WAUKESHA® MAGNETIC BEARINGS

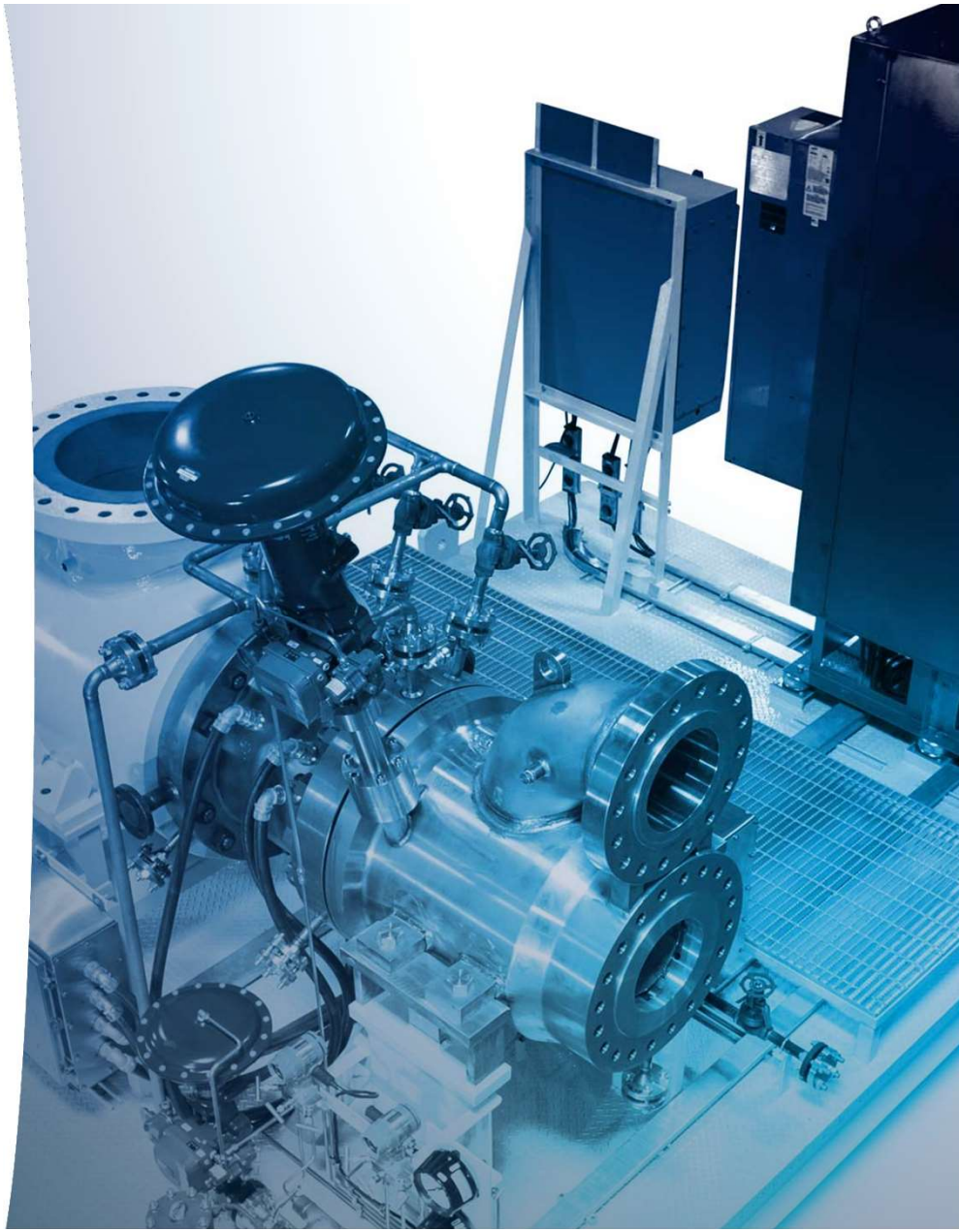
AMB Industry Trends, Challenges and Opportunities

