URBAN TRANSITIONS MISSION
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PRACTICAL IMPLEMENTATION GUIDE: 100% RENEWABLES

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TABLE OF CONTENTS

Abbreviations and acronyms

Acronym	Description
100% RE	100% renewables
LRG	Local and regional government(s)
RE	Renewable energy
EE	Energy efficiency
SE	Sustainable energy
SETS	Sustainable Energy Transition Strategy (game)
UTMC	Urban Transitions Mission Centre
UTM	Urban Transitions Mission

1 INTRODUCTION

Increasing the deployment of renewable energy (RE) is one of the key pillars in achieving climate-neutral and ultimately net-zero emission cities. Ambitious targets can serve to mobilize various stakeholders, draw greater attention and resources to cities' efforts, and challenge existing beliefs of what may or may not be possible. In this manner, several cities and regions around the world have shown interest in or have already committed to achieving 100% renewable energy in their territories.

This implementation guide, aimed at cities (and other local and regional governments) interested in kickstarting their renewable energy journey, lays out the path towards setting a renewable energy target—including up to 100 percent—followed by the development of plans and implementation mechanisms that can guide cities towards the achievement of such a goal. It addresses certain measures that can facilitate these processes, including stakeholder engagement, building local capacities, and developing bankable projects. It aims to provide actionable steps, drawing from the experiences under the 100% Renewables Cities and Regions Roadmap project, as well as insights from cities that are part of the Urban Transitions Mission (UTM).

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2 DEFINITION OF 100% RENEWABLE ENERGY

It is important to define what one means by the term '100% renewable energy'. In many cases, the terms 'electricity' and 'energy' are used interchangeably, even though this is not entirely accurate. The term '100% renewable energy' as used in this document has the following definition (IRENA Coalition for Action, 2020):

"Renewable energy encompasses all renewable resources, including bioenergy, geothermal, hydropower, ocean, solar and wind energy. One hundred percent renewable energy means that all sources of energy to meet all end-use energy needs in a certain location, region or country are derived from renewable energy resources 24 hours per day, every day of the year. Renewable energy can either be produced locally to meet all local end-use energy needs (power, heating and cooling, and transport) or can be imported from outside of the region using supportive technologies and installations such as electrical grids, hydrogen or heated water. Any storage facilities to help balance the energy supply must also use energy derived only from renewable resources."

