PdM Masters project proposal

(4 months full time at EPFL)

Company name	**GME / SMX with Laboratory for Processing of Advanced Composites (LPAC)**
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Project title or topic

"Monte Carlo modelling of NetZero scenarios for the carbon fiber industry"

Context and background

PdM master's project: Computer science/data science or Mechanical Engineering / Materials Science

This project will continue previous work developing a Monte Carlo model using Python interacting with Excel to model and develop NetZero strategies to decarbonization the carbon fiber industry.

The model examines the growth of the carbon fiber market to 2050 for different social economic pathways. Carbon fiber is a key material for the energy transition and is used in wind turbine blade and is needed for mobile liquid hydrogen storage. It is also a critical material for the aerospace industry.

The model examines different technological enablers including bio-based acrylonitrile for carbon fiber production, low energy carbonization, the grid mix used; together with aspects of the circular economy including product durability, different waste treatment scenarios for both post industrial and end of life waste recycling, and re-use of the materials. These are modelled for large arrays of high, medium, and low probability assumptions and data sets which are being pressure tested with industry.

Currently the model maps versus time to 2050, for different sets of assumptions: kgCO2e/kg carbon fiber, cumulative CO2e, mass flows (dynamic MFA), and also tracks revenue and CAPEX.

This masters project will extend the current Python code to generate cluster plots of multiple runs of the code and to write output Excel files that contain the variable levels and the response factors. This will be examined using JMP statistical analysis software to build a machine-learning model enabling trade-off studies of the overall system response. This will be used to generate sustainability strategies for the industry.

Previous experience with coding and Python is required.

It is anticipated that high quality work will be published and presented accordingly and used in lecture materials.