

High-Speed Centrifugal Compression & VSD Technology



MAN Diesel & Turbo North America Inc.



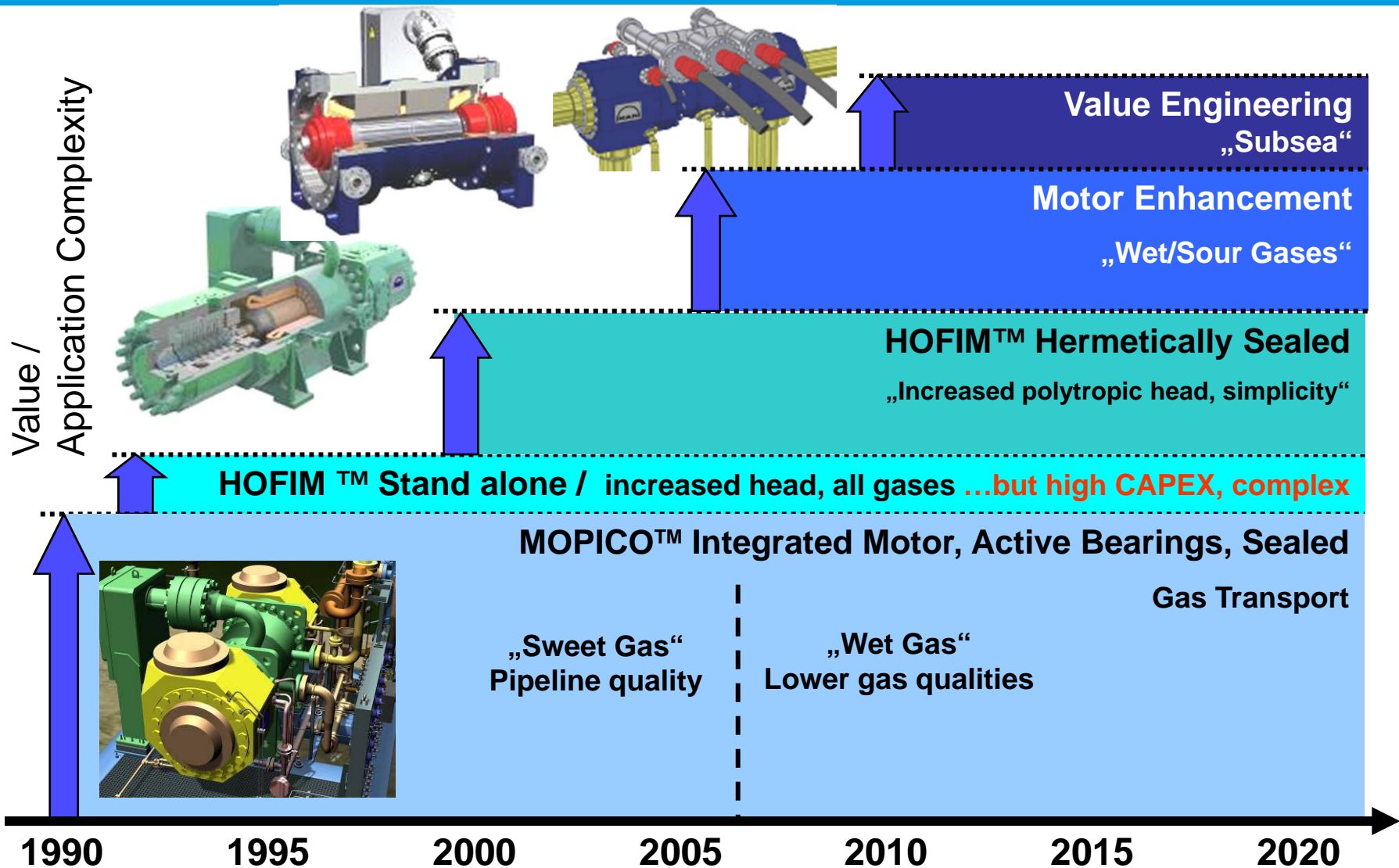
disclaimer

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Developmental Progression

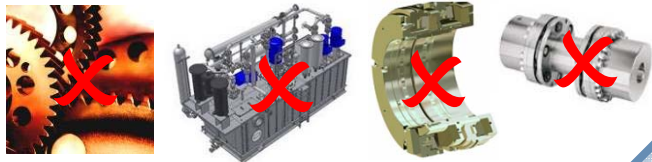


Advantages of High Speed Technology



Elimination of Components

- gearboxes
- couplings
- lube oil system
- shaft seals



Wear and Maintenance

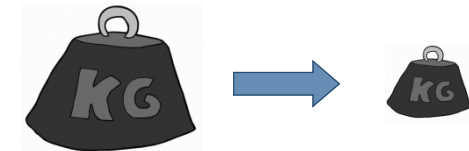
- contact and wear-free operation →
- minimum maintenance requirements



