

FUELCELL HYBRID SWITCHER LOCOMOTIVE

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Photo courtesy of RailPower Hybrid Technologies

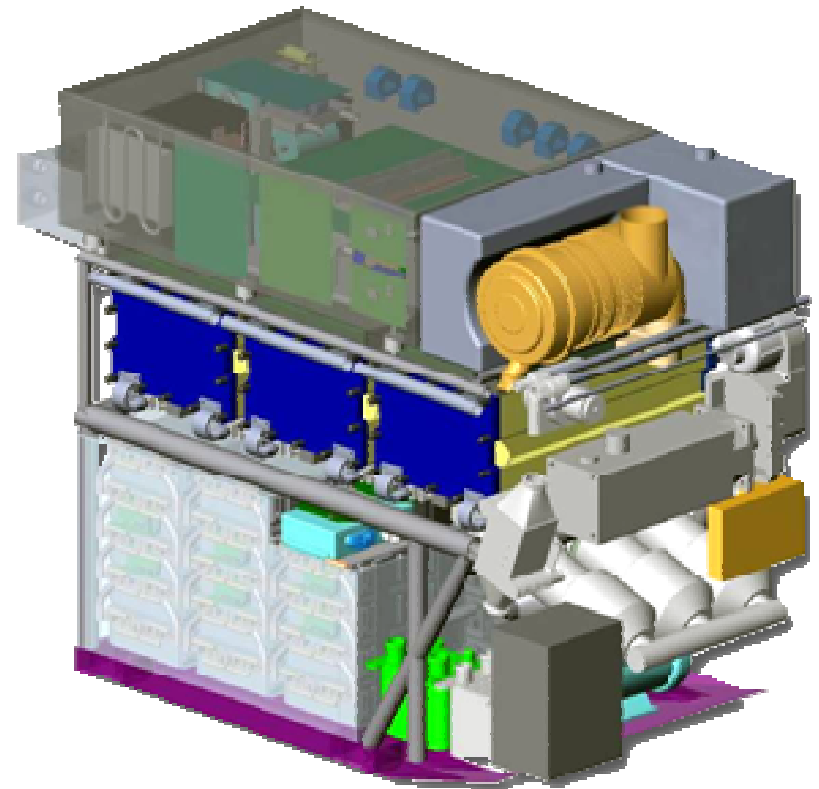


PROJECT STATUS AS OF 4 Dec 2006

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MISSION – VEHICLE PROJECTS LLC

Vehicle Projects LLC serves heavy industry and transport by developing and demonstrating prototype fuelcell vehicles that improve productivity, worker health and safety, environmental quality, or energy efficiency and security. Its core in-house activities are project conception and fundraising, vehicle engineering design, and consortium organization and management.





