



KK Wind Solutions

A specialised systems supplier for wind power solutions

We innovate to integrate®



Agenda



An overall introduction of KK Wind Solutions

1. Who we are
2. Where we operate
3. What we offer
4. Who we collaborate with
5. Recap



Agenda

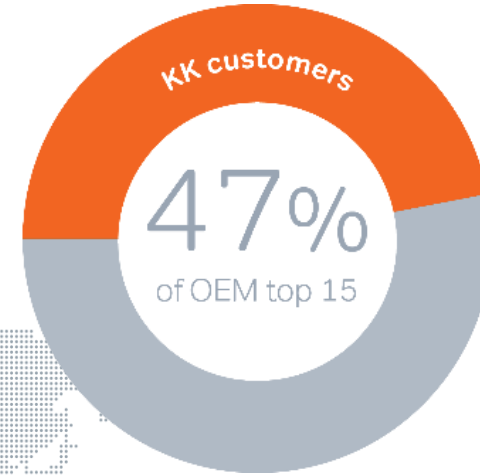


An overall introduction of KK Wind Solutions

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Systems supplier

Complex electro-mechanical solutions



+25,000

More than 25,000 **wind turbines** are equipped with our solutions.

+65%

of the global **offshore capacity** is equipped with our solutions.

+35

Years of experience

Building on more than 35 years of experience, KK Wind Solutions is a strong partner in electrical systems for wind turbines

