

Opportunities in Energy Efficiency

for Municipalities in South Africa

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1. Introduction

Over the past 17 years there has been a significant trend towards energy efficiency. The International Energy Agency (IEA) notes that since 2011 Global Energy Intensity, a measure of the amount of energy used per unit of Gross Domestic Product (GDP), has decreased on average more than 2% every year¹. This saving was estimated as high as USD 2.2 trillion in 2016 alone. The reduction in energy intensity is also contributing to greenhouse gas reduction and improving energy security. This trend is resulting in the world being able to produce more for the same amount of energy at less cost to the environment.

South Africa has also experienced a decrease in energy intensity over the same period. The Draft Post-2015 National Energy Efficiency Strategy notes that since 2000 South Africa has experienced an annual compounded decrease in energy intensity of 2.7% across all sectors. This reduction in energy consumption is being driven by several factors, such as the introduction of regulations, technology advancements and higher than inflation increases in the costs of electricity. The increase in energy efficiency is also being driven by concerns of security of supply, where customers have been forced to become less energy intensive simply due to the supply constraints of Eskom.

This trend towards energy efficiency is likely to continue further with increasing electricity prices, increasing technology innovation and increasing pressure to reduce greenhouse gases. This trend in the electricity sector has the potential to create both risks and opportunities for municipalities. Increasing energy efficiency could have significant impacts on income streams for municipalities, but could also provide potential for reduction in operating costs and is critical for local economies to remain efficient and competitive in a changing global environment. Without adequate preparation municipalities may not be able to adapt quickly enough to the changing market.

The purpose of this booklet is to provide an overview on how municipalities can respond proactively to these changes in the electricity sector. It is targeted at municipal councillors and officials in South Africa and summarises several possible scenarios that a municipality may be faced with in the future regarding increasing energy efficiency. The booklet also outlines some suggested ways in which a municipality can respond to the changes in the sector.

This booklet is part of a series of booklets about Energy and Electricity for Municipalities. This booklet is about Energy Efficiency. Another booklet in the series is about Renewable Energy. Other booklets are under preparation, including a booklet on the Challenges in the Electricity Distribution Industry. The purpose of the series of booklets is to provide municipalities with information on key topics within the energy and electricity sector that have implications for the role of municipalities in energy and electricity. The booklets also provide guidance on dealing with the various issues as well as access to additional resources.

1.1 Structure of This Booklet

The booklet summarises two primary areas of potential change for municipalities in relation to energy efficiency. These are:

- Installing energy efficiency
- Facilitating energy efficiency

Within each of these sections, various risks, opportunities, and possible actions are outlined.

This booklet is a snapshot in time, representing the status quo in early 2018. The energy sector is very dynamic, and opportunities and risks are evolving constantly. However, by proactively engaging with the changing environment of the electricity sector, municipalities can continue to ensure communities have access to affordable, sustainable and simplified electricity services into the future.

¹ https://www.iea.org/publications/freepublications/publication/Energy_Efficiency_2017.pdf

2. What is Energy Efficiency?

Energy efficiency (EE) is often defined as achieving the same services with less energy. Energy efficiency can take place in all activities and be implemented by all actors, including households, companies and industries. Within municipalities, energy efficiency can take place in municipal-owned and or occupied buildings, vehicle fleet management, water reticulation and waste water treatment plants. EE technologies are generally more expensive in terms of the initial capital outlay, but use less electricity for the same output and generally have a much longer lifespan than traditional energy-intensive technologies. EE contributes to a reduction in municipal energy consumption, saving money and reducing the carbon footprint of the municipality.

2.1 Some Key Terms

Energy audits

Energy audits are assessments of the amount of energy used by a building or operation. The key to energy audits is to understand how much energy is consumed in a municipal unit of operation (building, water plant, etc.), and what the cost of the energy consumed amounts to. They can take the form of simple walk-through audits, where the number of devices (such as lamps, HVAC unit, computers) in the building are counted and their energy usage is estimated, based on the characteristics of the devices, or they can be more complex.

A more complex audit involves detailed metering and sub-metering over a prolonged period to establish a baseline of energy usage. Once the energy consumption has been calculated, the second step is to identify opportunities for energy savings (e.g. energy efficient lighting in buildings or more efficient water pumps in the water reticulation plant and/or improved energy management).

