



# Steam Turbine Replacement

Electric motors and drive systems for downstream process optimization

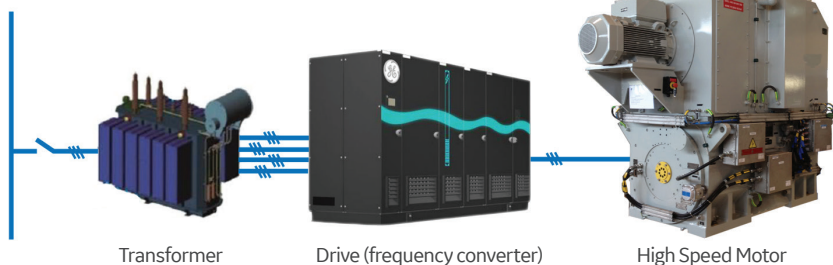
## REPLACING STEAM TURBINES WITH ELECTRIC SYSTEMS CAN HELP SAVE COSTS AND IMPROVE PERFORMANCE

Oil & Gas companies are tightening their grip on costs, and evaluating new ways to improve efficiency. In the downstream segment of the oil and gas industry—refineries, petrochemical and fertilizer plants—rotating machines process trains (such as compressors, blowers or pumps) are an important area for achieving potential process optimization. Previously, these process trains could be driven by steam turbines. For processes that do not develop or only partially generate steam, like recycle hydrogen, feed gas, and in some instance wet gas applications, electrification represents one of the best solutions today. Replacing old steam turbines with electric systems offers clear benefits like increased process efficiency hence lowering operational costs without compromising on reliability.

## ENHANCED EFFICIENCY AND INCREASED PLANT PERFORMANCE

GE's Variable Speed Drive Systems (VSDS) feature a unique combination of Voltage Source Inverter (VSI) and a high-speed motor to help increase reliability and availability of VSD systems. Thanks to the compactness of its high-speed motors, GE solution offers a similar footprint and preserves the plant layout in constrained environments, allowing a smooth plant integration.

### Key components



### VARIABLE FREQUENCY DRIVE (VSI)

MV7 range: reliable, scalable and modular

#### Features

- 1 to 100 MW, up to 13,8 kV
- Standard drive with high performance control
- Power factor >0.95 helps to eliminate reactive power injected to the grid

#### Benefits

- No torque pulsation on the shaft line
- No harmonics filter needed due to minimum harmonics level on the network
- Reduced noise and vibrations on the motor, allowing longer life cycle and reduced maintenance

### HIGH SPEED INDUCTION MOTOR

Efficient, compact, cost-effective

#### Features

- Variable frequency standalone motor directly coupled to a compressor without gearbox
- 2 poles, up to 18,000 rpm
- Water to air cooled motor or TEPV motor
- Several rotor diameters
- Magnetic or sleeve bearings
- Copper cage
- Certified Exp according to ATEX
- Shaftless rotor (patented)

#### Benefits

- No critical speed: reduced vibrations
- Laminated rotor reduces Eddy currents
- IEC 60034 & IEC 60079 compliant
- Proven track record: almost 200 high speed motors installed globally

## ELECTRIFICATION CONSULTING

With current oil prices, and increasing costs, it is more critical than ever that industrial operators adopt innovative ways to reduce CAPEX and OPEX.

GE experts can help you make informed decisions that continue to deliver across the lifetime of your project.

- Support in the **economic evaluation**: high level estimations of value in technology selection
- **Site survey**: existing field data capture & hardware audit, to understand the technical and environmental constraints and determine the opportunities
- **Documentation analysis**: current operating profile review and analysis (existing compressor, consumption, operating costs, etc.)
- **Replacement studies**: configuration proposals
- **Estimations**: OPEX estimations and value demonstration (maintenance costs, efficiency savings, emissions, availability and reliability value, spares needed, etc.)
- **Business plan**: commercial offer (report out and implementation roadmap)

# TECHNOLOGY COMPARISON

	STEAM TURBINE	ELECTRIC VSDS	BENEFITS OF THE ELECTRIC SOLUTION
DRIVER EFFICIENCY	50-80%	>95%	▶ High efficiency
SPEED RANGE	50-105%	0-105%	▶ Full flexibility
DYNAMIC RESPONSE	Load Step capability depends on temperature	Almost immediate	▶ Full flexibility in terms of power demand
STARTING TIME	> 15 minutes and depends on temperature	< 1 minute	▶ Minimum startup time requirement/Very high starting and operating reliability and availability
INRUSH CURRENT DURING START-UP	Not applicable	Inrush current = nominal current	
ENVIRONMENTAL IMPACT	CO <sub>2</sub> /NOX emissions (boiler)	Not applicable	▶ Emission-free/Meets with environmental restrictions
NOISE LEVEL	Usually >100 dB(A) May require noise enclosure	Usually between 85 and 90 dB(A)	▶ Lower noise
FOOTPRINT	Large (lube oil coolers, ventilation ducts, exhaust silencers, noise enclosure if any)	Small in hazardous area, medium in electrical room	▶ Minimum space requirement
INSTALLATION & COMMISSIONING	Complex auxiliary pipework and electrical & instrumentation tie-in	Limited to electrical & instrumentation tie-in	▶ Reduced pipework requirement
REQUIRED MAINTENANCE	1-yearly periodic inspection (few days without shutdown) + shutdown every 5 years	1-yearly periodic inspection (few days without shutdown) + shutdown every 5-6 years	▶ Minimum maintenance period over life cycle
MAINTENANCE COST	Minimal parts replacement required	Minimal parts replacement required	▶ Minimum maintenance cost
POWER REQUIREMENTS	Low voltage (415 V)	High voltage (>3 kV)	▶ Suitable for most areas, including with limited power availability

## CONTACT US

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## OUR CENTERS OF EXCELLENCE FOR THE OIL & GAS INDUSTRY:

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