Networking the world

By 2050, 70 percent of the world's population will live in cities. So-called smart cities are designed to meet this challenge, with benefits for governments and citizens.

Where electric cars will roll though the city in the future, construction workers with heavy equipment are still working on the vast - all under the blazing desert sun of Abu Dhabi. The hot sun shouldn't be much of a problem for the 40,000 future inhabitants of Masdar City, however. Thanks to sophisticated planning, intelligent technologies, and shade-optimizing building arrangements, this area near the airport should soon be a CO_2-neutral oasis: buildings will be cooled by geocooling instead of air-conditioning systems and individual vehicle traffic will be banned from the city. Instead, six-passenger people movers will bring people to one of more than a thousand selected destinations in the city.

Cities like Masdar may sound like a pipe dream, but in fact they have been a reality for some time – take New Songdo City in South Korea, for example, which lies 40 km southwest of Seoul, or the Fujisawa Sustainable Smart Town near Tokyo. These show the technical possibilities and act as playgrounds for companies testing a wide range of new urban optimization technologies. According to the consulting firm of Frost & Sullivan, there should be 26 new smart cities around the world by 2025, most of these in Asia.

Half of the world's population already lives in cities, and this number will rise to 70 percent by 2050. This trend will also affect European metropolitan areas such as Vienna, which will grow to more than two million inhabitants by 2029. To meet these challenges, an increasing number of municipal governments see the smart city as the solution. It is a legitimate approach, as the Swiss architecture critic Hans Frei points out: "This can be achieved only with intelligent technologies that promise efficiency, sustainability, and cost savings."

Everything is networked, and cameras monitor what goes on in the streets. Every day, millions of datapoints are measured, fed into the system, and responded to in real time: weather data, energy and water consumption, building temperatures, air quality, traffic movements. All of this data is used for analysis and optimization.

INTERNET OF EVERYTHING.

New Songdo City is a prime example for this concept. There are already 25,000 people living here, and that number is planned to rise to 70,000. The construction of this 40 billion dollar city began in 2003 based upon plans drawn up by the New York architecture firm Kohn Pedersen Fox, while the technical know-how was provided by Cisco. Thanks to total networking, the "Internet of Everything" is a reality here.

Residences are equipped with an interactive communication device that constantly delivers precise information for all the inhabitants – and tells the city government everything about its citizens. Rooms are heated as soon as people enter them, street lighting turns on only where needed, and traffic lights are switched based upon traffic volume.

This is made possible by millions of sensors that supply real-time data around the clock and initiate a prompt response. This enables the city to use 30 percent fewer resources than conventional cities.

It is also possible thanks to a smart disposal system. Garbage is transferred through pipes directly into a subterranean disposal system, where it is automatically sorted, recycled, buried, or burned for energy recovery. The entire city's waste management is managed by just seven people.

CITIZEN SERVICE.

Compared to these efforts, smart city attempts in Europe are great deal more modest. As Ulrike Huemer, CIO of the city of Vienna explains it, they didn't want to simply throw every possible innovation at the citizenry. Moreover, networking an existing city is naturally much more complex than simply building a new one. Nevertheless, the topic of the smart city is right at the top of the agenda in cities such as Vienna, Barcelona, Helsinki, and Copenhagen.

"Other Austrian cities hardly play a role here at all anymore," says Bernard Krabina of KDZ - Centre for Public Administration Research. Individual applications are gradually making headway in the bigger cities. "Technologies are the prime focus in Asia, whereas here the focus is on the citizens," explains Huemer. The goals are ambitious. By 2050, the current CO_2 emissions of 3.1 tons per capita should be reduced to one, 50% of energy should originate from renewable sources, and all vehicles should be using alternative drive technologies.

In 2011, for example, Vienna became one of the first cities in the world to make its data publicly available: geodata, traffic and environmental data, budgets, and statistics can be accessed and used by anyone. This has resulted in 186 new services and apps such as "Quando," which determines the user's location and displays the departure times for all public transportation in the area. An administrative app that allows users to draw queue numbers for government offices or obtain services based upon their specific life circumstances is currently in operation, as is an app called "Smile," which is designed to cover all means of transportation in the city. This is modeled on the Israeli city of Tel Aviv. Since 2013, that city has been using the DigiTel app (see box), which provides access to all of the city's service offerings.

