





Dossier on the applicability of existing transition pathways towards 100% RE for cities and regions





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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.

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

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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 support Local Governments (LG) wanting 100% Renewable to set а 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 give policy recommendations, on top of clarifications needed for the LG to pursue successfully 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 а climate neutral future. Finally, the specific context of the deep-dive 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.

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Executive summary

Strong behavioural and cultural changes and an audacious leadership towards a less energy-consuming lifestyle and development pathway are among the solutions of a successful transformative 100% RE roadmap of local governments.

Local governments and their leaders are among the most important actors that can overcome political roadblocks preventing large-scale decarbonisation strategies. Political leaders are expected to commit to a visionary, transparent and fast transition to a postcarbon future, which would unlock the enormous potential of the variety of benefits that this transition can bring along, foreseeing social and technological innovation and skilful implementation at all levels of society.

In the framework of a continuous improvement process and a lean strategy to be successful in rapidly changing environments, local governments can play a variety of key roles in the different phase:





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1. Introduction

The increasing risks related to global warming are an argument for visionary leadership and decisive action (Wiseman et al. 2013, Badino et al. 2020). The ambition of a community and its leader is independent from its size or location, being rather a vision and a direction for a sustainable, resilient, just and fair development.

As other and this assessment show (Badino 2020a, GSR 2020, IRENA 2019), the ambition and overall direction of energy transformation is still very timid and excessively slow. Also according to the majority of sources (such as UNEP 2019, Wiseman et al. 2013), the ambition of the National Determined Contributions (NDC) and local governments pathways must be drastically increased and supported by action in order to keep the chance of reaching the target of remaining "well below 2°C". Unless a rapid action is immediately implemented together with the current pledges, "costs would be much higher to reach deeper reductions necessary later and the damage from climate impacts would be far greater" (Wiseman et al. 2013).

The feasibility of a certain goal in the short or long term strongly depends on beauty of the pathway itself: the strategy the local governments set in place, as well as the actions that they implement are key to create enable a 100% RE development, thanks to the engagement of citizens and stakeholders on the same vision. Setting long-term goals and intermediate targets provide the framework that the local government is envisioning for energy transition and sustainable development, building momentum around the sustainable development itself. In a similar way, the goals are more likely to be achieved when the strategy affects various sectors and it is aligned with other objectives of the government (i.e. social inclusion and energy access among local others). Developing holistic policies and long-term funding schemes, supporting mechanisms and incentives, as well as implementing renewable energy projects in public properties first, enable the environment for business development around a clean, sustainable future. Clear, transparent communication and participation mechanisms ensure strong citizens and stakeholders' involvement and engagement in the process, anticipating potential obstacles and unlocking unforeseen potential for action. Multi-level governance and strong collaboration with other levels of governments, as well as with peer local governments unlock the possibility of developing higher ambition and of establishing stable measures that foster the development of the renewable energy market.

Renewable energy sources and community-wide 100% RE visions can be a great opportunity for global development on multiple dimensions, such as environmental, social and economic. For the poorest countries, social and economic development could be unfolded in a sustainable way since the beginning, avoiding making the mistakes of the industrialized countries and, supporting job creation, access to sustainable and affordable energy and adaptation to climate change, reducing environmental and health problems,



while stimulating a non-capitalistic environment with the least possible energy needs. Most crucially, renewable energy development can reduce greenhouse gas (GHG) emissions of existing processes to mitigate climate change, while supporting a shift of fossil fuel-based sectors to more sustainable productions, ensuring employment needs (IPCC 2011).

In the present dossier, the strategies and vision examined (Badino 2020a, Badino 2020d) are grouped according to similar pathways and assessed considering their applicability to reach the most ambitious energy transformation that can be hoped for, in order to mitigate and quickly adapt to the reality of climate change, which is becoming increasingly compelling.

Several roles that local governments can play in the sustainable energy transition are presented in <u>Chapter 2</u>, considering a on continuous improvement process indicated in the GreenClimateCities methodology (GCC 2020) and previous considerations (Badino 2020a). <u>Chapter 3</u> groups the 100% RE roadmaps previously considered (Badino 2020a, Badino 2020d) in "pathways", giving some indications considering their potential to reach energy transition and listing positive aspects and opportunities for improvement. Specific examples of cities are presented in each, in order to acknowledge strengths and weaknesses of the specific type of roadmap with a practical application. Technical and sectoral guidance is briefly given in Chapter 4. Final conclusions are drawn in <u>Chapter 5</u> and small <u>Glossary</u> together with the list of <u>References</u> follow.

"We are running out of both time and options because we are not being honest about what has to be done. The solutions exist, but unless you are honest about the problem, they will never be adopted." (Ian Dunlop, in (Wiseman et al. 2013))



2. Local governments and their role in the transition

Local governments have a key number of mandates and roles in supporting the roll-out of renewable energy in the community. On top of the policy recommendations already included in the "Dossier on transition pathways towards 100% RE for cities and regions" (Badino 2020a), the present chapter provides suggestions on general roles they can take, enabling them to exploit renewable energy sources in the best possible transition pathway to clean future can be highlighted considering the lessons learnt from the assessment of the existing pathways (Badino 2020a, Badino 2020d).

It is important to consider that the process supporting the successful implementation of an energy transition pathway such as the 100%RE is one of continuous improvement. The ICLEI's GreenClimateCities (GCC) methodology for integrated climate action (GCC 2020) offers a good process support to any size of local government, as the three main phases of Analyse, Act and Accelerate, further divided in steps, can accompany the process and support it with resources, tools and guidance.



Figure 2-1 GreenClimateCities 2.0 process (GCC 2020)



The responsibility and role of local and national leaders is of utmost importance to make sure that the global society invests money today to save us all tomorrow, that decisions are made following a vision and not cost-effective priorities: society needs to choose policies that are more expensive than the cheapest solutions. The courage and strength to support these kind of policies against the common decision patterns can be supported by technical, social and economical long-term analysis, which can increase citizens and stakeholders' awareness and engagement. Thanks to the LG actions, market and businesses can be regulated in order to get perfect alignment between social and business interest – something that didn't happen for the past 50 years, pursuing rather short-term objectives (Randers 2013).

The following sub-chapters present some clarification on how each phase of a GCC continuous improvement process can apply. They are not exhaustive, of course, and their practical application depends to the LG context, but can provide good guidance on how the policy recommendations (Badino 2020a) and a variety of roles that LG can play support the transition. The phases should not be considered as consequent.

Analyse phase – Commit politically to a 100% RE vision

The local government should, first of all, secure political commitment to a very ambitious vision and both short- and long- term commitments. It is important that the institutional structure is well defined, with roles and responsibilities.

We need visionary and ambitious people, ready to lead the communities and to make the local administration to perform as role models.

The unsustainability of the current fossil fuelled human-centred industries is long known to be noxious from various points of view: environmental degradation and biodiversity losses are caused in innumerable ways by market and energy needs; social and human rights are violated hurting the most vulnerable people and parts of society, while entire countries are exploited by their richer counterparts who aim at enriching themselves and meeting their market and energy needs. Moreover, a seemingly incapacity to understand we are living in a world of limited resources is common to most human beings, despite the fact that scientists have shared increasingly loud concerns for more than 50 years; and, finally but not exclusively, it is possible to assist to a raising tendency of disconnection from nature and from others, drifting into the utopia of "constant GDP growth" (Mazzuccato 2020, Meadows et al. 1972, Rull 2011, Wiseman et al 2013). A regenerative and distributing model designed to engage the whole population should replace the linear growth in order to be sustainable (Forbes 2020) and the narrow, GDP-based measures of societal progress should be replaced with broader economic, social and environmental well-being and resilience indicators and targets (Wiseman et al 2013). Local governments could be the drivers for cultural changes in this direction, supporting the creation of a



circular economy building on "multiple services and intangibles which offer vast and sustainable growth" (Forbes 2020).

"Managers work to get their employees to do what they did yesterday, but a little faster and a little cheaper. Leaders, on the other hand, know where they'd like to go, but understand that they can't get there without their tribe, without giving those they lead the tools to make something happen. Managers want authority. Leaders take responsibility." (Seth Godin)

Technological and political priorities are well understood and aligned among the researchers and available literature since the 70's, when notable scientists, economists, business leaders and former politicians started addressing urgently the multiple crises that humanity and the planet face and define comprehensive solutions to the complex and interconnected challenges of our world, while developing guidelines and practical tools (Meadows et al. 1972, Randers 2012, Randers 2014, Wiseman et al. 2013). Some practical suggestions to achieve a fair and sustainable future through a drastic cultural shift include:

- 1. **Slow population growth**: have fewer children is clearly a very efficient way of reducing the increasing energy demand, especially in the industrialised and rich parts of the world where the pro-capita footprint is very high.
- 2. **Rapid reduction in energy consumption** through reduced energy needs, improved energy efficiency and stringent demand side management.
- 3. **Rapid reduction in climate footprint of all sectors**: eliminate fossil fuels (in the rich world in the first place) and replace them completely with renewable energy.
- 4. **Drawdown and carbon sequestration** into sustainable carbon sinks, such as increasing forestation.
- 5. Help the poor: build a climate-friendly energy system in the poor parts of the world.
- 6. **Temper short-termism**: establish supranational institutions and develop long-term comprehensive visions.
- 7. **Establish new ambitious goals**: increase social well-being in a world without unlimited growth.





Figure 2-2 (Image by Yves Bernardi from Pixabay)

Analyse phase - Assess the context and connect with stakeholders

Among the first assessments that a local government should do is about which kind of topics should the "climate action" team of the local government focus on and plan capacity building activities accordingly, in order to develop the strategy and communicate it in the best possible conditions.