RICHARD JAYAWANT

20TH JULY 2023

18th International Symposium on Magnetic Bearings

18 – 21 July 2023 Lyon France

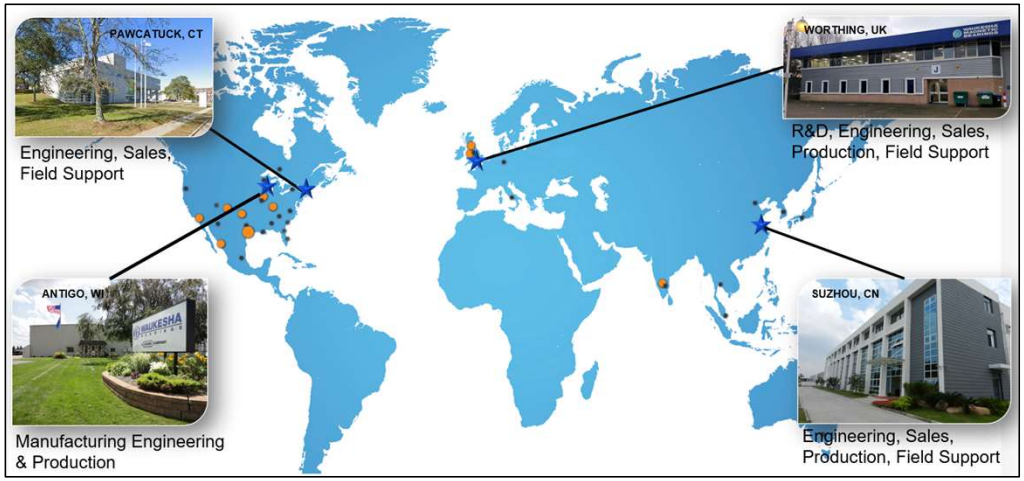


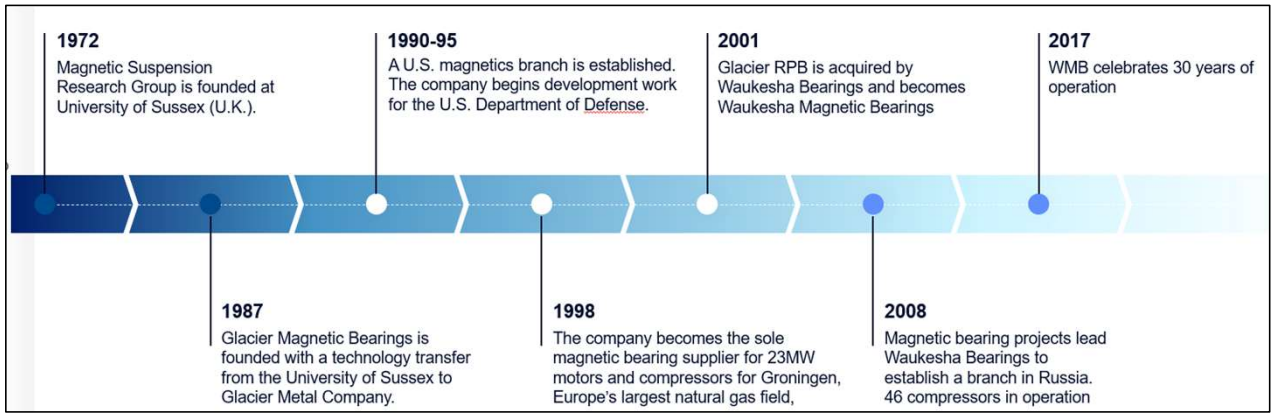
Who is Waukesha Bearings?

DOVER PRECISION COMPONENTS

WAUKESHA MAGNETIC BEARINGS

WAUKESHA BEARINGS





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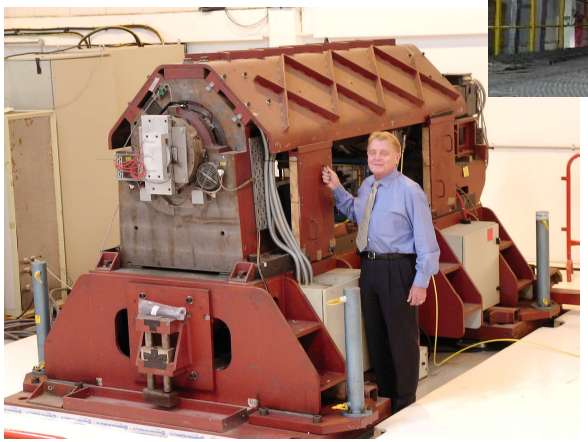
Why this talk? (Personal reflections)

Exciting toys!

Natural Gas Pipeline Compressor



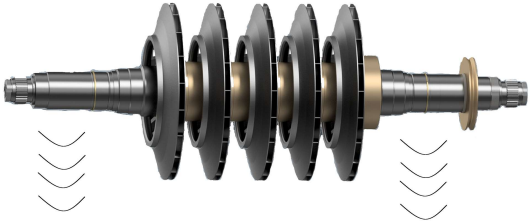
1.5 tonne AMB test rig

Smart people across a wide range of engineering!

Why this talk? (cont.)

