

CIMAC Circle Powergen Amsterdam 2015



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Compliance to Emission Regulation



Emissions

Hazardous

- NO_x
- SO_x
- CO
- Particles, dust
- Formaldehyde
- NMVOC
-

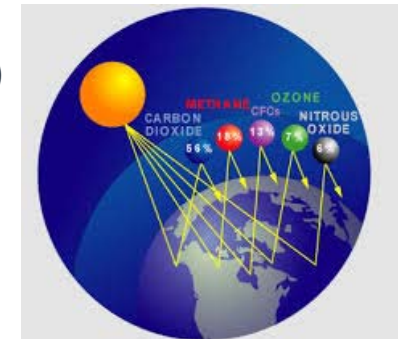


Regulatory

- little economical interest of industry to remove these substances
- Protection of society against hazardous substances is must do
- Identify limits and cast this into law

Greenhouse

- CO₂
- CH₄ (Methane)
- NO_x
- ...



Regulatory

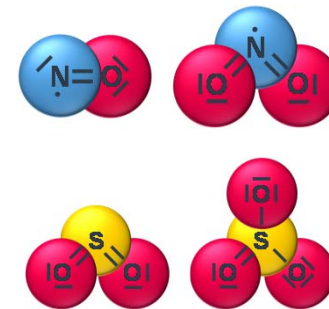
- High economical interest of industry as reduction of CO₂ and CH₄ always goes along with increase of engine efficiencies
- Regulatory limits should be based on greenhouse gas equivalents instead separate limits for CO₂ or CH₄
- Win – win position for industry and society

Emission Compliance Summary



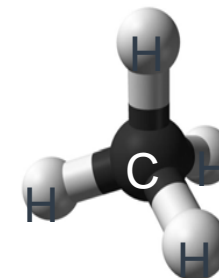
1. Hazardous Substances

- Solutions for emission compliance of most hazardous substances are well known and proven technologies
- Remaining issues are small NMVOCs ethane, ethylene, and formaldehyde
- Blending of biogas into LNG is detrimental to emission reduction, due to poisoning of catalysts
- There is significantly lower investment cost for gas engine after treatment systems, compared to liquid fuel HFO engines with DeSOx and particle filtering systems



2. Green House Gas

- Gas engines provide a 20% lower green house warming potential (GWP) compared to Diesel engines
- Remaining issues are centred around methane slip. There are continuous improvement programs ongoing at the labs of the engine manufactures