A well-defined citizens and stakeholders' engagement plan, as well as a strong and transparent communication plan, both to be implemented throughout the whole strategy development, implementation and reporting process, are key for the success of the vision.

The assessment of the local and national contexts is key to develop a vision that is aligned or support increasing ambition of other policies and development pathways. When committing to and setting a vision, it is important to consider all potential opportunities for synergy with other LG goals, such as social inclusion, climate adaptation, economic development, employment policies, education or urban planning.

Local governments can act as drivers for change and can support the development of businesses or can build on a longer track record of ambitious environmental policies, creating momentum for a sustainable and green economy. Vision and strategy, accompanied by ambition, are able to gain confidence and public trust thanks to good



communication, which can facilitate good policy outcomes (Forbes 2020, Mazzuccato 2020). LGs can:

- support private strategies serving the community,
- act as incubators for a new renewable energy industry sector, and
- support business that aims at reforming the city economic profile.

The local government can develop its vision together with local entrepreneurs and establish local clusters, which are key to successfully walk the pathway to 100%RE (IRENA and ICLEI 2013).

"We have to change what it is we consume. Not just what we consume but the rates and levels of our consumption. So, the number one thing is reduce what we consume. The number two thing is to try and consume differently and the number three thing is to try, in the wealthy parts of the world, to change the mechanisms that feed into that consumption." Kevin Anderson (Wiseman et al 2013)

Analyse phase - Analyse the baseline and created synergy

While assessing the baselines, (i.e. current status of the energy consumption, GHG emissions, risks and vulnerabilities of the community lead by the local government) including other relevant considerations allows taking action with a broader scope and optimise efforts, aligning them to the same goal.

The "2050 pathways: handbook" suggests many questions to be considered among the first to start the analysis (2050 pathways 2017).

The status-quo of energy and goods consumption should be put into discussion first, trying to imagine a different possible future, supporting citizens' engagement, market transformation, as well as behavioural and systemic changes to lower the consumption and step out of capitalistic patterns and fossil fuel dependency. The methodology indicated by GIZ in the handbook "Sustainable Urban Transport: Avoid-Shift-Improve (A-S-I)" (GIZ 2011), as well as the current indications on waste reduction and circular economy principles (such as Circular Future 2020), are great examples of this approach, which can be applied for other sectors: energy consumption should be first of all avoided, then reduced with energy efficiency and behavioural changes, then improved using renewable energy, improved infrastructures and optimisation processes. An example of the key decisions faced by a person willing to buy a given commodity because of the need to travel is given in the picture below.





Figure 2-3 Key decisions faced by a person willing to buy a given commodity because of the need to travel (GIZ 2011)

Only after these steps of consumption avoidance and reduction, should the LG address the remaining consumption with technological solutions to increase energy efficiency of existing and future processes, and then substitute the energy fossil sources with RES.

The single biggest failure of leadership is to treat adaptive challenges like technical problems (Hifetz and Linksy, Cambridge Leadership Associates) (Lahey 2017)

Analyse phase - Stringently reduce the energy demand

Behavioural changes and energy demand control is where the maximum potential for change relies together with a great potential to achieve positive change. As a result of the assessment of the pathways, it is possible to highlight a number of areas that have been, so far, largely marginalised, namely, reducing the demand for things that are making climatic upheaval worse and changing some of our most damaging and detrimental behaviours (Rapid Transition Alliance 2018).

Reaching the minimum of energy needs according to the context and supporting RES to cover this minimum demand is one of the safest strategies to enact. Moreover, a 100%RE



and a deep decarbonisation vision are the best instruments that a local government has to support a cultural change. Unfortunately, it appears that there is no pathway towards this direction and including a drastic reduction in energy use or avoided energy needs together with a deep decarbonisation of the economy.

"It's not really that I hate capitalism; I really couldn't care less what kind of system of economic distribution we have, as long as it works for the good of all." (Oscar Auliq-Ice)



Figure 2-4 (Image by Thanks for your Like • donations welcome from Pixabay)

Act phase – Develop a successful 100% RE pathway

Literature highlights criteria for a pathway to be successful (2050 pathways 2017, DDPP 2020, Wiseman et al. 2013) as follows:

 Clarity regarding the vision, the objectives of the strategy, the assumptions, the methods and the results. This requires good technical understanding and transparent communication regarding the goals and objectives, direct and indirect benefits for the community, roles, responsibilities, timelines, trade-offs and eventual changes to the original strategy, among others.

- **Relevance** to support energy transformation and global sustainability of the consumption pattern. The pathways must be "transformational in terms of their impact on emissions, address concerns about societal impacts and are communicated to audiences in terms they understand" (2050 pathways 2017). Citizens and stakeholders engagement in all phases of the development and implementation of the strategy is key, both to ensure the relevance of the strategy for the whole community, as well as engage them in the local government vision and create the right environment for a sustainable 100% RE economy.
- **Practicality** from the analysis to the implementation of the strategy: the assessment of the baseline should be scoped in a manageable way, the results described in concrete, physical terms and the strategy should provide concrete steps for implementation, also considering the role and practical engagement required from stakeholders and citizens for the vision to be successful.
- **Credibility** of the vision, the strategy and the results. The analysis should be robust and transparent, using appropriate methods and tools. Data constituting the pillars of the analysis, achievements, failures and the need for amendments should be transparent and available for third party objections.

"First they ignore you, then they laugh at you, then they fight you, then you win" (Ghandi)

The following practical principles can help to ensure all the above-mentioned criteria of clarity, relevance, practicality and credibility in general terms (2050 pathways 2017, Badino 2020a, Badino 2020d) and to support the success of the pathway implementation:

- **Socio-economic** (e.g. economic development, human rights, social justice, energy access or education), **adaptation and emissions objectives** are integrated and assessed together, from the analysis to the implementation phases of the strategy.
- **Backcasting** to identify the necessary conditions for the successful implementation of a desired ambitious strategy: start with the envisioned end state and work backwards to the present in order to identify the steps to be planned.
- **Analysis** of evolution in technologies, consumption, population growth, business models and local context, in order to identify the required physical transformations and policy decisions to meet short- and long-term goals.
- **Comprehensive assessment** of the scope of the target together with the analysis of the context conditions and the potential measures to be considered.
- Stakeholders' engagement and transparent communication during all the phases of the pathway and the strategy development: from the analysis and the findings to



the related governance, as well as planning, implementation and monitoring processes.

The details of strategy design and implementation, the capacity of the LG to be flexible and lean in matter of policies and regulations and to adjust as technologies, markets and other factors evolve, are critical in determining the effectiveness and efficiency of the 100% RE strategy (IPCC 2011). It is thus important to make sure that the strategy is well conceived, yet sufficiently lean to adapt to a changing environment and context while keeping its ambition. There is no one-size-fits-all approach to achieving 100% renewable energy and targets, as measures and enabling frameworks are determined by local circumstances (IRENA 2019).

Act phase – Concretise the vision as the driver for change

The 100% RE vision should be concretised in a strategy and an integrated action plan, with measures that allow reaching all the desired objectives step by step. A robust analysis of the baseline situation compared with the vision provides the local government with a stepby-step pathway built on concrete measures to be implemented with the aim of reaching the desired objectives.

Quantitative targets as well as qualitative goals can be carefully planned and prioritised, allocating funds and finding additional funding mechanisms, as well as implementing policies and regulations to enable the implementation.

As mentioned in the previous section, backcasting can be a good method to help the local government identifying the necessary steps to be included in the 100% RE strategy (2050 pathways 2017): a desirable future is defined quantitatively and qualitatively and the analysis can show the way to get there. The operating lifetime of infrastructures and equipment as well as the long timespan that bureaucratic procedures oftentimes need in order to be effective should be considered in order to optimise the measures to enact. Near-term actions should be already aiming at the same level of ambition, in order to set the scene and the tone of the development pathway of a community. The analysis can help highlighting measures, policies and investments that support reaching one goal in the short term, but are not compatible with long-term goals, posing the risk of stranded assets or missing emissions targets (e.g. coal to gas substitution in power generation).

The investment on policy instruments, such as deployment policies that enhance demand for new technologies (i.e. feed in tariffs on RE electricity, fiscal incentives for RE heating and cooling, RE fuel mandates or blending requirements in the transport sector), is most effective when complemented with public R&D (research and development) investments, which have proven creating a positive feedback cycle encouraging private sector investments (IPCC 2011).



LG should aim at using the 100% RE strategy as a driver to transform the economy in a sustainable way.

It needs to be highlighted that the long-term focus allows for a systemic change to happen thanks to careful visionary planning and to step by step implementation, "helping stakeholders develop a realistic understanding of what a low-carbon future requires in terms of infrastructure stocks, technologies (including required technological breakthroughs) market structures, behavioural changes, and investment over time, starting from an accurate description of present day conditions" (2050 pathways 2017). High level of granularity of the strategy implementation allows citizens and stakeholders to translate the necessary changes in actual action, as well as local governments to develop policies that enable the environment for transformation.

> "The cost of staying below 2°C can be less than 1% of global GDP, when investments are spread overtime. Coordinated early action (ie. starting now, well before 2020) will deliver the least cost way of staying below 2°C. The longer the delay, the higher the cost and the bigger the technological challenges." Climate Action Tracker Update, 2012 (Wiseman et al. 2013)

Act phase – Enable policy and support sustainable investments

The local government can attract direct investments by implementing supportive policies on land-usage, tax-return and financing to overcome challenges such as the small size of the local solar energy industry, the lack of well-developed financing mechanisms for growing industrial companies and the shortage of sector-related skills and expertise (IRENA and ICLEI 2013).

