



Dossier on the applicability of transition pathways towards 100% RE for each deep-dive city and region of the “100% Renewables Cities and Regions Roadmap” Project





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About



ICLEI Local Governments for sustainability (www.iclei.org) is a global network of more than 1,750 local and regional governments committed to sustainable urban development. Active in 100+ countries, we influence sustainability policy and drive local action for low emission, nature-based, equitable, resilient and circular development.



The dossier has been developed in the framework of the “100% Renewables Cities and Regions Roadmap” project (<https://renewablesroadmap.iclei.org/>).

The project facilitates the energy transition by raising local awareness on renewable energy sources, showcasing how local and national governments can create coordinated, enabling frameworks and policies, exploring access to public and private sector finance and building local renewable energy projects to address electricity, heating and cooling.

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By working with local and regional governments from Argentina, Indonesia and Kenya, the project will foster multilevel governance and put that collaboration at the heart of the sustainable energy transition.

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Dossier package on 100% transition pathways

The present document should be considered part of a package of Dossiers (and Annex) assessing existing pathways towards climate neutrality in order to pursue the objectives of the 100% Renewables Cities and Regions Roadmap project, as well as to support Local Governments (LGs) wanting to set a 100% Renewable energy target. The “Dossier on transition pathways towards 100% RE for cities and regions” (Badino 2020a) and its Annex includes pathways to 100% Renewable Energy and it offers policy recommendations, on top of clarifications needed by the LGs to successfully pursue their vision.

The “Dossier on the applicability of existing transition pathways towards 100% RE for cities and regions” (Badino 2020b) assesses the pathways according to replicability criteria in order to reach a climate neutral future. Finally, the specific context of the cities and regions supported by the project are considered in the “Dossier on the applicability of transition pathways towards 100% RE” for each deep-dive city and region of the “100% Renewables Cities and Regions Roadmap” Project” (Badino 2020c), where strategic considerations and suggestions can be found for each of them.

Cover image by Jude Joshua from Pixabay



Executive summary

The local governments (LGs) participating in the project come from a variety of contexts and have different experiences on climate mitigation or adaptation policies and renewable energy roll-out. Though, they all have big potential to reach the entire coverage of their energy needs through renewable energy. Horizontal and vertical collaboration play a big role in the process: connecting with other LGs support mutual learning with different, but similar experiences in the same region or abroad. Moreover, joining forces with other levels of government increases the opportunities for higher ambition and it enables the creation of the best policy environment, to reach with success the climate objective for the entire community and country.

After an overview on each country and LG, aimed at framing the context, specific indications and suggestions are given for each of the nine deep-dive administrations, considering the local potential for renewable energy roll-out and the need of creating synergy with other LG objectives.





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“There is a need for financial reform along ethical lines that would produce in its turn an economic reform to benefit everyone. This would nevertheless require a courageous change of attitude on the part of political leaders” - Pope Francis



1. Introduction

The consideration drawn following the assessment of existing transition pathways towards 100% Renewable Energy (RE) for cities and regions in the world (Badino 2020a, Badino 2020c, Badino 2020d) and available literature in the renewable energy (RE) field were used to support the development of the 100% RE roadmaps to be elaborated within the project “100% Renewables Cities and Regions Roadmap”. There are nine deep-dive cities and regions accompanied in the process, three for each of the countries, namely Argentina, Indonesia and Kenya.

Policy recommendations to implement a successful roadmap, the importance of the variety of roles of Local Governments (LGs) in the transition, as well as the need for continuous improvement and increased ambition (Badino 2020a, Badino 2020c) are part of the recommendations and assessments contained in the present Dossier, with the aim of reaching a 100% RE sustainable future.

Clearly, a thorough analysis of the baseline assessments of climate mitigation and adaptation as well as of population and economic trends should be made before translating into practice the considerations here described. All LG departments and local stakeholders should sit at the same table and support each other in order to increase ambition and enthusiasm for the vision and the strategy, finding the right pathway for the specific context and in accordance with community wishes.

Though, the Dossier aims at providing ideas and suggestions coming from the analysis of the available documentation on each deep-dive city/region supported by the project and their specific context, indicating similar experiences in other parts of the world as a source of inspiration or possible connection .

[Chapter 2](#) focuses on the potential of the 100% RE transition roadmap for Argentina, with subchapters regarding Avellaneda (Santa Fe), La Plata (Buenos Aires) and Rosario (Santa Fe).

[Chapter 3](#) focuses on Indonesia, with subchapters concerning Mataram City (West Nusa Tenggara – WNT), Sumbawa Regency (WNT) and West Nusa Tenggara Province (WNT).

[Chapter 4](#) focuses on Kenya, with subchapters regarding Kisumu, Mombasa and Nakuru Counties.

Final conclusions are drawn in [chapter 5](#) and a small [glossary](#), together with the list of [references](#), follow.



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2. Argentina

Argentina, or Argentine Republic (Spanish: *República Argentina*), is a country located mostly in the southern part of South America. The country occupies part of the Southern Cone beside Chile, located to the west, as well as it borders with Bolivia and Paraguay to the north, Brazil to the northeast, Uruguay and the South Atlantic Ocean to the east and the Drake Passage to the south.



Figure 2-1 Flag of Argentina

Economy, population and sectoral considerations

99% of the population has access to the electricity grid, with only few rural areas not yet covered; the natural gas grid, on the other hand, covers 64% of the population (ICLEI SAMS 2020a).

The capacity and reliability of the electricity transmission infrastructure should be improved, in order to include further grid-connected RES systems (CADER 2019, UNEP 2019, Singh 2019).

Energy use and emissions

The inclusion of natural gas and renewable energies in the energy matrix of the country by 2050 and the role of these sources in the transition process was one of the key themes in the dialogue process. The need to carry out an objective, transparent and independent



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cost estimation assessment, including subsidies and all other direct and indirect items, is highlighted before committing to a 100% RE pathway for the nation. At the same time, though, the dialogue highlights the need to increase the use of natural gas among the population (Hacia 2019).

As the following graph shows (Figure 2.2), greenhouse gases (GHG) emissions in Argentina are mostly due to the energy sector (53%), agriculture and land use (37%), followed by industrial processes, product use (6%) and waste (4%). The expansion of the GHG emissions in the energy and agricultural sectors is given below (Figure 2.3 and Figure 2.4) (SGAyDS 2019). The net overall emissions of the country are increasing in all sectors (Figure 2.5) (SGAyDS 2019).

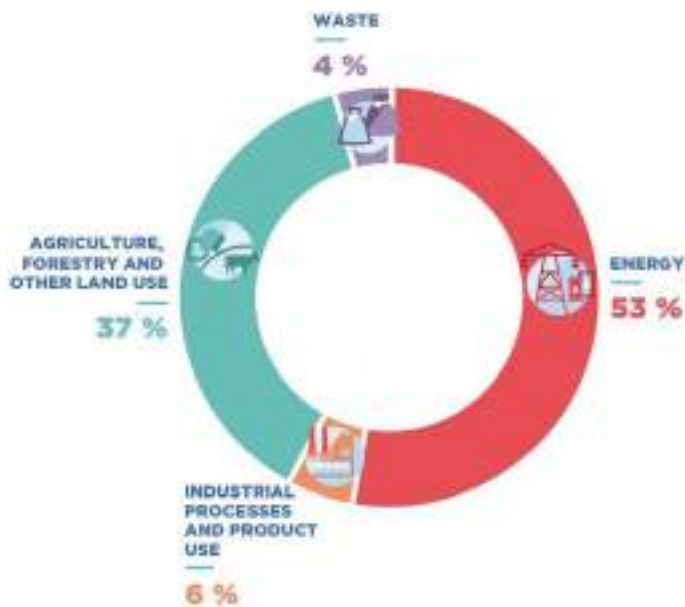


Figure 2-2 Sectoral GHG emissions in Argentina (2016) (SGAyDS 2019)



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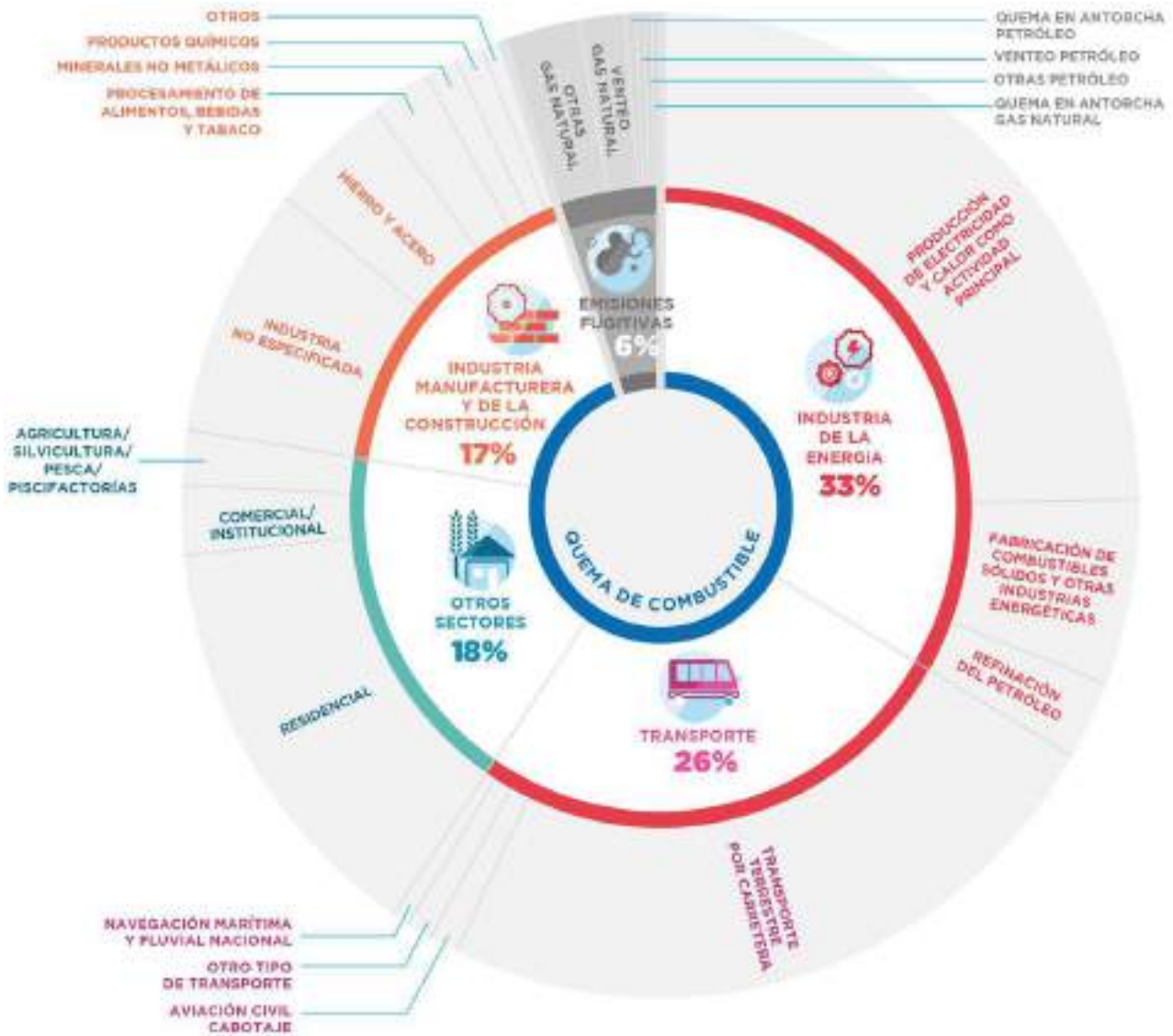


Figure 2-3 GHG emissions in energy sector in Argentina (2016) (SGAyDS 2019)

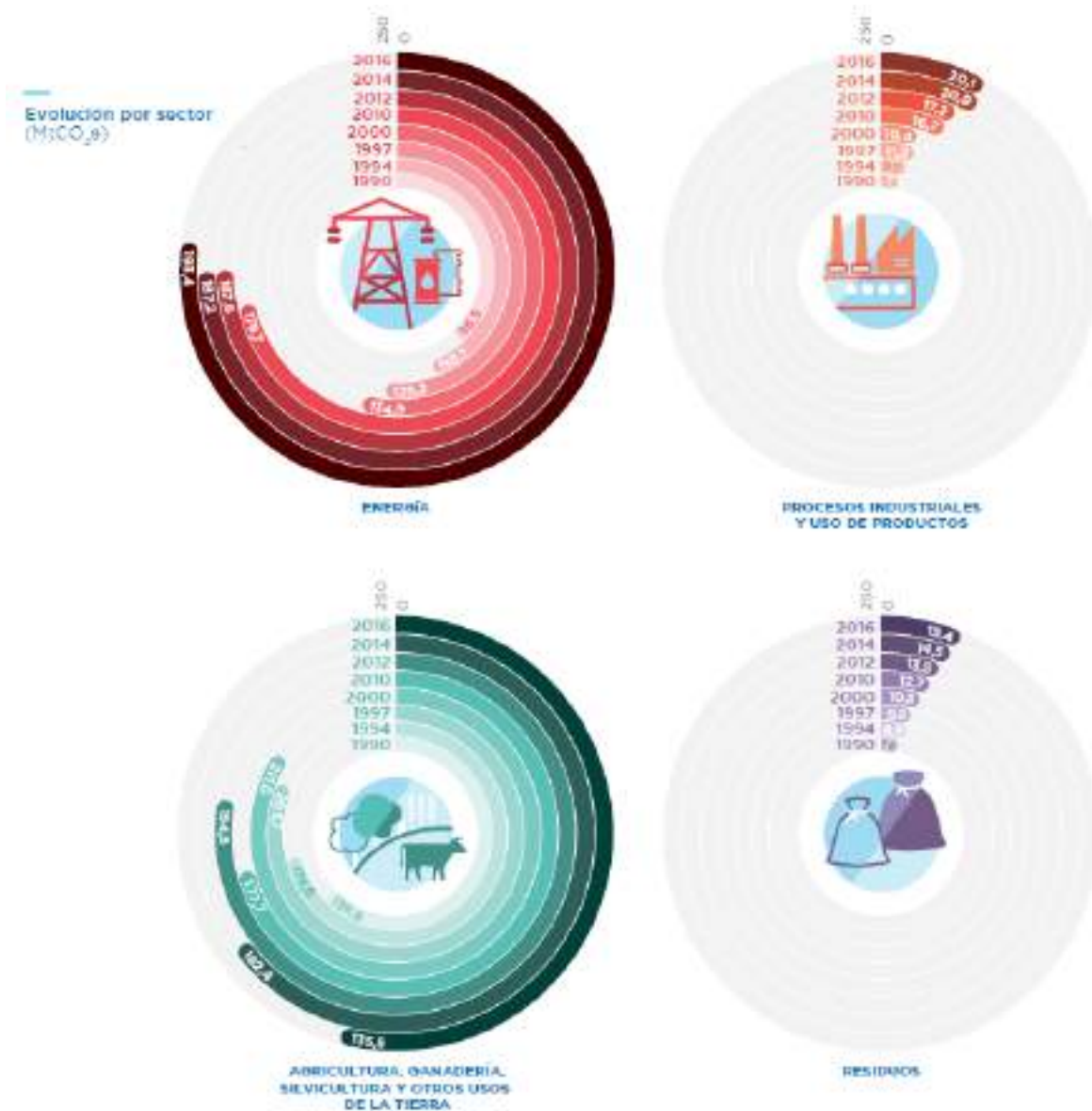


Figure 2-5 GHG emissions evolution in Argentina per sector 2009 - 2016 (Muzio et al 2019)

Fossil fuels represent 87% of the total energy use (ICLEI SAMS 2020a), with the main fuels being natural gas (58%), followed by oil derived fuels (diesel, nafta,...)(28%) and a small part of biodiesel (ICLEI SAMS 2020a, Muzio et al 2019). The national energy mix for electricity is dominated by natural gas (90%), followed by liquid and solid fossil fuels. Hydroelectric generation counts for 29% of the total, other renewables represent only 2.5%. Nuclear power plants provide 5% of electricity (ICLEI SAMS 2020a).

Energy distribution for final use is portrayed in Figure 2.6 (Muzio et al 2019), but the figures present in the Balance Energético Nacional 2018 appear to be very different (ICLEI SAMS 2020a, Hacia 2019): the transport sector is the main energy use contributor (31.5%), followed by the residential (24%) and industrial (23,8%) sectors.



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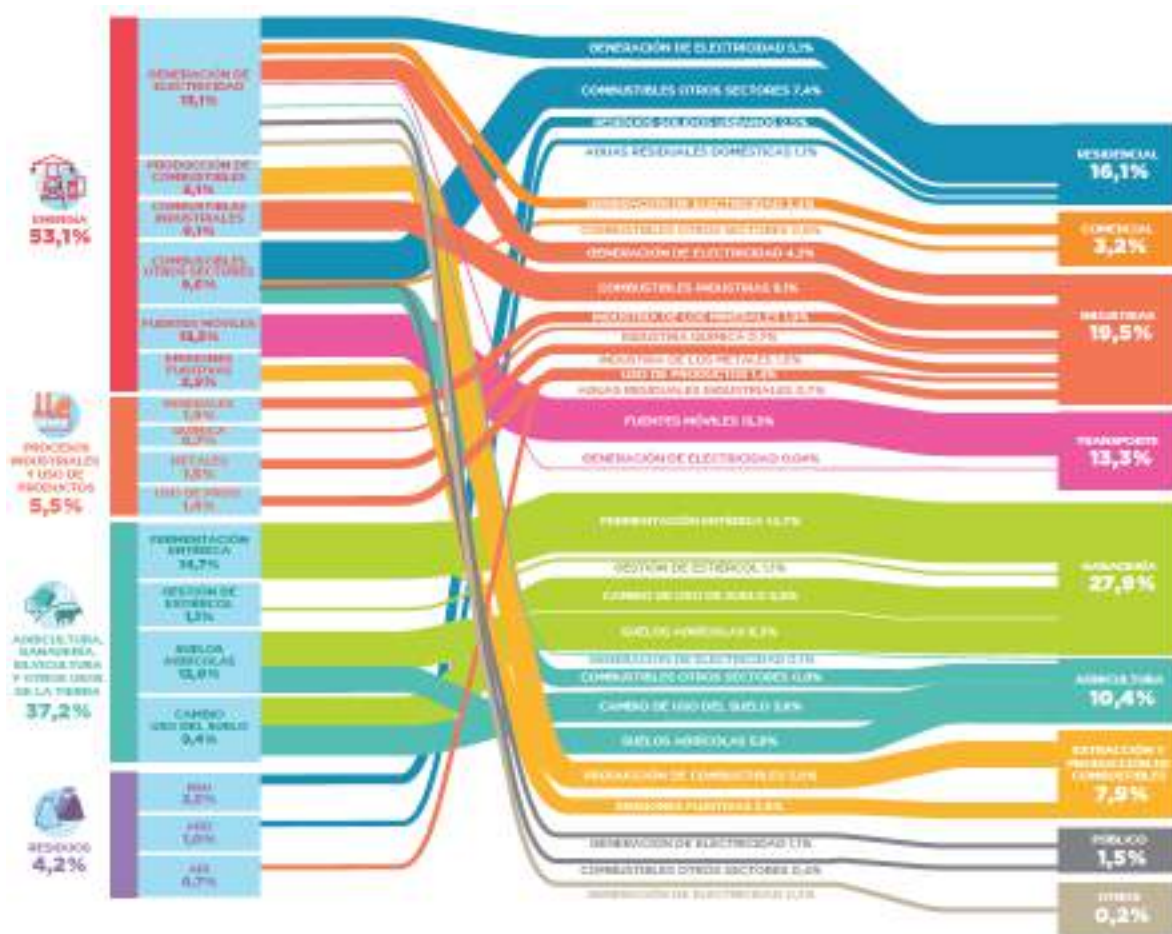


Figure 2-6 Energy distribution for final use in Argentina (2016) (Muzio et al. 2019)

Energy and climate policy landscape

The main pillars of the Argentinian energy transition, planned by the Executive Committee of the Energy Scenarios Platform are (Hacia 2019):

1. energy security;
2. environmental sustainability;
3. efficiency and competition;
4. social inclusion and employment.

