

Ensuring the Adequacy of CFD Models for Hydrogen Safety Applications

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Key project benefits:

- Improved deployment of CFD to hydrogen safety applications due to access and use of MEP and supporting documents
- Improved understanding of critical influences for models of physical phenomena related to safety in FCH technologies
- Improved capability of CFD users in applying CFD codes through access to best practice guidance
- Improved quality of CFD models due to opportunity to access benchmarking information through database

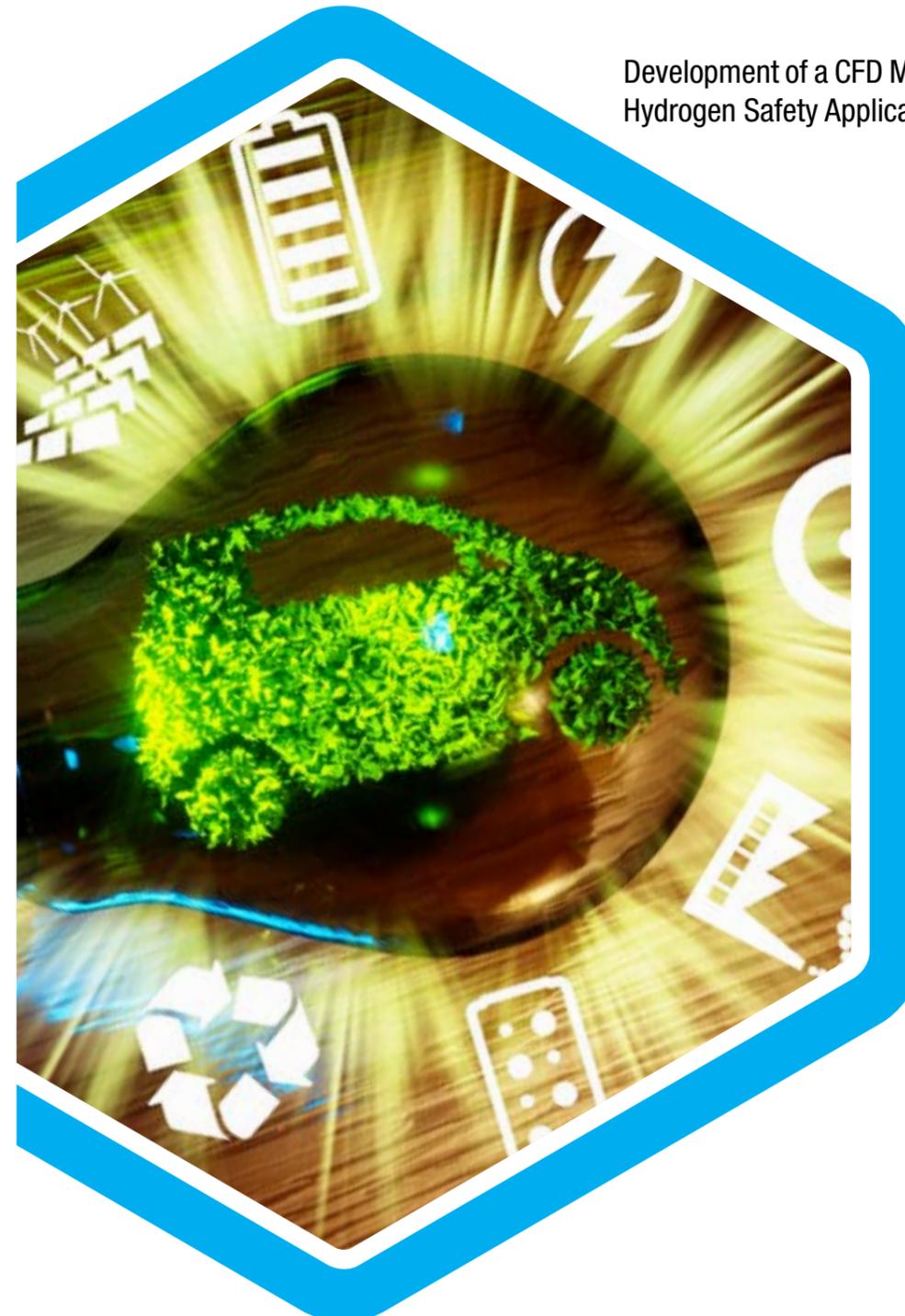
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Project Partners:



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Development of a CFD Model Evaluation Protocol (MEP) for Hydrogen Safety Applications