A can-do culture with innovation in the DNA



Creating value through partnership, specialised knowhow and business insight

Our vision

Enable a wind powered future

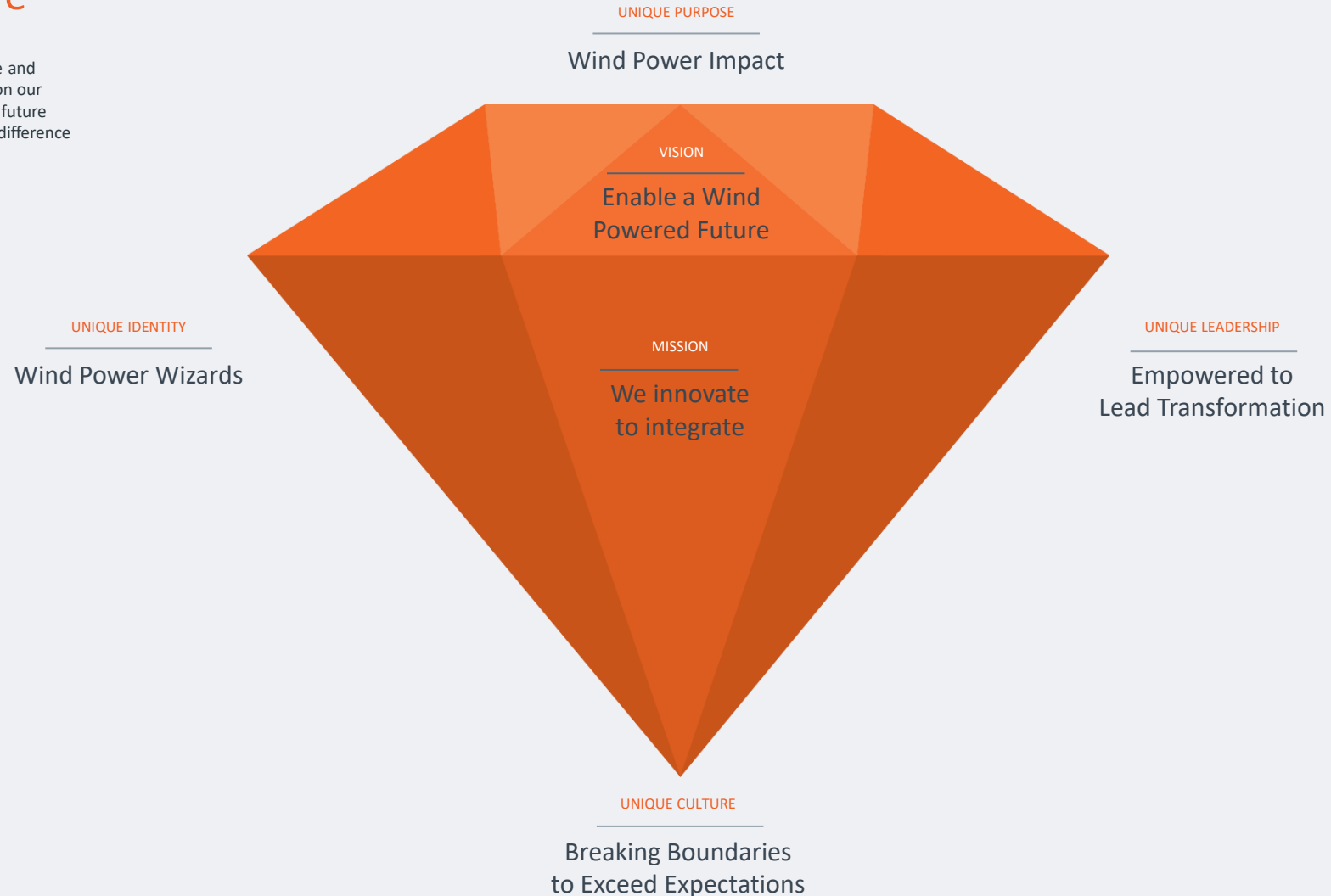
Our mission

We innovate to integrate

Caring to create value

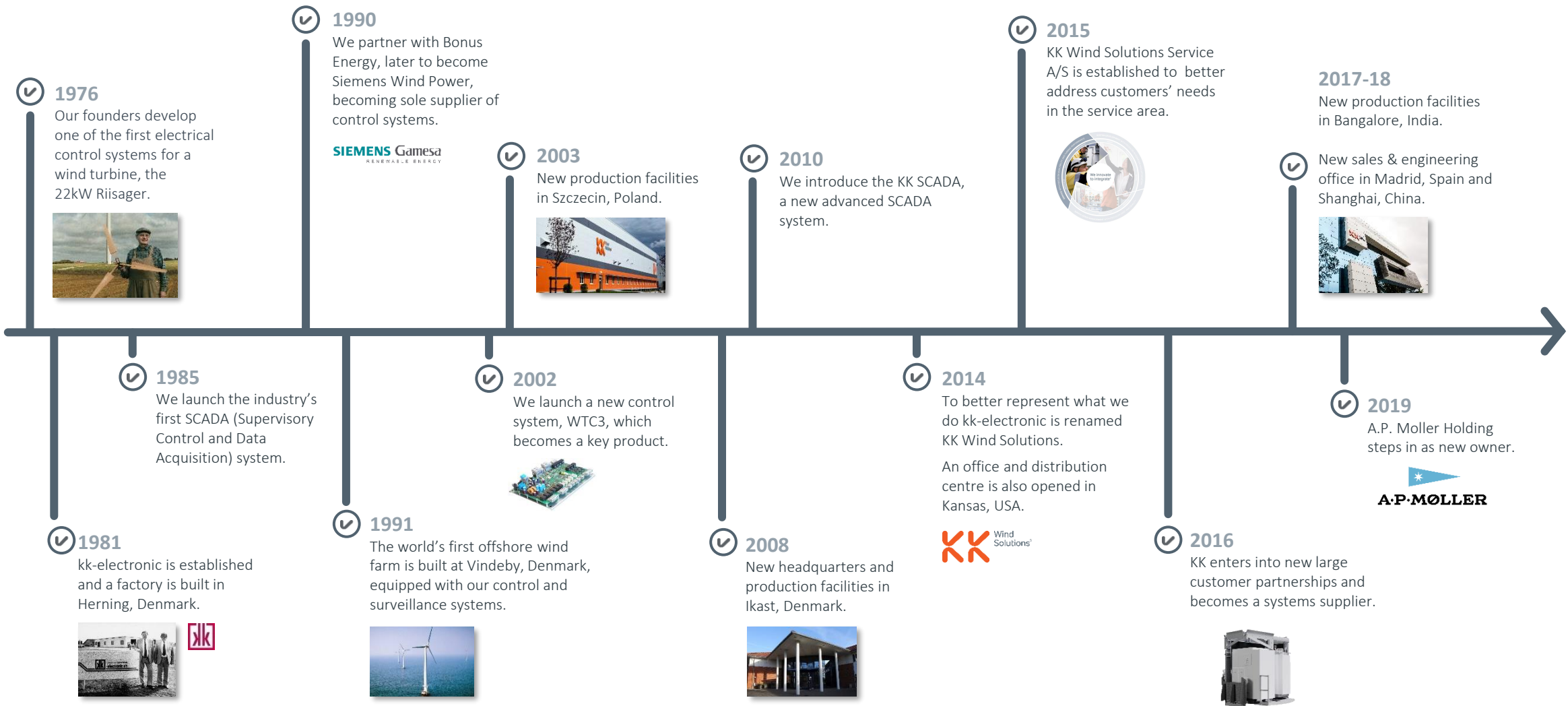
Our business diamond links vision, values, leadership to culture

Our strategic framework is meant to differentiate and accelerate our business. Keeping a strong focus on our uniqueness will inspire both daily execution and future innovation towards making the biggest possible difference for our customers, employees and society in general.



