Engineering Demand Management: Supporting your company to manage future wind engineering growth

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1. Introduction
2. The Wind Engineering Challenge
3. Engineering Demand Management
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AFRY is a leading global engineering and consulting firm with more than 20 years of experience in wind farm engineering and energy consulting

AFRY at a glance

~16,000
EMPLOYEES GLOBALLY
(at the end of 2020)

~1.9 bn
EUROS REVENUE in 2020

40+
COUNTRIES WITH OFFICES

AFRY divisions

1

ENERGY
Renewable Energy
Thermal Power
Hydro
Transmission & Distribution
Nuclear
Contracting

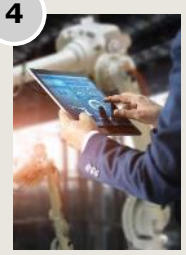
2

INFRASTRUCTURE
Transportation
Buildings
Project Management
Water
Environment
Architecture & Design

3

PROCESS INDUSTRIES
Bioindustries
Chemicals
Pulp, paper & tissue
Mining & Metals

4



INDUSTRIAL & DIGITAL SOLUTIONS
Advanced Automation
Connected Products
Automotive Design & Engineering
Food & Pharma
IT Solutions

5

MANAGEMENT CONSULTING
Energy Sector
Bioindustry Sector
Market Analysis
Strategic Advice
Operational Excellence
M&A and Transactions

Wind energy

20+
YEARS OF EXPERIENCE IN THE WIND INDUSTRY

30.000+
MW WIND FARMS WITH AFRY ENGINEERING INVOLVED

125.000+
MW CAPACITY OF RENEWABLE ASSETS VALUED IN TRANSACTIONS SINCE 2010

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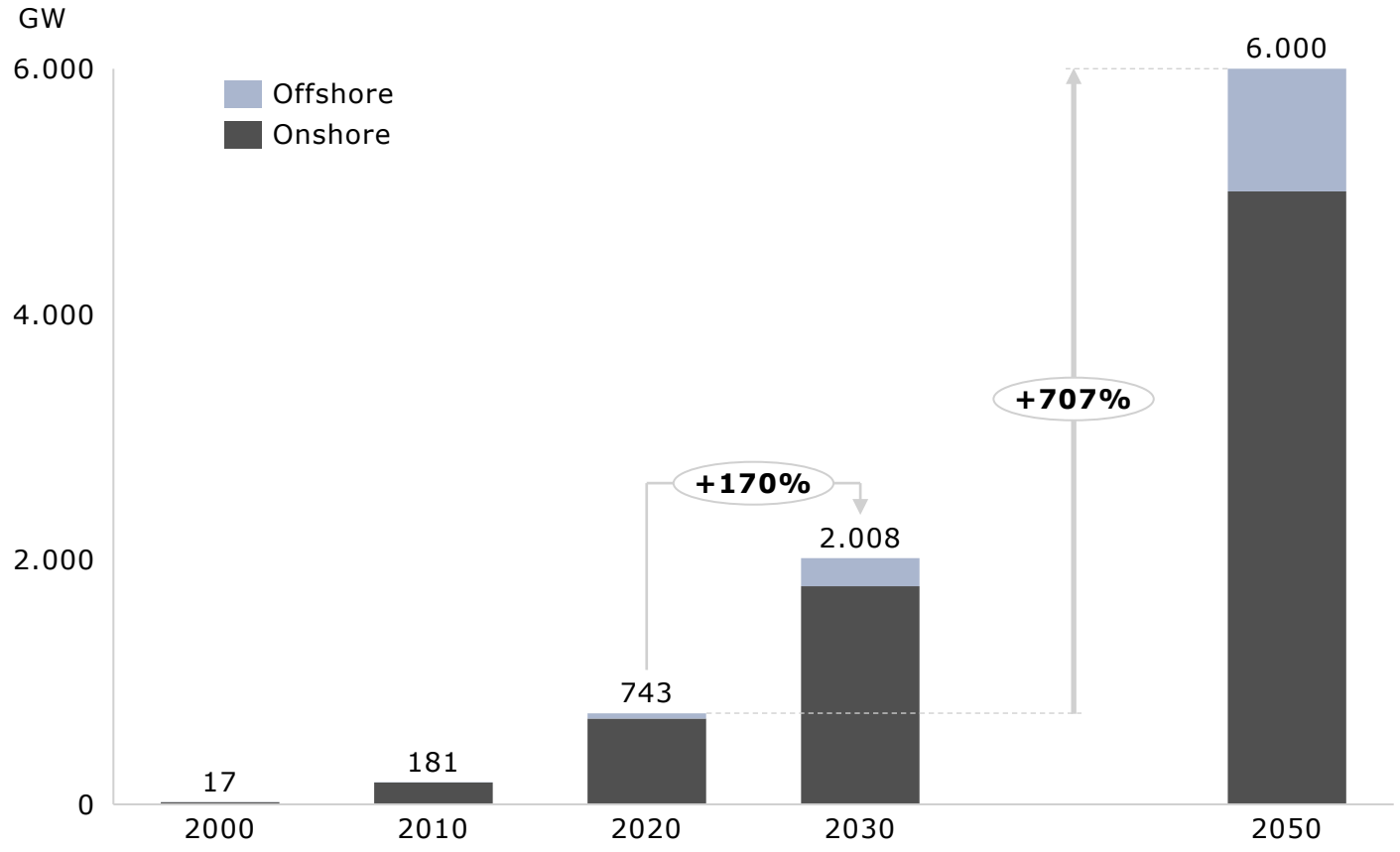
Global installed capacity in wind energy generation assets is going to increase 8-fold from 2020-2050

