



Partners in Power: How Propane Industry Investments Led to Tractors Powered by Propane and Natural Gas

Cinch Munson, Sr. VP for Business Development
Propane Education and Research Council

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PROPANE EDUCATION AND RESEARCH COUNCIL

- Propane Education and Research Act (October 11, 1996)
- Established, operated, and funded by the propane industry
- Assessment of \$0.005/gallon of propane
- Research & development, safety, education, and training
- Since 2012, over \$43M invested in product development

WHY TRACTORS?

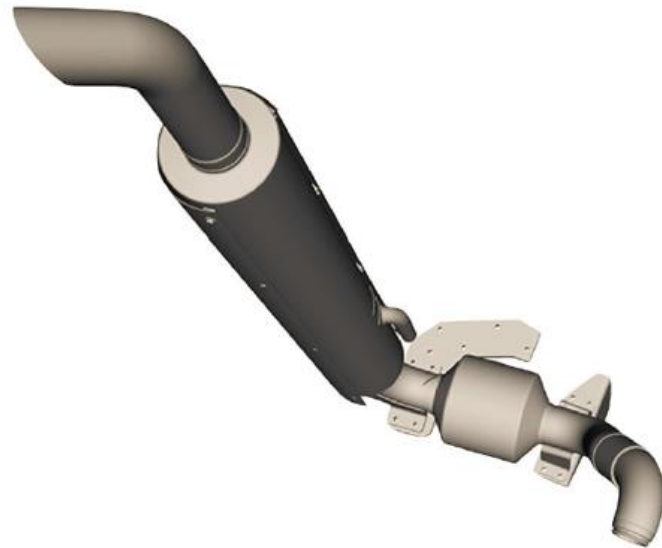
- In the United States, agricultural tractors consume nearly 3 billion gallons of diesel per year (Source: US EIA)
- Total United States domestic propane demand is approximately 1 billion gallons (Source: PERC)
- The United States accounts for less than 10% of the global tractor market (Source: NEMA)

WHY LPG-POWERED TRACTORS?

- Growing LPG supply
- LPG is common on US agriculture operations
- Cost of ownership advantage
- Reduced environmental impact
- Increasing adoption of Propane Autogas vehicles
- New fueling solutions in US (EN13760)
- Tier 4F impact on diesel engines

LPG vs TIER 4F DIESEL EXHAUST TREATMENT

LPG: 3-way catalyst



Diesel: After-treatment and filters

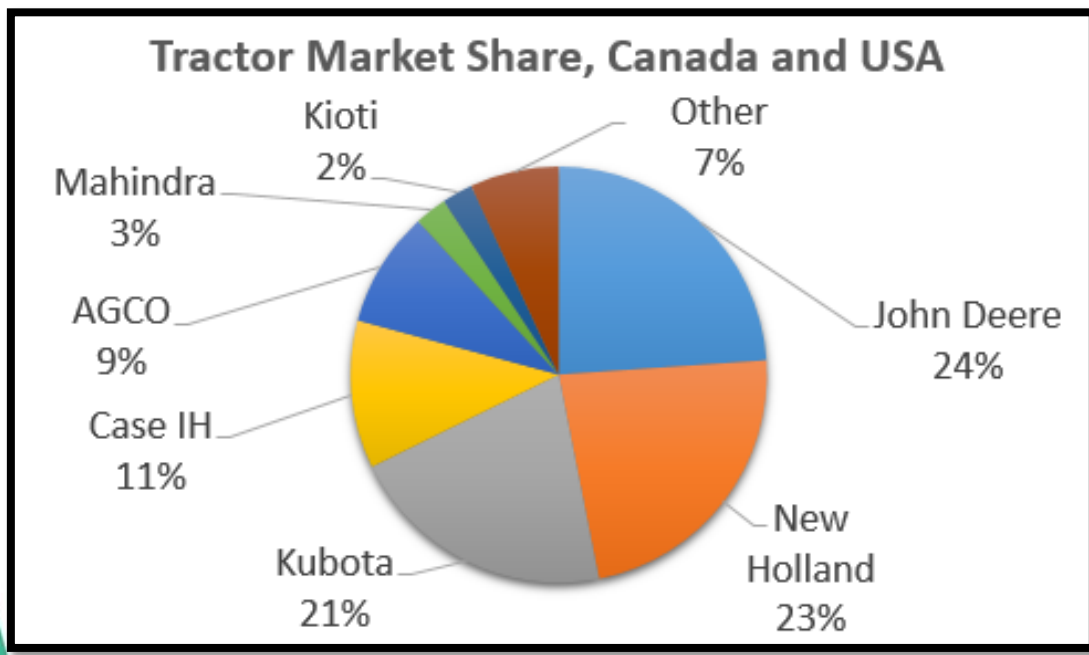


WHY NEW HOLLAND AGRICULTURE?