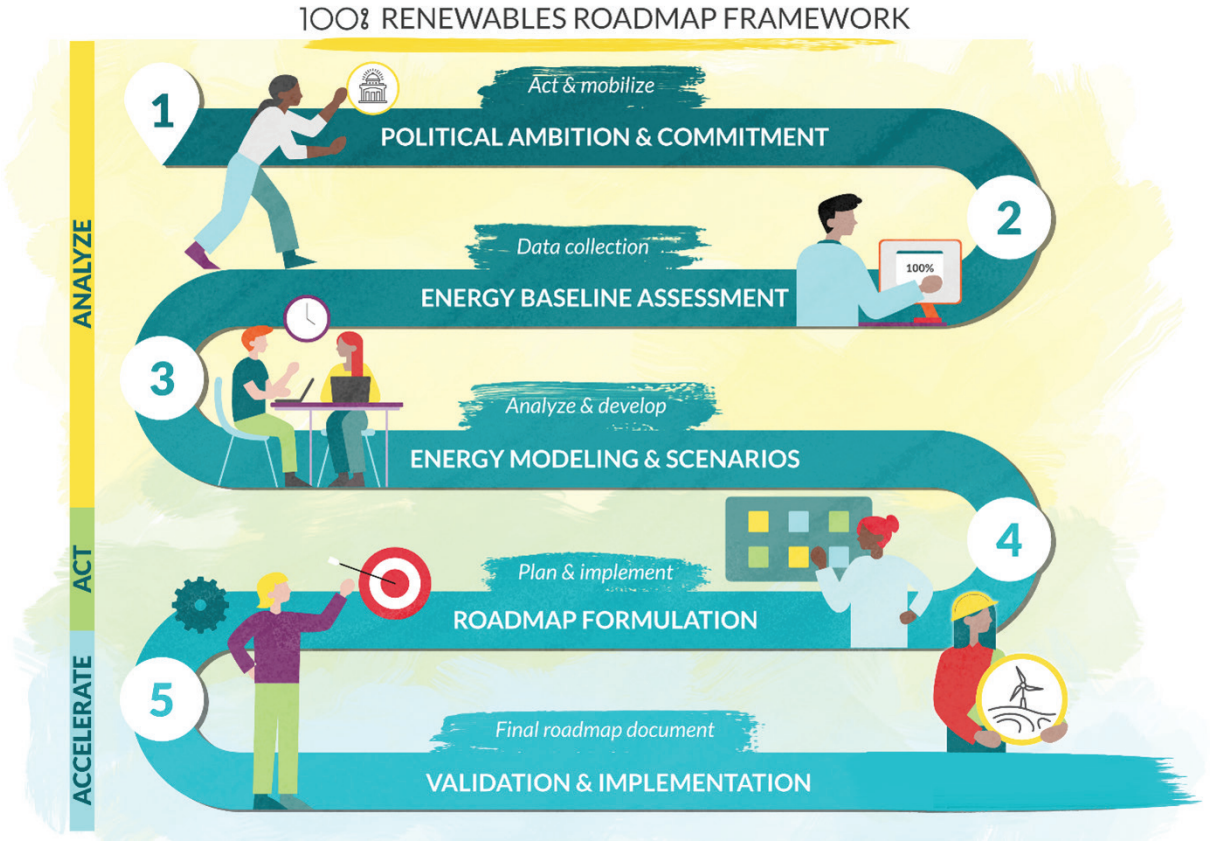
3 RAISING LOCAL AMBITION

Cities can play a pivotal role in increasing RE deployment, turning high-level national goals into concrete, on-the-ground actions that account for local social, environmental, and economic realities. They can achieve this through renewable energy targets, innovative policies, and careful planning. They are best-placed to identify the most pressing challenges facing their communities and serve as conveners to bring together various stakeholders—from the private sector to citizens and academia—to develop tailored energy solutions. Moreover, certain powers and authorities that typically fall under their jurisdictions—such as policies related to buildings and transport—provide a large domain for sustainable energy action. In addition to deploying RE solutions such as rooftop solar photovoltaics (PV) or solar water heating (SWH) across their own assets, cities can also act on energy efficiency (EE) and conservation which are also critical to consider owing to their benefits for system stability, infrastructure planning, lower energy costs, etc.

Still, cities differ with regards to their RE endowments, the powers and authorities they have, their access to various resources (financial, technical, political), their energy priorities, and so on. They also exist within differing national contexts that may empower them to act on climate and energy-related issues, or act as a barrier for such action. Compared to fossil fuels, RE offers the possibility of decentralized generation and community-centric solutions that local and regional governments (LRGs) can take advantage of to build climate-neutral futures while improving their independence, socio-economic outcomes, and resilience—provided they are empowered to do so.

The 100% Renewables Cities and Regions Roadmap Framework is one example of a framework that can guide cities along their journey. ICLEI developed this framework to guide LRGs, organizations, planners, and experts towards developing a pathway for transitioning to RE. The framework serves as a showcase of good practices and a constellation of steps and phases that could be adopted in part or as a whole, based on individual circumstances and contexts (Adepoju & Sen, 2021).

The action strategy is laid out in subsequent sections.



Source: Adapted from (Adepoju & Sen, 2021)

Figure 1: 100% Renewables Cities and Regions Roadmap Framework

4 ACTION STRATEGY

The path towards achieving a renewable energy transition, even up to 100% renewables, requires adequate planning underpinned by a clear target and a robust and relevant roadmap detailing realistic implementation mechanisms, all of which should be supported by meaningful stakeholder engagement and buy-in and sufficient capacities to carry out implementation.