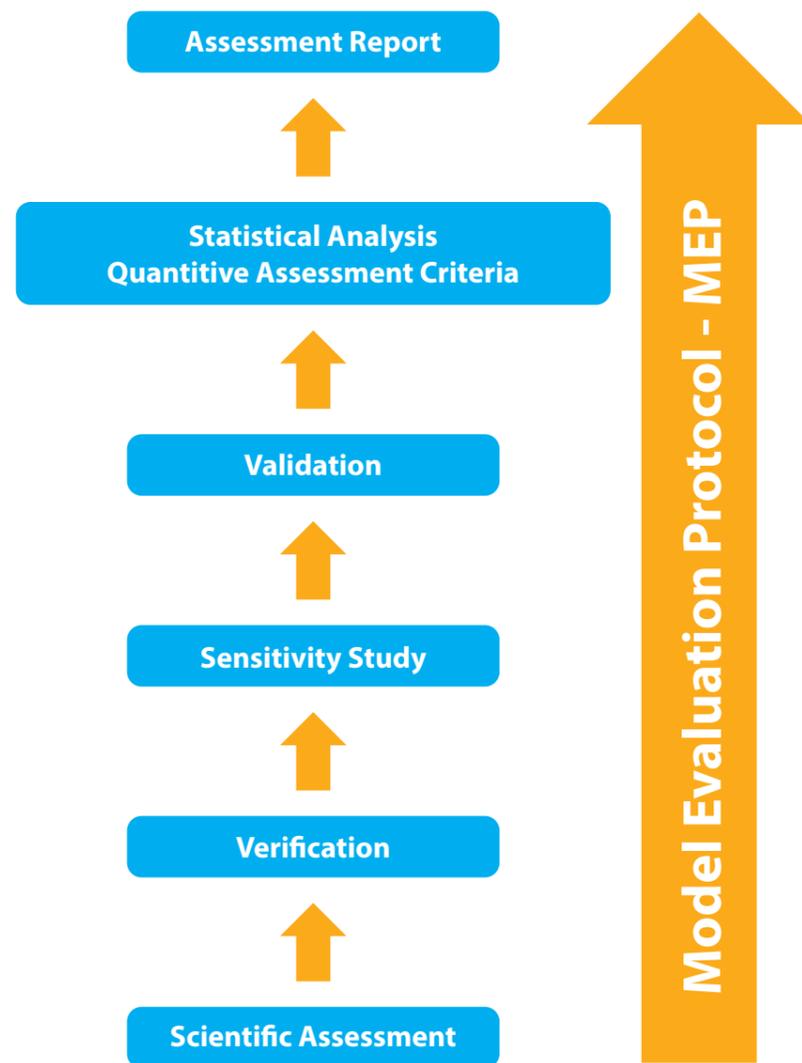


Ensuring the Adequacy of CFD Models for Hydrogen Safety Applications

The aim of the EU funded research project SUSANA (Support to Safety aNalysis of Hydrogen and Fuel Cell Technologies) is to support the use of Computational Fluid Dynamics (CFD) analysis in safety engineering relating to Hydrogen and Fuel Cell (FCH) Technologies through the development of a Model Evaluation Protocol (MEP).

Hydrogen and fuel cell technologies play a significant role in clean energy provision for a carbon neutral future. There are however uncertainties and unquantified risks that need to be understood and overcome to harness the full potential of the technologies.

- CFD is increasingly used to perform safety analyses of potential accident scenarios (production, storage, distribution of hydrogen and its use in fuel cells) and provides data as an alternative to experimental testing.
- CFD is a powerful numerical tool that can provide data and understanding of hydrogen behaviour. However, it requires a high level of competence and knowledge in order to yield meaningful results. The principal output from this project has been a protocol for the effective use and accurate deployment of CFD.
- Although the project was focused on hydrogen safety, the work carried out and the methods used for the development of the MEP are relevant to many other CFD analysis applications. As such they will benefit and interest a much broader audience of safety engineers.



Key elements of project

Critical review of physical and mathematical models

Models of physical phenomena related to safety in FCH technologies have been reviewed, and their strengths and weaknesses explored. This review covered the following phenomena: gaseous and liquid hydrogen releases, dispersion of permeated hydrogen, dispersion of hydrogen in the open atmosphere and ventilated enclosures, spontaneous ignition, jet fires & microflames and deflagrations & detonations.

Best practice guide in numerical simulations

This guide brings together knowledge on best practice in the application of CFD to safety engineering design of FCH systems from all of the SUSANA partners. It addresses the issue of users' capability in correctly applying CFD codes for each of the phenomenon that had been explored in the critical review. User education and training is also covered

The CFD MEP refers to the guide as a knowledge base beneficial to all CFD users, providing a learning tool for newcomers in the area of FCH technology as well as safety.

Verification and validation database

Organisational and technical frameworks to demonstrate the credibility of models and codes for their intended uses have been developed. The compilation of a database of suitable verification problems and validation data applicable to FCH technologies has been created. This database is freely available to all stakeholders through the SUSANA website.

Simulation benchmarking

The Project partners have simulated selected examples from the validation database to quantify predictive capabilities of models/codes. These results are available for future reference through the project website for anyone wishing to benchmark their CFD model.

Project Website

The key elements of the project will be publicly available, see: www.support-cfd.eu