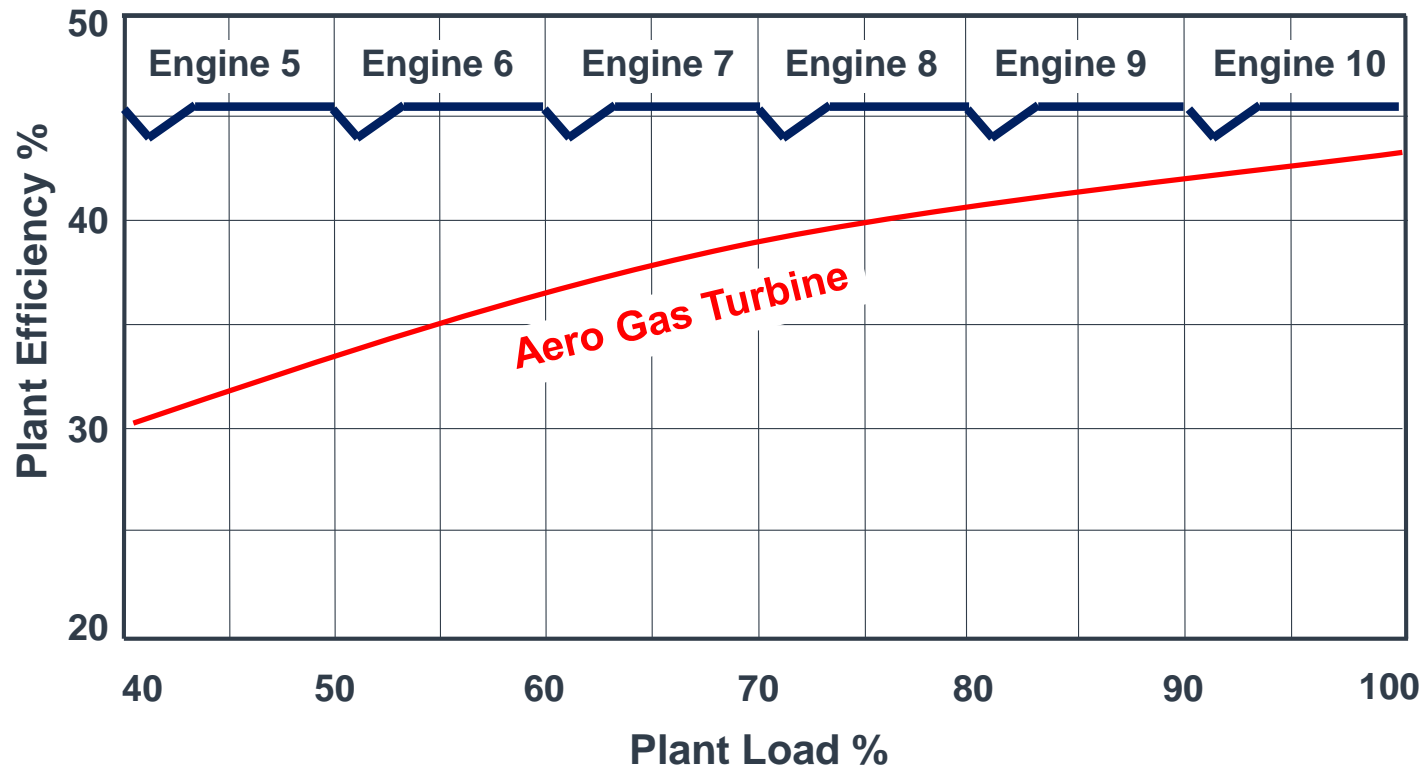


Power flexibility

Low Emissions and High Efficiencies



Emission advantage: high efficiencies in plant part load operation



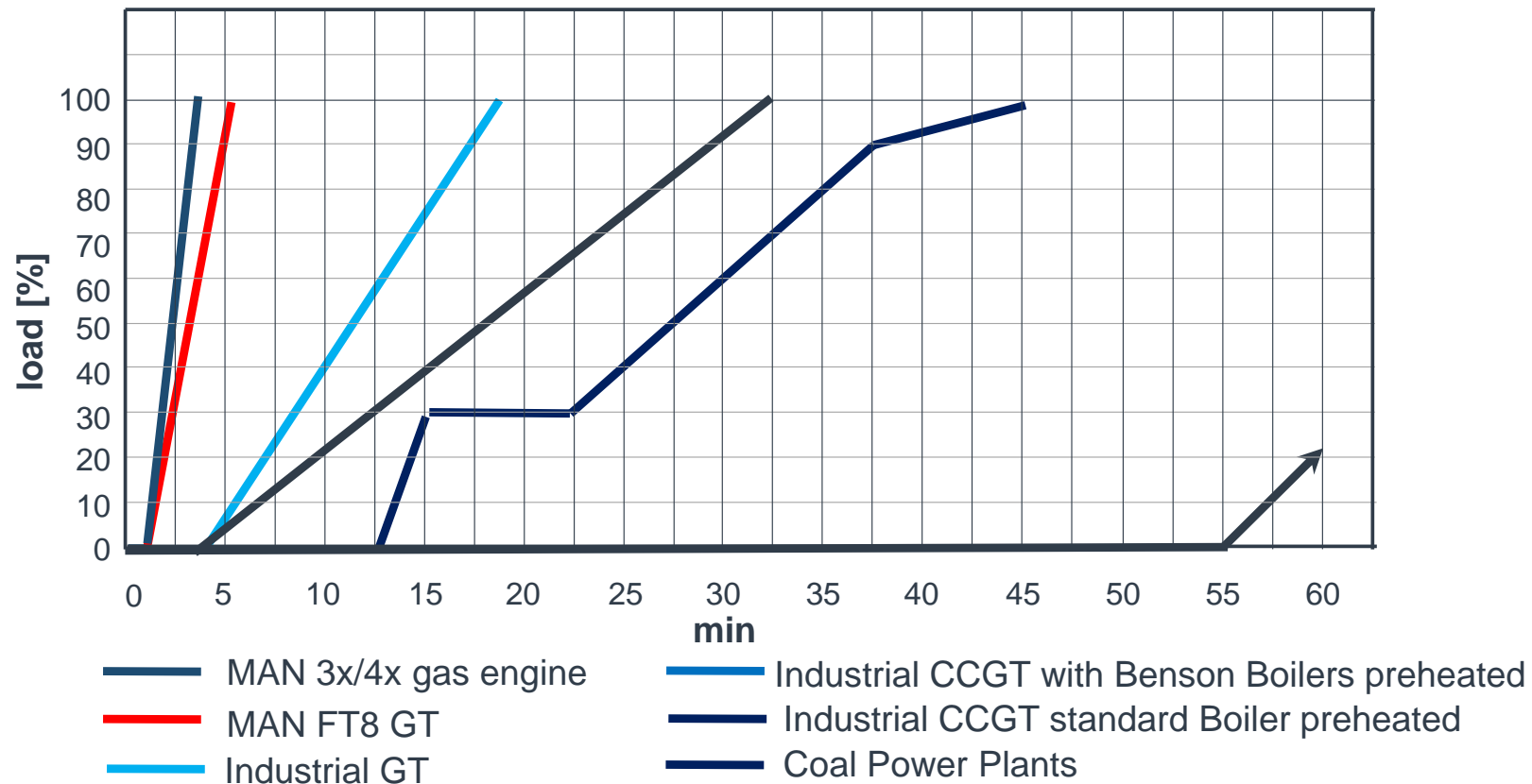
Power flexibility

Low Emissions and High Efficiencies