4.1 Political ambition and commitment

Without political will, the requisite vision, capacities, and resources required for a city's renewable energy journey will be difficult to align. Selecting an appropriate yet ambitious target can go a long way in serving this purpose. Target-setting for cities can be encompassed in the following steps (Figure 2):

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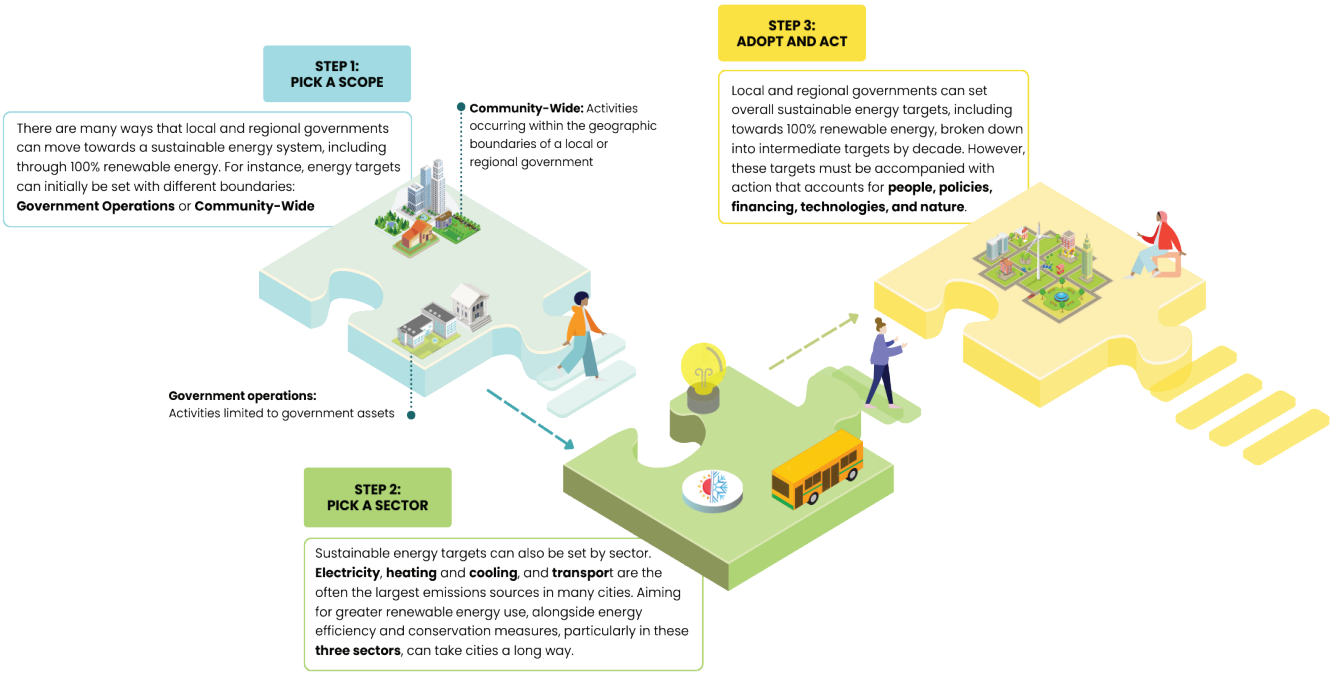

Figure 2: Renewable energy target setting for LRGs

As a first step, cities can start by defining the **scope** of their renewable energy target. Targets can focus solely on government operations—which include activities tied to government-owned assets such as buildings or transport fleets—or be expanded to a community-wide level, encompassing activities within a city's geographic boundaries, which would then require the cooperation of other stakeholders.

The next step is to identify the relevant **sectors** where such RE targets should be applied. The largest sectoral contributors to emissions in cities are typically **electricity, buildings** (heating and/or cooling), and **transport**. While grid electricity supply typically lies outside a city's control, they can still act by deploying RE sources (free-field or on rooftops), improving energy efficiency across various sectors, and encouraging private sector action in areas such as industry.

Finally, cities must develop and adopt a **robust action plan** to achieve their RE goals. This plan should account for the people, policies, financing, technologies, and other resources necessary for success. By breaking long-term goals into intermediate milestones, governments can ensure progress is measurable and maintained over time while providing clear signals to stakeholders such as investors and business. The following sections present the steps involved in developing such an action plan or '**roadmap**'.

