



**Anaerobic Digestion;
Growing rural opportunities.**

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Developing AD in NI

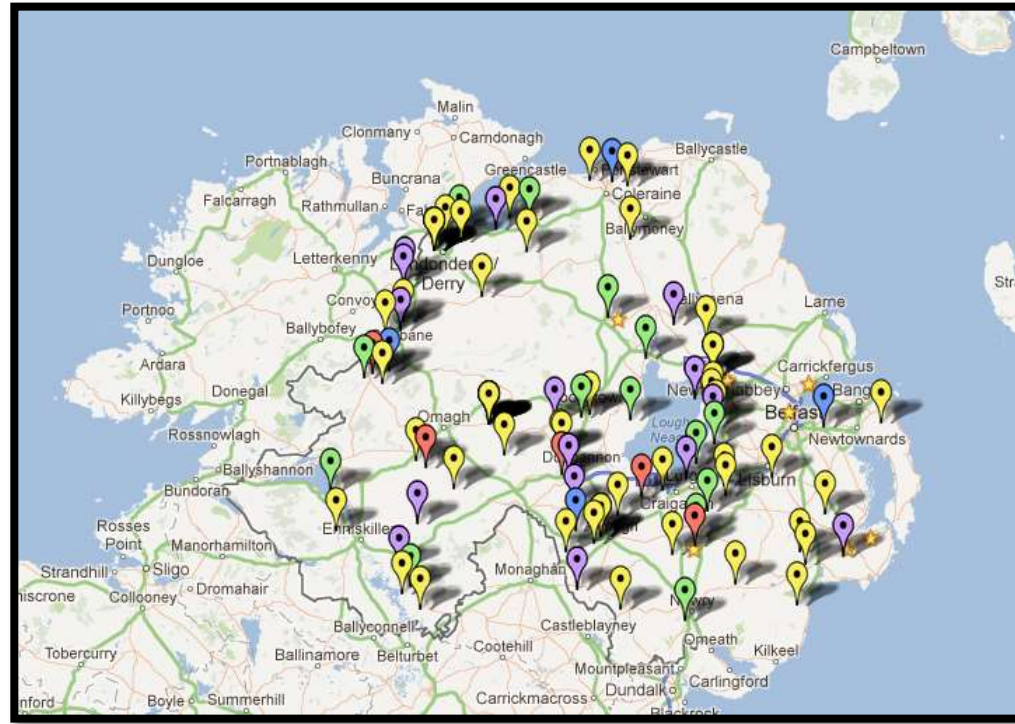


Opportunity for AD in Northern Ireland

- Most attractive financial regime for AD in Europe
- NI has perfect grassland conditions for providing AD feedstock
- Well established technology
- Significant on the ground interest, 40+ projects with planning approval and 100+ projects with planning applied for (see below)

Challenges for AD in NI

- Funding
 - Small scale and heightened risk of individual projects is a barrier
 - Limited experience of project financing within the NI farming sector
 - Few technology providers are fundable
- Market incentivised for electricity generation.
- Infrastructure



Introduction

The Green Investment Bank (GIB) was established by the Government to “accelerate investment in the green economy”. Waste, including recycling and energy from waste, is one of GIB’s priority areas for investment.

Anaerobic Digestion (AD) is at the core of the Government’s waste policies. In 2011 DEFRA and DECC jointly issued an “Anaerobic Digestion Strategy and Action Plan”; which set out the opportunity for the AD sector (including sewage treatment) and indicated that AD could deliver between 3 and 5 TWh of electricity by 2020. Consistent with these policies, renewable energy produced by AD facilities is entitled to support under the Renewable Obligation Scheme, Feed in Tariff (FiT) and the Renewable Heat Incentive (RHI).

The sector is developing rapidly. In March 2013, it was reported⁸ that the AD industry in the UK had 106 anaerobic digestion plants operating outside the regulated water industry, with a reported processing capacity of up to 5.1 million tonnes of food and farm waste every year. A further dozen plants were reported to be under construction.

The AD industry has however expressed concerns to GIB that securing funding, and in particular senior debt finance, is one of the key constraints to the on-going development of the sector. Yet, from discussions with prospective debt investors, the general view is that the UK AD industry is relatively immature and consequently has a risk profile better suited to equity rather than debt investment.

Key Findings

- **Growing opportunity:** There has been significant recent growth in the AD sector with 106MWe of capacity installed or in construction by FY2012, versus 45MWe in FY2010. An additional 148MWe of specific capacity has been identified as available to be developed which would require capital investment of circa £650 million;
- **Fragmented and immature market:** AD sector is highly fragmented and immature – with the top 5 operators accounting for less than 28% of the market with the majority of facilities in the UK having been in operation for less than 3 years;
- **Wide ranging industry load factors:** There is a marked divergence in operational performance between different facilities (much of which is attributed to feedstock). Operational performance for agricultural facilities in 2012 was 69%; 67% for source segregated food and 19% for residual waste;
- **Critical Factors to Project Success:** a) Feedstock selectivity; b) Deep understanding of, and access to local markets for Digestate; c) Dedicated operating personnel; d) Active process management

Critical Success Factors

From analysis of the data and discussions with industry, GIB has identified the following macro factors consistent with the delivery of an upper quartile operational performance.

