



"100% renewable is possible."

"Social inclusion and gender equality also relate to energy transition."

"100% renewable does not equal 100% sustainable - we also need to address consumption."

"This is a climate emergency."

HOW CAN YOUR CITY BECOME... 100% RENEWABLE?



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This toolkit covers the following indicator areas for the European Green Capital Award:

- Climate Change: Mitigation**
Climate Change: Adaptation
- Sustainable Urban Mobility**
Sustainable Land Use
Nature and Biodiversity
Air Quality
Noise
Waste
Water
- Green Growth and Eco-innovation**
Energy Performance
Governance

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OPENING STATEMENTS

European Commission – DG ENV

In times of crisis, renewable energy should not be a burden but it can rather play a crucial role to ensure a successful and sustainable economic recovery. The European Union has committed to achieving the climate goals and emissions reduction targets set out in the Paris Agreement.



Umeå

In 2019, we welcomed the European Green Capital Network cities to Umeå, to reflect on all of our work to become 100% renewable.



In Umeå, we believe in integrating different perspectives when thinking about the future of our city and citizens. That includes learning from peer cities about successful approaches in renewable energy, electric mobility, and building retrofits. It is also about integrating social, cultural and economic perspectives into our energy and environmental policies, and vice versa.

We believe in combining a systemic view of our energy system with a responsiveness to our citizens' changing needs and concerns. Implementing a 100% renewable energy vision therefore requires both technical considerations, as well as taking social elements into account to ensure a just energy transition. This can mean analysing and paying attention to gender, as well as socio-economic disparities, when developing 100% renewable cities. Although much work remains ahead, we are also proud of our achievements and transitions so far.

We are proud that public transport trips in Umeå are increasing, and that our buses now run on electricity and renewable energy. However, still not enough people are choosing sustainable modes of transport. Through our continuous monitoring and analysis of the social aspects of our transport system, we can see, for example, that women are 15-20 % more likely than men to choose sustainable travel for the same journey. The use of public transport has also decreased because of Covid-19 and we now need to win back people's trust in buses and trains. Moving forward, beyond climate neutrality, we are now also looking at consumption-based environmental targets in Umeå. This is a new way of thinking for cities, inspired by the Agenda 2030.

In May 2019, we had the pleasure of welcoming the European Green Capital Network to Umeå. This toolkit is an outcome of that inspiring exchange – of peer cities sharing experiences in working towards our common vision to develop 100% renewable cities.

Daniel Calleja
Director General for Environment
European Commission

Hans Lindberg
Mayor of Umeå

WHY IS NOW THE TIME TO ACT?

Cities are the focal point of the transition to renewable energy: they are simultaneously sites of unsustainability – energy hungry and carbon emitting – and sites of experimentation for radical decarbonisation. The potential for urban areas to lead the march towards 100% renewable energy systems is clear and recognised across all levels of government.

More than 70% of carbon emissions from final energy use can be attributed to urban areas.¹

There is broad consensus that we need to accelerate and upscale the sustainable energy transition if we are to prevent a climate emergency. Yet, the road ahead remains arduous, with just under 12 years to halve carbon emissions and reduce primary energy use by 40% to stay below 1.5 °C of warming.

Cities in action

5,700 cities with quantifiable commitments (35%)

6,500 cities involved in climate action networks (40%)²

The urgency and scale of this shift has only become clearer in the wake of the COVID-19 pandemic, which led to a moderate drop in carbon emissions and signalled the need for a more fundamental transformation of our energy systems. Yet, crises can also help spur a green recovery and accelerate our move towards renewable-powered cities.

This toolkit shares how the winners and finalists of the European Green Capital Award have tackled the thorny question of becoming 100% renewable. It explores the successes and challenges that they have faced in doing so, and puts forward lessons learned and a wealth of experience for other cities to build on.

A key lesson from this toolkit is that 100% renewable cities are not solely about renewable energy supply: they are also about reducing energy demand through energy efficiency measures such as building retrofits, electric mobility, and achieving ambitious policies and targets.

Another lesson is that there is no one way of doing things. However, the ways we organise our energy infrastructure has long-term effects, by locking us into specific pathways.

The role of local organisations and cities will be much greater in the energy systems of the future.³

Sustainable energy systems can be centralised, relying on large-scale infrastructure such as offshore wind parks and ultra-high tension lines; they can also be decentralised, giving citizens active roles as ‘prosumers’ and using small-scale infrastructure such as micro-grids.

Regardless of the technological configuration, the vision of 100% renewable cities cuts across social, economic and environmental dimensions. It means that rich and poor, men and women, old and young all need to benefit equally from this shift. This also means that ways in which cities respond to the many crises they face need to be just and sustainable – only then can green and renewable cities truly benefit everyone.

¹ IPCC AR5 Chapter 12

² Agora Energiewende (2019): European Energy Transition 2030

³ EU Energy Roadmap 2050 (10)

TRANSFORMATION STORIES

Nijmegen: Citizens building wind turbines

The people of Nijmegen have taken renewable energy into their own hands. Citizens, citizen organisations, and private companies have together formed a cooperative and built four wind turbines, which now produce a total of 12 MW of energy per year. At the same time, a local green energy company was founded, which provides regional green energy at a fair price. Transparent communication with all stakeholders and free electricity for directly affected residents helped minimise some initial resistance from locals, and the project became a communal effort and success. Both initiatives now contribute to the city's goal of becoming energy neutral by 2045.