Significant Advantages
compared to
Conventional
Compression Systems

Space and Weight

- minimum space requirements
- reduced weight
- minimal visual impact



Emissions

- environmentally neutral
- no emissions to atmosphere
- lower noise levels
- no oil spills

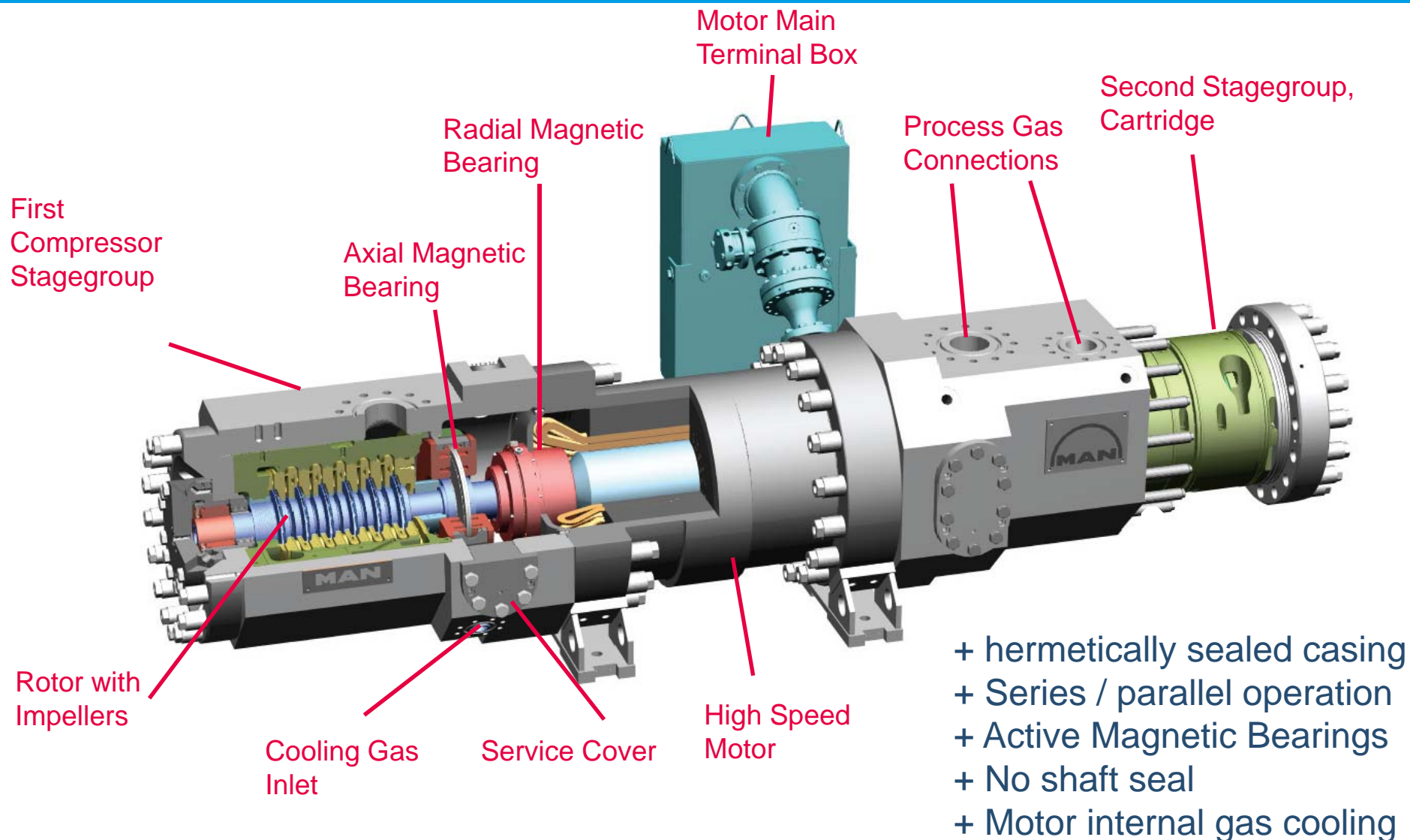


Operation

- best suited for remote operation
- minimum local manning requirements



Oil-free, Hermetically Sealed HOFIM™ product



High-Speed Trains with MAN Mxx Series Motors



Orders with MAN motors since 2008

Nuettermoor	3 x Tandem	HOFIM RB28+RB28	(M33 / 9,400 BHP)
Bergermeer	6 x Tandem	HOFIM RB45 + RB45	(M43 / 16,400 BHP)
Wierchzowice	2 x Tandem	HOFIM RB35 + RB35	(M43 / 13,700 BHP)
Hole House III	1 x Single	HOFIM RB45	(M43 / 19,800 BHP)
Chazelle	3 x MOPICO	RM50	(M43 / 17,400 BHP)
Bunde	2 x MOPICO	RM40	(M33 / 8,700 BHP)
Rheden	2 x MOPICO	RM50	(M43 / 14,800 BHP)
