A Renewable Energy Roadmap for African Cities

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Introduction

Cities need to be powered by renewable energy in order to deliver on their climate mitigation commitments and social and economic development priorities. The aim of this guide is to assist Cities to develop a renewable energy roadmap, which incorporates renewable energy into the energy mix over time and ensures the collaboration of stakeholders and coordination of investments. It draws upon the experience of Sub-Saharan African (SSA) cities in understanding energy demand and the learnings of eThekwini Municipality (in South Africa) which recently developed a Renewable Energy Roadmap.[1]

What is a renewable energy roadmap?

A renewable energy roadmap provides a City with a proactive and strategic approach to energy development in its jurisdiction. It is a plan, with goals and practical actions, to substantially increase the amount of renewable energy in the city's energy mix, thereby directing energy development on a low carbon pathway. It is a whole-systems approach to energy access and energy transition that must involve all stakeholders. Renewable energy roadmaps usually form an integral part of broader municipal strategies such as energy and climate response strategies and action plans, in which renewable energy targets are set. The roadmap serves to inform and pave the way as to how these targets can be achieved.

"It is a whole-systems approach to energy access and energy transition that must involve all stakeholders."

Why have a renewable energy roadmap?

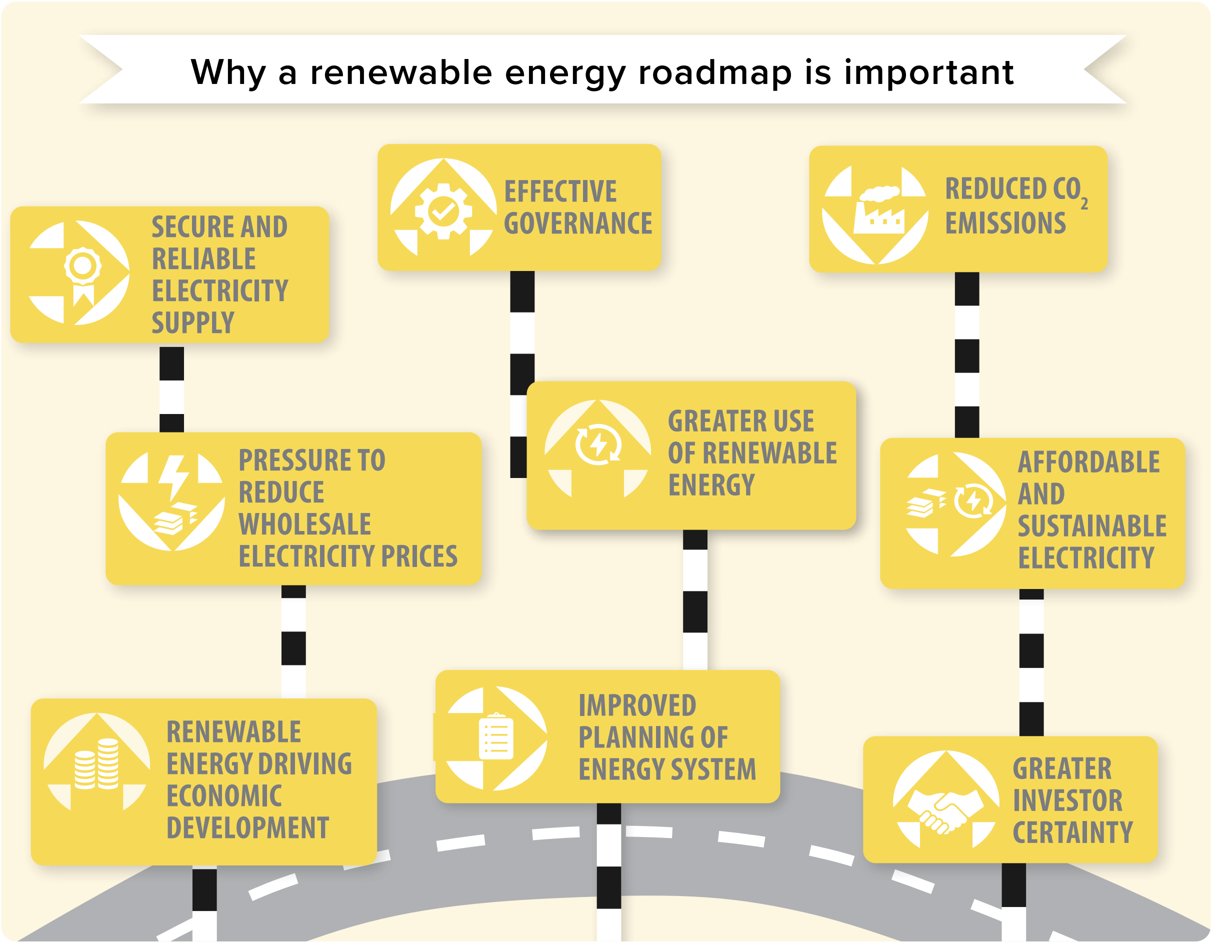
SSA city governments/authorities may have limited control over services, infrastructure, and even land use, but they can encourage renewable energy deployment and coordinate the multiple collaborations required for developing low carbon pathways. A renewable energy roadmap enables a city:

- To align local plans with national plans.
- To establish platforms for collaboration and partnership with other departments and stakeholders.
- To actively drive a common vision for energy development that is led by the interests of the public sector.
- To establish energy development related priorities and determine how to align these with the City's other priorities (e.g. poverty alleviation) in a way that optimises resource use.

1 ARUP, 2019. Durban Strategic Renewable Energy Roadmap, Durban: C40 Cities and eThekwini Municipality.

- To consider new approaches to energy service delivery.
- To highlight limitations, opportunities and barriers.
- To attract new private sector investment and development finance in the post-COVID-19 era that emphasises green economic growth.

