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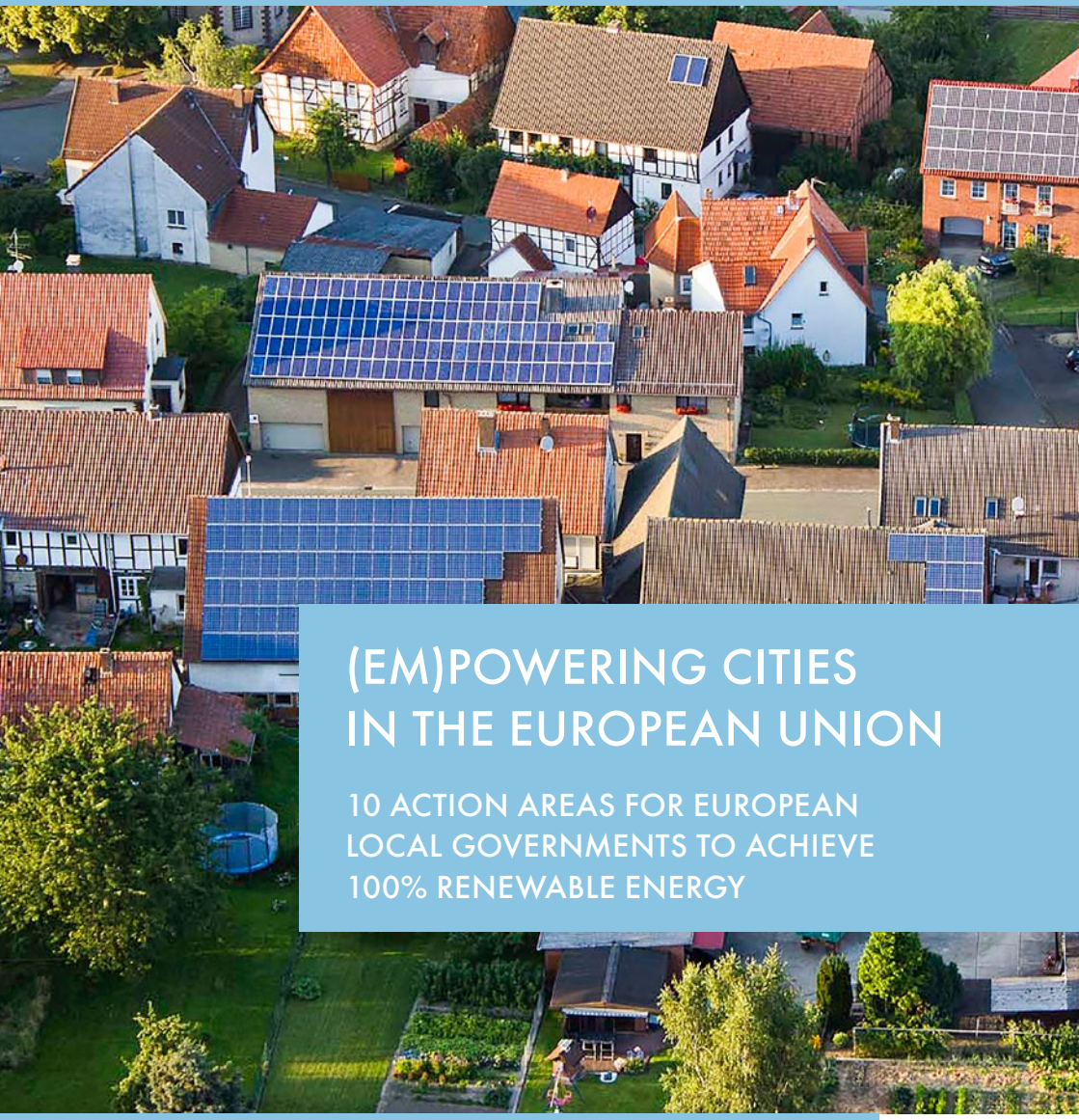

(EM)POWERING CITIES IN THE EUROPEAN UNION

10 ACTION AREAS FOR EUROPEAN LOCAL GOVERNMENTS TO ACHIEVE 100% RENEWABLE ENERGY

100% RENEWABLES

AUTHORS:

Stefan Schurig, Anna Leidreiter

CONTRIBUTORS:

Sara Giovanni, Alix Bolle, Filippo Boselli

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1 EXECUTIVE SUMMARY

Renewable energy remains at the top of the agendas of many policy makers worldwide. Technologies for renewable power generation, heating and cooling, and transport are affordable and most often the cheapest option. They are also advancing national energy security, economic growth, job creation, emission reduction and local pollution. Also in Europe, the transition towards renewable energy is underway: Away from an energy system powered by increasingly expensive and unsustainable fossil fuel resources towards one powered fully by abundant, local, and affordable renewable energy sources.

Local territories are pioneering this transition as they play a crucial role towards a low-carbon economy. Exploiting the full potential of existing renewable energy and energy efficiency technologies has allowed cities and municipalities to reduce their carbon footprint, boost local economies and improve health and living conditions for its citizens. Meanwhile, the majority of local policy makers seek guidance in policy planning and concrete measures to overcome challenges in achieving the transition to renewable energy. Especially the implementation of the Clean Energy Package for All Europeans may have a leverage effect on local energy transitions as the European Union aims at scaling up renewables and energy efficiency measures as well as gathering national climate and energy plans from member states. Legislators across government levels play a crucial role in this. They can catalyse and facilitate the implementation of the transition, develop policies to overcome remaining barriers and ensure international commitments are implemented.

All communities and cities have many commonalities. Exchanging experiences and best practices on energy transition can therefore be very effective. However, it has to be based on the recognition that there is no one-size-fits-all solution and the fact that there are always transferable and non-transferable, rather specific elements of policies. The two exemplary cases from the city of Frankfurt in Germany and Kisielice in Poland are proof of the variety of paths towards the same goal, namely a local zero economy.

It's important that the 'uniqueness' of a particular place does not serve as an excuse to hold back change. Instead, particular features of a place should mark the point of departure for a modernisation of the energy sector, for example. Sometimes even iconic narratives such as *'our city has always been a coal mining city'* can be 'upgraded' to *'our city has always taken care of its own energy resources'.* It would build on an existing narrative but suggests an additional dimension. Understanding existing identities and narratives first is therefore indispensable. The transition to a more sustainable future needs to begin with understanding each place.

All actors, from policy makers and legislators to local activists, must build on the distinctive features and potential engrained in a particular place, which can be described with the concept of a 'local DNA'. Accordingly, any sustainability action plan will need to correspond with this local DNA, allowing the community to continuously evolve towards a more optimal form – e.g. to harvest local renewable energy sources. Planning for a systemic, future-appropriate change must hereby acknowledge that individuals and communities are indigenous to a particular place, and incorporate these native attributes into planning processes. Understanding the local DNA of a particular place and displaying it alongside the characteristics of its climate, geography, ecology, cultural values, economy, social capital, human resources, public awareness and education is the first step.

Based on this understanding, the 'action areas' listed in this guide offer sufficient flexibility to be adapted to any local DNA. This includes the need for clear targets, citizen empowerment, the role of citizens as 'prosumers', alternative financing models or the need to think about new partnerships. They are put together as a toolbox including learnings from already existing policy recommendations such as the Building Blocks[1], developed by members of the Global 100 % RE Platform. The ten action areas are recommended in this report:

GOAL: **Defining the RE path**
ACTION: Set an adequate renewable energy target to define the RE path for your jurisdiction.

GOAL: **Building (on) local identity**
ACTION: Identify your local DNA, based on the local climate, geography, ecology, cultural values, economy, social capital, human resources, public awareness and education.

GOAL: **Putting energy conservation and efficiency first**
ACTION: Identify energy efficiency potential and prioritize adequate policy measures to reduce energy demand and enhance energy efficiency across sectors.

GOAL: **Connecting the sectors – synergies in power, heating/cooling, transport, waste**
ACTION: Encourage sector coupling across the energy sectors, including the electrification of the heating/cooling and transport sectors.

GOAL: **Empowering citizens**
ACTION: Provide citizens and communities with the right to participate across the energy system, including participation in renewables self-consumption, demand response, storage and energy efficiency, and access to the market through a supplier, or peer-to-peer arrangements.

GOAL: **Keeping city's control over energy**
ACTION: Ensure public influence on the provision of energy products and services including energy pricing, reliability of the grid and environmental impacts.

GOAL: **Testing innovations and new technologies**
ACTION: Provide space for understanding and testing emerging technologies. Establish a Chief Technical Officer (CTOs) and a 'digital control room' or department within the public authority to oversee and coordinate digitalisation processes and projects.

GOAL: **Involving the most vulnerable – RES fighting energy poverty**
ACTION: Establish specific programmes to support underprivileged citizens such as benefits for refurbishing proportional to income, zero-interest loans, energy scans, financial support for energy refurbishing as well as community energy tariffs.

GOAL: **Identifying alternative financing**
ACTION: Introduce innovative and alternative financing mechanisms, incl. internalisation of externalities and the establishment of inclusive support schemes.

GOAL: **Heading for new partnerships**
ACTION: Set up cross-party and cross-mandate platforms to initiate, convene, monitor and evaluate partnerships between sectors, authorities and jurisdictions.

