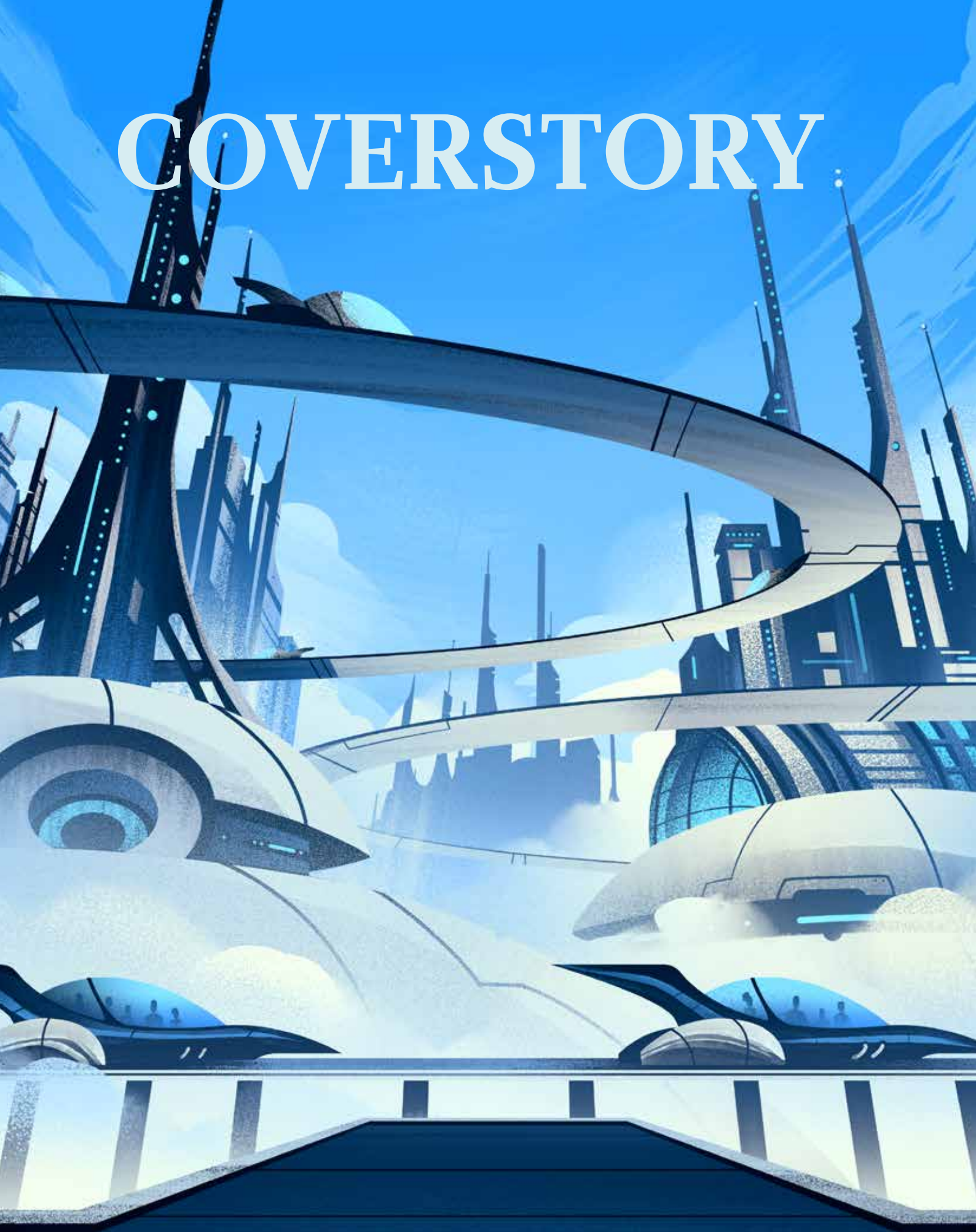
COVERSTORY



Will the city of Luxembourg manage to evolve into a smart city to meet the combined challenges of lack of space, more and more complicated transportation and the need to respect the environment?

Photo: Immobel

SMART CITY

THE CITY OF THE FUTURE WILL BE SMART

The Third Industrial Revolution strategy, initiated in Luxembourg in 2015, is preparing for a world where new technologies in communications and information, transport and energy will converge to deliver a more sustainable economic model. This is the road map that the country has set itself to address the future. We can easily break down this vision of the future at the city level. Everywhere in the world, cities are reinventing themselves with 'smart schemes'. But what is that exactly? What are the stakes and what are the potential promises held out by these new kinds of cities?

Text: Catherine Moisy
Interviews: Corinne Briault
Translation from French: Martin Davies

As long ago as 1970, a visionary Italian-American architect, Paolo Soleri, coined the term 'arcology', a portmanteau of architecture and ecology, to advance the idea of bringing these two worlds together. To give life to his vision, he embarked on a new city project, planted in the middle of the Arizona desert – Arcosanti. The city, 110 km from Phoenix, is more of a laboratory than a city, but it is the oldest contemporary example of a harmonious urban development that respects the environment. This issue of harmony with the environment becomes acute when we consider that 50% of the world's current population live in cities and that this proportion, according to UN forecasts, should increase to 70% by 2050 – that is, 2.5 billion more people than today – to reach an urban population of 6 billion people. Cities occupy only 2% of the earth's surface, but they have the sad responsibility of producing 80% of all greenhouse gas emissions. Some sources estimate that 60% of what will be urban space in 2030 has not yet been built. It is, therefore, not too late to consider things differently.

