

# **Bus and Truck Working Council (BTWC)**

**Host: Salt River Project (SRP)**

**Location: Project Employees Recreation Association (PERA) Club  
1 E Continental Drive, Tempe, Arizona 85281  
Mesquite Hall East**

**Tuesday PM, March 10, 2020**

Mark Kosowski

[mkosowski@epri.com](mailto:mkosowski@epri.com)

248-421-7124

Meeting was held the day prior to the IWC meeting. Thanks to SRP for hosting the meeting at their beautiful brand-new facility.

The attendance was very good considering the Coronavirus. There were about 46 people in attendance. The attendance was less than originally planned due to the Coronavirus. The roll call is shown below.

The minutes and presentations from the meetings are located at the link below for your reference. <https://www.epri.com/#/busandtruck>

The meeting started about 1:00 pm. The agenda was presented. It is shown at the end of these minutes.

## **Nikola: Elizabeth Fretheim**

- See slides shown
- They have the powersports vehicles and military vehicles as well as the class 8
- Nikola Badger: Hybrid pickup truck, fuel cell as battery.
  - 300 miles with just electric, but you double the capacity with fuel cell capacity too.
- Partnered with Thomsoncat for servicing
- They believe it is a battery AND fuel cell question. They can custom their vehicles depending on what you need.
- The drive train remains electric- which is more efficient.
- They only need a 35 miles per hour and 6% grade, which matches what diesel trucks are doing now.
- Can carry 82,000 lbs.
- Can start from stop at 17% grade at 82,000 pounds.
- 0-60 in 30 seconds with 82,000 lbs.

- Differential lock- enhances the traction of the vehicle.
- Battery: decentralized central architecture.
- What about safety with hydrogen.
  - Heat shield that goes between the battery and the fuel cell
  - Ballistics testing
- Cool interface- can custom it so that it only reports what you want people to see.
- They want to generate the hydrogen onsite through electrolysis. They will have a 1.5 day supply. This will help a utility to avoid a peak power need.
- They want 700 charging hydrogen and electric across the country.
- You need about 10 acres of land to be able to produce the hydrogen.
- 8 tons per day station. Supports about 200 trucks. 20K gallons of water per day. 22.5 MW of power.
- 2021 production BEV
- They are offering a lease that includes fuel, vehicle and maintenance in a \$/mile for fuel cell vehicles.
- For BEVs, they don't have a lease model. Charging will be onsite.

Nikola is designing hydrogen stations... thinking 700 stations across the US and Canada by 2028

- Considering having light-duty EV charging at these stations
- Station specs
  - 8-10 acres of land
  - 22.5 MW (constant) of power - incl. dispensing.
  - 8 tons of hydrogen ~ 200 trucks per day
  - 20 k gallons water per day

Catherine O asked - what is load profile of the station

- Generally flat but could be interrupted... plan to use interruptible service

Greg N - asked -- quality of water?

- Water needs to be cleaned - high purity

Timeline

- Production BEV 2021. Europe one year behind.
- Production FCEV 2023

Pricing

- FCEV: Bundled lease including fuel and O&M in single \$/mi charge
- BEV - probably customer will have their own infrastructure

Collaboration

- Trucking companies don't want to share "lane" (operational/locational) data

Question: who is betting on Hydrogen for trucking

- Europe and Canada interested

## **Gillig: Jing Yang**

- See slides shown
- Charging j1772 charging- manual.

### Gen 1 bus

- 29 ft bus
- wireless charging capability - during 10 minute stop - get ~10 miles of range
- CCS

### Gen 2 bus

- 40 ft bus
- Cummins powertrain
- Working on 35 ft bus
- Overhead pantograph in development: J3105-1
- J1772 CCS type 1
- Wireless: in development

### Challenges

- Charger installation
- Compatibility
- Fast charging
  - 2C battery charging - a challenge

### Kathy - tested in Arizona?

- Yes, 2 weeks in AZ

### Catherine O - biggest order can accommodate?

- 100 diesel buses to King County
- EV buses -- typically ~10 EV bus per customer; ~50 EV buses total in 2020, maybe 100 in 2021

Gillig - strength compared to competitors is their very low failure rate

## **North America Council for Fuel Efficiencies (NACFE): David Schaller**

- See slides shown
- Average truck is 6.5 miles/gallon.
- Formed in 2000 out of diesel price spike -- increasing efficiency of trucking
- All information available on web site
- 
- Supported by truck OEMs and
- 
- 6.5 mpg (some 6.0 mpg) typical
- Experiment w best equipment and driver--achieved 10 mpg
-

- Long haul - achieved 8.3 mpg

\*\*\*\*\*duty cycle of trucks -- "run on less" info on web site

Electric truck reports -- "college term papers" were charging \$1500 per download. Now free

- 4 reports available on web site
  - e.g. MD electric - TCO

Diesel powertrain incl fuel tanks = 8000 lb. Remove this when producing an EV truck.

Current focus - regional haul.

- Hewlett wants them to spread this message

[www.runonless.com](http://www.runonless.com)

David Peterson Question- how can utilities help?

