

# Solar-powered public transportation

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## **INTRODUCTION:**

As concerns about climate change continue to grow, cities worldwide are searching for innovative ways to reduce their carbon footprint and transition to renewable energy sources. One promising solution is solar-powered public transportation, which has the potential to revolutionize the way we travel while also reducing our impact on the environment. From reducing air pollution and improving public health to creating new jobs and stimulating economic growth, solar-powered public transportation has a wide range of benefits that could pave the way toward a more sustainable future. In this article, we'll explore the different types of public transportation that can be powered by solar energy, including buses, trains, and trams, and discuss their potential for the future.

The transportation sector is currently one of the biggest producers of greenhouse gas emissions. Solar-powered public transportation refers to transportation systems that run on energy generated from the sun. The use of solar power in public transit is becoming increasingly popular, although this technology is still in its infancy.

### **Some examples of solar-powered public transportation include:**

**Buses:** Solar buses are public vehicles powered by electricity generated from solar panels installed on the roof of buses. These solar panels convert sunlight into electricity, which is then stored in a battery and used to power the bus. Solar buses can be fully or partially powered by solar energy, depending on the size and capacity of the solar panels and batteries.

The use of solar-powered buses has several benefits. First, it reduces the carbon footprint of transportation. Second, it reduces the operating costs of the bus as solar energy is free and improves reliability.

Several cities worldwide have implemented solar-powered buses as part of their public transportation systems. For example, Adelaide in Australia has a fleet of solar-powered buses partially powered by solar energy, and the state of Ceará in Brazil has a solar bus with a battery bank that guarantees 300km of autonomy of the vehicle. Similarly, Bangalore in India has introduced a fleet of fully solar-powered buses operating on several city routes.

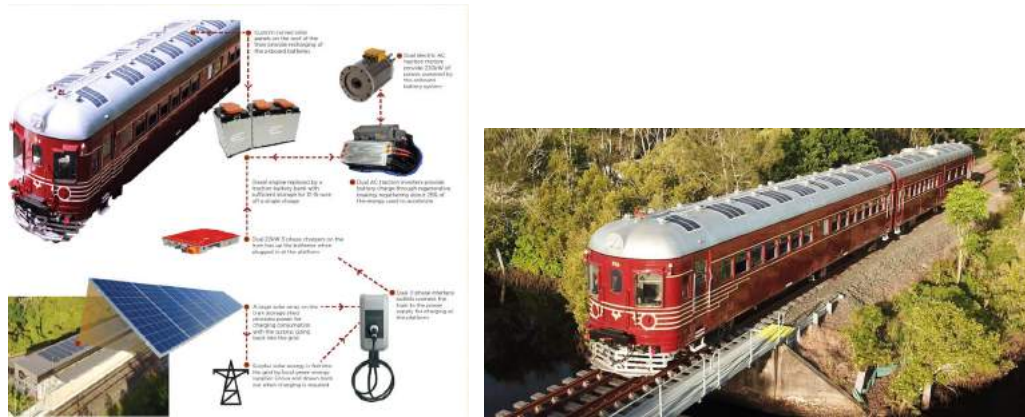


*Sonomotors (2023).*

**Trains:** Solar trains are public vehicles powered by electricity generated from solar panels installed along the tracks. These solar panels convert sunlight into electricity, which is then used to power the train. The electricity generated can be used directly to power the train or stored in batteries for later use.

The use of solar-powered trains has several benefits. First, it reduces the carbon footprint of transportation, as solar energy is a clean and renewable energy source. Second, it reduces the train's operating costs, as solar energy is free and does not require the use of fossil fuels. Third, it improves the reliability of the train, as it is less dependent on traditional fuel sources and more resilient to power outages.

Solar-powered trains are a relatively new technology being developed and tested in several countries around the world. For example, in Australia, the Byron Bay Railroad Company has converted a diesel-powered train to run on solar power, using a combination of solar panels and battery storage to power the train. Similarly, in the Netherlands, a pilot project is underway to test a solar-powered train that uses solar panels installed along the tracks to power the train. In India, Indian Railways is undergoing a project to meet the energy requirements of nearly 7,000 railway stations with solar power; more than 1,000 stations have already been covered with solar panels on rooftops.



*Byronbaytrain (2023).*

**Ferries:** Solar-powered ferries are watercraft powered by electricity generated from solar panels installed on the roof or deck of the ferry. These solar panels convert sunlight into electricity, which is then used to power the electric motor or motors that propel the ferry. Solar-powered ferries can be fully or partially powered by solar energy, depending on the size and capacity of the solar panels and batteries.

The use of solar-powered ferries has several benefits. First, it reduces the carbon footprint of water transportation, which depends on several factors, including the type of fuel used, the age and efficiency of the vessel, and the distance traveled. Generally, ferries that use fossil fuels such as diesel have a higher carbon footprint than those that use cleaner fuels such as liquified natural gas (LNG) or electricity from renewable sources.

