

RAINBOW ROOFTOPS: Policy Paper on Rooftops for a sustainable Europe

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Executive Summary

Over 30% of urban impervious area is made of rooftops, an underused resource that cities can activate for increased environmental, social and economic sustainability. Rooftops can be new community and creative spaces, in line with the principles of the European Green Deal and the New European Bauhaus.

The European Creative Rooftop Network (ECRN) is an EU-funded network of cities, cWreatives and urbanists working together to develop and share new methods for the sustainable and collaborative management of rooftop architecture across Europe. It has engaged ca 1850 urban stakeholders (policymakers and public servants, architects, real estate owners, project developers, social housing residents, neighbours' associations, artists and cultural producers, business owners, students, and children) across 8 countries in a dialogue about that question and the future of rooftop sustainability in Europe, informing this paper.

This paper provides an accessible, introductory review of what creative rooftop architecture is and what it may mean for sustainable urban development, as well as recommendations to urban stakeholders that want to creatively activate their rooftop landscape for increased urban sustainability.

Our definition of creative rooftop architecture: designing and activating the flat, outer surface of a roof and/or raised external platform of a building, for social and/or productive use.

This building and placemaking approach may focus on different rooftop functions:

Green: rooftops used to provide green space, increase biodiversity in the city and reduction of urban heat effect

Blue: rooftops used to collect and store (rain) water and ensure delayed drainage

Yellow: rooftops used to generate sustainable and renewable energy

Red: rooftops used as meeting spaces with social functions such as culture, sports or recreation, that promote social cohesion

Orange: rooftops used for urban mobility purposes

Purple: rooftops used for vertical densification by adding new volumes (mostly residential, but not exclusively)

Grey: rooftops used for technical functions, such as installations and utility services

Policy Recommendations on how to activate rooftops for increased environmental, social and economic sustainability are provided from page 13, to support policymakers, architects and urban planners, artists and cultural managers, and citizens to join the rooftop revolution.



1 Introduction

Climate change, socio-economic segregation, urbanisation and urban sprawl threaten the sustainability and livability of European cities, and the social cohesion of European communities.

Cities have the greatest potential for developing ways of sustainable development, but need to become more liveable. European cities need to promote climate adaptation efforts, local & circular economic development, and people-centric placemaking and community-building.

With population increases and unprecedented urbanisation, sustainable development depends on a successful management of urban growth. A growing number of European citizens are experiencing or will soon experience overcrowded urban environments. European cities are getting denser and busier, and urban land more expensive, as citizens, real estate developers, transport planners, and businesses compete for dwindling amounts of available urban space.

As such, cities face challenges to meet the needs of growing urban populations, including for housing, transportation, energy

systems and other infrastructure, as well as for employment and basic services such as education and health care. Despite this, what to do with unused, underused and misused urban space has emerged as a challenge for European cities undergoing constant expansion or shrinkage. As such, cities are increasingly transforming underused areas into productive spaces, with associated multiple benefits.

Rooftops in European cities, as underused space, have vast potential as sustainable development catalysts. These architecturally irresolute, underdesigned, and uncharacteristic spaces are not making full productive use of their rooftops due to zoning regulations and insurance policies, a culture of not prioritising public access, limited acceptance by users, difficulties in developing viable business models, and lack of qualified knowledge among urban stakeholders.

This paper explores possibilities on how policy makers, urban stakeholders and citizens can make the rooftops of Europe, an often unresolved landscape but capable of becoming the foundation of a new ground for urban sustainability, into a force for creativity, beauty, cleaner air, cleaner water, energy efficiency, better climate and socio-economic cohesion.

2 Rooftop Definition(s)

Rooftops are found in Europe as early as 1700 BCE, at Knōsós, called Europe’s oldest city. Creative rooftop architecture practices across Europe, from the Mediterranean house terrace to the post-war flat roof, have established different uses and forms for rooftops, tied to local context. This paper contributes a single working definition, informed by architecture and building construction standards:

Our definition of creative rooftop architecture: designing and activating the flat, outer surface of a roof and/or raised external platform of a building, for social and/or productive use.

