



GRAVITY FOUNDATION SYSTEM  
FOR OFFSHORE WIND

**STRABAG**

# THE BASE OF POWER

German Norwegian Offshore Wind  
Energy Conference  
4. May 2010, Bergen

Dr.-Ing. Klaus Weber



4. May 2010



COMPANY

**STRABAG**

## STRABAG SE project markets

- Biggest construction group in Germany and Austria
- Leading construction company in Central and Eastern Europe (CEE)
- 73,000 employees
- Annual turnover 14 billion euro



● Non-European  
projekt markets

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**ENERGY POTENTIAL OFFSHORE WIND NORTH SEA: 150 GW**



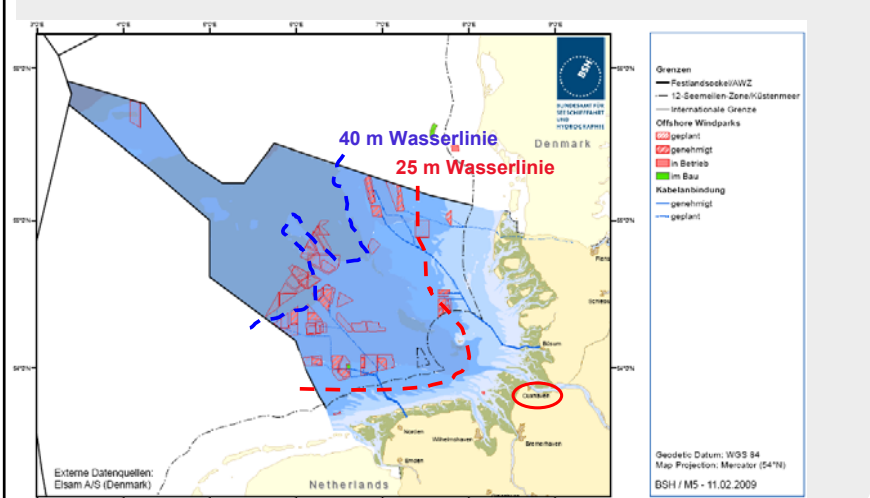
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**PROJECTS IN THE GERMAN NORTH SEA**

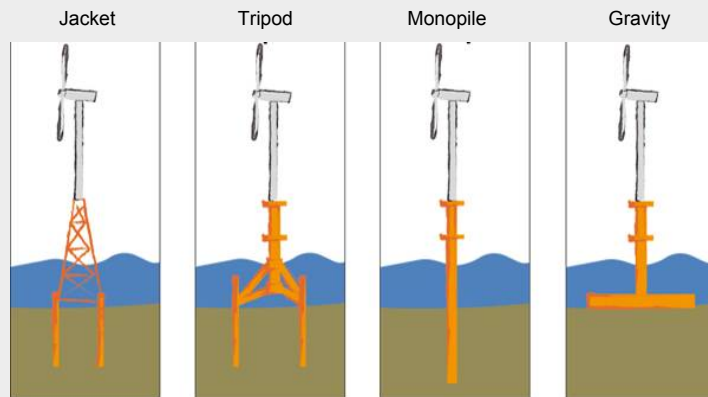


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**FOUNDATIONS**



**STRABAG OFFSHORE**

**Range of Services**

- STRABAG as general contractor for offshore foundations
- Package solutions: production, logistics, installation
- Own implementation planning of engineering bearing structures
- Project management and implementation of offshore wind farms
- Ocean Energy: development, planning and implementation of wave and current power plants



STRABAG SERIAL SYSTEM

**Concept**

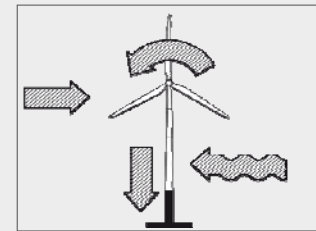
- Efficient package solution for foundations of offshore wind energy plants
- Production, transport, installation as a holistic process
- Large-scale production



STRABAG SERIAL SYSTEM

**360° Engineering**

- Holistic study of the complex load range at wind energy plants.
- Claim: fundamental understanding of specific offshore requirements.
- Target: optimisation of the entire system and maximum possible minimising of risk.

