

# Data Collection & Analysis for ARRA Fuel Cell Projects



**Recovery Projects  
Kick-Off Meeting**  
**New Cumberland, PA**

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# Overview

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- Objectives
- Data Flow
- Data Collection
  - Reporting, templates, considerations
- Composite Data Products (CDPs)
- Questions

# Data Analysis Objectives

- Independent assessment of technology, focused on fuel cell system and hydrogen infrastructure: performance, operation, and safety.
- Leverage data processing and analysis capabilities from the fuel cell vehicle Learning Demonstration project and DoD Forklift Demo.
- Establish a baseline of real-world fuel cell operation and maintenance data and identify technical/market barriers.
- Support market growth of fuel cell technologies by reporting on technology features relevant to the business case
- Report on technology to fuel cell and hydrogen communities and stakeholders

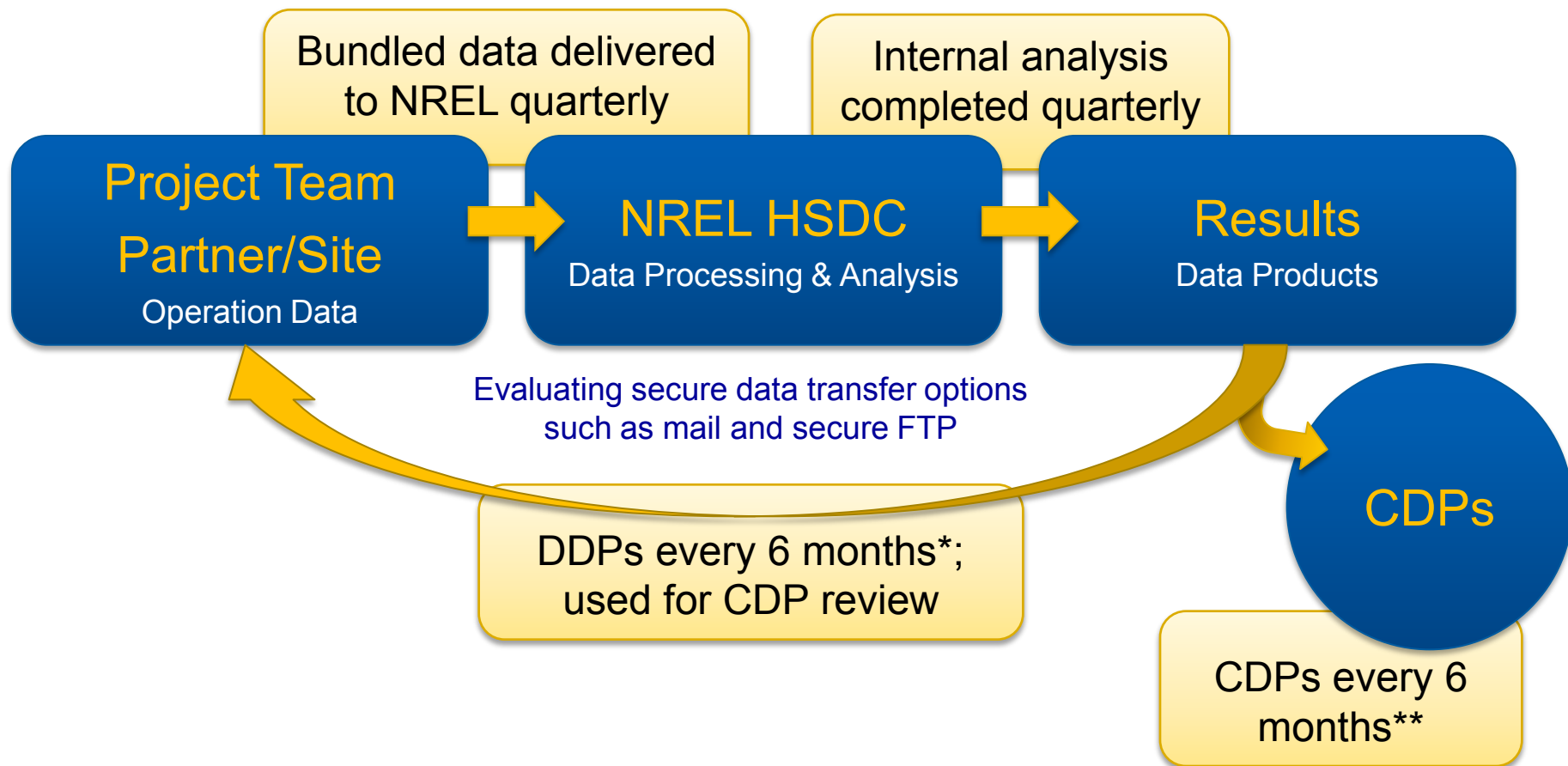
- Individual data analyses for each FC system and site
- Identify individual contribution to CDPs
- Only shared with partner who supplied data

