



IEA PVPS Task 17: PV and Transport

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IEA Photovoltaic Power Systems Programme (PVPS)



- The International Energy Agency (IEA), founded in 1974, is an autonomous body within the framework of the Organization for Economic Cooperation and Development (OECD).
- The Technology Collaboration Programme (TCP) was created with a belief that the future of energy security and sustainability starts with global collaboration. The programme is made up of thousands of experts across government, academia, and industry dedicated to advancing common research and the application of specific energy technologies.
- The IEA Photovoltaic Power Systems Programme (IEA PVPS) is one of the TCPs within the IEA and was established in 1993.
- 32 members - 29 countries, European Commission, 2 associations
- “To enhance the international collaborative efforts which facilitate the role of photovoltaic solar energy as a cornerstone in the transition to sustainable energy systems”



- Task 01 – Strategic PV Analysis & Outreach
- Task 12 – PV Sustainability
- Task 13 – Reliability and Performance of PV Systems
- Task 15 – Enabling Framework for the Development of BIPV
- Task 16 – Solar Resource for High Penetration and Large Scale Applications
- Task 17 – PV and Transport
- Task 18 – Off-Grid and Edge-of-Grid Photovoltaic Systems
- Task 19 – Photovoltaic Integration in Electricity Networks and Markets
- Task 20 – Energy Hubs & Green Hydrogen

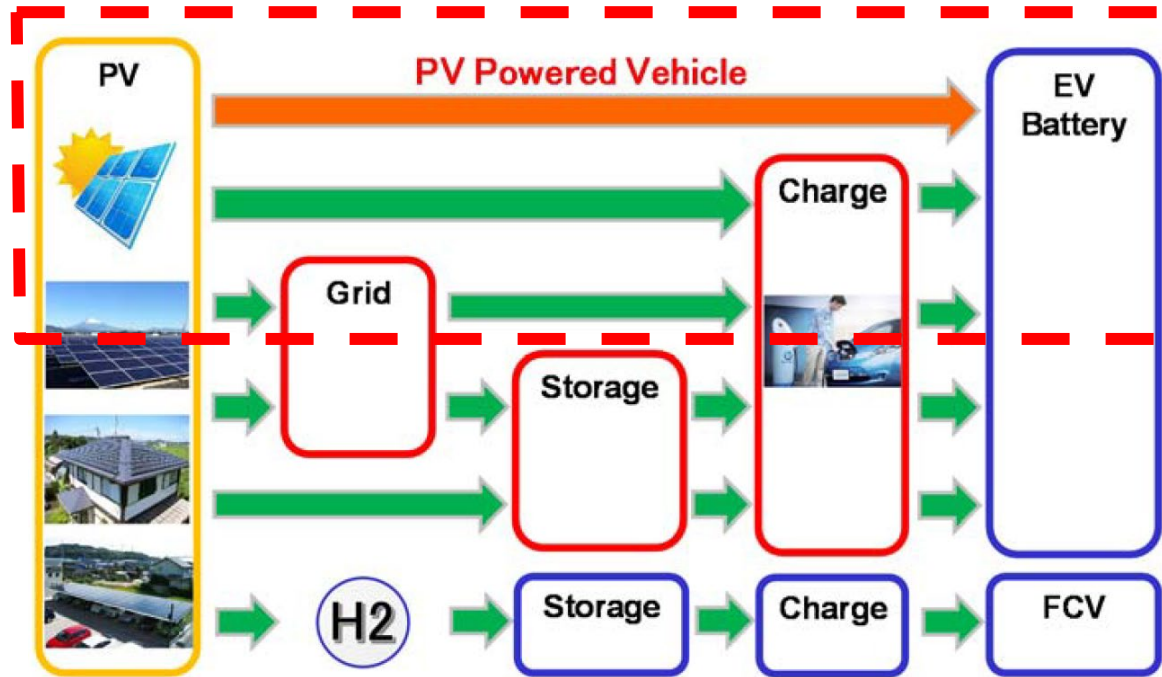
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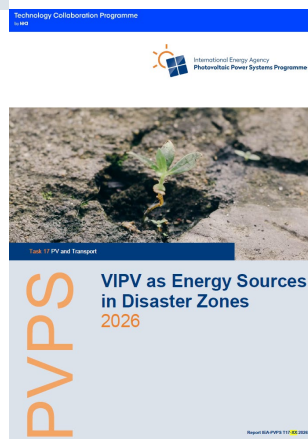
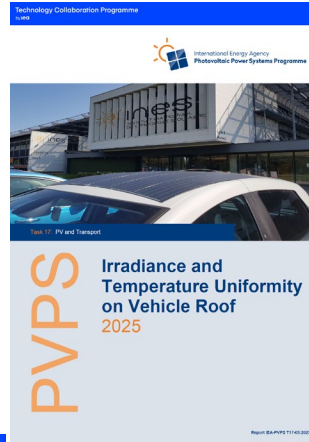
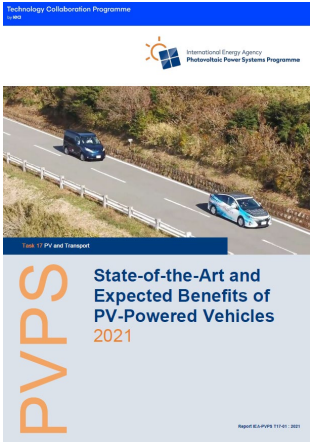
- The goal of Task 17 is *to Deploy PV usage in the transport, which will contribute to reducing CO₂ emissions of the sector and enhancing PV market expansions.*