The local energy transition is technically feasable and already the cheapest and most resilient option for most places in Europe. An energy sector powered by renewable energy sources will inevitably lead to a number of new future business models as well. Those will be more inclusive and participatory business models offering numerous benefits for the community such as jobs, tax revenues, ownership etc. It seems that the main barrier for local communities is based in a lack of political will. These ten steps focus on the role of the citizens and display a number of opportunities for local communities to take action and help establish a political will in the first place. In this sense, '*Participation triggers acceptance – acceptance triggers investments*', seems to be an adequate formula.

2 INTRODUCTION

In recent years, one can observe a proliferation of ambitious renewable energy (RE) commitments and policies adopted by local, regional and national governments, especially in the electricity sector. In the years ahead, this transition is poised to improve the quality of life for millions, reduce harmful greenhouse gas (GHG) emissions, and help forge a world that is fairer towards both current and future generations.

Local governments and its legislators are particularly invested in this transformation. Hundreds of cities, regions, and communities around the globe have set very ambitious Renewable Energy (RE) targets and have already begun the journey towards a fossil and nuclear-free society. As of late 2016, more than 300 cities, municipalities and regions including Frankfurt, Vancouver, Sydney, San Francisco, Copenhagen, Oslo, Scotland, Kasese in Uganda, Sumba Island in Indonesia and the Spanish island of El Hierro have demonstrated that the transition to 100 % RE is a viable political decision. Many of these municipalities and regions are setting the 100 % RE target as they consider it not only as technically and economically feasible, but as ethically imperative in the face of global climate change. European cities are leading this momentum. During the UN Climate Change Summit in Paris in December 2015 (COP 21), about 1000 mayors and councillors pledged to reach the 100 % Renewable

Energy target within their municipalities. It bears mentioning that not all cities represented by the mayors have accomplished the transition, yet an increasing number of communities and small as well as large cities have developed their roadmaps towards 100 % RE and embarked on their implementation.

Given that urban areas are responsible for 70–75 % of energy-related CO_2 emissions and 40–50 % of global GHG emissions, this energy transition is an encouraging trend. Indeed, cities are home to over half the world's population (4.2 billion people in 2018), which is expected to increase to 6.7 billion by 2050 (UNDESA 2018)[2]. The Paris Agreement specifically highlighted the role of cities, and the recent Intergovernmental Panel on Climate Change (IPCC) was devoted to the role of cities. This proves that local territories play a crucial role in the transition towards a low-carbon economy.

In fact, the renewable energy revolution is transforming cities into centers of innovation. Cities are pioneering in terms of solutions regarding cutting emissions, boosting sustainable development and increasing the resilience to the effects of future climate change. Local governments have become incubators of regionally suitable best practices and policies. They are proving that renewable energy is both financially and economically advantageous, generating a wide range of benefits for both citizens and governments (Global 100 % RE 2018[3]). These benefits range from savings on fossil fuel imports, improved energy and economic security and job creation to reduced energy and electricity costs for governments, local residents and businesses (World Future Council 2016[4]).

Simultaneously, the transformation of the energy sector towards renewable energy facilitates a polycentric urban development – an

urban and spatial planning concept which has experienced a renaissance in recent years. As a result of increasing challenges in constantly growing megacities, a number of smaller and well-connected urban centers with a smart division of tasks and public services have emerged. By nature, renewable energy generation requires a close cooperation of urban centers (demand) and its hinterland (supply) (Energy Cities 2016[5]).

One of the challenges many regions within the European Union face is the decline of rural population and a growth of certain urban agglomerations. The spatial distribution of cities in the European Union (EU) is generally characterised by a high number of small cities and towns that are distributed in a polycentric way. This reflects, to some extent, the EU's historical past which has led to a fragmented pattern of around 50 countries spread over the continent. By contrast, in some parts of Asia and North America, a relatively high proportion of the urban population is concentrated in a small number of very large cities.

However, with an increasing number of people abandoning the rural regions and moving into larger urban centers, this spatial distribution has experienced enormous changes in recent decades.

Cities are often seen as centers of economic growth, providing opportunities for study, innovation and employment. An increasing share of the European Union's population lives and works in cities and it is widely expected that this development continues, as urban areas account for a greater share of activity (Eurostat Regional Yearbook 2017[6]).

In addition to certain challenges cities face as a result of this development, rural areas are up against the risk of poverty or social exclusion. Fifteen countries within the European Union have the highest proportion of people who are at risk of poverty or social exclusion in rural areas. In 2015, this was particularly the case in Bulgaria, Romania and Malta, where at least half of the rural population was threatened by poverty or social exclusion. In nine additional EU member states, the share of rural population that was endangered by poverty or social exclusion was higher than the share recorded for the urban population (Eurostat Regional Yearbook 2017[7]). With increasing and decentralised renewable energy generation, this rural-urban divide can be minimised by offering new jobs on solar or wind farms and by combining farming and generating green electricity and heat.

While each community and city surely face unique challenges, they also have many commonalities. Exchanging best practices can be very effective as long as it is based on the recognition that there is no one-size-fits-all solution and the fact that there are always transferable and non-transferable, rather specific elements of policies that can be applied. The motivation for this guide is to provide a flexible and adaptable planning tool for the many contingencies that local conditions may present. The recommendations are designed to be adapted by local actors. Particularly, legislators concerned with catalysing and facilitating the implementation of the transition, developping policies to overcome remaining barriers and ensuring international commitments are targeted. Because in light of the complexity of the task, a subject-specific and technical exchange of experiences between parliamentarians is needed.

3 RENEWABLE ENERGIES IN EUROPEAN CITIES AND COMMUNITIES

The idea behind the European Energy Union was to ensure that Europe covers its energy demand using secure, affordable and climate-friendly energy sources. In accordance with Europe´s international commitment to the 2015 Paris Climate Agreement, renewable energy sources (RES) will play a predominant role in the EU's future energy mix. In fact, scientists proved that using 100 % renewable energy for the 28 EU member states (EU28) is technically feasible and possible, even without the consumption of an unsustainable amount of bioenergy through the adoption of a smart energy approach (Aalborg University 2015[8]). Cities, islands and countries across the EU are meanwhile also showing that the transition to RE is economically feasible and socially beneficial. It should also become a moral obligation to consign a livable planet to future generations (World Future Council 2016). Local authorities particularly, but not solely, in Germany, Denmark, Austria, Poland, the Netherlands and Spain are pioneering the trend towards RE (Global 100 % RE 2018).

Nevertheless, investments in renewables in the EU fell by 50 % between 2011 and 2017, to € 46 billion (Bloomberg New Energy Finance 2018[9]). The main reasons for Europe to lose its global status in renewables are policy disruptions and instability (REN21 2016[10]). This is quite the opposite of what President Juncker pledged at the beginning of his mandate, in favor of a European Union becoming 'the world number one in renewable energies.'

Eventually, neither the EU-wide policy nor a regulatory framework will facilitate the urgently needed transformation. The 'Clean Energy Package for All Europeans' targets a reduction of at least 40 % of GHG emissions, a minimum of 32 % renewables in the EU energy mix and a 32.5 % goal of energy efficiency savings. While this does not only fall short regarding the ambitions of the Paris Agreement, it also includes a fundamental change in the renewable energy policy that contrasts with the existing legislation, in which individual member state targets are imposed. Instead of binding national targets, EU member states are required to outline their individual contributions by 2030. It remains to be seen, how national governments will build on the expertise of cities and local authorities in this process.

In the 2050 Low Carbon Economy Roadmap, the European Commission proposed to reduce GHG emissions by at least 80 % domestically by 2050, with milestones of 40 % and 60 % reductions in 2030 and 2040.
As part of the Paris Agreement, the EU and its member states submitted the domestic 2030 target of at least 40 % GHG emission reductions compared to 1990 as its Nationally Determined Contribution (NDC) under the Paris Agreement. In order to reach this, the following legislations have been adopted, signalling action across political sectors:

Figure 1: **EU 2030 Climate & Energy Policies**

Each of these policies have a direct impact on cities and shape their future infrastructures. This is especially the case in the energy sector, where the residential energy demand is larger than the commercial and public services demands with a fuel and heat use that represents the biggest share of energy demand (Teske et al. 2018[11]). Scientists project that under the assumption that urbanization rates will remain above 70 % in Europe, the annual energy demand for buildings in urban areas is expected to increase by six Expansion Joints (EJ) in OECD Europe and four EJ in Eastern Europe, while the population and GDP continue to grow if the current policy pathways are to be continued. Exploiting the full potential of existing renewable energy and energy efficiency technologies could meanwhile lead to a decrease of the total energy demand for urban buildings across the continent. Further, this could also reduce CO_2 emissions in this sector by 250 million tons per year by 2030 in OECD Europe and by 129 million tons per year in Eastern Europe. These figures could even double by the year 2050 (Teske et al. 2018[12]).

To decarbonize the transport sector, renewable electricity will play a key role. Electric mobility in response to vehicle efficiency standards, a phasing-out of combustion engines in the transport sector by 2030 and a modal shift in favor of urban public transport will transform urban centers and their surrounding areas as well as require local authorities to develop the facilitating policy framework.

