MD/HD Advanced Technology Vehicles

CEC AB 118 Advisory Committee – 9/19/2012

Jamie Hall, CALSTART
Kevin Wing, SJVAPCD
Mike Simon, TransPower

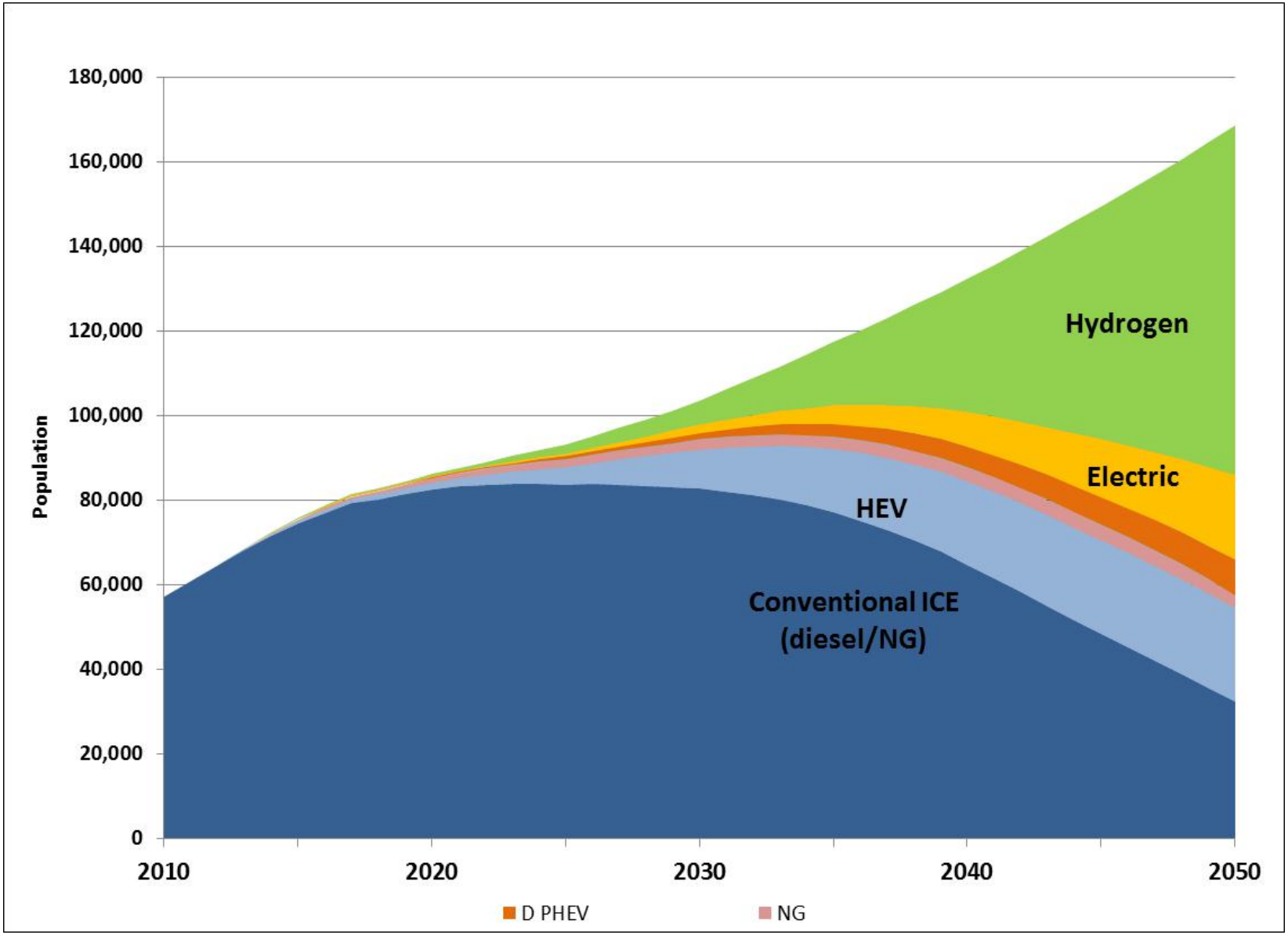
AGENDA

- **Overview of technology and investment needs –** *Jamie Hall, CALSTART*

- **Near-zero emission needs and tech: San Joaquin Valley perspective –** *Kevin Wing, SJVAPCD*

