ICLEI Local Governments for Sustainability

100% RENEWABLES CITIES & REGIONS ROADMAP

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IKI INTERNATIONAL CLIMATE INITIATIVE

solutionsgateway Climate, Energy, and Finance Solutions

100% RENEWABLES SOLUTIONS PACKAGE

Zero-emissions, efficient, and resilient buildings

This solution is part of a package of solutions meant to guide local and regional governments in implementing a local renewable energy transition by providing guidance on mechanisms, applications or technologies that can help accelerate their climate and energy action.

It was produced as part of the 100% Renewables Cities and Regions Roadmap project, which supports nine cities and regions across Argentina, Indonesia and Kenya to develop bankable renewable energy projects and in-depth local strategy and action plans to achieve one hundred percent renewable energy. The 100% Renewables Cities and Regions Roadmap project is implemented by ICLEI – Local Governments for Sustainability and funded through the International Climate Initiative (IKI), which is implemented by the Federal Ministry for Economic Affairs and Climate Action (BMWK) in close cooperation with the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) and the Federal Foreign Office (AA).

DISCLAIMER

All cities are unique. The Solutions Gateway has been developed as an advanced knowledge catalogue to provide an overview of possible Low Emissions Development Solutions. The Solutions and Packages it contains provide guidance on general conditions, which may not correspond to the existing conditions in your city or jurisdiction. The consultation and use of the Solutions Gateway does not waive the need for the Local Government to assess the feasibility of a Solution or Package in the local context in its city or jurisdiction, prior to implementation. Please note that the impacts, benefits and co-benefits indicated are generally valid but may not materialize in particular circumstances.

ABOUT SOLUTIONS GATEWAY

Solutions Gateway is an online resource platform for Local Governments where they will be able to find possible Low Emissions Development (LED) Solutions for their cities.

In the context of the Solutions Gateway, Solutions are processes, or groups of actions, which Local Governments can implement to deliver climate change mitigation results and enhance local sustainable development. Taking an integrated approach, and focusing on Local Governments usual responsibilities and roles, Solutions include core actions as well as enabling and multiplying actions essential to maximize their effectiveness and efficiency. These include policy, regulatory, governance, capacity building, awareness raising, stakeholder engagement, etc.

ABOUT ICLEI – LOCAL GOVERNMENTS FOR SUSTAINABILITY

ICLEI – Local Governments for Sustainability is a global network working with more than 2,500 local and regional governments committed to sustainable urban development. Active in 125+ countries, ICLEI influences sustainability policy and drives local action for low emission, nature-based, equitable, resilient and circular development. ICLEI's Members and team of experts work together through peer exchange, partnerships and capacity building to create systemic change for urban sustainability.

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1. INTRODUCTION

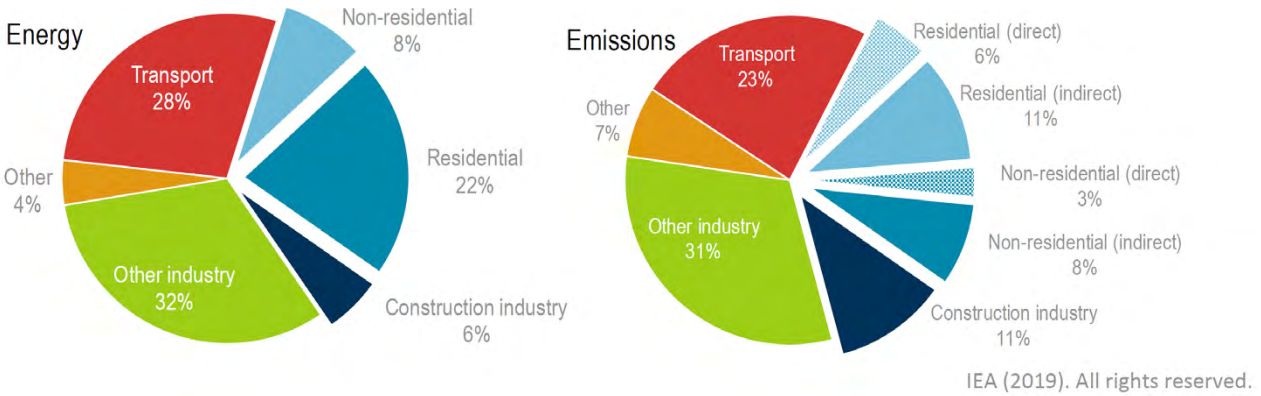
Architectural designs, construction practices, and technologies help optimize energy and resource use in buildings and provide benefits such as cleaner air, more comfortable homes and workspaces, and lower utility bills [1]. Improving energy efficiency in buildings aligns perfectly with the UN Sustainable Development Goals (SDGs) and the Paris Agreement by lowering greenhouse gas (GHG) emissions.

