MEXICO

Identifying Energy Efficiency Opportunities in Mexico

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 Mexico, the ICF team profiled the potential of opportunities to scale up energy efficiency.

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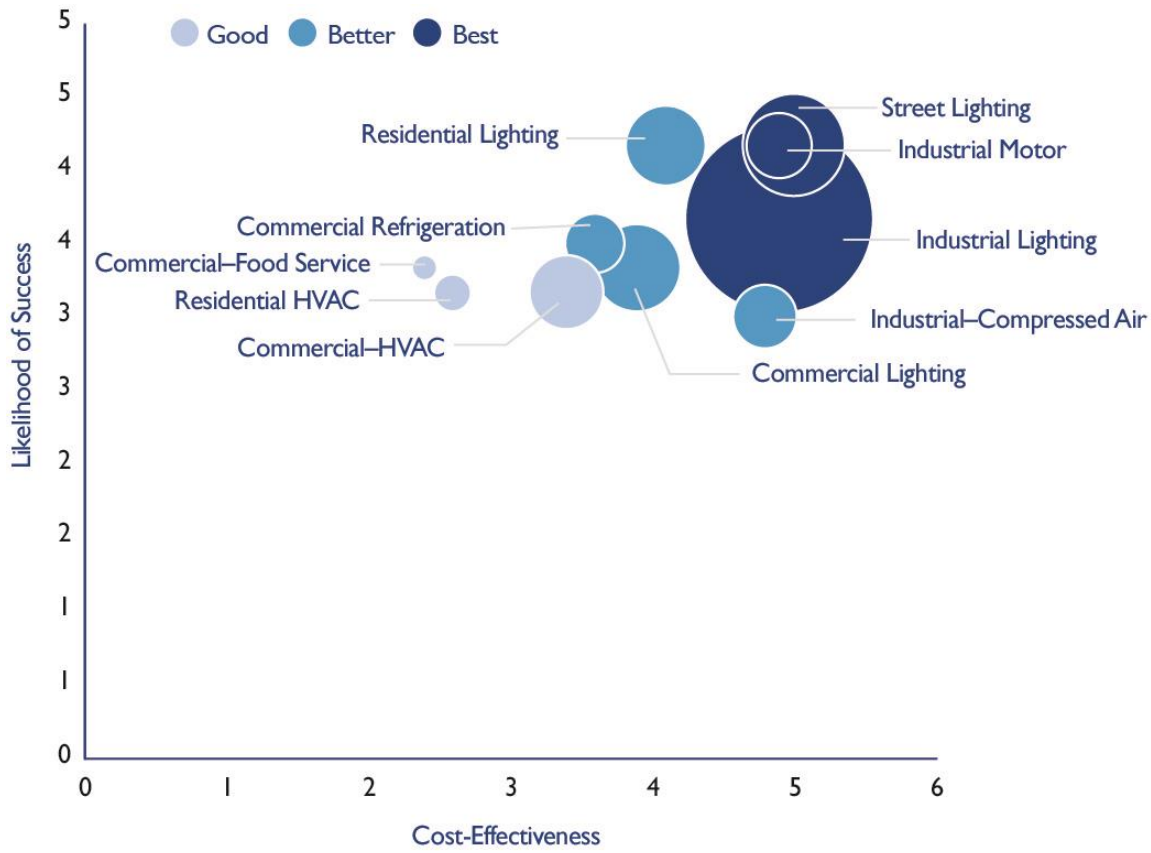
The most promising areas to invest in energy efficiency for Mexico are listed in Exhibit 1 below. The energy efficiency programs for street lighting, industrial lighting, and industrial motors are the most cost-effective and have the highest likelihood of successful implementation (shown at the upper-right side of the chart). 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 Mexico



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. Mexico 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 Mexico, as in many developing countries, energy efficiency competes with a number of other priority issues, including clean water, poverty, natural disasters, sanitation, and education. While increased energy efficiency can support development priorities, e.g., job creation, economic growth, and GHG emission reductions, the data needed to document the value of energy efficiency in achieving those outcomes are often not readily available. 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 Mexico 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 their June 2016 trip to Mexico, the ICF team met with key stakeholders from utilities, government, academia, and the private sector: the USAID Mexico Mission, the Oraganismo Nacional de