4 MADE TO MEASURE – THE SIGNIFICANCE OF 'LOCAL DNA'

The concept of the local Dynamic Native Attributes (local DNA) describes a way to better understand the unique character of a place. It stems from the belief that the transition to a more sustainable future needs to begin with understanding that each place is unique. All actors, from policy makers to local activists, must build on the distinctive features and the potential that are engrained in a particular place. In essence, effective and lasting changes can only be made by first developing a thorough understanding of the local DNA of a place.

Defining the DNA of a place
Contextually, a 'place' is defined as a location in which unique relationships emerge between individuals, communities, and their natural surroundings. Like any living organism, every place has native attributes encoded in its DNA. In line with this analogy, localities, communities and cities bear their unique set of characteristics. This inevitably includes the constantly changing nature of locally relevant circumstances. Just like the DNA of any living organism that changes with time and responds to variations in the environment, the local DNA of a place continuously responds to external input.

Advancing existing systems towards a viable future will involve understanding this DNA, i.e. carefully assessing the unique, individual traits of a place. Accordingly, any sustainability action plan will need to correspond with local DNA, allowing the community to continuously evolve towards a more optimal form. Hereby, planning for systemic, future just change must acknowledge that individuals and communities are indigenous to a particular place and incorporate these native attributes into planning processes[13].

'Eigenart' and similar concepts.
A similar aspect has been raised in the flagship report 'Humanity on the move: Unlocking the transformative power of cities' (Berlin, 2016) by the German Advisory Council on Global Change (WBGU). The above described conceptual approach of understanding the local DNA of every single place is what the WBGU describes as the 'descriptive and normative Eigenart'. The German word 'Eigenart' is probably best described with 'character' while its meaning goes beyond that and involves basically all factors that shape the specific local profile of a city or a community. According to the authors of the report, this aspect is not only hugely important for creating urban quality of life and identity, but is also seen as an indispensable resource of developing each city's specific potential for creativity and innovation. Another mention comes from the Regenesis Group in the USA: it invokes to the 'distinctive character of the land and the community' when describing the approach to sustainability known as the Story of Place,

i.e. 'a systemic and participatory process that identifies and honours the unique nature of a place' (Regenesis Group, 2015) (Mang & Reed, Designing from place: a regenerative framework and methodology, 2012).

Understanding local DNA

Understanding local DNA is fundamental to any best-practice approach to sustainability. This allows for an effective exchange of solutions across cities, regions and countries that becomes truly meaningful as it starts by contextualizing and tailoring general recommendations to the particular place to its local DNA. By identifying local DNA, communities are empowered to make best use of their inherent potential. By amplifying the native character and natural strengths of a place, communities activate the conduits necessary to develop a regenerative and future just approach to sustainability and progress.

Rediscovering identities

The investigation and understanding of local DNA allows communities to determine both the appropriate scale (e.g. house, block, neighbourhood, city and region) and the individual patterns of complex interrelationships that enable their community to thrive. By empowering societies to rediscover their common identity, their unique shared DNA enables them to leverage vital connections and harmonize conflicting interests. Discovering the natural identity of a particular place is not just important for applying suitable politics. Understanding the DNA of a place can also help to identify 'fake-identities' artificially created by a certain party – whether they're found in the car industry, the coal or agro-industry etc. Myths like 'we are a coal mining region by nature' have rarely anything to do with the natural local DNA as characterised above. Therefore, the process of understanding the local DNA can already help to question existing images and/or to reconnect with some of the specific characteristics of a city or a region.

Defining the attributes

Having discussed the concept of the local DNA and its relevance, it is now important to help define a framework to support communities identifying and describing their particular local DNA. The identification and appraisal of the local DNA can help communities develop transition plans more efficiently and effectively. In this light, it seems recommendable that certain attributes of a city or a community are understood as the particular resources and impediments contained within a community's DNA. Examples of local attributes could include (but are not necessarily limited to) the following attributes:

- Climate
- Geography
- Ecology
- Cultural Values
- Economy
- Social Capital
- Human Resources
- Public awareness
- Education

All attributes are obviously closely interlinked and should not be isolated. Also, the definition of the attributes of a local DNA as suggested in this report may not be exhaustive for every city or region. While each local entity is encouraged to define the distinguishing attributes of their city or region, the proposed attributes may provide guidance for

a better assessment of the local DNA. These are briefly introduced below.

Climate
Particular climatic conditions can be very different from place to place. Temperatures, solar irradiation values, humidity, wind speeds or seasonal climate variations will provide key guidance on specific energy needs, building design conditions, local renewable energy potential, space heating and cooling requirements, etc. Furthermore, it is important to note that the climatic conditions will increasingly depend on the impacts caused by climate change – as further described below the headline 'Geography'.

Geography
The physical geography of any place has many different characteristics, depending whether the place is located near water bodies such as rivers, lakes or the sea, closer to the mountains or to a plain, and so on. The geography and morphology of a place also gives information about the relationship of a place to its hinterland or the proximity to other bigger urban agglomerations. Both can again lead to very different conceptual approaches when defining an energy strategy, e.g. the quality of the grid connections (electricity and heat) or when assessing the most suited renewable energy resource for the particular location (e.g. potential for geothermal energy or hydropower).

Another geography-related factor is, of course, the local vulnerability to climate risks. Vulnerability refers to the degree to which people or things ‚valued' by the community are susceptible to, or are unable to cope with. The vulnerability of a certain place determines how severe the impacts of climate change might be. Value in this context means not only physical wealth and infrastructures such as a functional law enforcement or medical care or other services of the common good but also social infrastructures such as families, neighborhoods, nonprofit organizations etc. The expression even refers to factors such as economic growth rates and economic vitality.

Some people or things of value as defined above can be highly vulnerable to low-impact climate changes because of high sensitivity or low adaptive capacity, while others can have little vulnerability to even high-impact climate changes because of lower sensitivity

or high adaptive capacity. Climate change impacts will remain highly unpredictable and therefore bear a higher number of variations in vulnerability in time and space. However, it is recommendable to start assessing the level of vulnerability of a particular place by applying the three dimensions of vulnerability to climate change.

- **Exposure** is the degree to which people and things are exposed to potential impacts of climate change;
- **Sensitivity** is the degree to which they could be harmed by that exposure; and
- **Adaptive capacity** is the degree to which they could mitigate the potential for harm by taking action to reduce exposure or sensitivity.

Ecology

It is important to understand the different types of urban and peri-urban habitats and the flora and fauna inhabiting them. This will, for example, enable an effective impact assessment of every measure needed to upscale renewable energy. The ecology of a particular place does not only apply to the amount of green areas but also to the different types of natural or artificial water reservoirs, water ways and sewage water management systems. Furthermore, it refers to existing pollution levels, air quality and negative biogeochemical cycles such as eutrophication. Therefore, a clear picture about the urban ecology is crucial for developing different strategies to increase energy efficiency and design the most suitable renewable energy portfolio of a particular place.

Cultural values

The cultural aspect of local DNA is as important as the previous layers. Historically, cultural values have been at the heart of development and today they are at the heart of the perceived living quality of a particular place. Cultural values include the different kinds of spiritual values of a place, its cultural creativity as well as its cultural density. The dedication of people in specific local activities positively contributes to the quality of life. Mostly, people also have a firm stand on the cultural values of a particular place which can translate into a strong opposition if these cultural values were seen at risk. In reverse, people would be very supportive to innovations if they corresponded with the given cultural values.

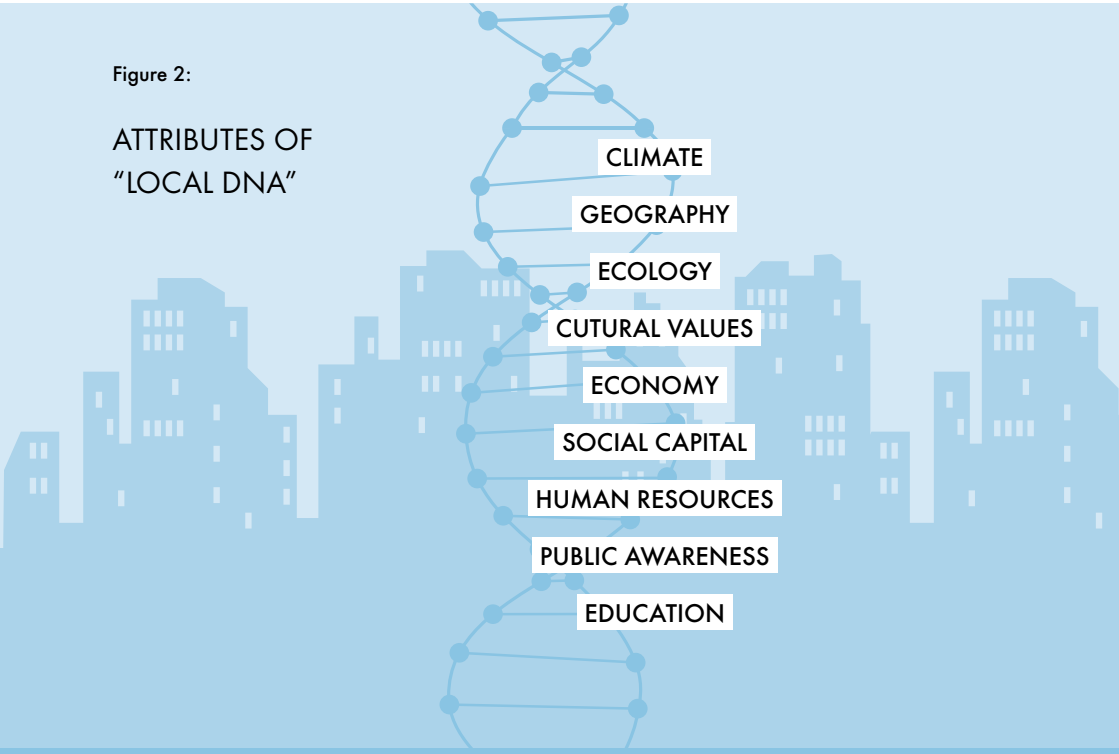
Therefore, the significance of understanding cultural values cannot be underestimated. Ultimately, it determines the 'sense of belonging' or the identification of many people with a place. A prosperous cultural life can increase social cohesion in cities and regions and avoid social and spatial segregation. It is obvious that the contemporary decline of cultural life in cities has to be reverted with newly emerging role models for cities. As for the development of the renewable trajectory, cultural aspects can have a significant impact, too. For example, local ownership of certain renewable energy facilities can have an enormous impact on whether people will be supportive or oppose to any new infrastructural development. Acceptance for new grid installations, wind turbines or biogas facilities is often the prerequisite for investors to engage. In that sense, it is true that 'participation triggers acceptance and acceptance triggers investment'.

