What is Green Infrastructure?

Green Infrastructure “is a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services. It incorporates green spaces (or blue if aquatic ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine areas. On land, GI is present in rural and urban settings. Linked together, these strategically planned networks of green elements are able to provide 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.

The energy sector - the burning of coal, natural gas and oil for electricity and heat - is the largest single source of global greenhouse gas emissions, and is responsible for over a quarter of all EU greenhouse gas emissions. Energy transmission infrastructure also generally leads to fragmentation of natural habitats, ecosystem destruction and depletion of ecosystem services. Green Infrastructure can play a role in reducing the negative impacts of the energy sector, by: (1) reducing energy consumption; (2) providing bioenergy; and (3) providing carbon uptake and storage (climate change mitigation).

These negative impacts can be mitigated by creating or restoring Green Infrastructure. For example, urban green areas such as urban parks, and tree-lined streets can play a role in reducing an area’s overall energy demand and thus contribute to the moderation of the ‘urban heat island’ effect. Trees, green roofs, and other Green Infrastructure features can cool urban areas by shading building surfaces, deflecting radiation from the sun, and releasing moisture into the atmosphere.

Buildings are responsible for 40% of energy consumption and 36% of CO2 emissions in the EU. A large proportion of this energy is used to maintain internal building temperatures through heating and cooling systems. Green Infrastructure elements such as green roofs can contribute to reducing primary energy consumption and therefore the CO2 emissions associated with buildings. By reducing local temperature and shading building surfaces, Green Infrastructure lessens the cooling demand for buildings, reducing energy needs and decreasing emissions from power plants. Green roofs also provide for energy savings through better thermal insulation.

Investments in Green Infrastructure can also contribute to meeting the objectives set in the EU Climate and Energy Package, i.e., raising the share of EU energy consumption produced from renewable resources to 20% and a 20% improvement in the EU’s energy efficiency. The Member States’ National Renewable Energy Action Plans (NREAPs) have shown that bioenergy is expected to make up over 50% of total renewable energy use by 2020. Green Infrastructure networks can...
provide biomass derived from trees and plants that can be used for heating and electricity generation. While increasing the use of solid biomass for renewable energy initiatives can help diversify the energy supply, special efforts, e.g., reforestation and sustainable forest management, should be made to avoid adverse effects on biodiversity and ecosystems.

Green Infrastructure vegetation also helps reduce the amount of atmospheric CO2 through direct carbon sequestration, where carbon dioxide is captured and removed from the atmosphere via photosynthesis and other natural processes.

Green Infrastructure can both capture and store carbon from the atmosphere, and provide biofuel, when it is managed in a way as to provide biomass (mowing, pruning, logging). There is a continuum between pure carbon sequestration by unmanaged ecosystems and pure energy crops. If energy crops are to be regarded as Green Infrastructure, they must provide a net gain to the site-based biodiversity and the delivery of multiple ecosystem services. It depends on the species selected (indigenous or not) and the harvest cycle whether that is the case.

Green Roof Building Regulations in the city of Basel (Switzerland).

The use of green roofs as an energy-saving measure for buildings in the city of Basel has been stimulated by a combination of financial incentives and building regulations. Building regulations have required the use of vegetation on roofs since their implementation in 2002. Initiatives aiming to increase the provision of green roofs were initially driven by energy-saving programmes, and subsequently by biodiversity conservation. To support energy saving measures, 5% of all customers' energy bills were put into an Energy Saving Fund that was used to fund energy-saving campaigns and measures. The municipality involved a variety of stakeholders, such as business associations and environmental organisations, in developing an incentive programme. Green roofs were funded in the mid-1990s to stimulate interest and awareness. A second programme was initiated in 2005.