Normalizacón y Certificación de la Construcción y Edificación (ONNCCE), Calidad y Sustentabilidad en la Edificación, A.C. (CASEDI), Tetra Tech - Programa para el Desarrollo Bajo en Emisiones de México II (MLED), Fideicomiso para el Ahorro de Energía Eléctrica (FIDE), La Comisión Nacional para el Uso Eficiente de la Energía (CONUEE), Cooperación Alemana al Desarrollo Sustentable en México (GIZ), Secretaría de Energía (SENER) Programa Nacional para el Aprovechamiento Sustentable de la Energía, and the International Energy Agency. In addition, the ICF team visited one local hardware stores, Sears. A description of each organization and contacts can be found in Appendix A.

In October 2016, ICF returned to Mexico to meet with stakeholders a second time to present preliminary findings and collect feedback on assumptions and the functionality of the tool. During this return trip, at the recommendation of Tetra Tech, the ICF team also met with independent energy consultant, Moisés Ángel Lino Linares, President of the Climate Change and Sustainability Committee.

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 Mexico 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.

The energy consumption at the sector- and end-use level (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).

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

Figure 1. 2016 Energy Consumption (GWh) by Sector in Mexico

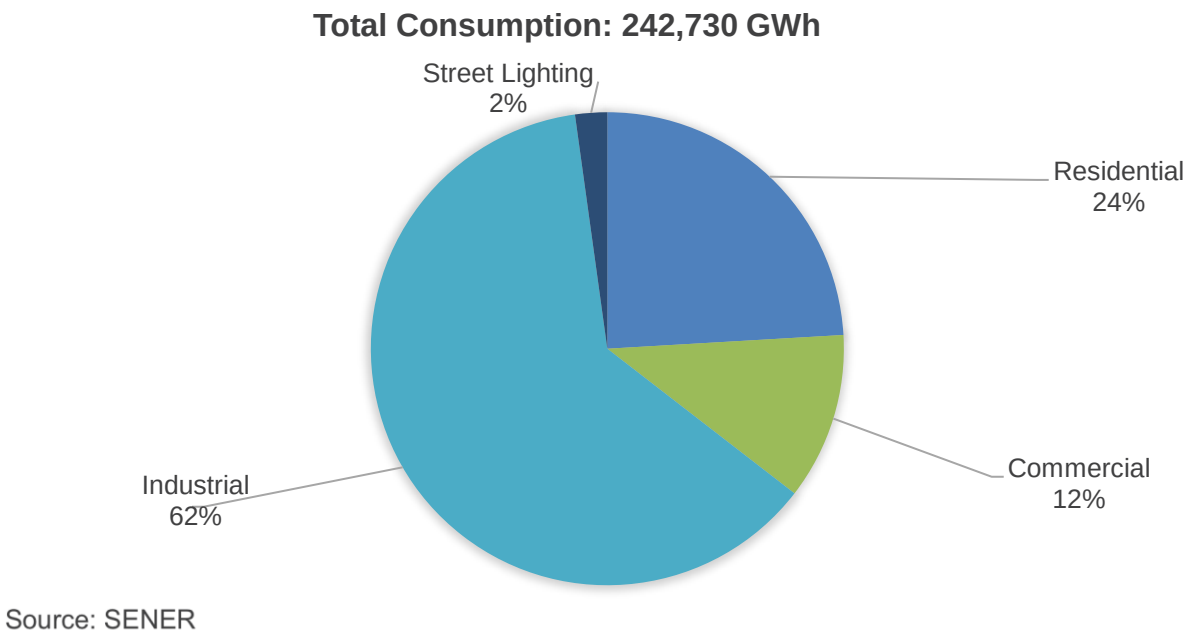


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Figure 2. Step 1 of USAID Energy Efficiency Assessment Tool and Workflow Description

