# KAZAKHSTAN

# Identifying and Prioritizing Energy Efficiency Opportunities in Kazakhstan

*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, demand side 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. When used to lower peak demand, energy efficiency and demand response (i.e. curtailing or shifting periods of energy consumption) are also less expensive than most supply options. In the utility industry, these opportunities are referred to as demand-side management (DSM) programs since they displace the need to purchase more power or build new power plants—considered *supply side resources*. DSM strategies can ensure lower customer bills, lower total system costs (which leads to lower tariffs over time), lower total emissions, and improved 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 demand side electricity and district heating 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 a database of energy-efficient technologies specific to Kazakhstan, the ICF team profiled the potential of opportunities to scale up energy efficiency.

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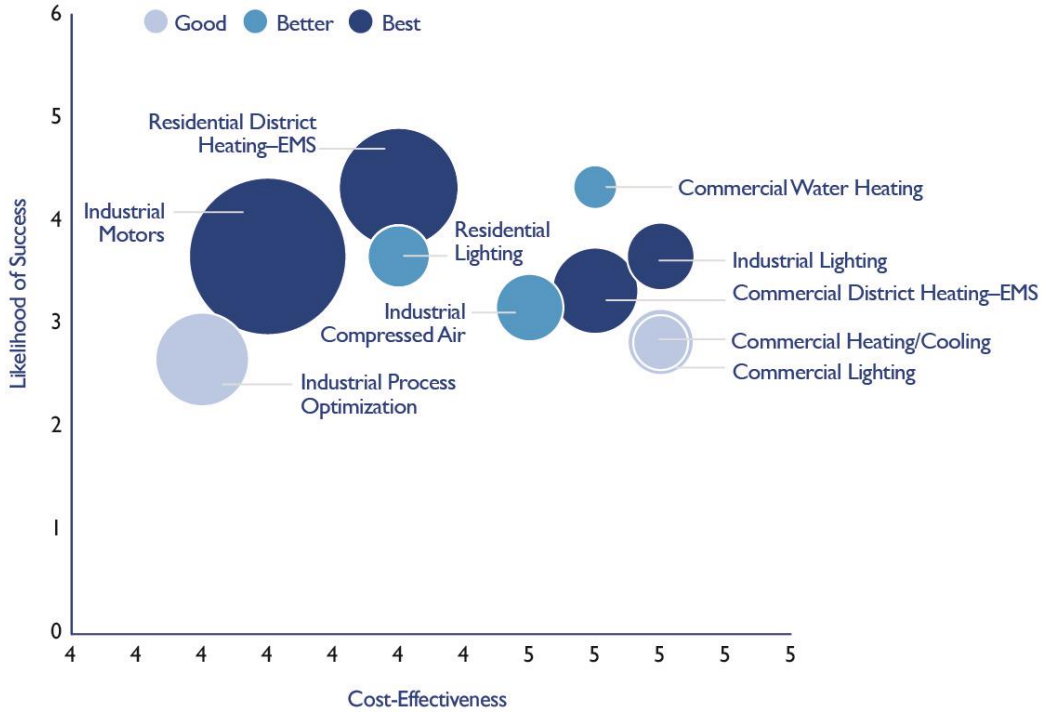
**Exhibit 1. Top ten energy efficiency opportunities for Kazakhstan**




The most promising areas for Kazakhstan to invest in energy efficiency are listed in Exhibit 1, above. The 'best' energy efficiency programs are Residential District Heating energy management system (EMS), Industrial Motors, Industrial Lighting, and Commercial District Heating EMS, as they were assessed to be the most cost-effective and have the highest likelihood of successful implementation (upper-right side of chart), and have the largest opportunities for savings. (Note that the commercial sector includes public buildings such as schools and hospitals.) 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 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: Local data collected n product costs and energy savings potential 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 area of each circle indicates the size of the energy savings potential of each energy efficiency program

# 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. Through strong energy efficiency, costs to expedite clean energy and upgrade transmission and distribution systems can be reduced, and families and businesses can save money on their utility bills.

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 information and tools to make decisions on the best investments in energy efficiency policy and program deployment.