According to a study by the International Association of Public Transport, the average carbon dioxide (CO<sub>2</sub>) emissions from a passenger ferry are around 28 grams per passenger kilometer (gCO<sub>2</sub>/km) for diesel-powered vessels and 21 gCO<sub>2</sub>/km for LNG-powered ferries. On the other hand, electric ferries have much lower emissions, averaging around 1.1 gCO<sub>2</sub>/km.

Second, it reduces the operating costs of the ferry, as solar energy is free and does not require the use of fossil fuels. Third, it improves the reliability of the ferry, as it is less dependent on traditional fuel sources and more resilient to power outages.

Several solar-powered ferries have been implemented around the world. For example, in Norway, the world's first all-electric and fully solar-powered ferry, the MS Folgefonn, was launched in 2018. The ferry is powered by solar panels and batteries and can carry up to 50 cars and 199 passengers. In Germany, Each year, the ferry (Sankta Maria of the Ostseestal) will transport an average of 143,000 people, 66,000 vehicles, 1,600 motorcycles, and almost 20,000 bicycles. The innovative new electric car ferry is 28 meters long and nearly 9 meters wide, with a carrying capacity of 25 tonnes and the ability to transport 45 pedestrians and six vehicles per crossing. By replacing the old ferry used for the crossing, the new ferry will save 14,000 liters of diesel per year, equal to the annual fuel consumption of 775 diesel-powered

cars. The new ferry also features significantly reduced noise levels and completely eliminates the exhaust gases and fine particulates emitted by the old diesel ferry. In the United States, New York has implemented a solar-powered ferry service that operates on the East River and connects several neighborhoods in Brooklyn, Queens, and Manhattan.



*Ostseestaal (2023).*

**Streetcars:** Solar-powered streetcars are public vehicles powered by electricity generated from solar panels installed on the roof or sides of the streetcar. These solar panels convert sunlight into electricity, which is then stored in batteries and used to power the electric motor or motors that propel the streetcar. Solar-powered streetcars can be fully or partially powered by solar energy, depending on the size and capacity of the solar panels and batteries.

The use of solar-powered streetcars has several benefits. First, it reduces the carbon footprint of transportation, as solar energy is a clean and renewable energy source. Second, it reduces the operating costs of the streetcar. Third, it improves the reliability of the streetcar, as it is less dependent on traditional fuel sources and more resilient to power outages.

Several cities worldwide have implemented solar-powered streetcars in their public transportation systems. For example, the city of Seville in Spain has a tram system that is partially powered by solar energy. Similarly, Melbourne in Australia, has a tram system that uses solar energy to power its onboard air conditioning and lighting systems.



*Beat (2022).*

## Conclusion

Solar-powered public transportation is developing worldwide, both in the Global South and the Global North, with examples from India to Europe. Research shows that many African and Latin American countries could meet all their energy needs by covering less than 0.1% of their landmass with solar panels.

Although solar is the fastest-growing energy technology in history, progress in solar-powered public transportation is happening relatively slowly, with most of the mentioned transportation forms taking many years to develop. The process takes longer due to jumbled decision-making, technical difficulty, and lack of resources. Efforts to build solar-powered public transportation should be scaled up. The main benefits of governments and cities investing in solar-powered public transportation are their lower costs compared to fossil fuels, these systems produce zero emissions, they lead to the creation of new jobs stimulating economic growth, and they contribute to increasing energy security and positive impacts on public health due to reduced air pollution.

It is important also to mention some cons of solar-powered public transportation that pose a barrier to viewing them as *the* solution for future public transportation. Solar energy is not always available, and solar technologies often need to be backed by batteries, such as solar buses. Batteries depend on lithium which is a non-renewable resource. Concerning solar trains, research shows that only parts of railway networks could eventually run on solar power, with the remaining parts requiring batteries.

### **Future of solar-powered public transportation:**

Finally, here are some innovative ideas relating to the future use of solar energy in public transportation:

- *More efficient solar panels:* Advancements in solar panel technology could lead to more efficient and cost-effective solar panels, allowing for increased energy production and reduced costs;
- *Improved energy storage:* Advancements in energy storage technology, such as batteries or capacitors, could allow for solar-powered public transportation systems to store excess energy for later use, increasing efficiency and reducing reliance on the electrical grid;
- *Solar roadways:* Research is ongoing in developing solar roadways, which could allow roads and highways to generate electricity from the sun, powering electric vehicles and reducing emissions.

- *Improved electric motors:* Advancements in electric motor technology could lead to more efficient and powerful electric vehicles, allowing for faster and more reliable solar-powered public transportation.
- *Integrated systems:* Future solar-powered public transportation systems could be integrated with innovative city technologies, allowing for better traffic management and improved passenger experiences.

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