4.2 Baseline assessment

While aiming to achieve a target, cities must have accurate information about their starting situations. A baseline assessment is therefore crucial to understanding certain key energy parameters and therefore what areas need prioritization. There are a number of relevant data points that would need to be considered, including: **energy demand and supply** (by sector and sources), **energy efficiency and intensity** indicators, **geographical information systems** (GIS) data for spatial planning, **energy costs, socio-economic data** (such as population, income, health, etc.), **environmental data** (including greenhouse gas emissions, water use, land use, etc.), and data on **policies** (such as tariffs, subsidies, etc.). When data is not available, it can be estimated or synthesized, keeping in mind the assumptions that go into it.

BOX 1: 100% RENEWABLES CITIES AND REGIONS: INITIAL STATUS REPORTS

Each of the deep-dive cities/regions from the 100% Renewables Cities and Regions Roadmap project—Kisumu County, Kenya; West Nusa Tenggara, Indonesia; and Avellaneda, Rosario, and La Plata in Argentina—began their journey with an initial status report that outlined the status of their energy systems. These included existing socio-economic conditions (such as the type of economic activity, dependence on agriculture, natural disaster risks) as well as pressing challenges, including energy access considerations or waste management. Energy profiles were prepared, identifying the predominant fuels used by various consumer groups (industry, household, commercial, etc.) as well as the potential for variable renewable energy sources in their respective territories. Energy policies were identified, laying out existing efforts underway as well as the powers and authorities available to local/regional governments in their respective countries to act on energy-related issues. These baselines served to highlight certain salient points—for example, as Kisumu County got most of its electricity from the Kenyan grid, which was almost entirely renewable already, its priorities were better aimed at its transport and building sectors (Islami, 2020) (ICLEI SAMS, 2020) (Buma, 2020).

4.3 Modelling and scenario development

Data collection efforts at the local or regional level can often be challenging, and adequate foresight and investment in data capabilities is always encouraged. Under the 100% RE project, accurate data collection was emphasized as it was crucial to help develop models that were relevant to each participating LRG. The collected or synthesized data was then fed into an **energy systems model**. In the case of the 100% RE project, the Fraunhofer Institute's KomMod model was used, which displayed hourly matching data for demand and supply in a 100% renewable energy system in the target year 2050. The model incorporated data from various RE sources in the target cities/regions, including their local potential, their costs, costs of alternatives, etc. and resulted in a final scenario for each city/region that showed the least-cost outcome for a fully renewables-based energy system in 2050.

Figure 3 is an example of a 100% renewable energy system in 2050 for West Nusa Tenggara (WNT) Province, Indonesia (Steingrube & Reggentin, 2022). This particular scenario was agreed upon by the Province and acted as the backbone for the further development of WNT's roadmap and associated policies. Depicted on the left are the various energy supply technologies that are deployed in the model. The deployed conversion technologies are shown in the centre, and on the right are the various demand sectors. The model shows how under a 100% renewable energy scenario, it is likely that renewables-based electricity will supply most energy end uses, with potential uses for hydrogen in transport and synthesized fuels in industrial applications. There was some scope for bioenergy in sectors such as cooking.

