WORLD GREEN INFRASTRUCTURE NETWORK
vegetation makes it possible!

October 2018

Urban Green Infrastructure: a solution to reduce EU greenhouse gas emissions

AN EFFECTIVE WAY TO TACKLE THE DAMAGING EFFECT OF RAPID URBANISATION ON OUR CLIMATE

The potentially catastrophic effects of climate change means that the world could be heading towards a major climate collapse if we do not dramatically change the way we live and work.

Man-made Greenhouse Gas (GHG) emissions have already reached the point that the earth is no longer able to absorb them.

We are losing around 350 square kilometres of forest a day and there are no longer enough green areas on our planet to soak up the emissions that are in danger of causing earth to overheat.

Urbanisation is a major cause. Cities, which are major producers of GHG emissions, are already home to more than half the world's population. It is predicted that if current rates of growth continue, the urban population will reach more than six billion by 2045.[1]

Such high urbanisation is generating "**urban heat islands**" which have a particularly negative effect on global warming.[2] During summer months, the temperature in cities is approximately 5-7ºC higher than in the countryside due to the heat absorption in buildings and roads. Warmer temperatures mean more water vapour is absorbed by the air, which in turn leads to torrential downpours of rain.

As there are fewer gardens and lawns to allow the water to permeate the land, so the risk of flooding increases.

To tackle the damaging effect of rapid urbanisation on our climate, policymakers need to focus on solutions which will cut these urban GHG emissions.

One such very positive solution would be the introduction of more and speedier Green Infrastructure, capable of cooling down our urban habitat, as a part of climate mitigation and adaptation measures.

[1] "World Urbanisation Prospects", United Nations Department of Economic and Social Affairs (2014)
[2] The "urban heat island effect" is defined as the rise in temperature of any man-made area, in comparison to more rural or green areas or more natural habitats

THE BENEFITS OF GREEN INFRASTRUCTURE

> ***"Green Infrastructure provides multiple benefits in the form of supporting a green economy, improving quality of life, protecting biodiversity and enhancing the ability of ecosystems to deliver services such as disaster risk reduction, water purification, air quality, space for recreation and climate change mitigation and adaption."***[3]
>
> *"Green Infrastructure and Climate Adaptation" European Commission*[4]

Urban Green Infrastructure, particularly **green roofs**[5], is a unique tool offering highly efficient environmental-friendly solutions to reduce energy consumption in buildings, and has a direct, positive impact on cooling down the surrounding environment, similar to trees and other vegetation. Green Infrastructure solutions can reinstate significant vegetation to paved areas, thus contributing very positively to climate change mitigation and adaptation.

Although Urban Green Infrastructure is an existing and available technology, its ecological benefits and its potential to tackle climate change are often underestimated.

IMPORTANT FACTS ABOUT GREEN ROOFS

Green roofs substantially reduce levels of CO^2

Vegetation is an extremely efficient and natural converter of CO^2 into oxygen. During its expected lifetime, each square metre of green roofing directly absorbs up to 15 kg of CO^2 [6]

Indirectly, each square metre decreases CO^2 by a further 50 kg over its lifetime as a result of improvements to a building's energy efficiency. This means that 1m² of a green roof can absorb the same amount of CO^2 per year as an average car would emit during an 80 km drive.

Green roofs considerably reduce urban heat

Green roofs are one of the most effective ways to reduce the ambient air temperature in urban areas. Vegetation can result in roofs being up to 40^0C cooler than regular roofs, vegetated walls can reduce the surrounding temperature by up to 6^0C.

Green roofs significantly improve energy efficiency

In peak winter months buildings with green roofs use up to 30% less energy for heating than buildings without green roofs.

Vegetation protects the roof underneath from heat and direct solar radiation. During peak summer a building with a green roof uses up to 100% less energy for cooling.

A temperature decrease of 1°C improves the efficiency of air conditioning by up to 2%. This translates into an energy efficiency increase of up to 40%[7].

---

[3] http://ec.europa.eu/environment/nature/ecosystems/pdf/Green%20Infrastructure/GI_climate_adaptation.pdf
[4] http://ec.europa.eu/environment/nature/ecosystems/pdf/Green%20Infrastructure/GI_climate_adaptation.pdf
[5] This paper focuses mainly on green roofs. However, a number of publications in recent years have highlighted other green infrastructure solutions, such as vegetated façades, as having significant potential to mitigate climate change.
[6] Environmental Product Declaration, Urbanscape
[7] Mitsubishi Electric, one of the largest producers of air-conditioning systems

A 1ºC decrease in surrounding temperature can improve the performance of photo-voltaic solar panels by up to 16%. A 1°C temperature decrease results in a 0,5% increase in electricity output[8].

Green roofs appreciably reduce pressure on urban drainage systems and help prevent flooding

Green roofs are able to retain large amounts of rainwater (up to 70-90%, in summer) and consequently reduce the volume and flow-rate of water entering the drainage system.

A fully saturated square metre of green roof can naturally evaporate at a rate of between three and five litres per square metre during a hot summer day.

