SOUTH AFRICA

Identifying Energy Efficiency Opportunities in South Africa

This report was developed by ICF International under USAID's Energy Efficiency for Clean Development Program (EECDP), a Leader with Associate 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. 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 means lower rates 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, the ICF team developed a methodology to evaluate the viability of energy efficiency programs using information on country-specific indicators and fundamental building blocks for energy efficiency. Through discussions and reviews with local stakeholders, along with research and the construction of an extensive database of energy-efficient technologies specific to South Africa, the ICF team profiled the applicability and viability of opportunities to scale up energy efficiency.

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The most promising program areas for South Africa are listed in Exhibit 1, below. The energy efficiency programs for commercial and residential lighting, residential water heating, and industrial motors are the most cost-effective and have the highest likelihood of successful implementation (upper-right side of chart). All of the programs listed in Exhibit 1 are included in the Top 10 and, therefore, would be worthwhile and cost-effective pursuits.

INTRODUCTION

Under USAID's Energy Efficiency for Clean Development Program (EECDP), ICF International conducted the Energy Efficiency Opportunity Study. 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. This study develops a rapid assessment methodology for identifying the programs and measures with the greatest likelihood of cost-effectively lowering energy demand through efficiency. Reducing the amount of electricity required to satisfy the energy needs of homes, offices, schools, hospitals, and other buildings directly supports low emission development. Through strong efficiency, power supplies can be stretched to serve more of the population, costs to upgrade transmission and distribution systems can be reduced, and families and businesses can save money on their utility bills. The Opportunity Study gives the policy makers of South Africa information and tools to make decisions on energy efficiency policy and future program deployment.

In South Africa, energy efficiency competes with a number of other focus areas, including health, governance, and literacy. USAID is also working to support South Africa to transition to a low emission economy. To convince policymakers to pursue improved energy efficiency, it is critical to not only connect efficiency to advancing these 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 and subsidies, energy intensity, and market development, means that energy efficiency measures that work well in one location do not necessarily work well in another. The uncertainty over what strategies to invest in can cause efficiency

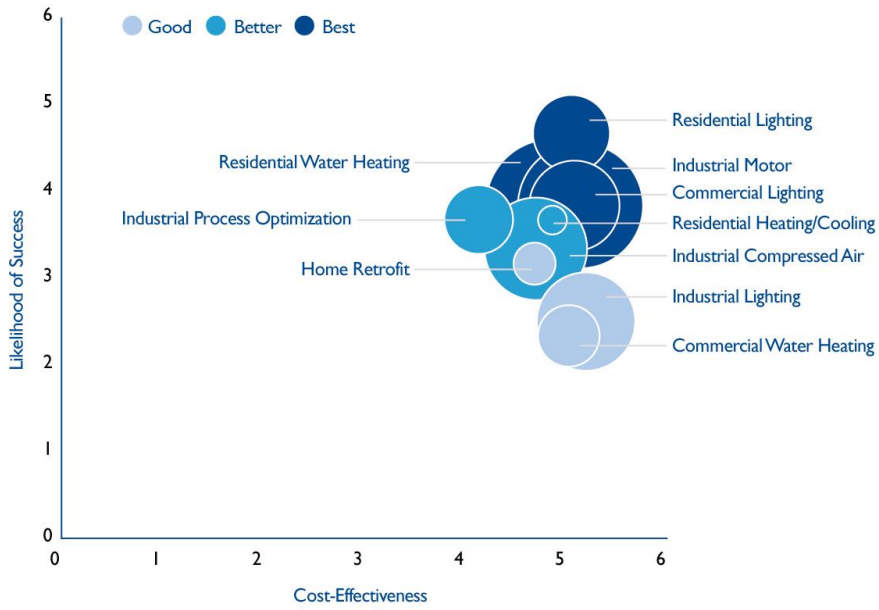


Exhibit 1: Top 10 energy efficiency opportunities for South Africa

to be deprioritized in favor of policy and program solutions that are better understood. Improved understanding of the opportunities for scaling up energy efficiency in specific markets is also required to build the necessary enabling market infrastructure within policy, financing, and commercial sectors for sustainable growth.

South Africa is the energy efficiency leader in the Sub-Saharan region, achieving over 1,037 MW in avoided generation capacity and 4,055 GWH in energy savings using only USD 674 million.