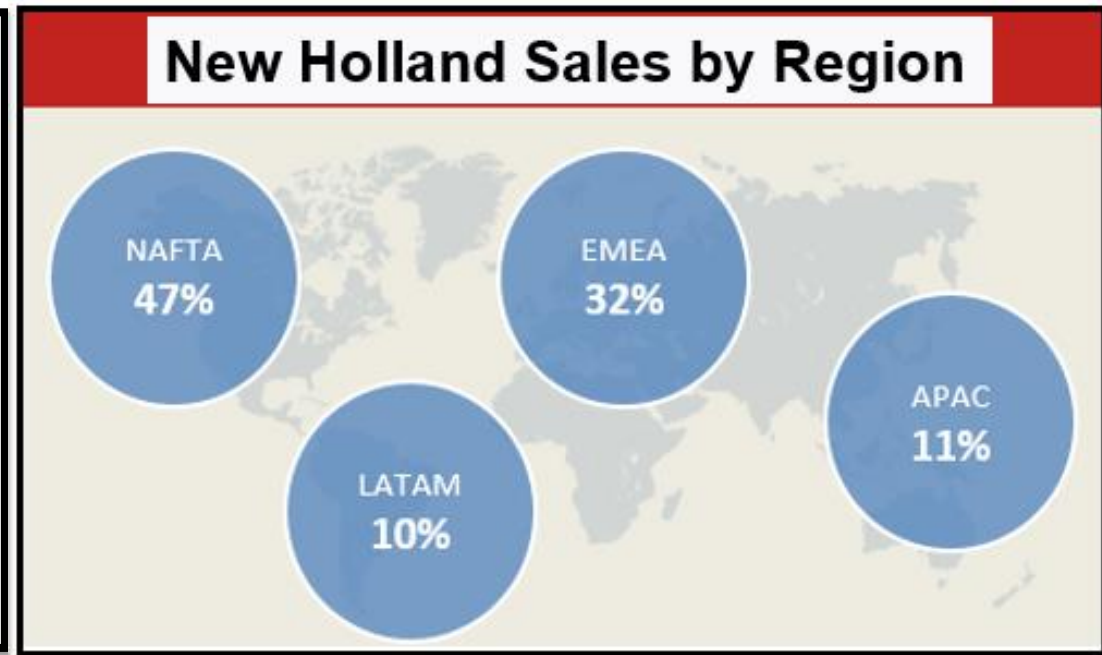
- Division of Case New Holland – Fiat International



WHY NEW HOLLAND AGRICULTURE



Source: AEMA



Source: New Holland



WHY NEW HOLLAND AGRICULTURE?



SCOPE OF OUR PROJECT WITH NEW HOLLAND

“The project scope is to define the technical feasibility and market receptivity of a propane powered tractor in two distinct customer segments which purchase small to mid-range agricultural tractors.”

- Identify a *cost-effective engineered solution*
- Identify *propane tank placement and refueling options* and solutions.
- *Assess and document performance.*
- *Assess and document market acceptance and predict commercial potential.*

PROTOTYPE: COMPACT TRACTOR



- New Holland Boomer 25
- Rated engine horsepower: 27 hp
- PTO horsepower: 19.9 PTO hp
- Fuel system: Indirect mechanical
- Fuel tank size:
 - Diesel = 8.7 gal
 - LPG = 7.9 gal
- Working runtime estimation:
 - Diesel = 10 hrs
 - LPG = 7.5 hrs

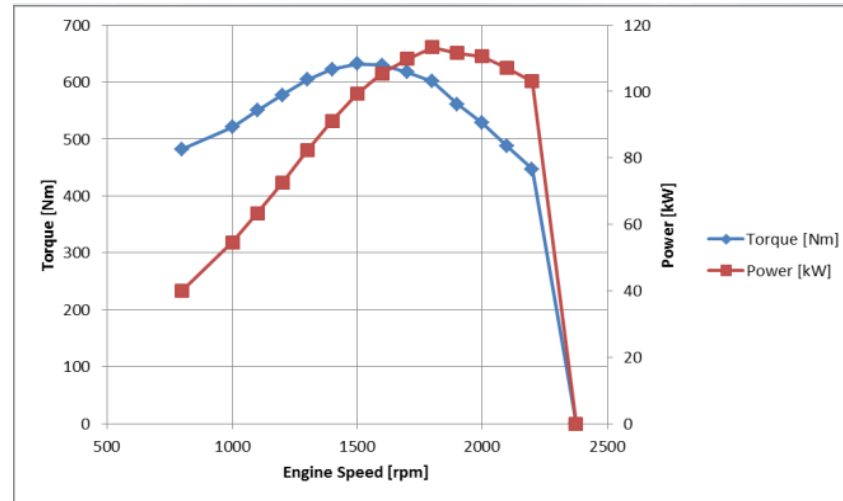
PROTOTYPE: MID-SIZE TRACTOR



- New Holland T6050
- Rated engine horsepower: 125 hp
- PTO horsepower: 120 PTO hp
- NEF 5.9L, 6-cylinder in-line, turbo
- Fuel system: Direct vapor injection
- Fuel tank size:
 - Diesel = 79.3 gal
 - LPG cylinders = 43 gal
- Working run time estimation:
 - Diesel = 10+ hrs
 - LPG = 5.5+ hrs

PROPANE-POWERED TRACTOR PERFORMANCE

- Power
- Cold Start
- Run time



TAKEAWAYS

- A committed and interested partner is important
- The commercial partner often dictates the pace
- Partner priorities do change
- Communication is critical
- Propane and natural gas can be great partners in power



Thank you!

Cinch Munson

cinch.munson@propane.com, 202-302-4495

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