Economy and human resources
The above-mentioned formula 'participation triggers acceptance and acceptance triggers investment' certainly also applies to the economic aspect of local DNA. Ultimately, a place can only be as innovative and prosperous as the local economy can benefit from it. And the question of costs is obviously at the core of every public (energy-related) discourse. At the same time, very few debates are loaded with such a large amount of myth and misconceptions. Therefore, it is highly recommendable to ensure a decent analysis on how the community and who exactly would benefit from investments into RE.

It is also worth mentioning that the question of RE investments costs can only be reliably answered in combination with a 'business as usual' scenario, or the economic layer of the local DNA. In other words: the 'costs' of renewable energy investments always have to be balanced against the 'costs' of a continued conventional energy market. Both scenarios should build on a comprehensive set of data and be of a comparable quality. Furthermore, it is important that all costs are considered, namely fuel costs, purchase and maintenance of the conversion technologies as well as costs related to environmental impacts.

Figure 2:

ATTRIBUTES OF "LOCAL DNA"



It is beyond the scope of this report to elaborate on all factors encompassing the aspect of an urban or regional economy. This report does not intend to describe the internal or external triggers that may or may not cause economic development. However, the benefits of accelerating the development of renewable energy in a city or community are obvious and have been discussed at a number of occasions in this report before including the case studies. A thorough economic assessment of any local RE strategy is absolutely key, and understanding the existing pre-conditions is fundamental for this assessment. This approach also facilitates understanding the economic heritage ('steel towns', 'coal mining regions' etc.) and how to make best use of the particular historical features of a place.

Social capital

The term itself refers to existing trusting relationships within a community. These relationships can be families as well as special interest groups but also the relationships among them. It is important to be aware of these relationships since their variety and quality can be an important indicator for the quality of life at this particular place. Therefore, supporting and enhancing social relationships is important for spiritual groups, recreation and sports, joint ventures with an economic background, non-profit organisations etc. This may go from infrastructural support such as providing space to meet outside individual homes, access to public transport systems to reliable internet connections.

Investments in the social capital of a place can also mean developing opportunities for joint activities or projects. Being aware of the social capital of a particular place, for example, can help to respond efficiently to potential states of emergency. This can translate into municipal engagement in renewable energy projects which can be observed by a globally emerging community power movement. In a nutshell, the social capital always consists of participation, reciprocity, joint interest and values, sense of belonging and diversity (Torche and Valenzuela 2011[14]).

Public awareness and education

Awareness about energy and energy use and why modernising the energy sector is so important really is the prerequisite to gain public support. It does not mean that people have to be familiar with all technical aspects of generating and distributing electricity or thermal energy. However, a general understanding of why such a transformation is happening and where it can be a stimulus for the job market and the local economy is the precondition for public support. The reverse conclusion is that unless the public is aware of the benefits of an energy transformation, public opinion is more likely to be in opposition to any change of the status quo.

'Telling the story' is at the heart of an energy transformation – no matter whether it refers to the big picture of the international and national Energiewende processes or regional and local efforts. And 'telling the story' successfully starts with the awareness about where to start and who is listening. The local DNA approach therefore requires that the existing intellectual environment of a particular place is well understood and that any educational or communicative efforts are compatible.

PARTICIPATION TRIGGERS ACCEPTANCE
ACCEPTANCE TRIGGERS INVESTMENTS

5 ACTION AREAS

Building policy planning and measures on available practices and experiences can provide decision-makers and community champions guidance for confronting the challenges of achieving the transition to renewable energy. This guide offers these guidelines and concludes learnings from existing experiences. These suggestions are corresponding with 10 Building Blocks that have been developed by members of the Global 100 % RE Platform, but are tailored to the European context.

5.1 DEFINING THE RE PATH

Act: Set an adequate Renewable Energy Target to define the RE path for your jurisdiction.

Background: The significance of quantitative targets must not be underestimated. Targets are exhibiting the political leadership and the basis for cross-sectoral cooperation. Such targets should be measurable, including a clear timeline and milestones and they should be taking into consideration the political responsibilities and processes. In addition to the clear guidance for investors, a quantitative target can also help in overcoming conflicting interests of different departments – from environment, transport, economy, buildings, etc.

For example, identifying and communicating a 100 % renewable energy target has a number of additional advantages: it can help engaging a wide range of stakeholders, ensure an efficient deployment of technical and administrative resources, provide validation

for necessary investments as well as reduce the risks of duplication and competing policy goals (UNEP 2015; World Future Council 2014). Further, setting ambitious targets can provide investment security and hereby also help attract domestic and international investors, ultimately making it easier to achieve the target. Experience across European jurisdictions demonstrates that targets can also help build awareness, both among external audiences as well as among the citizens in the local area. This awareness can be essential to building public support among local citizens and businesses to help to achieve the objective (World Future Council 2014[15]).

RE targets differ significantly as they can be pursued across a range of sectors of energy use, including electricity generation, lighting, heating and cooling, cooking and transportation as well as at different scopes such as community-wide or municipal infrastructure. In addition, local authorities can differentiate whether the RE target is to be achieved by harvesting local or regional resources or whether by offsetting the demand with renewable energy from elsewhere. Finally, a local authority or community may define in the RE target, to what extend the technology will be sustainable in the holistic sense including equipment sourcing and technology choice.

In addition to long-term targets, interim targets provide policy and investment guidance for the nearer future. Community targets, such as energy conservation and efficiency, GHG emissions and air pollution reduction targets should complement the RE target. It is worth mentioning, that depending on the national context, local authorities may not have the legislative power or the capacity for RE policies as implementation may fall to the jurisdiction of regional and national governments. Collaboration and policy coherence across governance levels (regional, national and international) is essential in order to be able to formalize declarations. The municipal to national level should identify pathways to establish a cross-sectoral and cross departmental cooperation in order to set up the necessary policy frameworks and institutional bodies able to align purposes and streamline efforts across jurisdictions and constituencies. This relevance of such proposal was also recognized by European legislators in the Clean Energy Package for all Europeans. The EU Governance Regulation foresees a multi-level governance dialogue platform (European Commission 2018[16]).

5.2 BUILDING (ON) LOCAL IDENTITY

Act: Identify your local DNA, based on the local climate, geography, ecology, cultural values, economy, social capital, human resources, public awareness and education.

Background: 'The energy transition might work elsewhere, but our city/country is special and it won't work here'. Such statements are not rare and are ironically be heard in all parts of the world. But it's correct and incorrect in the same time: It's true that every place is unique as explained above, but it's incorrect in the sense that this 'uniqueness' is necessarily a barrier or rate limiting factor for change. Therefore it's important not to use the 'uniqueness' of a place as an excuse to hold back any change. Instead, the particular feature of a place should mark the point of departure for a modernisation of e.g. the energy sector. Sometimes even iconic identities such as 'our city has always been a coal mining city' can be 'upgraded' to 'our city has has always taken care of its own energy resources'. It would build on an existing narrative but suggest a new layer to the existing identity giving way to renewable sources. However, understanding existing identities first is indispensable.

Following the concept of 'local DNA', the renewable energy potential of a particular region must be carefully explored to ensure that the unique benefits of a particular place are fully captured. The results of such an exploration can be very different and much depend on the local circumstances, e.g. the geography, the local economy, the availability of biomass, neighbourhoods', communities' or municipalities' consumption needs.

The identification of the local DNA can help communities develop transition plans more efficiently and effectively. In this light, it seems recommendable that certain attributes of a city or a community are understood as the particular resources and impediments contained within a community's DNA. Examples of local attributes could include (but are not necessarily limited to) the following attributes: climate, geography, ecology, cultural values, economy, social capital, human resources, public awareness, education.