DEVELOPMENT OF GLOBAL WIND GENERATION CAPACITY



Source: IEA, Statista, ResearchGate, GWEC

- **Global wind energy capacity is expected to continue growing strongly through 2050**
  - Current total installed capacity already amounts to more than 740 GW
  - In 2030, installed capacity is projected to nearly triple to more than 2000 GW
  - In 2050, total installed capacity is targeted at 6.000 GW globally – an 8-fold increase from today's capacity
- To deliver strong growth of wind generation capacity, wind developers are under pressure to **scale their project development/ engineering organisations**

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THE WIND ENGINEERING CHALLENGE

Engineering organisations face the challenge to deliver design and validation work for the increasing project pipelines

KEY QUESTIONS

- How can we ensure the delivery of engineering work-packages in time, budget and quality?
- How can we increase the output from our engineering departments to cope with the increased demand?
- How can we find the balance between rapidly developing technology and the long project lead times from site identification, through design and permitting until construction?
- On which activities/projects should we focus internally, and which work-packages can be outsourced?

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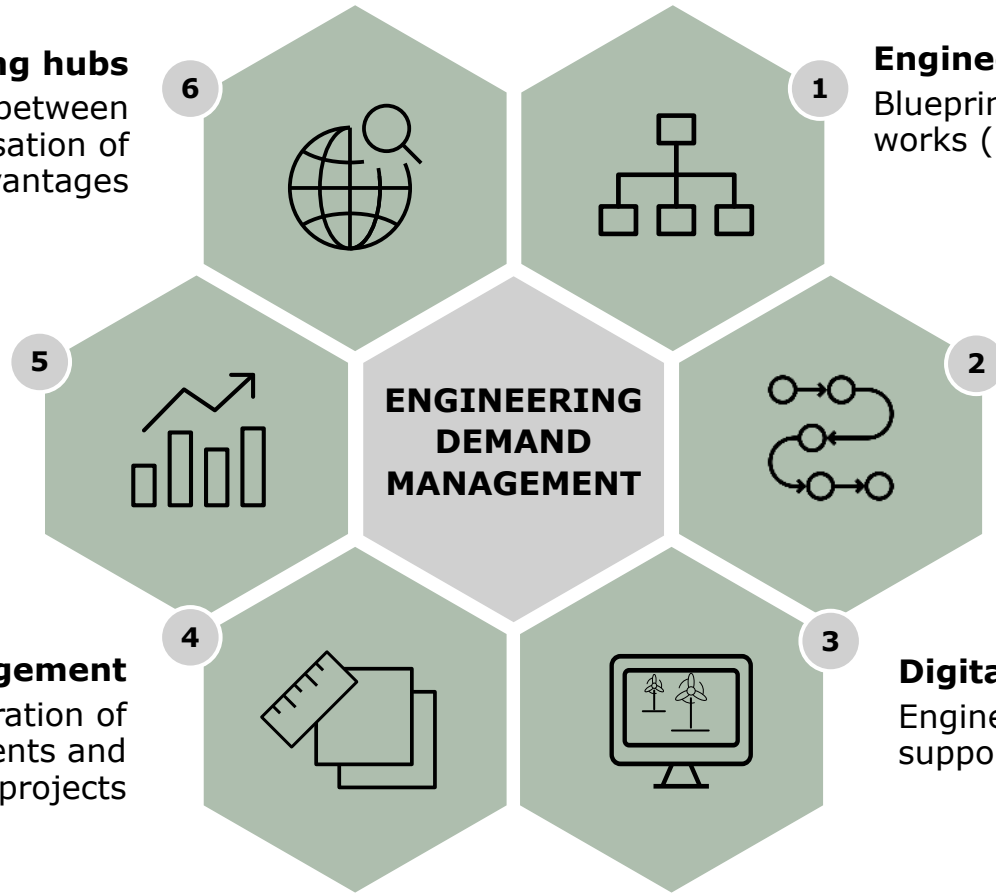
Our engineering demand management framework applies six levers to focus, optimise and digitalise design activities for on- and offshore wind projects

