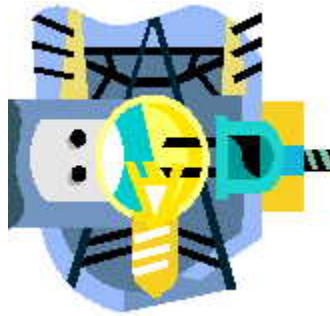


Nuveau Power, Inc.

Executive Summary

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SYNOPSIS

This report summarizes Nuveau Power’s response to University of North Dakota’s (UND’s) solicitation for space-based solar power plant system solution for terrestrial usage. A space-based solar power plant system generates power without using fossil fuels, which cause pollution, CO₂ build up in the atmosphere, energy shortages, and foreign fuel supply dependence. Solar Space-Based Power Plants (SPPs) are therefore one answer to the question of how humanity’s growing energy demands can be met with the least adverse impact on the environment. As a fully owned subsidiary of AltPowerCorp (a holding company that invests in alternate power source companies) Nuveau Power is always ready to answer the demand for space-based power plants.

Nuveau Power’s answer in this case is a Space-Based Power Plant (SPP), deployed as a constellation of Sun-Tower satellites (See Figure 1) in geosynchronous orbit with a supporting ground rectenna system (See Figure 2) to provide power to terrestrial US customers.

The remainder of this report will summarize how Nuveau Power arrived at this answer.



Figure 1: Sun-Tower Satellite Conceptualization [Fukada 2001]

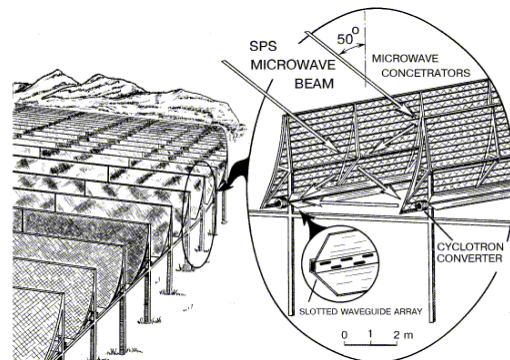


Figure 2. Wire mesh rectenna. [Vanke 1999]

OUR PATHWAY TO A CONCEPT

The Nuveau Power’s pathway to a concept was via research, trade space definition, and concept development. To assure the maximum attention was given to all related areas of the solar-power plant project it was divided into seven critical areas and the company empowered a high-level Vice President or consultant to resolve each area. These include and are resolved as follows:

Environmental: Several concerns exist over the safety and environmental impacts of the wireless power transmission of the microwave beam. Therefore, an assessment (See Environmental Impact Report[†]) of its environmental impacts was completed for Nuveau Power. Considering these findings of the scientific community, there are no environmental issues barring the development and implementation of the Nuveau Power’s 2002 Space-based Power Plant concept. [Johnson 2002]

Legal: In addressing the issue of space legislation and policy that would have an impact on a Space-based Power Plant (SPP) all existing pertinent regulations and legislation have been examined and addressed by Nuveau Power. It has been determined (See Policy Determinations Report[†]) that all licenses and permits can be secured and the project may proceed. [Gaston 2002]

Orbital: Nuveau Power considered orbiting in Low Earth Orbit (LEO), as well as geostationary orbit (GEO), along with multiple launch vehicle scenarios. After comparing fuel requirements for each vehicle and both orbit types, as well as considering “pros and cons” of LEO and GEO, the team determined that GEO was the best option. An Orbital Plan was produced that makes use of the Ariane 5 launcher to launch the satellites into GEO[†]. Transmitters operating in GEO formed the basis of rectenna size and power constraint determination for the ground segment. [Balser 2002]

Space Segment: Choosing the design concept for the Space Segment of Nuveau Power’s SPP solution involved balancing the following factors: development of new technology and materials, ease of assembly, minimizing number of launches to get a minimum set of components on orbit and overall extrapolation of what technology would allow in a 5 to 10 year development period. Nuveau Power found the best balance (See the Solar Power

[†] Nuveau Power SPP solution products can be found at <http://www.alpineaccess.com/spp/2/home.jsp>.

