Plant factory with artificial lighting:

innovation technology for

sustainable agriculture production

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**Abstract.** Food security and healthy eating are increasingly threatened by climate changes, pandemics, conflicts and economic crises. In the next years, the estimated rapid growth of the world population and the growing urbanization will lead to a global food requirement increase and to a highly complex food supply chain, with worrying environmental impacts. Conventional agricultural production systems have negatively contributed to the decline of the per capita land availability. Plant Factories with artificial lighting (PFAL), in the Urban Agriculture context, can give optimal answers to these issues, according to the UN Sustainable Development Goals. This work aims to provide a holistic assessment of the PFALs functions, to support decision-making processes for an efficient use of the resources with the food-energy-water nexus approach. Firstly, cultivated plant species and their production yield are indicated and the soilless culture technologies and water-nutritional fertigation systems are examined. For optimal plant growth, the thermo-hygrometric conditions and the CO2 level, as well as the P.A.R irradiation and the spectral composition of the lamps are defined. Furthermore, artificial intelligence for PFALs' integral management and the energy sources to power HVAC systems and artificial lighting are discussed. PFALs can be implemented in disused buildings in urban or peri-urban sites, with a view to a circular economy and 0 km agricultural production. The analysis shows that almost all the PFALs have been installed in countries with high urban population density and harsh climates, such as China, the US, Japan, and Northern Europe, to produce mainly herbs and leafy vegetables. Furthermore, artificial lighting is entrusted to LED lamps, by inducing a 95% decrease in the power emitted per unit area, compared to other types of lamps, thus ensuring higher energy efficiency. Finally, the PFALs' crop yields stand until to 1.1kg m-2 d-1, about 100 times higher compared to open-field agriculture, thus managing to satisfy the food requirements of the urban populations.