Kazakhstan 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. USAID is also working to support Kazakhstan's transition to a low emission economy through projects such as the Kazakhstan Climate Change Mitigation Project. This study identifies which energy efficiency programs and policies will have the greatest impact on reducing GHG emission reductions 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

Energy efficiency concepts and pilot projects have been implemented for some time in Kazakhstan, and much of the important market infrastructure needed to support future programs and greater impact is in place or under development. In order to identify the energy efficiency programs that represent the best investments in Kazakhstan today, three sets of data were considered: (1) cost and savings information for specific efficiency measures, (2) the applicability of energy efficiency measures (i.e. country-specific indicators), 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 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 for 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

The ICF team held meetings with 8 key stakeholder organizations in June 2016: the Association of Energy Engineers, the Almaty University of Energy and Telecommunication, JSC Institute of Electricity Development and Energy Saving, the Kazakhstan Electricity Association and AES Corporation, the Ministry of Energy of the Republic of Kazakhstan, the Kazakhstan Climate Change Mitigation Project, JSC Samruk-Energo, and the Kazakhstan Housing and Utilities Sectors Reform Centre.

The stakeholders and ICF team discussed energy efficiency opportunities, financing avenues, and

efficiency-related initiatives. They also described barriers for energy efficiency programs, relaying concerns about market conditions, capacity building, and access to international markets.

In October 2016, the ICF team returned to Kazakhstan to meet with stakeholders a second time to present preliminary findings and collect feedback on assumptions and the functionality of the tool. In addition, ICF met with additional stakeholder organizations, including the Ministry of Investment and Regional Development, the Centre for Energy Research at Nazarbayev University, the World Bank and the United Nations Development Programme. A description of each organization and list of associated contacts can be found in Appendix A.

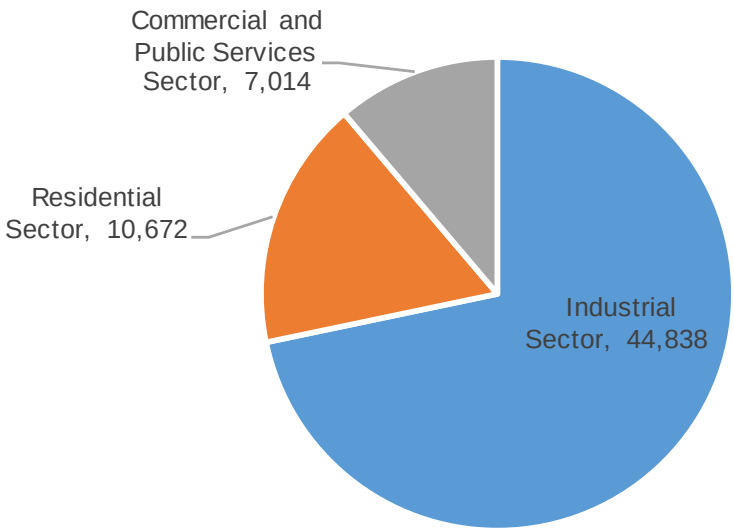
# COUNTRY ASSESSMENT

## 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 Kazakhstan using literature review, regional pricing information, discussions with key stakeholders, and results from pilot projects, case studies, and energy audits. Research into energy consumption at the sector- and end-use levels (e.g. industrial motors, residential lighting) was conducted using international data sources to ensure that the savings associated with individual measures were properly allocated and could be compared against total consumption (see Figure 1).

