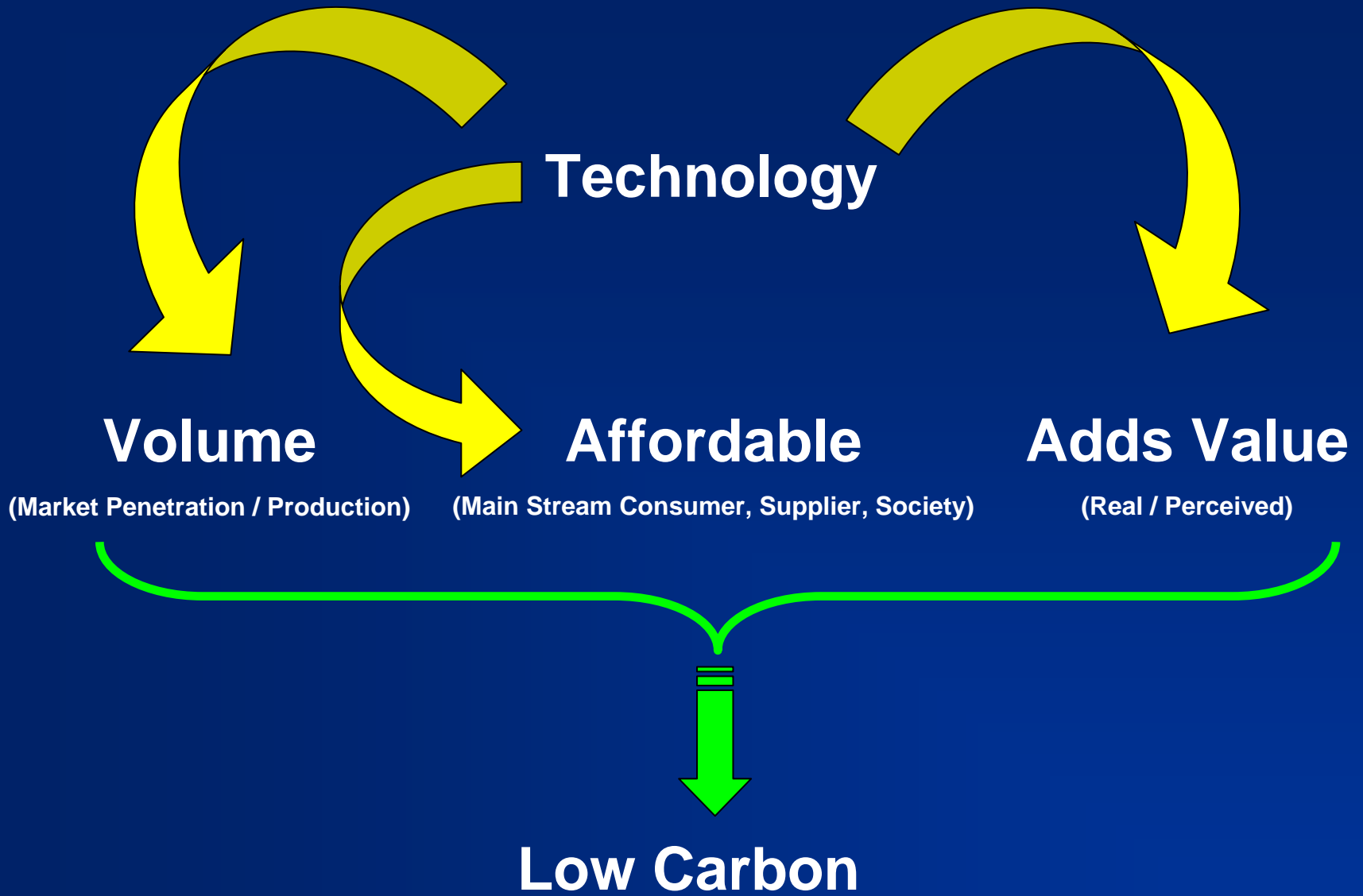


New Technologies for Low Carbon Vehicles

Steve Cautley
Ford Motor Company



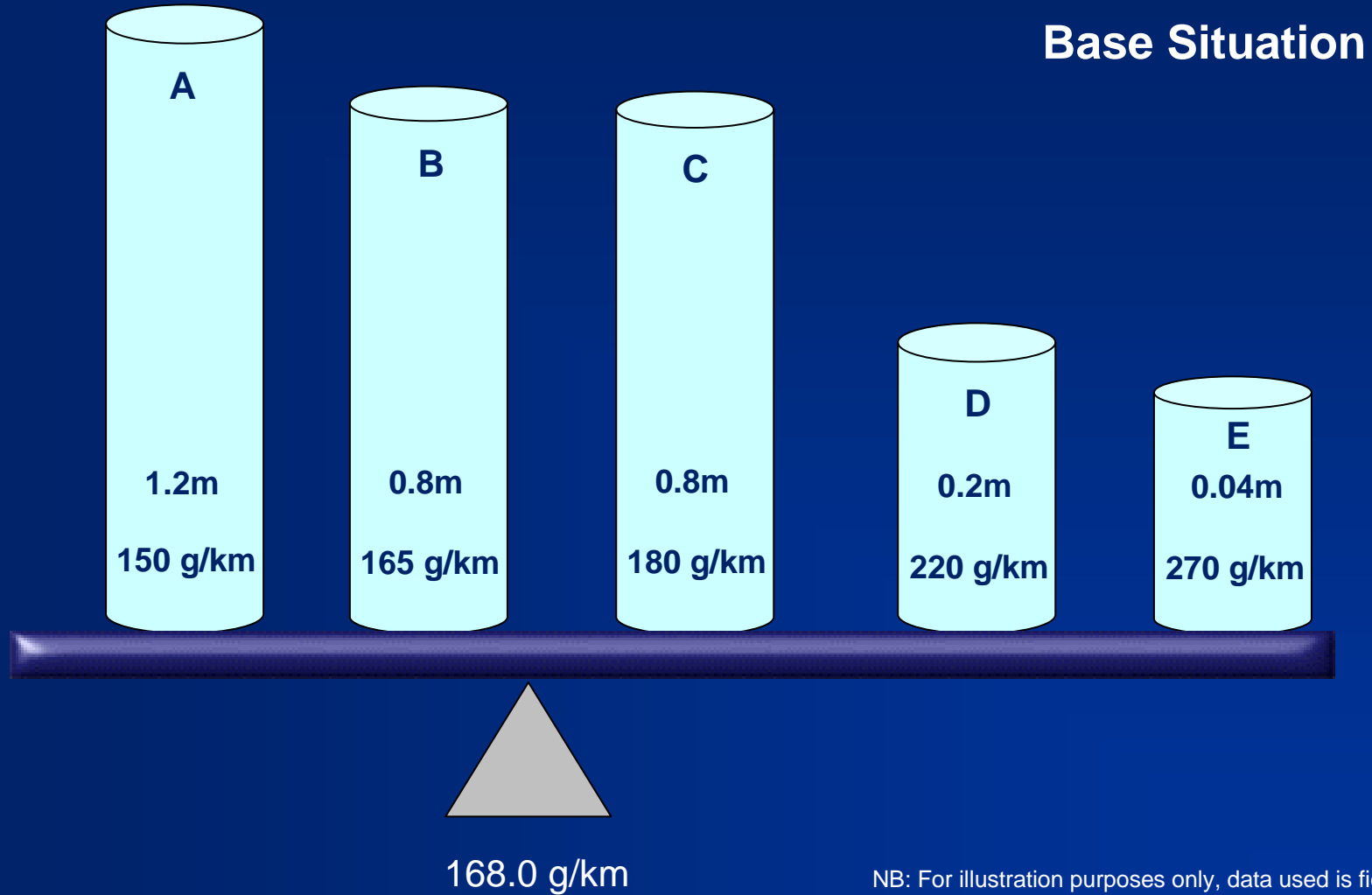


PROPOSITION

Low CO₂ Niche Products & Working at the Margins does not deliver a Low Carbon Market.

Seemingly smaller improvements applied to the volume market have a greater impact in reducing CO₂ emissions.

