

New Ethanol Blends

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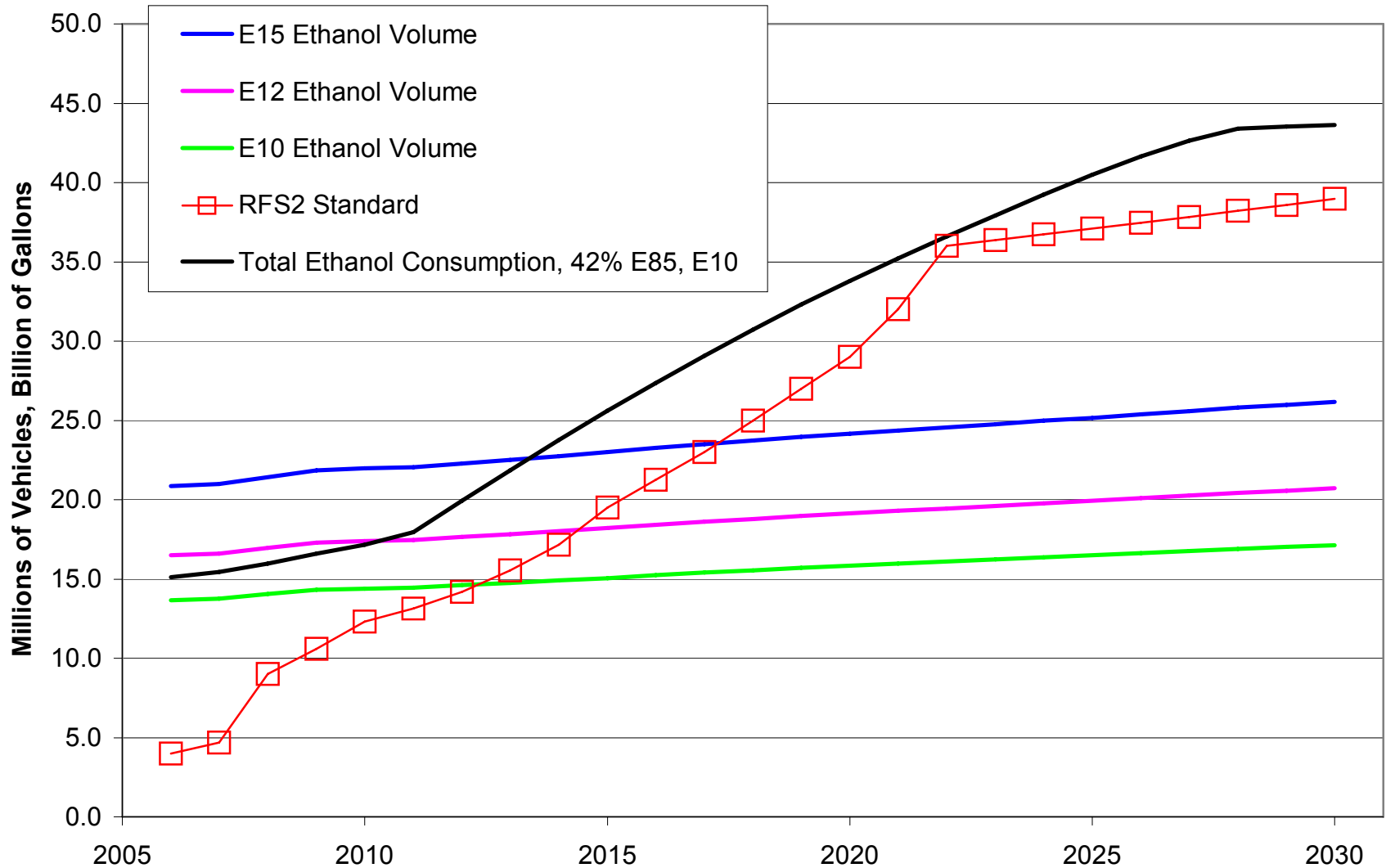