Our history

+35 years of experience in electrical and mechanical systems for wind



Corporate structure and ownership



A financially strong group with dedicated focus on wind



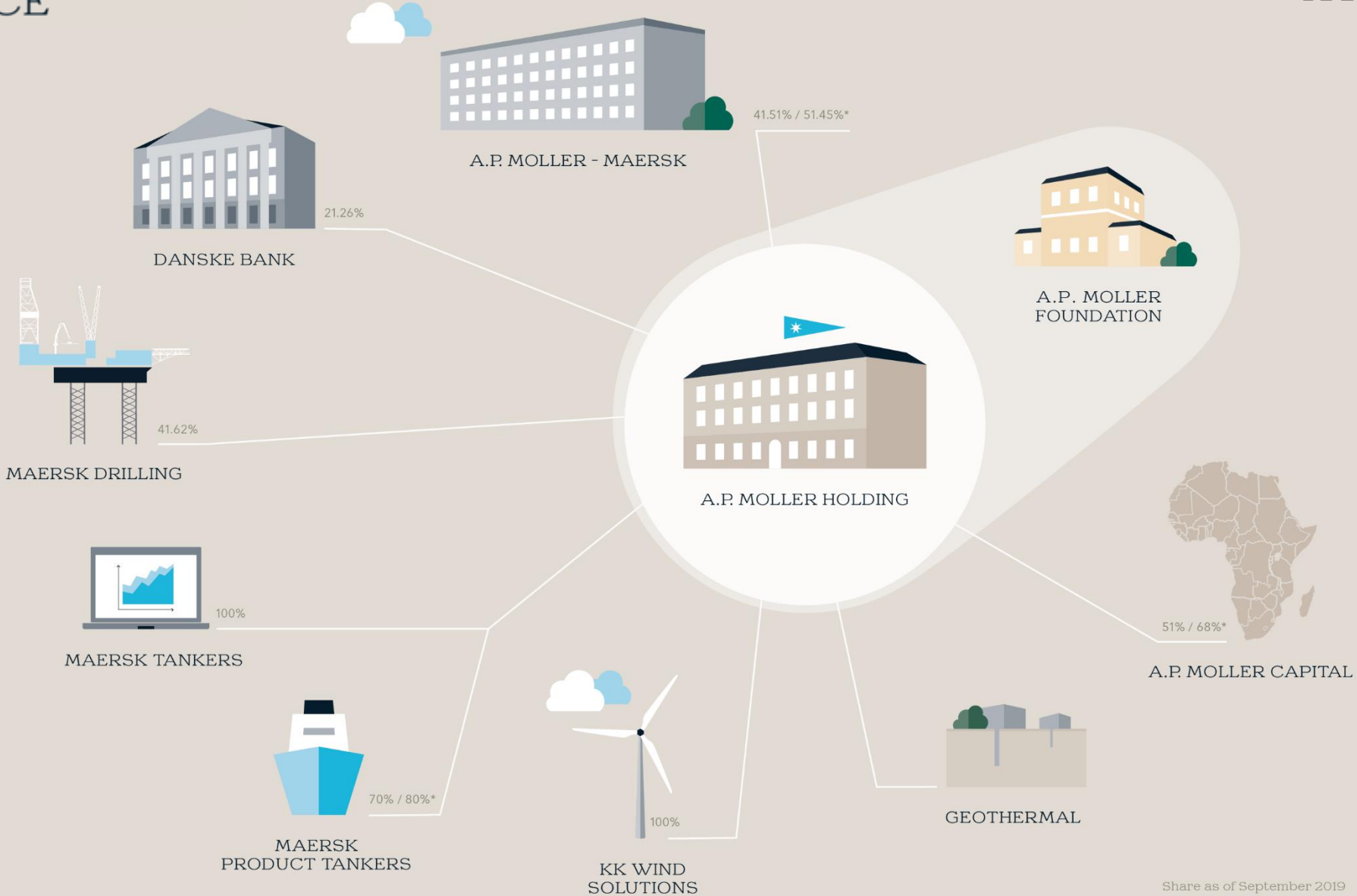
A.P. MOLLER

Strong ownership

A.P. Moller Holding is the parent company of the A.P. Moller Group, established in 1904.