This solution is directed to subnational governments that are considering or have already committed to lower the impact of the buildings and construction industry on the environment due to the rapid rates of urbanization. This is relevant for governments responsible for urban planning decisions and policy-makers that are seeking to foster zero-emission, energy-efficient and resilient buildings. This solution provides general guidance on all stages of implementation of an energy efficiency strategy and specific actions. It is particularly relevant to countries and cities with rapid urbanization processes. It must be noted that for this solution enhanced multi-level governance and stakeholder engagement is crucial for successful outcomes.

1.1 RELEVANCE

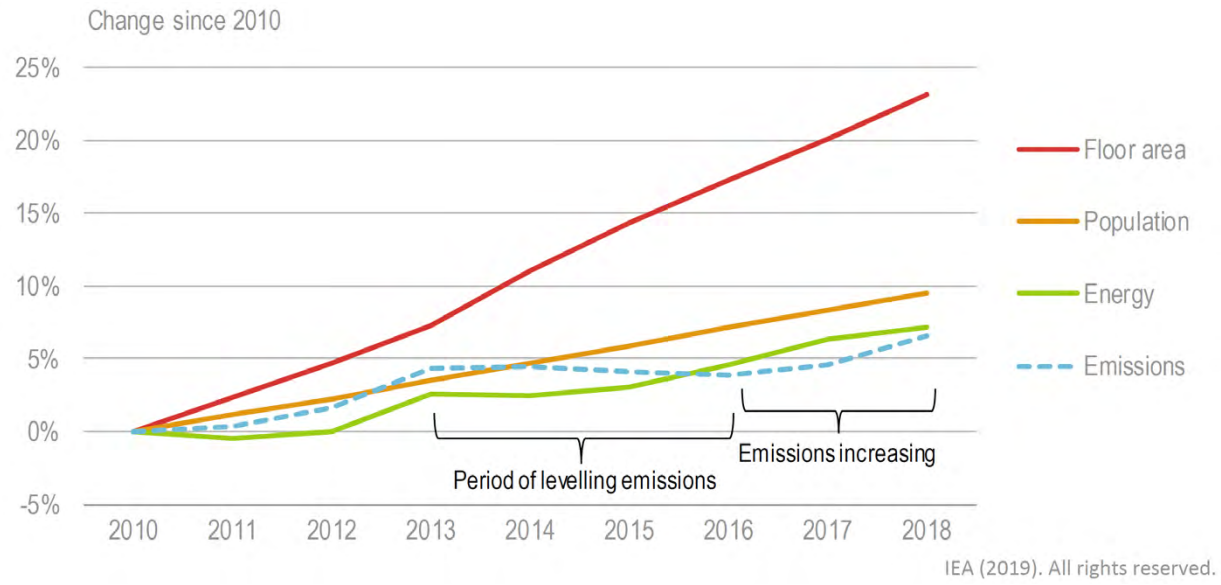
It is expected that 68% of the world's population will live in cities by 2050 [2]. Buildings are the most tangible reflection of the growing urban landscapes. The construction sector accounted for 36% of final energy use and 39% of energy and process-related carbon dioxide (CO2) emissions in 2018, 11% of which resulted from manufacturing building materials (such as steel, cement and glass) [3]. Final energy demand in buildings in 2018 rose by 1% from 2017, and by 7% from 2010.

Figure 1: Global share of buildings and construction energy consumption and emissions, 2018 [3]



Since 2010 the global building stock emissions continued to rise, directly related to the increase in urbanization:

Figure 2: Changes in floor area, population, buildings energy sector use and energy-related emissions [3]



Key global buildings sector trends are [3]:

- Buildings sector emissions (globally) rose by 2% from 2017 to 2018, to reach a record high.
- Final energy demand (globally) increased by 1% from 2017 and by 7% from 2010 to 2018.
- 82% of final energy consumption in buildings was supplied by fossil fuels in 2015.
- Increases are driven by population growth and strong floor area expansions, and therefore rising energy demand and emissions. Electricity mixes still include high levels of fossil fuels, especially in emerging economies. Continued decarbonisation of the electricity supply is therefore needed to achieve low-carbon building.
- While efficiency improvements continued to be made, they were not adequate to outpace demand growth. From 2010 to 2018, improvements were made in global average space heating (-20%) and lighting (-17%) energy use. Light-emitting diodes (LEDs) continue to be important in reducing the energy demand for lighting as floor area increases.
- As floor area has been expanding rapidly in warm countries, especially in the Global South, cooling demand is increasing. Efficient building envelopes are key to reduce energy use along with technology efficiency improvements [5].