Detailed  
Data  
Products  
(DDPs)

Composite  
Data  
Products  
(CDPs)

- Aggregated data across multiple systems, sites, and teams
- Publish analysis results without revealing proprietary data

# Data Flow



\*Data exchange may happen more frequently based on data, analysis, & collaboration

\*\*Via conferences, reports, and NREL Tech Val Website

# Data Reporting & Collection

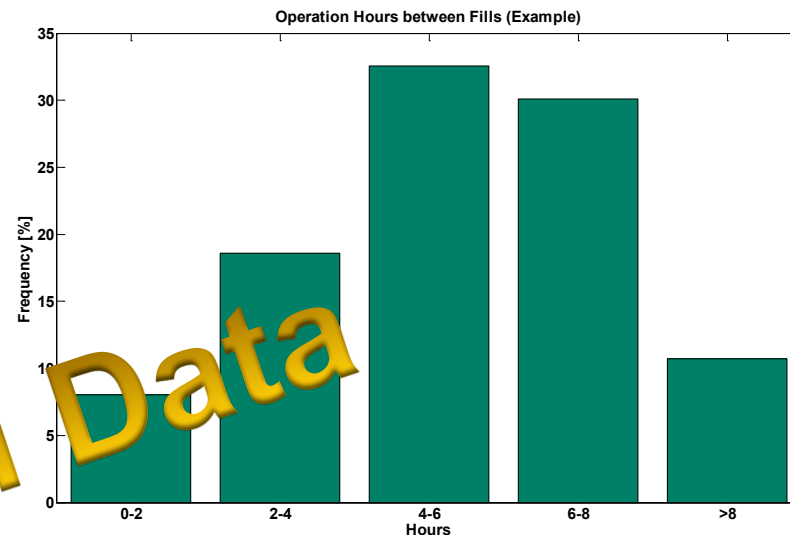
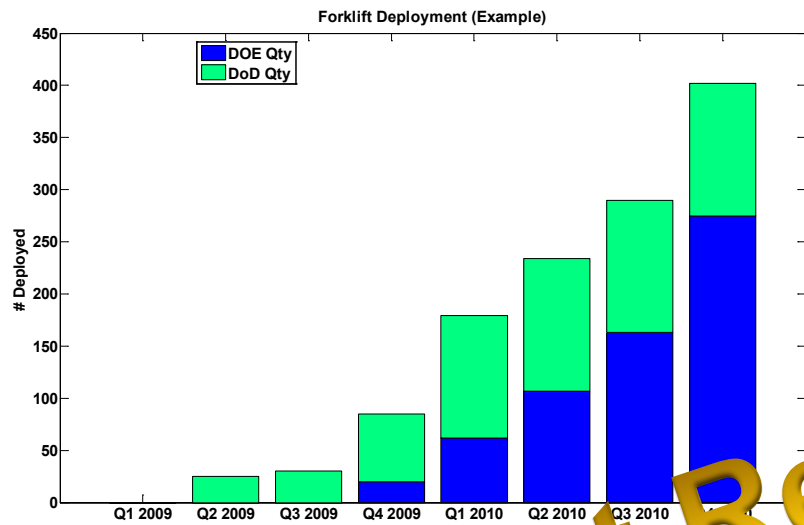
- Site Summary Report
  - Overview (Reported once\*)
  - Operation Log (Monthly)
  - Maintenance Log (Monthly)
- Site Cost Report
  - Installation Cost (Reported Once\*)
  - Operation Cost (Monthly)
- Site Hydrogen Report
  - Hydrogen Production Data\*\* (Monthly)
  - Usage (Monthly)
- Operation Data
  - Vehicle, system, or facility operations (Monthly)
  - On-board data acquisition for any operation (CSV files preferred)

- All data bundled and delivered to NREL HSDC quarterly.
- Data details are dependent on the application.
- Data templates are created for each different application & report.
- Data templates are common to all partners in an application.