The vision developed in the Nationally Determined Contribution (NDC) of Argentina foresees a very integrated approach, with policies and measures to reduce GHG emissions and to provide clean, reliable and sustainable energy in the framework of economic and population growth. On the other hand, no measures concerning a strong reduction in energy demand are given, rather, they focus on adaptation mechanisms and on reducing risk and vulnerability of social and energy systems (ICLEI SAMS 2020a).

Considering the projections foreseeing NDC goals easily achieved even in the least optimistic scenarios (UNEP 2019), there is a need of increasing the national ambition. The



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local level can drive the change, requesting changes and acting in accordance with the national objectives. For example, refraining from the use of fossil fuels, divesting from them, improving energy efficiency and sustainability in the transport sector, including RES in all sectors towards a 100% RE vision are among the possible interventions.

The energy Sectoral National Action Plan includes policies and measures addressing both the supply of and the demand for energy. For example, it includes several large-scale hydropower plants and various types of large-scale renewable energy power plants like wind, photovoltaic (PV) solar and biomass, but it also includes nuclear energy (which is non renewable) and foresees natural gas as a source of electricity generation. On the demand side, energy efficiency measures are considered, as well as thermal insulation in buildings (Plan Argentina 2019).

Though, three new nuclear power plants are also planned and the subsidies allocated to the extraction and distribution of fossil fuels in the country compensate for the emission reduction of the entire renewable energy plan (UNEP 2019).

The energy Sectoral National Action Plan also includes circular economy measures for waste and RE application in the waste sector, as well as policies and measures for transport, promoting low-emission urban mobility, the restoration of the intercity railway, the improvement of the road and rail freight efficiency, the use of biofuels and, finally, the implementation of hybrid and electric buses in large cities. Though, subsidies to the fossil fuel sector have been further allocated and the use of private cars over public transportation increased (UNEP 2019).

RES have been included in the policies and measures in the building sector, such as the use of solar water heaters and renewable energy systems for thermal-energy and electricity, accompanied by energy efficiency requirements, as well as in the agricultural sector, with conditional measures to increase the forested area and promote bioenergy made from different biomasses (UNEP 2019).

Horizontal and vertical cooperation

Argentina introduced the information support system "National Greenhouse Gas Inventory System of Argentina" (SNI-GEI-AR) to guarantee the enhancement and transparency of the national greenhouse gas inventory. It is based on inter-institutional interactions, defined roles and responsibilities and on standardised processes for data exchange, validation and compilation of robust and transparent GHG inventories (SGAyDS 2019).

Following the submission of its first NDC, Argentina established a Climate Change National Cabinet composed by representatives from most ministries, in order to design a low-carbon strategy and to ensure the coherence of policies and measures across the Federal Government (UNEP 2019).

Considering the objectives of the 100% RE Roadmap project, it is worth mentioning that the Province of Santa Fe (where Avellaneda and Rosario are located) has its own regulations regarding renewable energy and distributed generation (ICLEI 2020c).



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Avellaneda, Santa Fe (Deep-dive City)

The city of Avellaneda is situated in a metropolitan area of Santa Fe, Argentina (2019) (ICLEI 2020c).



Figure 2-7 Laguna Paiva, near Avellaneda (Image by irrekuperables from Pixabay)

Economy, population, infrastructure

The city of Avellaneda has a total population of over 30,400 inhabitants (2019) (ICLEI 2020c).

The city is located in a vast rural area whose predominant activities are agriculture (sunflower, soybeans, corn, wheat, sorghum, cotton and pastures) and livestock (cattle, pigs, poultry), with an additional growing stock of associated industrial companies. The agribusiness sector generates an industrial and technological pole whose companies are present in the main economic centres of Argentina (ICLEI 2020c).

100% of the population in Avellaneda has access to the electric power network (RE Roadmap 2020).

Energy use and emissions

The baseline assessment of the sectors (and relevant shares) constituting the total energy consumption of the city and of the energy sources covering each sector has not been developed yet.



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25% of the community's energy demand is generated from industrial waste by the company Biogás Avellaneda; such energy is injected into the National Grid (ICLEI 2020c). The houses in Avellaneda are powered by LPG: 23% are supplied with vaporised LPG distributed by the network, while the remaining 77% acquire it in gas cylinders. Industry is mostly powered by biomass and LPG, disconnected from the grid.

Currently, the RE capacity installed (6 MW) coincides with the current additional energy demand of the residential area of the city. The biggest share of energy consumption is due to the industrial sector (64%), followed by residential (25%) and commercial (8%). A small contribution is given by street lighting (2%) and public distributions (1%) (RE Roadmap 2020, ICLEI 2020c, ICLEI SAMS 2020b).

The main sources of energy used in the City are:

- National / provincial energy grid;
- Petroleum-derived fuels (with 5-15% biodiesel share);
- Biodiesel;
- Biomass (firewood) (only for the industrial sector);
- Liquefied petroleum gas (LPG);
- Biogas from biodigestion.

The current production of energy from biodigestion employs the biodegradable part of both urban and industrial waste, mainly generated by agribusiness and household organic waste (ICLEI 2020c).

Energy and climate policy landscape

The Government plans to develop policies aimed at improving energy efficiency actions at the local, domestic, urban and industrial levels in order to achieve an equitable and circular low carbon development (ICLEI 2020c).

The City has no RE plan yet. The distributed generation of affordable and non-polluting energy is encouraged by the Government to ensure independence from the provincial and national energy grid.

Among the projects in place it is possible to list (ICLEI 2020c):

- Electric transport promotion;
- Acceleration of regional transition to public transport with pure biodiesel (B100);
- Generation of energy through the use of biogas from waste;
- Energy efficiency in public buildings;
- Efficient lighting plan (PLAN);
- Efficient lighting in green spaces;
- Solar stations;
- Photovoltaic park in the Municipal Industrial Park.



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The city joined the Global Covenant of Mayors for Climate & Energy (GCoM) (GCoM 2020) and submitted its inventory. The city developed and launched its GHG Inventory in 2019.

Potential for RES application

The City has not fully tapped into its wide potential of renewable energy. Thanks to RES, the City can ensure energy access to the entire community, as well as a sustainable, healthy and wealthy development.

In the implementation of the foreseen projects on distributed generation (ICLEI 2020c), the LG should guarantee that a robust design ensures the entire energy needs to be covered with RES and that the projects technical specifications have been considered. For example, RE should provide the electricity for transport and a feasibility study on the use of pure biodiesel in the public transport should be developed. Technical specifications and maintenance standards are key to develop full trust in the technologies to be used in the strategy (ICLEI Rosario 2018).

Potential for RE projects can be found, first of all, in **solar** energy, thanks to the climate and the position of Avellaneda. Sustainable **biomass** can be also included in the plans, by using agricultural scraps and livestock waste from the industrial sector or the organic part of solid waste as biofuels. This type of biomass can also be used in Combined Heat and Power (CHP) plants for the industrial sector, providing both electricity and heating (and cooling energy if needed) and guaranteeing a very high efficiency rate.

Sectoral policies potential

In order for a 100% RE pathway to happen, Avellaneda should, first of all, fully commit to a long-term visionary development idea, making sure that the entire administration and political actors are involved. The 100% RE ambition requires the LG to stop thinking in the short term and focusing on economic benefit, yet to dare engage in an energy transformation and economic development building a sustainable, affordable and healthy future (Randers 2012, Randers 2013). The local government needs to enable the framework for this to happen, engaging LG officials, politicians, local stakeholders and citizens in all phases, creating a common vision together. When the strategy is well conceived and robust, the business case and investment from private and international actors are more financially viable.

Strong reduction in energy demand should be the first objective of a 100% RE vision, followed by stringent measures supporting energy efficiency and divestment from fossil fuels, together with the use of a variety of RES to cover the entire remaining consumption (Badino 2020a, Badino 2020b).

A thorough assessment of the baseline consumption is necessary, in order to define the first steps, to create a pathway towards the end goal and to foster synergy with other policies and LG goals.

As energy access is not a problem in terms of infrastructure, an increased share of RES in the energy mix should be sought. This is already part of the **“Sustainable Territory” axis**,



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which can increase ambition to support a 100% RE share in the transition: policies supporting energy efficiency and circular economy should be coupled with awareness raising and communication sharing the objectives of the energy transition, including the variety of benefits linked to the 100% RE vision.

In its role of driver for change (Badino 2020b), public investments in demonstration projects on **municipal operations**, as well as public buildings and facilities can support the uptake of new technologies together with adequate policies (ICLEI Rosario 2018).

In order to reach 100% RE for the city energy demand, the LG should set policies, initiatives and projects in place to exceed the increased energy requirement of the **residential area**.

Contributing for almost two third of the total energy consumption, the priority should be given to the **industrial sector** (ICLEI 2020c), as well as to awareness campaigns supporting the energy transformation, building on the momentum created by a change in the industrial culture.

The LG can concretise its vision acting as a role model, firstly, using 100%RE in all administration energy consumption, secondly supporting investments of local stakeholders and the private sector. Avellaneda can, for example, act as an incubator for the green economy or as an intermediary to support group purchase of RES based solutions (such as solar cooking stoves or solar panels).

Inspiration from the World

Sharing the 100% RE vision and pathway with others can support more effective and innovative development. It is important for the LG to monitor the implementation of the strategy, improving it whenever the results are not as expected or some conditions change. Sharing doubts and failures can support others to avoid them, as well as learning from other pathways can help finding good solutions for the specific context or vision.

Avellaneda can take inspiration from **Kisielice (Poland)** (100% RE Energy Atlas 2020, World Future Council 2019), which set a 100% RE community-wide target, reached in 2014. Three wind farms, a biomass Combined Heat and Power (CHP) plant, a biogas power plant and a district heating system compose the generation system. Previously highly dependent on lignite and hard coal, the city developed a strategy aiming at stimulating the local economy, also thanks to a clear political leadership that lasted 24 years. Kisielice changed its Spatial Development Plan in 1998 to ensure that the construction of wind turbines did not conflict with the existing administrative regulations. Technical assessments on technical challenges and economic results of the wind projects attracted investors. The city implemented strong community engagement measures, with transparent participation from different stakeholders and the creation of a local value chain for agricultural scraps. Four neighbouring municipalities started to cooperate on RES systems, following the example of Kisielice (Badino 2020a, Badino 2020d).



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Horizontal and vertical cooperation

Multi-level collaboration with other levels of government, local stakeholders, energy providers and peers around the world is key to ensure the success of the 100% RE vision. The political will to establish win-win collaborations with all the actors involved in the economy and in the energy consumption is needed to build trust and to enable the successful implementation of policies, measures and investments.

Environmental policies and sustainable practices have been integrated in different areas of the city since a decade (ICLEI 2020c): "Sustainable Territory" is one of the Government's axes, aiming at promoting the diversification of the local energy matrix with the inclusion of renewable energy sources.

The introduction of policies to increase energy efficiency and RE share are among the Government's mandates (ICLEI 2020c). This can encourage the transition to 100% RE, particularly when accompanied by a productive dialogue with the energy distributor (Public Services Cooperative) (ICLEI 2020c), local stakeholders and citizens. Multi-level governance at other levels of administration (such as the Province of Santa Fe) and cooperation with cities of the same province, such as Rosario, can ensure wider participation and broader interventions. Such partnerships can foster increased ambition concerning renewable energy and distributed generation at the local and Provincial levels (ICLEI 2020c).

Considering the experience the City has in suggesting and supporting cross-communities structural policies, such as the one concerning urban solid waste management (ICLEI 2020c), and its ability to use local experts and international cooperation for reciprocal benefit, the City of Avellaneda can be the driver of a larger energy transformation.

Awareness raising, capacity building and community engagement

The local government needs to make sure that the 100% RE vision is communicated in a clear, transparent and robust way. The context, the synergy with the community objectives and the benefits for the different parts of the society and for the businesses should be highlighted, in order to support their participation in the implementation of the development pathway.

In order for the strategy to be successful, it must include measures aiming at supporting education and training at all levels, thanks to the cooperation with schools, local universities and other local experts. Capacity and skills development on RE system designs, policies, finance, installation and urban planning, for example, are needed in order to build momentum for green economy and sustainable development based only on RES to happen.

As mentioned in the case study developed by IRENA and ICLEI on Rosario, *"technical skill trainings and workshops represent socio-economic benefits which may ultimately increase the political feasibility of more ambitious action on renewable energy deployment"* (ICLEI



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Rosario 2018). Collaboration with agribusiness can be fostered to find solutions on energy and educational activities.

La Plata, Buenos Aires (Networking City)

La Plata is the capital of the Province of Buenos Aires and it hosts the administrative headquarters of the 135 municipalities of the Province (ICLEI 2020c).



Figure 2-8 Aerial view of the estuary in the province of Buenos Aires (Image by Wikimages from Pixabay)

Economy, population, infrastructure

La Plata's population counts over 654,000 people (2010) and 97% of the population has access to electricity and 87% to natural gas.

Commerce and services are the main economic drivers, counting, for example, open-air shopping centers, trade in consumer goods and intermediate goods, professional services or software development. Other activities concern design and manufacture of industrial goods, as well as production and marketing of fruits and vegetables. La Plata is witnessing the development of other sectors, such as a growing industry zone, knowledge-based industries (IBC), agriculture and tourism (ICLEI 2020c, RE Roadmap 2020).



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The city is the center of a wide range of high quality educational offers attracting people from the whole country.

Energy use and emissions

The baseline assessment of the sectors (and relevant shares) constituting the total energy consumption of the city and of the energy sources covering each sector has not been developed yet (ICLEI SAMS 2020c). Though, it is known that the electricity consumption in La Plata, on average, is mostly due to the residential sector (59%), followed by the commercial and public (23.7%) and, finally, the industrial sector (19%).

The transport sector is entirely covered by fossil-fuels, namely diesel, compressed natural gas and gasoline.

La Plata government has good access to data regarding the energy consumption of the community and of the local government operations (ICLEI 2020c), which allows the city to properly plan and assess the feasibility of different RE interventions.

Private buildings are the main electricity consumers. A private company (EDELAP) provides the distribution and sale of electric power within the city and nearby towns. Solar technologies can be found in some public and private applications but the energy mix of the grid is mostly composed by fossil fuels.

Energy and climate policy landscape

The area where La Plata is located presents high risks caused by winds and because of floods caused by intense rainfalls. The “Sustainability agenda” of La Plata aims at implementing a 100% RE strategy linked to its climate mitigation strategy, urban growth and increased resilience (ICLEI 2020c).

La Plata is developing the following projects:

- 8 Wind farms are currently being installed under the RenovAr Program, which foresees distributed energy generation through small plants, supported by a variety of public and private funds and incentives: the Provincial Program of Incentives for Distributed Energy Generation (PROINGED), a PPP between electricity distributors (the Regional Electricity Forum - FREBA) and the Undersecretariat of Public Services of the Ministry of Infrastructure of the Government of the Province of Buenos Aires,
- LED replacement,
- electric public transportation,
- photovoltaic solar parks.

“Stop setting goals. Goals are pure fantasy unless you have a specific plan to achieve them” - Stephen Covey



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A pilot project on RE generation from photovoltaic systems to power the public lighting was developed (ICLEI 2020c).

La Plata has not developed an Action Plan on RE yet, but the concept of 100% RE is part of the mitigation plans and on the public agenda (ICLEI 2020c).

La Plata has not joined the Global Covenant of Mayors for Climate & Energy (GCoM) yet (GCoM 2020), but it developed and launched its GHG Inventory in 2014, as well as an Energy Efficiency Study in 2018 on the energy consumption of local government operations. The elaboration of a Climate Action Plan is ongoing (ICLEI 2020c).

Potential for RES application

The City has not fully tapped into the potential of renewable energy, which is wide. Thanks to RES, the City can ensure energy access to the entire community, as well as a sustainable, healthy and wealthy development.

Solar energy has high potential of application in La Plata, thanks to the available surfaces (mainly rooftops) and the irradiation of the area. Other potential RES to be used are **wind** (there are windy zones, such as Bahía Blanca, whose productivity could be assessed) and a great **biomass** resource (mostly organic waste) (ICLEI 2020c).

Sectoral policies potential

In order for a 100% RE pathway to happen, La Plata should, first of all, fully commit to a long-term visionary development idea, making sure that the entire administration and political actors are involved. The 100% RE ambition requires the LG to stop thinking in the short-term and focusing on economic benefit, yet to dare engage in an energy transformation and economic development building a sustainable, affordable and healthy future (Randers 2012, Randers 2013). The local government needs to enable the framework for this to happen, engaging LG officials, politicians, local stakeholders and citizens in all phases, creating a common vision together. When the strategy is well conceived and robust, the business case and investment from private and international actors are more financially viable.