It comes with a smile

"What we do is magic"



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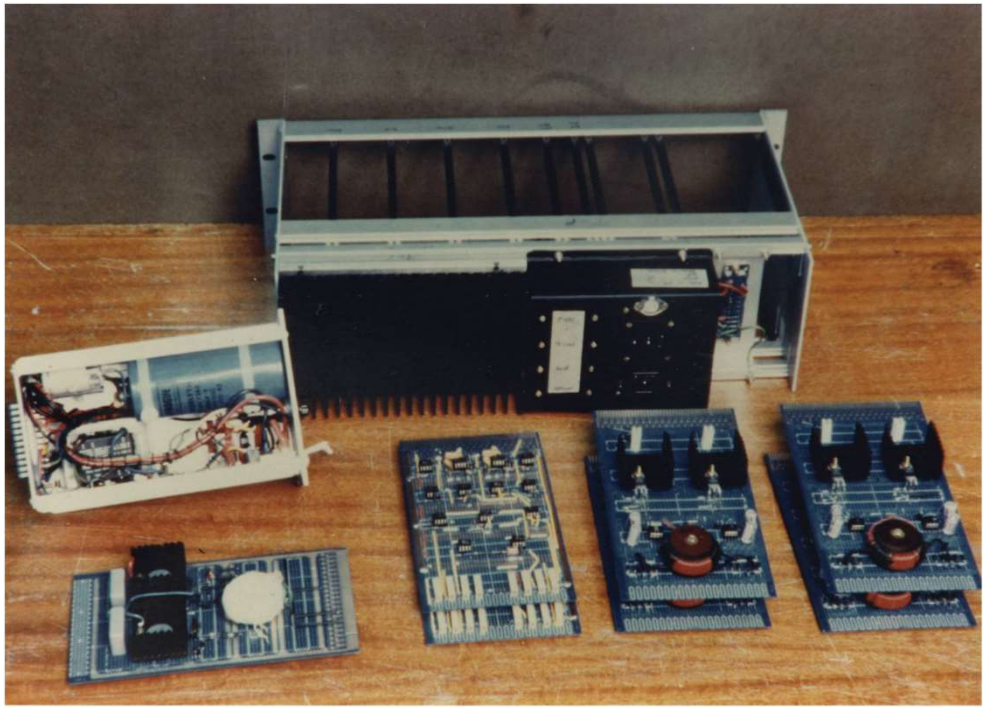
Why this talk? (cont.)

Original University Controller (circa 1987)



Industrial Controller (circa 1992)

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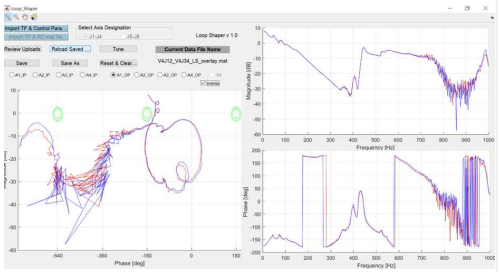
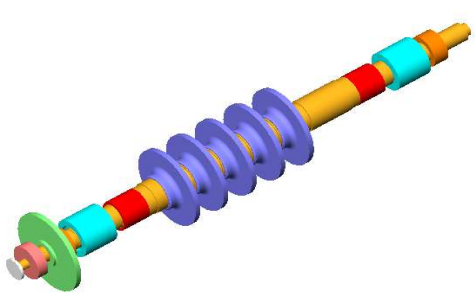
Core Technologies (competencies)