In Luxembourg, which is experiencing significant population growth, cities and towns have gained 40,000 inhabitants in 20 years. Therefore, it is no surprise that the country is looking closely at anything that can make living in the city more enjoyable and, above all, more efficient. ▶

The smart city has its magazine

Since December 2018, a new magazine has graced the kiosks: "Smart Cities Luxembourg' which, as the name suggests, is entirely devoted to smart cities. The magazine, published by Euro-editions, now comes out every quarter to inspire Luxembourg decision-makers working in the promising field of smart cities. The articles address the issue from different thematic angles: political decisions, the construction sector, social aspects, the environment, digital issues, and transportation.

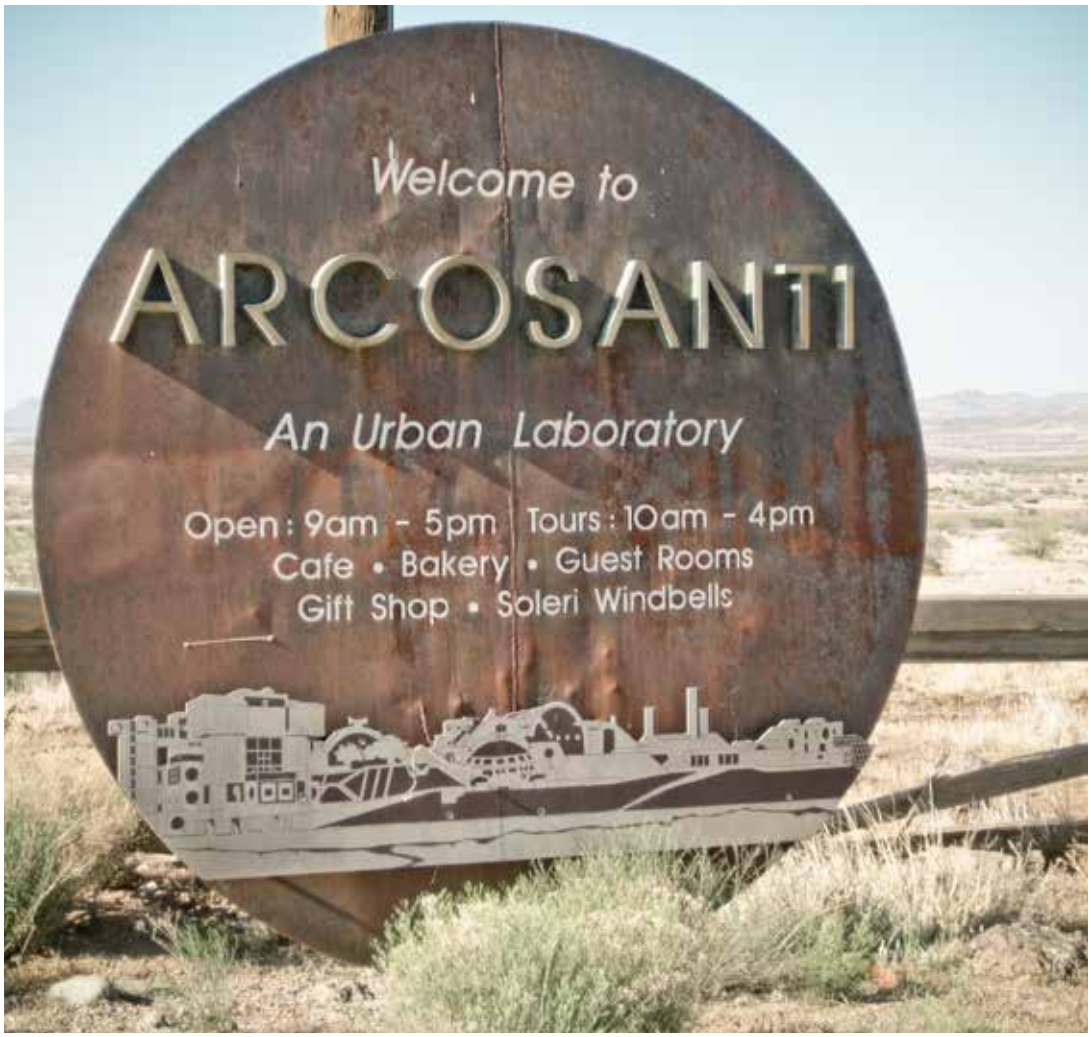


Photo : SignOfArizona

01.

CITIES ARE ALMOST AS OLD AS THE WORLD

Cities first appeared back in the 5th millennium BC when they could grow to up to 15,000 inhabitants. These large population groups developed wherever the topography allowed a harmonious life and facilitated human activities (fertile soil, protection against enemies or natural communication channels ...). The recent history of cities is marked by exponential development. In 1950, cities housed 30% of the world's population; the 50% mark was reached in 2008 and since then, the progression has been continuous. Cities are therefore becoming the most common form of human habitat, but this has not occurred without posing certain problems. Little by little, today's cities have become centres of pollution, traffic congestion, housing shortages and rising crime. They face profound sociological, environmental, and demographic challenges, such as climate change, the aging of the population, and the growing dematerialisation of trade and leisure, which must push us to rethink cities. This cannot be done without addressing some difficulties because they are real ecosystems that combine construction, the environment, flow management (transport, energy, waste management), and socio-cultural aspects such as governance, politics, and citizenship.

WHAT MAKES UP THE INTELLIGENCE OF A CITY?

