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# How to create a roadmap for your city's renewable energy transition

[Clean Energy](#)[Spotlight On: The Renewable Energy Transition](#)Author(s): **C40 Cities Climate Leadership Group, C40 Knowledge Hub**

A rapid, global transition to renewable energy is essential to avoid the worst impacts of climate change. Cities are vital to this shift as they are major energy consumers, accounting for around three-quarters of global final energy use.<sup>1</sup> Cities have the power to send a strong demand signal to the energy sector, the leverage to shift regional or national policies, and the opportunity to become more active participants in building new, decentralised and decarbonised energy systems. By moving to renewables cities can also reap rewards, from fewer pollution-related health issues to local job creation.

To achieve this transition, cities need to set out clear goals and impactful, locally appropriate actions. An energy ‘roadmap’ is an informed plan to increase the amount of renewables in the energy mix and accelerate the shift away from fossil fuels. In addition to establishing a city-wide renewable energy vision, it can align with national policies, establish platforms for collaboration within and outside city government, and attract private investment. It should be connected to your city’s climate action plan. This article outlines the key steps your city can take to build a roadmap.

## Begin by determining your city's current and future energy needs

Most cities will benefit from working with research institutions such as universities to assess energy needs, though the process should be led by a department or team in your city.

Tsévié in Togo, for example, collaborated with a local university and energy support agency to collect and



analyse energy demand data, projected to 2050, enabling the city to overcome data and English constraints.<sup>2</sup> Los Angeles partnered with the National Renewable Energy Laboratory, as well as an advisory group of stakeholders, to carry out a vast and complex energy systems analysis.<sup>3</sup> The data, including projections of the city's energy use to 2045, are published online.

## Assessing energy demand should include the following steps:

- **Establish the local context**, including, at a minimum, your city's demographics and trends, economic and social drivers, financial conditions and regulatory powers. If your city is home to people living in slums and informal settlements, it is critical that they are included in this assessment.<sup>4</sup>
- **Conduct a city energy survey to assess current and future energy needs.** Gather data to understand energy use within the city's jurisdiction, including the fuels and equipment used, sectoral and end-user demand, and behavioural patterns that impact energy use. Use this data, along with information about the local context and changing technologies and trends, to project future demand. Cities with growing populations and expanding economic activity will see a continued rise in energy demand.<sup>5</sup> Ensure that the assessment includes 'suppressed demand', where an energy source is currently unable to meet demand, or where citizens cannot afford the energy they need.<sup>6</sup> Also incorporate projected energy efficiency improvements, which is critical to meeting energy demand, as well as any anticipated increases in demand for cooling (see box).

## Energy efficiency first

The best way to meet energy demand is by increasing efficiency. Yet, barely more than one-third of global energy use is covered by energy-efficiency policies.<sup>7</sup> Any plan to transition to renewable energy should put energy efficiency at its heart to avoid wasting resources. Five impactful actions cities can take to reduce building energy demand explains the main options.

## Cooling is the fastest-growing energy demand in buildings<sup>8</sup>

Demand for cooling has already tripled since 1990. Rising urban temperatures and living standards, as well as population growth, are expected to lead to unprecedented demand for cooling in the coming decade. The International Energy Agency (IEA) explains more.