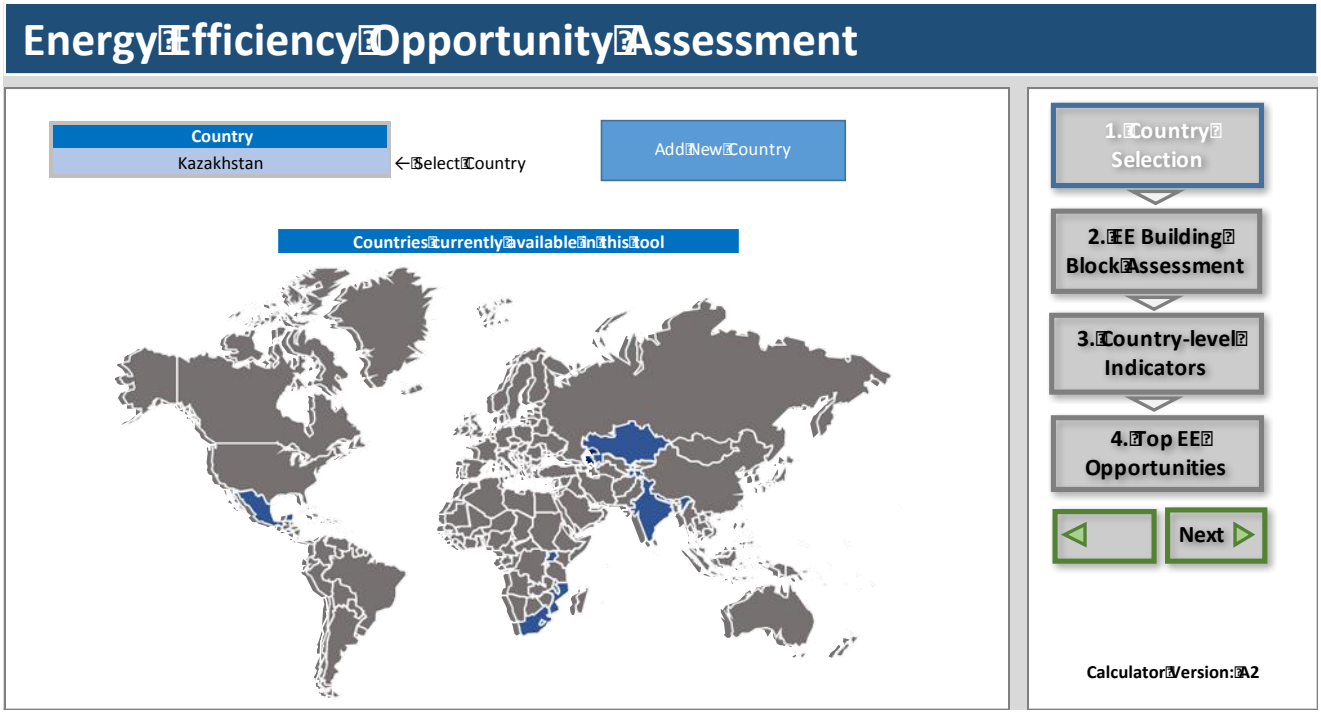
Step 1 of the tool involves selecting Kazakhstan from the list of countries currently available in the tool (see Figure 2).

**Figure 1. Electricity consumption in Kazakhstan** (residential, commercial and public services and industrial sectors only)




*Source: International Energy Agency*

**Figure 2. USAID Energy Efficiency Assessment Tool**




Once a country is selected, and the cost and savings data is entered, the tool generates a ranking of energy efficiency programs by cost 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. Table 1 lists the programs evaluated for Kazakhstan and the technologies bundled for each one. Costs are defined in terms of costs per kWh saved. Measures estimated to deliver large energy savings for little investment are shown as low, long bars, close to the horizontal axis. Impact is based on energy savings estimates, as well as sector-level and end use consumption to determine the potential for savings.

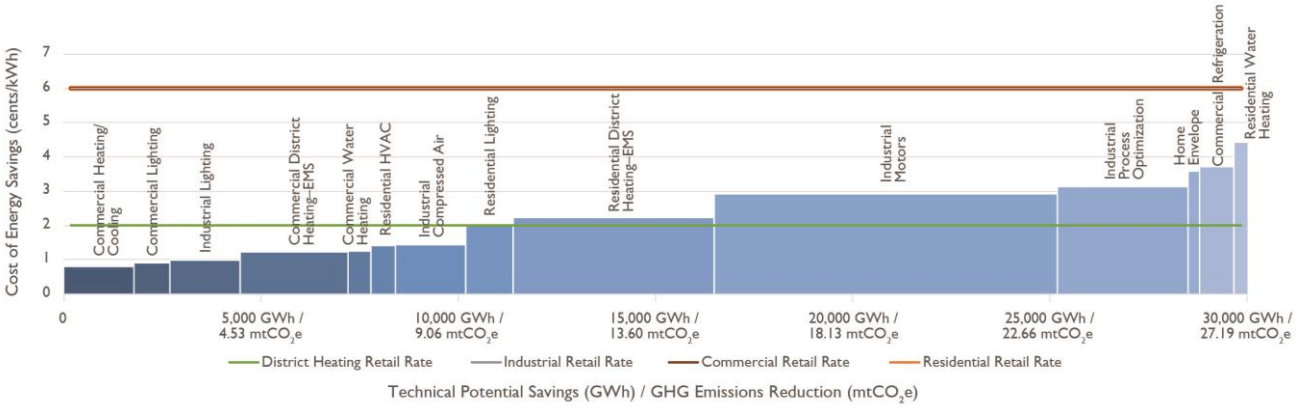
Stakeholders can use the graph to compare the costs of energy savings for these programs to the standard rate or tariff in the country (in Kazakhstan's case for both district heating and electricity) to show how competitive energy efficiency is when compared to increased generation.

