

Modelling and Optimisation of GDI Engines

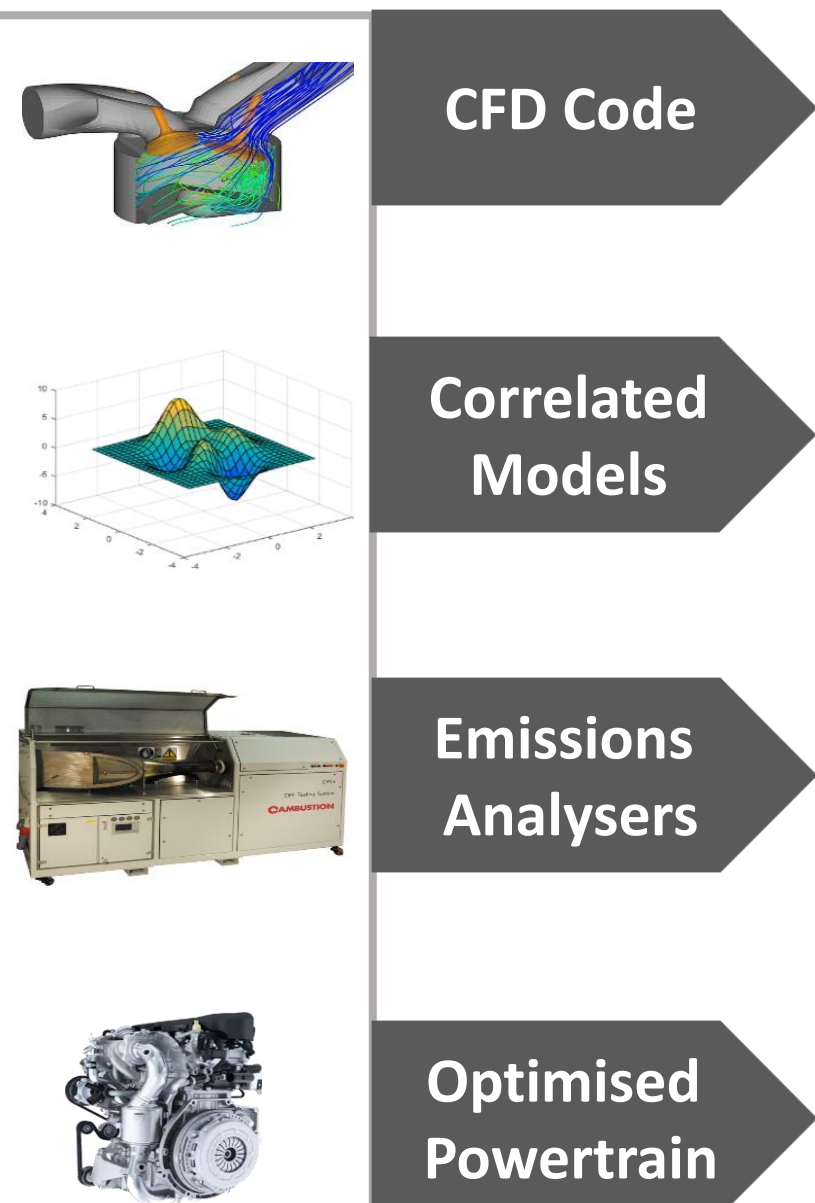
Aiman Shaikh - aiman.shaikh@stfc.ac.uk¹, Luke Mason

luke.mason@stfc.ac.uk¹, Federico Biagiotti fbiagiotti@brookes.ac.uk²,

¹Hartree Centre-STFC, ²Oxford Brookes University

Abstract

DYNAMO is an R&D project that aims to significantly improve the fuel efficiency of two high volume passenger vehicle powertrains with specific intent to simultaneously reduce CO₂ and noxious emissions.