Today the Group consists of private and public companies within transportation, logistics, infrastructure, energy, and financial services.

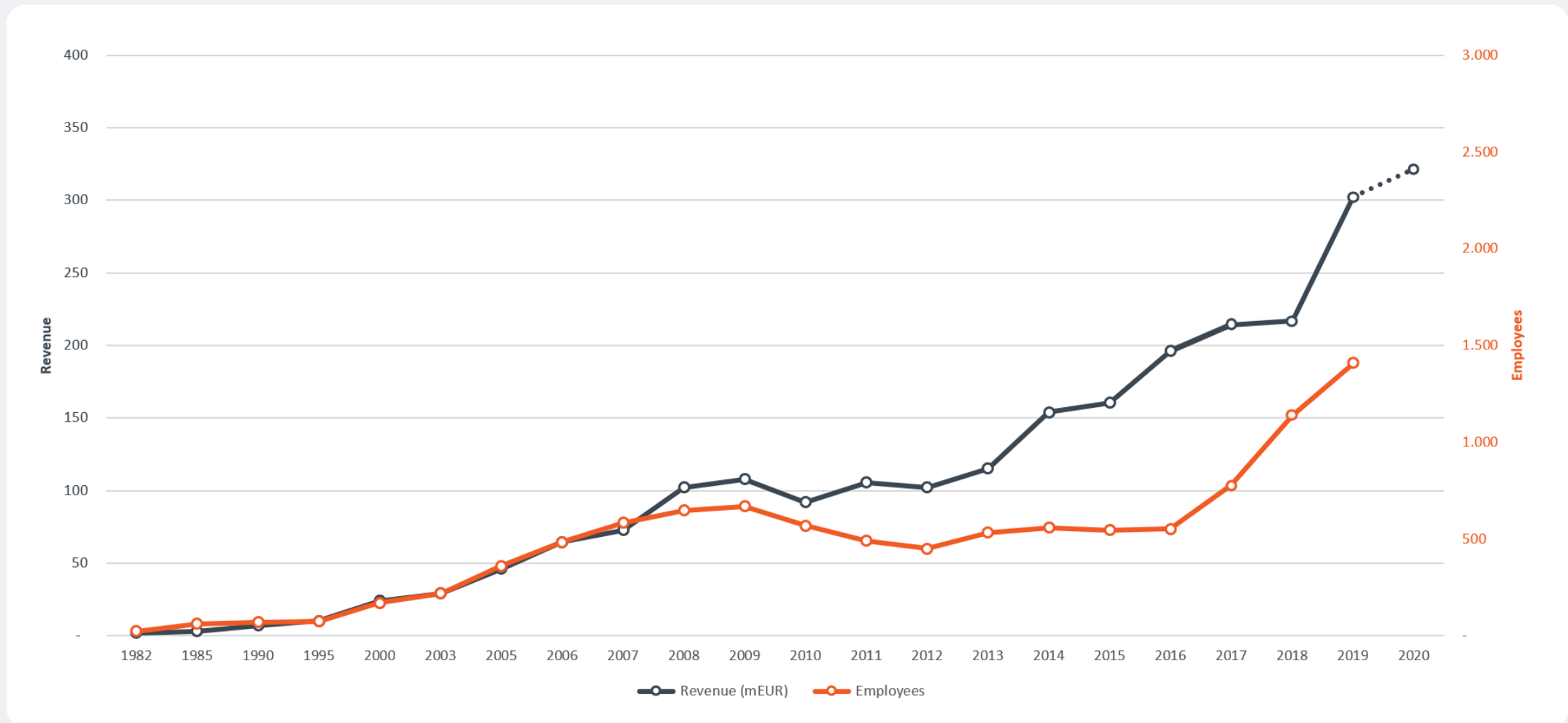
A.P. MOLLER HOLDING AT A GLANCE



Share as of September 2019
*Ownership/Voting share

Strong financial performance

A reliable and financially strong partner



Locations

Global setup with a strong presence in three regions: USA, Europe and Asia



Our solutions cycle

Built on more than 35 years of experience in electro-mechanical systems

- >35 years of experience
- +25,000 wind turbines are equipped with our solutions
- +1,400 dedicated people
- A trusted system integrator
- A global and agile partner



System Development

Ensuring seamless integration and turbine optimisation

- Innovation and R&D partner
- High level of expertise across electrical and mechanical systems
- Flexible setup
- Extensive track record
- Modular approach
- Industry-leading test and prototyping facilities