Oslo: Towards greener and cleaner cars

The city of Oslo's goal for its cars is twofold: it wants cleaner cars and it wants fewer cars on its streets. The success rates in achieving these goals so far is mixed. The city's target of reducing road traffic by 20% from 2015 to the end of 2020 will most likely not be reached, since they have only reduced road traffic by about 4% as of 2019. It will therefore also be challenging to reach the 2030 target of a 33% reduction. On the other hand, the city has been very successful in promoting electric car ownership. This is a result of its many incentives introduced over the past years, such as parking privileges for electric cars and its development of both public street chargers and of home charger infrastructure. By the first half of 2019, 69% of all new cars registered in Oslo were electric vehicles. Plus, 25% of Oslo's total car fleet is now either battery electric or plug-in electric vehicles. With 96% of all electricity in Norway produced by hydropower and 2% from wind power, electric cars are almost fully powered by 100% renewable energy.

For more transformation stories visit the [EU Green Capital website](#)

Lahti: Farewell to coal

Lahti needed to replace its old coal power plant. It took this as an opportunity to change pathways and replace it with a biothermal heat and power plant that will use certified wood and wood residues. The city estimates that the plant, which was completed in 2019, will reduce Lahti's CO₂ emissions by over 70%. As the plant's inputs will mainly come from within a 100km radius of Lahti, the plant will also create new jobs in the region. Lahti also intends to include carbon sinks and carbon storage in its climate protection plans, which are, however, still to be finalised.

Reykjavík: Fossil free transport

In Reykjavík, given its ideal location, electricity and district heating is already 100% renewable and mostly comes from hydro and geothermal power. Thus, a key aspect of Reykjavík's renewable energy strategy focuses on the transport sector, which is responsible for two thirds of emissions in Iceland's capital. The municipality has the goal of having its transport completely fossil fuel free by 2040, but is struggling to reduce emissions so far, in part due to a booming economy. Emissions from waste, the second largest source, are expected to drop significantly once the city completes its new waste plant in 2020.

Münster: Reducing consumption is key

The city of Münster has the goal of reducing emissions by 95% and using 50% renewable energy in the city by 2050. Halving energy consumption in the city is a central part of this goal. To ensure locals are on board with their goals, the city is carrying out comprehensive public relations work, while also relying on biomass farmers and solar system owners to help spread information. The city is also trying to inspire people to lead more energy efficient and climate friendly lives by role modelling this behaviour itself, pursuing energy efficiency campaigns, and supporting relevant programmes, such as one that provides residents with funding for energy retrofits.

TRANSFORMATION PATHWAYS

UMEÅ - TURNING DISASTER INTO OPPORTUNITY

When one of the biggest fires in Umeå's history destroyed parts of the Ålidhem neighbourhood in 2008, it was a nightmare come true for many. However, like other cities in the past, Umeå decided to take the disaster and give it a positive ending – in this case, a sustainable ending.

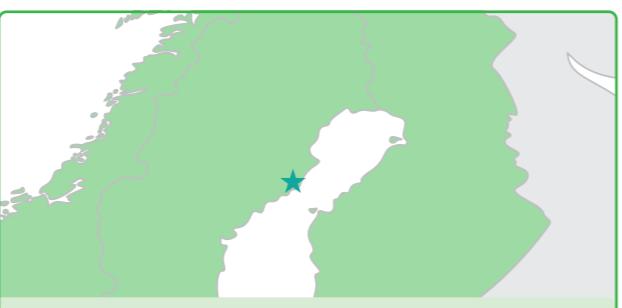
Built in the 1960s and 70s as part of a nationwide programme for more housing, the Ålidhem neighbourhood housed many students and migrants; speed rather than sustainability was the area's main concern. The aftermath of the 2008 fire led to the decision that Ålidhem should become a leading example in sustainable building and refurbishment. This project became known as Hållbara Ålidhem (Sustainable Ålidhem), and it was decided that energy consumption in the area would be reduced by more than 50% while rents would only increase minimally.

A central element of the project was the participation of residents, many of whom came from groups usually underrepresented in public participation processes.

After some initial setbacks and public wariness, the city-owned housing company Bostaden, hired an advertising agency to assist. This decision proved very fruitful – the agency was involved in the first resident discussion session, which participants described as "fun, real, and very visual." The campaign and participation process included many interactive activities such as sustainability walks and an improvisation theatre, which became a continuous part of the dialogue. One of the most memorable methods was the 'paintball dialogue', for which the city posted various answers on a wall at a main square, and residents could voice their opinions on questions by shooting at their preferred

"The ambition for the Umeå University City district is already high. Thanks to the Smart cities lighthouse initiative RUGGEDISED, we have been able to do even more. The project is an important part of working towards the vision of the University City master plan."

Hans Lindberg,
Mayor of Umeå



Umeå, European Green Capital Finalist 2016-2018

answer with paintball guns. The 36 million € project, run by Umeå Municipality, Umeå Energi and Bostaden, began in 2010 and was completed by 2014. In total, 137 new homes were rebuilt to replace the buildings that were completely destroyed by the fire, and the remaining 405 apartments were refurbished. Measures introduced to improve energy efficiency include the insulation of roofs and walls and the installation of new



Targets for the paintball dialogue in the Ålidhem neighbourhood



The new buildings in Ålidhem: low energy consumption and affordable rental prices

windows and air-to-air heat exchangers in ventilation systems. All buildings in the neighbourhood were built to use a maximum of 65 kWh/m²/year. In addition to the actual refurbishment, the Ålidhem neighborhood also profits from the installation of a large photovoltaic (PV) plant with a capacity of 405 kWp. PV cells have now been installed on all houses in the project area, including some balconies, supplying the area with one third of its required electricity. The rest of its electricity comes from Umeå Energie and is also 100% renewable. The district heating provided is almost 95% renewable.

All new and refurbished apartments were also fitted with a computer screen that monitors water and energy use in real time. The city has noticed a positive effect of these monitors in households with already low average consumption. However, there is no data yet available on the long-term impact. The question remains how to effectively communicate with residents about the importance of efficient energy use and more sustainable lifestyles.

