# DYNAMO-Dynamic Analysis Modelling and Optimisation of GDI Engines

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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 CO_2 and noxious emissions.
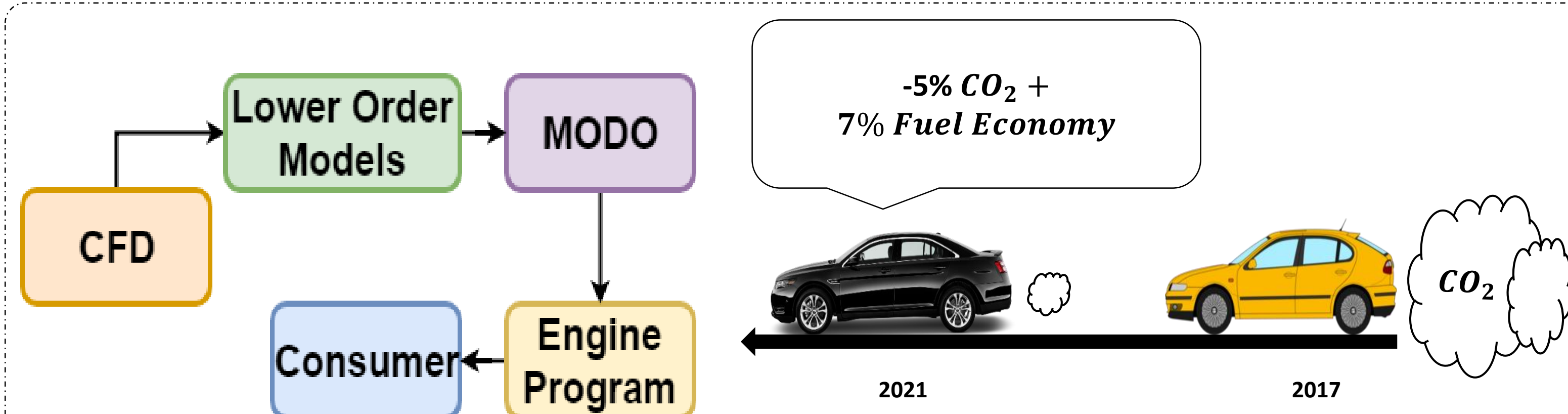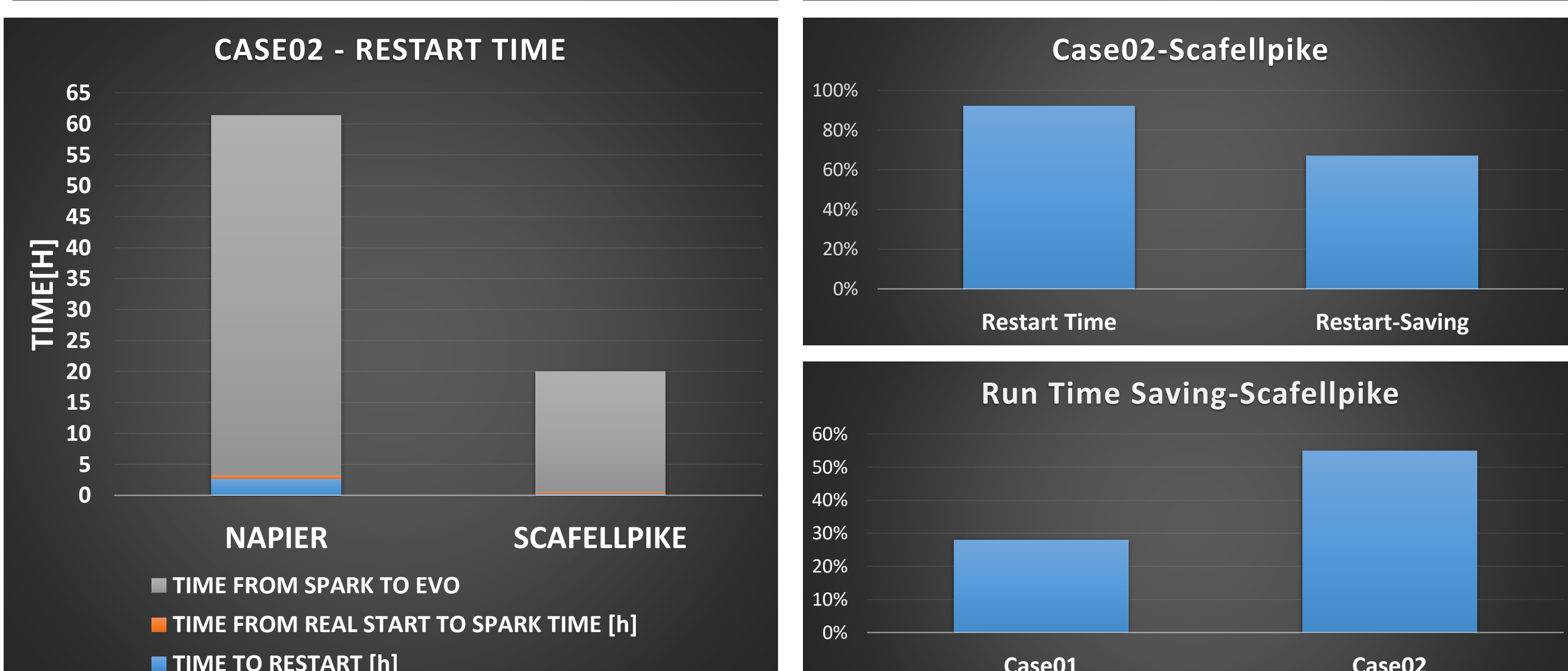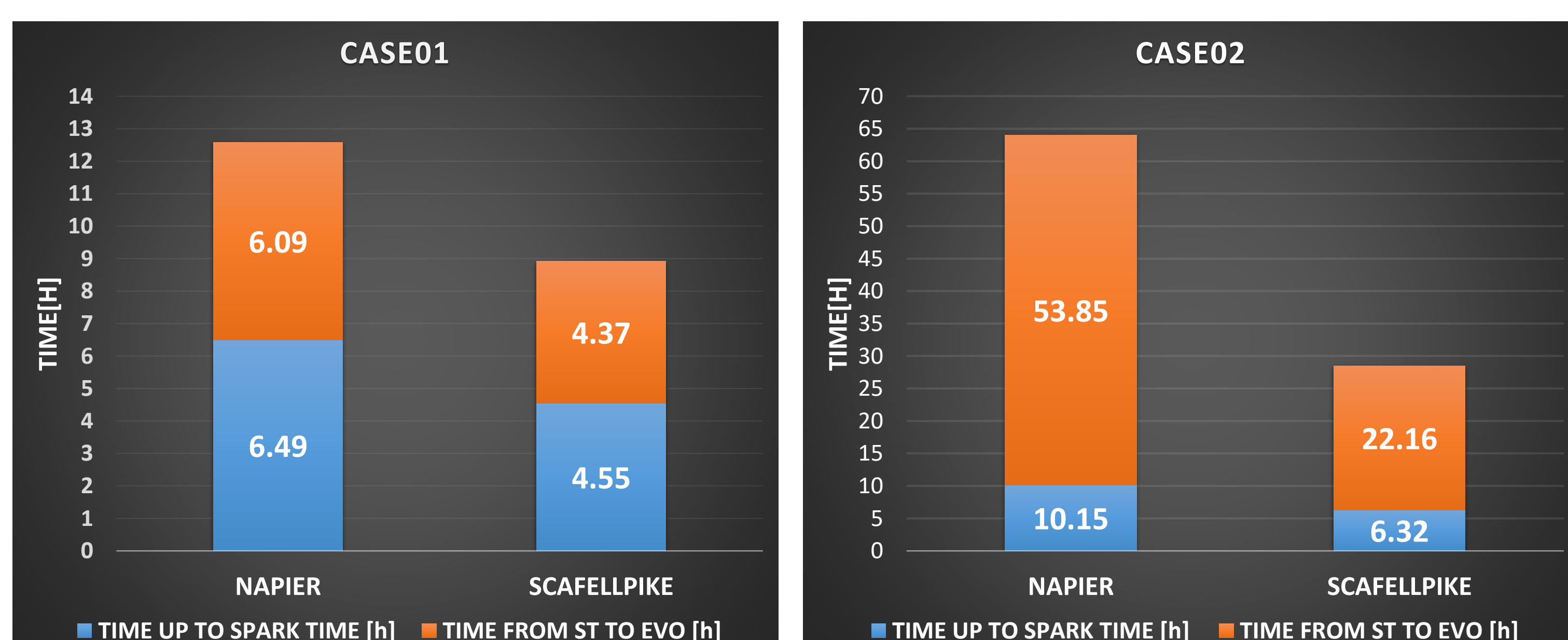
Background