Supply Chain Management

Reducing cost and complexity in your supply chain

- Lean and cost-efficient manufacturing & supply chain solutions
- Highly skilled & experienced staff
- Agile and fast introduction of prototypes and new products
- Flexibility in handling customer product mix and variations in demand
- High standards in quality, health and safety standards according to ISO9001, ISO14001 and OHSAS 18001



Service

Improving turbine performance through knowhow and flexibility

- Operations & maintenance of turbines with agile organization
- Experienced workforce with highly specialised skills across LV, MV and HV service
- Service engineering and retrofits
- Global distribution network of spare parts and upgrades
- Excellent safety track record and compliance with highest safety and quality standards



Customers and offerings

Solutions provider with focus on three customer segments



Wind Turbine Controls



Wind Turbine Subsystems



Park Management



Manufacturing and Supply Chain Solutions



Operations and Maintenance



Wind Turbine Manufacturers (OEM's)



Large wind park owners & operators*



Others**

* Turbine owners and operators with large fleets including Independent Service Providers (ISP's)

**Sub-suppliers, wholesalers, turbine owners with small fleets and turbine owners without operating responsibilities

Solutions to match any customer need in electrical systems



Wind Turbine Controls

Building on more than 35 years of experience we develop tailor-made control systems that integrate seamlessly to optimise turbine performance

Our solutions include:

- Control Systems
- Wind Turbine Application Software
- Development Tools
- IO Modules
- Grid Monitor
- Hub Module
- Safety Systems
- Retrofit Solutions



Wind Turbine Subsystems

Tailor-made subsystems built on proven technology to ensure easy, reliable integration with other turbine systems

Our solutions include:

- Converters
- Pitch systems
- Backup systems
- Protection Systems
- Rotor Speed Guard
- Wind Sensors
- Vibration & Acceleration Sensors
- Data Link & Connectivity



Park Management

Surveillance, monitoring and management systems that deliver high quality data to ensure transparency and continuous turbine optimisation

Our solutions include:

- SCADA solutions (PRO Engine)
- Data Transfer
- Datalogger (iBOX)



Manufacturing and Supply Chain Solutions

Lower costs and reduced complexity through lean manufacturing and flexible, efficient and high quality supply chain solutions

Our solutions include:

- Rapid New Product Introduction
- Strategic Sourcing
- Lean Manufacturing
- Cost Out & Cash Flow Optimisation
- Testing from W to MW
- Global Logistics



Operations and Maintenance

Utilising extensive experience and know-how of electrical systems in turbines to provide efficient and flexible on-site operations & maintenance and spare part services

Our solutions include:

- Prototype Installation & Testing
- Commissioning
- Re-engineering
- Field Implementation
- Spare Parts & Repair
- High Voltage service
- Training and technical support

Solution and product examples

Technology developed, manufactured and serviced by KK Wind Solutions

+ 20 ton complex systems



- Large platforms
- Tower internals
- Converters
- Transformers
- Switchgears
- Control systems
- Pitch systems
- Hub systems
- UPS systems
- Battery systems
- Auxiliary systems

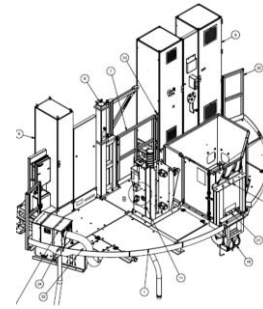
Modular platforms



Electro-mechanical platforms



Converter sub-assemblies

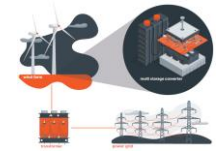


Distribution panel platform

Power conversion



Converters, On-offshore 2MW to +10MW



Advanced multi-level converters



Advanced stacks (inverters) for converters



Gate drivers and advanced electronics for converters

Control



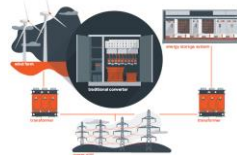
Controller units



IO units



Control, nacelle, generator, hub, pitch control panels



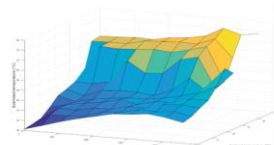
Solar, wind, storage control panels

Software and algorithms



Turbine control suite
Converter control suite
SCADA suite

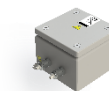
Prediction, reliability and health index algorithms
Performance algorithms