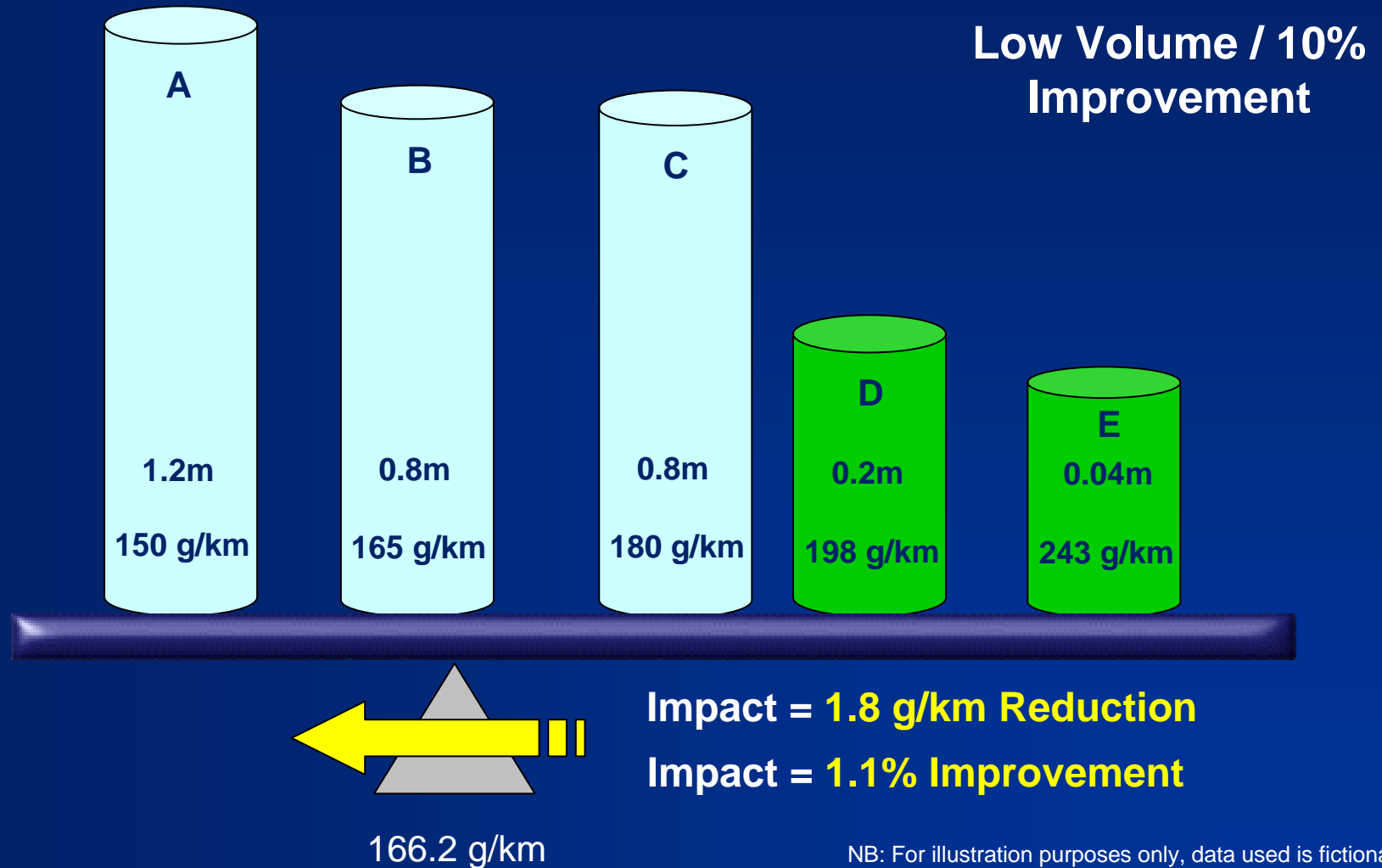
Illustrating The Fleet Average Balance



NB: For illustration purposes only, data used is fictional.