To develop a range of GDI-specific robust models, which will support reduced reliance on physical testing. An improved CFD software for engine development and an efficient optimisation framework that can be extended to the wider CAE sector.

CFD Code → Correlated Models → Emissions Analysers → Optimised Powertrain

HPC

High performance simulation undertaken by Hartree Centre. The 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.

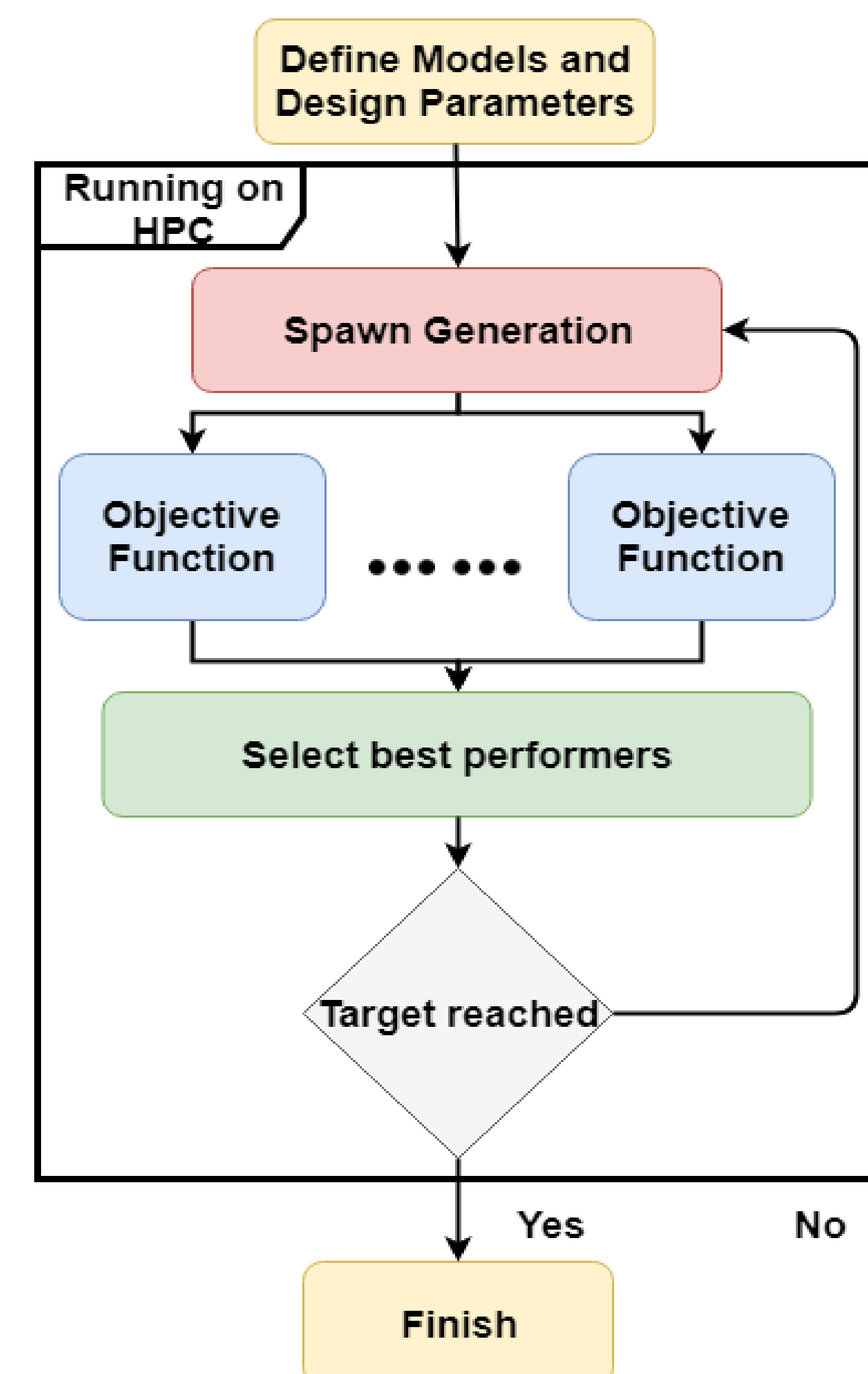Case01 =Light Chemistry & Case02 =Heavy Chemistry.

CASE01 — NAPIER: TIME UP TO SPARK TIME [h] 6.49, TIME FROM ST TO EVO [h] 6.09; SCAFELLPIKE: 4.55, 4.37

CASE02 — NAPIER: TIME UP TO SPARK TIME [h] 10.15, TIME FROM ST TO EVO [h] 53.85; SCAFELLPIKE: 6.32, 22.16

CASE02 - RESTART TIME

Case02-Scafellpike: Restart Time, Restart-Saving

Run Time Saving-Scafellpike: Case01, Case02

Aims

CFD → Lower Order Models → MODO → Engine Program → Consumer

-5% CO_2 + 7% Fuel Economy

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- 5% reduction in CO_2 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.

Define Models and Design Parameters → Running on HPC → Spawn Generation → Objective Function ..... Objective Function → Select best performers → Target reached → Yes → Finish / No

Conclusion

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