Based on local natural and cultural contexts, this rooftop-enabled building and placemaking approach may offer different functions for rooftop’s social and productive use. The city of Rotterdam, a pioneer in rooftop urban planning, has classified these functions in a colour-coded typology, also followed by this paper:

Green: rooftops used to provide green space, increase biodiversity in the city and reduction of urban heat effect

Blue: rooftops used to collect and store (rain) water and ensure delayed drainage

Yellow: rooftops used to generate sustainable and renewable energy

Red: rooftops used as meeting spaces with social functions such as culture, sports or recreation, that promote social cohesion

Orange: rooftops used for urban mobility purposes

Purple: rooftops used for vertical densification by adding new volumes (mostly residential, but not exclusively)

Grey: rooftops used for technical functions, such as installations and utility services

Rooftops may be multifunctional, combining purposes for added-value, as exemplified in Rotterdam’s rooftop catalogue, developed by architecture practice (and rooftop innovator) MVRDV. The definitions are explored and expanded in the next section.

roof	<i>1 those parts of the top of a building which provide shelter against the elements.</i>
	<i>2 the uppermost weatherproof level in a building.</i>
roof plane	<i>one of the flat surfaces which make up the outer surface of a roof.</i>
rooftop	<i>the outer surface of a roof</i>
	<i>the outside surface of the roof of a building</i>
terrace	<i>1 a raised external level or platform (...) protruding from a building, for leisure.</i>
	<i>2 a flat roof area used for social activity</i>
roof terrace	<i>an outdoor space at roof level of a building for the recreation of the occupants.</i>
roofscape	<i>the view over the tops of roofs in an urban environment.</i>



3 Rooftop Functions and Sustainability

GREEN ROOFTOPS

A green roof is a roof of a building that is partially or completely covered with vegetation (also sometimes called a living roof, eco-roof, vegetated roof, or rooftop garden). It may consist of many components such as plants, furnish substrate to source nutrients, water system to help the root to grow, and a drainage layer. This vegetation is often supported with a growing medium and planted over a waterproofing membrane, and can include additional layers such as a root barrier, drainage and irrigation systems as more complex components.

Sustainability Challenges:	Sustainability Impacts:
There are emerging urban heat islands in European cities, with negative effects on the health of citizens.	Green rooftops can reduce air temperature and mitigate the heat island effect.
There is loss of biodiversity in European cities, with negative effects on economic systems and society.	Green rooftops can prevent loss of urban biodiversity and create urban habitats.
Air pollutant concentrations are too high, and air quality problems persist in European cities, posing serious health risks.	Green rooftops can absorb air pollutants and help reduce air pollution.
European cities need to boost their energy efficiency and avoid green gas emissions.	Green rooftops can sequester carbon and reduce energy consumption.
The urban sprawl of European cities makes demand for land in and around cities increasingly acute.	Green rooftops can create space for the production of vegetable crops and replace green/agricultural space lost during construction.

Summary: Green rooftops can help European cities achieve sustainable development goals by reducing urban temperatures, by reducing loss of urban biodiversity, by reducing air pollution, by improving carbon sequestration and energy efficiency, and by increasing locally available land for food production.

Challenges to policies supporting green rooftops may be the need to increase the reliability and durability of green operated roofs. This is due to slightly more expensive maintenance and repair needs of roofing systems using roll-fed waterproofing materials (in comparison to traditional roofs).

BLUE ROOFTOPS

A blue roof is a roof designed for the retention of rainwater above the waterproofing element of the roof, to provide temporary storage and slow release of stormwater runoff. Blue rooftops can store water as open water surfaces, as storage within and/or beneath porous media or modular surfaces, or even below a raised decking cover. Blue roofs are typically flat, with control devices to regulate drainage outlets that enable water to be retained or drained. Blue rooftops are often combined with green rooftops and commonly used in dense urban areas where other methods of stormwater detention are impractical.

Sustainability Challenges:	Sustainability Impacts:
Increased urban flooding is likely to be one of the most serious effects from climate change in Europe, with severe economic losses.	Blue rooftops can contribute to stormwater management systems in urban areas, using specialised retention layers to delay stormwater run-off, or to retain stormwater for evaporation.
There are emerging urban heat islands in European cities, with negative effects on the health of citizens.	Blue rooftops can reduce building temperature and mitigate the heat island effect.
The urban sprawl of European cities makes demand for land in and around cities increasingly acute.	Blue rooftops can supply water for outdoor non-potable uses, reducing energy and economic costs for water treatment, the strain on potable water supply sources, and surface water pollution.
European cities need to deal with growing urbanisation as a phenomenon linked to increased health risks and social isolation.	Blue rooftops can provide beneficial effects on human health and wellbeing, as well as enhanced urban aesthetics and quality of urban life.