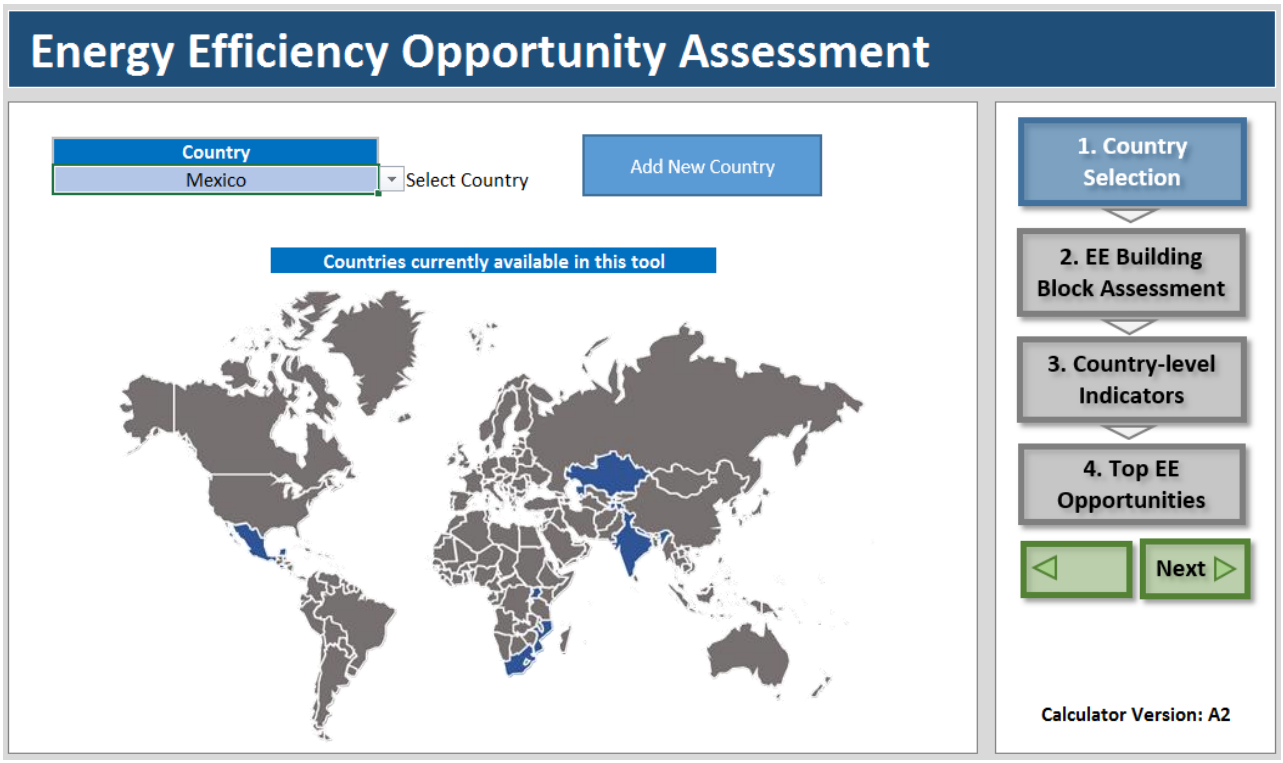
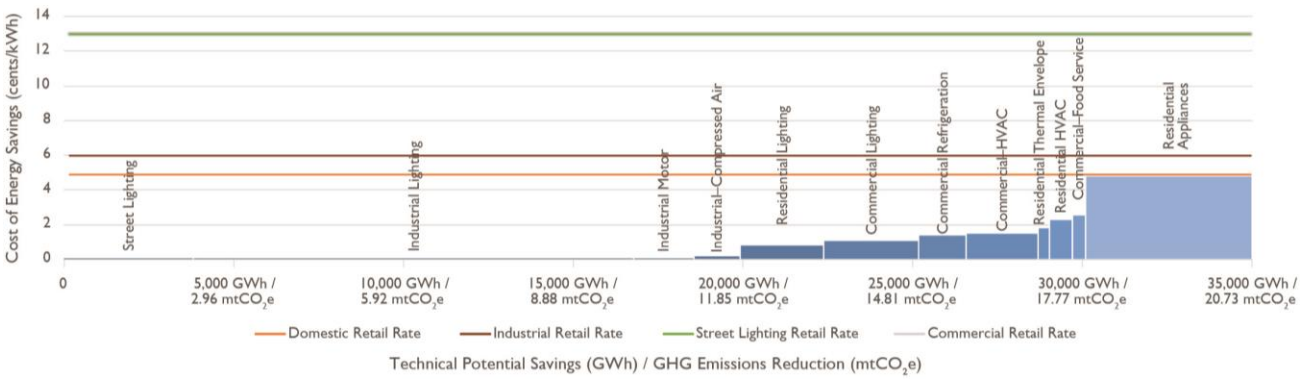


