



INTERNATIONAL OPERATIONS & MAINTENANCE CONFERENCE  
IN THE ARAB COUNTRIES

UNDER THE THEME  
"MANAGING MAINTENANCE WITHIN INDUSTRY 4.0"  
CONICIDE WITH THE 16<sup>TH</sup> ARAB MAINTENANCE EXHIBITION

**COST EFFECTIVE SERVICING,  
REPAIR & REFURBISHMENT.**

**JOHAN FREDRIK BOK**



**4.0**





## COST EFFECTIVE SERVICING (MAINTENANCE)

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Global players (OEMs) faces the challenge of increasing on-site-machining services (Aging fleet).

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- Successful validation of machining tools & devices for hydro applications initially in Europe.
- Maintenance improvements by using new generation of special mobile machining tools (OMMT).
- Rapid changes in the power industry (OEMs & ISPs), affecting services for new and old thermal power plants around the globe.

OMMT: Original Manufacturer Machinery Tools

# On-Site Machining Rotating Parts

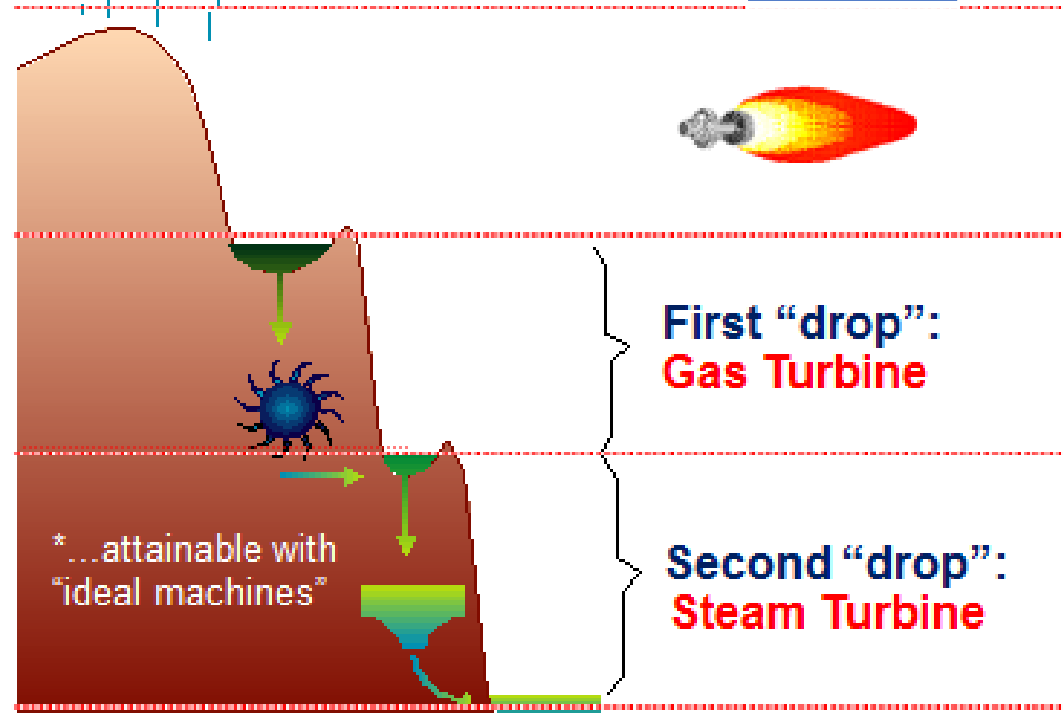


CARNOT efficiency  $\eta = 1 - \frac{T_{min}}{T_{max}}$  ...lowest possible highest

HYDRO

THERMAL

Incentive to have largest possible heat-“drop”



Flame temperature = 2,000 °C  
Theoretical maximal level

First “drop”:  
Gas Turbine

Upper level ca. 1,250 °C  
Limited by materials and cooling  
Lower level ca. 600 °C  
Exhaust gas to HRSG

Second “drop”:  
Steam Turbine

Upper level ca. 565 – 600 °C  
Live steam  
Lower level ca. 5 ... 40 °C  
Cooling water / Ambient air

\*...attainable with “ideal machines”

