# Another Look at Methanol as a Low Emission Alternative Fuel

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# *Why methanol, again?*

Commercial use of methanol for automotive application in 1980's, (e.g. 1981 Ford Escort, 1995 Ford Taurus) was looking for an alternative fuel, which quickly faded due to rapid drop in gas prices;

Renewed efforts by China government in the new century to use methanol for alternative energy

Renewed interests in other parts of the world to use methanol for low emissions

Another look at the methanol in US as a good opportunity to help US export of natural gas






*at high altitude*

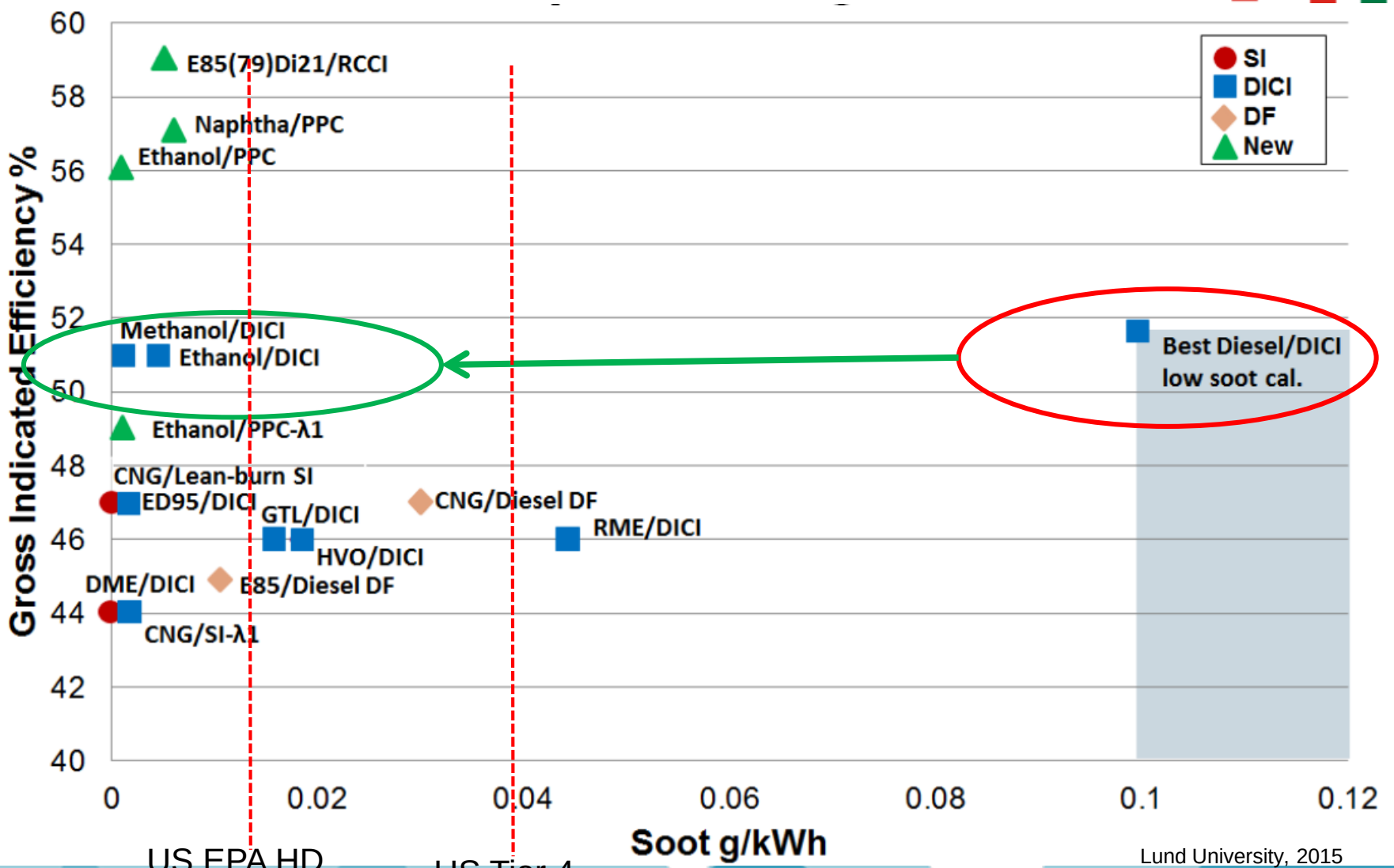
Over the past ten years, FiTech conducted field tests of M100 methanol passenger cars