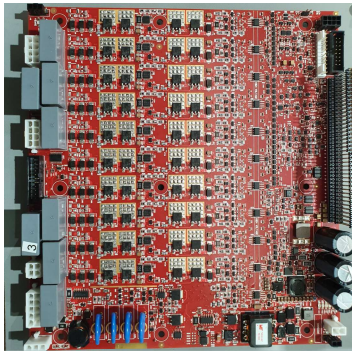
Mechanical

Rotor Dynamics and Control

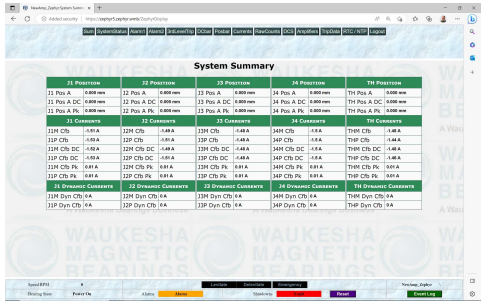




Electronics & Electrical



Embedded Software



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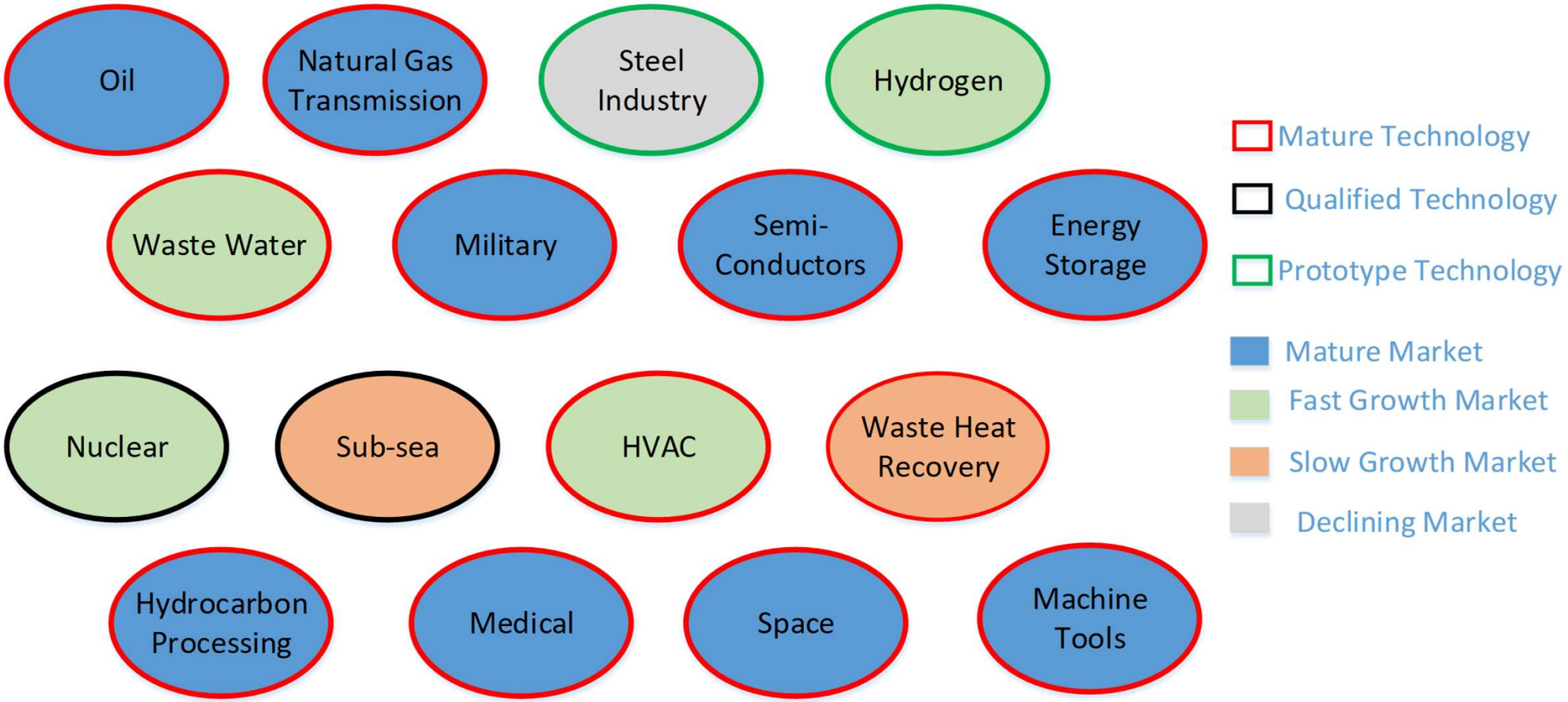
What a range of applications!



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Unfulfilled Potential?

Rolling Element Market

Fluid Film Market

AMB Market

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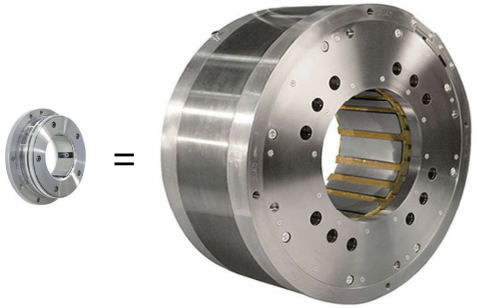
Why the false starts?

Inherent factors



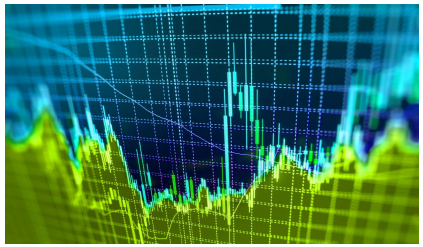
AMB vs FF equivalent load capacity

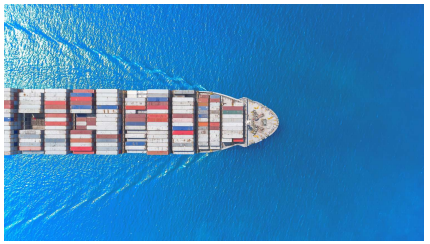
Custom Engineering =

Diverse skills requirement

External factors

- Compliance Concerns
- Global Economy
- Supply Chain
- Competition for Skilled Labour