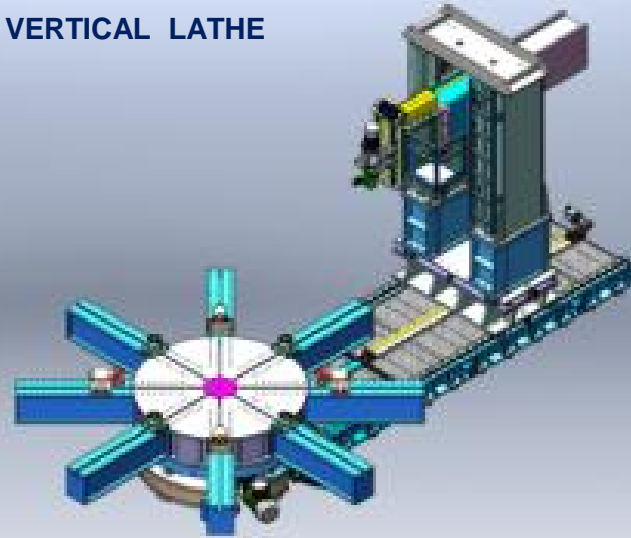
Experience From Thermal to Hydro

# Challenges

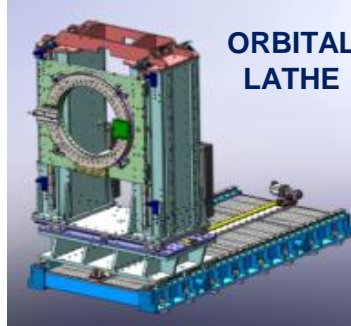


New generation of special portable machining tools

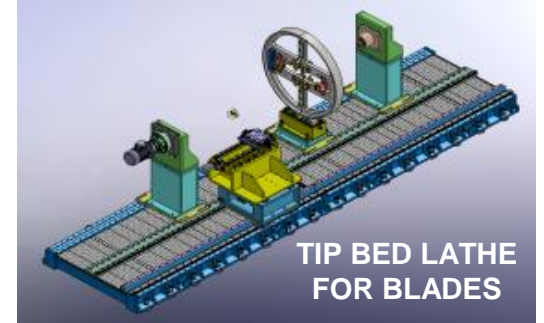
VERTICAL LATHE



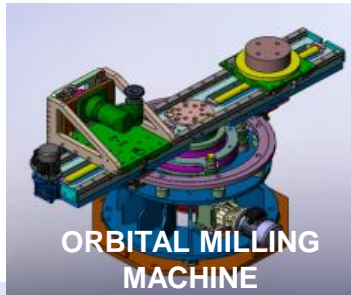
ORBITAL LATHE



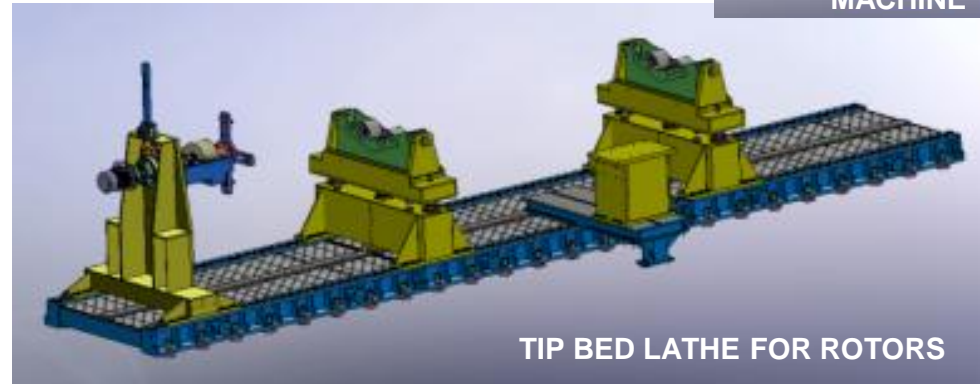
TIP BED LATHE FOR BLADES



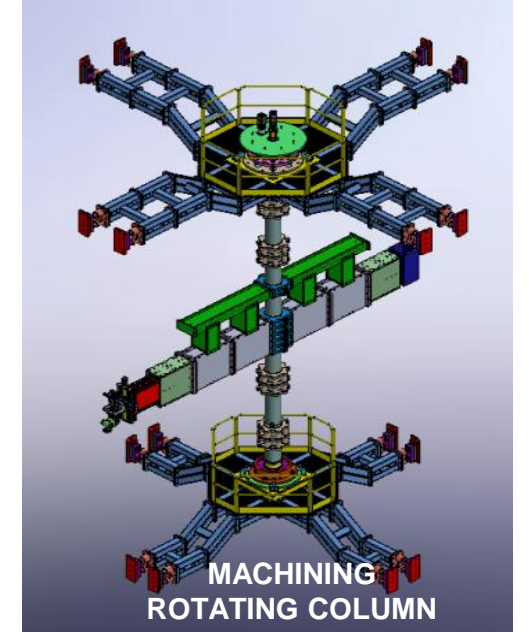
ORBITAL MILLING MACHINE



TIP BED LATHE FOR ROTORS



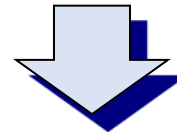
MACHINING ROTATING COLUMN





## NEW GENERATION Machining Rotating Column

- All components of the machining rotating column are adjustable as per machining requirements “type of work”.
- The design characterized its simplicity, versatility, stability, reliability and accuracy (+++ Performance)
- Almost all of the pre-engineering work is done & during the preparation of proposal (Base scope tendering).