Analysing literature, best practices and the way in which the existing targets are communicated, it seems clear that the main roadblocks are represented by social and political hindrances, rather than by technical problems (among others, Delucchi and Jacobson 2010, IPCC 2011, Louis 2017, Wiseman et al. 2013). Among the main problems highlighted are for example political hindrances, such as fossil fuels lobby and political inaction which are not supporting the market and system transformation to a new, smaller and sustainable consumption pattern. Social hindrances are also listed, such as climate change denial and other psychological barriers to citizens and businesses' engagement, as well barriers related to social and personal values and affecting the perception and acceptance of RE technologies. Outdated existing energy infrastructure, regulations or



financial constraints, as well as non-internalised environmental and health costs in the market are also considered.

Decarbonisation supports sustainable development and the aggressive intervention needed on the demand side are a key strategy to reduce energy poverty and improve energy access (DDPP 2020).

"What we didn't really anticipate was the success that the opposition would have in taking a few random anecdotes and turning them into enormous elements of doubt in the minds of people that had not yet begun to really focus on this." Roy Neel, former Chief of Staff to US Vice President Al Gore (Wiseman et al. 2013)



Figure 2-5 (Image by Thanks for your Like • donations welcome from Pixabay)



Accelerate phase – Shift rapidly the transition in a long-term vision, step-by-step

LGs should focus on investments and procurements in order to orient the community efforts towards the big challenges in our horizons, avoiding immediate, short-term recovery (Forbes 2020, Mazzuccato 2020, Randers 2013).

The need to make a rapid transition shift in the way we live, work and run the economy is also advocated by other authors (Rapid Transition Alliance 2018, Randers 2012, Randers 2013), in order to allow the world population to thrive, fairly, within planetary ecological boundaries. Considering the non-linear effects of climate change and resource exploitation that might occur in a very short time, we should aim at radical, "*clear, quantifiable changes in our values, behaviour, attitudes, and use of resources, energy, technology, finance and infrastructure*" over the next five to ten years (Rapid Transition Alliance 2018).

The way nations, governments and humanity typically make decisions, should be strongly modified, shifting from short-term, cheap solutions to long-term, expensive ones. Local and national governments, capitalism and democracy typically pursue the short-term interests of the voters and shareholders, and the market is designed in order to allocate capital to the most profitable projects (i.e. the cheapest solution) (Randers 2012, Randers 2013). The same cannot be the components of the ambitious vision and solution to avoid huge climate crisis. Now, technological advancement as well as research are available and it is proven that even only a tax increase of 2% on all the richest people and industrial regions could solve the climate problem globally (Randers 2012, Randers 2013).

Local governments should never stop setting goals to be achieved. They should not settle for a single medium-long term target with moderate ambition, but rather use a small achievement to test the system, enable the environment and create a momentum around sustainable energy consumption patterns and renewable energy use. While walking the pathway to a certain set goal, the local government should continuously monitor the status of the advancement, to tweak or change the measures initially planned, in order to increase ambition and to set new goals.

The long term goal should be the most ambitious achievable goal: as the feasibility mostly depends on the enabling environment and cultural perception of the possible transformation, no goal seems to be too ambitious, as long as the local government strongly activates in all directions to start walking the pathway to reach that goal.

"There is no greater waste of resources in ordinary organisations than the energy expended every day to hide our weaknesses and manage others' favourable impressions of us" (Kegan and Lahey 2016)



Middle steps should be always foreseen, to force a step-by-step approach which starts the implementation in the near-term, avoiding anything that does not support the long-term commitment: whether considering citizens and stakeholders' participation, local and international investments, policy and strategy development, psychological perception or communication, a strategy that foresees clear, intermediate goals is key for its success.

Accelerate phase – Communicate and build trust

Good quality, transparent communication activities should occur throughout the various phases of strategy development and implementation. Stakeholders and citizens' trust and engagement strongly rely on how well the local government shares and communicates in a variety of ways. Literature (2050 pathways 2017, Badino et al. 2020, DDPP 2020, Louis 2017, Mazzuccato 2020) gives guidance for good communication, such as:

- 1. **Internal communication.** Communication has to be organised within government decision-makers in relevant departments and their teams. The broad objective of the strategy, the research and policy questions and developments, the monitoring and results of the strategy, the integration of stakeholders' feedback, as well as data access, deliverables and analysis should be shared and communicated in a way that is understandable by all other departments.
- 2. **Two ways communication** with citizens and stakeholders should be envisioned, to solicit input and feedback while reporting on progress and results. Timing and opportunities for input should be clarified together with the kind of input sought.
- 3. External communication with broader audiences (i.e. citizens and stakeholders, as well as media, trade unions, non-governmental organisations, investors or legislators) will allow them to relate the local government's objectives and vision with their concerns beyond climate action, such as economic development, job creation or health.
- 4. **Understandable language** should be used, both in terms of avoiding using an excessively technical style while maintaining the robustness of communication, and in terms of using message contents with which the audience can relate acknowledging for example their drivers for action and socio-economic context.

The community needs to be reassured that the ambitious strategy for the community does not only entail more efficient and sustainable energy consumption and the long-term protection of the ecosystem, but it tackles inequalities and improves social well-being as well.

No failure, change of plan or middle step is not worth being communicated, and no step on the pathway is unimportant. The State of New York, for example, presents the vision and the plans clearly in their website, reports on results and amendments to the strategy and



sharing the minutes of the single board meetings held concerning the development of the CLCPA (Badino 2020d, New York 2020, Sierra Club 2020).

Communication activities, community dialogues and celebrations are part of the strategy of the city of Vancouver (Canada) (100%RE Energy Atlas, Badino 2020d, Brot für die Welt and World Future Council 2018, Go100RE 2017, ICLEI 2020a, IRENA 2018) to engage the public in an open dialogue with the municipality, to collect feedback during the planning and implementation phases, to discuss programmes and plans in consultation, to perform educational workshops and "100%RE Talks". Occasions to celebrate mid-point achievements during the action plan were organised with a "Bright green summer" fest.

A good understanding of the technical characteristics of the 100% RE strategy envisioned is key in order to avoid miscommunication: the assessment of the existing pathways shows that this is particularly worth mentioning. Trade-offs and key decisions taken while defining the strategy implementation, synergy of 100% RE achievement with other LG objectives, amendments needed to the first plan, as well as clear, transparent updates on the results and monitoring of the achievements should be shared via all communication channels, so that media coverage supports the engagement of the reader and builds trust and participation into the same objectives.

Accelerate phase – Ensure multi-level governance

Scaling up and continuous improvement depend also from capacity building, both inside the local government and outside, within the community and businesses, as well as from the collaboration with peer levels of LG or other levels. What is called horizontal and vertical integration, or multi-level governance, is key to increasingly remove barriers to citizens and businesses' engagement in the same LG vision.

Multi-level governance and horizontal cooperation are key to improve and implement an integrated 100% RE roadmap. A group of peer LG can advocate certain policy or regulation changes to the higher level of government, as well as to the business sector.

In the same way, being able to increase further knowledge on technical, financial, policy or any useful aspect that allows the implementation is key to success. It is important to underline the role that Sustainable Development Goal (SDG) 17 (namely "partnership for the goals") plays in the development of the pathway itself (Badino 2020a). Horizontal collaboration with peer local governments, in the same country as well as globally, with local businesses and stakeholders is key to ensure an effective and comprehensive approach unfolding the roadmap (World Future Council 2018).

A wide variety of existing studies, resources, literature, guidelines and courses just wait to be embedded in the capacity of the community (see <u>chapter 4</u>).



Showcasing the achievements, failures and overall strategy can support others around the world, making it easier to avoid the same mistakes and replicating what was successful.

"When we use the term 'Is it too late,' we have to say, 'Is it too late for what?' The question is, can we get carbon emissions coming down soon enough to avert the worst consequences of climate change? We're not going to avert all of them. We're already experiencing them. The question is, can we keep climate change from spiralling out of control? I don't know the answer to that question but we certainly have to try."(Lester Brown, Director of the Earth Policy Institute)

Accelerate phase – Support citizens' participation

A very important role a local government plays is being a local node of implementing broader (i.e. national) policy frameworks, with the potential of including bottom-up (i.e. citizens) mobilisation as part of the solution to improve the framework itself.

Citizens' participation as part of an "energy democracy" strengthens the public's engagement and hereby citizens can participate actively in the transition as energy "prosumers" (producers + consumers), while supporting the development of effective, accountable and transparent institutions. Local administration can support solar technology research and development, manufacturing, education and capacity building, creating clusters¹ for private actors, public stakeholders and research institutions. This can also help in building capacity within the local government itself, as well as in the community. From language courses to enable people to use available guidelines in other languages, to professionalising courses to support the creation of green jobs in the RE sector – the local government can be a key actor in making the same happen, through lending spaces, funds, connection and capacity, as well as by developing the vision.