Strong reduction in energy demand should be the first objective of a 100% RE vision, followed by stringent measures supporting energy efficiency and divestment from fossil fuels, together with the use of a variety of RES to cover the entire remaining consumption (Badino 2020a, Badino 2020b).

A thorough assessment of the baseline consumption is necessary, in order to define the first steps, to create a pathway towards the end goal and to foster synergy with the other policies and LG goals.

The LG could develop policies that support the implementation of the RE system to power the **commercial** and **service** sectors, aiming at the vision of a city producing and generating only “100% RE goods and services”. Considering that **knowledge-based industries (IBC), agriculture and tourism** sectors are under development, their growth



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could be coupled from the beginning with the 100% RE agenda development and implementation. RE could be included also in **port** terminals.

The introduction of policies to increase energy efficiency and RE share are among the **Government's operations** (ICLEI 2020c). This can encourage the transition to 100% RE, particularly when accompanied by a productive dialogue with the local and regional actors.

The LG can concretise its vision acting as a role model, firstly, using 100%RE in all administration energy consumption, secondly supporting investments of local stakeholders and the private sector. La Plata can, for example, act as an incubator for the green economy or as an intermediary to support group purchase of RES based solutions (such as solar cooking stoves or solar panels).

Inspiration from the World

Sharing the 100% RE vision and pathway with others can support more effective and innovative development. It is important for the LG to monitor the implementation of the strategy, improving it whenever the results are not as expected or some conditions change. Sharing doubts and failures can support others in order to avoid them, as well as learning from other pathways can help finding good solutions for the specific context or vision.

La Plata can take inspiration from **Byron Shire Council (Australia)** (Byron Shire Council 2020, Go100RE 2017, ICLEI 2020b), whose 100% RE vision includes a community scale commitment for the sectors of energy, waste, buildings, land use and transport. Biomass, hydro and solar energy systems are included in the strategy, following energy efficiency and emissions reduction measures. Examples of projects supporting the strategy implementation are the Zero Emissions Byron (ZEB) project and the presence of a community-owned solar photovoltaic energy generator. Byron Shire Council set in place strong institutional arrangements to support 100% RE strategy development and implementation, with the creation of sectoral working groups on energy, waste, buildings, land use and transport and with the involvement of the community (Badino 2020b, Badino 2020d).

Horizontal and vertical cooperation

Multi-level collaboration with other levels of government, local stakeholders, energy providers and peers around the world is key to ensure the success of the 100% RE vision. The political will to establish win-win collaborations with all the actors involved in the economy and in the energy consumption is needed to build trust and to enable the successful implementation of policies, measures and investments.

Political engagement on the 100% RE strategy has been endorsed by different political forces despite the former mayor not being elected again. The city's technical staff can further guarantee the development of the 100% RE vision. Formal political commitment and communication of the 100% RE strategy should be the next steps.



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La Plata is part of ICLEI's network, Mercociudades and the Argentine Council for International Relations (CARI). La Plata participates in the Committee of Internationalization of Cities of Argentina within the CARI (Argentine Council for International Relations), the committee is composed by the 12 most important cities in the country (ICLEI 2020c).

Partnership with the company EDELAP is needed to include a wide share of RES in the public grid. The role of the LG as incubator is key to foster investments and stakeholders' engagement. In the same way, the existing relationship that the local government has in place should be further improved, including all the actors in the workshops for development and implementation: business associations, investors, NGOs, local stakeholders, as well as specialist groups belonging to the National University of La Plata and Conicet, Business Chambers (La Plata Oeste Chamber - CALPO), Enersol Ingeniería, SMEs dedicated to innovation with the use of alternative energy, Professional Associations (ICLEI 2020c).

Awareness raising, capacity building and community engagement

The local government needs to make sure that the 100% RE vision is communicated in a clear, transparent and robust way. The context, the synergy with the community objectives and the benefits for the different parts of the society and for the businesses should be highlighted, in order to support their participation in the implementation of the development pathway.

In order for the strategy to be successful, it must include measures aiming at supporting education and training at all levels, thanks to the cooperation with schools, local universities and other local experts. Capacity and skills development on RE system designs, policies, finance, installation and urban planning, for example, is needed in order to build momentum for green economy and sustainable development based only on RES to happen.

"Through my education, I didn't just develop skills, I didn't just develop the ability to learn, but I developed confidence" - Michelle Obama



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Rosario, Santa Fe (Networking City)

Rosario is a river port, situated on the west bank of the Paraná River, located in the southern part of the province of Santa Fe, Argentina (ICLEI 2020c).



Figure 2-9 Rosario, Santa Fe (IRENA Rosario 2018)

Economy, population, infrastructure

Rosario is the third most populous city in the country, with a population of over 948,000 inhabitants (2010) and the most populous non-provincial capital city in Argentina (ICLEI 2020c). The entire population of Rosario has access to electricity (RE Roadmap 2020).

The predominant economic sectors are commerce and services, followed by the industrial sector, placing Rosario at the productive heart of Argentina and as the central urban core of the metropolitan area. Rosario is the head city of Rosario Department and it is located at the heart of the major industrial corridor of Argentina, playing the role of the main agribusiness centre and acting as the port hub of the region. The city is a major railroad terminal and it is the shipping center for the north-eastern part of Argentina, together with being specialised in the grinding and export of grains and their by-products (RE Roadmap 2020, ICLEI 2020c).



Energy use and emissions

The baseline assessment of the sectors (and relevant shares) constituting the total energy consumption of the city and of the energy sources covering each sector has not been developed yet.

Following the assessment of the GHG inventory of the City, the main contributors to GHG emissions in the city are electricity, heating (natural gas) and the packaging industry (RE Roadmap 2020, ICLEI 2020c, ICLEI SAMS 2020d).

Energy and climate policy landscape

Sustainability is one of the priorities on the Public Agenda, together with the concepts of coexistence and closeness, mentioned in the Agenda. The objective of the City of Rosario is to become a more environmentally sustainable city, thanks to the improved policies and actions on a variety of issues: local public management, private constructions, clean production methods, waste reduction, sustainable mobility, as well as where the need to mitigate and adapt to the effects of climate change is highlighted (ICLEI 2020c).

Rosario developed and presented its GHG Inventory in 2016, which is regularly updated every 2 years. The City joined the Global Covenant of Mayors for Climate & Energy (GCoM) and submitted its mitigation and adaptation inventory, as well as integrated plan (GCoM 2020). Rosario is currently¹ developing a Climate Action Plan including a Vulnerability and Risk assessment mapping (ICLEI 2020c).

Rosario has not developed an Action Plan on RE, but, following the mandate of the City, the strategy foresees renewable energy projects, as well as initiatives with a strong focus on energy efficiency to be included in the Climate Action plan.

Some projects are already being implemented:

- installation of solar water heaters in public buildings,
- Sustainable construction program,
- Replacement with LED technology in public lighting for energy efficiency,
- Photovoltaic generation pilot,
- Energy efficiency in companies (with a Sustainable Label Certification).

Two municipal regulations set obligations for inclusion of solar thermal systems in public buildings (Ordinance No. 8784/2011) and for analysing and optimising the energy consumption of buildings for heating and cooling (Ordinance No. 8757/2011).

The Sustainability agenda of the city is already including a variety of sectors and areas of intervention. 100% RE concepts and incentives could be included in all the interventions made in each of the sectors having a big potential to support the city with more ambitious climate mitigation and adaptation strategies.

¹ As of July 2020



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Rosario can play an active role in including the 100% RE transition in the cooperation and support projects and initiatives aimed at developing ambitious strategic, coordinated and integrated plans. The 100% RE vision is politically endorsed, with the willingness to participate in local and international events and to create the necessary arrangements within the city to support the strategy development and implementation in the long-term (ICLEI 2020c).

Potential for RES application

The City has not fully tapped into the potential of renewable energy, which is wide. Thanks to RES, the City can ensure energy access to the entire community, as well as a sustainable, healthy and wealthy development.

Solar and **biomass** energy have potential due to the location and climatic conditions, as well as from the large volumes of organic waste produced in the urban maintenance and agricultural production (for example, oilseed scraps) (ICLEI 2020c).

Sectoral policies potential

In order for a 100% RE pathway to happen, Rosario should, first of all, fully commit to a long-term visionary development idea, making sure that the entire administration and political actors are involved. The 100% RE ambition requires the LG to stop thinking in the short-term and focusing on economical benefit, yet to dare engage in an energy transformation and economic development building a sustainable, affordable and healthy future (Randers 2012, Randers 2013). The local government needs to enable the framework for this to happen, engaging LG officials, politicians, local stakeholders and citizens in all phases, creating a common vision together. When the strategy is well conceived and robust, the business case and investment from private and international actors are more financially viable.

Strong reduction in energy demand should be the first objective of a 100% RE vision, followed by stringent measures supporting energy efficiency and divestment from fossil fuels, together with the use of a variety of RES to cover the entire remaining consumption (Badino 2020a, Badino 2020b). A thorough assessment of the baseline consumption is necessary, in order to define the first steps, to create a pathway towards the end goal and to foster synergy with the other policies and LG goals.

The inclusion of the **productive** sector, holding high national importance (ICLEI 2020c), in the 100% RE vision, is key both to ensure the sustainable roll-out of the strategy and development of the business sector towards a sustainable future, and to make the case as a role model for other cities. Pilot and model activities could be designed and implemented, aiming at increasing awareness in daily life. For example, a strong RE use in the production of packaging could be recommended, seeing that such activity contributes to a high share in the GHG emissions (ICLEI 2020c). Sustainable construction programs can include capacity building at all levels (from schools to experts) to ensure that RES, use



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of resources, construction material assessment and sustainability concerns are included to become a status quo in the building sector.

RES can be useful also when coupled with energy efficient measures, such as energy efficiency in companies or the foreseen LED technology to replace old systems in the public lighting (ICLEI 2020c). Standalone or connected RE technologies can be designed to cover the entire consumption of the grid, providing a great example of implementation, from the LG to citizens and stakeholders. A variety of financial models can be found, such as the contracts typically stipulated with the local Energy Service Company (ESCO).

The LG can concretise its vision acting as a role model, firstly, using 100% RE in all administration energy consumption, secondly supporting investments of local stakeholders and of the private sector. Rosario can, for example, act as an incubator for green economy or as an intermediary to support group purchase of RES based solutions (such as solar cooking stoves or solar panels).

Inspiration from the World

Sharing the 100% RE vision and pathway with others can support more effective and innovative development. It is important for the LG to monitor the implementation of the strategy, improving it whenever the results are not as expected or some conditions change. Sharing doubts and failures can support others to avoid them, as well as learning from other pathways can help find good solutions for the specific context or vision.

Local renewable energy industries and activities, such as the creation of clusters for private actors, public stakeholders and research institutions, can be fostered by the local government in the community, stimulating innovation and economic development. The RE sector can become central to economic development, attracting private investments thanks to long-term policies and LG investments themselves. This was implemented, for example, by the city of **Dezhou** (China), which established a mature technology innovation system, as well as excellent capacities in engineering, research and commercialisation, stimulating RE industry and catalysing economic development in the region (IRENA Dezhou 2013). Through the proximity of activities, cities hold a number of opportunities to realise cluster effects and industrial agglomeration economies (IRENA Dezhou 2013).

In the framework of the development of RE business case in the area, local governments can play a variety of roles (Badino 2020b, IRENA Dezhou 2013):

- Provide an ambitious innovative vision for the city development towards a 100% RE sustainable future, with committed leaders;
- Concretise the vision as a driver for change, acting as incubators to create a new industry sector, attracting business development and providing the right resources to support the strategy;
- Enable policies and support sustainable investments;
- Communicate and build trust, creating additional economic value in the sector;



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- Ensure multi-level governance to foster further implementation of RE policies at other levels of frameworks, supporting citizens and stakeholders' participation in the development of the strategy itself.

Horizontal and vertical cooperation

Multi-level collaboration with other levels of government, local stakeholders, energy providers and peers around the world is key to ensure the success of the 100% RE vision. The political will to establish win-win collaborations with all the actors involved in the economy and in the energy consumption is needed to build trust and to enable the successful implementation of policies, measures and investments.

The introduction of policies to increase energy efficiency and RE share are among the Government's mandates (ICLEI 2020c). This can encourage the transition to 100% RE, particularly when accompanied by a productive dialogue with the local and regional actors. When developing the city ordinance on Solar Water heaters (IRENA Rosario 2018), the broad partnership that the city developed between governmental and non-governmental organisations played a significant role in developing the policy, contributing to the rise in ambition of the initial plan.

A local multi stakeholder working group was created in the city of Rosario, thanks to which representatives from different municipal areas for Energy and Climate Change issues can develop and implement the strategy (ICLEI 2020c).

Rosario seeks integration with other cities of the metropolitan area, while at the same time, being an active part on the international arena. The City has an ideal stance in terms of regional and international cooperation: member of ICLEI's network (www.iclei.org), UCLG - United Cities and Local Governments (<https://www.uclg.org/>), Red Argentina de Municipios frente al Cambio Climático (RAMCC) (<https://www.ramcc.net/>), Mercociudades (<https://mercociudades.org/>) among others, Vice President City of Climate Change and Sustainability of Mercociudades and member of the Council of the Argentina Municipalities Network against Climate Change (ICLEI 2020c). Also at the local level, Rosario can foster collaboration in the metropolitan areas, being the head of the Metropolitan Area and chair of the Metropolitan Coordination Body, where the policies of the different municipalities are articulated. These spaces allow the experiences developed in Rosario to be known and replicated in other cities.

Awareness raising, capacity building and community engagement

The local government needs to make sure that the 100% RE vision is communicated in a clear, transparent and robust way. The context, the synergy with community objectives and the benefits for the different parts of the society and for the businesses should be highlighted, in order to support their participation in the implementation of the development pathway.

In order for the strategy to be successful, it must include measures aiming at supporting education and training at all levels, thanks to the cooperation with schools, local



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universities and other local experts. Capacity and skills development on RE system designs, policies, finance, installation and urban planning, for example, is needed in order to build momentum for green economy and sustainable development based only on RES to happen.

An awareness campaign on resilient cities was conducted by Rosario.

“No matter where you’re from, your dreams are valid” (Lupita Nyong'o)



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3. Indonesia

Indonesia, or Republic of Indonesia (Indonesian: *Republik Indonesia*) is a country in Southeast Asia and Oceania, between the Indian and the Pacific oceans. It consists of more than seventeen thousand islands, including Sumatra, Java, Borneo (Kalimantan), Sulawesi and Papua.



Figure 3-1 Flag of Indonesia

Economy, population and sectoral considerations

Indonesia is still characterised by an uneven concentration of wealth in a limited part of the population, while the largest part of the population has low income, despite its economy growing significantly in the last decade (Wijaya et al. 2020, INDC Indonesia 2020). Reaching the NDC's and country objectives on 100% RE for electrification is going to be particularly difficult due to geographic conditions. *“Decentralised renewable energy (DRE) can increase energy access to Indonesia’s underserved regions and contributes to its National Energy Policy targets. However, existing DRE business models fail to address prevailing barriers in the sector, ranging from policy barriers, limited access to finance, and high investment risks, discouraging private investments”* (Wijaya et al. 2020).



Energy use and emissions

According to Indonesia's Ministry of Energy and Mineral Resources (MEMR), the country has significant potential for renewable energy, in particular geothermal, holding 40% of the world's reserves, followed by hydropower, solar and wind, among others. At the moment, though, the majority of Indonesia's primary energy supply comes from fossil fuels (oil, coal and gas), with only 5% of the total consumption in 2015 from RES (RUEN 2017). In 2015 the share of fossil energy in the national energy mix was as shown in Figure 3.2 (RUEN 2017).

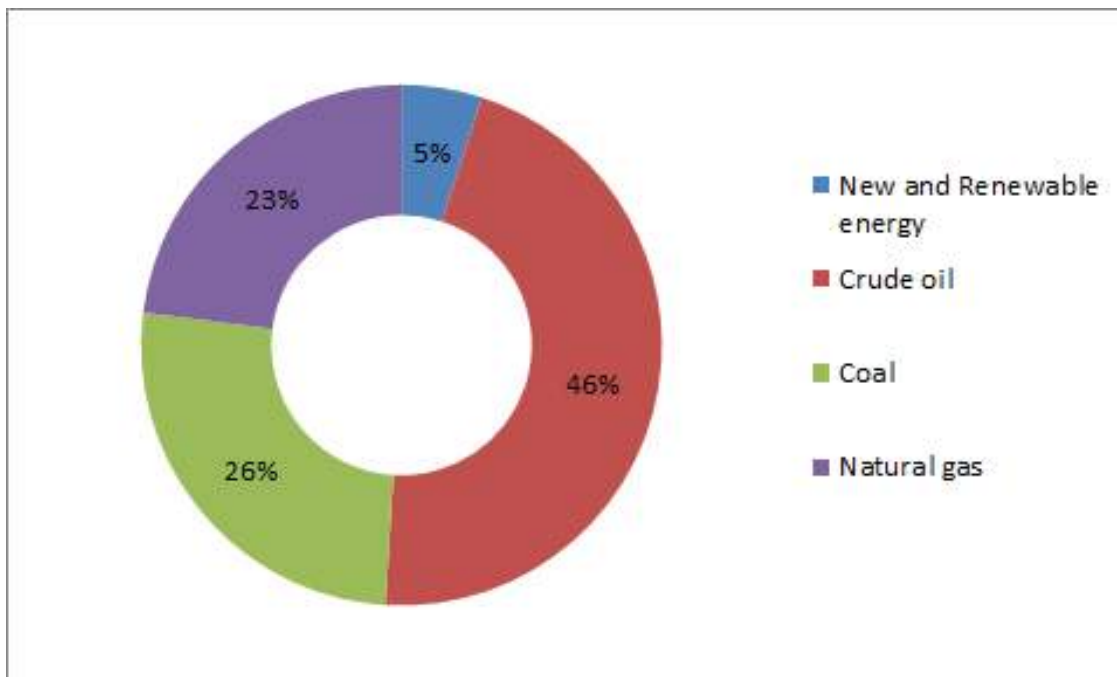


Figure 3-2 Indonesia Energy Mix in 2015 (RUEN 2017)

The National energy targets for 2019 didn't foresee any generation from RES, focusing rather on "strengthening the availability of primary energy through oil production, supported by gas and coal production" to achieve 96.6% electrification ratio (Tharakan 2015).