In this case, it is crucial to note that while a certain technology might be acceptable to one community, it might not be to another. An inclusive policy dialogue is therefore needed to determine what sort of RE development is most desirable for a particular setting, taking

the area's distinctive economic, social and environmental values and objectives into equal account. Under the leadership of the mayor or the head of the local authorities,

- existing community groups/stakeholders should be mapped
- a broad coalition of concerned local actors, including City Councillors, active residents, community leaders, businesses, etc. should convene
- an engaged citizenry should be inspired and given a purpose
- platforms should be provided such as workshops and roundtables that bring people together, and should start to identify interests, roles and their level of engagement before decisions are taken
- should engage with those, who might be opposed to the changes and measures in order to understand their objections
- should engage with local utilities and regulators
- should ensure pro-active outreach to low-income communities and minorities.

To harvest the local RE capacities, the corresponding governments need information on the financial and technical implications, especially cost and infrastructure requirements. Information on job creation and the impact of such pathways on local economic development is also desirable. Preliminary assessments and community energy consumption baselines therefore provide greater understanding of the current state of energy use and help prepare the data needed for formulating an ambitious RE scenario and its specific implementation measures. Here, it is important to adopt a holistic energy

approach, including heating, cooling and transport use. Customized energy scenarios can create a credible baseline that can help build support and understanding, especially in terms of necessary technologies and infrastructural changes. However, the quality of a local energy scenario can be only as good as the quality of the data used, which is sometimes a struggle that local authorities face. Crosschecking the data before feeding it into a local model is essential. Furthermore, energy scenarios should be reviewed on a regular basis and adjusted according to the implementation progress, market developments, energy prices and other factors that could change the model's projections.

5.3 PUTTING ENERGY CONSERVATION AND EFFICIENCY FIRST

Act: Identify energy efficiency potential and prioritize adequate policy measures to reduce energy demand and enhance energy efficiency across sectors.

Background: Reaching high shares of renewable energy must go hand in hand with energy conservation and efficiency. The IEA called energy efficiency the 'first fuel' in 2013 (IEA 2013[17]). It showed that energy savings from efficiency measures exceeded the output of every other fuel in 11 IEA countries from 1974-2010. 'Energy Efficiency First' is also one of the five pillars of the EU's Energy Union (European Commission[18]).

As the UN points out in the Sustainable Development Goals (SDGs), 'industries and infrastructure must be upgraded' to meet future challenges (SDG 9[19]). There are proven technologies that enhance energy efficiency through improvements in infrastructure such as cogeneration systems (Combined Heat and Power), district heating and cooling systems, especially those designed to shift from using fossil fuels to renewable sources, decentralised electricity generation, blockchain, smart grids and micro-grids, and recapturing industrial waste heat and other secondary heat sources (UNEP 2015[20]). However, regulatory measures such as introducing standards, zoning and permitting as well as financial incentives and voluntary energy benchmarking are crucial to boost the transition.

Retrofitting existing buildings is a key pillar to increase energy efficiency (Calderone 2015[21]). Local governments must develop policies with robust standards for new buildings, while becoming a role model for the private sector and invest in retrofitting existing public building stock. Measures may address a) embodied energy required to extract, manufacture, transport, install and dispose of construction materials; b) operational energy required for example for lighting, heating and cooling; c) passive energy conservation provided by the interface between the interiors and the outdoor environment); d) on-site energy generation which unveils the potential of integrating renewable energy technologies into the building design; and e) other energy end-uses in buildings that can reduce demands with state-of-the-art technologies substituting older and less efficient technologies (National Platform for the Built Environment 2017[22]). While retrofitting is often a substantial investment, experiences prove that value can be generated beyond energy cost savings (Miller and Benewald 2015[23]).

Finally, an integral part of energy management is to address energy usage, hence the behaviour of consumers. Enhancing energy efficiency therefore requires increased knowledge and awareness of energy use and needs to continuously address shortcomings.

As such, community engagement is crucial. Gardening, tree planting, energy saving initiatives and other community energy projects are platforms for people to interact and undertake community activities. Generating room for individual and collective participation and learning in a social context, community engagement platforms can lead to a more sustainable behaviour: First, participatory decision-making processes help create a sense of identity, ownership and belonging to a community which impacts behaviour. Notably, if rules and regulations guide behaviour and are decided through a participatory process, people are more likely to act by these rules and model their behaviour to follow them. Second, community activities and active democratic participation create better-informed citizens, who are aware of how they depend on one another. They should also be more inclined to consider their individual behaviours in the context of their community. Finally, participation also means investing in public and shared spaces and promoting activities that fulfil our most important human needs, diverting people from merely material or consumption-based actions.

Further, governments must consider how particular laws and policies are affecting behaviour. For example, holistic and cross-sectoral considerations, such as human-scale and integrated urban planning, dense mixed-use development, pedestrian and bicycle-friendly developments are all solutions that can lead people to make energy-wise choices (Williams 2005[24]). Similarly, providing attractive routes and planning for pedestrians and cyclists can lead to considerable savings in the amount of energy used for transportation. Creating a dense, multi-modal, affordable, accessible and well-functioning public transport network can also encourage car-free mobility and, overall, a more sustainable transport system. Similarly, mixed-use developments can create denser urban areas, where people work and live in the same area of the city allowing them to walk or cycle to work. All of these interventions impact behaviour and can significantly reduce the overall demand for energy.

5.4 CONNECTING THE SECTORS: SYNERGIES OF POWER, HEATING/ COOLING, TRANSPORT, WASTE

Act: Encourage sector coupling across the energy sectors, which includes the electrification of the heating/cooling and transport sector.

Background: Achieving high shares of RE will require increasing the interconnection between the power, the heating/cooling as well as the transport sector. This allows renewable electricity to be applied in a wider range of dispatchable end-uses such as in thermal systems, alternative forms of storage or in electric vehicles. Therefore, the move toward greater electrification of heating and transport is likely to make it easier for local governments to expand RE. Denmark´s cities and municipalities, for instance, integrate renewable electricity in the heating sector through combined heat and power (CHP), fuelling its district heating infrastructure. Besides being highly efficient, this approach has added the benefit of easy on and off switching, which provides the flexibility needed to operate in an all RE system well.

Established technologies such as low-temperature heat pumps and rail transport, as well as innovations such as high-temperature heat pumps and electric mobility, may help local authorities to boost renewable energy deployment as surplus electricity from renewables can be used, offering new business models and economic opportunities. Further, district heating infrastructure provides a form of decentralised storage for excess renewable power. Such approaches can lead to more resilient local economies as jurisdictions can eliminate their dependence on imported fossil resources. Comprehensive studies that include this approach of sector coupling help understand how best to realize socio-economic or environmental objectives (UNEP 2015[25]).

5.5 EMPOWERING CITIZENS

Act: Provide citizens and communities with a right to participate across the energy system, including participation in self-consumption, demand response, storage and energy efficiency, and to access the market through a supplier or peer-to-peer arrangements.

Background: Transforming local energy markets and infrastructure is more than the substitution of one fuel for another. To support this substantial change, create acceptance, boost local economies and unleash the necessary investments, local authorities must empower new players such as citizens, businesses, farmers, administrative authorities, etc. This includes citizens and communities to become 'prosumers'— producers of energy rather than solely consumers. Citizens must gain access to the local electric grid, and ownership of renewable energy technologies at the household level needs to be simplified and rewarded financially. As the case studies from across Europe have shown, broad-based ownership of the infrastructure and assets also ensures the long-term success of the energy transition (Energy Cities 2017). The idea should be to co-build a new energy model (Energy Cities 2016[26]). In fact, a study conducted by the Institute for Distributed Energy Technologies (ide) on behalf of Stadtwerke Union Nordhessen (SUN) showed that cooperative-owned projects generate eight times more revenue for the local economy than a project conducted by an external power company (ide 2016[27]). Further, case studies and surveys indicate that local communities often oppose energy projects due to a perceived lack of fairness in both the decision-making processes and in the distribution of project outcomes (Science-Nordic 2018[28]).

With the Renewable Energy Directive agreed for the period 2020 to 2030, the EU, for the first time, acknowledges the role that democratically controlled cooperatives play in the energy transition. The European legislation establishes the right of European citizens, local authorities, small businesses and cooperatives to produce, consume, store and sell their own renewable energy without being subject to punitive taxes or excessive red tape (European Commission 2018[29]).

By providing market access for new players, innovative business models have emerged helping to facilitate the transformation of the energy system. Hence, enhancing renewable energy can enable policy makers to deliver on a wide range of non-energy and non-environmental-related priorities (World Future Council 2016[30]). Building on experiences,

legislations should therefore be designed on the assumption of decentralized, people-centred, participatory and community-owned renewable energy systems. Case studies from around Europe, and indeed the world[31], have shown that this does not only raise acceptance but is also the most cost-effective path. While large scale projects are particularly necessary with regard to infrastructural interventions, local governments should consistently enable a transition that benefits all citizens, for example, by becoming prosumers, i.e. consumers as well as producers of energy (Energy Cities 2017[32]). Policies should provide investment security for all, and legislative frameworks should follow two principles:

- Give way to new players in the energy market
- Favour renewable technologies over polluting fossil resources and make the economic case by comparing costs of a business, as the usual scenario, with a renewable energy trajectory

On September 22 in 2013, 50.9% of the **Hamburg** citizens voted in a referendum for the full remunicipalisation of the energy distribution grids in the city. The referendum was initiated by the citizen's initiative 'Our Hamburg – Our Grid' (OHOG) and constituted the climax of an intense political controversy that lasted for more than three years. This referendum reversed the decision of the city at the end of the 1990s and beginning of the 20th century, when the former government privatised its electricity, gas and district heating distribution grids.