¹ The term cluster refers to a geographic concentration of interconnected economic and innovative activities in a particular field. Clusters exist whether companies are aware of it or not and exist independently from any intervention, project or organisation. A cluster consists of members belonging to industry, academia and government institutions (the triple helix) - often co-ordinated by an organisational unit in the cluster. Source: University of Amsterdam and ICLEI (2012)





Figure 2-6 (Image by Thanks for your Like • donations welcome from Pixabay)

3. Assessment of existing transition pathways

First of all, it should be highlighted that the expression **"pathway towards 100% RE"** should be carefully used to group local governments' roadmaps, as it is straightforward to understand how the expression "100% RE target" can refer to extremely different visions and levels of commitment. As the examples clearly demonstrate (Badino 2020a), the same term can describe vague pledges for a sustainable future (which were not included in the any of the Dossiers (this and Badino 2020a, Badino 2020d), as the same do not represent a commitment), first steps of commitment to cover a certain sector or energy use (such as governmental operations) with renewable energy sources (RES), or a strong carbon neutrality vision together with strategies concerning all sectors to cover community-wide energy consumption.

The transition pathways included in the "Dossier on transition pathways towards 100% RE for cities and regions" (Badino 2020a and Badino 2020d) were grouped according to similarities (see sub-chapters below), in order to assess their applicability in more general terms. As the local governments analysed have extremely different context and it is impossible to group existing roadmaps in a strictly assigned way, the pathways presented in the following chapters are rather examples for more or less effective way to reach a sustainable energy transition globally, considering the transformative power that a 100% RE strategy and vision can have in a community, and criteria and principles to ensure its success. The division in different pathways is not meant to be a ranking, but to provide examples of good and bad practices on certain aspects. A 100% RE vision is ambitious and requires multi-faceted experience, so any failure or mistake should be taken as opportunity for improvement to actually reach the foal, learning from similar experiences that solved the same issue in a more effective way.

The considerations in the following sub-chapters are in line with the criteria for a pathway to be successful, highlighted in <u>Chapter 2</u> (2050 pathways 2017, DDPP 2020) and available literature (Badino 2020 et al. 2020, Badino 2020a, Wiseman et al. 2013 among others).



Pathway type 1 – Rapid action within a long-term ambitious vision of 100% RE strategy to cover the least possible energy demand.

As arising from the present assessment as well as the "Dossier on transition pathways towards 100% RE for cities and regions" (Badino 2020a), the ideal pathway envisions strong energy demand control to reduce energy needs thanks to behavioural and systemic changes, followed by stringent energy efficiency measures on the remaining consumption. The strategy is an integrated community-wide 100% RE including a variety of RES systems, a thorough assessment of their impact and co-benefits considering the context. Communication is fair, transparent and clear from the development to the implementation phases, considering also the times in which plans must be changed. The vision is long term, yet including rapid actions in line with the ambitious goals, in synergy with other local government objectives and with continuous participation of citizens and stakeholders. W This approach would ensure that RES are used to support mankind to live sustainably on the planet, while revising the way in which resources have been used in the past couple of centuries, acting with extreme urgency.

Unfortunately, no 100% RE roadmap among those assessed (Badino 2020a, Badino 2020d) seem to meet this level of ambition yet. It seems that there is no experience of local governments that question the current economic growth model, while proposing a step-by-step phasing out from the current consumer approach or daring new development models based on low consumption and a 100% RES approach on the remaining share.

None of the assessed roadmaps takes into consideration the contentious issues of stringent energy demand reductions, such as consumption patterns driven by market and fossil-fuel lobbies, or policies addressing birth control, a topic which is particularly delicate as it enters the area of human rights and personal freedom. Though, these should be issues to be raised and discussed openly, in particular for developed industrialised countries, for which the pro-capita footprint and energy consumption is way above the global average.

"(...) the abolition of slavery, the end of apartheid, the fall of the Berlin Wall, and the still unfolding possibilities of the Arab Spring. Such reminders of the complex and unpredictable relationships between the constraints of our physical environment and the human capacity to imagine and create alternative futures provide valuable starting points for thinking about political scenarios with the potential to inspire and drive rapid post carbon economy transition strategies" (Wiseman et al. 2013)



Pathway type 2 – Integrated community-wide and diverse 100% RE strategy with lowered energy consumption.

The most ambitious type of pathway to be found in the assessment of local governments with existing 100% RE roadmaps (Badino 2020a, Badino 2020d) consider a communitywide 100% RE strategy including many different energy sectors, with a variety of RES to be integrated. These local governments implement policies on energy efficiency in order to lower the energy consumption, well aligned and in synergy with other objectives of the community. Citizens and stakeholders are part of the development and implementation process, supporting the creation of a local economic development based on a common vision, building the momentum for business value and job creation for the community.

Clearly, there is no one-size-fit-all approach and the pathways highly depend on the assessment of the context and opportunities for the specific community. Though, some examples from the local governments with 100% RE roadmaps with these characteristics have been given here, to clarify how each point could apply.

Strong political support

The political support and enabling environment of **Sweden** (Badino 2020d, IRENA 2019, NER 2015, Sweden 2020) is one of the best in the world: the Climate Act policy was adopted by the Swedish government in collaboration with most of the political parties in Sweden and set the obligation for current and future governments to pursue a climate policy in line with its goals. The same include the presentation of a climate report every year and the development of an action plan every 4 years to monitor the process, scrutinised by a politically autonomous Council.

Long term vision with intermediate steps

The city of Malmö (Sweden), as well as Sweden and Denmark provide great examples on how a step-by-step approach can help reach s a very ambitious long term vision.

The city of **Malmö (Sweden)** (Badino 2020d, Energy Cities 2017, Go100RE 2017, ICLEI 2020a, IRENA and ICLEI 2013) set a 100% RE goal for all sectors and for the whole community by 2030, to be achieved by halving the energy use, compared with the 2001 levels. The foreseen intermediate steps are 100% RE district heating supply by 2020 and climate neutrality with municipal operations run on 100% RE by 2030. Many of the targets are already achieved or on a good pathway, as the government enabled an environment for investments and cooperation towards a common goal.

Sweden (Badino 2020d, IRENA 2019, NER 2015, Sweden 2020) committed to the goal of carbon-neutrality (net zero GHG emissions) by 2045 and thereafter achieve "negative emissions". Intermediate targets of 100% RE electricity production by 2040, vehicle fleet



independent from fossil fuel by 2030 are considered. Step-by-step phasing out from fossil fuels is implemented through energy policies promoting RE use, mostly via carbon tax introduced in 1991, as well as green electricity certification, funds allocation to the Swedish solar cell market, investments in RE research (solar power, solar photovoltaics (PV) and solar fuels) through the Swedish Energy Agency and investments to support engagement of private, public and commercial actors. The role of nuclear power in the strategy is not completely clear, yet currently nuclear and hydropower cover almost 80% of the country energy needs for electricity.

The country has little energy-intensive industry compared to other Nordic countries; 80% of electricity production in Sweden comes from nuclear and hydroelectric power. The carbon tax has already affected many sectors such as heating and transport sectors, supporting the emissions to decline by 26%.

Also **Denmark** (Badino 2020d, Brot für die Welt and World Future Council 2018, Go100RE 2017, IRENA 2019, NER 2015, World Future Council 2014) built its vision among the world's pioneers on energy and climate issues, setting a long term goal of community-wide renewable energy coverage, with intermediate steps of phasing out from fossil fuels dependence. The 100% RE goal in the overall energy mix (electricity, heat and fuels, transportation) by 2050 is implemented through mid-term milestones: 50% in net electricity consumption from wind power in 2020, phasing out coal consumption at power plants by 2030, phasing out oil burners by 2030 and covering all electricity and heat supply with renewables by 2035. In 2017, the country reached 32% of gross energy consumption from RE, GHG reduction of 33% compared to 1990 levels and 43% of net energy consumption from wind power.

Energy efficiency measures

The **State of New York (USA)** (Badino 2020d, New York 2020, Sierra Club 2020) has a longterm target including 85% GHG emissions reduced and 600 trillion Btu increase in statewide energy efficiency from 1990 levels economy-wide by 2050. Intermediate steps on GHG emissions reduction, electricity sector and energy storage capacity are foreseen by 2030.

The strategy developed by the **City of Osnabrück, City of Rheine and the Counties of Osnabrück and Steinfurt (Germany)** (Badino 2020d, Go100RE 2017, Osnabrück 2020) aims at 95% of the region's energy demand covered by renewable energy by 2050. The highly ambitious RES coverage is accompanied by reduction in energy consumption and GHG emissions reduction targets (reduction of GHG emissions by 95% and final energy consumption by 50% of the 1990 levels).



Multi-sectoral approach

The city of Malmö (Sweden) (Badino 2020d, Energy Cities 2017, Go100RE 2017, ICLEI 2020a, IRENA and ICLEI 2013) can also be mentioned as a great example of including many sectors in its strategy: electricity, heating and transport are part of the 100% RE vision by 2030. The city ambitious vision and integrated strategy ("Energistrategi för Malmö") is of complete transformation from an industrial to a renewable capital, and it is reflected into committed local politicians, private investments in RE, strong cooperation with regional stakeholders and a thorough knowledge of the locally available RES. The city removed legislative obstacles to wind power and reduced energy demand, increasing the production of local solar energy and cooperates with property owners to facilitate energy efficiency measures in buildings and districts thanks to different measures, including matchmaking between owners and energy suppliers and testing of new business models. Ambitious campaigns of revitalisation and development have been launched by the LG, mixed-use, resource-efficient urban districts enabling to become the norm.

Also **Denmark** (Badino 2020d, Brot für die Welt and World Future Council 2018, Go100RE 2017, IRENA 2019, NER 2015, World Future Council 2014) included electricity, heat and fuels, transportation in the strategy to reach 100% RE for the country. Fiscal and financial policies, which comprise funding for energy and climate related research, support the achievement of the national targets.