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Satellite Analysis Report[†]) to be attained by selecting a small constellation of Sun-Tower satellites for its space segment. This solution allows for expansion and replacement of components based on a Sun-Tower's modular design. [Sussman 2002]

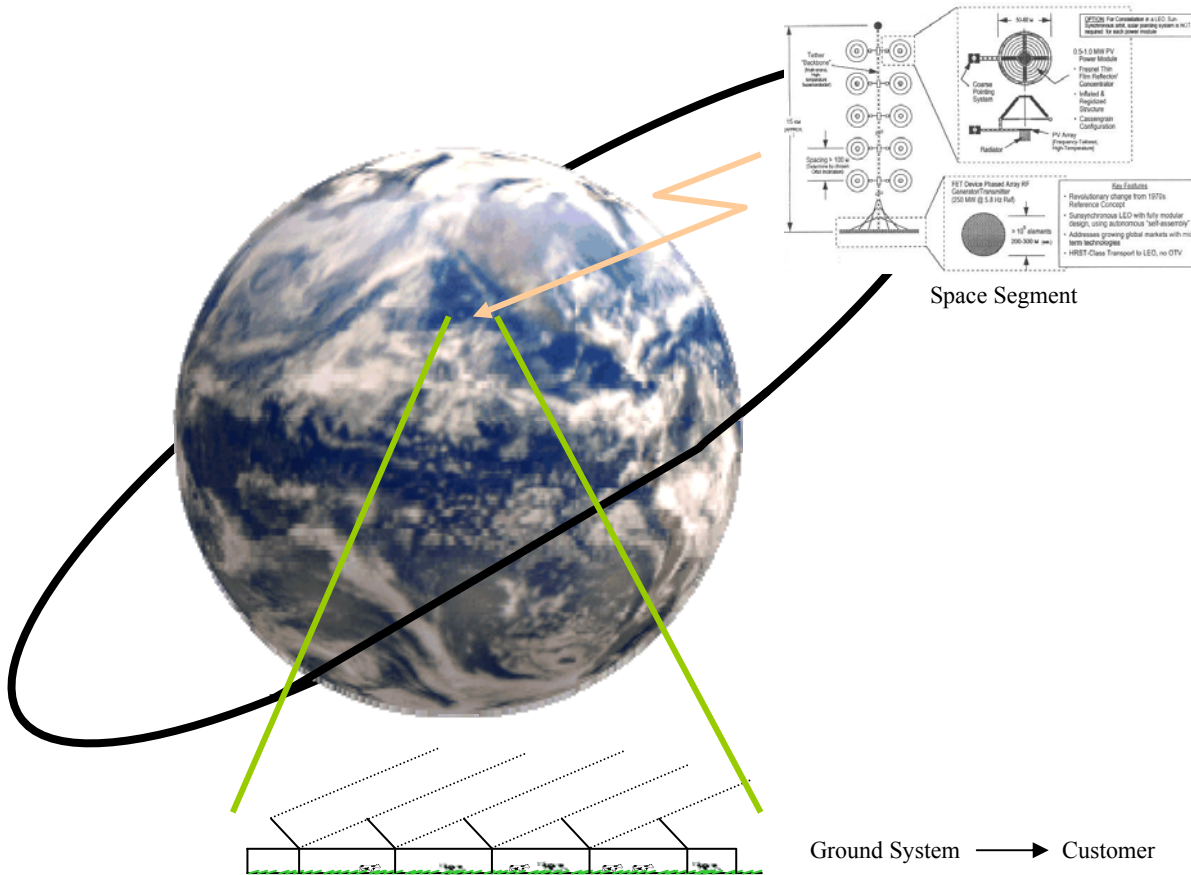
Ground Operations & Control: Ground operations and control includes the rectenna and the ground station. Nuveau Power considered different options for the design of the rectenna farm, including wire mesh and magic carpet, and using individual dishes versus dipole antennas. The decision ultimately came down to a combination of the costs, as well as the optimization of the system, and the wire mesh structure using dipole antennas was selected. Factors for ground station locations were determined and a site in western Kansas was chosen. Satellite operations and conversion of energy to electricity are also included in the Ground Station Plan[†]. [Bunin 2002]

