

## THE ROLE OF DATA-DRIVEN MODELLING IN SUSTAINABLE ENERGY TECHNOLOGIES

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### ABSTRACT

One of the greatest challenges facing our society is fighting the climate change. To mitigate its effects, it is necessary to develop new sustainable technologies capable to reduce atmospheric pollution. Sustainable energy technologies are technologies aimed at improving energy efficiency, which can also use renewable energy sources. Fluid mechanics is a science with multiple applications in this field, for example the knowledge of fluid systems contributes to develop new technologies suitable for more efficient aeronautical designs, improve efficiency in combustion systems, reduce air pollution in urban areas, improve the performance of renewable energy sources such as wind power, etc.

This Invited Special Session will deal with novel machine learning tools applied to the development of low-dimensional models capable of improving the energy efficiency of systems in different complex flow applications.

Complex flows (turbulent, multi-scale, multi-physics) are present in most of industrial applications. The large number of spatio-temporal flow scales involved in complex flows and the high-dimensional systems solving complex problems in computational fluid mechanics makes it challenging to develop novel technologies in a fast and efficient manner. A good alternative is to develop low-dimensional models capable to predict the temporal evolution of the flow dynamics with high-accuracy at a reduced computational cost. Data-driven methods, such as modal decompositions or other machine learning tools (i.e. based on neural networks), has been proved to be efficient tools capable to model complex flows with high accuracy, also contributing to advancing turbulent flow simulations, improving the knowledge from experimental measurements, providing interpretable feature extraction techniques, delivering generally applicable approaches to locally adapt closures, and developing robust and predictive digital twins of large-scale assets. This session is interested in all these topics but is not limited to. In the same line, also new advances from the projects (Marie Curie – DN) MODELAIR and ENCODING will be presented.