Holistic policy approach

A very good example of ambitious and holistic vision is given by the **State of New York (USA)** (Badino 2020d, New York 2020, Sierra Club 2020), which includes all sectors of energy use in the community, as well as its social aspects. Monitoring, reporting and communication are important parts of the strategy, as well.

Among others, the Climate Leadership and Community Protection Act (CLCPA) requires all state agencies to identify alternatives or GHG mitigation measures to be recognised in case permits, licences or other approvals are inconsistent or interfere with achieving the targets. State entities should advance the development of short-term and long-term strategies for achieving this transition in an orderly manner and for promoting long-term economic growth, mitigating the financial impacts on local governments and delivering clean energy at low cost to consumers.

Energy storage, distributed solar and energy efficiency measures, as well as social consideration and investments favouring disadvantaged communities are included in the strategy.

The CLCPA requires that 35% of climate adaptation benefits frontline communities through efficiency, renewable energy, jobs programs and more; it protects disadvantaged communities by requiring an air quality monitoring program and it prohibits carbon offsets for the electric, transport and building sectors. Despite not aiming at 100% community-



wide RES coverage in the long-term, the CLCPA presents strong GHG emissions reductions measures as well as 100%RE targets in specific sectors, such as electricity, and it foresees a synergic approach.

The strategy developed by the City of Osnabrück, City of Rheine and the Counties of Osnabrück and Steinfurt (Germany) (Badino 2020d, Go100RE 2017, Osnabrück 2020) is one of the best examples of comprehensive, large-scale collaboration to develop a climate valorising and protection strategy synergies cooperation measures. The "Masterplan 100% Climate Protection" region defines a comprehensive, large-scale cooperation between neighbouring regions, through offsets and shared accounting of electricity generation and consumption, strong cross-border cooperation (especially in transportation) between urban centres and hinterlands, cooperation on projects, awareness campaigns and training programmes. Clear definition of tasks and activities among the different local authorities is given, in order to ensure the meeting of the interests of the whole region, as well as to align strategies. Regular meetings and public events (such as an annual regional climate summit) are organised with various partners and stakeholders.

Variety of renewable energy sources

The type of renewable energy source (RES) to be taken into consideration should come from the analysis of the baseline assessment against the local context (Badino 2020a). For example, the region of the **City of Osnabrück, City of Rheine and the Counties of Osnabrück and Steinfurt (Germany)** (Badino 2020d, Go100RE 2017, Osnabrück 2020) includes hydro, wind, biomass and solar among the RES of the strategy, while **Scotland** (100% RE Atlas 2020, Scotland 2020) includes wind, hydro, ocean, the **State of New York (USA)** (Badino 2020d, New York 2020, Sierra Club 2020) off-shore wind, distributed solar, hydropower and biomass.

One of the most interesting examples is **Frankfurt (Germany)** (Badino 2020d, Brot für die Welt and World Future Council 2018, Go100RE 2017, IRENA 2019, World Future Council 2019), whose 100% RE target is closely connected to its climate strategy, which has an ambitious and pioneering vision on sustainability and climate protection, featuring mutually reinforcing components and policy objectives. The RES included are solar PV and thermal solar, wind energy, as well as biomass coming from local organic waste for heating and power generation.

Renewable energy as a driver for economic development

Denmark (Badino 2020d, Brot für die Welt and World Future Council 2018, Go100RE 2017, IRENA 2019, NER 2015, World Future Council 2014) built its vision on a long history of



leadership on energy and climate change, both at the European level and on the international stage. Budget and policies are set in place to achieve the national targets (green electricity, green biogas, energy saving in industry and building sector, green mobility), tax relieves policies supporting the modernisation of the heating sector. Budget is also annually allocated for energy and climate-related research.

Also the **State of New York (USA)** (Badino 2020d, New York 2020, Sierra Club 2020) used the vision to create the momentum around green development. The Reforming the Energy Vision (REV), coordinated by the Climate Leadership and Community Protection Act (CLCPA), aims at "creating a stronger and healthier economy by stimulating a vibrant private sector market to provide clean energy solutions to communities and individual customers throughout New York". Considering the 1990 levels as baseline, the CLCPA mandates New York to achieve economy-wide targets by 2050. The results so far show that 25% of electricity community-wide was covered by RES already in 2014 and a wide variety of projects, initiatives, policies and investments to support the energy transition have been developed in multiple sectors.

Another example is given by **Scotland** (Badino 2020d, 100% RE Atlas 2020, Scotland 2020) which has a very ambitious strategy aiming at net zero emissions target by 2045. The country included several intermediate steps in GHG emissions reduction, sectoral approach on electricity and heating, as well as energy efficiency measures. The Community and Renewable Energy Scheme (CARES) was launched to maximize public involvement and community benefits. CARES facilitates funding application for projects and offers advice and support for developing community-owned projects. The strategy is developed in the framework of economic development, green jobs and opportunities for research and development.

Strong stakeholders and citizens' engagement

The city if case of **Växjö (Sweden)** (Badino 2020d, Brot für die Welt and World Future Council 2018, Go100RE 2017) backed the vision of fossil-fuel freedom by GHG emissions reduction and a very integrated approach. The city aims at becoming a fossil fuel-free city in order to eliminate climate impact and fossil fuel dependency, planning for reaching a community-wide 100% RE coverage by 2030 using mainly local biomass, geothermal energy, district heating network. The high ambition of the local government and its role of early pioneer in RE integration are well communicated to the community, with methodical process of monitoring and reporting performance. As of 2015, the city reached 64% of its target and 54% pro-capita greenhouse gas (GHG) emissions decrease compared to 1993 levels.

Frankfurt (Germany) (Badino 2020d, Brot für die Welt and World Future Council 2018, Go100RE 2017, IRENA 2019, World Future Council 2019) included strong citizens and



stakeholders' participation measures. The city collaborated with Fraunhofer ISE to develop a technical scenario, and implemented a combination between top-down and bottom-up approaches involving citizens and businesses into the creation and implementation of the strategy. Between 1990 and 2012, the City managed to reduce its emissions by 15% while the economy grew by over 50%.



Figure 3-1 (Image by adege from Pixabay)

Pathway type 3 – Integrated community-wide strategy with intermediate targets.

The examples included in this group set an integrated, community-wide target but did not mention any strong intervention to reduce the consumption first. As the examples show, the integrated approach considering all aspects of the community energy use ensures the success of the vision, as it is seen as a reliable development pathway. Though, the need for strongly focusing on energy efficiency measures, behavioural changes for the whole community, business transformation towards the forthcoming sectors of interest and a more holistic approach to the system would be needed in order to aim at a cultural transformation towards a sustainable energy future.

As for all other pathways, each local government has a different roadmap, similar characteristics have been assessed and some examples are given for each here, to clarify how each point could apply.



Strong political support

Iceland (100%RE Energy Atlas 2020, Badino 2020d, Iceland CAP 2018, Renew Economy 2012) already achieved 100% RE coverage in the electricity sector, aiming at carbon neutrality as its long-term target by 2040, with interim target of cutting net emissions by 40% compared to 1990 emissions (National Determined Contribution to meet its Paris Agreement) by 2030. The action plan of the Country consists of 34 Government measures, ranging from an increase in reforestation to a ban on new registration of fossil fuel cars by 2030. The government arranges to make the plan available for public consultation and to update it systematically.

Broad is the political support for the plan, as was demonstrated by the fact that it was introduced by seven ministers. This lead to astonishing results: as of 2012, 100% of the country's electricity comes from RES (75% large hydro, 25% geothermal), as well as 87% of heating sector (mainly geothermal energy through an extensive district heating system) and altogether, 81% of Iceland's primary energy requirements for electricity, heat, and transportation.

Multi-sectoral approach

High ambition is shared by the **Rheinland- Palatinate State (Germany)** (Badino 2020d, IRENA 2019, Under2Coalition 2020) aiming at being climate neutral by 2050 and setting an alternative goal for important GHG emissions reduction, in case the climate neutrality is not reachable by that time. Many intermediate steps pave the way to enable the environment to achieve the goals in various sectors, such as electricity, governmental operation and building sector. The inclusion of a variety of measures, such as legislation on climate protection and participation to pilot projects for climate neutrality for example, as well as the synergy with adaptation and other governmental strategies are particularly worth mentioning.

The region_aims at a regionally balanced, consumer-oriented and economically viable development of renewable energies in order to further improve the added value and acceptance in the regions of the state. Among the objectives of the region is the establishment of favourable framework conditions to further develop renewable energies and to remove obstacles, also via investments in the research and development sector and business sector. In order to reach this, an Energy Agency was established to support local capacity building and best practices.

Holistic policy approach

The city of **Tshwane (South Africa)** (Badino 2020d, ICLEI 2020a) set a strategy that involves all sectors and the whole community as well as it takes into consideration synergy with other aspects, namely waste production to recovery biogas from organic refusal, transport or building sector activities. Despite setting exclusively one target for



50% consumption and exploring solely for the 100% coverage of energy consumption from RES, it is worth mentioning the inclusion of education initiatives and the role model that the local government planned, with energy efficiency and renewable energy projects in its which enable the environment for а sustainable premises, development. The city is part of the national Sustainable Energy and Climate Change (SEED) Programme, aimed at encouraging the integration of sustainable energy and environmental concerns into urban development in South Africa. City initiatives include biogas recovery from waste, fuel for the city-operated bus fleet, the installation of two solar powered electric vehicle charging stations. Tshwane is retrofitting municipal buildings with renewable energy installations and encouraging the installation of solar water heaters for private homes.

