical framework that integrates three types of data: (1) cost and savings information for specific efficiency measures, (2) the applicability of energy efficiency measures (i.e. country-specific indicators of program success), and (3) market readiness and enabling environment (i.e. "energy efficiency building blocks"). Using information in all three of these areas together makes it possible to fully integrate energy efficiency into emerging markets. Elements of the framework are described in more detail in the following sections.

The ICF team encoded the analytical framework in a software tool: the USAID Opportunity Assessment Tool, which uses Microsoft Excel to create a simple visual way to record information collected for each data type, and to identify energy efficiency programs with the highest potential and likelihood of success. The user-friendly tool is designed for USAID and local stakeholders implementing programs in developing countries. Users can select their country, and then proceed through additional steps to determine country-specific energy efficiency program recommendations. The assessment includes scoring the country-specific indicators for each program under consideration, and evaluating the building blocks for energy efficiency through a customized set of questions.

In its June 2016 trip to El Salvador, the ICF team met with key stakeholders from utilities, government, academia, and the private sector: the USAID El Salvador Mission, the Consejo Nacional



de Energía (CNE), Centro Nacional de Producción Más Limpia (CNPML), Tetra-Tech, Universidad Don Bosco, Universidad Centroamericana (UCA), Asociación Salvadoreña de Industriales (ASI), and AES El Salvador. In addition, the ICF team visited two local hardware stores, Freund and Sears. A description of each organization and contacts can be found in Appendix A.

The stakeholders expressed concern about the government's ability to continue payment on electricity subsidies provided to the majority of consumers, expressed an interest in developing energy efficiency programs and strategies, and described previously implemented energy efficiency programs for LED lighting and recycling programs. In October 2016, ICF returned to El Salvador to meet with stakeholders a second time to present preliminary findings and collect feedback on assumptions and the functionality of the tool. During the return trip, in addition to revisiting some of the above stakeholders, the ICF team also met with Superintendencia General de Electricidad y Telecomunicaciones (SIGET), Banco de Desarrollo de El Salvador (BANDESAL), and Alianza en Energía y Ambiente con Centroamérica (AEA) organization supported by UCA faculty.

COUNTRY ASSESSMENT

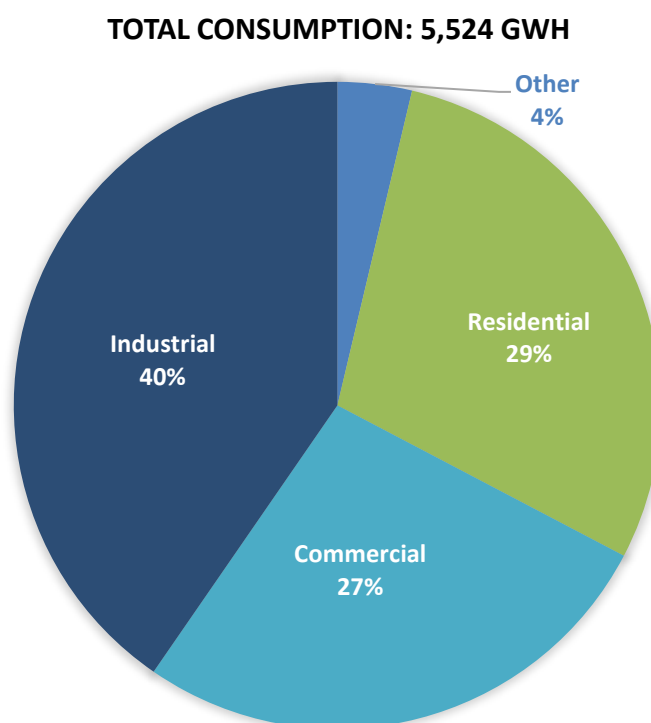
Cost and Savings Information

The collection of explicit costs and energy savings data for a particular country is required to calculate the potential impact of energy efficiency measures and programs and make comparisons. To do this, the ICF team created a database of costs specific to El Salvador using literature review, conversations with key stakeholders, available utility evaluation reports, case studies, and direct documentation of costs to consumers. Costs were documented from in-store visits to hardware stores and equipment suppliers for products such as commercial and residential HVAC and lighting, refrigeration, and industrial motors. Due to limitations on the availability of reliable data, some of the cost inputs were derived from other markets.

In consultation with key stakeholders, the project team applied a 20 percent cost increase to some measures over their market cost in Mexico. This is attributable in part to the import tariffs El Salvador has in place on its products. As data collection improves within El Salvador, costs and savings estimates can be updated over time using the tool to increase the accuracy of results.

The energy consumption at the sector- and end-use levels (e.g. industrial motors, residential lighting) was also researched to ensure that the savings associated with individual measures were properly allocated and could be compared against total consumption (see Figure 1).