Decarbonisation in Indonesia is technically and economically feasible (DDPP Indonesia 2015). It requires investing specifically in low-carbon options, such as low- or zero-carbon emitting power plants, low- or zero-carbon fuel production units, and the procurement of low- or zero-carbon emitting vehicles. Moreover, a share equal to 1.22% of Indonesian GDP, decreasing in time to 0.54 % (investment that DDPP project's finding considered "perfectly manageable for the Indonesian Economy" (DDPP Indonesia 2015)), would allow the country to reach decarbonisation by a few decades (DDPP Indonesia 2015). This kind of investment, the same resource notes, must happen together with divestment from fossil fuels and reduction in fossil production. With an increased share of GDP, faster transition might be feasible.



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Energy and climate policy landscape

In 2009, Indonesia initially pledged to reduce emissions against the business as usual emission scenario by 2020: either by 26% using its own efforts or up to 41% with international support. The unconditional target by 2030 is to reduce emissions by 29% compared to the business as usual emission scenario by 2030, using its own efforts (INDC Indonesia 2020, RRI Indonesia 2020, Thamrin S. 2011). In Indonesia's National Energy plan (RUEN 2017), the country plans to use RES to cover at least 23% of the total primary energy mix by 2025 and at least 31% of the total primary energy mix by 2050 (RUEN 2017).

During the period following the Paris Agreement (2016-2018), the comparison of the carbon emissions per unit GDP with those of the prior decade (2005-2015) in Indonesia shows that emissions are not being decoupled from GDP growth (Bassi and Tamanini 2020). *"During the same period 2016-2018, Indonesia's GDP grew by 18.79% while emissions grew by 9.82%. Yet despite Indonesia's emissions per unit/GDP declining by around 1.82% annually in the years since the Paris Climate Agreement, Indonesia has not currently pledged to reduce their emissions by 2030 as they are set to nearly double (+98.15%) in the next decade, with GDP also projected to double"* (Bassi and Tamanini 2020). This presents a big problem in reaching a 100% RE vision, which should rather be used to ensure sustainable green growth for the entire country (Badino 2020b).

Horizontal and vertical cooperation

At the national level, the Ministry of Energy and Mineral Resources (MEMR) holds the most important role in the energy sector, acting as a focal point. It holds the authority to develop and issue energy policies and programs, to ensure that the energy vision stipulated in the National Energy Policy (KEN) and Plan (RUEN) is implemented at the national and local levels.

The RUEN is a general energy management direction in Indonesia that depicts the energy vision and status, GHG emission impact reduction, energy availability for national needs, energy development priority, energy utilisation and energy reserves. The RUEN is used as a reference for the development of the National Electricity Plan (RUKN). In addition, under the RUEN, the Provincial Government is appointed for the development of the Regional Energy Plan (RUED) which sets out the provincial target concerning the energy mix, including renewable energy for 2025 and 2050.

At the local level, the provincial and city/regency governments have different roles in the energy sector. At the provincial level, the Energy and Mineral Agency will be the focal point which will coordinate with the Minister of Energy and Mineral Resources (MEMR) in day-to-day tasks. This type of department does not exist at the city/regency level and the Regional Development Planning Agency (BAPPEDA) will be in charge of all planning and development tasks on its behalf, including the energy sector.



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Most of the energy authority is held by the national and provincial governments, while the city/regency government has exclusively the authority to issue the geothermal permits at the city/regency level. However, the city/regency can develop renewable energy in city-scale, such as waste-to-energy plants, as a part of the waste management sector.

Mataram City, WNT province (Networking City)

Mataram City is located on the western side of Lombok Island; it is the capital city of West Nusa Tenggara (WNT) Province and it hosts the provincial government (RE Roadmap 2020). The towns of Ampenan, Mataram and Cakranegara, located in the Mataram, are distinct but run together.



Figure 3-3 Landscape in Lombok island (Image by Herwin Prabawananda from Pixabay)

Economy, population, infrastructure

The City has a population of over 466,700 inhabitants (2019) and it is the largest and most populous area in WNT. The whole population is connected to the electricity grid.

In 2017, Mataram City had 100% electricity access (Suarantb 2017).

Mataram has become the center of government, education, commerce, industry and services. The city is served by the Lombok International Airport (Bandara Internasional



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Lombok). The first is a seaport city, the second is the governmental and office center for the province and the latter is the major commercial center on the island (Wiki 2020).

Energy use and emissions

The baseline assessment of the sectors (and relevant shares) constituting the total energy consumption of the city and of the energy sources covering each sector has not been developed yet.

Coal and diesel are the major energy sources for the City, through the State Electricity Company (PT Perusahaan Listrik Negara (Persero) - PLN). This company is an Indonesian government-owned corporation having a monopoly on electricity distribution in Indonesia and it generates the majority of the country's electrical power. Only less than 1% of the power comes from non-PLN distributors (RE Roadmap 2020, Wiki 2020).

Energy and climate policy landscape

The City government has set a commitment to develop RE and diminish dependency from fossil fuels, but there is no RE action plan in place yet. Unfortunately, there is no political mandate for the city to develop a Local Energy Plan (RUED), since this is only a role of the provincial government (ICLEI 2020c). The advancement of a clean energy development plan, strengthening multilevel governance for sustainable energy, is outlined: a 100% RE vision in the City brings opportunities for vertical and horizontal integration to achieve the national RE and NDC targets (RE Roadmap 2020).

The energy consumption is increasing due to the development of urban activities, and the priorities of the City energy policies are focused on energy saving, energy affordability, RE development and on the installation of a waste-to-energy plant using the city's solid waste (ICLEI 2020c, Lombok Post 2020).

Mataram City joined the Global Covenant of Mayors for Climate & Energy (GCoM) but has not developed an inventory or a plan yet (GCoM 2020).

Potential for RES application

Considering the scant available energy data regarding RES potential (ICLEI 2020c), a first assessment should be done to overcome such limitation, developing a database and conducting the first feasibility studies in the specific context.

The City has not fully tapped into the potential of renewable energy, which is wide. Thanks to RES, the City can ensure energy access to the entire community, as well as a sustainable, healthy and wealthy development.

Sectoral policies potential

In order for a 100% RE pathway to happen, Mataram City should, first of all, fully commit to a long-term visionary development idea, making sure that the entire administration and political actors are involved. The 100% RE ambition requires the LG to stop thinking in the



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short-term and focusing on economic benefit, yet to dare engage in energy transformation and economic development, building a sustainable, affordable and healthy future (Randers 2012, Randers 2013). The local government needs to enable the framework for this to happen, engaging LG officials, politicians, local stakeholders and citizens in all phases, creating a common vision together. When the strategy is well conceived and robust, the business case and investment from private and international actors are more financially viable.

Strong reduction in energy demand should be the first objective of a 100% RE vision, followed by stringent measures supporting energy efficiency and divestment from fossil fuels, together with the use of a variety of RES to cover the entire remaining consumption (Badino 2020a, Badino 2020b).

A thorough assessment of the baseline consumption is necessary, in order to define the first steps, to create a pathway towards the end goal and to foster synergy with the other policies and LG goals.

Waste management practices and the use of the organic fraction of collected waste to produce biofuels can be explored in the clean energy development plan.

The inclusion of strong energy demand reduction, energy efficiency and RE systems in offices and commercial activities can be a strong driver for the implementation of the 100% RE strategy of the city, providing the major economic sectors with a sustainability development vision. In the same way, the implementation of green sustainable **tourism** policies and measures, supporting the energy transformation of the sector and of the main connected activities (such as the airport and public transportation), are also building a very ambitious image of the city, and the island itself, towards the rest of the country and abroad.

The LG can concretise the vision acting as a role model, firstly, using 100% RE in all administration energy consumption, secondly, supporting investments of local stakeholders and of the private sector. The City of Mataram can, for example, act as an incubator for green economy or as an intermediary to support group purchase of RES based solutions (such as solar cooking stoves or solar panels).

Inspiration from the World

Sharing the 100% RE vision and pathway with others can support more effective and innovative development. It is important for the LG to monitor the implementation of the strategy, improving it whenever the results are not as expected or some conditions change. Sharing doubts and failures can support others to avoid them, as well as learning from other pathways can help find good solutions for the specific context or vision.

Mataram City can take inspiration from **Sweden** (IRENA 2019, NER 2015, Sweden 2020), aiming at carbon-neutrality by 2045 (net zero GHG emissions) and achieving “negative emissions” thereafter. Sweden set ambitious intermediate targets, such as having a vehicle fleet independent from fossil fuel by 2030 and 100% RE electricity production by



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2040. The political engagement of the Country is particularly interesting for Mataram: the Climate Act policy was adopted by the Swedish government in collaboration with most of the political parties in Sweden and it set the obligation for current and future governments to pursue a climate policy in line with goals, to present a climate report every year and to develop an action plan every 4 years to monitor the process, scrutinised by a politically autonomous Council (Badino 2020a, Badino 2020c).

Horizontal and vertical cooperation

Multi-level collaboration with other levels of government, local stakeholders, energy providers and peers around the world is key to ensure the success of the 100% RE vision. This seems to be particularly important for Mataram City. The political will to establish win-win collaborations with all the actors involved in the economy and in the energy consumption is needed to build trust and to enable the successful implementation of policies, measures and investments.

There is significant potential for vertical and horizontal collaboration between the province (WNT) and the city (ICLEI 2020c), which could allow for a successful development of a 100% RE vision and strategy. Thanks to further synergy with the national objectives and increased potential for implementation and financing of RE technologies (solar, hydro, geothermal), RES could replace most, if not all, fossil-fuelled power plants. The decarbonisation pathway can include the transformation of the country's economy towards a less energy-intensive one, i.e. through structural changes towards more service-oriented industries (DDPP Indonesia 2015).

Considering the monopoly of the energy distribution and generation system, collaboration and dialogue among the City, the national government and the electricity provider, PLN, is key to reach the 100% RE coverage thanks to interventions and policies supporting divestment from fossil fuels and investments in RES. Distributed electricity generation can be a parallel approach to be taken, acting as a driver for energy transformation through independence from the distribution monopoly, while creating a stand-alone RE grid for entire City districts.

Awareness raising, capacity building and community engagement

The local government needs to make sure that the 100% RE vision is communicated in a clear, transparent and robust way. The context, the synergy with community objectives and the benefits for the different parts of the society and for businesses should be highlighted, in order to support their participation in the implementation of the development pathway.

In order for the strategy to be successful, it must include measures aiming at supporting education and

"Despair shows us the limit of our imagination. Imagination shared creates collaboration, and collaboration creates community, and community inspires social change." - Terry Tempest Williams



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training at all levels, thanks to the cooperation with schools, local universities and other local experts. Capacity and skills development on RE system designs, policies, finance, installation and urban planning, for example, is needed in order to build momentum for green economy and sustainable development based only on RES to happen.

Sumbawa Regency, WNT (Networking region)

Sumbawa Regency is the local government for the islands of Sumbawa, where it is located, and Moyo (RE Roadmap 2020). Sumbawa Regency is divided into 23 administrative districts (*kecamatan*) and its capital is Sumbawa Besar (Wiki 2020).



Figure 3-4 Tambora Mountain, Sumbawa (Image by かねのり 三浦 - Kanenori from Pixabay)

Economy, population, infrastructure

Sumbawa regency has a population of 457,671 people (2019) (RE Roadmap 2020).

The island is electrified through the Sumbawa-Bima grid system and the energy access for electricity covers around 85% of the population (2017) (SambuEnergy 2017). One of the priorities of the regency is to focus on rural areas' access to electricity (RE Roadmap 2020), but it seems that fossil fuels are dominating the scene also in the development of infrastructures (SambuEnergy 2017).



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The most important contribution in the regional GDP stems from agriculture, fishery and forestry (RE Roadmap 2020). Tourism is just beginning, with a few renowned surf spots.

Energy use and emissions

The baseline assessment of the sectors (and relevant shares) constituting the total energy consumption of the regency, and of the energy sources covering each sector has not been developed yet. The electricity of the Sumbawa grid is dominated by oil and coal sources. However, high and promising renewable energy potential in geothermal, hydro, biomass and solar energy exists (RE Roadmap 2020).

Energy and climate policy landscape

There is no RE action plan in place. Unfortunately, there is no political mandate for the city to develop Local Energy Plans (RUED), since this is only the role of the provincial government. This brings opportunities for vertical and horizontal integration to achieve the national RE and NDC targets (ICLEI 2020c). A few hydro, mini-hydro and solar plants are already installed in Sumbawa (ICLEI 2020c).

Sumbawa Regency has not joined the Global Covenant of Mayors for Climate & Energy (GCoM) yet (GCoM 2020).

Potential for RES application

In the Sumbawa Development Plan, potential for the development of biogas, solar, hydro, geothermal and wind plants is identified (ICLEI 2020c).

The Regency has not fully tapped into the potential of renewable energy, which is wide. Thanks to RES, the Regency can ensure energy access for the entire community, as well as a sustainable, healthy and wealthy development.

Considering the lack of available energy data regarding RES potential (ICLEI 2020c), a first assessment should be done to overcome this limitation, developing a database and first feasibility studies in the specific context. The bankability of projects requires also the availability of good quality data, to provide investors with the needed trust in the project.

Sectoral policies potential

In order for a 100% RE pathway to happen, Sumbawa Regency should, first of all, fully commit to a long-term visionary development idea, making sure that the entire administration and political actors are involved. The 100% RE ambition requires the LG to stop thinking in the short-term focusing on economic benefit, yet to dare engage in an energy transformation and economic development building a sustainable, affordable and healthy future (Randers 2012, Randers 2013). The local government needs to enable the framework for this to happen, engaging LG officials, politicians, local stakeholders and citizens in all phases, creating a common vision together. When the strategy is well conceived and robust, the business case and investment from private and international actors are more financially viable.



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The electricity and economic targets of the region can be reached thanks to an ambitious RE development. Strong reduction in energy demand should be the first objective of a 100% RE vision, followed by stringent measures supporting energy efficiency and divestment from fossil fuels, together with the use of a variety of RES to cover the entire remaining consumption (Badino 2020a, Badino 2020b). A thorough assessment of the baseline consumption is necessary, in order to define the first steps, to create a pathway towards the end goal and to foster synergy with the other policies and LG goals.

The opportunity of a leap development for green sustainable **tourism** policies and measures including a variety of RES should be taken, supporting the energy transformation of the sector and of the main connected activities (such as public transportation), setting the scene for a green image of Sumbawa tourism towards the rest of the country and abroad.

Production scraps from **agriculture** and **forestry** could be converted into biomass and the freight related to these sectors could be electrified, in order to exploit the full potential of the renewable energy.

Considering that the RE sector is yet to be developed in the Regency, setting a target of 100% RE **governmental operations** could support the building of trust and initiate the energy transformation. Appropriate and robust step-by-step implementation of the 100% RE strategy can allow all sectors to be independent from fossil fuels.

The LG can concretise the vision acting as role model, firstly, using 100% RE in all administration energy consumption, secondly, supporting investments of local stakeholders and the private sector. Sumbawa Regency can, for example, act as an incubator for the green economy or as an intermediary to support group purchase of RES-based solutions (such as solar cooking stoves or solar panels).

Inspiration from the World

Sharing the 100% RE vision and pathway with others can support more effective and innovative development. It is important for the LG to monitor the implementation of the strategy, improving it whenever the results are not as expected or some conditions change. Sharing doubts and failures can support others to avoid them, as well as learning from other pathways can help find good solutions for the specific context or vision.

Sumbawa regency could follow the great example of **Jeju** Province (Republic of Korea) (100%RE Atlas 2020, ICLEI 2020a, Jeju 2019), which aims at 100% renewable coverage on electricity and transport sectors by 2030, on top of being a "carbon-free island" by 2030. Jeju set intermediate targets of increasing the share of RES in the total energy demand up to 50% by 2020 in order to ensure a step-by-step development and the implementation of clean energy solutions. The island was selected by the Korean Government as a test-bed for this type of vision, in the framework of Korea's commitment to reduce its GHG emissions. Jeju includes wind, solar and small hydro plants in its energy mix and it



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implements a smart grid business model with a battery-based energy system to ensure grid stability.

Horizontal and vertical cooperation

Multi-level collaboration with other levels of government, local stakeholders, energy providers and peers around the world is key to ensure the success of the 100% RE vision. The political will to establish win-win collaborations with all the actors involved in the economy and in the energy consumption is needed to build trust and to enable the successful implementation of policies, measures and investments.

There is significant potential for vertical and horizontal collaboration between the province (WNT) and the regency (ICLEI 2020c, RE Roadmap 2020), which could allow for the successful development of a 100% RE vision and strategy. Thanks to further synergy with the national objectives and increased potential for implementation and financing of RE technologies (solar, hydro, geothermal), RES could replace most, if not all, fossil-fuelled power plants. The decarbonisation pathway can include the transformation of the country's economy towards a less energy-intensive one, i.e. through structural change towards more service-oriented industries (DDPP Indonesia 2015).

Awareness raising, capacity building and community engagement

The local government needs to make sure that the 100% RE vision is communicated in a clear, transparent and robust way. The context, the synergy with the community objectives and the benefits for the different parts of the society and for the businesses should be highlighted, in order to support their participation in the implementation of the development pathway.

In order for the strategy to be successful, it must include measures aiming at supporting education and training at all levels, thanks to the cooperation with schools, local universities and other local experts. Capacity and skills development on RE system designs, policies, finance, installation and urban planning, for example, needed in order to build momentum for green economy and sustainable development based only on RES to happen.

“Effective leadership is putting first things first. Effective management is discipline, carrying it out” (Stephen Covey)



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West Nusa Tenggara (WNT) (Deep Dive Region)

West Nusa Tenggara (WNT) (Indonesian: *Nusa Tenggara Barat* – NTB) Province is composed of two main islands, namely Lombok (west) and Sumbawa island (east) (RE Roadmap 2020). It comprises the western portion of the Lesser Sunda Islands, with the exception of Bali which is a province on its own. [Mataram City](#), on Lombok Island, is the capital and largest city of the province (Wiki 2020). This province has two cities and eight regencies (RE Roadmap 2020).