Through water retention, green roofs also play an important role in helping to lower energy and infrastructure costs of urban waste water treatment.

Fast-growing city populations are putting huge pressure on often ancient drainage systems resulting in municipalities having to fund costly water treatment facilities.

Evidence has shown that municipal and domestic energy use can be significantly reduced by implementing Green Infrastructure practices, such as green roofs,

Green roofs result in notably cleaner air

Plants on green roofs capture airborne particles such as smog, heavy metals and volatile organic compounds.

Researchers estimate that 1m² of a green roof can absorb 0.2kg of airborne particles from the air every year[9]

MEASURABLE RESULTS

The impressive results from green roofs in helping to mitigate climate change and adapt to its consequences are measurable and can be substantiated. Tools for modelling the real performance of green roofs are becoming widely available and there are an increasing number of studies being conducted to amplify the weight of evidence.

An ongoing study, being performed by the Laboratory of Sustainable Studies in Buildings of the University of Ljubljana for example, focuses on the thermal and hydrological response of lightweight extensive green roofs. The model that has been developed has been integrated in user-friendly software that combines worldwide meteorological data. It allows energy and water performance evaluations to be carried out on customised green roof designs in specific climate zones or selected cities in almost any part of the world, and at any time of year.

Thanks to Green Infrastructure's performance evaluation tools it is also possible to define average yearly rain water retention rates for a specific municipality and define energy savings that can be easily transferred into a reduction of CO^2 emissions as a result of green roof implementation. The water retention capacity of green roofs averages around 78%[10], whereas the retention capacity of regular roofs is limited to only evaporation

[8] Study performed by R. Appl & W. Ansel in 2004 - Future oriented and sustainable green roofs in Germany, published in proceedings from the 2nd annual Greening Rooftops for Sustainable Communities at a Green Roofs for Healthy Cities conference in Portland, USA.
[9] National center of excellence/ASU
[10] According to available performance tools

of about 1-2% of rainfall when a roof is still hot. The rest of rainwater goes directly into sewage systems.

THE NEED TO PROMOTE URBAN GREEN INFRASTRUCTURE

Available studies and performance tools clearly demonstrate the potential of Green Urban Infrastructure and its benefits in different climate zones.

Several cities, including Hamburg, Paris and Copenhagen, have set up programmes with incentives to promote the implementation of Green Infrastructure focusing especially on green roofs on buildings.

However, stronger leadership is still needed at EU, national and local levels to take full advantage of the tremendous potential offered by green infrastructure to tackle climate change.

POLICY RECOMMENDATIONS FOR DEVELOPING URBAN GREEN INFRASTRUCTURE WITH THE AIM OF REDUCING GHG EMISSIONS

Implementation of Green Urban Infrastructure, especially green roofs and vegetated walls, should be promoted as an effective climate change mitigation and adaptation tool. As such, we ask policymakers to:

At EU level

- **Support Green Urban Infrastructure development within the new EU Multiannual Financial Framework (2021-2027) and its specific programmes**. Green Infrastructure can make a significant contribution to many sectors and EU policy objectives providing a much needed focus on climate change mitigation and adaptation, stormwater management and biodiversity.

- **Link the EU budget financial programming** with the development of **national climate change adaptation plans and strategies** required under the new Regulation on the Governance of the Energy Union[11].

At national level

- **Ensure actions by Member States to facilitate the implementation of Green Infrastructure within the national climate change adaptation plans and strategies** required under the Regulation on the Governance of the Energy Union.

- **Introduce Green Infrastructure to replace lost green space taken over by new building construction** is a good way forward. A leading example is Singapore where legislation requires investors to replace 100% of lost green space due to new construction to be replaced. This is being achieved by implementing Green Infrastructure methods such as green walls and green roofs.

- **Prioritise Green Infrastructure and/or natural water retention measures over grey infrastructure in planning and investment decisions.** For example, in Slovakia, Green Infrastructure is one of the main approaches for flood prevention. It is being given priority over other urban and non-urban flood prevention measures, both in the Operational Programme Environment and the Regional Operational Programme under the EU financing perspective 2014-2020[12].

At local level

- **Create a comprehensive Green Roof Strategy at city level.** This should combine the urban development policy objectives of sustainable area development with the objectives of climate change mitigation and adaptation. An example is Hamburg's Green Roof Strategy[13], which is embedded in urban landscape planning policy. The Strategy aims to incorporate green roofs into legally binding regulations such as the Hamburg building law, the wastewater law, planning regulations for structural systems, and land-use plans.

[11]Regulation on the Governance of the Energy Union was proposed by the European Commission on 30 November 2016 as the part of the Clean Energy Package
[12]http://ec.europa.eu/environment/water/pdf/EU_overview_report_%20operational_programmes%20.pdf
[13] https://climate-adapt.eea.europa.eu/metadata/case-studies/four-pillars-to-hamburg2019s-green-roof-strategy-financial-incentive-dialogue-regulation-and-science/#objectives_anchor