Dickon Posnett
Argent Energy NZ Ltd

Cold Properties of Biodiesel

3rd Annual EECA Biofuels Conference

April 2007

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Cold Flow Plugging Point - CFPP

What is CFPP?

- CFPP is the temperature at which a fuel will cause a fuel filter to plug because of fuel components that have begun to crystallise or gel. This crystallisation may lead to blockage in the fuel line/filter and could ultimately lead to fuel starvation during engine start up.

- CFPP requirements will differ but are important quality criteria in regions of temperate and artic climates and usually encompass seasonal variations.

- Other measurements:

  - Cloud Point
  - Low Temperature Flow Test
  - Pour Point

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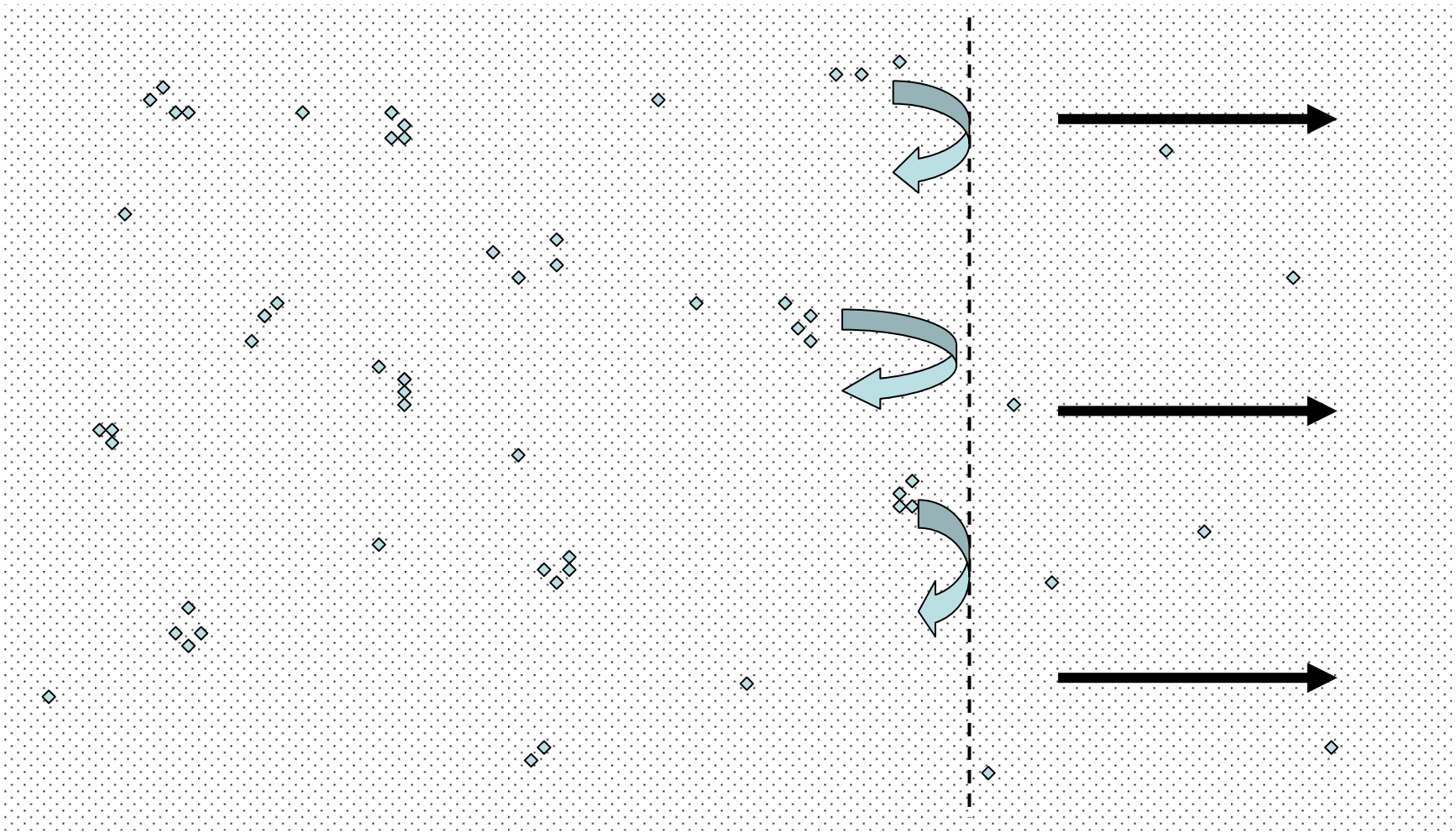
Cold Diesel/Biodiesel



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Cold Flow Plugging Point - CFPP

Differences in CFPP between Mineral and Biodiesel

- Generally, the CFPP of mineral diesel is lower than its biodiesel counterparts.
- Cold flow properties are greatly influenced by the degree of saturated components that exist within the fuel.