Figure 3-5 Lombok Island (Image by sulox32 from Pixabay)

The landscape in the island of Lombok presents a fairly straight coastline, with the central and eastern parts in the form of mountains, while coastal lowlands are present in the east. Sumbawa Island has a jagged coastline because of the many headlands and bays and the central part is covered with hills and limestone mountains, reaching over 3,700 m a.s.l. (Mount Rinjani) (Wiki 2020).



Economy, population, infrastructure

WNT has a population of around 5,000,000 inhabitants (2019) (RE Roadmap 2020, Wiki 2020), growing at a rate of about 1.4% per year. About 53% of the population lives in cities (RUEN 2017).

Almost 99% has access to electricity (RE Roadmap 2020), yet in some areas the electricity provided is only sufficient for basic lighting and small electronic appliances which are unable to increase significant productivity. The region doesn't have an adequate energy access, it is very dependent on fossil fuels from outside the area and on imported oil with its price fluctuations (ICLEI 2020c, Casindo 2011): the electricity network is not connected between the two islands nor to the national grid (ICLEI 2020c).

The main economic sectors are tourism and agriculture (RE Roadmap 2020, ICLEI 2020c), followed by fisheries, livestock and seeds production (Wiki 2020). Dairy farms are expected to become the driving forces and levers of the economic sector, through programmes such as One million cows (Casindo 2011).

Energy use and emissions

The composition of energy use in WNT (Figure 3.6) is dominated by the transport sector by almost 53%, followed by the commercial sector (31%), the household sector (8.5%), other sectors (7.6%) and a tiny 0.1% of the industrial sector (RUED 2019).

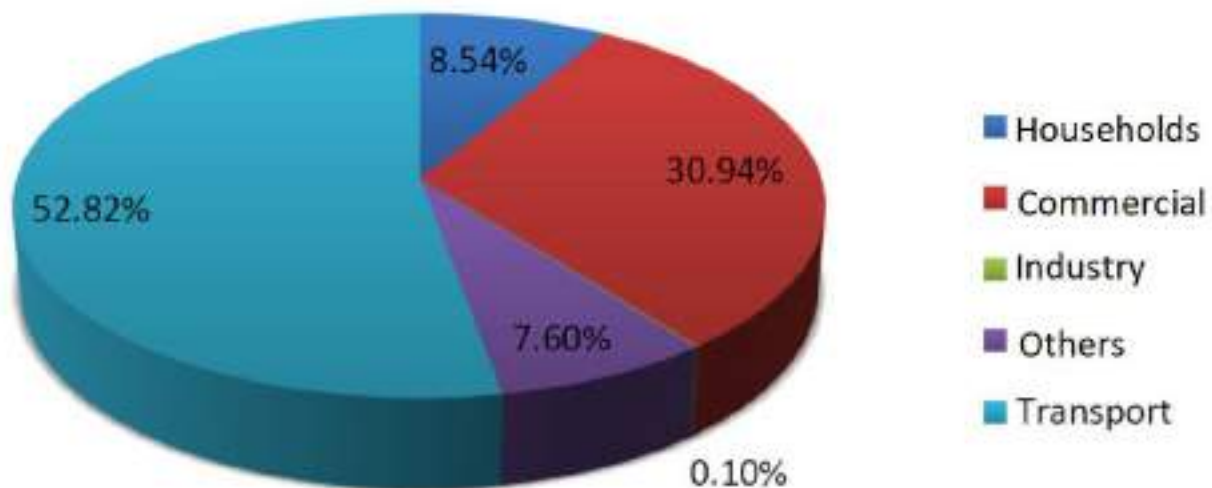


Figure 3-6 WNT energy consumption by sector (RUED 2019)

Essentially, the entire energy generation (Figure 3.7) relies on fossil fuels, with the majority being provided by diesel oil (49%) and gasoline (24%), and only 0.12% by RES (RUED 2019, Casindo 2011).

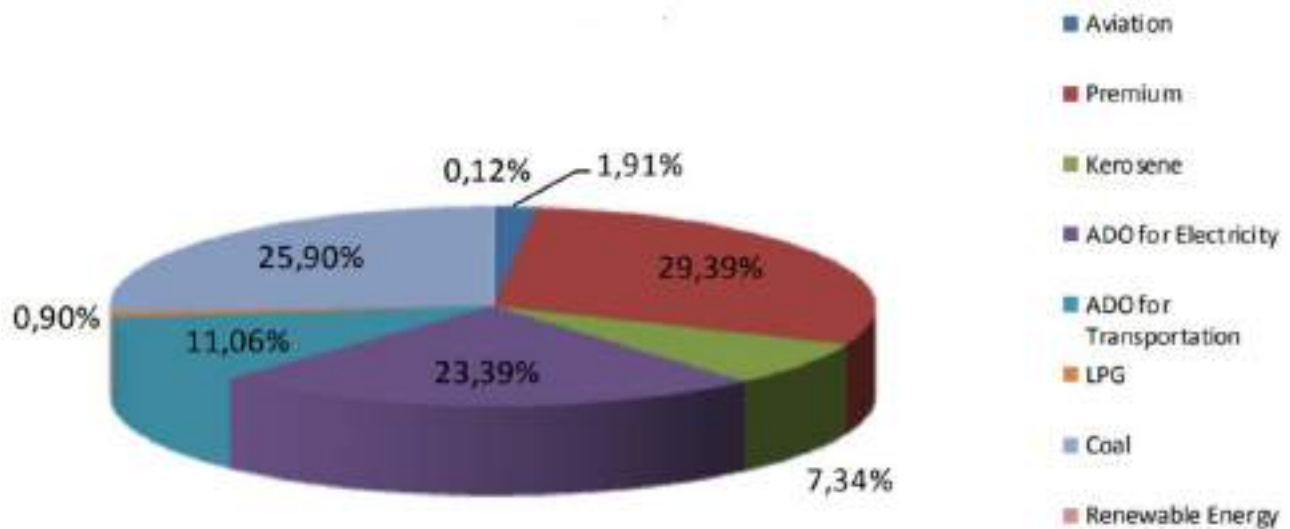


Figure 3-7 Energy generation in WNT (2010) (Casindo 2011)

Energy consumption is growing, mainly, but not limited, as a consequence of increased population and the business/tourism sectors consumption (ICLEI 2020a).

Energy and climate policy landscape

The Province of WNT has a national mandate to develop local energy plans (LEP), referring to the national energy plan (NEP). The energy sector is a priority in the local development plan (ICLEI 2020c).

The main energy issue in WNT province is energy security, as the existing grid system relies on coal and diesel plants and therefore fossil fuel import. In line with national mandates for energy development, West Nusa Tenggara Province stipulated a Provincial Energy General Plan (RUED) to determine energy targets and activity planning for energy development. In accordance with the RUED, the province set a renewable energy target in the electricity sector of 35% by 2025 and 50% by 2050, (ICLEI 2020c), with the RES share as per Figure 3.8 (RUED 2019).

| Type of Energy | 2010 | 2025 |
|------------------------|-------|---------|
| Minihydro Power Plant | - | 100,000 |
| Microhydro Power Plant | 1,274 | 2,000 |
| Solar Power | 641 | 1,500 |
| Biogas | 1,301 | 10,000 |
| Geothermal Power Plant | - | 600,000 |
| Biofuel | - | 300,000 |
| Biomass Power Plant | - | 800,000 |
| Wind Power | - | 1,500 |

Figure 3-8 WNT - RE Target in the electricity sector per source (RUED 2019)



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Photovoltaic systems are being implemented by the Government through the Rural Electricity Program, by community initiatives and by other stakeholders through Corporate Social Responsibility (CSR) funds (for example the People's Independent Electricity (PLN LIMAR) program). As the generated electricity is mostly needed in households, the highest potential lies on off-grid systems. In 2016, the construction of 20 MW Communal Power Plant was approved (RUED 2019). Programmes such as Self Sustained Energy Village have been developed, *“which aims to maintain energy supply for the community, diversifying the energy sources, increase the productivity of rural economic activities, increase employment, and improving welfare in general through the provision of renewable energy which is affordable and sustainable”*(Casindo 2011).

WNT has not joined the Global Covenant of Mayors for Climate & Energy (GCoM) yet (GCoM 2020).



Figure 3-10 Mount Rinjani in WNT (Image by Arhnue Tan from Pixabay)



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Potential for RES application

Huge is the potential of RES application in WNT province, being suitable for geothermal, wind, hydropower and solar, as well as biomass potential thanks to the utilisation of scraps and organic waste (ICLEI 2020c, Casindo 2011).

In respect of the RE Development Action Plan, it seems that the WNT province could have a bigger potential to develop **solar** energy and **wind** systems to cover a wide share of the electricity needs, but the efforts in this direction should be further increased from the current goal of 35% by 2025 (RE Roadmap 2020). With a careful planning and assessment, the topography of the islands could provide good potential for wind systems. Stepping out from fossil fuels projects implementation and divesting from the sector is a needed accompanying measure. A strategy aiming at 100% RE ensures also the energy security advocated for by the Local Government, allowing for independence from fossil fuel import.

Geothermal development in Sembalun (East Lombok Regency), Maronge (Sumbawa Regency) and Hu'u (Dompu Regency) should be further explored, provided that the environmental assessment is positive.

Many opportunities for the WNT Province come from creating off-grid **solar** networks for remote areas, fully tapping into the potential of RES and supporting remote communities in getting access to sustainable and affordable energy. RES providing thermal energy (such as solar thermal) or the electrification of the current thermal energy uses, should be fostered, in order to phase out from fossil dependence in the thermal sector.

Sectoral policies potential

In order for a 100% RE pathway to happen, WNT Province should, first of all, fully commit to a long-term visionary development idea, making sure that the entire administration and political actors are involved. The 100% RE ambition requires the LG to stop thinking in the short-term and focusing on economic benefit, yet to dare engage in energy transformation and economic development building a sustainable, affordable and healthy future (Randers 2012, Randers 2013). The local government needs to enable the framework for this to happen, engaging LG officials, politicians, local stakeholders and citizens in all phases, creating a common vision together. When the strategy is well conceived and robust, the business case and investments from private and international actors are more financially viable.

Strong reduction in energy demand should be the first objective of a 100% RE vision, followed by stringent measures supporting energy efficiency and divestment from fossil fuels together with the use of a variety of RES to cover the entire remaining consumption (Badino 2020a, Badino 2020b).

A thorough assessment of the baseline consumption is necessary, in order to define the first steps, to create a pathway towards the end goal and to foster synergy with the other policies and LG goals.



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Considering the energy sectors that most contribute to WNT consumption (RUED 2019) and its future plans (ICLEI 2020c), the primary focus of WNT's government should be in:

- the increased use of public **transport** and the electrification of the entire sector, providing the needed electricity via RES distributed systems.
- the **tourism** sector presents a high potential for RES application and green development. The same could support all the LGs composing the WNT as well as it would improve the image of the regency around the world. Considering the plan of developing 99 touristic villages, it is the right opportunity for the 100% RE vision and business case to take off. Combined with efforts to lower the energy consumption in the commercial sector, this would also contribute to reduce GHG emissions by almost 31% of the total share (RUED 2019).

Considering the focus set on this sector by previous policies, biogas produced from **dairy farms waste** can also be considered, expanding a current program implemented in WNT, (Casindo 2011, LKIJP 2018). While biomass from agricultural scraps can reduce the waste while providing energy, biomass from plantations is highly discouraged, because of the risk of depleting biodiversity and of reducing the island's appeal for tourists. Solar applications covering existing surfaces and a variety of other RES should be privileged.

Increased focus on programmes such as the Self Sustained Energy Village (Casindo 2011) should be fostered, in order to use locally available potential for RE generation, reducing the dependency from fossil fuels for lighting and cooking.

The LG can concretise the vision acting as a role model, first, using 100% RE in all administration energy consumption, as well as supporting investments of local stakeholders and of the private sector. WNT Province can, for example, act as an incubator for the green economy, or as an intermediary to support group purchase of RES based solutions (such as solar cooking stoves or solar panels).

Inspiration from the World

Sharing the 100% RE vision and pathway with others can support more effective and innovative development. It is important for the LG to monitor the implementation of the strategy, improving it whenever the results are not as expected or some conditions change. Sharing doubts and failures can support others to avoid them, as well as learning from other pathways can help find good solutions for the specific context or vision.

WNT Province can take inspiration from **El Hierro Island (Canary Islands, Spain)** (Brot für die Welt and World Future Council 2018, IRENA 2019, World Future Council 2014), which aims at electrifying the transport sector and, afterwards, at reaching 100% renewable electricity. The strategy developed by El Hierro considers the island's climate and geology and it foresees the development of a combined pumped hydro-energy storage system to manage the variability of wind generation and to guarantee the security and the quality of the power supply. The vision was developed with strong political support at the local level,



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in synergy with regional and national governments. On top of providing energy security thanks to energy efficiency and RE, the vision aims at strengthening and diversifying the local economy and at protecting the climate and the environment (Badino 2020a, Badino 2020b).

Horizontal and vertical cooperation

Multi-level collaboration with other levels of government, local stakeholders, energy providers and peers around the world is key to ensure the success of the 100% RE vision. The political will to establish win-win collaborations with all the actors involved in the economy and in the energy consumption is needed to build trust and to enable the successful implementation of policies, measures and investments.

RE development is prioritised in eastern Indonesia (ICLEI 2020c) and this could provide a good opportunity for WNT to reach 100% RE within a multi-level governance collaboration. Thanks to further synergy with the national objectives and increased potential for implementation and financing of RE technologies (solar, hydro, geothermal), RES could replace most, if not all, fossil-fuelled power plants.. The decarbonisation pathway can include the transformation of the country's economy towards a less energy-intensive one, i.e. through structural changes towards more service-oriented industries (DDPP Indonesia 2015).

Considering the 100% RE vision shared also by [Mataram City](#) and [Sumbawa Regency](#), the regional government of WNT should make sure that proper vertical and horizontal collaboration is fostered, in order to develop and implement a territorial strategy and plan, together with policies and regulations, which support the 100% RE vision of the entire area. The New and Renewable Energy Development Team established in 2020 based on RUED can play a key role in this process, creating synergy and cooperation between different contexts, with the engagement of all the departments of the administration, local and regional stakeholders.

A funding scheme considering the participation of different types of contributors is recommended, starting from the considerations reported in the RE Development plan (Casindo 2011).

Collaboration with already known relevant stakeholders (ICLEI 2020c), as well as with new local and international actors, should be fostered.

Awareness raising, capacity building and community engagement

The local government needs to make sure that the 100% RE vision is communicated in a clear, transparent and robust way. The context, the synergy with the community objectives and the benefits for the different parts of the society and for the businesses should be highlighted, in order to support their participation in the implementation of the development pathway.



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In order for the strategy to be successful, it must include measures aiming at supporting education and training at all levels, thanks to the cooperation with schools, local universities and other local experts. Capacity and skills development on RE system designs, policies, finance, installation and urban planning, for example, is needed in order to build momentum for green economy and sustainable development based only on RES.

Further development of community-solar projects can be fostered thanks to the intervention of the WNT Province, which can set the scene for the application in other parts of Indonesia as well.

“Positional leaders ignore the fact that every person has hopes, dreams, desires, and goals of his own. And leaders must bring their vision and the aspirations of the people they lead together in a way that benefits



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4. Kenya

Kenya, or Republic of Kenya (Swahili: *Jamhuri ya Kenya*), is a country located in the east of Africa, situated between Somalia and Tanzania and bordering the Indian Ocean. 80% of Kenya's territory is considered either arid or semi-arid (ASAL) (Kenya INDC 2015, ICLEI AS 2020e).

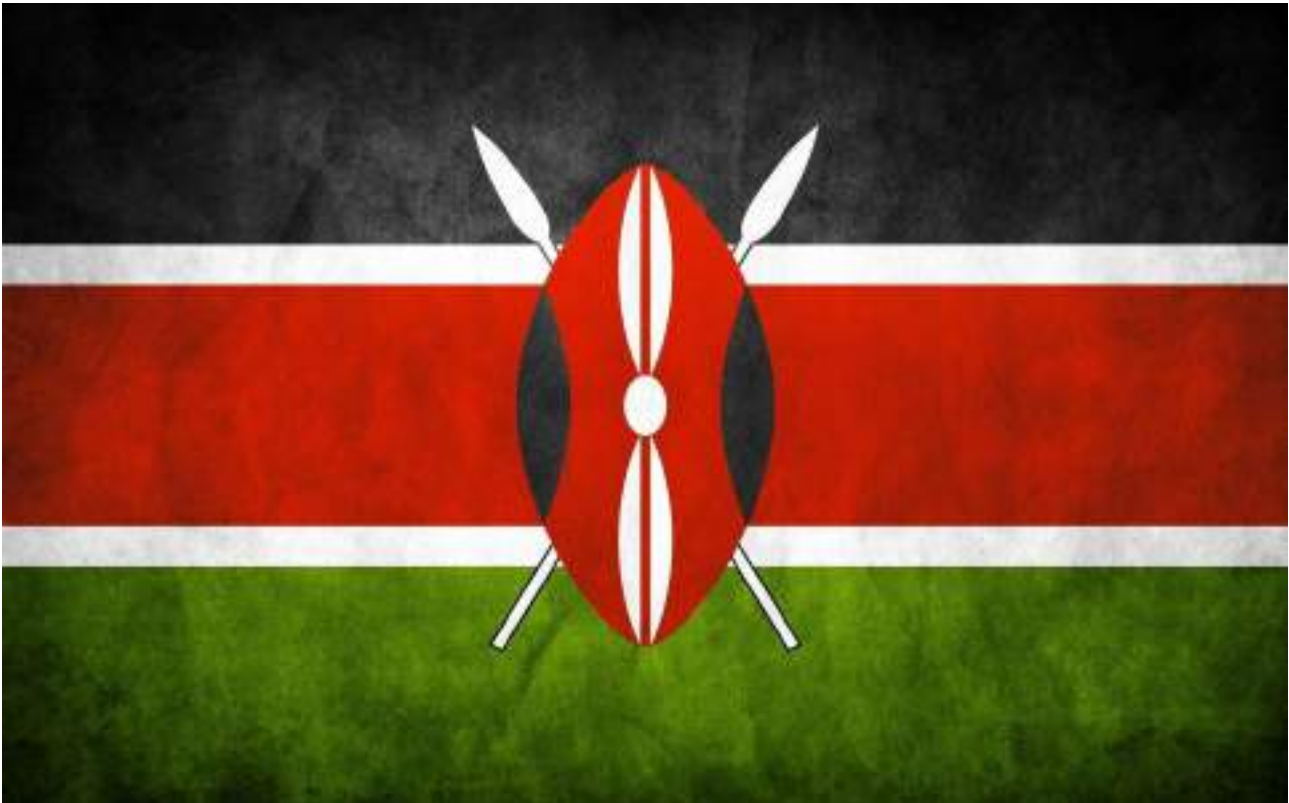


Figure 4-1 Flag of Kenya

Kenya is a democratic republic with two spheres of government: national and county (CLGF 2018).