METHODOLOGY

Energy efficiency concepts and programs have been implemented for some time in South Africa and have built up some of the important market infrastructure needed to support future programs and greater impact. In order to identify the energy efficiency programs that represent the best investments in South Africa today, three sets of data were considered: (1) cost and savings information, (2) the applicability of energy efficiency measures (i.e. country-specific indicators), and (3) the enabling environment (i.e. "energy efficiency building blocks"). Only when using all three of these sets of data together, is it possible to integrate energy efficiency into the full scope of energy-related decisions being made in emerging markets. Elements of the framework are described in more detail in the following sections.

The research team developed the USAID Opportunity Assessment Tool using Microsoft Excel to create a simple visual way to record information collected for each data set, 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 in step 1, and then proceed through two 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 standard set of questions.

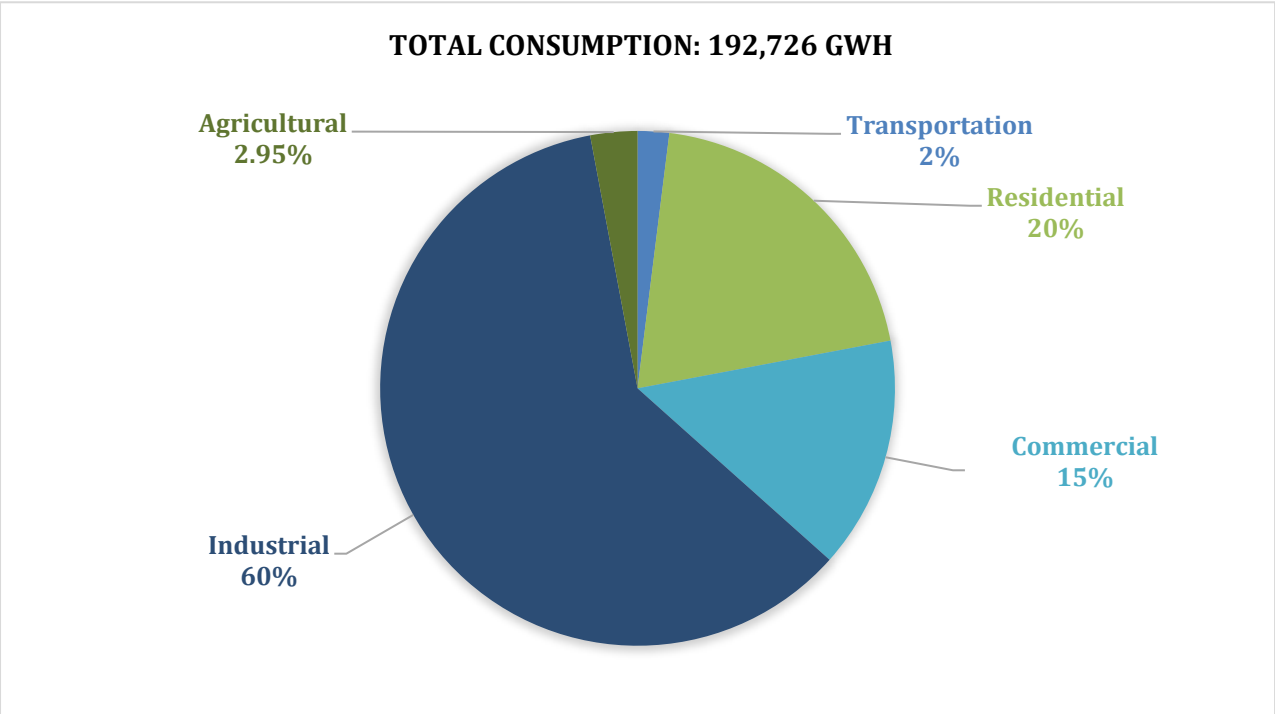
The ICF team held meetings with 8 key stakeholder organizations in October 2015: the CSIR (Council for Scientific and Industrial Research) Built Environment, the South Africa Department of Energy, the Guateng Provincial government, NBI/PSEE (National Business Initiative/Private Sector Energy Efficiency), SAEE (Southern African Association for Energy Efficiency), the NCPC-SA (National Cleaner Production Centre of South Africa), USAID Southern Africa, and the South African National Energy Development Institute (SANEDI). A description of each organization and list of associated contacts can be found in Appendix A. The stakeholders and ICF team discussed energy efficiency opportunities, financing avenues, and previous efficiency-related initiatives, such as free audits for industrial facilities. They also described barriers for energy efficiency programs, relaying concerns about market conditions, capacity building, and promoting technology manufactured outside of South Africa. In June 2016, the ICF team returned to South Africa to meet with stakeholders a second time to present preliminary findings and collect feedback on assumptions and the functionality of the tool.

