



# *Zero Emission Truck Commercialization*

Summary of the

**I-710 Project Zero-Emission Truck Commercialization Study Draft Report**



*ITS Working Group Meeting  
Rancho Dominguez, CA – November 13, 2013*

# AGENDA

- Why Are We Doing ZETs
- Are ZETs Possible
  - Key Performance Parameters
  - Types of ZETs that meet KPPs
- The Promise of Payback
- Challenges to Commercialization
  - Meeting the Needs
- Actions We Must Take
  - Path to Commercialization
- How Do We Get There
  - Near Term Actions

**Zero-Emission Trucks (ZET) can be deployed in the Gateway Cities I-710 region if both public and private stakeholders take action now to accelerate ZE technology commercialization**

# Why Are We Doing ZETs?

- Adopting trucks with zero emission technology is really an effort to improve air quality and health outcomes for everyone living and working in the Gateway Cities and beyond
  - Support economic growth in the future
  - Reduce petroleum dependence
  - Create a better environment for our children and grandchildren
- The Gateway Cities and Los Angeles County Metropolitan Transportation Authority (Metro) charged CALSTART with assessing the commercial viability of zero-emission drayage trucks (ZET). This Commercialization Study is one component of the *Gateway Cities Technology Plan for Goods Movement*.

# Are ZE Drayage Trucks Possible?

## YES!



1

Initiate a focused truck development effort to move prototype designs toward production

2

Plan, develop and roll-out infrastructure for recharging and refueling the trucks

3

Work with Federal, State, and Local agencies to develop guidelines for ZETs

4

Define the business case, ownership models and incentives to make ZET solutions cost-effective and

5

Build supporting markets for zero-emission technologies for vehicles other than drayage trucks