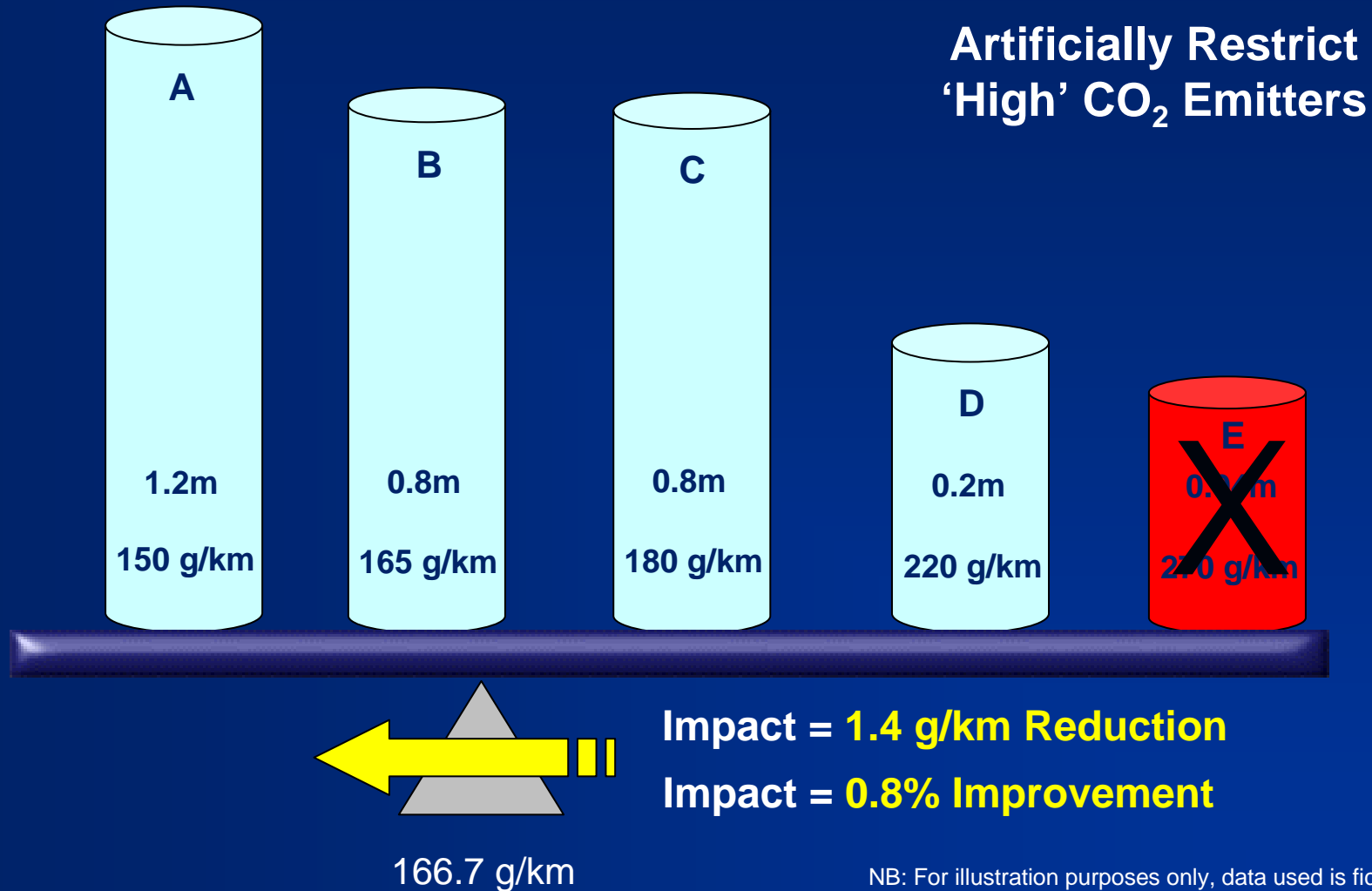
Illustrating The Fleet Average Balance



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