Decarbonising the sector is fundamental to achieve the goal of the Paris Agreement target and SDGs, especially through energy efficiency measures and meeting the demand for heating and cooling through renewable sources.

1.2 MAIN IMPACTS

Efficient buildings create "triple bottom line" impacts: environmental, social and economic:

- Air quality improvement and associated public health benefits.
- Energy security and reduced fossil fuel supply, due to lower energy demand in buildings and higher renewable energy use.

- Reduced socio-economic impacts of fossil fuels' price volatility.
- Reduced energy poverty as zero-energy and energy efficient buildings lower the utility bills due to less energy consumed.
- Creation of local green jobs in the building and energy services sector especially.
- Reduced waste generation due to longer lifetimes of buildings and putting value to old constructions, avoiding demolition.
- Contribution to climate change mitigation due to reduced GHG emissions by using efficient materials and clean energy sources

1.3 BENEFITS

LOWER ENERGY DEMAND AND ENERGY COSTS

Policies fostering resilience in buildings, including using energy efficient appliances, LED lights, proper building insulation and leak avoidance (with efficient windows and doors), use of renewable energy sources, among other initiatives, have the advantage of reducing energy demand. In developing countries research shows that decrease can account for 50% energy savings [3]. Improved building efficiency is a win for city leaders and local planners: every $1 invested in efficiency saves $2 in new power plants and electricity distribution costs [1]. Utility bills can also be a significant burden on a household or business budget. Increasing energy productivity through measures like building efficiency has the potential to lower lifetime costs and reduce fuel poverty. Reduced electricity demand also has the benefit of reducing overall electricity system costs due to a reduced reliance on peak load power plants (usually the most expensive).

IMPROVED QUALITY OF LIFE

60% of the 2030 global building stock is yet to be built, with the newest construction in developing countries [1]. More resilient and efficient housing can bring a host of benefits to residents.

REDUCED GHG EMISSIONS

As construction is one of the most GHG intensive sectors, climate action acceleration in this field is crucial to achieve global ambitions to limit the rise in average global temperature to less than 2°C above pre-industrial levels by 2050, according to the Paris Agreement.

1.4 SUGGESTED INDICATORS FOR MONITORING RESULTS

- Property value ($ per square meter) before and after renovation (in case of existing buildings) or property value with or without energy efficiency implementation (for new projects);
- Profitability of the investment;
- Cost impact (investment cost, operation cost, life-cycle cost)
- Indoor air quality: Air quality summary Index (parts per million PPM);
- Thermal comfort: air temperature (°C) and humidity (%) indicators (industry standards compliance like ISO 7730);
- Visual comfort: Visual Comfort Probability index (VCP) or Luminance (lx))
- Acoustic comfort: Average equivalent sound absorption area (%) and Evaluation in accordance with room acoustics classes (Db).
- Energy performance index (EPI): total energy consumed in a building over a year divided by building area in kWh/sq m/year.
- Climate change (Carbon Footprint indicators);
- GHG emissions savings (% of CO_2)[1];
- Waste (Kg of waste generated per capita);
- Resource depletion (non-renewable energy, non-renewable materials, water - embodied and in use indicators).
- Energy balancing: Physical units (tons or m^3) are converted to energy units using Net calorific values (NCV) [kJ/kg];
- Peak power need (Gw);
- Storage capacity (Gw).

1.5 TYPICAL LOCAL GOVERNMENT ROLES

- Policy maker
- Regulator
- Advocator
- Planner/Architect/Engineer
- Role model
- Investor
- Coordinator
- Operator and energy service provider

1 The GHG Indicator: UNEP Guidelines for Calculating Greenhouse Gas Emissions for Businesses and NonCommercial Organisations". Accessed 12 Oct. 2020. https://www.unepfi.org/

