SAFETY AND RISK REVIEW IN OFFSHORE WIND FARM OPERATIONS

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Abstract: This report presents a review of the current state of safety in offshore wind industry operations. The latest research, injury statistics, and the legislative framework governing the sector are reviewed. Additionally, the report examines how the industry's risk profile may evolve in the coming years. The research is aimed at improving safety and efficiency during the transit of technicians from shore to offshore wind installations and between turbines.

Keywords: Offshore wind industry, safety, transfer, psychophysical effects, automation, risk management.

1. Introduction

A study has been conducted to examine the effects of sailing on vessels used to transfer technicians to offshore wind installations on their mental and physical well-being. The overall goal is to generate better opportunities for achieving safety and comfort. Compared to other industries, the amount of research on the impact on people and workers' health in the wind industry is limited. As the industry continues to grow and develop, further research aimed at data collection and systematization is crucial.

The analyses conducted so far have formulated the following conclusions:

- The injury rate is up to four times higher than that of the offshore oil and gas industry (according to statistical data). On the one hand, this is understandable due to more frequent transfers from one location to another, but on the other, the lack of sufficiently clear procedures, closely related to the limiting conditions for successful and safe transfers, also plays an important role.
- The risk to workers is expected to increase due to the continuous expansion of the industry and technological advancements (shorter time frames for completing tasks).
- Safety legislation requires reform to address specific risks in the industry.
- Innovations from other industries in safety management should be adopted.

2. Literature Review

To analyze the subject of the research, a review of the latest literature related to safety in the offshore wind industry has been conducted, including relevant sources from related industries. The review is structured based on the sources and subject area, covering topics such as incident reporting, key performance indicators (KPIs), human impacts, decision-making, safety management, health, and environment, as well as legislation.

3. Methodology of the Literature Review

The literature sources were identified using the search engines **Compendex and EEE (Electronic and Electrical Engineering)**. The search was conducted using keywords such as "safety," "health and safety," "wind farm," "wind turbine," and "wind energy." The initial review of the results showed that most of them were related to the safety of wind turbines and their components, rather than the safety of personnel. To narrow down the scope of the search, keywords such as "technician transfer" and "personnel transfer" were added. This led to few and mostly irrelevant result, which prompted manual searches in the reference lists of key articles, applying the snowball method.

4. Incident Reporting in the Industry

Reports from industrial organizations are a primary source of information about the safety level in any industry, with a particular focus on the offshore wind industry. **G+ (Global Offshore Wind, Health and Safety Organization**) publishes an annual report with the latest incident statistics, along with safety initiatives and industry performance analysis【1】.