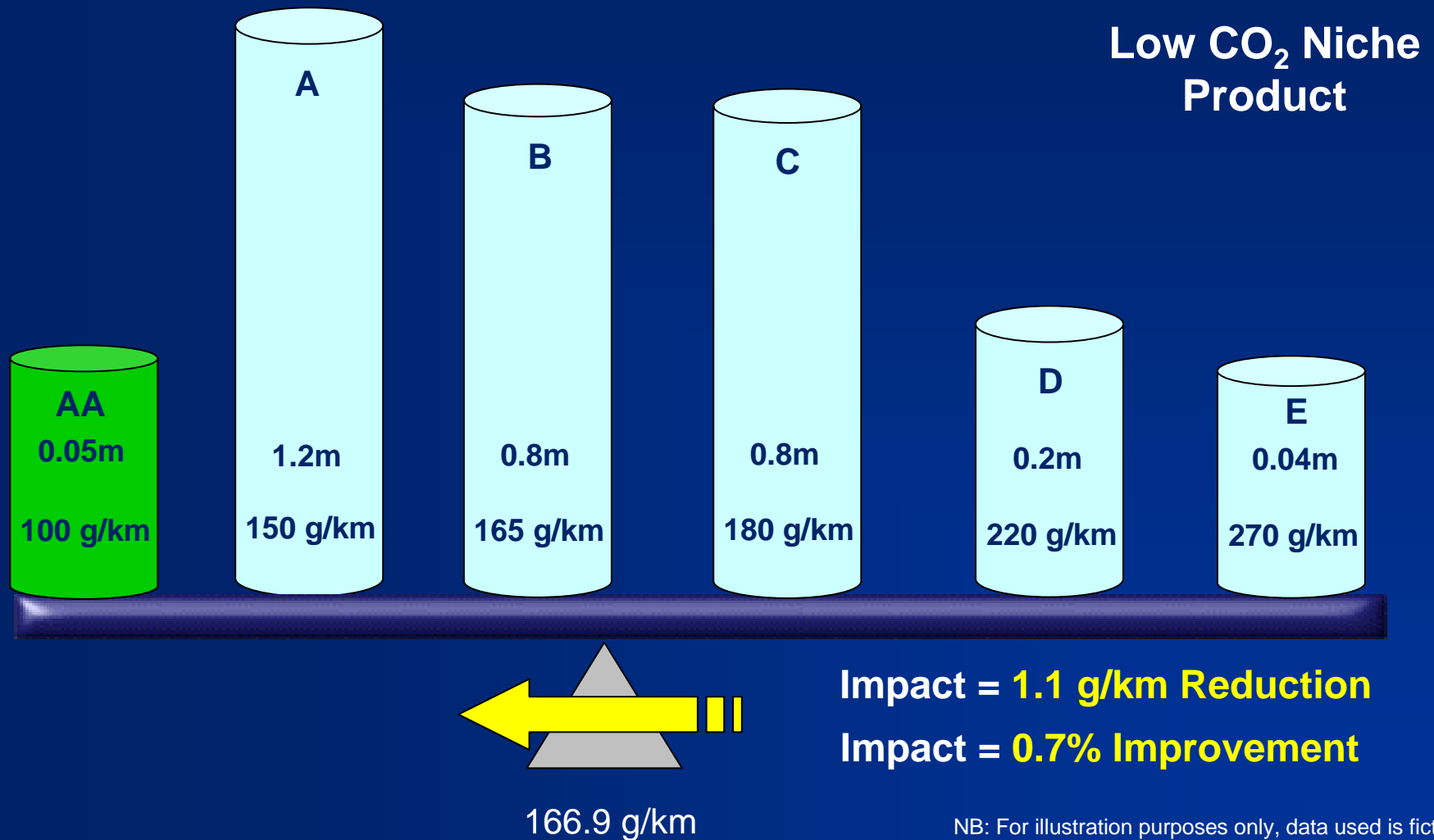
Illustrating The Fleet Average Balance