Emission advantage: short start up times – no wastage in idle running

Comparison of Starting Speeds of Powerplants

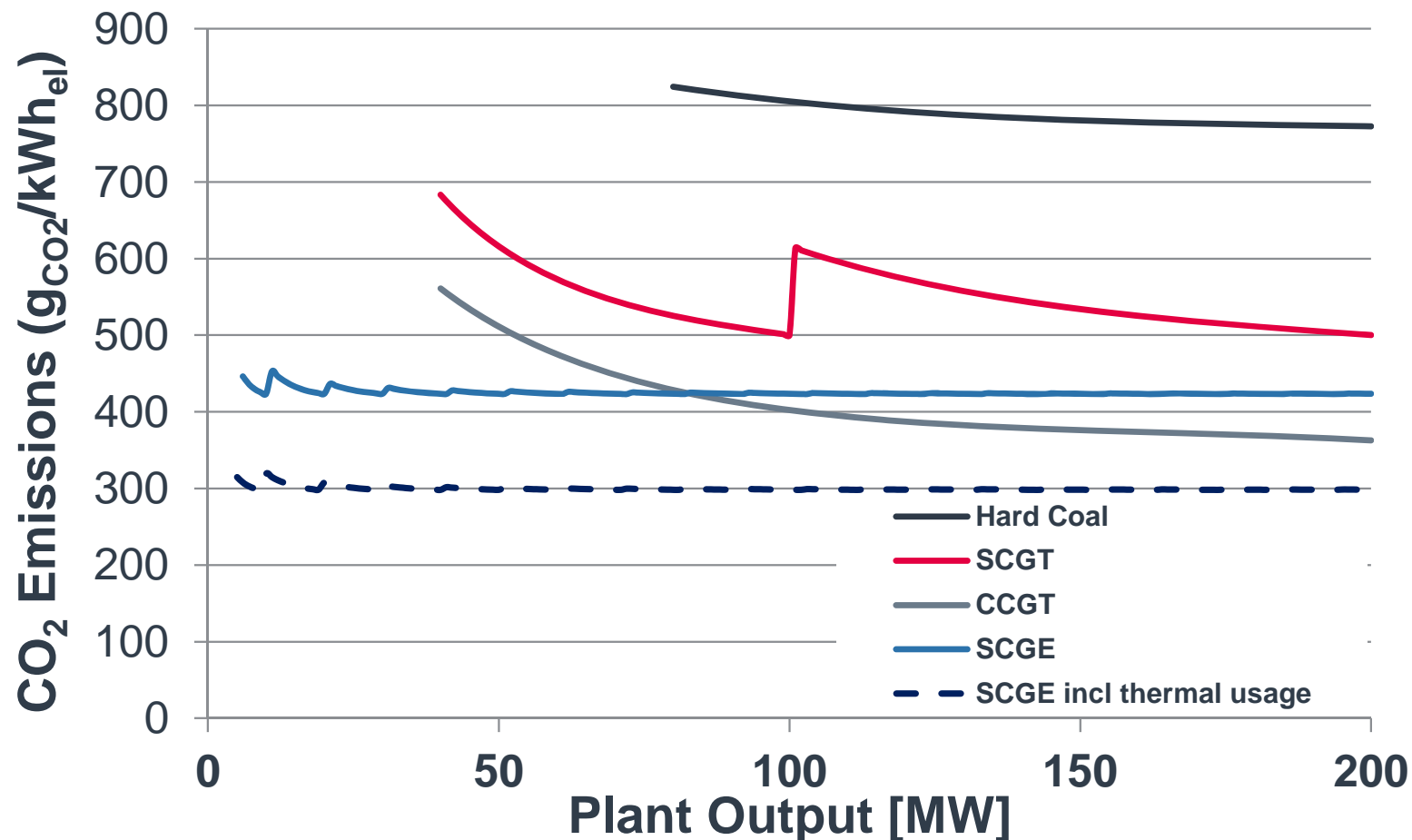


Power flexibility

Low Emissions and High Efficiencies



Compelling CO₂ advantage compared to coal fired power plants



Reciprocating Engines Deliver a good Fit