Figure 3. Energy Efficiency Program Load Curve for Mexico



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.

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 cost of energy savings for these programs to the standard rate or tariff in the country to show how competitive energy efficiency is when compared to increased generation. 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 Mexico and the technologies bundled for each one.

Table 1. Cost-Effective Programs Analyzed for Mexico

Program	Technologies Included
Residential Lighting	LED lighting
Residential Heating/Cooling	Efficiency air conditioners
Residential Appliances	Efficient refrigerators and efficient clothes washers
Residential Thermal Envelope	Whole home improvements: air sealing, roof insulation, window shades, and double glazed windows (low SHGC)
Commercial Refrigeration	High efficiency freezers, refrigerated vending machines, and reach-in coolers.
Commercial Lighting	Fluorescent and LED linear and downlight fixtures (e.g., T8, T5 and LED downlight fixtures).
Commercial HVAC	Efficient packaged and split system air conditioners and building energy management systems
Commercial Water Heating	Hot water pipe insulation, hot water tank insulation, and drain water heat recovery
Commercial Food Service	High efficiency cooking equipment: fryers, griddles, hot food holding cabinets, and steam cookers.
Industrial Motor	Proper sizing of motors and high efficiency motors
Industrial Compressed Air	Alternate compressors, VFD compressors, and compressor leak reduction
Industrial Lighting	LED linear and downlight fixtures (e.g., T8, T5 and LED downlight fixtures).
Street Lighting	LED Street Lighting.

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 of the service industry to install and maintain equipment, and the level of acceptance among the population to spend money on efficiency. Due to the importance of these factors to the success of programs, it is essential to develop 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). 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 established and tested 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 Mexico

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 be energy-efficiency 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 burden 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 the local manufacturing industry. 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 customer class 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 scale of one (1) to five (5), with five (5) representing the highest probability of success for a program, and one (1) representing the lowest or no probability of achieving positive outcomes within a given indicator (see Figure 4). These are subjective scores and are intended to be sensitive to shifts and changes in the marketplace.

When 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, the scores should represent the best available information and understanding of the market at a particular point in time. Scoring for country-specific indicators are one of the areas that can be modified as markets mature and change through growth in technology availability, technical capacity, and in other areas including policy 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 Mexico

Program Name	Market Transformation Potential	Political Feasibility	Program Complexity	Environmental Aspects	Economic Aspects	Equity
Residential Lighting	5	5	5	3	2	5
Residential HVAC	3	2	3	4	4	3
Residential Appliances	3	3	4	4	4	3
Commercial Refrigeration	4	3	3	4	4	3
Commercial Lighting	4	3	4	3	2	4
Street Lighting	5	5	5	3	2	5
Industrial Motor	4	5	4	4	4	4
Industrial - Compressed Air	3	2	2	4	4	3
Commercial - HVAC	3	2	3	4	4	3
Commercial - water Heating	3	3	3	3	3	3
Commercial - food service	4	4	3	4	3	2
Residential thermal envelope	2	2	2	3	3	3
Industrial Lighting	4	4	4	3	3	4

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 Mexico, 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.

- Industrial– Compressed Air is scored with a Program Complexity of 2 because a higher level of expertise is needed to administer and ensure savings for this type of program.
- The Residential Lighting program is scored with a Program Complexity of 5 since this program is straightforward to design, implement, and manage.
- The Commercial Refrigeration program is scored with a Market Transformation potential of 4 because the government already has a MEPS standard that would create an energy efficient baseline for a program, and related products are commonly found in small businesses.