The example of Hawaii (USA) (Badino 2020d, Hawaii 2020, IRENA 2019, Sierra Club 2020) is the first US state to set 100% RE target for the whole power sector by 2045 and to adopt a holistic approach in all kinds of energy policy making decisions made by the government, utilities and consumers. It is one of the best pathways found in the assessment (Badino 2020d), including all sectors and exploiting a variety of RES (solar, wind, geothermal, hydro, ocean, biomass and biofuels), on top of building on the local context and vision. The Hawaiian 21st Century energy agenda is based on the following five principles: (1) Diversifying the energy portfolio (2) Connecting and modernising the grids (3) Balancing technical, economic, environmental and cultural considerations (4) Leveraging Hawaii's position as an innovation test bed (5) Creating an efficient marketplace that benefits and producers consumers. lt The Hawaii Clean Energy Initiative (HCEI) law requires all utilities to generate 100% of their electricity from RES by 2045. Finally, additional law measures provide for communitybased renewable energy farms and set net-zero energy goals for the University of Hawaii System.

The strategy supported the creation of a robust clean energy industry, accelerating innovation and stimulating economic growth. Clean transportation sector is particularly developed: there are over 5,000 Electric Vehicles (EVs) on Hawaii's roads, supported by over 530 publicly available charging stations state-wide as of 2020.

Variety of renewable energy sources

The government of **Iceland** (100%RE Energy Atlas 2020, Badino 2020d, Iceland CAP 2018, Renew Economy 2012) mainly plans to exploit large-hydro plants to cover the majority of its electricity needs and Iceland takes advantage of its volcanic nature to use geothermal sources for the thermal needs of the community. Though the sustainability of these choices could be further investigated, the action plan to reach climate neutrality contains a variety of measures, ranging from an increase in reforestation to the phasing out from



fossil fuels (for example, there is a ban on new registration of fossil fuel cars by 2030). The main emphasis of the plan of the country is on phasing out fossil fuels in transport, and increasing carbon sequestration in land use, by restoration of woodlands and wetlands, revegetation and afforestation. A general carbon tax, already in place, will be gradually increased.

Fukushima (Japan) (100%RE Energy Atlas 2020, Badino 2020d, IRENA 2019, World Future Council 2014) is planning to reach its 100% RE target via wind, solar PV and solar thermal, hydro and geothermal. The vision is 100% of the primary energy consumption of the entire community covered by RES by 2040, with sound milestones every ten years supporting the transition. Strong focus on research and development together with policies and financial measures to support the revitalisation of the regions are worth mentioning.

The Renewable Energy Pioneer Action Plan focuses on the expansion and integration of wind and solar resources, as well as on giving support to research and development (aiming at a hydrogen-based society) and it includes policies and initiatives regarding the establishment of a renewable energy promotion centre, concerning a demonstration project foreseeing the creation of a floating offshore wind farm and as regards the permission to use devastated agricultural land for renewable energy purposes. Finally, the plan concentrates on the creation of a regional subsidy programme and feed in tariff system to support solar photovoltaic installations for privates and businesses.

Renewable energy as a driver for economic development

As part of Korea's commitment to reduce its greenhouse gas emissions by 37% by 2030, the Korean government selected **Jeju (Province (Republic of Korea)** (100%RE Atlas 2020, Badino 2020d, ICLEI 2020a, Jeju 2019) as test-bed for clean energy solutions. Jeju's vision is to have 100% renewable electricity and transport by 2030, being a "carbon-free island" by 2030. Considering the context of the island, the energy mix includes wind, solar, and small hydro plants and the implementation of the strategy foresees smart grid business models through battery-based energy storage systems and fuel cell power plants to ensure grid stability and address wind and solar intermittency.

The **Australian Capital Territory (ACT) Australia)** (ACT Government 2020, Badino 2020d, Go100RE 2017, ICLEI 2020a) uses a series of innovative large-scale reverse auctions to deliver RE to the territory at the lowest possible cost. By providing a fixed price of energy for the next 20 years to renewable energy project developers, ACT was able to unlock private sector investments in renewable energy. New investments in research, education and local business development are also diversifying the economy.

Costa Rica's decarbonisation plan (Badino 2020d, Brot für die Welt and World Future Council 2018, Go100RE 2017, IRENA 2019, World Future Council 2020) includes the vision of zero-net emissions by 2050 with interim goal of 100% RE electricity by 2030. The



Decarbonisation Plan promotes the modernisation of the country through green growth and the development of projects for a variety of RES (solar photovoltaic, wind energy, biogas and geothermal). The process involved different stakeholders to create a common policy roadmap based on scientific findings and embracing perspectives and needs from the civil society, industry, academia, private sector and various governmental bodies. The National Programme Carbon Neutrality 2.0 launched in 2017 serves as a tool to reduce GHG emissions to zero as part of a decarbonised economy. Municipalities are encouraged to develop a GHG emissions inventory for the community. The results were very good: despite electricity only accounts for about one-quarter of the total energy consumption, 95-98% of the country's electricity has come from renewable sources since 2014, while providing access to energy to almost the entirety of the population. Since October 2018, 98.15% of the country's electricity was generated through five different renewable sources: hydropower (72.24%), wind (16.14%), geothermal energy (8.92%), biomass (0.76%) and solar (0.09%).

Strong stakeholders and citizens' engagement

Pioneer on the energy transition for Poland, highly dependent on lignite and hard coal, the city of **Kisielice (Poland)** (100%RE Energy Atlas 2020, Badino 2020d, World Future Council 2019) shows the effects of role models in achieving ambitious goals. The town reached community-wide self-sufficiency thanks to wind generation, biomass from local agricultural scraps and investments in solar photovoltaic. Kisielice developed a strategy aiming at stimulating the local economy, also thanks to a clear political leadership lasted 24 years, changing its Spatial Development Plan early in 1998 to ensure that the construction of wind turbines did not conflict with existing administrative regulations. The technology used is three windfarms, a biomass CHP plant, a biogas power plant, and a district heating system. Technical assessments on technical challenges and economic results of the wind projects attracted investors. A local district energy system, as well as the involvement of local businesses (such as farmers) in the communication and in the strategic business model were keys to its success. Strong community engagement measures with transparent participation from different stakeholders and the creation of a local value chain for agricultural scraps.

Also in case of **Sumba Island (Indonesia)** (100%RE Energy Atlas 2020, Badino 2020d, Brot für die Welt and World Future Council 2018, Sumba Iconic Island 2020, World Future Council 2014) the strategy includes a broad approach with strong citizens' participation and cooperation with international financiers.

The Island vision is 100% RE coverage for all sectors of energy consumption in the community, as well as electrification of 95% of the island by 2025, using solar PV, biogas and mini-hydro. The 100% RE strategy is part of a broader strategy to empower local



residents, spur economic development and support public services such as electrification. The Indonesian Ministry of Energy has taken responsibility for the implementation of the strategy and efforts are now underway to increase both domestic as well as foreign investments. Both the Asian Development Bank as well as the Dutch and Norwegian governments have financially contributed to support the initiative. Partnership with a Dutch global energy consultancy company to assess the RES potential and with Hivos, a local NGO, led a series of stakeholder engagement initiatives.



Figure 3-2 (Image by Carabo Spain from Pixabay)

Pathway type 4 - Unclear 100% RE target and definition

The local governments grouped here share ambitious roadmaps aiming at different 100% RE targets, and their vision is not necessarily similar, but each of them communicates, defines or sets "100% RE" targets with some kind of technical or communication flaws. It is important to notice that, unless these are solved, it is difficult for the local government to build trust and ensure the participation of citizens and stakeholder to reach the vision. When the definition of the target and its components is not clear, it is difficult to discuss and communicate about achievements. This represents a missed opportunity to maintain the high level of ambition that is part of the vision in practice, as well as an additional



effort to reconsider some parts of the strategy itself would be required. In order to step out from fossil fuels, a change of paradigm together with a strong technical effort of integration of the different systems might be needed, which allows the strategy to grow stronger and clearer in its direction.

The miscommunication of the vision does not support citizens and businesses' engagement, nor the interest of investors who might be confused about what they are committing to, which can doom the strategy to fail.

The following subchapter present examples for some of the most common problems.

Target set on installed capacity and not on energy use

Cape Verde (Badino 2020d, Brot für die Welt and World Future Council 2018, Cape Verde 2018, World Future Council 2014) and **Kenya** (100%RE Energy Atlas 2020, Badino 2020d, Brot für die Welt and World Future Council 2018) established a commitment based on new installed capacity rather than on the total energy consumption. In particular, being the case of developing communities with important needs for increasing access to energy for the population, it is important to ensure that setting a target on RES consumption should be seen as an opportunity to learn from the mistakes of the past global development pathways that caused the current dependence on fossil fuels and the continuous growth in energy needs, rather than aiming at energy independence and just, sustainable development.

Though, Cape Verde developed a Sustainable Energy for ALL strategy including strong sustainable energy access focus for vulnerable parts of the communities, either by grid connection where it is technically and economically feasible or by the creation of isolated systems or by the distribution of individual equipment. Among the policies, initial public investments with progressive involvement of the private sector (both businesses and citizens) to take over was foreseen.

Fossil fuels or nuclear power listed in the 100% RES strategy

In some cases, the strategy shares a 100% RE target while including the use of nonrenewable sources, or being accompanied by parallel LG strategies aiming at an increased usage of fossil based solutions. In case of **Capo Verde** (Badino 2020d, Brot für die Welt and World Future Council 2018, Cape Verde 2018, World Future Council 2014), for example, the promotion of butane gas is included in the strategy as a solution to energy access; while in the case of **Kenya** (100%RE Energy Atlas 2020, Badino 2020d, Brot für die Welt and World Future Council 2018), some fossil energy sources have been accounted for in the strategy to compose the RES goal.