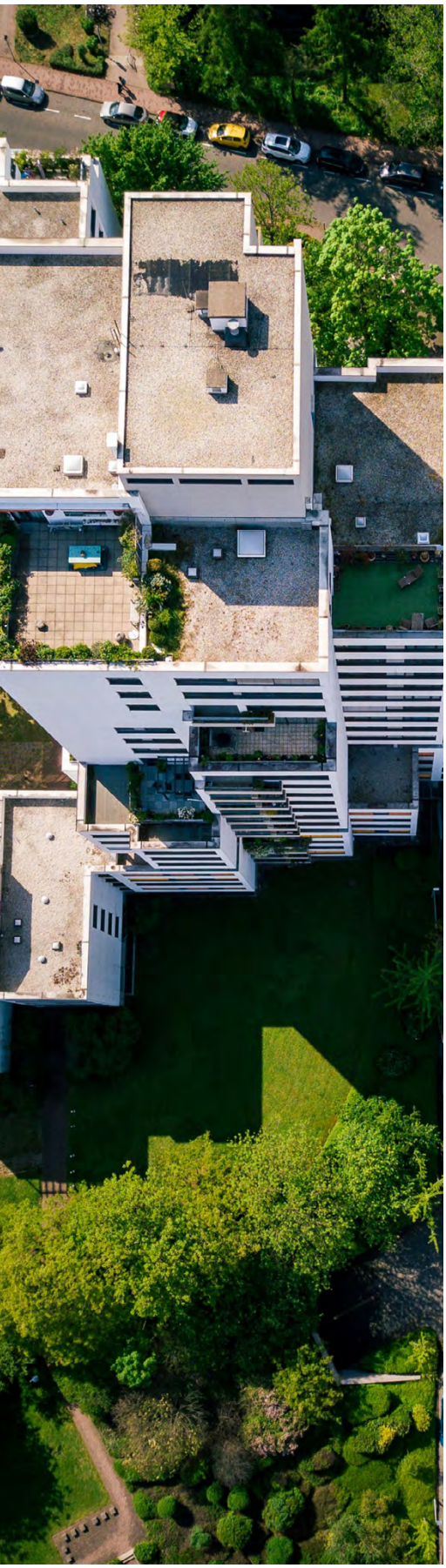
2. INTEGRATED SOLUTION OVERVIEW

	Enabler Actions	Required Actions	Multiplier Actions
Policy	• Relevant policy creation to regulate the energy performance of new buildings to address future emissions growth • Relevant policy creation to retrofit existing buildings to address emissions from existing building stock • Produce guidance on science-based targets identifying a common metric and language for all users. An example is the Science-Based Targets for Buildings (SBT4buildings) project led by the World Business Council for Sustainable Development (WBCSD)	• Development (or adaptation) of a strong mandatory building code that has to be improved progressively over time according to new technologies and regulations and with an effective implementation; setting standards for buildings will reduce the long-term energy demands of the construction sector • Creation of policy with the aim to reduce energy demand, increase renewable energy capacity and improve infrastructure resilience • There is general consensus that a combination of building energy codes and appliance efficiency standards are the most cost-effective policy measures for encouraging these actions in most markets globally [4]	• Aligning international commitments, such as updated NDCs, with action in the buildings sector e.g. mitigating building emissions through switching to low-carbon and renewable energy sources, and encouraging the use of low-carbon building materials, building envelope improvements, nature-based solutions, and equipment and system efficiency • Foster industrial synergies with the different stakeholders
Stakeholders and Awareness	• Identify and contact local, state, national and international stakeholders for early engagement, including local business, landowners, investors, building owners, tenants, local communities, energy suppliers, technology creators, NGOs, regional and national entities • Educate the construction sector on its transformation potential • Develop communication and information campaigns for different target groups • Provide accessible information for building operators and occupants to make informed decisions	• Conduct public consultation on energy efficiency to involve citizens in an early stage • Carry out community meetings and educational activities • Raise awareness of the benefits of climate action towards energy-efficient buildings to make energy efficiency an attractive alternative for local communities and building owners through campaigns using different tools including social media • Determine criteria to regulated and license based on stakeholder consultation, land rights, and other factors	• Engage in local, regional, national and international initiatives promoting energy efficiency in buildings to share good practices and multiply actions • Explore cooperation opportunities and synergies for further replication and up-scaling • Creation of an enabling environment: efforts to continue raising awareness and social acceptance of energy efficiency, especially tackling the misconception that is financially unviable and not worth the investment

