Getting Attention for Energy Efficiency in Emerging Markets

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ABSTRACT

In developing countries, energy efficiency competes with a number of other priorities, including clean water, poverty, natural disasters, sanitation, and education. To help convince policymakers to prioritize efficiency, it is critical to demonstrate the value of high-impact policies and practices. However, given the significant variability between countries in terms of energy tariffs, subsidies, energy intensity, and market development, measures that work well in one setting may not work well in others. In addition, while increased energy efficiency can support a number of development priorities, e.g., job creation, economic growth, and greenhouse gas (GHG) emission reductions, the data needed to document the value of energy efficiency in achieving those outcomes are often not readily available. This can cause efficiency to be deprioritized in favor of policy and program solutions that are better understood. For long term growth, improved understanding of the process for scaling up energy efficiency in markets is required in order to build the necessary enabling market infrastructure within policy, financing, and commercial sectors.

This paper presents the results of a USAID-funded project that uses a data-driven analytics approach to profile energy efficiency opportunities for representative countries. Its "short-list" methodology identifies high impact efficiency opportunities in emerging markets, along with critical supporting infrastructure needs, or "building blocks", for successful local implementation (e.g. data collection, testing and labeling, training, financing support, and analytical tools). The profiles developed using this approach are designed to inform the policy and program actions of U.S. Agency for International Development (USAID) missions.

Introduction

USAID is interested in determining how energy efficiency can best fit into development plans and larger scale initiatives related to key policy priorities such as energy access and low emission development. Low emission development includes strategies and plans that promote sustainable social and economic development while reducing long-term greenhouse gas emissions to provide a pathway to preparing for a global low emission future. Energy efficiency is often raised as a solution as it can provide multiple benefits including increased affordability through lower energy bills, improved grid reliability through demand reduction, and lower emissions through direct reductions and increasing the share of cleaner energy generation. However, at the same time challenges to the implementation of energy efficiency typically present themselves, including lack of information on the character and scale of efficiency resources, variability in the specific energy efficiency policies and programs that are most applicable in a given country, and the wide and potentially confusing array of technology solutions and implementation strategies a country could pursue.

Accordingly, this energy efficiency opportunity study is designed to give policymakers the tools they need to make decisions on energy efficiency policy and program deployment based on a robust, flexible methodology that can be applied on a country-by-country basis. Two reference countries have been studied to date to "road test" the methodology before expanding to additional countries.

This project was completed under USAID's Energy Efficiency for Clean Development Program (EECDP). ICF International leads global implementation of the six-year EECDP under a cooperative agreement. EECDP is designed to promote sustained and achievable reductions in energy use and associated greenhouse gas (GHG) emissions through analysis and capacity building. Energy efficiency can be a first-responder, least-cost solution for countries to address GHG levels, energy supply and demand constraints, and energy independence. Through partnership with USAID headquarters to provide general assistance, and to address specific needs for USAID Missions, projects demonstrate replicable strategies which engage a full spectrum of stakeholders, respond to local market constraints, and align policy and regulation with implementation. Since 2011, EECDP has worked with USAID missions globally on projects addressing key questions and critical barriers around energy efficiency to enable strategies to expand across countries and regions. Project locations include Bangladesh, Kazakhstan, Indonesia, Ghana, and Tanzania.

Methodology

In order to assess where the selected reference countries (South Africa and Mozambique) stand in terms of being poised to implement energy efficiency programs, there are three sets of data that must be considered: (1) cost & savings information (2) the applicability of energy efficiency measures to the country studied (i.e. indicators), and (3) the market conditions in the country (i.e. building blocks). Only when using all three of these sets of data together is it possible to paint energy efficiency into the landscape of energy-related decisions being made in emerging markets. The following sections walk through each of these three components in more detail.

South Africa and Mozambique were selected as the first two countries in a set of seven initial reference countries that are designed to cover a wide range of energy market development and maturity. South Africa was selected as there is a wealth of information on energy efficiency programs that have been implemented in country. Conversely, Mozambique was selected as these concepts have only begun to be implemented (in addition to being in close proximity to South Africa). After the assessment of the seven reference countries, the ultimate goal of this approach is to be able to use the methodology in additional individual countries in a range of development levels.

