

CITIES OF THE FUTURE

ANTICIPATING TRENDS AND POSSIBILITIES



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PREPARED BY:
future→iQ
PARTNERS

AUTHORS:

Lehna Malmkvist, Freija van Duijne, David Beurle

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INTRODUCTION

Cities of the Future - Anticipating Trends and Possibilities has been developed to expand upon the work that Future iQ Partners currently undertakes in our various strategic planning and foresight projects. Having worked in regions and communities across Europe, North America and Australia for over a decade, it is an exciting challenge to extend the practical development of future thinking into this research piece that looks at real world trends and examples of applied innovative practices. This document is one of a series of 'future thinking' papers being developed by Future iQ Partners.

Cities and those that live within them are becoming one of the most influential factors shaping the future of the planet. The world population is becoming increasingly urban. In 2008, for the first time in history, more than half the world's population lived in cities. On the current trajectory, by 2050 the urban population is estimated to be 6.3 billion (66% of the world's projected population). Additionally, more than 60 percent of the land projected to be included within urban areas by 2030, has yet to be developed. As more people become urban dwellers and the global urban footprint expands in the next several decades, it is essential to examine how cities can evolve into the future.

Cities of the Future - Anticipating Trends and Possibilities is based on scientific research and trend information. We have endeavored to draw this research from various areas into one engaging and visual thought piece, which shows trends that have the potential for widespread adoption over the next two decades. This information is presented to encourage people to explore how various trends could play out during this timeframe and to consider the potential real world implications and possibilities.

Our focus is primarily on presenting examples that incorporate a balanced approach to the transformation of cities in the future, comprising economic, social and ecological perspectives. Macro trends such as declining supplies of fossil fuels, climate change, technological advancement and dependence, and escalating global populations are creating increased levels of uncertainty. However, embedded in these changes are new opportunities. Renewable energy and local food systems offer potential new economic pathways. Technology could fundamentally alter how educational, health and social services are delivered, removing the barriers to access even in relatively remote locations. Changes in the way we live and work are further reshaping the definition of what a 'city' is, and how we interact with it.

Future iQ Partners has presented **Cities of the Future** - Anticipating Trends and Possibilities' to provide examples of what is possible. While this is drawn from current information, we recognize this is not the complete 'solution'. This publication is offered as a resource, for people to consider what may be possible in their own cities, as they explore the challenges and opportunities in the next 20 years.



David Beurle

CEO

Future iQ Partners



NEIGHBORHOODS & COMMUNITIES

Neighborhoods are the pounding hearts of cities. This is where people, live, work, go to school and recreate. Vibrant neighborhoods that are walkable and include a mix of uses are becoming the preference of many people from young to old, and this trend is expected to continue. The social fabric of life is created in neighborhoods, as people meet and interact. Homes, offices, shops, workshops, schools, medical facilities, cultural venues and more are all integrated in the same lively neighborhood.

- | | | | |
|-----------------------------------|--------------------------|---------------------------|-------------------------|
| Single Family Residential | Multi-Family Residential | Central Business District | Pedestrian Area / Trail |
| College / University | School | Agriculture | Rainwater Management |
| Community Center | Hospital | Creek | |
| Cultural Facilities | City Hall | River Corridor | |
| Community Garden | Library | Mall | |
| Industrial Area / Technology Park | Commercial | LRT | |



HOUSING

Housing is integrated into mixed use neighborhoods, which better meets the needs of smaller households with fewer children, and an aging population. There are many low rise, high density buildings with smaller apartments that are adaptable to provide opportunities to work at home, and to meet the needs of physically challenged individuals.

- New housing and retrofitting is primarily through attached (multi-family) apartments and townhouses and small detached lots, with a variety of sizes, use, and focus groups.
- People have walking access to residents, retail, office, culture, entertainment, restaurants, schools, community centers, and green space.
- Smart apartments ensure wise resource use with low energy and water consumption, and integrated recycling and composting systems.
- Outdoor spaces integrate pedestrians, cyclists, playgrounds and ecology.
- Cars are guests in the streets and are respectful of other users.



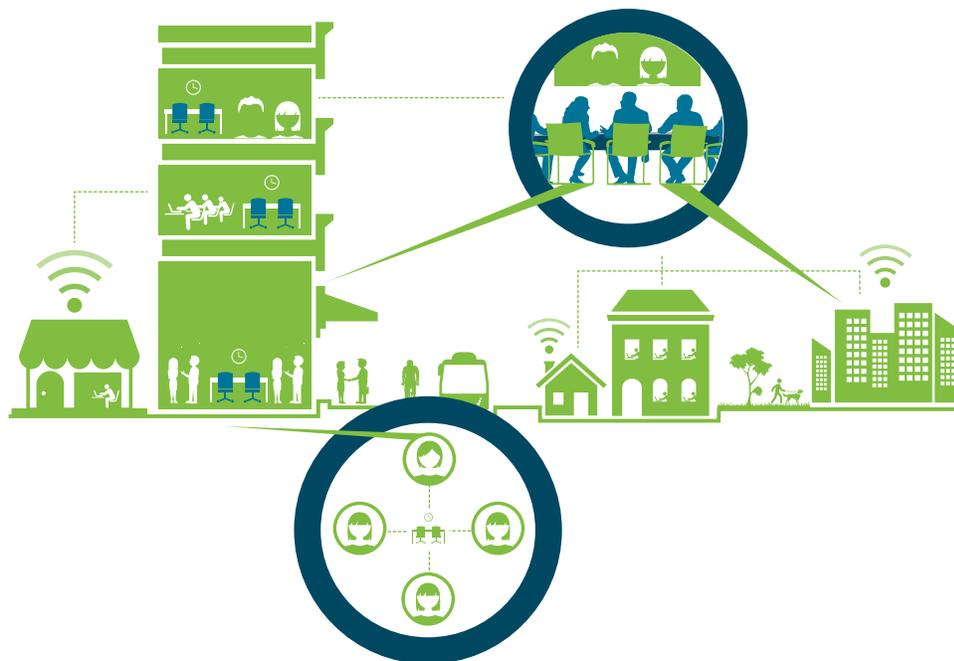
Mixed use neighborhoods are becoming a better match with current and expected future housing needs than traditional suburban neighborhoods. More people are preferring smaller houses, which are more affordable, and have lower costs for maintenance, energy and water. As population density increases, and citizens are using their neighborhoods more intensely, there will be a transformation of streets to spaces shared by automobiles and other uses, more areas will become car free, and there will be other initiatives that improve safety on the streets. The shift in desired housing, combined with changes in working modes, means that more people are self-employed and/or work remotely, this may be from home, a local co-working space or even a coffee shop. People are more often mixing work and leisure time, and therefore want to work within their community, where they also recreate and engage in social activities.



