SAND2014-1833C

Managing Safety in Energy Storage System Projects

Daniel Borneo, P.E.
Moderator

NAATBatt Symposium

Hilton San Diego Resort and Spa

San Diego, California (USA)

January 2014

Sandia National Laboratories

Exceptional service in the national interest

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

SAND Document

Acknowledgements

Sandia's participation in this event is funded by DOE's **Office of Electricity** managed by **Dr. Imre Gyuk**.

Managing Safety in ESS Projects Agenda

Panelists

Daniel R. Borneo, Project Lead for DOE/OE ESS Demo Program at Sandia National Laboratories

Quinn Horn, Ph.D., P.E.; Principal Engineer
Exponent, Inc.

Chris Orendorff, Principal Investigator
Battery Safety R&D and Battery Abuse Testing
Sandia National Laboratories

Davion M. Hill, Ph.D. ; Principal Engineer
DNV·GL Research & Innovation

Laurie B. Florence, Principal Engineer – Large Format Batteries, Fuel Cells and Capacitors
Product Safety at UL LLC

Dan Cass, Vice President Loss Control & Engineering Services
GCube Insurance Services, Inc.

Topics

- Overview
- Failure Modes Unique to Large Format Cells and Battery Systems
- Inherent Safety Challenges with Battery Materials
- **Technology Qualification** for Battery Systems: Safety Considerations, Testing, FMECA, and Examples
- **Safety Standards for Energy Storage** - Process for Development and Current Landscape
- **Energy Storage Loss Mitigation** and Risk Transfer

Managing Safety in ESS Projects

Symposium OVERVIEW

- PROBLEM STATEMENT
  - *Real or imagined* **there is a safety concern** with Energy Storage, especially batteries
  - **Past** innovations in other areas **improved safety** through **post-mortems**
  - Energy Storage (ES) for **grid applications** is not well received in all markets, so problems will be amplified
  - In order **for ES to be successful in grid applications** the industry need to be proactive in finding and fixing problems before they happen

- This panel will discuss
  - Features of batteries that cause them to fail (singularly and in systems)
  - Challenges to fixing these features
  - Testing and qualification processes and considerations
  - Standards that are important for our industry to use for guidance
  - Insurance expectations concerning safety in the commercial world

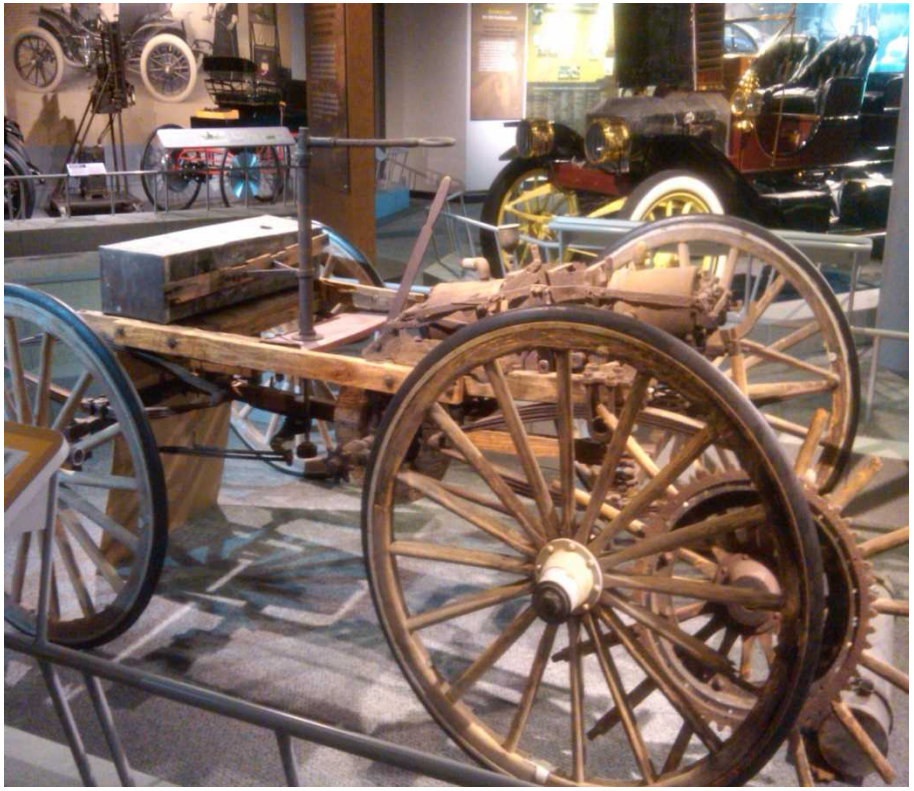
Meeting Logistics

- Each panelist will give a short presentation
- Audience participants
  - Save questions until after panelists have presented
  - Cards are located on tables
  - Microphones (optional)

http://www.ait.ac.at/uploads/pics/elektr.Energiespeicher_499x250_03.jpg

Principles of the SNL **Energy Storage Demonstration** Program

Innovation: Something to Consider



One of the first gasoline powered cars ~1891 by Henry Nadig of Allentown, Pa.
Courtesy of American Automobile Museum, Allentown, Pa.

Courtesy of American Automobile Museum, Allentown, Pa.

Innovation: Something to Consider

*Quotes about the Nadig in 1891**

- Blasted as a "**dangerous device**" –
  - backfiring caused **fires**
  - **Open Fuel** can with wick to carburetor
- Car **not allowed** on the **streets** during the day as it **"frightened"** the horses
- Constable served notice; drivers/operators could be **arrested,** held liable for creating a "**public nuisance**"
- "Shouts of 'Get a horse!' were followed by the grand insult of the day - "***Flying Cabbages***" that were thrown at the hapless Nadig."

** Whelan, Frank "Did Auto Age First Dawn in the Valley? Allentown Mechanic Built One of Country's First Gas-powered Cars" Sept, 14, 1989 The Morning Call*