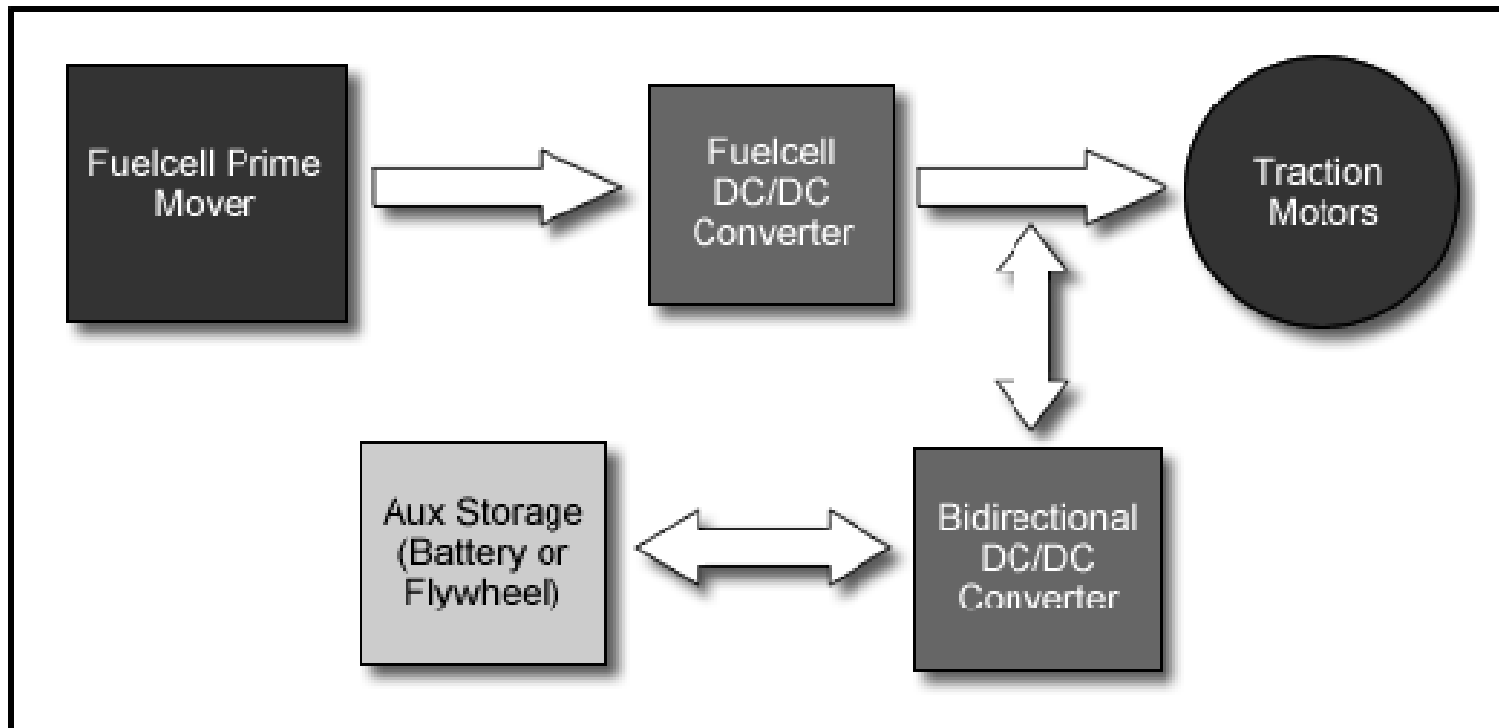
PROJECT OBJECTIVES

Develop and demonstrate a prototype fuelcell hybrid switcher locomotive leading to commercial locomotives that will:

- Reduce air pollution in urban rail yards, in particular, yards associated with seaports
- Increase energy security of the rail transportation system by using a fuel independent of imported oil
- Reduce atmospheric greenhouse-gas emissions
- Serve as a mobile backup power source (“power-to-grid”) for military bases and civilian disaster relief efforts



