Space Based Solar Power (SBSP) & Space infrastructure with mining

Background:

We have an imminent climate crisis, and with that an associated energy crisis. Yet in near space (the inner solar system) there are basically unlimited amounts of energy and mineral resources. The method to tap energy from our Sun with large scale solar array stations in space is called Space Based Solar Power (SBSP), where the energy is then transmitted back to Earth ground stations (or to other space facilities) via preferentially micro-waves. Initial tests on ground to carry out this transmission of energy has been successful. Major goals and roadmaps to facilitate tests and make SBSP commercial is pursued by Japan, China and lately also US. The firsts tests in orbit around Earth was already made by NRL in US during 2020, and another test is foreseen next year by Caltech. The plans in Japan and China are to send down sizable amounts of energy to ground by 2035. I know the Japanese plans best, where industry lead by Mitsubishi Heavy Industries together with academia have been studying SBSP since the 90-ties, but recently (2020) got a go ahead for a major effort triggered by the Fukoshima tragic accident that cut a major part of the nuclear energy supply in Japan. The reason is that I am married to the daughter (Michiko Morooka at IRF) of one of the engineers that was involved in the development. The Japanese are way ahead of Europe on this matter. I am convinced that SBSP can provide a major part of clean energy to Earth's population within about 30-50 years' timeframe. This development is worth preparing for in Europe and in Sweden, as it can provide all the energy we need for the next few hundreds of years, and that without greenhouse gas emissions nor a climate effect.

The construction of an infrastructure in space is on its way, with regular transports to a manned base around the moon (Lunar gateway, planned launch in 2025), potential manned Mars travels after 2030. Development of asteroid mining is on the other hand on hold, and many companies earlier involved in these preparations about 10 years ago seems currently more passive. Nevertheless, the slow but steady build-up of the infrastructure and associated transports should be followed and considered by both European and Swedish space activities. For instance, the easier access to the moon and later Mars can be used with advantage by robotic space exploration research, space weather activities and even space debris mapping. The continued interest of prospecting of various asteroids near Earth (NEOs) and in the main asteroid belt will also prevail, and it is much better that science probes arrive there first and do the exploration before the pristine environments are destroyed and the clues for the origin of the solar system disappear. A joint Swedish or European effort to do asteroid exploration together with, e.g., Japan should be investigated.

Proposal:

SNSA should put together a task force group of people from SNSA, IRF, and Swedish space industry to follow/inform the development of SBSP and the space infrastructure by other agencies/commercial bodies. Roadmaps for SBSP and space infrastructure participation should be worked out. The task force should meet regularly and suggest implementations/test/missions/coordination to best take advantage of the now rather fast development and identify opportunities and make recommendations. This group should be set up as soon as possible to coordinate Swedish efforts, even promote other parts of society, like solar cell research and development, to focus these efforts. The group should only consider civilian use of space.

Project Owners:

IRF, SNSA, Swedish space industry

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SPACE-BASED SOLAR POWER

esa

Advanced Concepts Team

1

INCIDENT SOLAR RADIATION

In orbit, the intensity of sunlight is much higher than the intensity at Earth's surface.

2

SUNLIGHT CAPTURE AND ENERGY REGULATION

Sunlight is converted into a current, then prepared for radio frequency beaming to Earth, the Moon or another planetary surface.

3

POWER BEAMING

Energy is sent down to Earth using phased arrays, laser emitters or other wireless technologies. The energy beam must be accurate, reliable and should retain as much of its power as possible as it travels through Earth's atmosphere.

BEAM CAPTURE AND ENERGY CONVERSION

The energy beam is captured with photovoltaic cells or with an antenna that converts electromagnetic energy into electricity. Satellites can beam energy down to a single ground site, or to several locations around a planetary object.

4

POWER TRANSMISSION

Systems that collect the space-based solar power on Earth must be safely and sustainably integrated into existing power grids. Power distribution is also vital in science, exploration and colonisation missions.

5

6

ENERGY UTILISATION

As well as having the potential to aid Europe's goal of becoming carbon neutral by 2050, space-based solar power technologies could provide the flexibility and reliability required for science and exploration missions where other power sources are limited, for example rover missions during the lunar night.