Egtved	4 x MOPICO	RM40	(M33 / 8,200 BHP)
Baumgarten	2 x MOPICO	RM50	(M43 / 18,900 BHP)
Asgaard Subsea	4 x Single	HOFIM RB45	

Total **29 x High Speed Trains (16 HOFIM/ 13 MOPICO)**

95 Total Units Sold Since 1990!

HOLE HOUSE 3 M43 2010



ONSHORE GAS STORAGE

Plant: HOLE HOUSE
End Client: EDF Energy Ltd., UK
Duty: Gas Storage Compressor

MAN Diesel & Turbo Equipment:

Compressor type: 1 x single HOFIM RB45-4
Driver: MAN M43 / ABB VFD

Frame Size: RB45-4

Handl. Gas: Natural Gas

Flow:	Nm ³ /h	647'450
	MMSCFD	580
Inlet/Outlet pressure:	bar	20 / 66
	psi	290 / 960
Power:	kW	14'800
	hp	19,800
Speed:	rpm	9'175
Seal types:	None	
	Hermetically Sealed Unit	

VSD References



Worldwide number of non-LCI VFDs for compressor drive to date within the size range of the MOPICO and HOFIM compressors (5,000 to 24,000 HP)

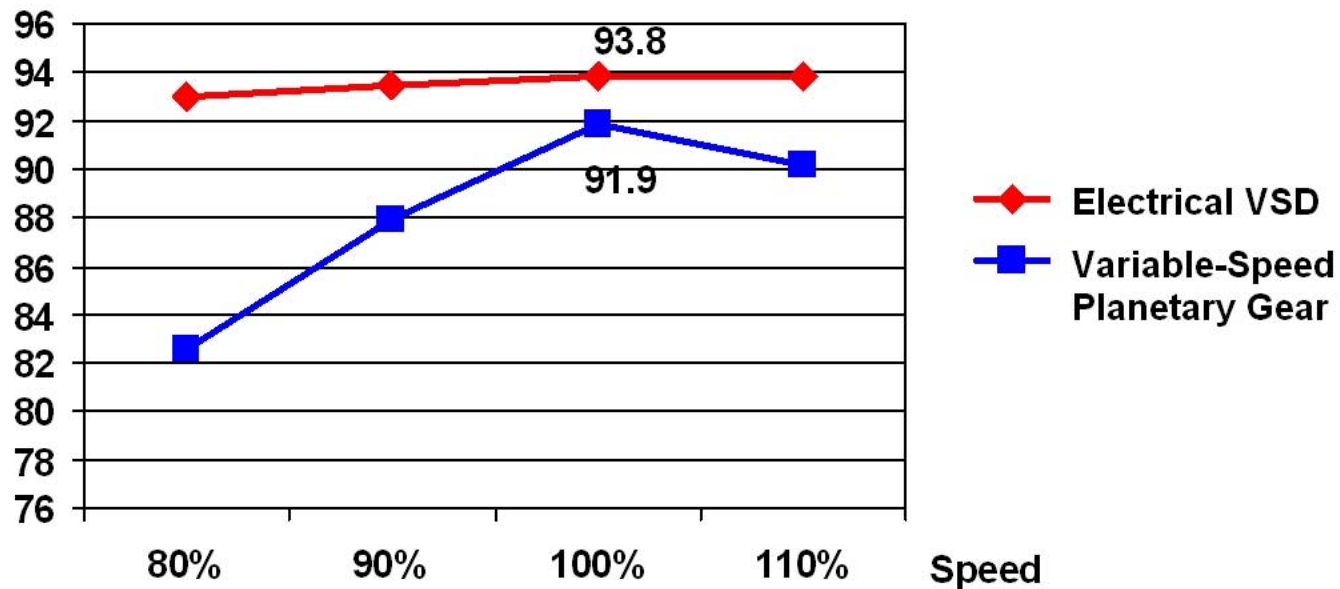
Over 500 units!