The energy audit can, therefore, provide key information to support decision-making about in-

vestment in energy efficiency technologies/interventions. Municipalities can contract professional auditors to conduct energy audits or develop the capacity in-house to do it themselves.

Energy management

Energy management is the process of optimising the amount of energy used over all municipal operations. Energy management usually begins with the drafting of an internal energy management policy, which outlines targets, methods, responsibilities and monitoring. Once the policy is in place, an energy metering system is typically installed to help develop a baseline as well as trends and peaks for consumption. This information is then used to identify key interventions for energy savings, which could amount to simple behaviour change or retrofitting of technologies.

Energy performance contracting

Energy performance contracts (EPCs) are a particular type of contract used in energy retrofit projects. EPCs (not to be confused with engineering, procurement, construction) are different from standard contracts in that they link the payments to the contractors with savings achieved through the implementation of the EPC. The cost of investment into the energy efficiency project is paid back through the generated savings.

Energy service companies

Energy service companies (ESCO) can assist municipalities to conduct energy audits and to recommend the best model for financing the implementation of energy efficient projects.

Resource Tip

For more information on ESCo, contact the South African National Energy Development Institute (SANEDI) which hosts a register of ESCo (www.sanedi.org.za) or the ESCo Association of South Africa (EASA) established in cooperation with the Southern African Energy Efficiency Confederation (SAEEC) www.saeec.org.za



3. Installing Energy Efficiency

The first broad area of opportunities for energy efficiency is where the municipality installs energy-efficient technologies and management interventions within municipal operations. This could be through energy-efficient lighting, hot water systems, variable speed drive (VSD) motors for water systems, improved insulation and heat recovery. Depending on the profile of the municipality, energy efficiency opportunities are easiest to realise in lighting interventions (particularly street and traffic light retrofits). However, the largest energy savings are often realised in bulk infrastructure improvements, such as wastewater treatment works.

A key element of successful energy efficiency interventions is the availability of energy consumption data. A good energy metering system allows municipalities to develop a baseline and assess whether EE interventions reduce the amount of electricity over time.

What are the benefits?

There are significant opportunities for municipalities in installing energy-efficiency technologies within municipal operations. These include:

- Financial saving on the amount of money spent for electricity.
- Less maintenance due to increased lifespan of the new technologies.
- Improved energy security due to decreased demand.
- Reduction in carbon emissions.
- Achieving energy efficiency targets.
- Green job creation.

3.1 Scenario One: Procuring EE Technologies

What is the opportunity?

The municipality may decide to retrofit certain types of municipal-owned infrastructure with energy-efficient technologies. This could include LED lights,

variable speed drives for pumps or more efficient water heaters. The financing of the intervention or interventions could be done through the Department of Energy, Energy Efficiency Demand Side Management (EEDSM) programme or through the municipal budget allocation. The EEDSM is available to all municipalities, but limited in terms of the number of municipalities that can receive funding and the amount of funding each municipality can receive in a given year. Municipalities are often required to implement projects within one financial year and it is therefore advisable to prepare baselines and tender documents in the previous year of applying for the EEDSM.

Resource Tip

The Department of Energy (DoE) has an annual call for funding for municipal infrastructure retrofits, called the Energy Efficiency Demand Side Management (EEDSM) programme. The grant is administered by the DoE and funded by National Treasury through the Division of Revenue Act (DoRA). See: <https://www.savingenergy.org.za/>



What are the risks?

The main risk with EE installations is that the technology selected is not of sufficient quality, does not last as long as expected or has a lower output than expected (for example, lower lighting levels). It is therefore important to carefully scope the technology requirements when compiling the terms of reference for the installation.

A second key risk is inaccurate and unavailable baseline information. Without an accurate baseline it is very difficult to determine the potential savings that can be achieved and consequently to justify the investment in the EE technology.

What should you do?

The process for installing energy efficiency technologies is well established and generally follows these steps:



- ✔ **Step 1** – Develop an overall energy management plan outlining aims, objectives and targets for energy efficiency interventions.
- ✔ **Step 2** – Conduct an infrastructure and building assessment to determine which infrastructure has high electricity consumption.
- ✔ **Step 3** – Shortlist particular infrastructure for further investigation.
- ✔ **Step 4** – Conduct an energy audit on the infrastructure to determine energy efficiency potential (this could include installing a metering system).
- ✔ **Step 5** – Develop a business plan for assessing payback periods and potential technology interventions or management approaches.
- ✔ **Step 6** – Secure funding through the EEDSM or municipal budget.
- ✔ **Step 7** – Conduct a procurement process.
- ✔ **Step 8** – Monitor energy savings.
- ✔ **Step 9** – Ensure there is adequate stock of the new technologies in stores for maintenance purposes.