Renewable energy is closely coupled with energy efficiency, which is always the cheaper and more effective option. Therefore, cities should also run a demand reduction programme that includes energy audits and retrofitting municipal buildings and facilities, and energy efficient appliance campaigns with residents.



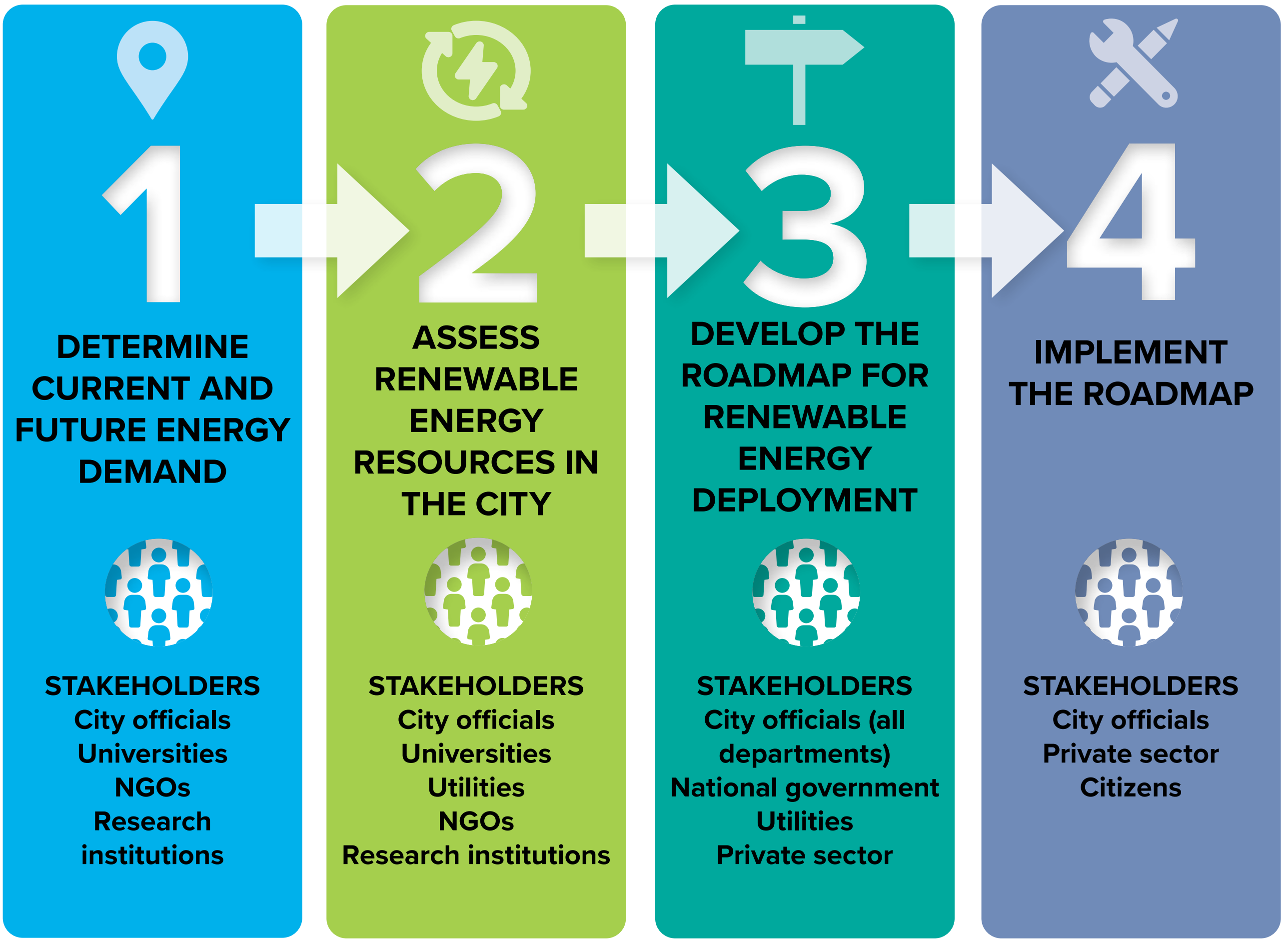
Municipal powers and functions relevant for energy efficiency and renewable energy deployment:[2]

- **Planning:** allocating land for renewable energy and including in new infrastructure development.
- **Regulations and enforcement:** land use and building requirements
- **Service provision:** promoting renewable energy service solutions.
- **Facilitating/communicating:** bringing parties together and driving behaviour change.
- **Operations:** using municipal facilities for renewable energy and encouraging “green” procurement.

2 SEA (Sustainable Energy Africa). 2017. Sustainable Energy Solutions for South African Local Government: A practical guide. Available at: http://www.cityenergy.org.za/uploads/resource_434.pdf [Accessed 8 August 2020].

Four steps to a roadmap for renewable energy deployment

The process of developing the roadmap must bring on board all stakeholders involved in city development. The starting point is to have a clear picture of the energy demand, now and into the future, and of the available renewable energy resources. Only then can the roadmap be developed and implemented.

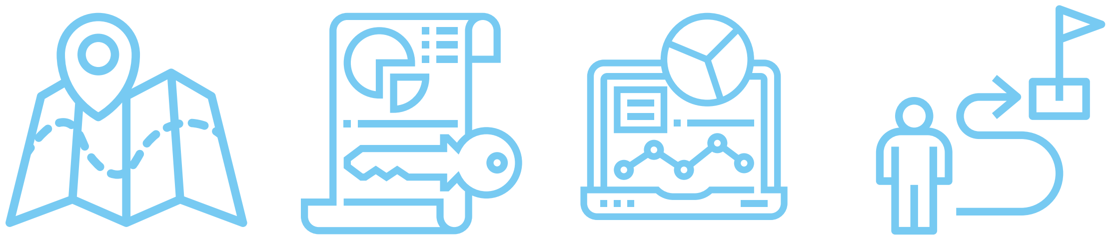


STEP ONE

DETERMINE CURRENT AND FUTURE ENERGY DEMAND

This step is about gathering information and assessing energy demand within the city's jurisdiction.