## Assess which renewable energy resources are most feasible locally

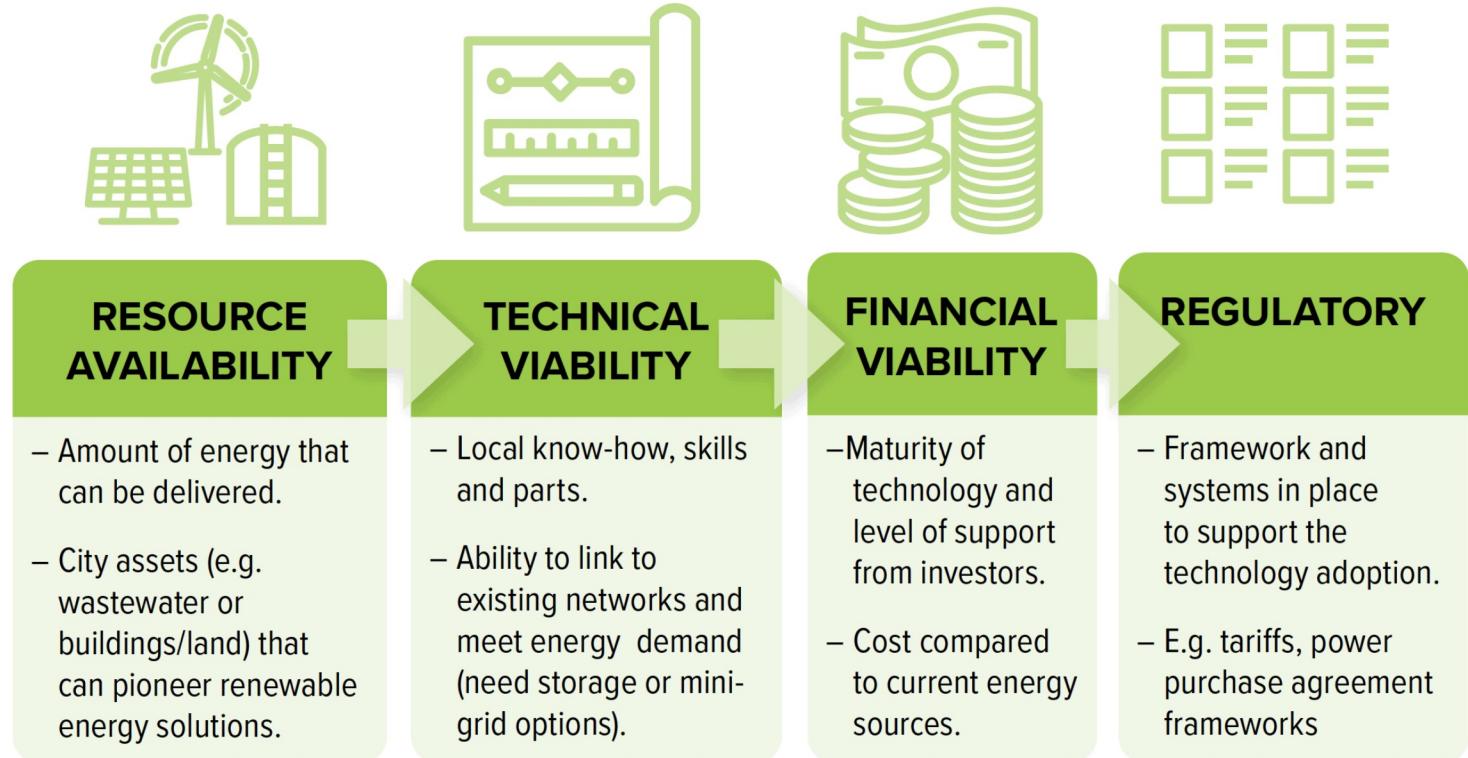
The main renewable energy sources cities can deploy are solar photovoltaic (PV) power, wind power, tidal and wave power, biomass, geothermal power, landfill gas to energy, wastewater gas to energy and hydro power. The viability of each depends on the natural resources available locally, as well as the technical capacity, financial viability and regulatory barriers, as shown below.<sup>9</sup>



## Do not turn to natural gas or ‘clean’ coal as transitional fuels

Both are fossil fuels, producing emissions and air pollution. Both are also likely to be more expensive to develop than new renewables – solar PV or wind now offer the cheapest source of new electricity generation in most markets – and leave cities and residents exposed to volatile energy costs.<sup>10</sup>