Sustainability Impacts:

Summary: Blue rooftops can help European cities achieve sustainable development goals by helping flood mitigation efforts, by reducing urban temperatures for microclimate improvement, by contributing to waterway health protection, and improving the amenity values in urban landscapes.

Challenges to policies supporting blue rooftops are technical limitations of water storage systems outside flat roofs or roofs with shallow slopes, which may offer limited benefits on locations where roof area is only a small portion of total impervious area; and limited load capacity of existing roofs, which might not withstand increasing weights as water retention volume increases.

YELLOW ROOFTOPS

A yellow roof is a roof designed to produce energy from renewable sources atop residential or commercial buildings. It may include photovoltaic cells (PV), a technology to absorb and convert sunlight into electric energy. Rooftop power stations can be either on-grid or off-grid, as well as used in conjunction with other power components like wind turbines, batteries, etc, as solar hybrid power systems capable of providing a continuous source of power.

Sustainability Challenges	Sustainability Impacts
European cities need to satisfy high energy demands to maintain current living standards, and improve them (80% of energy consumption in Europe is linked to urban activity).	Yellow rooftops in Europe can potentially produce 680 TWh of solar electricity annually (representing 24.4% of current electricity consumption).
European cities need to replace consumption of fossil fuels with renewable energy sources like solar, to help reduce emissions of greenhouse gases and other pollutants.	Yellow rooftops (PV-wind hybrid systems) can provide an energy supply source which produces no emissions during generation itself, with a smaller carbon footprint from “cradle-to-grave” than fossil fuels.
There are emerging urban heat islands in European cities, with negative effects on the health of citizens.	Yellow rooftops may reduce temperatures in summer, reducing the energy needed for air-conditioning (by 12%) and also the urban heat island effect.
High energy prices for businesses and households are a risk to Europe’s economic competitiveness and stability.	Yellow rooftops can produce levelised solar electricity produced at a lower cost than retail electricity prices.
European cities need to reduce exposure to unreliable energy suppliers, and the geopolitical risks those may represent.	Yellow rooftops can increase Europe’s energy independence and improve energy security.

Summary: Yellow rooftops can help European cities achieve sustainable development goals by contributing to production of locally-sourced, renewable, economically accessible electric energy, by reducing emissions of greenhouse gases, as well as urban temperatures, and energy dependence on external powers.

Challenges to policies supporting yellow rooftops are high investment costs, productivity issues, and the current lack of infrastructure to collect and facilitate recycling of solar panel technology on a large scale.

RED ROOFTOPS

A red roof is a roof designed as a social space (gathering place where people interact), that can support different functions as a private, public or semi-public meeting place. Social rooftops can be mono or multifunctional, temporary or permanent, and take many different forms: commercial spaces like licensed rooftop bars or meeting venues, residential spaces like shared rooftop terraces, cultural centres or venues, sports facilities, leisure spaces like city parks or community-focused urban farms. Accessibility is integrated into red rooftop design, because it is intended to be used by a diversity of users (as opposed to other types of rooftops, which have firstly technical purposes).

Sustainability Challenges	Sustainability Impacts
European cities lack space to provide sports facilities, resulting in insufficient physical activity of citizens in relation to recommendations by public health plans.	Red rooftops can host sports facilities that maximise space and provide sporting opportunities to promote healthy lifestyles and social cohesion.
European cities, often unhealthy places, need to modify their urban fabric to deliver health improvements and promote high-quality healthcare provision as a public good.	Red rooftops can provide (garden) areas intended for therapeutic purposes in hospitals, and are associated with a series of benefits related to human health.
European cities need to invest in culture-based urban strategies to promote social, economic and spatial development.	Red rooftops can provide cultural experiences that ignite transformative effects and create social and economic value.
European cities need to prepare for an ageing population, of which a growing share suffers from social isolation and loneliness.	Red rooftops can provide social areas for people to socialise safely, and become an element of spatial prophylactic design in the post-pandemic city.
European cities need to optimise the distribution and use of public space to ensure that it is safe, accessible and inclusive for all.	Red rooftops can provide public space to improve urban livability, by offering multisensory experiences of “height” and the roofscape.

