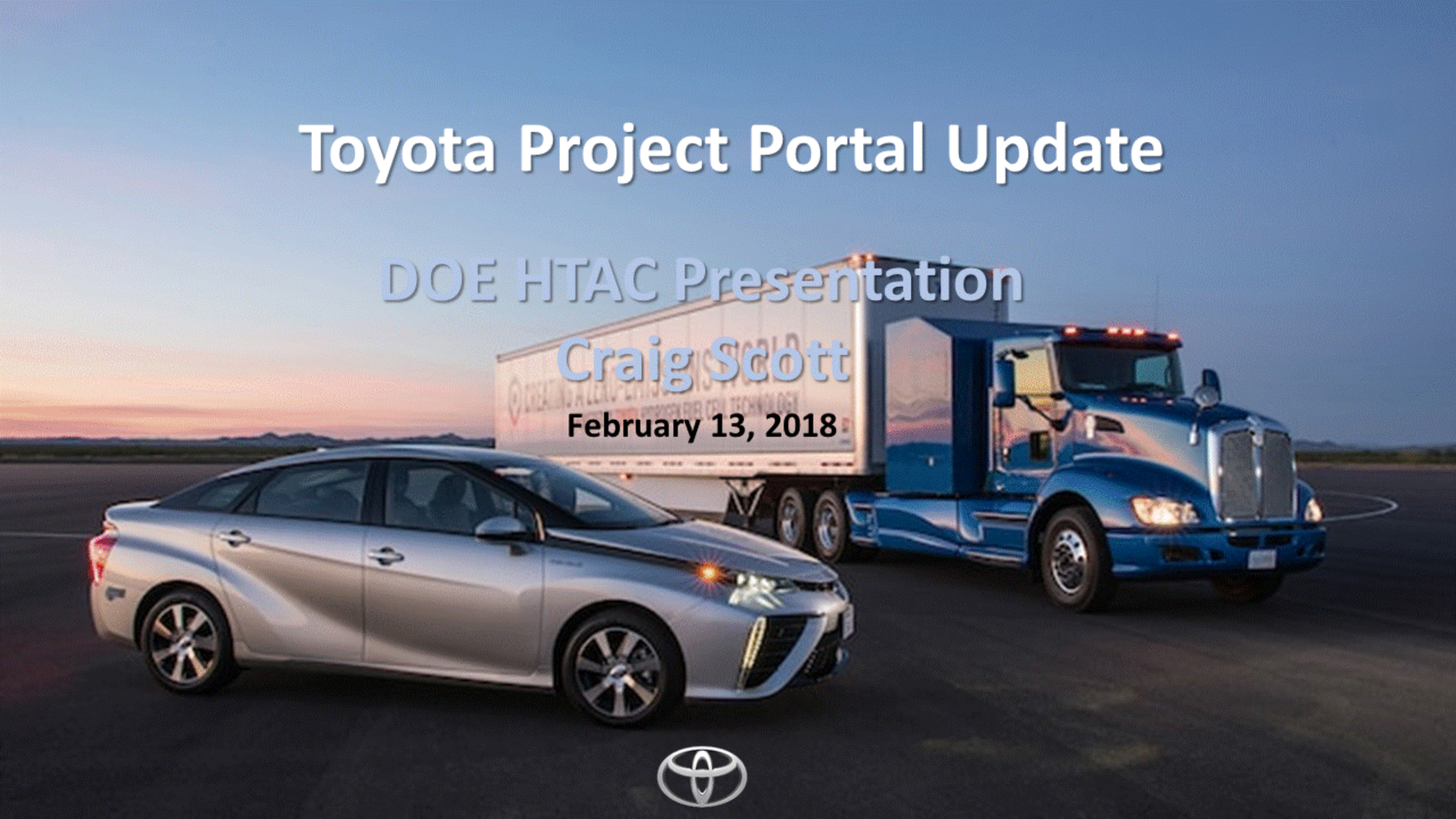
Toyota Project Portal Update

DOE HTAC Presentation

Craig Scott

February 13, 2018



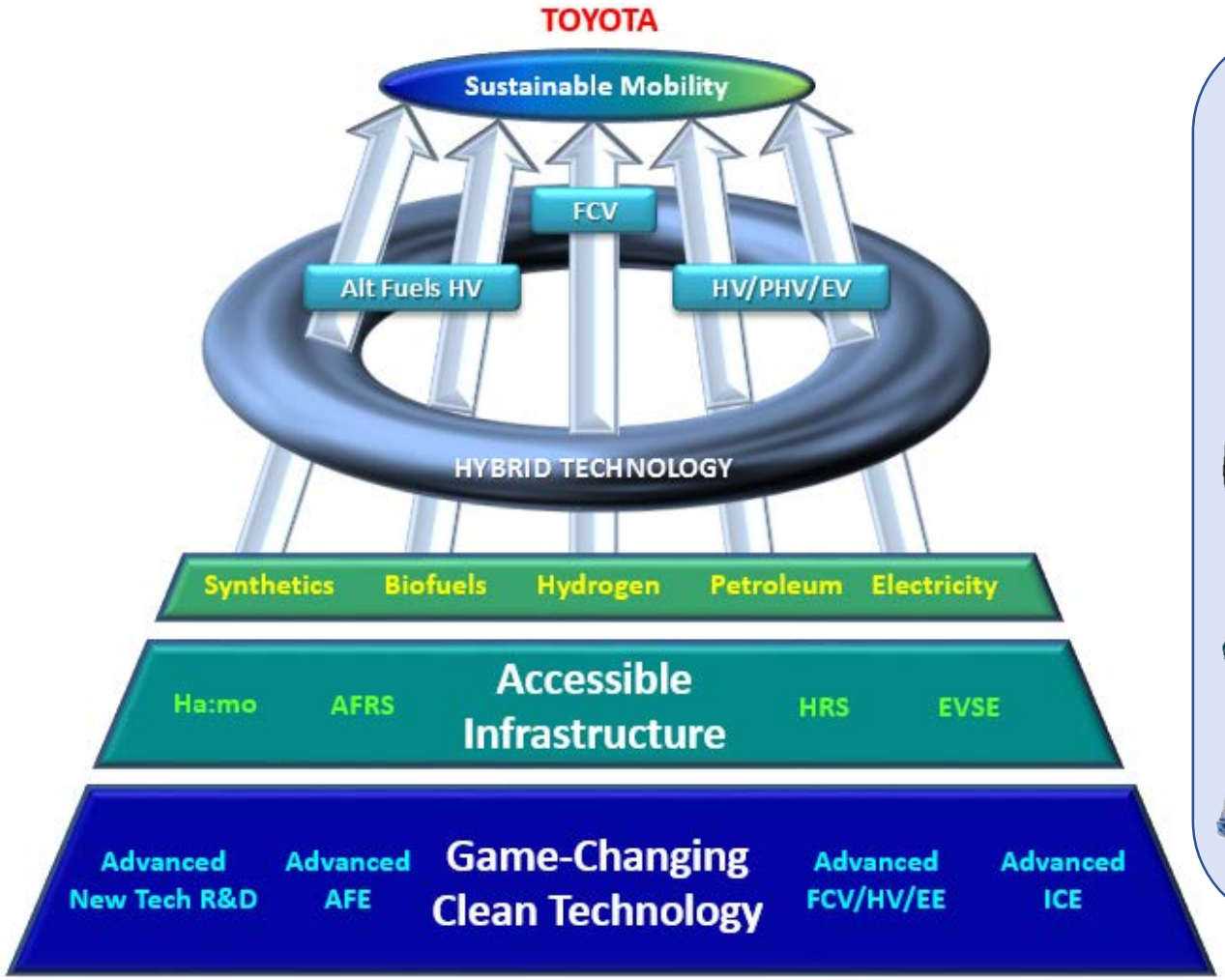
Presentation Outline

- Why Portal?
- Project Details
- Collaboration and Path Forward

Why Portal: Toyota Motivation

TOYOTA ENVIRONMENTAL CHALLENGE 2050

CHALLENGE 1	CHALLENGE 2
New Vehicle Zero CO_2 Emissions Challenge	Life Cycle Zero CO_2 Emissions Challenge
CHALLENGE 3	CHALLENGE 4
Plant Zero CO_2 Emissions Challenge	Challenge of Minimizing and Optimizing Water Usage
CHALLENGE 5	CHALLENGE 6
Challenge of Establishing a Recycling-based Society and Systems	Challenge of Establishing a Future Society in Harmony with Nature

