



POWERCELL

Bränsleceller – kunskapsförsörjning till en begynnande miljardindustri

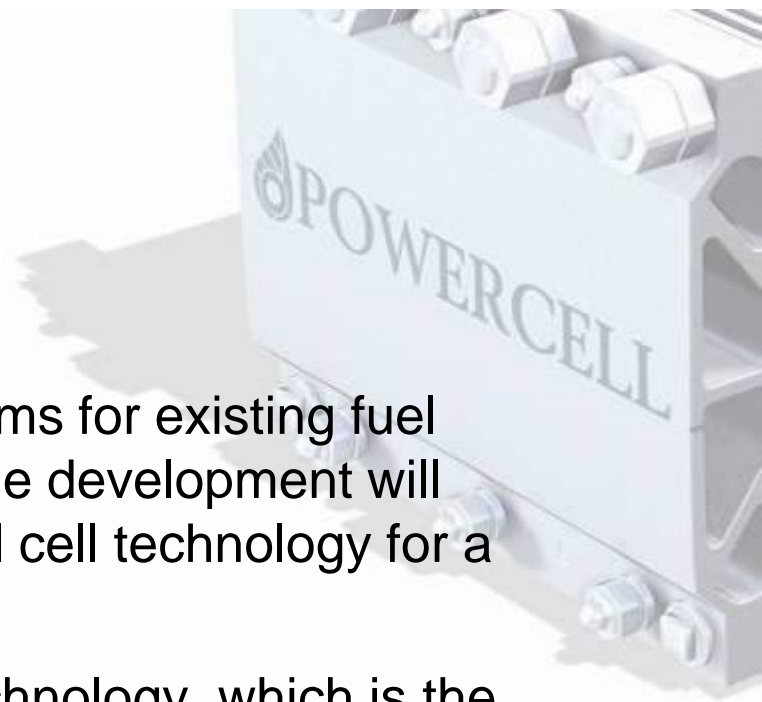
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Volvo Powercell Sweden

Company background

- Develop and supply electrical power systems for existing fuel infrastructures to the transport industry. The development will utilize unique reformer technology and fuel cell technology for a clean environment.
- Based on exclusively patented fuel cell technology, which is the result of more than 15 years of research and development at Volvo. Bringing together the fuel reforming, fuel cell competence and application knowledge.
- The fuel cell design is based on result from MISTRA “Fuel Cell” research program.



Fuel cell vehicles offer the potential to greatly reduce greenhouse gas emissions and could eliminate them completely in the long term.

Why fuel cell?

- Fuel cells offer significantly higher efficiency in transport as well stationary applications
- Fuel cells are a zero emission technology when operated with hydrogen
- Fuel cell vehicles provide options for further electrification of the vehicle (e.g. air conditioning while standing)
- Fuel cells has low noise emission

Which fuel?

Low temperature fuel cell use hydrogen as fuel, but;

- There exist no hydrogen fuel infrastructure.
- Huge investments are need for a new fuel infrastructure.
- Significant technical improvement is needed in hydrogen storage, distribution and production.



Fuel Cell Power Unit

the environmental friendly power generator



Autothermal Reformer

Function:

- Converts truck diesel into a hydrogen rich gas

Features:

- High scalability
- Functional with all heavy hydrocarbons
- Clean conversion
- Low production cost

Power Generator Unit

Features:

- 5-15 kW Power system
- Developed for marine and truck applications
- Operates on diesel

Advantages:

- Zero emission of NO_x, CO, SO_x
- Low noise levels
- Low thermal signature
- High fuel efficiency

Fuel Cell

Function:

- Produces electricity from a hydrogen rich gas

Features:

- Fast start up power
- High power density
- High scalability
- Patented design
- Robust technology

System Uniqueness

- Fuel flexibility
 - diesel, methanol, propane, gasoline and others
- Fuel efficiency
 - Increased cycle efficiency
- Emission levels
 - Low environmental impact