- **Zero emission tech: industry perspective on electrification –** *Mike Simon, TransPower*

Dramatic Technology Advancement and Fleet Turnover Needed



CARB/SCAQMD/SJVAPCD
Vision for Clean Air – truck tech scenario 2

6 Truck Categories – Based on Tech Applicability

Class 7/8 Tractors

Over the Road

- Younger Trucks; High Annual VMT
- Mostly higher average speed, highway driving

Short Haul/ Regional

- Between cities; Drayage; Day Cabs
- Includes second use trucks; trucks with smaller engines

Class 3-8 Vocational Work Trucks

Urban

- Cargo, freight, delivery collection
- Lower VMT; Lower Average speed; Lots of stop start

Rural/ Intracity

- Cargo, freight, delivery collection
- Higher VMT; Higher Avg speed; Combined urban/ highway

Work site support

- Utility trucks, construction, etc.
- Lots of idle time; Lots of PTO use

Class 2B/3

Pickups/ Vans

- Commercial use; Automotive OEMs & volumes

Technology Strategies

Advanced Electrification

- Hybrid-electric
- Electrified accessories
- Full electric powertrains
- Electrified Power take-off (PTO)
- Plug-in hybrid-electric
- External power to electric powertrain for ZEV Corridors
- AF/Hybrid Combinations

Engine and Driveline Efficiency

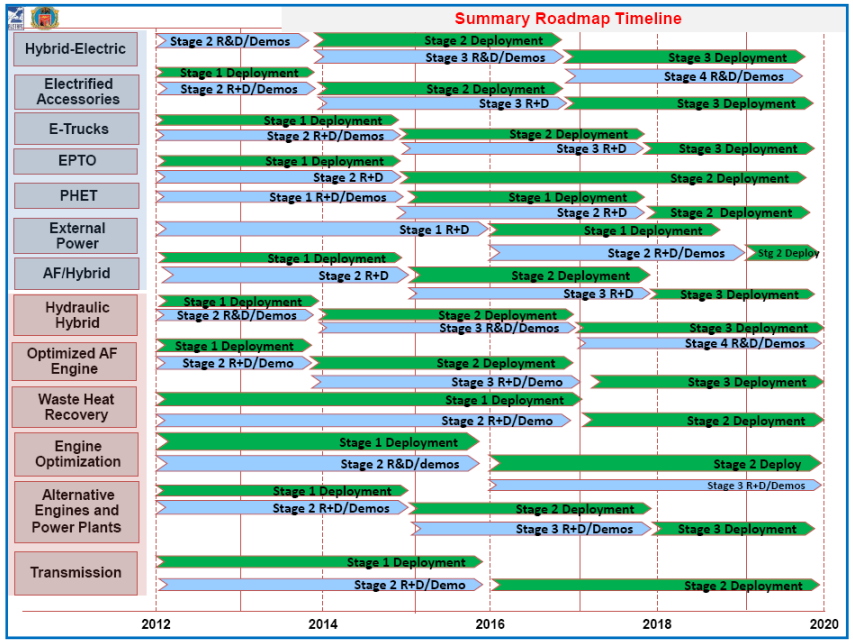
- Hydraulic hybrid
- Optimized engines for alternative fuel (AF)
- Energy recovery
- Engine efficiency improvements
- Alternative power plants and combustion cycles
- Transmission and driveline improvements

Chassis, Body, and Roadway Systems

- Light weighting
- Aerodynamics
- Lower rolling resistance
- Intelligent vehicle technologies, e.g. forecasting, adapting
- Corridors and platooning
- Longer, heavier single trucks