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 audits 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.
- 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.
- Public Awareness of energy efficiency and 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.

- Regulatory Mechanisms and policies that support energy efficiency 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.
- 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.
- 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 quality, 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 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 Mexico, the reasoning behind several selections is outlined, below.

- Under Skilled Workforce, “Trained professionals that focus on identifying energy efficiency opportunities” is marked as not yet present in Mexico since there is a need for more energy efficiency experts in the country that can work in the fields of design, financing, and implementation of energy efficiency.
- 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 because there is strong stakeholder communication between academia, government, and utilities.
- Under Regulatory Mechanisms, “Energy prices reflect true cost of production, procurement, and transmission (i.e. not subsidized)” is marked as not yet present in Mexico as it was noted that energy subsidies make energy efficiency difficult to make cost effective on the consumer side.

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	No	Energy Services Companies (ESCOs) exist and energy performance contracts are able to be contractually upheld under current regulatory framework
4	Yes	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	Yes	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
Financing Support		
9	No	Significant funding for energy efficiency measures
10	Yes	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	Yes	Government incentives to buy down first cost of new technologies exists
Public Awareness		
14	No	Customer awareness level of energy efficiency programs (incentive offerings) already in place is high
15	Yes	Consumers have previous positive experience with energy-efficient products achieving marketed claims
16	No	High consumer/purchaser knowledge of energy efficiency - allows customer to make informed decisions when purchasing products
17	Yes	Current energy efficiency programs are accessible to and positively affect all levels of income
Regulatory Mechanisms		
18	No	EE legislation to leverage municipalities and companies to implement energy efficiency
19	Emerging	Country/utilities have clear short and long term goals for energy development/expansion
20	No	Building energy codes for commercial/residential buildings have compliance mechanisms in place

	Building Block Present?	Building Block Description
21	Yes	Building energy codes for commercial/residential buildings exist
22	Yes	Energy efficiency contributes to local/regional plans such as Low Emission Development plans (LEDs)
23	No	Energy prices reflect true cost of production, procurement, and transmission (i.e. not subsidized)
24	Yes	Limited taxes or tariffs are collected on the import of energy-efficient products, keeping prices reasonable
25	Yes	Governmental functions operate independently of energy sales (i.e. municipalities and governments are not dependent on energy sales)
Smart Incentives		
26	Yes	Residential demand side management programs with incentives exist
27	Yes	Commercial demand side management programs with incentives exist
28	Yes	Industrial demand side management programs with incentives exist
29	Emerging	Tax incentives for purchasing specific energy-efficient products exist
Technology Development		
30	Yes	Testing facilities for energy-efficient products exist in country/region
31	Yes	Appliance energy rating standards exist and are complied with
32	Emerging	Non-energy benefits (i.e. cascading benefits of utility bill reduction, avoided emissions, job creation) are included in energy efficiency planning and cost-effectiveness
33	Emerging	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 Mexico, 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 Mexico's power sector.

Energy Efficiency Building Block Results

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

For Mexico, Skilled Workforce is the least developed areas of the market, and some work is also needed to build public awareness and provide financial means for implementing energy efficiency measures. Examples of improvements that can be made include creating low-interest financing mechanisms at lending institutions for energy efficiency upgrades, based on an understanding that the initial investment will yield long term energy cost savings, and improved data collection for existing energy efficiency programs.

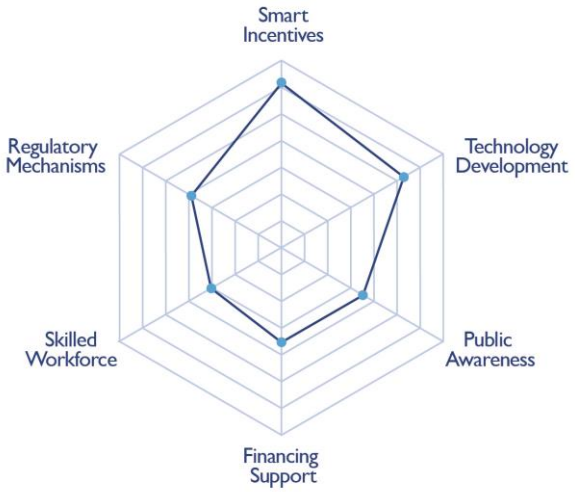


Figure 7. Building Blocks for Energy Efficiency Achievement in Mexico

However, Mexico is positioned for success in scaling up energy efficiency. Energy efficient technology is available in the market and there are a number of successful current and past energy efficiency programs. Additional improvement can be gained through further advances in public awareness and the continued adoption of minimum efficiency standards (MEPS) that will elevate the technological baselines within the country.

