SMART URBAN SPACES GENERAL ROADMAP

ROADMAPS FOR ENERGY

SMART URBAN SPACES

2016 — 2020 — 2030 — 2040 — 2050

Sustainable technology

URBAN PLANNING STRATEGIES

- **Integrated mapping of existing assets** — Holistic map of all resources and their value to society based on a life-cycle approach and indicators such as carbon footprint and human capital.
- **Human-centric approach** — A planning strategy that addresses personal parameters for happiness; also covers the holistic social and environmental costs and impact.
- **Pilot projects & living labs** — Experimenting and experiencing to gain awareness and to initiate public discussion, learning and to create commitment for new solutions.
- **Master transition plan** — Establishing clear goals and strategies for urban transformation of blue, green, grey and red, e.g. by redefined density, flexibility and adaptability of spaces, energetic refurbishment.
- **Re-purposing space** — Redesign of urban space respecting human scale and creating room for pedestrians and cyclists and/or renewable energy solutions.
- **Territorial planning** — Increasing the sustainability of the city and its periphery: redefining the interrelationships between leisure and agriculture, and enhance biodiversity etc.
- **Resilience planning** — Goal-centred planning that enables flexibility in solutions and upcoming technologies, as well as learnings from pilot projects.
- **Participatory urban planning** — Community-driven planning processes based on simple, clear indicators for social value (e.g. health, happiness).
- **Redesigning the city (infra-) structure** — Converting space and infrastructure that become available through new mobility solutions, and providing flexible use with new services.
- **Smart scapes** — Urban landscapes that adjust in real time, responding to specific use, users and conditions.

SUSTAINABLE ENERGY TRANSITION

- **Renewable energy production** — Progressive introduction of local, decentralised renewable energy systems.
- **Demand reduction** — Energy demand reduction for public spaces and services, through refurbishment, optimisation and substitution.
- **Micro energy systems** — Energy solutions at micro level, using diverse renewable-energy carriers.
- **District energy optimisation** — Energy optimisation at district level by connecting old and new buildings for real-time sharing of resources.
- **District heating** — Renewable-energy solutions for district heating networks, e.g. based on large solar thermal, biogas, biomass.
- **Bidirectional smart grids** — Balancing supply and demand in the city through an open bidirectional energy grid.
- **Smart grid optimisation** — Low-voltage and low-temperature grids avoid unnecessary energy losses.
- **Local energy management** — Connecting buildings, mobility and public space into one local system for energy production, distribution, storage and use.
- **Integrated grid** — Bidirectional, interoperable, open grid, integrating thermal, electrical, water and gas networks into one energy-management system.
- **Energy-storage solutions** — Energy-storage solutions (e.g. power to gas, batteries) are available all year round and at all required scales.
- **Proactive energy grids** — Decentralised smart grids for a mix of renewable energies.

CLIMATE RESILIENCE & BIODIVERSITY

- **Water-stress reduction** — Building and maintaining green spaces managed by the municipality with the focus on water infiltration capacity, and small-scale buffers created by residents (e.g. green roofs).
- **'Biofilia'** — Reconnecting people with nature by improving accessibility of green spaces in the city and surrounding areas.
- **Redundant buffer capacity** — Handling large rainstorms through redundant buffer capacity for temporary storage of excess water, e.g. in underfloor spaces of buildings.
- **Greening the urban space** — Creating green corridors to enhance flora and fauna in the urban area, producing more liveable and usable urban spaces for cycling, walking etc.
- **Heat-stress reduction** — Improving the micro-climate with green and trees to reduce heat stress through the cooling effect of trees (evaporation, shade and reflection) to combat urban heatwaves.
- **Smart water management** — Using improved weather forecasting for water management and e.g. timely emptying of buffers.
- **Ecosystem services** — Interconnected systems provide ecosystem services, e.g. grey water purification, water storage for irrigation, urban farming, clean air, healthy living soil etc.
- **Reconnection between urban and rural areas** — Open cooperation towards self-sufficiency of communities in resources, e.g. food, water, energy, materials etc.
- **Healthy urban living** — Design of the public spaces so they encourage healthy behaviour (e.g. more active lifestyles with walking and cycling).
- **Ecological regeneration** — Synergistic living of nature and the artificial world in a closed total value chain and decentralising production, with 3D printing, new materials, robots and fablabs.
- **Local weather modification** — Preventive influencing of weather conditions (e.g. rain and snow outside the city) to prevent 'disasters' and regulate irrigation.

