



Use of Solar Panel on Railway Track

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Abstract – The rapid growth in energy demand and the need for sustainable infrastructure have encouraged the exploration of innovative renewable energy solutions within existing transport networks. Railways, being one of the largest consumers of electricity, offer vast stretches of unused corridor space that can be effectively utilized for solar power generation. This study examines the concept, design, feasibility, and benefits of installing solar photovoltaic (PV) panels on and along railway tracks.

The paper discusses various installation models such as panels placed between rails, alongside tracks, and on elevated structures above tracks. It analyzes the working principle, required components, engineering considerations, and power generation potential of such systems under Indian climatic conditions. Economic analysis shows that the approach is cost-effective due to the absence of land acquisition costs and low maintenance requirements, with a reasonable payback period. Environmental benefits include significant reduction in carbon emissions and support for national renewable energy goals.

Keywords- Renewable energy, Sustainable Infrastructure, PV Panel

INTRODUCTION

The use of solar panels on railway tracks is an innovative approach to generate renewable energy by utilizing the vast unused space available along railway corridors. Railways require a continuous supply of electricity for train operations, signaling systems, lighting, stations, and other services. Meeting this demand through conventional energy sources increases operational costs and environmental pollution. Installing solar photovoltaic (PV) panels on, above, or alongside railway tracks offers a sustainable alternative.

METHODOLOGY

The methodology for implementing solar panels on railway tracks follows a step-by-step engineering approach to ensure safety, efficiency, and compatibility with railway operations.

Step 1: Preliminary Study and Data Collection

- Collect solar radiation data of the selected railway location.
- Study train frequency, track layout, and maintenance schedules.
- Identify available space (between rails, trackside, or above track).

Step 2: Feasibility Analysis

- Check technical feasibility considering vibration, dust, and safety clearance.
- Estimate the potential area available for panel installation.
- Calculate expected power generation based on area and solar intensity.

Step 3: System Design

- Select suitable installation model (between rails / alongside / elevated).
- Design vibration-resistant mounting structures.

- Decide panel tilt angle and orientation for maximum sunlight. Plan electrical layout for inverter, batteries, and grid connection.

Step 4: Selection of Materials and Equipment

- Choose high-efficiency PV panels with tempered glass.
- Select GI/aluminium mounting frames with anti-corrosion coating.
- Procure inverters, cables, junction boxes, earthing, and safety devices.

Step 5: Installation

- Fix mounting structures with anti-vibration supports.
- Install panels securely at calculated tilt.
- Connect panels electrically through proper insulated wiring.
- Provide earthing and lightning protection.

Step 6: Electrical Integration

- Connect inverter output to railway loads or grid supply.
- Install meters and monitoring systems for performance tracking.
- Ensure protective devices are in place to prevent faults.

Step 7: Testing and Commissioning

- Inspect mechanical stability of structures.
- Test electrical output and inverter operation.
- Confirm no obstruction to train movement or maintenance.

Step 8: Operation and Maintenance

- Schedule regular cleaning of panels.
- Inspect structures for vibration damage.
- Monitor daily energy generation and system health.

Step 9: Performance Evaluation

- Compare actual energy output with estimated values.
- Evaluate cost savings and environmental impact.
- Suggest improvements for large-scale implementation.



Fig. 1- Solar Panel Installation

REVIEW OF SOLAR PANEL INSTALLATION ON RAILWAY TRACKS AT BANARAS (VARANASI)

In August 2025, Banaras Locomotive Works (BLW), Varanasi implemented a pilot solar panel installation directly on active railway tracks—a first-of-its-kind initiative in India. This project represents an innovative approach to using otherwise unused space within railway infrastructure for renewable energy generation.

- Location: Line No. 19, BLW workshop,
- Installation Type: Removable solar panels Figure 2 .Solar Panel Installed mounted between railway tracks on sleepers.
- Scale: 70 meters of track length.
- Panels Installed: 28 solar panels, totalling 15 kWp capacity.
- Daily Output: Estimated generation of around 67 kWh/day.
- Power/Energy Density: Approx. 220 kWp per km and 880 units/km/day.

CONCLUSION

The installation of solar photovoltaic panels on and along railway tracks is an innovative and practical approach to generating renewable energy by utilizing unused railway corridor space. This study demonstrates that such a system is technically feasible, economically viable, and environmentally beneficial for railway infrastructure.

By adopting suitable installation models and vibration-resistant designs, solar panels can operate safely without interfering with train movement or maintenance activities.



The generated power can effectively support railway stations, signaling systems, and other auxiliary loads, thereby reducing dependence on conventional electricity sources and lowering operational costs.

In conclusion, the integration of solar energy into railway infrastructure offers a promising pathway toward greener, more energy-efficient, and sustainable railway operations in the future.

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