Assuming that the specified AD technology is ‘fit for purpose’, the factors are predominantly market/operational rather than technology driven:

- a Feedstock selectivity; including the ability to ensure both a continuous supply of suitable feedstock throughout the year and to ensure optimal biology at all times;
- b Deep understanding of, and access to, local markets for digestate;
- c Operational personnel who are able to dedicate sufficient time to the operation of the facility;
- d A culture of seeking to make a series of small changes to actively improve operational performance.





Decisions Issued on planning applications involving 'Renewable Energy' proposals by Type of Proposal Sorted by Financial Year

Please Note: Figures quoted for the current financial year relate to decisions issued up to 30 April 2013

Financial Year

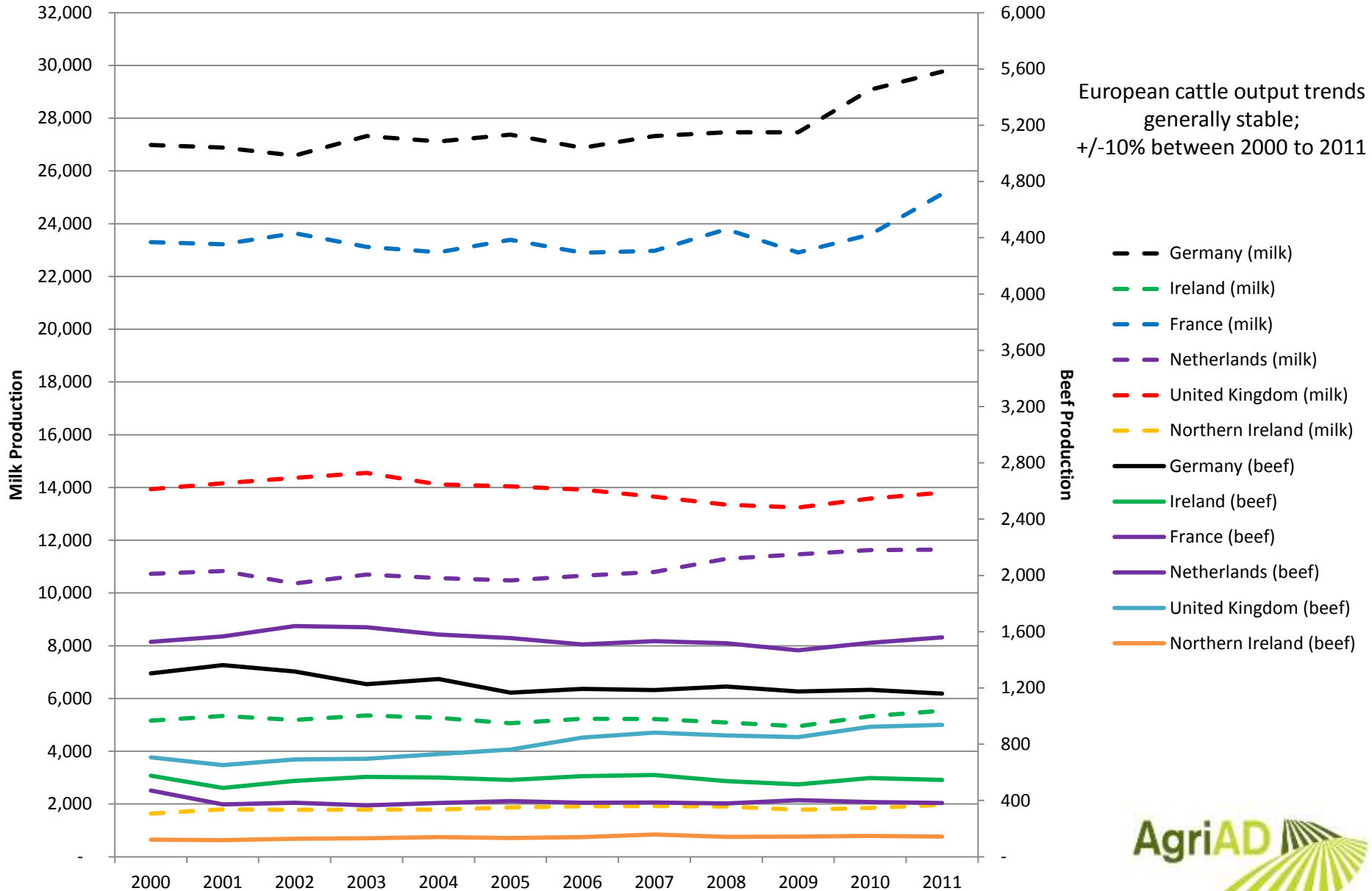
Type of Proposal	Decision	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	Total 02/14
Anaerobic Digestion	Application Withdrawn			1	1		2				1	4		9
	Permission Granted		1				2	2	3	4	23	50	1	86