FIGURE 1. 2014 ENERGY CONSUMPTION (GWH) BY SECTOR IN EL SALVADOR

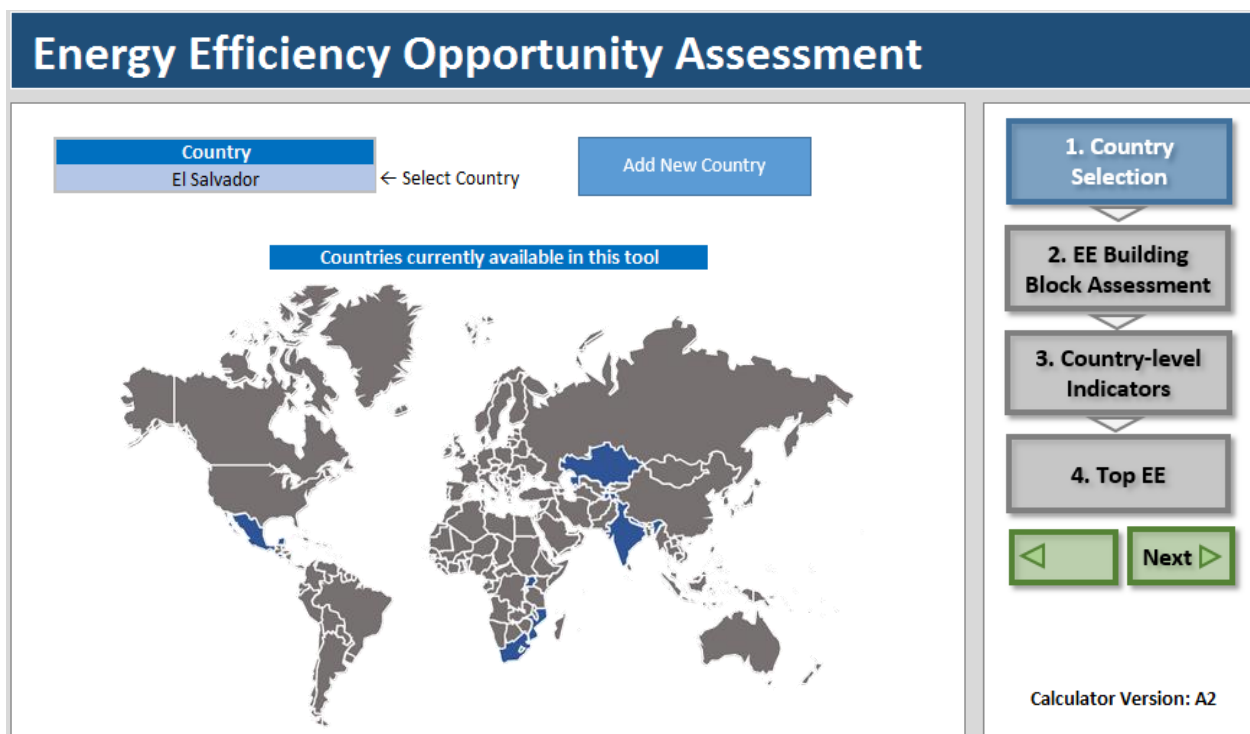


Source: *International Energy Agency*

Step 1 of the tool involves selecting El Salvador from the list of currently available countries (see Figure 2).



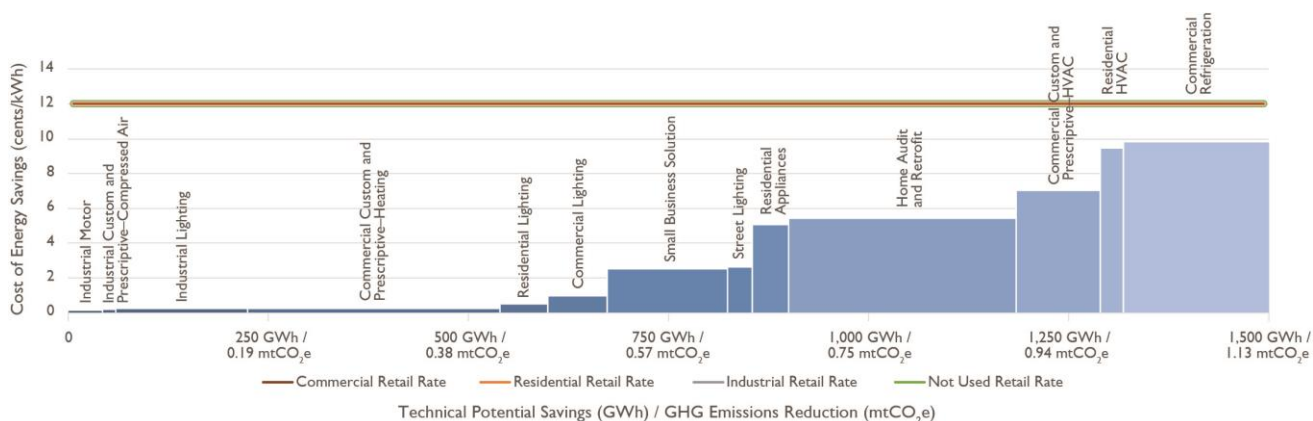
FIGURE 2. STEP 1 OF USAID ENERGY EFFICIENCY ASSESSMENT TOOL AND WORKFLOW DESCRIPTION



Once a country is selected, and the cost and savings data is entered, the tool generates a ranking of energy efficiency programs by costs and energy savings (see Figure 3). The distribution in the graph shows which programs have the lowest cost and the largest impact, thus being the most

cost-effective if no barriers were present in the market. Programs are designed to either promote individual measures, such as industrial motors, or bundles of related measures, such as various residential appliances.

FIGURE 3. ENERGY EFFICIENCY PROGRAM LOAD CURVE FOR EL SALVADOR





Costs are defined in terms of costs per kWh saved. Measures estimated to deliver large energy savings for little investment are shown as low bars, close to the “0” axis. Impact is based on energy savings estimates, as well as sector-level and end-use consumption to determine the potential for savings. Stakeholders can use the graph to compare the costs of energy savings for these

programs to electricity costs in the country to show how competitive energy efficiency is compared to generation resources. Note, these costs are exclusive of any program or administrative costs and only represent the cost-effectiveness of the energy savings measures included. Table 1 lists the programs evaluated for El Salvador and the technologies bundled for each one.