WORK

Many people don't commute, but work close to where they live. They work online, meet, and collaborate with others. They don't have an office, but work from their home or shared office spaces, work schedules are flexible. During office hours, they bring liveliness to their neighborhoods. They visit coffee shops, lunchrooms, hospitals, pharmacies, and other shops and services in their breaks from work, giving identity to the neighborhood.

- Officeless workers
- Collaboration
- Spontaneous networks
- Shared work spaces for independent and officeless workers
- Homes, offices, shops, workshops, chop shops, schools, medical facilities, restaurants all integrated within the same neighborhood (this is an important characteristic of a lively neighborhood, it all happens there)
- For those with offices, they are walkable from home, or have good transit connections



Technological advances and changing values are leading to a variety of options for workplaces and working styles. More often people work where or near to where they live.

Flexible working hours are becoming commonplace and communicating remotely with coworkers or clients via technological services is becoming reliable, secure and acceptable. More people will work in informal places such as shared office spaces, from home or in semi-private commercial locations. The shift from traditional working hours to flexible schedules also benefits the neighborhood through increased livelihood, and safety during the day and night, as people move around at various times.



FOOD

Community spirit is built through the love of food, and people connect by growing, cooking and eating food together in families and community groups. Many people eat vegetables from local, neighborhood food gardens, and gardening is considered a great hobby for health and stress relief.

- Vegan and vegetarian options are common in restaurants, diners and delis. Healthy food is often the first choice, including in fast food.
- Locally produced or manufactured foods create added community value.
- Passing on knowledge of cooking and healthy foods through family and community members, food sharing.
- Nutrient cycling is integrated into the waste management cycle through composting.
- Food waste is largely avoided, through smart management of 'best before dates' by sensors, and supply management.



Growing awareness of food security and sustainability is leading the development of urban agriculture and food sharing. Food is one of the most powerful ways to connect to other people, and growing your own food in neighborhood gardens is increasing in popularity. Local food production facilitates the development of community connections. Combined with food production, cooking classes, and preparing/sharing healthy meals at home or in local restaurants with friends and family creates deeper networks, and also helps to create an active lifestyle and improved health and wellness.



SHOPPING

Sharing and renting is appreciated as much as owning. For many items, such as tools, people prefer peer to peer sharing. Customized, home made, one of a kind, locally produced goods are praised for their uniqueness, which large brands cannot offer. Peer to peer shopping has given rise to alternative currency, bartering and timebanking (e.g. receiving time from others in terms of services).

- People are used to contactless, mobile payment
- Stores are replaced by online stores and outlets of craftsmanship
- Drone delivery frees the streets from delivery vans
- Billboards are personalized through augmented reality, matched to individuals preferences
- Sharing Economy
- New entrepreneurship, everyone can sell and/or share goods and services



The process of shopping is undergoing a transformation that is expected to continue to develop with new technological advances. Online shopping and drone delivery are expected to become commonplace as the large stores are able to provide almost all products that people want to buy. Thus, there will likely become less of a need for physical stores. Traditional shopping malls will continue to close down in some regions and their buildings can provide opportunities for retrofitting for other purposes (such as art and recreational spaces). Technological solutions are also leading to the creation of a sharing economy, through networks which allow people to access to items that they use occasionally, without having to accumulate and store them. Many sharing services have emerged that allow people either to swap, or earn money by lending their equipment. Also, handcrafted products are becoming more highly valued, as they express uniqueness that large brands cannot provide. With the increase in hobbies and creative activities many people will likely earn some of their income from selling or sharing homemade products.



CULTURE AND EDUCATION

As we move into the future, people look for culture and entertainment locally. The city provides a home for artisan workshops and studios, which generates an environment where cultural activities emerge. People design and present after school/ work programs, training and education to share their knowledge and teach others.

Single Family Residential	Multi-Family Residential	Central Business District	Pedestrian Area / Trail
College / University	School	Agriculture	Rainwater Management
Community Center	Hospital	Creek	
Cultural Facilities	City Hall	River Corridor	
Community Garden	Library	Mall	
Industrial Area / Technology Park	Commercial	LRT	



SCHOOLS

Learning is individualized and takes place in multiple locations and at any time, in school, home, online, and at other institutions (e.g. museums, galleries, civic buildings). Schools offer curricula that stimulate exploration and finding new opportunities.

