

LEGAL ASPECTS OF SOLAR POWER SATELLITES

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The present article tends to give a general overview of the legal principles applicable to solar power satellites – the so-called SPS. The idea to collect solar energy by Earth orbiting satellites, and then to beam this energy to Earth receiver stations in order to convert it to electricity, is not a new one. It has actually been studied since the late 1960's, and several space law eminent authors explored the legal aspects applicable to such possibility, mainly during the 70's and 80's, when first SPS projects arose. Recent technical advances have however conducted space agencies to reconsider SPS projects. The present paper will consequently attempt to come back on these legal aspects by taking the most recent law developments into account. For such purpose, first a general overview of the basic legal principles applicable to SPS will be given (I). Then, the paper will be divided according to the two main phases of a given SPS project – the construction (II), and the operational phase (III).

I. Issues relating to the basic legal principles applicable to SPS

Since SPS will be developed and operated in outer space, will require orbital positions, and use radio-frequencies, solar and eventually lunar materials, they will be subject to the relevant principles of space law, and firstly to the freedom of outer space principle, as stated by Article I of the Outer Space Treaty¹. Secondly, and in the light of Article II of the Outer Space Treaty and Article 11 of the Moon Agreement², SPS shall not conduct to an appropriation of outer space. The legal notion of appropriation is generally described as constituted of three elements: *usus*, *abusus*, *fructus*. *Usus* refers to the ability to use a resource, *abusus*: the ability to destroy, to give and to sell it, and *fructus*: the ability to harvest its fruits. Applied to SPS, the consequence of the non-appropriation principle is that no use of the resources concerned (solar and/or lunar) shall conduct to its appropriation. This principle might constitute a problematic issue concerning the use of lunar resources by SPS, since such use tends to consume these resources,

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thus prohibiting any subsequent use by other entities – the conditions of *abusus*, as well as *usus* and *abusus* are met and such activity shall therefore be forbidden as an appropriation of lunar resources. SPS operators will therefore have to face such legal constraint in the eventuality of lunar-based SPS projects.

Thirdly, and since SPS involve a use of the radio frequency spectrum, both for telecommunications (the so-called space services) and for energy transmission, they will have to conform with the ITU regime, at least concerning space services. The issue of ITU rules applicability will however appear concerning energy transmission as such, since it does not enter the definition of "telecommunications" as defined by the Union. ITU regulation may nevertheless find application for such uses of the radio frequency spectrum, to the extent that they may cause harmful interference to other existing services. Legal requirements for getting frequencies will therefore also have to be met. On the contrary it must be underlined that ITU is not competent for regulating laser power transmission. Thus laser-based SPS concepts shall be regarded as free from any regulation in terms of frequency allocation.

II. Legal requirements for SPS construction

Three categories of legal requirements will subsequently be identified as applicable to SPS during their construction phase. The first category is linked to security issues (a), the second one to registration issues (b), and the third one to electromagnetic compatibility matters (c).

a) Security issues

Article IV of the Outer space treaty forbids the placement in outer space of any object carrying nuclear weapons or any other kind of weapon of mass destruction. Such weapons shall neither be installed on celestial bodies. Therefore, the construction of SPS shall be undertaken so as to avoid their qualification, once constructed, as weapons of mass destruction. Otherwise, their placement into orbit or on celestial bodies, such as the Moon, would be forbidden. Reference can therefore be made to international texts, according to which only three kinds of weapons are currently considered as entering the category of weapons of mass destruction – namely: nuclear, biological, and chemical weapons. While SPS projects here taken as reference are not intended to enter one of these three categories, some SPS concepts are based on laser power transmission. To that extent, and according to the Additional protocol on blinding laser weapons to the Convention on prohibitions or restrictions on the use of certain conventional weapons of 1995³, SPS shall not be "*specifically designed, as their sole combat function, or as one of their combat functions, to cause permanent blindness to unenhanced vision*".

b) Registration

According to Article VIII of the Outer space treaty, a State on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such an object and over any personnel thereof while in outer space. Applied to SPS, this concretely means that the law of the State of registry will apply to the space object and to the activities of hypothetical personnel being in this object.