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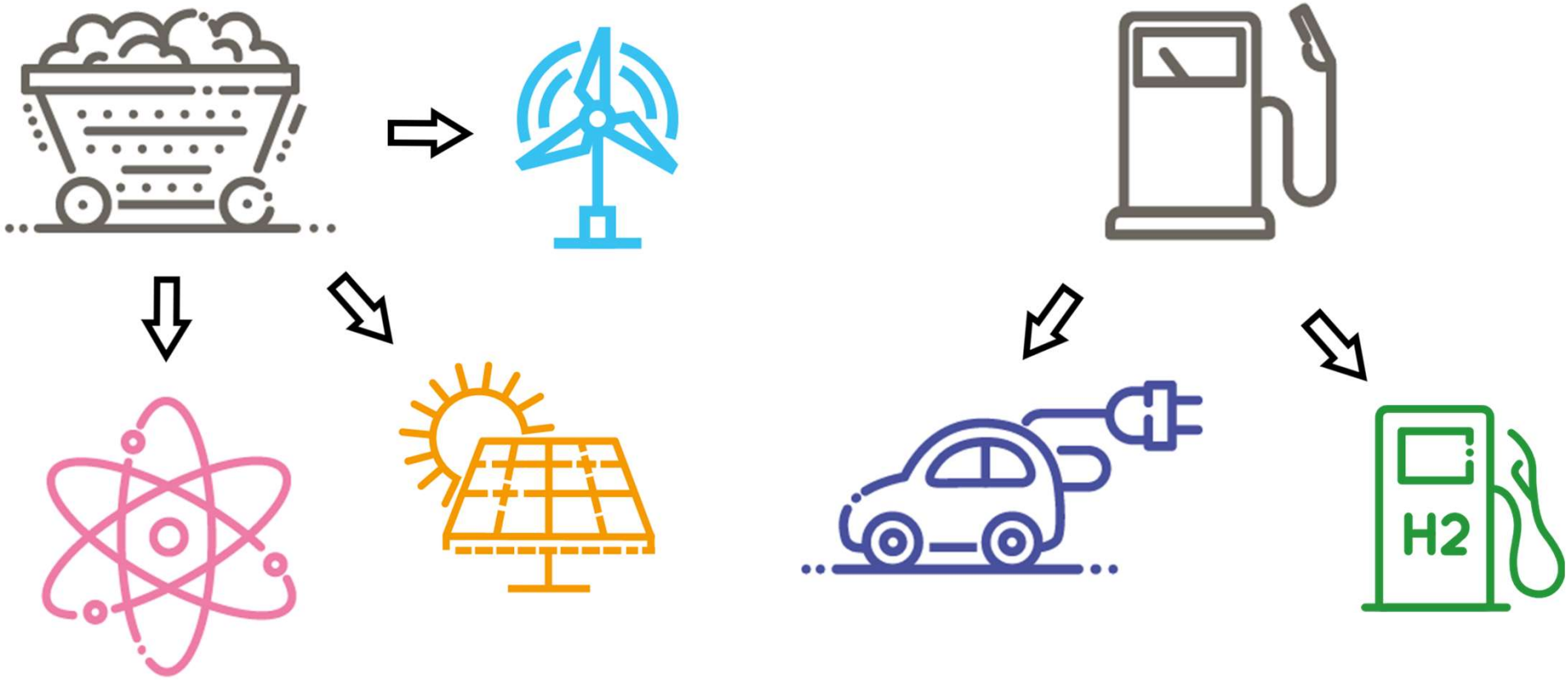
Net Zero Objectives for key industries



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AMB contribution towards net zero

How AMBs Can Contribute

- Improved efficiency of existing machines and systems
- Enabling of new technologies
- Carbon capture and sequestration