There are practically as many definitions of the smart city as there are individuals who, influenced by their function or their sensitivity, have tried to define it. According to Wikipedia, smart cities are cities that use Information and Communication Technologies (ICT), as well as data collected from residents, businesses and public bodies to improve urban services, whilst reducing operating costs. This definition has also been put forward by Fabien Cauchi, founder of Metapolis, a French start-up specialising in supporting local authorities in the appropriation of innovative technolo-

Photo : hospitality-on

02.

gies, and speaker at the Smart City Wallonia 2018 event, for whom the smart city is '*a city, a territory that appropriates digital innovation to provide better services to its users – its citizens.*' Architect Shahram Agaajani of Luxembourg's Metaform office says the smart city '*is managed by sensors and computers that listen, see, measure and calculate*'. But he adds that this raises a problem of providing the energy needed to power all these devices. Romain Poules, CEO of PROgroup, a company specialising in sustainable construction projects, insists on the need to put the well-being, safety, and comfort of people at the centre of ideas. Still others consider it essential to introduce the notions of ecology and energetic frugality, and even nature itself, into the design of tomorrow's cities. This is exactly the credo of, among others, Johana Jacobs, Belgian architect and urban planner who emphasises that '*man is part of nature and the city is his habitat. We must not create conflict between city and nature*'. So, questions about the cities of the future are not ▶

01. Half utopia, half tourist attraction, the American city of Arcosanti pioneered the quest for new ways of living in a city. Although 7,000 people participated in its construction in the 70s, it has only one hundred residents today but still attracts about 40,000 visitors a year from around the world.

02. The Neom project, a 26,000 square kilometre futuristic city, will see the light of day in a vast area bordering the Gulf of Aqaba, at the northern end of the Red Sea. Neom is part of Saudi Arabia's 2030 vision to accelerate the diversification of its economy and reduce its reliance on hydrocarbon exports.

INTERVIEW
ROBERT KOCIAN
Marketing and development director, Agora

"Today we are betting on more evolutionary planning"

Was the Belval project designed as a smart city or eco-neighbourhood?
The first conceptions of Belval date back more than 20 years. At the time the debate was more about the rehabilitation of a wasteland, a big first in the Grand Duchy, than about any notion of a smart city or eco-neighbourhood as these ideas were not yet very developed. We succeeded in demonstrating that from a technical, environmental and economic point of view, this piece of land had the capacity to host new activities, including residential, and that it could also contribute to changing the image of the region. Belval then emerged as both an audacious and voluntarist urban project. To be convinced of this, you just need to look at the 11 criteria that Agora set itself to develop the project: diversity, simplified orientation, short paths, connection of buildings with public space, sustainable construction and energy supply, integration into transport policy and spatial planning.

And the future Schifflange neighbourhood?
The Esch-Schifflange site is directly connected to the Esch and Schifflange town centres. Urban issues are therefore very important. Because we are twenty years later than Belval, the pattern of development will be different. Where in Belval we chose to refer to a very detailed master plan, today we are betting on more evolutionary planning. This is the whole exercise in which the teams of planners we engaged are currently competing. This new approach is accompanied by environmental, social, urban and architectural prerequisites that are more varied and more demanding than twenty years ago. Legislation imposes it, behaviours evolve, requirements are more demanding and new techniques appear.

What are your sources of inspiration for designing a neighbourhood 'from scratch'?
Our sources are multiple. We do not prohibit anything. On the contrary. We look at what is happening elsewhere and take the pulse of trends. We consult experts from all areas: urban planners, architects, landscapers, experts in transport, sustainability, ecology or urban sociology .... At major international property fairs, we are systematically in contact with major cities that are developing new neighbourhoods on innovative themes. During the spring, we will go on a study trip to Copenhagen, which is at the forefront of 'smart green cities'. Finally, we must not ignore the population. It has a say and suggestions to make. The people who live in the neighbourhood can best express their needs.

INTERVIEW
MARC FLESCHEN
Président, Zero1

“Connecting people without compromising eco-responsibility”

What theme is your start-up working on?
Zero1 is working on the issues of connectivity, communications infrastructure and wireless networks. For several years, wireless networks have evolved very little. They have certainly been optimised but have experienced little disruptive change. Today, we face challenges that we did not consider a few years ago such as the impact of radio waves on health or energy consumption allied to all these wireless relays and access points. The real challenge will come from all the devices we will want to connect in the future because we will have to open up new radio waves and climb into frequency ranges that will start to cause health problems. This is without even mentioning the saturation of the frequencies. Zero1 is one of the leaders of a disruptive alternative technology proposing a new communi-cation network: the LIFI, that is to say Light Fidelity: the wireless internet passing through the light of LED lamps. This technology is faster, emits no radio waves because it is light pulses and saves energy because we use LEDs already placed in buildings or streetlights. It's like, if you can imagine it, fibre optics without fibres...

What applications do you think your work might find in a 'smart' city?
If you imagine that the smart city of tomorrow will be ultra-connected, managing a fleet of driver-less cars and allowing all residents to be connected to broadband, LIFI can help the communication infrastructure. Thus, thanks to their LED headlights, driver-less cars could communicate with each other and transmit crucial information at the speed of light and without delay. Then, in order to create an intelligent traffic system, all traffic lights and signalling equipment could transmit information to driver-less cars thanks to LEDs. You can easily imagine that a traffic light could send information through the red LED to stop the vehicle - something that seems simple for us today but is impossible to achieve for a driver-less vehicle. Street lamps are changing. LEDs won't just save energy but tomorrow could also become wireless access points for pedestrians in the streets. Public places such as airports, museums, shopping malls, hospitals will be able to use the LED lights already in place to connect the largest number of people to the internet without waves and without increasing energy needs. This technology of the future is still in its infancy, but in the long term it offers the prospect of connecting more people and objects to the internet without compromising eco-responsibility.

