SiEUGreen
Sino-European innovative green and smart cities

Sino-European Innovative Green and Smart Cities

Project Brief

by seecon international gmbh

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Background

For most of human history, the majority of people lived in small communities. In recent centuries - and especially in recent decades - this has changed dramatically (see Figure 1). There has been a massive migration of population from rural to urban areas. According to United Nations (UN) estimates, 2007 marked the point when the number of people living in cities exceeded those living in rural areas. By 2020, the share of urban population has risen to about 56% and is expected to reach 68% by 2050. It is generally higher in developed economies (about 79% in 2020) than in developing countries (about 52%).

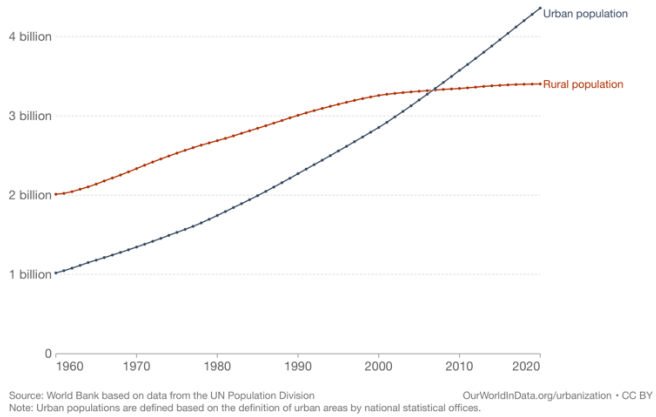

Figure 1: Number of people living in urban and rural areas

Increasing urbanisation leads to massive flows of agricultural products, water and energy coming from rural areas to cities. This generates high amounts of heat, carbon dioxide (CO_2), wastewater and other wastes. In 2016, with the understanding that Urban Agriculture (UA) can improve food security and bring economic, environmental and social benefits to cities, the European Commission (EC) launched a call for Innovation Actions. seecon joined hands with like-minded organisations from Europe and China in submitting a project proposal to assess and demonstrate how technological and social innovation in UA can help overcome the shortcomings of urban food systems while providing cities with other ecosystem services (e.g. mitigating climate change, closing nutrient cycles) and improving the resilience of urban areas.

About the project

The Sino-European Innovative Green and Smart Cities (SiEUGreen) project aims at enhancing the EU-China cooperation in promoting UA for food security, resource efficiency, and smart and resilient cities. In the general context of zero-waste circular economy, the project uses existing technological tools and develops innovative resource-efficient agricultural techniques and integrated concepts to demonstrate how technological and societal innovation in UA can have a positive effect on economy, society and environment in China, Europe and elsewhere beyond the project period.

SiEUGreen brings together a multidisciplinary consortium of European and Chinese researchers, technology providers, Small and Medium Enterprises (SMEs), financiers, local and regional authorities and resident communities to facilitate the development and deployment of state-of-the-art urban agriculture models. Building on the zero-waste and circular economy model, SiEUGreen combines technological and societal innovation in promoting urban agriculture for food security, resource efficiency, and smart, resilient cities.

Showcases

The project prepares, deploys and evaluates five ground-breaking multidisciplinary showcases in urban and peri-urban areas in Europe and China that contribute to the future development of urban agriculture (Figure 2).

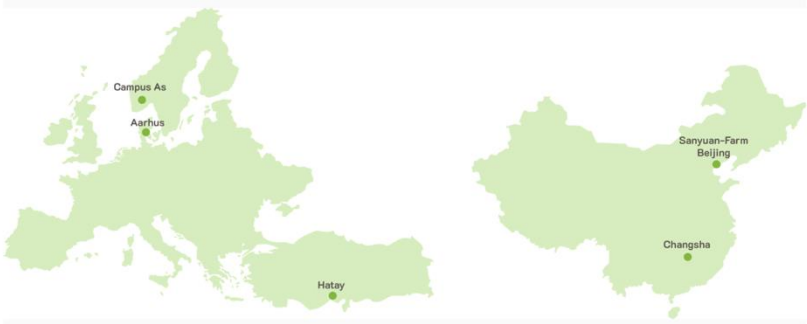

Figure 2: Map with SiEUGreen Showcases

Campus Ås is home to Norway's largest interdisciplinary academic environment in the field of life sciences. The full-scale implementation of a GREENergy concept demonstrate that an innovative combination of known and emerging technologies, actions and planning can contribute to resilient, climate-, environment- and people-friendly urban development.

Aarhus is located in the Central Denmark Region (Midtjylland) and is an ethnically diverse city where 15% (about 50 000 people) of the population is made up of immigrants and direct descendants of immigrants. The municipality of Aarhus is known for its bottom-up initiatives that show how cities can create more socially inclusive places and communities by focusing on edible nature and urban agriculture.

Hatay province is located in the southern part of Turkey. Its proximity to the Syrian border has had a strong influence on population development in recent years, leading to a sharp increase in the number of inhabitants, especially in the border municipalities. The project supports the Hatay Municipality on how local authorities can ensure food security and self-sufficiency for Syrian refugees and socially disadvantaged members of the local community.

Beijing is home to more than 20 million people. People living in the Chinese megacity find it difficult to connect with nature. The Sanyuan Farm within the Citizen Farm Project tries to meet the city dwellers' aspirations for greenery, nature and environmental protection and to support the first step from traditional agriculture to urban farming as a leisure activity.

Changsha is the capital of Hunan province and one of the most densely populated provinces in China. As such, it faces a huge environmental problem in terms of food supply via long transport routes. Changsha also has to deal with water shortages, as it has limited water resources. The Changsha showcase supports the use of waste and wastewater reuse and recycling technologies in a housing project to create green neighbourhoods and develop circular systems where waste recycling and wastewater management go hand in hand with resource-efficient, smart and sustainable urban agriculture.