Information based on survey of 4 of the top VFD manufacturers in the World

Efficiency VSD vs. Fluid Couplings



Comparison of Total Efficiency



> 2% better efficiency of VSD solution, compared to Variable-Speed Planetary Gear @ nominal conditions, far better under part-load conditions!

Significance of Higher VSD Efficiencies at Part Load on Variable Cost; The Largest Portion of the Iceberg



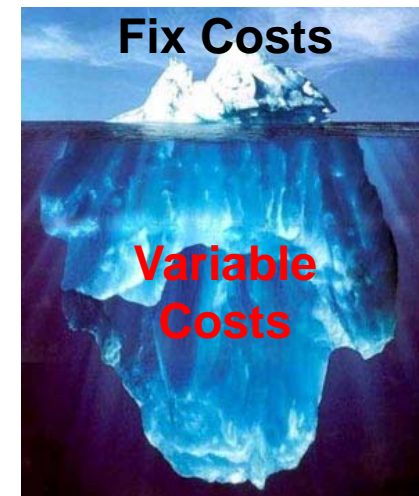
Economical evaluation based on a full Life Cycle Cost analysis has to be performed for all alternative technologies

Fixed Cost:

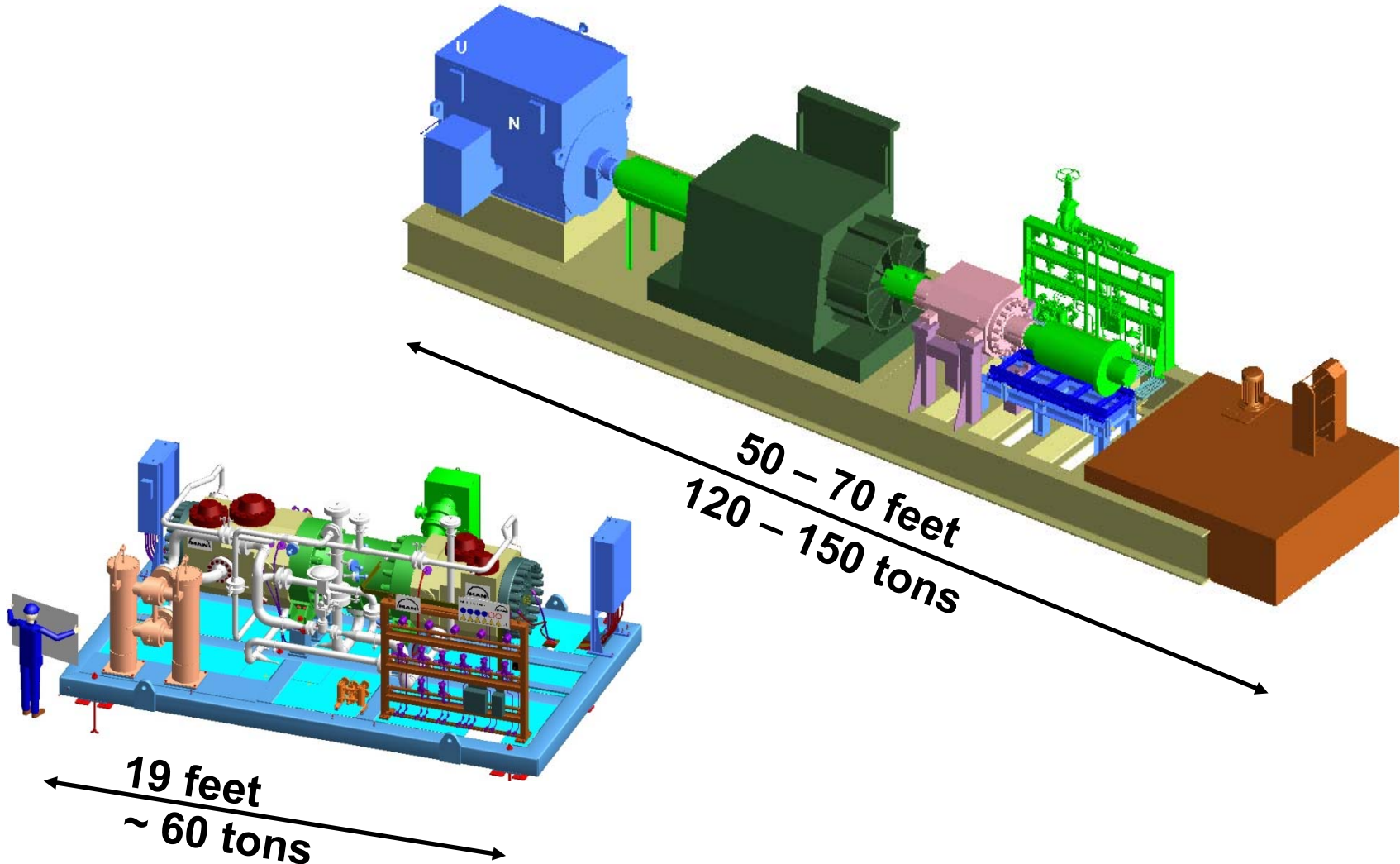
- CAPEX- Analysis: considering all overall installation costs, like costs for compression train, building, grid connection
Install.&Comm. ,Permit