CIRCULAR SYSTEMS

- **Water-purification systems** — Transparancy of costs/benefits of central vs. de-central purification, sewer-free infrastructure, separation of water flows, disconnection etc.
- **Resource management optimisation** — Actions towards separate collection of waste and waste water, recycling and waste reduction of (scarce) materials.
- **Constructed wetlands** — Purification of rainwater and 'grey' water to a usable quality for surface water replenishment.
- **Zero waste and upcycling** — Closing material life-cycles at different scales to re-use waste as new resource; upcycling of raw materials into new, usable materials.
- **Nature as water purifier** — Large-scale use of nature and microbiology for purification (e.g. reed beds) to close the residential water cycles.
- **Cleantech solutions** — New purification technologies (e.g. ceramic membranes) and re-use (e.g. bioplastics from waste) with smaller installations at neighbourhood level.
- **Integrated closed resource cycles** — Circular systems for food, energy, materials and water, such as large scale water-storage facilities and transport systems.
- **Compact resource cycles** — Shorter and more compact cycles for material, water and waste ('drink your own waste water').

DATA, CONNECTIVITY & MANAGEMENT SYSTEMS

- **Environmental impact measurement** — Consistent measurement of environmental impact at personal and societal levels, combining e.g. mobility, food and lifestyle data.
- **Mapping of potentials** — Discovery of hidden potential of resources (soil, ground, underground infrastructure, green and blue, geothermal potential) through data collection and monitoring.
- **Open data** — Addressing ethical issues regarding the transparency of data, privacy protection and security.
- **Reactive systems** — Demand-response systems based on prediction of use and production of energy, water etc.
- **Urban sensors** — Data collection by sensors to provide detailed information about water, energy levels and public green as well as usage and demand.
- **Information management platforms** — Converting real-time measurement data into actions by means of apps and new services that promote better use of the space (e.g. 'Hackathons').
- **'Gamification'** — Future users experience concepts and spatial solutions through virtual reality (3D models and games): they can use this experience to co-create solutions for urban space.
- **Interoperability** — Open systems allow the connection of data, devices and assets to optimise operation and generate new services.
- **Predictive systems** — Artificial intelligence & data science to proactively match supply and demand of raw materials, water and waste flows.
- **Inclusive design tools** — Design-supporting ICT system with all relevant information; new tools deal with real-time data and support participatory urban planning.
- **Self-organising systems** — Linking local communities through ICT for real-time smart overall control and 'happiness as a service'.

Sustainable behaviour

VALUES, MOTIVES & BEHAVIOURAL CHANGE

- **Change of perception** — (Educational) programmes to change people's perception of resources and their value (e.g. materials, energy, water, food, social capital).
- **Societal discussion to define quality of life** — Co-creation of new parameters and indexes for quality of life to prioritise issues to be addressed, when and at which scale.
- **Transdisciplinary approach to professional education** — Educational programmes at a range of levels to promote in-depth knowledge of sustainability in all sectors of society.
- **Inspirational pilot projects** — Introducing sustainable change in pilot projects for specific lifestyle groups of citizens to show 'how things could be', using model homes, neighbourhoods and campuses.
- **Evidence-based knowledge** — Generation and communication of evidence-based knowledge on the significance of sustainability for society, and to avoid the impact of miscommunication.
- **Culture of participation** — Municipalities encourage and value citizens to contribute and take responsibility in participation processes (e.g. societal discussion of data and privacy, or co-creating urban transformation).
- **New knowledge creation** — Generating new knowledge and holistic models of nature-based solutions for taking action in the transition of society towards sustainability and happiness.
- **Enhancing social interaction in public space** — Redesigning public space for social interaction and activities to enhance inclusiveness and awareness of the social value of public space.
- **Education to serve society** — The educational system shifts to a focus on personal competences and life-long learning, as well as actively contribute to sustainable quality living in cities.
- **Smart society** — People hold strong values on sustainability and act accordingly.

