






























Fuel Cell Specialty Vehicles

Company	Vehicle	Partners	Year	Fuel Cell Mfr.	Fuel Cell Size/Type	Range	Max. Speed	Fuel/Storage Type	Comments	Picture
All-Terrain Vehicles (ATVs)										
Quantum Fuel Systems Technologies	Quantum Aggressor™ hybrid fuel cell alternative mobility vehicle (AMV)	U.S. Army TARDEC	2004	N/a	10 kW PEM	N/a	80 mph	Compressed hydrogen/ impact resistant carbon fiber storage tanks	High performance off-road stealth fuel cell vehicle	
Peugeot	Fuel cell hybrid Quark	MES-DEA	2004	N/a	1.5 kW MES-DEA PEM	60 mi	68 mph	Compressed hydrogen @ 700 bar	2-seater, 4-wheel drive quad concept car	
Aviation – Airplanes										
Boeing	Fuel cell-battery hybrid airplane	UQM Technologies, Gore, Diamond Aircraft, SAFT France, Air Liquide, Regional Govt. of Madrid	2008	Intelligent Energy	PEM	N/a	62 mph	N/a	Manned aircraft. Flown in Spain in 2008. Used batteries & fuel cells to gain altitude, then cruised using solely fuel cell power.	
DLR (German Space Agency)	A320 ATRA (Advanced Technology Research Aircraft) with fuel cell-powered nose wheel	DLR, Lufthansa Technik, Airbus	2011	N/a	N/a	N/a	N/a	N/a	In July 2011, DLR, Airbus and Lufthansa Technik taxied the A320 ATRA aircraft, equipped with a fuel cell-powered electric nose wheel, around Hamburg Finkenwerder Airport using solely fuel cell power.	
	Antares DLR-H2 fuel cell airplane	Lange Aviation, Serenergy, Lange Aviation	2009	BASF Fuel Cells	N/a	450 miles	102 mph	N/a	Manned aircraft. Take-off, cruising and landing using only fuel cell power. Flown in Hamburg, Germany. Will be the flying test platform of DLR fuel cell test activities.	
European Community "ENFICA-FC" project	Rapid 200-FC fuel cell-hybrid airplane	Turin Polytechnic University, SkyLeader, APL, Mavel Elettronica, University of Pisa	Project started in 2006	Intelligent Energy	20 kW	N/a	N/a	Compressed hydrogen at 350 bar	2-seat airplane. Two taxiing tests conducted in 2009. Manned test flight is planned. ENFICA-FC™ project (Environmentally Friendly Inter City Aircraft powered by Fuel Cells).	









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FASTec/ATP	Fuel cell E-plane	UQM Technologies, NASA, American Ghiles Aircraft, Giner Electrochemical Systems, Satcon Technology Corp., Diamond Aircraft, Analytic Energy Systems, Lockwood Aviation, Lynntech	2001	N/a	Phase 2 – 25kW Phase 3 – 75 kW	Phase 2 – 250 mi Phase 3 – 500 mi	230mph at sea level	On-board hydrogen	FC-battery hybrid powered plane. First fuel cell flight in 2005	
Polytechnic University of Turin	Enfica-FC	Intelligent Energy, Skyleader, APL, Mavel Elettronica, Pisa University	2010	Intelligent Energy	20 kW PEM	N/a	N/a	N/a	2-seater, single-engine, ultralight aircraft powered by a fuel cell, has a 20kW Li-ion battery for backup and extra power for take-off and climbing if needed; flown for 2 ½ hrs. in May 2010	
Aviation – Unmanned Aerial Vehicles (UAVs)										
Aerovironment	Helios UAV	NASA Dryden Flight Research Center, Quantum Technologies	2003	N/a	10-25kW PEM	250 miles	17-27 m	2 compressed hydrogen tanks	Flew for 15 hours during 1 st flight. Destroyed in crash in 2003, fuel cell not responsible	
	Hornet fuel cell MAV (micro aerial vehicle)	N/a	2003	N/a	N/a	N/a	N/a	N/a	Test flight in 2003, powered entirely by a fuel cell. The Hornet was developed under a DARPA sponsored research contract.	
	Global Observer UAS (unmanned aircraft system)	N/a	2005	N/a	2 hp fuel cell	N/a	N/a	Liquid hydrogen	Mission applications include communications relay & remote sensing payloads for military or commercial customers.	
	Fuel cell-battery hybrid Puma UAV	Protonex, US Air Force Research Laboratory, Naval Research Laboratory, Millennium Cell	2007	Protonex	1 kW	9+ hours	N/a	Metal hydride on-board hydrogen storage	First shown in 2007, in 2008 beat its own record twice – first flying 7 hours and then 9 hours	
	HALE Global Observer	1 st aircraft developed under the Global Observer™ Joint Capability Technology Demonstration (JCTD) program	2010	N/a	N/a	5-7 days at 55,000-65,000 ft.	N/a	N/a	Tested at Edwards Air Force Base in CA, climbed to 4,000 ft. where it performed a series of maneuvers before landing successfully one hour later	
Baranov Central Institute of Aviation Motors (CIAM)	CIAM-80 mini UAV	CIAM, Horizon Energy Systems	2010	Horizon Energy Systems	PEM	N/a	N/a	Compressed hydrogen	The flight, near Moscow, lasted several minutes.	
BlueBird Aero Systems	Thunderbird UAV	N/a	Planned in 2010	N/a	PEM	N/a	N/a	N/a	10 hour flight planned in 2010	

