

# Inexpensive Wobbe Index Sensor to Measure Gaseous Fuel Quality

Tech ID: 31689 / UC Case 2016-026-0

## FULL DESCRIPTION

### Background

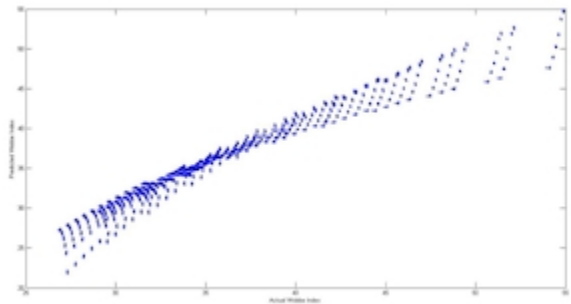
Variable Natural Gas Vehicles (VNGV) run on conventional natural gas, but could also operate on any arbitrary mixture of natural gas and renewable natural gas (RNG) contained in its on board compressed gas storage tank. The two technologies needed by VNGV are:

- ▶ On-board detection of fuel properties; and,
- ▶ Adaptive combustion control for a wide range of fuel variations.

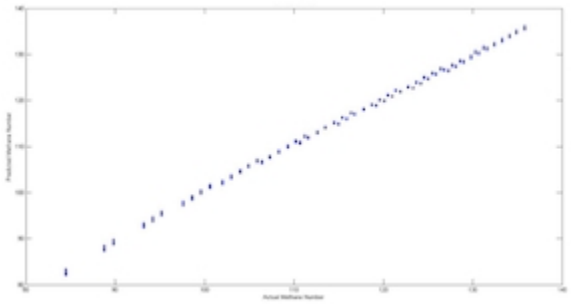
On-board detection of fuel properties is an essential part of adaptive engine control - determining the engine combustion mode and integration of emission control systems. Among the fuel properties, Wobbe Index (WI) is a critical factor for fuel interchangeability. The complex, destructive and expensive nature of existing WI measurement systems prevent its use for VNGV applications - especially as an on-board diagnostic sensor.

### Technology

Prof. Chan Seung Park and his research team at the University of California Riverside have developed a portable and reliable sensor for natural gas fuel quality. The fuel sensor is not only capable of measuring WI but also Methane Index (MI) as well as inert gas content in real time. MI provides an indication of the knocking tendency of the fuel. Inert gas content (e.g., Nitrogen, CO2) of the fuel is important in guiding the exhaust gas recirculation strategy of the engine to minimize pollutant emissions.



Predicted Wobbe Index by Using the Developed Model vs Actual Wobbe Index



Predicted Methane Index by Using the Developed Model vs Actual Methane Index

## CONTACT

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## OTHER INFORMATION

### KEYWORDS

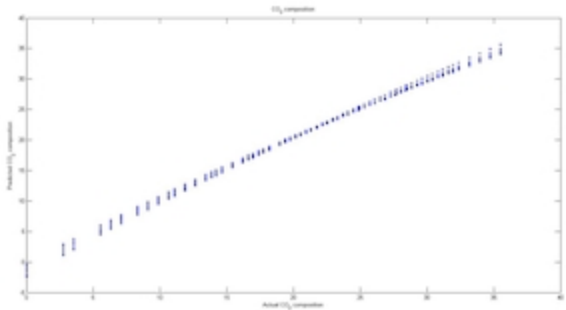
gas, Wobbe index, boilers, landfills,  
pools, fuel quality, sensor, renewable  
natural gas, emission control, fuel  
sensor, Methane index, biogas

### CATEGORIZED AS

- ▶ **Energy**
  - ▶ Bioenergy
  - ▶ Hydrocarbon
  - ▶ Other
- ▶ **Engineering**
  - ▶ Engineering
- ▶ **Sensors & Instrumentation**
  - ▶ Analytical
  - ▶ Physical Measurement
  - ▶ Scientific/Research
- ▶ **Transportation**
  - ▶ Automotive

### RELATED CASES

2016-026-0



Predicted Inert Percentage by Using the Developed Model vs Actual Inert Percentage

ADVANTAGES

- ▶ The sensor is non-invasive, rugged and small in size allowing the ability to overcome limitations and bulkiness of conventional measurement technologies.
- ▶ Wobbe Index, Methane Index and Inert Gas Content of the fuel mixture can be measured in real time (within 5% accuracy) using advanced data analytics (multivariate analysis and/or artificial neural network).
- ▶ The technology will enable the increased use of RNG as a transportation fuel resulting in significant reductions in GHG emissions.

APPLICATIONS

- ▶ The sensor may be used to estimate the Wobbe Index of gaseous fuel in real time.
- ▶ The sensor may be used to measure the methane number, which is analogous to the octane number (the amount of compression a gas can take before igniting).
- ▶ The data from the sensor may be used to adjust certain control parameters to maximize fuel efficiency in vehicles, gas appliances such as pool heaters, boilers etc.
- ▶ The data from the sensor may be used to utilize the renewable natural gas from landfills into an alternative power source.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,132,251	11/20/2018	2016-026

RELATED MATERIALS

- ▶ [Park, C, et al. Development of a Fuel Sensor Technology for a Variable-Blend Natural Gas Vehicle, J Nat Gas Sci Eng Volume 31, April 2016, Pages 149-155. - 03/08/2016](#)
- ▶ [Development of Key-Enabling Technologies for a Variable-Blend Natural Gas Vehicle](#)

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