Cost and Savings Information

In addition to profiling the market conditions, the explicit costs and energy savings associated with individual measures and programs are required to accurately compare programs and calculate the technical potential. As a solution, a database of costs specific to the two reference countries was developed leveraging sources found through literature review, conversations with key stakeholders, and access to data released through interactions while in-country. These data sources included internal and external utility evaluation reports, country-specific case studies, and direct documentation of costs to consumers 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.

The energy consumption in each country 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.

Country-specific Indicators

The feasibility of individual energy efficiency programs must be addressed on a country-by-country basis due to the high variability in enabling factors seen among different markets. 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 "make or break" importance of these factors to the success of programs, it is essential to develop a set of indicators to help drive activity toward programs with the highest likelihood of achievement.

The applicability and market-readiness of a given program can be judged across six dimensions using a 1 to 5 score. As an example, in a country where 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). 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. As discussed later in this paper, country-specific indicators are one of the areas that can be modified as markets change to reflect different, and hopefully more complex program opportunities with greater impact potential.

Figure 1, below, includes each of the areas in which indicators are assessed for potential programs and policies.

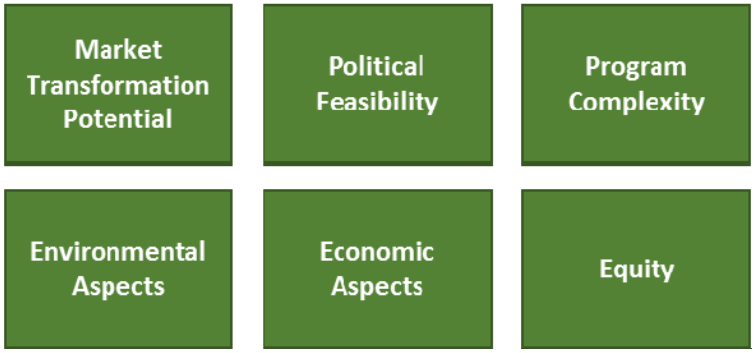

Figure 1. Energy Efficiency Program Indicators

Market Transformation Potential. This factor is evaluated based on 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. Scores are based on 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. This indicator is evaluated based on 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 are evaluated to determine the economic aspect indicator. 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. This indicator is evaluated based on 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.

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 Indicators. ICF and USAID have categorized influential market conditions for energy efficiency into six building blocks (see Figure 2) (IEA 2010). While there are certainly additional factors that lead to strong country-level support for efficiency, these building blocks were selected as the most relevant for project-level success (Watson et al 2015). 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, information, and technical expertise (RCEEE 2015). A careful assessment of the available opportunities to strengthen each of these areas can provide needed infrastructure and support to energy efficiency activities and lead to greater impacts for energy savings and emission reductions.

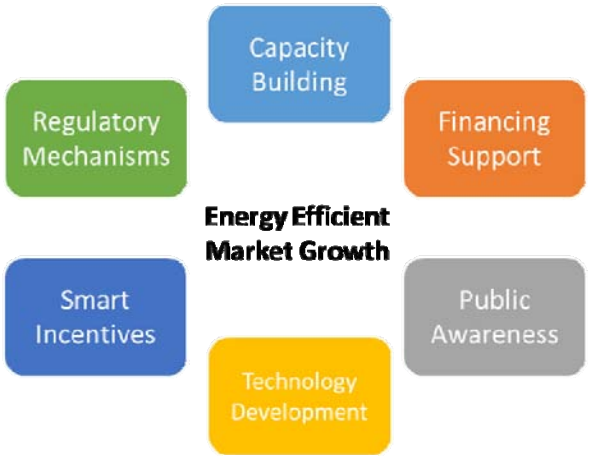

Figure 2. Building Blocks for Energy Efficiency

Capacity Building represents the presence of a local network that can support the important processes of identifying and implementing energy efficiency improvements. An effective network includes the presence of 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 also 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 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 is about 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 they 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 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 energy-efficient 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.

Assessment & Visualized Outputs

Through the assessment framework used for each country (i.e. cost/savings information, indicators, and building blocks), a clear picture emerges of which energy efficiency programs have the greatest chance of success and impact and are, therefore, the best investments. This section walks through how each piece of information is assessed and how, when combined, they create a surprisingly simple, visual way of determining the most suitable energy efficiency program to pursue under different market conditions.

