

Diesel Multiple Unit

DMU



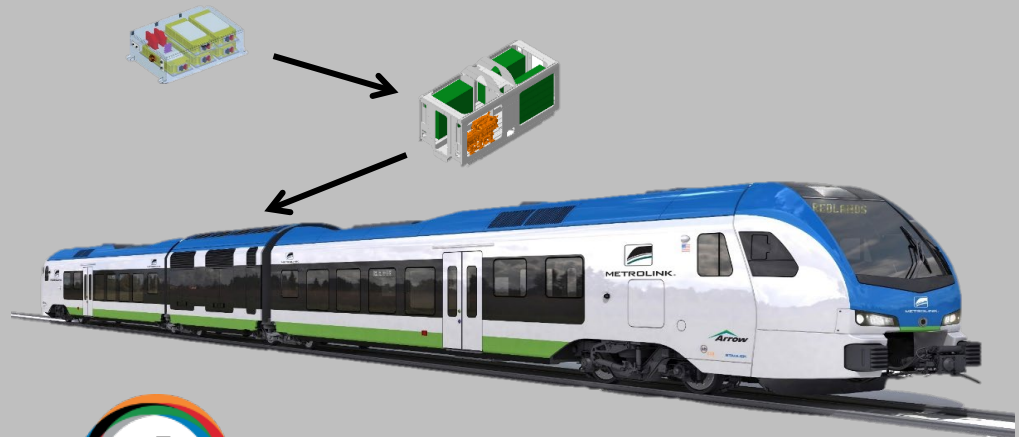
Zero-Emission Multiple Unit

ZEMU



Goals:

- Decarbonization by implementing a zero-emission passenger rail vehicle on existing infrastructure
- Select a technology that could be implemented on corridors outside of 9-mile Arrow service corridor
- Deliberate and thoughtful hazard analysis process with key partners





Funding Agency
California State
Transportation Agency



Railroad of Record
Southern California Regional
Rail Authority



Regulatory Agency
Federal Railroad Administration



Regulatory Agency
South Coast Air Quality
Management District

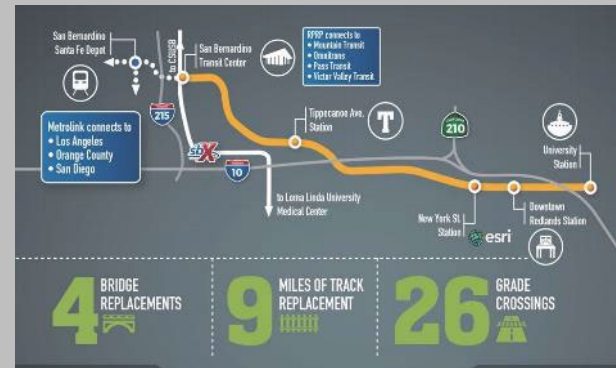
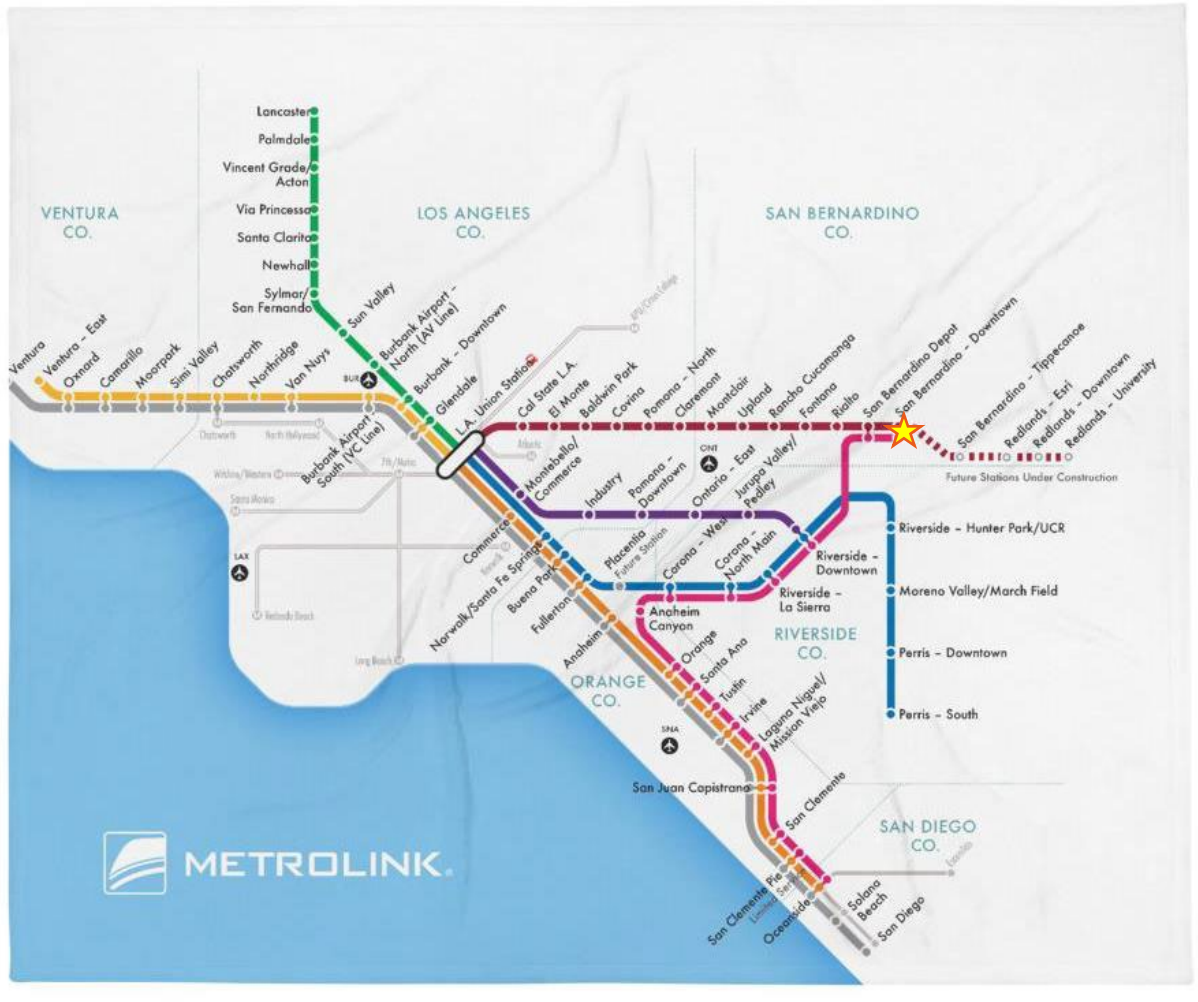


