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SPACE BASED SOLAR POWER: A CLEAN, RENEWABLE AND PILOTABLE ENERGY FROM SPACE

Abstract

In 2022, the world started facing a highly critical energy crisis directly impacting the climate. Indeed, the first source of energy used for energy generation are fossil fuels. For example, Europe is still dependant at 70% on their use. This dependency is not only bad for climate, but also for the economy since it represented about 330B of import in 2018, and even bad for the democracy since it shows the dependency of main European economies and societies on a few countries such as Russia, Algeria or Qatar.

Today, existing solutions are the following ones:

- First, energy sobriety will allow a reduction of the consumption and therefore of the emissions. However, it will be difficult to apply without a cultural change of the society.
- The second solution is to increase the share of renewable energy sources. Renewables come however with drawbacks since they are intermittent, producing only when Sun or wind are available, and there is no energy storage solution existing today at the right scale that could allow to pass a winter night in Europe. Therefore, renewables always need to be backed up by fossil fuels.
- The third solution is nuclear fission, which produces controllable baseload power but also long-term radioactive wastes and is not accepted by some countries. Nuclear fusion would be much cleaner, but is not expected to be commercially available at least before 20 to 30 years.

It is less known, but the Space sector could play a role in the energy transition, providing a h24/7 source of carbon-free energy thanks to space-based solar power (SBSP). SBSP is composed of a satellite converting Sun light to radio-frequency power and beaming it to the ground where it is converted to electricity for insertion in the grid. The technical feasibility of all the independent building blocks has been already demonstrated either on ground or in Space at a small scale. Today, what needs to be demonstrated is the sustainability (ethical and financial) linked to the scalability of the solution up to GW power level and the final cost of energy to be competitive with (Earth) ground-based baseload power sources.

In this article, we will review the status of SBSP history and worldwide initiatives as a technology that can have a direct impact on climate change reduction. Key challenges for the implementation will be introduced, either technical, financial or from population acceptance point of view.