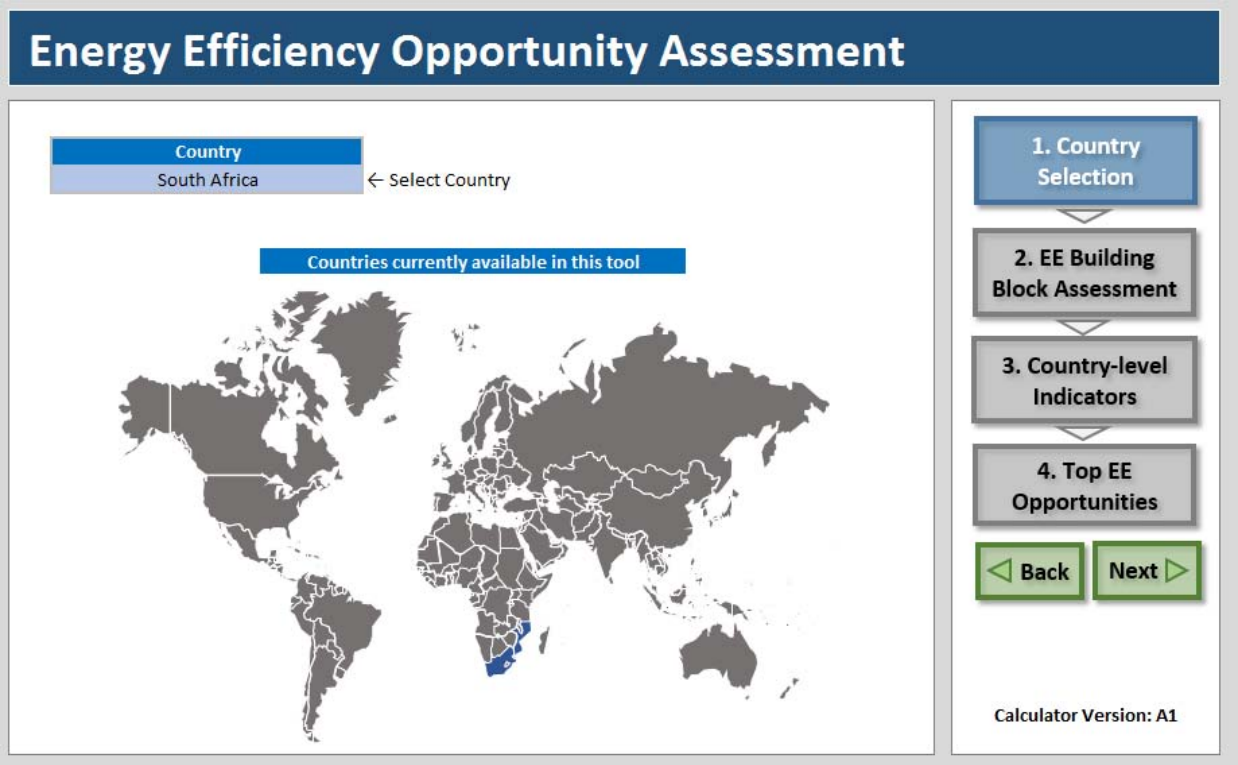

Figure 3. Step 1 screen and tool workflow description

The assessment framework is captured in a user-friendly tool, designed to be used by USAID and local stakeholders working in developing countries. As displayed in Figure 3, 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.

Cost-effectiveness

Using costs and energy savings estimates specific to the country, along with sector-level and end use energy consumption, a ranking of energy efficiency programs by levelized cost is created. These costs are designed to be compared to the standard rate or tariff in the country to show how competitive energy efficiency is when compared to increased generation. For example, many of the measures displayed for South Africa (Figure 4) have a levelized cost of less than 5 cents per kWh. With a standard residential tariff of 14 cents per kWh, policy makers can quickly understand how all of the measures under consideration can be highly cost-effective. Note that these costs are exclusive of any program or administrative costs and only represent the cost-effectiveness of the energy savings measures included in program. If there were no barriers present in the country, the programs and measures shown for South Africa and Mozambique (Figures 4 and 5) would be the most cost-effective programs to run.