The types of RES envisioned in order to reach 100% clean electric power for **California** (Badino 2020d, ICLEI 2020a, IRENA 2019, Sierra Club 2020) are not clearly defined: the policy mentioned generically "eligible renewable energy resources" and "zero-carbon resources", yet the same include nuclear power.

Spain (Badino 2020d, Euractiv 2018, IEA 2020) has a very ambitious strategy considering grand long- and middle-term targets towards 100% RES, combined with a GHG emission reduction strategy, but nuclear power plays a big role in the source mix (currently accounting for more than 20%).

Clashing strategies within the LG

Portugal (ADENE 2018, Badino 2020d, IEA 2020, Renew Economy 2018) seems to have a very ambitious carbon neutrality pathway together with its relevant middle steps, but the role played by the natural gas supply and its transmission infrastructure to and from neighbouring countries is unclear and it seems to clash with the overall vision.

Also in the case of **Kenya** (Badino 2020d, Brot für die Welt and World Future Council 2018) electric power generation capacity from fossil sources is planned to increase from 0.69 GW in 2014 to 2.91 GW in 2030 (Kenya Action Agenda) and different fossil energy sources are included in the strategy, while the overall objective is declared as phasing out from fossil fuels.

Unclear RES definition

The city of **Vancouver (Canada)** (100%RE Energy Atlas, Badino 2020d, Brot für die Welt and World Future Council 2018, Go100RE 2017, ICLEI 2020a, IRENA 2018) presents a very comprehensive strategy including electricity, thermal energy and transportation for the whole community, aiming at being the greenest city in the world already in 2020. It is worth mentioning that the selection of RES is made on a project-by-project basis, depending on resources availability, site conditions, technical considerations, environmental impact and potential risk factors. The foreseen requirements are shared as follows: 60% renewable electricity, 15% district energy, 14% biofuels, 10% bio methane and 1% hydrogen. Concerning district energy, sewage heat recovery, wood chips, geothermal energy and heat recovery from industrial processes will be exploited. Though, it is not clear the value of the share that will be covered by biomass and which other sources will be employed, despite already 24% of the foreseen requirements seem to be covered by biomass.

Though, the city action plan was developed through a wide consultation and participation process, with contributions given by over 60 individuals belonging to the City staff, more than 120 organizations and thousands of citizens. The Renewable City Strategy was integrated with other strategies focusing on sustainable transportation, health and economic development. The Renewable City Strategy – in conjunction with the Zero



Emissions Building Plan – arranges changes gradually to build standards that allow for the construction industry to adapt over time.



Figure 3-3 (Image by Akshay Ranganath from Pixabay)

Pathway type 5 – Unclear roadmap and miscommunication.

The LGs grouped here committed to a more or less ambitious 100% RE pathway and many report some achievement, however, their assessment shows a lack of clarity on the actual extent of the target. As in the examples of pathway type 4, unclear definition of strategies and targets can lead to important problems in communication and community engagement. The LG should use 100% RE vision as an opportunity for economic development, building on subsequent steps of achievements. When misunderstandings, potential inclusion of non RES in a 100% RES vision, potential unsustainable effects on biodiversity and social systems or no further commitment after a first 100% RE step have been reached, occur, the LG misses the opportunity to support the community in its development and to get support from the same in return in order to reach a healthy and wealthy sustainable future. The achievement of smaller 100% RE commitments should be exploited as a trampoline to build momentum and to enable the environment for RES development and job creation and it should not be seen as the end point of the LG efforts.



Consequently, communication becomes weak and it does not convince people, businesses and investors to engage in the LG vision, on top of potentially backlashing on the beauty of the RES themselves. In these cases, for example, the LG could invest in capacity building within the administration or in support of external technical experts and then revising the strategy and raising its level of ambition and sustainability.

The pathways in this group are diverse, but the following problems have been assessed and opportunities for improvement given.

Unclear definition of "zero energy", "zero emission", "climate neutrality" or "100%RE"

An example of unclear pathway definition can be found for **Inje County (Republic of Korea)** (100%RE Atlas 2020, Badino 2020d, Go100RE 2017, ICLEI 2020a, World Future Council 2014), starting from the name of the plan "Zero energy independence" which does not clarify whether the wished independence is from import or fossil fuels (or else). The target is set in 100% of the total installed capacity instead of on energy consumption. Though, the plan identify several policy fields, such as expansion of new renewable energy production, energy efficiency, energy conservation, creation of a civic culture, expansion of carbon sinks and building and strengthening the cooperative foundation.

Unclear communication of the pathway

The example of **Kasese (Uganda)** (100%RE Energy Atlas 2020, Badino2020d, Brot für die Welt and World Future Council 2018) shows a strategy that was not clearly communicated. Some sources seem to refer to a community-wide, ambitious goal, while others appear to make reference to a more limited, renewable energy coverage of the energy needs of the local government administration. In the strategy, though, a variety of actions can be found, going from policy (i.e tax breaks for RE related business) to capacity building (traineeships for the installation, maintenance and distribution of RE technologies) and horizontal cooperation (collaboration with universities, businesses and NGOs to implement small and localised RE projects, as well as partnership with WWF and Barefoot Power Uganda for small-scale solar installations in mountain villages).

Byron Shire Council (Australia) (Badino 2020d, Byron Shire Council 2020, Go100RE 2017, ICLEI 2020b) shared a resolution which is reported as carbon neutral in the official website, but in other two sources the commitment seems to be only on installed capacity. Though, the strategy considers all the sectors of energy, waste, buildings, land use and transport, with energy efficient measures and strong institutional arrangements to support vision development and implementation, such as the creation of sectoral working groups.

Low-carbon development and increased climate resilience are at the core of **Cook Islands'** strategy (100%RE Energy Atlas 2020, Badino 2020d, IRENA 2019), which committed to



100% RE electricity by 2020. The updated results are not available, as well as other future commitments for the community. Moreover, the role of diesel and its sustainability in the hybrid systems with solar PV mentioned in the results should be further investigated. Though, the government committed to mitigate the Cook Islands' carbon footprint by following a pathway integrating low-carbon development and increased climate resilience. The Cook Islands Renewable Energy Chart restructured part of the institutional and policy framework, including revising existing legislation, regulation and electricity tariff structures. A net metering policy was introduced to encourage customers to generate their own electricity from RES and subsidies for RES production were established.

No updated information on the achievements

In some cases, local governments advertise the setting of the target, but fail to offer further information on the development of the same or on setting new more ambitious targets for the future. This is the case **Šentrupert (Slovenia)** (Badino 2020d, Go100RE 2017), **Burgerland (Austria)** (100%RE Energy Atlas 2020, Badino 2020d) and other governments which set 2020 as their long-term end year but no information can be found on the current achievements, despite being already late 2020.

Other local governments achieved a first 100% RE step, but they seem not to have established any further step in the direction of energy transition or consumption reduction. For example, in the case of **El Hierro (Spain)** (Badino 2020d, Brot für die Welt and World Future Council 2018, IRENA 2019, World Future Council 2014) and **Stockholm (Sweden)** (Badino 2020d, IRENA 2019) the foreseen 100% RE target (electricity and public transport sector respectively) has already been reached, but no information can be found on further goals setting plans.

Aruba and **Bonaire (Caribbean Netherlands)** (100%RE Energy Atlas 2020, Badino 2020d) both targeted 100% renewable electricity sector, the first aiming at 2020 as target year, the second not indicating any target year for this commitment. Currently, little information can be found on the developments and achievements: according to 100%RE Energy Atlas, the first island reported 15,4% in 2019, while the second 33% (the year of this achievement is unclear).

No clear strategy

Norway (Badino 2020d, NER 2015, Norway 2020) already achieved 100% RE coverage in the electricity sector, aiming at carbon neutrality as its long term target. In the case of Norway, the strategy is not very clear, due to the fact that a significant portion of the carbon cuts will likely be achieved through offsetting against the reduction in emissions abroad and that the government mainly plans to exploit large-hydro plants to cover the majority of its electricity needs.



The strategy of **Uruguay** (Badino 2020d, Evwind 2019, IRENA Uruguay 2015, IRENA Uruguay 2019, SEforAll 2011) foresaw 50% community-wide primary consumption from RES by 2015 and it was almost reached in 2011 with a percentage of 44% RES in the energy mix. Further clarification should be given on the "energy mix" (as it is a term usually referred to electric grid), as well as on the sources accounted for in the definition "endogenous resources, mostly renewables" mentioned in the National Energy Policy 2005-2030 and, finally, on the sustainability impact of biomass and large hydro projects included in the strategy. Finally, there seems to be no further ambition after this first target was

Though, the National Energy Policy follows the overall objective of diversifying the energy mix, reducing dependency from fossil fuels, improving also energy efficiency. The plan includes renewable energy for electricity generation, industrial and domestic heat and transport. Auctions have been the main instrument for promoting RES in the electricity sector, followed by feed-in tariffs for biomass sources and net-metering systems. Regulations for self-consumption from wind-power for industrial consumers allowed for the generation both in-site and off-site, as well as for groups of industries to develop one wind power project. Solar thermal mandate was established by a law requiring new constructions and refurbishments of public buildings, hotels, health and sports facilities where hot water is expected to account for over 20% of the building's energy consumption, to obtain at least 50% of water heating energy from solar thermal energy. Mandates for biofuel blending in the transport sector were legislated, requiring locally produced biofuels to be included in fuel blends.