Cities must be aware of the "suppressed demand" that results from an energy supply unable to meet the demand and from citizens unable to afford the energy needed for a productive and healthy life. To factor in this suppressed demand, cities must understand their current energy deficits and plans in place to bridge these gaps/deficits.



ESTABLISH CITY CONTEXT

Gather information on:

- Location and demographics
- Economic/social drivers
- Financial/investment context
- Climate change/ renewable energy commitments
- Regulatory/ institutional situation
- City challenges/ priorities

GATHER ENERGY DATA

Conduct city energy survey

Use national energy data and scale to city

Partner with research institutions or organisations

DEVELOP BASELINE ENERGY PICTURE

Use a set of indicators to analyse the current energy picture

Establish:

- Total energy
- Energy by fuel
- Energy by sector (residential, commercial, industrial, transport)

DO FUTURE ENERGY MODELLING

Apply social/economic drivers (population, economic growth etc.) to baseline energy picture to model future growth

Align timeframes with city plans (20-year growth plans) or climate action plans (2050 target)

Consider the impact of future energy policies or technology drivers such as energy efficiency and electrical vehicle adoption on future energy demand

(a) Establish city context

A brief background to the city's overall context can be developed by answering the questions in the table below. The responses should be considered when exploring current and future energy demand in part (b) of this step.

LOCATION AND DEMOGRAPHICS	ECONOMIC AND SOCIAL DRIVERS	FINANCIAL AND INVESTMENT CONTEXT
• Where is your City – are there any obvious opportunities or constraints to renewable energy associated with location? • What is the demographic of your City? How is population expected to change over time (numbers, economic status)? • What infrastructure is available in your city that would support renewable energy systems (power grid network, buildings, etc.)?	• Are there high levels of poverty, or inequality? • What are the main economic activities (manufacture, commerce, services sectors)? • Does the population currently utilise adequate energy for sustainable development? • Is there expected economic growth into the future?	• What is the financial status of your City and would it be able to finance these renewable energy systems? • Would your citizens be able to afford renewable energy e.g. distributed energy systems (solar home systems, mini-grids etc)? • What type of industries are available in the city, and would renewable energy be able to supply the energy required? • Does your City have ongoing partnerships with private sector partners, NGOs, national or international agencies or other institutions specifically to finance renewable energy projects (e.g., rooftop solar leasing, etc)?
CLIMATE CHANGE AND RENEWABLE ENERGY COMMITMENTS	**REGULATORY AND INSTITUTIONAL CONTEXT**	**CITY CHALLENGES AND PRIORITIES**
• Has the City made any commitments towards increasing renewable energy use or reducing climate change? • Are these commitments in line with the City's goals and plans?	• Does the City have the mandate to implement renewable energy systems in the City? • What regulations (local or national) are in place that determine what renewable energy systems can be implemented? • What policies and regulations (local or national) indirectly support the development of renewable energy in the City? • Can the City play an enabling role (e.g. land permits, environmental impact assessments) using their current mandates?	• What are the major development challenges facing the city? • What are your city's priorities?

(b) Doing an energy demand assessment:

An energy demand analysis develops a picture of current energy use in different sectors within the City's jurisdiction (residential, commercial, industrial, transport) and then considers how this might grow into the future (based on the city context and social and economic drivers identified above).
This assessment will answer the questions in the table below. The answers rely on developing a sound energy demand database.

ENERGY DEMAND ASSESSMENT: STATUS QUO AND FUTURE DIRECTIONS
What is the total consumption of energy in your city?
What fuels are being used? Consider all fuel types: electricity, diesel, kerosene, gas, charcoal, wood, etc
Which sectors use what fuels? (residential, commercial and industrial).
What are different fuels used for different end-uses? (Consider: cooking, lighting, space heating and cooling, motors and heating in industry)
What proportion of current energy demand comes from renewables?
Does the population currently utilise adequate energy for sustainable development?
Are these fuel uses changing? E.g. household cooking fuels?
How are the social and economic drivers noted in your context study likely to drive the growth of demand for energy?
How will changing technology affect demand, e.g. will electric vehicles result in more demand for electricity? Are households likely to use electricity for cooking in the future?
Is there an electricity grid present, and how can this be supported/strengthened by renewable energy?

Managing Step 1

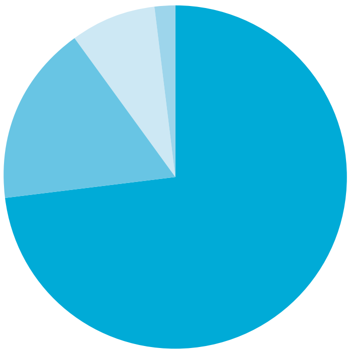
- Identify and mandate a lead department and team in the City to drive the work.
- Set up a multi-disciplinary steering committee and reference group, comprising key stakeholders – they are your partners in the journey of the Roadmap.
- Hold an introductory stakeholder workshop with the reference group, to establish a common vision for renewable energies.
- Establish cross-sector working groups, including any city departments working in planning or service delivery that may have data to contribute.
- Engage experts from research institutions or organisations, to support the information gathering, analysis and management.
- Manage data gathering and analysis exercise.
- Establish links with key sources of data (regional and national government departments, and academics).
- Develop a database of key information sources and stakeholders.