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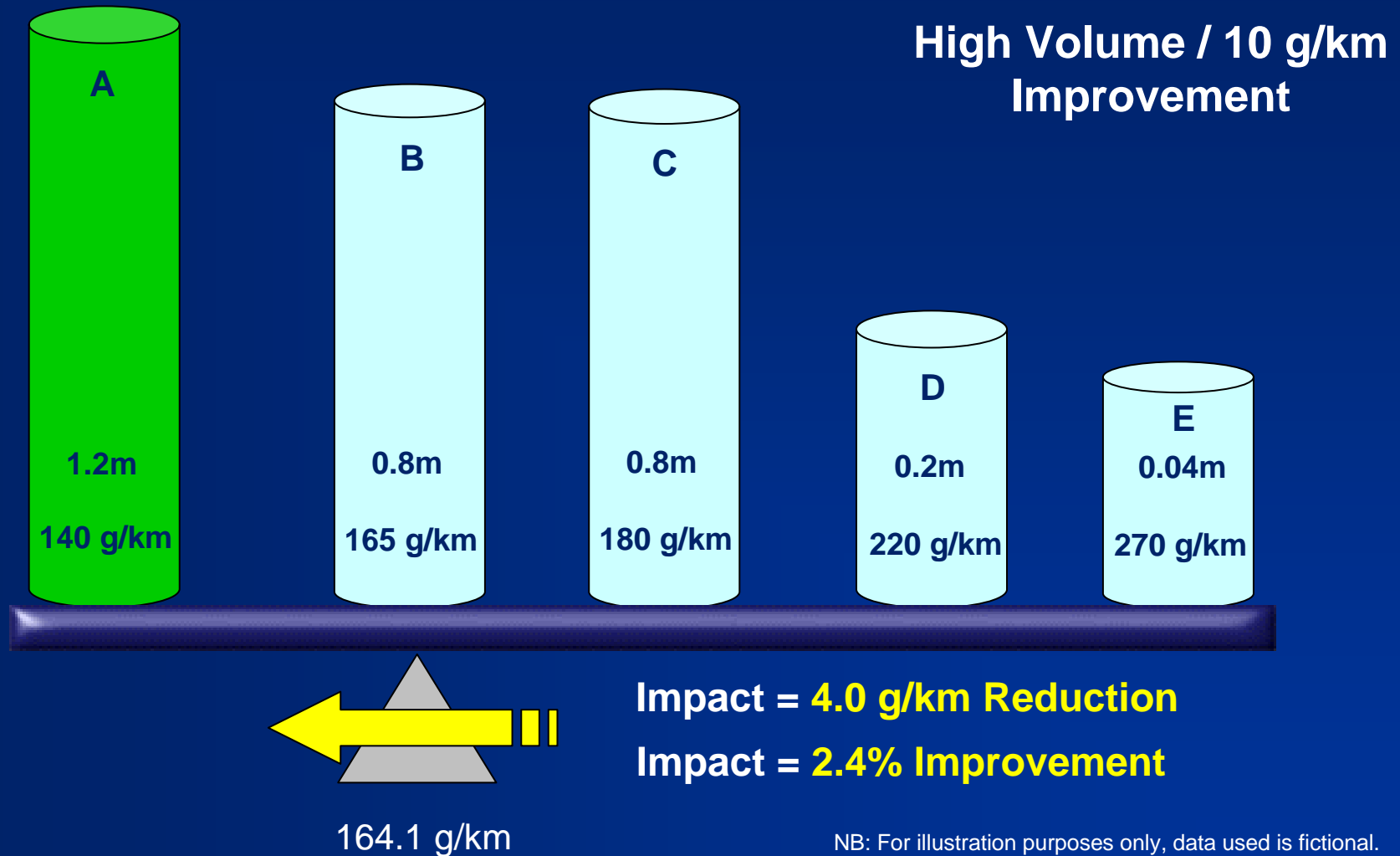
Illustrating The Fleet Average Balance



