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From Uranium Enrichment To Renewable Energy

Harold Bon

Solomon Brown

Michael Cisneros

Kent Engel

Tyler Goldberg

See next page for additional authors

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Authors

Harold Bon, Solomon Brown, Michael Cisneros, Kent Engel, Tyler Goldberg, Matt Kissel, Alexa Krivoniak, Brandon Lutz, Zach Reese, Amanda Roberts, Colin Stonerook, Zoe Zeszut, and Anthony Zoccola

From Uranium Enrichment to Renewable Energy

Student Production Team
Harold Bon, Solomon Brown, Michael Cisneros,
Kent Engel, Tyler Goldberg, Matt Kissel, Alexa Krivoniak,
Brandon Lutz, Zach Reese, Amanda Roberts, Colin Stonerook, Zoe Zeszut and Anthony Zoccola

Faculty Mentors
Don Flournoy and Kyle Perkins
Ohio University, Athens Ohio

ABSTRACT

The goal of this Science/Engineering visualization is to show how gigawatt quantities of renewable energy can be generated at former nuclear processing sites as they are repurposed into industrial scale electrical power generation stations. The breakthrough product of this research is the design of an integrated terrestrial solar/space energy receiving station that will produce “baseload” electricity 24 hours a day.

This research focuses attention on a Cold War-era uranium enrichment facility located on 3,700 acres of land in a rural area of SE Ohio. This site is judged to be suitable for research leading to the first-ever combination ground-based and space-based solar energy production facility. Were this research to be successful in designing, constructing and testing a space solar power receiving antenna (rectenna) mated to the operational structures of a terrestrial photovoltaic farm, this facility (and others like it) could be transformed from an environmental hazard to a societal benefit.

In the case of the former Portsmouth Gaseous Diffusion Plant (PORTS), it is projected that the site has the capability to produce as much renewable energy as it once consumed in the form of coal-produced electricity, when two plants were installed on the Ohio River to sustain its operation.

To read the White Paper on which the following creative visualization, Technical Brief and Business Plan are based, search the Journal for *From Uranium Enrichment to Renewable Energy: Conversion of the US-DOE's Former Portsmouth Gaseous Diffusion Plant (PORTS) in Piketon, Ohio, into a Clean Energy Production Facility Within a Decade*.

Sol Invictus - Cold War Weapons to Green Energy Production (YouTube)

TECHNICAL BRIEF

The proposal on which this visualization is based suggests a systematic schedule of investigation, innovation, design, and testing that brings together two complementary fields of study that have never been combined before. What is distinctive about this project is that a space solar power rectenna – a rectifying antenna - will be integrated into the operational structure of a terrestrial photovoltaic platform for the first time.

If this research proves successful, the novel combination of two here-to-fore separate renewable energy sources will be a breakthrough opportunity for conventional solar, in that power can be generated even after the sun sets. And it will address at the same time one of the troublesome questions about where and how to safely and economically capture future energy beams from space on the ground.

GOALS AND METHODOLOGY

In cooperation with the former Portsmouth Gaseous Diffusion Plant (PORTS) in Piketon, Ohio, managed by the U.S. Department of Energy, Ohio University has proposed a three-year project divided into the following phases:

Phase I will consist of design work carried out by established experts across disciplines. Collecting photovoltaic and electromagnetic energy - and converting it into commercially usable electricity in the same space - has never before been done. Our team will define a plausibly workable approach to such a system and optimize it through simulation and modeling, including both technical performance and economic viability. Using the Piketon site, the scale of potential future energy production operations will be studied, including optimal acreage, environmental concerns, connections into the existing electrical switches and transmission lines, and local/regional opportunities for creating new businesses and high-paying jobs using this new approach to energy production.

Phase II will see the reduction to practice of modular components comprising the dual-receiver solar farm concept through the creation of engineering drawings and bills of materials based on one acre of flat land at the PORTS site. Prototype-scale components will be solicited for tender,

with requests to project costs to full-scale operation. While subsystems are being fabricated by vendors, the PORTS team will develop testing protocols and secure appropriate permissions from the FCC, FAA, EPA, DOE and regional regulatory agencies. Detailed financial models will be built based on component costs. From these, the team will compute energy returned on energy invested (EROEI) so that the refined concept for an integrated ground solar/space solar farm can be compared on an equal footing with competing methods of power generation.

Phase III will involve the deployment and testing of a sub-scale "dual solar" farm on-site at the PORTS Plant. The International Space Station, an airship or aerostat (a tethered balloon) will be used as a proxy for a solar power satellite in a proof-of-concept test of the integrated terrestrial photovoltaic and space solar receiving antenna. Performance data gathered will be used to validate and refine both the engineering drawings and financial models. The end result will be a package of materials ready for consideration/ implementation by a public-private partnership, the nature of which will have been refined over the duration of the project.

BUSINESS PLAN

During the Cold War, huge amounts of coal energy were consumed to produce enriched uranium for nuclear power plants and for atomic bombs.

The "layered solar farm" concept aims to repurpose contaminated sites for a unique merging of two complementary forms of renewable energy. Terrestrial solar follows the local sun, and power production peaks just before demand peaks, especially on late summer afternoons. Ground solar cannot provide energy during the important evening hours, but space solar power can. Power beamed from space is a steady-state amount, making it suitable as a baseload source. By appropriate sizing of the dual solar farm, its electrical output can be matched to demand, eliminating, or at least greatly reducing, concerns about intermittency when using ground-based photovoltaics. Large-scale ground solar/space solar farms can replace conventional power plants in locations where the transmission and distribution infrastructure is already in place. Such retrofitting applications may be appropriately applied and be transformational in their impact in numerous critical sites at home and abroad.

In the long run, Space Solar Power could represent the form of renewable energy that makes all economic activity sustainable and clean. While the concept is 50 years old, the realization of its promise has not even started. A financial bridge is needed to ameliorate the technical and fiscal risk of this proposal.

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