- Teachers are learning facilitators, with a flexible mindset
- Technology is included in the classroom practice to keep up with the fast changing world and includes online courses and games
- Traditional textbooks are displaced by Open Source and E-Textbooks
- Curricula involves real world education, including mentorships with practitioners, project based learning and integration of life skills
- Learning is adaptable to prepare for professions that do not yet exist
- Small scale neighborhood learning groups and home schooling programs are commonplace
- After school programs take place at school or other facilities on a wide variety of topics, from gardening to emerging technology



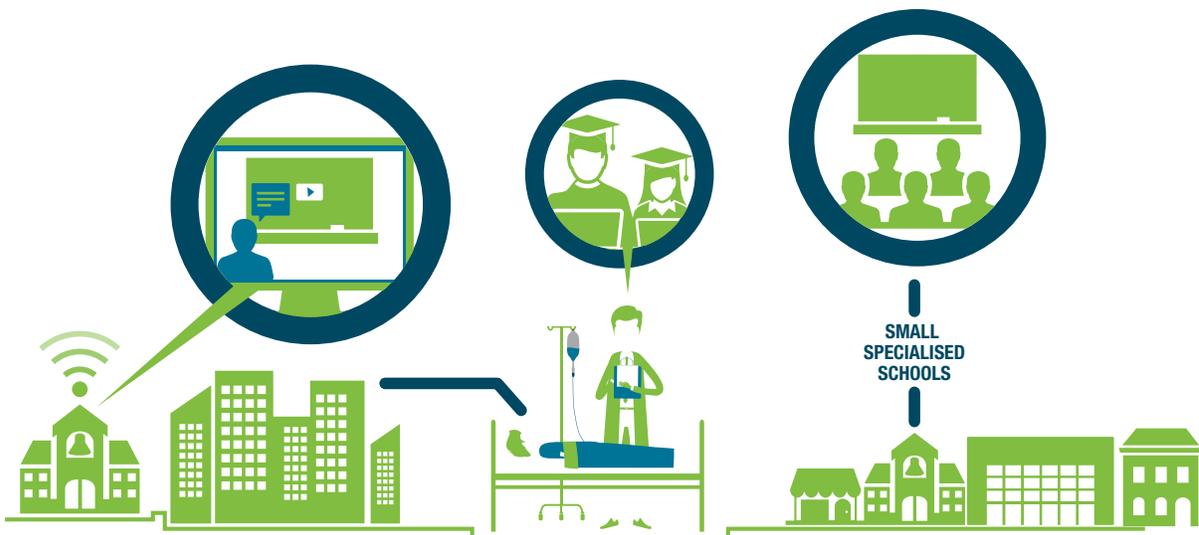
As new technology is changing production processes and the service economy, students need to be prepared for jobs that don't yet exist. As schools prepare for the future, flexibility in learning and curriculum development is crucial to avoid gaps in preparing students for future employment opportunities. Adaptive learning programs, both online and offline will help students with varying learning levels. Learning will take place in many locations (formal and informal) and students will connect through mobile devices for studying and completing their assignments. Field trips and after school activities will continue to be part of the learning process. The importance of mentors will be further recognized, and experts from business organizations, retired professionals and people with a remarkable life story will act as mentors. Homeschools of the future also offer flexibility and will adapt to new technology.



POST SECONDARY EDUCATION

People engage in lifelong learning and are open to new ideas. Learning is part of working, to stay competitive, and keep up with new technologies and information. Traditional college and university curricula are augmented by formal and informal processes.

- Mentorships
 - Internships and training programs
 - Practitioner training
- Informal, mobile learning - online courses, knowledge portals podcasts, videos, expert communities, games



Post-secondary education will adapt to become lifelong learning. Ongoing learning is important to remain competitive and flexible, as new technologies change the way people work. Training is provided in formal and informal settings, and experimenting with new technologies is encouraged. Young people also become mentors of older coworkers to assist with adapting to new technologies. In particular, coding is a skill that is likely to become more important in the future, and younger generations are more familiar with that role. Online possibilities of training will develop in many fields and massive open online courses (MOOCs) will likely become a mainstream way to access to all sorts of professional education and learning communities.



PUBLIC LEARNING SPACES

A wide variety of training courses are locally offered on all aspects of life. Local experts share their knowledge with fellow residents. Public buildings such libraries, community centers, cultural spaces, after hours in city, school, college and university spaces offer opportunities for meeting and learning.

- Online social networks lead to real world gatherings on specific topics
- Knowledge sharing is everywhere, in book clubs, craft circles, mechanics, building, emerging technologies, languages, gardening, etc.
- Shared workshops and maker spaces are created for the sharing of knowledge and equipment



As lifelong learning becomes an accepted practice, one's personal learning network will be considered an important asset for their learning environment. Knowledge sharing through book clubs and other meeting groups of likeminded people will encourage development, as well as incorporate fun into learning. Online communities will serve the same goal. Makerspaces will become favorite spots for young and old to learn and play with construction materials and new technology, such as 3D printers. These spaces will be opportunities to explore new worlds of technological possibilities.



WELLNESS

People are actively involved in their neighborhood, which gives a sense of gratitude and connectiveness. Health care supports physical and mental health, and shifts to preventative care. Wellness spaces with fitness facilities, health care specialists and spas are available throughout the city.

- Online social networks provide a caring community that brings friends and family closer.
- Community learning and informal education keeps minds active
- People staying healthy by doing fun things together
- People connect in different roles (e.g. accountant who loves teaching tap dancing)
- Social connections are created through cultural activities, community gardening, etc.
- Learning about healthy lifestyles is integrated into education
- Apps and technology provide real time self monitoring



People are becoming more involved in their neighborhood by providing social services to the community. Volunteering not only helps others, it also builds a sense of gratitude, which has a positive health effect. Online social networks are evolving to do the same, building long distance relationships with friends and family. There is increasing awareness of the positive effects of hobbies and creative activities on career and life balance. As people develop new interests, it will become common for people to share and teach topics that are completely different than their profession. These activities will help to build new networks and bridge communities that wouldn't otherwise exist. Activities such as gardening, cooking and dancing are fun and engaging, and attract a community, which makes it easier to create a healthy lifestyle.



RECREATION

Open air sport facilities are available in most neighborhoods. There are trails, biking lanes, running tracks, playgrounds and skate(board) parks. People regularly walk or cycle to their favorite park, café, library or theater.