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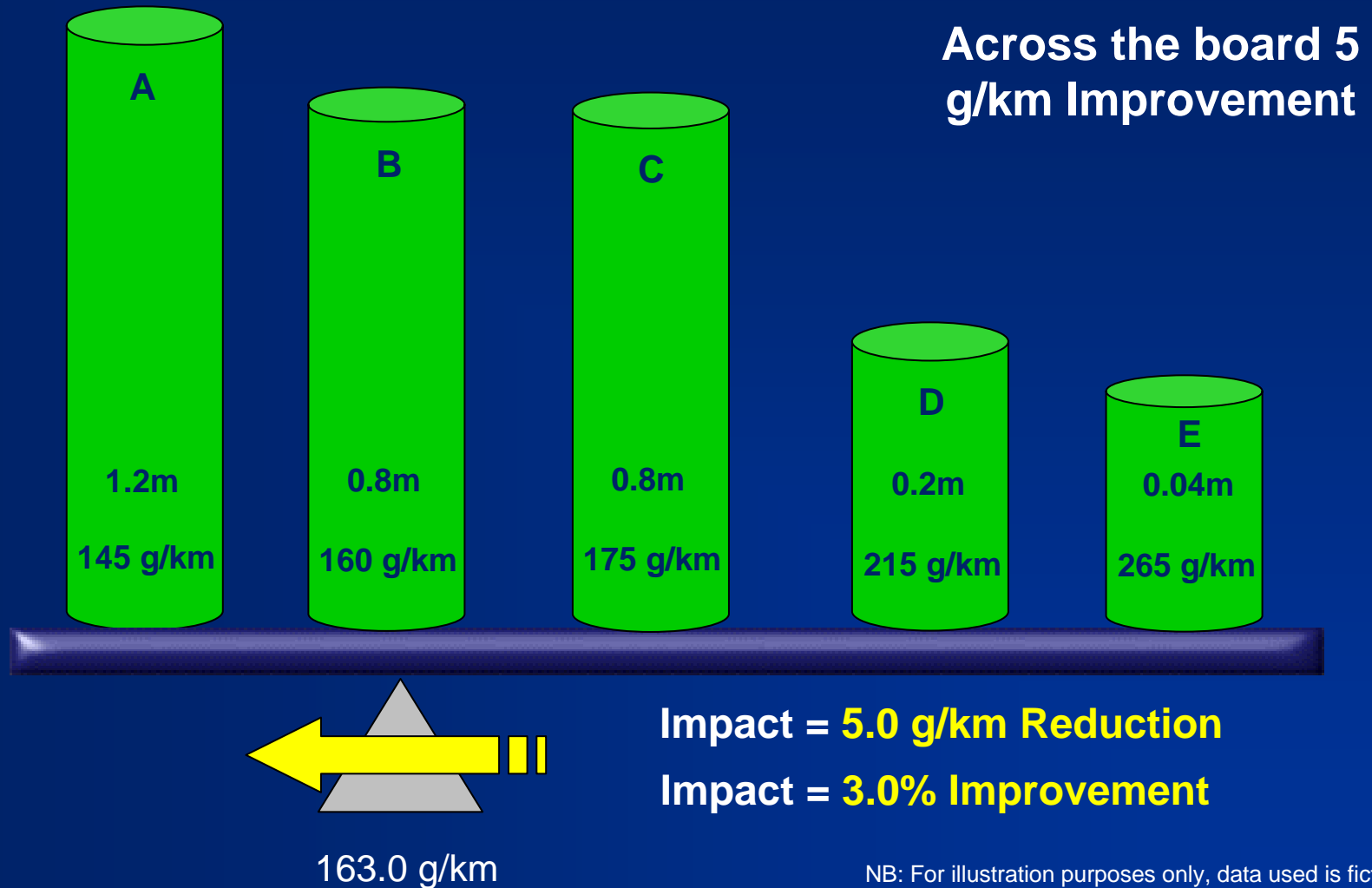
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Illustrating The Fleet Average Balance



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Illustrating The Fleet Average Balance

Position	Scenario	g/km Reduction	% Improvement
1	Across the Board 5 g/km Improvement	5.0	3.0
2	High Volume Company / 10 g/km improvement	4.0	2.4
3	Low Volume / 10% Improvement	1.8	1.1
4	Artificially restrict 'high' CO ₂ emitters.	1.4	0.8
5	Low CO ₂ Niche	1.1	0.7

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Ford Approach

**Introduce Affordable Technology that
Impacts the Volume Market**



Technologies – Fiesta ‘Micro Hybrid’