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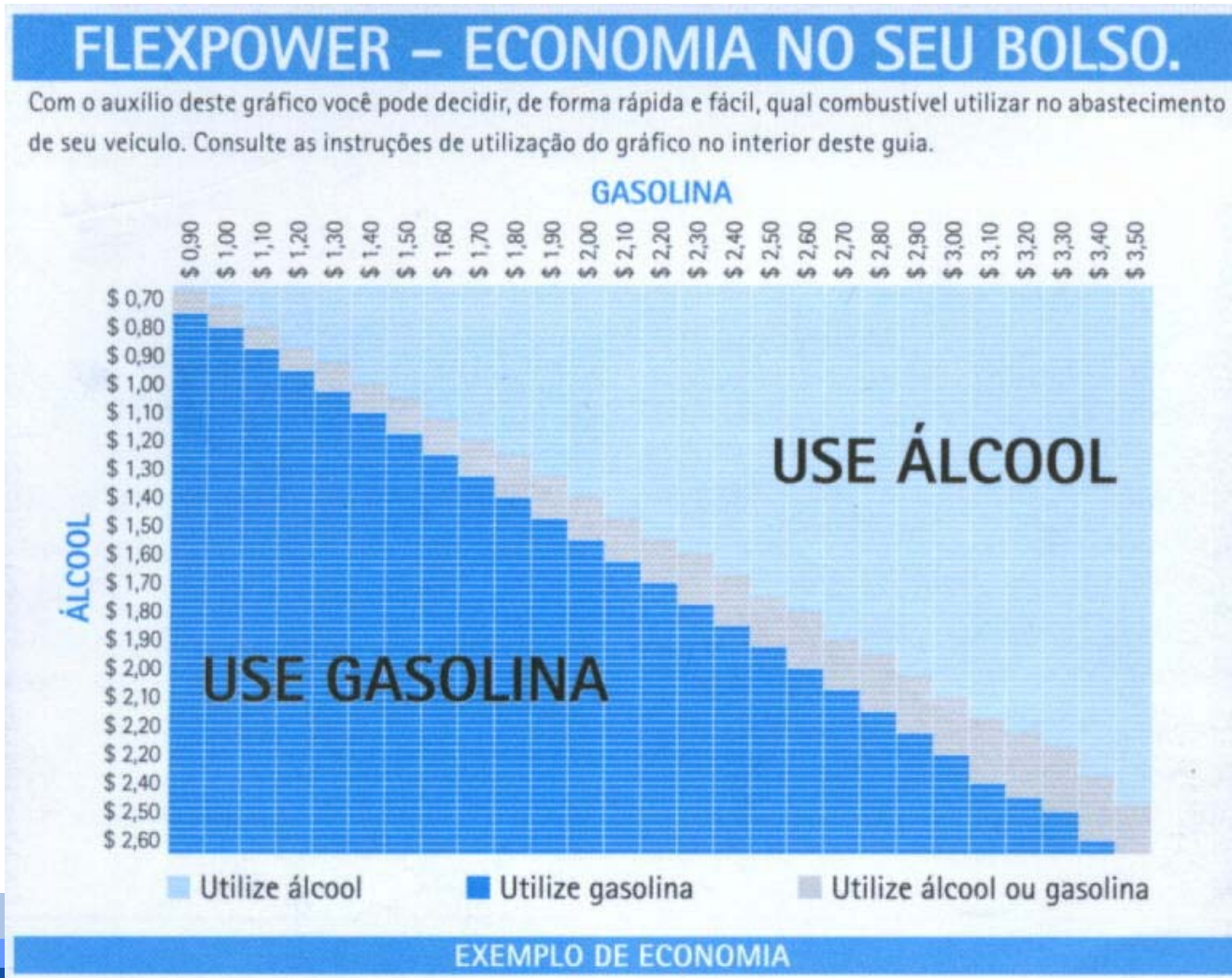
- Ethanol Usage in Various Blend Scenarios
- Reasons and Barriers for Mid-Level Blends
- What are Possible Effects of Their Use?
- What Testing is Required?



Forecasts of Ethanol Usage



Pricing: Brazilian Hang Tag



Pricing of Mid Level Blends

– Pricing

- In Brazil and Sweden high ethanol blends (E85 & E100) are marketed at energy parity or lower with gasoline, ensuring widespread acceptance
 - Ethanol has only two thirds the energy of gasoline
- In the US, E10 is not typically discounted relative to gasoline
 - This supports a higher ethanol price than energy parity
- The expectation is that E20 would not be discounted fully relative to gasoline
 - This would continue to support a relative ethanol price above its energy value



E20 in the Field: Sheboygan, WI

E85: 1.99₉
E20: 2.95₉
UL: 2.99₉



At this station,
E85 is priced below its energy parity price,
and E20 is priced above its energy parity price.