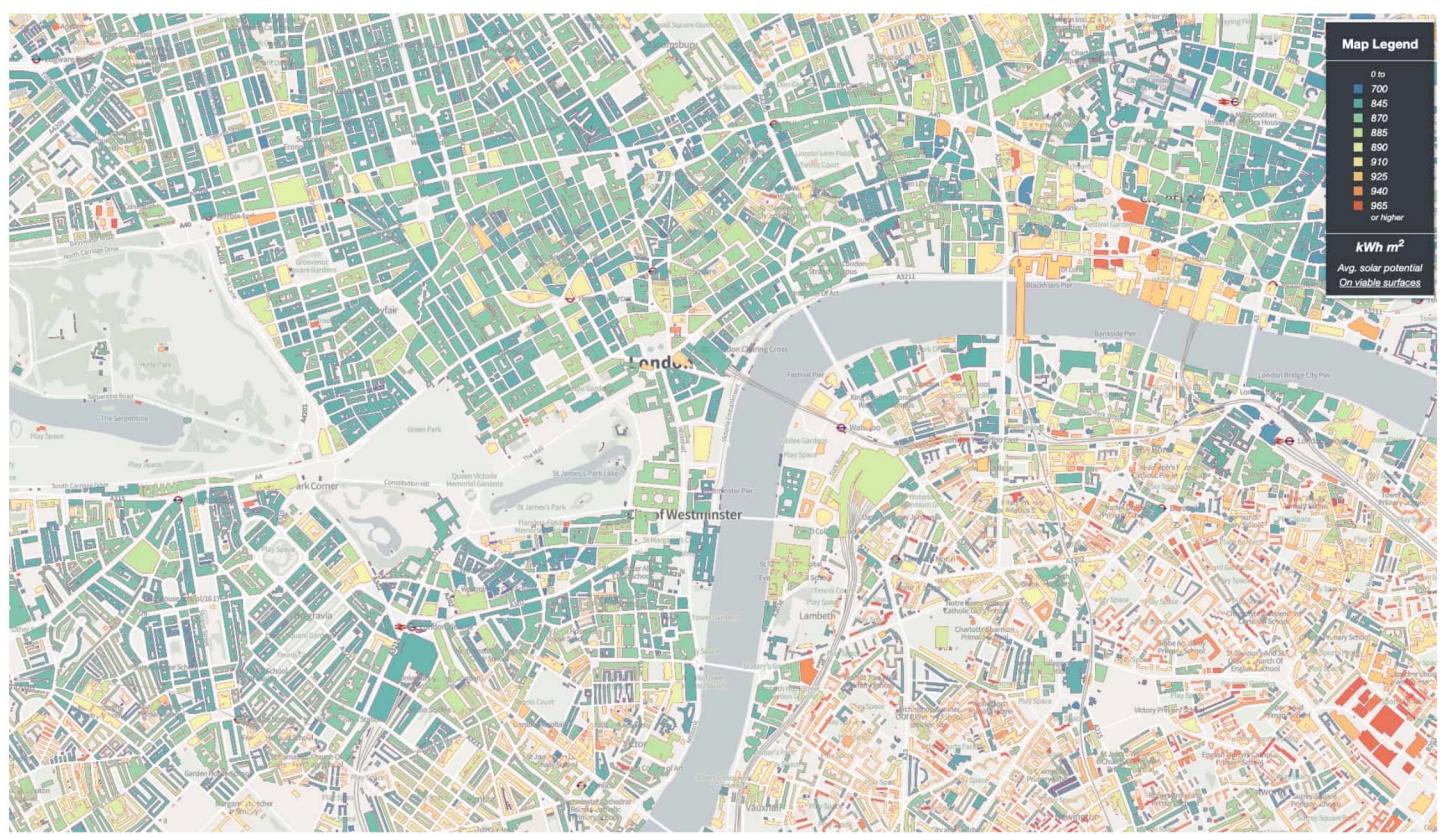
It is unlikely that your city can produce all the renewable energy it needs within urban boundaries – at least some supply will need to be imported from neighbouring municipalities, smaller cities and the wider region. This means that the build-out of renewables should be approached as a regional issue, considering where it will be located and who will provide, and planned in collaboration with regional partners.



To analyse these factors, engage external experts, energy companies and national and/or regional governments, and investigate existing projects in your region that could provide insight into what is feasible.

- **Resource availability.** Develop natural resource maps. These can be supported by free data portals, such as SolarGIS, the National Renewable Energy Laboratory’s (NREL) PVWatts Calculator and

C40 Cities' mapping tool for municipal properties. Examples include London's Solar Opportunity Map, illustrated in the image below,<sup>11</sup> and Tokyo's solar maps for energy potential and for use in heating.<sup>12</sup>