# Some Key Performance Parameters

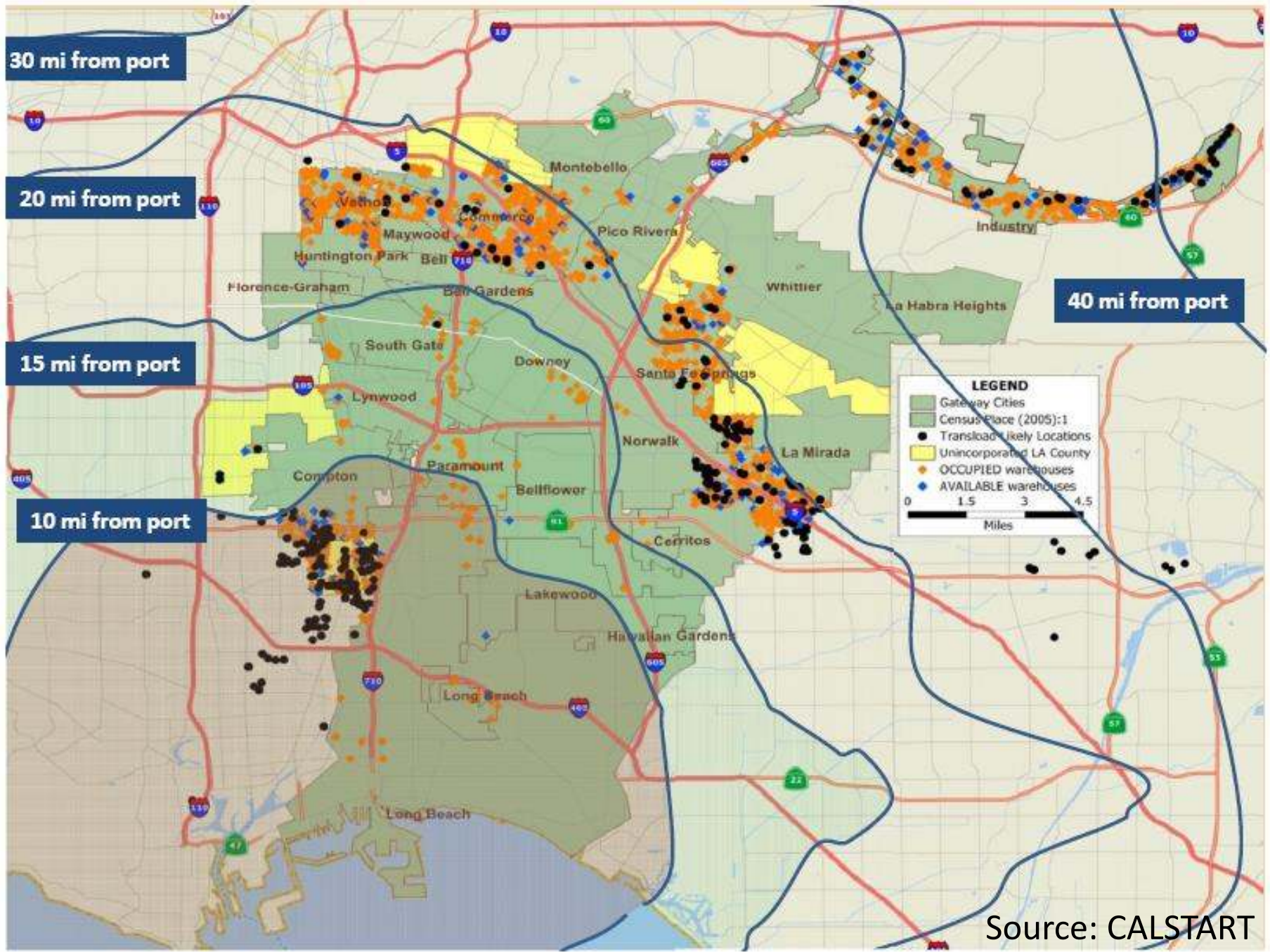
Source

CALSTART

Key Performance Parameter	Baseline Values
Daily Range	Up to 200 miles.
Distance per trip	40 miles, for example from the ports to the Inland Empire.
Number of turns per day	3 is typical, 4-5 on a good day
Refueling interval	Baseline 2-4 days for diesel, daily for LNG. Varies greatly on number of turns daily and the container destinations.
Fuel economy	4.5-5.5 MPG is typical; some new trucks up to 8 MPG.
Range per tank of diesel	400 miles typical for diesel trucks
Availability of refueling infrastructure	On-site refueling is best, either through depot fueling infrastructure or a contractor traveling to the yard to fill up the trucks. Otherwise centralized infrastructure is important.

- Capability to do any delivery task like a current diesel truck
- Pulling power to do any task (approx. 350-400hp, 1200+ ft-lbs)
- 50 miles Zero Emission Range; Total range 100+(pref. 200+) miles

# Distance Ranges from Ports



Source: CALSTART



# Technology Option 1

## Range Extended Electric Vehicle (REEV)

The “Chevy Volt of Trucks”



- Electric drive with engine backup – Natural Gas, Diesel, Turbine
- ZE much of the time; very low emissions otherwise
- CA funded demo projects

# Technology Option 2

## Battery EV (BEV)



## The “Nissan Leaf of Trucks”

- Zero Emissions all the time
  - Only battery power; no engine
  - ~100 mile range per charge
- Some Smaller BEV Trucks are Available Right Now





# Technology Option 3

## Fuel Cell Range Extended EV (REEV)

### The “Honda Clarity of Trucks”

- Zero Emissions all the time – hydrogen fuel with batteries
- Produces only water



#### Tyrano™

The worlds 1st Hydrogen Fuel Cell powered Class 8 Truck

#### FEATURES:

ZERO EMISSIONS  
ZERO CO2  
ZERO FOSSIL FUELS  
ZERO NOISE POLLUTION  
ZERO CARBON FOOTPRINT

Financial Incentives: Federal tax credit and State incentives available



# PROMISE of Payback

- Our initial analysis shows the promise of acceptable ROI, but needs more study – verify assumptions and estimates
- CNG REEV, then FC REEV, then BEV esp. for short routes

