HART Takes You There.

Adapting New Fuel Technologies

Legislative and Strategic Planning Committee
May 15, 2017

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Transit Bus Inventory

Current U.S. Public Transit Bus Inventory

- Diesel Buses Dominate the Market but Numbers are Declining
- 16.9% Hybrid Electric
- 16.7% CNG
- Other Alternative Fuel Vehicles are Less Than 1%

Source - 2015 American Public Transit Association (APTA) Report on Alternative Fuels

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HART - Current Fleet

- 191 Fixed Route Buses
- 35 CNG in Service
- 25 CNG Buses Arriving
- CNG - Lower Operating Costs

Bus Type	Maintenance Cost	Fuel Cost	Total – Cost per Mile
Diesel	.24	.47	.71
CNG	.10	.29	.39

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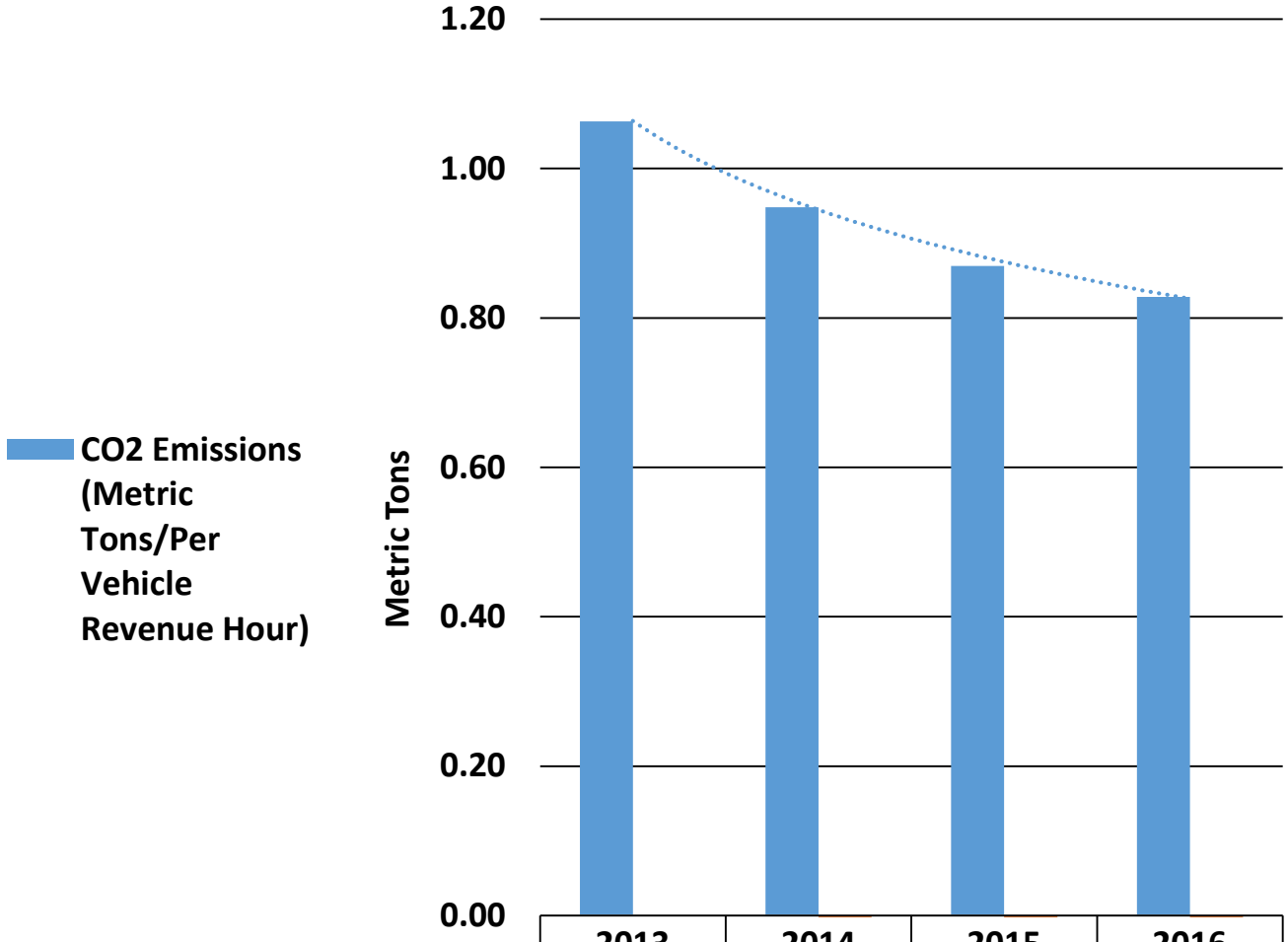
Revenue Fleet Carbon Performance