Draft CalHEAT Roadmap Findings

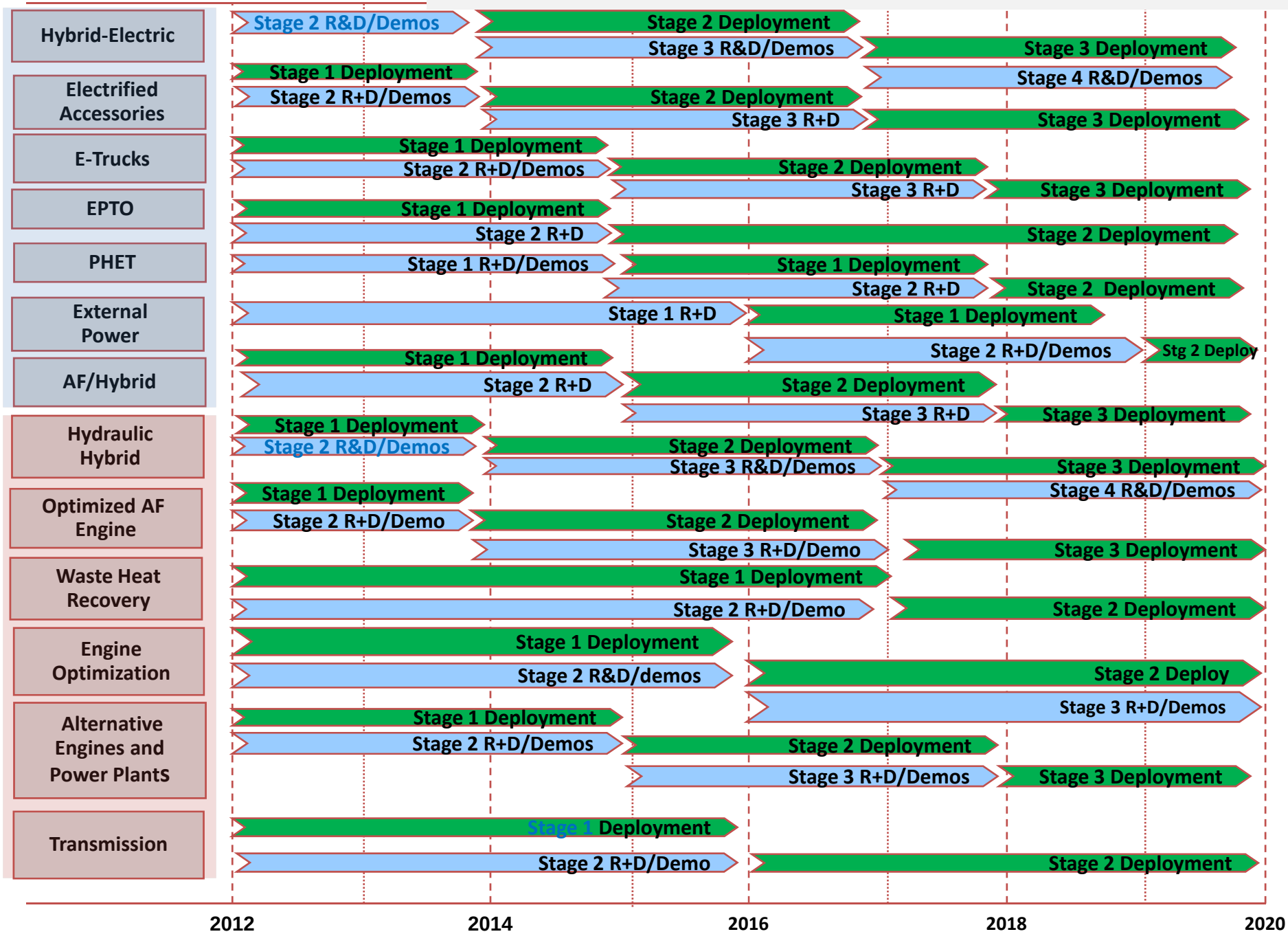
- » **Thirteen Technology Strategies representing two key pathways**
  - » **Advanced Electrification**
  - » **Engine & Driveline Efficiency**
  - » Prelim: Needed Investment FY13 -18
    - » $287,000,000 FY13-FY20
    - » $36 million/year
    - » 50/50 Develop-demos vs. Incentives
  - » Major **Near Zero Emission** gap on Driveline Technologies – needed for state goals



Short List of Some Priority Technologies Needing Action:

- Optimized Alternative Fuel Engines
- Alternative Combustion Cycle and Power Plants
- Plug-In Hybrid Electric Technology
- Hybrid Electric Technology
- Engine Optimization

Summary Roadmap Timeline



Investment/Demo Categories Example: ZE Freight Movement Options

Preliminary Assessment

Technologies, Barriers & Opportunities

I-710 Zero-Emissions Freight Corridor Vehicle Systems

Based on Technology, Truck and System Designer Interviews

SECOND DISCUSSION DRAFT - VERSION 2.0
June 2011

CALSTART

CALSTART ZE Freight Truck Technology report for LA Metro and SCAQMD finds:

- » Several zero and near zero approaches can be demonstrated NOW
- » Technology available with consistent, focused develop/demo over next 10 years
- » If technology accelerated, key barriers are economic – need to develop market – create economic "eco-system" to support a successful deployment

Tech Options:

Dual-Mode Hybrid (with ZE mode)

Series Electric/ Range Extender

Full Battery Electric

Road Connected Power

Near-ZE NG Engines

Need Smart Investment Strategy

- CEC AB 118 important, complements other programs
- Need ongoing investment, commitment to iterative process
- Need coordinated investment strategy
  - Focus on enabling technologies
  - Focus on best early applications, then expand

No easy answers – path is complex and depends on specific tech and application

Valley Air Quality Challenge

- The Valley experiences unique and significant difficulties in achieving EPA's increasingly stringent standards
- Not many available or foreseeable opportunities remaining for new control measure commitments
- Existing standards already require long-term, "black box" (unknown) measures
- Technology advancement will be necessary to achieve necessary reductions
  - Meeting the current standard requires 75% reduction in emissions
  - New standards will require another 80–90%
  - Transformative measures require significant investment in new technology and time

Near-Zero Emissions Technology

The San Joaquin Valley's Unique Needs

Goods Movement

- Heavy duty trucks
  - Major N/S corridors: Interstate 5 & Highway 99
  - 45% of truck traffic in major CA trade corridors in SJV
  - Large distribution centers
  - Lower density population for urban delivery
  - Sig. Impact to environmental justice communities
- Technology challenges and options
  - Zero/Near-zero emissions ***long-haul*** truck technologies
  - Alternative systems and fuels

Near-Zero Emissions Technology

The San Joaquin Valley's Unique Needs

People Movement

- San Joaquin Valley Challenges
  - Lower density population
    - Increases VMT; challenges for transit
  - Higher population growth than state average
  - Low income/high unemployment
  - Older and heavier vehicle fleet
- Technology challenges and options
  - Advanced light-duty vehicles
  - Advanced transit options

Technology Advancement

- The District adopted the Technology Advancement Program March 18, 2010
- Also promote deployment of advanced technology through variety of incentive programs
  - AB118 funded HVIP and the District's HVIP Plus
  - Drive Clean! Program
  - Advanced transit and infrastructure funding
- Currently seeking proposals for demonstrations
  - $4 Million in available funding
  - Proposals due October 18, 2012
  - http://www.valleyair.org/TAP
  - technology@valleyair.org

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TRANSPOWER ACTIVITIES SUPPORTED BY ARFVT

BATTERY-ELECTRIC CLASS 8 TRUCKS

- Zero-emission vehicles
- Designed for port drayage and other applications vital to California economy
- **Each truck can eliminate 100 tons of greenhouse gases and reduce petroleum use by 10,000 gallons *each year***

INTEGRATED SUBSYSTEMS

- Energy storage subsystems
- Vehicle control subsystems
- Motive drive subsystems
- Electrically-driven accessory subsystems
- **All assembled in California**

COMPONENTS

- Inverter-Charger Units
- Propulsion modules
- Automated manual transmissions
- Control modules
- Building blocks of all vehicles

