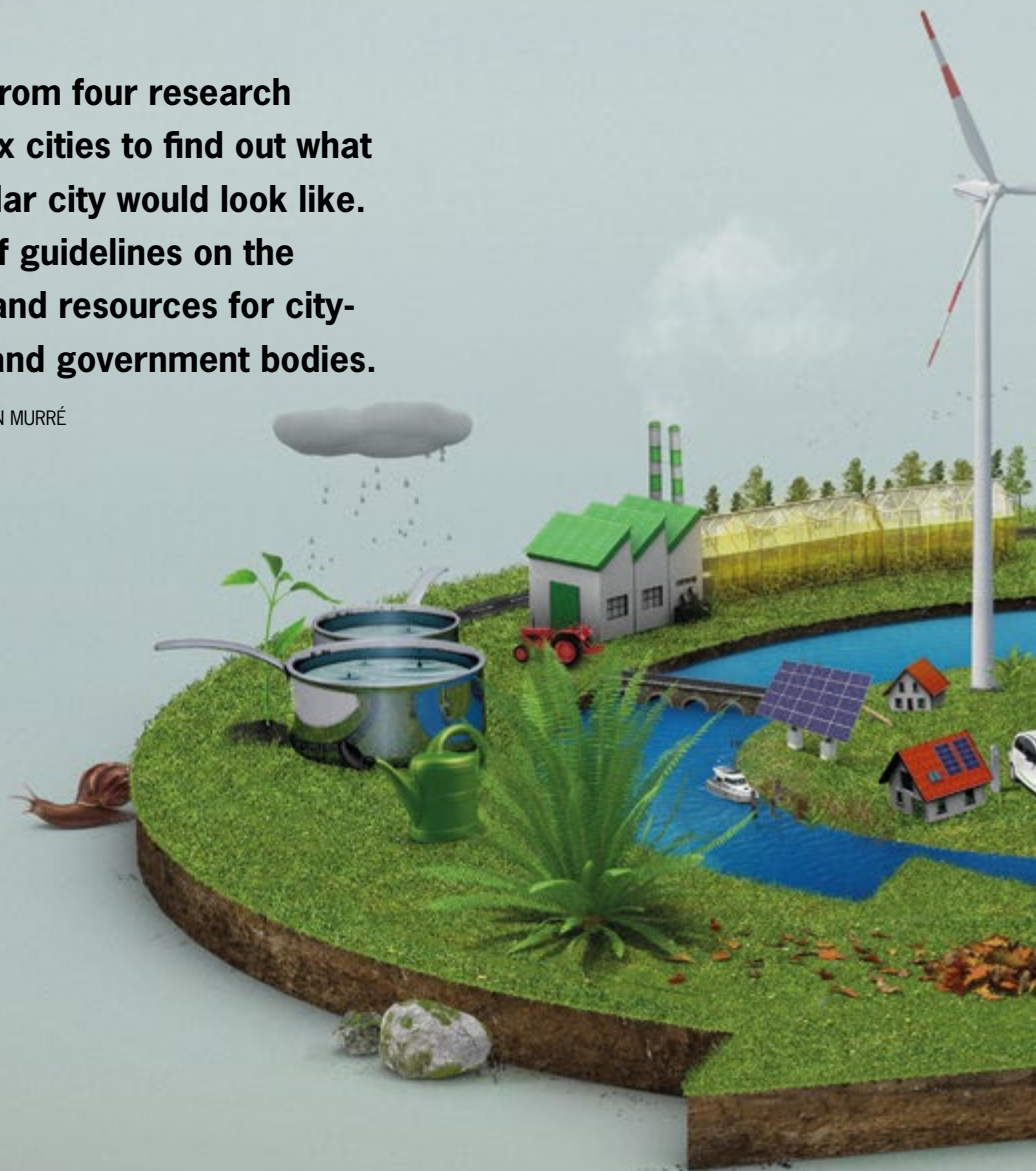


CIRCULAR ADAPTIVE CITIES

# Sustainability comes to town

**In 2015 researchers from four research institutes set off for six cities to find out what a climate-proof, circular city would look like. The result was a set of guidelines on the rational use of water and resources for city-dwellers, businesses and government bodies.**