The total cost of each program can be determined based on the area of each column. Note, these costs are exclusive of any program or administrative costs and only represent the cost-effectiveness of the energy savings measures included. It is important to note that Figure 3 mixes thermal and electric GWh, so caution should be used when comparing opportunities.

**Table 1. Cost-effective programs assessed for Kazakhstan**

| Program | Technologies Included |
|---|---|
| **Residential Lighting** | Combination of LED and CFL screw and pin-based lighting. |
| **Residential Water Heating** | Solar water heater, electric tankless water heater, low-flow showerheads, and tank insulation. |
| **Residential Heating/Cooling** | Efficient heat pumps and heat pumps with VRF technology. |
| **Residential Appliances** | Efficient refrigerators. |
| **Commercial Refrigeration** | High efficiency freezers, refrigerated vending machines, multi-deck coolers, and reach-in coolers. |
| **Commercial Lighting** | Fluorescent and LED linear downlight fixtures (e.g., T8, T5 and LED downlight fixtures). |
| **Industrial Motors** | Proper sizing of motors, optimized drives, high efficiency motors, variable frequency drive (VFD) retrofits. |
| **Industrial Compressed Air** | Power factor optimizers, air compressor controls (demand controls), VFD compressors, compressor leak reduction |
| **Industrial Process Optimization** | Process piping insulation, heat recovery systems, energy management systems, automated temperature controls, and heat pumps for process water heating. |
| **Commercial Heating/Cooling** | Efficient packaged and split system air conditioners, dual enthalpy economizers, chiller systems variable speed drives (VSD), building energy management systems, and design assistance for new construction projects. |
| **Commercial Water Heating** | Solar water heater -- commercial heat pump water -, low-flow faucets, tank insulation, and pipe insulation. |
| **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, double glazed windows (low SHGC) and high performance new homes. |
| **Industrial Lighting** | Fluorescent and LED linear and downlight fixtures (e.g., T8, T5 and LED downlight fixtures). |

**Figure 3. All energy efficiency programs ranked by cost-effectiveness**




## Country-Level 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 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). 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. Description of Country-Level Indicators**

| 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 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. Programs are scored based on information gathered through direct conversations with key stakeholders in addition to 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 each country-specific indicators should be modified as more information becomes available and as markets mature and change through growth in technology availability, technical capacity, and in other areas including policy that enable new program opportunities.

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 Kazakhstan, the reasoning behind several of the selections are outlined, below.

- The Industrial Lighting program is scored with a *Market Transformation Potential* of 4 because industrial customers are likely to understand and value the savings that result from this program, causing them to continue to invest in high efficiency lighting moving forward.
- The Commercial Lighting (including public sector buildings such as schools and hospitals) program is scored with a *Program Complexity* of 5 since this program is straightforward to design, implement, and manage. Additionally, street lighting retrofits in Kazakh cities such as Astana have been initiated.
- The Commercial Refrigeration program is scored with a *Program Complexity* of 3 because it is relatively difficult to administer and ensure savings for this type of program, as it requires specialized skills.
- The Residential Appliances program is scored with a *Political Feasibility* of 5 as it is a high-profile residential sector measure. It is anticipated that an opportunity to upgrade to new, high-efficiency products that homeowners interact with daily is something that would gain political support.

**Figure 4. Scoring summary for Kazakhstan country-level indicators**

| Program Name | Market Transformation Potential | Political Feasibility | Program Complexity | Environmental Aspects | Economic Aspects | Equity |
|---|---|---|---|---|---|---|
| Residential Lighting | 5 | 4 | 3 | 3 | 3 | 4 |
| Residential Water Heating | 1 | 3 | 2 | 4 | 3 | 3 |
| Residential HVAC | 1 | 3 | 3 | 4 | 3 | 3 |
| Residential Appliances | 2 | 5 | 4 | 3 | 2 | 2 |
| Home Envelope | 2 | 3 | 1 | 3 | 3 | 2 |
| Residential District Heating - EMS | 4 | 5 | 3 | 5 | 4 | 5 |
| Commercial Lighting | 5 | 3 | 5 | 3 | 4 | 4 |
| Commercial Refrigeration | 3 | 2 | 2 | 5 | 3 | 2 |
| Commercial Heating/ Cooling | 3 | 2 | 3 | 4 | 3 | 4 |
| Commercial Water Heating | 3 | 2 | 3 | 3 | 3 | 3 |
| Commercial District Heating - EMS | 4 | 5 | 3 | 5 | 4 | 5 |
| Industrial Lighting | 4 | 3 | 4 | 3 | 4 | 2 |
| Industrial Motors | 4 | 4 | 4 | 5 | 3 | 2 |
| Industrial Compressed Air | 4 | 4 | 4 | 5 | 3 | 2 |
| Industrial Process Optimization | 3 | 4 | 2 | 4 | 4 | 2 |
| Residential District Heating - Envelope | 2 | 4 | 1 | 3 | 3 | 3 |