Step 1 Outputs

- Mandated city lead department
- Database of energy stakeholders
- Database of energy-related information and sources
- Energy demand assessment report, including brief city context

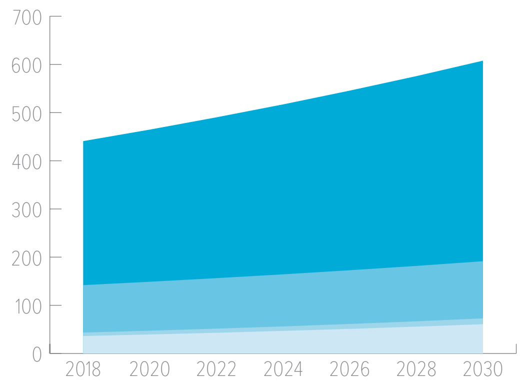
CASE STUDY 1:
City of Tsévié, Togo

In developing its Sustainable Energy and Climate Action Plan (SECAP), one of the city's first steps was to determine current and future energy demand. Like many other cities, Tsévié had severe data constraints and limited resources to conduct the research required. Therefore, the city collaborated with the University of Lomé and received future energy modelling assistance from Sustainable Energy Africa, a South African-based local energy support agency. The University of Lomé deployed enumerators into the Tsévié community to collect information from representative samples of the residential, commercial and industrial sectors, on the type and amount of energy used for cooking, heating water, lighting, space heating and transport per month. The residential sector consumes most energy, which is largely because the city has only a few, small-scale businesses and industries. The data was then projected to 2050, using expected population growth, GDP growth, as well as GDP per capita rates.



Tsévié energy consumption in base year 2017

- **73%** Residential
- **17.7%** Passenger transport
- **1.7%** Commercial _Industrial
- **8.1%** Freight transport



Energy demand projections, by sector under business as usual

- **73%** Residential
- **17.7%** Passenger transport
- **1.7%** Commercial _Industrial
- **8.1%** Freight transport

Residential users depend largely on biomass and charcoal. As the demand for energy grows with the growing city, this will result in forest destruction and worsening air pollution and related health challenges. Some wealthier households have back up diesel generators for electricity and along with anticipated growth in transport, city growth will increase dependence on polluting petrol and diesel. These fuels are also imported and costly. The Renewable Energy Roadmap then sets out to explore how this pathway can be adjusted to be more renewable.

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STEP TWO

ASSESS THE CITY'S AVAILABLE RENEWABLE ENERGY RESOURCES

This step is about evaluating the renewable energy potential of a city and so considers the available renewable energy resources and the associated regulatory framework.

This assessment would look firstly at renewable energy potential within the territory, and then at the procurement of renewable energy from outside of the City boundaries. Developing the local renewable energy sector involves assessing the viability for each type of renewable energy technology: solar PV (small scale/rooftop, medium scale/mini-grid and large-scale); wind power (small scale, medium to large scale); ocean power; biomass; geothermal, landfill gas to energy; wastewater gas to energy and hydro-power. The business model through which different resources would be developed would be determined down the line. The availability of renewable power for procurement from an Independent Power Producer or utilities from outside of the territory should also be explored.

RESOURCE AVAILABILITY	TECHNICAL VIABILITY	FINANCIAL VIABILITY	REGULATORY
– Amount of energy that can be delivered. – City assets (e.g. wastewater or buildings/land) that can pioneer renewable energy solutions.	– Local know-how, skills and parts. – Ability to link to existing networks and meet energy demand (need storage or mini-grid options).	– Maturity of technology and level of support from investors. – Cost compared to current energy sources.	– Framework and systems in place to support the technology adoption. – E.g. tariffs, power purchase agreement frameworks

Managing Step 2

- Develop city capacity to understand the technologies being considered and the regulatory framework.
- Partner with research institutions (universities, government research institutions) specialising in renewable energy assessment.
- Engage key external experts or consultants to undertake or support the study.
- Gather information about municipal assets from all relevant line departments.
- Continue to report to the steering committee on a regular (monthly) basis.
- Workshop the outcomes with your stakeholder reference group for input and cross checking.
- Draw on free data portals such as SolarGIS[3] that provide renewable energy resource maps.
- Investigate existing renewable energy projects in the city/country/region that could provide data and insight into what is feasible.

Step 2 Outputs

- Renewable energy technical assessment report

3 SolarGIS: https://solargis.com/maps-and-gis-data/overview

Case Study 2a:
eThekwini, South Africa – feasibility study

The purpose of the feasibility study was to determine the type and amount of renewable energy resources available in the city, and then analyse each resource from a national level and then from the city context. The study used existing studies and new research done by specialist consultants and research organisations. The resources identified included solar, wind, hydro, ocean energy, waste-to-energy, landfill gas and biomass. The technologies were assessed on their resource potential as well as the following factors:

- Ability to reduce emission and support other sustainability goals
- Regulations that could hinder/support implementation
- The municipality's ability to implement technologies.
- Investments required
- Impact on the environment.