TABLE 1. COST-EFFECTIVE PROGRAMS ANALYZED FOR EL SALVADOR

Program	Technologies Included
Residential Lighting	LED screw and pin-based lamps and fixtures
Residential Water Heating	Solar water heater
Residential Heating/Cooling	Efficient packaged, split system air conditioners, efficient fans
Residential Appliances	Efficient refrigerators
Commercial Refrigeration	High efficiency freezers, refrigerated vending machines, multi-deck coolers, reach-in coolers, and high efficiency refrigerated display cases
Commercial Lighting	Fluorescent and LED linear downlight fixtures (e.g., T8, T5 and LED downlight fixtures), and street lighting
Industrial Motors	Proper sizing of motors and high efficiency motors
Industrial Compressed Air	Power factor optimizers, air compressor controls (demand controls), VFD compressors, compressor leak reduction
Commercial Heating/Cooling	Efficient packaged and split system air conditioners, and building energy management systems
Commercial Custom and Prescriptive Water Heating	Solar water heater
Commercial Appliances	High efficiency cooking equipment: fryers, griddles, hot food holding cabinets, and steamers
Home Retrofit	Whole home improvements: air sealing, roof insulation, window shades, solar control films, and double glazed windows (low SHGC)
Industrial Lighting	LED linear and downlight fixtures (e.g., T8, T5 and LED downlight fixtures)
Street Lighting	LED Lamps



Country-Specific Indicators

Critical factors that contribute to the feasibility and impact of individual energy efficiency programs vary on a country-by-country basis. These factors include the relative price and accessibility of technologies, the expertise and capacity of service sectors to install and maintain equipment, and the willingness of energy users to invest in efficiency. Because these factors are vital to program success, ICF developed a set of indicators to help identify programs with the highest likelihood of achievement.

To rate indicators for a given program, it is assessed across six dimensions in terms of its anticipated level of impact (see Table 2 for a description of each indicator). As an example, in El Salvador, where compact fluorescent (CFL)

lighting has already achieved high market penetration as a baseline technology and is being replaced with light emitting diode (LED) lighting, the market transformation indicator for a program focused on CFL lighting would be low due to lack of remaining potential to change purchasing decisions (UNEP en.lighten, 2010).

These dimensions were developed based on factors included in program evaluation methodologies used in emerging economies combined with ICF's extensive experience designing and implementing energy efficiency programs in the U.S. and internationally. This framework is being tested and refined as a part of this *Opportunity Study* project. Engagement with stakeholders in different countries is intended to provide the desired vetting and feedback needed for further improvement.

TABLE 2. COUNTRY-SPECIFIC INDICATORS IN USAID ENERGY EFFICIENCY ASSESSMENT TOOL FOR EL SALVADOR

Indicator	Description
Market Transformation Potential	The potential for programs to influence their relevant market channels over the long run (e.g., the extent to which the program may change retailer stocking practices over time) and the likelihood of changing purchasing decisions (e.g., the probability that consumers would select energy-efficient products once a financial incentive is no longer available).
Political Feasibility	How likely local utility and government stakeholders are to accept and support the program. Without buy-in from key stakeholders, a program is likely to never make it out of the planning stage. This may be affected by key stakeholders having backed a similar program in the past that did not have positive results.
Program Complexity	Marketing, administration, and evaluation burdens all add to the complexity of implementing programs. This factor is evaluated based on available resources, experience, and expertise in these areas. The score could be high if a particular country has implemented similar programs recently that can be leveraged when implementing a new activity.
Environmental Aspects	The lifecycle impact of the program on waste, water use, and emissions. For example, if facilities and infrastructure for recycling CFL lamps are not present in the country, a CFL lighting program may score poorly in that country.
Economic Aspects	The potential to increase jobs and development of local manufacturing. If, as a part of the program, manufacturing demand is increased or jobs are created as people are needed for energy audits or installations, this score will be high.
Equity / Affordability	How a program would perform in providing DSM options to customers within each of its target sectors. The score relates to the relative benefit to one particular market segment over another and if the cost associated with the program to the end user is affordable given their income level.



Indicators for each energy efficiency program considered under the evaluation are scored using a one (1) to five (5) scale, with five (5) representing the highest probability of success for a program, and one (1) representing the lowest probability of achieving positive outcomes within a given indicator (see Figure 4). These are subjective scores and can be sensitive to shifts and changes in the marketplace; therefore, in scoring programs it is critical to gather information through direct conversations with local stakeholders in addition to conducting literature reviews. While not an exact

science, this scoring approach represents the best available information and understanding of the market at a particular point in time. Scoring for country-specific indicators can be modified as markets mature and change through growth in technology availability, technical capacity, and policy actions that enable new program opportunities. The current scoring is based on both discussions with stakeholders regarding the performance of past programs, and a country-specific literature review.

FIGURE 4. SCORING ENERGY EFFICIENCY INDICATORS BY PROGRAM FOR EL SALVADOR

Program Name	Market Transformation Potential	Political Feasibility	Program Complexity	Environmental Aspects	Economic Aspects	Equity
Commercial Custom and Prescriptive - HVAC	3	4	3	2	3	3
Commercial Custom and Prescriptive - Water Heating	2	2	2	4	3	3
Commercial Lighting	3	3	4	3	3	4
Commercial Refrigeration	2	4	3	3	2	2
Home audit and retrofit	3	2	2	3	4	4
Industrial Custom and Prescriptive – Compressed Air	2	2	2	3	2	3
Industrial Lighting	3	3	3	3	3	4
Industrial Motor	3	4	2	3	2	2
Residential HVAC	3	4	3	2	3	2
Residential Appliances	4	4	2	3	3	4
Residential Lighting	4	4	5	3	3	4
Small Business Solution	2	2	1	3	1	2
Street Lighting	4	4	4	3	3	5

Once the assessment tool has identified energy efficiency programs that are cost-effective for a specific country, the indicator scores are used to further assess each program on the viability of implementation. This shifts the focus onto cost-effective programs that have a high chance for success in a particular marketplace. As an illustration of how these scores were assessed for programs in El Salvador, the reasoning behind several of the selections are outlined below. Moving forward, these indicator scores can be adjusted directly by stakeholders working in these markets.