COUNTRY ASSESSMENT

Cost and Savings Information

The explicit costs and energy savings of energy efficiency measures and programs are required to compare and calculate the technical potential of programs. To do this, the ICF team created a database of costs specific to South Africa using literature review, conversations with key stakeholders, released utility evaluation reports, case studies, and direct documentation of consumer

Figure 1. 2013 Energy Consumption (GWh) by Sector in South Africa



Source: International Energy Agency

costs. Consumer costs were documented from in-store visits to hardware stores and equipment suppliers for products such as commercial and residential HVAC and lighting, residential water heating, refrigeration, and industrial compressed air. Energy consumption at the sector- and end-use levels (e.g. industrial motors, residential lighting) was also researched to ensure that the savings associated with individual measures were properly allocated and could be compared against total consumption (see Figure 1).

The assessment framework is captured in a user-friendly tool designed to be used by USAID and local stakeholders working in developing countries. Step 1 of the tool involves selecting South Africa from the list of countries currently available in the tool (see Figure 2).

Once a country is selected, the tool generates a graph ranking energy efficiency programs using costs and savings estimates and sector-level and end use consumption. Stakeholders can use the graph to compare program costs to the standard rate or tariff in the country to show how competitive energy efficiency is when compared to increased generation (see Figure 3). Note, these costs are exclusive of any program or administrative costs and only represent the cost-effectiveness of the energy savings measures included. If there were no barriers present in South Africa, the programs and measures shown would be the most cost-effective programs to run (see Table 1 for program descriptions).

Figure 2. Step 1 of USAID Energy Efficiency Assessment Tool and workflow description