Sustainable organisation

PARTICIPATION & COMMUNITIES

- **Citizen initiatives** — Municipalities encourage citizen initiatives to take care of their direct living environment (e.g. participatory budgets).
- **Visibility of human talent** — Discovery of hidden potential and talent of citizens through social networks, apps and mobile devices.
- **Transition towards citizen participation** — Exploring and improving different models for citizen participation and up-scaling successes.
- **Community platform** — Implementing platforms and tools to support new ways of self-organisation and citizens taking the lead.
- **Resilient communities** — Resilient communities strive for greater self-sufficiency, supported by small-scale facilities and decentral systems.
- **Self-organising communities** — Committed communities invite the municipality to collaborate in the transition towards a sustainable society.
- **Citizen science** — Citizens influence the definition and prioritising of research fields to ensure that sustainable quality of life in cities is addressed.
- **Smart communities** — A new generation of citizens jointly take responsibility for their living environment and social community, and collaborate for joint value creation in public space.

INNOVATIVE BUSINESS MODELS

- **New financing schemes** — New funds for urban transformation, e.g. from local sources such as banks, companies or families and experiments with earning models and innovation budgets.
- **Entrepreneurial administration** — Municipalities embrace innovation and understand and accept the associated risks.
- **Social responsive companies** — Companies adapt their business models, extending corporate social responsibility to integrate social responsibility for the community.
- **Cooperative approach** — Citizens and companies jointly invest in renewable energy solutions, e.g. enabled by new business models such as leasing.
- **Climate-resilient investments** — All investments in the region (public and private) are used to address climate-resilience.
- **Currency for sustainability** — New currencies are implemented to include sustainability parameters (e.g. carbon footprint) in the monetary processes and systems.
- **Promoting the local economy** — Stimulating local business activities to increase sustainability, e.g. local food production.
- **Business models for circular systems** — Business models to address the holistic value of ecosystem services and integrated closed resource cycles.
- **Business models for platform services** — Business models integrating energy and open data by providing a platform for the use of distributed resources.
- **Currency for health** — New currencies are implemented to include health parameters (e.g. the value of a green environment, clean air and the absence of noise) in the monetary processes and systems.
- **Sharing economy** — Transition to new initiatives, such as the sharing economy and 'everything as a service', enabled by ICT platforms and real-time data.

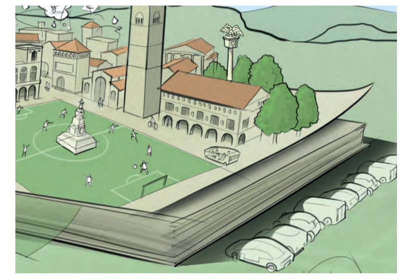
POLICIES & LEGISLATION

- **Goal-driven policies** — New policies define the desired outcomes rather than the way to get there, e.g. zero-energy neighbourhoods.
- **Inclusive policies** — New laws favour societal benefits over individual benefits, e.g. the right and obligation to exploit all opportunities for the use of sun-facing roofs for solar energy harvesting.
- **Balancing influences** — Municipalities take the responsibility to balance the diverse interests of private, public and societal organisations, supporting citizen participation processes.
- **Policies for sustainable development** — New regulations, incentives and taxes to enable sustainable development and fight 'climate criminals'.
- **Legislation to protect privacy** — Legislation at EU level to ensure transparency of data, privacy protection and security.
- **Public procurement** — All public procurement processes address integrated sustainability and social values (e.g. happiness).
- **Aligned policies** — Integration and simplification of policies at all levels (local, regional, national, European and global).
- **Stimulating policies** — Policies to promote positive contributions, such as actions with a 'positive hand-print', e.g. tax benefit for car sharing initiatives.
- **Transformation guidelines** — Simple, clear indicators for the use of public space as input for the participatory planning process (e.g. percentage of urban space reserved for public green).