- The Small Business Solution is scored with a Program Complexity of 1 because it very difficult to administer and ensure savings for this type of program. The difficulties in importing the necessary types of technologies, and the high

level or marketing required to educate small businesses on the benefits of the program, reduce the overall opportunity to successfully scale up this type of program.

- The Residential Lighting program is given an Environmental Aspects score of 3 because this program would increase the presence of LED bulbs that have longer lifecycle impacts, but would be replacing CFLs and incandescent bulbs that are unable to be properly disposed due to lack of facilities and infrastructure for recycling those bulbs.
- The Commercial Refrigeration program is scored with a Market Transformation potential of 2 because while it very difficult to administer and ensure savings for this type of program, the government is working to approve a minimum energy performance standard (MEPS) that would



create an energy efficient baseline for a product commonly found in small businesses.

- The Street Lighting program is scored with an Equity of 5 since AES Solutions, El Salvador's largest utility, has already begun working with municipalities to retrofit street lighting to LEDs and this program is applicable and accessible to a wide variety of municipalities

Building Blocks for Energy Efficiency

An enabling policy and market environment significantly improves the opportunity for success and long-term impact of individual energy efficiency programs, as well as the continued uptake of related practices and technologies, as discussed above under *Country-Specific Indicators*. With this in mind, the ICF team categorized areas of the market that enable and support the scaling up of energy efficiency into six building blocks. This approach builds on and complements informal guidance on building blocks for renewable energy from USAID's Global Climate Change Office (i.e. grid integration, smart incentives, competitive procurement of generation capacity, locational concentration, climate planning, and financing support). The building blocks for energy efficiency are derived from ICF's 20+ years of international experience designing and implementing energy efficiency programs. They encompass recognized drivers and barriers for energy efficiency (IEA 2010), as well as market characteristics associated with a strong environment for energy efficiency, including effective policies, easily accessible information, and technical expertise (RCEEE 2015). While there are certainly additional factors that lead to strong country-level support for efficiency, these non-country-specific building blocks were developed by ICF as the most relevant for success.

The building block assessment does not affect the final ranking of energy efficiency opportunities under this study; rather, it informs opportunities to improve the enabling environment for energy efficiency in the future. The assessment includes

country-specific questions in order to uniquely define potential improvement under each building block. This approach avoids the pitfall of judging well-developed smart incentives in India, for example, against the potential for appropriate smart incentives in Mozambique. The building blocks provide a universal structure to evaluate opportunities to strengthen the market, promote market transformation, and scale up energy efficiency by reducing the most significant barriers.

Each of the six areas are generally equal in importance and no specific order to their development is required. A careful assessment of the available opportunities to strengthen each of these areas can advance needed infrastructure, provide support to energy efficiency activities, and lead to greater energy savings and emission reduction impacts.

- **Skilled Workforce** represents the presence of a local network that can support the important processes of identifying and implementing energy efficiency improvements. An effective network includes trained professionals to perform energy assessments and other analyses for residential, commercial, and industrial buildings, as well as technicians to install and service energy-efficient equipment and building components (e.g. energy management systems, lighting, windows, and insulation). This network can be developed through partnerships with universities and professional trade organizations, and should include mechanisms to provide workforce training and certifications that help the service and professional industries keep pace with technical and strategic advances in energy efficiency. USAID could facilitate the training of energy auditors to create a network of professionals in El Salvador that would be able to provide recommendations for how home and businesses owners can improve their efficiency. While several universities are taking initiatives to develop these types of professionals at the higher education level, there is an opportunity to enhance vocational training to drive down the costs of energy auditing.



- **Financing Support** refers to recognition among banks and other lenders of the need for, and the potential return on investment from energy efficiency. Financing can be an essential building block in helping overcome the capital-cost barrier associated with higher-cost/greater-savings energy efficiency investments. Public policies and lending practices that enable energy efficiency project finance can be key to increasing initial consumer investment in efficiency, and thus delivering the many associated economic and environmental benefits. While the Inter-American Development Bank (IDB), in conjunction with Banco de Desarrollo de El Salvador (BANDESAL), has enhanced financing opportunities for energy efficiency in El Salvador, most of the funding is accessible at the larger commercial and industrial level. USAID has the opportunity to enhance energy efficiency financing at the individual level so savings are distributed equitably across different income levels.
- **Public Awareness** of energy efficiency, including the understanding that efficiency means getting the same level of service with less energy, is a fundamental building block across most end-use markets. Awareness is foundational to energy consumer interest in and action on efficiency investment; it is, therefore, important that consumers are not only aware of the economic and environmental benefits that efficiency provides, but also are aware of the best strategies to improve efficiency. Opportunities exist to enhance knowledge of energy efficiency benefits through public awareness campaigns similar to how the Health Ministry developed public awareness campaigns to fight the proliferation of the Zika virus.
- **Regulatory Mechanisms** and policies that support energy efficiency can include building energy codes, product and appliance standards, requirements for energy audits, utility regulatory reform to encourage utility investment in efficiency, and national or regional energy efficiency targets. These are effective at influencing the market to adopt efficiency technologies, building designs, and operating

practices. Standards also set a baseline that can reduce costs by establishing a reliable market for these products. The continued development of MEPS for products available in El Salvador and the design of new building standards are opportunities for USAID to further influence the market.