One of the most critical and impressive aspects of the Ålidhem project was rent prices. There was a great initial fear among residents that rents would go up – after all, in other parts of Sweden refurbishments like these have led to an increase of 60-70%. **The challenge was to find a way to finance the project, keep rents down and at the same time improve the energy efficiency of the buildings.** The increase in rent was eventually set at 5-10%, as agreed with the tenants' association. This increase enabled the financing of the project, as well as an increased energy efficiency of 40%. A higher increase in efficiency would have been possible – the initial target was 50% – but was not desired, because of the costs. This also helped keep most of the residents in the neighbourhood, which was seen as a huge success.



The meeting room in the Ålidhem neighbourhood helps create a sense of community



Image: Fredrik Larsson
The University City district is part of H2020 Ruggedised project looking at smart city solutions

Another 100% renewable' success story in Umeå is the University City district. It is part of an ongoing project aiming to create a smart and energy efficient district, which came into being, partly, because of the positive experiences in Ålidhem. The basic idea was to decrease CO₂ emissions in an area characterised by a hospital, parking lot, and university buildings, by using less energy overall, and ensuring that energy used comes from mainly renewable sources. The key method used is the storage and exchange of geothermal energy between buildings in the district.

Energy storage is extremely important, in particular for renewable energy sources, as their availability can fluctuate more than that of fossil fuels. This can become a problem, most notably at peak consumption times. An energy storage facility is being used in the University City district to exchange heat between buildings during peak times. This works very well even though the buildings are owned by different companies. **The geothermal energy storage delivers a total of 7GWh of heating energy and 5 GWh of cooling energy per year.** It is one of the 30 biggest facilities in the world. There are also sensors throughout the neighbourhood, which can monitor how people move in the buildings and determine when it is best to heat or cool certain buildings. For example, university buildings are best serviced during university breaks, when students are gone and buildings are not used as frequently.

The city of Umeå has the goal of being overall fossil free by 2040 and having municipal buildings and services fossil free by 2030. While constant population growth makes overall success difficult, a per capita reduction of about 21% between 1990 and 2015 has been achieved. The city has also been part of a study⁴ calculating consumption-based emissions in the city.

⁴ English summary: [Umeå Komun: Climate-smart choices for sustainable lifestyles](#).

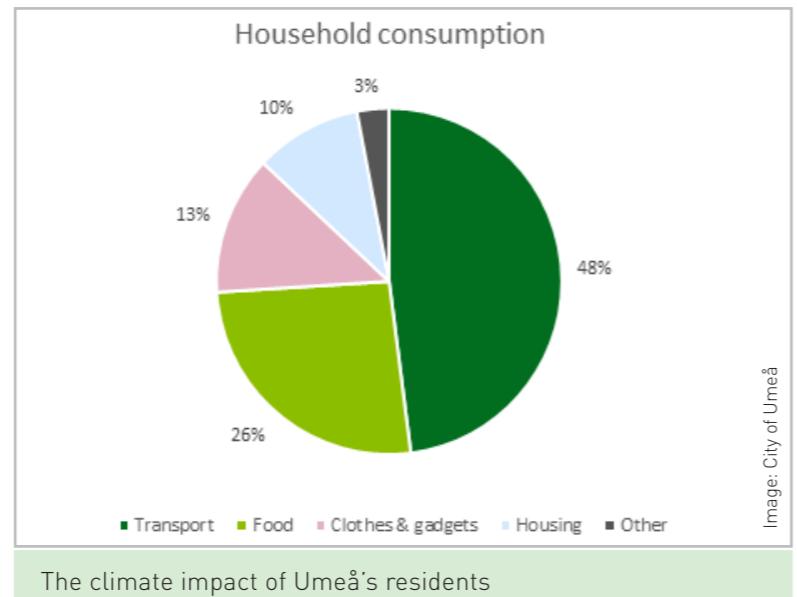
This study, conducted as part of the “low-carbon place” project, was carried out in 2018 as a collaboration between the municipality and Umeå University. Through the project, **Umeå became one of the first municipalities in Sweden to calculate the climate impact of the consumption of its residents.** This was done by sending a survey to more than 4,000 residents and asking about their consumption habits. The Stockholm Environment Institute then did the calculations based on the 1,475 responses they received.

The study found that air travel and car use accounted for almost half of the emissions. Food consumption – mainly meat and dairy products – were found responsible for about a quarter of emissions. Clothing and other goods such as furniture caused 13% of the emissions, while electricity and heating were the biggest source of emissions in homes and accounted for about 9% overall. Reducing emissions in these identified areas is therefore seen as key for Umeå if the city wants to achieve its climate goals.

The low-carbon place project is also associated with concrete outputs. For one, the sharing platforms Cykelstället and U-bike were both a direct result of the project. Also part of the project, the Sustainable Restaurants network came into being in Umeå with very positive reactions so far. The network provides trainings for restaurants on various sustainability issues such as “sustainable food” or “environment and climate”. The network also increases awareness among the citizens of Umeå on the importance of reducing their food-based emissions. A website was created to promote the results of the project and the municipality also launched the “Uåååh-song”. It was composed of the noises locals made when asked to express climate anxiety. Umeå has



One of the largest geothermal energy storage units in Sweden is underneath this parking lot



The climate impact of Umeå's residents

also decided to explicitly include consumption-based emissions into its reduction targets: with the current rate of emissions at about 7.6 tons of CO₂ equivalents per person/per year, the city aims to reduce that number to 2 tons by 2040. One of the reasons transport is responsible for such a high proportion of emissions in the city is that, unlike other forms of energy consumption in Umeå, it is mainly powered by fossil fuels. The city has put in a lot of effort to electrify the transport sector since electricity sources are often renewable in Umeå, with a hydro power plant located about 50 km up the river from the city centre. In addition to providing a reliable sustainable energy supply, it creates income for the municipality which owns 25% of the plant. This has also increased political support for renewable energy in Umeå.