**Efficient and competitive  
in the after sales service market**

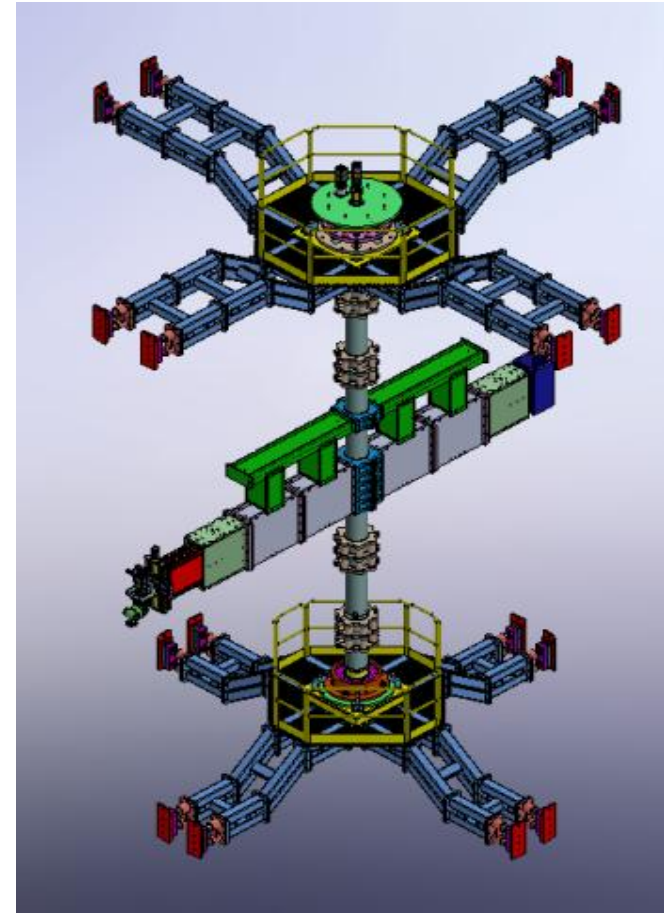


## Machining Rotating Column

### A Versatile Machining-Tool Component

1.  
Stay ring  
embedded  
flanges

2.  
Runner  
chamber



3.  
Draft tube  
cone

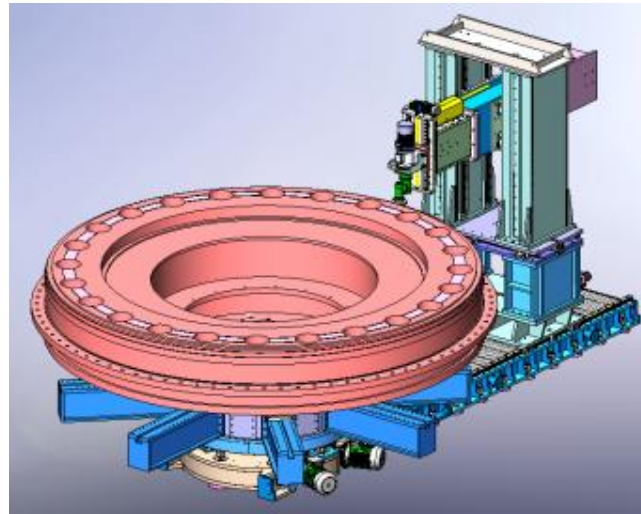
4.  
Machining  
Kaplan & Bulb  
turbine



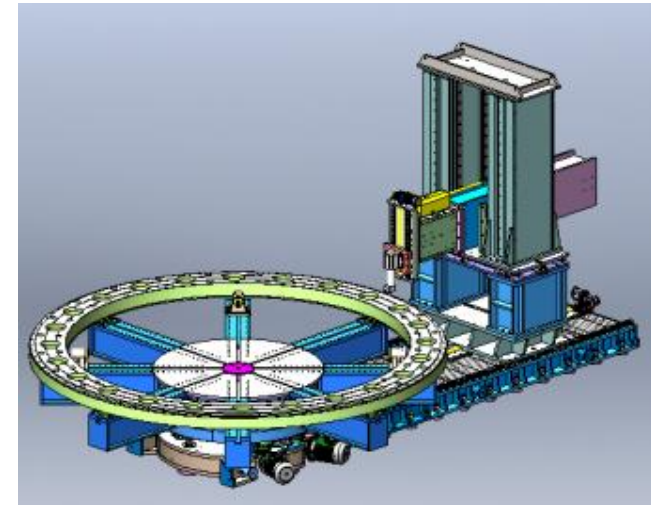
## Machining Rotating Column

### A Versatile Machining-Tool Component

- Head cover
- Head cone
- Bottom ring
- Regulating ring
- Runner
- Radial and axial bearings
- Valves casings and shutters
- Labyrinth rings



Head cover machining



Bottom ring machining



## New Generation Tools

### Special Mobile Machining Tools

- Inherited experience from machining on job site for major turbine components of thermal PP.
- In-house development & manufacturing of machining tools, special “validated” design for hydro and thermal power plants.
- Successful implementation in multiple European job-sites, for new & rehabilitated hydro power projects.



