Risk assessment of hydrogen refuelling stations for social implementation

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Abstract

Toward the realization of a carbon-neutral society, which is a global issue, the introduction and dissemination of hydrogen-based technology systems is progressing as a key measure, and the spread of hydrogen and other technologies is rapidly progressing through industry-government-academia collaboration, such as the Revised Basic Hydrogen Strategy in Japan, which was approved by the Cabinet in June 2023, and the Hydrogen Society Promotion Act, which was also approved by the Cabinet in February 2024 and enacted in June. Under this scheme, the government will approve the business plans of companies that produce and use low-carbon hydrogen, and will subsidize the funds necessary for the companies' capital investment. The Japanese government has set a goal of achieving net-zero CO2 emissions by 2050, but it is said that decarbonization will be difficult in sectors that use fossil fuels, such as steel and power generation.

Based on the concept of risk symbiosis or risk coexistence, that is living together with well-managed risk, we have created the concept of societal comprehensive risk with the aim of supporting the social implementation of advanced science and technology by appropriately dealing with various risks in society, and have proposed a risk assessment method that takes into account the relevant parties, development stage, and social values, in addition to evaluating the risks within the system from an engineering perspective [1].

In this presentation, we introduce an example of risk symbiosis, focusing on the safety assessment of a hydrogen station that we conducted as part of the Cabinet Office Strategic Innovation Promotion Program "Energy Carriers." New perspectives on a comprehensive societal risk framework for technological systems are introduced and discussed in relation to an example application involving a hydrogen refueling station for fuel cell vehicles. The comprehensive societal risk framework consists of not only technological and economic risks, but also environmental and societal risks. This framework will be indispensable to risk communication efforts and initiatives to foster the public acceptance of technological systems.

Potential risks associated with hydrogen refueling stations were identified through brainstorming work with scenario analysis and HAZID study, and then quantitative analysis of the frequency of occurrence of accidents, and consequence analysis by experiments and simulations were done. By analyzing the economic, environmental, social system and technological risks related to the system as well as the social life risks in and surrounding the system, it was possible to assess the technological system according to the social situation.

Then, the comprehensive risk analysis results can be communicated to the stakeholders of the system, such as the administrators and general public, which may help to alleviate concerns and assist with the successful implementation of the new technology.

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References

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