In February 2014, the company Vattenfall and the City of Hamburg reached an agreement over the purchase of the 27,000-kilometer-long electricity distribution grid for the total price of 550 million Euros. The transition from shifting Vattenfall shares into municipal ownership was eventually completed in April 2016 by maintaining the entire workforce. This also proved the concerns of the workers' union IG Metall before the referendum groundless.

In the first year, the electricity grid operation generated a total benefit of 34.5 million Euros for the city. The gas distribution grid is fully owned by the city government as of 2018 for a total price of 355.4 million Euros. Negotiations about the district hearting grid are still ongoing (World Future Council 2016[34]).

5.6 KEEPING CITIES IN CONTROL OF ENERGY

Act: Ensure public influence on the provision of energy goods and services including energy pricing, reliability of the grid and environmental impacts.

Background: Access to energy is a basic human right and should not be subject of speculation or short-term profits. Furthermore, reliable energy access is one of the most influential factors for society, including safety, health and economic development. Therefore, ownership of energy infrastructures has an enormous impact on the price of energy, fuel choices and grid maintenance and technics. Historically, in most of the European countries the electricity, gas or district heating grid used to be owned by public utilities. While many cities and communities have been capitalizing the grids and production sites in recent decades, this trend is reversing again. Experience has shown that a municipalised grid provides direct access and the ability to scale up renewable energy. Primarily, this refers to grid-related investment decisions or the reinvestments of profits from the grid management. Publicly owned energy distribution grid companies are detached from the maxim of utility or profit maximisation and instead perceive the performance of their task as a public service to the common good.

In fact, in several European countries, local authorities themselves have become a new players in the energy market. Various factors have accelerated the development of energy remunicipalisation (Energy Cities 2017[33]). In Germany for example, the renewal of over 20,000 concession contracts for managing electricity and gas distribution networks opened a window of opportunity, while the political momentum generated by the implementation of the Energiewende provided a favourable legal framework. In the UK, by contrast, remunicipalisation moves were rather driven by social concerns linked to tackling energy poverty. A wide range of possible models exist for cities who wish to activate in the energy landscape. In Germany, local authorities most commonly act as integrated operators along the whole value chain (production, distribution, supply) and in various sectors (energy, waste, water, transport, etc.). In France, cities are essentially involved as investment operators, providing also technical assistance to energy efficiency and renewable energy projects, while in the UK a lot of the recently created entities have become active as direct energy providers.

5.7 TESTING INNOVATIONS AND NEW TECHNOLOGIES

Act: Provide space for understanding and testing emerging technologies. Establish a Chief Technical Officer (CTOs) and a 'digital control room' or department within the public authority to oversee and coordinate digitalisation processes and projects.

Background: Scaling up renewable energy requires the integration of new technologies and development of innovation. First and foremost, this refers to the new concepts such as smart cities, smart technology, industry 4.0, blockchains or artificial intelligence. Therefore, it is important to note that digitalisation is not a natural force but designed by human beings. The overall goal of technologies and innovation is to serve the people – not the other way around. They need to contribute to well-being and sustainable communities. Hence, the question for any local authority is how these innovations and new technologies can help reach their goals and how universal access for all citizens can be ensured. An example for this type of innovation is car sharing – the air quality is improved and the use of fossil fuels reduced. Digitalisation provides opportunities to develop attractive, user-friendly systems that reduce the number of cars on city roads.

However, the 'Internet of things' or artificial intelligence are still abstract concepts for most people. Digitalisation develops rapidly which often means that citizens and policy makers are overwhelmed or even excluded. Local authorities must therefore provide the space to learn and test emerging technologies. Further, they must adapt to the requirements of the private sector as well as of citizens. Therefore, a central focal point or a go-to-point is necessary, ensuring coordination and monitoring as well as sharing expertise. In addition, inclusive platforms that encourage broad participation are crucial to allow targeting people's needs and ensuring acceptance rather than making this an issue for experts.

Finally, new technologies may influence the energy infrastructure as digitalisation, for instance, requires significant new data centers, which again require significantly more energy. In Germany alone, data storage and exchange demands about 18 TWh. This is expected to increase to about 25 TWh by 2025 (German Parliament 2017[35]). Local authorities may therefore invest in the new renewable energy generations to cover the increasing demand, developing new business models and income opportunities.

5.8 INVOLVING THE MOST VULNERABLE: RES FIGHTING ENERGY POVERTY

Act: Establish specific programmes to support underprivileged citizens such as premiums for refurbishments proportional to income, zero-interest loans, energy scans, financial support for energy refurbishing as well as social energy tariffs.

Background: More than 50 million households in the European Union are experiencing energy poverty according to the European Commission[36]. Households suffering from energy poverty with only inadequate levels of essential energy services are caused by a combination of high energy expenditure, low household incomes, inefficient buildings and appliances or specific household energy needs. Energy tariffs therefore, always cast a shadow over the risk of energy poverty. The higher the tariffs for electricity, heat or mobility are compared to the individual income, the higher the risk of falling into energy poverty. This aspect of 'energy vulnerability' has to be taken into account when embarking on an energy transition trajectory.

While the challenge to tackle energy poverty seems to be very complex, starting with the absence of commonly accepted indicators, 'not doing anything' is not an option. Energy poverty is ethically and socially unacceptable. Furthermore, households lacking energy services don't contribute to or benefit from the local economy as much as they could. This puts the social cohesion of a community at stake. Developing and implementing action plans against energy poverty should be a key component of every local, regional or national energy roadmap.

Measuring energy poverty, however, remains challenging due to a lack of available data and the range of quality as regards the data that is actually available. This data is also considered to contain culturally highly sensitive information and may conflict with national data protection regimes. However, a number of countries have already adopted a plan to avoid or limit energy poverty. Among those are concepts like the Energy Bank, a municipal public private partnership of the city of Arnhem, Netherlands. It coordinates the efforts of the city to assist households by providing short-term financial support for energy bills as well as energy advice through a voluntary advisor. Also, some

small materials to improve energy efficiency are provided. Savings per household are between 56 and 113 Euro per year[37].

Awareness of energy poverty is growing rapidly across Europe. The European Commission has developed the so-called Energy Poverty Observatory (EPOV) to help member states in their efforts to combat energy poverty. It seeks to improve measuring, monitoring and sharing knowledge and suggests a number of case studies.

Also, suggestions for developing local fuel poverty eradication plans, as suggested by Energy Cities, is highly recommendable. Such a plan would be built on accurate and geo-localised diagnoses of both collective and individual situations. The overall aim of those local action plans should be to eradicate the cause for energy poverty, e.g. the lack of insulation in dwellings, poorly efficient heating systems or peri-urban sprawl.

The energy transition will not come without some level of socio-economic disruption. To guard against impacts of a potential fall-off concerning traditional manufacturing and construction jobs, policies to enable families and businesses to alter their professions, business models and their consumption choices in responsive and effective ways must be in place. Therefore, equity needs to gain a fundamental role within any RE plan. Policies must protect vulnerable communities, such as low-income, which tend to be the most impacted by system changes.

As the first Flemish city, **Ghent** signed the **Covenant of Mayors** in 2009 and released its first climate plan in 2011, pushing for climate neutrality in 2050 and aiming at emission reductions by 20 % (baseline 2007). This first climate plan was designed to generally express a political will, to collect the necessary data and information for the local energy transition and to start a participatory process. In 2015, the city council **approved a second climate plan** with concrete measures to reach the target for 2019 and a commitment to invest an amount of 105 million € in actions that directly concern GHG-emissions reduction. Just before the decisive climate conference in Paris in 2015, the city committed to the second Covenant of Mayors with 40 % CO_2 reduction by 2030.

One of the key pillars of Ghent´s energy transition is ensuring the involvement of low-income households. The authority initiated specialized programmes as energy poverty is a particular challenge to this group. It wants to tackle this by specific measures to support underprivileged families in their efforts regarding energy-efficient living and refurbishing. These

measures include premiums for refurbishments proportional to income, zero-interest loans, energy scans, and extensive guidance by the non-profit association **REGent**. In addition, the city administration also aims at making social housing refurbishing to be more energy efficient. This is why the City of Ghent provides financial support for energy refurbishing by the social housing companies operating within its territory.