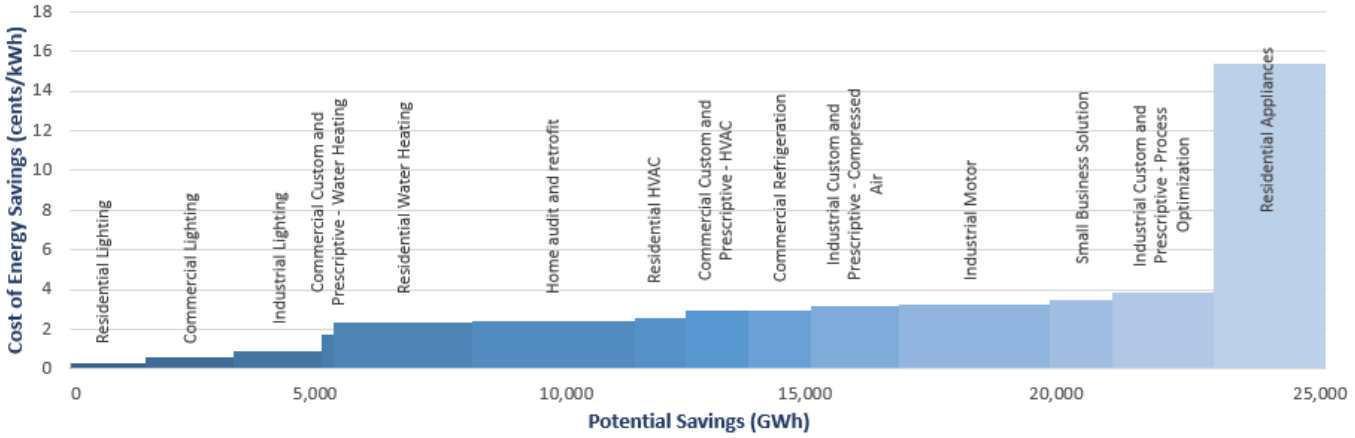

Figure 4. Energy efficiency load curve for South Africa.

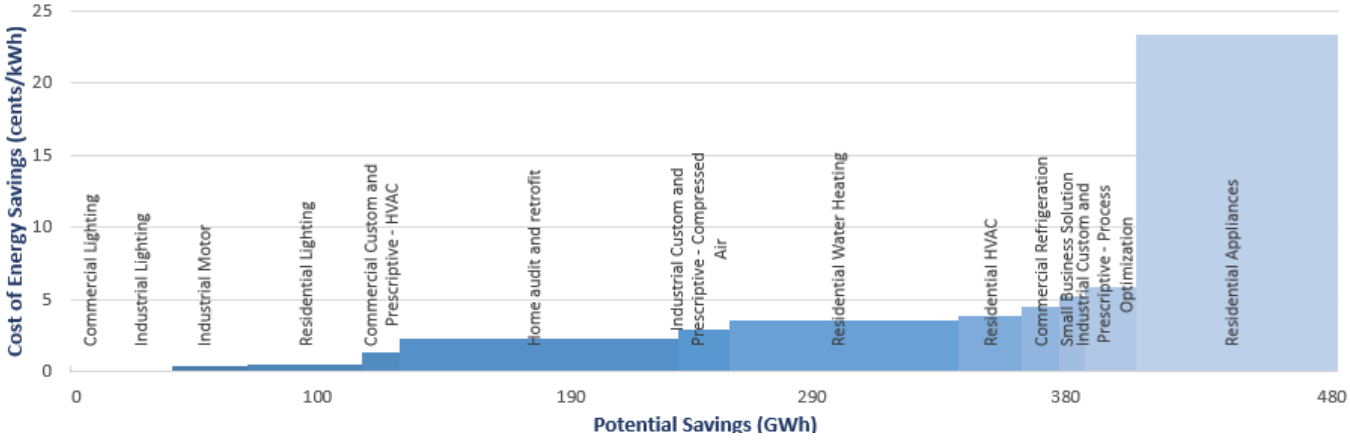

Figure 5. Energy efficiency load curve for Mozambique.

Country-specific Indicators

Once the assessment has identified energy efficiency programs which are cost-effective in a specific country, each program is scored on the viability of implementation. This shifts the focus onto those programs which have a high chance for success in a particular market place. Figures 6 and 7 show the results of this assessment for both South Africa and Mozambique. The scoring uses 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.