- Public space is a playground
- Many amenities are within walking distance
- Social networks connect people to various activities
- Technology assists all ages and abilities
- Interactive landmarks and displays in the public space
- Good or bad weather, people are active and outdoors



The importance of physical activity in overall health and wellness is leading to the development of a wide variety of recreation options beyond traditional sporting activities. These vary from walking to nearby amenities such as shops and cafes, to extreme sports. Recreational communities will continue to develop informal and formal areas to practice their sports on water, land and in the air. Online communities allow knowledge of new activities to easily spread. Technological advancements in assistive devices such as prosthetics and robotic exoskeletons will help people to stay active, even with physical limitations.



AGING POPULATION

Independent living into well past eighty years old is very common, and elderly people are integrated into neighborhoods with all age groups. Neighborhoods provide access to amenities and social connections within walking distance, with transportation options for those with mobility challenges.

- Getting older, but feeling still young is the ‘baby boomer style’
- Remaining independent, as well as socially and physically active
- Health status is monitored in real time through apps and sensors
- Doctors, nurses and family members can monitor from a distance, with periodic visits for physical checkups and care taking
- Advanced medical aids take over the need for many nursing and home services



It is expected that with improved health and wellness, and advancements in health care, the baby boomer generation in their 80s will have a lifestyle that is similar to what people in their 60s experience now. Aging generations want to prolong independence and quality of life. The development of smaller, adaptable apartments with easy access to services, in vibrant community neighborhoods will allow this lifestyle. Additionally, good health will be facilitated through the support of online services and health monitoring. Doctors, nurses and family members can check in by monitoring health statistics provided by smart watches and other wearable devices, reducing visits to health care facilities and keeping family members informed.



ECOLOGY & SUSTAINABILITY

In the future, cities will mimic the natural processes and functions of ecosystems including water, nutrient, energy and waste cycles. Habitats of other species are integrated into the land use planning.

We are only recently starting to understand the extent to which ecosystems are extraordinarily valuable to society by providing essential goods and services, including clean water, fresh air, pollinating insects and protection from natural disasters.

Single Family Residential	Multi-Family Residential	Central Business District	Pedestrian Area / Trail
College / University	School	Agriculture	Rainwater Management
Community Center	Hospital	Creek	Green Space
Cultural Facilities	City Hall	River Corridor	Urban Forest
Community Garden	Library	Mall	Living Wall
Industrial Area / Technology Park	Commercial	LRT	Green Roof



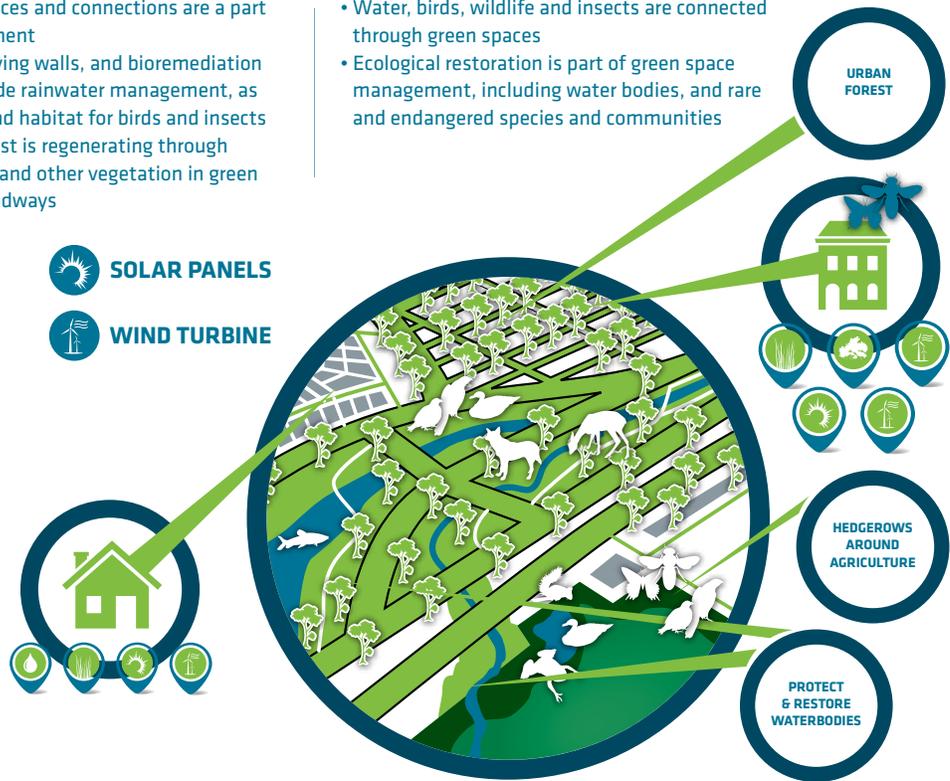
ECOLOGY AND GREEN SPACES

The city is integrated within the ecosystem, green spaces provide opportunities for water management, habitat for birds and wildlife, and connections to nature for the community.

- New green spaces and connections are a part of re-development
- Green roofs, living walls, and bioremediation facilities provide rainwater management, as well as food and habitat for birds and insects
- The urban forest is regenerating through planting trees and other vegetation in green spaces and roadways

- Water, birds, wildlife and insects are connected through green spaces
- Ecological restoration is part of green space management, including water bodies, and rare and endangered species and communities

-  RAINWATER CAPTURE
-  SOLAR PANELS
-  LIVING WALLS
-  WIND TURBINE
-  GREEN ROOF



Green spaces within urban areas provide important ecosystem services, such as filtering dust, absorbing carbon dioxide from the air, improving air quality, infiltrating and filtering stormwater runoff, and reducing urban heat island effect.