Background

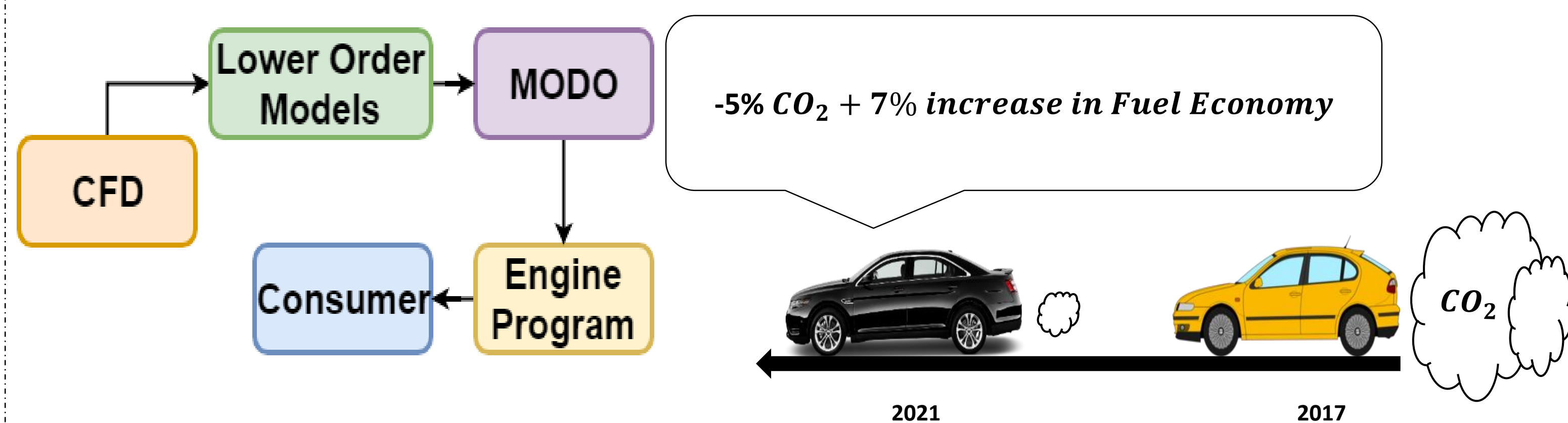
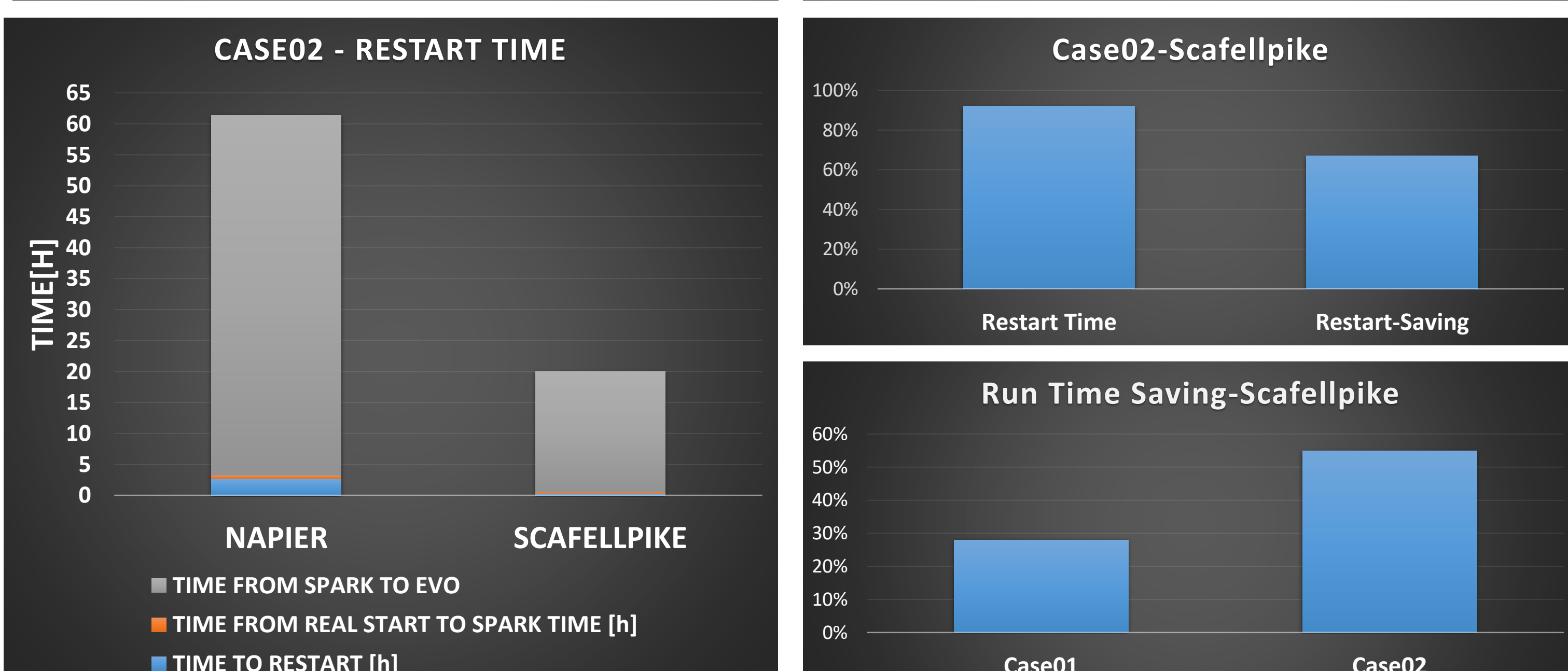
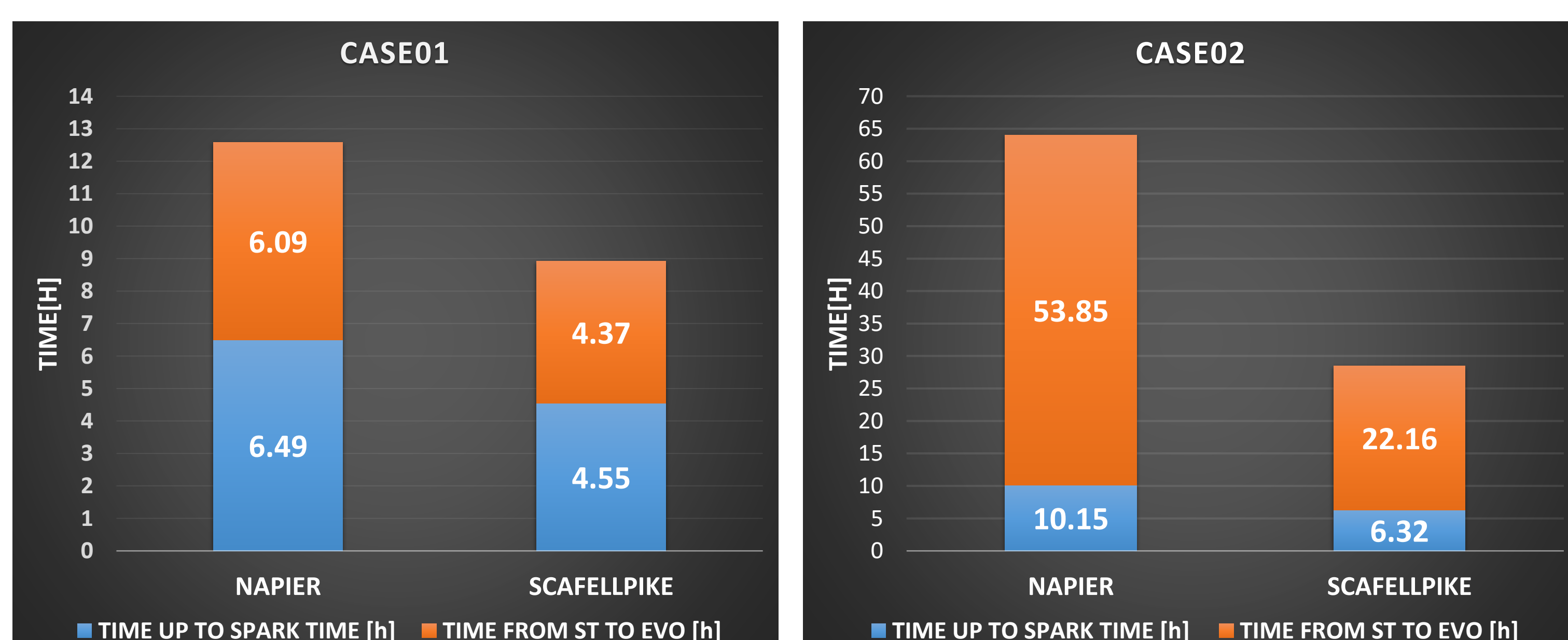
Whilst electrification promises to dramatically reduce the environmental impact of transportation it is unlikely that electronic vehicles will form the majority of the fleet for several years. DYNAMO will benefit the environment in the near future.