Economy, population and sectoral considerations

The economy is based on 3 major sectors: agriculture (24.2%), industry (14.8%, mostly small-scale manufacturing) and services (62.5%, mostly tourism) (ICLEI AS 2020c).

Despite the Republic of Kenya being the fifth largest economy in sub-Saharan Africa, it is classified as a low-income country with a gross domestic product (GDP) of \$85 billion (2018) (USAID 2019). The Vision 2030 of the country is to become a middle-income country by 2030, with increased industrialisation. Still, 45% of the population lives below the poverty line and developmental challenges should be addressed (Umwelt Bundesamt



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2018). Due to the future economic costs of climate change, the GDP is foreseen to decline by about 3% per year by 2030 and about 5% per year by 2050 (SEI 2009).

Kenya is extremely vulnerable to climate change (especially droughts), as the agricultural sector is strongly reliant on weather conditions. (ICLEI AS 2020e).

Kenya is urbanising rapidly, with half of the country's population expected to live in urban areas by 2033. Currently, over 30% of Kenya's population lives in cities, thousands of individuals are moving to cities every year and 22% of the inhabitants of Kenya's five biggest cities currently live in slums (ICLEI AS 2020a).

In many urban areas across the country, the provision of basic services remains poor and the population density adds challenges to deliver proper services in cities (ICLEI AS 2020a).

In 2010, 23% (31.2 million) of people in Kenya had no access to electricity and 32.6 million had no access to non-solid fuels, with big differences between rural and urban areas. The estimates in 2018 were not very different, with access to electricity estimated to be 75% from both grid and off-grid electrification (KNES 2018, ICLEI AS 2020d).

Energy use and emissions

The national primary energy consumption is dominated by biomass (69%) (wood fuel, dung), followed by petroleum products (22%) and electricity (at only 9%). In 2015, the national energy mix (i.e. electricity) was generated by fossil fuels (36%) and a variety of renewable energy sources (geothermal energy 32%, hydroelectric 26% and less than 1% of wind and solar energy) (ICLEI AS 2020c, ICLEI AS 2020d), while in 2019 and 2020 the majority of electricity was generated by renewable energy sources and the contribution from fossil fuels was less than 10% (LEI 2020). Kenya Electricity Generating Company (KenGen) is the main player of electricity generation (77%) in the country. Transmission and distribution is largely provided through state owned companies (ICLEI AS 2020c).

75% of Kenya's total GHG emissions is generated by land use, land-use change, forestry (LULUCF) and agriculture, (Kenya INDC 2015, ICLEI AS 2020e).

The projection of the greenhouse gas emissions for Kenya can be seen in figure 4.2.

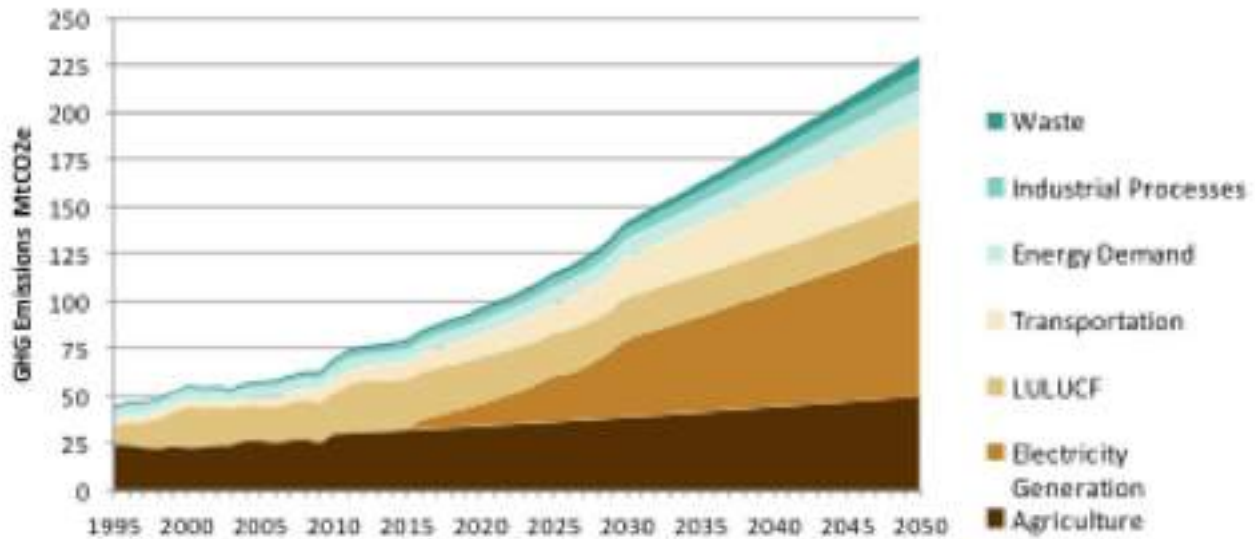


Figure 4-2 Greenhouse gas emissions baseline projection for Kenya (MtCO₂e) (Government of Kenya 2017, Kenya NCCAP 2018)

Renewable energy potential

Kenya has a considerable hydropower potential, located in five geographical regions, representing Kenya's major drainage basins: Lake Victoria basin (329 MW), Rift Valley basin (305 MW), Athi River basin (60 MW) and Tana River basin (790 MW). Currently the main hydropower generation is provided by large installations owned by the national provider (KenGen) (ICLEI AS 2020e).

Geothermal resource potential in Kenya is estimated at 10,000 MW along the Kenyan Rift Valley (ICLEI AS 2020e).

Kenya has great potential for a stable use of **solar** energy throughout the year because of its strategic location near the equator with an minimum average insolation of 4-6 kW/m² per day (REEEP 2014, ICLEI AS 2020d, ICLEI AS 2020e). A high number (200,000 estimated) of photovoltaic solar systems are currently installed in households, but this accounts only for a little more than 1% of all households in Kenya. Off-grid solar products in Kenya are also increasingly used and the solar water heating sector is growing by 20% per year (ICLEI AS 2020d, ICLEI AS 2020e).

Wind energy generation is not well developed yet, but awareness and interest are steadily growing. The existing highland and mountainous areas, the Rift Valley, the northwest and along the Indian Ocean, as well as other geographical features, were highlighted by the Kenya Renewable Energy Association as the ideal conditions for the high wind speeds required for commercial wind energy generation (ICLEI AS 2020d). A wind energy data analysis and development programme conducted in 2013 shows that the potential for wind generation is twice the current total installed capacity in Kenya (ICLEI AS 2020e).



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Kenya has substantial potential for energy generation using **biomass** resources such as animal waste or agricultural scraps, as well as the organic part of municipal waste produced by communities and the tertiary sector. In 2014, the use of biomass constituted two-thirds of Kenya's primary energy supply, mostly for residential use (ICLEI AS 2020e).



Figure 4-3 The Project cities in the Country of Kenya (RE Roadmap 2020)

Energy and climate policy landscape

The country plans to reach almost 80% of additional installed capacity from RES by 2030. The majority of RES included are geothermal, hydro, wind and solar power (Badino 2020b, Badino 2020d, Brot für die Welt and World Future Council 2018). Kenya's target is universal access to electricity by 2022 (KNES 2018).

Within the key climate policies (ICLEI AS 2020c, ICLEI AS 2020e), some useful points for the assessment of 100% RE pathways in Kenya's Counties are the following:

- the Constitution of Kenya (2010) stipulates that all citizens have the right to a clean and healthy environment
- Kenya Vision 2030 has a long-term development focus to 2030, with a vision for Kenya of an industrialised, middle-income country providing a high quality of life to all its citizens in a clean and secure environment (Kisumu CIDP 2018). The Medium-Term Plan (MTP) 2018-2022 implements Kenya Vision 2030. Economic, Social and Political focus are the main 3 pillars of the Vision 2030:



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- Economic pillar: to achieve an average economic growth rate of 10% per annum and sustaining the same until 2030, with priority sectors composing 57% of Kenya's GDP: *"Agriculture; Manufacturing; Tourism; Wholesale and retail (trade); Financial Services and Information Technology enabled services. Additional sectors included are Blue Economy and Energy and Petroleum"*(Kisumu CIDP 2018);
- Social pillar: invest in people with programmes and initiatives on the following priorities: *"Education and training, Health (Medical Services and Public services and Sanitation), Environment, Water, Housing and Urbanization, Gender, Youth and Vulnerable Groups, Labour and Manpower Development and Sports, Culture and Arts"*(Kisumu CIDP 2018);
- Political pillar: *"realizing an issue-based, people-centred, results-oriented and accountable democratic system. Strategies: areas; the rule of law-the Kenyan Constitution; Electoral and political processes; democracy and public service delivery; transparency and accountability and security, peace building and conflict management"*(Kisumu CIDP 2018).
- The Climate Change Act (2016) seeks to mainstream climate change planning in all sectors and at all levels of government providing incentives to the private sector to enable their involvement in both adaptation and mitigation and to develop business cases.
- The Energy Act (2019) promotes mitigation of climate change through energy efficiency and renewable energy (in particular, geothermal energy). It encourages local distributed generation, it provides for a Feed-in-Tariff system for electricity generation through RES and it demands the local provision of goods and employees (Energy Act 2019).
- The National Climate Change Action Plan 2018-2022 (Kenya NCCAP 2018) aims at achieving a low carbon climate resilient development. Among the priority interventions are: climate-proof energy and transport infrastructure; electricity supply based on renewable energy; transition to clean cooking; sustainable transport systems. While reducing GHG emissions is critical, Kenya prioritised mitigation actions that have adaptation and sustainable development benefits.
- Kenya's Nationally Determined Contribution (NDC) (2017) mitigation goals rely on emission reductions in several sectors, namely Land Use, Land-Use Change and Forestry (LULUCF) sector and they include expanding renewable energy sources (e.g. geothermal, solar and wind), increasing tree cover density to at least 10% (from a current level of 6.2%) and adopting practices that sustainably increase productivity and build resilience to climate change impacts in agriculture (ICLEI AS 2020e).
- Public Private Partnership (PPP) Act (2013) (amended in 2017) aims at creating an attractive environment for investments that will extend the scope of PPPs to cover



economic (including for power generation) and social infrastructure projects (including solid waste management facilities).

- Kenya Green Economy Strategy and Implementation Plan 2016-2030 is geared towards enabling Kenya to attain a higher economic growth rate consistent with the Vision 2030, which firmly embeds the principles of sustainable development in the overall national growth strategy (Kenya 2016).

Several projects and programmes of activities were developed by Kenya on Clean Development Mechanism (CDM), in sectors such as reforestation, energy efficiency, geothermal, wind and hydro. For example, Kenya also hosted two projects issuing voluntary carbon credits: the Kasigau Wildlife Corridor REDD project on forestry and the Kenya Agriculture Carbon project for sequestering carbon in soil (Kenya NCCAP 2018).

Among the key strategies, investment projects target grid and transmission lines expansion and large-scale hydro projects. One on-grid solar project and three off-grid projects are listed among the investment opportunities. 57% of households will be using improved cook stoves run on solid biomass (char-coal and firewood) by 2030 (Brot für die Welt 2018).

Each County in Kenya prepares a **County Integrated Development Plan (CIDP)** for a 5 year period that covers economic, sectoral and spatial plans; prioritising projects and informing the county budget. First CIDPs were in 2013-17 and they were found to be unrealistic, non-actionable. The counties currently have a new and second generation of CIDP from 2018-22 period. Additionally, each county must prepare a 10-year **County Spatial Plan** and a **County Sectoral Plan** (ICLEI AS 2020c).

Horizontal and vertical cooperation

All County governments shall develop a County Energy Plan and a planning framework for public funds is needed (County Governments Act 2012, Energy Act 2019). Vertical cooperation and collaboration can improve with a less centralised process of governance (ICLEI AS 2020c).

Kenya's budget process is strongly sectoral as financial allocation leaves limited room for cross-cutting issues such as climate change, mostly financed by development partners instead. Yet, Counties are not empowered to align donor-driven projects and national funds to local priorities and needs, neither to effectively implement projects because of the Country policy framework (ICLEI AS 2020c).

The Kenya Cities Forum (KCF) was established by stakeholders to explore and formulate options available for the financing of urban infrastructure development and services. The forum is composed of members drawn from the county governments of Nairobi, Mombasa, Kisumu, Nakuru and Uasin Gishu (ICLEI AS 2020c).



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Important stakeholders in the country include potential financiers like the KfW development bank, the Agence Française de Développement (AfD), the African Development Bank (AfDB) and the EU Delegation to Kenya, as well as the Civil Society Organisations (CSOs) and other local partners (ICLEI 2020b, ICLEI AS 2020c).

Kisumu County (Deep dive region)

The county hosts the third largest city in Kenya, Kisumu city, which serves as the County's headquarters. There are five major urban centers; Ahero, Katito, Muhoroni, Chemilil and Maseno. Other emerging fast-growing centers include Awasi, Pap-Onditi, Holo, Kombewa and Sondu.



Figure 4-4 Lake Victoria (Image by Reinout Dujardin from Pixabay)

Economy, population, infrastructure

Kisumu county is composed by a diverse background comprising urban and rural areas as well as a rich ethnic, racial and cultural diversity.

Kisumu County's population is estimated at just over 1.2 million (2018) and it has an average population density of 610 persons per square kilometre (2018), much higher than the national average of 66 people per square kilometre. Kisumu city counts a population of



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over 1,150,000 inhabitants in 2019 (Kenya 2019) and it has a population density that is significantly above the national average, making the provision of urban services difficult.

Around 50% of the total population lives in rural areas, depending on land for subsistence and economic purposes. 40% of the remaining population living in urban areas (around a quarter of the total population) reside in informal settlements (Kisumu CIDP 2018).



Figure 4-5 Obunga Informal settlement in Railways ward (CIDP 2018)

As of 2015, electricity access covered 46% of the population. According to the CIDP, the County targets to increase electrification by 90% by the end of the plan implementation period (2022) through a partnership program between the County Government and the Rural Electrification Authority - now known as the Rural Electrification and Renewable Energy Corporation (REREC) (Energy Act 2019).

The county's strategic position serves as a gateway for Kenya into the rest of the African Great Lake region. It is located on the shores of Lake Victoria and it serves as the **main commercial and transport hub** for the Western part of Kenya and the East African region. Kisumu was identified as a special economic zone (SEZ). **Trade, farming and fishing** are the major economic activities. The County's vision is to create a prosperous and dynamic county that is a harbour of excellence (Kisumu CIDP 2018). The **trade** sector was identified as a key engine to the economy due to its immense contribution to Kenya's GDP and employment creation through trade and investments, while the Kisumu Governor's campaign promise includes the promotion of the use of sustainable energy sources in the industrial and service sectors (RE Roadmap 2020).



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Energy use and emissions

The baseline assessment of the sectors (and relevant shares) constituting the total energy consumption of the city and of the energy sources covering each sector has not been developed yet. Though, it is known that thermal energy comes mainly from wood fuel, fuel oil, agricultural residues and other oil products. Over 87% of households in the County rely on traditional use of biomass for cooking. The use of firewood, charcoal and paraffin for cooking is prevalent in the County at 58%, 29% and 7% respectively. In some cases, biogas plants as pilot projects have been installed as alternative sources of energy to wood fuel (RE Roadmap 2020).

The main sources of renewable energy that are exploited in the County for electricity generation are **hydropower and biomass**. The County has two hydro plants: Sondu Miriu and Sang'oro which contribute with 60 MW and 20.2 MW respectively to the national grid (RE Roadmap 2020).

Solar energy exploitation is mainly related to commercial application solar systems (which compose three quarters of the current installed capacity), off-grid solar power systems (powering markets, health centers and other social amenities) and solar house systems (distributed to schools and community social organisations).

Kisumu prioritised the following turnkey investments (Kisumu CIDP 2018):

- Increased use of solar and wind energy for industrial and domestic use;
- Solar electricity generators for water heating and electricity generation;
- Wind power generation;
- Integrated solid waste management;
- Biofuel production;
- Promotion of water treatment technologies (e.g. reverse osmosis processes that rely on energy).



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Figure 4-6 Sang'oro turbine (Sondu- Miriu hydro electric power station) (CIDP 2018)

Energy and climate policy landscape

The CIDP II integrates the Kenya Vision 2030 and its MTP III, the Sustainable Development Goals and other sectoral plans. The central focus of the Governor's Manifesto of the CIDP "Kisumu Stand Up" is on job creation and on ending poverty through sustainable development in agriculture, industry and service sectors. The following key priorities are identified, in order to create "a peaceful and prosperous County where all citizens enjoy high quality life and a sense of belonging" (Kisumu CIDP 2018).

1. Revitalising agriculture for food security and agribusiness;
2. Ensuring a healthy population living in a clean and secure environment;
3. Modernising infrastructure;
4. Promotion of skills development and innovation;
5. Conservation of environment while opening the Kisumu lake-front for business;
6. Promotion of decent housing;
7. Promotion of sports, culture and arts;
- 8. Promotion of sustainable energy sources in industrialisation and service sector development;**
9. Promotion of tourism driven by culture and heritage;
10. Deepening the structures of devolved governance.

There is currently no RE specific Action Plan. There is, however, the draft of a sustainable Energy Policy and of the County Energy Masterplan (2017). Though, under the county's



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CIDP, in the Renewable Energy for Sustainable development Program, the following key sub-programs are proposed for the 2018-2022 implementation period:

- Solar flood lights for powering markets, schools and health facilities
- Integrated Solar-powered Water pumping from boreholes
- Community Solar Integrated power box installations in 4 sub counties.

The promotion of the design, development, standardisation and commercialisation of products and services, as well as the objective of facilitating the use of renewable energy technologies are also mentioned.

In the CIDP, the highlighted Policy Strategy and Intervention includes a variety of renewable energy sources (RES): Hydropower energy, Biomass, Solar energy, Mini-hydro, Wind, Agro-waste and Municipal waste (Kisumu CIDP 2018).