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	Boomerang mini-UAV	N/a	2009	Horizon Fuel Cell Technologies	N/a	50 km/9+ hours	30-60 knots	N/a	5-hour endurance flight in 2009	
Boeing	Phantom Eye UAV	Boeing, NASA	Planned in 2011	N/a	N/a	N/a	N/a	N/a	First flight planned in 2011 for 4-8 hours. Will be able to stay aloft at 65,000 feet for up to four days.	
Cal State MFDC Lab	Pterosoar UAV	Oklahoma State University	Project started in 2007	Horizon Fuel Cell Technologies	N/a	N/a	N/a	Compressed hydrogen	Range test - flown 74 miles in 3 hours. Flown in endurance test for over 12 hours.	
	Fuel cell UAV	N/a	2006	Horizon Fuel Cell Technologies	650 W PEM	N/a	N/a	N/a	First flown in 2006. Four test flights were conducted by MFDC Lab.	
DLR (German Aerospace Agency)	HyFish fuel cell jet wing UAV	Team SmartFish, DruKon, Luxfer, BaltiCo, Horizon Fuel Cell Technologies, Technikzentrum Ainet, LTB-Borowski	2007	Horizon Fuel Cell Technologies	1 kW	N/a	124 mph	Compressed hydrogen	A successful first flight was carried out in 2007 in Switzerland.	
Elbit Systems	Skylark UAV	Elbit Systems	2010	Horizon Energy Systems	PEM	900 Wh per quart of fuel	N/a	Compressed hydrogen	Flown in Israel, with an operational payload integrated onboard in simulated battlefield conditions. Flown in turbulent weather.	
EnergyOr	EO-360 fuel cell-battery hybrid UAV	N/a	2009	N/a	PEM	N/a	N/a	N/a	8-hour flight is planned. EnergyOr has also test flown its UAVs in Canada and Israel in 2007.	
Georgia Institute of Technology	UAV	Georgia Institute of Technology, NASA, FC/BT	2006	N/a	500 W PEM	N/a	N/a	Hydrogen	Flew for 22 minutes	
Korea Advanced Institute of Science and Technology	UAV	N/a	2007	N/a	N/a	5 hours	N/a	Liquid hydrogen	N/a	