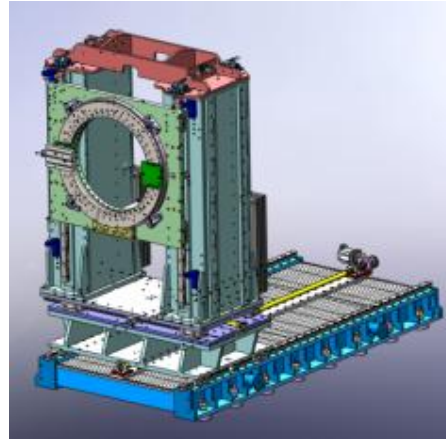
**Level play field for all participants  
(OEMs, PUs, IPPs) in the power industry**





Mobile Orbital Lathe

## A Versatile Machining-Tool Component



- Butterfly valve trunnions
- Trunnion housings on body valves
- Blades bearing housings in runners

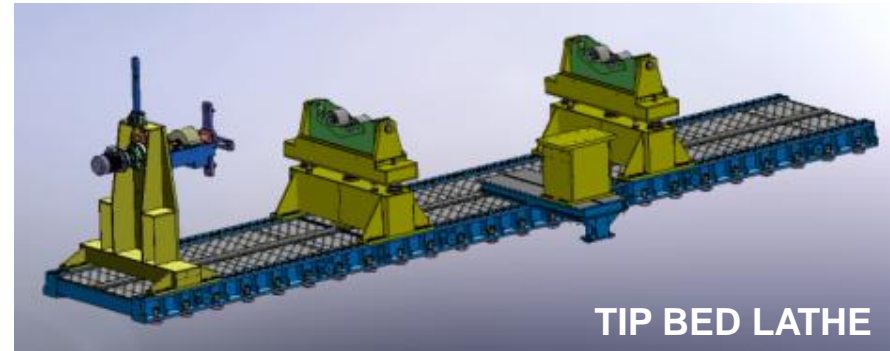
Butterfly valve trunnions machining



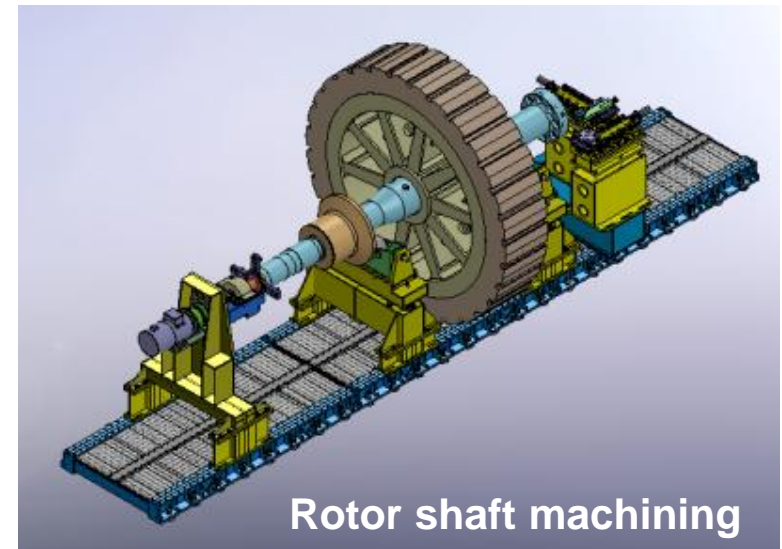


Mobile Tip Bed Lathe

## A Versatile Machining-Tool Component



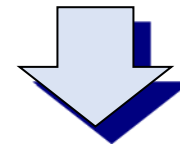
- Shafts
- Runner
- Drive blades
- Dynamic balancing





## Power Producers Battle Ground

- Recognising external capabilities for on job-site machining
- Value the experience in dealing with the power industry
- Mobility & flexibility, a must in the service supply change
- Merging expertise within the service provider's team
- Share costs & benefits from increasing maintenance value

