



2024 RAC SHORTLINE CONFERENCE

Wabtec Sustainability

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Locomotive Technology Road Map for Sustainability

2022

2024

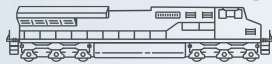
2026

2028

2030+

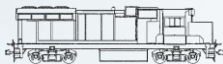
FUEL SAVINGS

AC44 – FDL Advantage



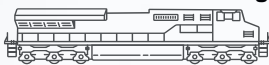
5% SFC Reduction

ET23



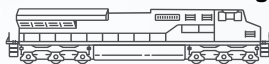
~15% SFC Reduction

ES44AC – EVO Advantage



~5% SFC Reduction

ET44AC – T4 Advantage



~5% SFC Reduction

HS44AC – EVO Hybrid



10-15% SFC Reduction

CARBON REDUCTION



Up to B5
Up to R30

~20% CO₂ Reduction



Up to B11
Up to R50

~37% CO₂ Reduction



Up to B20
Up to R100

~60% CO₂ Reduction

H2 ICE HHP/tender



Main line locomotive
EVO T3/T4T Advantage Dual Fuel H₂

ZERO LOCOMOTIVE EMISSIONS

BATTERY

BEL Demo



2.4 MWh

FLXdrive



~8 MWh

FLXswitch



~3 MWh

FLX H2 Demo



Switcher / Short line

H2 Fuel Cell HHP/tender



Main line locomotive
Fuel Cell + Battery

FLXdrive 3.0



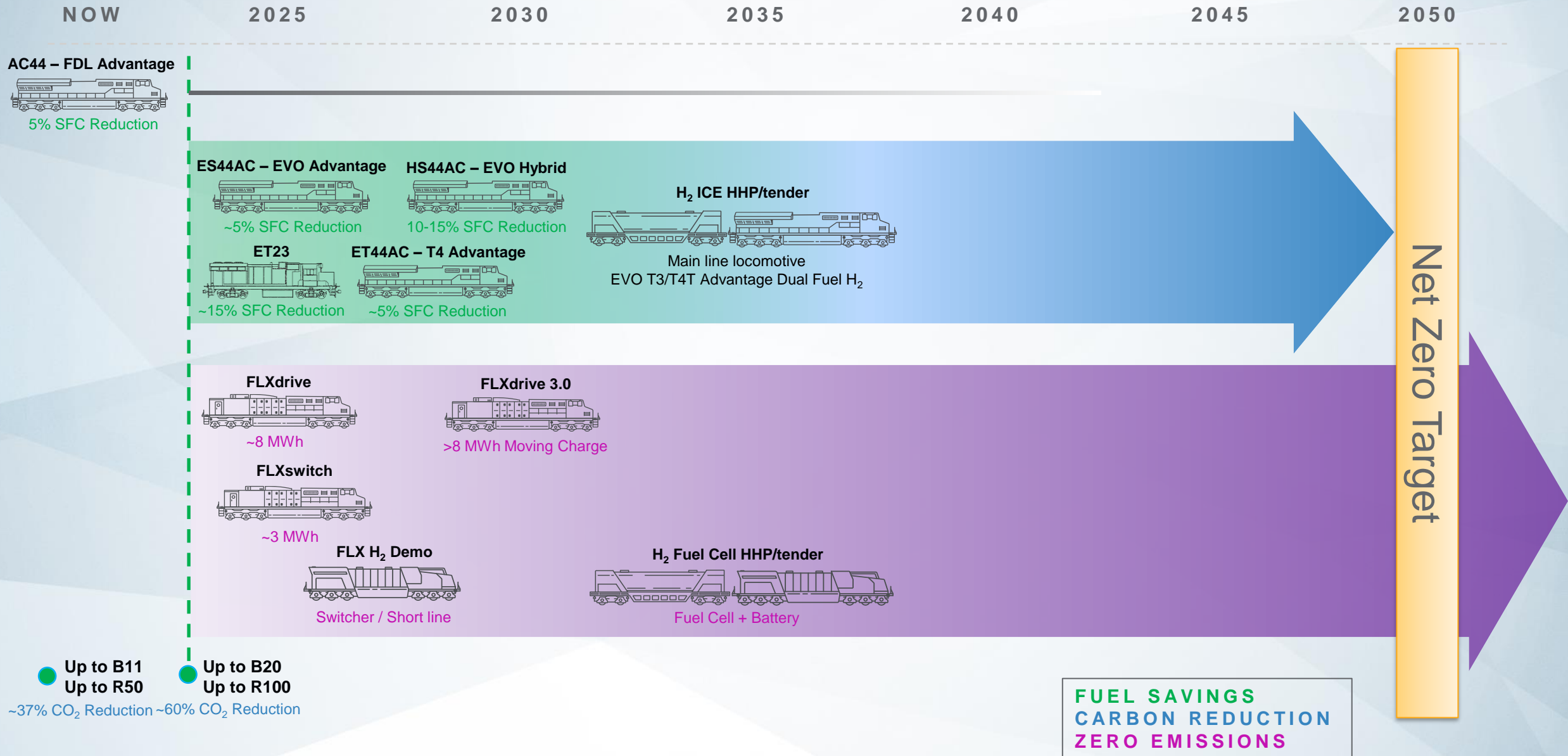
>8 MWh Moving Charge

MOVING CHARGING

Net Zero Fleet Transition (2050)