Summary: Red rooftops can help European cities develop new public spaces that contribute to physical and mental health, and generate social and economic value for the city, while improving livability for citizens.

Challenges to policies supporting red rooftops are possible issues with accessibility and user experience/safety, as well as potential public conflicts regarding light and noise pollution in residential areas caused by social/cultural activity in rooftops.

ORANGE ROOFTOPS

An orange roof is a roof designed as infrastructure for rooftop-enabled urban mobility. It may mean: urban air mobility, via heli- and vertiports, including emergency evacuations; or hybrid pedestrian and cycling networks via rooftop bridges connecting buildings.

Urban air mobility is a novel vision for air transportation in densely populated urban areas, using rotorcraft, vertical take-off and landing aircraft (VTOL, and if electrified, eVTOL) and unmanned aerial vehicles (drones). It may be used for intra-urban and inter-urban airborne passenger transportation, cargo & package delivery, private/recreational use, as well as public services, e.g. fire fighting, medical or flood evacuations, vaccine delivery, law enforcement, humanitarian missions, news-gathering, traffic assessment, weather monitoring and maintenance of public infrastructure.

Rooftop bridges that connect buildings with pathways accessible to pedestrians and cyclists are a form of outdoors skyway, either temporary or permanent, and allow people to move above street level and coordinated densification, with a focus on proximity and walkability.

Sustainability Challenges	Sustainability Impacts
European cities need to use their limited public space for public transport more efficiently, and invert the post-pandemic shift from shared to individual transport.	Orange rooftops can potentially reduce transit time and effort required for all passengers, including passengers with special mobility requirements.
European cities need to deal with increased traffic problems and congestion, which in turn affects travel times, and the overall quality of urban life.	Orange rooftops can provide sustainable mobility solutions to potentially alleviate congestion and reduce road traffic in cities and improve commuting experience.
European cities need to boost their energy efficiency and reduce green gas emissions, including from increased traffic congestion.	Orange rooftops can facilitate eVTOL use, causing a reduction of global emissions, without accounting for life cycle emissions.
European cities need to safeguard critical transport infrastructures and promote multimodality, to ensure utility to users during disastrous events.	Orange rooftops can contribute to transport network resilience in case of disruptions, such as the closing of a critical roadway or bridge.

Summary: Orange rooftops can help European cities reduce traffic congestion, improve public transportation, reduce greenhouse gas emissions, and increase resilience of their transport system, as well as adding to a city's walkability and sustainable densification.

Challenges to policies supporting orange rooftops are its dependence on highly and efficient infrastructure in a highly constrained urban environment, development of airspace management solutions, scattered data across industry, research and regulatory authorities, and low/uncertain levels of public acceptance and user adoption during the concept's current innovation trigger phase.

PURPLE ROOFTOPS

A purple roof is a roof designed for roof stacking, e.g. structures constructed upon the top floor space - generally the roof - of an existing building, adding one or more stories. That is to say, roofs that provide an extra layer of densification on which functions that would usually require extra and/or new land area at ground level can be set up instead. Examples are for trial production (mostly food) and mixed-use areas (in connection to other colour-type rooftops).

Sustainability Challenges	Sustainability Impacts
European cities need to increase existing housing stock and supply, with compactness, polycentrism and mixed use as goals, to prevent urban sprawl and socio-economic marginalization.	Purple rooftops can provide new homes by redeveloping existing buildings to include extra floors of flats on top of them.
European cities lack qualitative public space and functions, mixed-use and urban green at street level, and need to reduce car use, including by restricting car parking space.	Purple rooftops can provide innovative and integrated options to design car parking solutions that make space for more buildings and attractive urban spaces.
European cities need to bridge the spatial and social mismatch between living and working conditions, regenerate the built environment to consume less territory, and to improve food availability and quality.	Purple rooftops can provide new space for small-scale urban manufacturing, and rooftop farming (greenhouse or plant factory) as a solution for urban vegetable and fruit production, as a way to overcome limitations in food security and land access.