These are subjective scores and are intended to be sensitive to shifts and changes in the marketplace. Guidance on determining the most appropriate scores is currently under development and are initially based on both discussions with stakeholders regarding the performance of past programs, and a country-specific literature review. Moving forward, these indicators can be scored by stakeholder who are working in these markets.

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

Figure 6. Energy efficiency indicators by program for South Africa.

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

Figure 7. Energy efficiency indicators by program for Mozambique.

Building Blocks for Energy Efficiency

An assessment of building blocks within each country provides the basis for strengthening the market infrastructure and ability to support more complex energy efficiency programs. If there is low public awareness of energy efficiency in the market, for example, a program that may have the best chance of success, and is the most strategic, is a simple lighting campaign. Not only does this type of program utilize a simple message of cost savings, but it builds understanding among consumers that energy efficiency is not about compromising quality. A market that is more experienced with energy efficiency may be ready for a building audit and retrofit program that requires businesses to invest in energy saving equipment, that may require a higher initial investment, but delivers cost savings over time through lower energy bills. Knowing where there are opportunities to strengthen building blocks provides a strategy to build the market while simultaneously implementing efficiency programs.

The results of the assessment for South Africa and Mozambique are displayed in figures 8 and 9 below. They are listed in order of least to greatest in terms of achievement so that building blocks that appear to the left have opportunities for improvement and those on the right

are performing in a manner that is relatively supportive of energy efficiency investment. For South Africa, the greatest opportunities lie in incentivizing and providing financing support to energy efficiency. In the middle of the range, implementing regulatory mechanisms (e.g. mandatory energy efficiency targets) could be improved but are better developed. Lastly, the building blocks for both public awareness and the infrastructure for delivering of energy efficiency services are strongly in place in South Africa.

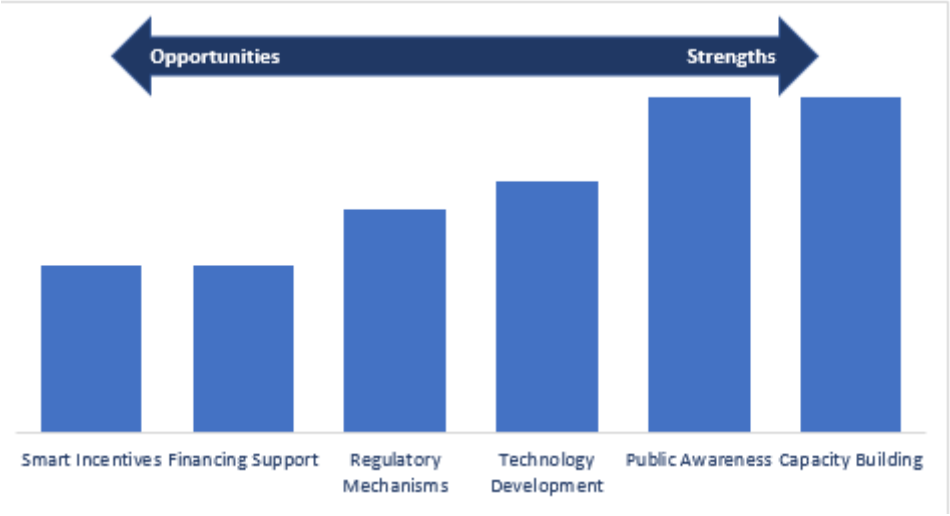

Figure 8. Building blocks for energy efficiency achievement in South Africa.

Similarly, for Mozambique, incentives and financing support round out the bottom of the list, which much work needed to bring these factors into play in promoting energy efficiency. In the other four building blocks, Mozambique is poised for success.