TECHNOLOGY	STRENGTHS	WEAKNESSES
Solar PV	• Free solar resource • High economic potential • Potential area for installation available • Large-scale infrastructure investment not required • Municipality has a level of skill and know-how from recent installations • Capital and operation costs likely to decrease	• Energy storage should be considered to maximize benefit for peak shaving - currently battery storage is expensive and batteries replacement needs to be taken into account • Dependent on appetite from private sector to available land and roof space • Multiple rooftop connections may affect grid stability
Wind energy	• High technological potential • Renewable resource • High economic potential • Free resource available for turbines installation in specific area • Capital and operation costs likely to decrease	• Environmental sensitivities seem prevalent in the Municipality for birds and bats • Scattered dwellings may prevent installations in rural areas • Municipality does not possess skill and know-how

2

TECHNOLOGY	STRENGTHS	WEAKNESSES
Landfill gas	• The Municipality does possess skill and know-how • Potential to avoid both methane related emissions and avoid electricity related emissions from predominantly coal based power • Potential to reduce tailpipe emissions through the use of cleaner vehicle fuel	• Infrastructure will need to be invested in • Longer term future hopes to eradicate landfills • Negligible contribution to 2050 demand target • Yield will vary based on waste arising and waste composition • High technological potential
Wastewater network gas extraction	• Available resource from existing wastewater networks and future predicted population growth • Feasibility has been established for three sites	• Relatively low yield from sewage • Infrastructure will need to be invested in • Negligible contribution to 2050 demand target • Municipality does not possess skill and know-how
Hydro	• Available resource from existing water networks • Free resource available for turbines installation in specific areas	• Retrofitting turbines in existing infrastructure could prove to be complex as space might be limited and other design challenges may arise • Smaller systems may prove to be unfeasible • Negligible contribution to 2050 demand target • The Municipality does not possess existing skill and know-how
Biomass	• Significant resource near to the Municipal boundary from the sugar cane and forestry industry • Sugar cane industry generates the sugar cane biomass and bagasse from existing processes • Significant potential contribution to the City's demand • Potential to reduce emissions from burning sugar cane biomass or cane trash	• Biomass must stem from sustainable sources to be considered renewable • Firewood for fuel can be a major cause of deforestation if not sourced from a managed forest or from agricultural waste e.g. bagasse • Preparation and transportation of biomass can be a source of emissions depending on where the feedstock originates and where it is processed. • Likely to be purchased from IPP's – legislature prevents this currently • It will require behaviour change with regards to existing processes in the sugar cane industry as well as significant upgrades to equipment

The most viable options that emerged from the assessment were: solar PV, onsite wind, small-scale hydropower, power generation from landfill gas and biogas from wastewater treatment plants, and biomass. The most significant resources were solar irradiation and biomass.

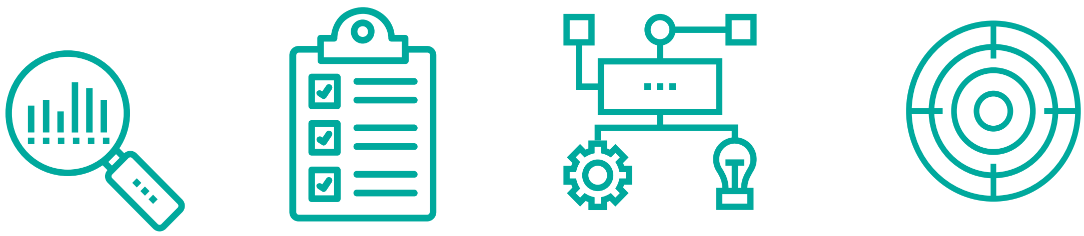
The assessment was used to develop scenarios of energy mixes for the roadmap (see Step 3).

STEP THREE

DEVELOP THE ROADMAP FOR RENEWABLE ENERGY DEPLOYMENT

This step is about considering a set of scenarios and deciding collectively on a common vision of the renewable energy combinations that could meet the city's demands.

This process needs to be very inclusive and consultative, and the roadmap must align with other city plans and goals. In engaging with the set of scenarios, stakeholders should consider the following aspects.



TECHNICAL ASSESSMENT

– Does the energy generation profile match the demand (hourly load) for the city?

REGULATORY FRAMEWORK

– Is the regulatory framework in place to support the renewable energy?

DISTRIBUTION SOLUTIONS

– How would/can the renewable energy integrate into the existing grid?

– Could off-grid or under-grid renewable energy solutions be used?

STAKEHOLDER GOALS

– Does the scenario take into account the emissions reduction and other social, economic and environmental goals?

Managing Step 3

- Develop scenarios that consider different growth rates and different combinations of renewable energy.
- Engage internal and external stakeholders to evaluate the scenarios through a series of workshops or meetings. The buy-in of all key actors is vital at this point.
- Hold workshop with the reference group to select a final scenario and discuss the actions to be taken.
- Consider sector-based, smaller group sessions to develop action plans.
- Continue to report to the steering committee on a regular (monthly) basis.

Step 3 Outputs

- Renewable energy scenarios report
- Renewable Energy Roadmap with actions, timelines and quantity for deployment of each of the chosen technologies, as well as clear roles and responsibilities of various stakeholders to guide the implementation process.