Moving forward, these indicator scores can be adjusted directly by stakeholders who are working in these markets.

Once the assessment tool has identified energy efficiency programs which are cost-effective in a specific country, the indicator scores are used to further assess each program on the viability of implementation. This shifts the focus onto those programs which have a high chance for success in a particular marketplace.

## 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, public, 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 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, 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 cost and environmental savings that efficiency provides, but also know about strategies to improve efficiency.
- 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.
- 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 offer greater 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 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 energy-efficiency 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).

**Figure 5. Energy efficiency building block responses for Kazakhstan**

| | Building Block Present? | Building Block Description |
|---|---|---|
| **Skilled Workforce** | | |
| 1 | Emerging | Trained professionals that focus on identifying energy efficiency opportunities (Ex: energy auditors or home energy raters) |
| 2 | Emerging | Network of actors in government, utility, and private sector are well connected and able to work together to deliver energy efficiency programs |
| 3 | Yes | Energy Services Companies (ESCOs) exist and energy performance contracts are able to be contractually upheld under current regulatory framework |
| 4 | Emerging | 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 | No | Tools and models to analyze energy efficiency opportunities are available to energy professionals |
| 8 | No | Tools and models to analyze energy efficiency opportunities are available to financial professionals |
| **Financing Support** | | |
| 9 | Yes | Significant 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** | | |
| 15 | No | Customer awareness level of energy efficiency programs (incentive offerings) already in place is high |
| 17 | No | High consumer/purchaser knowledge of energy efficiency - allows customer to make informed decisions when purchasing products |
| 18 | Emerging | Current energy efficiency programs are accessible to and positively affect all levels of income |
| **Regulatory Mechanisms** | | |
| 21 | Yes | Energy efficiency legislation to leverage municipalities and companies to implement energy efficiency |

| | Building Block Present? | Building Block Description |
|---|---|---|
| 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 | Emerging | Building energy codes for commercial/residential buildings exist |
| 25 | Yes | Energy efficiency contributes to local/regional plans such as Low Emission development (LEDs) plans |
| 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. tenets) |
| 28 | Yes | 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 | No | Commercial demand side management programs with incentives exist |
| 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 | No | Appliance energy rating standards exist and are complied with |
| 38 | 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) |
| 39 | No | Energy efficiency measures capable of modifying market behavior even after incentives are removed |

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

- Under Regulatory Mechanisms, “Energy efficiency legislation to leverage municipalities and companies to implement energy efficiency” is marked as a building block that is present for Kazakhstan since existing legislation sets targets at the National level.
- Under Financing Support, “Government incentives to buy down first cost of new technologies exist” is marked as a building block to be developed in Kazakhstan because the government does not offer any programs to reduce the cost of energy efficient technologies.
- Under Skilled Workforce, “Trained professionals that focus on identifying energy efficiency opportunities (Ex: energy auditors or home energy raters)” is marked as an emerging building block, as significant efforts exist within Kazakhstan to train energy efficiency professionals (for instance, the Association of Energy Engineers hold regular training sessions for Certified Energy Managers). However, newly trained energy efficiency experts require more experience and regulatory guidance to improve their effectiveness.