	Enabler Actions	Required Actions	Multiplier Actions
Stakeholders and Awareness	• Convey a sense of urgency, develop common narratives, and formulate key messages	• Open and regular disclosure of performance, as well as compliance verification reports should be produced	• Promote the integration of energy-efficiency aspects in the education curricula, including easy techniques to save energy in the households
Governance	• Encourage technical and managerial energy-efficiency and building retrofitting expertise within the local government human resources • Collaboration and coordination across departments and organizations	• Development of national alliances and integration of sustainable building objectives into National Determined Contributions (NDCs), and enable city and subnational engagement. • Lead by example to ensure governmental buildings are energy-efficient and comply with the new code and ideally with latest certifications. These actions will raise awareness and promote the replication of the measures • Assess and improve the strengthened codes in cycles (e.g. 5 years) to improve performance requirements with the aim of gradually reaching net-zero-energy codes; clearly communicate this to industry and building owners	• Encourage market facilitation and capacity building by having a dedicated city unit to provide technical training, free consulting services and financing opportunities
Capacity Building	• Identify opportunities, facilitate community-level climate and energy strategies and promote co-operation among national and subnational governments • Strengthen human resources: both by hiring suitable experts and by training the existing staff. Additionally, support capacity-building among them • Promote a market transformation to engage the private sector and other stakeholders in decarbonising the entire construction supply chain. This involves volunteer agreements, but can be accelerated by financial and tax benefits	• Educate the construction sector on its transformation potential • Offer training in energy management systems to local communities • Disseminate new approaches and solutions, share best practices, establish an interactive knowledge database to enhance peer learning, and provide training and education through webinars and online courses	• Promote the integration of new and more efficient technology • Promote the development of training-based certification for suppliers and installers to raise confidence in the market and create a solid workforce • Continue training and building capacity in qualified staff to implement energy strategy and administrative procedures accordingly • Foster energy-efficiency aspects in the higher education curricula to promote the creation of new innovative solutions

	Enabler Actions	Required Actions	Multiplier Actions
Technical	• Assess municipal staff´s expertise on energy-efficiency and the need for external expertise and support • Assessment of existing local technologies and the need to import others • Assess the human and economic resources to provide inspection and monitoring once new and more ambitious building energy code standards are set • Create a database on the current state of the building stock and to keep track of the improvements in the future using proper indicators	• Optimwize the design of buildings to provide thermal comfort and natural light based on local conditions • Promote building designs that use passive cooling and external shading, in order to avoid excess cooling demand • Increase the energy efficiency of building envelopes to reduce demand for space heating and cooling • Introduce a "lifecycle approach" to decide on building materials in order to decarbonise the construction value chain • Increase the efficiency of appliances through improved national guidelines and standards and encouraging the use of LED lighting • Electrify cooking and other end uses e.g. heating where possible • Increase the depth of renovation in old buildings to reduce energy consumption by 30-50% or more [8] • Support building occupants to reduce energy consumption • Include roof-top photovoltaic and solar thermal installations and standards • Encourage the installation of smart controls: temperature, lighting and ventilation controls and sensors as well as smart energy metering to monitor the use of energy inside buildings • Reduce demolition by implementing policies to prioritize reuse when possible	• Investigate the possibility to incorporate district energy into planning to deliver more efficient low-carbon solutions e.g. through wastewater heat • Investigate the options to include a higher percentage of renewable energy sources • Assess and improve the existing codes in cycles (e.g. 5 years) to strengthen performance requirements with the aim of ultimately reaching net-zero-energy codes • Facilitate the export of surplus electricity generated by buildings incorporating renewable energy on site technology (e.g. solar panels on rooftops) to the grid • Form or strengthen an inspection and monitoring team to assess the compliance with the policy and building code standards • Explore innovative mechanisms such as cap-and-trade programs to synchronize action in the buildings sector across an entire territory [1]

	Enabler Actions	Required Actions	Multiplier Actions
Technical		• Encourage the use of recycled construction materials • Endorse thermal-resistant and seismic construction more resistant to extreme temperatures and weather events in order to be able to withstand the worsening impacts of climate change • Connect buildings to low-emissions district energy systems, for example using wastewater heat • Incorporation of building energy certifications to evaluate the performance of a building and its energy service systems. The aim of energy performance certification for buildings is to inform consumers about their buildings compliance with standards and eventually create a market for more efficient buildings	
Finance	• It is vital to increase access to financing to enable private investment in renovations especially to face upfront costs [3] • Map existing financing opportunities and promote innovative financing tools, enabling the flow of reliable information for investors; see [9].	• Include grants and rebates, energy-efficient bond and mortgage financing, tax incentives, priority processing for building permits, floor-area allowances, bond and mortgage financing, revolving loans, dedicated credit lines, and risk-sharing facilities [1]	• Strengthen and further plan project finance structures by securing different means of finance, such as: ◦ Create more incentives through tax credits and exemptions within tax systems ◦ Provide loan guarantees and underwriting to reduce risk ◦ Secure and provide grants from various sources e.g. development finance institutions, national government schemes etc. ◦ Expand city-level subsidies where possible