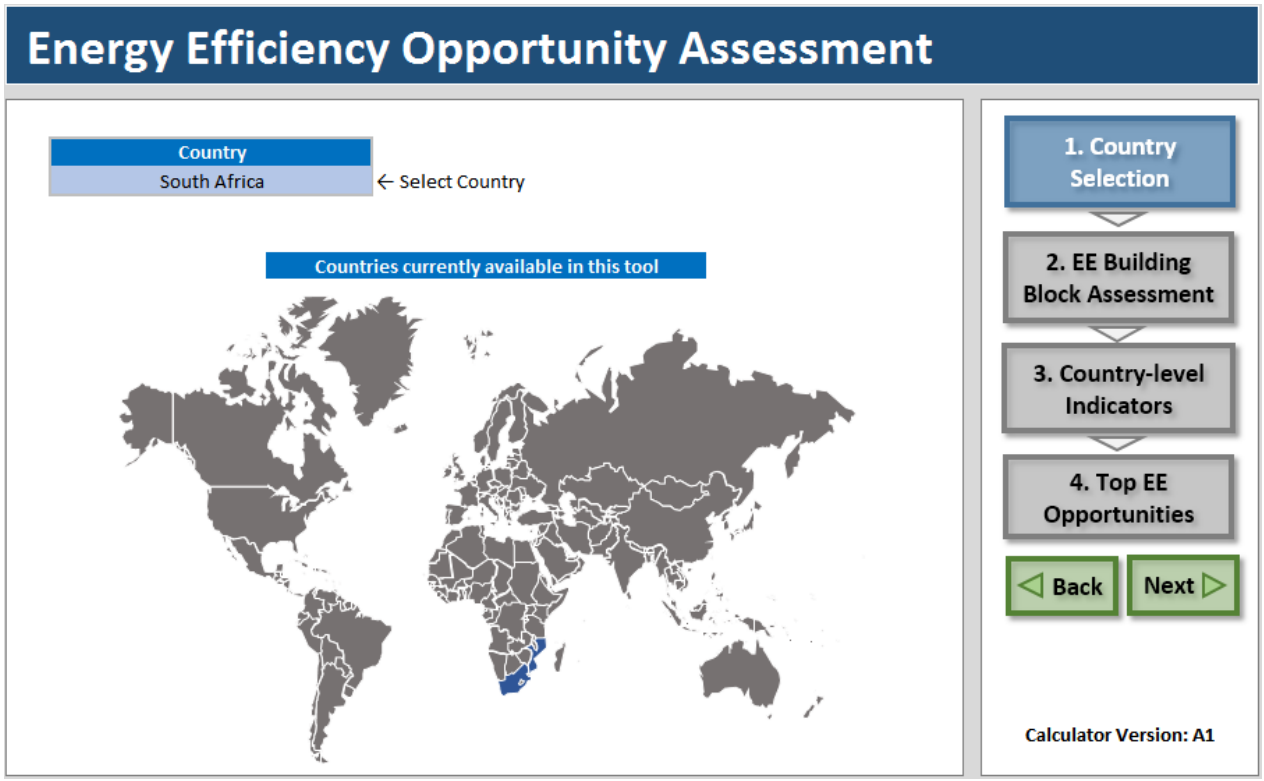


Figure 3. Energy efficiency program load curve for South Africa

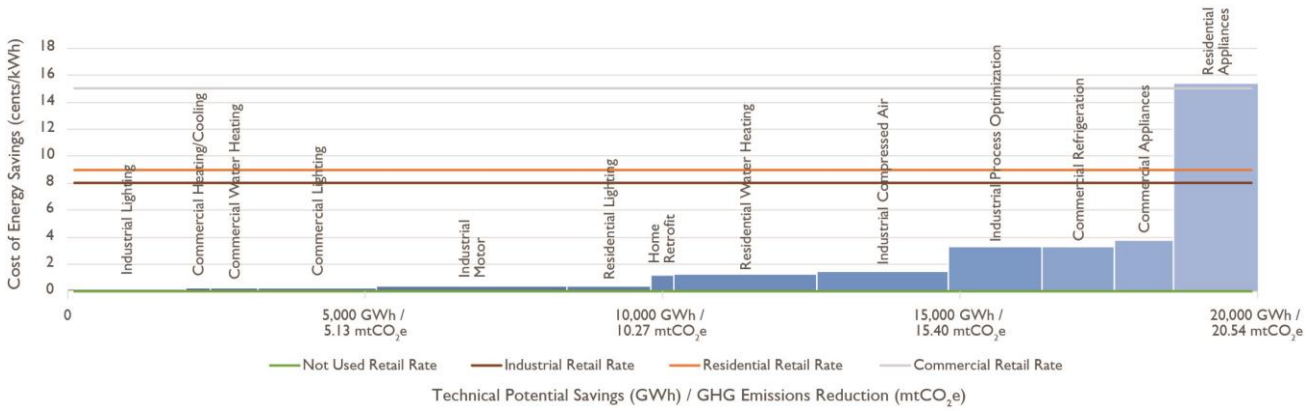


Table 1. Cost-Effective Programs Analyzed for South Africa

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 and downlight fixtures (e.g., T8, T5 and LED downlight fixtures).
Industrial Motor	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	Drainwater heat recovery, tankless water heaters, solar water heaters, commercial heat pump water heaters, 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).

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 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.

The ICF team developed an approach to judge the applicability and market-readiness of a given program across six dimensions using a 1 to 5 score (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 20+ years of experience designing and implementing

Table 2. Country-Specific Indicators in USAID Energy Efficiency Assessment Tool for South Africa

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

energy efficiency programs. This framework is being established and tested as a part of this project. Engagement with stakeholders in different countries covered by this study will provide the proper vetting and feedback needed for further improvement. As an example, in South Africa, where compact fluorescent (CFL) lighting has already saturated the market, the indicator for a program focused on CFL lighting would be low due to the lack of market transformation potential and additional savings opportunities (Eskom, 2011).

Indicators for each energy efficiency program considered under the evaluation is scored using a scale of one (1) to five (5), with five (5) representing the highest probability of success for a program within a given indicator, and one (1) representing the lowest or no probability of achieving positive outcomes for 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 stakeholders on the ground 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. Country-specific indicators are one of the areas that can be modified as markets mature through growth in technology availability, technical capacity, and in other areas including policy that enable new program opportunities with greater impact potential.