Sub-systems and components



Hub modules



Accelerometers



Speed guards



Grid modules



Fiber/electrical links



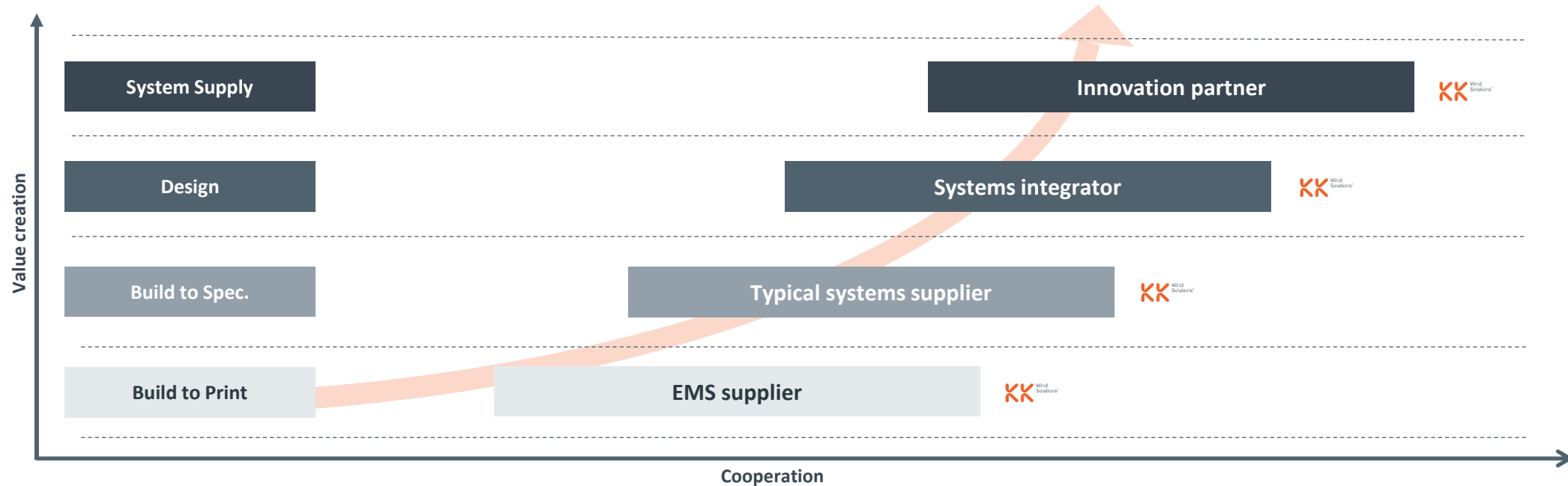
UPS systems
Battery systems



Interface boxes

Flexible collaboration models

Partnering with customers at all stages



Build to Print

Traditional built to print where customer owns the design and KK offers fast and competitive implementation from prototype to manufacturing process including delivering to anywhere in the world.

Build to Specifications

KK design according to customer specification with full IPR flexibility, owning the design, partnering teams to design, or transferring the design. Following design, prototyping, testing and 3rd body certification, KK offers competitive manufacturing.

Design

More than 35 years of experience in designing wind turbine systems for different customers.

From minor junction boxes and controls to electrical control panels and complex mechanical structures such as fully equipped tower platforms.

Systems Supply

Delivering complete systems, hardware and software integrating the design in the customers' wind turbine.

Fully supported process from idea to site-delivery.

Customers

Broad collaboration in the wind industry



SIEMENS Gamesa
RENEWABLE ENERGY



Vestas®



MHI VESTAS OFFSHORE WIND™



上海电气
SHANGHAI ELECTRIC



DOOSAN



UNISON®



ENVISION



HYOSUNG



SENVION
wind energy solutions



Orsted



CSIC



NEXTera
ENERGY



ANNO 1846
FRITZ SCHUR ENERGY



COLERES



Hydratech Industries
Wind Power



Recap

- ✓ +25 years of experience in manufacturing and supply chain solutions
- ✓ We offer solutions within system development, manufacturing, supply chain and service solutions
- ✓ We specialise in electrical and mechanical systems for wind turbines and offer our customers solutions that lower costs and maximise turbine performance
- ✓ Proven track record in reducing cost and improving the customer's cash flow – together with the customer
- ✓ Our lean manufacturing setup ensures you world-class performance in terms of delivery performance, quality and cost
- ✓ We never compromise on safety or quality

Questions?





Thank you for your attention

We innovate to integrate®