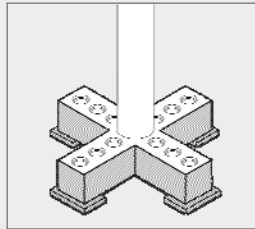




**STRABAG SERIAL SYSTEM**

**Gravity Foundation**

- Foundation system for large-scale production
- Use in water depths to approx. 40 metres
- Rapid and cost-effective implementation
- Minor dependency upon steel prices
- Environmentally sound installation, no ramming
- Ship-friendly collision behaviour
- Completely removable



**REFERENCES**

**Arkona Basin South East**

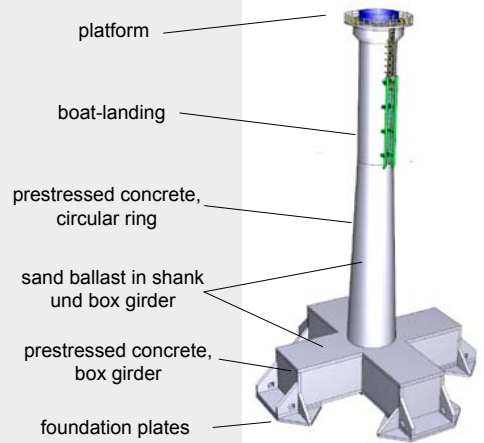
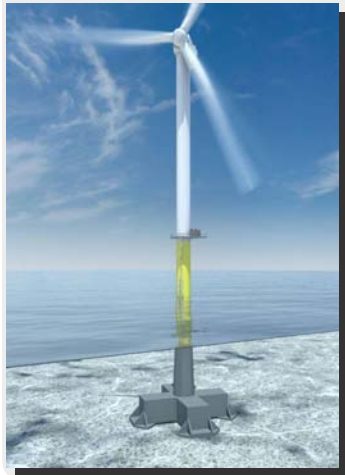
- First use of the STRABAG gravity foundation
- Overall planning and project management by STRABAG
- Construction period: 09/2006 to 11/2006
- Total height: 120 metres
- Water depth: 24 metres





## GRAVITY FOUNDATION

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## TRANSMISSION OF LOADS INTO THE SEABED

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### Seabed preparation:

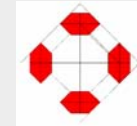
- Excavation of loose sand to reach adequate load-bearing ground
- Creation of subgrade with offshore-grader

### Scour protection:

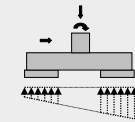
- local measure skirts to protect each of the 4 foundation plates
- global measure scour protection with big bags around the cross



### optimised shape of foundation plates



### limitation of base pressure



### Handling of tolerances:

- Source: planeness of the subgrade, diverse settlements
- Crouting under foundation plates

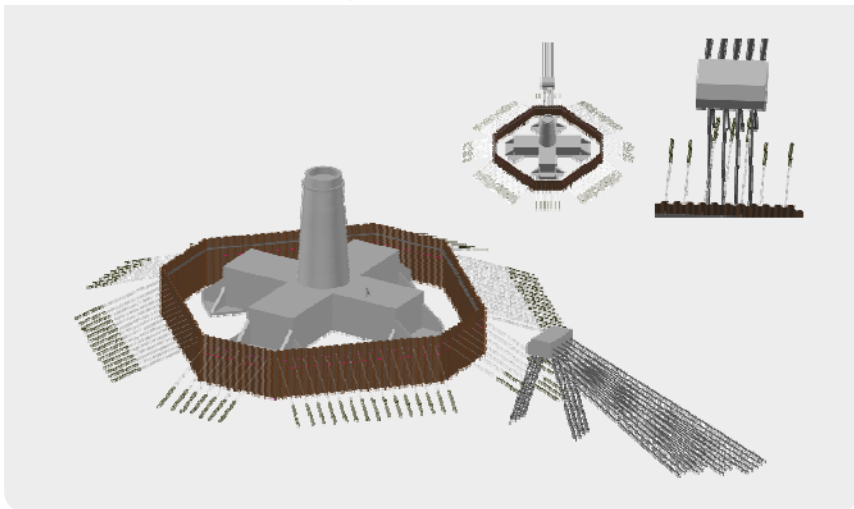
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TEST SITE IN CUXHAVEN; SCALE 1:1