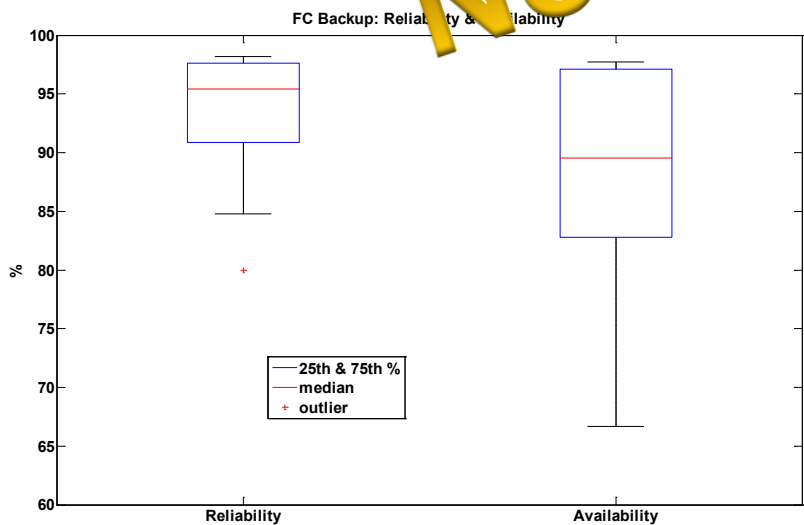
\*Updates needed for any significant changes

\*\*Only for on-site production

# Example of CDPs



**Not Real Data**



## Other Likely CDPs

Operation Hours & Durability

Efficiency

H<sub>2</sub> Fill Rate, Frequency, & Production

Power, Voltage, Energy

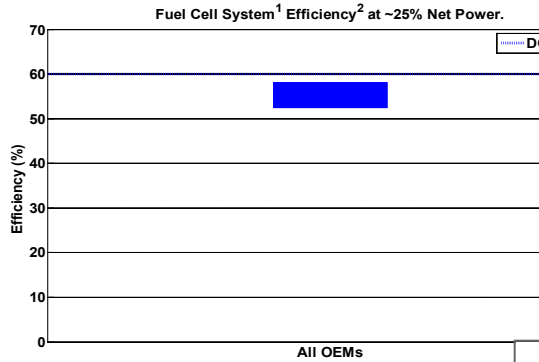
Safety

Maintenance

Cost (install, op, life)

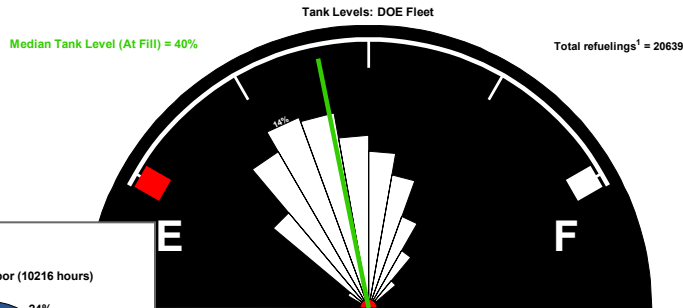
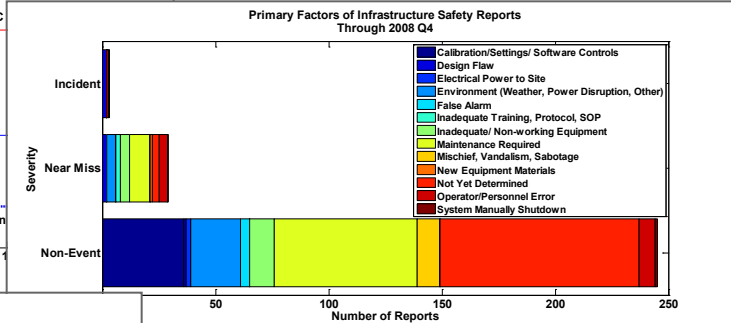
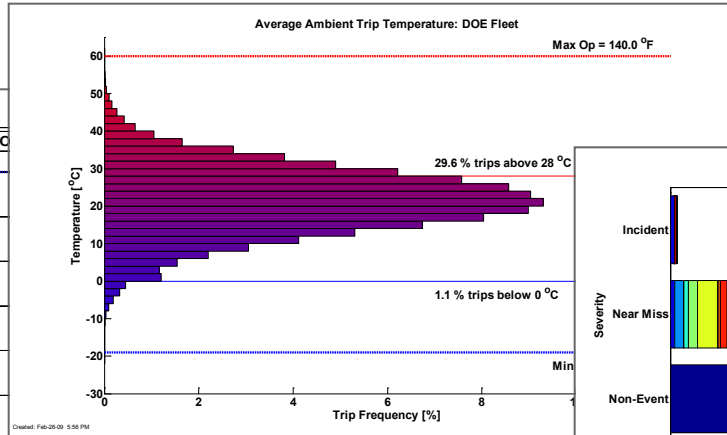
Market Application Comparisons

