A Safety Case Framework for Offshore Wind

Siemens has been operating in the Offshore Wind Industry since 1991 and provides integrated solutions throughout the entire energy conversion chain with products, logistics and services.

Risktec is an independent and specialist risk management consulting and training company which forms part of the TÜV Rheinland Group. Risktec assist clients in major hazard industries and commercial and public sectors to manage health, safety, security, environmental and business risk.

Background

As the renewable energy industry continues to push the boundaries of Offshore Wind Farm potential, developing projects further from shore, in deeper water, with larger turbines, Siemens identified the need for an approach to ensure this increased risk is reduced ALARP (As Low As Reasonably Practicable). This approach was required to:

- Ensure risk is managed effectively within Siemens — ensure they are doing all the right things internally.
- Demonstrate to their Customers they are managing risk effectively - tell the story.
- Demonstrate to the Regulator that they are managing risk effectively — building trust and respect.

Is a Safety Case approach suitable for Offshore Wind?

The Safety Case approach has been adopted by high risk industries such as Oil & Gas, Nuclear Power and Transportation. In some industries it is mandated by industry regulators. This is not the case in Offshore Wind at present. However, the benefits that a Safety Case provides of being able to demonstrate that adequate controls are in place to reduce the major risks ALARP were noted by Siemens, whilst recognising the complexity needed to satisfy a licensing regime was not required.

A Safety Case approach for Siemens

Risktec and Siemens have worked together to develop a Safety Case Framework which takes lessons from other more mature industries and benefits from their tried and tested tools and techniques, but presents a wholly optimised solution for Offshore Wind. It is adaptable to cover the different roles Siemens plays on different projects, is easy to understand and simple to implement. But most importantly, it is not a report based system (a characteristic which can undermine the approach in more mature Industries) but a living process which provides a central focal point to maintain and continuously improve safety.

What does the Safety Case Framework Cover?

The unique challenge for the Industry is that each Offshore Wind Farm (or Project) involves a combination of complex components (or Products e.g. Wind Turbines, Offshore Platform, Onshore Substation etc.) arranged and configured in a different way for each Wind Farm and supported by often bespoke Logistics arrangements (e.g. Construction, Marine Operations, Aviation etc.), as illustrated at the foot of this page. With Siemens personnel exposed to risk in all aspects of Offshore Wind, the Safety Case Framework needed to cover the complete life-cycle of any Project including all constituent Products and operational Logistics.

How was it developed?

The Safety Case Framework was developed via the following steps:

1. A hypothetical Offshore Wind Farm was established; one which encompassed all the infrastructure, operations and challenges which could be expected as the industry continues to grow and develop.
2. All reasonably foreseeable hazards associated with the complete lifecycle of this hypothetical Wind Farm were identified considering all Project, Product and Logistics elements — including those not usually a Siemens responsibility. This was achieved through hazard identification workshops involving designers, engineers, construction teams and operators/technicians as well as reviews of Industry experience, events and incidents.
3. The associated risks were assessed with significant hazards screened-out using the Siemens Risk Assessment Matrix.
4. The significant hazards were then subjected to more detailed analysis using the Bowtie approach. A Bowtie diagram shows, in a very clear, visual way, the safety measures in place to prevent the hazard being realised and the mitigation measures in place to prevent the hazard resulting in the potential ultimate consequences.
5. A review was performed to determine whether it is (and equally importantly, whether it is not) appropriate to implement further risk reduction measures to achieve an ALARP position. A key benefit of the Bowtie approach is that it shows in clear, pictorial form how each significant risk is being managed. This allows engineers, designers, operators, technicians etc. to ask themselves “what more can we do to reduce risk?”, “is it reasonably practicable to implement any further risk reduction measures?”, “are the risk reduction measures provided as effective as they can be recognising the hierarchy of risk controls?” and; “are we focusing our efforts on the most effective barriers?”. These questions are fundamental to a robust ALARP demonstration.

6. The equipment and activities associated with these barriers which are safety critical (i.e. those which play a central role in achieving this ALARP position) were identified.