	2013	2014	2015	2016
CO2 Emissions (Metric Tons/Per Vehicle Revenue Hour)	1.06	0.95	0.87	0.83
% Difference (From 2013)		-10.79%	-18.18%	-22.09%

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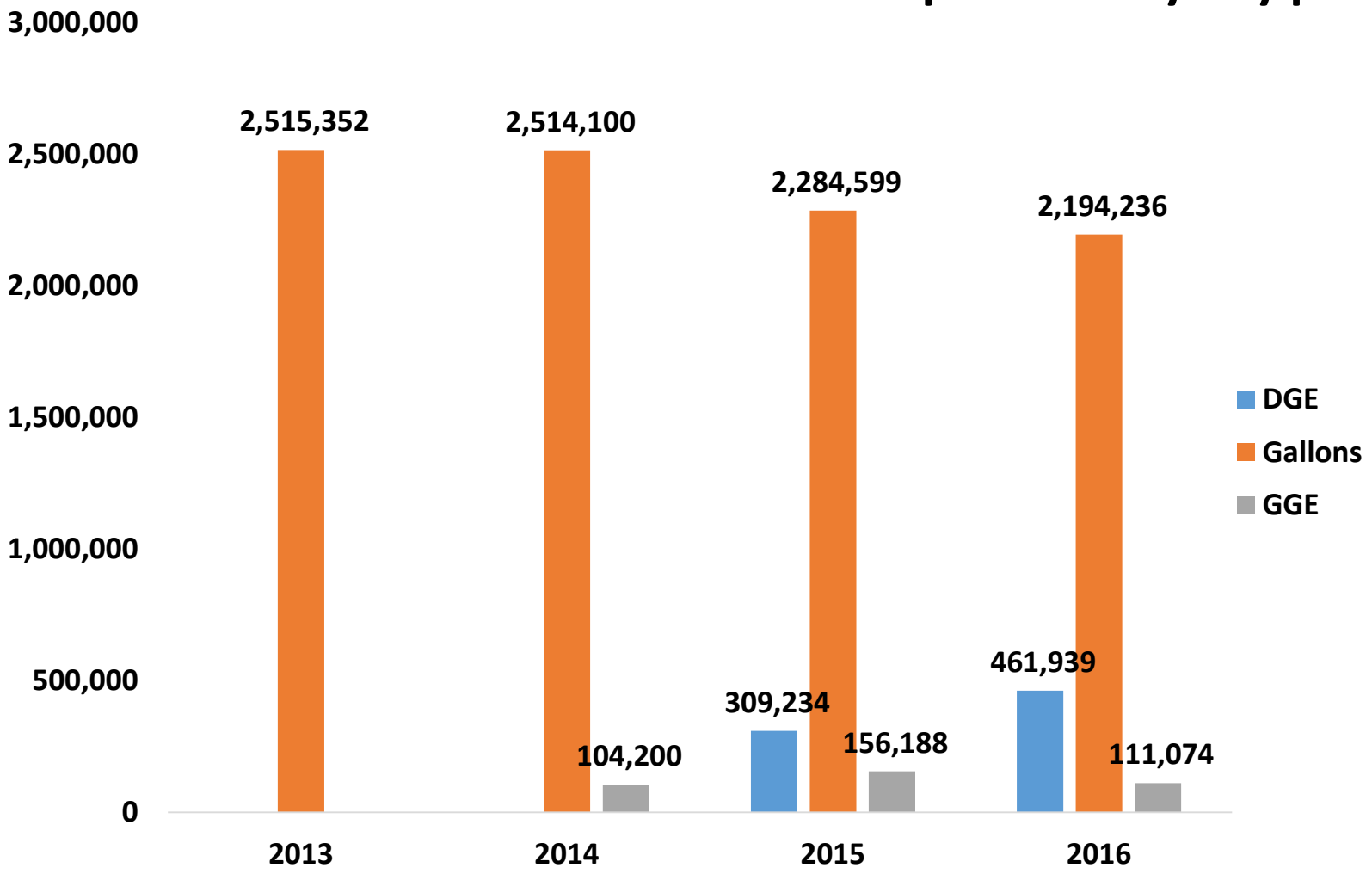
Fuel Consumption by Type



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Electric Bus Market

Manufacturers of Electric Buses for U.S. Market

- Build Your Dream BYD – Headquarters in China. Bus Built in Lancaster CA. Major Supplier of Electric Buses Globally.
- Proterra – U.S. Based Company, Bus Built in Greenville, South Carolina. Major Supplier in U.S. Market
- New Flyer – Headquartered in Canada
- Nova – Headquartered in Canada

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CNG - Electric Bus Comparison

"Foothill Transit Battery Electric Bus Demonstration Results"