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## ‘We must make sure all the good ideas don’t just evaporate’

The world’s cities are facing complex challenges. Not only must they accommodate more and more people, but they also need to deal with climate change and growing shortages of energy and resources. It is becoming more and more common for torrential rain to cause disruption in public spaces. Besides, cities are massive energy guzzlers, consume vast amounts of resources and generate mountains of waste. When it comes to sustainable energy, energy-saving and recycling, there is vast room for improvement in homes and business premises.

Nowadays, however, waste counts as a resource that can be converted into valuable products. Waste water can be reused, with fertilizer ingredients being extracted from faeces and urine, rainwater is allowed to filter into the soil to prevent streets from flooding after every shower of rain, and green roofs can store water too. More vegetation on the streets helps combat heat stress, while heat generated by industries can be used for heating houses and offices. The aspirations of cities in this regard are often expressed in catchwords: cities want to be ‘climate-neutral’, ‘emissions-free’, ‘rainproof’ and ‘circular’.

In the Adaptive Circular Cities project, Wageningen University & Research and the research institutes Deltares, TNO and ECN conducted research in a number of cities in 2015, with the aim of putting such ambitious ideas into action. Funding to the tune of 1.3 million euros was available from a Ministry of Economic Affairs fund for strategic research. The ministry sees adaptation to a changing climate and responsible use of scarce resources as crucial investments for cities. What is more, expanding the knowledge base on these topics could help create export opportunities for Dutch companies and institutions.

Project leader Marco Hoogvliet of Deltares, a specialist in water and soil-related issues, talks of a ‘unique collaboration’ between the four institutions. ‘We worked with various disciplines and we’d like to do so again. This project is finished but we are talking about follow-up research.’

### CONCRETE JUNGLE

‘Maybe the cities formulate their ambitions in rather abstract language,’ says Hoogvliet, ‘but what it boils down to is taking steps to make the city resilient and able to cope with climate change using existing techniques and design frameworks and within a given budget. Further goals of these measures are to make sure resources in the urban area are used as efficiently as possible, and to minimize how much the city encroaches on green spaces. The city of the future must not be a concrete and asphalt jungle.’ In 2015, researchers from the four research institutes set out for six urban areas in the Netherlands. One was Buiksloterham, a self-sufficient residential neighbourhood being created on the northern banks of the IJ, a former sea arm in Amsterdam. This 100 hectare area features many abandoned factories from the shipping and machinery industries and has become a breeding ground for socio-cultural initiatives. In Duiven, near Arnhem, the researchers studied a 60-hectare industrial estate which aims to become the most sustainable business park in the Netherlands. Wim de Haas of Wageningen Environmental Research (formerly Alterra) is delighted with the 30-odd studies carried out in the course of just one year at the six locations. De Haas coordinates the ‘water, food and energy’ component of the project. ‘The various studies constitute 30 pieces of a large puzzle made up of maybe 500 pieces that form a picture of a climate-proof circu-

lar city,’ he says. ‘That gives us some of the answers, mainly to technical aspects of a climate-proof and circular city,’ says De Haas.

‘One nice result of this is a new form of monitoring which cities and/or their residents can make immediate use of. With this monitoring you can map out the energy use and waste production at the neighbourhood level. Technical interventions which then reduce that energy use or waste production, or make it more sustainable, are decisions that can have far-reaching consequences,’ says De Haas. ‘Up to now, for instance, infrastructure has been created in every neighbourhood for natural gas, sewage pipelines and sometimes for heating if there is a heating grid accessible, as there is in Amsterdam. But the question is whether you need natural gas in new neighbourhoods if they are on a heating grid and if enough solar panels can be installed on the roofs.’

### COCKTAIL

These kinds of questions are more than just technical, they also touch on governance processes, the interests of companies and the concerns of residents. De Haas: ‘In the old days the town planning services just said: “This is what we are going to build, and we’ll build it there and there.”