HPC

High performance simulation undertaken by Hartree Centre. Hartree Centre is performing scalability analysis in order to minimise the time to solution when performing complex simulations.

Two cases tested using optimal configurations obtained via Napier and Scafell Pike HPC system – latest/fastest machine available at Hartree Centre.

Case01 =Light Chemistry & Case02 =Heavy Chemistry.

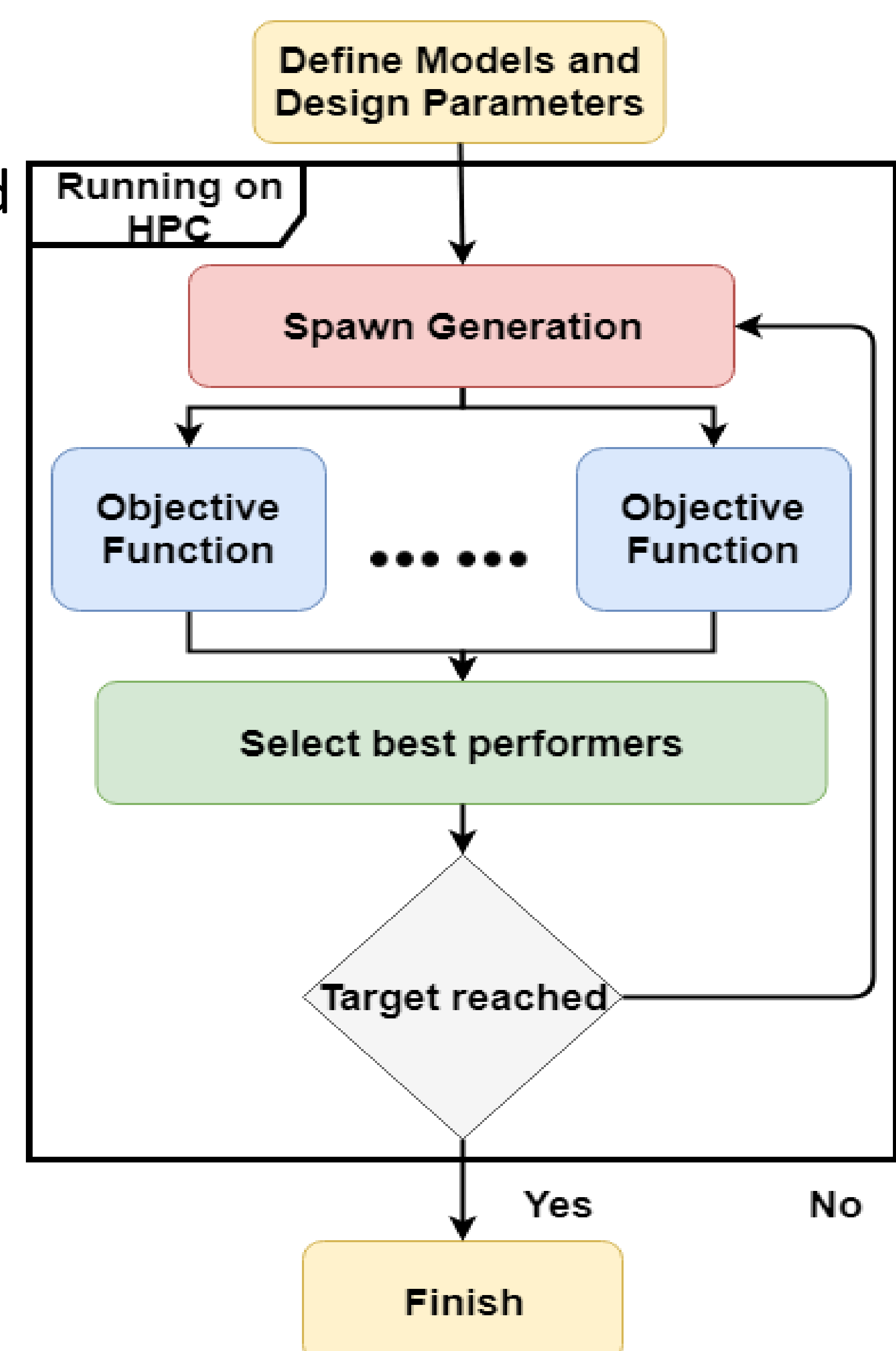


Aims

- 5% reduction in CO₂ at no further hardware cost from the most common engines.
- 7% increase in fuel economy with minimal hardware changes .
- Development cost and time reduction.
- Use of high performance computing and model reduction strategies to optimise across systems.
- Minimise engine out soot production through advanced analysis and optical measurement.

LIGER

An open source integrated optimization environment which is designed to be extensible and have a smooth learning curve. Liger will be use to optimise the models developed in MATLAB Hartree will parallelise Liger to run on multiple nodes/cores that would make multiple objective functions run simultaneously.



Conclusion

- Future releases of Liger will include the ability to run on HPC.
- Tools development and exploitation.
- UK productivity improvement.
- Research publications with results.