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Heavy Duty Vehicles: Efficiency Opportunity, Options, Demonstration and Barriers

LCV 2016

Chris Thorne, CTO Heavy Duty Vehicles

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Introduction

- What is the Energy Technologies Institute and what are we trying to achieve with Heavy Duty Vehicles (HDV)
- What is the value of HDV carbon abatement (and therefore efficiency) to the UK energy system?
- What are the options to deliver carbon abatement?
- What are the current barriers preventing the uptake of carbon abating technologies?
- How might these barriers be addressed?



What is the ETI?

- The ETI is a public-private partnership between global energy and engineering companies and the UK Government

Delivering...

- Targeted development, demonstration and de-risking of new technologies for affordable and secure energy
- Shared risk

ETI members



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Business, Energy
& Industrial Strategy

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Pioneering research
and skills

Innovate UK
Technology Strategy Board

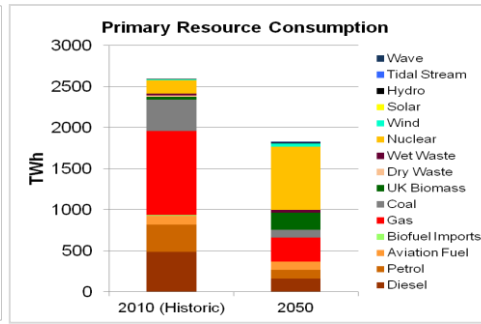
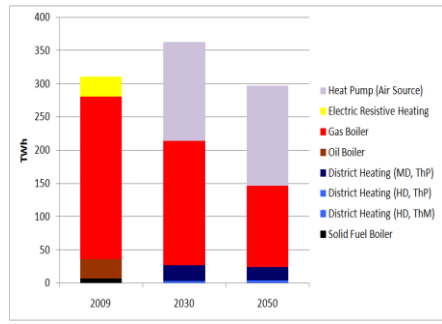
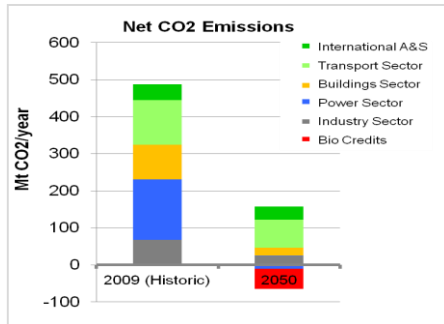
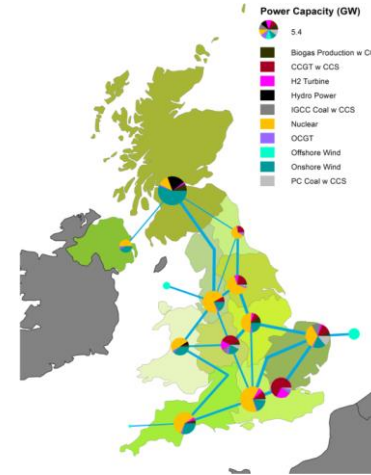
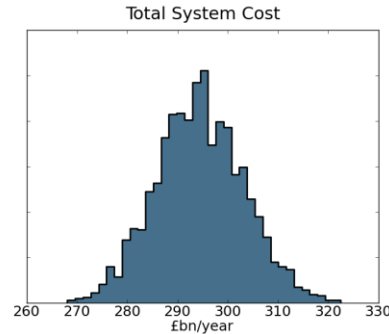
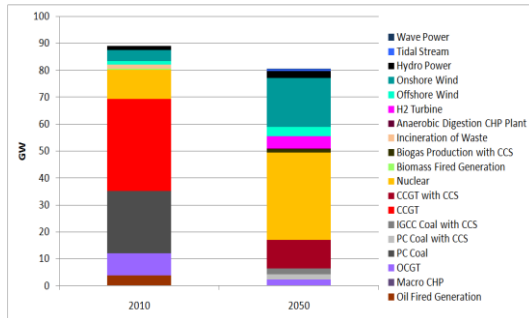
ETI programme associate