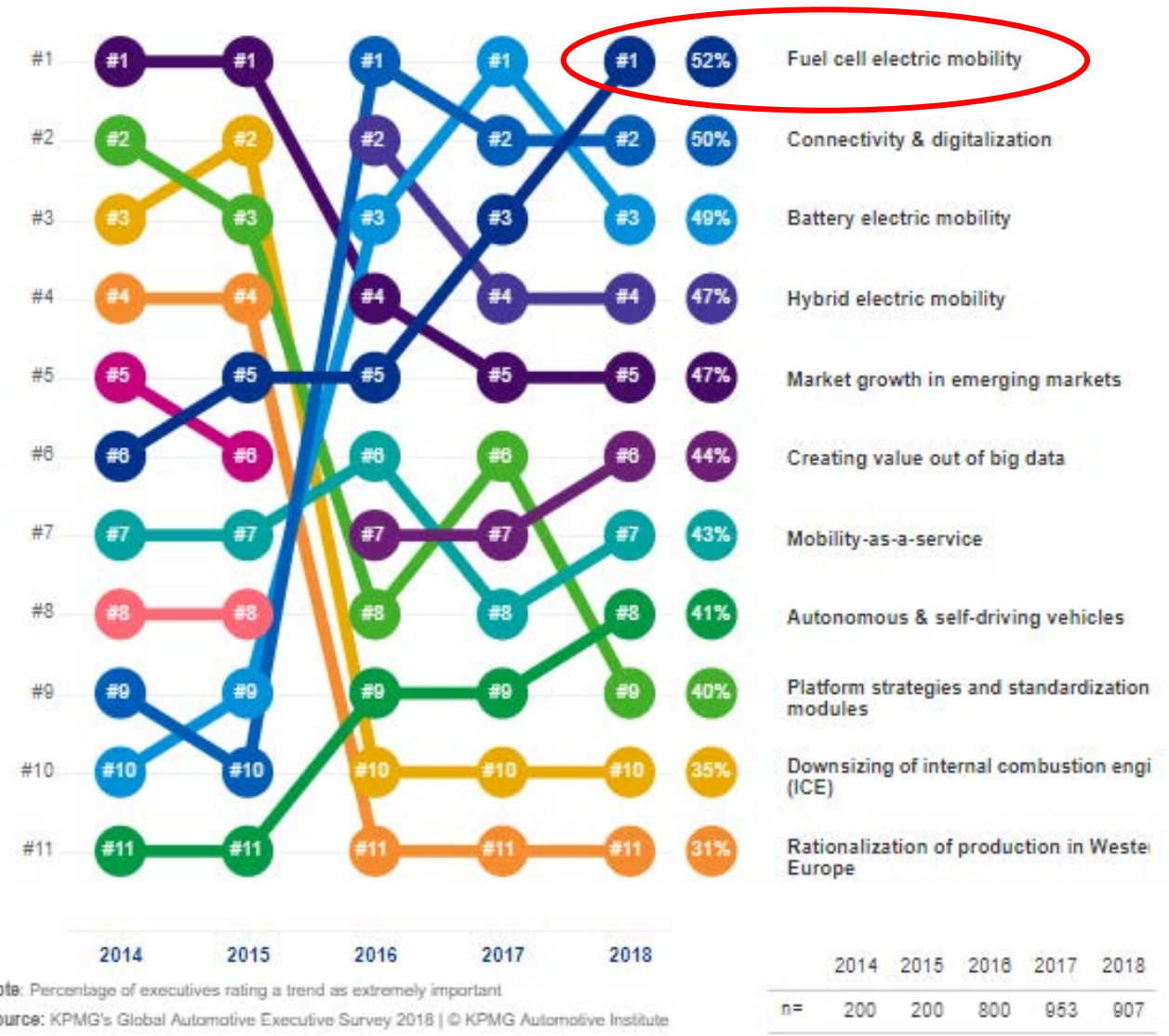


20+ Years of Toyota FCEV

P/T Advancement & Scalability

Why Portal: Shift to Electrification

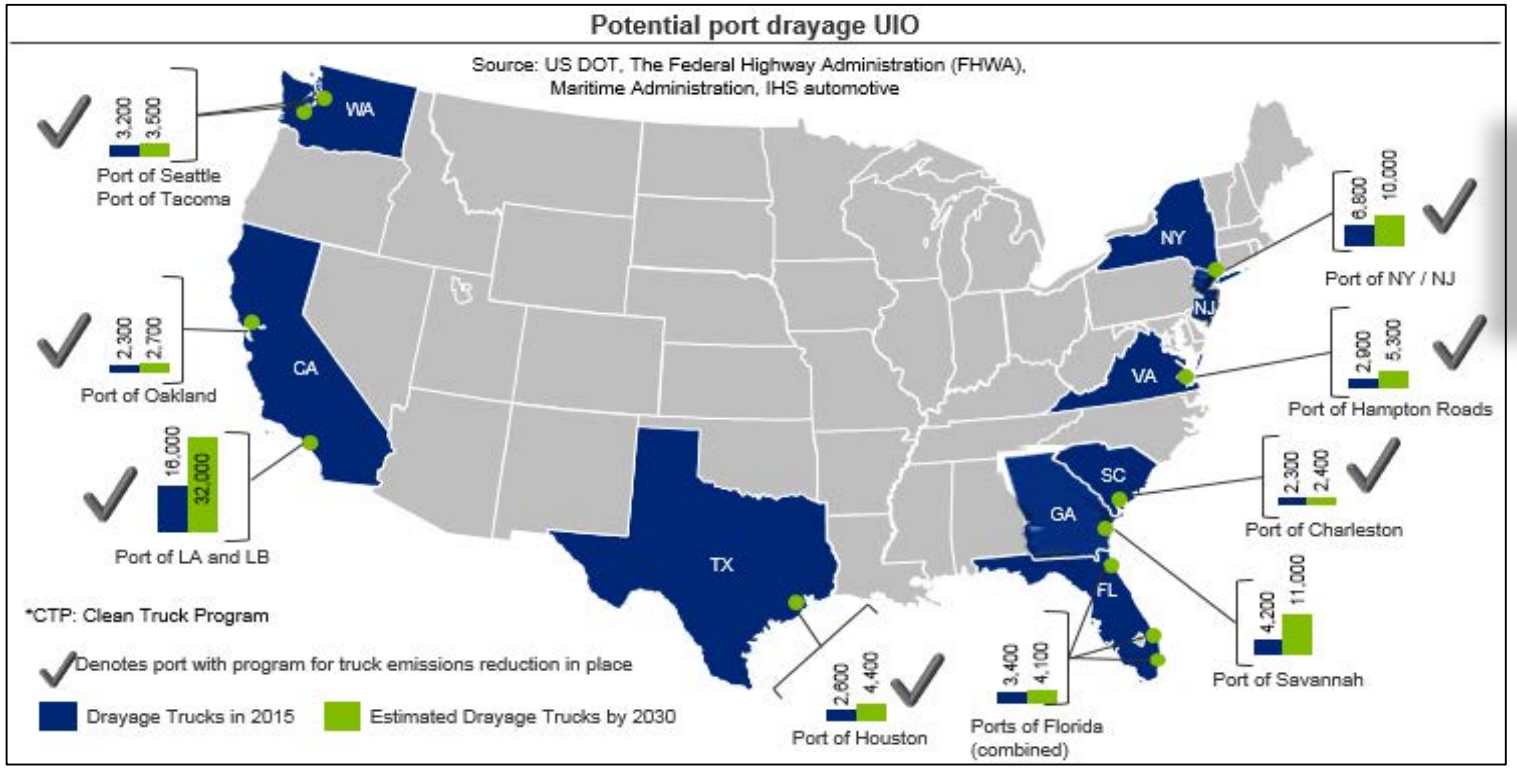
- Global shift to electrification
  - Automotive Executives rate FCEVs as the #1 priority in 2018
- Strong ZEV and emissions goals
  - **Countries**: Non-EV sales bans
  - **Auto Companies**: phase out non-EV production and sales