Variable Costs:

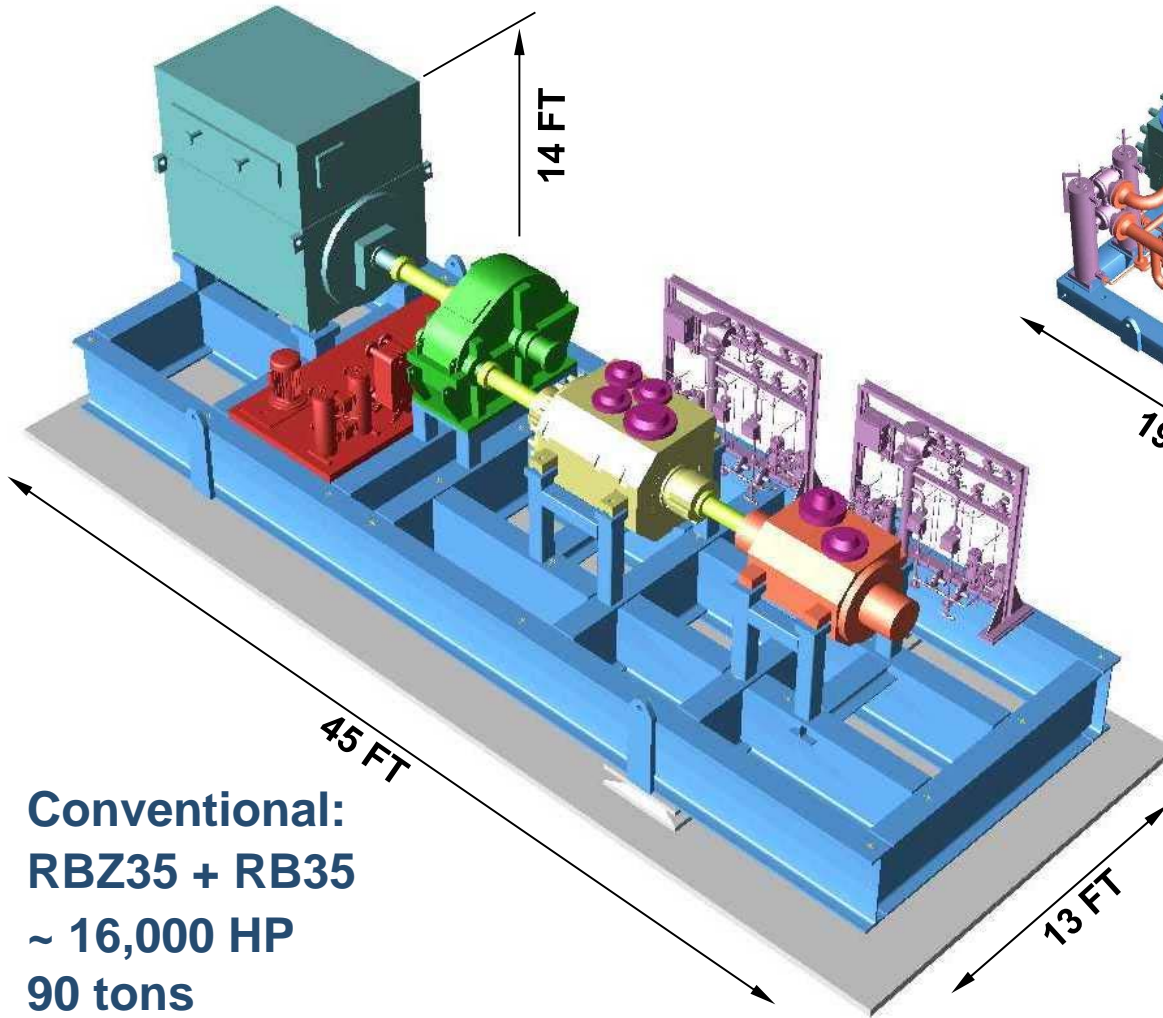
- OPEX-Analysis: costs for energy, personnel, buildings, emissions, interest rates, downtime
- MAEX-Analysis: spare parts, personnel, downtime