- **Smart Incentives** include subsidies or rebates offered to encourage the purchase and installation of energy-efficient products or the purchase of a service to promote efficiency, such as a building audit. Incentives are particularly effective when promoting new or unfamiliar technologies and related services. Energy-efficient products often enter the market with a higher initial cost even though they pay for themselves through cost savings over time. Smart incentives can influence skeptical customers to try out products and services, and then be phased out as those technologies and strategies become more accepted and consumers have a greater understanding of their value. These incentives can be utilized in lieu of large government subsidies currently distributed to the majority of Salvadorians. Recent government funding challenges have made the maintenance of high subsidies difficult. Converting some of those subsidy payments into energy efficiency smart incentives could facilitate a decrease in the monthly subsidy resulting from decreased energy demand.
- **Technology Development** is critical to sustainable market transformation for efficiency. In order for efficient products to be purchased, they must be easily identifiable, deliver consistent energy performance, and not be cost prohibitive. The necessary infrastructure for producing, testing, and labeling quality products needs to be in place for this to be ensured. This can include in-country or regional testing and labeling protocols and programs. Promoting the resulting energy-efficient technologies and labels, and showcasing country-specific application of technologies, are also important. The development of a testing laboratory and process for enforcement of MEPS is a crucial step in ensuring energy efficiency program



success. El Salvador’s current lack of a facility makes them reliant on other countries in the region, fosters confusion over different labeling systems, and hinders consumers’ purchasing decisions.

The Opportunity Study Assessment Tool provides users with a list of questions about six different building blocks. The answers determine how well developed, or under developed, a building block area is in the current market (see Figure 5).

As an illustration of how the presence of these building blocks was assessed for El Salvador, the reasoning behind several selections is outlined, below.

- Under Public Awareness, “Current energy efficiency programs are accessible to, and positively affect, all levels of income” is marked as not currently present in El Salvador, because the available energy efficiency financing has a high interest rate making it less attractive to consumers with access to other options.
- Under Skilled Workforce, “Network of actors in government, utility, and private sector are well connected and able to work together to deliver energy efficiency programs” is marked as present in El Salvador because there is strong stakeholder communication between academia, government, and utilities.
- Under Skilled Workforce, “Trained professionals that focus on identifying energy efficiency opportunities (Ex: energy auditors or home energy raters)” is marked as not currently present, as it was noted that while UCA and Don Bosco have curricula to train professionals at the higher education level, there is still a significant lack of accessible programs that would meet the needed demand.
- Under Financing Support, “Funding opportunities for energy efficiency measures” is emerging in El Salvador. IDB is working with BANDESAL to provide some energy efficiency financing, but accessibility to financing for all income levels is still limited.

FIGURE 5. ANSWERS IN THE ASSESSMENT TOOL TO QUESTIONS ABOUT EACH BUILDING BLOCK

	Building Block Present?	Building Block Description
Skilled Workforce		
1	No	Trained professionals that focus on identifying energy efficiency opportunities (Ex: energy auditors or home energy raters)
2	Yes	Network of actors in government, utility, and private sector are well connected and able to work together to deliver energy efficiency programs
3	Emerging	Energy Services Companies (ESCOs) exist and energy performance contracts are able to be contractually upheld under current regulatory framework
4	No	Government and/or industry effort to collect and maintain inventory of energy efficient technologies exists
5	No	Standard training or certification exists for performing energy efficiency assessments in buildings
6	No	Standard training and certification for performing energy efficiency assessments is widely adhered to
7	Emerging	Tools and models to analyze energy efficiency opportunities are available to energy professionals
8	Emerging	Tools and models to analyze energy efficiency opportunities are available to financial professionals



	Building Block Present?	Building Block Description
Financing Support		
9	Emerging	Funding for energy efficiency measures
10	No	Consumers are not discouraged by high initial cost of implementation of energy efficiency measures
11	No	Energy efficiency perceived as low risk/high return investment
12	No	Government incentives to buy down first cost of new technologies exists
Public Awareness		
13	No	Customer awareness level of energy efficiency programs (incentive offerings) already in place is high
14	Emerging	Consumers have previous positive experience with energy-efficient products achieving marketed claims
15	No	High consumer/purchaser knowledge of energy efficiency - allows customer to make informed decisions when purchasing products
16	No	Current energy efficiency programs are accessible to and positively affect all levels of income
Regulatory Mechanisms		
21	No	Energy efficiency legislation to leverage municipalities and companies to implement energy efficiency
22	Emerging	Country/utilities have clear short and long term goals for energy development/expansion
23	No	Building energy codes for commercial/residential buildings have compliance mechanisms in place
24	No	Building energy codes for commercial/residential buildings are in place
25	Yes	Energy efficiency contributes to local/regional plans such as Low Emission Development plans (LEDs)
26	No	Energy prices reflect true cost of production, procurement, and transmission (i.e. not subsidized)
27	No	Mechanisms in place to assist on this issue of those financing the energy efficiency measures (e.g. building owners) paying cost, but only users benefiting (e.g. tenants)
28	No	Limited taxes or tariffs are collected on the import of energy-efficient products, keeping prices reasonable
29	Emerging	Governmental functions operate independently of energy sales (i.e. municipalities and governments are not dependent on energy sales)
Smart Incentives		
30	No	Residential demand side management programs with incentives exist
31	Yes	Commercial demand side management programs with incentives exist



	Building Block Present?	Building Block Description
32	No	Industrial demand side management programs with incentives exist
33	No	Tax incentives for purchasing specific energy-efficient products exist
Technology Development		
36	No	Testing facilities for energy-efficient products exist in country/region
37	Yes	Appliance energy rating standards exist and are complied with
38	No	Non-energy benefits (i.e. cascading benefits of utility bill reduction, avoided emissions, job creation) are included in energy efficiency planning and cost-effectiveness
39	No	Energy efficiency measures capable of modifying market behavior even after incentives are removed