High Efficiency HVAC Centrifugal Compressor

CO2 Re-Injection Compressor

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Nuclear

Fuel Ball Blower

Helium circulator

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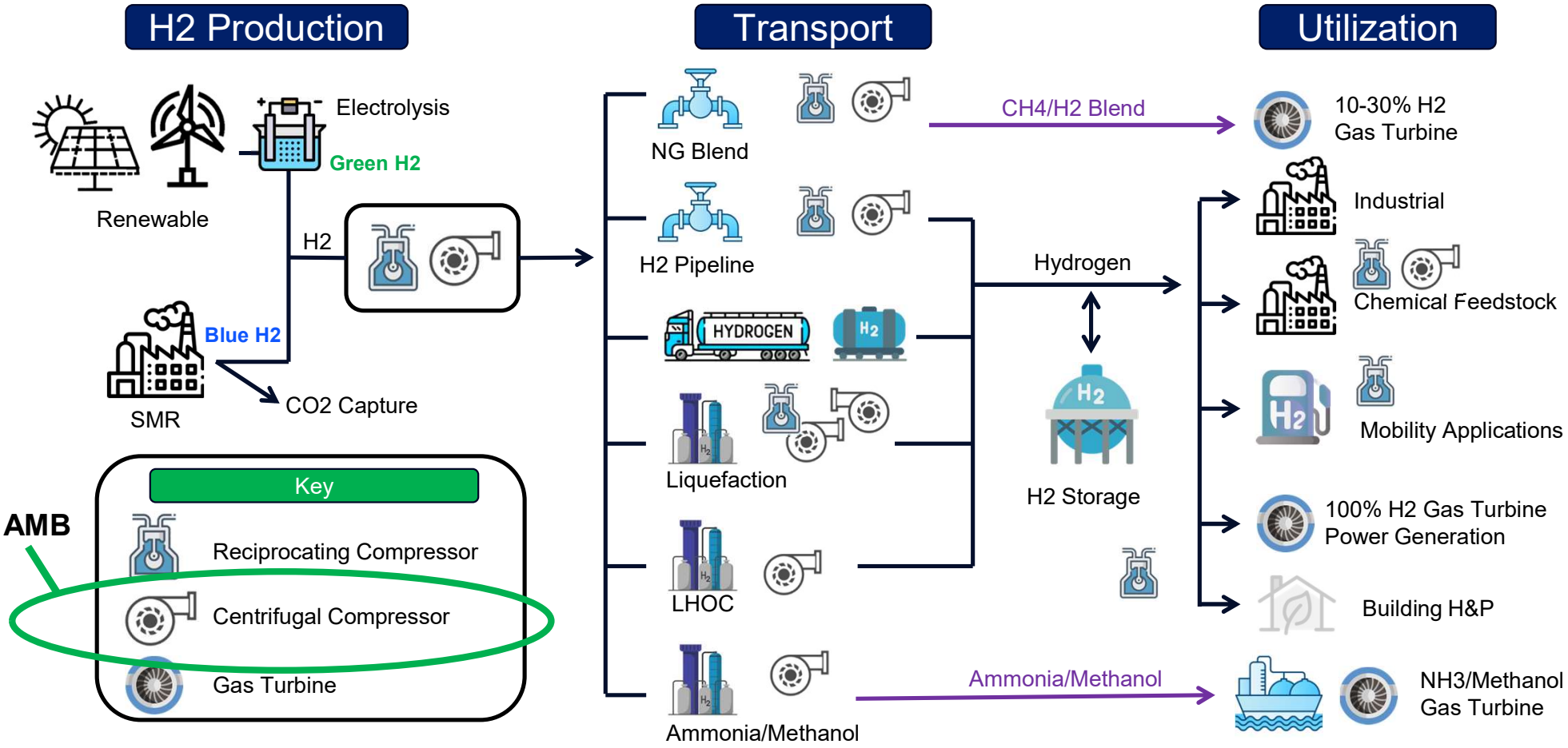
Hydrogen



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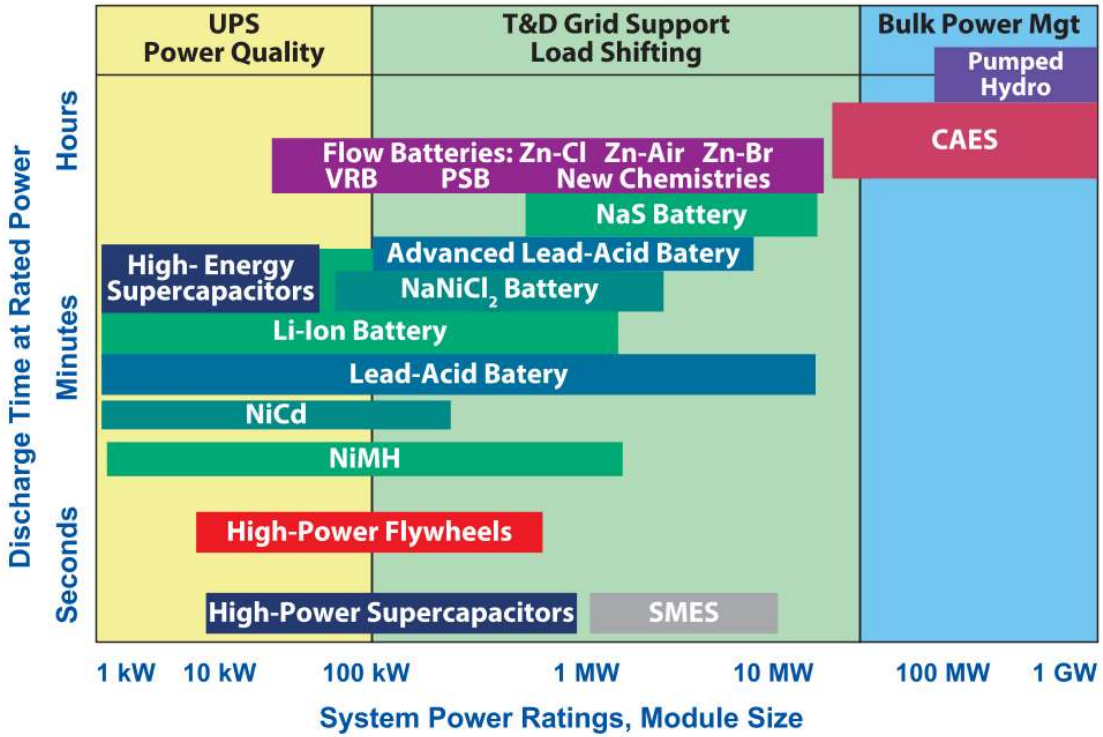
Flywheels



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How can we support those industries?