Additionally, access to green spaces and ecosystems has positive effects on human health through improved air quality and reduced respiratory ailments and allergies, greenways and trails promote active living and physical activity, and urban agriculture facilitating dietary diversity, improve nutrition and food security while also supporting agricultural species conservation and limiting the urban food-supply footprint.

Municipalities are beginning to consider and incorporate ecological functions and habitat into master planning, resulting in new and redevelopment projects including more ecosystem features including: wildlife protection and conservation, ecological restoration, greenway connections, as well as, living roofs and walls incorporated into buildings and other hard surfaces.

Management tools such as the City Biodiversity Index are also being used by municipalities to assess their environmental protection measures, to monitor and evaluate their progress in conserving and enhancing biodiversity.



CLIMATE CHANGE MITIGATION & ADAPTATION

Government, businesses and citizens implement practices to mitigate and adapt to climate change to reduce the vulnerability and to increase the resilience of social, ecologic and economic systems.

- greenhouse gas reduction strategies
- preparations for sea level rise and changing weather patterns
- preparations for natural disasters and extreme climate events (heat waves, ice storms, extreme snow falls, flooding)
- landscape modifications for drought tolerance
- adapting building codes to future climate conditions
- watershed management planning and rainwater management facilities
- habitat restoration and migration corridors for plants and wildlife
- infrastructure upgrading



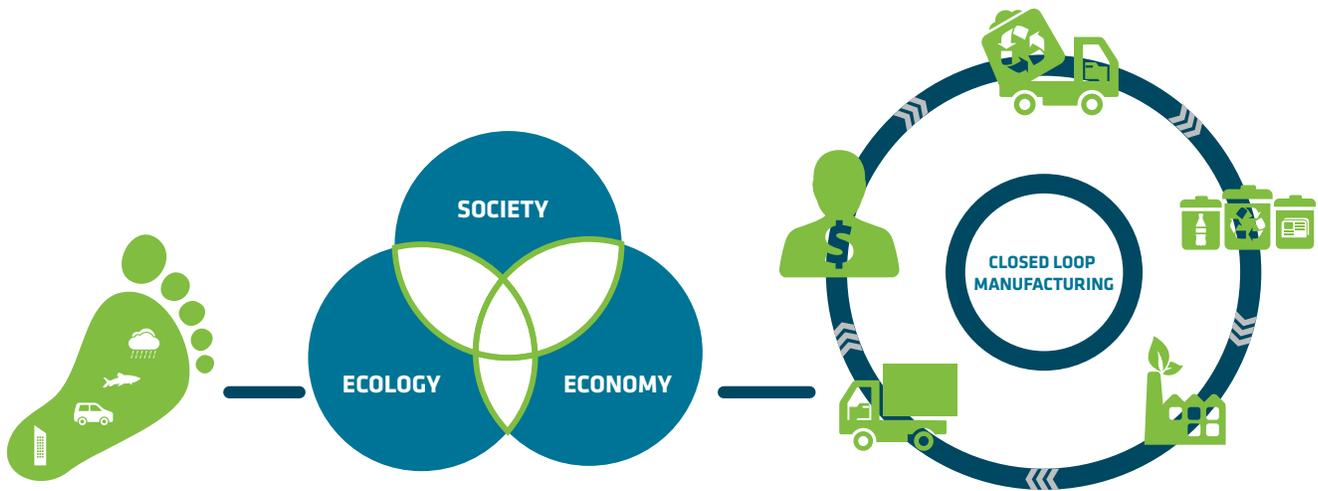
Green spaces and ecosystem connections, including parks, agriculture, residential gardens and lawns, street trees and roof gardens also provide opportunities for climate change mitigation and adaptation. Vegetation in these spaces uptake and store carbon, while providing habitat, rainwater interception and infiltration, and pollutant filtration. The shade and cooling provided by trees also reduces the heat island effect and overall energy consumption. In most cities around the world, there are abundant opportunities to increase urban vegetation.



SUSTAINABILITY CONCEPTS

Sustainability concepts are integrated into decision making process for all city planning activities.

- Biomimicry
 - Ecological footprint
 - Resiliency
 - Net Zero
 - Cradle to Cradle
- Closed loop
 - Community-scaled solutions
 - Triple Bottom Line - Economy/Society/Ecology



Natural systems also function as role models for building better human systems. For example, ecosystems are closed loop systems with no waste (one organism’s waste is another’s food), and they run entirely on renewable energy, along with nature being an excellent engineer.

Urban design and management (along with other disciplines) are beginning to integrate these principles. Opportunities include biomimicry for architectural and green space design; net zero, cradle to cradle and closed loop systems for managing infrastructure; and triple bottom line and ecological foot print assessments to establish baselines and monitor progress.



INFRASTRUCTURE

Infrastructure is a long-term societal investment that helps us build a more efficient, better functioning society. Future cities will integrate infrastructure systems such as water, energy, waste management and transportation to provide better service to residents and businesses, environmental protection and cost savings. This information will be available to the public through real time monitoring and reporting technologies.

