DOE Hydrogen and Fuel Cells Program Record		
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Title: Industry Deployed Fuel Cell Backup Power (BuP)		
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Item:

Table 1: Number of fuel cells deployments (current and planned) for applications in backup power (BuP).

	DOE Funded[1] (ARRA) as of Record Date	DOE Funded (Appropriations)[2,3] as of Record Date	DOE Total	Industry-Funded Fuel Cell Shipments and Units On Order (Globally)[4-9, 13-18] from 2009 – Record Date	DOE and Industry Total from 2009 – Record Date
Number of Backup Power Deployments (current and planned)	824	83	907	7,660	8,567

The successful deployment of more than 900 BuP fuel cell systems with U.S. Department of Energy (DOE) funds has led to more than 7,600 BuP fuel cell shipments and units on order with no DOE funding. The 8,567 BuP fuel cell shipments and units on order equate to almost 43,000 kW of fuel cell systems.[i]

Data/Assumptions/Calculations:

The manufacturers providing the fuel cells for the deployments (current and planned) mentioned in Table 1 above are:

Altergy	Ballard	GenCell
Hydrogenics	Plug Power	

[i] Estimated total kW of fuel cell systems deployed assumes each BuP system has a 5 kW capacity. This is the average BuP system size based on the NREL report *Backup Power Cost of Ownership Analysis and Incumbent Technology Comparison*: http://www.nrel.gov/docs/fy14osti/60732.pdf

Total DOE American Recovery and Reinvestment Act (ARRA) investment for these fuel cell projects was $18.5M, with an industry cost share of $30.8M.[ii] While publicly available sales information for BuP fuel cell sales is difficult to obtain, industry reports of sales activity in recent years show signs of substantial growth.

In August 2011, Ballard Power Systems purchased IdaTech Power Systems and in April 2013 they announced the shipment of their 500th methanol-fueled telecom BuP system.[10] Also in 2011, ReliOn announced that is has deployed more than 3.9 MW of its fuel cell systems at approximately 1,350 customer sites globally and Altergy Systems' Freedom Product achieved 5 million operational hours in telecommunications and other applications worldwide.[11]

In early April of 2014, Plug Power Inc. announced the acquisition of ReliOn Inc., a developer of hydrogen fuel cell stack technology and fuel cells systems based in Spokane, Washington. The acquisition brings fuel cell stack technology and products in-house which Plug Power plans to integrate into several models of its GenDrive fuel cell systems with first deployments in 2014. Under the "GenSure" brand, Plug Power's ReliOn business unit develops modular, scalable proton exchange membrane (PEM) hydrogen fuel cell systems featuring innovative air-cooled stack designs with low-cost snap-and-build stack assembly technology. The company has deployed over 5,000 fuel cell stacks at customer sites.[12]

In May 2016, Ballard announced the sale of its methanol backup power business assets to Chung-Hsin Electric & Machinery Manufacturing Corporation, a Taiwan-based power equipment company.[17]

Based on fuel cell manufacturers' feedback, it was determined that their purchase orders for deployments were considered either directly or indirectly due to results of the DOE Fuel Cell Technologies Office (FCTO). This includes fuel cell R&D, Market Transformation, and American Recovery and Reinvestment Act deployment funding. In some instances, companies increased the number of purchases beyond those with DOE funds assistance. In other instances, the fuel cell manufacturers were able to show the business case using data collected from DOE projects and obtained purchase orders with no DOE funding.

[ii] ARRA funding supported deployments in BuP power for: ReliOn with deployments at AT&T and PG&E sites, Sprint Nextel with deployments at Sprint sites, and Plug Power with deployments at Warner Robins Air Force Base and Fort Irwin. Funds included units as well as other aspects of the project such as installation, pre-testing, data collection, analysis, maintenance, and reporting.

References:

Information based on public documentation of deployments and orders in addition to composite data products (CDPs) and fuel cell system assignments by NREL based on DOE-funded projects.