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Cold Flow Plugging Point

Showing how the CFPP can differ between raw materials:

Diesel	RME	SME	Sunflower ME	UCOME	PME	TME
- 8 [1]	- 4 [2]	- 2	- 1	3	10	9
Typical CFPP values for various fatty acid methyl esters						

[1] *Infineum*
[2] *National Renewable Lab.*

As with biodiesel the CFPP of mineral diesel can depend upon the crude's origin and can be variable. Bearing this in mind most fuels require differing degrees of winterisation to meet more demanding climatic conditions

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TME CFPP

- Based on our own experience of UK tallow the CFPP is +9ºC.
- Tallow is highly saturated and can contain up to 40-55% saturated fat, dependent on feedstock (lamb/beef/pork).
- Variances of CFPP in tallow are usually dependent on the mix of certain saturated fractions namely C14:0 (myristic acid), C16:0 (palmitic acid) and C18:0 (stearic acid).
- Typical values:

		Melting Point
C14:0	2.5%	19ºC
C16:0	22%	30ºC
C18:0	15%	39ºC

- Now for the good news…

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Utilisation of TME as a fuel

A number of solutions are available to enable the utilisation of TME these are:

1. Blending of various Methyl esters e.g., RME, SME, UCOME etc
2. Blend out with mineral diesel at B5, B10, etc
3. The use of winterisation additives
4. Vehicle modifications

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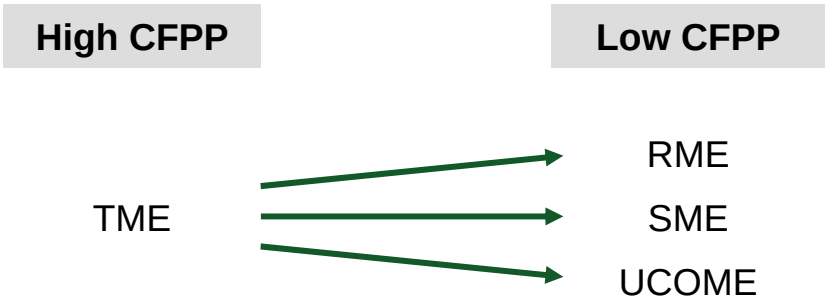
Utilisation of TME as a fuel

Blending with Methyl Esters

- A composite methyl ester comprising of 2 or 3 individual components can reduce the overall CFPP



- The outcome can be predicted for any mixture as it is almost linear with the highest degree of deviation being for 50:50 mix which is normally between 1-1.5ºC.

- A 50:50 blend of RME at -6ºC and TME at 9ºC would give a combined CFPP of up to 3ºC and would have a far lesser impact on the B5 or B10 mineral diesel blend.

- It is possible to optimise the blend in order to meet economical constraints of biodiesel feedstock and at the same time give good blending characteristic with mineral diesel.

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Utilisation of TME as a fuel

Blend out

- Current blending in the EU is based around a B5.
- At these levels you would encounter a loss of CFPP of between 1-2ºC when using TME and slightly less for others types of methyl esters.
- This loss can be offset by increasing the winterisation base temperature inline with the anticipated loss.

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Utilisation of TME as a fuel

Additives

Argent has carried out tests in the UK looking predominantly at TME and UCOME with a leading additive manufacturer.

- Additives were used on pure biodiesel comprising TME, UCOME and TME/UCOME and also in the mineral diesel blends (B5 up to B20).
- Initial results saw improvements of up to 5ºC in CFPP and 2ºC for cloud point.
- It is best to ‘uptreat’ after blending with the mineral diesel.
- The ongoing work will investigate the impact of additives on fuel operability. It is already established that the introduction of additives, as above, has no impact on filterability.