Resource Tip

See “Sustainable Energy Solutions for Local Government - A Practical Guide”. This recently published guide is the most comprehensive work to date covering a full range of sustainable energy interventions that can be implemented at the local government level. It covers the most relevant topics in sustainable energy initiatives, macro developments, governance and legislation that influence the feasibility and successful implementation of such projects.
<http://www.sustainable.org.za/resource.php?id=44>



What should you not do?

EE technologies are often more expensive than traditional technologies, however, they are expected to be more efficient and last for a longer period. Municipalities shouldn't procure EE technologies that do not have sufficient guarantees of performance.

Because EE technologies are expensive up front, but have cheaper overall life cycle costs, direct engagement with the municipal finance department may be required to motivate for funding for interventions.

Resource Tip

See "How to include energy efficiency and renewable energy in existing infrastructure grants" for more information on funding: http://www.cityenergy.org.za/uploads/resource_435.pdf



What needs to happen to help unlock possibilities?

These are the main requirements:

- Coordinated support to municipalities to implement EE in the form of a local government support programme led by the Department of Energy.
- Development of standardised technical specifications for EE retrofits.

- Development of a standardised public infrastructure energy metering and monitoring system.
- Ensure that new infrastructure is built with energy efficient technology to avoid the later need of retrofitting the infrastructure.

3.2 Scenario Two: Using Energy Performance Contracts

What is the opportunity?

The municipality may decide to retrofit certain municipal-owned infrastructure with energy-efficient options. However, in cases where the municipality does not have access to funding or the necessary technical capacity to do the retrofit,



Case Study: EEDSM in Msunduzi Municipality

What was the EE intervention?

The Msunduzi Municipality was awarded R8,000,000 for the year 2016/2017 by the Department of Energy through the EEDSM programme. The budget was mostly used for the retrofit of existing streetlights with more energy-efficient LED lights. The Msunduzi Municipality identified 67 streets within its central business district that were eligible for retrofits. There were a total of 1,752 street lights where old fittings were replaced with LED ones. The old ones included a combination of high-pressure sodium, mercury vapour and various high-mast lighting technologies.

What did it aim to achieve?

The project aimed to achieve a reduction in the amount of electricity used by the municipality for streetlights. The project also aimed to improve the maintenance of streetlights. LED streetlights have a much longer lifespan and therefore have less maintenance and replacement costs.

What were the challenges and successes?

The municipality is expected to achieve annual savings of 453MWh and R771,219.45

because of the newly installed LED technology. This is approximately a 34.17% reduction in the energy used by the 1,752 streetlights.

There were several key lessons learned through the project. These included the following:

- The ability to accurately measure savings from streetlight retrofits is challenging, as their consumption is generally not measured.
- Procurement of new technologies can greatly impact on the timeframes of the project, as developing new technical specifications can be complex.
- Support from supply chain management in the initial procurement process greatly improved the speed at which the project could be implemented.
- It is important to do upfront planning for energy efficiency interventions, so that it is clear where within the municipal infrastructure large areas of electricity consumption take place.
- There has been a large benefit to the municipality in terms of the decrease in maintenance of the new lights.

it may consider alternative funding options such as energy performance contracts (EPCs).

In an EPC an external organisation, referred to as an Energy Service Company (ESCO), implements an energy efficiency project and the municipality uses the income generated from the energy savings to repay the investment and associated project costs. There are several types of EPCs that municipalities can consider. An EPC where the ESCo guarantees the savings but doesn't pay for the installation is called a guaranteed savings scheme, whereas an EPC where the ESCo and client share in the energy savings is called a shared savings scheme.

Resource Tip

For more information on energy performance contracts, see: <http://www.energycontractsupport.org>



What are the risks?

An EPC can be very difficult to implement given the current municipal finance regulations in South Africa. It should only be undertaken if the municipality is willing to allocate human resources and capacity to contract management. EPCs can often take place over more than three years and Section 33 of the MFMA, which governs contracting beyond a three-year

period, is of relevance here. An EPC may also require a complex tendering process involving different service providers participating in the same installation.