As the owner of its own energy production company, Umeå ensures (most of) its energy supply comes from renewable sources including wind, solar, biomass and hydropower. Other than through water, Umeå is producing energy through wind and solar power as well as heating from biomass. Given the relatively cold climate, heating plays a major role in energy use in buildings. A crucial development in Umeå’s near future will be increasing grid capacity and reducing energy consumption in households. As proven in previous projects, stakeholder involvement and dialogue will be extremely important factors to the success of these developments.

The Ålidhem fire was a shock to the city of Umeå. But it created an opportunity that the city embraced by creating one of the most famous and successful sustainable neighbourhoods in Sweden. With the transformation of the University City district, the city is now well on its way to becoming 100% renewable.

TRANSFORMATION PATHWAYS LISBON - CITY OF LIGHT

Lisbon is not just the capital of Portugal. It is the capital of all European capitals – at least when it comes to hours of sunlight. What may read like a tourism advert is, in fact, Lisbon’s best chance for a transition to renewable energy, achieved not by forcing certain technologies on a city, but by best utilising the resources available.

Lisbon has the goal of reducing its emissions by 60% by 2030 and of becoming entirely carbon neutral by 2050. Between 2002 and 2016, the city already saw a reduction of 42% CO₂ emissions. **Currently, the city's energy comes from about 60% fossil fuels and 40% renewables.** Today, only about 0.2% of that energy comes from solar – this represents a great amount of currently untapped potential. As of September 2018, the total photovoltaic capacity in Lisbon was around 4MW with an estimated annual electricity output of 5,600 MWh.

To increase solar energy use in the city, Lisbon has created a strategy called Lisboa Cidade Solar® (Lisbon Solar City) that has high-level political backing. Between 2017 and 2021, a sixfold increase is expected in solar energy production for buildings and public transport in the city. An integral part of Lisbon’s strategy is the SOLIS information platform aimed at citizens, companies, home-owners and policy-makers. SOLIS, created by the municipality and the local energy agency, was officially introduced in May 2019 and is financed by the federal government. Funding of 162,000 € has been limited to the creation and maintenance of the platform. Future funding may come from advertisements or companies providing solar services. The platform itself is open source, adaptable and could be replicated by any city wanting to harness its solar energy potential.

SOLIS provides an overview of solar potential on three different scales: the city, the 24 districts (“freguesias” – often referred to as parishes), and their buildings. The main feature is a solar radiation map where the



One of the largest solar PV plants in Lisbon is located on the rooftops of the Faculty of Science (FCUL)

“Lisbon has potential for capturing solar energy as few other capital cities in the European scene.”

José Sá Fernandes

Deputy Mayor for Environment, Green Structure, Climate and Energy, Municipality of Lisbon



radiation on every rooftop is visible. **People are able to click on their own roof, see the radiation and a rough estimation of the costs, as well as the potential payback.** The SOLIS platform also includes educational videos and a smartphone app – the SolisApp – which enables locals to engage in a competition to be ‘the most solar’ district. Participants receive “SOLIS coins” – a form of cryptocurrency – for taking photos of PV systems. By the end of the competition, the district with the highest number of photographs or SOLIS coins wins a PV system for one of its buildings. The platform also informs people about the legal framework. In the future, the city hopes to provide lists of certified installers and financing tools.

SOLIS was launched in May 2019, and received about 700 visits in the first four months. Dissemination is an ongoing process and the city hopes to continuously reach more people with the help of social media and more collaboration with the districts. The city hopes that the platform will reduce the perceived risks of solar by providing all necessary information, including a list of trustworthy installers. One of the biggest barriers to solar energy in Lisbon is a lack of awareness and misunderstandings of its costs and benefits. SOLIS aims to promote wider acceptance and massive adoption of PV systems in the city, for an inclusive solar community.

Every city has different natural conditions to work with. In Lisbon, the pathway towards renewable energy is clear: it has a lot of sun, so solar is the easiest and cheapest source of renewable energy. If all roofs had PV installations, the city could cover over 90% of its electricity consumption. The launch of the SOLIS platform is a first step towards reaching Lisbon’s target of zero emissions by 2050.

TRANSFORMATION PATHWAYS

LJUBLJANA - BUILDING THE WAY TO A BETTER FUTURE

Retrofitting of buildings is a hot topic in Europe. While new energy efficient buildings tend to grab a lot of attention, many Europeans still live in older buildings, which use a lot of energy and are in dire need of a retrofit. In fact, buildings are responsible for nearly one-third of global energy-related carbon emissions. Thus, in Ljubljana, energy retrofits have become a key approach to reaching the city's emissions reductions targets.

In the past 10 years, Ljubljana has invested more than 7 million € to make buildings more energy efficient. In 2013, with the help of the European funding programme for technical assistance, ELENA, the city initiated a project to retrofit up to 250 publicly owned buildings – mainly schools, health centres, kindergartens, and administration buildings. The project consists of three phases and is currently in the second one. In the first phase of the project, which was concluded in 2018, 48 buildings were retrofitted. 25 of these were deep energy retrofits and the remaining 23 buildings were partially retrofitted. The second phase includes an additional 11 buildings and is due to be concluded in 2020.