## Summary of Business Case Analysis Results

Source: CALSTART

	Total Range (ZE Range)	Daily Driving	Simple Payback Period (years)	Incentive for 5-year Payback Period	10-yr. O&M savings	2020 Truck Incremental Cost (\$ per truck)	Infrastructure Cost (\$ per truck)
#1 BEV	100 (100)	100	17	\$87,708	\$67,798	\$100,000	\$25,000
#2L CNG REEV Low Utilization	200 (50)	100	13	\$42,983	\$43,051	\$60,000	\$8,400
#2H CNG REEV High Utilization	200 (50)	200	7	\$20,692	\$74,507	\$60,000	\$8,400
#3L Fuel Cell REEV Low Utilization	200 (200)	100	16	\$23,808	\$14,907	\$31,500	\$3,350
#3H Fuel Cell REEV High Utilization	200 (200)	200	10	\$17,142	\$19,879	\$31,500	\$3,350

# What are the Challenges to Commercialization

Zero-Emission Trucks (ZET) can be deployed in the Gateway Cities I-710 region if **both** public and private stakeholders **take action now** to accelerate ZE technology commercialization.

## **BUT HERE'S WHAT WE KNOW HAS TO BE ADDRESSED**

- Truck owner/operators need “all-purpose” drayage trucks able to do anything a conventional diesel truck can do.
- Truck OEMs need to see the business case for building zero-emission trucks
- Infrastructure has to be planned and built in parallel



# Meeting the Needs & Challenges

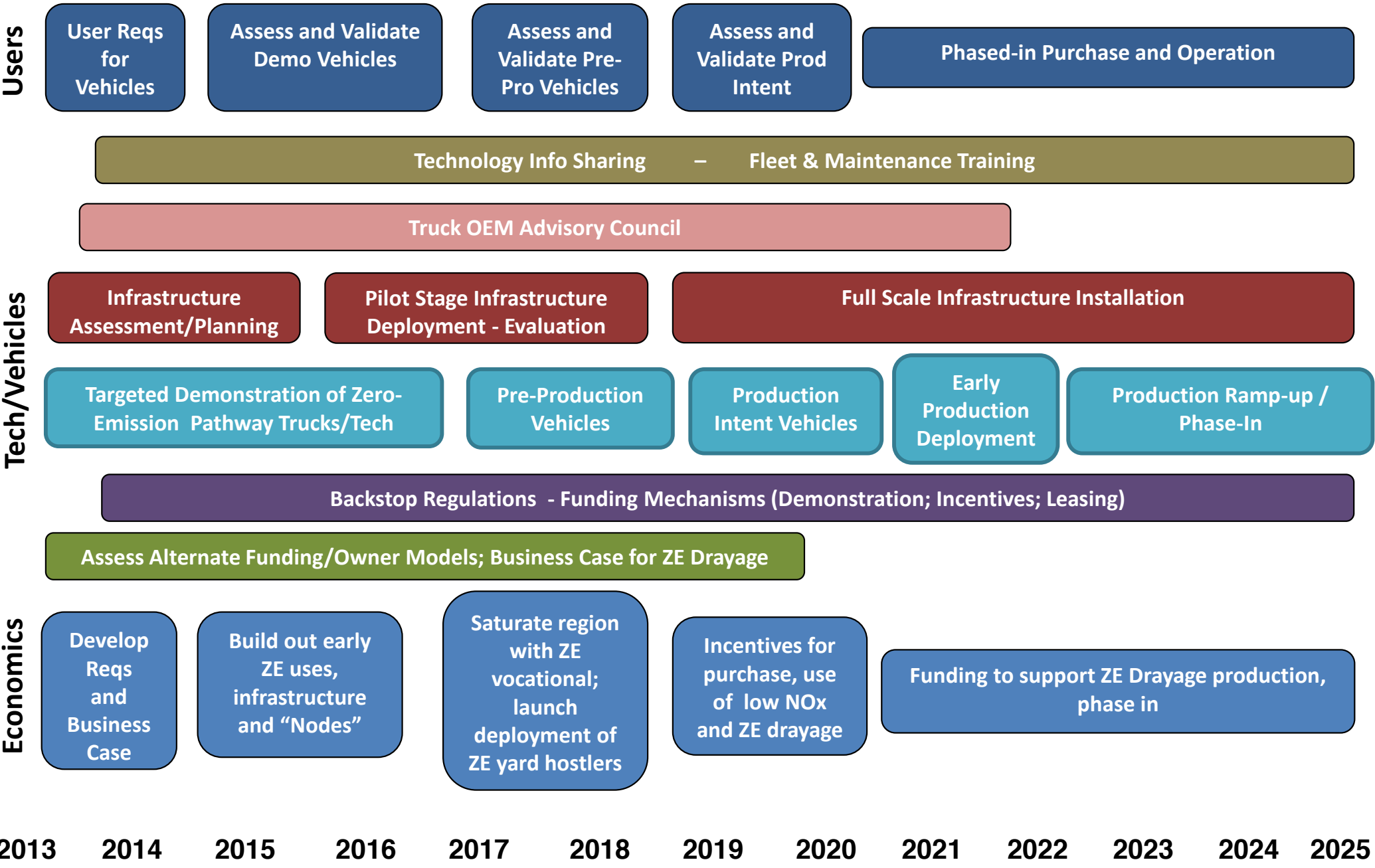
The main driver for the accelerating development of clean truck technology is proving the value for all three major stakeholders:

- The **drayage operators**: Focused on operating costs and fuel savings;
- The **truck OEMs**: Potential sales and profits from building zero-emissions trucks
- The **Gateway Cities sub-region**: Reducing the negative health impacts from dirty air and enjoy economic growth in the future

# Actions We Must Take

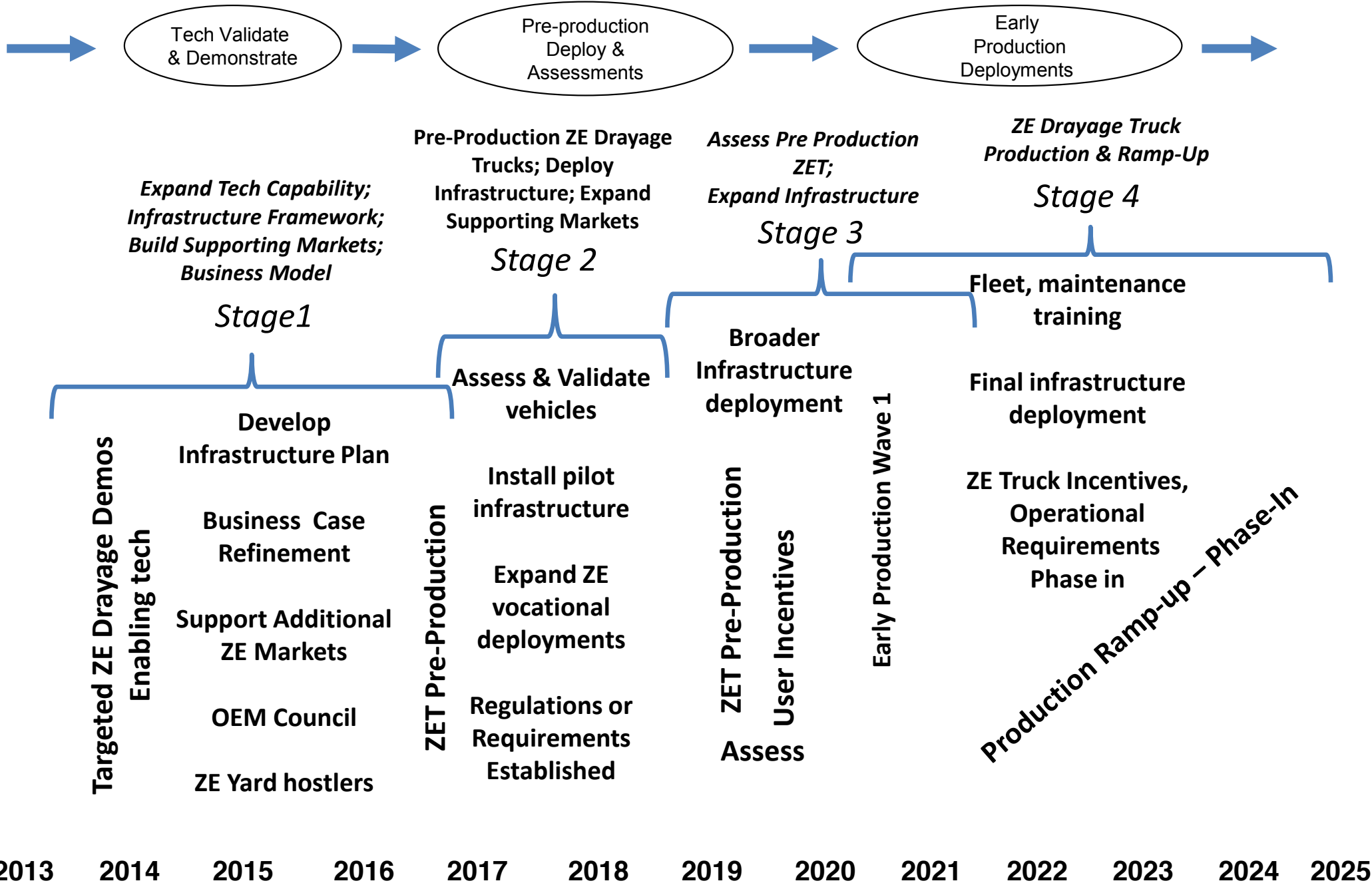
- The commercialization process will require an aggressive and collective effort by both the private and public sector.
- 5 critical steps:
  - 1) **Initiate a focused truck development effort to move prototype designs toward production**
  - 2) **Plan, develop and roll-out infrastructure for recharging and refueling the trucks**
  - 3) **Work with Federal, State, and Local agencies to develop guidelines for ZETs**
  - 4) **Define the business case, ownership models and incentives to make ZET solutions cost-effective**
  - 5) **Build supporting markets for zero-emission technologies for vehicles other than drayage trucks**