Economic: The use of renewable energy technologies for electricity generation is projected to grow slowly because of the relatively low costs of fossil-fired generation and because electricity restructuring favors less capital-intensive natural gas technologies over coal and terrestrial renewables. Where enacted, State mandates, which specify a minimum share of generation or sales from renewable sources, contribute to the expected growth of renewables. Total renewable generation, including co-generators, is projected to increase by 0.7 percent per year. Therefore Nuveau Power conducted market and economic viability analyses (See Market Analysis & Economic Analysis Reports[†]). Findings indicate that Nuveau Power's SPP 2002 concept has profit potential. [Curley 2002]

Management: Producing a Space-Based Power Plant (SPP) is a significant production goal for any corporation therefore Nuveau Power developed a detailed plan of action (See Management Plan[†]) so it could achieve its goal. Being a small business, fully owned, subsidiary of AltPowerCorp (a holding company that invests in alternate power source companies) Nuveau Power plans to establish a project oriented organizational structure with both internal and external integrated product teams (IPT) arranged in a hierarchical manner and controlled by empowered vice-presidents of Nuveau Power. Each product IPT will have full ownership of its product's performance, schedule, budget, and lower-level organizational structure. [Lindsey 2002]

[†] Nuveau Power SPP solution products can be found at <http://www.alpineaccess.com/spp/2/home.jsp>.

OUR CONCEPT



Images Courtesy of [Sussman 2002] and [Bunin 2002]

A Space-Based Power Plant (SPP), in this case is a constellation of Sun-Tower satellites in geosynchronous orbit with a supporting ground rectenna system to provide power to terrestrial US customers. Initially the SPP constellation will consist of paired Sun-Tower Satellites at the 85-degree-West and 110-degree-West orbital slots ((one active & one spare) * two slots = 4 satellites total). Initial deployments will establish an active Sun-Tower in each slot. Follow-on deployments will increase operational reliability by positioning an on-orbit spare in each slot. Expansion of this 4-satellite constellation to support a wider customer market is feasible without system re-designs due to the generic (non-customer customized) satellite design. Although additional ground systems may be needed.

The SPP ground system will be a single ground station with a wire-mesh dipole rectenna farm to receive and convert the Sun-Tower transmitted energy. The ground system will facilitate the transfer of collected power to SPP’s customers via the standard power grid. The wire-mesh design will allow shared usage of the ground

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system's land with agricultural interests. Additional facilities can be deployed as the Sun-Tower constellation expands without system re-designs due to the generic (non-customer customized) ground station design.

OUR VIABILITY AND FUTURE

As expandable and flexible as the Nuveau Power's solution is to serving more and more customers the company realizes that its solution is based on satellites in GEO, which will not last forever. In fact, GEO satellites have a lifespan of about 15 years. While its "first generation" GEO based power plant transmits energy for terrestrial needs (and furthers the proof of the concept) replacements will be constructed and designs for more advanced space-based power plants (i.e., lunar based systems or alternate orbital scenarios) will be developed. The Nuveau Power Sun-Tower satellites and rectenna ground systems are being generically designed and therefore will be able to be reused or revamped to support any follow-on space-based power plant efforts.

Nuveau Power foresees that Polar or sun-synchronous orbital scenarios should be able to re-use their current solutions technology with only minor tweaking for optimization; Allowing energy from space to reach customers outside of GEO orbital coverage. However, all orbital solutions may become obsolete when a lunar presence is reestablished [PhysicsCentral 2002]. As a natural satellite of the Earth the Moon solves many costly logistical issues for SPP deployment. However, Nuveau Power's current technological solution (i.e., rectenna ground system(s)) would need major renovations to support a lunar energy transmission system (analogous to how Apollo facilities were revamped to become Space Shuttle facilities). Therefore Nuveau Power sees its SPP project as viable as well as the project's successful completion as the dawn for foreign oil non-dependence, and the beginning of energy production without pollution.

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