3. WORKFLOW / PROCESS PHASES

3.1 COMMIT AND MOBILIZE

- Secure the initial commitment to decarbonise the construction sector and make buildings energy efficient
- Organize the institutional structure to prepare for the commitment
- Identify the key stakeholders and start an early engagement process by public consultancies and informative sessions

3.2 RESEARCH AND ASSESS

- Assess existing building energy-efficiency policies (if existent) and identify measures that can be built upon to modernize the approach
- Assess the human resources that the government will need to implement energy efficiency and the need to hire experts or train the existing staff
- Assess the financial resources that the government already has available and look into new possibilities to finance the projects
- Assess the existing building stock and future demand to determine how best to implement policies

3.3 SET BASELINE

- Set up a baseline to achieve the different phases of the project
- Analyze how the current situation will evolve in a "Business As Usual" (BAU) scenario and forecast the expected outcomes when the actions are implemented over a period of time. It is particularly important for this solution to estimate the GHG emissions reduction potential compared to BAU and the economic savings (due to lower energy consumption) compared to BAU in order to make the case stronger
- Set up systems for energy efficiency data collection and monitoring. Local or regional governments should define relevant criteria for determining what data to collect, considering local circumstances and identified needs
- Compile a baseline synthesis report summarizing the above-mentioned assessments to prove transparency and clear goals

3.4 DEVELOP STRATEGY

- A major workshop(s) needs to take place involving all relevant line functions and departments, and key stakeholders in order to set priorities, using the baseline report as input to inform the debate

- Involve relevant stakeholders since the beginning of the process to understand everyone's needs and expectations, create ownership and avoid potential reluctance to undertake the measures
- It is crucial to set ambitious targets by producing or updating relevant policy and strong building and energy codes to move towards a specific outcome
- Start the transition from voluntary to mandatory codes
- Approve a Low Emissions Development Strategy (LEDS)

3.5 DETAIL AND FINANCE PROJECTS

- Detail LED Strategy and specific actions (look at the "technical" required actions section)
- Test and demonstrate the actions: first implement the LEDS on governmental buildings to act with the example. That experience will help the assessment of possible risks and help mitigate them
- Implement the Strategy on privately-owned buildings
- Select a financing model(s) and secure funding. Have a clear understanding of the economic and financial features

3.6 IMPLEMENT AND MONITOR

- Implement a strong energy efficiency code for buildings
- Prepare, approve and implement targeted policies and regulations to maximize the effectiveness and benefits of the planned programs and projects
- Implement a monitoring and evaluation (M&E) system for internal assessment of the implementation of projects and of the LED Strategy. Track progress against overall objectives and specific targets using defined KPIs according to the needs of the city implementing the strategy

3.7 INTEGRATE AND COLLABORATE

- Close the information gap and support policies and investments with measurable, reportable and verifiable data. Work to achieve an industry-wide global effort to develop a digital building data and information collection tool, known as a "building passport", to promote greater cross-sectoral collaboration and data transparency
- Connect with cities developing similar LED strategies and join networks to share good practices
- Collaborate horizontally and vertically to enhance the ability to implement the actions
- Commit for the next round of NDCs to mitigate building emissions with a more ambitious LED strategy

3.8 REVIEW AND UPSCALE

- Refresh data, review assessment and analysis. A periodic update and review e.g. annual or bi-annual, of the GHG inventory should be conducted
- Assess the implementation of the overall Strategy and specific actions to ensure the city stays on track to achieve its targets
- Make the most of the lessons learnt that emerge from the evaluation of the strategy to accelerate progress in a targeted way, to overcome barriers, replicate and up-scale successful approaches

3.9 ADVOCATE AND INSPIRE

- Report achievements and advocate: share the benefits and results perceived by implementing energy efficiency first in governmental buildings and infrastructure and then in privately owned buildings
- Create a platform to share best practices to give guidance to the involved stakeholders, to contribute to global climate advocacy and to gain recognition
- Produce an annual corporate report documenting the benefits derived from use of energy efficiency in buildings to the end-customer