What should you do?

The initial process for EPCs is similar to procuring EE technologies. It will be necessary to conduct an energy audit and develop a business plan at the outset. However, once the initial planning is in place, the following steps should be followed:

- ✔ **Step 1** – Develop a draft EPC.
- ✔ **Step 2** – Initiate a monitoring and verification process to establish a valid baseline.
- ✔ **Step 3** – Conduct an EPC tender process.
- ✔ **Step 4** – Conduct a Section 33 process for long-term contracts.
- ✔ **Step 5** – Implement and manage the EPC.

What should you not do?

In some instances, service providers will offer to implement an EPC “at no cost” to the municipality. Although there may be no upfront capital costs with some EPCs, the costs are still incurred over time through the energy saving. Municipalities should not enter into an EPC contract with service providers without careful consideration of the long-term implications of the contract and procurement process.



What needs to happen to help unlock possibilities?

These are the main requirements:

- Development of standardised procedures to follow when implementing EPCs.
- Buy-in and support from National Treasury in implementing EPCs.
- Development of a mechanism to ring fence electricity savings as an income stream within the municipal finance system.
- Support from provincial and national government when conducting Section 33 processes.



Case Study: City of Cape Town Energy Performance Contracting

What was the EE intervention?

The City of Cape Town has successfully used the guaranteed savings form of energy performance contracts (EPC) for several energy efficiency interventions in buildings.

To implement the EPCs within the municipal procurement process, the City of Cape Town uses a two-stage tender process. The first stage involves contracting a service provider to undertake an audit and cost a suite of potential energy efficiency interventions for a municipal building. At the end of stage one the City of Cape Town had a list of potential interventions and the expected payback period for each intervention. In stage two, the City of Cape Town selected the interventions that it believed were most cost efficient and commissioned the service provider to implement these.

Once the interventions are completed, and the service provider has been paid, the performance guarantee period starts. Through the EPC, the service provider is required to manage and maintain the installations and to guarantee performance for the entire payback period of the intervention. For example, if it is anticipated that it will take five years for the City of Cape Town to recoup the costs of the interventions through energy savings, the guarantee period will be five years. In the event the intervention does not achieve the anticipated payback, the service provider is obliged to reimburse the City of Cape Town for the difference.

What did it aim to achieve?

The EPCs aim to ensure that the City of Town achieves the savings predicted by the service provider during the audit process. Because the service provider guarantees the savings to be achieved through reduced electricity use, the City of Cape Town is protected against wasteful expenditure.

What were the challenges and successes?

The City of Cape Town EPCs successfully solve two key challenges for municipalities.

Firstly, there was no need for a Section 33 process because the contract was limited to three years. Section 33 of the MFMA requires municipalities to follow several special steps for contracts that “will impose financial obligations on the municipality beyond the three years covered in the annual budget for that financial year”. While the performance guarantee period of the contract is often longer than three years, this does not impose any financial obligation on the City of Cape Town. It does, however, impose a financial obligation on the service provider.

Secondly, because the City of Cape Town EPCs have a two-stage process, the same service provider undertakes the audit and implements the interventions. This prevents a problem where a service provider implementing an intervention indicates that it cannot be done at the cost or with the savings proposed in the original audit. Increases in the cost of implementation or decreases in the savings can mean that an intervention is no longer financially viable.

4. Facilitating Energy Efficiency

The second broad area of opportunities for energy efficiency is where the municipality plays a facilitator role in driving energy efficiency, both within municipal operations and the broader community. This could be through a communication focus on energy-efficient interventions, promotion of EE technology retrofits, such as an incandescent light bulb replacement programme, or a behaviour-change programme, such as competitions and games.

What are the benefits?

The key benefit to the municipality in promoting energy efficiency is the improved productivity of operations. This allows the freeing up of energy and financial resources for other key development objectives. The benefits include the following:

- Ensure the local economy remains efficient and competitive.
- Decrease in energy intensity.
- Reduction in carbon emissions.
- Achieving energy efficiency targets.
- Promoting the green economy and green job creation.
- Higher levels of customer retention by reducing the overall electricity costs for those customers. This is particularly important for higher-income customers who cross subsidise other services in the municipality.