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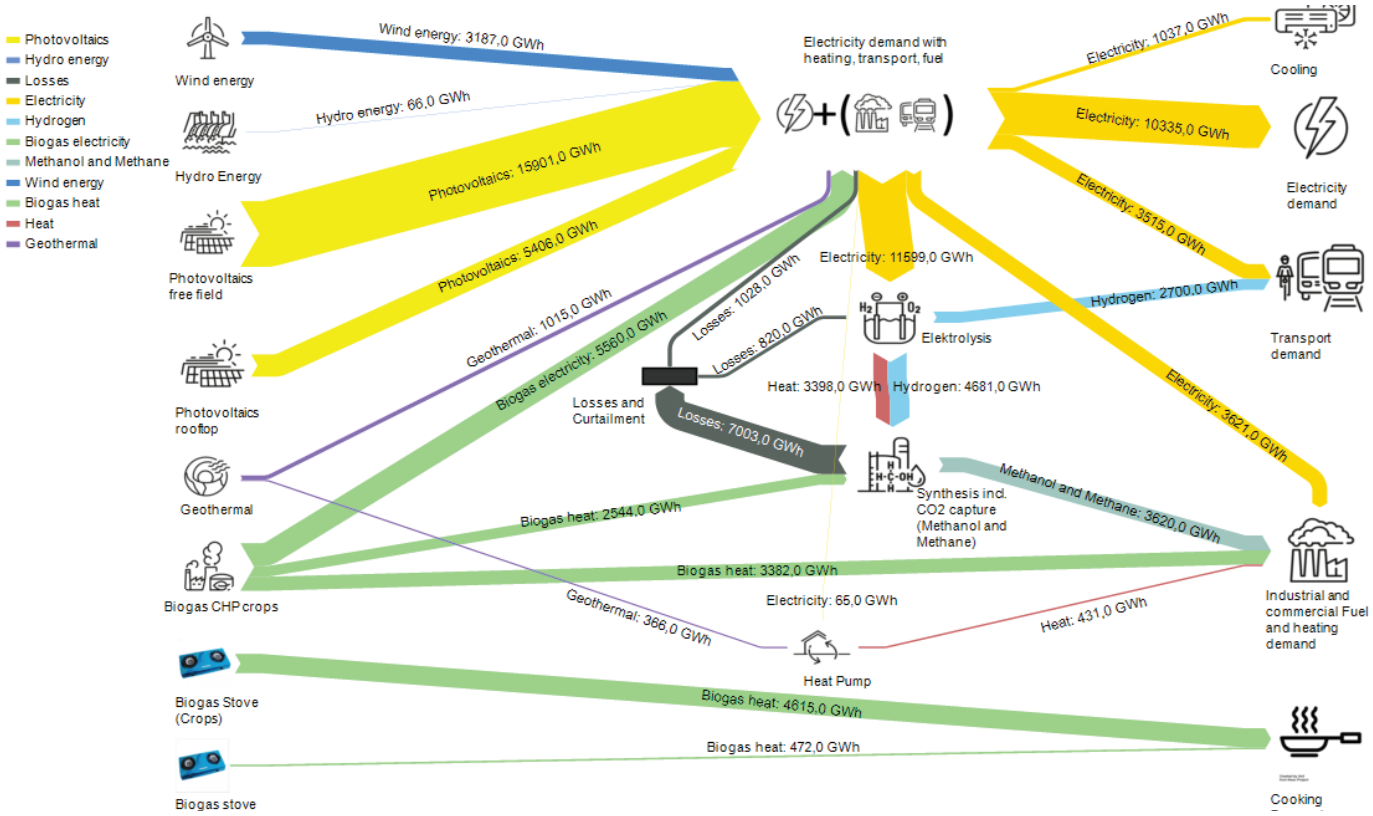
This was just one of the possibilities—the choice of model can imply different data requirements, assumptions, interoperability with other models, and so on. Such modelled scenarios can help provide a direction for large-scale implementation but are not prescriptive, and reality will often be quite different to what a model estimates. Such an exercises therefore needs to be followed up with more detailed studies and policy analyses in order to develop actionable and context-specific plans, as will be explained in the next section.



Source: (Steingrube & Reggentin, 2022)

Figure 3: 100% renewable energy system model in 2050 for West Nusa Tenggara, Indonesia