Legal Barriers to Mid Level Blends

- EPA approval as “substantially similar”
 - In order to protect human health and the environment, EPA is obligated to consider effects of any new fuel, including ethanol gasoline blends, on vehicle emissions controls and human health.
 - Two Clean Air Act requirements would have to be satisfied in order to register and make available for commercial use ethanol blends with >10% ethanol:
 - Clean Air Act 211(f) – Fuel Waiver Testing
 - Producer of new fuel/fuel additive (F/FA) must show that F/FA will not cause or contribute to the failure of any vehicle/engine to meet emission standards.
 - Clean Air Act 211(b) – Health-effects Testing
- E20 is not part of ASTM D4814, Spark Ignition Engine Fuel
 - This specification regulates fuel quality in many jurisdictions

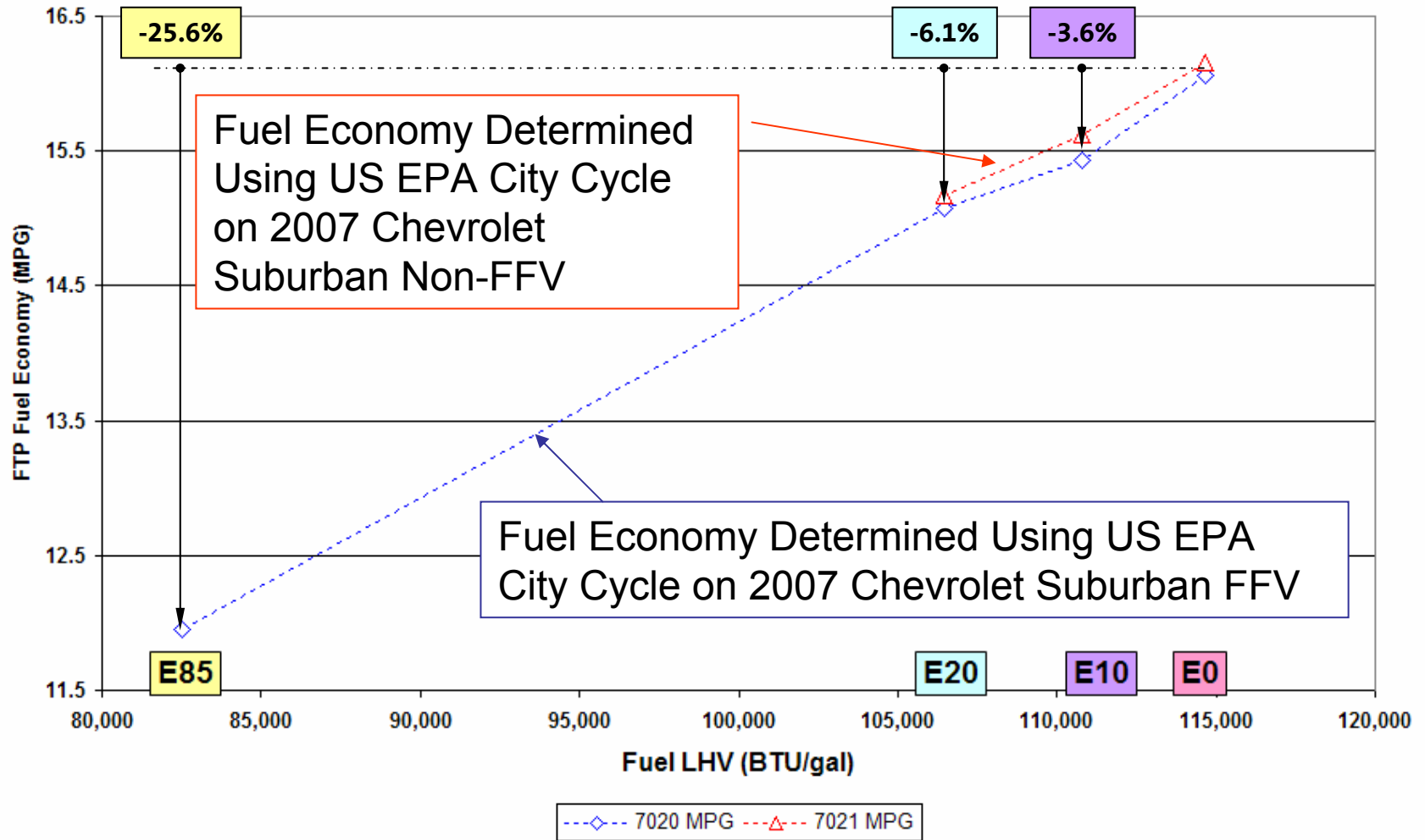


Effects of Using Mid Level Blends

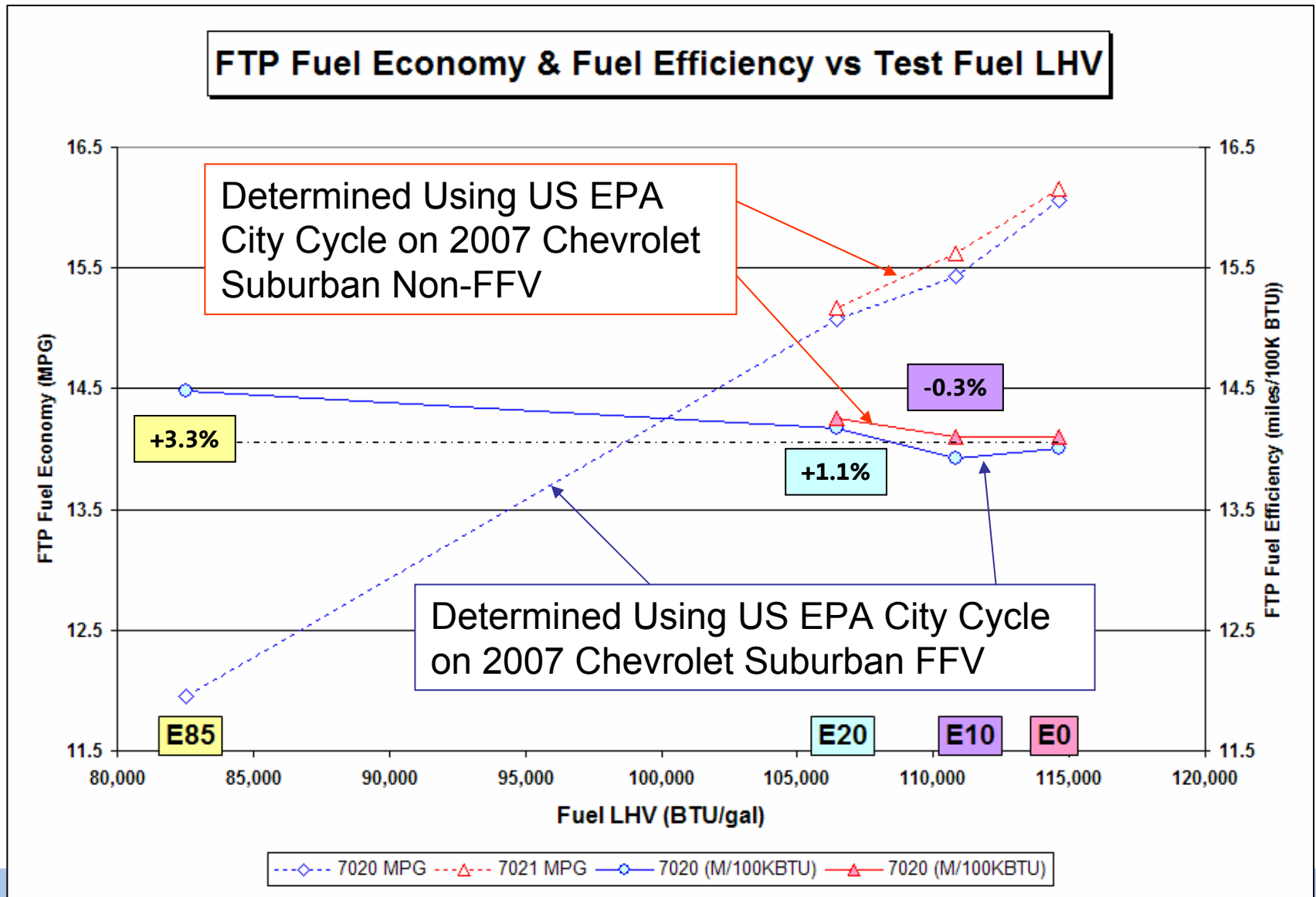
- To hardware owners
 - Potential for damage to engines and fuel systems
 - Reduced fuel economy
- To general public
 - Potential for reductions in air quality
 - In Australian tests, 40% of vehicles showed catalyst damage after running E20
 - Potential for increased permeation and evaporative emissions
- To ethanol industry
 - Potential loss of goodwill and beneficial public policies that result from public goodwill
 - in Australia, damage to ethanol's reputation caused by E20 set the Australian industry back a generation