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.

Each of the energy efficiency opportunities listed 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 been color-coded for quick assessment as *good, better* and *best.*

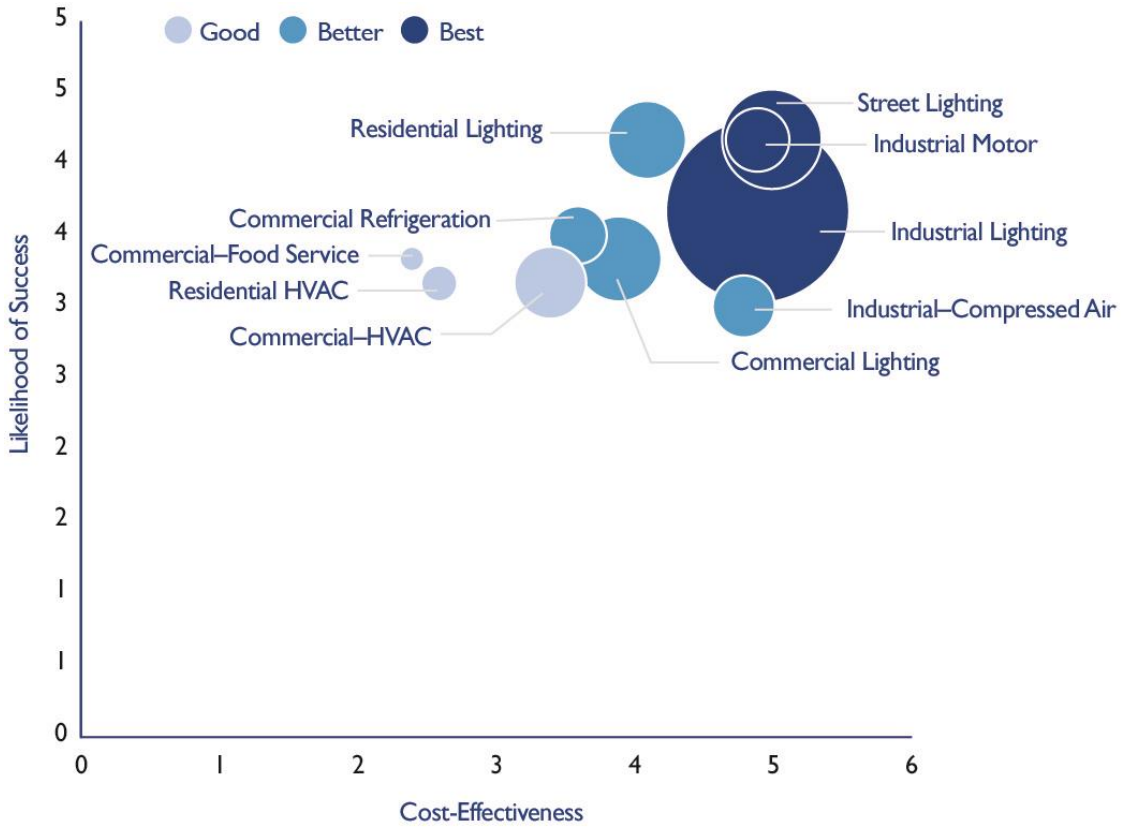
For Mexico, street lighting, industrial motors, and industrial lighting round out the top of the list as being both cost-effective and having a high likelihood to succeed given the status of market readiness in Mexico at this time. In particular, street lighting has a large energy savings and GHG emission reduction opportunity and can be highly successful as the complexity is relatively low and the chance of receiving political support should be high due to the associated public visibility of the programs.