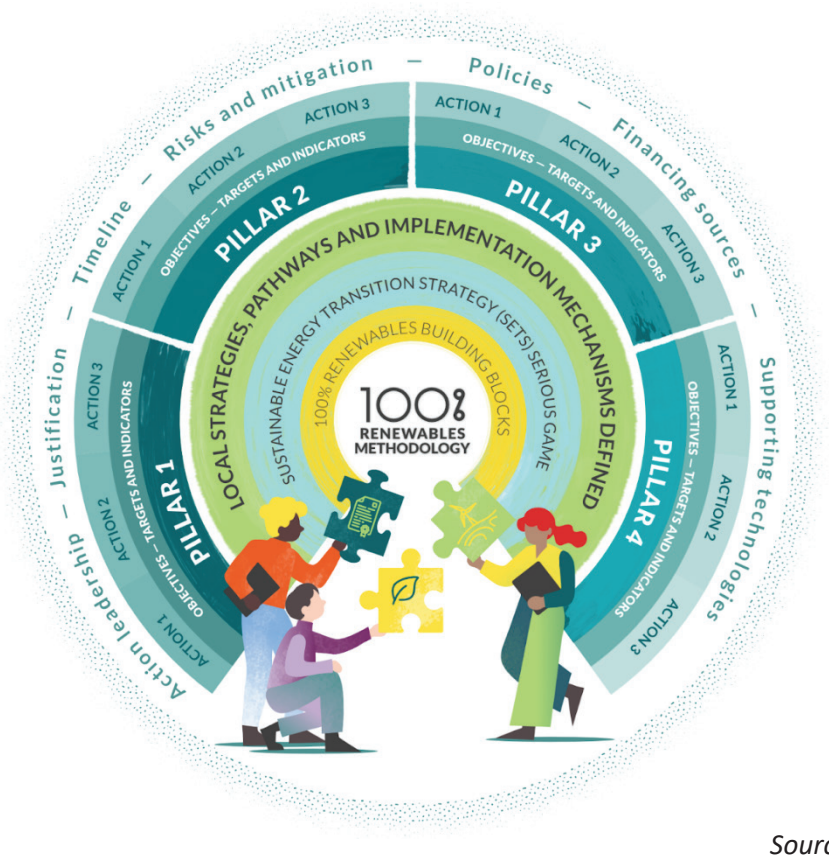
4.4 Roadmap formulation, validation and implementation

Once a leading scenario is chosen, the roadmap can further build on it to translate models and data into relevant real-world insights. This process must lay out clear priorities for the city, consider existing policies and identify any gaps, and specify progress indicators along with building robust monitoring and verification processes. Most importantly, the roadmap should lay out specific and realistic implementation actions and mechanisms along with the entities responsible for them. In order to be actionable, they must be linked to potential timelines and intermediate targets. To ensure community acceptance and applicability, they should also account for the differential impacts on various stakeholders.

The roadmap can also help identify possible financing sources, either from government institutions, the private sector, or through partnerships and international support. It can also lay out possible financing mechanisms available to LRGs, such as taxes, national government funds, or other sources of revenue. These actions must lie within the scope of LRG responsibilities but can also work in tandem with other levels of government. All these considerations are depicted in Source: (Steingrube & Reggentin, 2022)

Figure 4.

The roadmap can be a valuable document to help focus LRG capacities and resources and can be updated as progress is made or if new information or technologies become available. Its implementation depends on effective coordination among various LRG departments who can help mainstream sustainable energy action across their various responsibilities.



Source: (Chetty, 2024)

Figure 4: Methodology for developing a 100% Renewables Roadmap

4.4.1 Stakeholder engagement

The energy transition is bound to have profound effects on communities owing to the centrality of energy in human activity and the growing decentralization of our energy systems. The local nature of the roadmaps themselves allows for local community priorities to be included, as LRGs have good insight into the challenges faced by their communities. Still, in the development of a renewable energy roadmap, establishing robust feedback mechanisms and securing active stakeholder buy-in are fundamental in creating a dynamic, effective, and locally relevant plan. There are several tools available, such as participatory community workshops, public consultations, surveys, and scenario modelling platforms, that can act as vital channels for engagement and feedback. Engaging stakeholders in the roadmap development process fosters a supportive environment that paves the way for successful implementation by avoiding phenomena such as 'NIMBYism'. For example, during the development of the 100% RE Roadmaps, several workshops, including community visioning, validation, business matchmaking, were conducted.

