

## Bifacial photovoltaic noise barrier horizontal configuration yielded the highest annual AC energy output compared to other tilt angles studied

This study evaluated the energy generation of a bifacial photovoltaic noise barrier in Vilnius, Lithuania, across different PV segment tilt angles. The key finding is that the horizontal configuration (0° tilt) yielded the highest annual energy output, suggesting that a lower tilt angle is optimal for this specific site and configuration



### Introduction

Noise pollution remains a significant environmental issue in urban areas, mainly caused by traffic and rail transport. To mitigate this, noise barriers are widely used, and their integration with photovoltaic (PV) technology offers a sustainable solution by combining noise reduction with renewable energy generation.

This study focuses on Photovoltaic Noise Barriers (PVNBs), particularly those integrated with bifacial solar panels, it investigates how the slope angle and orientation of PV elements affect their annual energy yield. The research includes the analysis of a single PVNB segment applied to a railway setting in Vilnius, Lithuania, with reference to real-world project in Juodšiliai.

The integration of renewable energy systems into infrastructure, like noise barriers, supports climate targets, reduces reliance on fossil fuels, and optimizes land use for both noise mitigation and clean energy production.

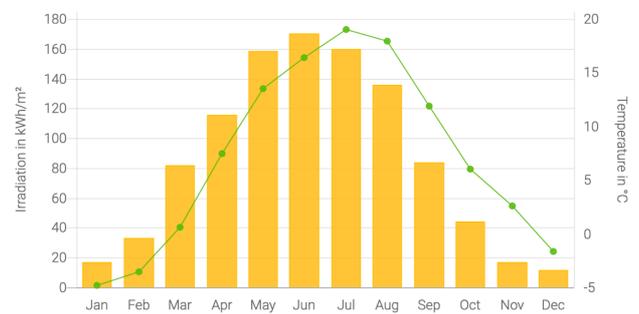
### Methodology

By evaluating the energy production of a PVNB in the studied location across five scenarios with different tilt angles of the PV segment the study used an open-source tool to calculate the annual global horizontal irradiation and average temperature for the selected location.

Scenarios	Tilt angle $\beta$
I	0° (Horizontal)
II	36°
III	45°
IV	75°
V	90° (Vertical)

The PVWatts Calculator was then used to simulate the annual AC energy output for each scenario based on specific input parameters, including the tilt angle and calculated system losses. The performance of each configuration was then compared based on the simulated energy output.

### Results



Shown above is the Global Horizontal Irradiation throughout the year, and below are the AC energy yields in kWh and the captured solar radiation per unit area.

