Plug Power is a Leader in Hydrogen and Fuel Cell Technology

1st to create a market for HFC technology

31.9MM+ fuelings; 35T+ liquid H2 used daily

40,000 Units Deployed by Year End 2020

GenKey end-to-end solution provides fuel and H2 infrastructure, fuel cells and service

Expansion into electrolyzers and green hydrogen plants via acquisitions

In-house capability to become one of the largest green hydrogen generators over the next several years
Why the GSE Market

- Significant regulatory pressure on emission reduction
- Operators striving for sustainable solutions
- Large shift to electrification and/or alternate fuels
- Airports are effectively standalone ‘ecosystems’
- Contract 3rd party operators & maintenance companies to consolidate equipment demands
- Increasing global demand for air cargo
- Overall GSE market (powered & non-powered) is approx. $20-25B
Why Hydrogen

Value Prop Drivers – Similar to Material Handling
- Energy efficiency: 45% FC vs. 20% diesel
- Energy recovery via regenerative braking
- Decreased maintenance costs

Ancillary Benefits
- Data to evaluate EV performance
- Prognostics - see issues before they happen, less downtime
- Lower noise and diesel emissions - operator health and satisfaction benefits

Market Drivers
- Zero emission regulations
- Cost of compliance, creating more costly exhaust abatement
- Trend toward EV autonomy

Elimination / Reduction of Diesel Tractor Maintenance Items
- Oil changes
- DPF (Diesel Particulate Filter) changes
- Starters (policy to turn off tractor when getting off)
- Brakes (Regenerative braking eliminates or minimizes replacement interval)
  - Typical route is 1.8 miles including 10-12 stops.
  - Diesel tractors require heavy brake usage to stop 40,000 lbs. from 10-15 mph

Battery vs. Hydrogen FC
- Charging infrastructure does not scale with fleet size
- Electrical infrastructure expensive to install – $30k/vehicle
- Demand charges can become significant given the energy needs of the vehicles.
- Fast charging is more costly to install and to charge.
- FC infrastructure scales very well from 10 to 1000 vehicles at a site. Incremental vehicles add little if any new cost.
## Electric Ground Support Equipment

### GSE Type
- Main Deck Loader
- Lower Deck Loader
- Belt Loader
- Baggage Tractor
- Pushback Tractor
- GPU
- Cargo Transporter
- Ramp Crew Van
- Ramp Mgmt. Vehicle
- Crew Shuttle Bus

### Integration Complexity
- Battery Replacement & Lower Level of Chassis Integration
- Higher Level of Chassis Integration with OEM

### Fuel Cell Target
- Current Trials & Product Development
- Under Consideration
Recent Publicly Announced GSE Fuel Cell Trials

Memphis & Albany – DOE/FedEX/Charлатte
- Electric - 80V, Mid-mount 1600 Fuel Cell
- Completed multi-year program at Memphis & Albany
- Albany cold weather testing – 41 days below freezing
- DOE Program reports are public

Hamburg Germany – MULAG Comet 4E
- Electric - 80V, Mid-mount 1600 Fuel Cell
- Completed 2 Month Trial at Hamburg Airport
- Exceptional Performance
Questions?