Photo: BusinessDestination

03.

limited just to innovative technologies. Might we conclude that the truly intelligent city will have to harmonise the cohabitation of people, nature and technology? The future will tell.

NEOM, STOCKHOLM, BARCELONA - SAME FIGHT?

Having a totally blank page in urban planning is rare, and almost non-existent in Europe. But other regions of the world present examples of cities developing out of nowhere that have adopted ‘smart’ tools right from their conception. This is the case with Neom, in Saudi Arabia, which owes its name to the association of the Latin *neo* with the initial letter ‘M’ of mostaqbal (‘future’ in Arabic). The project, which is sprouting out of the desert and whose first neighbourhoods are expected to be finished in 2025, focuses on broadband, wireless, and free internet, as well as an overall concept of e-administration. It is a very specific vision of a smart city but its barely imaginable size - the city is supposed to occupy 26,000 km^2 - casts doubt on the quality of life of

03. Songdo, a city in South Korea, has been fully developed on the principle of smart cities thanks to a network of sensors to control every aspect of city life: waste management, traffic, water supply, energy efficiency and sustainable development. The backbone of the city is a central park, crossed by an artificial canal, lined with attractions for families.
04. Building design represents an important part of the thought-process for creating cities of the future. The choice of durable, removable and recyclable materials is becoming the norm, while the integration of vegetated surfaces is becoming more and more common. These contribute to the filtration and reuse of rainwater, have an influence on regulating the temperature of the building while contributing to the fight against global warming. Some of these vegetated surfaces can even be conceived as veritable urban farms.

Photo : Yvan Glavie

04.

its future inhabitants. A similarly hyper-connected model is the city of Songdo in South Korea, built on land reclaimed from the Yellow Sea, which is home to 65,000 inhabitants. This city is completely under surveillance via security cameras, which film almost everything. In Songdo, all residents are automatically connected to everyone else, as well as to the stores, by an Internet network. It is therefore possible to book goods and services, or arrange services between neighbours, without leaving home. Songdo is nonetheless ecological, with a central park, many bike paths, and river taxis. The rooves of buildings are covered with vegetation and solar panels. It is the first city in the world to have only buildings of high environmental quality (HQE). The city is also a model for its system of collecting and filtering rainwater, which is located under the golf course, and for its waste collection system that functions by underground suction, which in turn produces electricity. The flip side of this coin was the destruction of a natural ecosystem that was home to several threatened species of bird.

Other cities of the future have been imagined in many places around the globe by net giants or wealthy businessmen. In the United States, Bill Gates has a project for the Arizona desert and in Canada, Google is working on a neighbourhood in Toronto. In Asia, cities of this new type are also growing. Those initiated by the major players in the Internet are controversial because the dimension of 'data collection' is almost omnipresent. These projects do not seem to correspond to what Europeans mean by a smart city. On the old continent, human and environmental dimensions – particularly the search for solutions that do not concrete over ever more land taken from nature – are put forward much more often.

MORE COMPLICATED BUT NOT IMPOSSIBLE

The European continent has many old cities whose architectural heritage is precious. However, it is not necessary for a city to be new to integrate smart technologies that improve life in the city. Santander in northern Spain is a good example. Its origins date back to Roman times and it now has nearly ▶

The smart city has its international congress

From 19 to 21 November 2019, Barcelona will host the Smart City Expo World Congress. This event, annual since 2011, is the meeting place for policy makers, entrepreneurs and researchers to share inspiration and increase their collaboration to support better urban development. This year, the theme will be 'Towards Zero Waste'. For the first time this year, the Luxembourg Chamber of Commerce will set up a 150 m2 national pavilion to welcome Luxembourg companies wishing to exhibit their innovative solutions.

For more information:
International Affairs
Luxembourg Chamber
of Commerce
Contact: smart-city@cc.lu

05. The smart bins in Los Angeles combine several advantages: the energy provided by the solar panels on their lids is used to continuously compact the waste, thus greatly increasing their capacity. The smart bin communicates information on its fill rate to enable on-demand collection and thus alleviates traffic by eliminating unnecessary garbage truck trips. These bins also have the advantage of raising public awareness of the need to sort waste.
06. The intelligent bus shelter created by JC Decaux for the city of Paris displays bus wait times on a screen that can be seen from a distance. It also has touchscreens and a 42 inch screen with 16 Android apps that make moving around the city easier by providing useful information, such as where to find businesses in the vicinity, restaurants, tourist attractions, cultural sites … and getting help in case of emergency. Screens also display a news feed, job announcements, and photos from the city archives. As a final touch, the bus shelter also offers USB ports for charging mobile devices.

Photo: JCDecaux

05.

200,000 inhabitants. Its metamorphosis was decided on in the late 2000s and, since 2009, 20,000 sensors have been installed to make the city smarter. Their applications are multiple. Sensors measuring the degree of moisture in the soil of public parks can trigger automatic watering at a certain degree of dryness; others, integrated in street lighting, light them up only when pedestrians are present. Far from being a gadget, this measure saved 80% of the city's electricity costs. Other sensors, integrated into rubbish skips, send a signal when they are full, which optimises route planning for the collection trucks. Finally, an application that couldn't be more useful in an old town centre with narrow streets: parking spaces are equipped with sensors allowing motorists to be automatically guided to free parking spaces.

Also in Spain, one of Barcelona's former mayors launched the Fab Cities network in 2014, proving that one can be the head of a city several hundred years old and still apply new ideas. This network has 28 member cities on 5 continents. Their common peculiarity is the challenge they have set themselves to produce all of what they consume by 2054. To achieve this, these cities will have to make full use of the combined possibilities of the circular economy, resource optimisation, and energetic frugality.