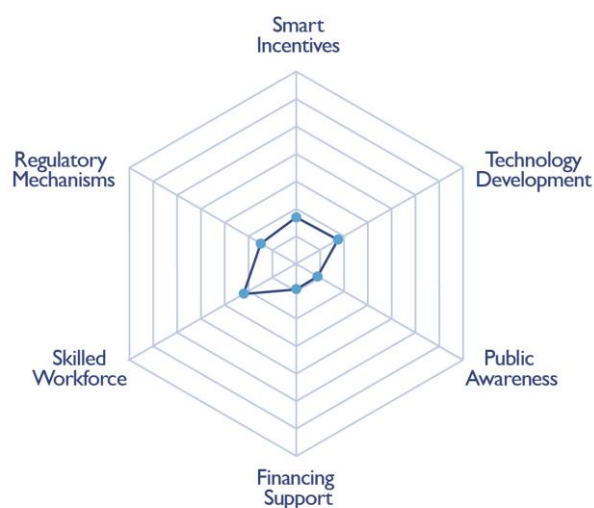
RESULTS

After completing the steps of the assessment framework (i.e. cost/savings information, indicators, and building blocks), a clear picture emerges of market readiness for energy efficiency in El Salvador, as well as the programs that are the best investment opportunities at this time, having the greatest chance of success and impact. The tool uses simple graphics to display this information and helps users determine the most suitable energy efficiency programs to pursue under different market conditions. This section summarizes the building blocks assessment, program indicator rankings, and program impact estimates, and integrates these three outputs into an overall assessment of the top 10 energy efficiency opportunities for El Salvador's power sector.

Energy Efficiency Building Block Results

The results of the building block assessment for El Salvador are displayed in Figure 7. Areas that are well-developed in the marketplace and have few barriers are marked further from the center of the chart.

FIGURE 7. BUILDING BLOCKS FOR ENERGY EFFICIENCY ACHIEVEMENT IN EL SALVADOR



For El Salvador, financing support and public awareness are the least developed areas of the market where more work is needed to expand accessibility for energy efficiency financing to all market segments and fostering awareness that higher initial costs for energy efficient technology result in long term savings benefits. Across all the building block areas, improvements can be made, such as implementing DSM programs with



incentives and developing training and certification programs for energy efficiency professionals.

Despite some weaknesses in certain building blocks, El Salvador is positioned for success in scaling up energy efficiency. Energy efficiency technology is available in the market and there are pending regulatory mechanisms that can support continued improvement. The government is currently reviewing the following legislation to create MEPS for commercial and residential refrigeration, air conditioners, and industrial motors:

- Air-Conditioners
 - RTS XX.YY.ZZ:14 Parte 1 (NOM-011-ENER-2006),
 - RTS XX.YY.ZZ:14 Parte 2 (NOM-021-ENER/SCFI-2008)
 - RTS XX.YY.ZZ:14 Parte 3
- Motors
 - RTS 29.47.02:14
- Commercial Refrigeration
 - RTS 97.47.03:14
- Residential Refrigeration
 - RTS 97.47.04:14

The ratification of MEPS will elevate the technological baselines within the country. Additional improvement can be gained through further advances in public awareness, smart incentives, and capacity building.

Top 10 Energy Efficiency Program Results (“Opportunities”)

To advance energy efficiency under current market conditions, the Opportunity Assessment Tool identifies ten programs with significant potential for impact. Figure 8 shows the cost-effectiveness of each program on the horizontal axis, and the likelihood of success (based on indicator ratings) on the vertical axis. The diameter of each circle represents the amount of energy savings associated with each opportunity. These top 10 opportunities combine the results of the cost-effectiveness calculations and energy efficiency

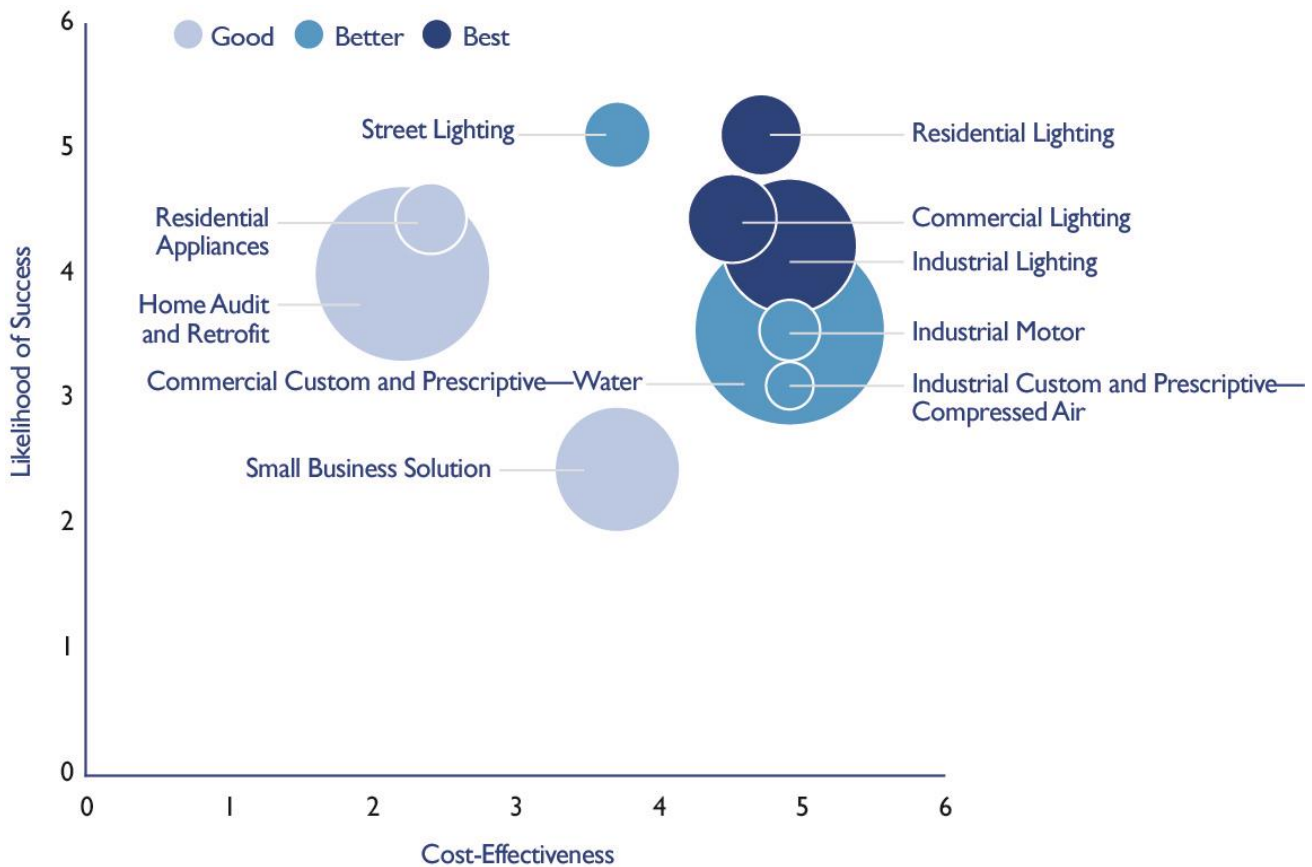
indicators in a three-dimensional view of how energy efficiency program options perform in a specific type of developing country market.