HITACHI
Inspire the Next



ESME – ETI's system design tool

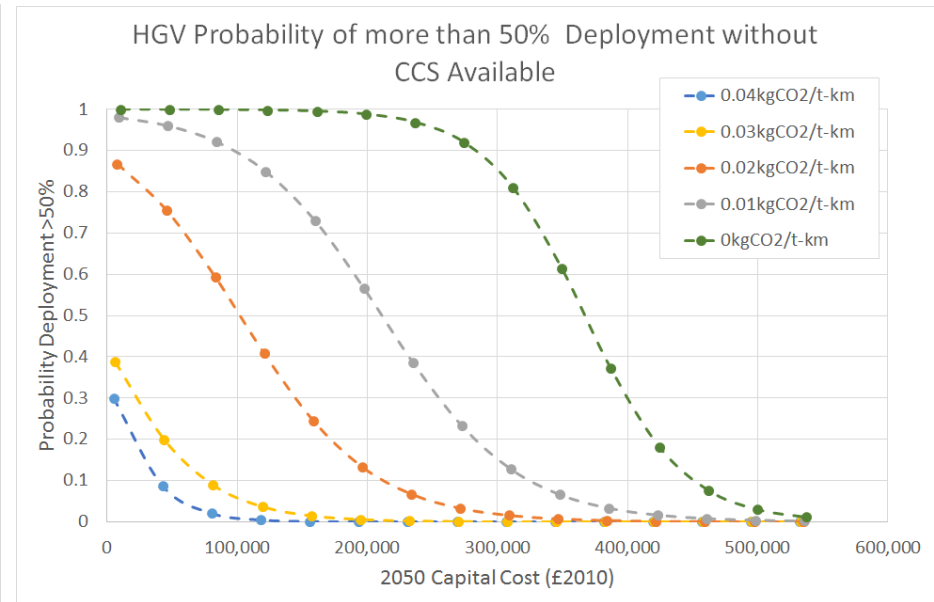
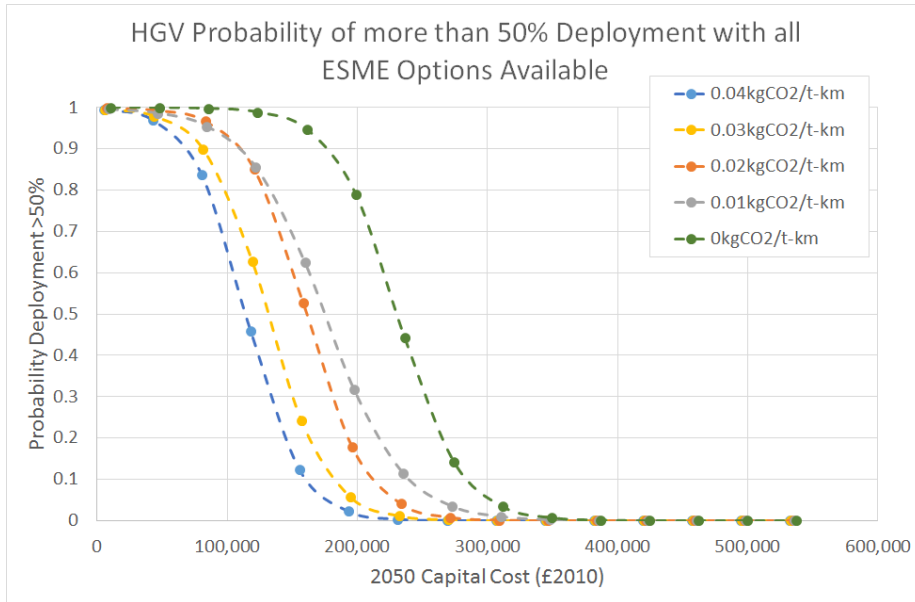
integrating power, heat, transport and infrastructure
providing national / regional system designs



ESME example outputs



HDVs and the UK Energy System



CCS (Carbon Capture and Storage)