Results

The project has achieved numerous results, some of which are described:

DRAXIS Environmental S.A. has developed an app called **Commurban** (Figure 3) that engages citizens in urban farming by maintaining and expanding a dynamic communication and knowledge/guidance sharing between UA initiatives and practitioners. The app is a simple way to explore new ideas and find inspiration in various Do it yourself (DIY) projects related to agriculture, urban farming, gardening, smart balcony, energy, recycling, waste management and generally any topic that promotes an environmentally friendly culture! The application encourages users to create DIY projects, based on step-by-step instructions, in a way that is easy to follow, and share photos, and videos from their projects with other users around the world. The app is available for free from Google Play Store and Apple App Store (and also in China for android devices).

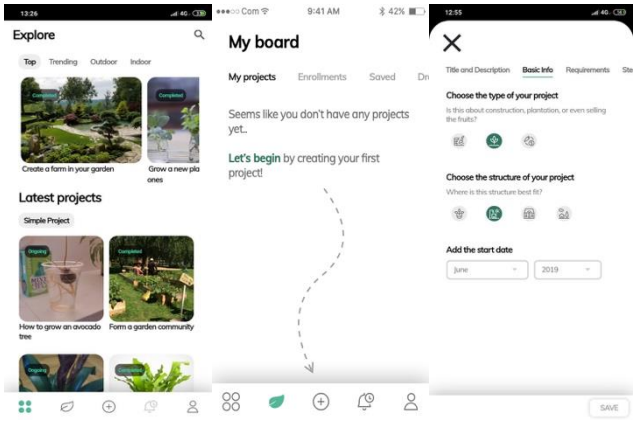

Figure 3: Screenshots of Commurban

Beijing Green Valley Sprouts (BGVS) Co. Ltd. has further developed its **paper-based microgreens technology**, a production method that grows edible sprouts on paper as an alternative to sowing them in the soil (Figure 4). The idea is to get residents to grow microgreens at home using the paper-based technology (balcony gardening). The produce would then be bought by the company to be processed into soap and nutritious food and later sold at the market.

Figure 4: Sprout planting equipment for private (left) and commercial (right) use

Beijing Photon Science & Technology Co. Ltd. is a Chinese national high-tech enterprise that has made outstanding achievements in the fields of agricultural intelligence, agricultural ecological demonstration garden planning, soilless cultivation facilities, green house engineering and materials, balcony gardening, etc. The company offers a set of home appliances such as the **vegetable, mushroom, fruit and succulent planters** that can serve the purpose of reconnecting urban population with nature (Figure 5).

Figure 5: Fruit and vegetable planter, mushroom planter and succulent planter (from left to right)

The Norwegian Institute of Bioeconomy Research (NIBIO) and the Norwegian University of Life Sciences (NMBU) have developed and tested a **Biomass Estimation App** using machine learning (Figure 6) as an easy and quick method for the prediction of vegetable biomass (yield). Traditional approach with scores of several growth parameters requires much more time input with less accuracy.

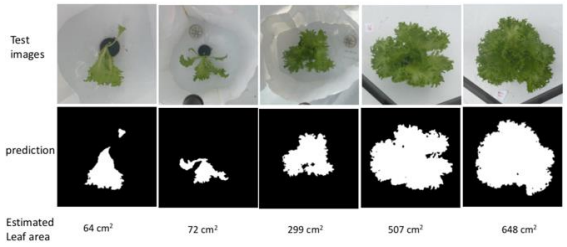

Figure 6: Leaf area estimation using deep learning

Scandinavian Water Technology (ScanWater) AS., NIBIO, the NMBU and the Hunan Hengkai Environmental Protection Science & Technology Investment (HHEPSTI) Co. Ltd. have developed and deployed the **GREENergy** concept. The concept is based on the principle of circular economy and is a smart integrated solution for water, sanitation, storm water, energy supply and nutrient management in cities and urban areas (Figure 7). Integrated into building infrastructures, it aims to increase resilience of cities and make urban development more climate-, environment- and people-friendly, with near-zero emissions and a low ecological footprint. Specifically, GREENergy aims to reduce water consumption through the promotion and use of water-saving fixtures (e.g. vacuum toilets) and the (re)use of rainwater and greywater, to generate heat and power from toilet waste (blackwater) and organic household waste (e.g. through biogas production), and to reuse nutrients for urban and peri-urban agriculture.

Figure 7: Appearance of Changsha Hengkai Industrial Park Base

Partners

Norwegian University of Life Sciences (NMBU)

Norwegian Institute of Bioeconomy Research (NIBIO)

The Institute of Vegetables and Flowers, Chinese Academy of Agricultural Sciences (CAAS)

Nordregio

Emetris S.A.

Aarhus Kommune (AAKS)

ViLabs (CY) Ltd.

Okys Ltd.

Beijing Eco-Creative Agricultural Service Alliance (BAEISU)

Scandinavian Water Technology AS (ScanWater)

Hatay Metropolitan Municipality

Chinese Academy of Social Science (CASS)

Sampas Bilism Ve Iletisim Sistemleri Sanayi Ve Ticaret A.S. (SAMPAS)

Hunan Hengkai Environmental Protection Science and Investment Group Co. Ltd. (HHEPSTI)

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Leibniz Institute of Vegetable and Ornamental Crops (IGZ)

Beijing Photon Science & Technology Co. Ltd. (PHOTON)

Beijing Green Valley Sprouts Co. Ltd. (BGVS)

DRAXIS Environmental S.A.