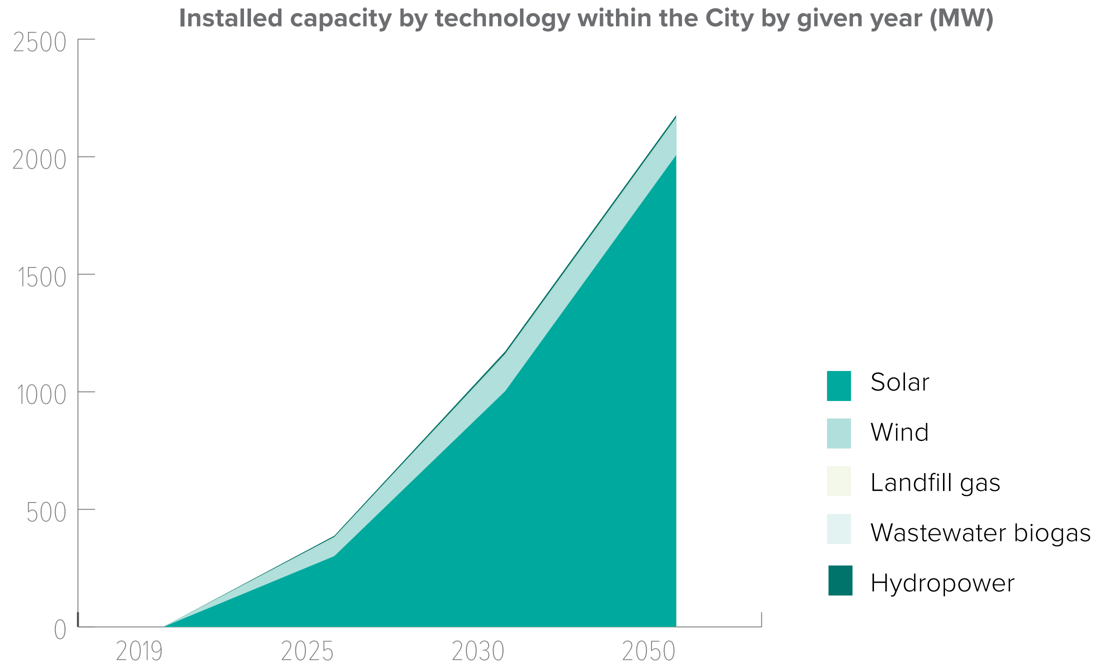
Case Study 2b: eThekwini, South Africa – scenarios development and selection

Scenarios were developed showing the various combinations of the technologies that could be included into the energy mix. Some scenarios emphasised renewable energy generation from within the city's boundaries, while others included procurement from outside sources. The strengths and weaknesses of each scenario were evaluated based on both qualitative and quantitative processes.

SCENARIO	TECHNOLOGIES	STRENGTHS	WEAKNESSES
1	All renewable energy technologies	• Lowest upfront costs • Majority of energy supply from local renewable energy sources • Combination of multiple renewable energy sources (increases reliability) • Builds on municipalities experience with solar installations and landfill gas.	• Second lowest LCOE • Undermines efforts to eliminate waste to landfill • Biomass generation has complex supply chain • Biomass generation is a source of air pollution • Municipality does not have know how with regards to biomass, wastewater treatment or wind energy.
2	All renewable energy technologies with solar scaled	• 100% energy supply from local renewable energy sources. • Combination of multiple renewable energy sources (increases reliability). • Builds on municipalities experience with solar installations and landfill gas.	• Highest levelised cost of energy and 3rd highest in terms of upfront capital investment required • High reliance on solar generation which would require private investment and presents a challenge to scale to target installed capacity, approx. 30% of available land to be utilized • May undermine aims to eliminate waste to landfill • Biomass generation has complex supply chain • Biomass generation is a source of air pollution • Municipality does not have know-how with regards to biomass, wastewater treatment works or wind energy
3	Biomass excluded	• Lowest levelised cost of energy (depending on procurement) • Greater flexibility in electricity supply as not constrained by local supply conditions • Lower risk of air pollution from biomass generation except where this is part of generation mix produced	• Not all renewable energy sourced locally • Higher reliance on purchasing electricity. Given risk that renewable energy supply is not available, there is a higher chance that the city's renewable energy target is not met • Predominantly reliant on solar generation • May undermine aims to eliminate waste to landfill

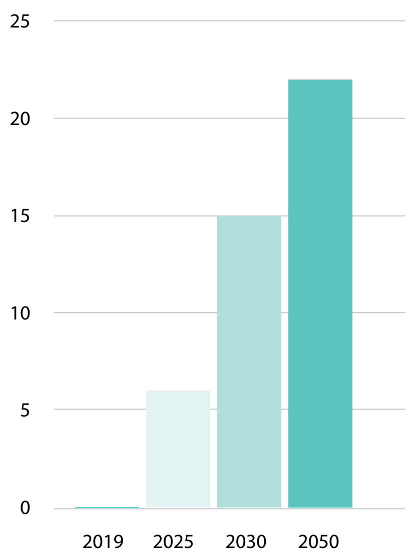
SCENARIO	TECHNOLOGIES	STRENGTHS	WEAKNESSES
4	Landfill excluded	• Lowest upfront capital investment (similar to scenario 1) • Majority of energy supply from local renewable energy sources • Lower risk of air pollution from biomass generation except where this is part of generation mix • Doesn't compromise aims to eliminate waste to landfill	• Not all renewable energy sourced locally • Reliance on purchasing electricity. Given risk that renewable energy supply is not available, there is a higher chance that the city's renewable energy target is not met
5	Biomass excluded, solar scaled	• Scenario with lowest levelised cost of energy except for Scenario 3. • 100% energy supply from in-city renewable energy sources • No risk of air pollution from biomass generation • Costs of solar are likely to decrease and technological improvements are on the rise	• Scenario with second highest upfront capital investment • Highly reliant on single renewable energy source that is solar generation. This also requires private investment and presents a major challenge to scale to target installed capacity, over 78% of identified land to be utilized • Multiple rooftop installations may affect grid stability and face challenges of balancing demand and supply • Introduction of energy storage could support energy balancing however at increased cost • May undermine aims to eliminate waste to landfill
6	Biomass and landfill gas excluded	• Scenario with lowest LCOE except for Scenario 3 (same LCOE as other high solar contribution scenarios) • 100% energy supply from in city renewable energy sources • No risk of air pollution from biomass generation • Doesn't compromise aims to eliminate waste to landfill as not reliant on landfill gas • Costs of solar are likely to decrease and technological improvements are on the rise	• Scenario with highest upfront capital investment • Highly reliant on single renewable energy source that is solar generation. This also requires private investment and presents a major challenge to scale to target installed capacity, over 75% of identified land to be utilized • Multiple rooftop installations may affect grid stability and face challenges of balancing demand and supply • Introduction of energy storage could support energy balancing however at increased cost

Scenario 3 was recommended for inclusion in the renewable energy roadmap, based on feasibility and cost effectiveness. An indicative roadmap was then developed that detailed the amount and types of renewable energy to be deployed over the next 30 years to ensure that all goals are achieved.