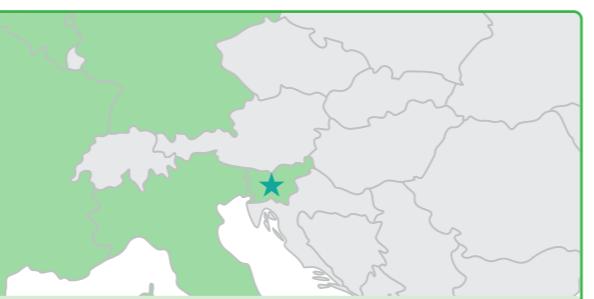
There was a lot of stakeholder involvement within the project, including all heads of departments from the city, as well as the managers of the buildings. The latter group was initially sceptical of the project, and particularly opposed to the retrofits being carried out by private companies. They were worried about the quality of the work and that these companies would only care about making a profit. However, once they learned that the companies (private partners) were to be hired based on energy performance contracts and therefore paid according to the quality of their work and the energy reduction targets being reached, they became less wary. The fact that maintenance would last 15 years – meaning that for 15 years after the completion of the retrofits the private partners would be responsible for the results



The retrofitted sports hall Kodeljevo

"A decade ago, the City of Ljubljana made a commitment to promote sustainable development. One of the innovative projects that I am extremely proud of is the retrofitting of a number of public buildings, including kindergartens, primary schools, sports and scientific facilities, all of which now consume significantly less energy, contributing to a more sustainable future."

Zoran Janković,
Mayor of Ljubljana



Ljubljana, European Green Capital Winner 2016

and any necessary additional work – also contributed to gaining stakeholder acceptance.

The private partners are also obliged to educate the people using the buildings on energy consumption, in particular those in the retrofitted kindergartens. This was, for example, done with stickers that said, "be a hero and turn off the lights". They also organised workshops to explain what was being done in the buildings, and how to use the new technology. A technical support hotline is now available on a 24-hour basis in case of emergencies. There are also sensors installed in the buildings to monitor factors such as humidity, CO₂ concentration, temperature or energy consumption. The city has access to the data and if the performance needs improving, the building managers are asked to react accordingly. So far, there have been no complaints about this process.

A big challenge throughout the project was related to cultural heritage concerns. These were addressed together with the local institution in charge of heritage. Additional requirements to preserve cultural heritage protected components often made the retrofit process more expensive. For example, certain wooden windows

had to be kept, which made retrofitting more complex and expensive. There were also buildings – mainly schools – with heritage protections, as they had been designed by famous architects. However, the city did nonetheless find ways to retrofit these buildings, through investing more time and money into the process. This resulted in both an improved energy performance and general condition of the buildings.

Original building construction posed another challenge. Buildings built after 1984 were statically reinforced in former Yugoslavia, while for older buildings, the city had to check whether retrofits were even possible. As it turned out, some of the buildings did have to first be reinforced, and the city then had to look for an additional funding source to support that work. However, to make things easier, these measures were carried out either before or alongside the energy retrofits. In fact, one of the key takeaways was to make sure that other necessary repairs were done while retrofits were taking place, even though some of the necessary repairs had no impact on energy saving, as this would still save money in the long-run.

Technical assistance funding from the ELENA initiative covered pre-investment documentation, while funding for the actual implementation of the project came from the city itself, as well as from private partners. The deep energy retrofits were co-financed – private partners financed 51% and the city covered 49% of costs. Since this was done using 'cohesion funding', which accounted for 40% of the city's investment, Ljubljana only directly paid for 9% of the deep energy retrofit. As of mid-2019, the total investment costs of the city amounted to about 15 million € for the buildings in the first phase of the project and about 4.7 million € for the 11 buildings in the



The public swimming pool, Tivoli, which was energy retrofitted in 2018



One of the retrofitted primary schools in Ljubljana, Jože Moškrič

second phase. **All buildings were retrofitted following the Public-Private Partnership Energy Performance Contracting principle (PPP EPC approach).** The payback period was calculated at 15 years.

The mayor of Ljubljana, Zoran Janković, stands behind the project. His support was essential because there was a lot of scepticism in the city council that needed to be overcome. While Janković cared about the environmental impact, as an economist, he also understood the financing mechanism and the potential of the project, which is why he was convinced of such an approach. The energy retrofits are expected to have a huge impact on emissions reductions in the city. Prior to the investment, extended energy audits were performed on the targeted buildings. Using this data, private partners made the decision to pursue either deep or partial energy retrofits. However, the city does not yet know how much energy will be used or saved in the completed buildings, as this data is still being collected.

It is expected that the retrofits will significantly contribute to Ljubljana's goal of reducing its emissions by 30% by 2020 compared to 1990 levels. Between 2008 and 2018, the city made important progress by reducing its emissions by 20% to 2 million tons of CO₂ emissions per year. Renewable energy sources also play an important role in Ljubljana meeting its reduction goal and provided 18.5% of the energy in the city in 2018. In municipal buildings, 100% of electricity used comes from renewable sources.

One of the key takeaways from this project for the city was to not be discouraged by early opposition. Despite the many hurdles, it was worth doing the project. They advise, if you believe in your project and know it will be effective, you should go ahead with it even if some actors are scared. **Creating renewable cities takes, above all, courage – and Ljubljana had it.** Other Slovenian cities such as Maribor, Kranj or Novo mesto have been inspired by their example and are now following Ljubljana's lead.

TRANSFORMATION PATHWAYS NUREMBERG - THERE IS NO "I" IN NUREMBERG

Global cooperation is, of course, central to solving worldwide issues like climate change. However, effective cooperation needs to start at a much lower level. The City of Nuremberg has not only learned how important regional, rural-urban cooperation is to implementing climate action, but also how much more effective this cooperation makes the actions themselves.

Nuremberg's road to becoming a pioneering city in climate protection started in 2000, when the city launched its first roadmap to reduce GHG emissions. This has since been updated to guide the way to 2050. The goal is to reduce emissions in the city by 40% by 2020 and by 95% by 2050.