4.1 Scenario Three: Promoting EE in Municipal Operations

What is the opportunity?

A municipality may decide to set an electricity reduction target of 20% for all municipal operations to reduce costs, promote energy efficiency and meet greenhouse gas targets. Achieving this target would involve procuring energy-efficient technologies for retrofits, but also include more behaviour-related interventions. For example, the municipality may offer an award

to the unit that reduces the highest percentage of electricity over time.



What are the risks?

There are no significant risks associated with promoting energy efficiency within municipal operations. However, it is important to clearly communicate with staff why some behaviour changes are being requested.

What should you do?

There will need to be a coordinated approach to achieving large-scale reductions in energy consumption across different municipal services. An internal municipal energy strategy should be developed that outlines where the key areas of savings will be achieved. It should also highlight how, when, and by who, these targets will be achieved. Once the strategy is in place, an internal coordinating energy committee should be established to track the implementation of the strategy. The following steps should be followed:

- Develop an overall energy management plan based on data. (including about liquid fuels) outlining aims, objectives and targets for energy efficiency interventions.
- Set up an internal energy management committee consisting of key officials and councillors.
- Set up a monitoring system for EE interventions.

What needs to happen to help unlock possibilities?

These are the main requirements:

- Support in developing internal energy management systems and strategies.
- Development of a standardised public infrastructure energy metering and monitoring system.

4.2 Scenario Four: Promoting EE in the Community

What is the opportunity?

The municipality may decide to promote energy efficiency within the broader community to assist residents in becoming more efficient and promoting green jobs. It also offers an opportu-

nity to ‘free up’ electricity for new development without requiring capital investment in new grid capacity.

What are the risks?

The key risk for municipalities in promoting energy efficiency in the broader community is a potential loss of revenue from the sale of electricity (this only applies to municipalities that sell electricity). Municipalities therefore need to consider alternative revenue streams to address this potential loss of income.

What should you do?

As with municipal energy management, there will need to be a coordinated approach to



Case Studies: Municipal Energy Efficiency Campaigns

Cape Town Energy Efficiency Promotion

The City of Cape Town has several initiatives to assist residents and businesses to become more energy efficient. The website <http://savingelectricity.org.za/> allows residents to get quotes from accredited solar water heater suppliers. It also provides a range of “No Cost”, “Low Cost” and “Invest to Save” tips for saving electricity with different technologies.

The Cape Town Energy Efficiency Forum consists of private and public-sector stakeholders, including owners and managers of offices, shopping centres, hotels and other commercial and public buildings. The forum aims to provide support and practical information on implementing and promoting energy efficiency action and investments. The forum receives funding from a range of organisations who provide contributions ranging from venues, in-kind services and financial support.

For more details see:

<https://www.capetown.gov.za/Work%20and%20business/Doing-business-with-the-city/Energy-Efficiency-Forum/About-the-Energy-Efficiency-Forum>

eThekweni Shisa Solar Programme

The Shisa Solar Programme aimed to promote the uptake of energy-efficient hot water technologies in the eThekweni Municipality. The programme focussed specifically on solar water heaters, because geysers are one of the highest users of residential electricity.

In general, the programme was well received by the public and became one of the municipality’s flagship green communication programmes. However, one of the key challenges of the initiative was assessing the impact of the programme. It was difficult to tell how many additional solar water heaters were installed in the municipality as a direct result of communication activities linked to the programme.

Knysna Energy-Saving Tips

The Knysna Municipality provides residents with a range of energy-saving tips on their municipal website. These tips cover how to use different types of appliances more efficiently, as well as tips on how to better insulate and heat houses.

From more details see:

<http://www.knysna.gov.za/electricity-saving-tips/>



achieving municipal-wide reductions in energy consumption. A municipal energy strategy should be developed that outlines where and how key energy saving areas will be achieved in different sectors of the economy. The strategy should also highlight how, when, and by who, these targets will be achieved. Once the strategy is in place, an internal coordinating energy committee should be established to track the implementation of the strategy.

What needs to happen to help unlock possibilities?

These are the main requirements:

- Coordination and support in achieving national energy efficiency targets at a sub-national level.
- Development of national EE campaigns, in consultation with municipalities.
- Assistance in developing alternative revenue models to compensate for a potential loss of income from increasing EE.





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