Guidance on determining the most appropriate scores is currently under development. The current scoring is based on both discussions with stakeholders regarding the performance of past programs, and a country-specific literature review.

As an illustration of how these scores were assessed for programs in South Africa, the reasoning behind several of the selections are outlined, below.

- The Residential Water Heating program is scored with a *Market Transformation Potential* of 1 because several programs to distribute and install solar water heating systems have been implemented, reducing the potential to make further advances in adoption of this technology.
- The Residential Lighting program is scored with a *Program Complexity* of 5 since this program is straightforward to design, implement, and manage. Additionally, South Africa has previous experience in running residential lighting programs.

Figure 4. Scoring energy efficiency indicators by program for South Africa

Program Name	Market Transformation Potential	Political Feasibility	Program Complexity	Environmental Aspects	Economic Aspects	Equity
Residential Lighting	3	5	5	5	5	5
Residential Water Heating	2	5	4	4	5	3
Residential Heating/Cooling	3	4	3	4	5	3
Residential Appliances	3	5	3	3	2	2
Commercial Refrigeration	3	2	1	3	2	1
Commercial Lighting	3	5	4	3	4	4
Industrial Motor	3	4	3	5	4	4
Industrial Compressed Air	3	2	3	5	3	4
Industrial Process Optimization	3	4	4	3	4	4
Commercial Heating/Cooling	3	2	1	3	3	2
Commercial Water Heating	3	2	1	3	3	2
Commercial Appliances	3	1	1	1	1	1
Home retrofit	3	3	3	4	4	2
Industrial Lighting	3	2	3	2	3	2

- The Commercial Refrigeration program is scored with a *Program Complexity* of 1 because it very difficult to administer and ensure savings for this type of program.
- The Residential Appliances program is scored with a *Political Feasibility* of 5 as it is a high-profile measure in the home. 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.

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 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*. The team categorized influential market conditions for energy efficiency into six building blocks developed by ICF (IEA 2010). While there are certainly additional factors that lead to strong country-level support for efficiency, these non-country-specific building blocks were selected as the most relevant for project-level success (Watson et al 2015).

While the building block assessment does not affect the final ranking of energy efficiency opportunities, the results inform future activities that seek to impact the enabling environment for energy efficiency. Strengthening the market through each of these building blocks promotes market transformation and scaling of energy efficiency by clearing away many of the typical barriers.

Market characteristics associated with strong energy efficiency include policies, easily accessible information, and technical expertise (RCEEE 2015). Each of the six areas are 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 result in needed infrastructure and support to energy efficiency activities and lead to greater impacts for energy savings and emission reductions.

- **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 should also 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 return on investment available through energy efficiency. Despite the low cost of many efficiency measures, building upgrades, for example, can significantly lower operating costs when electricity tariffs are high and pay a profit to owners over time. Loans and other means of financing support help consumers save money while decreasing the need of governments to invest in new power generation.
- **Public Awareness** of energy efficiency and understanding that efficiency means getting the same level of service with less energy, is a fundamental building block for markets. Energy efficiency is primarily paid for through consumers—homeowners, businesses, and manufacturers, as well as the public sector. Their

investments improve the efficiency of homes, buildings, plants, agriculture processing, and even street lighting. It is important that consumers are not only aware of the cost and environmental savings that efficiency provides, but also know about strategies to best improve efficiency in the buildings and services they can have the ability to impact.

- **Regulatory Mechanisms** and policies that support energy efficiency include building energy codes, product and appliance standards, requirements for energy audits, 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 drive costs to become more affordable by establishing a reliable market for these products, and incentivizing manufacturers to invest locally.
- **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 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 testing and labeling protocols and programs, or the adoption of a regional program that can be enforced within the country. Promoting the energy-efficient technologies and labels, and showcasing country-specific application of technologies, are all important components of an effective program.

The Opportunity Study Assessment Tool provides users with a list of yes/no questions about barriers related to each building block. 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 these barriers were assessed for South Africa, the reasoning behind several selections are outlined, below.