For El Salvador, residential, commercial and industrial lighting lead off the top-ten list as high-impact, cost-effective, and likely to succeed in El Salvador at this time. Each of the energy efficiency opportunities shown in Figure 8 deserves consideration for implementation, as they all represent proven, cost-effective strategies. However, to simplify the selection of which energy efficiency opportunities to pursue, they have also been color-coded for quick assessment as *good*, *better* and *best*. For instance, the top ten chart includes residential appliances, which include residential refrigeration, is an attractive energy savings and GHG emission reduction opportunity. Although not as large or rated as highly as some other program options for cost-effectiveness, it has the potential to be highly successful due to low program complexity and potentially strong political support coming from high visibility with stakeholders.

These results can be used to frame and explore next steps. Further analysis of any or all of the identified opportunities should include program design and support for implementation. Program design defines the details of how technology will be promoted and the segment of the population that will be targeted. These details take this analysis to a level of specificity that can be used to deploy effective programs in Salvadoran markets. Program design details also enable the calculation of achievable energy efficiency savings and advance beyond the general estimated energy savings, included in this report. Using the estimated achievable savings, incentive levels and other costs that can be borne by the program are then calculated as part of a total program offering, including many details on the administrative structure, markets methods, and delivery channels for the program.



FIGURE 8. TOP 10 ENERGY EFFICIENCY OPPORTUNITIES FOR EL SALVADOR



Support for program implementation includes important activities such as marketing and stakeholder engagement. This may involve advertising and engaging with business/building owners involved in the relevant program sector. Other activities may include developing management systems, such as processes for approving and documenting participants and projects that come through the program, along with aggregating energy and emissions savings from the program.

DISCUSSION

Energy efficiency technologies and programs are well-positioned to expand in El Salvador, but further development of national MEPS, and increasing public awareness and other important market infrastructure elements are needed to support programs and realize the potential market

for transformation. Increasing energy efficiency is a cost-effective strategy to support multiple objectives, including lower customer energy bills, reduced power system costs, improved system reliability, low-emission development, and economic development. Reducing the amount of electricity needed to run machinery at industrial plants, light office buildings, and cool houses, for example, are widely recognized as measures having a beneficial effect on the entire power sector. Given that electricity system operations and institutional capacity have greatly improved in El Salvador in recent years, the country's power sector, in particular, may be in a strong position to scale energy efficiency projects as part of its next phase of development. There are, nevertheless, significant security challenges that may inhibit rapid development of energy efficiency in the El Salvador and the region. These challenges were not heavily weighted in consideration of the energy efficiency opportunity in El Salvador.



It is important to highlight that efficiency also supports sustainable economic growth and important USAID objectives in other ways. Efficiency is implemented through trainings and skill development, investment by businesses and homeowners in new technology, and the creation of new services. Not only are energy efficiency programs making investments in energy demand reduction, they are investing in local businesses and long-term jobs.

The main challenge for the Government of El Salvador in capturing these benefits, particularly through its policy processes, is to improve the quality and granularity of energy data and analysis to support further evidence-based decision-making. The need for rapid and reliable assessments of energy efficiency opportunities is the driving force behind this Opportunity Study. The project in El Salvador specifically focused on developing a methodology for prioritizing potential measures and programs to uncover those which can deliver the greatest impact for the least cost.

The scarcity of available data was a significant barrier in projecting potential costs and energy savings of the measures identified in this study. This led to reliance on proxy data modified from other countries. El Salvador's participation in larger regional markers make technologies widely available, but a comprehensive market study on available products, their energy performance, and their purchase costs would significantly enhance local stakeholders' ability to use the tool to provide more accurate estimates of the top efficiency opportunities.

This analysis, including the application of the tool, does not replace the need for a more detailed and comprehensive energy efficiency potential study, nor does it capture all of the barriers to implementation for energy efficiency programs. By identifying the top ten energy efficiency opportunities in El Salvador, the study's goal is to bring energy efficiency into the conversation on power sector planning and economic development in a concrete way. By communicating the scale of potential impact and focusing on a small set of areas where success is likely to be achieved, the results empower further action and cost-effective

next steps for program design.