Summary: Purple rooftops can help European cities provide additional housing, parking and manufacturing options to the urban fabric, by means of vertical densification that reutilizes already impervious areas and does not consume new land area.

Challenges to policies supporting purple rooftops are possible issues are compliance with building restrictions on height, potential policy conflicts with actions to reduce car traffic in the urban space, and uncertainties regarding the yield and environmental performance of rooftop vegetable production in comparison with conventional production methods.

GREY ROOFTOPS

A grey roof is a roof designed as space with no significant value other than hosting high-density equipment and technical utilities such as heating ventilation and air conditioning (HVAC) units and associated subsystems, mobile and cellular network infrastructure (3-5G telecommunications), mechanical, electrical and plumbing equipment, installations for window cleaning, storage space and advertisement banners. These rooftops maximise technical use to complement a building envelope's inefficiencies regarding thermal insulation, air sealing and excessive solar radiation, and provide space for potentially critical infrastructure necessary to provide several public services. This however reduces appeal and possibilities for multidimensional use purposes, and prevents access by citizens due to security and safety protocols.

Sustainability Challenges	Sustainability Impacts
<p>European cities need to adapt their building practices to follow the energy efficiency first (EE1st) principle, including building retrofits, to improve their energy efficiency and reduce green gas emissions.</p>	<p>Grey rooftops can provide opportunities for roof retrofit measures with energy-saving potential and practicability.</p>
<p>European cities need to manage European regulatory frameworks to simplify and accelerate 5G network installations, facilitated through a permit-exempt deployment regime.</p>	<p>Grey rooftops can offer a solution to permit-exempt 5G network deployment, enabling innovations in e.g. clean energy management.</p>

Summary: Grey rooftops can help European cities directly and indirectly improve their livability and sustainability performance, as laboratories for retrofitting of built-environment, including cultural heritage buildings.

Challenges to policies supporting grey rooftops are potential conflicts between commercial and public interests in the management of grey rooftop spaces.



4 Future Rooftop Scenarios

The European Union has set the goal of becoming the first (post-industrialization) climate-neutral continent by 2050, as per the European Green Deal. A major catalyst for it is the New European Bauhaus, a creative and interdisciplinary initiative that connects the European Green Deal to our living spaces and experiences.

The European Creative Rooftop Network (ECRN) is an EU-funded network of cities, creatives and urbanists pulling together knowledge, efforts, and local initiatives, to develop and share new methods for the sustainable and collaborative management of rooftops across Europe. The work of the network is implemented by 9 partners: Faro Town Hall (Portugal), Stichting Rotterdamse Dakendagen (Netherlands), Stadt Chemnitz (Germany), Stad Antwerpen (Belgium), Coincidències (Spain), Urban Gorillas (Cyprus), Urban Scale Interventions (UK), Stichting Stadvinderij/ROEF (Netherlands), and Folkstadens ideella förening (Sweden). ECRN predates the New European Bauhaus as an initiative, but provides a concrete method and field of intervention to work towards the futures sought by the European Green Deal and the New European Bauhaus, as it reimagines rooftops as sustainable and inclusive resources for the transformation of European cities into climate neutral urban ecosystems.

Circa 72% of Europeans live in cities and urban areas, and ca 30% of cities' surface are rooftops. That Europe's transition to climate neutrality will involve a conceptual and technical revolution of European rooftop architecture seems inevitable, but how that will happen in practice is still unknown, due to complex and uncertain futures, as that process will signify changes in individuals, institutions, societies, and cultures. Three horizons is a practice for transformation that generates agency while work-

ing with uncertainty. Rather than a method for detailed analysis and prognosis, it is more of a process to structure dialogue, assist sense-making and strategic action. Its simple framework includes three lines, with each line representing a system or pattern of what is happening, as in the following figure:

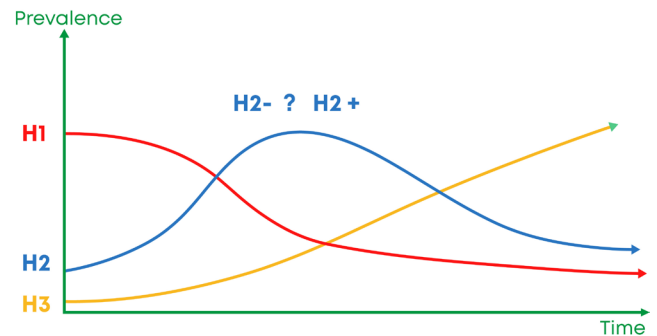


Fig 1. H1 is a current, declining, pattern. H3 represents an emerging future pattern. H2 is the turbulent space of experimentation between H1 and H3.