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University of Michigan	Endurance UAV	N/a	2008	Adaptive Materials, Inc.	N/a	N/a	N/a	N/a	Flown for 10+ hours in 2008.	
U.S. Naval Research Laboratory	Ion Tiger UAV	the University of Hawaii, and HyperComp Engineering	2009	Protonex	550 W	N/a	N/a	N/a	Flown 23+ hours.	
	Mako UAS	Pennsylvania State University's Applied Research Laboratory, Kuchera Engineering, L3 Communications/BAI	2009	Jadoo Power	63 W	N/a	N/a	Compressed hydrogen	N/a	
	Spider-Lion UAV	Protonex Technology Corporation	2005	Protonex	100 W fuel cell	N/a	N/a	Compressed Hydrogen	Long-term goal is development of an efficient fuel-cell propulsion system for long-endurance (8-24 h) mini-UAV applications.	
Marine - Boats, Submarines, Yachts										
Anuvu, Inc.	Fuel cell boat	Millennium Cell, Duffy Electric Boats, Seaworthy Systems	2003	Anuvu	4 1.5 kW PEM	N/a	N/a	Hydrogen from sodium borohydride	18 passenger boat was tested in San Francisco Bay	
British Columbia govt. and Canadian Foundation for Innovation	Tsekoa II research vessel	B.C. government, Canadian Foundation for Innovation, University of Victoria	Planned in 2011	N/a	N/a	Na	N/a	N/a	The vessel will be refit with an all-electric propulsion system powered by batteries, fuel cells and low-emission diesel generators – the generators used when power demands are high, acoustically sensitive studies conducted using quiet electric power	
EIVD/MW-Line	Hydroxy 3000	Paul Scherrer Institute (PSI)	2003	N/a	3 kW/PEM	160 km	10- 15 mph	Compressed hydrogen@200 bar	Switzerland's first family leisure fuel cell boat, had several versions before	
HaveBlue LLC	XV-1 Sailboat	Texaco Ovonic Hydrogen Systems, Hydrogenics, Catalina Yachts	2004	Hydrogenics	10 kW PEM	N/a	N/a	Metal hydride on-board hydrogen storage	Public demonstrations in 2004	








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Howaldts-werke-Deutsche Werft AG (HDW)	U212 and U214 class submarines	N/a	2002	Siemens	300kW fuel cell	N/a	N/a	N/a	German Navy ordered 4 U212 FC subs, Greek navy ordered 4 U214 FC subs, South Korea ordered 3 U214 FC subs, Italian Navy ordered 2	
MTU Friedrichshafen	"No. 1" Yacht	Ballard Power Systems	2003	Ballard Power Systems	CoolCell™ 4.8 kW/PEM	225 km	6 km/h	Hydrogen	Demonstrated on Lake Constance	
Proton Motor Fuel Cell	Alsterwasser	ZemShip (Zero Emission Ship) project partners: Linde, Proton Motor, Germanischer Lloyd AG	2008	Proton Motor Fuel Cell	Two 50kW PEM fuel cells	N/a	14 km/h	50 kg gaseous hydrogen	Operates in Hamburg, Germany, holds 100 passengers	
Fuel Cell Boat BV	"Nemo H2" Canal Trip Boat	N/a	2009	Hybride	60-70 kw PEM	N/a	16 km/h	Hydrogen	87 Passengers. Power to electrolyze hydrogen provided by North Sea wind farm	
Frauscher	Recreational Motorboat	Fronius International, Bitter GmbH	2009	Fronius	4 kW	80 km	N/a	Hydrogen	Hydrogen comes from photovoltaic electrolyzer. Can change fuel cartridge in 5 minutes	
Statue Cruises	Hornblower hybrid fuel cell ferries	Statue Cruises	San Francisco ferry – 2008 Statue of Liberty/Ellis Island ferry – planned in 2011	N/a	PEM	N/a	N/a	N/a	The New York ferry will operate using a combination of energy generated by Tier 2 diesel engines, fuel cells, solar panels and wind turbines. The San Francisco ferry is the United States' first hybrid ferry.	
Tropical Green Technologies	GreenBoat	N/a	N/a	N/a	1 kW	N/a	N/a	Metal hydride	Hydrogen Outboard motor that operates with 1kW Fuel Cell System and has approximately 2Nm³ Metal Hydride Hydrogen Storage Tank for operation at lakes and small bays.	
Unkknown	Tsekoa II	British Columbia, University of Victoria	N/a	N/a	Fuel cell/plug-in battery hybrid	N/a	N/a	N/a	The former Coast Guard vessel will be retrofitted with a fuel cell and used by the University for ocean research.	