Among the actions foreseen in the CIDP II, the development of an Integrated Resource Plan (IRP) is mentioned, as a platform for the development of alternative energy generation (Kisumu CIDP 2018).

Kisumu joined the GCoM, and it set a climate adaptation target (GCoM 2020). The County is planning to be part of the Covenant of Mayors in Sub-Saharan Africa (CoM SSA).

Potential for RES application

The County has not fully tapped into the potential of renewable energy, which is wide. Thanks to RES, the County can ensure energy access to the entire community, as well as a sustainable, healthy and wealthy development.

In line with the Human development approach and the Energy Access chapter mentioned in CIDP II (Kisumu CIDP 2018), opportunities come from creating off-grid solar networks for remote areas, fully tapping into the potential of RES and supporting remote communities to get access to sustainable and affordable energy. RES providing thermal energy (such as solar thermal) or the electrification of current thermal energy usages, should be fostered, in order to phase out fossil fuel dependence in the thermal sector.

Kisumu County has potential for developing small to medium **hydro** power plants (Kisumu CIDP 2018). The County also receives an estimated 5 kW/m² per day of **solar** energy throughout the year (Kisumu CIDP 2018), making the use of solar energy in the County's energy mix a viable solution. Solar photovoltaic applications could go beyond commercial application, but they should be exploited to improve security of urban and rural areas with stand-alone solar systems (ICLEI 2020c). They could also cover available surfaces such as rooftops or used to shade particular plantations, as well as off-grid wind farms could also be combined with agricultural land.

In the framework of the expansion and modernisation of Kisumu Airport and in the revamping of Kisumu Port, all the available surfaces could be covered with solar panels, providing for the energy consumption of the airport.



Biofuels could be generated from cattle and livestock activities or be part of the waste management plans of Kisumu County. The community generates about 5,720 tons of solid waste per day, of which two third is organic (Kisumu CIDP 2018). This can give opportunity for using this part as biogas. In the waste management process, RES can also be used to fuel the freight collection and transport of waste, as well as to power the buildings of the waste facilities (ICLEI 2020c). The environmental impact of the gasification projects, though, should be well assessed in the long-term, considering as first priority the need to reduce waste at the source and not energy generation.

Sectoral policies potential

In order for a 100% RE pathway to occur, Kisumu County should, first of all, fully commit to a long-term visionary development idea, making sure that the entire administration and political actors are involved. The 100% RE ambition requires the LG to stop thinking in the short-term and focusing on economic benefit, yet to dare engage in an energy transformation and economic development building a sustainable, affordable and healthy future (Randers 2012, Randers 2013). The local government needs to enable the framework for this to happen, engaging LG officials, politicians, local stakeholders and citizens in all phases, creating a common vision together. When the strategy is well conceived and robust, the business case and investments from private and international actors are more financially viable.

Strong reduction in energy demand should be the first objective of a 100% RE vision, followed by stringent measures supporting energy efficiency and divestment from fossil fuels together with the use of a variety of RES to cover the entire remaining consumption (Badino 2020a, Badino 2020b). A thorough assessment of the baseline consumption is necessary, in order to define the first steps, to create a pathway towards the end goal and to foster synergy with the other policies and LG goals.

In the case of Kisumu County, policies for the development of the RE system could support the development of sustainable solutions in **industrial parks**. The rooftops of industrial facilities could be covered with solar panels and the heat of waste water from industrial processes could be deployed for heating and cooling purposes.

Also in the **transport** sector there is big potential for RES application:

- Electric mobility opportunities can be given by the electric motorcycle pilot project recently started in Kisumu (ICLEI 2020c), as well as by the expansion of the railway transport foreseen by the County.
- The development of a sustainable green public transport connecting the city with the outskirts and with the airport could be included in the plan, to avoid over densely populated areas and to keep the economy running outside the city centers. Electric buses or trams, charged with solar systems, would be the preferred alternative, but also biofuel can support.



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- Inland water transport systems and the freight involved in the revamping of the port could also be fuelled with RES.

Tourism is another sector where potential for RES can be used in Kisumu County.

- Policies can be developed, requiring hotels, amusement parks, conference areas, tourist attractions and activities, as well as the transport sector to assess their use of energy and resources and to use RES for their energy consumption.
- Collaborations with Tourism Fund and Tourism Finance Corporation could be sought.
- Educational and research tourism, already among the possible potential areas for CIDP, could be used to further explore the potential of RES in the sector.

Sustainable ways for cooking should be sought, enabling the business case for alternative solutions to fossil fuels.

The LG can concretise the vision acting as a role model, firstly, using renewable energy sources to cover the entire energy consumption of the LG administration, secondly supporting investments of local stakeholders and the private sector. Kisumu County can, for example, act as an incubator for the green economy or as an intermediary to support group purchase of RES based solutions (such as solar cooking stoves or solar panels).

Inspiration from the World

Sharing the 100% RE vision and pathway with others can support more effective and innovative development. It is important for the LG to monitor the implementation of the strategy, improving it whenever the results are not as expected or some conditions change. Sharing doubts and failures can support others to avoid them, as well as learning from other pathways can help find good solutions for the specific context or vision.

Kisumu County can take inspiration from **Sannich (Canada)** (100% RE Atlas 2020, ICLEI 2020a, Saanich 2017), which set a 100% RE community-wide target (electricity, heating and cooling, transportation) by 2050. The City defined two middle steps before the target year: reduce GHG emissions by 33% in the community and by 50% in municipal operations by 2020, based on 2007 levels, with a focus on systems framework to identify potential areas of intervention across sectors. The role model played by the city inspired the neighbouring communities to action (Badino 2020a, Badino 2020d).

Other suggestions can come from the city of **Sydney (Australia)** (Sydney 2020, World Future Council 2014), aiming at reaching 100% RES community-wide (electricity, heating and cooling) by 2030. Sydney's strategy put strong emphasis on bioenergy and tri-generation technologies (namely, integrated production of heating, electricity and cooling), including also solar PV and wind technologies. After the city declared the state of climate emergency, in July 2020, a new agreement with an innovative renewable energy company, Flow Power, was planned, to ensure that all the operations of the City of Sydney, including pools, sports fields, depots and buildings and the historic Sydney Town Hall, would be



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powered by 100% RES. The City identified 13 enabling actions to implement the strategy and developed a detailed mapping analysis of the city to ensure robust and data-driven measures (Badino 2020a, Badino 2020d).

Horizontal and vertical cooperation

Multi-level collaboration with other levels of government, local stakeholders, energy providers and peers around the world is key to ensure the success of the 100% RE vision. The political will to establish win-win collaborations with all the actors involved in the economy and in the energy consumption is needed to build trust and to enable the successful implementation of policies, measures and investments.

Kisumu county can use the 100% RE vision and the collaboration with the other Counties supported by the project to lobby and advocate towards the national government, for the creation of an enabling framework and facilitating financing regulations (ICLEI AS 2020c).

The CIDP II was developed and implemented through an inclusive and consultative process to ensure public participation in public policy-making, including citizens and external stakeholders. Partnership with the national government and external partners was sought, in order to mobilise human, financial and technical resources and to reach the objectives of the plan. The structure of the county government was innovated in order to increase efficiency and efficacy of the implementation (Kisumu CIDP 2018). A Public Private Partnership (PPP) framework is also foreseen to allow more private investments (Kisumu CIDP 2018) and Kisumu County Government is committed to managing foreign investments through well-designed sectoral policies.

The County has already good horizontal cooperation in place, as well as engagement of citizens and stakeholders in the development of the plan. The County should pursue collaboration among different offices and institutions of the County, including the County Assembly, constitutionally mandated to undertake the legislative oversight and representation role on behalf of the County, and the Kisumu County Public Service Board (CPSB), developing and implementing human resource policies and frameworks for the government of the County, in line with the relevant laws (Kisumu CIDP 2018).

Potential collaboration can take place with universities, such as Maseno University or the Maseno Agricultural Training Center and the Agribusiness hub in Ahero Town. Collaboration with the artisanal sector can take place, in order to embed RES into products and on the rooftops of the laboratories. Kisumu Department of Trade and Energy publicly indicated willingness to associate with strategic partners in order to set up solar energy panels to spur the growth of cottage industries (ICLEI 2020c).

The County can search for collaboration with Micro, Small and Medium Entrepreneurs (MSME), major drivers of the economy according to CIDP (Kenya CIDP 2018), and support them in solving their challenges for development, including RE for their activities. Policies could support, for example, bundling demand and facilitating access to credit, as well as capacity building in the RE system to further develop green jobs and sustainable green economy.



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Collaboration with financiers, such as the Central Bank of Kenya located within Kisumu Central Business district, to support RES advancement can be developed.

Awareness raising, capacity building and community engagement

The local government needs to make sure that the 100% RE vision is communicated in a clear, transparent and robust way. The context, the synergy with the community objectives and the benefits for the different parts of society and for the businesses should be highlighted, in order to support their participation in the implementation of the development pathway.

In order for the strategy to be successful, it must include measures aiming at supporting education and training at all levels, thanks to the cooperation with schools, Kisumu University and other local experts. Capacity and skills development on RE system designs, policies, finance, installation and urban planning, for example, is needed in order to build momentum for green economy and sustainable development based only on RES to happen.

Kisumu can act as an intermediary for group purchase in the RES system for the private and business sectors.

The use of the vibrant community, performing visual and performance art, music, fashion and textiles designers, can be a great collaboration in Kisumu County to raise awareness on RE, environmental concern, resource use, local and climate sustainable development.

Mombasa County (Networking region)

Mombasa County is located in the South Eastern part of the Coastal region of Kenya (RE Roadmap 2020). The county and the city are divided into four divisions:

1. Mombasa Island – 14.1 km²
2. Chagamwe – 54.5 km²
3. Likoni – 51.3 km²
4. Kisauni - 109.7 km²

“We will stop walking with the chicken and begin to fly with the eagles” Hon. Prof. Peter Anyang’ Nyong’o (Kisumu CIDP 2018)



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Figure 4-7 Mombasa Old Port (Image by Melvin Cox from Pixabay)

Economy, population, infrastructure

The County enjoys proximity to an expansive water mass as it borders the exclusive economic zone of the Indian Ocean to the East (RE Roadmap 2020). It is the smallest County in Kenya, covering an area of 219.9 km² (excluding 65 km² of water mass), yet Mombasa County has the fourth highest average contribution to Gross Domestic Product (GDP) in Kenya at 4.7%. Mombasa County is located in the strategic location within the Northern Economic Corridor (NEC) which connects Mombasa to the rest of East African nations. NEC is the most significant multi-modal corridor in East Africa (MGCMP 2017).

The county has a population of approximately 1.5 million people, with a density around 5,500 people per km² (ICLEI 2020c), much higher than the national average of 66 people per km². Between 2015 and 2040, the population is expected to grow by 2.4 times (mostly on mainland North) and the economy by 5.2 times (MGCMP 2017).

24% of Mombasa residents live in slum areas (ICLEI AS 2020a, ICLEI 2020c).

The figures on energy access are not available, as well as the overview of the main sectors contributing to the County economy.

Energy use and emissions

The baseline assessment of the sectors (and relevant shares) constituting the total energy consumption of the city and of the energy sources covering each sector has not been developed yet.

Though, it is known that Mombasa's main source of energy for cooking and lighting is paraffin which accounts for 53.6%. The other sources of energy used for cooking are



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charcoal (30%), firewood (8.8%), LPG (4.7%) and electricity at only 1.7%. The use of electricity for lighting stands at 47.5% (RE Roadmap 2020, ICLEI 2020c).

Most industries in the county rely entirely on electricity as a source of energy (ICLEI 2020c).

Energy and climate policy landscape

The county's County Integrated Development Plan (CIDP) includes motivation for putting in place a legal and regulatory framework for solar and wind energy resource potential. There is a renewed emphasis on modernisation of Mombasa County's energy infrastructure, with a special focus on development of renewable, affordable and reliable energy sources, as well as on the expansion of the rural electrification program (RE Roadmap 2020).

Mombasa Gate City Master Plan (MGCMP) aims at improving urban conditions and at strengthening logistics conditions which contribute to improving Northern Economic Corridor as a gate city, with target year 2040 (MGCMP 2017).

The city Master Plan (MGCMP 2017) was prepared together with local stakeholders and participation activities, communicated in a variety of media.

The implementation of the Master Plan doesn't seem to foresee any RES yet, presenting big potential for the inclusion of RES in a variety of priority projects, in any of the sectors included: transport, urban infrastructure, social and public facility, tourism and urban management (MGCMP 2017). The County renewed the focus on the modernisation of the energy infrastructure, with a special focus on the development of renewable, affordable and reliable energy sources (ICLEI 2010c).

Public engagement and information campaigns took place to involve citizens and stakeholders, in the form of meetings, civic education, essays and art competitions, on top of advertisement and media coverage. Technical working groups were organised for the development of the Master Plan, including those on land use, settlements, socio-economy, transport, social and environmental considerations, tourism, infrastructures and governance.

Supporting policies/strategies (ICLEI 2020c)

- As per the county's CIDP, the aim is to put in place a conducive legal and regulatory framework that will guide the RE potential;
- Within the General Economic and Commercial Affairs sectors, a primary developmental objective is the provision of factual data and information to support policy formulation;
- Expansion of the rural electrification program;
- Installation of power lines and connection to grid;
- Encouragement for the use of alternative energy; formulation and implementation of policies and of a regulatory framework.



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No RE action plan is in place. The county's CIDP Sector Programs for the Energy Sub-sector include (ICLEI 2020c):

- Renewable energy Policy development;
- Database of licensed Renewable Energy players developed;
- Identification of potential renewable energy generation areas;
- Formation of green energy promotion forums;
- Renewable energy centers;
- Energy efficient cooking stoves.

Mombasa has not joined the Global Covenant of Mayors for Climate & Energy (GCoM) yet (GCoM 2020), but it was selected as CoM SSA pilot city, with which the 100%RE strategy will be aligned (ICLEI 2020c).

Potential for RES application

The county has a high potential for the generation of solar and wind energy, which are unexploited (ICLEI 2020c) and it presents favourable conditions for geothermal energy development (RE Roadmap 2020). Thanks to RES, Mombasa County can ensure a good living environment, access to education and a quality health care system in health infrastructures.

On top of providing energy in remote areas, RE stand-alone systems can also be used as adaptation measures to secure reliable, affordable and sustainable power supply, in case of blackouts or temporary lack of energy in an area, in line with the objectives of the MGCMP (MGCMP 2017).

It is estimated that the metropolitan area of Mombasa produces approximately 700-750 tons of bio waste per day, which could be used as **biomass**. Only 30% of the waste generated in the County is collected. Opportunities for establishing a waste-to-energy system exist, composting organic waste for biogas generation (ICLEI 2020c).

Sectoral policies potential

In order for a 100% RE pathway to happen, Mombasa County should, first of all, fully commit to a long-term visionary development idea, making sure that the entire administration and political actors are involved. The 100% RE ambition requires the LG to stop thinking in the short-term and focusing on economic benefit, yet to dare engage in an energy transformation and economic development building a sustainable, affordable and healthy future (Randers 2012, Randers 2013). The local government needs to enable the framework for this to happen, engaging LG officials, politicians, local stakeholders and citizens in all phases, creating a common vision together. When the strategy is well conceived and robust, the business case and investments from private and international actors are more financially viable.

Strong reduction in the energy demand should be the first objective of a 100% RE vision, followed by stringent measures supporting energy efficiency and divestment from fossil



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fuels, together with the use of a variety of RES to cover the entire remaining consumption (Badino 2020a, Badino 2020b).

A thorough assessment of the baseline consumption is necessary, in order to define the first steps, to create a pathway towards the end goal and to foster synergy with the other policies and LG goals.

The **transport** development strategy provides opportunities to include RE strategies in the creation of the “infinite industrial loop” connecting Kilindini Port, the bulk cargo terminal in Shimanzi, Moi International Airport, the Kipevu Container Terminal and new berths, berths and future development sites in Tsunza and Dongo-Kundu with a well-developed and high-quality highway network (MGCMP 2017).

The region-wide road transport network can also be supported by RE strategies, from biofuels stations, to stand alone solar systems covering the needs of facilities along the road.

The enhancement of the tourist circuit (MGCMP 2017) could also take into consideration sustainable transport services to connect the destinations.

Inclusion of RES systems (such as solar or geothermal networks) in the development of infrastructures for **telecommunication** can have huge potential.

Bamburi Cement factory is rehabilitating its **quarries** by planting trees as a future source of energy for its manufacturing plant (ICLEI 2020c). Suggested interventions are mainly concentrated on solar and wind, keeping trees as carbon sinks and for the restoration of natural resources.

Solid waste management facilities can use RE generated within the facility for their operations and for the waste collection freight, in the framework of an improvement of the waste management system as a whole.

Tourism is another sector where potential for RES can be used in Mombasa County. Policies requiring the need to consider RES for tourism products and activities can be developed, ensuring also the protection and preservation of natural resources, transforming, therefore, the entire sector.

The LG can concretise the vision acting as role model, first, using 100% RE in all administration energy consumption, as well as supporting investments of local stakeholders and of the private sector. Mombasa County can, for example, act as an incubator for green economy or as an intermediary to support group purchase of RES based solutions (such as solar cooking stoves or solar panels).

Inspiration from the World

Sharing the 100% RE vision and pathway with others can support more effective and innovative development. It is important for the LG to monitor the implementation of the strategy, improving it whenever the results are not as expected or some conditions



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change. Sharing doubts and failures can support others to avoid them, as well as learning from other pathways can help find good solutions for the specific context or vision.

Mombasa County can take inspiration from **Hawaii (USA)** (IRENA 2019, Hawaii 2020, Sierra Club 2020), aiming at becoming energy self-sustaining with 100% RE by 2045. All possible RES (solar, wind, geothermal, hydro, ocean, biomass and biofuels) have been included in the strategy, which aims at diversifying the energy portfolio while connecting and modernising the grid. All policy making decisions made by the governments have been participated by utilities and consumers and community-based RE systems in farms were included in law measures. All energy utilities are required to generate 100% of the energy they provide with RES. Using its position as a test bed for 100% RE, the strategy of Hawaii supported the creation of a robust clean energy industry, accelerating innovation and stimulating economic growth (Badino 2020a, Badino 2020c).

Horizontal and vertical cooperation

Multi-level collaboration with other levels of government, local stakeholders, energy providers and peers around the world is key to ensure the success of the 100% RE vision. The political will to establish win-win collaborations with all the actors involved in the economy and in the energy consumption is needed to build trust and to enable the successful implementation of policies, measures and investments.