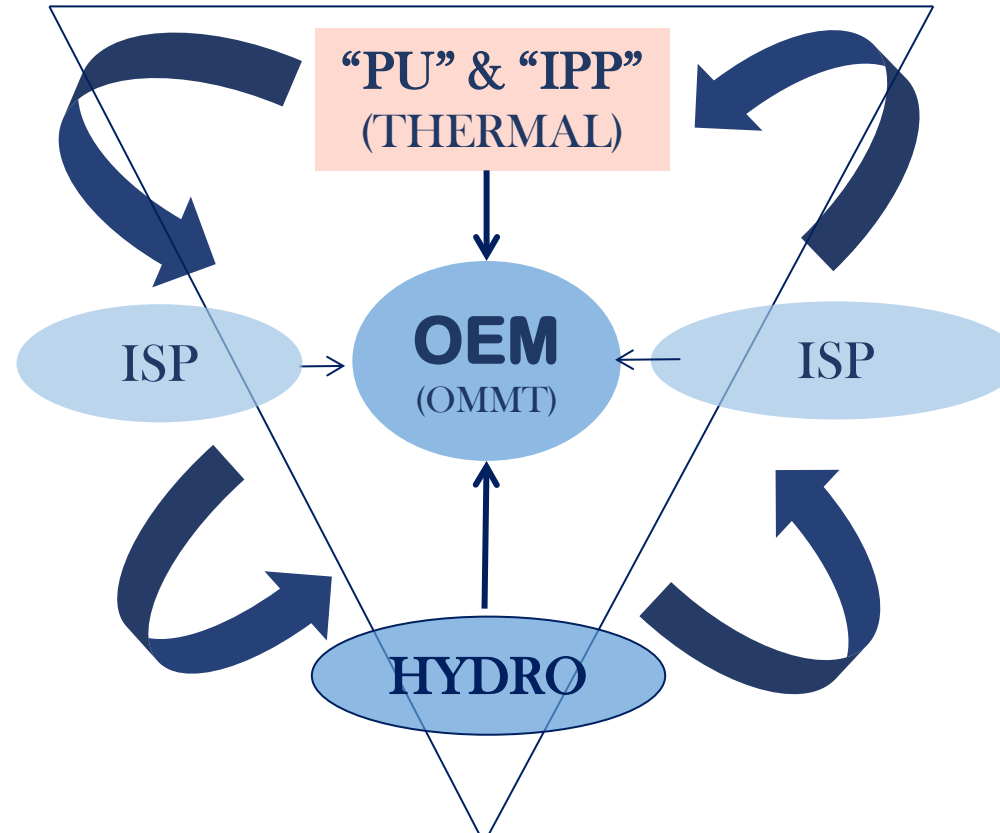


**Corporate image not only for the consumers**

# Challenges



## A TYPICAL CASE FOR CONTRACTING



**“OMMT” ALWAYS COMPLEMENTARY TO “OEM”**

### Support Sources

- Engineering (OMMT)
- Tender & Contract
- Terms (Scheduling)
- Project Management
- Deliveries (Logistics)

PU: Public Utility (Power Producer)  
IPP: Independent Power Producer  
OEM: Original Equipment Manufacturer  
ISP: Independent Service Provider  
OMMT: Original Manufacturer Machinery Tools

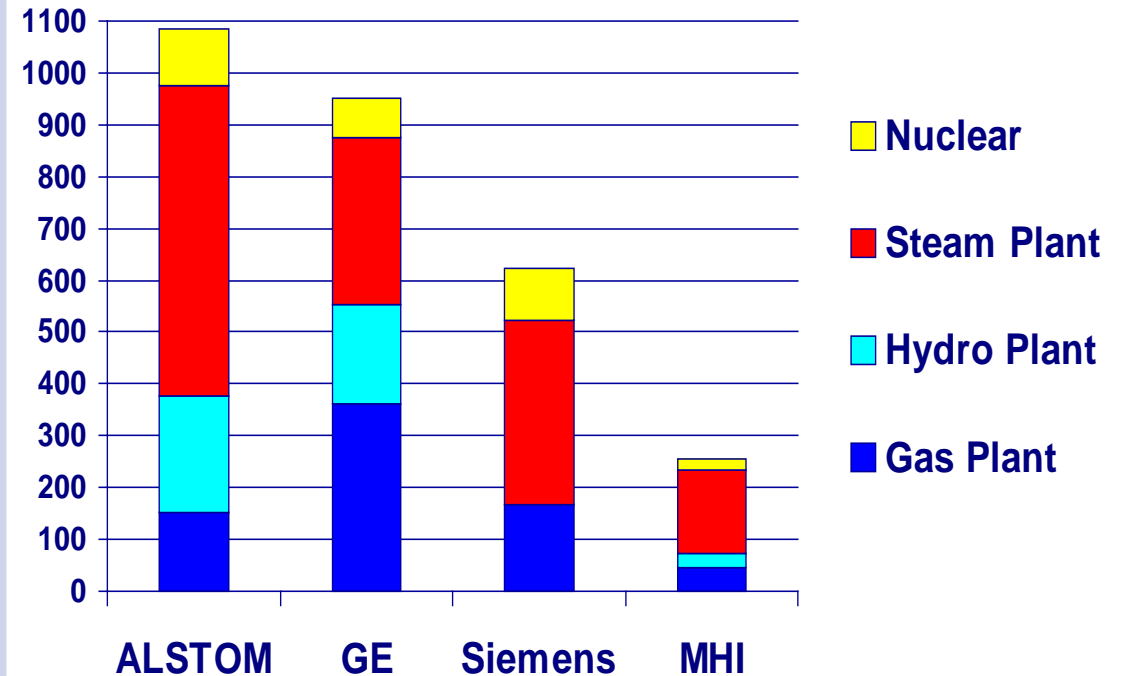
# Challenges – Installed base (Units)