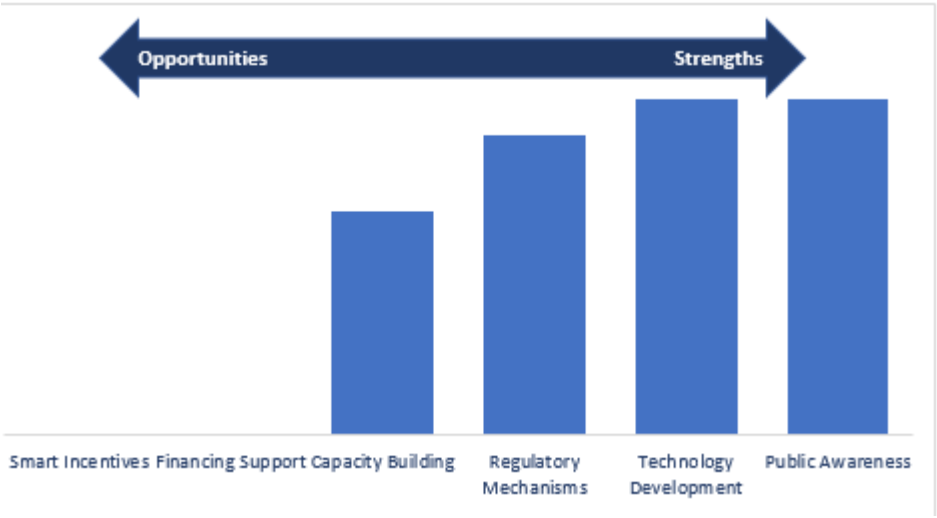

Figure 9. Building blocks for energy efficiency achievement in Mozambique.

Top 10 Energy Efficiency Program Results

Combining the cost-effectiveness calculations, energy efficiency indicators, and assessment of the building blocks results in a three-dimensional view of how energy efficiency program options perform in a specific type of developing country market - Figures 10 and 11 show 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 in Figures 10 and 11 deserve 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*. Referring to the guidance for South Africa, the energy efficiency opportunities that should be pursued first are Residential Lighting, Commercial Lighting, Residential Water Heating, and Residential HVAC.

These programs are very competitive from a cost-effectiveness standpoint as they are all less than 5 cents per kWh in levelized cost in a country where 14 cents per kWh is the prevailing tariff. Although programs such that are as cost effective as these, the market conditions in South Africa inhibit the success of these programs. For example, a commercial refrigeration program would be very cost-effective. However, using the indicators assessed for this program, the complexity, combined with a lack of equity (refrigeration-specific businesses), would make other programs that are less complex and reach a more diverse group of customers a more successful choice.

For Mozambique, a similar list of top programs is displayed in Figure 11. Residential Lighting, Commercial Lighting, and commercial HVAC round out 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 Mozambique. In particular, residential lighting has a large energy savings opportunity and can be highly successful as the complexity is low and will likely be backed politically as it has a high visibility with stakeholders.