Vehicle Manufacturer
Stadler Rail



Managing Consultant
Mott MacDonald Team





4 BRIDGE REPLACEMENTS

9 MILES OF TRACK REPLACEMENT

26 GRADE CROSSINGS

Selection of Preferred Technology



Cost



Capital, Operations & Maintenance

Infrastructure



Right-of-Way, Charging & Fueling, Utilities

Environmental Considerations



Land use, GHGs, Aesthetics, Noise, Socio-Economic

Operations



Range, Scalability, Reliability, Operations, Life Span

Regulatory Compliance



FRA , NFPA, CPUC

Implementation Schedule



Timeline for Planning, Design, Construction phases

Risk Analysis



Identify and document risks for further analysis



Evaluation Criteria

High Level Pre-Screening

Category	Baseline – Arrow DMU	Wayside Power Supply		On-Board Energy Storage System					Hybrid System			
Rail Technology	Diesel	Overhead Contact System (OCS)	Ground Level Power Supply – Third Rail	Battery	Supercapacitor	Hydrogen Fuel Cell	Biofuel	Natural Gas	Hydrogen Fuel Cell + Battery	Diesel + Battery	Biofuel + Battery	Natural Gas + Battery
Relative Capital Costs	Good	Poor	Poor	Moderate	Moderate	Moderate/ Poor	Good	Good/ Moderate	Moderate/ Poor	Good	Good/ Moderate	Moderate
Relation Life Cycle Cost	Moderate/ Poor	Good/ Moderate	Good/ Moderate	Moderate	Good/ Moderate	Moderate	Moderate/ Poor	Good/ Moderate	Moderate	Moderate	Moderate	Moderate
GHG Emissions	Poor	Good	Good	Good	Good	Good	Moderate/ Poor	Moderate	Good	Poor	Moderate	Good/ Moderate
Aesthetics	Good	Poor	Moderate	Good	Good	Good	Good	Good	Good	Good	Good	Good
Range	Good	Good	Good	Moderate	Poor	Good	Good	Good	Good	Good	Good	Good
Scalability	Good	Poor	Poor	Moderate	Moderate	Good	Good	Good	Good	Good	Good	Good
Life Span	Good	Good	Good	Poor	Moderate	Moderate	Good	Good	Moderate	Moderate	Moderate	Moderate
Regulatory Compliance	Good	Moderate	Poor	Moderate	Moderate	Moderate	Good	Moderate	Moderate	Moderate/ Good	Moderate/ Good	Moderate
Result	Baseline	Incompatible	Incompatible	Compatible	Compatible	Compatible	Incompatible	Incompatible	Compatible	Incompatible	Incompatible	Incompatible