	2014	2015	2016	2017	2018
n=	200	200	800	953	907

Why Portal: MHDV Opportunity

- Large potential market
- High mileage, long idle time, low fuel economy = higher emissions



Numerous MHDV announcements

Why Portal: The Port

Desire to expand while reducing emissions

High impact to disadvantaged communities

Clean Air Action Plan

Requires ZEV solution

CALIFORNIA SUSTAINABLE FREIGHT ACTION PLAN

Project Details: The Unveiling

- Toyota opens a 'Portal' to the future in April 2017
- Goals of Project Portal
  - Demonstrate scalability of fuel cell systems
  - Verify desired performance on real-world duty cycles
  - Provide a potential ZEV solution for heavy-duty applications

Project Details: Components and Specs

- Leverage Mirai components from 2 vehicles
- Benchmark current class 8 truck performance

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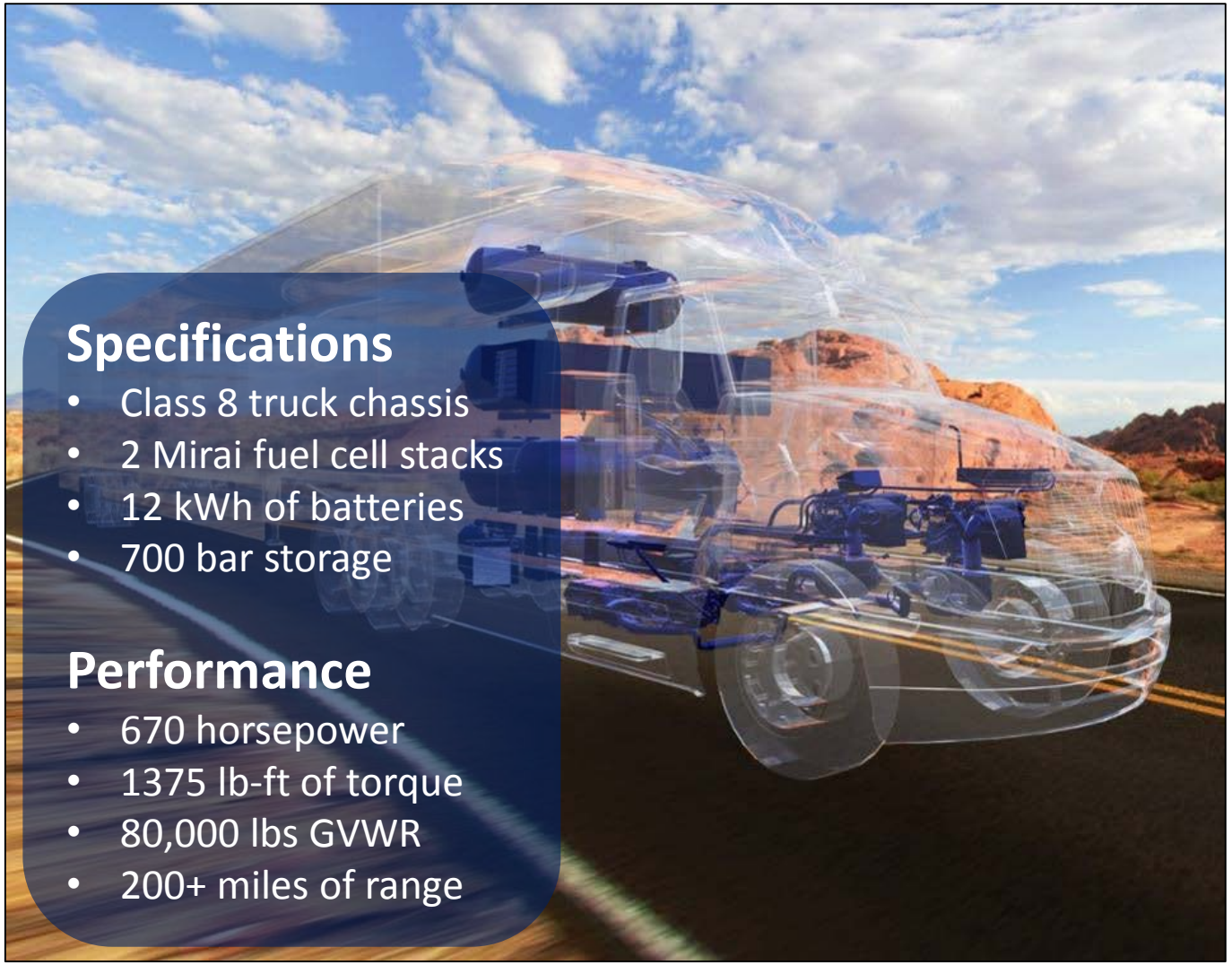
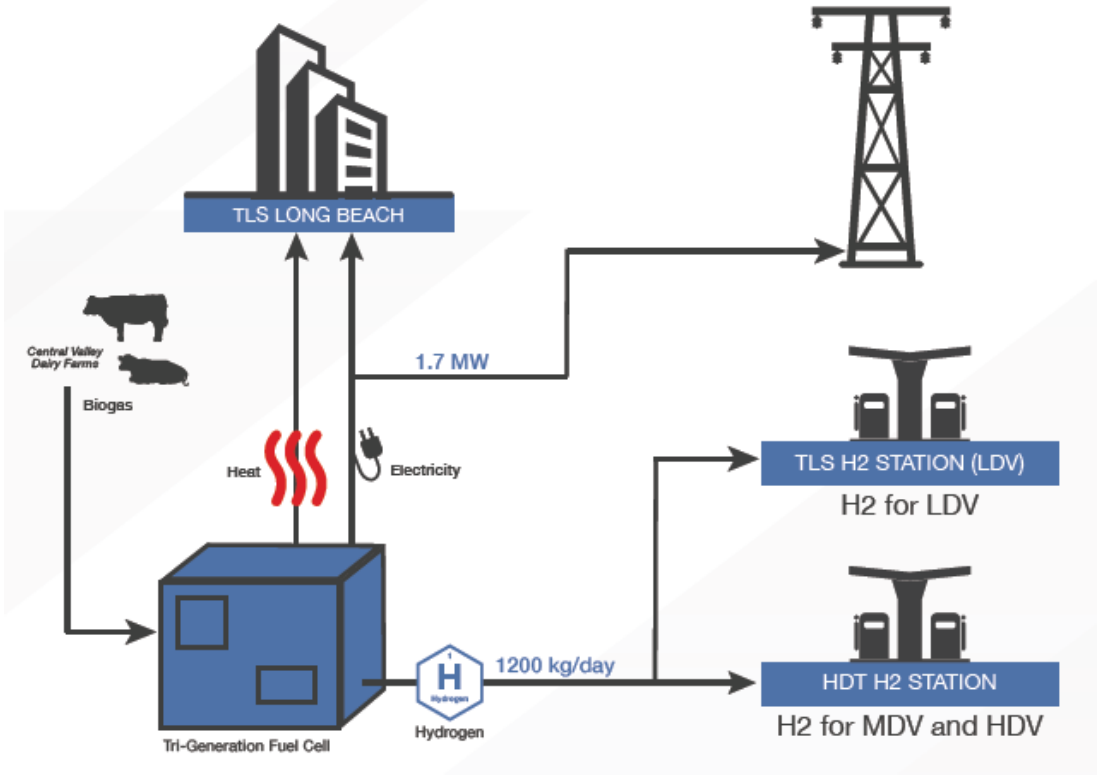