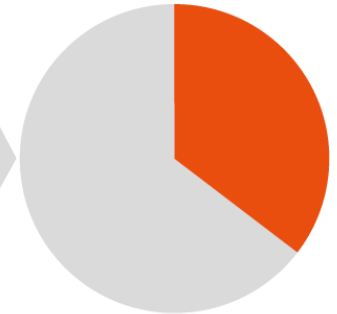
Programme Objective

Develop new
**vehicle
concepts**

Develop new
technologies to
support concepts

Produce
**demonstration
vehicles** that are
30% more
efficient

**Develop supply
chain** to enable
meaningful
market
deployment



**Enable
substantial
reduction in
CO₂ emissions
across sector**

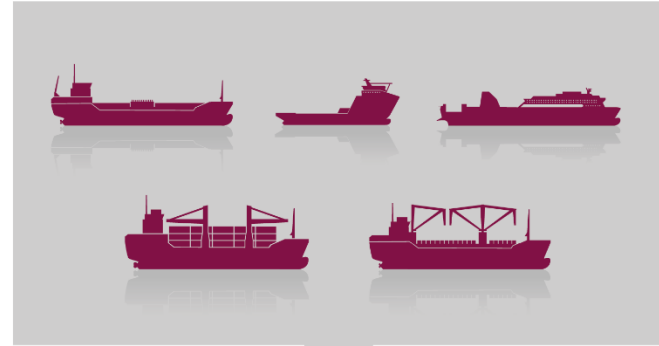