Opportunity

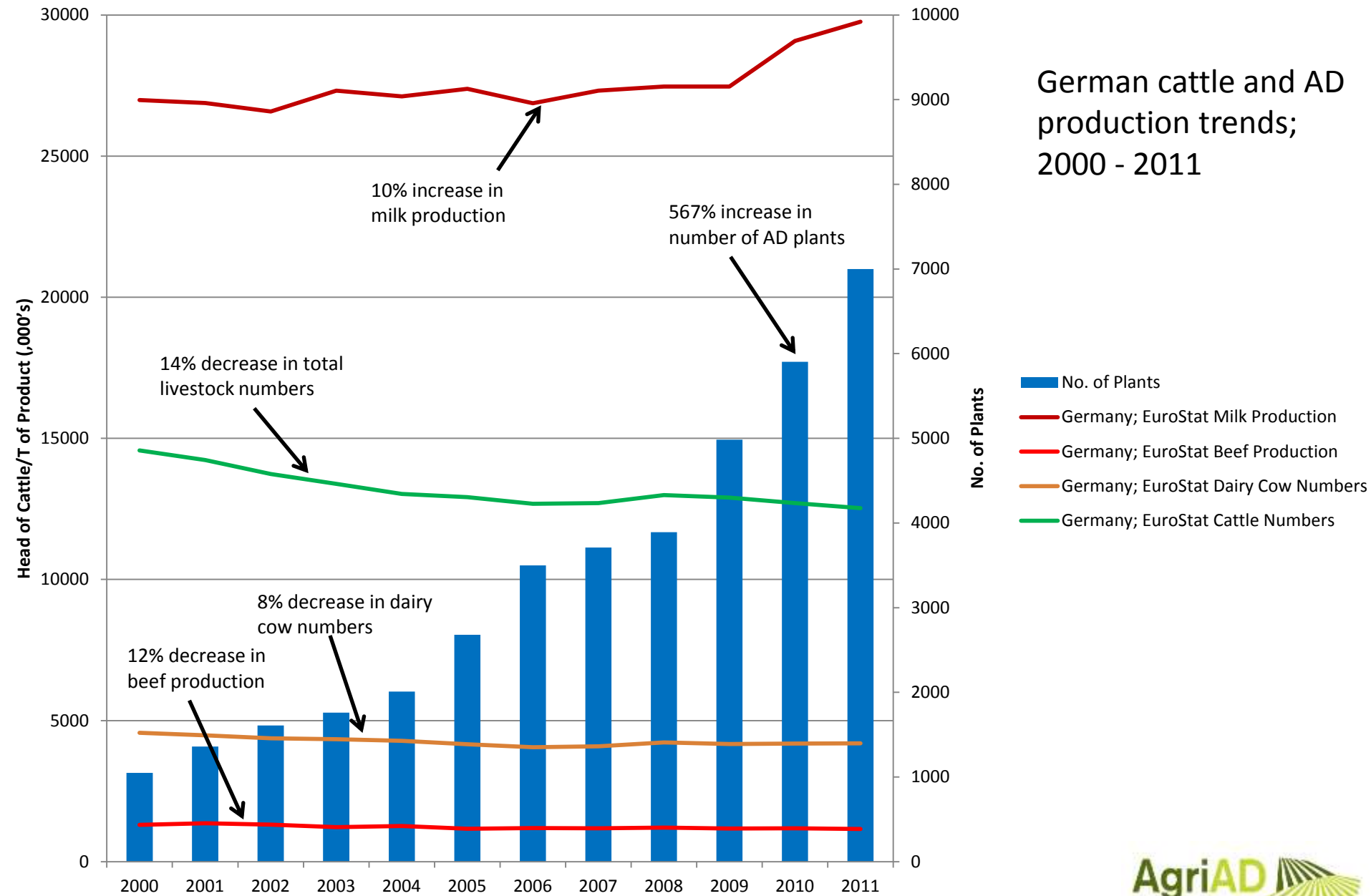
- Capacity of ~36MW
- DECC cost of £4.4m per MW
- £160m inward investment
- £80m will be spent with NI companies during construction
- Operational phase contracts; ~£20m per MW.
- £720m of additional contractually guaranteed incomes to rural NI economies over 20 years.



