

The logo for CIMAR (Center for Integrated Marine and Atmospheric Research) is a circular emblem. It features a central lighthouse with a multi-tiered top, flanked by two circular motifs resembling gears or propellers. Below the lighthouse is a gear-like structure. The entire emblem is enclosed within a circular border with a decorative, segmented pattern.

2-Stage Turbocharging and VVT

**Two technologies in one package enhancing
performance in future marine engines**

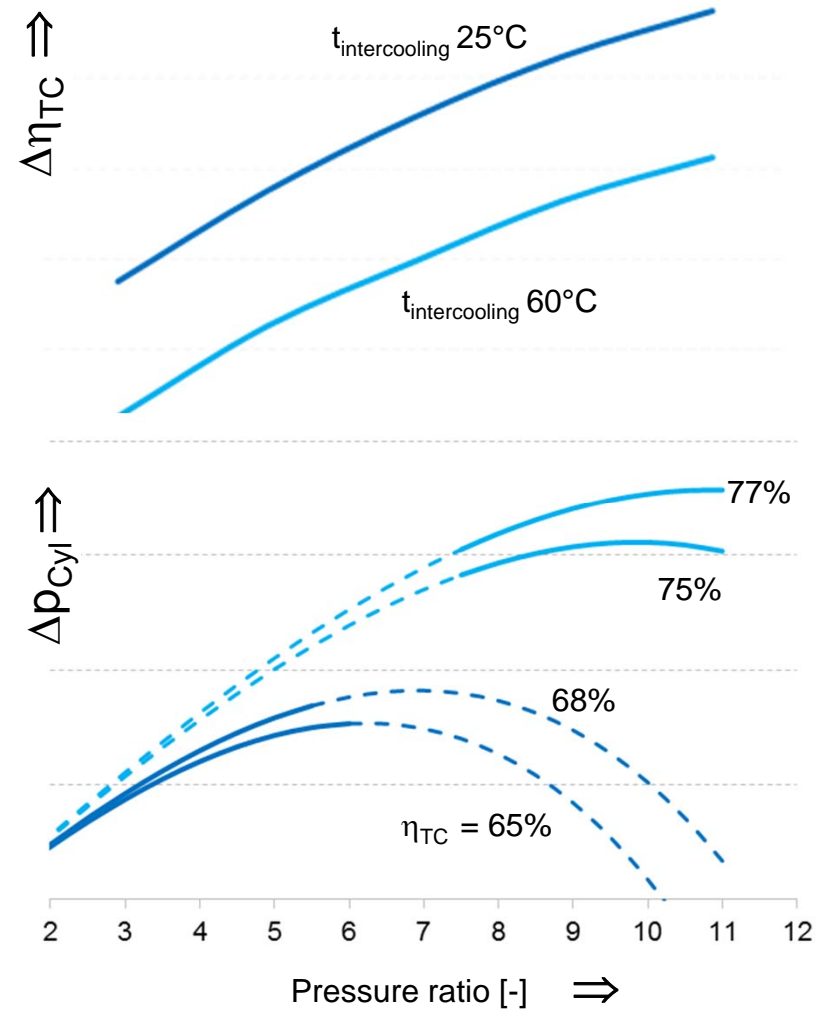
2013-12-05

2-Stage Turbocharging



- ⇒ **Pressure ratios up to 12**
- ⇒ **Turbocharging efficiencies over 75%**

- ⇒ **With higher pressure ratios:**
 - Increase of η_{TC}
 - Increase in Δp_{Cyl}
 - More compact 2-stage system