Nowadays there are new relationships between government bodies, industry and citizens. In Buiksloterham, for instance, the initiative does not lie directly with the municipality. But implementing bodies such as the water board Waternet, the energy company AEB and two housing cooperatives are intensively involved in the cocktail of plans developed by residents, advisors and artists.’

Self-build projects, second-hand stores, greenhouses that produce food using ferti-



lizer obtained from toilet waste from the neighbourhood, solar panels and roofs that store rainwater: these are just a few of the many exciting ideas being experimented with in Buikslooterham. But these myriad blooms do require a bit of structure to form a bouquet that is not just harmonious but also stands a chance of lasting. 'If you want to make sure all the ideas don't just evaporate, leaving only good intentions behind, you need to get organized. We made a specific proposal for that,' says De Haas. The proposal came out of a study carried out by Wageningen Economic Research (formerly LEL).

As an example, a number of progressive residential projects were based on the assumption that there would be no connection to the sewerage system. Another idea the initiators are considering for self-build plots is sourcing drinking water from rainwater. 'But even if the mains water company is willing to cooperate, it will demand guarantees of the safety of the water, not just for these initiators but also for future residents,' says De Haas.

De Haas's research group also looked at possibilities for composting green household waste in the future neighbourhood. 'Of course you can do that with a compost heap at every home, but you can also digest green waste centrally and then compost it, as is currently done by waste disposal companies. To get more value and make more money out of organic waste, you could even consider an installation for the whole city which can isolate the components for bioplastics and then digest and compost the remaining organic material.'

### INDUSTRIAL SYMBIOSIS

At the Innofase industrial estate in Duiven, near Arnhem, Wageningen researchers documented the substances going into the

area and those coming out of it. 'On 46 hectares of the estate there are waste-processing companies for household waste, sewer sludge and wood waste. On the remaining 14 hectares the municipality's preference would be to locate companies that use these waste products in their production process,' says Bert Annevelink, who is involved in the study on behalf of Wageningen Food & Biobased Research. 'That could for instance include companies which can make use of building blocks for bioplastics extracted from sewerage sludge, such as polyhydroxyalkanoates. But businesses can also make

**'Is natural gas still necessary in a new neighbourhood?'**

use of each other's waste flows, heat or energy generated from waste. You need to create an industrial symbiosis,' says Annevelink. He and his colleagues put together a matrix to link existing production techniques and techniques still under development with the biomass waste flows in Duiven.

'The matrix is used to evaluate the opportunities in Duiven for using the waste flows from cities,' says Annevelink. 'We looked at three possible scenarios: a scenario with an emphasis on processing garbage that is driven by government bodies, a scenario with an emphasis on developing new products that is driven by the business

world, and a combination of the two. The scenarios show that the development of a circular economy in the Innofase area requires good collaboration and a shared ambition among all parties, business partners and government bodies.'

### MOTIVATING RESIDENTS

'We have not arrived at detailed figures on the costs and benefits. Partly because we don't know the exact price of the technology that needs to be developed,' explains Annevelink.

That is a pity, agrees project leader Marco Hoogvliet, but the lifespan of a complex project such as Adaptive Circular Cities is too short to specify all the costs and benefits very precisely. 'For that reason we couldn't yet come up with business models in 2015, but we are working on that now. For example you can create quite a bit of water storage on roofs and in the gardens but we don't yet have any financial systems for stimulating residents to do that or rewarding them for it.'

In the longer term, government and water managers should work towards a system such as that used for remunerating people for solar energy supplied to the network. You might for example get compensation in the form of lower charges for sewerage services, suggests Hoogvliet.

Ideally the researchers would like to do follow-up research to work out more complete calculation models that would let cities choose from a range of 'packages', depending on their ambitions as well as technical matters such as soil types and water situation. Hoogvliet: 'If we make that applicable for new climate-proof circular cities around the world, we'll have a great export product at our disposal.' ■

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