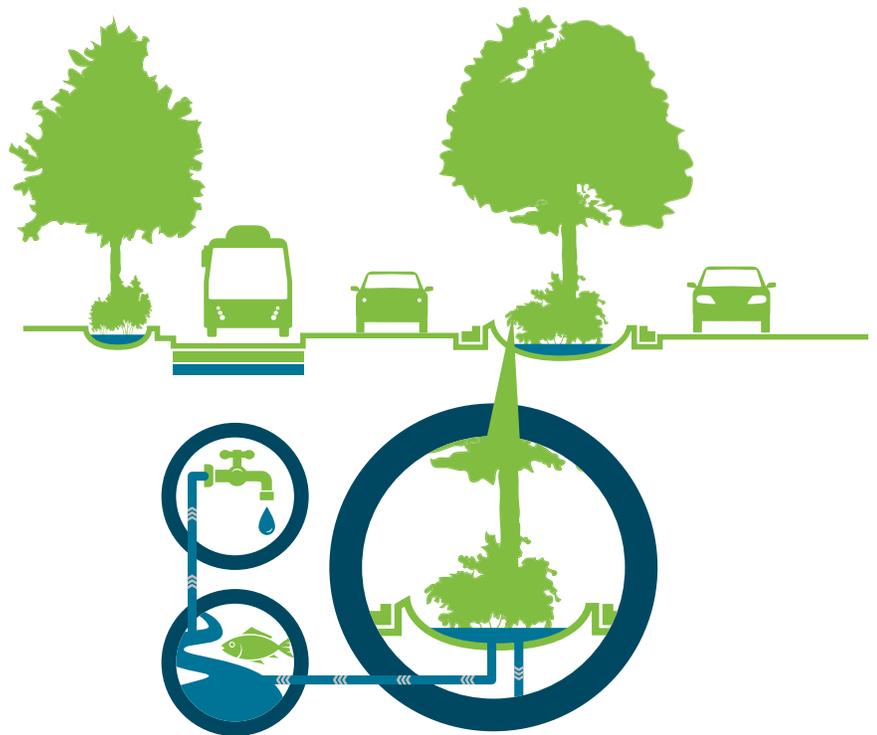
Single Family Residential	Multi-Family Residential	Central Business District	Pedestrian Area / Trail
College / University	School	Agriculture	Rainwater Management
Community Center	Hospital	Creek	Bus
Cultural Facilities	City Hall	River Corridor	Bike
Community Garden	Library	Mall	Recycle Center
Industrial Area / Technology Park	Commercial	LRT	Electric Car Port



WATER

Water is integrated into the city and celebrated. Water management is on the surface and visible, when it rains, runoff is captured on roofs and in landscaping. Water is conserved and used wisely.

- Water conservation happens at all levels, residential, commercial, and industrial
- Biomimicry - cities mimic the natural water cycle including interception, evapotranspiration, filtration and groundwater recharge
- Fit For Purpose water usage - use of non-potable water for non-drinking purposes such as irrigation, toilet flushing
- Rainwater Management is integrated into public spaces such as parks and road right-of-ways, as well a private property in features such as green roofs, street trees, increased green space, rainwater capture and use, rain gardens, and permeable pavement



Municipalities are increasingly understanding the importance of water in the urban landscape, including integrated watershed management planning, protecting and restoring aquatic ecosystems, rainwater management, rainwater capture and use, and sewage treatment. They are beginning to grapple with how to incorporate non-potable water uses (fit-for-purpose) into buildings and public spaces.

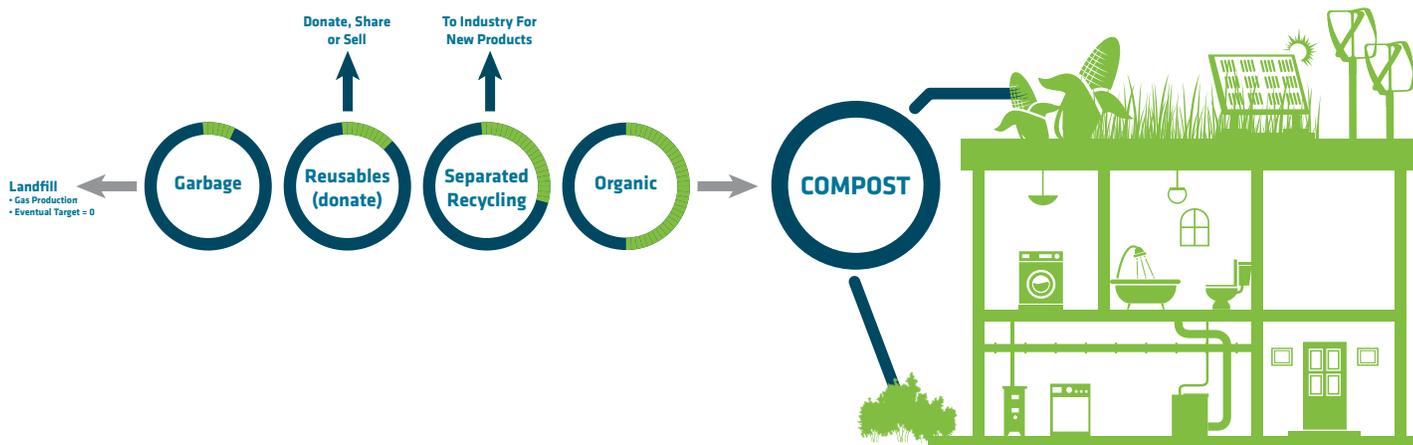
Some examples of innovative water management are: park planning that incorporates wetlands that also retain and filter stormwater runoff, while providing habitat and an aesthetic amenity; bioswales and rain gardens incorporated into vegetated areas of road right-of-ways; and buildings that incorporate green roofs to capture roof water that is used for irrigation and toilet flushing. Combining functions creates more connections within cities and saves costs.



WASTE

The city is an ecosystem and there is no waste, the byproducts of one activity are used to feed another. Recycling and composting are integrated throughout the city. Residents, businesses and industries separate items, which are collected and transported to the locations of their next use.

- Cradle to Crade, closed loop waste cycle where there is no waste
- Targets are established for residential, commercial and industrial process with the ultimate goal of the closed loop.
- Resource Recovery is integrated into the infrastructure system and heat, water, and gas are recovered.
- Waste cycle and resource recovery are monitored and reported, this information is available in real time for private monitoring and public accountability.



The future of waste management in cities provides many opportunities for working towards closed loop systems. There is a shift from looking at what are currently viewed as waste, to resources. This includes: materials recycling that is closely linked to manufacturing so that materials are easily connected to where they can be reused; linking local agriculture with composting of restaurant and household organic waste, and using the food grown with that compost locally (farmers markets, restaurants); and wastewater reclamation, using recycled non-potable water for irrigation, laundry, toilets and commercial or industrial uses, and ultimately, in the future drinking water.