In other words: The first horizon (H1) represents the way things are done now, generally called “business as usual.” The third horizon (H3) represents the emerging pattern that will be the long-term successor to the current first horizon. The second horizon (H2) is the turbulent domain of transitional innovations that people are trying out in response to the changing landscape between the first and third horizons. Importantly, each way of doing things is present at all times, only to a greater or lesser extent. Innovations emerging in H2 can either subsume back into H1 or go on to create the space for, and emergence of H3.

This paper presents the following horizon-scenarios for the future of European rooftops, not as a prediction to be tested, but as a prompt for further dialogue, sense-making and strategic planning from urban stakeholders across Europe:

H1 Rooftops-as-Usual

The dominant pattern of European rooftop use continues to dominate and is the most prevalent even in the future. The vast majority of rooftops are underutilised urban surface without public access, and designed without productive or social functions as its defining characteristic. Grey (technical) rooftops are the majority, with some functions like green (climate-adaptation), blue (stormwater management) and yellow (solar power) rooftops established as fields of experimentation for innovators (architects, property owners, public authorities). Development is asymmetric and uncoordinated, with publicly-approved and transdisciplinary rooftop policies a rarity.

H2 Rooftop Silos Re-imagined

The transitional pattern of European rooftop use follows, develops and increases innovative practices from the present. Grey (technical) rooftops still dominate, but social and productive use - green, blue, yellow, red, orange, and purple - becomes common in new construction and as a field for technological and architectural experimentation, as well as for creation of economic and social value, as a larger number of rooftops gradually becomes public or semi-public space. Construction of (public or private) flagship projects integrate multifunctional rooftop use and pushes the architectural limits of rooftop design. Public rooftop policies are increasingly popular, but mostly monofunctional, with policies focusing on single use frameworks and standards, e.g. green, blue or yellow rooftops.



H3 Rainbow Rooftop Revolution(s)

The now emerging pattern of European rooftop use spreads across Europe as a sustainable alternative for vertical expansion of the public realm in European cities, and comes to dominate both architectural practice and urban planning policies. A large majority of rooftops are retrofitted and/or built for multifunctional added-value, mixing use and colour typology at the service of environmental, social and economic sustainability and aiming to improve urban livability for European citizens. Rooftops

become the so-called 5th façade of buildings and sites for vertical sprawl, and cities add a new ground layer of space to their urban tissue, mostly public or semi-public. Rainbow (multifunctional and transdisciplinary) rooftop policies are a standardised practice across Europe, and an integral part of the economic, technical and academic development in the fields of urban planning, architecture, engineering, and construction, as well as culture, health-care, education, transport, energy, and others.





5 Rooftop Policy Recommendation(s)

From these potential scenarios, this paper invites and urges urban stakeholders (policy makers, citizens, property owners, creatives and entrepreneurs, among others) across Europe to start local processes of dialogue and policy-making on how to make sustainable rooftops a part of their cultural, urban development, climate and economic policies. Relevant questions to be asked are:

- How are the city's rooftops outdated for the sustainable development you are implementing?
- What are the artistic or entrepreneurial aspirations for the future of city's rooftops?
- What are the inspirations for that future that exist already today in the city's rooftops?
- Who are the actors and stakeholders driving those inspirations?
- What is essential to maintain from the city's rooftops as they are today?

The European Creative Rooftop network, which publishes and funds this paper, is a leading agent of Europe's potential "Rainbow Rooftop Revolution", and has engaged ca 1850 urban stakeholders (policy makers and public servants, architects, real estate owners, project developers, social housing residents, neighbours' associations, artists and cultural producers, business owners, students, and children) across 8 countries in a dialogue about the future of Rooftop Sustainability in Europe. That collective dialogue has resulted in a set of policy recommendations that can inform and complement a city's own dia-

logues and policies to improve rooftop sustainability in their local context. The recommendations target not only policy-makers, but all urban stakeholders as a community.