URBAN LABORATORIES

Halfway between the entirely new cities that integrate smart concepts in their design and the old cities that use the possibilities of new technologies to modernise their management, are the eco-districts: open-air laboratories for innovative urban solutions. These are blooming everywhere, when urban space is freed up, for example, on old industrial or military sites. These types of projects are planned over the long term. It is not uncommon for twenty years to pass from the time of conception to the arrival of the first inhabitants. These new neighbourhoods are an opportunity to test new transportation solutions, or innovative, evolving, dense, or multi-usage habitats. There are many examples of these neighbourhoods reinventing the city of tomorrow. Among the oldest are three districts in the German city of Tubingen. One of them is car-free, the second one

Photo : Big Belly

06.

emphasises the social dimension with a large population mix and the establishment of systems for sharing and mutual aid, and the last favours ecological aspects, with corridors of air and the carefully studied orientation of building facades regulating the temperature. The three neighbourhoods of the city are meant to be a common good and not a profitable commodity. A very recent example, in France this time, is the district surrounding the new High Court, built on former rail yards west of Paris, and the fruit of a co-design by public and private sectors. A 16,000 m2 building will house mixed, hybrid, and non-specialised, modular, and evolving spaces as well as an urban kitchen garden on the roof. The offices occupied by the court's lawyers during the day will become hotel rooms at night, for a better use of the building and the guarantee of having a living district at all hours.

LUXEMBOURG'S ECO-NEIGHBOURHOODS

In Luxembourg, Belval, which was first conceived over 20 years ago, can be considered as the first attempt to build an eco-neighbourhood given the principles ▶

INTERVIEW
GILLES DOSTERT
Managing director Verkéiersverbond

“Move intelligently”

In Luxembourg, transportation has become one of the key issues for the future development of the city. How do you approach this problem?
There is no single solution to tackling the growing challenges of transportation in Luxembourg. Not everyone has the same needs. We try to think of individual solutions based on people's daily journeys taking into account their preferences and accessibility of different modes of transport. We need to make people aware of these issues so that they ask themselves how they might get around and plan their journeys before automatically jumping into their car. To this end, we are launching a number of tools and initiatives, such as the annual 'Mam Vëlo op Schaff oder an Schoul' campaign (By bike to work and school), which aims to get people to use their bicycle rather than their car to get to work or school for at least 15 days. This action allows us to draw attention to alternative modes of transport, such as cycling, that can be integrated in our movements.

Among the tools for addressing transport difficulties, you are working on a multi-modal travel planner. Can you explain the principle to us?
This new application 'mobiliteit.lu' relies on the user personalising the service and offers intelligent and relevant multi-mobile journeys thanks to the 'My Mix' tab. It allows users not only to combine bus, train, tram, car, bicycle and walking, but also includes information on 'electromobility', the combined offer of P+R and self-service bicycles, public transport and the traffic situation and possible problems in real time. Thanks to the integration of all these modes of transport, everyone can create their own transportation chain adapted to their own personal needs. For example, everyone can know that they can walk 10 minutes to a self-service bike station, how many bikes are available, whether the ride includes hills, what time the train is, if the bus will be late, how long this route will take depending on the departure time ... To maximise the potential of the application, the Verkéiersverbond is working closely with partners such as the Bridges and Roads Administration, the Cadastral and Topography Administration, the municipalities and the ACL, as well as transportation service providers, such as Chargy charging stations for electric cars or Vel'OH and Vël'OK self-service bicycle systems. The panoply of functionalities will be able to expand further to cross the borders of the country. It will enable us to move from point A to point B intelligently.

The smartest cities

The company Easy Park (an application to easily find a parking space in town) published a ranking of the smartest cities in 2017. Having studied 500 cities around the world, judged on the criteria of transport, sustainable development, governance, an innovative economy, and connectivity, their Top 10 is:

1. Copenhagen
2. Singapore
3. Stockholm
4. Zurich
5. Boston
6. Tokyo
7. San Francisco
8. Amsterdam
9. Geneva
10. Melbourne

Photo: Daniel Ibanez

07.

of sustainable development that guided its conception: social and functional diversity, easy transportation, limiting/improving the ecological footprint and citizen participation. However, at the time, the concepts of a smart-city or eco-neighbourhood had not yet developed very much. According to Robert Kocian, Marketing and Development Director of Agora, a company founded in 2000 from a public-private partnership between the Luxembourg government and the ArcelorMittal group to rehabilitate former steel plants, '*The lessons learned from Belval's experience* were invaluable to us when we started a new project at the Esch-Schifflange site. Because we are twenty years on, today we are betting on a more evolutionary planning approach, which can adapt to the time, circumstances and new trends and opportunities that will inevitably appear over the next twenty to thirty years. We will have to ask ourselves how to optimise the utility of each piece of infrastructure. We will also have to ask ourselves how housing can evolve. What can new technologies bring us in terms of services and social links? This is also why we will rely on future intelligence, going beyond what we ourselves can put in place at the moment of conception'.

Other new neighbourhoods will be pilot projects for reinventing city life: the North Kayl district; the Wunne mat der Wooltz district in Wiltz, which aims to operate on the principles of the circular economy; and the '*Lentilles Rouges*' neighbourhood in Esch-sur-Alzette, which is exemplary for combining functions (housing, recreational areas, green spaces, shops), but also in terms of sustainable development through renewable energy, rainwater harvesting, as well as a ratio of private spaces (housing and businesses) to collective spaces (public spaces and green spaces) of 40/60.