Desired future scenario

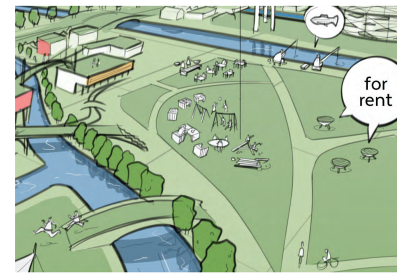
EINDHOVEN — Comune di Forlì — Ajuntament de SantCugat

The Smart Urban Spaces theme focuses on sustainable energy solutions for public spaces, where multiple functions and activities physically come together. The ambition of the cities is to create liveable urban spaces by engaged citizens and all the other stakeholders. Circular systems contribute to smart use of resources. Sustainable transportation solutions contribute to a healthy living environment.



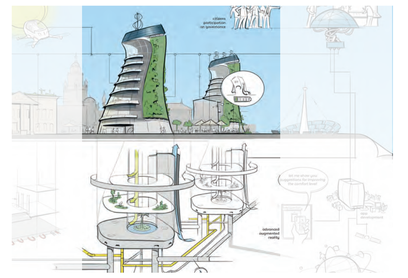
Flexible and attractive living environment

- Pleasant living environment for everyone
- Adapting while preserving the identity of the city (like history and culture)
- Ecological system connecting the green and blue areas
- Urban space is for people, not for private use (like parking cars)
- Enabling multifunctional use of urban space



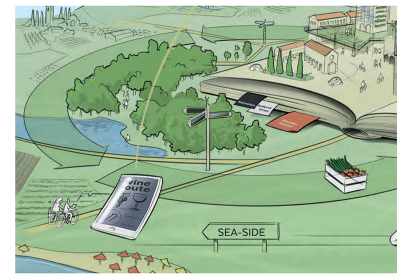
Social interaction and healthy behaviour

- Active use of public spaces for sustainable lifestyles
- Well-connected and well-equipped green areas enhance social life
- Healthy living environment with extensive green and blue to support social activities
- Open platforms to encourage citizens to initiate and participate in social events



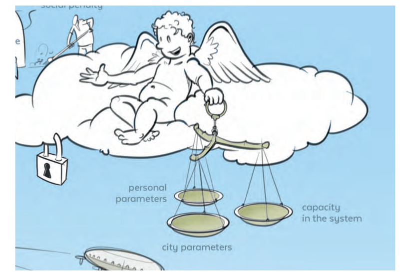
Climate resilience

- Integrated physical planning to strengthen interdependencies between water, flora, pavement, buildings
- Green areas help produce and store (renewable) energy, reduce heat stress and allow recovery of rainwater
- Private property should be climate resilient as well



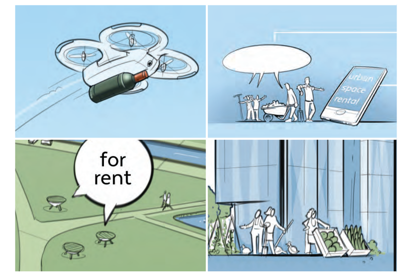
Synergy between urban and rural areas

- Open territorial cooperation encourages innovation and contributes to local economic development
- Reducing footprint by using circular systems
- Well-designed route network supported by smart technologies connects urban and rural areas, promoting quality lifestyles



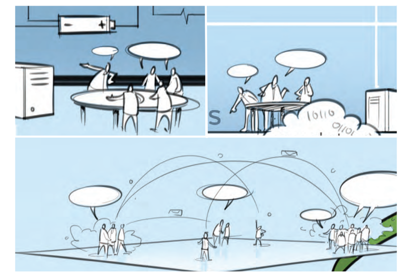
Smart systems and grids

- Real-time info helps people to engage in social activities
- Smart grid connects public spaces and services
- Centralised 'brain' enables information sharing
- Secure system ensures privacy by understanding the boundary between public and private data
- Resilient system (matching resources to conditions)



New business and financing models

- Providing an ideal environment for (local) entrepreneurs with sustainable and healthy services
- Accessible data to develop new apps and services
- Citizens and administration jointly invest in the living environment
- Public space is always freely accessible; added-value services may be charged



Citizens taking the lead and co-creation

- People feel responsible for sustainability and are engaged in urban planning use and maintenance
- People take the initiatives, supported by the administration
- Citizens use smart systems to monitor the quality of the environment and contribute to its improvement
- Citizens actively take part in making decisions that influence their living environment

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