## Observations

### Past Market Record ABB / ALSTOM

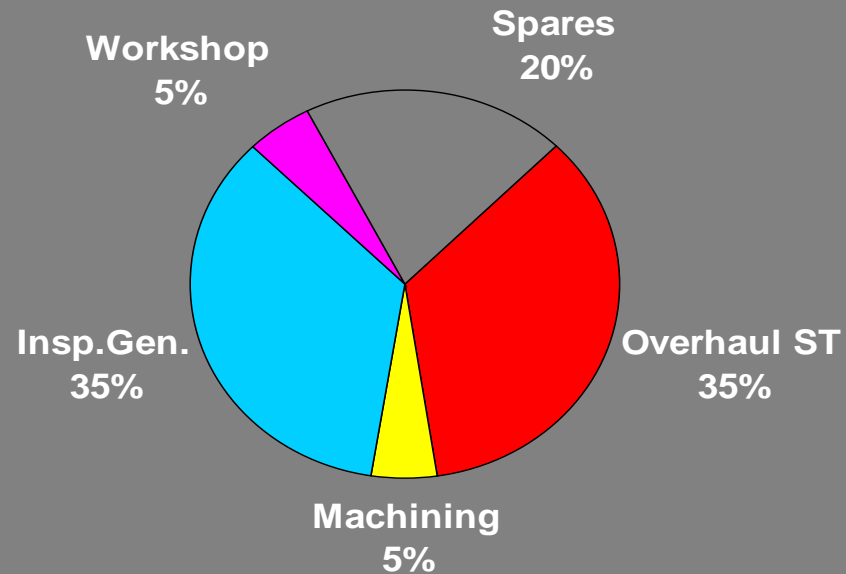
- During the OEM booming time, ABB/ALSTOM had the largest installed based in the Industry.
  - GE Largest installed GT & ST fleet, mainly in the Americas
  - SIEMEN's largest installed GT & ST fleet, mainly in Europe and USA (Ex-Westinghouse)
  - MHI largest installed GT & ST fleet, mainly in Asia.
- 
- Above market record for aging fleet only & excludes today's total installed based (units) in the industry



# Challenges – Orientation



Typical PO Volume (40 MW) ST&G Rehabilitation = 8.0 MEUR.



## Third Party Service Provider

Price break down from an independent service provider!

Not having appropriate tools for complete on-job-site machining!

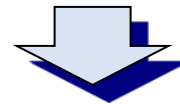
Requiring workshop repair activities (Off-shore) for parts of turbine & generator!

- Condensing steam turbine & generator w/focus on > repair & < replacement.
- Machining on the job site was less than 5% of the CP (Incl. Off-shore Workshop = 10%)
- With versatile job-site machining tools, savings could be achieved, cost and time wise!