The Spanish city of Santander has similar programs. It was selected by the EU as a model smart city in 2010, and receives 11 million euros in subsidies for its Living Lab. In this project, 12,500 sensors monitor the inner city: from the amount of trash in trashcans to the number of open parking spaces and the number of people on the streets. Using this information, the city government generates real-time data on energy consumption, controls the sequence in which garbage trucks empty trashcans, or anticipates the expected water consumption by lawn sprinklers in the parks.

The project was started by embedding sensors in the asphalt. "People were able to avoid traffic jams and find open parking spaces more quickly using an app. This reduces traffic and thus pollution from car exhaust," explains project manager Luis Muñoz. Using an application that was already successfully tested in London-Westminster, sensors in Santander's streetlights know whether full lighting or only dim light is necessary at any given time. In this way, the city saves 25 percent of its energy costs and 20 percent of its trash removal costs. Using the "Pace of the City" app, photos documenting damage in the city can be sent directly to city government. This information goes straight to the office responsible for repairing the damage and to the politically responsible individuals. All of these data are public, which speeds up repairs.

"The more people use these services, the smarter the city becomes," says Muñoz.

DATA SIMULATION.

In Vienna there is as yet no interest in an all-encompassing sensor network. Instead, the city is the first in the world to test out the City Performance Tool (CyPT) developed by Siemens. This is based on 400 datapoints from the areas of energy, traffic, and environment. "If we want to reduce CO_2 emissions, the program first uses the data to calculate how emissions would grow over the next two years if no action were taken. If you change a few parameters, the program simulates which steps can be taken to improve the situation," says Klaus Heidinger, Head of City IT Applications at the Siemens Center of Competence Cities in London. The application is free, but the company is of course hoping for subsequent orders.

With a projected volume of 1.5 billion dollars by 2020, the global market for smart city technologies is enormous in any case. The Japanese firm Panasonic has already created the Fujisawa Sustainable Smart Town on its own, building a smart city from scratch for 3,000 inhabitants. Electricity is collected using photovoltaics, hot water is supplied through heat pumps, and a battery system saves the energy surplus. CO_2 emissions are almost zero. This is also because daily electricity and water usage flits across the screen in the living rooms of each house, and is compared with the neighbors' usage.

Fujisawa may be an extreme example, but sociologists are worried that while cities are becoming more intelligent, inhabitants are seeing their personal decisions being taken out of their hands. City planners are also struggling against corporate-dominated urban planning. For example, Hans Frei notes that infrastructure solutions are being offered, but social problems are not even touched upon. A small city like Fujisawa may be smart, but the intelligent city of tomorrow makes no promises as far as personal freedom is concerned.

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AMBITIOUS GOALS. The heat in Abu Dhabi makes strolling around outside during the day next to impossible. In Masdar, however, the construction of buildings should keep the temperatures at a constant 20°C below their usual level. Buildings are designed so that they shade each other and also provide shade for walkways.

USING RESOURCES. Outsized sunscreens in public spaces provide shade and save heat during the day. In the evenings, they are folded up and give off heat during the cool desert nights. Measures such as these should push energy costs down to almost zero.

MASDAR CITY in the desert of Abu Dhabi should become a CO_2-neutral "knowledge-based city" for 40,000 inhabitants by 2030. Vehicles with fuel cells will be a thing of the past here. Thanks to sophisticated planning by Norman Foster, the use of air-conditioning equipment for extreme cooling, a common phenomenon in the Arab region, will also disappear.

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FUJISAWA SUSTAINABLE CITY. In Japan, Panasonic has built a sealed-off, energy-independent city for 3,000 inhabitants. The houses produce the necessary energy themselves, while the central government office monitors usage to make sure no one unnecessarily wastes electricity and water.

SMART SANTANDER. The Spanish city serves as a Living Lab for smart city applications in the EU. Sensors distributed throughout the old town monitor what goes on in the city (see graphic). The city government responds.

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SUSTAINABLE TRANSPORTATION. In Masdar City, six-passenger people movers will replace cars. Vienna also plans to ban internal combustion vehicles by 2050.

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NEW SONGDO CITY. 25,000 people already live in this South Korean smart city. The technology firm Cisco ensures controlled and optimized processes by means of thousands of sensors. This allows the city to use 30 percent fewer resources than traditional cities.

CENTER FOR INNOVATION.
Working on the model of a midsize American city, the US state of New Mexico is creating the first large-scale test laboratory where companies, universities, and public institutions will be able to test self-driving cars, smart electricity supply, or logistics drones in the future.