

# Minor change – major consequence

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# Case study

- Winter diesel in colder climates differs in composition to summer diesel
- Additives are added to prevent waxing of the refined diesel
- There are ASTM standards that specifies the criteria for the various grades of petroleum derived fuels
- Tests were carried to characterise winter fuel parameters and a test called Cloud Point adopted to define acceptable limit in winter

# Winter grade diesel

- Winter grade diesel is formulated to prevent wax crystals forming at low temperatures, by the use of additives that resist gelling, in extremely cold temperatures. It could be used all year round but normally the diesel used in summer does not contain this additive which helps prevent waxing down to about  $-16^{\circ}\text{C}$ .

# However!

- The tests were developed and adopted about 1970 for cloud point
- The tests were based on the jets and filters used in engines at that time
- Engine development led to improvements that used very much finer filters
- In about 1990, the filters were blocked by the EVA polymer used for suppressing wax formation and many locomotives on British Railways all failed on the same day due to fuel starvation (blocked filters)