The city's actions are embedded in an important network in the Nuremberg region called the Forum for Climate Protection and Sustainable Development. It works on three main topics: contributing on a local level to global climate protection, increasing urban-rural cooperation in the metropolitan region, and improving communication on climate protection internally and externally. There are currently 80 members in the forum including mayors, deputy mayors, administrative staff and county commissioners, as well as representatives from the private sector and universities.

The forum's first meeting, in 2010, was initiated by municipalities from the area around Nuremberg. Those who came together believed climate protection needed greater political backing. The forum gradually developed to include the whole metropolitan region, as well as economic and university representatives. The climate pact, which outlines the climate protection goals for the region, was then put together in early 2011.



PV installation integrated onto the roof of a school in the middle of the historical old town

"The Metropolitan Region of Nuremberg has made a 'climate pact' to implement a regional energy supply system based on renewable energy and decentralised production and distribution. Cooperation between urban and rural areas will lead to a truly sustainable system."

Dr. Peter Pluschke
Deputy Mayor, Nuremberg



The 'Energiewende' and corresponding political debate in Germany then led to a sharp increase in forum members. This is now the body in the metropolitan region for all relevant climate issues. The forum and its working groups are more active on the political than the administrative level, and more economically focused, with little representation of civil society. However, significant decisions are made by the council. In that body, civil society is, indeed, represented. The forum formulates suggestions that are binding insofar as decision-making bodies that make up the forum's members have to take them into account.

There has been a lot of support for the general work of the forum; but, there has also been opposition to specific projects. **For example, influential residents from rural and urban areas have led a movement opposing wind turbines.** The regional development of wind energy in the Nuremberg metropolitan region suffered from the Bavarian „10-h-rule“, which states that the minimum distance to houses must be ten times greater than the height of a wind turbine. This rule drastically reduced the building of wind turbines in Bavaria. Nevertheless, there are initiatives which are trying to change the legal framework and establish feasible procedures for the implementation of new wind turbines.

The fact remains that the region needs more wind power to achieve its climate goals. The local Weihenstephan-Triesdorf University of Applied Science is based in the rural area of Triesdorf and specialises in green engineering. It is another important actor that helps spread know-how on renewable energy and the use of biomass.

Renewable energy in the Nuremberg region is used commercially. But, investment capital comes from different sources. More than half of the investments so far have been made by private partners in the region – companies as well as individuals. Private partners are the driving force in implementation, especially in solar energy installations. **Of the 50,000 solar energy units in the grid, more than half comes from investments by the people.** There are various examples of 'Citizen Solar Plants' or 'Citizen Wind Parks' in the region, which have helped increase their acceptance.

Another valuable source of renewable energy in the Nuremberg metropolitan area is biomass, used for heating and electricity production. One of the biggest concerns of opponents in this case is the creation of monocultures. Here, the Weihenstephan-Triesdorf University also comes into play. The university has a centre researching alternative sources of biomass. Today, about 40% of biogas plants in the Nuremberg region are no longer reliant on corn, for example. However, no new plants have been built recently, and necessary upgrades to older plants will be too expensive and may lead to closures in the mid 2020s, when updated laws and technical regulations will render them outdated. Here, the metropolitan region is also struggling internally, since there is no real strategy for dealing with this yet. They will first have to agree on a way forward internally, and then approach the Bavarian and federal governments.

Another crucial part of the climate pact relates to the grid. Federal regulation has a strong focus on the



Mobility point in Nuremberg to support climate action from the transport perspective



Cultural and Youth Centre in Nuremberg. This passive house is a combination of a historical building and a new one

national grid structures going from the North to the South of Germany, and requires the region to accept wind energy from the North Sea. This creates problems for smaller, regional providers. Many conflicting economic and political interests come into play here. This is an important issue that affects the entire region, but also shows the limits of the forum and regional policy makers when it comes to high-level decisions made in Berlin.

The City of Nuremberg has various smaller actions contributing to the city's and the region's reduction targets. From the renovation of buildings, installation of PV cells on private homes and on commercial buildings, competitions among schools and trainings on energy saving measures for families – local measures are going hand-in-hand with the regional work the city is doing. Nonetheless, the Nuremberg metropolitan region, like most of Germany, is struggling to meet reduction targets. Emissions reductions as of 2015 in Nuremberg are at 34%, and at 19% in the metropolitan region. Future targets in the region can be illustrated by the formula 4+2+1: the region is aiming for a fourfold increase in solar energy, a double in wind energy, and keeping biomass stable.

Nuremberg has high targets for its emissions reductions and has put in a lot of effort to achieve these. This is only possible because the city has been thinking in regional terms from the beginning. Since most cities are too dense to install the required amount of renewable energy within city limits, cooperation is essential, and Nuremberg is showing how it is done. **One of the most important lessons learnt is to let your neighbours know what you are doing.** The earlier you talk about things, the more acceptance you will get and the more chances you have of solving potential problems.

LEARNING FROM THE BEST

The aim of this toolkit is to share with you the key lessons that the EU Green Capital winners and finalists have collected over the years, as well as to give you a feeling of being part of a growing community of change-makers that is willing to share both successes and failures.

Every city needs to find its own way to becoming 100% renewable, taking into account its geographic location, the history reflected in its urban fabric, as well as the needs and skills of its inhabitants. The transformation of our energy systems needs to go faster and deeper than we can probably imagine and yet we should strive to leave no one behind.

Does this seem impossible? Luckily, you are not alone – the EU Green Capital Network cities have a lot of experience to share. Two common examples:

How to move from “not in my backyard” to “yes, please”

When citizens of Nijmegen set up an energy cooperative and decided to put four wind turbines on the city-owned land, the inhabitants of nearby villages were strongly against it. So the cooperative decided to create a “neighbourhood fund” to support local initiatives of the wind park neighbours, and to introduce technical measures that reduce disturbances to a minimum. This turned initial resistance into mutual trust, leading to a new solar park initiative in the same area. Success depended on involving neighbours very early in the project.

