



# Living Roof. Urban gardens at roofs and terraces

A new and innovative cropping system of horticultural and ornamental species on roofs or terraces of buildings, with CO2 capture and night lighting by O-LEDs

Researchers from the Technical University of Madrid and the University of Valladolid, have designed a system which lets urban crops to grow on roofs and terraces of buildings, 100% sustainable. Those urban orchards contribute to mitigate the CO2 which pollutes the environment of big cities. Moreover, during the winter, they could take advantage of the CO2 of flue gas heating boilers. These kinds of orchards have already been installed at the Agricultural Engineering School of the Technical University of Madrid.

#### Technology solution supported by the Technical University of Madrid

## **Technology solution**

The urban orchards will be covered by a greenhouse in order to avoid that contaminant particles (heavy metals) which come from urban contamination are deposited over the crops. Rainwater will be harvested and nutrients will be circulated.

During the winter, the CO2 of flue gas heating boilers is used in order to carry out the carbonic fertilization. During the rest of the year, porous materials are used to capture the CO2.

## **Areas of application**

• Environment & Health: CO2 reduction in cities which is translated in fewer allergies, less cardiovascular problems, decrease of breathe diseases, etc.

• Food production: ecological vegetables and fruits can be produced with no risk as they will be under a greenhouse.

"Urban orchards are specially indicated to absorb the CO2 produced in the heating boilers of the buildings, during the gasoil combustion, natural gas or biomass in the winter time"



# Market demands

#### Environment

•Currently the number of people living in cities is higher than the rural habitants.

•Around 90% of the EU population which live in cities are exposed to atmospheric contaminants which are considered as nocuous by the World Health Organization [European Environment Agency, 2013].

•In Spain, approximately 50% of population is exposed to higher levels of ozone and tropospheric nitrogen particles [European Environment Agency, 2013].

### Health

•A bad quality of the air produces high risks for human health and can cause or contribute to the development of illness such as cardiovascular and breath diseases or lung cancer.

•Air contamination has a big economic impact reducing life expectancy, increasing healthcare costs and reducing productivity.

## Food production

Growing vegetables and fruits in the cities means less contamination and the minimization of the economic waste during transport.



"In order to achieve a healthy urban environment will be enough to landscape 10-20% of all roofs of the city"

## Market potential

•Costs due to the contamination in EU are estimated from 330 to 940 billion € per year (absence of work, less productivity, health waste...). There were around 400 000 premature deaths in 2010 [European Union].

•1m2 vegetation cover makes the amount of oxygen required by a person in the whole year. It captures from the environment 50 grams of CO2 per day; it isolates thermally the building around 5°C; it reduces the acoustic contamination in 10 db; it produces fruits and vegetables in more quantity, quality and precocity; it does not consume electrical energy [Darlington, 2001].

## **Competitive advantages**

•The greenhouse will avoid the deposition of contaminant particles (heavy metals) from urban contamination.

•It will harvest the rainwater.

•Uptake and utilization, during the winter, of flue gas heating boilers.

- •Self-powered, generating night light.
- •The circulation of nutrient solutions will be done.
- •It moderates the temperature of the building.

"Beyond creating landscaped spaces in cities for private enjoyment, the trend is to create spaces that improve the urban environment "

### References

- Multidisciplinary team with extensive research experience and collaboration with industry.
- Several green roofs have been set up at the Agricultural Engineering School of the Technical University of Madrid.

### IPR

Patent granted in Spain ES2504818

#### **Development stage**

- Concept
- 🕀 Industrial Prototype
- Production
- Lab Prototype

# Solution Contact

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