TECHNOLOGY	2019	2025	2030	2050
SOLAR	0.1	301	1 003	2 007
WIND	–	77	153	153
LANDFILL GAS	0.3	1	2	2
WASTEWATER BIOGAS	–	3.3	3.7	4.1
HYDROPOWER	–	5.3	10.6	10.5
% IN-CITY RENEWABLE ENERGY	0.02%	6%	15%	22%

Proportion of electricity demand met from in-city renewables 2019 – 2050



Based on the technical studies which demonstrated availability and cost, solar technology is the driving force behind the eThekwini Renewable Energy Roadmap. Wind will help to balance power as it is often available at times when the sun is not shining. Although they contribute a very small amount, the use of Municipal assets, wastewater biogas, landfill gas and hydropower (micro hydro from run of pipes) are an important source of renewable energy to develop and demonstrate Municipal leadership.

STEP FOUR

IMPLEMENT THE ROADMAP

The last step is about keeping stakeholders involved and delivering on the agreed-upon actions, in order to accelerate renewable energy deployment and achieve the roadmap's targets.

Cities should set milestones along the way at clearly identified dates and identify 'flagship' projects that will give your programme visibility. Local government is often the single largest energy consumer in a city. An excellent starting point is to undertake a City-led renewable energy project, e.g. solar rooftop PV on a municipal building and build towards ensuring that all municipal energy demand is covered by renewable energy.

POLICY AND REGULATIONS

- Develop city-level integrated resource plan that outlines city's future energy mix, supported by a regularly updated energy strategy.
- Put in place energy access and poverty reduction plans related to renewable energy.
- Streamline licensing process, developed in collaboration with national government.

FUNDING

- Explore alternative business models that can be incorporated into city operations, e.g. private-public partnerships, community-owned projects.
- Allocate city budget to on-site renewable energy development.
- Build on links with funding and lender institutions.

DATA MANAGEMENT

- Have a database of projects underway or planned that could feed into future initiatives.
- Use data to plan for electricity demand reduction through energy efficiency measures.
- Identify areas where renewable energy can be implemented using trend analysis.
- Ensure that municipal energy for own use is met by renewable energy.

CAPACITY-BUILDING

- Develop a unit within the lead department that drives the process over the short, medium and long term.
- Focus on stakeholder collaboration.
- Establish forums for exchanging information, collaborating on action plans and providing guidance and feedback.

MONITORING AND REPORTING

- Develop monitoring and evaluation processes to determine the challenges and progress made in implementation.
- Establish a communication/ reporting format to keep all stakeholders informed of success and challenges.

Managing Step 4

- Ensure capacity is developed through strategic partnerships and knowledge transfer.
- Partner with universities or environmental NGOs to bring in much-needed skills and capacity.
- Network with other cities in the region to share experiences of technology, regulatory and funding issues, etc.
- Develop public-private partnerships to facilitate the implementation of renewable energy in the city.
- Build interdepartmental collaboration, as energy projects are often cross-cutting in nature but the lack of communication and coordination prevents departments from working together.
- Continue to report to the steering committee on a regular (monthly) basis.
- Hold ongoing stakeholder reference group meetings to monitor the action plan's implementation.
- Develop municipal renewable energy projects that can be showcased to stakeholders as an indication of the positive impact of renewable energy.

Step 4 Outputs

- City plans and strategies, e.g. Municipal Energy Management Strategy, Energy Strategy, etc.
- Financial mechanisms to support renewable energy deployment (City budget line items, PPP templates, blended finance mechanisms for lenders, etc).
- Leading by example City flagship project or target identified.
- Regional city learning network established.

Case Study 2c: eThekwini, South Africa – Energy Office[4]

To successfully implement a renewable energy roadmap requires a champion department or unit. In eThekwini, the champion is the Energy Office (EO), whose mandate and staff key performance indicators include the implementation of the roadmap. Launched in 2009, the Energy Office initially focused on reducing electricity consumption in municipal infrastructure. This focus was then broadened to include sustainable energy interventions across the municipality, in accordance with Durban's Energy Strategy (2008). The Energy Office's responsibility has grown to include renewable energy and climate change mitigation (reducing emissions). The EO frequently partners with other municipal units and departments to implement projects and participates in national and international projects. This ability to collaborate with a broad range of stakeholders will help the implementation of the Roadmap.

4 http://www.durban.gov.za/City_Services/energyoffice/Pages/default.aspx

Summary of implementation action

Extract from eThekwini's detailed implementation plan, provided for illustrative purposes

STRATEGIC GOALS	
	Municipality to achieve 40% of renewable energy supply by 2030 and 100% renewable by 2050
	Ensure 100% of electricity purchased by eThekwini Municipality for resale is produced from Renewable Energy sources by 2050
	Ensure 40% Industrial Energy Efficiency by 2050 (from a 2018 baseline)
	Reduce Electricity Consumption by 40% by 2050 across residential, commercial and municipal users
	Ensure 70% of public and private electricity demand is provided by self-generated Renewable Energy by 2050

LEVEL OF DIFFICULTY	
Green	Action items that build on existing work that has been completed or involves new steps to be taken in areas where existng data and research exists. These action items are relatively straight forward to launch.
Amber	There is a level of complexity regarding these action items which is further exacerbated due to the lenghty time scales and processes associated with the majority of the item. Certain items are also dependent on external participation and approvals. Detailed planning and preparation will be required.
Red	There is a level of complexity and uncertainty surrounding these action items. Action items are highly dependent on external participation and approvals. Detailed planning and preparation will be required in addition to support from external partners.