BUILDINGS

The desire for walkability and mixed use neighborhoods will develop some low density, underutilized areas into village centers with mixed uses including residential, retail, office, culture, entertainment, restaurants, schools, community centers, and green space, as well as the transformation of obsolete buildings into places for startups, artisan studios, community centers and group activities.

- Adaptability is integrated into new buildings and retrofits
- Existing buildings are retrofitted for water and energy efficiency, air quality improvement
- Buildings offer opportunities for living and working in the same spaces, as well as integral connections to the outdoors.
- New buildings, commercial, industrial, institutional, residential incorporate green building principles, which evolve as knowledge grows.



From cabins to highrises, in residential, commercial and industrial buildings, there have been many innovations in architecture and building construction in terms of efficient use of energy and resources, and integration into urban food systems and ecosystems.

Buildings are capable of being energy efficient through appliances, heating and cooling, and use of natural light, as well as generating renewable energy through wind, solar and geothermal technology. There are opportunities for sourcing sustainable materials, as well as recycling wastes and capturing rainwater.

Smart controls will monitor everything from water usage to ventilation to heating and lighting, and the internet of things will allow adaptable interiors in which buildings and appliances are linked to allow the most efficient use of resources.

Building rating programs that certify sustainable buildings will continue to develop, such as Leadership in Energy and Environmental Design (LEED), and Building Research Establishment Environmental Assessment Methodology (BREEAM).

There are many pilot and demonstration projects worldwide on buildings of all scales that show what is possible, with new examples every year. The next step is for sustainable buildings to become 'the way' through retrofitting existing buildings, as well as in new or re-development.



TRANSPORTATION

The road ways are transformed to have less focus on cars, and include a mix of uses. Public transit is efficient, cost effective, and provides good service in the city with connections to larger metro area. Many transportation options are available:

- Convenient sharing systems for bicycles and variety of vehicles
- Trip planning applications allow community members to share resources
- Alternative fuels - electric charging stations, non-food biofuels
- Extensive cycling and walking trails connect the city off roadways
- Automated vehicles provide delivery services



Roadways will be modified to include multiple uses, such as personal vehicles, public transit, pedestrians, bikes and other self-propelled vehicles, combined with rainwater management, street trees, and utility corridors. Additionally, smart technologies will allow monitoring and adaptability in roadways.

Methods of moving people and goods will also transform to include increased public transit, self driving vehicles, alternative fuels, and sharing programs for bikes, automobiles and other vehicles, as well as development of self-driving vehicles and drone delivery.



ENERGY

There is currently a shift in focus from traditional fossil fuel based energy sources to alternatives including renewable sources (e.g solar, wind, geothermal, marine, cogeneration), as well as non-traditional fossil fuels (e.g. shale natural gas).

As energy demand continues to rise, and there is an increased focus on low carbon energy to minimize potential climate change effects, cities in the future will move towards managing energy in a hierarchy: conservation, local renewable energy production and connection to the regional grid.