1. "Early Fuel Cell Market Deployments: ARRA and Combined (IAA, DLA, ARRA)", National Renewable Energy Laboratory, May 2013: http://www.nrel.gov/hydrogen/cfm/pdfs/arra_deployment_cdps_q12013_4web.pdf

2. State of the States: Fuel Cells in America 2012. Fuel Cells 2000, September 2012: https://energy.gov/eere/fuelcells/downloads/state-states-fuel-cells-america-2012

3. "FAA Rolls out Fuel Cells for Backup Power", Radio Resource Media Group, April 28, 2010: http://www.radioresourcemag.com/onlyonline.cfm?OnlyOnlineID=168

4. "Altergy Awarded Largest Fuel Cell Order in Telecom History," Altergy Systems announced an order totaling 1,965 fuel cell systems to be deployed for backup power for wireless cell towers, March 1, 2012: http://www.altergy.com/wp-content/uploads/2014/06/ALTERGYS-AWARDED-LARGEST-FUEL-CELL-ORDER-IN-TELECOM-HISTORY-.pdf

5. "PEM Fuel Cell Systems Providing Backup Power to Commercial Cellular Towers and an Electric Utility Communications Network," presented by ReliOn at the DOE FCTO's Annual Merit Review on May 16, 2012: http://www.hydrogen.energy.gov/pdfs/review12/h2ra006_maxwell_2012_p.pdf

6. "Altergy's Freedom Power Systems To Power Major Telecom Network Upgrade," Altergy announced an order of over 1,000 systems for a wireless telecom carrier, August 2012: http://www.altergy.com/wp-content/uploads/2014/06/ALTERGY%E2%80%99S-FREEDOM-POWER-SYSTEMS-TO-POWER-MAJOR-TELECOM-NETWORK-UPGRADE.pdf

7. "Ballard Signs Supply Agreement With Azure Hydrogen For Backup Power Systems in China," Ballard supplies Azure Hydrogen in China with 120 direct hydrogen systems and 100 methanol-fuelled systems, July 26, 2013: http://www.ballard.com/about-ballard/newsroom/news-releases/news07261301.aspx

8. "Ballard Fuel Cell Systems Prove 100% Reliable, Providing Backup Power During Hurricane Sandy," Ballard deploys 17 units in the Bahamas, November 6, 2012: http://www.ballard.com/about-ballard/newsroom/news-releases/news11061201.aspx

9. "Broad Deployment of Ballard ElectraGen Fuel Cell Systems By CALA Region Telecom Providers," Ballard deploys 272 methanol-fueled systems, May 2, 2013: http://www.ballard.com/about-ballard/newsroom/news-releases/news05021301.aspx

10. “Ballard ships 500th ElectraGen-ME methanol fuel cell system for telecom backup,” Green Car Congress, April 13, 2013: http://www.greencarcongress.com/2013/04/ballard-20130413.html?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+greencarcongress%2FTrBK+(Green+Car+Congress)

11. Fuel Cell Technologies 2011 Market Report: https://energy.gov/fuelcells/downloads/2011-fuel-cell-technologies-market-report

12. “Plug Power Acquires ReliOn Inc. Bringing Innovative Fuel Cell Stack Technology In-House,” April 2, 2014: http://www.ir.plugpower.com/profiles/investor/ResLibraryView.asp?ResLibraryID=69150&GoTopage=6&Category=44&BzID=604&G=795

13. “Ballard Reports Third Quarter 2013 Results,” October 29, 2013: http://ballard.com/about-ballard/newsroom/news-releases/news10291301.aspx

14. “Ballard Reports Q4, Full Year 2013 Results & 2014 Outlook,” February 25, 2014: http://www.ballard.com/about-ballard/newsroom/news-releases/news02251401.aspx

15. “Plug Power Identifies SouthernLinc Wireless as Multi-Year ReliOn Fuel Cell Customer,” January 5, 2015: http://www.ir.plugpower.com/profiles/investor/ResLibraryView.asp?ResLibraryID=74560&GoTopage=2&Category=44&BzID=604&G=795

16. “Ballard Reports Q4, Full Year 2014 Results & 2015 Outlook,” February 25, 2015: http://www.ballard.com/about-ballard/newsroom/news-releases/news02251501.aspx

17. “Ballard Signs Agreement for Sale of Methanol Telecom Backup Power Business,” May 2016: http://ballard.com/about-ballard/newsroom/news-releases/news05171601.aspx