Phase 1 - Market understanding & concept engineering

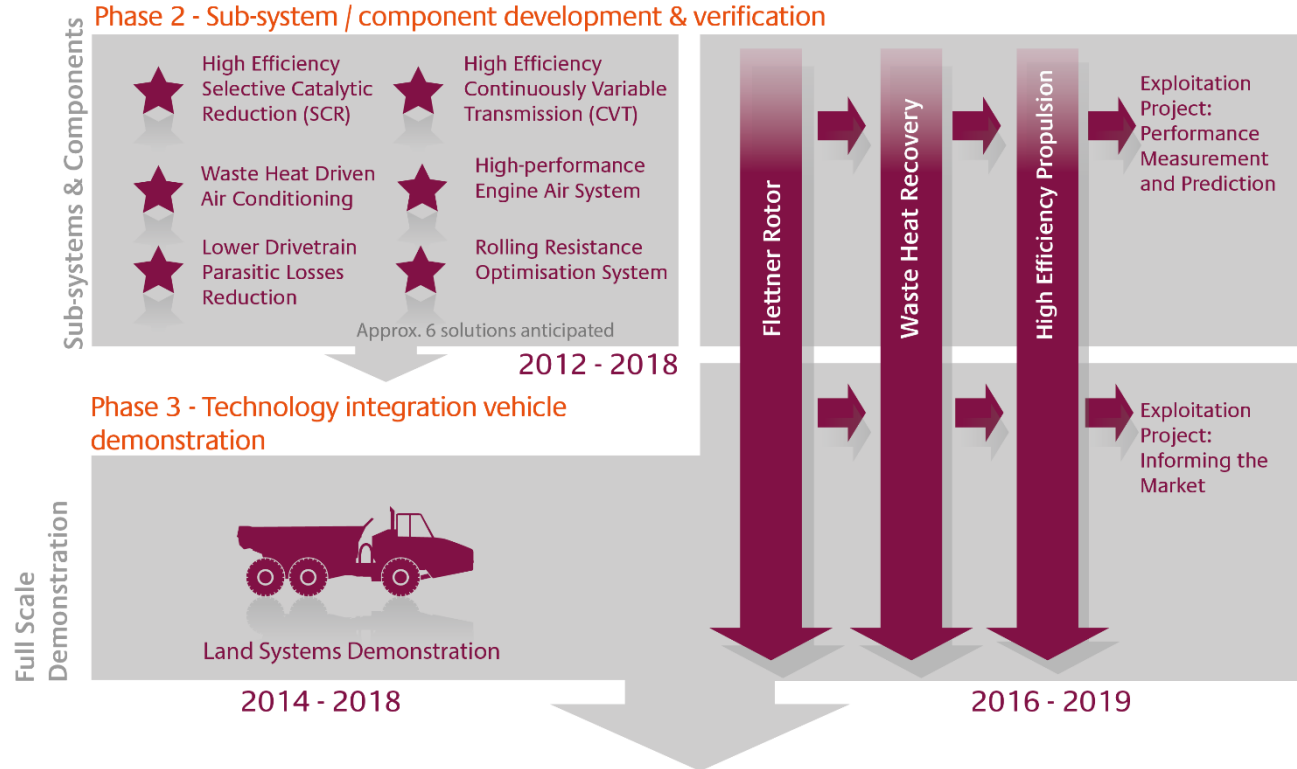
Vehicle Concepts



2012 - 2013

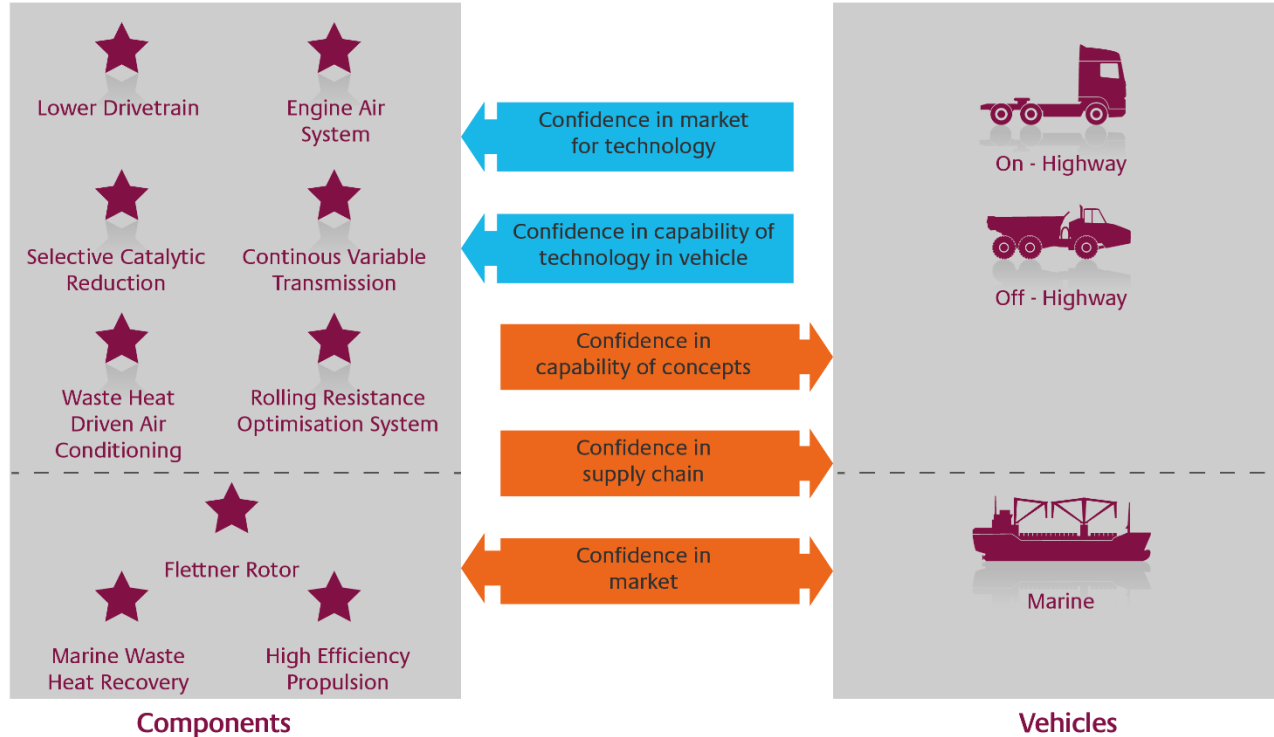


2012 - 2014





Outcomes





ETI Phase 1 Project Results

Through High Fidelity Simulation Confirmed Significant CO2 Reduction potential of the selected technology roadmap