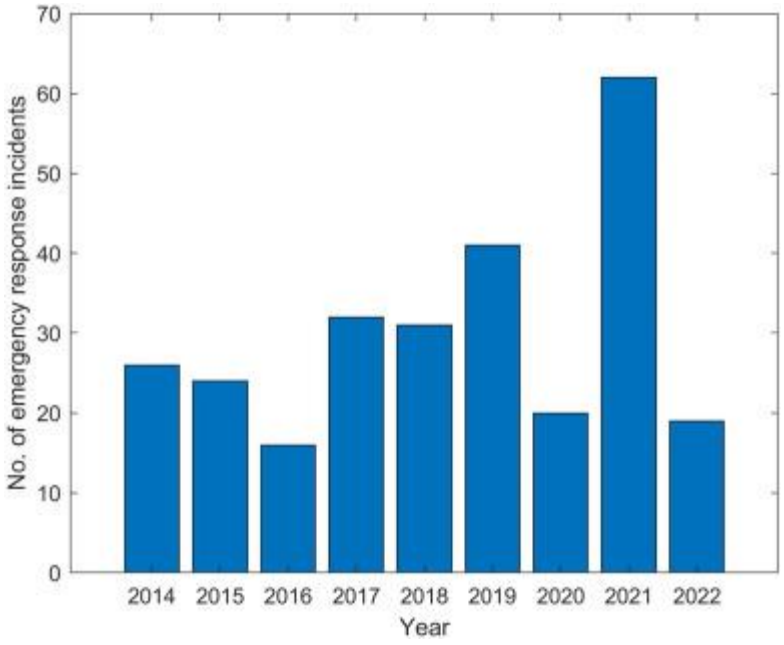


Fig. 1. Annual Incident Statistics

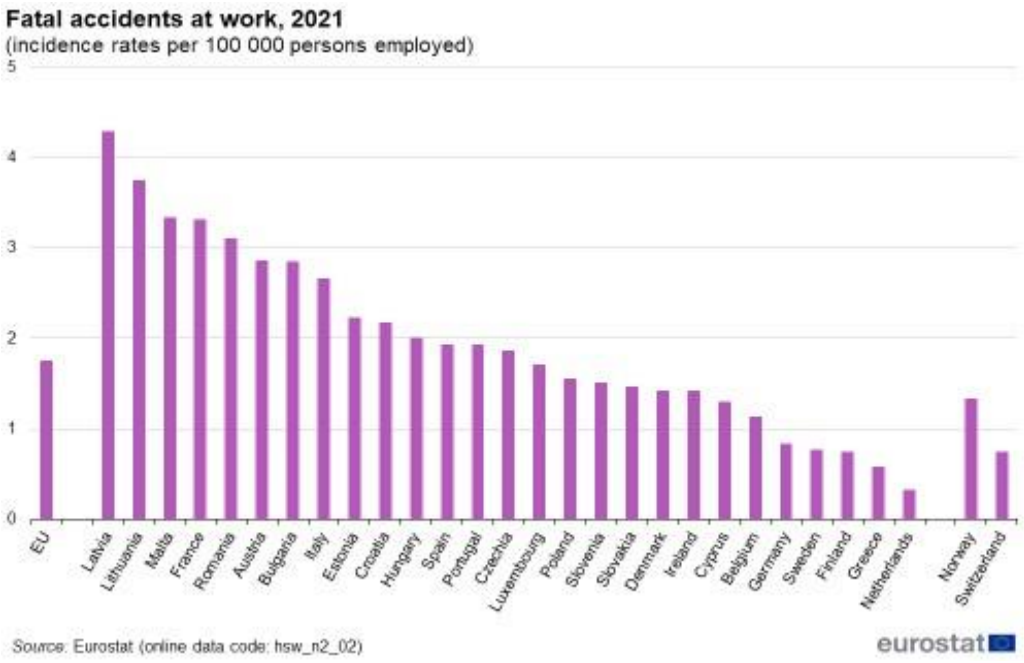


Fig. 2. Fatal Incident Statistics in the EU for 2021

G+ provides the main guidelines for good practice and data collection for incidents. Their reports indicate that manual handling of heavy objects and tool usage are the most common causes of incidents, with wind turbines being the primary location of accidents. In addition to G+, large wind farm operators also publish incident data, but this information is often limited to events reported in the media【2-4】.

5. Human Factor and Decision-Making

In the offshore wind industry, the human factor plays a key role in incidents, especially during the construction and operation of wind farms. The primary risks are associated with the transportation of technicians and equipment to turbines, as well as working at heights. A comparative analysis with other industries shows that the offshore wind industry has a higher risk of fatal incidents per unit of energy produced compared to onshore wind farms and other energy sectors.

6. Legislation and Regulations

Legislation in all countries requires the reporting of incidents related to occupational health and safety. For example, in the UK, there is the RIDDOR *(Reporting of Injuries, Diseases and Dangerous Occurrences Regulations)* register, which, however, does not separate offshore wind

incidents into a specific category. As a result, incident data is often combined with that of the electricity industry as a whole【5, 6】. Norway's oil and gas sector is more advanced in data collection, publishing annual risk level reports through RNNP (*Risk Level in the Norwegian Petroleum Sector*) 【7】. These reports cover both lagging and leading indicators of the risk level in the industry.

The literature review provides additional information on the key aspects of safety in the offshore wind industry, based on sources and data from related industries and studies.

7. Discussion

The offshore wind industry has experienced significant growth in recent years, with installed capacity exceeding 35 GW and a projected growth rate of 30% per year until 2025【Fig. 3】. This growth is leading to an increase in the number of wind farms located farther offshore, necessitating the expansion of the workforce and improving its safety. In the UK, where the industry is particularly developed, there have been criticisms regarding worker safety and health, as incidents have increased【8】.