- Energy efficiency legislation to leverage municipalities and companies to implement energy efficiency" is marked as present for South Africa since existing legislation sets efficiency targets at the provincial level.
- "Tools and models to analyze energy efficiency opportunities are available to energy professionals" is marked as an existing strength under the *Regulatory Mechanisms* building block because energy service companies (ESCOs) have been successful in identifying, analyzing, and implementing energy efficiency opportunities at scale in South Africa.
- "Trained professionals that focus on identifying energy efficiency opportunities (e.g., energy auditors or home energy raters)" is assessed as "not present" since with the removal of utility funded incentive programs, owners were not seeking to make upgrades and were instead waiting for incentives to be put back into place. During this time, energy auditors have moved to other countries in the Southern Africa region where there are greater opportunities, creating a gap of expertise within South Africa.

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	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	Yes	Government incentives to buy down first cost of new technologies exists
Public Awareness		
13	No	Customer awareness level of energy efficiency programs (incentive offerings) already in place is high
14	No	Consumers have previous positive experience with energy-efficient products achieving marketed claims
15	No	High consumer/purchaser knowledge of energy efficiency - allows customer to make informed decisions when purchasing products
16	No	Current energy efficiency programs are accessible to and positively affect all levels of income
Regulatory Mechanisms		
17	Yes	EE legislation to leverage municipalities and companies to implement energy efficiency
18	Yes	Country/utilities have clear short and long term goals for energy development/expansion
19	Yes	Building energy codes for commercial/residential buildings have compliance mechanisms in place
20	Yes	Building energy codes for commercial/residential buildings exist
21	Yes	Energy Efficiency contributes to local/regional plans such as Low Emission Development plans (LEDs)
22	Yes	Energy prices reflect true cost of production, procurement, and transmission (i.e. not subsidized)
23	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)
24	Yes	Limited taxes or tariffs are collected on the import of energy-efficient products, keeping prices reasonable
25	No	Governmental functions operate independently of energy sales (i.e. municipalities and governements are not depenent 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	No	Industrial demand side management programs with incentives exist
29	No	Tax incentives for purchasing specific energy-efficient products exist
Technology Development		
30	Yes	Testing facilities for energy-efficient products exist in country/region
30	Yes	Appliance energy rating standards exist and are complied with
32	Yes	Non-energy benefits (i.e. cascading benefits of utility bill reduction, avoided emissions, job creation) are included in EE planning and cost-effectiveness
33	No	EE measures capable of modifying market behavior even after incentives are removed

RESULTS

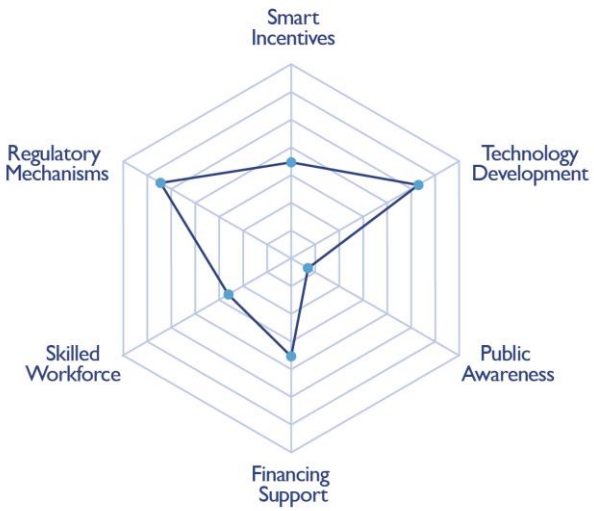
After completing the steps of the assessment framework (i.e. cost/savings information, indicators, and building blocks), a clear picture emerges of the top 10 energy efficiency programs that have the greatest chance of success and impact in South Africa and are, therefore, the best investments at this time. The tool uses simple graphics to display this information and help users determine the most suitable energy efficiency program to pursue under different market conditions.

Top 10 Energy Efficiency Program Results ("Opportunities")

The results of the building block assessment for South Africa 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 South Africa, skilled workforce and public awareness round out the bottom of the list, where much work is needed to build infrastructure that promotes energy efficiency. Examples of improvements that can be made to strengthen these building blocks include implementing public information campaigns, including energy efficiency in school curricula, and developing training and certification programs for energy efficiency professionals.