Misunderstanding of the different types of target

The **Australian Capital Territory (ACT) (Australia)** (ACT Government 2020, Badino 2020d, Go100RE 2017, ICLEI 2020a) provides an example of misunderstanding of the technical differences between the various types of targets, therefore communicating and committing for a "net zero emissions" target, when describing a "GHG emissions reduction of 100% on 1990 levels" in the ACT Climate Change Strategy 2019-2025 details. Also in the communication on Canberra's target (ACT 2016) the title implies a comprehensive target while it is only on electricity sector.





Figure 3-4 (Image by ingonutzteinbild from Pixabay)

Pathway type 6 – Limited social and ecological sustainability concerns in the strategy.

As for the other groups, the pathways in this group can be various, but the same are grouped due to some sort of concern raised after the assessment of the roadmap. Considering the discussion on the "Dossier on transition pathways towards 100% RE for cities and regions" (Badino 2020a, Badino 2020d), some types of RES (such as biomass and large-hydro plants) should be carefully assessed in regards to potential social and biodiversity impacts and should be considered only in case no other RES is available in the context. The analysis of the RES included in the following roadmaps show the strong reliance on these types of RES, missing a deep analysis and detailed description of the sustainability of the projects and of the resource management.

In the case of **South Australia (Australia)** (Badino 2020d, IRENA 2019, Renewables SA 2020), no intermediate targets seem to be foreseen in the strategy and the sustainability impacts of the focus on large plants, such as hydrogen and biomass, are not clarified. Though, it is worth mentioning that a focus on demand management and energy efficiency is foreseen.

Also in the case of **Paraguay (South America)** (Badino 2020d, IRENA Paraguay 2015, Paraguay 2020), the achieved target of 100% electricity from RES was not followed by



further commitments and the sustainability of the projects developed should be further assessed, as a large binational hydropower with Brazil and Argentina and biomass plants are mentioned.

Currently running 100% on renewable energy at a community-wide scale, the city of **Güssing (Austria)** (100%RE Energy Atlas 2020, Badino 2020d, Go100RE 2017, Go 100 percent 2020, Gussing Clean Energy 2020) relies only on biomass. According to the city dedicated website (Gussing Clean Energy 2020) it seems that only residues are used, but a further research should be needed to ensure that the local residues of biomass production ensure the needs of the plant, as well as to evaluate the social and environmental implications of this choice.

Also the city of **Stockholm (Sweden)** (Badino 2020d, IRENA 2019) reached its target based only on biomass and its sustainability impacts are not clear.

In addition, **Uganda** (Badino 2020d, Brot für die Welt and World Future Council 2018) shares a strategy mostly composed of large-hydro plants to cover electricity needs, with the utilisation of biomass and fossil fuels for thermal purposes.

Moreover, **Kenya** (100%RE Energy Atlas 2020, Brot für die Welt and World Future Council 2018) foresees large-hydro as one of the main RES to cover consumption.

The strong focus on biomass is shared by the strategy of **Sydney (Australia)** (Badino 2020d, Sydney 2020, World Future Council 2014) as well, but it is not accompanied by an assessment of its sustainability impact or by further details.

The pathway of **Palauan (Philippines)** (100%RE Energy Atlas 2020, Badino 2020d, Go 100 Percent 2020) aims at promoting access to electricity, increasing reliability and local jobs, protecting the environment of the island and lowering energy costs. The sustainability impact of the strong focus on hydro, geothermal and biomass should be further explored.





Figure 3-5 (forestry-960806_1920 by Pixabay)

"Limiting global warming to below 2°C maximum, or even reducing to below 1.5°C by 2100 remains technically and economically feasible, provided there is sufficient political ambition backed up by action to introduce the required measures and policy changes now" (Wiseman 2013).

4. Technical and sectoral guidance to develop an ambitious pathway

In order to successfully develop and implement a local government strategy that can further improve and increase ambition in time, finally reaching climate neutrality and 100%RE for the whole community, the local government administration and technicians are not alone. On top of connecting with other peer LGs, global and local networks of experts and sectoral initiatives, they can get support from the existing guidelines and process management tools.

There is a wide variety of free literature accessible (even online) on any kind of topic, which can be useful in all the phases of the pathway, such as:

- Global and local frameworks, as well as knowledge about climate change, environmental pollution, social justice and leadership transformation;
- Process and project management techniques;
- Team collaboration methods;
- Psychological barriers to engage on climate action and overcome behavioural changing hindrances;
- Technical explanations on action plan development and RES implementation;
- Practical guidelines on technical solutions;
- Discussions about the different technologies and possible problems or trade-offs;
- Policy guidelines;
- Financial tools and opportunities;
- Communication guidelines;
- Language and capacity building courses on a variety of topics.





Figure 4-1 (Image by Free-Photos from Pixabay)

In order to give some useful sectoral guidelines on RE technology, policies and development pathways, as well as reliable sources of relevant information in the framework of a 100% RES roadmap development and implementation, it is possible to refer to²:

- 2050 pathways Handbook (2050 pathways 2017)
- Post Carbon Pathways towards a just and resilient post carbon future (Wiseman et. al 2013)
- ICLEI's GreenClimateCities (GCC) process methodology (GCC 2020)
- 100% Renewable energy for sustainable development (World Future Council 2018)
- 100% RE Building Blocks A practical toolkit for a sustainable transition to 100% Renewable Energy (Go100RE 2017)
- Climate Action Network (CAN) Toolkit, http://www.retoolkit.transitioninaction.org/
- IPCC Renewable Energy Sources and Climate Change Mitigation report (IPCC 2011)
- Principles for effective communication and public engagement on climate change (IPCC 2018)

² This is not meant to be a comprehensive list.



- Building Urban Climate Change Resilience: A Toolkit for Local Governments (ICLEI ACCCRN 2014)
- Sourcebook on Sustainable Urban Transport: Avoid-Shift-Improve (A-S-I) (GIZ 2011)
- Sustainable Urban Transport Project SUTP, <u>https://www.sutp.org/all-publications</u>
- Deep Decarbonisation Pathway Project website, <u>http://deepdecarbonization.org/</u>
- Project Drawdown solutions, https://www.drawdown.org
- European Environmental Bureau (EEB) Circular Future, <u>https://eeb.org/circular-future#Recycle</u> (Circular Future 2020)
- Zero Carbon Buildings for All initiative, https://wrirosscities.org/ZeroCarbonBuildings

Local governments can always refer to the following websites for reliable and robust reports, guidelines and opportunities for improvement and collaboration:

- The Global 100% Renewable Energy Platform, <u>http://www.global100re.org</u>
- REN21, https://www.ren21.net/
- IRENA International Renewable Energy Agency, https://www.irena.org
- UNEP UN Environmental Program, https://www.unenvironment.org
- Under2Coalition, <u>https://www.under2coalition.org/</u>
- ICLEI Local Governments for Sustainability (ICLEI) <u>www.iclei.org</u>
- IEA International Energy Agency, https://www.iea.org
- Sustainability for All SeforAll, <u>www.seforall.org</u>
- World Future Council, <u>https://www.worldfuturecouncil.org/</u>
- IISD International Institute for Sustainable Development, https://www.iisd.org/
- Greenpeace International, <u>https://www.greenpeace.org/global/</u>
- WWF World Wide Fund For Nature, https://wwf.org/
- For free online courses, among others: <u>https://www.edx.org/</u>

These are not meant to be comprehensive lists, of course, but support the search for information and connection in the framework of the development and implementation of the LG vision.

5. Conclusions

Being 100%RE an ambitious, game-changing perspective and vision, it can only be accompanies by ambitious, game-changing leadership and strategies. Thinking to develop a 100%RE future without shaking and shattering the status quo of the indefinite growth chimera and fossil fuel cannot be sustainable and is not a long-term success.

There is still huge potential and opportunities at the global level for local governments to show up as main actors of the energy transition. Considering the variety of benefits that a carbon neutral 100% RE economy can have in all the areas of SDGs and further, many are the drivers that can let the current energy model step away from fossil-fuel and growth dependency. As the overall ambition shows, "our social and economic systems are too recalcitrant to even acknowledge, let alone abandon or reduce their destructive practices" (Rull 2011).

Urgent is the need for action and to resolve the conundrum between making sure the human footprint is controlled and reduced, and human right and other sensitive aspects connected with population growth and consumption patterns. Market measures such as carbon taxes or including the costs of environmental externalities of current development systems should be also addresses, such as the costs of the irreversible damages caused by natural exploitation, by additional healthcare needed due to increased pollution, just to mention few examples).

As becomes clear from the most successful examples in the World, 100%RE is not reached thanks with stand-alone measures, but it is rather a system change and development pathway for the community, embracing all possible sectors and LG priorities (e.g. adaptation, energy access, infrastructure, human rights environmental concern, economic development...) together with all local actors involved. 100%RE must be first of all a political decision, but cannot be just that. It must be accompanied by careful strategizing, planning and implementation efforts and can give great results and benefits.

In conclusion, a broad recognition of the transformative potential of a post-carbon and renewable future still needs to be concretised, leading to the enormous social and economic benefits of switching investments from fossil based and consumer culture to more careful development patterns.

"I believe that once we start behaving as if we were in an existential crisis, then we can avoid a climate and ecological breakdown. But the opportunity to do so will not last for long. We have to start today" (Thunbergs 2019a)



6. Glossary

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

- GDP Gross Domestic Product
- GHG greenhouse gases
- IPCC Intergovernmental Panel on Climate Change
- LG Local Government
- **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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