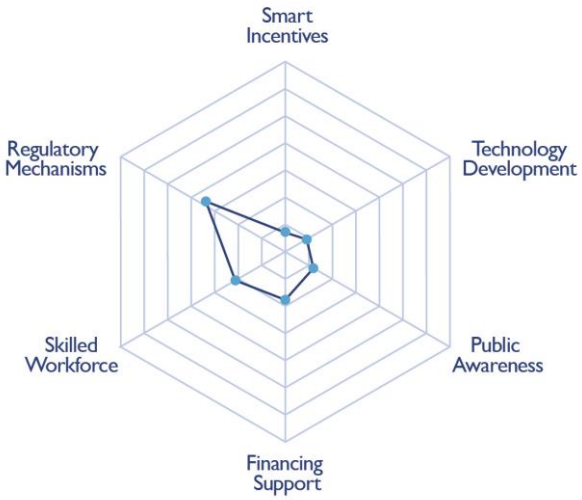
# RESULTS

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 Kazakhstan, as well as the programs with 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 data types into an overall assessment of the top 10 energy efficiency opportunities for Kazakhstan’s power sector.

## Energy Efficiency Building Block Results

The results of the building block assessment for Kazakhstan 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.

**Figure 7. Building blocks for energy efficiency in Kazakhstan**




For Kazakhstan, smart incentives and technology development are the areas of the market most in need of development to support the deployment of energy efficiency programs. Examples of improvements that can be made to strengthen these building blocks include introducing programs that offer smart incentives (e.g. subsidized residential LED lighting), and improved labelling and enforcement of the ban on incandescent lighting. Although energy efficiency technology is available, recent significant devaluation of the Kazakh Tenge drastically increases the cost of imported energy efficiency products.

However, Kazakhstan is positioned for continued success in scaling up energy efficiency. Regulatory mechanisms supporting efficiency are in place, such as the Energy Saving 2020 national target. In addition a 90 million USD revolving fund is being established by the World Bank - although additional financing support is required to meet energy efficiency and greenhouse gas (GHG) targets.

## 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 country-level indicators) 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.