- Participating countries

Australia
Belgium
France (TM)
Germany
Japan (TM)
the Netherlands
Portugal
Spain
Sweden (new member)
Switzerland
Turkey (new member)



Task 17 technical reports: VIPV



PVPS

<https://iea-pvps.org/research-tasks/pv-for-transport/>

Task 17 technical reports: PVCS



Technology Collaboration Programme

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International Energy Agency
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Task 17 PV and Transport

PVPS

**PV-Powered Electric Vehicle
Charging Stations**
*Preliminary Requirements and
Feasibility Conditions*
2021

Report IEA-PVPS T17-02 : 2021

Technology Collaboration Programme

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International Energy Agency
Photovoltaic Power Systems Programme



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PVPS

**PV-Powered Electric
Vehicle Charging
Stations**
Requirements, barriers, solutions
and social acceptance
2025

Report IEA-PVPS T17-04:2025

Technology Collaboration Programme

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International Energy Agency
Photovoltaic Power Systems Programme



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PVPS

**PV-Powered Charging
Stations:**
Sizing, Optimization and
Control
2026

Report IEA-PVPS T17-8:2026

Task 17 technical reports: Fact Sheet



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FACT SHEET



Task 17 PV & Transport

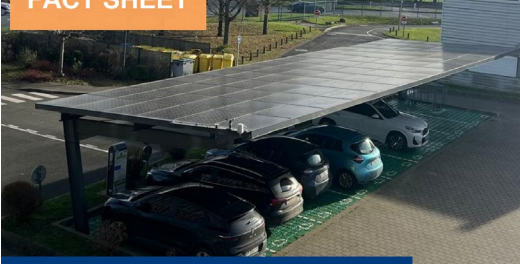
PVPS **Vehicle-Integrated PV**
Status and Perspectives

August
2025

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FACT SHEET



Task 17 PV & Transport

PVPS **PV-Powered Charging Stations**
Sizing, Optimization and Control

July
2026

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FACT SHEET



Task 17 PV & Transport

PVPS **VIPV as Energy Sources in Disaster Zones**

July
2026

Fact Sheet: PV-Powered Charging Stations, Sizing, Optimization and Control



PV-Powered Charging Stations



PV-Powered Charging Stations



PV-Powered Charging Stations



What is a PV-Powered Charging Station?

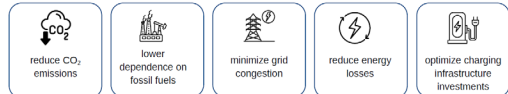
A PV-powered charging station combines solar electricity generation with electric vehicle (EV) charging and intelligent energy management. Depending on local conditions and user needs, these systems can operate grid-connected or off-grid and may integrate battery storage and Vehicle-to-Grid (V2G) functionality.*



A PV-powered electric vehicle charging station.

Why PV-Powered Charging Matters

The rapid expansion of electric mobility is increasing electricity demand worldwide. PV-powered charging stations enable the use of locally generated renewable electricity for EV charging, helping to:



Through smart coordination of PV generation, storage, and charging demand, PVCS can support both energy and mobility transitions.

Smart sizing for workplace charging

A workplace charging facility in southern France was analysed using six years of operational data, including more than 32 000 charging sessions from over 350 EV users across approximately 80 charging points. The study compared uncontrolled charging with solar-aligned smart charging strategies [1].

Key outcomes:

- Smart charging strategies can reduce required PV capacity by up to 50% compared to basic approaches.
- Aligning charging demand with solar production significantly lowers infrastructure needs.
- Modular sizing allows fast replication across multiple similar sites.

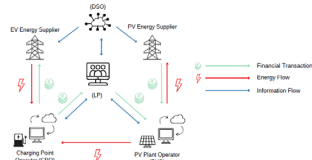


Figure 1: Interactions of the EVCS's stakeholders

Cost and emissions optimization

Designing an efficient PV-powered charging station requires balancing both economic and environmental objectives. The optimal combination of PV capacity, battery storage, charging infrastructure, and grid interaction depends strongly on local operating conditions, electricity prices, mobility patterns, and solar resources [2, 3].