Global engineering hubs
Optimised task allocation between different regions and utilisation of regional advantages

Resource management
Planning of engineering resources based on in- and outsourcing strategy, project pipeline, criticality of project and regional aspects

Technology & variant management
Understanding and integration of technology developments and standardisation across projects



Engineering operating model
Blueprint how the engineering organisation works (people, process, technology, etc.)

Lean EPC processes
Standardised processes & milestones along the tendering and EPC process with clear responsibilities and deliverables for engineering

Digital engineering
Engineering and validation processes supported by stats-of the art tools

EPC: Engineering Procurement Construction PM: Project Management AR: Augmented Reality VR: Virtual Reality

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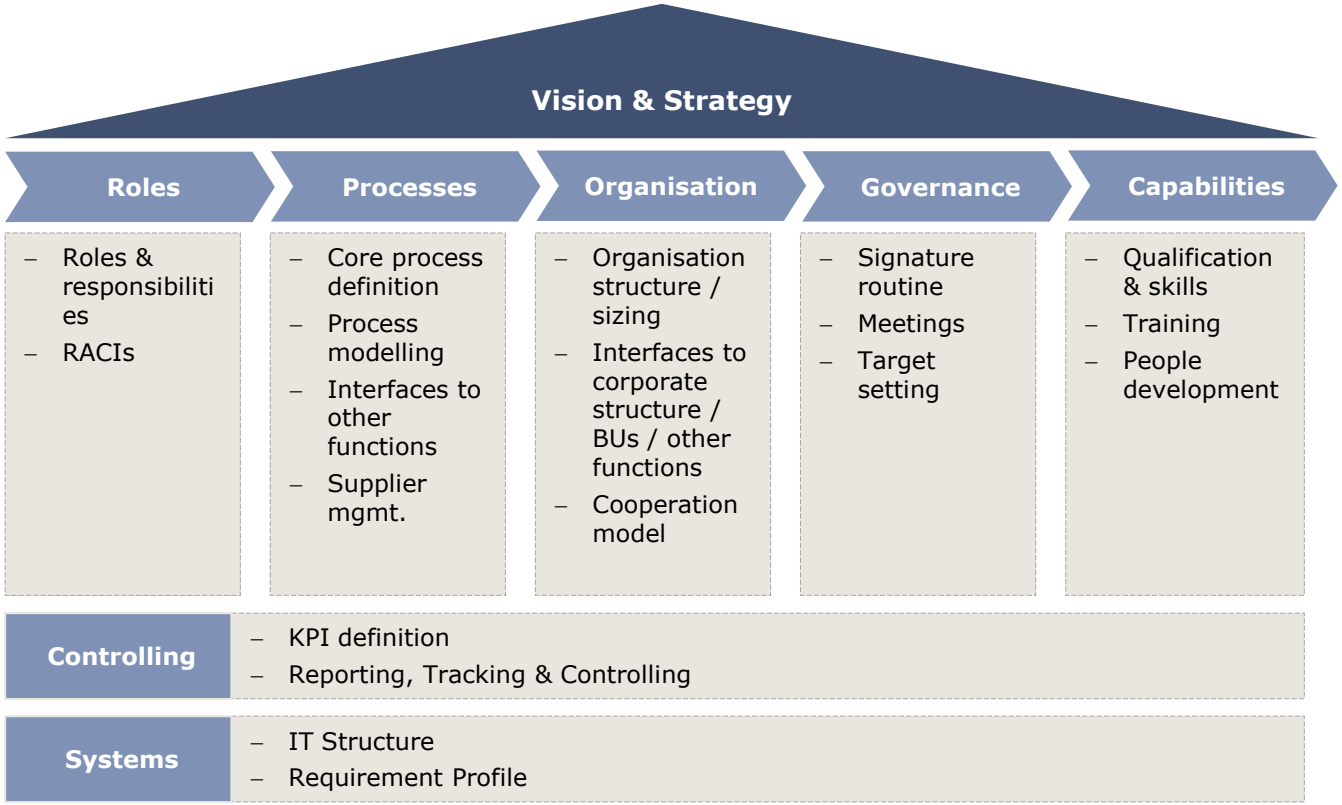
An engineering operating model needs to be aligned to the strategy and clearly define roles, processes, organisation, governance and capabilities