*and in cold environment*

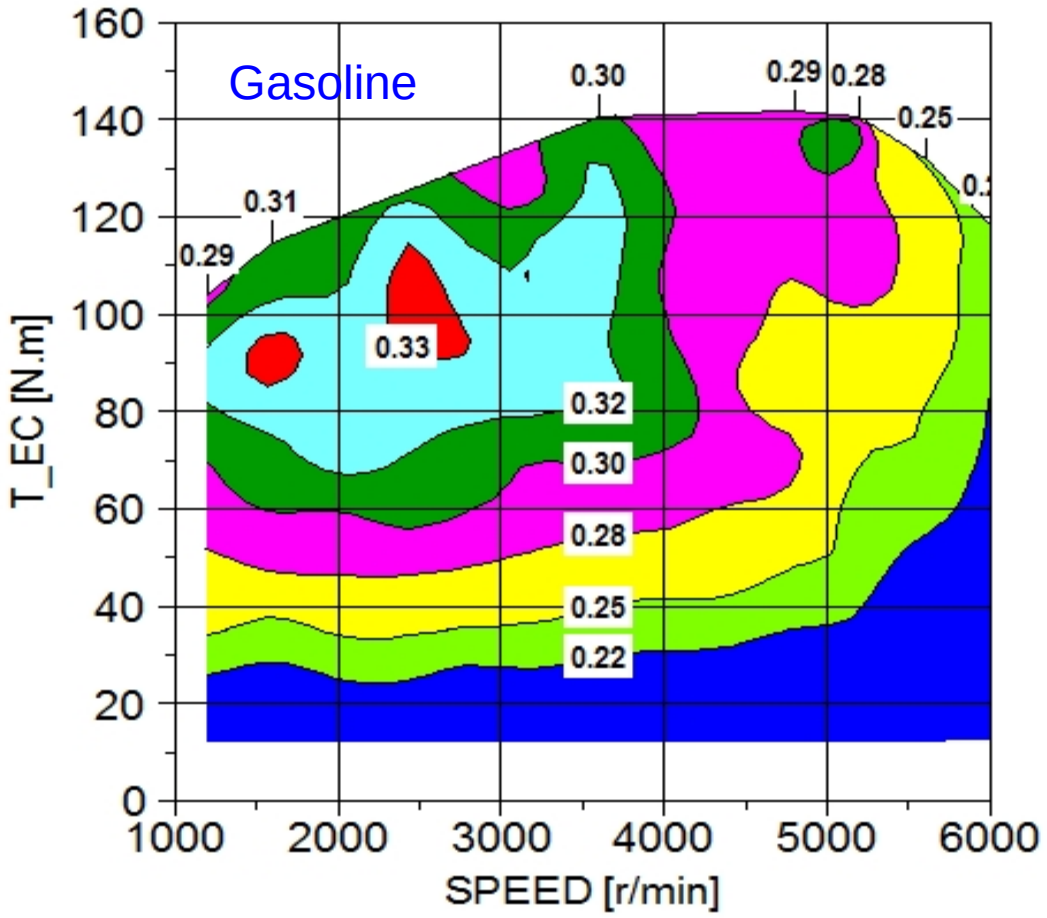


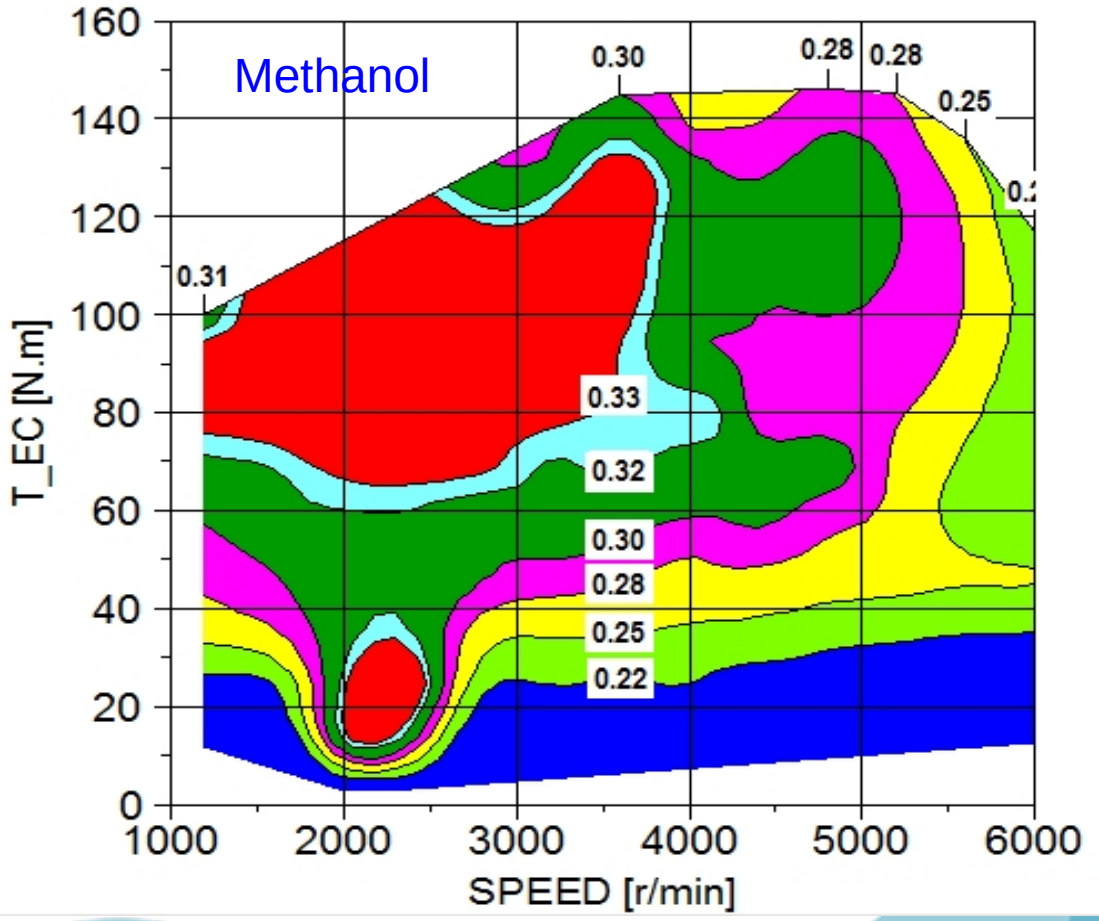

- With oxygen but without aromatic component in the fuel, Methanol is basically a smokeless combustion
- Can pass 2015 US EPA PM standard with 3-way catalyst only
- Thermal efficiency better than gasoline, close to diesel