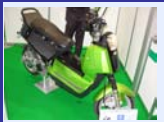


Materials Handling Equipment - Forklifts, Lift Trucks, Tugs (for a chart of recent forklift deployments, click [HERE](#))










Company	Vehicle	Partners	Year	Fuel Cell Mfr.	Fuel Cell Size/Type	Range	Max. Speed	Fuel/Storage Type	Comments	Picture
Cellex Power Products (later purchased by Plug Power)	CX-P150 fuel cell pallet truck	Cellex Power Products, Crown Equipment Corp., Plug Power	2004	Plug Power/ Ballard	4.8 kW PEM	N/a	N/a	Compressed hydrogen	Wal-Mart participated in field trials at two distribution centers and placed purchase order for Cellex FC pallet trucks in 2007	
Crown Equipment Corp.	Fuel Cell Forklifts	N/a	2009	Works closely with a variety of fuel cell manufacturers and customers to qualify trucks as new fuel cell pack models are introduced	N/a	N/a	N/a	Compressed hydrogen	Crown has qualified 20 of its electric forklift models to operate with various fuel cells, offers 29 qualified combinations of fuel cell packs and trucks	
Siemens	Fuel cell forklift	SWB partnership (Siemens, Linde, BMW, Bayerwerk)	1998	N/a	10 kW PEM	8 hrs.	N/a	Compressed hydrogen w/ metal hydride onboard storage	Demonstrated at site in Neunburg vorm Wald, Germany	
Hydrogenics	HyPX Power Packs	N/a	2007	Hydrogenics	PEM	N/a	N/a	Compressed hydrogen	Hydrogenics offers HyPX™ Power Packs that fit popular makes of new and used counterbalanced and lift trucks with no modifications	
	Fuel Cell Forklift	Deere & Company, FedEx Canada, General Motors of Canada, HERA Hydrogen Storage Systems, NACCO Materials Handling Group and City of Toronto	2004	Hydrogenics	10 kW PEM	N/a	N/a	Compressed hydrogen	Numerous demonstrations at GM, FedEx and other locations.	
Hyster Co.	Fuel Cell Forklifts	Hydrogenics	2005	Hydrogenics	PEM	N/a	N/a	Compressed hydrogen	Hyster Company has partnered with Hydrogenics to offer fuel cell power modules (HyPX™ Fuel Cell Power Packs)	
LiftOne	Fuel Cell Forklifts	N/a	Ongoing since 2007	Several fuel cell manufacturers	PEM	N/a	N/a	Compressed hydrogen	Several week demonstrations of two fuel cell-powered lift trucks at large electric fleet user sites in the SC area	
Nissan Forklift	Fuel Cell Forklift	General Hydrogen	2006	General Hydrogen	9 kW PEM	N/a	N/a	Compressed hydrogen	Concept forklift	
Nuvera	PowerEdge	N/a	2009	Nuvera	10 kW PEM	N/a	N/a	Compressed hydrogen	PowerEdge products are interchangeable with standard lead acid batteries in Class 1, 2 & 3 forklifts	









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Oorja Protonics	OorjaPac™ Model III	N/a	2008	Oorja Protonics	DMFC	N/a	N/a	Liquid methanol	OorjaPac™ Model III operates as an on-board battery charger for a wide variety of Class 3 vehicles	
Plug Power	GenDrive	Ballard Power Systems	2007	Plug Power/Ballard Power Systems	PEM	N/a	N/a	Compressed hydrogen	Plug Power fuel cells fit into the existing battery compartment of all major OEM material handling equipment.	
Proton Motor Fuel Cell	Fuel cell lift truck	Linde and STILL	2004	Proton Motor Fuel Cell	PEM	8 hours	N/a	Hydrogen	Undergoing field trials at Munich Airport	
Raymond Corp.	Forklifts	N/a	2010	Plug Power	N/a	N/a	N/a	N/a	GenDrive fuel cell power units have been tested and approved for use in Raymond® Model 8400 pallet trucks, Model 4100 and 4200 stand-up counterbalanced trucks, and various Model 7400 Reach-Fork® trucks.	
Still GmbH	Still FM-X 20 reach truck	Hoppecke, Linde Gas, federal state of North Rhine-Westphalia, as part of "progres.nrw" funding program	2010	Hoppecke	N/a	N/a	N/a	N/a	Being tested at BASF Coatings AG in Münster, Germany	
Toyota Industries Corp.	Forklift	Toyota Motor Corp.	2005	Toyota	30 kW/PEM	N/a	18 km/h	Hydrogen	Toyota developed fuel cell stack	
Tropical Green Technologies	GreenForklift	N/a	N/a	Tropical Green Technologies	10 kW	N/a	N/a	Metal hydride hydrogen storage	N/a	
Yale Materials Handling Corp.	Fuel Cell Forklifts	Plug Power	2008	Plug Power	PEM	N/a	N/a	Compressed hydrogen	Yale sells lift trucks that use cleaner burning alternative fuels, including fuel cells (Plug Power GenDrive)	
Personal Mobility - Wheelchairs, Carts										
Besel S.A.	Fuel cell Wheelchair	MEYRA, ONCE	2003	Axane	0.35 kW PEM	N/a	N/a	Metal hydride on-board hydrogen storage	34 wheelchairs being developed under the European HyChain project.	