The City of Luxembourg has meanwhile decided to dedicate a plot of 7,000m^2 in the heart of the Limpertsberg district to experiment with a new way of living in the city without cars. This frees up urban space for other functions, such as green spaces (including an orchard), and spaces for recreation, while reducing the cost of construction (saving by not building garages and parking spaces), while reducing the concreted over surface area. Another advantage, this

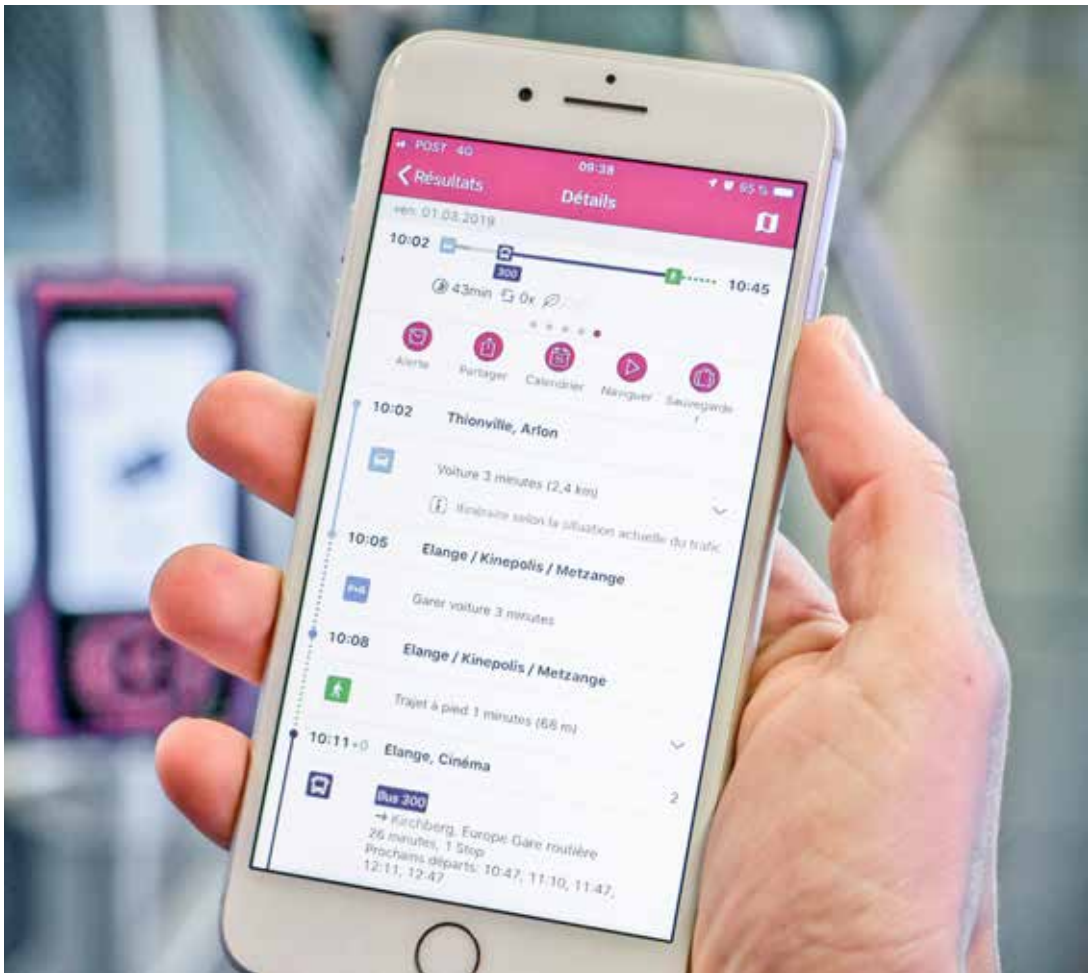


Photo : Verkéiersverbond

08.

07. The FabLab House in Barcelona (102, Carrer de Pujades) is an autonomous experimental building that produces twice as much energy as it consumes. It has state-of-the-art machinery for making tools and everyday objects. This 'house' has been designed by architects from more than 20 countries and developed by the Institute of Advanced Architecture of Catalonia (IAAC), the Center for Bits and Atoms of the Massachusetts Institute of Technology (MIT) and the global network of Fab Labs, as well as by private companies.

08. The Verkéiersverbond, a public establishment whose main mission is to improve the coordination of Luxembourg's public transport network, is finalising a new version of its Mobiliteit.lu planner to include all types of transport, including walking, cycling and the car, in addition to the trains, tram and bus already taken into account by the application. Each user will also be able to customise their results by setting their preferences.

new neighbourhood is preparing to accommodate a relatively large number of new residents without generating additional traffic. This project is made possible only because it is part of an urban fabric, Limpertsberg, already very well endowed with local services and shops.

NEW BIOTOPE FOR HUMANS

These examples show how closely the different dimensions of a city's living space are intertwined and how important it is to think about them holistically. Designing the city of tomorrow is not just about organising space and different construction works but about transportation, water and energy management, waste management, the place of nature and ecology, and about the social links between individuals, and between individuals and the city's governance. The trend in smart cities is to approach these points not as isolated subjects, but on the contrary in interactive and concerted ways. For example, waste treatment can be grouped together with energy. This is the case in the eco-district of western Paris previously mentioned. Waste is collected there, in a discrete and odourless way, by a 5km-long underground pneumatic network directly connected to the sorting and compaction plant. Depending on its nature, this waste is then recycled or incinerated. This operation produces both steam to supply district heating and residue to be used in road construction. Result: less pollution because there are no garbage trucks, and energy and new materials are generated by burning waste.

