

SunShot Grand Challenge Summit & Technology Forum - Denver, CO

Title: Low Capital Photovoltaic Panel Electrical Output-Booster System

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Overview - Objective

Create significant financial leverage, gain superior ROI and reduced payback periods for Solar PV utility-scale arrays utilizing known technologies with a novel process configuration.

Boost PV electrical generation output by installing small, mobile “delivery van size” solar-panel light spectrum booster systems alongside existing (or newly constructed) Solar PV arrays for utility and community solar applications. Spectrum adjustable LED light will be distributed via fiber-optics cables and focused via tiny mirror reflector onto Solar PV panels.

Problem to be Solved

During all daylight hours solar light “spectral quality” varies dramatically when striking a Solar PV panel. Most of the light passes through the panels, providing no electrical output . This fact forms the major limiting factor in PV electrical panel output. This is equivalent to running a high-performance combustion engine with “low-octane fuel”.

Each panel design and materials used are unique for various manufacturer specifications. If light spectra can be adjusted to match the “premium octane” requirements for various PV panel materials, electrical output can be dramatically “boosted”. Considering low quality light incidence of early morning or late evening; and impacts of cloudy and seasonal conditions, enormous output can be gained.

Solution: Boosting PV panel efficiency output ("Boosters") by combining arrays with flashlight beam-sized "focused lens technologies" enhanced with small-scale LED (spectrally adjusted) lighting distribution via fiber-optics could generate 60% to 80% efficiency improvement. Details of technology can be open-source.

Financial Advantages & Benefits

1 - Best locations for solar installations are often near existing utility usage locations in larger communities. Line loss definitely impacts power distribution costs and financial benefits.

2 - Land costs become a major factor when locating solar arrays in or near large communities with higher land costs. However, these communities have both power

demand and faster growth.

3 - **Large land plots** are often more difficult to permit, take excessive environmental impact reviews and must compete with other more profitable uses for properties.

Review time + engineering costs can be far higher.

4 - **Public resistance/concerns** over solar arrays of large size is a definite factor for local government approvals. Reducing PV array footprint by factor of say 60% will alter real and perceived visual impacts.

5 - **Low capital methods** such as "Boosters" can reduce land costs; slash PV panel array and structure/installation costs; help to streamline capital acquisition; cut power distribution costs in populated areas; markedly improve ROI; and gain support from City/County officials in permitting and siting.

6 - **Power source for "Boosters"** can be bio-gas, natural gas, solar battery storage, or any combination of lowest costs alternatives. Suggest this approach could gain about 50% + overall capital cost advantage (reduction) for PV panel arrays (e.g. Community Solar). Financing alternatives offer far greater upside benefits to payback time (years) for solar projects and could eliminate future need for public subsidies.

Description - Technology, Components & Assemblies

- Adaptable to varying Solar PV panel designs and specifications
- Use available components (fresnel lens, LED assemblies, electronics & fiber optics)
- Laboratory tests to be completed and performance validated within first year in existing laboratory. Technology skills to implement are available in U.S.
- Can scale up to Pilot Testing in second year on an existing utility PV panel array
- Commercial scale can use off-the-shelf components and power supply sources
- Cost estimates & systems design can be verified and completed in one (1 year).

Financial Leverage Factors

- Capital cost reduction - land, engineering, components, permitting, solar PV panels and construction
- Locate utility arrays close to communities and reduce line loss
- Siting flexibility to match needs of local or regional utilities

- Capital addition - Booster system @ +/- 5 percent range of overall capital cost
- Ease of install with mobile vehicle-mounted system (self-contained)
- System adaptable to both existing and new PV panel arrays, all makes/models
- Power source can be adapted to locally available supply or combination of supplies

Timelines for Implementation

- Prototype designed, built and tested (one year)
- Pilot Scale on existing utility PV panel site (built, installed, operational) + one year
- Full Scale Commercial operations sited at existing location + one year
- Program Management & Production - Implementation Plan has been developed
- TBD - Commercial Project Rollout for Existing Solar Panel Arrays
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- Propose design and system assembly in Washington State near Seattle

Development Considerations

1. Seeking first-year financing and agreements with preferred local utility site
2. Open to develop Joint Business Plan and Financial Analyses with investor funding
3. Open-source technology will limit intellectual property protection (disclosed herein)

Significant Cost Factors

1. Large Commercial Scale Fresnel Lenses for concentrating specific light spectra must be built to order. Lens Manufacturers listings are available and costs depend on size and design specifications.
2. High output LED (Commercial) Lighting can be acquired for specific light spectra outputs (adjustable). These are available through lighting manufacturers.

3. Bundled fiber-optics cable of various size, lengths, and light transmission quality is commercially available over a wide range of specifications and manufacturers.

Applicability - Limitations TBD

Some PV panel installations may gain only minor financial benefits from “Boosters”.

Each of the above financial leverage factors are dependent on siting/location, geography, climate, latitude, seasonal daylight, weather patterns, and so forth. DOE and existing utility installations have data available to calculate overall Financial Benefits for specific sites.

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