- Conducted by the National Renewable Energy Laboratory – U.S. Department of Energy, January 2016
- Comprehensive Operating and Capital Cost Comparison of CNG verses Electric Buses at Foothill Transit, in Los Angeles, CA.
- Study Included 12 Proterra Electric Buses and 8 NABI CNG Powered Buses
- Conducted April 2014 through July 2015

NREL National Renewable Energy Laboratory
Innovation for Our Future

CNG- Electric Bus Comparison

Study Findings

	Electric Bus	CNG Bus
Fuel Economy – DGE MPG	17.48	4.51
Miles Between Road Calls	9,331	45,547
Bus Purchase Price	$904,490	$575,000
Maintenance Cost per Mile	.18	.16
Energy Cost per Mile	.39	.23
Total Operating Cost per Mile	.55	.41

CNG - Electric Bus Comparison

Range Between Fueling/Charging

- CNG - 400 miles
- Electric – Up to 350 Miles in Ideal Conditions.
  - Varies by passenger load, use of A/C, terrain, battery temp. and driving habits
  - Requires Charging Stations for Longer Routes

CNG - Electric Bus Comparison

Electric Bus Initial Capital Investment

- Bus - $800,000
- Overnight Charger - $50,000 (plus supply charges)
- Fast Charge Station - $750,000 to $1.0 Million per Station

CNG - Electric Bus Comparison

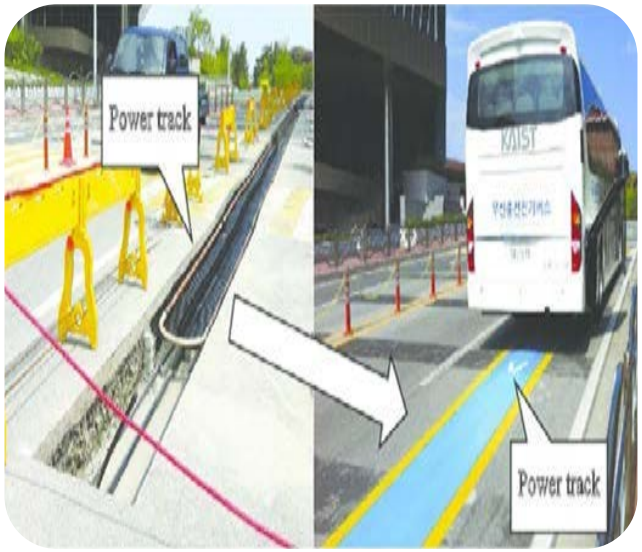
20 Bus Scenario – Comparison of Capital Costs Per Mile

	Electric Bus	CNG
Vehicle Price	$800,000	$525,000
Number of Buses	20	20
CNG Station Cost	NA	$5,500,000
Charge Station	Up to $1,000,000 per Station	NA
Garage Charger	$50,000 per Bus	NA
Total Capital Cost per Mile	3.00	2.28

CNG - Electric Bus Comparison

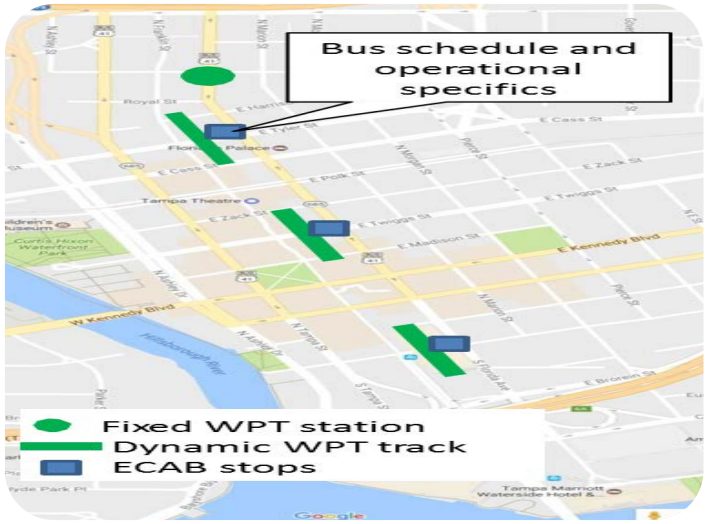
Conclusions:

- Electric Bus Technology is Improving Rapidly
- Initial Capital and Operating Cost is Higher than CNG
- Electric Bus Cost will Decrease as Technology Improves
- Market Share is Growing
- Long Term Maintenance Costs for Electric Buses are Unknown, Especially Battery Life and Battery Replacement Cost
- Maintenance Considerations – Employee Training
- Inventory Considerations – 60 CNG Buses - $515,000 cost per bus
- CNG Infrastructure Investment – Fueling Station Investment



Low-No Project Concept

FDOT & HART AV Project



Transit-IDEA WPT Decision Making Tool