# Comparable Fuel Cell Vehicle CDPs



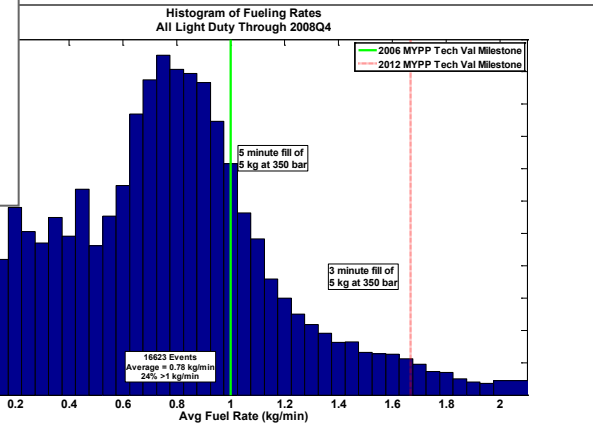
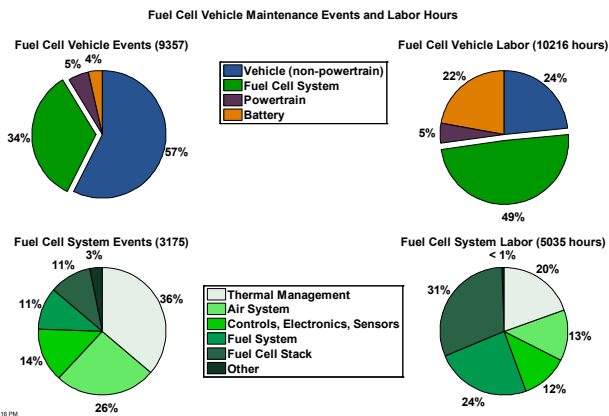
<sup>1</sup> Gross stack power minus fuel cell system auxiliaries, per DRAFT SAE J2615.

<sup>2</sup> Ratio of DC output energy to the lower heating value of the input fuel (hydrogen). Excludes power electronics and electric drive.



1. Some refueling events not recorded/detected due to data noise or incompleteness.  
 2. The outer arc is set at 20% total refuelings.  
 3. If tank level at fill was not available, a complete fill up was assumed.

is an event that results in:  
 -line accident and/or injury to personnel  
 -unplanned downtime for project equipment, facilities or property  
 -to the public or environment  
 -hydrogen release that unintentionally ignites or is sufficient to sustain a flame if ignited  
 -leak of any volatile, hydrogen containing compound (other than the hydrocarbons used as common fuels)  
 -is not that under slightly different circumstances could have become an incident  
 -if not for H2 release insufficient to sustain a flame



All published results can be found at: [http://www.nrel.gov/hydrogen/proj\\_tech\\_validation.html](http://www.nrel.gov/hydrogen/proj_tech_validation.html)

# What Others Are Saying About NREL's FC Analysis

## Partner Collaboration and Confidence

"NREL team has gained the highest credibility with both industry and DOE"

"Outstanding collaborative interactions"

"have earned the complete confidence of industry during the course of this project"

"Close collaboration with industry partners providing data is a primary contributor to project success"

## Communication of Results

"comprehensive and needed summary of hydrogen fuel cell vehicle testing"

"Public results have been widely and proactively disseminated through numerous conferences, reports and publications"

## Approach and Methodology

"superb system for collection, storage, securing, analyzing, and reporting on sensitive performance and other data submitted by industry"

"Strong analysis methodology"

"strong, experienced, flexible team, which is committed to achievement of challenging project and hydrogen program objectives"

"Excellent approach to maximize useful information from a massive amount of data"

## Importance and Relevance

"vital to determining whether the Program's hydrogen and fuel cell activities are on course to achieve established research and development targets"

"the most important and critical element of the Technology Validation Sub-program"

Source: 2008 Annual Merit Review and Peer Evaluation Report, [http://www.nrel.gov/hydrogen/pdfs/amr\\_peer\\_evaluation\\_report\\_2008.pdf](http://www.nrel.gov/hydrogen/pdfs/amr_peer_evaluation_report_2008.pdf)

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