# Conclusive Remarks (1)

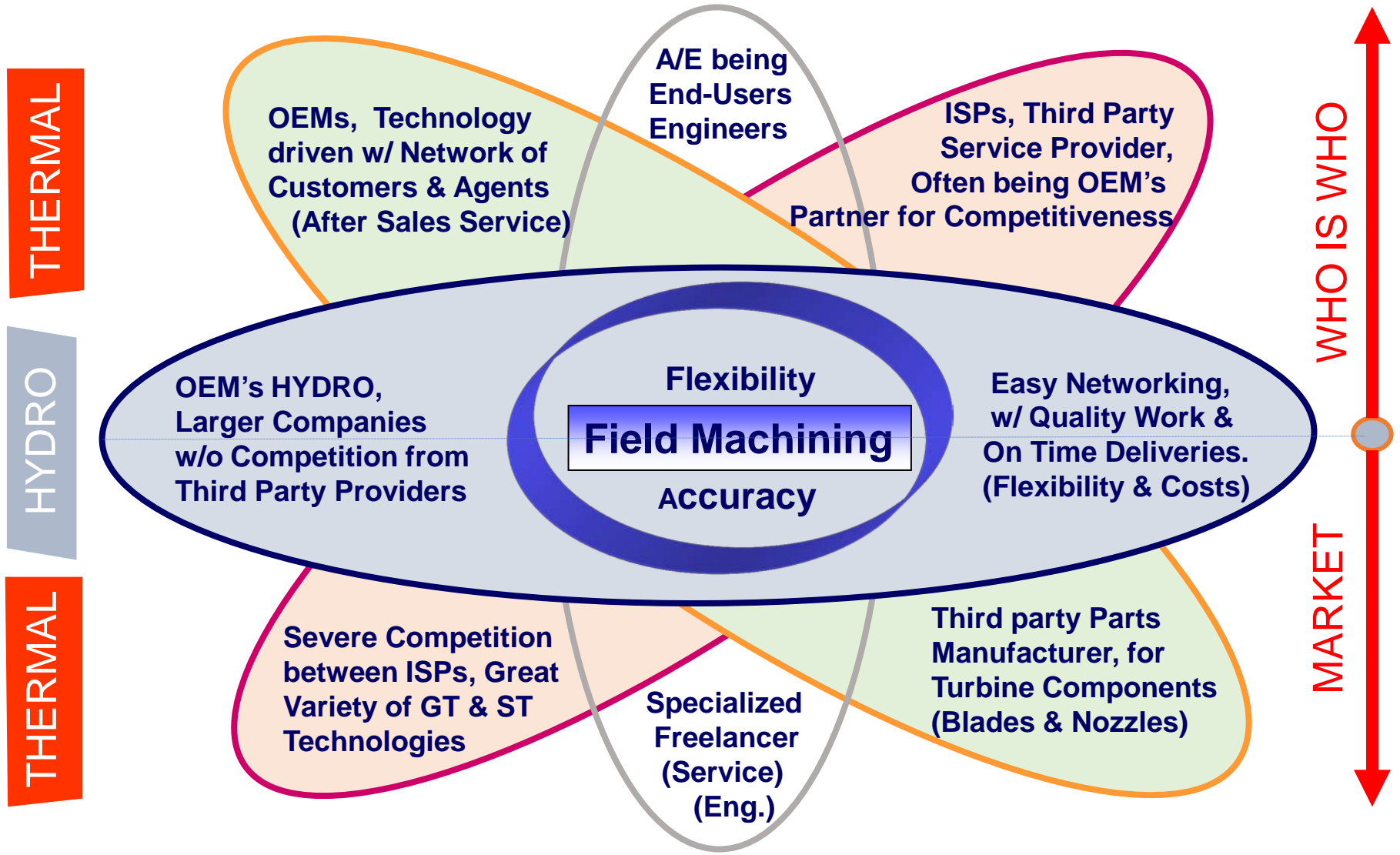


- Experienced & complementary service providers are key for global players to meet the challenges and faces a rapid changing energy sector. (Renewable, hydro, thermal)
- Single source for on-site machining, developed & manufactured its own machine tools, familiar with the power industry and w/track record in after sales services for thermal and hydro power plants, is advantageous
- Innovations in the after sales service market by presenting new generation of special, mobile & validated machining tools. (Improved maintenance & enhanced resilience).