Innovative stakeholder engagement tools can also be deployed. For instance, a 'serious game' is a game whose primary purpose is not entertainment—they are rather used to simulate certain situations or generate

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awareness across a wide range of topics such as healthcare, military action, etc. As such, given the complexity of the energy transition, such tools can help engage stakeholders—such as local government officials, community leaders, and technical experts—through a role-playing scenario where they must work collaboratively to design, implement, and manage renewable energy strategies and approach the problem from each others' perspectives. This immersive experience helps build an understanding of the dynamic and interconnected nature of energy transitions, promoting collaborative and creative problem-solving and negotiation among diverse stakeholders, which can be carried over into real-world situations. For example, the Sustainable Energy Transition Strategy (SETS) serious game was used during the development of the 100% RE Roadmaps for the project cities, and the insights gained from these sessions were fed back into the roadmaps.

5 CONTRIBUTION TO THE UTM FRAMEWORK

The 100% Renewables Cities and Regions Roadmap Framework aligns with several steps within the **Urban Transitions Mission Framework**, specifically across four key stages: **assessing impacts and risks, setting targets and goals, developing climate actions and adaptation strategies, and implementation**. Its approach integrates governance, stakeholder engagement, and iterative planning, making it a valuable tool for addressing the complexities of urban transitions.

In the "**Assess Impacts and Risks**" stage, the 100%RE Framework emphasizes conducting a baseline assessment to evaluate the current energy landscape, including demand, supply, costs, and socio-economic factors. This process identifies critical context-specific risks, such as highly fossil-fuel-dependent sectors, exposure to volatile energy markets, and community vulnerabilities to climate-related impacts like extreme weather events. Through thorough data collection, cities are better able to understand the energy-related risks within their urban systems. Such a base analysis can also help identify potential opportunities.

During the "**Set Targets and Goals**" stage, the 100% RE Framework guides LRGs in establishing ambitious yet realistic renewable energy goals that align with sub-national or national climate action plans. It provides structured steps for defining the scope (government operations vs. community-wide targets) and prioritizing sectors with the highest emissions, such as electricity, transportation, and heating and cooling. This process ensures that energy goals are both measurable and actionable, facilitating integration with broader sustainability objectives under the UTM Framework. Such goals should ideally be made public with associated progress indicators and monitoring and evaluation efforts in order to help build accountability and trust among the city's communities.

In the "**Develop Climate Actions and Adaptation Strategy**" stage, the 100%RE Framework offers guidance in developing and outlining implementation mechanisms in the roadmap, in this case linked to RE and EE solutions. Such actions can span across fiscal tools, policy and regulatory incentives, mandates, bans, communication campaigns, partnerships, technology development, etc. Tools such as SETS further enhance this process by offering novel ways of stakeholder interaction and planning, allowing for inclusive strategies that account for local capacities, governance structures, and stakeholders. This iterative approach ensures that energy transition strategies are adaptive and responsive to local contexts while contributing to the resilience and sustainability of urban systems.

Under "**Implementation**", while a roadmap itself is only a strategy document, it can still play a big role by helping identify actions that can be implemented and matching them with potential funding sources. It also acts as a sign of commitment from the city and provides a strategic direction for their climate and energy objectives. Clear signals such as this can help bolster investor confidence and attract resources. For example, under the 100% RE Roadmap project, following the development of the roadmap, the project cities/regions were supported in developing bankable RE/EE projects. Such an implementation approach—involving smaller pilot projects to better understand roadblocks, supply chain issues, skills, etc.—can also be a promising one.

6 UTM CITIES AT THE FOREFRONT

The following are some examples of UTM cities that are undertaking their transition towards renewable energy. The **City of Rosario** in Argentina developed a 100%RE Roadmap tailored to its specific needs, resources, and capacities. Rosario's approach emphasizes collaborative planning, local stakeholder engagement, and phased implementation to ensure a sustainable transition to renewable energy across all major sectors.

The first step was defining the geographical scope of the project, focusing on the city-wide level while considering synergies with regional and national policies. Key sectors identified for intervention include electricity, public and private transportation, and heating and cooling systems, which account for a large portion of the city's energy demand and emissions. This sectoral focus was selected based on emissions assessments and local renewable energy potential, with significant emphasis placed on reducing energy intensity in municipal operations as well as in community-wide initiatives.