Knowledge & Innovation

- 1 Rethink rooftops and roofscapes as public spaces and public good, opening them up for new uses like cultural centres, playgrounds, parks, farming and horticulture, next-generation digital and wireless networking infrastructure, or even urban air mobility.
- 2 Map the existing rooftop built-environment, its heritages, possible uses, in dialogue with your city's rooftop community (the agents that own or control the rooftop area).
- 3 Gather and connect rooftop stakeholders in a steering group, to jointly develop and implement potential visions for rooftop surfaces.
- 4 Develop local visions for rooftop sustainability by means of collective and public dialogue, in an inclusive process that engages all kinds of urban stakeholders, e.g. property owners, architects, artists, social housing residents, children, the elderly.
- 5 Connect to regional, national and/or international partners for knowledge exchange and implementation support on rooftop sustainability practices.



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Access & Activation

6 Improve, retrofit and upgrade rooftop infrastructure for multifunctionality, in line with current knowledge and demand, as well as future use (e.g. slab reinforcement for public use, lavatories, energy efficiency, etc.)

7 Improve, retrofit and upgrade rooftop infrastructure for accessibility and safety, in line with current knowledge and demand, as well as future use (e.g. elevator access, emergency exits)

8 Support and allow citizen access to rooftops as safe and inclusive spaces, including from perspectives on age (elderly, children), gender (female-identifying and LGBTQIA+), class (different socio-economic backgrounds), culture & ethnicity (different language and cultural backgrounds).

9 Fund architectural experimentation in rooftop projects, in line with local and global development goals, with a focus on artistic creativity, civic participation, and environmental adaptation.

Planning & Regulation

10 Reform urban planning, building codes, and insurance requirements to allow more open, flexible and mixed-use of rooftop spaces, including for example different types of commercial and non-profit concessions (e.g. art studios, restaurants, sports facilities).

11 Develop a rainbow rooftop toolbox/policy framework that proposes solutions for architects, property owners, entrepreneurs and citizens to implement multifunctional rooftops within an integrated design standard.

12 Support more sustainable construction practices for rooftops, with a focus on green, blue and yellow technological requirements, by means of tax incentives, public procurement criteria, and other forms of public or private-public investment.



Funding & Ownership

- 13 Establish processes and mechanisms for collective management of rooftop resources, with a focus on community complementarity, economic diversification, and urban livability.
- 14 Develop legal options for shared ownership

of rooftop surfaces, via profit and/or non-profit models, so that (literal) urban stakeholders may actively participate in rooftop decision-making and management

Rainbow Revolution

- 15 Get started with creative rooftop architecture with multifunctional use:

15.1 Stimulation

Encourage multifunctional rooftop activation through subsidy programmes, funding, etc. to help individuals and organisations take the first step, instead of making it an obligation which can instigate opposition.

15.2 Storytelling

Educate urban stakeholders on the importance of multifunctional roofs, and their possible contributions to sustainable urban development and well-being of the whole city.

15.3 Obligation

Incorporate requirements for the installation of multifunctional roofs into building codes and regulatory frameworks, as historically done with sewage systems and safety regulations.

- 16 Motivate urban stakeholders to want to invest and practice rooftop multifunctional use:

16.1 Examples

Create opportunities for people to experience multifunctional rooftop architecture with their different senses (touch, sight, hearing, smell and taste), making showcase examples available to visit and as part of education and storytelling.

16.2 Ambassadors

Engage famous people such as architects, business owners and so on as ambassadors, borrowing their social and trust capital to inspire others to follow - citizens will prefer to listen to somebody they know and trust, rather than public authorities.

16.3 Urgency

Start with multifunctional rooftop design in a building for which urban stakeholders (owner, tenants, neighbours) are already excited about rooftop activation, and not necessarily the rooftop with the greatest potential for impact.

16.4 Value

Calculate both costs and benefits of multifunctional roofs, including economic and social criteria, to be able to show what value did it provide - as a not inexpensive public and/or private investment, financials will be questioned at several levels.

NB: recommendations 15 and 16 adapted from *Novak, M. (2022). Multifunctional Roofs & How to Implement Them in Your City. CityChangers.org – Home Base for Urban Shapers. <https://citychangers.org/multifunctional-roofs/>*

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