Case studies demonstrate that no single system configuration is optimal for all applications. Instead, PVCS design should be adapted to the specific site and charging profile to achieve the best balance between cost, renewable energy use, and emissions reduction.

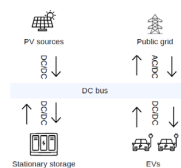
Component Optimization	Economic Impact (LCOE)	Environmental Impact (LCI)
Increased PV Capacity	Lowers Levelized Cost of Energy over time.	Reduces reliance on carbon-heavy grid mixes.
Larger Battery Storage	Increases initial capital investment (CapEx).	Lowers Life Cycle Emissions by capturing excess solar.
Grid Interaction	Radically improves financial viability.	Buffers seasonal solar drops, stabilizing the system.

Key outcomes:

- Larger batteries reduce life-cycle emissions; increased PV capacity lowers energy costs.
- Grid interaction generally improves both cost and environmental performance.
- Site-specific conditions strongly influence optimal system design.

Vehicle-to-Grid (V2G) integration

Vehicle-to-Grid (V2G) technology enables electric vehicles to act not only as electricity consumers, but also as flexible energy resources. When connected to a charging station, parked EVs can temporarily store excess solar electricity and feed electricity back to buildings or the grid when needed [4].



PV generation, stationary storage, electric vehicles, and the public grid are connected through a common DC bus. Bidirectional power flows enable EVs and battery storage to act as flexible energy resources, supporting charging demand, renewable energy integration, and grid interaction.

Figure 2: Scheme of PV-powered charging station with V2G service

Key outcomes:

- Parked EVs can provide flexibility and grid services.
- Large-scale V2G applications (campuses, fleets) deliver the strongest benefits.
- Smart scheduling minimizes costs while respecting user requirements.

V2G can improve the integration of renewable electricity, increase system flexibility, and support more efficient operation of PV-powered charging stations.

PVCS for electric buses

Electric buses are essential for clean and efficient urban transport. Integrating solar PV into bus depots can reduce operational emissions, lower electricity costs, and support the transition to low-carbon public transport [5].

The report analyses how PV-powered charging stations can be optimized for electric bus depots, considering battery size, charging power, grid interaction, and solar generation.

Key outcomes:

- Electric buses significantly reduce tailpipe emissions and improve urban air quality.
- Charging strategies involve trade-offs between battery size, grid impact, and infrastructure cost.
- PV integration reduces CO₂ emissions and peak demand, though seasonal variability requires storage solutions.

Want to know more?

If you are interested in more insights and detailed data, explore the full "PV-Powered Charging Stations: Sizing, Optimization and Control" report.

About IEA PVPS Task 17

IEA PVPS Task 17 explores how PV can support the decarbonisation of transport by integrating solar energy into electric vehicles, charging infrastructure, and mobility systems, while providing technical knowledge and practical guidance for their large-scale deployment.

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Photo Front Page: STELLA Smart Transport and Energy Living Lab, Innovation Center of Université de Technologie de Compiègne, France

Task 17 Subtasks & Objectives



Subtask 1: PV-Powered Vehicles (VIPV)

- To recognize current status and future potential of PV-powered vehicles
- To identify requirements, barriers and solutions for PV-powered vehicles
- To clarify expected contributions by PV-powered vehicles
- To clarify expected benefits for users and industry by PV-powered vehicles

Subtask 2: PV charging systems and PV power infrastructure (PVCS)

- To explore how PVCS can optimally utilize solar energy to charge vehicles
- To understand how intelligent charging systems can adapt to varying solar energy availability
- To identify key metrics for efficient PVCS operation
- To explore the financial and environmental impacts of PVCS
- To examine how advanced technologies—such as vehicle-to-grid (V2G), battery swapping, artificial intelligence (AI), and peer-to-peer energy trading—can be integrated on PVCS

**Resilience & Sustainability
→ Common issue**

Subtask 3: Potential of PV integration into the transport

- Develop and describe customer potentials of VIPVs
- Evaluate and describe challenges for the market entry of VIPV's
- Evaluate and describe market niches for VIPV-application in vehicles/ boats and planes
- Dissemination strategies for VIPS
- Elaborate the potential of light-weight VIPVs in industrialized and developing countries
- Describe challenges and chances of grid integration of VIPVs

Subtask 4: Market analysis and business approaches for VIPV & PVCS

Assess current market trends, identifying key players, and exploring innovative business models that leverage the integration of photovoltaic systems in EV applications

Thank you

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