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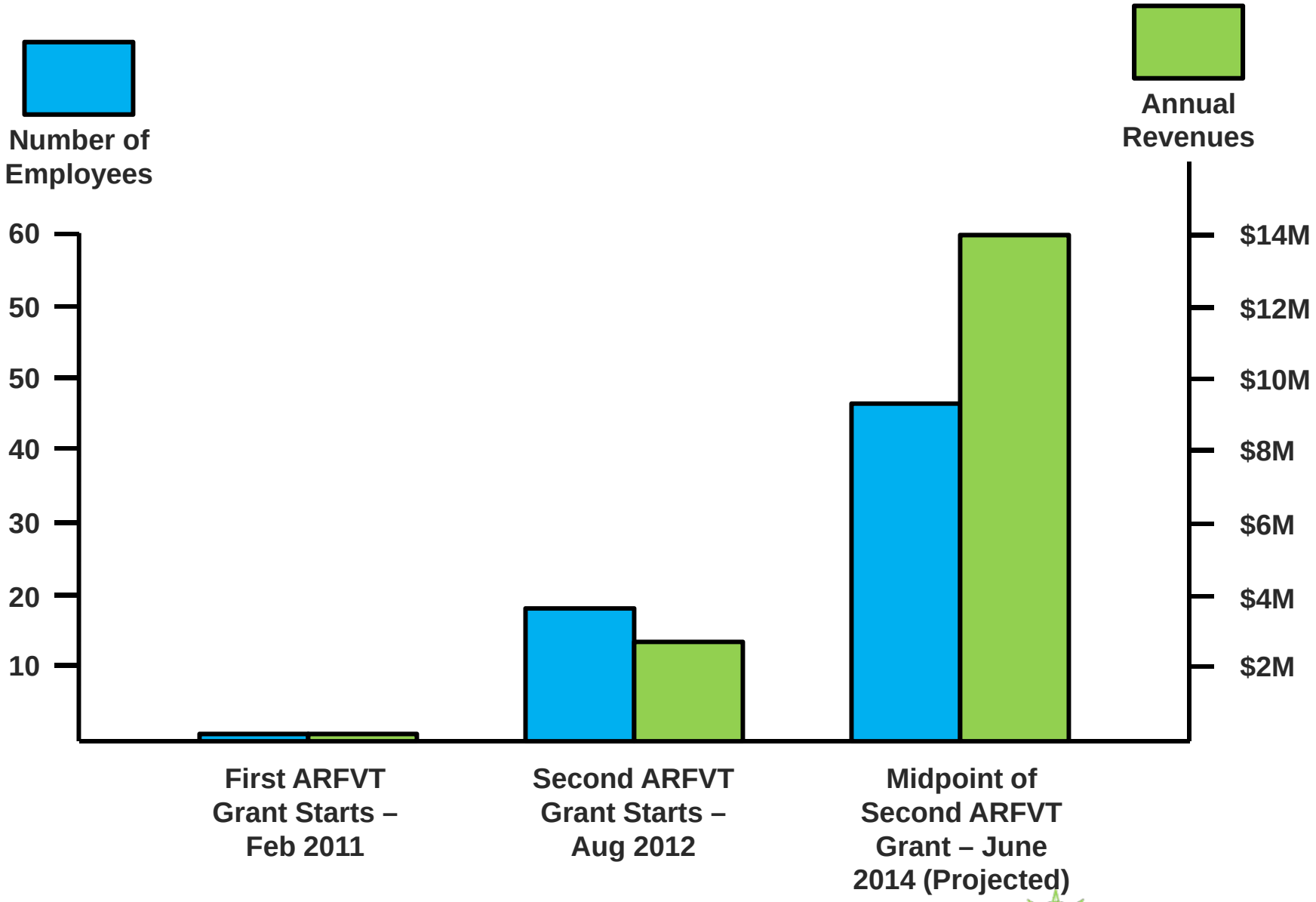
IMPACT OF ARFVT ON TRANSPOWER'S GROWTH



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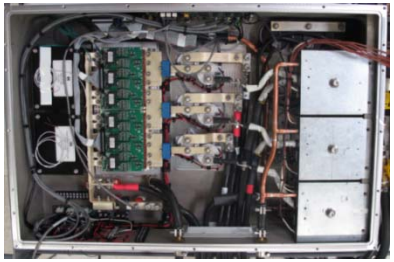
CRITICAL DEMONSTRATION AND TECHNOLOGY ADVANCEMENT NEEDS

- **Battery Energy Storage**
  - Integration of large, high-energy battery packs
  - Battery cell monitoring and cell balancing

- **Power Electronics**
  - More robust, lower cost inverters
  - Wireless/inductive battery charging



- **Propulsion**
  - Low cost, brushless DC motors
  - Electronic shifting and gear reduction

- **Drive System Integration**
  - Drive system customization for different vehicle models
  - Advanced controls and prognostics
  - Low-cost electrically-driven accessories

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THE BROADER PATH TO WIDESPREAD ELECTRIC VEHICLE ADOPTION

- **Continued financial support is needed for:**
  - Development of vehicles and components
  - Construction of new manufacturing facilities
  - Development of refueling/recharging infrastructure

- **Future needs that should be considered include:**
  - Expanded demonstration projects – a medium or heavy-duty vehicle should accumulate ~1 million test miles before commercialization
  - New incentives to purchase battery-electric vehicles
    - Capital cost is higher, mostly due to battery costs, BUT:
    - Fuel operating costs are much lower
    - Potential solution: "Battery Bank" – loans to cover battery (or incremental vehicle) costs, repaid out of fuel savings
  - Assistance in securing favorable rate structures from utilities for battery charging

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QUESTIONS?