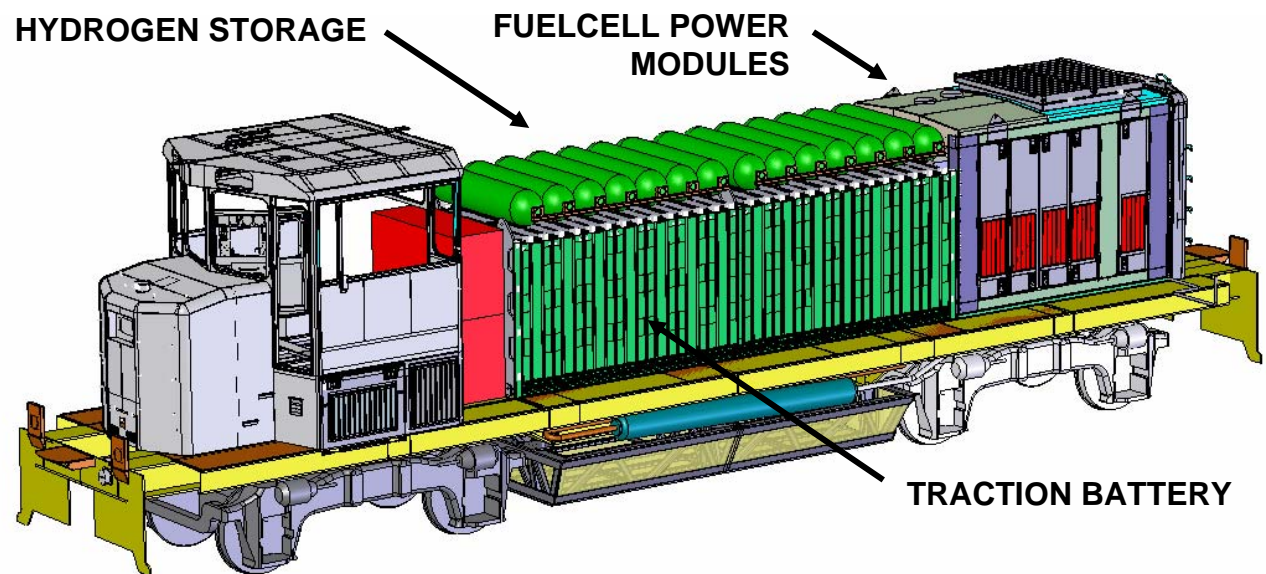
FUELCELL-HYBRID POWERTRAIN



This configuration is termed a “parallel hybrid.” A “series hybrid” uses the prime mover as a battery charger or “range extender.”

HYBRID LOCOMOTIVE CONCEPT

The locomotive's fuelcell prime mover provides 250 kW of continuous net power for traction or power-to-grid, and the auxiliary traction battery allows transient power in excess of 1 MW.





TECHNICAL CONSORTIUM



Ballard Power Systems
BNSF Railway Company

**Defense Gen. & Rail Equipment Center
(DGRC)**

Dynetek Industries (pending)

Power Inverters/General Atomics
RailPower Hybrid Technologies
Transportation Technologies Center, Inc
Vehicle Projects LLC

**Washington Safety Management
Solutions LLC**

Fuelcell manufacturer

**Industry funder; vehicle integrator; rail-
yard demonstrator**

**Advisor on military applications; power-
to-grid demonstrator**

Hydrogen storage manufacturer

Power electronics developer

Manufacturer of Green Goat platform

Railway safety regulations interpreter

**Leader of engineering design; project
manager**

Safety analysis



BNSF TOPEKA RAIL SHOP



Vehicle integration will take place at the BNSF Topeka Rail Shop. The completed chassis is being loaded onto a flatcar for transfer to RailPower Hybrid Technologies for addition of the body shell, traction battery, and vehicle controls.



PROJECT SCOPE

Phase	Executor	Start	Finish
1. Engineering Design	Vehicle Projects	May 06	Mar 07
2. Fabrication of Green Goat Platform	RailPower	Jul 06	Mar 07
3. Fabrication of Major Subsystems: Fuelcell power modules Power electronics Hydrogen storage subsystem	Ballard, Vehicle Projects Power Inverters Dynetek	Mar 07	Aug 07
4. Integration of Major Subsystems into Platform	BNSF Topeka Rail Shop	Aug 07	Dec 07
5. Demonstration in Rail Yards	BNSF	Jan 08	Jun 08
6. Demonstration of Power-to-Grid	DGRC	Jul 08	Sep 08

Total period of performance: 29 months





OVERALL PROJECT BUDGET

(Thousands of Dollars)

Task/Phase	BNSF	DoD FY07	DoD FY08*	Total
Engineering Design (Phase 1)	150			150
Fabrication of Green Goat Platform (Phase 2)	800			800
Fabrication of Major Subsystems (Phase 3)		1,050		1,050
Integration of Major Subsystems into Platform (Phase 4)		100		100
Demonstration in Rail Yards (Phase 5)			180	180
Demonstration of Power-to-Grid (Phase 6)			230	230
Project and consortium management	50	800	140	990
Total:	1,000	1,950	550	3,500

* To be requested