- Dave S --- Call your own main phone # -- help fleets get to the right people at the utility
- David P - Maybe work with EEI or SEPA
- Dave S - We are doing that, plus EPRI and others. Very much want to help. Considering putting together a Trucking industry primer

## **CharIn Charge Connector update: Rustam Kocher**

CharIn task force

Truck is not making money when it is parked -- how to minimize charge time  
MW-level charging using a conductive connector

New solution - not backward compatible with CCS 1 and 2

John H - UL 2251 adequate for these connectors?

- 2251 limited to 1000 V -- working to increase to 1500 V

Pat Hayes - Biggest roadblock--- battery, charger, infrastructure?

- Batteries not a limit - can do 2C today
- 500-600 kWh battery

Nobody asked, but Rustam said -- Power levels seem to be a problem

- Look at sites where power has become available, e.g. due to coal plant shutdown etc
- Don't shoehorn into current truck stop sites

Jordan S question: have you done a projection or model of growth rate of this connector, and where stations might be

- Awaiting west coast collaborative

- Sites for long-distance -- TBD
- Medium-distance / drayage - put where trucks are
- David - NACFE -- high school math competition - 14 hour. Subject was how to site charging for trucks.
  - Can share more in April
- Rustam - whole trucking situation could be different with electric trucks -- don't design to fit existing infrastructure
  - Do a white roof survey -- find white roofs on Google maps --- utility can determine where capacity is available

Jordan S question: governing board

-----

## **SAE J3105 update: Mark Kosowski**

See attached slide deck.

Rich Scholer - asked about charge sequencing --

- Mark K - on next meeting agenda. Will be working on it

## **Break**

## **eTRU trailers- Robert Koelsch Advanced Energy Machines**

See attached slide deck.

TRU -- refrigeration units for trucks

"off-road" classification

40V DC connection

They are the only manufacturer that is ZEV solution certified. Others work on diesel

More efficient than diesel - rivals ammonia

Performance compared to diesel. Electric-driven has reputation of not performing as well.

- More powerful than diesel -- more delta-T

Infrastructure for 400 spaces

eTRUs in AZ -- see slide

- \$382 million

CA is about 10x AZ numbers

Typical 50 kWh/day on their system.

## **WAVE wireless charging: Mike Masquelier**

See slides

- 500 kW
  - Los Angeles. Cummins powertrain
- 1MW wireless charging!
  - Seattle -- Portland -- 30 min charge -- 400 mi/day

85% efficiency

Question -- efficiency/losses?

- Spec 85%
- Some OEMs reaching >90%. 92-93%

Question - voltage feeding plate in ground

- 1000V

Question- (Heather J, APS) - alignment requirement

- 10-12" window

Question - Mike Rowand -- what's required to go to higher power

- Larger or multiple coils (side-by-side)

## **Future Topics**

Mark K asked - what can we do to improve / what topics would you like for future meetings?

Alexander ABB -- asked for commercial fleet operators (Fedex, UPS, etc.) -- explain their operation, etc.

Catherine O, APS -- what about smaller businesses that don't own their parking area - e.g. flower shop

- Kyle Pynn, Burns&Mac- DHL is an example - they don't typically own their properties

Catherine O, APS -- Other OEMs of trucks etc - Nikola

- Mark K - Bluebird canceled this time. Yes, will be more
- Dave S, NACFE -- Calstart just released a database of MD-HDV future plans

Alexander ABB -- asked if NACFE could give 1-hour commercial vehicle operator overview

Heather J - high-level benefits/costs for those fleets not yet decided to go electric