 **Matthew Bach** @matthewbach

@EU_GreenCapital #Lisbon is fostering #solar citizenship through an online platform that lets #citizens see the potential of their rooftop & access the right technology and financing. @CamaraLisboa is aiming for 103 MW by 2030! #EGCN #100percentrenewable #Umea



ICLEI Europe and 2 others

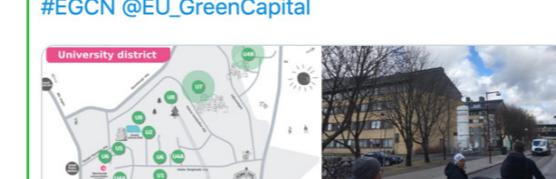
The art of giving (and taking back!) incentives

The city of Oslo has done a lot to make using electric cars as easy and cheap as possible, such as eliminating road tolls for electric car drivers, and installing and maintaining public charging infrastructure. However, the very success of this strategy led the incentives to become a potential municipal problem. For example, the city was concerned about losing substantial income from road tolls, and was concerned about the high costs associated with the maintenance and expansion of charging infrastructure. Considering the increasing popularity of electric cars that came from incentive schemes, the city has decided to roll some of them back. As of 2020, they will charge electric car drivers 50% road tolls, and will introduce charging fees. This represents a natural cycle in the introduction of new technologies but also needs a well-thought-through communication strategy to keep everyone informed.

“If everyone travelled like women do, we would have already reached our sustainability targets”

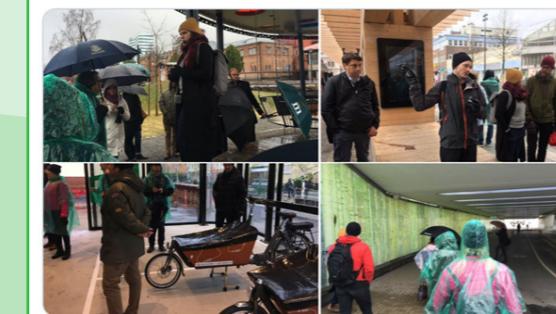
 **eskubi** @eskubi

Innovative thinking is at the core of the City of Umeå's overall vision of continued social, economic and environmentally sustainable growth. Nice technical tour to the local @Ruggedised lighthouse scenario #EGCN @EU_GreenCapital



 **Ania Rok** @missrok

#EGCN cities braving wind & cold to learn more about #gender sensitive urban planning, #cargobike experiments & reducing #traffic in @UmeaKommun. This group is fearless & so inspiring!



EU Green Capital and 6 others

“My electric car uses the same amount of energy as my toaster”

“We need to change how we move, not just how we power our mobility”

“Communication, communication, communication and a lot of meetings”

“The property department has never heard of the climate strategy”

..The capacity of the grid is not a problem of the distant future, but one we are facing already today”

“Energy is cheap, it's the infrastructure that is expensive”

“We have no space for renewable energy”

“Too much and you fail to mitigate climate change”

“We can't have sustainability transition at the cost of the liveability of the countryside”

“Should vegetarians get bigger houses?”

Ambitious targets by EGCN cities

2t CO₂ emissions per capita by 2040

103 MW installed solar capacity by 2030

20,000 new home chargers in 2018

Burning wood from a **100km** radius

Save **1 million €** annually in heat & energy costs

IT'S YOUR TURN

Time to sober up

The first step towards fixing our fossil fuel addiction is to simply use less energy and move towards – as the French aptly call it – energy sobriety. The battle for 100% renewable cities will not be won in shiny new eco-districts, but in post-war suburban housing estates, heritage-protected 19th century tenements and 1970s office buildings. Renewable energy may be zero-carbon, but the infrastructure needed to produce, store and distribute it still is not. Start with comprehensive energy audits to understand where your energy goes and invest in ambitious retrofitting programmes combined with environmental education.

Let your energy mix tell the story of your strengths

The energy mix of a city tells a story of its geographical location, its historical trajectory and its local potential. Does your energy mix reflect your city's strengths or is it a result of decisions made elsewhere? Solar, wind, hydro, geothermal, biomass – the menu is long, and combinations are basically unlimited. Not every city is blessed with Lisbon's sunshine, Reykjavik's underground heat, or Lahti's forests, but there are some less obvious success stories out there too. Did you know that Umeå's Sustainable Ålidhem housing estate gets a third of its electricity from photovoltaic cells? Yes, we are talking about northern Sweden.

Technology is (only part of) the solution

Energy transitions can benefit greatly from new technologies that make it possible to produce, store and distribute energy differently, but also to better understand and reduce its use. The good and bad news is that humans are able to outsmart some of the smartest technologies, so changing user behaviour is also of great importance. On the other hand, we are seeing a growth in technologies that help energy infrastructure adapt to human behaviour, such as sensor-regulated heating systems or new storage solutions. A truly smart solution is not the one that makes sustainable choices possible but the one that makes it a default option.

Think in systems and not buildings

Building a 100% renewable city requires system thinking. When designing grids, accounting for different types of producers, and mixing various sources, planners need to consider multiple scales, from household to national (or even beyond). This can require very different skills to those needed when planning big, centralised infrastructure. It also offers new opportunities to develop more resilient, less carbon-intensive and often more affordable solutions. This is an ongoing learning process for most cities that requires support from different partners, governance levels and other cities acting as peers.

