Fuel Diversification to Improve Transportation Resilience in Tampa Bay, FL

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State of Transport Resilience
- Hurricanes are increasing in frequency, intensity, duration, and projected to continue increasing (NOAA 2019, Kossin 2018)
- Most transportation resilience progress has been made by state DOTs, and has been focused on roads and bridges
- FEMA funding directed overwhelmingly to recovery, not preparation
- A series of disasters proved the value of transportation fuel diversification
- The Initiative for Resiliency in Energy through Vehicles (IREV) – By DOE, Clean Cities, and the National Association of State Energy Officials (NASEO)
  - Case studies on EVs, biodiesel, natural gas, and propane vehicles
  - Tools/kits developed for Virginia and Lancaster County
  - Tracking tool helps combine and visualize inventory

5-Pronged Approach to Resilience
1. Redundancy
   - Multiple fuels, sources, modes, and routes to reach Tampa
   - Multi-purpose vehicles
2. Storage
   - Have fuel stored nearby where source gets cut off
3. Access
   - Make sure access to stored fuel is maintained during natural disaster
   - Location of storage
   - Communication is key
4. Resupply
   - Ensure that local storage facilities are resupplied as soon as possible after a disaster
   - Renewable energy to resupply EVs
5. Efficiency
   - Get the most work done for given amount of fuel
     - Maximize passengers/volume miles per vehicle
     - Maximize miles per gallon or BTU

Natural Gas: Key Information
- Natural gas supply chain less likely to shut down than petroleum due to the large amount of redundancy in the system.
- Transmission pipeline—the loss of one compressor station would reduce flow 20-25%. Losing 3 stations in series could halt operation.
- Transfer from transmission to distribution takes place at the city gate. Most cities have 2 or more gates.
- Distribution lines are kept pressurized to prevent infiltration.
- Some CNG stations have natural gas-powered generators in case of electrical outages.
- Tracked in Alternative Fuels Data Center
- Natural gas powered compressors can be brought to the fleet.
- Superstorm Sandy
  - The New York Authority of NY and NJ used CNG vehicles to provide critical services when gasoline was in short supply
  - CNG "ferry" buses continued to operate in Atlantic City (PBS MotorWeek HIGHLIGHT)
- Hurricane Harvey
  - Freedom Island in Houston

Electric Vehicles: Key Info
- PHEVs are the only vehicles that don’t need oxygen
- Distributed generation can provide electricity to vehicles when the grid is down, if designed correctly
- EVs, PHEVs, and Fuel Cell vehicles can provide backup power to appliances, buildings and potentially to microgrids
- In CA wildfires, PG&E (Excess 1.5TB) trains with exportable power modules to provide power to shelters
- During Japan’s 2011 earthquake/tsunami, oil refineries were destroyed and EVs were a tremendous asset
  - Used to transport doctors, deliver supplies, and inspect buildings for safety
  - Allowed the “leaf to home” power stations
  - Hands also offers power exporter

Natural Gas

Propane: Key Information
- Propane arrives via rail to Tampa, from Pennsylvania, West Virginia, and Ohio.
- Propane can be stored indefinitely (it doesn’t degrade) and accessed quickly
- Propane allows for mobile fueling (wet-hosing)
- Takes about the same amount of time to refuel as gasoline

Electric Vehicles

Notable Findings From Site Visits
1. Chokepoint at Port Tampa—Pilots need to board tankers on the open ocean and navigate 43-mile narrow channel
2. Hurricane Irma shut the Port down for 5 days, and traffic was backed up longer
3. Fuel Mules operate on regular municipal gas lines (60 psi) and contain their own natural gas powered generators
4. Tampa’s grid circuits are 950 customers each
5. Transmission control module is the lowest electronic component on a school bus, but can be moved higher
6. Most school buses have “Edulog” trackers

Notable Findings From Workshop
- "Push teams" are trucks that clear the roads after a hurricane
- Tampa is considering a BRT lane that needs to be used strategically
- SunSmart E-Shelters program is equipping schools/emergency shelters with solar panels
  - Sky is normally clear directly after hurricanes
- Hurricane Irma impacted 65 out of 67 counties and 6.8 million people evacuated
- Gas Buddy was used to connect drivers to available fuel
- There are resilience plans being made at local, regional, and state levels that could benefit from a transportation fuel resilience plan