- Controller & Sensor Technology for very high speed machines
- Efficient Implementation of existing Nuclear technology
- Innovative designs for challenging H2 rotor-dynamics
- Materials for H2

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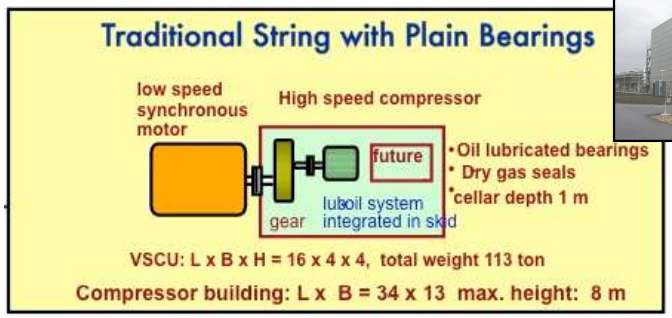
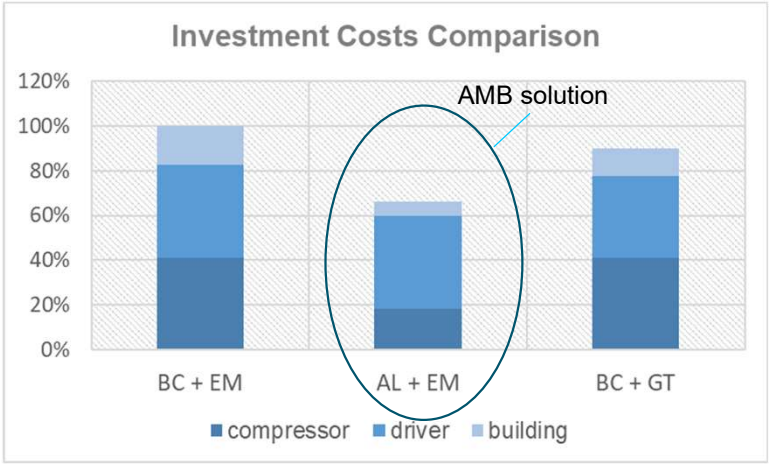
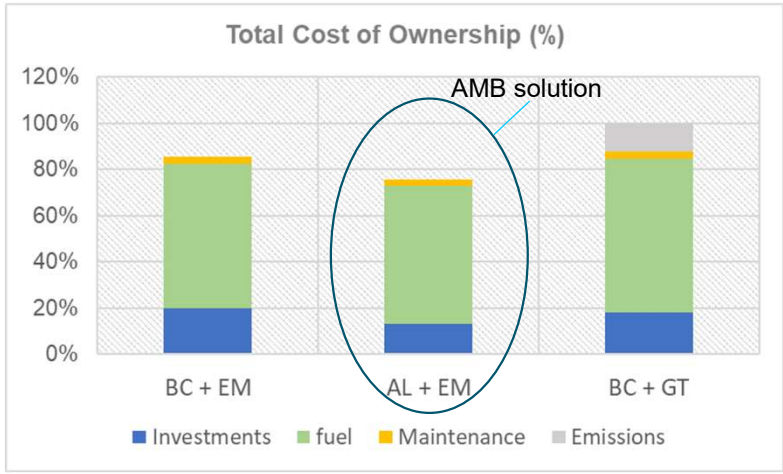
Price / Technology?



Compressor Building

Compressor without Building





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Retrofits / Life Extension

Retrofit Considerations

- Sensor Compatibility
- Amplifier voltage
- Magnet current
- Field Cable re-use – yes/no
- Customer Logic Interface
- Input Power systems
- Footprint

WMB -> WMB Retrofit (2017)

Competitor -> WMB retrofit (2022)

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What happened to IIoT?