Project Details: Drag Test

Project Details: Tri-Generation

- Tri-Generation Announcement (LA Auto Show)
- Generate renewable electricity and hydrogen at Toyota Long Beach Port facility
- First Toyota location in North America powered 100% by renewables



Toyota's Port Operations

Collaboration and Path Forward

- Strong collaborations are needed to enable hydrogen and fuel cell technology
  - Federal Government
  - State Governments and agencies
  - Industrial gas suppliers
  - OEMs
  - National labs
  - Equipment suppliers
- Portal's Path Forward
  - Demonstrate vehicle performance, scalability, and feasibility
  - Develop corresponding infrastructure (tri-gen)
  - Continue and expand collaborations to support vehicle development, infrastructure rollout, and codes and standards progress

Thank you!

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Appendix

New Challenges: How DOE can help

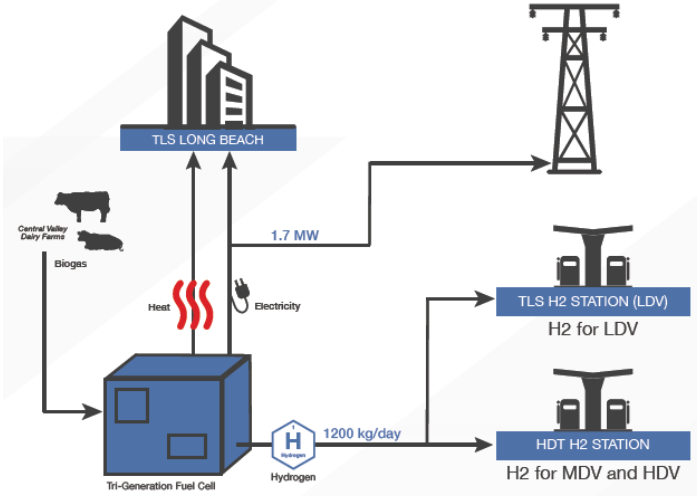
- Fueling infrastructure to support HD
  - Fueling protocols
  - Increased demand
  - Large footprint
- FC stack durability
- Powertrain system weight
- H_2 storage system cost

INFRASTRUCTURE IMPORTANCE

H2 Infra Development is Key to Enable ZEV FC HD

- Spurring growth of H2 infra is essential for FCEV adoption/competitive TCO (H2 $)
- Support by vested-interest stakeholders is vital (e.g. gov., customers, energy co.'s)
- Ability to leverage existing H2 supply and key strategic locations to grow eco-system
- Large facility-based RH2 Tri-Gen solution amortizes investment across FC applications

TOYOTA Renewable-H2 Tri-Gen Power Station Announcement



- TLS LB location
- Online by 2020
- 1st TMNA facility 100% renew.
- 2+ megawatts of electr./day
- 1+ ton of renewable H2/day
- Fueling for Toyota LD FC
- Fueling for PORTAL/HD FC

RH2=Renewable Hydrogen; Tri-Gen=Tri-Generation;
TLS LB=Toyota Logistics Services-Long Beach

ZEV=Zero Emissions Vehicles; HD=Heavy Duty; LDV=Light Duty Vehicles
FCEV=Fuel Cell Electric Vehicles; TCO=Total Cost of Ownership

Video Links

- Drag Race

  http://pressroom.toyota.com/video_display.cfm?video_id=34150

- Full 3 minute video

  http://pressroom.toyota.com/video_display.cfm?video_id=34149