Sustainable Locomotive Technology Fleet Planning

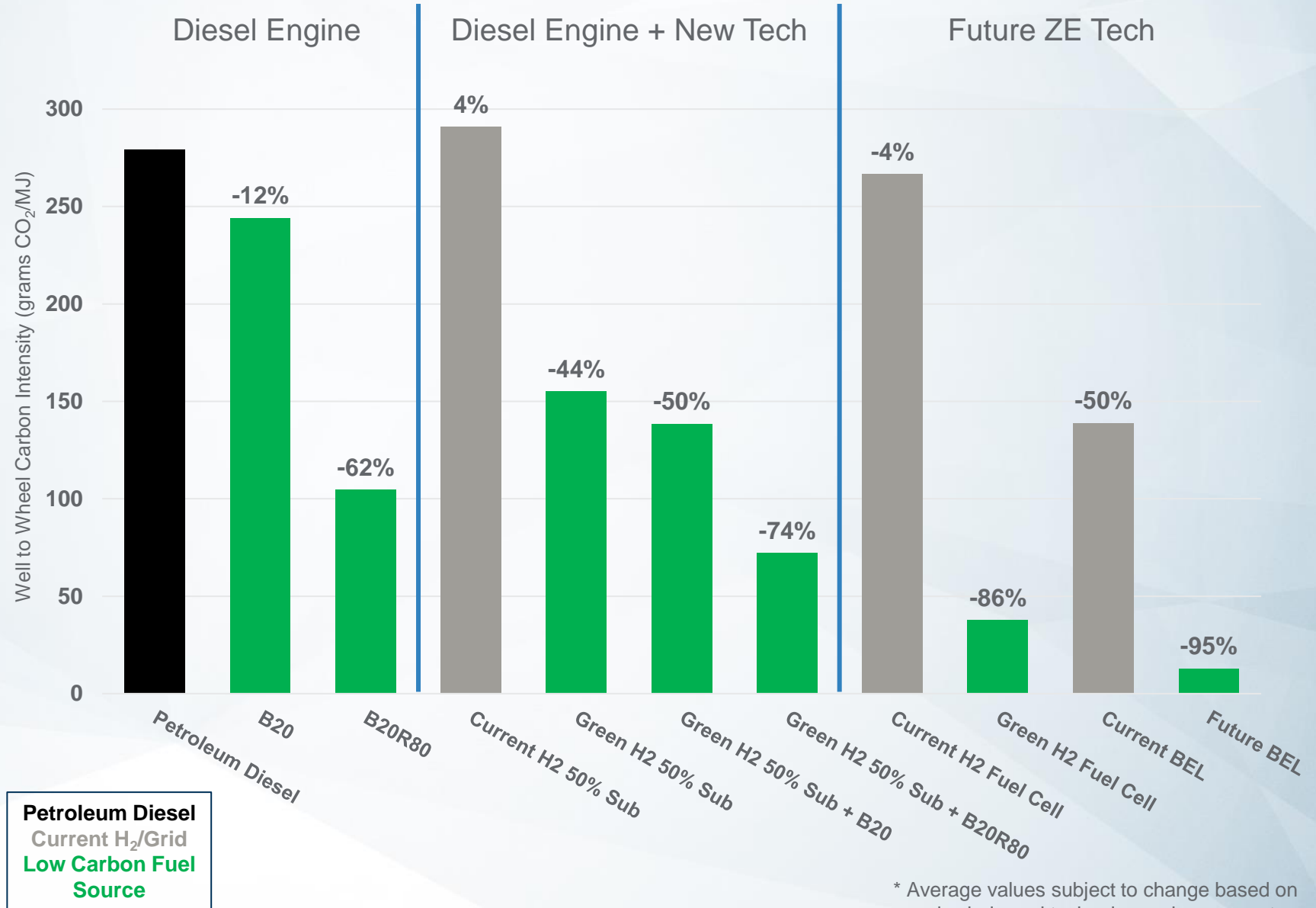


CI REDUCTION
PRODUCT CAPABILITY

Well to Wheel Comparisons

- Internal Combustion Engine (ICE) can significantly reduce carbon intensity
- Biomass-based fuels can achieve lower carbon intensities today than technologies like fuel cells and battery electric with current infrastructure/supply