Rosario's roadmap includes a diverse set of projects designed to accelerate the city's renewable energy transition. Among the key initiatives are projects to upgrade public lighting to energy-efficient LED, install solar water heaters in public buildings, and support the adoption of solar power through the "Prosumidores" program, which enables residents and businesses to generate their own electricity and contribute to the grid. The roadmap also includes measures for sustainable mobility, promoting public transport and infrastructure for electric vehicles, and ensuring that urban development aligns with sustainable energy goals. (ICLEI Argentina, Municipalidad de Rosario, 2024).

The City of **Zhytomyr**, Ukraine identified the pressing need to reduce their dependence on fossil fuels (primarily natural gas) before exploring the use of renewable energy sources, including bioenergy and waste, acting as an example of how fossil-fuel phasing out efforts and renewable energy expansion efforts can and should go hand-in-hand. This was done by prioritizing energy efficiency and energy-saving measures in their buildings sector—including public buildings—in particular in order to reduce heat loss due to waste or leakages. They also implemented a new energy management system and invested in training for local technicians and staff. In terms of renewable energy sources, they were able to take advantage of locally-available fuels, such as wood chips, to construct a combined heat and power (CHP) plant. They were also able to install a waste recycling plant that allowed for the use of refuse-derived fuel, serving both sustainability and energy purposes simultaneously (UTMC, 2024).

They were supported in these efforts by international and private partners through financing as well as technical assistance. Zhytomyr's efforts were made possible by a number of actors, including political will at the mayoral level. Moreover, there were efforts in Ukraine around 2015 to decentralize governance, allowing local governments greater control over funds and enabling their access to diverse financing sources.

7 INITIAL RECOMMENDATIONS

The following are some recommendations for LRGs looking to apply the 100%RE Framework to their contexts or are simply interested in expanding the use of RE in their territories:

Context-specificity: While there is a lot to learn from the examples of other LRGs, their experience is not often directly applicable. LRGs differ in their authorities, financial situations, resources, and capacities. LRGs should opt for solutions that make sense in their specific contexts, while advocating for change in their national and regional frameworks in cases where these act as barriers. Knowledge exchange across LRGs in a country can help identify promising solutions as well as any pitfalls in their implementation. Exchanges with a more global

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cohort can help the diffusion of knowledge and spark new ideas and approaches.

Invest in people: A lack of local skills (technical, financial, data) can hamper even the most ambitious efforts. LRGs should proactively invest in training programs for technicians in order to develop the local value chain—especially in areas such as energy efficiency that can involve very local activities. LRGs should also invest in their own training to keep up to date with new technologies and approaches and understand how they relate to their local contexts. This can help break siloed working styles and encourage cooperation across departments.

Track progress: Identifying performance indicators and timelines and actively reporting these results can help course-correct as needed. But it can also enhance transparency, which can improve engagement with local communities and create greater trust. Reporting platforms such as CDP-ICLEI Track can provide standardized formats to report data, reducing some of the reporting burden.

Engage relevant stakeholders early-on: Renewable energy generation can have direct impacts on local communities, including farmers, households, etc. Involving them early on in the decision-making process for renewable energy development can help create safeguards to protect their interests which can help reduce backlash to any RE projects. Supporting such engagement efforts with effective communication about the benefits or RE/EE and challenging any misconceptions can help bring a wider swatch of society onboard.

Explore diverse financing sources: LRGs should identify potential public and private funding sources, including grants, green bonds, and partnerships with private investors. Public finance cannot fund the transition on its own—private finance is invaluable, and LRGs can play a role in mobilizing it. Public-private partnerships across different forms can also play a promising role. Supportive measures and funding might also be available at different levels of government to support local action.

Start at home: LRGs have several tools at their disposal that can directly or indirectly impact their transition efforts. They can spur energy-efficient and renewable-energy-friendly outcomes through sustainable procurement practices for their assets, including vehicles or lighting. They can install their own RE generation (if their energy system frameworks allow them to). They can modify existing building codes in order to be more efficient, and also mandate RE generation in new buildings as an example. By taking these actions, LRGs can help spur the local value chain and also provide concrete examples of their commitment to the transition.

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