# An Industrial Process Operations Recommendation System for Energy Performance Best Practices - Big Data Driven, AI Embedded and Digital Twin-based

**PhD student**: Zhipeng Ma (zhma@mmmi.sdu.dk)

**Center:** Center for Energy Informatics, Maersk McKinney-Moller Institute, University of Southern Denmark

**Principle supervisor:** Associate Professor, PhD. Zheng Grace Ma

**Co-supervisor:** Professor, PhD, Head of center. Bo Nørregaard Jørgensen

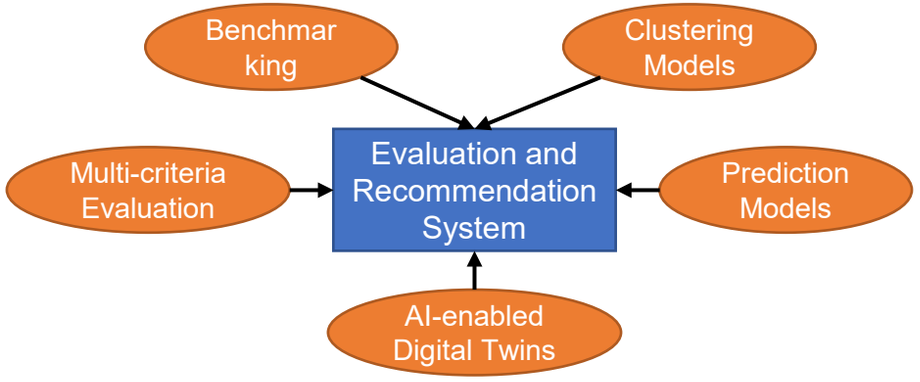
## BACKGROUND

In Denmark, the production industry accounts for up to 22% of the total national energy use and is the second largest source (20.8%) of the total national CO2e emissions. The Danish climate goals of 70% emission reductions by 2030 and climate neutrality by 2050, will require the Danish production industry to significantly reduce CO2e emissions. However, there are many potential energy savings in industrial processes are still not realized. Based on a survey of more than 70 production companies in Denmark, the main hindrance for the production industry to realize the potential energy savings in industrial processes is the high risks due to uncertainties about the economical, technical, and practical feasibilities of the energy efficiency strategies. The literature shows that AI, especially machine learning, is the latest advanced SotA technology for enabling energy-efficient industrial process operations. However, the current SotA technologies do not support the investigation, evaluation, and decision-making of energy-efficient and flexible best practices. In addition, there is no method that ensures the effective implementation of best practices.

## AIM

develop a multi-criteria evaluation and recommendation system that can facilitate industries to find the best energy efficient and flexible practices for the industrial process operations in consideration of energy efficiency, CO2e emission reduction, cost efficiency, and production throughput maximization.

## OBJECTIVES




## METHODOLOGY

- Programming (Python and Java)
- Machine Learning Frameworks (e.g. PyTorch, Keras)
- Big Data Analytics
- Object Oriented Programming in Java
- Simulation Platform (AnyLogic)