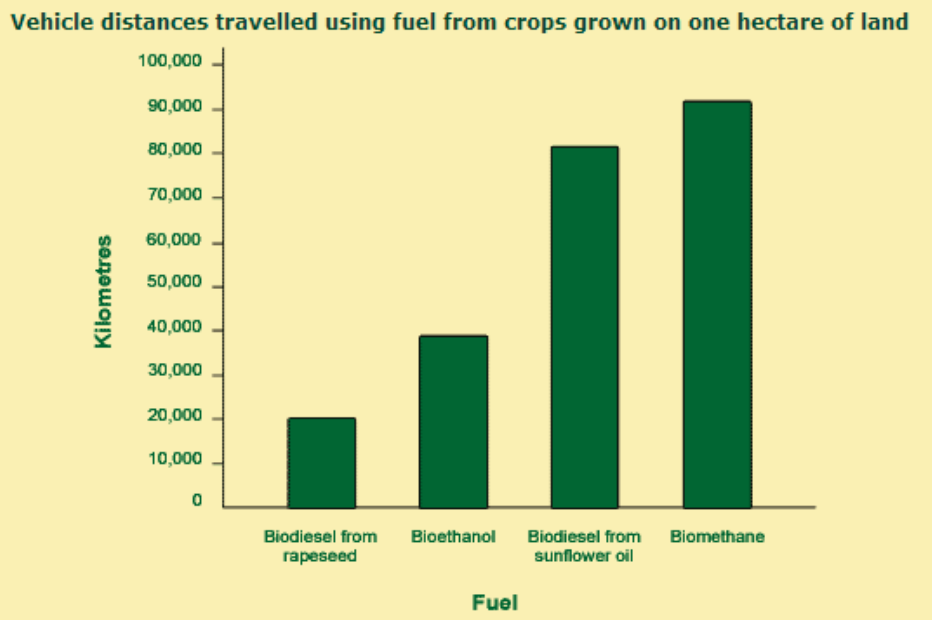
European cattle production trends; 2000 - 2011



German cattle and AD production trends; 2000 - 2011



Biomethane fuelled Heavy Transport; Sustainable and Affordable



Fuel Price Report

FUEL PRICES Week of Oct 8

CNG Compressed Natural Gas	\$2.37*
LNG Liquefied Natural Gas	\$2.92*
Diesel	\$4.09
Gasoline	\$3.47*

**Diesel Gallon Equivalent*

Diesel and gasoline data from the U.S. Energy Information Administration. CNG and LNG data from a nationwide price survey of Clean Energy Fuels public-access stations.

America's Natural Gas Highway

LNG truck fueling coast-to-coast and border-to-border

2012/2013 Corridor Plan

- 2012 Stations
- 2012 Corridors
- 2013 Stations



Opportunities to overcome the barriers uptake of low emission technologies for each commercial vehicle duty cycle



Duty cycle	Duty cycle description	Share of CO ₂
1 Long Haul	Delivery to national and international sites (mainly highway operation and a small share of regional roads).	45 %
2 Regional Delivery	Regional delivery of consumer goods from a central warehouse to local stores (inner-city, suburban, regional and also rural and mountainous roads).	25 %
3 Construction	Construction site vehicles with delivery from central store to very few local customers (inner-city, suburban and regional roads; only small share of off-road driving).	16 %
4 Urban Delivery	Urban delivery of consumer goods from a central store to selling points (inner-city and partly suburban roads).	10 %
5 Municipal Delivery	Urban truck operation like refuse collection (many stops, partly low vehicle speed operation, driving to and from a central base point).	4 %



Report for the Task Force on Fuel Efficient, Low Emission HGV Technologies, funded by the Transport Knowledge Transfer Network and delivered through the LowCVP

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	Technology / fuel	Estimated duty cycle WTW CO ₂ e saving*	Estimated duty cycle TTW CO ₂ e saving*	Payback range***
1. Long haul				
1=	Dual fuel engine	16 % (CNG) 9-12 % (LNG)** 42 % (biomethane)	14 % (CNG / LNG / biomethane)	2-4 years
1=	Dedicated natural gas engine	5-16 % (CNG) 11 % worse to 8 % better (LNG)** 61-65 % (biomethane)	0-12% (CNG / LNG / biomethane)	1-3 years
2	Aerodynamic improvements	6-9 %	6-9 %	3-12 months
3	Predictive cruise control	1-2 %	1-2 %	1-2 months
4	Reduced ancillary loads	1-2 %	1-2 %	1-3 months
5	Stop / Start and idle shut-off	1 %	1 %	2-3 years

Using biomethane as a fuel for heavy transport

Opportunity

- abundance of natural gas
- biomethane blended with natural gas
- lower cost than diesel
- upgrading biogas to biomethane proven process
- most efficient biofuel land use
- highest GHG reductions
- truck manufacturer buy-in

Challenge

- refuelling station infrastructure
- truck fleet buy-in
- market momentum