- **Technical viability.** Work with experts to understand the renewable technologies being considered, how renewable energy systems could be connected to existing networks, whether additional infrastructure or systems like mini-grids need to be established, and whether the skills and expertise are available locally.
- **Financial viability.** Understand financing options for locally applicable renewable energy sources and the level of support from private investors. The Clean Energy Business Model Manual explains business models and financial instruments that cities can use to implement clean energy projects and policies. The two most common financing structures, depending on which is enabled by local regulation, are power purchase agreements (PPAs) and lease arrangements. In a PPA, a municipality commits to purchasing power produced by a third party, enabling private developers behind renewable energy technology to raise finance while giving the city a clean source of local energy. Read How cities can create demand for large-scale clean energy generation for more on PPAs. In a lease arrangement, a third party installs the energy technology and leases it to a municipality for a fixed fee.
- **Regulatory viability.** Analyse the regulatory tools and frameworks in place at regional or national level that can support the deployment of renewable energy technologies, such as feed-in-tariffs, PPA



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frameworks or net/virtual metering mechanisms. Green tariffs that enable customers to source up to 100% of their energy from renewables can offer a way forward for cities served by a monopoly utility, which can reduce the viability of approaches like PPAs.<sup>13</sup>

## Financing renewable energy in Latin America

The [Guide to Incentivizing Renewable Energy Generation and Energy Efficiency in Buildings in Latin America](#) explains key mechanisms that cities in the region and beyond can explore, many of which aim to reduce the upfront costs involved in transitioning to renewable energy. For example, Mexico City's government is providing grants of up to 30% of investments in solar panels by residential and commercial building owners, as well as soft loans.

## Estimating your city's solar potential

Your city's solar potential can be estimated using freely available online data and tools. For example, obtain building footprint data for your city from [Google Open Buildings](#) and [Open Street Maps](#). For ease, consider excluding all buildings smaller than 25 m<sup>2</sup>, which can be too small for solar installations, and add up the total rooftop area of buildings above this size. Of this total, only a portion will be usable rooftop space for solar PV due to roof angles, shading, building heritage rules and other factors – the figure will vary city by city. You can consider adopting the useable roof space figure C40 used for an analysis of solar potential across member cities (that 10% coverage of buildings over 25 m<sup>2</sup> is useable roof space). You can then use [NREL's PV Watts Calculator](#) tool to estimate the potential electricity your rooftops might produce, assuming (for example) a standard, fixed array, and an average panel size of 2.5 m<sup>2</sup> with a power of 0.25 kWh.

You can also estimate costs using [IRENA Renewable Power Generation costs](#) (accounting for inflation since publication), and estimate the job creation impact [using employment multipliers from Vivid Economics](#).

Examples of city estimates produced by C40 using this methodology include:

- Covering 10% of Cape Town's rooftop surfaces with solar panels could generate 2,744 GWh of electricity and generate 87,000 job years.
- Covering 10% of Mexico City's rooftop surfaces with solar panels could generate 4,119 GWh of electricity and generate 54,000 job years.
- Covering 10% of London's rooftop surfaces with solar panels could generate 1,366 GWh of electricity and generate 23,000 job years.

## Set targets and map out scenarios for meeting them



To keep warming within the necessary 1.5°C limit, targets for city-wide energy use show clean electricity by 2035 and 100% clean energy by 2050, at the latest.

Involve utilities, large energy-using institutions, relevant civil society groups, the public and other stakeholders in the process to determine local targets that are ambitious but achievable. Informed by the feasibility assessment, an inclusive and consultative target-setting process will help to achieve widespread buy-in for targets. It will also help to identify the most suitable and desirable scenarios for meeting them, ultimately accelerating the transition to renewable energy.

Map out scenarios with different renewable energy combinations and growth rates, and align the targets with existing city infrastructure plans. Host stakeholder workshops and meetings to develop and provide feedback on these scenarios. While focussed on the wider climate action planning process, *How to engage stakeholders for powerful and inclusive climate action planning* provides relevant advice on involving stakeholders in target- and vision-setting.

Consider setting more ambitious targets for municipal operations to provide a clear mandate for city government leadership. Over 50 local council leaders in the United Kingdom, all members of UK100, have set targets for net zero municipal emissions by 2030 alongside 2045 citywide targets, for example.<sup>14</sup> Also convene sector-based stakeholder groups to develop sectoral targets and action plans within the broader strategy.<sup>15</sup>