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From Concept to Car	H-ergo Piemonte Personal Mobility Vehicle	From Concept to Car is a consortium of Italian auto part makers, government agencies & universities	2009	Politecnico di Torino and HySyLab	N/a	2 hours	12/4 mph (20 km/h)	Hydrogen	No info available on commercialization plans for this fuel cell-powered wheelchair	
H2 Logic	H2 Service Truck	A. Flensburg - Herning A/S	2005	N/a	PEM hybrid fuel cell system	4 hrs.	15 km/hr (9.3 mph)	Low pressure hydride storage	Includes an H2 Filling Station where replaceable H2 canisters inside the truck can be refilled with H2. For internal transportation in industrial sector, warehouses, hospitals, airports and other applications. 6 sold during 2005.	
Kurimoto, Ltd	Fuel cell cart II	N/a	2007	N/a	250 W PEM & Li-on battery	250W/PEM	3.7mph 6km/h	H2 storage 190g/4 canisters	Can run continuously for 5 hours/30km	
	Fuel cell wheelchair	APFCT	Four versions released between 2003 - 2006	N/a	APFCT 250W/PEM & Li-on battery	APFCT 250W/PEM	3.7mph 6km/h	Pure Hydrogen @150psi / H2 storage 180g/4 canisters	Can run continuously for 10 hours/60 km	
Los Alamos National Laboratory (LANL)	Personal mobility vehicle	Ergenics	2003	N/a	140W/PEM	50 miles	5 mph	Metal hydride on-board hydrogen storage	N/a	
Manhattan Scientifics	Fuel cell Segway	U.S. Army ERDC/CERL, FC Tec, Concurrent Technologies Corporation	November 2003	N/a	700 W/PEM	Range should double	12- 17 mph	Compressed hydrogen (2-liter)	N/a	
Research Centre Jülich	JuMOVE fuel cell electric vehicle	Ministry for Science and Research of the Federal State of North Rhine-Westphalia	2004	N/a	DMFC 1.3 kW	120 km	N/a	Methanol	Successfully completed road trials. Still being tested.	








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Suzuki	MIO Wheelchair	N/a	2006	N/a	DMFC	25 miles	N/a	Methanol solution	N/a	
Rail – Locomotives										
Vehicle Projects, LLC	Mine locomotive	Nuvera	2002	Nuvera	Two 17 kW PEM	8.5 hours	N/a	Metal hydride	Also working on Army locomotive	
Vehicle Projects, Inc.	Prototype Switch Locomotive	BNSF Railway Co., Dept. of the Army	2009	Ballard Power Systems	Two 125 kW	8-24 hours	N/a	Hydrogen	Can also serve as mobile backup power source for disaster relief efforts.	
Small Transport - Golf Carts, Shuttles, Neighborhood Vehicles										
Astris Energi	Freedom fuel cell golf cart	N/a	2001	Astris Energi	1 kW alkaline fuel cell	8-10 hours	19 mph/31 km/h	Compressed hydrogen gas	N/a	
Fuyuan Fuel Cell Company	Golf cart concept vehicle	N/a	2002	N/a	2.5 kW PEM	500 km	80 km/h	Ammonia	N/a	
Global Electric Motorcars	GEM hybrid neighborhood car	GEM	TBD	Anuvu, Ballard, ECN, Hydro-genics	Anuvu-3 kW PEM Ballard-1.2 kW ECN-5 kW PEM Hydrogenics- 5 kW PEM	N/a	N/a	Hydrogen	Several fuel cell companies have installed fuel cells into the GEM hybrid neighborhood vehicles as demonstrators. Anuvu's FC GEM car is deployed at Mohegan Sun Hotel & Casino. Photo (right) is ECN's HydroGEM.	
Shanghai Automotive Industry Corp.	Shenshi 11-seat fuel cell vehicle	N/a	2010	N/a	N/a	50 miles / 80 km	40 km/h / 25 mph	N/a	N/a	