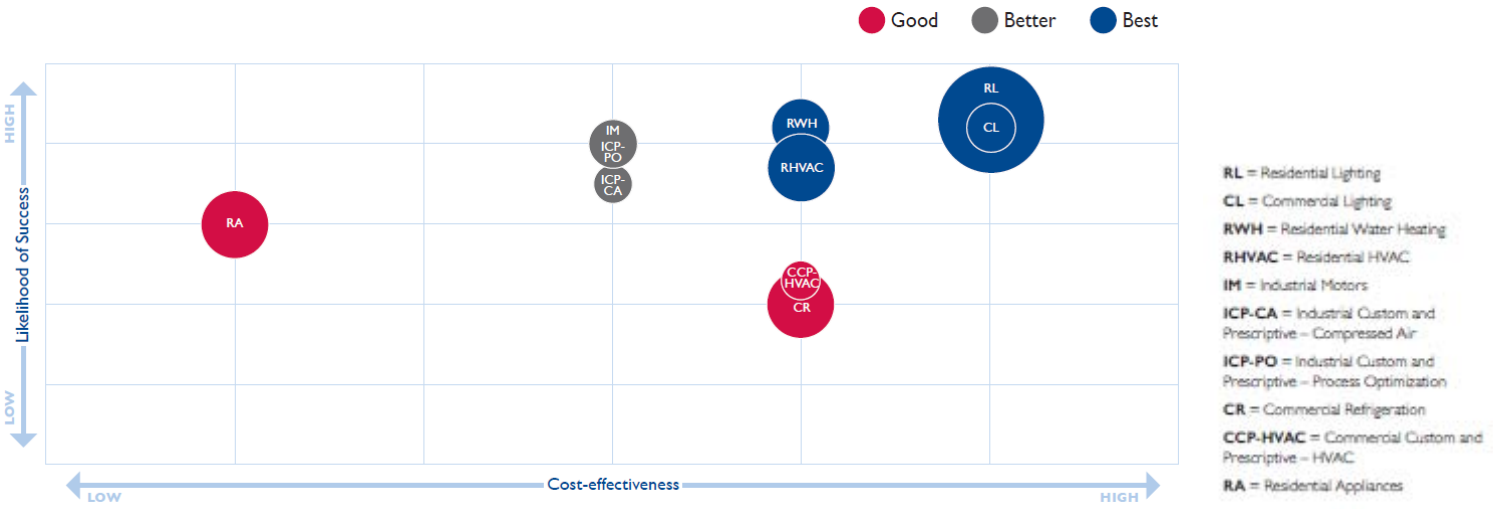

Figure 10. Top 10 energy efficiency opportunities for South Africa.

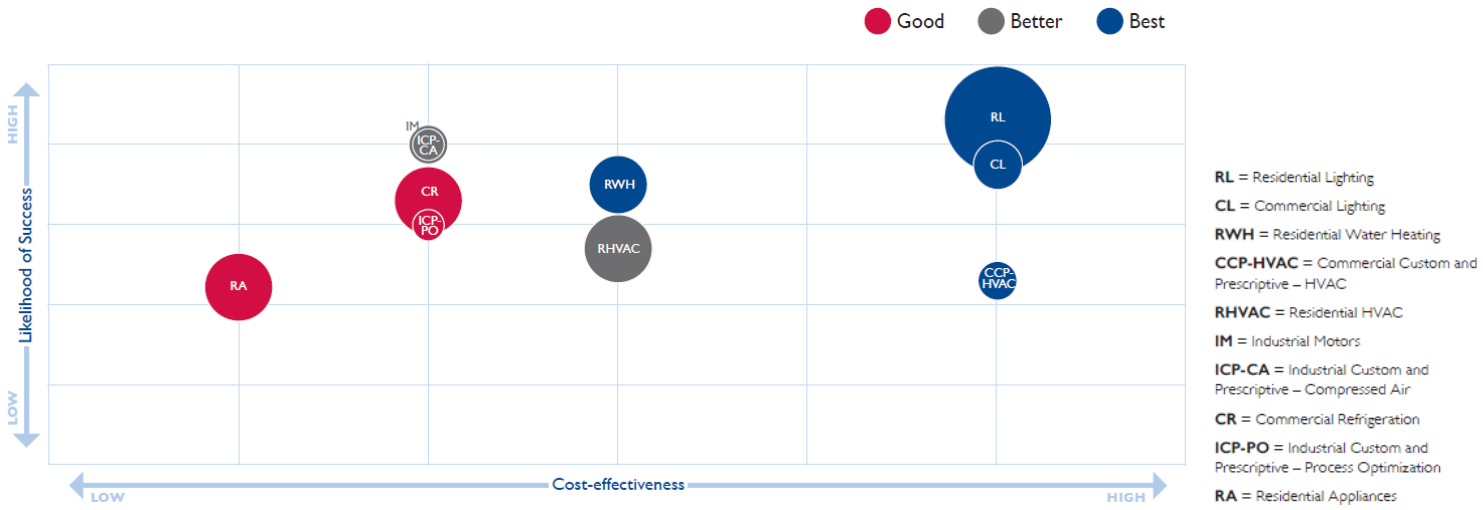

Figure 11. Top 10 energy efficiency opportunities for Mozambique.

Conclusions

After successful analysis of the two representative countries to "road test" the methodology, the tool is able to apply a consistent framework to the process of identifying energy efficiency opportunities in emerging economies. The key outputs from the tool include important data points that can aid decision-makers in comparing energy efficiency to other energy development projects in their specific country. Phase I of this study is designed to profile both reference countries, and there are plans for the tool to be refined before expanding to additional countries as well as modifications so that it is able to be used by less technical staff.

The tool can also evolve with changing conditions on the ground as the building blocks can be reassessed, programs re-scored, and a new set of top 10 EE programs is generated. This ensures that the framework can be used in future years and provide updated recommendations based on progress seen in each country studied. Additionally, this tool does not replace a comprehensive energy efficiency potential study or capture all of the barriers to implementation of energy efficiency programs. It simply is designed to clearly, consistently, and effectively bring energy efficiency into the conversation so that deeper consideration and analysis can be pursued.

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