Particular attention shall therefore be given to registration issues before launching SPS. To that extend, the provisions of the Registration convention⁴ shall be observed, which means that the launching State shall in particular furnish to the Secretary-General of the United Nations: the name of the State(s) launching SPS, the appropriate designator of the SPS or its registration number, the date and territory or location of SPS launch, as well as the basic SPS orbital parameters and general functions of SPS.

c) Electromagnetic compatibility

It has already been mentioned that SPS imply Earth-based stations in order to collect the solar energy transmitted by the satellites. Should they be territorially subject to European regulations, these ground stations will have to be constructed in accordance with the provisions of the EU Directive on electromagnetic compatibility⁵. This means that they will have to be constructed so that to insure that the electromagnetic disturbance they generate does not exceed a certain level allowing radio and telecommunications equipment to be operated as intended. If applicable to them, SPS constructors will have to design SPS ground stations electrical and electronic elements with due regard to the relevant provisions of the directive.

III. Legal requirements for the SPS operational phase

As far as the operational phase of SPS is concerned, four issues must be emphasised: jurisdiction and control issues (a), frequency issues (b), environmental issues (c) and liability issues (d).

a) Issues of Jurisdiction & control

While in outer space, jurisdiction and control over SPS and personnel thereof will be retained by the State of registry. The law applicable to SPS ground station(s) will be the law of the territory of the State where this (these) station(s) is (are) established. Should a SPS station be based in an extraterritorial zone, such as the high sea, the State retaining jurisdiction and control over this station will be the State of registry of the concerned maritime platform. In all cases, the State retaining jurisdiction on SPS will have to control them and insure, through national authorisations and licences, that SPS conform with the legal principles identified as relevant in this report.

b) Frequency issues

Frequencies will have to be allocated to SPS, for both space operation services and power transmission via radiofrequencies. Whereas the frequencies allocated to space operation services should not cause particular problems, due to the fact that it is already foreseen by the ITU Radio regulations, two different possibilities may be studied concerning the frequencies allocated for power transmission. The first solution is to use the bands dedicated by the ITU to the industrial, scientific and medical applications – the so-called ISM. This would present sound interest for SPS operators since according to the Radio regulations, radiocommunication services operating on ISM bands must accept harmful interference that may be caused by other ISM applications. SPS operators would therefore not face the risk of claims due to interference their services might cause. The second solution however foreseeable is to require new frequency bands before

the ITU, specially dedicated to SPS, via competent national authorities.

c) Environmental issues

Environmental law, and in particular the prevention principle, must be regarded to be applicable to SPS operations as well. According to this principle, States have the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction. SPS operators will indirectly be submitted to this principle of international law, since they will, in particular, have to comply with national legislation stating radiation standards. In most cases, national measures in this field are based on the basis of the recommendations made by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). In the European Union in particular, the Council Recommendation of 12 July 1999⁶ strictly reproduces the standards formulated by the ICNIRP.

d) Liability issues

As far as liability issues are concerned, the main question relies in the applicability of the space law regime, as provided by the Outer space treaty and the 1972 Liability convention, to damage that could indirectly result from the beam projected on Earth by SPS. This issue, which has not found clear solutions yet, will be very important, since it will determine the regime applicable to SPS for such damage. The general international liability regime might be preferred by SPS operators, but it would be less advantageous for hypothetical victims than the space law regime. Even if this question has not been answered

concerning other space applications, the potential damage that SPS could cause, notably on the environment, justify that this problem should be tackled with in a near future.

¹ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies, 27 January 1967, 610 *UNTS* 205.

² Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, 18 December 1979, 1363 *UNTS* 3.

³ Additional Protocol to the Convention on Prohibitions and Restrictions on the Use of certain Conventional Weapons which may be deemed to be excessively injurious or to have indiscriminate effects, Vienna, 12 October 1995, CCW/CONF.I/7.

⁴ Convention on Registration of Objects Launched into Outer Space, 14 January 1975, 1023 *UNTS* 15.

⁵ Council Directive 89/336/EEC of 3 May 1989 on the laws of the Member States relating to electromagnetic compatibility, as amended, *Official Journal* L 139, 23.05.89.

⁶ Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz), 1999/519/EC, *Official Journal* L 199, 30/07/1999 p.0059-0070.