The way buildings are designed also has a huge impact on energy consumption. By designing buildings whose shape and orientation aim at energy self-sufficiency by self-regulation of temperature or light, contemporary architects are already creators of the habitat of tomorrow. In the smart city, some approaches go further by integrating into buildings real spaces of nature, even urban agriculture, fed by rainwater for example, which can serve as a meeting place for occupants while contributing to the fight against global warming. Multi-use is indeed one of the keys to the necessary frugality in resources that feeds the inspiration of smart cities. This same logic pushes some eco-neighbourhoods to directly ▶

Photo: LaLa La photo / Maison Moderne

INTERVIEW
SERGE WILMES
First deputy mayor of the city of Luxembourg

Making Luxembourg a good place to live

The city of Luxembourg has experienced strong growth in recent years and faces many problems (housing, transport, public spaces, energy, services, parking ...). On which themes do you hope to find answers to the challenges of sustainable development? How is the city preparing to become intelligent?
Housing and transportation are among the major challenges that the country will face in the coming years. The main priority is that the city will have to create affordable housing, which will have a direct impact on improving mobility. Housing, work and leisure have to be concentrated in the capital. There are approximately 180,000 jobs located in the City of Luxembourg while its active population is 50,000 for 116,000 inhabitants. So, every day 130,000 people enter the capital to work here. This huge imbalance is the main cause of traffic problems. To solve this problem, some of these commuters must be able to move to the city. This problem is true all the more as we still expect the population coming to live in the city to grow. We want to be able to guarantee a good quality of life for all the citizens who live and work here. We are doing a lot of work in this direction to improve travel in the city, fight against waste, treat wastewater, offer access to new technologies, but Rome was not built in a day! Then, there is not an established single model for a smart city, for that, we are working to create our own smart city strategy and we want to involve the population living in the different neighbourhoods of the city by inviting them to meetings and taking account of their comments to develop the different public urban developments.

How do you imagine the smart city of Luxembourg tomorrow?
In developing our strategy, we can say that the model that inspires us the most today is Vienna, bearing in mind the proportions, as Luxembourg City is not a huge metropolis. So, we will try to make Luxembourg a city where there will be green spaces, where the living environment will be harmonious, less polluting and even more sustainable. Our goal is not to climb the rankings of smart cities, but to offer a city where life is good. If we succeed in this endeavour, then we can say that Luxembourg is a smart city.

Photo: Creos

09.

empower residents by providing them with tools to measure their consumption in real time, such as in the Confluence district in Lyon (France).

TRANSPORTATION IS A TOP PRIORITY

In Luxembourg, one of the key topics is undoubtedly transportation. In this field 'intelligence' means 'efficiency' and 'efficiency' means saving time and space and reducing pollution. This efficiency not only involves the development of new forms of transportation but also better management of the car in the city and therefore, among other things, parking. This can be done through the design of next-generation car parks, which prioritise stacking rather than sprawl, but also by new applications guiding drivers to available spots – which avoids the pollution and the traffic generated by cars turning around indefinitely looking for a space – or by access to fleets of shared vehicles. At the 10th International Symposium on Smart Cities held in Belval on 5–6 March 2019, Francesco Ferrero, a researcher at the Luxembourg Institute of Science and Technology (LIST), protested that '*cars are used on average 5% of the time. This absurd situation cannot last*'. Even more so, he continues, because '*in the era*

09. By 2020, Luxembourg plans to be equipped with a network of more than 800 charging stations for electric vehicles. Electromobility is one of the priorities of the Ministry of Mobility and Public Works. Half of these kiosks are in Park and Ride type car parks and the other half are installed in municipal public car parks. Eventually, each municipality must be equipped with at least one terminal (two charging points) close to points of interest such as activity areas, schools, businesses, the town hall or other government departments.
10. Since September 2018, a new type of vehicle completes the range of public transport in the city of Luxembourg. The driver-less Shuttle City in Pfaffenthal connects the funicular to the cemetery of Val des Bons Malades and thus demonstrates its effectiveness in covering the first (or last) kilometre in the context of an old urban centre where some places are not very accessible for vehicles of bigger size.

Photo : Catherine Moisy

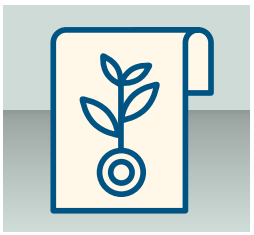
10.

of e-commerce, streets and roads are also crowded with delivery vehicles.' According to him, the solution lies in seeing transportation as a service, i.e. adapting the type of transport used to each situation (short or long journey, baggage or not, individual journey or transport of several people ...) thanks to shared fleets of different types. In Luxembourg, the city of Dudelange has applied to integrate MUV (Mobility Urban Values), LIST's research programme which consists of using co-creation with users and 'gamification' to induce new behaviours regarding transportation. These tools are designed to interact with other systems, such as the multi-modal travel planner now being developed by the *Verkéiersverbond*.

The development of our transportation habits will necessarily impact urban space itself. The growing number of electric vehicles, for example, will lead to a thought process concerning the best locations for charging stations. These could also play a role in boosting the attractiveness of certain businesses or places of leisure, by offering the user the chance to mix business and pleasure by satisfying two needs at a time. The expected arrival of autonomous vehicles will also bring new challenges. Here again, Luxembourg is not being left out with Sales-Lentz testing a driver-less shuttle in the Pfaffenthal district.