For future programming, the ICF team designed the tool to be updated to reflect changes that support improved implementation of energy efficiency (i.e. "Building Blocks"). Modifying the tool to reflect, for example, newly available financing mechanisms or a reduction in the price difference between an energy efficient product and its conventional counterpart, will improve the likelihood of success for some measures. Over time, strengthening of the building blocks will enable more sustainable energy efficiency programs that can have a larger impact across the market on electricity demand, GHG emissions, job growth, and general economic development.

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Additional cost and savings references included in the tool itself.



APPENDIX A

The ICF team met with public and private organizations that had a significant role in previous energy efficiency efforts or impact on shaping future energy efficiency programs. These meetings were facilitated with an in-country contacts at USAID and Tetra Tech, an energy efficiency contractor.

TABLE 1. USAID IN-COUNTRY MEETINGS WITH STAKEHOLDERS, JUNE 2016

Organization	Contacts	Description
Tetra Tech	<ul style="list-style-type: none"> Salvador Vega 	Supports USAID Central America Regional Clean Energy Initiative. They are providing technical assistance to develop efficient public lightning programs with municipalities in coordination with Consejo Nacional de Energía (CNE) in El Salvador and have supported the development of MEPS for industrial motors, air-conditioners, commercial and residential refrigeration.
National Council for Energy (CNE, Consejo Nacional de Energía)	<ul style="list-style-type: none"> Mario Caceres, Energy Efficiency Director 	Government council supporting the promotion of energy policy and strategy that contributes to sustainable growth in El Salvador.
Salvadorian Association of Industrialists (ASI, Asociación Salvadoreña de Industriales)	<ul style="list-style-type: none"> Juan Ceavega, Engineer, Gerente de Energy 	Trade association representing 23 industrial and agro industrial sectors accounts for 92% of El Salvador's exports. Organizes the "Energy Program" which trains engineers and contractors, El Salvador administrator of the Performance Excellence in Electricity Renewal (PEER) project.
The Foundation National Center for Cleaner Production in El Salvador (Centro Nacional de Producción más Limpia CNPML)	<ul style="list-style-type: none"> Yolanda de Tobar, Executive Director Luis Umanzor, Technician 	Provides technical assistance and consulting services in energy efficiency, and supports a variety of environmental initiatives including renewable and toxic chemical management.
AES El Salvador	<ul style="list-style-type: none"> Juan Carlos Cabezas 	Operates 4 of the 5 electricity distribution companies in El Salvador accounting for approximately 75% of all electrical distribution. Is involved in energy service contracts for street lighting LED upgrades.
Universidad Don Bosco	<ul style="list-style-type: none"> Carlos Roberto Pacas, Director Energy Research Institute 	Energy Research Institute focuses on expanding number of trained professionals for commercial building energy audits. Organizing group of stakeholders to become LEED Certified Professionals in Guatemala.
Universidad Centroamericana (UCA)	<ul style="list-style-type: none"> Luis Martinez 	Energy and Fluid Science Department tasked to actively participate in the analysis, formulation and presentation of proposals for solutions to address the problems facing the sectors energy and water resources of the country. Focus to strengthen capacities of trained professionals in the area of water management and energy in El Salvador
USAID El Salvador	<ul style="list-style-type: none"> Manuel Cerrato, Project Management Specialist – Clean Energy 	USAID Mission in El Salvador, through its Central American Regional Program, USAID supports key foreign assistance objectives that have a regional or global impact, including citizen security, trade, climate change, food security, and HIV/AIDS prevention.



TABLE 2. USAID IN-COUNTRY MEETINGS WITH STAKEHOLDERS, OCTOBER 2016

Organization	Contacts	Description
Universidad Centroamericana (UCA) - Alianza en Energía y Ambiente con Centroamérica (AEA)	<ul style="list-style-type: none"> Luis Martinez Ismael Sánchez 	Energy and Fluid Science Department tasked to actively participate in the analysis, formulation and presentation of proposals for solutions to address the problems facing the sectors energy and water resources of the country. Focus to strengthen capacities of trained professionals in the area of water management and energy in El Salvador
Superintendencia General de Electricidad y Telecomunicaciones (SIGET)	<ul style="list-style-type: none"> Christian Lama Jose Luis Regalado 	El Salvador's national energy regulator for electricity and telecommunications sector. Responsible of regulating the power market, the distribution companies and consumer prices.
Banco de Desarrollo de El Salvador (BANDESAL)	<ul style="list-style-type: none"> Lic. Haydee de Mendoza Christophe Hoor, Independent Sustainable Environment and Energy Solutions Consultant 	Provides financing for long-term investments energy efficiency (EE). Also provides technical support for environmental investments for both energy efficiency and renewable energy.
The Foundation National Center for Cleaner Production in El Salvador (Centro Nacional de Producción más Limpia CNPML)	<ul style="list-style-type: none"> Yolanda de Tobar, Executive Director Luis Umanzor, Technician 	Provides technical assistance and consulting services in energy efficiency, and supports a variety of environmental initiatives including renewable and toxic chemical management.
Tetra Tech	<ul style="list-style-type: none"> Salvador Vega, Alfonso Rodríguez, Director Iniciativa Regional de USAID Energía Limpia 	Supports USAID Central America Regional Clean Energy Initiative. They are providing technical assistance to develop efficient public lightning programs with municipalities in coordination with Consejo Nacional de Energía (CNE) in El Salvador and have supported the development of MEPS for industrial motors, air-conditioners, commercial and residential refrigeration.
USAID El Salvador	<ul style="list-style-type: none"> Manuel Cerrato, Project Management Specialist – Clean Energy 	USAID Mission in El Salvador, through its Central American Regional Program, USAID supports key foreign assistance objectives that have a regional or global impact, including citizen security, trade, climate change, food security, and HIV/AIDS prevention.