



# ZEMU

Zero-Emission Multiple Unit



## Overview

The San Bernardino County Transportation Authority (SBCTA) is leading the charge for a greener passenger rail future by piloting zero-emission rail technology for Southern California and throughout the state. In late 2025 ZEMU, a Zero-Emission Multiple Unit and North America's first federally compliant, self-powered, zero-emission hybrid hydrogen and battery passenger train will begin service on Metrolink's 9-mile Arrow corridor that serves the eastern portion of the San Bernardino Line between the San Bernardino Downtown Station and Redlands University Station.

Thanks to significant investment by the state of California, SBCTA's efforts to develop and prepare ZEMU to enter service are laying critical groundwork for transit agencies throughout California to introduce the new, cleaner passenger train into their existing infrastructure and provide a cleaner transit option for communities statewide.

## Project Benefits

California's air quality is affected by many factors and sources, such as emissions from cars, trucks, buses, and freight trains. These emissions not only contribute to local air pollution, but also drive global climate change. When ZEMU begins service, it will provide a transit option free of greenhouse gas emissions and act as a major piece in the progression to an eco-friendly regional transit system for generations to come.

ZEMU has an on-board, center-located fuel cell that uses hydrogen fuel and oxygen to generate electricity to power the train's propulsion system. The only emission from the train is water vapor, thus not contributing to greenhouse gas and air pollutant emissions in one of the most challenged regions for air quality.

The ZEMU passenger train will:

- Use hydrogen as a primary fuel source
- Provide seating for 108 passengers and offer a generous amount of space for standing passengers
- Reduce greenhouse gas emissions on transit systems
- Improve air quality within the region

## Funding

With more than a decade of planning and an investment of State and Local funds totaling \$60.2 million, SBCTA's efforts to develop ZEMU, North America's first federally compliant, self-powered, zero-emission hybrid hydrogen and battery passenger train, are laying critical groundwork for transit agencies throughout California to introduce the new, cleaner passenger train into their existing infrastructure and provide a cleaner transit option for communities statewide.

Project funding covered the costs of the vehicle, project oversight, regulatory testing and analysis, initiative studies, retrofit of the maintenance facility and addition of a fueling station.

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Aug 2025

# Plan. Build. Move.

## Schedule

### APRIL 2018

SBCTA awarded a \$30 million grant from the State of California from the California Transit and Intercity Rail Capital Program (TIRCP) to develop a zero-emission multiple unit passenger train

### NOVEMBER 2019

SBCTA signs contract with Stadler US to begin manufacturing hydrogen-powered ZEMU train

### OCTOBER 2022

Service starts on Metrolink's Arrow corridor along the San Bernardino County Line with cleaner diesel multiple unit trains also made by Stadler

### AUGUST 2023

ZEMU arrives in the U.S. and begins testing under Federal Railroad Administration guidelines at the Transportation Technology Center in Pueblo, Colorado

### JUNE 2024

ZEMU arrives in San Bernardino and begins integration and testing under Metrolink's operating system

### SEPTEMBER 2025

ZEMU to enter service on the Arrow corridor along the San Bernardino Line between Redlands and San Bernardino

## Frequently Asked Questions

### HOW DOES ZEMU WORK?

ZEMU uses a combination of hydrogen fuel cells and batteries to propel the train. The train has an on-board, center located fuel cell that uses hydrogen fuel and oxygen to generate electricity to power the train's propulsion system. The only emission from the train is water vapor, meaning cleaner air, less global warming and healthier, quieter neighborhoods.

### ARE THERE ANY SAFETY RISKS ASSOCIATED WITH TRAVELING ON A HYDROGEN-POWERED TRAIN?

When used in accordance with proper guidelines, hydrogen fuel is safe for public transportation. Today, hydrogen-powered buses and private automobiles are currently being used in California and nationally. SBCTA's ZEMU train will be the first for passenger rail use in the United States. SBCTA and Metrolink will follow strict fueling protocols and guidelines to protect its rail operators and ensure hydrogen fuel safety for passengers and surrounding community.

### WHERE WILL ZEMU REFUEL ITS HYDROGEN?

A hydrogen storage and fueling facility is under construction at the southern end of the existing Arrow Maintenance Facility located in San Bernardino. The facility is being constructed in compliance with state and local requirements. Facility construction is anticipated to finish in 2026.

### WHAT ARE THE BENEFITS OF A HYDROGEN-POWERED PASSENGER TRAIN?

In addition to offering a cleaner rail option between San Bernardino and Redlands, SBCTA's ZEMU is creating the innovative green technology framework for transit agencies throughout California to introduce the zero-emission train into existing infrastructure. The self-powered ZEMU train has been designed and built to operate on existing tracks, which means additional track infrastructure isn't needed for operation.

### ARE THERE OTHER HYDROGEN-POWERED PASSENGER TRAINS IN THE US OR THE WORLD?

ZEMU is the first of its kind in North America that meets federal guidelines. The world's first hydrogen powered passenger train went into service in Germany in 2018. Canada also held a three-month pilot program of a hydrogen-powered train in 2023 with the intent of transitioning to a broader hydrogen-powered rail system.

## We Plan.

SBCTA envisioned a new passenger rail service that could reconnect San Bernardino and Redlands but also have the ability to connect commuters to Los Angeles in a cleaner, pollutant-free way. In 2016, the 9-mile service was officially dubbed Arrow and three diesel multiple unit (DMU) vehicles were ordered from the rail manufacturer. In 2018, a California State Transportation Agency grant allowed SBCTA to begin research and development of a low or zero-emission rail passenger vehicle to operate along the Arrow corridor.

## We Build.

The 2018 commitment of state funding and a contract signing in 2019 between Stadler US and SBCTA cleared the path to begin manufacturing the first two-car hydrogen-powered passenger train to operate in the United States. This represented a critical milestone for SBCTA's investment in its sustainable future, zero-emission transportation options and the transition away from using fossil fuels to protect the health of its 2.1 million residents and visitors. Support from the California State Transportation Agency is proof that SBCTA's innovative work to develop ZEMU will benefit passenger rail transit throughout the state and nationwide.

## You Move.

The Arrow service began operations in 2022 and uses eco-friendly DMUs to operate along the line. After the ZEMU vehicle testing is completed, it will enter Metrolink's passenger service in early 2025. ZEMU will offer passengers a first of its kind, environmentally friendly train and deliver a balanced and sustainable transportation system for San Bernardino County's future.



San Bernardino County  
Transportation Authority

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