AMB: Naturally born IIoT …COVID Resistant

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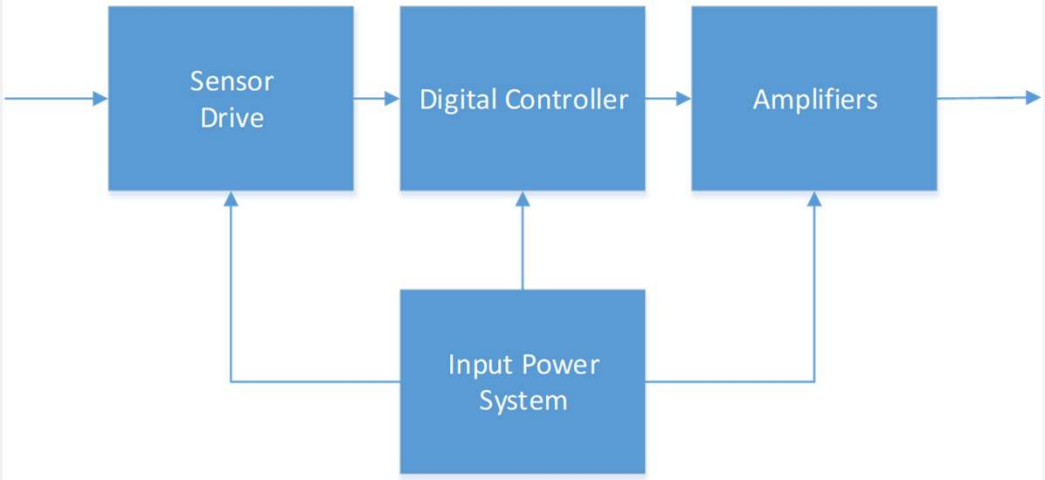
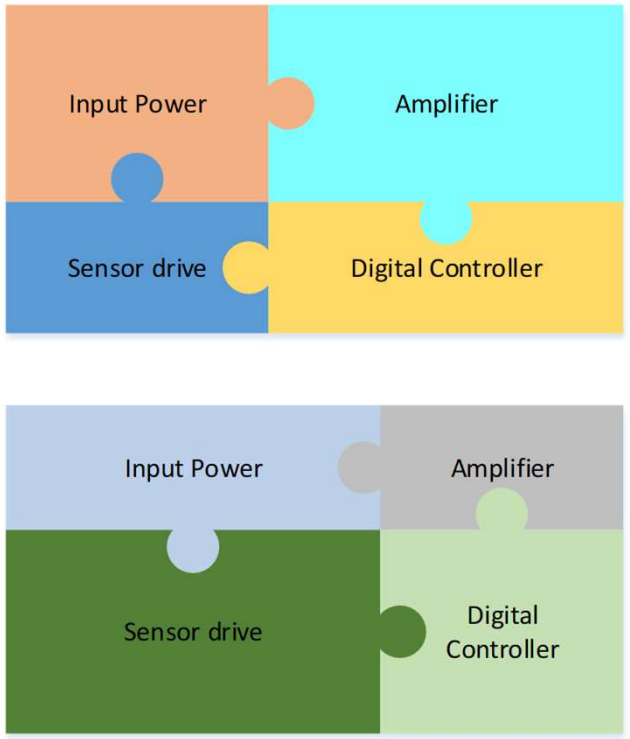
Standardization and Interoperability

AMB System Architecture



Interoperability



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Contribution from the AMB Community

API 617

Axial and Centrifugal Compresso
and Expander-compressors

API STANDARD 617
NINTH EDITION, APRIL 2022

American Petroleum Institute

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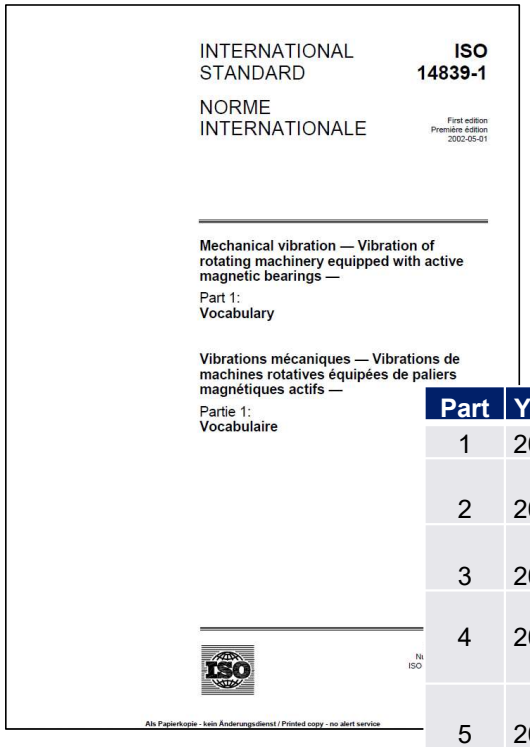
ISO 14839



INTERNATIONAL STANDARD **ISO 14839-1**

NORME INTERNATIONALE

First edition
Première édition
2002-05-01

Mechanical vibration — Vibration of rotating machinery equipped with active magnetic bearings —
Part 1:
Vocabulary

Vibrations mécaniques — Vibrations de machines rotatives équipées de paliers magnétiques actifs —
Partie 1:
Vocabulaire

ISO

Als Papierkopie - kein Änderungsdienst / Printed copy - no alert service

Part	Year	Topic	Notes
1	2018	Vocabulary	
2	2004	Evaluation of Vibration	
3	2006	Evaluation of Stability Margin	
4	2012	Technical Guidelines	To be revised to remove section on touchdown bearings
5	2022	Touchdown Bearings	
6		Load Capacity	Under Development

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Closing remarks

The Future is Bright for AMBs

Acknowledgements

Andrea Masala – who co-authored this presentation.

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