**Figure 8. Top ten energy efficiency opportunities for Kazakhstan**

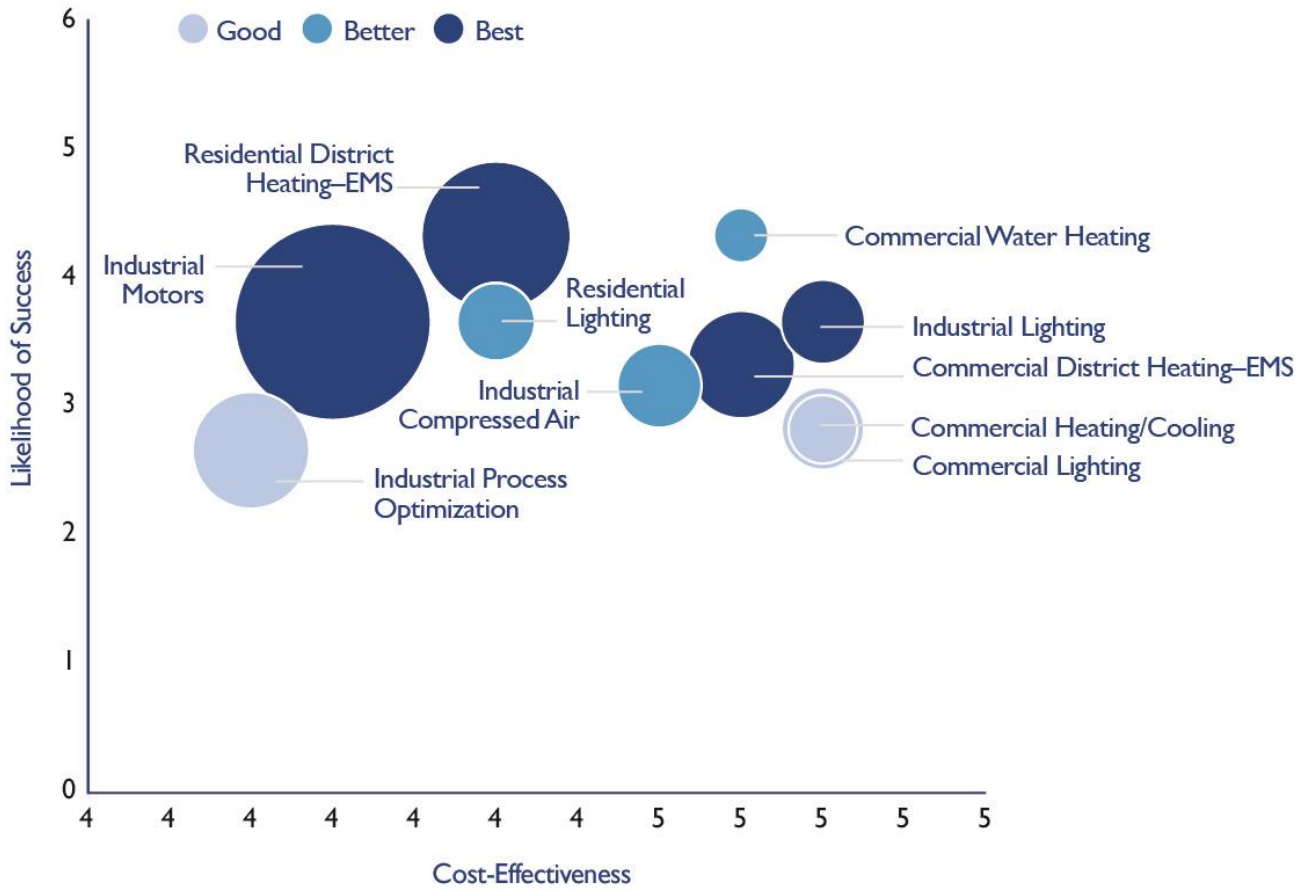
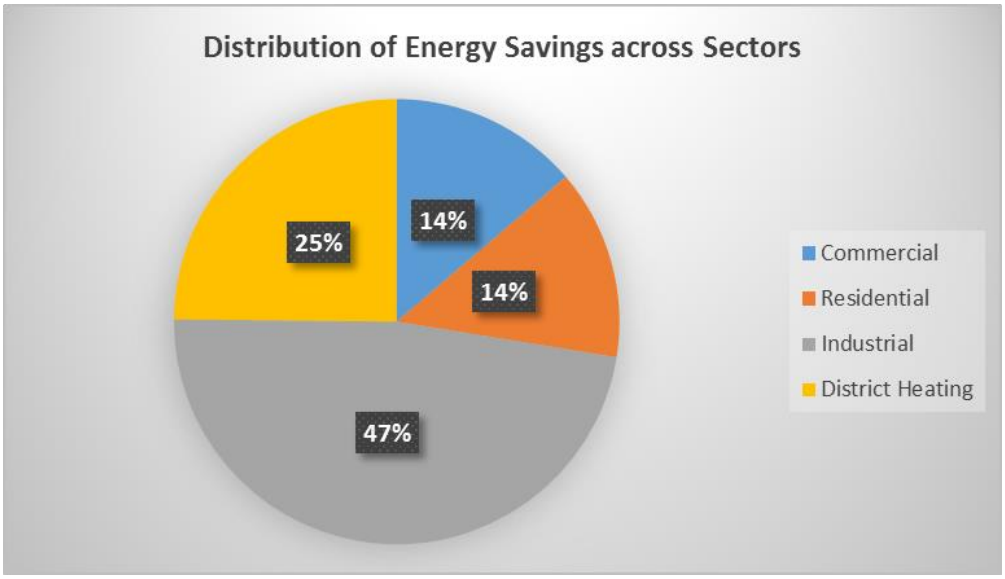


**Figure 9. Distribution of energy savings across sectors**




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 Kazakhstan, Residential District Heating energy management system (EMS), Industrial Lighting, Industrial Motors, and Commercial District Heating EMS are the most cost-effective opportunities with a high likelihood of success given the country level indicators as assessed at this time. In particular, residential and commercial district heating energy management systems have significant potential (close to 8 TWh of thermal energy) and is relatively easy to implement and therefore more likely to be successful. In addition, residential lighting is an attractive option as it is very cost-effective and political support is likely to be stronger due to the associated 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 technical 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 within a particular region of Kazakhstan. Program design details also enable the calculation of achievable energy efficiency savings in specific oblasts or regions in Kazakhstan, and advance beyond the general estimated energy savings included in this report. Using the estimated achievable savings, incentive levels or cost-levels that can be borne by the program are then calculated and a program offering, including many details on the administrative structure, markets methods, and delivery channels for the program.

Support for program implementation includes important activities such as further research into

specific program opportunities through stakeholder engagement. Other activities include a process for approving and documenting program projects, along with aggregating energy and emissions savings from the program. Other stakeholders involved in this process include regional governments in oblasts and cities, as well as the local electricity and district heat distribution companies.

During this phase, it will be important for stakeholders to work together to gather and analyze data. For instance, the State Energy Register (administered by the JSC Institute of Electricity Development and Energy Saving) has significant access to data; furthermore, researchers at Nazarbayev University have worked diligently to collect relevant data from cities and oblasts across Kazakhstan. Plans to facilitate the collection of energy and GHG data from industry by collecting it electronically in the near future may be helpful in this regard.