Emission and Efficiency Comparison

	Conventional APU (small diesel engine, US regulation)	Powercell APU
CO	6.6 g/kWh	0 g/kWh
CO ₂	1.47 kg/kWh	0.9 kg/kWh
NO _x	} 9.5 g/kWh	0 g/kWh
NMHC		0 g/kWh
Particulate	0.8 g/kWh	0 g/kWh
Efficiency (optimal point)	30%	30%
Efficiency (load cycle)	18%	30%

The fuel cell APU is the cleaner alternative, with only half the CO₂ emissions compared to conventional diesel engines and no particulate or toxic emissions

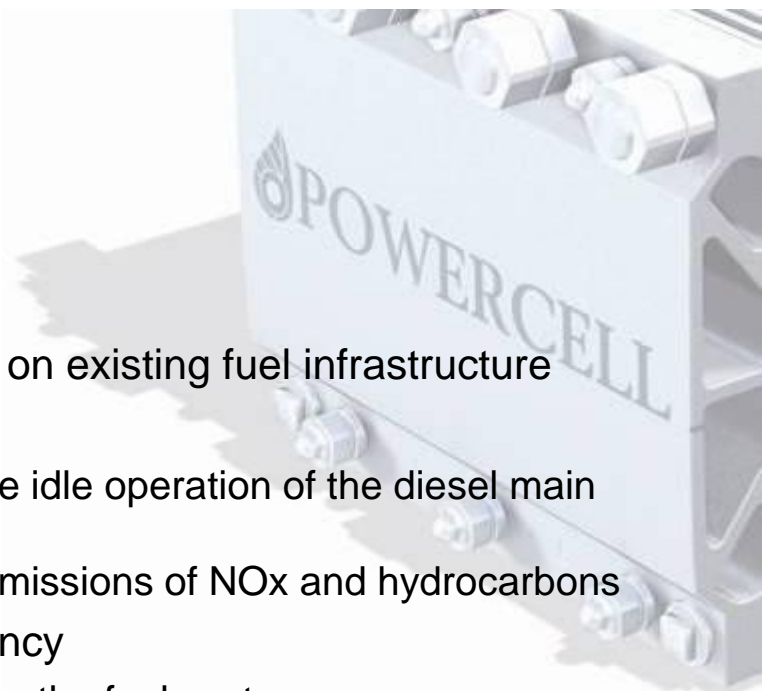
Future regulations will impose specific NO_x regulations, making an even stronger case for the fuel cell based systems

Truck Market

Motivations for APU in Trucks



- Dependent on existing fuel infrastructure
- Legislation
 - Eliminate idle operation of the diesel main engine
 - Lower emissions of NOx and hydrocarbons
- Cost efficiency
 - Decrease the fuel cost
 - Compact and reliable Power Systems
- Enhanced comfort
 - Reduced noise and vibration
 - Reduce noise pollution in cities
- Pollutions – US Market
 - 2.3 million large diesel trucks in the US. 600,000 have sleeper cabs ⁽¹⁾ .
 - A typical intercity tractor-trailer idles an estimated 1800 h/yr ⁽²⁾



(1) Source: US Census Bureau, 2002 Economic Census

(2) Argonne National Laboratory, US Department of Energy

Marine market

Needs for Marine Gensets in the Leisure segment



- Produce electrical power
 - off shore and in harbor areas
- Increase on-board comfort level
 - Reduced noise levels and vibrations
 - Reduce smell
 - Compact size saves space
- Cost efficiency and environmental care
 - Increased reliability
 - Minimize emissions
- Dependent on existing fuel infrastructure

Conclusion

- Fuel cell technology has high potential in reducing emissions and improving fuel economy and enable fuel flexibility.
- Volvo Powercell is committed to fuel cell technology products
- Fuel Cell exhibited a great opportunity for a wide supplier base in Sweden