Advanced Variable Valve Trains



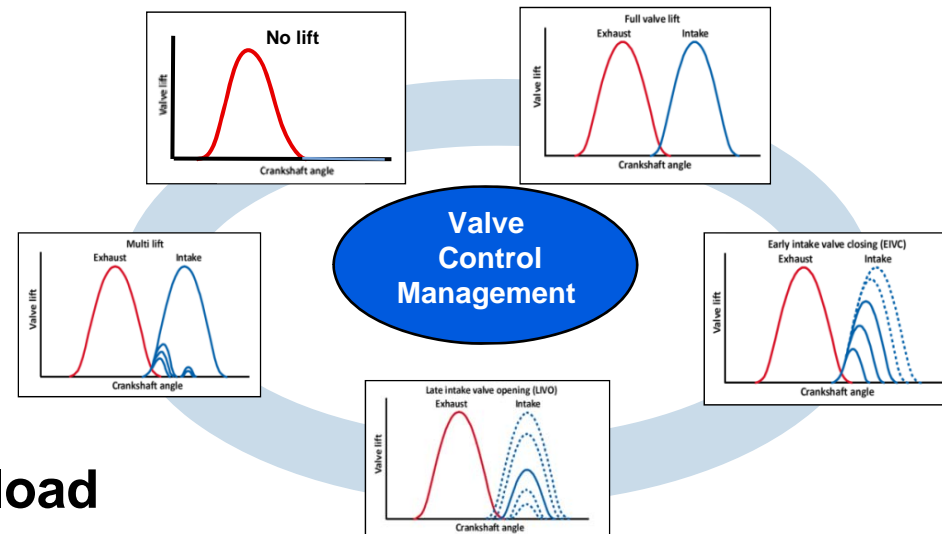
⇒ Individual valve control

- Closing time
- Opening time
- Lift height

⇒ Steep closing flanks

⇒ No increase of mechanical load