GAME FIELD FOR RESEARCH

The themes related to smart cities and new ways of designing urban housing open up a field of possibilities for the world of research and not just for researchers. Indeed, research and innovation can take the form of alternative projects, carried out by citizens wishing to change the world, or at least the world around them, immediately. This is the case of Aerdschëff, driven by Katy Fox, a young initiator of the Transition Luxembourg movement, who has just obtained authorisation to develop an experimental habitat on a site in Redange, where she intends to prove, with her team, that it is possible to design buildings fully autonomous in water, energy, sanitation, and even in food production. In the various research institutes in Luxembourg, many teams are working on different aspects of the cities of tomorrow. LIST has been collecting, storing, and using city management data for the last 10 years and has conducted several research projects, in addition to the already mentioned MUV project. Among them, 'Connecting' aims to cre- ▶



Charter of Eco-neighbourhoods

The French Ministry of Housing and Sustainable Habitat has published guidelines to evaluate eco-neighbourhoods. It lists 20 commitments to be respected to be able to claim the title. These are divided into four main categories: design and process; living environment and uses; land development; environment and climate. The 20 commitments cover all questions relating to new life in the city, from the requirement to 'realise projects that meet the needs of all', to the 'preservation of biodiversity', through to 'a living environment that integrates major health issues' and 'optimal use of resources'. In short, this ambitious document is a good checklist for inventors of the cities of tomorrow.

Plan: helsbourg strotz architectes

11.

ate a tool to assess the environmental impact of different transportation options; the 'Success' project is behind several types of software aimed at helping urban decision makers to optimise projects in the fields of construction, logistics or transport; and lastly, in the field of smart technologies, LIST also runs two programmes concerning energy efficiency. For its part, LISER is working on transportation with the Mobitweet project, which aims to analyse the experience of urban transport users in the Greater Region by analysing messages posted on Twitter. The advantage of this methodology lies in its duration, the data being collected every day for two years.

OPPORTUNITIES FOR BUSINESS

The solutions being studied in the R & D departments of some of the world's leading companies are the stuff of dreams. Some work on the concept of heated outdoor floors, to be activated in case of snow, or soils that can change colour depending on the changing allocation of a space, or retractable rain shelters, which would come out of pavements in case of bad weather, all of which operate using sensors. According to US consultancy Grand View Research, the global smart city equipment market is expected to grow to $1.4 trillion by 2020. Another source says $3.7 trillion in infrastructure investment will be needed between now and 2030. It is therefore a huge global market. Jean Schiltz, Deputy Director for Smart Mobility at the Ministry of the Economy, underlined during the 10th international symposium, that technologies used in smart city projects are '*at the crossroads of several industries*'. If we take the example of mobility, new solutions involve both the manufacturers of physical infrastructure (roads, streets, railways …), those of digital solutions, those of products (vehicles in particular), and those who offer the services intended to make the new solutions available to users (web platforms, …). Collaboration is therefore to be encouraged. But since we also need to connect new entrepreneurs with large companies, the Luxembourg Open Innovation Club (LOIC) and Enterprise Europe Network (EEN-Luxembourg) organised an event in December 2018 dedicated to smart city solutions and

Photo : House of Startups

12.

11. The plan to develop Wiltz's new district Wunne mat der Wooltz shows the desire to balance areas dedicated to buildings, nature, leisure and traffic. The future district should accommodate 1,800 residents. Its urbanisation concept provides for the re-wilding of the Wiltz River, reduced use of the car, and the creation of spaces for social interaction.
12. On 20 November 2018, the Luxembourg Open Innovation Club (LOIC) organised a workshop on smart cities, bringing together European startups and established businesses to share innovative solutions for the city regarding data collection, management of car-share vehicles, intelligent parking, construction, Li-Fi… . During the event, Eric Dubois (photo), director of the IT for Innovative Services (ITIS) department at the Luxembourg Institute of Science and Technology (LIST), presented the smart city vision of Luxembourg.

transportation. No fewer than 31 European start-ups responded to the invitation and 10 of them were able to present their solutions during the workshop.

For years, several companies in Luxembourg have been working on these topics of the future, whether start-ups or more traditional companies surfing the waves of technological change. In the field of transportation, particularly important for the country, we can mention Sales-Lentz which is developing driverless public transport vehicles and Ujet, a Russian company that is developing in Luxembourg a model of a 2-wheeled electric vehicle, foldable and easily transportable. As far as start-ups are concerned, Mileswap is developing a car-sharing platform linking individuals, and Moovee is offering a rental and maintenance platform for electric vehicles (cars, bicycles, scooters, etc.). In the field of construction, projects are also multiplying under the impetus of LUSCI (Luxembourg Smart Construction Institute), which delivers training dedicated to smart technologies, and Neobuild, a pole of innovation in sustainable construction. The Nesto pilot residences (Wiltz, Differdange and Nonnenwisen) are among the first examples of different constructions combining technology, ecology and moderate rents, and which succeed in reconciling modernity with environmental and social dimensions.

Is there nothing but happiness to expect from the coming revolution in city life? It seems that the answer is more nuanced. Points of vigilance accompany the movement, first and foremost the significant energy consumption induced by the proliferation of sensors and connected objects of all kinds that must communicate our data to better manage the urban space. Then the vulnerability of an 'everything connected' society vis-à-vis cyberattacks and the preservation of privacy. One can still ask how the evolution of cities can integrate the protection of our ancient built heritage. Another question: who will have ultimate responsibility for these issues that are reshaping our ways of living together? State, municipalities, citizens? Many researchers seem to think that success is based on putting people at the heart of the process. ●