Involving citizens and local stakeholders and offering them a chance to participate in the projects is also a part of the social dimension. The project *Buurzame Stroom* ('Sustainable Neighbourhood Electricity') for instance aims at increasing the RES share in a specific city district by installing technical solutions and coaching people to save energy. Further, it is meant to bring citizens together, enabling them to realize something bigger together. By connecting people owning suitable roofs for PV but have no investment appetite together with people search for such roofs and want to invest, the city can facilitate the deployment of RES in the city and increase the share of locally owned and produced electricity. *Buurzame Stroom* combined elements and inspirations from pre-existing projects in Germany, the Netherlands, Sweden, the UK and the USA. The political target is to double the share of locally produced renewable energy from 7.5% in 2011 to 15% in 2019 (from total household consumption), to be achieved among other things by increasing the amount of local PV-electricity.

5.9 IDENTIFYING ALTERNATIVE FINANCING

Act: Introduce innovative and alternative financing mechanisms, incl. internalisation of externalities and the establishment of inclusive support schemes.

Background: Carrying out a successful energy transition is only feasible with effective and innovative financing mechanisms. Therefore, financing the energy transition requires strong technical, financial, legal, and coordination skills and expertise in local authorities. Local authorities need to raise capital to support local projects, especially in jurisdictions that have little capital available and strongly depend on central governments. While governments at all levels (European, national, regional and local), financial institutions, businesses and citizens should channel funds to boost common energy and climate measures, local authorities' role is to motivate and coordinate players on their territory (Energy Cities 2014[38]).

Local authorities across Europe have tested and implemented successful innovative financing schemes (Energy Cities 2014[39]). These include options such as public private partnerships (PPP), local public and semi-public companies, private financing initiatives (PFI) such as investment funds, grants and soft-loan schemes, civic crowdfunding, co-operative funding models and local share-based cooperative models (World Energy Council 2016[40]; Energy Cities 2014, Energy Cities 2017). Regardless of the choice of instrument, open and accessible monitoring tools that include evaluation of public expenditures are crucial to ensure transparency and acceptance. Further, close collaboration with national governments to develop and implement decentralized fiscal policies are necessary to ensure access to the tax revenues and financial instruments needed to make the necessary local investments (UCLG 2008[41]).

Monetizing positive and negative externalities to combat the market distortion has been a desirable tool for various stakeholders across governance levels. Yet, little progress has been made. Local authorities have several instruments at hand, including the adoption of innovative, locally-based fee systems, such as a carbon tax, waste tax or pollution tax (UNEP 2015[42]) or favouring low-polluting technologies over carbon and resource intensive processes—especially in certain sectors, such as in the building sector where natural gas heating, for example, remains cost

competitive (Cunningham 2016[43]). A strong collaboration with other governance levels and cities are essential to ensure acceptance.

As the energy transition is a long-term endeavour, it is crucial for local authorities to establish stable financial support schemes beyond the legislative timeframe. This may include financial incentives that stimulate private investments and that encourage private individuals to invest in renewable energy projects (World Future Council 2014[44]; Energy Cities 2017). Consistent public support is essential to develop the renewable energy market, stimulating participation of companies and private individuals in moving this transition forward. Such inclusive support schemes should not only target generation technologies but also energy efficiency and solutions to reduce consumption.

5.10 HEADING FOR NEW PARTNERSHIPS

Act: Set up cross-party and cross-mandate platforms to initiate, convene, monitor and evaluate partnerships between sectors, authorities and jurisdictions.

Background: Renewable energy strategies must be institutionalised in the sense that formal bodies or organizations need to be set up or strengthened to be responsible for designing, implementing and monitoring the transition. Ideally, these formal or informal institutions facilitate multi-level governance, cross-sectoral collaboration and peer-to-peer cooperation between regions, cities and local governments. A cross-party and cross-mandate platform for permanent, efficient organization and allocation of the necessary resources can enable generational continuity of the transformation and coordination of local actors and projects. In order to do so, such a platform can be hosted by a local authority, its energy agency, or a third-party as the host, as well as its funding source, should not depend on corporate interests, the influence of private investors and short-term political trends. This is crucial to moderate changes in political leadership and mandates. Proper monitoring and evaluation is also essential to assess progress and ensure adequate political measures.

The structural shift to RE is a complex transformation that requires various stakeholders, sectors, parties and governance levels to engage. To succeed, this process must be a collaborative effort, built upon an alliance of stakeholders permeating all departments and different levels of local government. Communication plays the central role and can be informal or formal. While sometimes this cannot be clearly separated, three different types of communication can be identified and in fact be combined: bilateral, unidirectional top-down and unidirectional bottom-up. Institutionalised communication is recommended to ensure effectiveness and appropriate implementation. Examples of a supervisory body for multi-level governance include a National Commission for Sustainable Development, which is practised for example in Finland, coordinating the sustainability agenda across various levels of government (Ministry of Economic Affairs and Employment of Finland[45]).

Collaboration may also include cooperation between regions, especially between urban and rural areas, which face different challenges and opportunities during an energy transition. Indeed, most cities are too densely populated to produce all necessary renewable energy within their own boundaries. Hence,

collaboration between neighbouring municipalities is needed (Energy Cities 2016). This may hold advantages for both sides in terms of sustainable energy development. While large cities, due to their limited surface area, would not be able to fully meet their energy demands—even if reduced—by producing their own renewable energy, they are richly equipped with know-how, investment capital and pools of varied competencies (especially in the services sector).

By comparison, rural areas can provide the necessary space to produce RE. This offers investment opportunities for cities and revenue opportunities for regions to generate and sell the surplus energy they produce. New business models and cross-party collaboration may arise. Finally, cooperating is not only favourable for city-hinterland partnerships, but also for villages that are too small to produce a sufficient or balanced mix of RE.

6 CASE STUDIES

The case profiles exposed in this report are exhibiting different ways of how communities and cities spur the transition to renewable energy. In correspondence with the local DNA, these case studies represent proof evidence of the fact that political leadership, clear targets and, ultimately, the will to unlock the economic benefits of a transition towards Renewable Energy are the prerequisite for a community to embark on that journey. The following cases have been chosen because of their diversity in approach, scale and national environments. They suggest features that may be considered as transferable to other jurisdictions, while other elements are deeply embedded in the local context (the local DNA).

6.11 FRANKFURT, GERMANY GOES 100% RENEWABLE ENERGY

Frankfurt is known as a global financial center and runs one of the biggest airports in Europe. As one of the most densely populated cities in Germany with about 717,000 inhabitants, Frankfurt imported around 95 % of its energy consumption totaling 22,600 GWh in 2010. Nevertheless, Frankfurt is one example that shows how local economies can be strengthened through the transition towards 100 % renewable energy. Between 1990 and 2012, the city reduced its emissions by 15 %, while the local economy grew by 50 %[46].

In 2008, the City Council adopted an energy and climate action plan comprising a set of 50 concrete measures to reduce GHG emissions. Central elements aimed at decreasing heat and energy demands by rewarding electricity savings in private households, public awareness raising campaigns, modernising residential buildings and promoting energy efficiency in businesses. As a result, energy efficiency has saved Frankfurt € 100 million in energy costs since then and this trend is still projected to increase. Through the initiative 'Frankfurt spart Strom' (Frankfurt saves electricity), private households have saved about 657 tonnes of CO_2, which equals the compensation of about 26,298 trees (Stadt Frankfurt 2017[47]). More than 1,600 on-site consultations at private homes between June 2015 and December 2016 result in long-term savings of about €165,800. Experiences have shown that each household can save about 243 kWh, which equals about €69 (City of Frankfurt)[48]. Further measures of the energy and climate action plan included the expansion of local and district heating supplies, the promotion of decentralised power plants (co-generation units) and the promotion of renewable energies,

Master Plan 100 % Climate Mitigation
Subsequently to its early climate mitigation concept, Frankfurt developed a so-called 'Master Plan for 100 % Climate Mitigation',

envisioning to cover the city's energy consumption by 100 % local and regional renewable energy sources until 2050. With this roadmap, Frankfurt intends to decrease its energy import costs of € 2 billion a year to zero. Accordingly, CO_2 emissions should be reduced by 95 % until 2050. Instead of remaining dependent on energy imports, Frankfurt aims at using local and regional resources, while creating revenues for investing in the regional economy. Frankfurt's 100 % renewable energy target is also closely linked to the city's climate strategy, as well as the national policy framework. At the national level, the National Climate Mitigation Initiative from 2013 triggers and supports climate action at the regional and local level. Both the federal and the state-level governments have provided grants to support this transition. From 2013 to 2016, the City of Frankfurt received about €800,000 from the national government for climate protection activities. Until 2018, additional €105,000 could be unlocked (City of Frankfurt 2017[49]).

A core element of Frankfurt's Master Plan is to combine both a top-down and bottom-up approach. The Master Plan was developed in a participatory process, which started in 2013. Regional experts were participating in different working groups, such as energy supply of the future, buildings, mobility, education, economy and value chains. In total, about 100 institutions and 150 experts contributed to the pathway towards 100 % renewable and local energy supplies by 2050, drawing upon strategies and measures to be taken. For the implementation of Frankfurt's Master Plan, a broad coalition of architects, urban planners, engineers, consultants, local businesses as well as local residents are being involved. Since 2013 about 100 institutions with about 150 experts have engaged in strategy groups (City of Frankfurt[50]). A citizen dialogue platform with several events, discussions and fora has been established to engage stakeholders in urban development (City of Frankfurt[51]). This should ensure a holistic consideration of the 'local DNA', as various local stakeholder

groups and experts are profoundly involved in the city's transition plan.