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 move this analysis to a level of specificity that can be used to deploy

effective programs in Mexican 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.

Stakeholder feedback commonly expressed that the tool would be greatly beneficial to governments at the state and municipal level. It was suggested that given Mexico's geography, engagement at the local and state levels may yield more specific data on energy usage and savings. Given the challenges with collecting and sharing data at the national level, state level engagement may be a more effective method of engagement moving forward.

Figure 8. Top 10 Energy Efficiency Opportunities for Mexico



DISCUSSION

Increasing energy efficiency is a cost-effective strategy to accomplish a number of objectives. Reducing the amount of electricity needed to run machinery at industrial plants, light office buildings, and cool houses, for example, is widely recognized as having a beneficial effect on the entire power sector. Delivery of electricity and transmission have greatly improved in Mexico in recent years which places Mexico in a strong position to scale energy efficiency projects.

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 Mexico in capturing all of these benefits, particularly through policy, is the need for data and analysis to assist with evidence-based decision-making. The need for accessible data was a significant barrier in projecting potential costs and energy savings of the measures identified. This led to heavy reliance on proximity data modified from the United States. Mexico, as a result of strong domestic manufacturing and a heavy import market, makes technologies widely available, but a comprehensive market study on available products and costs would significantly enhance the user effectiveness in utilizing the tool to project top efficiency opportunities. The need for a rapid and reliable assessment of the energy efficiency opportunity is the driving force behind this Opportunity Study. The project in Mexico 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.

This analysis, including the application of the tool, does not replace a comprehensive energy efficiency potential study, nor capture all of the barriers to implementation for energy efficiency programs. By identifying the top ten energy efficiency opportunities in Mexico, the goal is to bring energy efficiency into the conversation on power sector planning and economic development. 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 in areas of the market that support improved successful implementation of energy efficiency (i.e. “Building Blocks”). Modifying the tool to reflect newly available financing or a reduction in the price difference between an energy efficient product and its conventional counterpart, for example, will shift the likelihood of success for some measures. Over time, strengthening of the areas of the market, reflected in the building blocks, will enable more sustainable energy efficiency programs to be successful, and enable efficiency programs to 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
USAID Mexico	• Don McCubbin, Environment Officer Mission Disaster Relief Officer	Supports USAID Central America Regional Clean Energy Initiative.
Oraganismo Nacional de Normalizacón y Certificación de la Construcción y Edificación (ONNCCE)	• Evangelina Hirata Nagasako, Executive Director	The National Agency for Standardization and Certification of Building and Construction, S.C. (ONNCCE) is a nationally recognized dedicated to the development of the activities of standardization, certification and verification, which aims to contribute to improving the quality of products, processes, systems and services Civil Society.
Calidad y Sustentabilidad en la Edificación, A.C. (CASEDI)	• Arturo Echeverría Aguliar, Vice President of International Affairs • Evangelina Hirata Nagasako, President	CASEDI is a civil association formed by 21 founding members including professionals, professional associations and companies related to construction in Mexico interested in promoting quality buildings that contribute to sustainable development of cities.
Fideicomiso para el Ahorro de Energía Eléctrica (FIDE)	• Rubén Zaga, Program Operations Manager • Dr. Jorge Toro, Subdirector of Programs • Dr. Juan Luis Diaz de Leon Santiago, Information Technology Coordinator	Private trust, non-profit, established on August 14, 1990, on the initiative of the Federal Electricity Commission (CFE), in support of the Program Electric Energy Saving; to assist in the actions of saving and efficient use of electricity.
Tetra Tech - Programa para el Desarrollo Bajo en Emisiones de México II (MLED)	• Ignacio Rodriguez • Rogelio Avendaño, Communications Manager • Alejandro Gutierrez, Project Finance Advisor	The MLED Program is sponsored by the U.S. Agency for International Development (USAID), and provides technical assistance to the Government of Mexico for low-carbon development strategy, system strengthening for measuring reporting and verification of (GHG), implementation of demonstration projects harnessing clean energy, and Coordination of the Global Climate Change (GCC) USAID/Mexico.
La Comisión Nacional para el Uso Eficiente de la Energía (CONUEE)	• Herbert Leon Sanchez, Director of Energy Efficiency in Buildings • Sergio A.Segura Calderon, Director of International Cooperation • Israel Jauregui Nares, Deputy Managing Director of Energy Efficiency Management	The National Commission for the Efficient Use of Energy (CONUEE) is a decentralized administrative body of the Energy Secretariat. Its main objective is to promote energy efficiency and act as a technical body in the field of sustainable energy use.
Cooperación Alemana al Desarrollo Sustentable en México (GIZ)	• Ana Córdova, Senior Advisor • Ernesto Feilbogen	German Cooperation for Sustainable Development in Mexico supports its Mexican counterparts to increase the sustainability of the energy system and promote renewable energy and energy efficiency. To this end, improve the legal framework, implement development programs and outreach, and to strengthen training measures, training and awareness plans.