7. The roles and responsibilities for ensuring that these barriers continue to work effectively and reliably were identified and communicated.

What does the Framework look like?
The Safety Case Framework comprises a Risk Assessment Procedure which documents the complete Safety Case approach as well as a detailed Toolkit which provides worked examples, templates (e.g. template Bowtie diagrams) and guidance on the effective implementation of this procedure.

What benefits does it deliver?
The real advantage of the approach is that it provides clear links between hazards, the preventative and mitigating safety measures selected to reduce risk ALARP and, of greatest benefit, it clarifies the accountable individual for the associated policies, procedures etc. and the responsible individuals for their implementation. In some cases, for example Marine Coordination, they may be outside of Siemens control.

It therefore goes beyond the usual risk assessment ‘snapshot’ ensuring that risks are truly managed rather than just analysed. As a result Siemens:
- Understand what can go wrong.
- Know what systems are in place to stop this from happening.
- Can assure themselves that these systems are working effectively.

But the benefits stretch way beyond Siemens. With the Safety Case Framework covering the complete life-cycle of an Offshore Wind Farm, it can be easily tailored to suit any Project or associated Product and Logistics elements. It therefore serves as a blueprint for the effective management of risk, benefiting any organisation involved in any aspect of Offshore Wind.

What has been achieved so far?
Applying the Safety Case Framework has identified errors and gaps in risk mitigation measures. Solutions have been identified in collaboration with Risktec which include:
- **Fire**: reassurance that turbine fire prevention was adequate; however, turbine evacuation took longer than the spread of smoke and escape would result in unplanned water entry. New processes, procedures and equipment have been introduced to protect technicians and these have been shared with regulators, customers and other manufacturers.
- **Emergency Response**: Siemens and industry guidance had not evolved to cope with larger structures positioned further offshore. Personnel and resources were allocated to assist RenewableUK in developing the new Integrated Offshore Emergency Response – Renewable (IOER-R) document which harmonises stakeholder expectations.
- **Marine and Air Risk Management**: Rather than producing standards in isolation, Siemens Marine and Aviation specialists have supported trade bodies in developing new industry guidelines which Siemens will adopt to control and coordinate Marine and Aviation operations.

How are these benefits being shared?
Siemens are keen to share this learning experience with the wider industry. The Safety Case approach has been shared amongst RenewableUK, the G9 Group, IMCA, GWO, NWBA-HSE, and European Regulators and at dedicated customer events. Siemens has encouraged Risktec to engage with other developers and OEMs to adopt the same approach. To demonstrate its effectiveness, Siemens are being transparent about how the Safety Case approach has helped to identify issues which were previously missed and highlighting these issues to other companies, for example through sharing Bowtie diagrams.

Summary and Conclusions
The Safety Case Framework provides a systematic process to identify all serious product and project risks that may be encountered offshore, independent of who may own them. It is a living process that allows lessons from other products and projects to be shared, internally and externally, enabling continued improvement. The focus on the risk to people has helped break down the silo mentality based in design risk assessments.

The development of the Safety Case Framework has not been an academic exercise; it has led to a cultural change in risk ownership and, although still in its infancy, has driven changes to processes, procedures and equipment. Logistics and emergency response have been shown to be areas of concern, with multiple risk owners trying to control heightened risk emanating from the hostile marine environment.

Siemens, with the support of Risktec, has, and will, continue to share the methodology and the improvements arising from this Safety Case work. Although originally intended to cater for the complex hazards encountered offshore, Siemens has already started to use elements of the Safety Case approach in other complex risk areas such as the blade factory in Hull, again with the support of Risktec. This illustrates the flexibility and versatility of this approach.

The Safety Case approach is not new for major hazard industries; however, its proportionate application to Offshore Wind is new for Siemens and the Industry as a whole. The investment in time and effort has been considerable; however, success should not be measured in the documents produced but in the changes initiated. Those changes are not only altering Siemens way of working, making them safer, but are already crossing into the wider Renewable Industry.

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