A special focus is also to support low-income families to benefit from the transition. Between June 2015 and December 2016, about 230 low-income households exchanged their fridges, installing innovative, efficient technologies for half the price supported by a special programme[52].

To reach more people, the City established a communication office only for climate protection issues in 2015 and developed a unique brand called 'Team Frankfurt' to unite existing initiatives and projects, highlighting common goals and unveiling synergies (Fiebig 2018[53]). For example, the DANKE initiative aims at reaching all inhabitants more than 20 times to appreciate individual climate action. For this, large scale electronic posters (CLPs) were put up at public places across the city, an image film was displayed in the city during the Christmas season, facts and figures as well as recommendations and suggestions for climate action were published on an online platform and disseminated through social media. A survey in 2015 showed that 85% of Frankfurt's inhabitants consider climate protection as important (City of Frankfurt[54])

As a first step to implement its Master Plan, Frankfurt's energy consumption and saving potentials to reduce carbon emissions were comprehensively analysed. With the support of a feasibility study, tailored recommendations for the sectors and departments of Frankfurt were developed – taking the 'the local DNA' into account. From 2014 to 2015 the Fraunhofer Research Institute simulated various energy scenarios on an hourly basis, showcasing that the energy demand can in fact be covered by local renewable energy sources by 2050, while recommending corresponding implementation strategies. With energy scenarios covering each sector, a concrete mapping of renewable energy sources has been defined, resulting in a concrete RE and energy efficiency strategy (cf. Fraunhofer IBP 2015).

To achieve these ambitions, the total energy consumption in Frankfurt needs to be reduced by 50 %. The remaining 50% of the current energy consumption will be covered by a local supply of renewable energy sources in Frankfurt and the Rhine-Main region (Stadt Frankfurt am Main 2015, 38). Ultimately,

Figure 3: **Master plan for 100% climate protection**

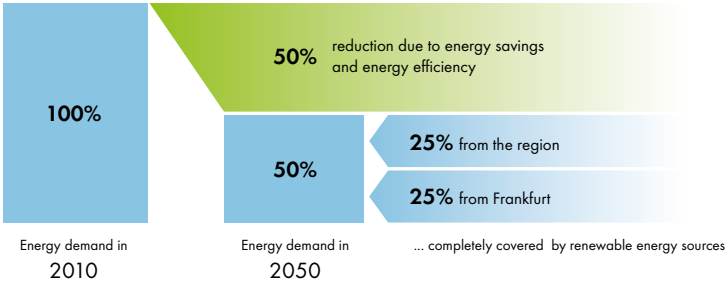
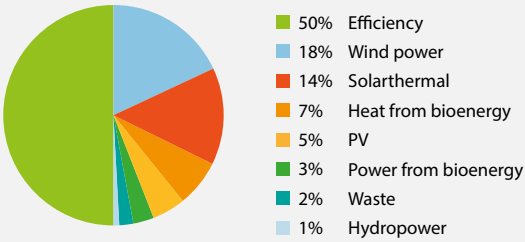


Figure 4: **Energy Sources Frankfurt 2050 (Scenario)**
https://www.masterplan100.de/zum-projekt/ziele-und-co2-bilanzen/

Master Plan 100% Climate Protection in the City of Frankfurt am Main, Germany
Energy sources for Frankfurt am Main in 2015 (based on the scenario)



Feasibility study for the master plan "100% Climate Protection in Frankfurt am Main", 2015
https://www.masterplan100.de/kacheln/masterplan-100-klimaschutz-frankfurt-am-main/

Frankfurt's energy demand will be largely covered by regional solar and wind farms.

Due to the publicly-owned local utility, mainly driving this energy transition, the city of Frankfurt not only benefits from savings through increased energy efficiency, but also generates additional income in form of revenues and tax incomes. By prioritizing energy production from within the city and from the surrounding region – while still being connected to the national grid – the money stays in the region. In general, this transition towards a fully RE society provides additional benefits to the local population, mainly in terms of the reduction in air, water and land pollution, leading to health benefits. Besides the local production of Renewable Energy ensures energy security and opportunities for sustainable economic growth and social development. By enabling the participation of experts as well as residents, a broad coalition was forged, empowering the local people and making the best use of the inherent potential of the city and its region.

Consequently, Frankfurt's far-reaching and progressive climate action not only receives increasing attention, but was also already rewarded with numerous awards, including the 'Klimaschutzkommune' – the award for Climate Mitigation Communities. Furthermore, Frankfurt was the finalist in the 'European Green Capital' competition 2014 and is the founding member of the Climate Alliance of European cities.

6.12 KISIELICE, POLAND LEADS THE ENERGY TRANSITION IN POLAND

Kisielice is a small city in the North of Poland in the province of Warmia-Mazury with some 6000 inhabitants. Located in the South of Dolne Powiśle region, the semi-rural municipality puts itself on the global map of pioneers of renewable energy transition, in contrast to Poland's enormous national dependency on lignite and hard coal. The city decided to become independent from fossil fuels and invested in two windfarms and additional renewable energy capacities back in the late 1990s. The main motivation for the municipality was to stimulate the local economy. After setting the target to become Poland's first self-sufficient community, Kisielice now generates more electricity than it needs and has reached the target of a self-sufficient community.

In order to pave the way for this transition, Kisielice changed its Spatial Development Plan in 1998 to ensure that the construction of wind turbines did not conflict with existing administerial regulations. Since Poland had almost no experience with emerging renewable energy installations, it required a number of legislative updates. Also, clear political leadership by Tomasz Koprowiak, who was mayor from 1990–2014, can be considered the most relevant success factor. The municipality conducted a number of surveys about expected wind capacity, technical challenges and economic results before installations started, which was a prerequisite for successfully attracting investors and the support of the local population. In addition, a number of different participation

efforts was undertaken and a vast majority of residents in Kisielice seemed to ultimately support the concept after early doubts had been addressed.

Today, there are a total of three wind farms with a combined installed capacity of some 120 MW. Local farmers have an additional income of about €5,000 per year for the lease of each wind turbine on their land. This profit sharing mechanism ensures the acceptance of the installation of windfarms among the local farmers, since they are not excluded from the revenues.

In addition, a biomass-based Combined Heat and Power (CHP) plant has been built in the last years. The plant consists of two straw boilers of 6 MW combined with cereal straw combustion – again purchased from local farmers. The plant is connected to a district heating system, which provides heating to 250 buildings, i.e. serving more than 90 % of the local population. The taxes paid by the wind energy investors amount to a significant revenue for Kisielice authorities and the municipal budget, providing the capital for the investment into the CHP plant.

It is worth mentioning that the road to these participatory, less polluting and beneficial measures was not easy. In fact, far from it, as it required much determination from the mayor to stick to the plans and ensure the support of local residents in the municipality in order to become one of the truly pioneering municipalities in a coal-based country. These attributes were particularly required when the city planned to additionally generate renewable electricity from agricultural and food waste. The city did not get permission from the Regional Directorate for Environmental Protection to use waste from the food industry generating electricity. However, eventually a biogas plant was built in 2014 which now generates 1 MW electricity and 1 MW thermal energy.

'When implementing the biogas project, Kisielice authorities pro-actively pursued transparent consultations with the local community to discuss openly possible concerns and create local ownership among residents. Local opinion leaders – village administrators, school directors and members of the municipal council – were invited for study visits to biogas plants in Germany and in Poland. A project presentation, open to all inhabitants of Kisielice, was organised in the town hall and results from the study visit were presented. As a result, the biogas plant construction was not met by any local social protests.'(Węglarz et al 2015[55])

In 2012, Niepolomice and three other municipalities decided to cooperate for the purchase and installation of renewable energy systems on their territory. Led by Niepolomice, they invested over 17.3 million to boost green energy in their area. 60% of the total budget was co-funded by the Polish-Swiss Cooperation Fund, while the remaining 40% were covered by the municipalities' own contribution.

Poland, a country with a total number of 38.5 million in population (OECD)has a long tradition in the agricultural sector. Next to the industrial sector and the service sector, agriculture is the third most important

labour market of the country and an important factor to the economy, contributing 3.8 % to the national GDP. Poland's two million private farms cover 90 % of all farmland and most farms have an average size of 8 hectares. This means that hundreds of thousands of farmers could be inspired by the example of Kisielice. Farmers can benefit largely from investing into renewable energy facilities – by co-owning windfarms, generating energy from biomass or simply converting their fields or roof tops into additional revenues by letting them to RES investors.

The particular role of the municipal government exhibiting a strong leadership proofs evidence that mayors and local communities are at the forefront of the global energy transition if they are aware of their power and willing to use it through collaboration.

In addition, the example of Kisielice showcases that a clear target in combination with the capability to roadmap this target involves the public, as well as different stakeholders to ensure the acceptance as the key for such a transition. The development of RES in Kisielice has also led to investments in the local infrastructure with the modernisation of municipal roads or newly built power grid connections financed by the investors of wind farms. This proves that investing in RES on a local level can pay off.

Kisielice received the ManagEnergy Award 2014 for its leadership on energy transition. Today, it is powered by 100 % renewable energy. The prize awards outstanding, local and regional, sustainable energy projects.

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