Figure 7. Building blocks for energy efficiency achievement in South Africa



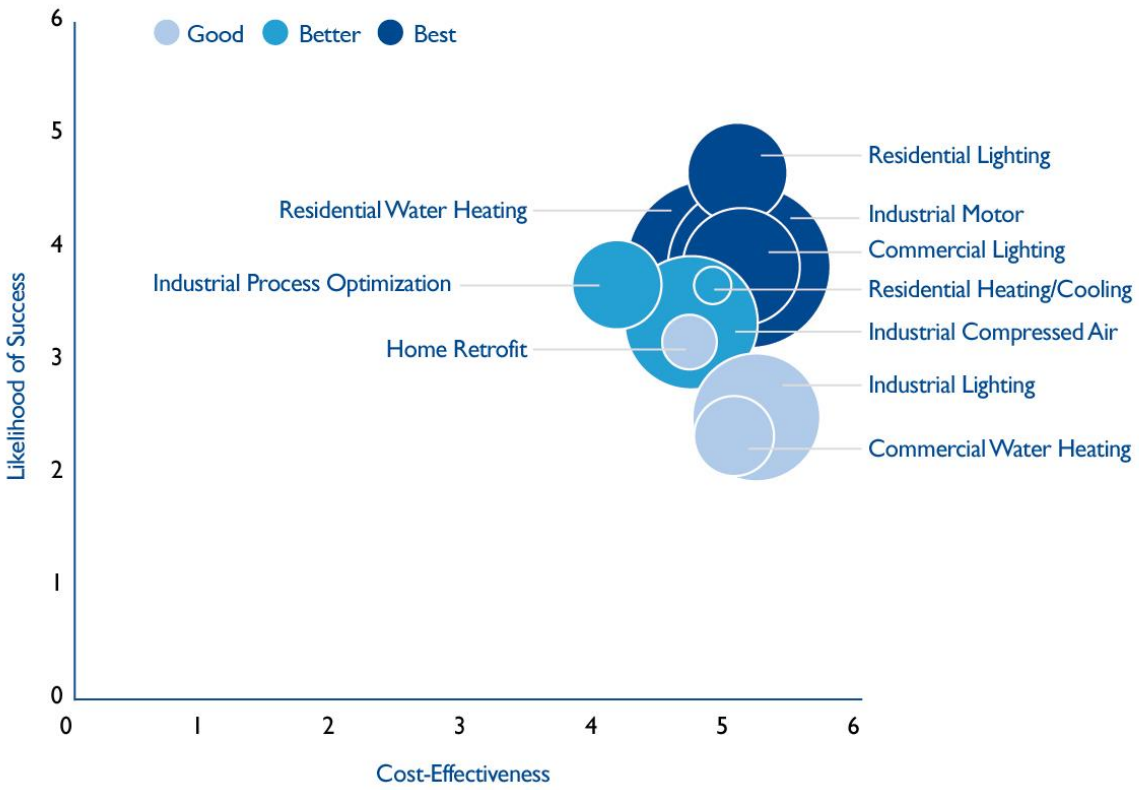
However, South Africa is positioned for success in scaling up energy efficiency. Energy efficiency technology is available in the market and there are regulatory mechanisms that support efficiency. Additional improvement can be gained through further advances in financing support and the development of new incentives to promote adoption of efficient technology and practices.

Combining the results of the cost-effectiveness calculations with the energy efficiency indicators, and the market impact potential provides a three-dimensional view of how energy efficiency program options are likely to perform in a specific type of developing country market – Figure 8 shows the cost-effectiveness of each program on the horizontal axis, and the likelihood of success (based on indicators/building blocks) on the vertical axis. The diameter of each circle represents the amount of energy savings associated with each opportunity.

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 South Africa, residential and commercial lighting, industrial motors, and residential water heating programs are at the top of the list as being both cost-effective and having a high likelihood to succeed given the indicators and building blocks in place in South Africa at this time. Residential lighting has a significant energy savings (and therefore GHG emission reduction) opportunity and can be highly successful as the complexity is low and chance of receiving political support is high due to the associated visibility with stakeholders.

Figure 8. Top 10 energy efficiency opportunities for South Africa



Two types of support need to be provided as next steps to pursue one of these top 10 highly impactful programs: (1) technical program design support, and (2) account management implementation support.