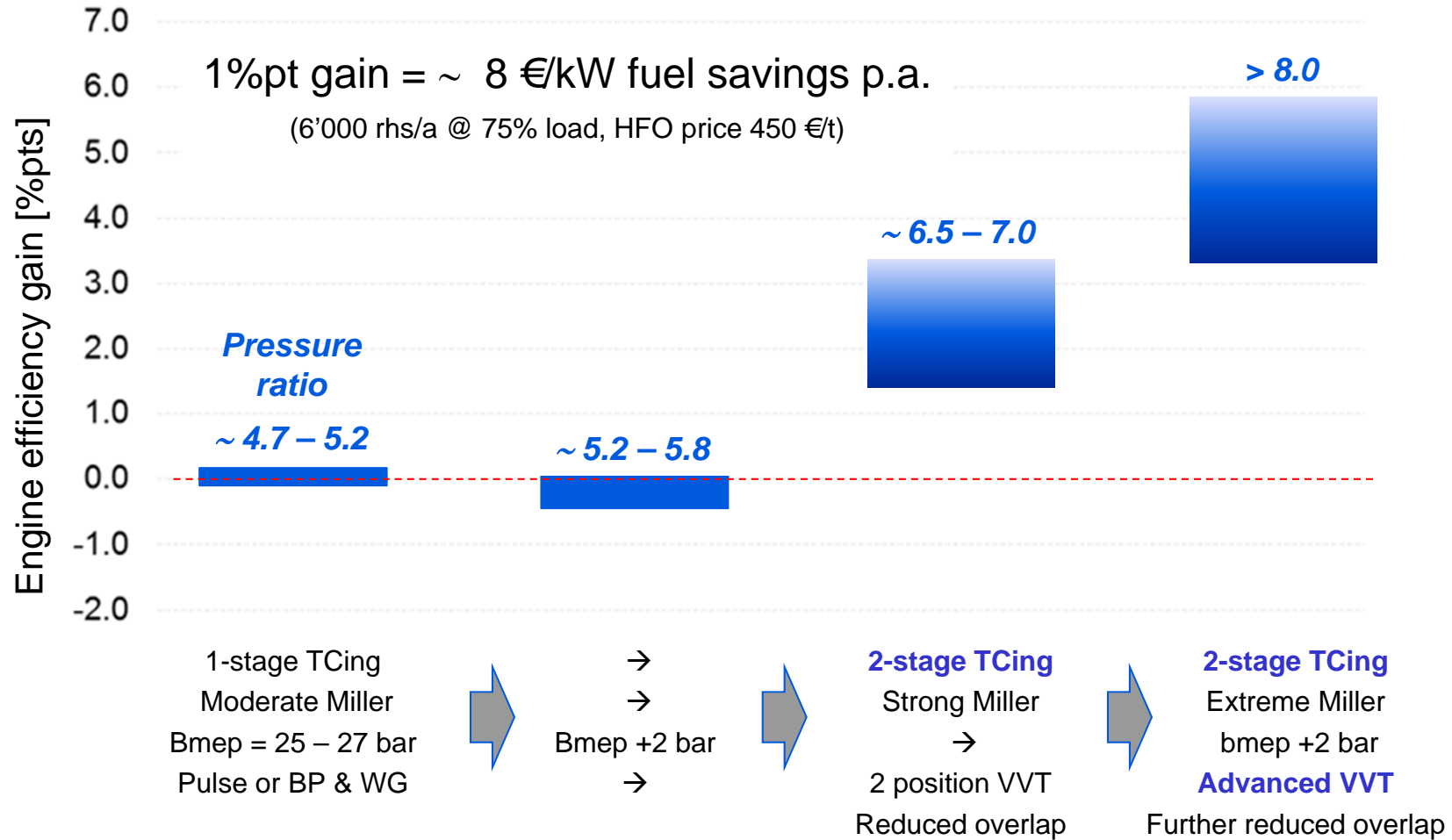
⇒ Variation from cycle-to-cycle





Medium-Speed Diesel (FPP, E3 cycle)

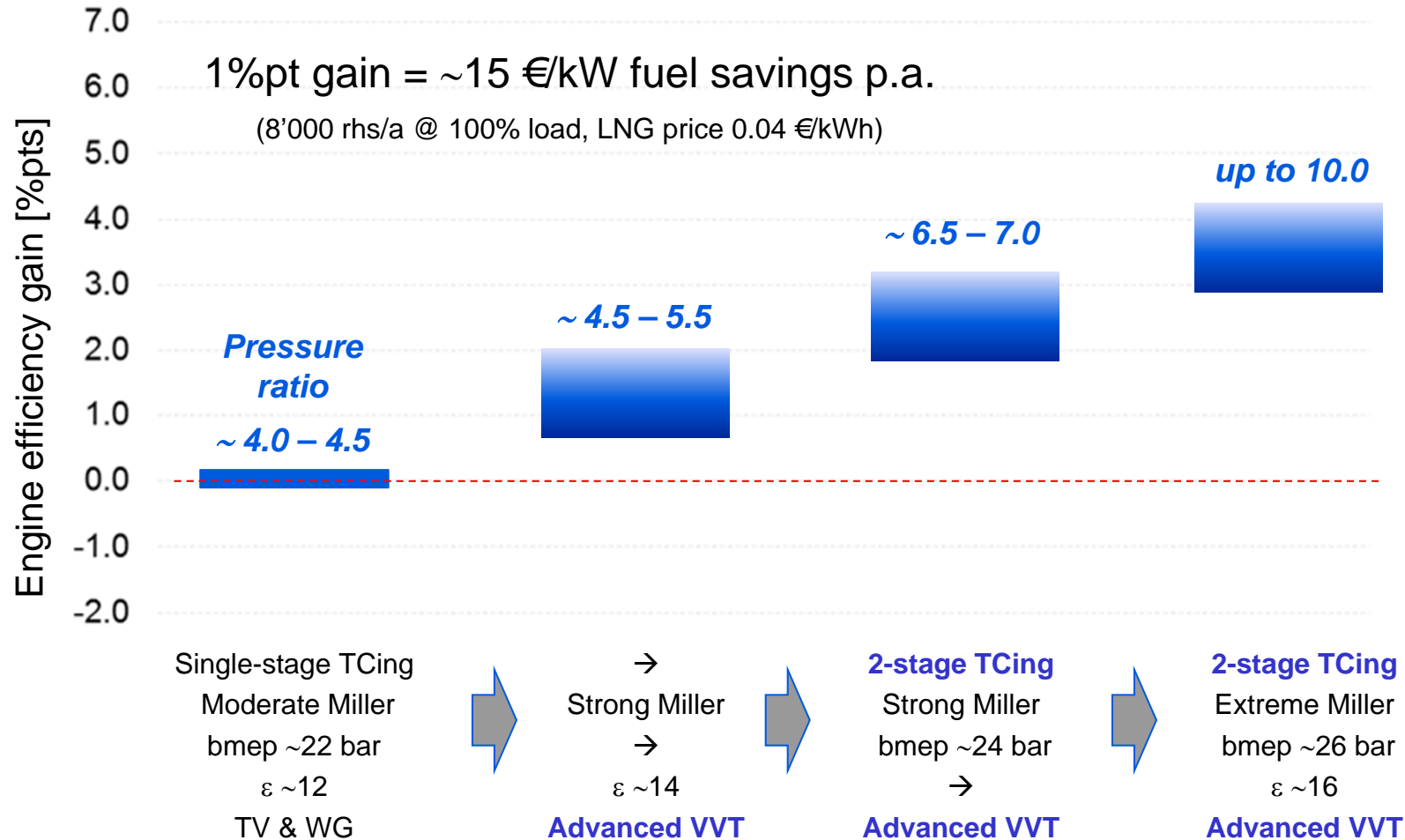
Potential consolidated based on simulations and test results