1 ENGINEERING OPERATING MODEL



- **Define how engineering operates**
  - Roles & responsibilities
  - Organisation & interfaces
  - Governance, target setting and controlling
  - Balance between RES technologies
  - Required capabilities
- **Focus on project development**
  - Asset management & site selection
  - Overall project development and management Conceptual and basic design
  - Package management
  - Wind farm & LCOE optimization
  - Driving the technology development
- **Become excellent in managing the solution contributors**
  - Technology understanding of wind systems
  - Technology assessment and selection
  - Technical contracting and supplier mgmt.
  - Design reviews

LCOE: Levelled Cost of Energy

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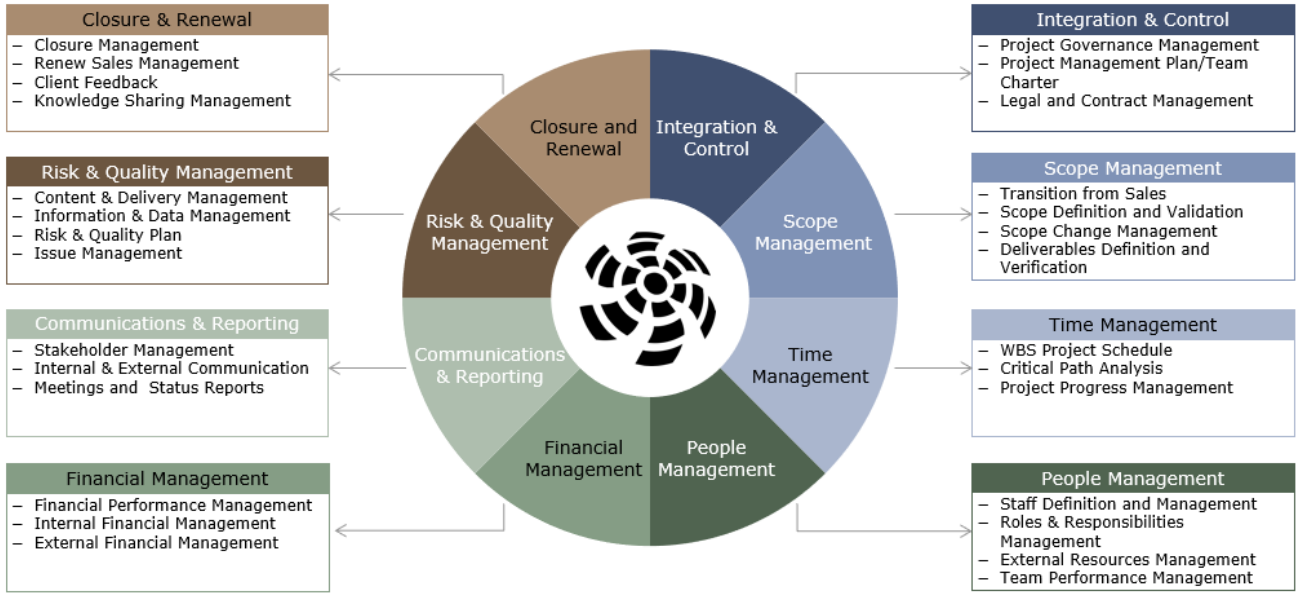
Lean engineering is achieved by standardised engineering, program management processes and regular progress monitoring