# 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 heat houses, for example, are widely recognized as having a beneficial effect on the entire power sector. Delivery of electricity can be more consistent and investments in transmission and distribution upgrades can be scaled back. Energy efficiency also can be incorporated into power sector planning to accomplish a significant share of GHG emission reductions. Energy efficiency offers an opportunity to reduce the cost of adding new clean and high-efficient generation technology by reducing the total amount of generation needed. The cost to reduce energy demand, through energy efficiency programs, is cheaper than the cost of building new generation to supply the same amount of power.

USAID and many local stakeholders in Kazakhstan are actively promoting energy efficiency as a strategy for developing a low-emission economy. It is also understood that the potential to improve efficiency is widespread across sectors.

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 Kazakhstan in capturing all of these benefits, particularly through policy, is the need for more and higher quality data to support analysis and evidence-based decision-making. The need for a rapid and reliable assessment of the energy efficiency opportunity is the driving force behind this study.

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 Kazakhstan, 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.

The ICF team designed the tool to be updated to reflect changes in areas of the energy efficiency market, more and more reliable and disaggregated energy end use information and measure costs. 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 information used in the tool 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.

# REFERENCES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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 understanding and shaping future energy efficiency programs. For more information regarding this project, please contact Sergey Yelkin, Energy Projects Specialist, USAID Central Asia; Telephone: 7 727 2507612; Email: syelkin@usaid.gov

| Organization | Contacts | Description |
|---|---|---|
| Association of Energy Engineers | Yerbulat Buxukbayev, President, AEE Kazakhstan Chapter | Industry association that promotes energy efficiency, certifications, education and energy management. |
| Almaty University of Energy and Telecommunication | Professor Vyacheslav V. Stoyak, Vice-Rector, Almaty University of Power Engineering and Telecommunications | Technical university focusing on power engineering and telecommunications in central Asia. |
| JSC Institute of Electricity Development and Energy Saving | Aydar Makhambet, Chairman of the Board | The Institute supports effective policy design, innovation and development of electric power and an energy efficient economy based on data collection and analysis. |
| Kazakstan Electricity Association and AES Corporation | Daulet Akhmetov Director, Regulatory Affairs AES Kazakhstan | The mission of the KEA is to coordinate activities and represent the electric power industry, and act as a link between private companies and government. |
| Ministry of Energy of the Republic of Kazakhstan | Zhanar Bakatova, Senior Expert | The Ministry of Energy is responsible for developing policy and regulation of the oil & gas and petrochemicals industries, and transportation of raw hydrocarbons. |
| Kazakhstan Climate Change Mitigation Project | Alexei Sankovski, Chief of Party | The KCCMP works to achieve long-term sustained reductions in greenhouse gas emissions intensity in Kazakhstan by supporting efforts by government and business to implement relevant policies. |
| Samruk-Energo JSC | Kenzhegul Iskakova, Performance Management | *Samruk-Energo JSC*is a holding company that engages in the production, transmission, distribution, and sale of electricity to households and industrial enterprises in Kazakhstan. |
| Kazakhstan Housing and Utilities Sectors Reform Centre | Sergey Chaizhunussov, Chairman of the Board | Works to develop and pilot energy efficiency programs and policies for residential sector in Kazakhstan. |
| Ministry of Investment and Regional Development of the Republic of Kazakhstan | | The Ministry is state authority responsible for leading investment, development and innovation in industry and the economy of Kazakhstan. |
| Centre for Energy Research, Nazarbayev University | Yerbol Akhmetbekov, Laboratory Director, Centre for Energy Research | The National Laboratory carries out multidisciplinary applied research in the field of energy and energy efficiency. |
| World Bank | Aksulu Kushanova, Energy Analyst | The World Bank provides financial and technical assistance to developing countries around the world to reduce poverty and support development. |
| United Nations Development Programme | Alexandr Belyi, Program Analyst, Energy | The UNDP works with communities in nearly 170 countries and territories worldwide to build and sustain healthy, vibrant and peaceful societies. |
| USAID Central Asia | Sergey Yelkin Energy Projects Specialist, Economic Development Office | USAID is the lead U.S. Government agency that works to end extreme global poverty and enable resilient, democratic societies to realize their potential. |