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Overview construction technique

- Hub height: 90 m
- Distance WE – plants: 800 m



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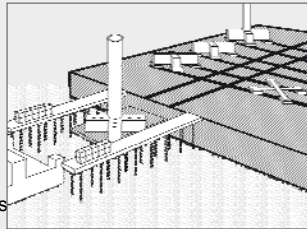


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### STRABAG SERIAL SYSTEM

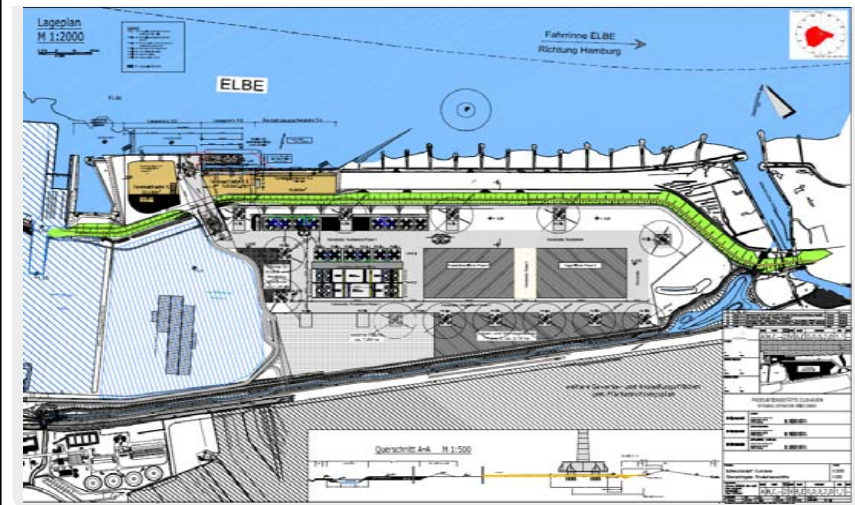
#### Production Terminal

- Industrial plant for large-scale production
- High automation: assembly line procedure
- In-house development
- Flexible adjustment of capacities
- Pre-installation onshore
- Securing the economic future of coastal locations at the North and Baltic Seas



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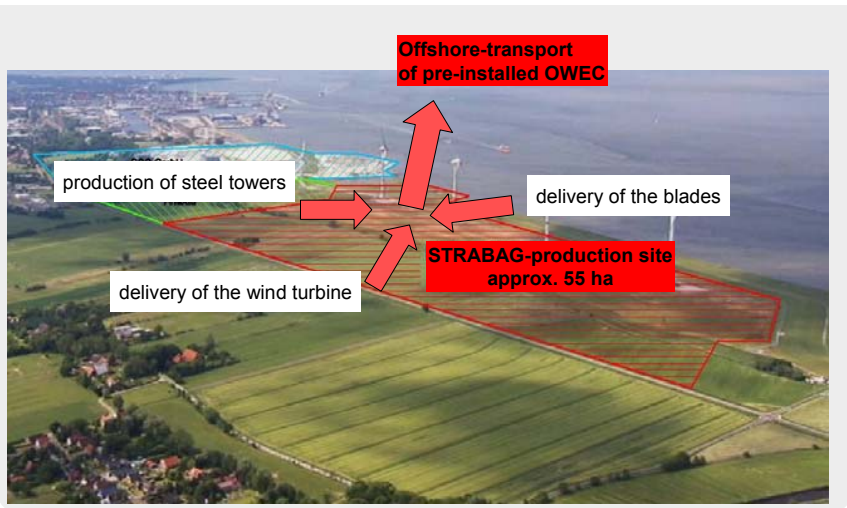
### PRODUCTION SITE CUXHAVEN





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**MAIN ADVANTAGE:  
PRE-INSTALLATION ONSHORE**



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**PRODUCTION SITE CUXHAVEN (25.MARCH.2010)**