4. REALITY-CHECK

Energy-efficiency and retrofitting initiatives in buildings are particularly important to cities in emerging economies with the most rapid urbanization rates. There is still considerable need for countries and cities to develop energy-efficiency measures in order to avoid expensive retrofits later. However, its general approach is applicable to any city in order to optimize their existing and new building stock. This solution is relevant to all kind building typologies, purposes and periods of construction:

- Old buildings that need refurbishment
- New buildings in the design phase
- Buildings include residential, mixed use, offices, commercial, industrial, with different adaptations depending on the use
- It is advisable to apply this solution first in governmental buildings to prove its benefits and be coherent with the measures, and then make it replicable to privately owned properties

4.1 REQUIRED PRE-CONDITIONS

- Political commitment to strengthen building codes and associated policies and to provide financial tools for its application
- In some countries certain systemic gaps may need to be addressed before this solution can be implemented, such as expertise within the local government and strengthening of the energy supply to avoid disruptions
- Collaboration with the buildings and construction industry can help improve policymaking, and provide clear direction and incentives for them to adopt these changes

4.2 SUCCESS FACTORS

- Establishing the political will to streamline policy, planning, decision-making, implementation and monitoring and to hold all stakeholders accountable
- Practicing multi-level governance between local government and across non-governmental organizations and stakeholders to expand and scale up ideas
- Engaging with local stakeholders which requires transparency and information sharing and stakeholder engagement from an early stage
- Adopting a long-term approach to avoid “locking in” inefficient practices established in building design and construction and assure investors this is a long-term commitment

- Providing financial incentives, as retrofitting has been proven one of the most cost-effective climate action measures, but the up-front cost must be incentivised, and adopting a commercial approach to highlight that retrofitting is financially viable and economically sustainable over the long term to avoid the misconception that these measures will be expensive and hard to maintain
- Phasing-out old and inefficient materials and technologies through concerted efforts
- Encouraging iterating and building-on the existing building techniques to incorporate new technologies and practices
- Having energy targets and standards in place to prioritize renewable energy and make this solution completely coherent and aligned with other local strategies and plans
- Public sector engagement in project development because of its longer-term planning focus and city-wide vision, applying the measure firstly in the governmental building stock to prove its effectiveness and raise awareness with concrete actions
- Identify the existence of local technologies to develop energy-efficiency using locally produced materials and technologies, both to adapt the measure to the city implementing it, and also to boost the economy by supporting local suppliers
- Use a systemic approach—planning and regulation should take into account the single building scale and also promote a systemic approach that generates economies of scale and considers city planning as a whole
- Ensure system flexibility to allow improvements over time, as innovations and new technologies are bound to be developed and policies will have to adapt accordingly
- Assess all the financial resources and mechanisms available to support project development and implementation such as tax policy, feed-in-tariff, bond and loans

4.3 FOLLOW-UP NEEDED AND/OR RECOMMENDED

- Define a robust monitoring and evaluation (M&E) mechanism to measure progress of the initiatives and define clear indicators for progress
- Continue business development efforts to increase building retrofitting market share
- Continue to foster relationships with key stakeholder groups by using different channels: meetings, customer services, educational activities in schools, public hearings, etc

4.4 BARRIERS

MARKET BARRIERS:

- Price distortions and inadequate signals prevent consumers from considering energy-efficiency measures; effective communication can help tackle this
- High transaction costs due to lack of standardized tools; this can be tackled by setting standards at higher governmental levels
- Dispersed and diffused market structure with multiple locations and small end-users can be addressed through encouraging innovative business models
- Multi-industries involved with different interests (construction, energy, industries) can be engaged with consultations

FINANCIAL BARRIERS:

- High upfront costs with benefits over the longer term, so support can be provided as is feasible
- Perception in the financial sector that energy-efficiency financial returns are insufficient, which can be tackled through sharing evidence of success stories and factors
- Lack of external finance for building owners

TECHNICAL BARRIERS:

- Lack of suitable energy-efficiency technologies and/or know-how, which can be addressed by engaging industry and training institutions
- Lack of capacity to monitor energy-efficiency investments and sustain them over the time, which can be addressed with greater digitalization and improved data gathering and monitoring
- Insufficient number of firms that can absorb multiple related services in only one business
- "Locking in" inefficient practices due to lack of minimum efficiency codes and standards or lack of clarity and communication of them, especially in rapidly urbanizing emerging economies. Iterating policy and standards, and setting out a predictable timeline for increasing these standards, can be a solution.