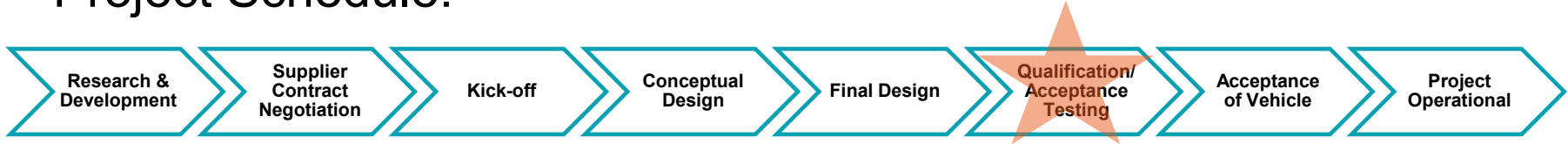


Selection of Preferred Technology

- Early on assumed battery solution would be the easy pick
- Battery and hydrogen hybrid scored almost identical based on our goals and objectives
- Looked to SBCTA Board to determine best course
- Direction from Board was to focus on our objective to **select a technology that could be implemented on corridors outside of 9-mile Arrow corridor**
- We then decided to select Hydrogen Hybrid due to easier expandability and range



Project 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 (ZEMU).

NOVEMBER 2019

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

2022

Begin operating Arrow service with DMUs

LATE 2023

Begin testing zero-emission train along rail line

LATE 2024

Integrate zero-emission train with Arrow's rail fleet and begin operating zero-emission passenger train





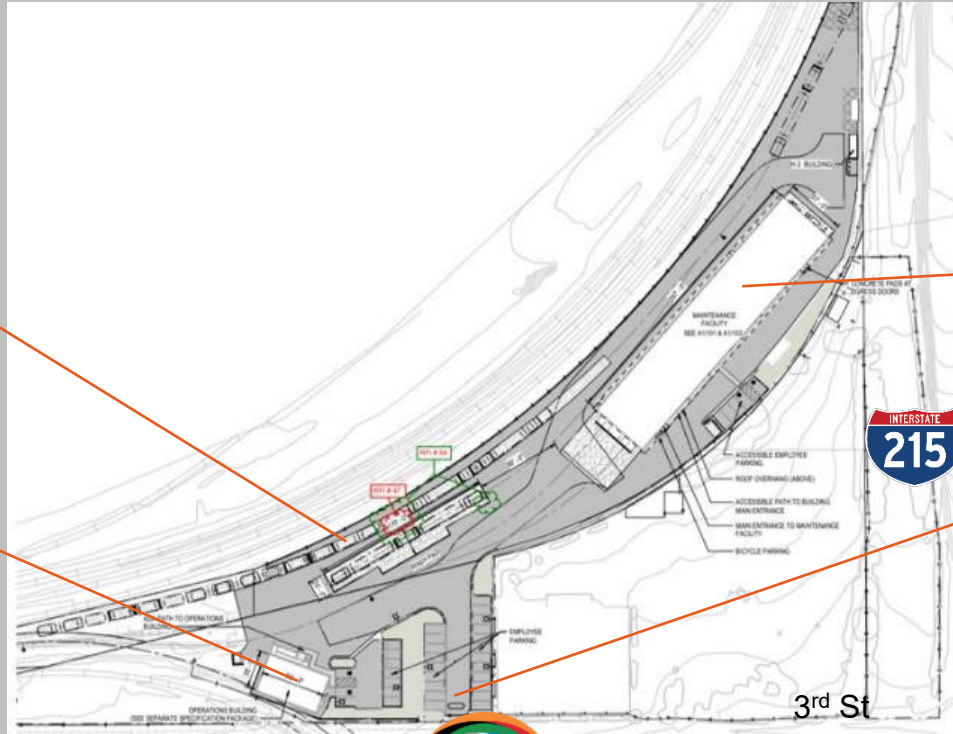


Arrow Maintenance Facility (AMF)

Maintenance and Fueling Facilities

Storage
Tracks

Proposed
H2 Fueling
Area



Maintenance
Building

Main
Entrance



Maintenance and Fueling Facilities

Proposed
H2 Fueling
Area

Main
Entrance

Maintenance
Building



Maintenance Facility-Exterior



Maintenance Facility -Interior



Plan. Build. Move.

www.goSBCTA.com
909.884.8276



@goSBCTA