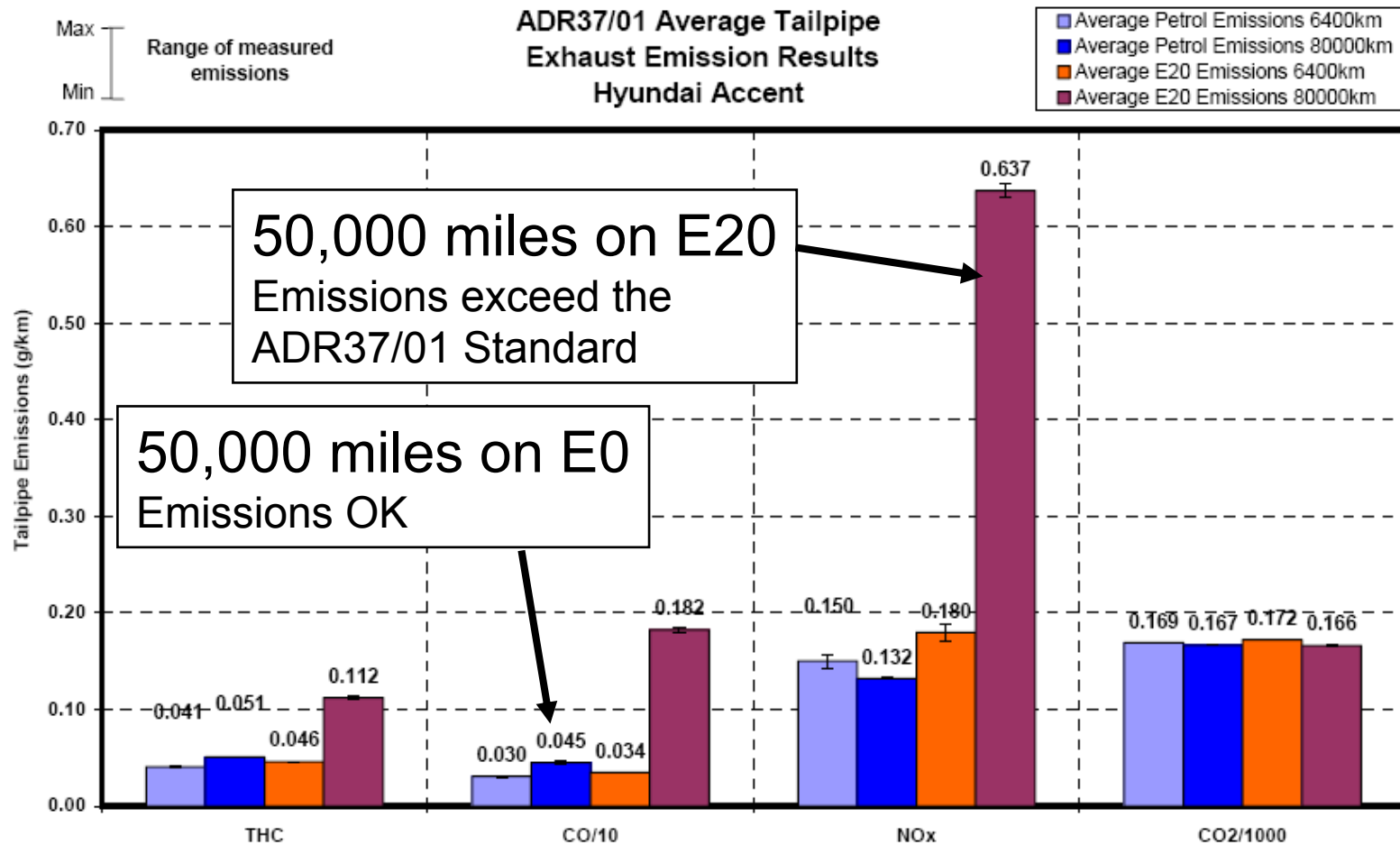
FTP Fuel Economy vs Test Fuel LHV



Ethanol Blend Fuel Economy vs Fuel Efficiency



Orbital Engine Company Phase 2B Final Report to the Australian Department of the Environment and Heritage



“The increases in tailpipe emissions have occurred due to degradation of the catalyst, the primary cause of which is the increase in the exhaust temperature caused by the use of the 20% ethanol blend during particular modes of operation.”



What Testing Is Required?

- The USCAR (United States Council on Automotive Research) test plan identifies 8 areas that need to be investigated for E20 effects on cars and trucks
 - Catalyst Durability
 - Evaporative emissions
 - Fuel systems durability (pump, level sender, tank, fill tubes, ...)
 - Fuel damper
 - Engine exhaust hardware
 - Fuel permeation
 - Exhaust emissions, particularly at cold ambient temperatures
 - Emissions inventory and air quality
- In addition, lawn and garden equipment, boats, motorcycles, and off-road vehicles and equipment need to be comprehensively evaluated



Conclusions

- Many issues require resolution prior to any introduction of E20
 - Demonstration of compatibility with in-use vehicle fleet – carry out the USCAR test plan
 - Demonstration of compatibility with in-use off-road fleet – carry out the EMA test plan
 - Successful health effects testing
 - Granting of EPA “substantially similar” waiver





Flexpower

BioPower