2 LEAN ENGINEERING

Example AFRY PM Framework



- **Implement lean wind engineering and project management processes**
  - Standardised processes
  - Milestones with clear approval criteria
  - EPC & PM guidelines & checklists
  - Attention to engineering change, risk and claim management
  - Integration with non-technical work streams (permitting, contracting, financial planning)
- **Institutionalise cross-functional meetings**
  - Milestone reviews
  - Hand-over sessions
  - Engineering changes reviews
  - Coordination with non-technical workstreams
- **Integrate partner & supplier as early as possible**
- **Set-up regular performance monitoring**
  - KPIs on progress and performance
  - Regular status reviews on project and engineering level

EPC: Engineering Procurement Construction PM: Project Management WBS: Work-Breakdown Structure

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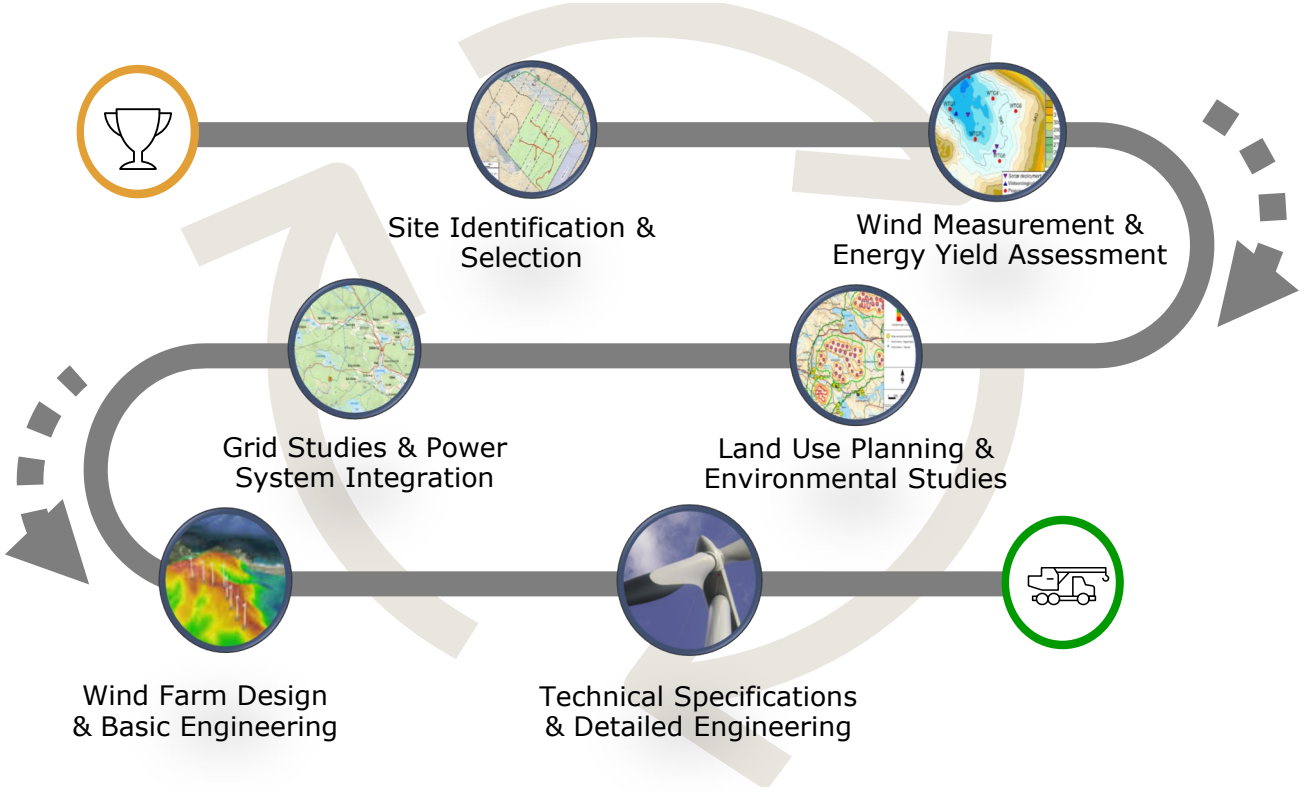
Engineers are supported by state-of-the-art tools for design, modelling, simulation and validation