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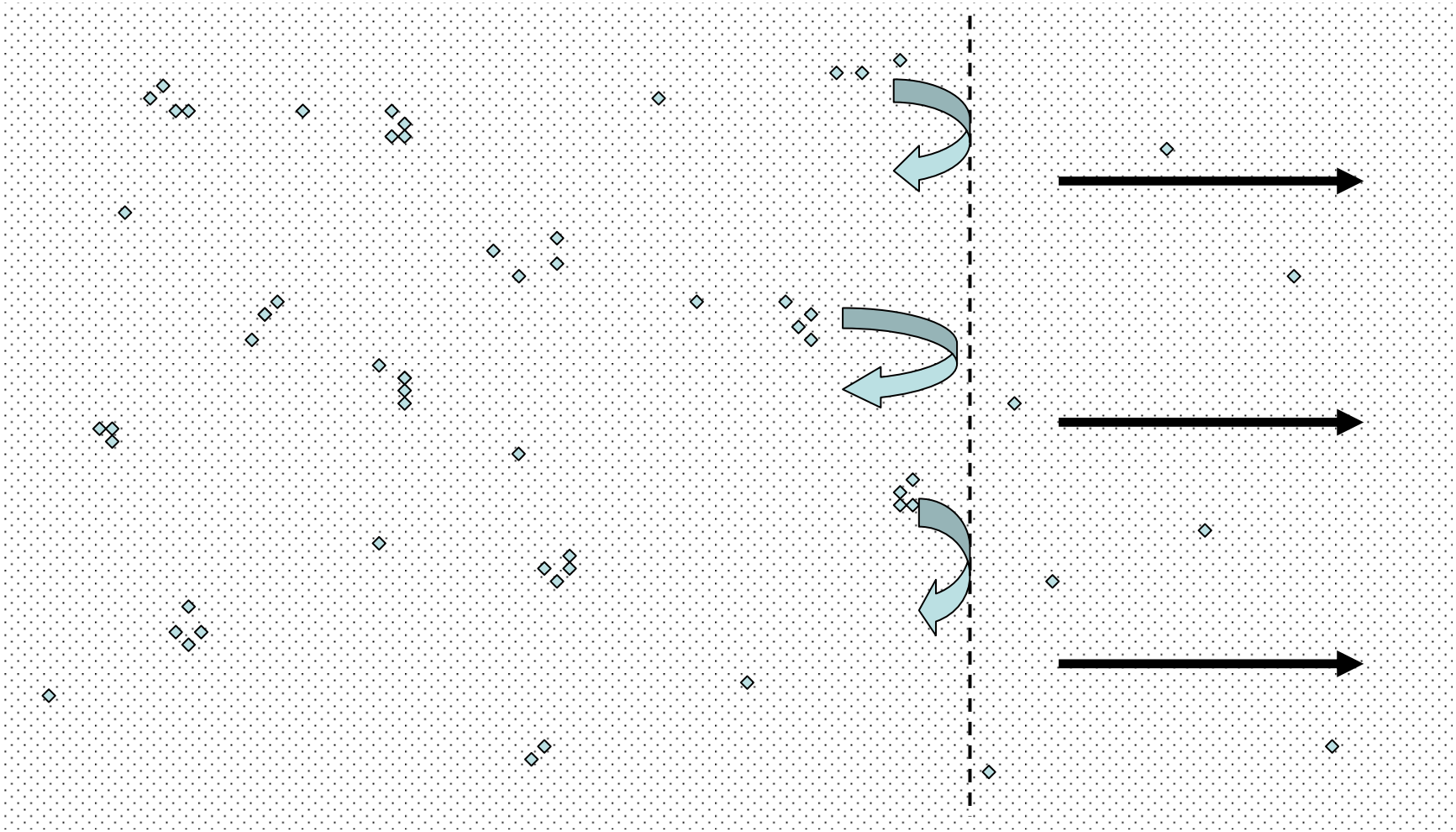
Cold Diesel/Biodiesel



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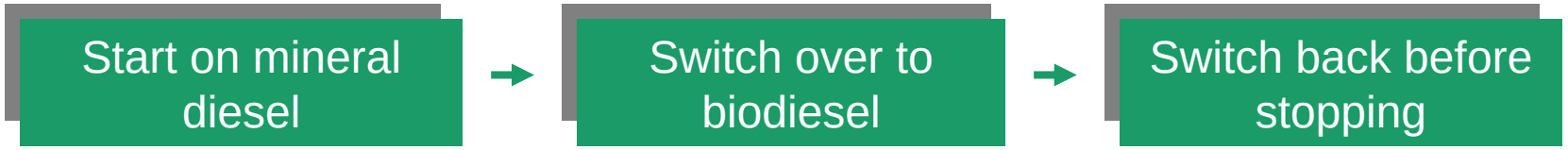
Utilisation of TME as a fuel

Vehicle Modifications

- Currently, vehicles using B5 blends do not require modifications, however higher blends of TME would require certain enhancements.

- Modifications have already been made to vehicles in the EU that involve.

  – heated biodiesel tanks using exhaust gases to ensure that crystallisation does not occur.
  – Duel tank system (biodiesel/mineral diesel).
  – Modified operational profile.



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Way Ahead

1. Test NZ mineral diesel with blends of biodiesel to achieve the required CFPP results.

2. Further to B5, continue work on winterisation products.

3. Work with fleet operators and others to implement any engine, training, operational or maintenance modifications to allow blends of B10 to B100.

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Summary

- Fuels with higher degree of saturated components result in higher CFPP.
- All fuels require some degree of treatment to meet winter characteristics.
- Higher utilisation of TME can be achieved:
  - Blending high and low CFPP methyl esters
  - Blending out with mineral diesel and incorporating a winterisation offset
  - Use of additives that can improve the CFPP of the blended fuel
  - Vehicle modifications involving duel and heated tank along with a modified operational profile to allow B100
- It is working elsewhere in the world - we just need to ensure the right outcomes in New Zealand.

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