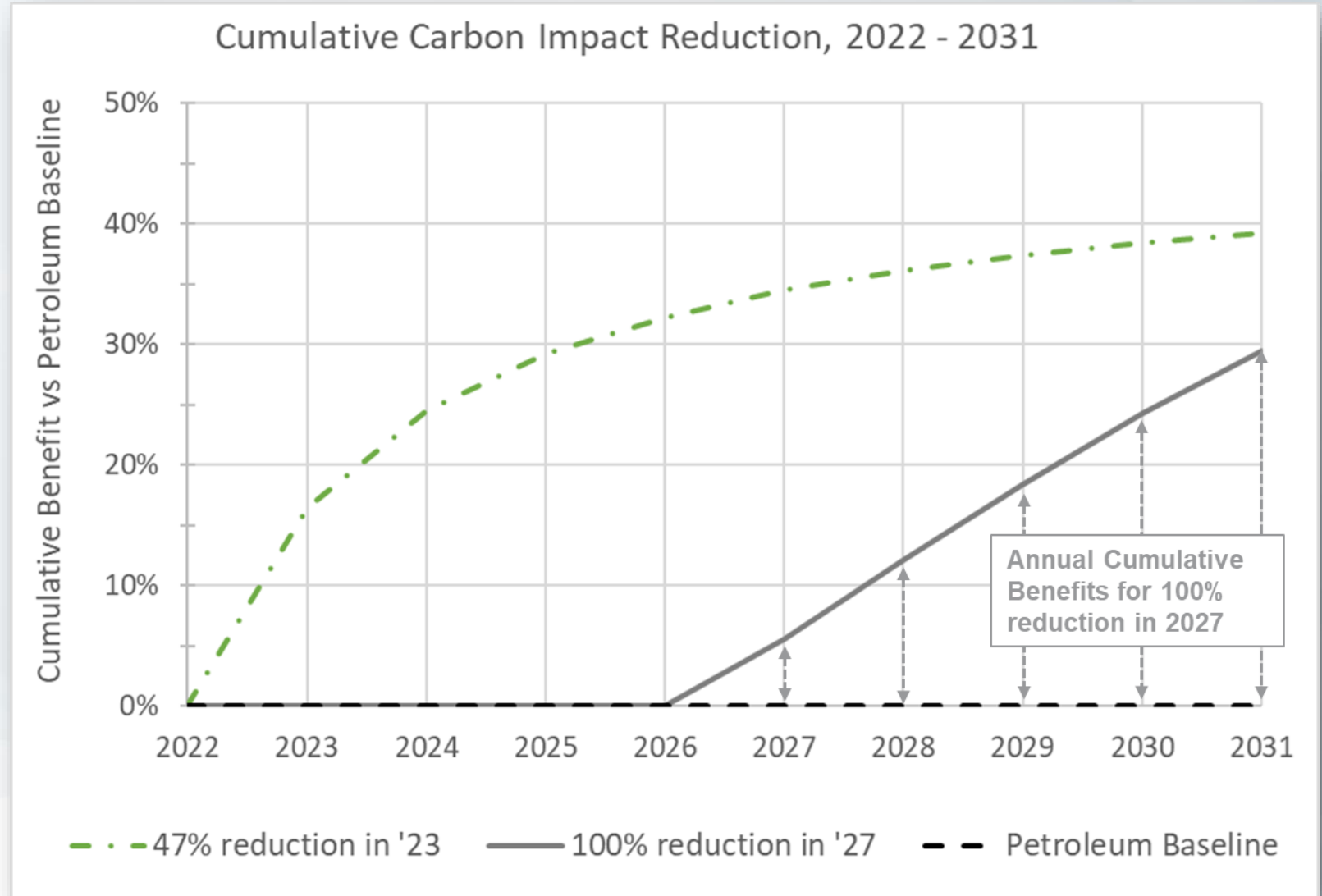
Well-to-Wheel Carbon Intensity of Various Locomotive Technologies*



GHG REDUCTION

Cumulative Carbon Impact

- Looks at the cumulative level of GHG in the atmosphere, not the current level of emissions
- More accurately determines the extend of the warming effect of GHG emissions on the planet
- GHG persist in the atmosphere creating negative impact for many years



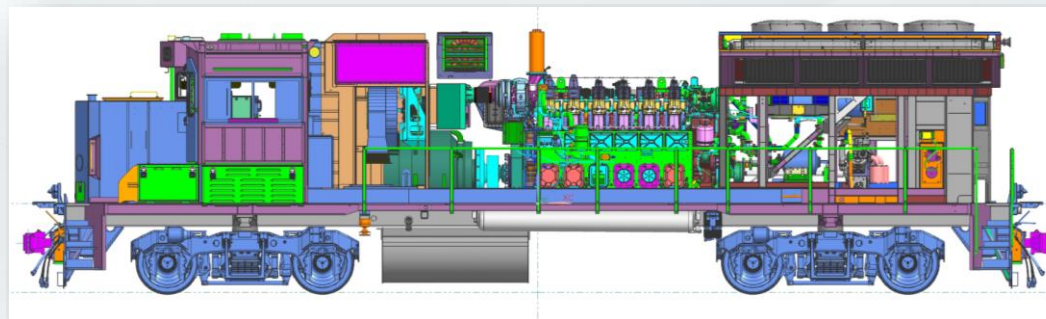
ET 23

T4 Repower... Leverage existing GP/SD's

Features:

- EPA T4 Certified & CARB Verified
- In-line, 6-cylinder engine, shared technology with 4,500HP V12
- No exhaust aftertreatment
- Reuse existing propulsion & traction equipment
- Applies to GP38-2, GP40-2, and SD40-2
- **85%+** NOx & PM reduction (T4 vs. T0+);
- **~15%** fuel savings
- **50%** oil consumption reduction
- **20+** year OH cycle
- Future Hydrogen internal combustion engine (ICE) capabilities