- Belt-driven Integrated Starter Generator for Stop-Start operation in city driving
- 5 –6% FE benefit on NEDC
- Real world: up to **15 % FE** possible
- Beneficial to align with regen. braking and thermal comfort systems
- Acceptance validated in customer clinic
- Functionality equal to conventional system
- No compromise in driving habits



Technologies - Ford Transit “HYTRANS”

- Ford Transit Micro Hybrid for urban delivery w/ diesel engine
- Fuel Economy improvement in real world urban delivery cycle:
- UP to 21 % FE
- Technology & Features:
 - Belt-Driven Integrated Starter Generator
 - Comfortable & robust stop / start
 - Regenerative braking
 - Stall recovery
 - Advanced Lead-Acid battery
 - Battery Management System



Technologies - Focus Flexible Fuel (Ethanol)

- Only sold by Ford
- Since its launch in 2001:
already 13,000 units on the road
in Sweden
- Bi-fuel – Gasoline / E85
- Tailpipe CO₂ = 172 g/km
- Well 2 Wheel CO2 Emission =
50% to 70% reduction by using
bio-ethanol
- New Model – June 2005 (Focus
& C-Max)
- UK Fleet trial planned end 2005
- Sustainable Transport Solution
– Fuel Provider, Vehicle
Manufacturer, Customer



Longer Term Technologies - Ford Focus H₂ ICE

- Ford Europe: 2 prototypes with hydrogen internal combustion engine
- Base engine: 2.3 L 4 cylinder gasoline engine: 110 PS (82 kW)
- Different packaging
- Special safety system
- 350 bar compressed hydrogen; 3 tanks: 119 L = 3.5 kg
- 200 km range



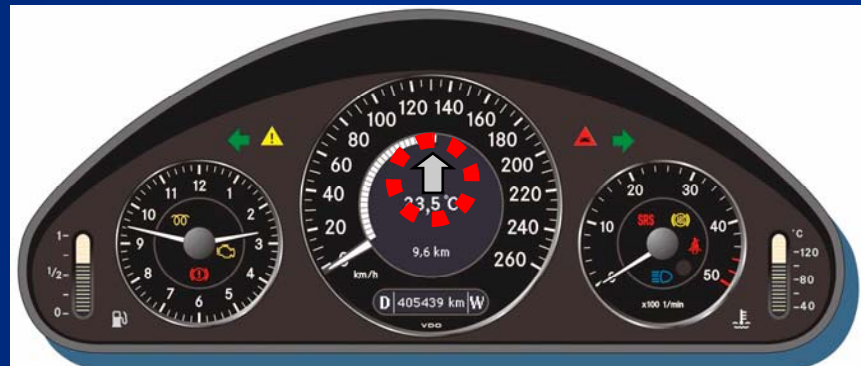
Longer Term Technologies – H₂ Fuel Cell Focus

- Zero Emission vehicle – only exhaust waste = H₂O
- Production fleet of 60 vehicles launched late 2004 - 4 in Europe
- Fully engineered vehicle programme
- 3 Year programme - USA, EU & Japan
- Plan for next generation 2007.
- Meets all US cert. requirements
- Fleet testing with selected fleet operators started early 2005
- 5 vehicles - Vancouver, Canada
- 3 Vehicles Clean Energy Partnership, Berlin



Solutions & Conclusions

- Niche products alone will not move the fleet CO₂ dial significantly.
- Small improvements applied to volume products have a greater effect.
- Solutions must be affordable and have perceived / real value.
 - Eg. Gear Shift Indicator – Low Cost Innovation, delivers CO₂ reduction on NEDC and in Real World, Engages Consumer.



Solutions & Conclusions

- ?? Could the key to success be:
 - To make **progressive incremental technology steps** to improve CO₂ efficiency
 - Make each step **affordable**
 - **Do not frighten** the consumer with too much of a step
 - Make sure each step provides **actual / perceived** additional features and **benefits**.
- An **Open Market** leads to **competitiveness**, which leads to **Innovation**, which leads to **Improvement**