John Deere 6150R



DAF XF105



Alexander Dennis
Enviro 300



Cat @ 966L MWL



Cat @ 725C AT



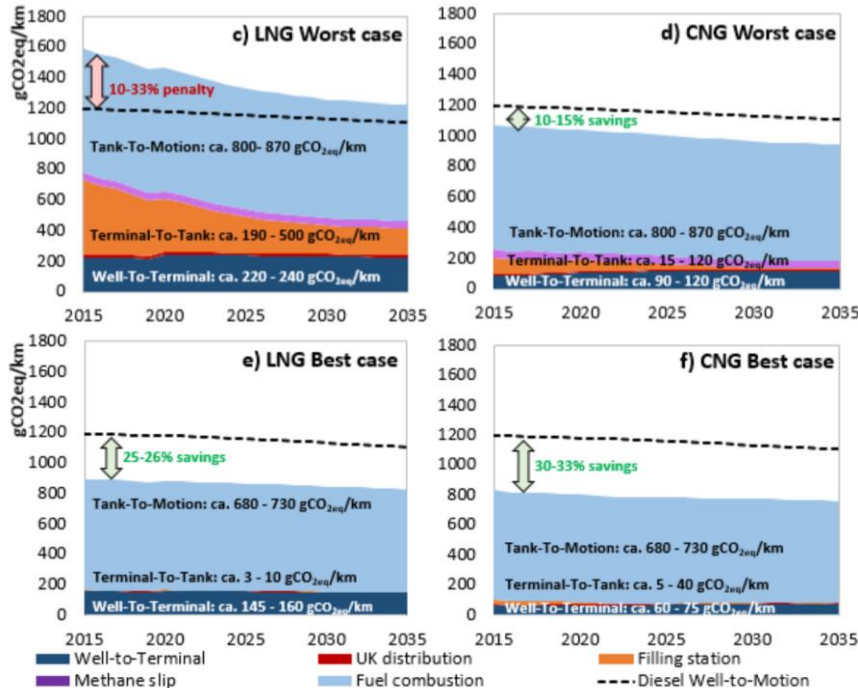
Cat @ 320E HEX

Circa 28%
benefit across
the HDV fleet
with feasible
payback periods





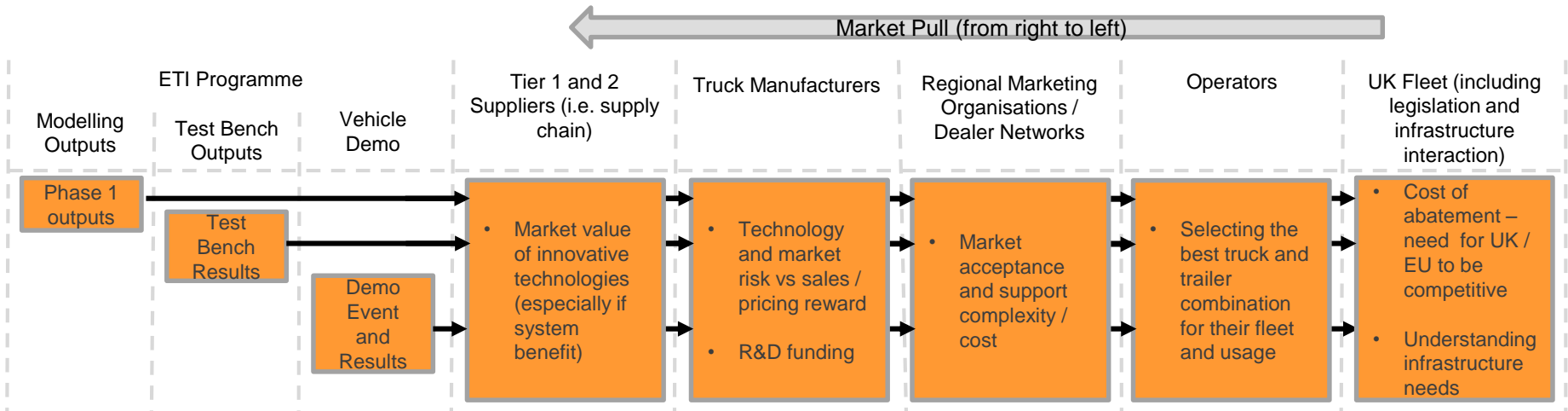
Gas Well-to-Motion study & zero emission options



- Truck architecture (engine and transmission) that allow fuelling flexibility to manage the transition?
- Battery Electric + Mobile Charging?
- Hydrogen fuel cell and electric hybrid?
- Large battery electric hybrid with IC engine?



Market and Potential Barriers





Summary

- HDVs represent an opportunity to cost effectively decarbonise the UK energy system across a range of abatement and cost levels
- In the first instance, the ETI's efficiency projects have shown that a 30% reduction in fuel efficiency across the UK fleet can be achieved with reasonable payback periods
- Properly sourced and managed natural gas when coupled to a low methane slip powertrain can provide further CO₂ (equivalent) benefits
- As the UK transitions to a very low CO₂ energy system (circa 2040 to 2050), further 'carbon priced' HDV options could become attractive
- The marginal carbon price will be a function of the other technologies deployed in the energy system (e.g. CCS versus no CCS), but thresholds can be set using the ETI's ESME tool
- Barriers exist in the uptake of fuel efficiency technologies and new tools, techniques and policies are required to overcome them – a subject for future work



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