DIGITAL ENGINEERING



- **Use state-of-the art software tools**
  - Land access and grid connection
  - Wind measurement & modelling
  - Noise emission calculation
  - Wind farm design & optimisation
  - 3D design
- **Ensure availability of data & documents for engineers**
  - Document management systems
  - Integration of information into 3D model
  - Shared folders & access rights
- **Enlarge virtual product modelling** to accelerate product simulation and validation
  - Digital twins
  - Augmented & virtual reality
- **Apply latest technology in construction monitoring**
  - LiDAR distance sensors & profile scanners
  - Drone-based monitoring and data collection

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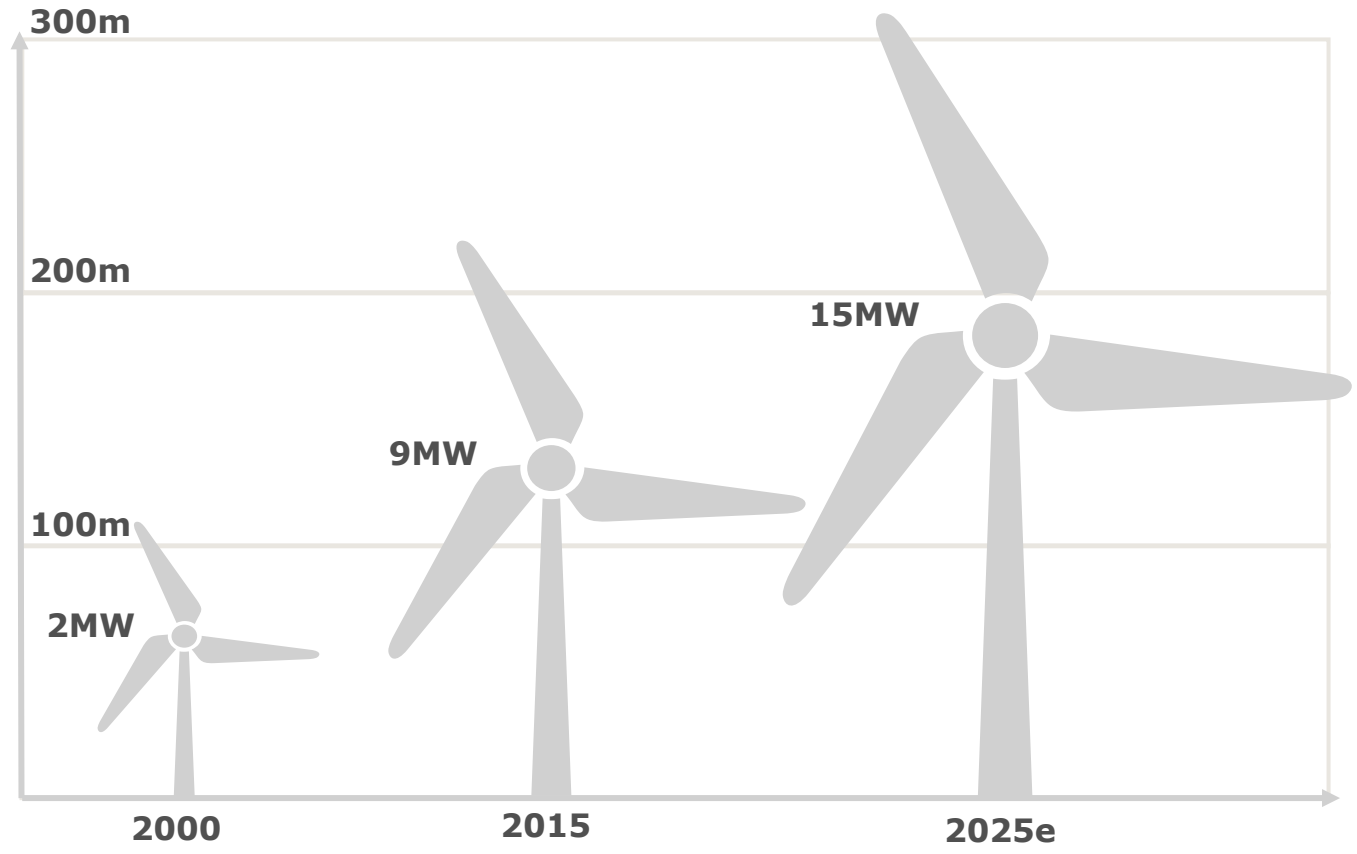
New technologies should be screened and integrated into the projects and standardisation of components across projects should be maximised