Organization	Contacts	Description
Secretaría de Energía (SENER) Programa Nacional para el Aprovechamiento Sustentable de la Energía	• Maria del Rosario Vadillo Paniagua, Director for Energy Efficiency • Santiago Creuheras Diaz, General Director for Energy Efficiency • Gabriela Reyes Andres, Director of Sustainable Energy Use	National Program for Sustainable Use of Energy General Direction for Energy Efficiency and Sustainability establishes strategies, objectives, actions and goals that will achieve optimal use of energy in all processes and activities for exploitation, production, processing, distribution and final consumption.
International Energy Agency	• Ana Lepure, Mexico-Based Consultant for the IEA	Mexico is a member of the OECD and candidate countries for accession in the IEA.

Table 2. USAID In-Country Meetings with Stakeholders, October 2016

Organization	Contacts	Description
Oraganismo Nacional de Normalizacón y Certificación de la Construcción y Edificación (ONNCCE)	• Evangelina Hirata Nagasako, Executive Director	The National Agency for Standardization and Certification of Building and Construction, S.C. (ONNCCE) is a nationally recognized dedicated to the development of the activities of standardization, certification and verification, which aims to contribute to improving the quality of products, processes, systems and services Civil Society.
Calidad y Sustentabilidad en la Edificación, A.C. (CASEDI)	• Arturo Echeverría Aguliar, Vice President of International Affairs • Evangelina Hirata Nagasako, President	CASEDI is a civil association formed by 21 founding members including professionals, professional associations and companies related to construction in Mexico interested in promoting quality buildings that contribute to sustainable development of cities.
Tetra Tech - Programa para el Desarrollo Bajo en Emisiones de México II (MLED)	• Mark Oven, Vice President • Rogelio Avendaño Avenda, Communications Manager	The MLED Program is sponsored by the U.S. Agency for International Development (USAID), and provides technical assistance to the Government of Mexico for low-carbon development strategy, system strengthening for measuring reporting and verification of (GHG), implementation of
La Comisión Nacional para el Uso Eficiente de la Energía (CONUEE)	• Sergio A.Segura Calderon, Director of International Cooperation	The National Commission for the Efficient Use of Energy (CONUEE) is a decentralized administrative body of the Energy Secretariat. Its main objective is to promote energy efficiency and act as a technical body in the field of sustainable energy use.
Colegio de Ingenieros Mecánico y Electricistas, A.C XXV Consejo Directivo	• Ing. Moisés Ángel Lino Linares, President of the Climate Change and Sustainability Committee	Independent energy consultant and engineering professor focusing on energy efficiency and building audits.
Secretaría de Energía (SENER) Programa Nacional para el Aprovechamiento Sustentable de la Energía	• Gabriela Reyes Andres, Director of Sustainable Energy Use	National Program for Sustainable Use of Energy General Direction for Energy Efficiency and Sustainability establishes strategies, objectives, actions and goals that will achieve optimal use of energy in all processes and activities for exploitation, production, processing, distribution and final consumption.
International Energy Agency	• Ana Lepure, Mexico-Based Consultant for the IEA	Mexico is a member of the OECD and candidate countries for accession in the IEA.
USAID Mexico	• Don McCubbin, Environment Officer Mission Disaster Relief Officer	USAID Mexico