Gas (n=const, 100%)

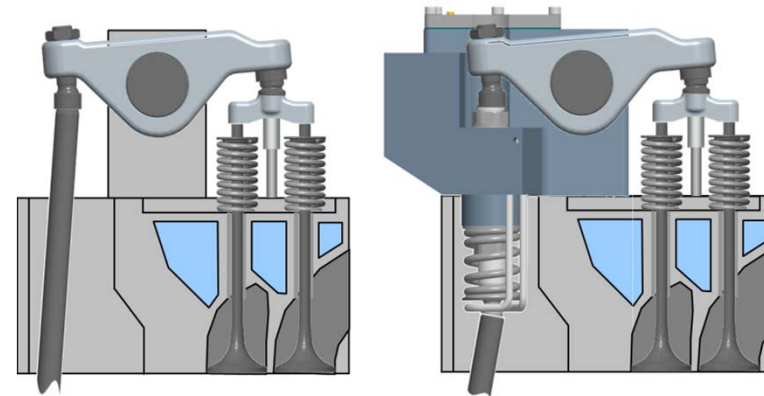
Potential consolidated based on simulations and test results



Further Potentials

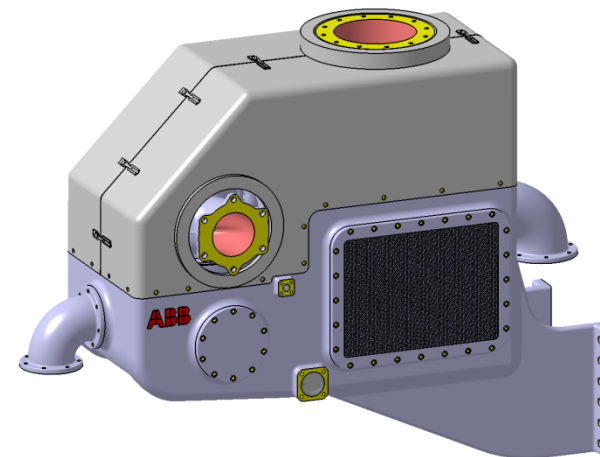


⇒ On engine integration,
standardization and service
friendly design



Conventional valve train

Advanced VVT



Integrated 2-stage turbocharging module