Lund University, 2015

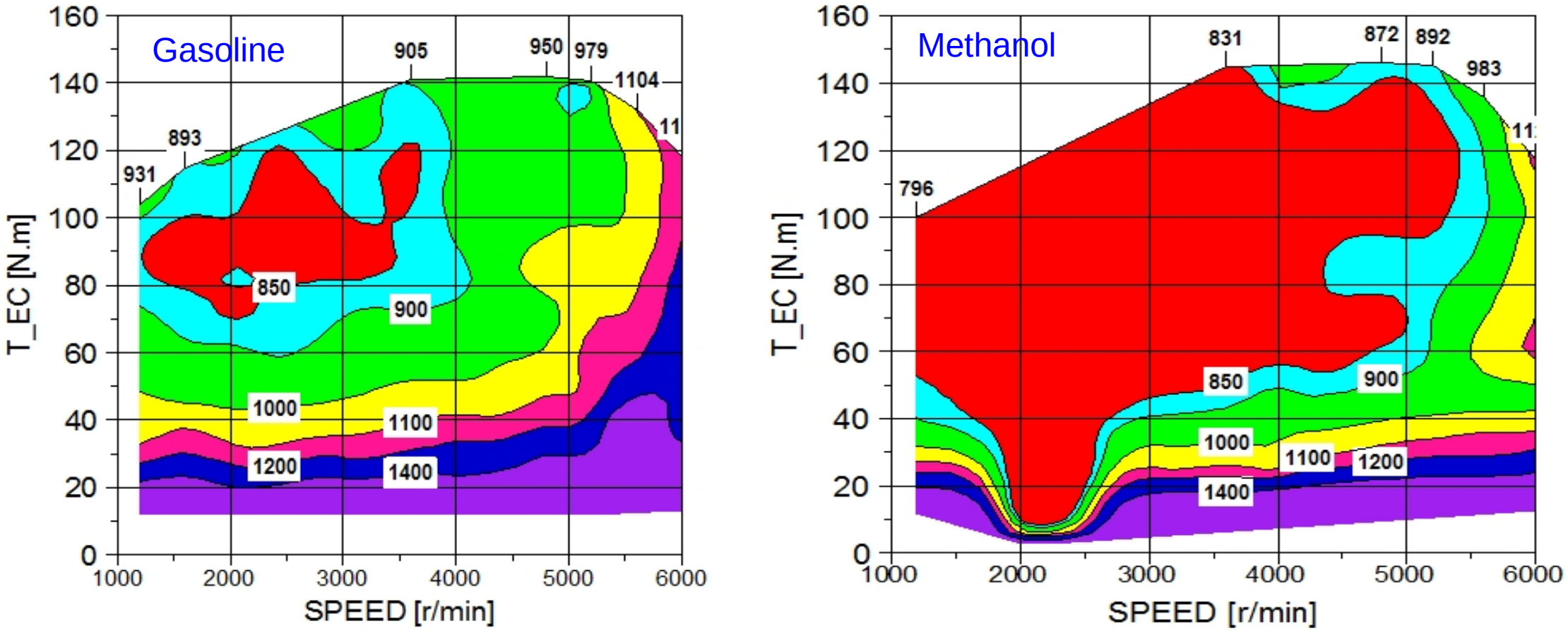
# Thermal efficiency of gasoline (left) and methanol (right) engines




The spark ignited methanol engine has much higher thermal efficiency over wide operation range (as tested on a passenger car)

# $CO_2$ emission of gasoline (left) and methanol (right) engines

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# Methanol Experience at FiTech:

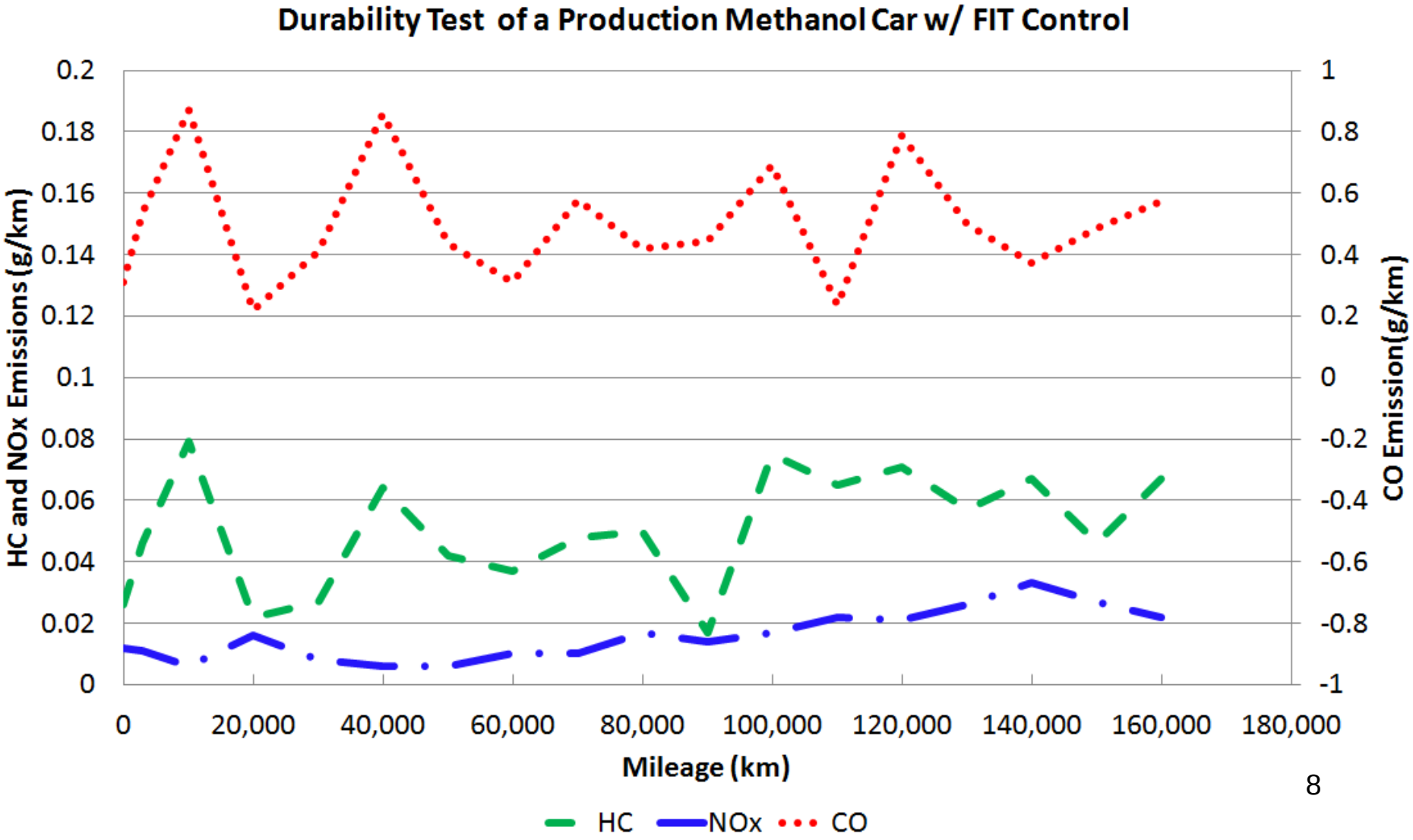
## In 2010: 1ST production methanol car test result: aldehyde emission is below the USA (LEV III) limit.

| Aldehyde Emission (Test location: Beijing Institute of Technology, China) | | | |
|---|---|---|---|
| **Emission** | **unit** | **Methanol car test result** | **Aldehydes standard USA LEV III** |
| **Aldehyde** | **Milligram / km** | **0.8** | **2.5** |

Methanol port injection with spark ignition, gasoline cold start assistance and three-way catalyst has successfully addressed the aldehyde emission concerns

The methanol passenger car now in production demonstrated China V emission compliance over its useful life with a 3Way catalyst

*Durable and Reliable!*



# Paths to the Green Transportation

- FiTech has worked with one OEM in china over 10 years on methanol application for passenger car (2000+ on the market)
- FiTech is currently working on methanol application for  pilot boat, off-highway engines
- FiTech is also working on methanol/diesel, methanol/natural gas dual fuel engines for off-highway and marine applications

# Methanol is cheaper, cleaner and more efficient!