INSTITUTIONAL BARRIERS:

- Local governments, especially in developing countries, prioritizing more tangible development goals; however they can be encouraged to focus on longer term benefits as well, and align them with shorter term gains in other sectors
- Insufficient multi-level governance coordination to ensure coherence between measures; cooperation between peer local governments can help amplify their voices to encourage more multilevel governance

- Energy suppliers are compensated for energy sales, but have no financial incentive to promote energy-efficiency to their customers
- Governments and the private sector rarely form partnerships to tackle energy inefficiency; authorities should take active measures to encourage such dialogue

AWARENESS BARRIERS:

- Lack of straightforward information for building owners and tenants to make efficient decisions can be addressed through awareness campaigns that are targeted and relatable
- Lack of understanding of energy performance of buildings and the different indicators can be addressed through campaigns as well
- Inexistent benchmarks for performance, which can be addressed at the local or national level for policy alignment and communicated to communities
- Distorted perception that energy-efficiency and building retrofitting is financially risky [1].

4.5 RISKS

- **Climate Change threats** will particularly affect buildings: storms, flooding and seepages, lower materials durability and increased risk of structure damage or collapse, lowering building lifetime and increasing health-related as well as economic risks
- **The urban heat island effect** can pose a risk to existing and new buildings due to overheating levels, changing the expected impact on cooling demand; design codes may have to take these into account
- **Low social acceptance** towards energy-efficiency due to misconceptions about the benefits, especially economic doubts and the inability to choose between many technology options

5. CLIMATE CHANGE MITIGATION POTENTIAL

A study by the International Energy Agency (IEA) shows that, if implemented globally, energy efficiency measures in buildings could deliver 5.8 billion tonnes (Gt) CO_2 emissions savings by 2050, decreasing GHG emissions by 83% below the BAU scenario [1].

6. FURTHER SCIENTIFIC AND TECHNOLOGICAL INSIGHTS

The Climate Bonds Standard provides detailed sector-specific criteria for what qualifies as green for building stocks. This includes proxy indicators for carbon thresholds, such as LEED gold or platinum certified and ASHRAE 90.1 compliant [7].

7. NATIONAL – SUBNATIONAL INTEGRATION IN THE CONTEXT OF THIS SOLUTION

This section shows how the national-subnational integration can facilitate the implementation of this solution, focusing on the benefits that such integration can bring to the different levels of government.

7.1 BENEFITS TO LOCAL GOVERNMENT

- Participation in nation-wide capacity building programs for municipalities.
- Be part of larger-scale infrastructure projects that include more than one municipality and therefore creation of synergies and cooperation for future projects.
- Gain access to national credits and financial opportunities.
- Get help from dedicated national and international agencies to implement the strategy.
- Creation of green jobs and capacity building.

7.2 BENEFITS TO OTHER LEVELS OF GOVERNMENT

- Projects that are well implemented and monitored help to make the case and evidence the benefits. The experience of a city can be used by others encouraging higher levels of governments and international institutions to invest and create upscale programs, benefiting several levels of government.
- A city can involve neighboring municipalities in implementing a joint retrofit of different publicly owned buildings and infrastructure.
- Creation of an integrated policy feedback loop supported by local governments.

8. REGIONAL-SPECIFIC GUIDANCE AND INFORMATION

In 2017, the European Union started testing a new voluntary reporting framework called Level(s) using existing standards. The system seeks to improve the sustainability of buildings through a common framework of indicators and metrics that can be used to measure the environmental performance of a building both for new and old constructions. It considers a wide range of aspects related to building energy and environmental performance, ranging from health and comfort to life cycle costs and energy consumption. It is targeted for professionals that play a critical role in buildings development and management, including design teams, construction firms, property owners and facility managers [6].

9. RESOURCES/SUPPORT

9.1 CASE STUDIES

- TOKYO, Japan. Reducing emissions through green building. ICLEI Case Study 144
- BUENOS AIRES, Argentina. Energy efficiency of public buildings in Buenos Aires: The case of an office building. ICLEI Case Study 123
- FREIBURG IM BREISGAU, Germany. Long-term strategies for climate protection in Green City Freiburg. ICLEI Case Study 104
- MELBOURNE, Australia. Building an Eco City, building a Sustainable City. ICLEI Case Study 151
- BETIM, Brazil. Solar heaters in low income housing: Energy and financial savings. ICLEI Case Study 112.
- VANCOUVER, Canada. Zero-emissions buildings: A strong foundation for 100% renewable energy and carbon neutrality. Available at: https://renewablesroadmap.iclei.org/wp-content/uploads/2021/11/Vancouver-case-study_final_compressed-1.pdf

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