First, technical program design needs to be performed to take this analysis to a level of specificity that could be used within a particular region of South Africa. This technical program design includes advancing one step beyond the technical energy efficiency potential calculated in this report, to calculate achievable energy efficiency potential. From this potential, incentive levels or cost-levels that can be borne by program are then calculated and a program offering is designed.

Second, account management support includes stakeholder engagement, such as advertising and engaging with business/building owners involved in the relevant program sector, can be determined. Program design also includes a process for approving and documenting projects that come through the program, along with aggregating energy and emissions savings from the program.

Other stakeholders involved in this process include provincial governments (to see if their current initiatives align) and Eskom (as they have run programs similar to this in the past).

If pursuing the industrial motors initiative, it will be important to interact with the National Cleaner Production Centre of South Africa, as they have made a lot of headway in working with owners and businesses at the individual project level.

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 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 share of Greenhouse Gas (GHG) emission reductions. South Africa's INDCs (Intended Nationally Determined Contributions) focus on replacing the country's outdated coal-fired power plants. 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 South Africa 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. In USAID's Country Development Cooperation Strategy (CDCS) 2013-2017, IR 2.4: Transition to a low-emission economy promoted, energy efficiency is recognized as a mitigation strategy to reduce emissions, along with investments in renewable energy.

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 investments in reducing energy demand, they are investments in local businesses and long-term jobs.

The main challenge for the Government of South Africa in capturing all of these benefits, particularly through policy, is the need for data and analysis to assist with evidence-based decision-making. USAID recognizes the importance of this in IR 2.2 Evidence-based policies and practices for sustainable growth promoted. The need for a rapid and reliable assessment of the energy efficiency opportunity is the driving force behind this Opportunity Study. The project in South Africa 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 South Africa, 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 building blocks will enable more sophisticated and 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 contact at Manoa Holdings (Pty) Ltd, an energy efficiency contractor.

Table 1. USAID In-Country Meetings with South African Stakeholders, October 2015

Organization	Contacts	Description
CSIR (Council for Scientific and Industrial Research) Built Environment	• Stefan Szewczuk, Senior Engineer, Renewable & Alternative Energy	Supports the country's response to national priorities by drawing on its multidisciplinary science, engineering and technology (SET) skills base. Contributes to sustainable infrastructure development, asset preservation, socio-economic growth and global competitiveness in and for the built environment.
South Africa Department of Energy	• N/A	Provides funding to municipalities to implement energy efficiency programs, including street lighting, heat pumps, and smart meters. Their energy efficiency strategy from 2005 is being updated from 2015-2020.
Guateng Provincial	• Green Economy Office representative – N/A	Develops green strategy programs that include energy efficiency, and provide guidance to municipalities.
NBI/PSEE (National Business Initiative/Private Sector Energy Efficiency)	• Dr. Peter Mukoma PSEE Program Head	Work with industry to perform free energy audits for mid-sized industrial facilities that are not large enough to review their own operations. Concluded activities in November 2015. Identified 6,000 energy saving opportunities in South Africa through work with more than 3 500 small, 900+ medium and 37 large companies.
SAEE (The Southern African Association for Energy Efficiency)	• JJ (Karel) Steyn, SAEE Board Member	One of 82 chapters of the American Association of Energy Engineers (AEE). Promotes the scientific and educational interests of those engaged in the energy industry and to foster action for sustainable development.
NCPC-SA (National Cleaner Production Centre of South Africa)	• Podesta Maepa, Project Manager • Sashay Ramdharee, Project Manager	Part of a program launched by the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Programme (UNEP). Promotes the implementation of resource efficiency and cleaner production (RECP) methodologies to assist industry to lower costs through reduced energy, water and materials usage, and waste management.
USAID Southern Africa	• Graham Paul, Environment and Climate Change • Kishori Kedlaya, Regional Energy Advisor	USAID Mission in South Africa addresses the changing development challenges of the sub-region. Programs increase trade and strengthens regional economic ties, address the HIV/AIDS crisis, mitigate food insecurity and support democratic processes.
South African National Energy Development Institute (SANEDI)	• Barry Bredenkamp, Senior Manager: Energy Efficiency	Public entity entrusted with the coordination and undertaking of public interest energy research, development and demonstration. Established by the Minister of Minerals and Energy as a subsidiary of CEF (Pty) Ltd, the state energy company in South Africa.