 **Single Family Residential**

 **Multi-Family Residential**

 **Central Business District**

 **Pedestrian Area / Trail**

 **College / University**

 **School**

 **Agriculture**

 **Rainwater Management**

 **Community Center**

 **Hospital**

 **Creek**

 **Geothermal Plant**

 **Cultural Facilities**

 **City Hall**

 **River Corridor**

 **Solar Energy**

 **Community Garden**

 **Library**

 **Mall**

 **Wind Energy**

 **Industrial Area / Technology Park**

 **Commercial**

 **LRT**

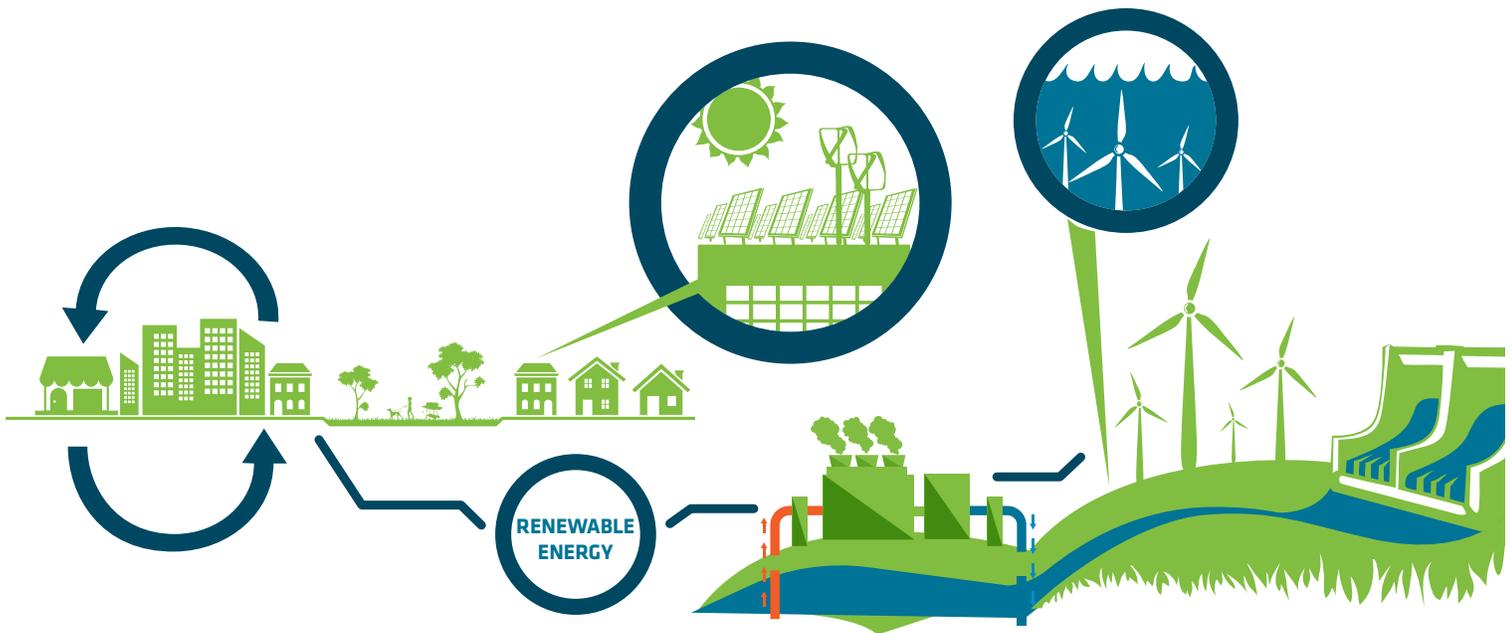
 **Electric Car Charge Station**



RENEWABLES

Energy production is shifting from a focus on fossil fuels and nuclear energy to renewable, low CO2 energy.

- small scale local production and use, combined with large scale renewable plants
- wind - onshore/offshore
- solar - photovoltaic, water heating, concentrated solar power plants
- hydro - hydro electric dams and run-of-river hydro
- geothermal
- tidal turbines
- wave



A team at Stanford University, has developed the The Solutions Project to determine how each state can transition to 100 percent clean, renewable energy with a custom mix of wind, water and solar to provide energy for all purposes (electricity, transportation, heating/cooling and industry). The plan proposes to stabilize energy prices, create jobs, minimize air pollution, and begin to control global warming. This will create investment opportunities for clean energy, transportation and energy efficiency.



ENERGY SAVINGS

Energy conservation is improving through the use of high efficiency appliances, improved building practices and Smart energy management.

- Energy rating on appliances
- Buildings - new and retrofits meet green building standards (e.g. LEED, Net Zero, Living Buildings)
- Usage is monitored and displayed in realtime, and can be managed remotely.
- Energy Management Systems optimize usage by automatically controlling consumption



Industry is currently creating pilot projects to test new technology in real world settings. For example, Toshiba, Sekisui House and Honda worked together to build an experimental two-household, two generation family home using IT, personal mobility, and sustainable energy management where all energy usage by both households is centrally controlled, and energy is produced onsite.

Smart meters are currently available that allow real time customer monitoring and control such as thermostats by Nest Labs and Honeywell. Applications such as Wattcost, track energy consumption by appliances in a home or business environment, alert users when they are not behaving in the most cost-effective or eco-friendly way and provides advice for improved use.



LOCAL ENERGY GENERATION

In the future it is expected that energy, heat and electricity, will be generated within homes and businesses using renewable sources. Heat, electricity and mobility are shared within the community energy network.

- Sources are primarily renewables such as solar and wind
- Small scale cogeneration systems in each building, which are connected in a network
- Smart Meters manage multiple households to share energy and heating
- Shared mobility with neighbors via a variety of electric vehicles for different uses
- Connected to regional grid



Onsite generation of energy is becoming a possible solution to improving energy security and providing energy where it is needed. In particular, the costs of photovoltaic solar technology have been dropping rapidly, and along with increased accessibility, grid parity has been reached in several countries (e.g. Germany, Italy and Spain) and it is expected in the next decade within the United States. Grid parity means it is cheaper to produce energy at home on your solar cells than to buy it from utilities. Combining local renewable energy generation with improvements in energy storage (e.g. battery technology) will support renewable sources as solar and wind to supply consistent electricity.

FURTHER READING

The infographics and text created for Cities of the Future are based on research into real world examples of innovative projects. The following list of additional reading materials is not an exhaustive list of references. It is intended to provide opportunities to delve deeper into the various topics covered within the document.

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MORE INFORMATION

ABOUT THE AUTHORS:



Lehna Malmkvist

Expert Team - Environment / Ecosystems

Lehna sees a future in which people live integrated within their ecosystems, and where their built environments mimic the processes and functions of nature. She is a registered professional biologist and has extensive professional and academic experience in applied ecology. She completed a B.Sc. in Biology and Environmental Studies and obtained an interdisciplinary M.Sc. at the University of Victoria (Canada), in rainwater management and aquatic/riparian habitat restoration associated with residential, agricultural and commercial development. Lehna has worked for over 10 years providing ecological expertise within multi-disciplinary teams across a wide range of projects. Lehna has produced and presented extensive educational material, as well as coordinated conferences, workshops and courses.



Dr Freija van Duijne

Expert Team - Future Planning / Trends

Freija is an expert speaker of trend presentations and discussions, writer of short articles about the future, and facilitator of group sessions for future strategy development and visioning. She has led a range of large projects that involved scenario planning, technology assessment, story telling, expert reflections and future strategy. Freija is a founding member, and the inaugural President of the Dutch Future Society, which aims to propagate professional futurism in the Netherlands. She holds an M.A. in Cognitive psychology from Leiden University and a Ph.D. in Applied ergonomics and design from Delft University, specialising in risk perception.



David Beurle

CEO, Future iQ Partners

David specialises in creating innovative future planning approaches for use in regional and organisational settings. He developed the groundbreaking Future Game, which has been successfully used across the world in community, regional, industry, corporate and governmental settings. He pioneered the application of Scenario Planning to regions and rural industries around the world. He has worked in the remotest parts of Australia through to working at the highest levels of Government, with eight years as the 'right-hand man' to a senior Australian Cabinet Minister. He has held a position on the Board of the Western Australian Community Foundation, and has a B.Sc in Agriculture degree from Sydney University.

FOR MORE INFORMATION, PLEASE CONTACT US AT INFO@FUTURE-IQ.COM
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