FLOATING OFFSHORE SUBSTATIONS

Executive Summary
Conclusions & Key Advantages

› High level of modularization and standardization to reduce cost and lead times

› Scalable modularised design adaptable to meet local content requirements, standards and certification requirements

› Well-adapted industrial solution with existing supply chain

› Equipment accelerations confirmed with ABB

› Quayside mating of hull and top-side and testing/ pre-commissioning

› Low-cost tow to offshore wind farm sites
Cables

› Configurations workable in 40m water depth - around 30m water depth, careful consideration needed

› Configurations already being tested on the Floatgen demonstrator up to 28m offset in 30m water depth

› A large portion of fatigue damage is caused by water particle kinematics

› 220kV export cables data are provisional and will need further confirmation

› 66kV cables can now be well modelled

› Cable maintenance philosophy to be defined with OSS operators to fine-tune design

› Offshore installation of buoys, etc. took half a day on Floatgen cable with similar design
SeeOS concept

› Modular, Scalable from 200 to 900 MW
› Flexible: 33/66 kV, with or w/o shunt reactors, backup gensets, helideck, crane...
› Cost saving stress skin design
› Short lead time
› Certified
› No offshore lifting

› Cost-effective through serialisation
Electrical Equipment

- Acceleration withstanding of main electrical equipment is guaranteed. Specific studies might be necessary for special products or solutions (early engagement suggested).
- Local content, standards and certification requirements can be met.
- Well-adapted industrial solution for existing supply chain.
- ABB Ability® digital solutions can bring superior benefits.

Floating Offshore Wind is a reality with existing references and ongoing product development.

- Early engagement with electrical product supplier is recommended to evaluate the most suitable product and system approach.
Dynamic cables

- 66(72max) kV Dynamic Cables are in construction now
- Solutions with qualified HV dynamic cables systems are existing, including accessories
- Dynamic cables system qualified up to 145kV, no technical gap identified to reach 220kV
- Cables will be project-specific, manufacturers to be involved very early in project process to design the proper solution
- Development and Demonstration Projects are underway to qualify MV/HV component and cable technology, ready for the substantial floating offshore wind market
Insurability

› Insurances ‘are not used to insure additional technology and design risk of floating incl. the consequential loss of the wind farm (business interruption)’
› Insurers willingness to insure floating wind is similar to what we experienced with bottom fixed offshore wind between 2005 and 2008
› Floating Foundations, Cables, Moorings should achieve at least LEG 2
› Technical Risk Mitigation as key for insurability:
   › Redundancy in mooring system
   › Safety factor (10) in fatigue calculations of dynamic cables
   › Redundancy in export cable
   › Spare cables for replacement in port
   › Ballasting and emergency systems
› A lot of insurance managers and advisors have to be convinced
Bankability

- Built on the fixed-bottom offshore wind experience with technology-specific adjustments
- Debt could be raised for the first commercial projects
- Debt terms will not be aggressive, but should still help investors
- Risk allocation and interfaces are key
- Technical and contract interfaces need to be clearly identified and managed carefully
- Although bankability ultimately depends on several parameters, information sharing, technical review and creation of precedents are prerequisites to successful transactions

- Ideol substation is paving the way to making floating substations bankable