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Shen Li High Tech	Fuel cell tourist cart	N/a	N/a	N/a	10 kW PEM	N/a	N/a	Low pressure hydrogen	Seats 11 passengers	
	Fuel cell tourist cart	N/a	2004	N/a	PEM	N/a	N/a	N/a	N/a	
Tropical Green Technologies	GreenCityCar (2 seats)	N/a	N/a	N/a	1 kW PEM (5 kW optional)	N/a	N/a	2 nm ³ metal hydride hydrogen storage (5 nm ³ optional)	N/a	
	GreenCityCar (4 seats)	N/a	N/a	N/a	5 kW PEM (1 kW optional)	N/a	N/a	5 nm ³ metal hydride hydrogen storage (2 nm ³ optional)	N/a	
	GreenTourBus	N/a	N/a	N/a				Metal hydride hydrogen storage	Seats 15. Hydrogen storage is mounted on the roof.	
Quantum Technologies	Fuel cell hybrid utility vehicle	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a	
Two-Wheeled Transport - Motorcycles, Scooters, Mopeds and Bicycles										
Asia Pacific Fuel Cell Technologies (APFCT)	ZES V.b motorcycle	N/a	2008	APFCT	PEM fuel cell - Li-lon hybrid	80 km	60 km/h	Metal hydride on-board hydrogen storage	Takes less than 1 minute to refuel	
	ZES IV motorcycle	N/a	2003	APFCT	2 kW PEM	60 km	35 km/h	Metal hydride on-board hydrogen storage	APFCT, DuPont Fuel Cells and DuPont Taiwan	
	ZES III motorcycle	N/a	2002	N/a	5 kW PEM	120 km	58 km/h	Metal hydride on-board hydrogen storage	Plans to introduce in the European market, ZES II introduced in 2000.	

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Besel S.A.	Scooter	Derbi	Project January 2003 – October 2004	N/a	PEM	N/a	N/a	Metal hydride on-board hydrogen storage	N/a	
ECN	FRESCO scooter	Piaggio & C SpA, Selin Sistemi SpA and Commissariat a l'Energie Atomique	2004	N/a	12 kW PEM	100 km goal	75 km/h goal	Hydrogen	Project ended November 2004	
FAAM	Camaleo Hydrogen bicycle	Beijing Fuyuan	2003	N/a	400 W PEM	90 km	N/a	Metal hydride on-board hydrogen storage	N/a	
Honda	Fuel cell scooter	N/a	2004	Honda	PEM	N/a	N/a	Hydrogen	Based on a 125cc scooter	
Horizon Fuel Cell Technologies	HMX – Hydrogen Mobility X-tender bike	N/a	2008	Horizon Fuel Cell Technologies	PEM	300 km 190 mi	25 km/h	Metal hydride on-board hydrogen storage	300 km pedal assisted range	
Intelligent Energy	ENV - fuel cell motorbike	Seymourpowell	2005	Intelligent Energy	1 kW PEM	100 miles	50 mph	High pressure composite cylinder	N/a	
Iwatani Corp.	Fuel Cell Electric-Assisted Bicycle	N/a	2008	N/a	300 W	N/a	N/a	N/a	N/a	
Manhattan Scientifics	Mojito FC scooter	Aprilia s.P.a.	2002	NovArs	3 kW PEM	100 km	55 km/h	Hydrogen	N/a	
	Enjoy FC Bicycle	Aprilia s.P.a.	2001	N/a	600 W/PEM	43 miles	20 mph	Compressed hydrogen (2-liter tanks)	N/a	