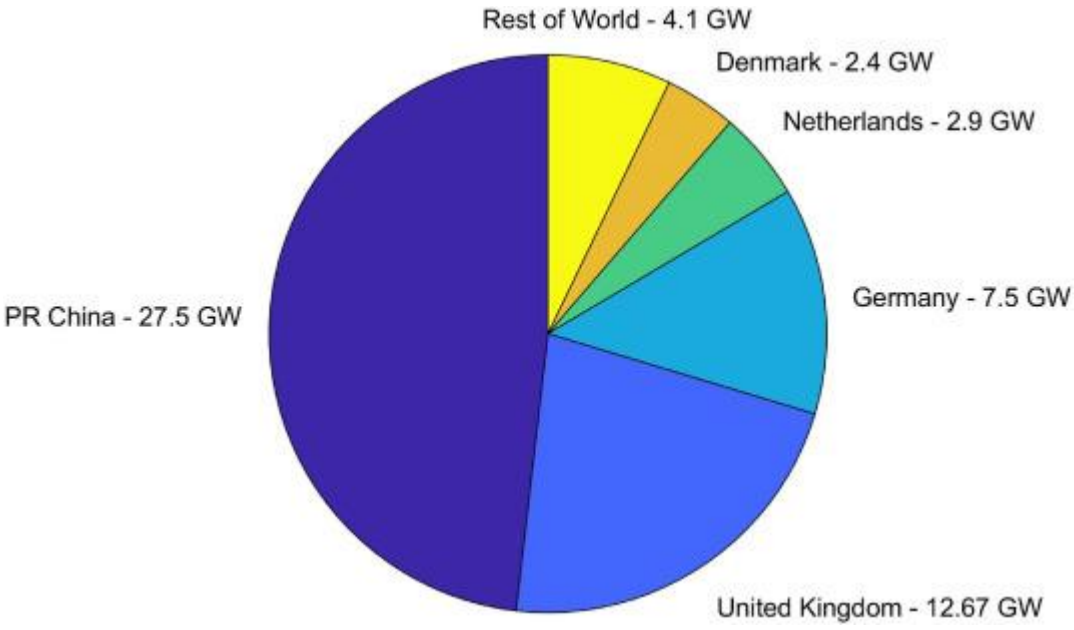


Fig. 3. Installed Offshore Wind Capacity in GW by Country

8. Challenges and Risks

The main challenges facing the industry include a higher rate of injuries compared to the offshore oil and gas industry, due to more frequent transfers between different locations and the lack of clear safety procedures. It is expected that with the development of technology and the

expansion of the industry, risks to workers will increase. Additionally, safety legislation needs to be reformed to address the specific risks in the industry.

9. Research and Psychophysical Effects

Research in the offshore wind industry is limited, particularly regarding the impact on the mental and physical health of technicians. A project was conducted to study the effects of sailing on vessels used for technician transfers and their psychophysical status. The main goal of such studies is to propose measures and identify best practices for ensuring safety and comfort during transfers, based on the results and identified measures to reduce negative impacts.

10. Legislation and Safety Management

The European Agency for Health and Safety has commissioned a report that examines the safety challenges in the industry. The report highlights the higher risks associated with the remoteness of wind farms and lower profit margins. It is recommended that safety legislation be reformed to address these new challenges and integrate innovations from other industries, including automation, which can reduce the risk exposure of workers at wind installations.

11. Projections

Data analysis from the United Kingdom indicates that as the number of transfers between turbines increases, so does the risk to technicians. Legislation needs to consider these new realities and provide stricter safety standards. Relying on traditional performance statistics is not sufficiently reliable due to the underreporting of incidents.

12. Recommendations

It is recommended that the industry adopt innovations from other sectors, including wider application of automation, to reduce health and safety risks for workers. Furthermore, legislation must be adapted to the specific needs of the industry to ensure sustainable growth and guarantee that there is no compromise between economic goals and safety.

13. Conclusion

From the analysis, the following conclusions can be drawn:

- The offshore wind industry is growing rapidly, both geographically and spatially. With this growth, the risks to the safety of the personnel servicing the installations will increase.

- The appropriate response to the increasing risks is the generation and implementation of integrated safety measures, innovations, and adequate legislation to ensure a sustainable working environment for technicians and workers.

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