# 710 Zero Emission Drayage Truck Commercialization





# I-710 Zero-Emission Drayage Truck Commercialization & Phase-In Process



# How Do We Get There? What Will It Take?

## Near Term Actions

- Expand Technology
  - ZET Demonstration Projects
  - Supporting Technologies Demonstrations
  - Advanced Infrastructure Demonstrations
  - ZE Yard Hostler Demonstrations
- Plan and Develop Infrastructure
  - Fuel Infrastructure Availability & Impact Study
  - Infrastructure Deployment Plan

# How Do We Get There? What Will It Take?

## Near Term Actions

- Business Case and Operational Model
  - Analysis of ZET Operation and Maintenance Costs
  - Assessment Report of Secondary Use Markets and Residual Value of ZET
  - Refine Specific ZET Operational Cycle from Origin-Destination Data
  - Detailed Business Case Development for ZET
  - Assessment of Ownership Models Supporting ZET Use
  - Organize and operate a Truck OEM Advisory Council
  - Organize and Stage Regular Fleet Workshops on ZET Tech and Operations



# How Do We Get There? What Will It Take?

## Near Term Actions

- Build Supporting Markets
  - Accelerate early deployment of existing ZE trucks in Gateway Cities and Ports region
  - Coordinate targeted incentive funding from regional, state and federal partners for early deployment
  - Research, Determine and Evaluate Markets for Wider ZET Use and Deployment
  - Collaborate with regional and state regulators to guide and establish policy for use of ZET

# Conclusion

**Zero-Emission Trucks (ZET) can be deployed in the Gateway Cities I-710 region if both public and private stakeholders take action now to accelerate ZE technology commercialization**

***We Look Forward to Working With You  
Making This Future a Reality***



CALSTART  
Clean Transportation Technologies  
and Solutions