## Sign up to renewable energy campaigns

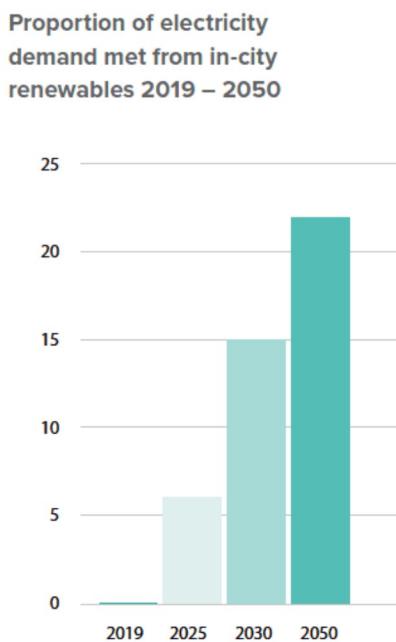
Joining a renewable energy campaign will help to raise the visibility of clean energy targets and align with other cities doing similar work. Such collaboration can also enable cities to pool resources, share lessons, increase their purchasing power with energy companies or leverage their collective power to put pressure on national governments.

Cities should join the *C40 Renewable Energy Declaration*, open to all cities globally, whereby they pledge to take all possible steps to accelerate the full decarbonisation of electricity, heating, cooling and cooking and the phase-out of fossil fuels. It promotes targets along three pathways, depending on a city's feasibility assessment. Other relevant global campaigns include *Cities Race to Zero*, which requires signatories to commit to targets and actions for renewable energy, as well as other key sectors.

The movement is accelerating. By the end of 2020, more than 1,300 cities had set targets or introduced policies to boost renewable energy; more than 600 had made commitments for 100% renewables by a certain date. Most of these cities are in Europe and the United States.<sup>16</sup> In the latter, more than 180 cities have signed up to the Sierra Club's commitment to power their communities with 100% renewable energy.<sup>17</sup>

## Durban's renewable energy scenarios<sup>18</sup>

After conducting a feasibility study, Durban developed several scenarios, with different technological combinations from inside and outside the city that could be included in the energy mix. Each was evaluated based on qualitative and quantitative factors, such as feasibility and cost effectiveness, to determine their strengths and weaknesses. Through this process, the city determined that solar technology should be the driving force behind the roadmap, enabling Durban to meet an increasing proportion of energy demand from in-city renewables over the coming decades, as the figure shows.



## Plan for effective implementation

The following actions and linked resources can support the successful implementation of your city's roadmap:

- **Take the lead.** Cities can lead by switching municipal energy consumption to renewable energy, and by maximising the use of municipal buildings, brownfield sites and other assets to produce renewable energy. City projects can showcase new technologies and options to stakeholders, develop the local market, and help to pave the way for broader take up of renewables to achieve a city-wide transition. Starting with smaller projects on municipally-owned sites also offers a lower-risk way for cities to gain experience with renewables.<sup>19</sup> *How to install solar panels on city-owned property* and *How cities can create demand for large-scale clean energy generation* explain two impactful ways to do this. Cities that are supplied by coal-based grid energy can also lead action to phase out coal.
- **Target building energy use.** Buildings account for a major portion of cities' energy use. As well as

implementing policies to reduce buildings' energy demand, cities should promote English heating and cooling and, where relevant, shift away from natural gas. In addition, encourage residents and businesses to install building-scale clean energy.

Consider a 24/7 Carbon Free Energy approach – manage demand as well as supply to enable electricity use to be met with carbon-free sources every hour of every day.

- **Ensure everyone has affordable energy access.** Energy access means that a household is connected to a secure, affordable and sustainable source of energy. Inadequate energy access holds people back from economic participation, damages health and leads to significant greenhouse gas emissions, among other issues. 10 ways to boost urban renewable energy access and 10 ways cities can tackle energy security and energy poverty provide advice oriented toward the issues faced in Global South and Global North cities respectively.
- **Ensure energy investments are resilient to climate risks.** Reducing climate change impacts on clean energy supply introduces ways to integrate climate change adaptation into clean energy investments.
- **Develop structures for continued collaboration and coordination.** In addition to supporting the development of the roadmap, cities should forge partnerships and create forums with expert organisations, such as universities or environmental non-governmental organisations, and create platforms for interdepartmental collaboration to aid its implementation.
- **Manage data effectively and monitor and report on progress.** Develop processes to manage data and to monitor and evaluate progress, alongside a reporting plan for keeping stakeholders updated. The City Climate Data Management Framework can support this.



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