# Meeting Attendance

| Full Name            | Email Address                   | Company  | Status   |
|----------------------|---------------------------------|--|----------|
| Bowermaster, Daniel  | dbowermaster@epri.com           | Electric Power Research Institute (EPRI)                       | Attended |
| Canada, Tom          | tcanada@southernco.com          | Southern Company Services, Inc.                                | Attended |
| Coop, Mike           | mcoop@thinksmartgrid.com        | ThinkSmartGrid   | Attended |
| Cottengaim, Isaiah   | isaiah.cottengaim@srpnet.com    | Salt River Project Agricultural Improvement and Power District | Attended |
| Daniels, Cedric      | cidaniel@southernco.com         | Alabama Power Co.  | Attended |
| Dunckley, Jamie      | jdunckley@epri.com              | Electric Power Research Institute (EPRI)                       | Attended |
| Frye, Andrew         | agfrye@tva.gov                  | Tennessee Valley Authority (TVA)                               | Attended |
| Goldman, Jay         | jay@recargo.com                 | PlugShare  | Attended |
| Halliwell, John      | jhalliwell@epri.com             | Electric Power Research Institute (EPRI)                       | Attended |
| Harju, Megan         | maharju@burnsmcd.com            | Burns & McDonnell Engineering Co.                              | Attended |
| Hayes, Pat           | pat.hayes@us.abb.com            | ABB Inc.   | Attended |
| Hedges, Edward       | ed.hedges@evergy.com            | Evergy Services, Inc.  | Attended |
| Jones, Thomas        | thomas.jones@mastec.com         | MasTec, Inc.   | Attended |
| Kennedy, James       | james@tritium.com.au            | Tritium  | Attended |
| Kosowski, Mark       | mkosowski@epri.com              | Electric Power Research Institute (EPRI)                       | Attended |
| Krauthamer, Michael  | michael@EVadvisors.com          | EV Advisors, LLC   | Attended |
| Lalonde, Alexandre   | alexandre.lalonde@ca.abb.com    | ABB Inc.   | Attended |
| Madriz, Mariela      |                                 | EPRI   | Attended |
| Nieminski, Greg      | silvergregn@verizon.net         | Gregory C Nieminski, LLC                                       | Attended |
| O'Brien, Catherine   | catherine.obrien@srpnet.com     | Salt River Project   | Attended |
| Perez, Tony          | tony.perez2@srpnet.com          | Salt River Project   | Attended |
| Pratt, Jeff          | jeff.pratt@opc.com              | Oglethorpe Power Corp.   | Attended |
| Pynn, Kyle           | kpynn@burnsmcd.com              | Burns & McDonnell Engineering Co.                              | Attended |
| Robertson, John      | jay.robertson@lge-ku.com        | LG&E and KU Energy LLC   | Attended |
| Rowand, Mike         | michael.rowand@duke-energy.com  | Duke Energy Carolinas, LLC                                     | Attended |
| Schaller, David      | david.schaller@nacfe.org        | North American Council for Freight Efficiency (NACFE)          | Attended |
| Scholer, Rich        | richard.scholer@fcagroup.com    | Chrysler Group, LLC  | Attended |
| Schubert, Amanda     | amanda.schubert@srpnet.com      | Salt River Project   | Attended |
| Schurhoff, Rob       | rschurhoff@epri.com             | Electric Power Research Institute (EPRI)                       | Attended |
| Stoker, Mark         | mark.stoker@us.schunk-group.com | Schunk Graphite Technology                                     | Attended |
| Vogt, James          | javogt@tritiumcharging.com      | Tritium  | Attended |
| von Schramm, Valerie | vvvonschramm@cpsenergy.com      | CPS Energy   | Attended |
| Whitehead, Kendell   | kendell.l.whitehead@us.abb.com  | ABB Inc.   | Attended |
| Whittemore, Luke     | luke.whittemore@pgn.com         | Portland General Electric Co.                                  | Attended |
| yang, jing           | jing.yang@gillig.com            | Gillig, LLC  | Attended |
| Bright, James        | james.bright@nypa.gov           | New York Power Authority                                       | Phone    |
| Geraghty, Melissa    | mgeraghty@epri.com              | Electric Power Research Institute (EPRI)                       | Phone    |
| Keating, Neil        | nkeating@firstenergycorp.com    | FirstEnergy Service Company                                    | Phone    |
| Kocher, Rustam       | Rustam.Kocher@Daimler.com       | Daimler Trucks North America LLC                               | Phone    |
| Lehman, Jeffrey      | jwlehman@aep.com                | American Electric Power Service Corp.                          | Phone    |

|                  |                                  |  |       |
|------------------|----------------------------------|--|-------|
| MacCurdy, Dwight | Dwight.MacCurdy@smud.org         | Sacramento Municipal Util. Dist.         | Phone |
| Owen, David      | david.owen@centerpointenergy.com | CenterPoint Energy Houston Electric, LLC | Phone |
| Porter, Emily    | eporter@epri.com                 | Electric Power Research Institute (EPRI) | Phone |
| Smith, Jordan    | jordan.smith@sce.com             | Southern California Edison Co.           | Phone |
| Thompson, Amy    |                                  | EPRI                                     | Phone |



# BUS AND TRUCK WORKING COUNCIL

Host: Salt River Project

Location: Project Employees Recreation Association (PERA) Club

1 E Continental Drive, Tempe, Arizona 85281

Mesquite Hall East

Tuesday, March 10, 2020

## Agenda

| 1:00 PM | Welcome and Introductions                         | Mark Kosowski, EPRI   |
|---------|---|---|
| 1:15 PM | Nikola Trucks                                     | Elizabeth Fretheim, Nikola  |
| 1:45 PM | Gillig Bus Update                                 | Jing Yang, Gillig   |
| 2:00 PM | North America Council for Fuel Efficiency (NACFE) | David Schaller, NACFE   |
| 2:15 PM | CharIN Update for High Power Charging             | Rustam Kocher, Daimler  |
| 2:45 PM | Update SAE J-3105 Automatic Charging              | Mark Kosowski, EPRI   |
| 3:00 PM | Break   |   |
| 3:30 PM | eTRU Development                                  | Robert Koelsch, Advanced Energy Machines  |
| 4:00 PM | SAE J-2954-2 High-Power Wireless Update           | Mike Masquelier, WAVE   |
| 4:30 PM | Discussion and Review next meeting                | All   |
| 5:00 PM | Adjourn   | All   |
| 5:30 PM | Casual Dinner Reception                           | <b>Culinary Dropout</b><br><b><u>149 S. Farmer</u></b><br><b><u>Tempe, AZ 85281</u></b><br><b><u>480.240.1601</u></b> |