Available starting Q4 '25 for ET23C and Q2 '26 for ET23B



4-axle (ET23B)

GP38-2 and GP40-2 Donor
286,000 lbs max weight
65 mph max speed
Plate M Clearance
1,700 gallons fuel capacity



6-axle (ET23C)

SD40-2 Donor
432,000 lbs max weight
65 mph max speed
Plate M Clearance
3,600 gallons fuel capacity

Proven mid-speed engine designed for rail ... no aftertreatment

Diesel Engine & Drive Train

T4 EVO Inline 6 Engine (2,350 HP)
Driveshafts for AR10/CA5, Aux
Gen, and Air Compressor

Traction & Drives

OH AR10/CA5
OH Trucks & Combos
OH 18kW Aux Gen

Control System

BrightStar Control System
Tier 4 Engine Controller
AESS equipped

DB & Ventilation

Extended Range Dynamic Braking
AC Driven Equipment Blower
OH DC exhauster

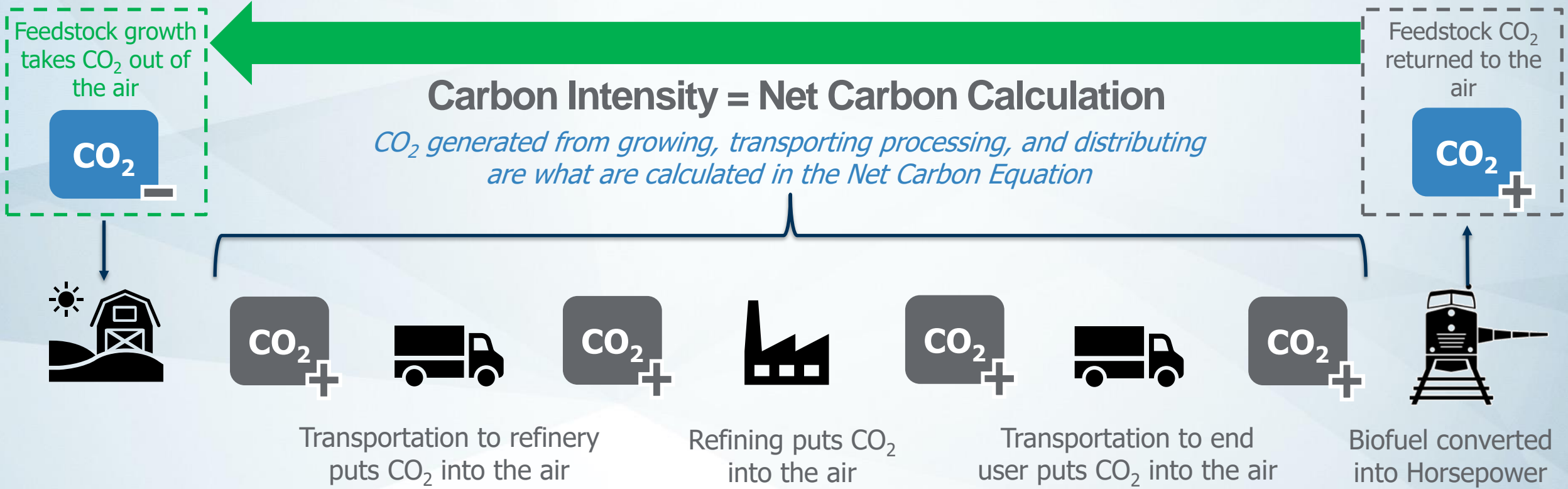
Operator Cab

Refresh Flooring, Windows & Seats
Rooftop Air Conditioning

BIOFUEL

Carbon Intensity (CI) Reduction

Biofuel ranges from **20 to 50** gCO₂/MJ versus petroleum diesel of **100** gCO₂/MJ





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CORPORATION