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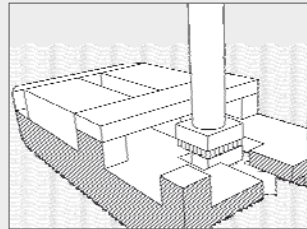
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### STRABAG INSTALLATION VESSEL

- Multifunctional, mobile offshore construction equipment
- In-house development
- Mostly independent from weather and sea conditions
- Minimization of offshore operations
  - Onshore pre-installation of the tower and wind turbine (if appropriate also the rotor blades)

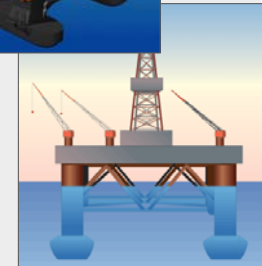
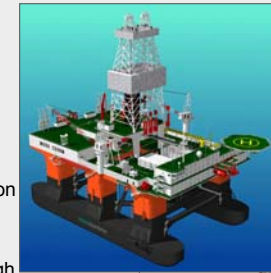


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### STRABAG INSTALLATION VESSEL: TECHNOLOGIES / OBJECTIVES

#### Semi - Submersible - Floating - Technology

- Floaters mainly under the water level.
- Minimization of the impacted cross section in the sea line
- The motion of the sea mainly flows through the ship body.



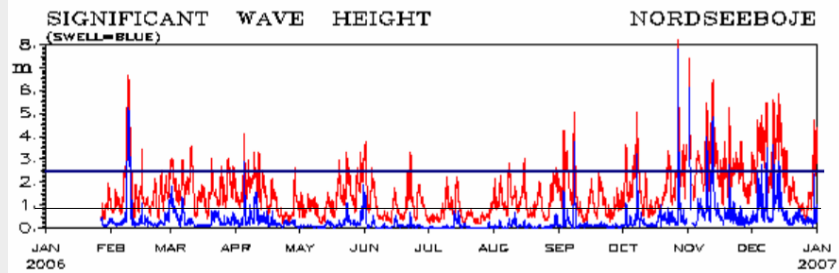
→ **Marginal motions and accelerations.**



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STRABAG INSTALLATION VESSEL

significant wave height 2006: NSB 3



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MAIN ADVANTAGES:  
OFFSHORE-LOGISTIC CONCEPT



transit



installation process



completed installation

→minimizing offshore risks

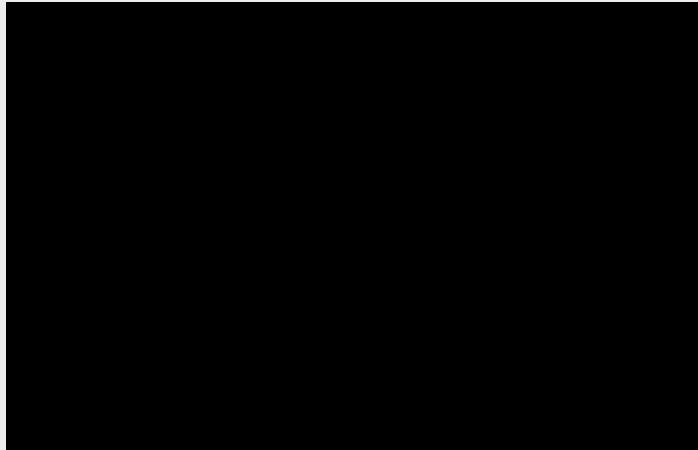
→fast offshore installation

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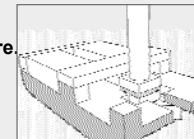
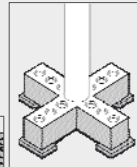
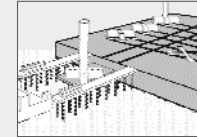


SUMMARY - ANIMATION



SUMMARY

1. **Innovative gravity based foundation system.**
2. **Plant for large scale production.**
3. **STRABAG Terminal in Cuxhaven.**
4. **Main pre-installation onshore.**
5. **Offshore installation**  
→ **Excessively robust equipment!**





GRAVITY FOUNDATION SYSTEM  
FOR OFFSHORE WIND

**STRABAG**

**We are ready to go ...**

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