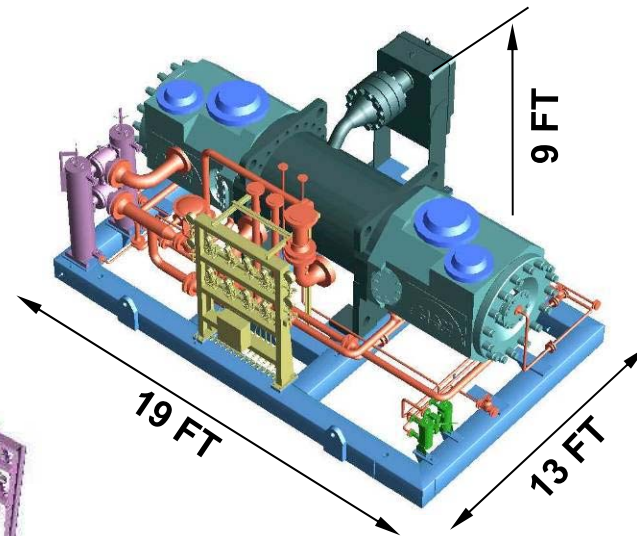
Comparison – 20,000 HP Fluid Drive vs Tandem HOFIM



Footprint and Weight



Conventional:
RBZ35 + RB35
~ 16,000 HP
90 tons



HOFIM:
2 x RB45
~ 16,000 HP
60 tons

Why VSD?



Electrical VSD

- Better efficiency
- Less cooling needed
- Lower inrush current from supply
- Better dynamic response
- Environmental friendlier
- Less space required at motor
- Larger speed control range
- Load sharing between parallel units

Variable-Speed Planetary Gear

- Higher losses, less efficiency
- More cooling capacity required
- Network impact at DOL start
- Space required between motor and machine
- Higher total operating costs

„Throw Away“ Myth



- Two decades of pioneering innovative compression technology **1989-2012** resulting in 95 compressor units – over 500,000 operating hours

OUR COMMITMENT TO THIS PRODUCT:

- Inventorying spare parts in the **US** (Warehouse)
- **US** service facilities
- Availability Guarantee
- Guaranteed support for the life of the product (Dismissal of “Throwaway Myth”)

MAN Turbo Inc USA PrimeServ Shop Locations



MAN Turbo Inc USA PrimeServ Shop Locations



Baton Rouge

Core Competence:

OEM & 3rd Party Repairs
Field Service
Paper Industry

Area

Buildings: **100,000 ft²**
Land: **970,000 ft²**

Prattville

Core Competence:

Paper Industry.

Area

Buildings: **32,000 ft²**
Land: **- ft²**

Corpus Christi

Core Competence:

Small ST repairs
Small parts manufacturing

Area

Buildings: **32,000 ft²**
Land: **172,000 ft²**

Deer Park

Core Competence:

OEM & 3rd Party Repairs
ST Repairs & Components

Area

Buildings: **40,000 ft²**
Land: **300,000 ft²**



24 Hour Service



Thank you
for your
attention

Engineering the Future –
Since 1758.