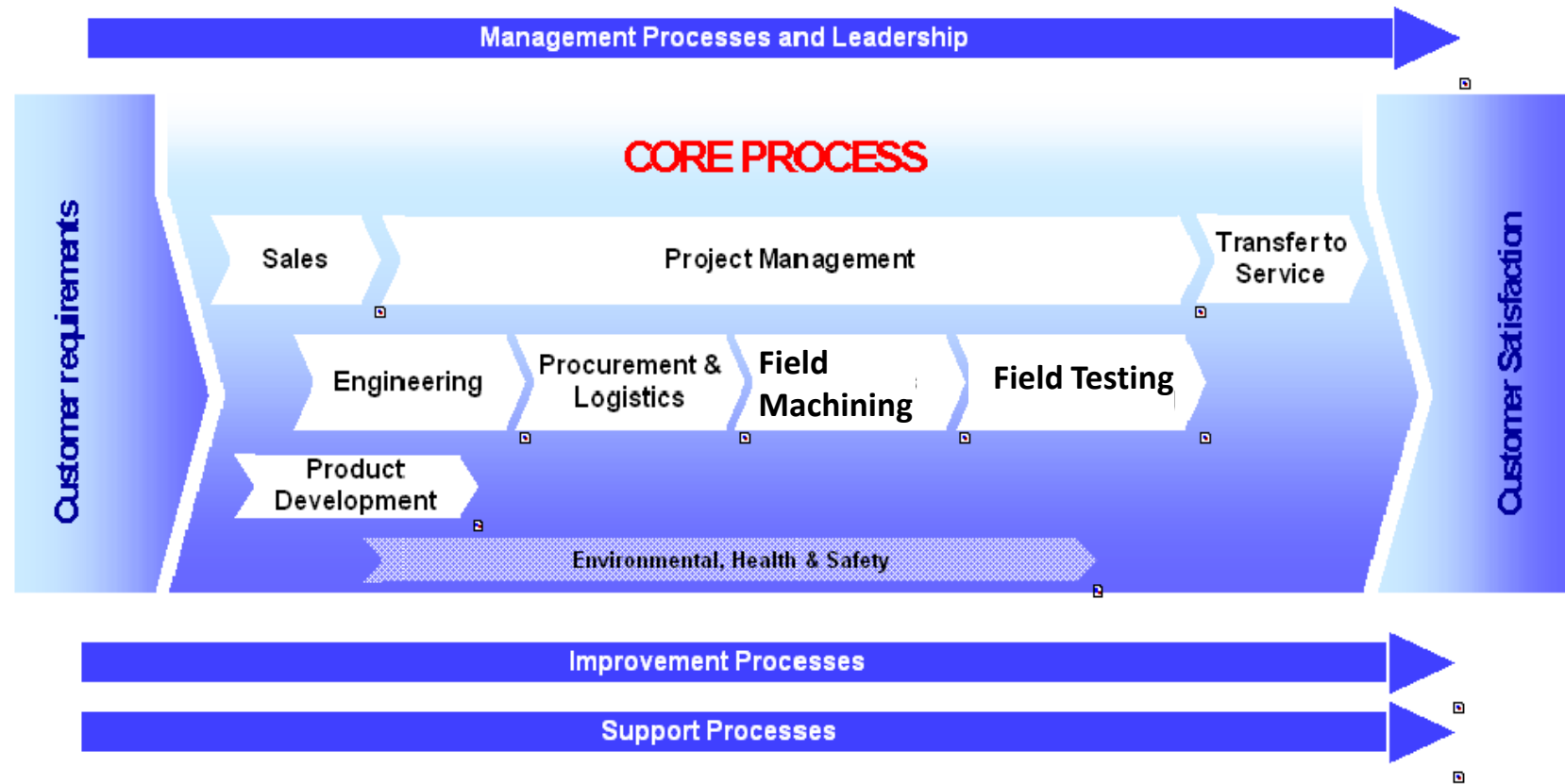
**New Business Opportunities in the Region**

# Conclusive Remarks (2)





# Conclusive Remarks (4)

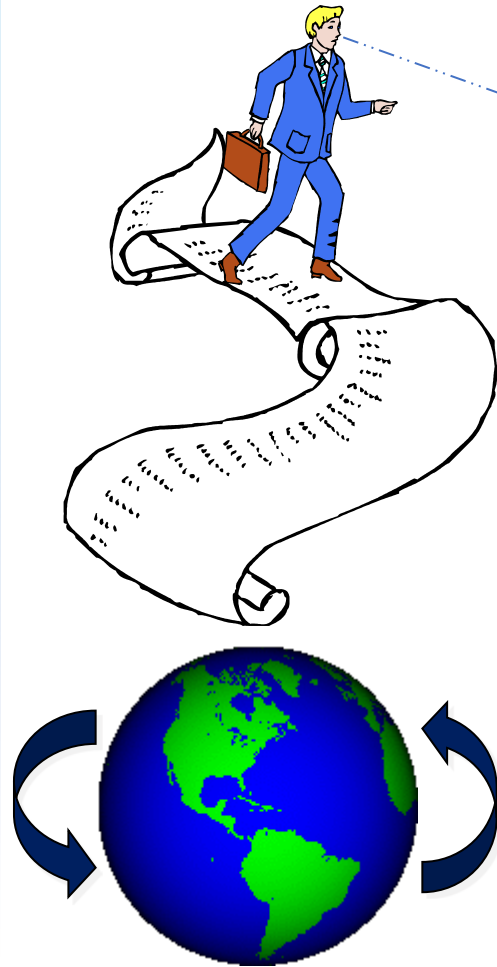


**The Talent Wedge:** The growing gap between *supply of* and *demand for* talented people, is the greatest issue facing the service industry today.

# Customer Satisfaction (Thermal)



Thank You



It's Stormy Out There!



Does choice matter?



# Where You can Find Us

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**“VINCIT  
QUE  
PATITUR”  
(He Who Suffers  
Conquers)**



The Issue of Interest

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# Final Remarks (OMAINTEC)

The Issue of Interest