4 TECHNOLOGY & VARIANT MANAGEMENT



Source: AFRY Market Experience & Research

- **Drive standardisation across projects**
  - Reference designs
  - Catalogues of standard parts and components
  - Design principles
  - Cost catalogues
- **Integrate new technologies into reference design**
  - Systematic technology screening
  - Evaluation of technologies (commercial & technical)
  - Systematic integration of new technologies into reference designs
- **Link technology & variant management into standard EPC process**
  - Tendering based on reference designs
  - Use of references & standard parts to be checked at milestones
  - Link of reference designs and standard parts catalogues to 3D model

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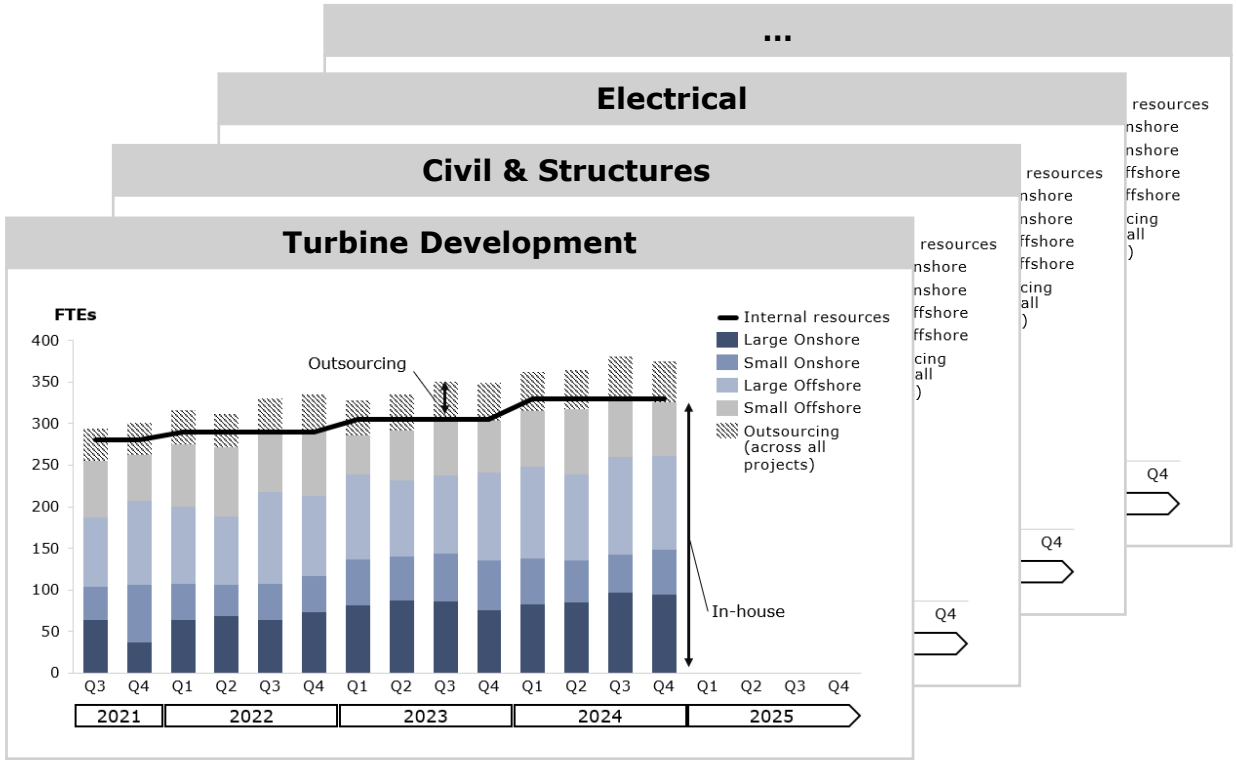
Holistic resource management is used to size the future engineering organisation and to deploy engineers to strategically important projects