TARGET AREAS	STRATEGIC GOALS	TACTICAL INTERVENTION AREA	ACTIONS/ACTIVITIES	LEAD OWNER	TIME	EFFORT LEVEL
Policy Management		Update and revise the Durban Climate Change Strategy annually to ensure that the strategy is relevant and capitalising on technology advancements in the sector	• Ensure the most advantageous time to set the review date (prior to Budget speech, Financial year end) • Allow adequate time for the review process • Invite external stakeholders and technical specialists in the clean energy transition space to participate in the review • Invite and engage with at least one representative from each of the municipal departments • Identify items that require further investigation and appoint personnel to follow through	Environmental Planning and Climate Protection Department	Long	Amber
Generation licenses		Investigate generation licenses for: • Bundled generation license applications • Mini-grid license applications for rural areas	• Set up regular meetings with the Regulator to discuss the option for the municipality to bundle generation license applications • Submit license application to the Regulator and Department of Energy	Energy Office	Long	Red
		Investigate options to purchase energy from [Energy Traders]	Submit the relevant information to the trader to establish the business case	Energy Office	Short	Amber

Conclusion

The process of developing a city's renewable energy roadmap should bring all parties together in order to achieve a common goal, based on clear actions and timeframes. As more SSA cities undertake renewable energy roadmap processes, the more lessons will be learned about the key steps, major opportunities and important barriers that need addressing.

ROADMAP AT A GLANCE

1 DETERMINE CURRENT AND FUTURE ENERGY DEMAND

ACTIONS	STAKEHOLDERS	CHALLENGES	SOLUTIONS
• Survey of current energy use • Desktop research on energy use • Future energy modelling • Emissions modelling	• City officials • Universities • Non-governmental organisations • Research institutions	• Limited expertise in Municipality to conduct the analysis. • Lack of data • Lack of finances to outsource	• Partner with organisations with relevant expertise. • Apply for grant funding to finance studies.

2 ASSESS RENEWABLE ENERGY RESOURCES IN THE CITY

ACTIONS	STAKEHOLDERS	CHALLENGES	SOLUTIONS
• Determine amount of resources in City • Comparison of costs for different technology • Analysis of associated regulations/policy	• City officials • Universities • Non-governmental organisations • Research institutions	• Limited expertise to conduct assessment • Lack of data • Lack of finances to outsource	• Partner with organisations with relevant expertise. • Apply for grant funding to finance studies.

3 DEVELOP THE ROADMAP FOR RENEWABLE ENERGY DEPLOYMENT

ACTIONS	STAKEHOLDERS	CHALLENGES	SOLUTIONS
• Scenario development • Development of Roadmap (with timelines) • Consensus on Renewable Energy Vision	• City officials across all departments	• Gaining consensus on the Renewable Energy vision.	• Collaboration with all departments throughout the Roadmap development process.

4 IMPLEMENT THE ROADMAP

ACTIONS	STAKEHOLDERS	CHALLENGES	SOLUTIONS
• Establishment of team to drive implementation • Data management • Development of relevant policies and licences • Obtaining financing.	• Establishment of team to drive implementation • Data management • Development of relevant policies and licences • Obtaining financing.	• Lack of personnel to develop a new team. • Lack of financing to develop database system and to develop renewable energy. • Restrictive renewable energy regulations/ policies	• Capacity build current staff. • Constant engagement with both local and national stakeholder to adjust policies. • Innovative financing

Useful resources

Do you want to find out more about city scale energy data collection and analysis?

- Energy and Emissions Data Collection: A Guide for Developing Cities, developed by Sustainable Energy Africa under the CoM SSA project, with support from C40 and DANIDA. http://www.cityenergy.org.za/uploads/resource_461.pdf
- Generic State of Energy Terms of Reference gives an overview of how to gather and analyse energy data including indicators used to do the energy assessment and useful conversion factors. http://www.cityenergy.org.za/uploads/resource_145.pdf

Do you want to find out more about different renewable energy technologies and energy efficiency actions that make sense at the city scale?

- Guidelines to Clean Energy: A practical guide for Sub-Saharan African municipalities http://www.africancityenergy.org/uploads/resource_101.pdf
- Scaling Up Renewables in Cities: Opportunities for Municipal Governments https://www.irena.org/publications/2018/Dec/Scaling-up-Renewables-in-Cities
- Getting to Zero: A guide to developing net zero Carbon Buildings in South Africa https://gbcsa.org.za/wp-content/uploads/2020/08/Getting-to-Zero_2020.pdf

Do you want to find out more about how to do energy futures modelling at the city scale?

- Modelling the urban energy future of Sub-Saharan Africa: working paper http://www.africancityenergy.org/uploads/resource_26.pdf

Do you want to find out more about City energy governance?

- Sustainable Urban Energy Planning A handbook for cities and towns in developing countries http://www.cityenergy.org.za/uploads/resource_185.pdf
- What role can African cities play in low-carbon development? A multilevel governance perspective of Ghana, Uganda and South Africa, by Tait, L and M Euston-Brown, Journal of Energy Southern Africa, vol. 28, No 3: http://www.cityenergy.org.za/uploads/resource_457.pdf
- Decentralised urban infrastructure in African cities – Distributed Energy Resources (DERs) & Urban Climate Resilience. Produced by African Cities Thought Leadership Programme in partnership with the African Centre for Cities, University of Cape Town and Pinsent Masons an international law firm which specialises in the energy, infrastructure and financial services https://www.pinsentmasons.com/-/media/pdfs/en-gb/special-reports/african-cities/african-cities-campaign-fourth-report.pdf?la=en-gb&hash=A481A15956E4C99E658B53EC7E1A82E9