Low-carbon cities need to support low-carbon lifestyles

Many cities have made considerable progress in decarbonising their energy systems. However, the usual methods of calculation do not take into account carbon emissions generated elsewhere and linked to products and services we consume. The flights we take, the meat and dairy we eat, the clothes and furniture we buy – all those choices blow up our personal carbon budgets, accelerating climate change on a global scale. Cities can influence those choices by offering education programmes for citizens, supporting local businesses in developing more sustainable offers, or changing municipal procurement practices. Consumption-based emissions are a challenge to be addressed collectively and not something to be conveniently forgotten or used for shaming those who speak up for the climate.

100% renewable cities harness the power of their citizens

Many people and organisations are eager to play a part in the energy transition. All they need is a space to act. Members of energy cooperatives, passive house owners, prosumers, climate activists and others have ideas, resources and the commitment needed to push the city towards its climate-friendly future. You cannot afford to ignore this potential. Many more will join if they recognise their own needs, fears or interests through the way the city communicates about the energy transition. Strip your communication of technical jargon and focus on issues people care about, as well as concrete steps they can take right now.

Define targets that will not only look good but also help you act

Most cities in Europe have adopted sustainability targets related to energy. They differ wildly in terms of level of ambition, scope of reduction and timelines. The majority of them, even assuming they will be met, are below what is needed to limit global warming to 1.5 °C, which is considered by the IPCC to be the threshold of climate catastrophe. And yet, politically-agreed targets are what sets in motion the local government administrative machinery, and so we should not underestimate their importance. The most effective targets look at the long-term while specifying interim values, cover both the city as a whole (e.g. carbon-neutral) and specific sectors (e.g. fossil fuel-free transport), and are regularly publicly reported.

Make energy everybody's business

Local, decentralised energy systems can translate into new economic opportunities for the public, private and civic sectors. Reclaiming the energy system from big state-owned monopolies or multinational corporations creates space for new, often local actors to emerge and flourish. This story of social and technological innovation leading new organisational forms and new partnerships is too rarely told. To build and sustain political support for energy transition, we need to get better at nurturing and sharing these positive examples.

Asking “can we afford the energy transition?” is the wrong question

Transitioning to 100% renewable energy system is a political response to the risks of continued fossil fuel extraction, as evidenced by science. It is up to politicians to create a legal framework that will make this transition feasible within the existing economic system, by, for example, putting a fair price on carbon emissions, supporting prosumer initiatives or making sure that costs are not pushed onto those most vulnerable. These decisions depend largely on national and European policy makers, with many of them too slow to act or under heavy pressure from the fossil fuel lobby. This lack of ambition significantly limits the degree to which local governments and citizens can act, putting at risk current and future generations.

THIS IS NOT THE END

Ready to act? There are a number of additional resources available to support you in your efforts and to help you move faster.

The Covenant of Mayors

The Covenant of Mayors is the world's largest movement for local climate and energy actions. Signatory cities (almost 10,000 from 59 countries) pledge action to support implementation of the EU 40% greenhouse gas-reduction target by 2030, and commit to the adoption of a joint approach to mitigate and adapt to climate change. The cities are obliged to adopt a Sustainable Energy and Climate Action Plan (SECAP) and regularly report on its implementation. The plans and reports are available online, alongside a number of resources to support cities in developing, funding and implementing local mitigation and adaptation actions.

www.covenantofmayors.eu

EU Urban Agenda Partnership on Energy Transition

One of 14 EU Urban Agenda partnerships, this partnership is working on identifying feasible proposals for actions linked to better regulation, better knowledge, and better funding in the field of energy transition. The Partnership, led by the three cities of Gdańsk, London, and Roeselare, kicked off in September 2017 and presented its final Action Plan in May 2019.

<https://ec.europa.eu/futurium/en/energy-transition>

ICLEI's carbonn Climate Center

The carbonn Center supports cities, towns and regions (over 1,000 entities registered) with developing robust reporting practices that enhance transparency, accountability and credibility, encouraging measurable, reportable and verifiable (MRV) local climate action. Data from the unified reporting system shows the impact of local climate action and how it can contribute to national climate action plans submitted under the Paris Agreement (NDCs) and to global climate targets.

<https://carbonn.org>

Energy Cities: best practices

Energy Cities is the European association of cities in energy transition. Their best practice database features over 100 city actions from 20 European countries that represent creative and practical approaches to shifting our energy system.

<https://energy-cities.eu/best-practices>

ResCOOP

ResCOOP.eu is the European federation for renewable energy cooperatives that brings together 1,500 European renewable cooperatives and their 1 million citizens. REScoop.eu is one of the main drivers of the Community Energy Coalition, a diverse network of like-minded organisations who engage with one another to drive a future energy system in Europe that is sustainable, carbon-free, socially fair, publicly owned and controlled by local communities and people.

<https://www.rescoop.eu>

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THE EUROPEAN GREEN CAPITAL NETWORK: INFORM. EXCHANGE. GROW.

The European Green Capital Network is a network of former European Green Capital Award winners and finalists. Founded by the City of Copenhagen during its own award-winning year in 2014, the Network's main role is to:

- ★ share best practices, discuss challenges and create solutions for impactful sustainable urban development in Europe, and
- ★ serve as a platform for change, representing European cities in relevant European and global political processes.



Toolkits for cities

The European Green Capital Network encourages other European cities on their paths towards a more sustainable future by providing guidance and support. During 2018-2020, the Network is holding expert workshops to develop toolkits based on four thematic vision clusters for European sustainable cities. The toolkits will provide recommendations and strategies for cities both inside and outside of the network.

The vision clusters are:

Human scale

Integrated urban planning and sustainable mobility, green spaces, inclusive communities

Future-proof

Climate change adaptation, resilience, sustainable water sources and eco-systems

Less Waste, More Value

Sustainable waste management, circular economies and responsible consumption

Network Members

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