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	Hydrocycle™	Aprilia s.P.a.	December 2000	NovArs	670 W PEM	100 km	30 km/h	Compressed hydrogen (2-liter tanks)	N/a	
Masterflex AG	Cargobike	N/a	2007	Masterflex	250W PEM	250 km	6km/h (3.7mph)	90 grams of hydrogen storage	Already being sold to industrial customers and at least 40 Cargobikes will be deployed in four regions in Europe as part of the HyChain-MINITRANS project over the next two years.	
	Fuel cell bike	Veloform	2004	Masterflex	250W PEM	120 km	N/a	Metal hydride stored hydrogen (45 grams)	2005 Masterflex also signed agreement with Swizzbee AG for fuel cell bikes.	
MES-DEA	Aprilia Atlantic Zero Emission fuel cell scooter	Aprilia	2004	N/a	Two 3kW fuel cells	140 km (87 miles)	85km/h (53 mph)	Hydrogen	N/a	
Palcan Fuel Cells Ltd.	Scooter	MOU with Celco Profil S.R.L.	June 2003	Palcan Fuel Cells	2 kW PEM	N/a	45km/h	Metal hydride on-board hydrogen storage	Commissioned by University of Victoria to prepare and supply two scooters for comparative research purposes – one will be a fuel cell scooter.	
	E-bike	Yamaha	May 2002	Palcan Fuel Cells	500 W PEM	N/a	20mph	Metal hydride on-board hydrogen storage	N/a	
PEM Technologies, Inc.	PemPower-04 3-wheel motorcycle	N/a	June 2003	PEM Technologies, Inc.	1 kW PEM	50 km	30 km/h	N/a	N/a	
	PemPower-03 2-wheel motorcycle	N/a	January 2003	PEM Technologies, Inc.	1 KW PEM	50 km	30 km/h	N/a	N/a	

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Powerzinc Electric	Motorcycle	N/a	2003	Powerzinc Electric	Zinc-Air fuel cell (ZAFC)	250 km	70 km/h	Zinc oxide	N/a	
	Scooter	N/a	2003	Powerzinc Electric	ZAFC	150 km	30 km/h	Zinc oxide	N/a	
	Fuel cell/electric bicycle	Shanghai Green Light Electric Bicycle	2002	Powerzinc Electric	ZAFC	200 km	20 km/h	Zinc oxide	N/a	
Shanghai Pearl Hydrogen Power Source Technology Ltd.	Fuel cell moped	N/a	2008	N/a	PEM	70-80 km	15 mph	Metal hydride on-board hydrogen storage	N/a	
Suzuki	Crossage Motorbike concept	Intelligent Energy	2007	N/a	PEM	N/a	N/a	Hydrogen	Introduced at Tokyo Motor Show	
	Burgman Fuel Cell	N/a	2009	N/a	PEM-Li-on battery hybrid	350 km	N/a	Hydrogen	Granted Whole Vehicle Type Approval in the E.U.	
Taigene	Scooter	APFCT, Japan Steel Works (JSW)	2007	N/a	PEM	100km 30km/h	60km/h	Hydrogen	A full demonstration project of 20 scooters will begin in April 2007 in a science park.	
Tropical S.A.	GreenScooter (2 wheels)	N/a	2008	N/a	500 W PEM	150km	30 km/h	Metal hydride on-board hydrogen storage	Delivered to Center for Renewable Energy Sources in Athens, Greece	
	GreenScooter (3 wheels)	N/a	N/a	N/a	500 W PEM	130	35 km/h	Metal hydride on-board hydrogen storage	N/a	
University of Tasmania	Fuel cell scooter	Technical University of Nurenborg, Germany	2004	N/a	PEM fuel cell	N/a	N/a	Metal hydride on-board hydrogen storage		