Estimations have shown energy savings from green roofs at 15-45% of annual energy consumption, mainly from reducing costs for cooling. For example, in New York it was estimated that providing 50% green roof cover within the metropolitan area would lead to an average 0.1-0.8°C reduction in surface temperatures. It was noted that for every degree reduction in the urban heat island effect roughly 495 million KWh of energy would be saved. Urban trees also bring multiple benefits including energy savings from cooling and heating. A 20% tree canopy over a house results in annual cooling savings of 8 to 18% and annual heating savings of 2 to 8%. The energy benefits provided by a green belt were an important motive behind the Municipality of Mirandola’s (Italy) decision to create a green belt around the city for instance. The green belt is expected to provide cooling and shading in summer and capacity to store carbon dioxide and hence contribute to climate mitigation targets. The green belt is created by using “transfer of development rights” whereby developers are allowed to increase the size of their buildings if they allot significant part of their land to green space.

Two other links between energy and Green Infrastructure, i.e., carbon sequestration and biofuel production, come with low costs and high benefits, as the photosynthesis process powered by the sun is free. Both have the benefit of mitigating climate change by reducing CO2 concentrations (carbon sequestration) or reducing the use of fossil fuels (biofuels).

Good practices in Energy & Green Infrastructure

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Between 1996 and 2006, the City of Basel invested CHF 2 million in a green roof incentive programme. The average costs/m² of installation of green roofs decreased in the 1990s from CHF 100 to CHF 20. The cost-benefit ratio of this initiative appears to be positive.

**Neighbourhood regeneration in Malmö (Sweden)**

EcoCity Augustenborg is one of Sweden’s largest urban sustainability projects. Currently, the neighbourhood is an example of an ecologically, socially and economically sustainable quarter. Green and blue spaces have been incorporated into the regeneration plans to address issues such as flooding, new renewable energy sources, recycling systems, sustainable construction and local transport initiatives. The project included Green Infrastructure elements such as green roofs, gardens, recreation areas, wildlife habitats and renovated courtyards. Providing renewable energy from biomass is only one of the benefits from Green Infrastructure in this example which shows how Green Infrastructure can be used as an effective element in a re-development strategy, providing multiple benefits. The project achieved various economic, social and environmental benefits, and biodiversity increased by 50%.

**Using biomass for heating a public building in Malopolska Region (Poland)**

The Tarnow District authorities in the Malopolska Region of Poland provided free of charge biomass when the old coal boiler in the School of Economics in Wojnicz was replaced with a boiler using biomass. The installation with the total power of 1 MW uses biomass from the maintenance of the Green Infrastructure in the Tarnow District (trimming of trees in parks, roads and green areas). The local authority also funded part of the costs of the new boiler. Benefits include a reduction of CO2 of about 1200 tonnes/year and heat production of about 1.312 MWh. The project raised awareness among the local authorities about the potential of residual biomass for energy use and the environmental and economic benefits it brings.

**Challenges and opportunities**

Further uptake of Green Infrastructure in the energy sector requires:

- Providing a stronger evidence base on the integration of Green Infrastructure into the energy sector and its related benefits.
- Awareness-raising among public authorities, businesses and citizens on Green Infrastructure-based energy.
- Prioritising research on Green Infrastructure integration into the energy sector as part of the knowledge base needed to underpin the transformation processes towards a resource efficient economy. Horizon 2020 could be a useful instrument to support such research.
- Promoting the development of long-term Green Infrastructure policy frameworks that highlight the benefits Green Infrastructure brings for the achievement of energy-related targets and ensure the availability of appropriate implementing instruments.
- Providing funding for implementing Green Infrastructure is a challenge in many European regions and urban areas. It is important to explain to stakeholders across many different policy areas the economic benefits of Green Infrastructure including its role for achieving energy objectives and generating support for the planning and implementation of Green Infrastructure initiatives.
- Avoiding the risk of biodiversity loss in the case of biomass use by encouraging a stronger emphasis on sustainable forest management practices and safeguarding the ecological and social functions of forests.
- Promoting Green Infrastructure as a mitigation tool for energy (production, emission, infrastructure) impacts: e.g., including Green Infrastructure in Environmental Impact Assessments and Strategic Environmental Assessments for energy transmission infrastructure projects or programmes.

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**Contract details**


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