5 RESOURCE MANAGEMENT



- **Establish strategic resource management to size future engineering**
  - Sizing per engineering capability / activity
  - Allocation of resources to projects
  - Utilisation of departments / regional offices over time
  - Definition of activities to be outsourced
- **Base resource management on strategic and operational input criteria**
  - Engineering activities and capacities
  - Project pipeline and engineering demand
  - Engineering resources & recruiting plans
  - In- and outsourcing strategy
  - Criticality evaluation of project
  - Region specific aspects
- **Review the future sizing of engineering on a regular basis**

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A global engineering network should be established to serve your global wind projects

6 GLOBAL ENGINEERING NETWORK

Example AFRY Wind Network

Aarhus | Bangkok | Beijing | Boston | Copenhagen | Düsseldorf | Gothenburg | Genova | Hanoi | Helsinki | Jakarta | Lima I Manila | London | Moscow | New Delhi | Oslo | Oulu | Santiago de Chile | Stockholm | Vienna | Zurich

- **Set-up network of engineering offices with varying focusses**
  - Industries
  - Customers
  - Capabilities (e.g., testing)
  - Technology development vs. project execution
  - Region
- **Set-up close collaboration between engineering hubs**
  - Joint project development (regional and central engineering)
  - Lessons learned from projects to central engineering
- **Utilise regional advantages**
  - Support of sales and project activities in the region
  - Improved collaboration with local customers, partners and research institutes
  - Recruitment of highly qualified people
  - Utilisation of cost advantages
  - Better understanding of local requirements

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KEY MESSAGES

The AFRY framework supports wind developers and engineering organisations to manage the future demand for wind engineering

ENGINEERING DEMAND MANAGEMENT

- **Define a blueprint how engineering operates** and become excellent in project development and min managing the solution contributors
- **Optimise and standardise processes** in engineering and project management
- **Use state-of-the-art tools** to accelerate design and testing
- **Integrate new technologies** into reference design and ensure use of references designs and **standard parts**
- **Integrate engineering process with non-technical workstreams** and ensure all are on the same page and working towards common goal
- Apply **strategic resource management** to size the future engineering organisation and to deploy engineers to strategic important projects
- Establish a **global engineering network** to serve your global projects

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CONCLUDING REMARKS

Contact us

- Reach out to us for more information:
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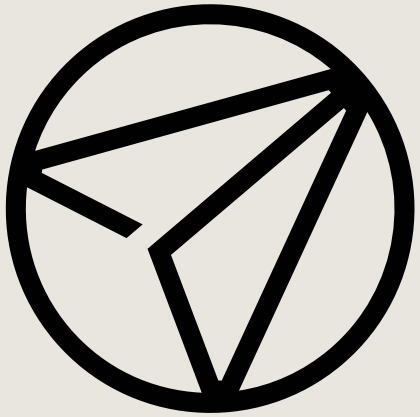
- More webinars will follow with relevant topics, and any update on the evolving situation.



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