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Vectrix	N/a	Parker Hannifin, Protonex and NGen	November 2004	Protonex	500 W DMFC	240 km	100 km/h	Methanol	N/a	
	Fuel cell/electric hybrid scooter	Parker Hannifin, Methanex, Giner Electrochemical Systems, GP Batteries, Robrady Design	November 2003	N/a	800 W DMFC	250 km @ 40 km/h	100 km/h	Methanol	N/a	
Veloform	3-wheel electric bicycle	SFC Smart Fuel Cell AG	October 2006	SFC Smart Fuel Cell	EFOY DMFC	N/a	N/a	Methanol	N/a	
Yamaha Motor Company	FC-Dii	N/a	November 2007	N/a	1kW DMFC	N/a	N/a	Methanol	N/a	
	FC-AQEL	N/a	2006	N/a	PEM	N/a	N/a	Compressed hydrogen gas	N/a	
Yamaha Motor Company	Fuel cell motorcycle	Yuasa Corporation	September 2003	N/a	500W DMFC	200 km	40 km/h	Methanol stored in 4-liter tank	Road-testing	
Unmanned Ground Vehicles (UGVs)										
Adaptive Materials	Fuel cell-battery hybrid UGV	N/a	2009	Adaptive Materials	150 W SOFC	N/a	N/a	Propane	Completed 40-mile, 12-hour test drive.	
Foster-Miller, Inc.	TALON robotic fuel cell-battery hybrid UGV	N/a	2009	Protonex	N/a	N/a	N/a	N/a	FC platform allowed TALON robot to increase mission range from 15 to 45 km. Demonstration conducted under Next Generation Manufacturing Technologies Initiative led by SC Research Authority	
Utility Vehicles – Trucks, Work Vehicles, Tractors										

Company	Vehicle	Partners	Year	Fuel Cell Mfr.	Fuel Cell Size/Type	Range	Max. Speed	Fuel/Storage Type	Comments	Picture
Coval H2 Partners	Utility truck	Shell hydrogen, UK government, City of Westminster	1999	Zevco	Alkaline fuel cell		100 km/h	Compressed hydrogen	28 Nm3 CGH stored in tank outside and on top of the cab. Range of 200 km. City of Westminster parks maintenance van.	
Deere & Company	Commercial Work Vehicle (CWV)	Hydrogenic, Dynatek	2005	Hydrogenics	20 kW PEM	4 hours	50 km/h	Compressed hydrogen	Uses a modified Deere ProGator work utility hauler	
Still GmbH	Still R 07-25 fuel cell tractors	Hydrogenics	2006	Hydrogenics	N/a	N/a	N/a	N/a	Two tractors have been transporting baggage at Hamburg airport	
Entwhistle	MB-4 Aircraft Tow Vehicle		2006	Hydrogenics	65 kW	N/a	N/a	Hydrogen	Tows F-15 fighters for Hawaii Air National Guard Unit at Hickam AFB	
	Step Van		2006	Hydrogenics	65 kW	150 miles	N/a	Hydrogen	Used by maintenance squadron at Hickam AFB, Hawaii	
	Still R 60-25 fuel cell truck	HHLA Logistics	2008	N/a	N/a	N/a	N/a	N/a	Test operation at the port of Hamburg since 2008	
Heliocentris	Fuel cell garbage truck	German Federal Ministry of Transport, Heliocentris Energiesysteme GmbH and FAUN	2011	Hydrogenics	32 kW PEM	N/a	N/a	N/a	Currently undergoing tests with BSR and will be in everyday operation for two years in Adlershof, Friedrichshain and Lichtenberg, Germany	
Hydrogenics	Airport tow tractor	U.S. DoD, FCTec	TBD	Hydrogenics	65kW	N/a	N/a	N/a	Will be used in fuel cell demonstrations at select Air Force Bases and civil airports in the USA	
New Holland	NH2 fuel cell tractor	Iveco	2009	N/a	N/a	N/a	N/a	Hydrogen @ 350 bar	Carries enough fuel to operate 1.5-2 hrs. Shown at Turin, Italy in Jan. 2009. Production planned in 2013.	
	Mine loader	Nuvera, Modine Manufacturing Company, HERA Hydrogen Storage Systems, Caterpillar, U.S. DOE, UQM Technologies, Natural Resources Canada	2004	Nuvera	160kW/ battery	N/a	N/a	Metal hydride	Expected to be placed in demonstration at a mine in Nevada in early 2005	

Company	Vehicle	Partners	Year	Fuel Cell Mfr.	Fuel Cell Size/Type	Range	Max. Speed	Fuel/Storage Type	Comments	Picture
Vision Motor Corporation	Tyrano Class 8 truck	Ports of Long Beach and Los Angeles	2010	N/a	Fuel cell/battery hybrid	8-hr shift: standard drayage range 200 mi, extended range 400 mi	N/a	Hydrogen	Pre-production prototype vehicle, demonstrations at the ports of Los Angeles and Long Beach, CA, 15 trucks will be retrofitted	