Mombasa can seek for example cooperation with the “*Jumuiya ya Kaunti za Pwani*”, as a mean to develop cross-county project developments, socio-economic interventions and to support green growth and RES business case in Kenya, tackling common challenges together.

Awareness raising, capacity building and community engagement

The local government needs to make sure that the 100% RE vision is communicated in a clear, transparent and robust way. The context, the synergy with the community objectives and the benefits for the different parts of the society and for the businesses should be highlighted, in order to support their participation in the implementation of the development pathway.

In order for the strategy to be successful, it must include measures aiming at supporting education and training at all levels, thanks to the cooperation with schools, Kisumu University and other local experts. Capacity and skills development on RE system designs, policies, finance, installation and urban planning, for example, is needed in order to build momentum for green economy and sustainable development based only on RES to happen.

“Kumkata kobe kichwa - It requires smart timing to cut the head of a tortoise” (Swahili saying)



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Nakuru County (Networking region)

The County's capital and largest town is Nakuru Town, followed by Naivasha. Other major towns in Nakuru are Molo, Gilgil, Njoro, Maai Mahiu, Subukia, Dundori, Salgaa, Mau Narok, Bahati, Rongai and Olenguruone (Nakuru 2020).

Nakuru County is divided into 11 Sub-Counties/Constituencies and 55 wards.

Nakuru County covers over 7,400 km² and it is home to Lake Elmenteita, Lake Naivasha and Lake Nakuru, some of the Rift Valley soda lakes, known for the innumerable flamingoes that nest along its shores (RE Roadmap 2020). The County's main topographical features are Mau Escarpment, the Rift Valley floor, Oldonyo Eburru volcano, Akira plains and Menengai Crater (Nakuru CIDP 2018).



Figure 4-9 Flamingos in Nakuru (Image by Nick115 from Pixabay)

Economy, population, infrastructure

The county is the fourth most populous county in Kenya, with an estimated population of 2.1 million (2019) (Kenya 2019, RE Roadmap 2020). The population growth rate is currently around 3%, with the young population aged below 30 years comprising the largest part of the population and the fertility rate is expected to decline from 39% in 2014 to almost 32% in 2030 (Nakuru CIDP 2018). Nakuru County has a very high population density of 290 per km² (Kenya 2019).



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Electricity coverage in the County stands at 80% with most of these connections in urban areas (ICLEI 2020c).

The fast population increase might imply a decline in social welfare and water shortage in urban centres, due to increased pressure on the available infrastructures and facilities. Due to the rapid urbanisation and the failure of the formal sector to supply adequate houses especially for the low-income segments of the society, the last decades witnessed a proliferation of informal settlements to meet the housing gap. This is manifested by the slums and squatter settlements and by other forms of shanty developments (Nakuru CIDP 2018). Furthermore, current solid waste management facilities do not cope with the ever-growing needs of the urban population (Nakuru CIDP 2018).

The County ecosystems are under pressure from unsustainable management practices such as poor waste management, deforestation and degradation of the environment, pollution, poor land use planning etc. (Nakuru CIDP 2018).

Nakuru County is the fourth highest contributor to the national Gross Domestic Product (GDP), with 6.1%, second only to Nairobi county. The major economic activities include agriculture, financial services and tourism (RE Roadmap 2020, ICLEI 2020c). Agriculture is the main part of economy, considering that 70% of the area of Nakuru County is arable and a highly productive land (Nakuru 2020). The city of Naivasha is ranked as the number one non-capital investment destination in Africa, as well as the fourth investment destination in Africa after Dar es Salam, Kampala and Kigali (Nakuru 2020).

Known as a centre for business and trade, *“Nakuru is a county of unlimited opportunities”* (RE Roadmap 2020).

Energy use and emissions

The baseline assessment of the sectors (and relevant shares) constituting the total energy consumption of the city and of the energy sources covering each sector has not been developed yet.

Electricity is the main source of energy for lighting in the County (55.4%), while firewood and charcoal are the major sources of energy for cooking (42.6% and 30.7% respectively) (RE Roadmap 2020, ICLEI 2020c, Nakuru CIDP 2018). The demand for wood fuel and other timber products caused deforestation, leading to aridity and increased soil erosion within the County (RE Roadmap 2020, ICLEI 2020c).

Renewable energy sources like wind, solar and biogas account for less than 3%. However, underground hot springs in Olkaria are an important source of geothermal power, both for the County and for the national grid (Nakuru CIDP 2018); the 140 MW Olkaria plant is the single largest geothermal plant in Africa (RE Roadmap 2020, ICLEI 2020c). Potential for geothermal energy is also in the city of Menengai, where a pilot project confirmed that geothermal direct steam from Menengai Crater can be used for milk processing plants, heating fish ponds and greenhouses as well as powering laundry (Nakuru 2020). Further



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potential can be found in Ol-Doinyo Eburru with a view of generating more electricity (Nakuru CIDP 2018).

Energy and climate policy landscape

The County Government mapped out the implementation framework for the County Integrated Development Plan (CIDP) 2018-2022 with a clear financing plan for proposed projects/programs (ICLEI 2020c).

Neither RE action plan, nor RE development are considered in the 4 Governor's key agendas or CIDP (Nakuru CIDP 2018, Nakuru 2020). The aim of the planned sectoral initiatives, though, is building a society "*where all residents enjoy equal social economic and political right and live in harmony and unity*" (Nakuru CIDP 2018).

The need of slowing down the pace of **population growth** while making investments in the health, education, economic and governance sectors is included in the CIDP (Nakuru 2018), and it is well aligned with a 100% RE pathway. This is connected with awareness raising activities and increased opportunities to accelerate economic development of the County in a sustainable way (Nakuru CIDP 2018).

The County developed the CIDP finding synergies with the focus of the national development agenda, including the following priorities:

- development of social and physical infrastructure;
- value addition in agriculture and other productive sectors;
- mainstreaming climate change, gender, youth, Disaster Risk Reduction (DRR) and other cross cutting issues in development;
- integration of Sustainable Development Goals (SDGs) in County Planning;
- County public sector reforms, transparency and accountability in the delivery of public goods and services;
- promotion of faster growth for Small & Medium Enterprises and the private sector.

Enhancing County competitiveness, modernising agriculture, diversifying tourism, providing appropriate infrastructures, managing human settlement, promoting industrialisation, preserving the natural environment and improving the transport network are among the strategies to be carried out. Exploiting the RE potential is listed in the County Spatial Development Strategies of CIDP 2018-2022 (Nakuru CIDP 2018).

Supporting policies/strategies include (ICLEI 2020c) a variety of RES and application in new households.

Nakuru has not joined the Global Covenant of Mayors for Climate & Energy (GCoM) yet (GCoM 2020), but it was selected as CoM SSA pilot city (ICLEI 2020c).

Potential for RES application

The County has significant potential for generation of solar and wind energy (ICLEI 2020c), as well as for geothermal power (Nakuru 2020), but it has not fully tapped into it yet.



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Thanks to RES, the County can ensure energy access for the entire community, as well as a sustainable, healthy and wealthy development.

Wind power presents good potential in Naivasha sub-County, while solar energy can be exploited everywhere.

Considering that almost 93% of households use corrugated iron as roofing material (Nakuru CIDP 2018), the application of **solar** systems on rooftops should be carefully assessed. Though, it can provide a good win-win opportunity for improving the roofing system while generating energy.

Due to the high deforestation already caused by wood products exploitation, it is highly recommended that the County avoids the development of non-sustainable **biomass** systems, rather fostering solar, wind or geothermal hydro power applications. Whenever this is not possible, after careful assessment, biomass from forest scraps following management activities could be used, provided that a robust, sustainable management plan, in cooperation with the Ogiek community living in the forest, is thoroughly developed. Such a precious natural resource for the County, acting as a carbon sink, representing an attraction and a substantial part of the context, should be carefully preserved.

Sectoral policies potential

In order for a 100% RE pathway to happen, Nakuru County should first of all fully commit to a long-term visionary development idea, making sure that the entire administration and political actors are involved. The 100% RE ambition requires the LG to stop thinking in the short-term and focusing on economical benefit, yet to dare engage in energy transformation and economic development building a sustainable, affordable and healthy future (Randers 2012, Randers 2013). The local government needs to enable the framework for this to happen, engaging LG officials, politicians, local stakeholders and citizens in all phases, creating a common vision together. When the strategy is well conceived and robust, the business case and investments from private and international actors are more financially viable.

Strong reduction in the energy demand should be the first objective of a 100% RE vision, followed by stringent measures supporting energy efficiency and divestment from fossil fuels together with the use of a variety of RES to cover the entire remaining consumption (Badino 2020a, Badino 2020b).

A thorough assessment of the baseline consumption is necessary, in order to define the first steps, to create a pathway towards the end goal and to foster synergy with the other policies and LG goals.

The high share of organic waste (60%) (ICLEI 2020c) in the waste production of the County provides a good opportunity for production of bio-energy while, in the meantime, supporting measures to improve the **waste management** systems. The improvement of solid waste management facilities and waste management practices would allow the organic part to be separated and used as a source of biofuel, at the same time alleviating



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the need for landfills and disposal problems mentioned in the CIDP (Nakuru CIDP 2018). The development of a sewage system could allow for the production of biofuels, as well, generated from the treatment process of the disposed waters, at the same time lowering the risk of outbreaks of waterborne diseases (Nakuru CIDP 2018).

The County can find win-win applications of the RE system to cover the entire energy consumption of **public lighting** and **telecommunication** infrastructures, while supporting the implementation also in remote areas (for example, thanks to solar mini grids). Implementation of the Flagship program on LED street lighting powered by solar energy (ICLEI 2020c) should be fully supported by the County.

Infrastructure development plans are also a great place where synergy with the 100%RE roadmap can be found, such as on the rail network, the expansion of the airstrip at Lanet Military base for commercial activities (Nakuru CIDP 2018), or the Information and Communication Technology (ICT) infrastructure across the County.

Nakuru county can use **tourism** as a driver for a 100% RE culture, promoting and incentivising green sustainable activities and the use of RES. The ambition of the County's plan to diversify tourism can be further increased, supporting the development of a green sector, which would also set the scene for a peculiar offer of the County.

The city of Naivasha is going to host an **industrial park**, planned to be *“near energy production point so as to cut on power costs”* (Nakuru 2020). RES need to play a strong role in the project.

Furthermore, Nakuru County could include RE implementation in the 4 key agendas for the County. In the **“Agriculture”** agenda, RES systems could be part of the rural infrastructure, planned to be improved (Nakuru 2020).

Local governments can facilitate the inclusion of RES for slaughter houses, cattle dips facilities or fishing activities, as well as providing the energy needed in the agricultural sector for post-harvest, processing, preservation and storage technologies (e.g. potato storage facilities and milk cooling plants mentioned in the Key Agenda “Agriculture” (Nakuru 2020));

Collaboration and cooperation with farmers with potential for biomass from scraps can be sought.

Also the key agenda **“Health”** can provide good opportunities. In the modernisation process of health care facilities (Nakuru 2020), the local government can require and incentivise RES systems to ensure warm water, cooling or electricity, even in remote areas, while, at the same time, promoting healthcare as a driver of economy in the county (Nakuru 2020). The rehabilitation and upgrade of urban **infrastructures**, as well as the improvement of rapid response management units for disasters and emergencies, can benefit from RES technologies both in terms of adaptation to climate change and of image to be given to citizens and stakeholders on RES vision (Nakuru 2020). Finally, RES can provide energy for **water** pumping devices required in the distribution system.



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The LG can concretise the vision acting as a role model, firstly, using 100% RE in all administration energy consumption, secondly supporting investments of local stakeholders and the private sector. Nakuru County can, for example, act as an incubator for the green economy, or as an intermediary to support group purchase of RES based solutions (such as solar cooking stoves or solar panels).

Inspiration from the World

Sharing the 100% RE vision and pathway with others can support more effective and innovative development. It is important for the LG to monitor the implementation of the strategy, improving it whenever the results are not as expected or some conditions change. Sharing doubts and failures can support others to avoid them, as well as learning from other pathways can help find good solutions for the specific context or vision.

Nakuru County can take inspiration from **Costa Rica** (Brot für die Welt and World Future Council 2018, Go 100RE 2017, IRENA 2019, World Future Council 2020). It can provide Nakuru with a great example of reducing GHG emissions as part of a decarbonised economy, promoting the modernisation of the country through green growth. Perspectives and needs from the civil society, industry, academia, private sector and various governmental bodies have been embraced thanks to a highly participative process, creating a common policy roadmap. Costa Rica issued a law to provide incentives for public and private electric transportation technologies and to create the needed infrastructures (Badino 2020b, Badino 2020d).

Horizontal and vertical cooperation

Multi-level collaboration with other levels of government, local stakeholders, energy providers and peers around the world is key to ensure the success of the 100% RE vision. The political will to establish win-win collaborations with all the actors involved in the economy and in the energy consumption is needed to build trust and to enable the successful implementation of policies, measures and investments.

Nakuru has good cooperative relationships with the national government entities, neighbouring local governments, other levels of government and local stakeholders (ICLEI 2020c). The infrastructure, energy and ICT sector set the enhancement of close inter-departmental collaborations with other sectors as a strategic priority.

Independent Power Producers (IPPs) can support the geothermal systems implementation. Further collaboration with the national level can mobilise financial resources for implementation, as well as it can create enabling policies to involve private investors in the 100% RE vision development, such as on infrastructures or housing (Nakuru CIDP 2018).

Awareness raising, capacity building and community engagement

The local government needs to make sure that the 100% RE vision is communicated in a clear, transparent and robust way. The context, the synergy with the community objectives



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and the benefits for the different parts of the society and for the businesses should be highlighted, in order to support their participation in the implementation of the development pathway.

In order for the strategy to be successful, it must include measures aiming at supporting education and training at all levels, thanks to the cooperation with schools, local universities and other local experts. Capacity and skills development on RE system designs, policies, finance, installation and urban planning, for example, is needed in order to build momentum for green economy and sustainable development based only on RES.

Awareness creation on energy efficiency and conservation measures is particularly important for Nakuru. Public participation, one of the key national values and principles of governance espoused by the new Constitution (Nakuru 2020), can be fostered by the LG in order to create momentum for RE development and the business sector. Financial institutions (Nakuru CIDP 2018) should also be involved in the implementation of the 100% RE strategy, in order to facilitate access to credit and finance.

Particular attention to the most numerous age cohorts of citizens should be given, supporting education and capacity building for the young population aged below 30, in order to pave the 100% RE pathway with professional and expertise skills. This can be developed in line with enhanced youth participation in decision making, foreseen in CIDP as one of the objectives of Education (Nakuru CIDP 2018). It can be implemented within the partnership in place with the national government, such as the National Youth Service programmes or the Kenya Youth Employment Opportunities Programme (KYEOP), as well as with collaboration with Youth polytechnics, Egerton and Kabarak Universities and secondary education facilities (Nakuru CIDP 2018). Adult and continuing education centres can partner in the implementation of capacity building activities aimed at increasing the expertise of workers.

In the Access to Government Procurement Opportunities framework, support to local industry, suppliers and contractors can develop also in terms of cheaper purchase of RES technologies as a group, or facilitating the access to financing opportunities.

Opportunities to cooperate with research institutions offering services to farmers, as well as Cooperative societies, can develop biomass systems using agricultural scraps, as well as other RES deployed in other agricultural activities throughout the County. In a similar way, cooperation with farmers' cooperatives and ranches to use the waste generated by livestock can be sought.

Sports, culture and creative arts centres, as well as Talent Academies and Cultural sites, can increase awareness among the community, being an important component of social life (Nakuru CIDP 2018).

The development and implementation of the 100% RE strategy is in line with the County's wish to contribute to all the 17 Sustainable Development Goals (SDGs) with their action for the well-being of the citizens.



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5. Conclusions

The deep-dive cities and regions of the project started a beautiful pathway thanks to the project, which have all the potential for realisation.

Though each reality has different characteristics, contexts and standpoints, none fully tapped into the potential of the renewable energy transition. In all the experiences here assessed, many RES can be used in synergy and, following a stringent reduction in energy demand and energy efficiency measures, they can ensure the feasibility of the 100% RE. The assessment of the local contexts, potential and opportunities and eventual tradeoffs to be defined is an important point of any strategy, as well as the communication of benefits that arise for the community from the integration of all LG goals

Deep decarbonisation and 100% RE pathways can support sustainable development, including a variety of benefits across all the Sustainable Development Goals (SDGs) (2020a, Badino 2020b, DDPP 2020, World Future Council 2018), including improving income distribution, alleviating poverty and reducing unemployment (DDPP 2020). The impact of climate change on the well-being of the population, particularly the most vulnerable part, jeopardises many development goals. While transforming the system towards the 100% RE vision, the local policies and the infrastructures serving a community, Local Governments can see untapped opportunities for economic and environmental benefits to arise.

In a variety of different ways, Local Governments and their ambitious leaders are key actors to ensure that a sustainable, affordable, clean future for all is a priority for the community, starting to assess, plan and implement right now.

Each of the assessed project cities and regions can use the 100% RE strategy to develop and foster existing collaborations within the community, while, outside, towards other levels of government and international peer Local Governments. But this is also an opportunity to shape the economy and development of the community in a step-by-step, yet urgent and ambitious sustainable way.

“The situation the Earth is in today has been created by unmindful production and unmindful consumption. We consume to forget our worries and our anxieties. Tranquilising ourselves with over-consumption is not the way” - Thich Nhat Hanh



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6. Glossary

The most relevant acronyms used in the paper are the following:

CHP – Combined Heat and Power

CoM SSA - Covenant of Mayors in Sub-Saharan Africa

DDPP - deep decarbonization project

GCoM - Global Covenant of Mayors for Climate & Energy

GDP – Gross Domestic Product

GHG – greenhouse gases

IBC - knowledge-based industries

ICLEI AS – ICLEI African Secretariat

ICLEI SAMS – ICLEI South American Secretariat

ICLEI SEAS – ICLEI South-East Asian Secretariat

IPCC - Intergovernmental Panel on Climate Change

LG - Local Government

NDC - Nationally Determined Contribution

PV - Photovoltaic

RE - Renewable Energy

RES - Renewable Energy Source(s)

Please refer also to the IPCC Glossary (IPCC 2019) for more technical terms on RES.





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