
THE UNIVERSITY OF
AUCKLAND
Te Whare Wānanga o Tāmaki Makaurau
NEW ZEALAND

GOCPI

A Scalable Energy Modelling Solution

Developed by Connor McDowall

Supervised by Rosalind Archer

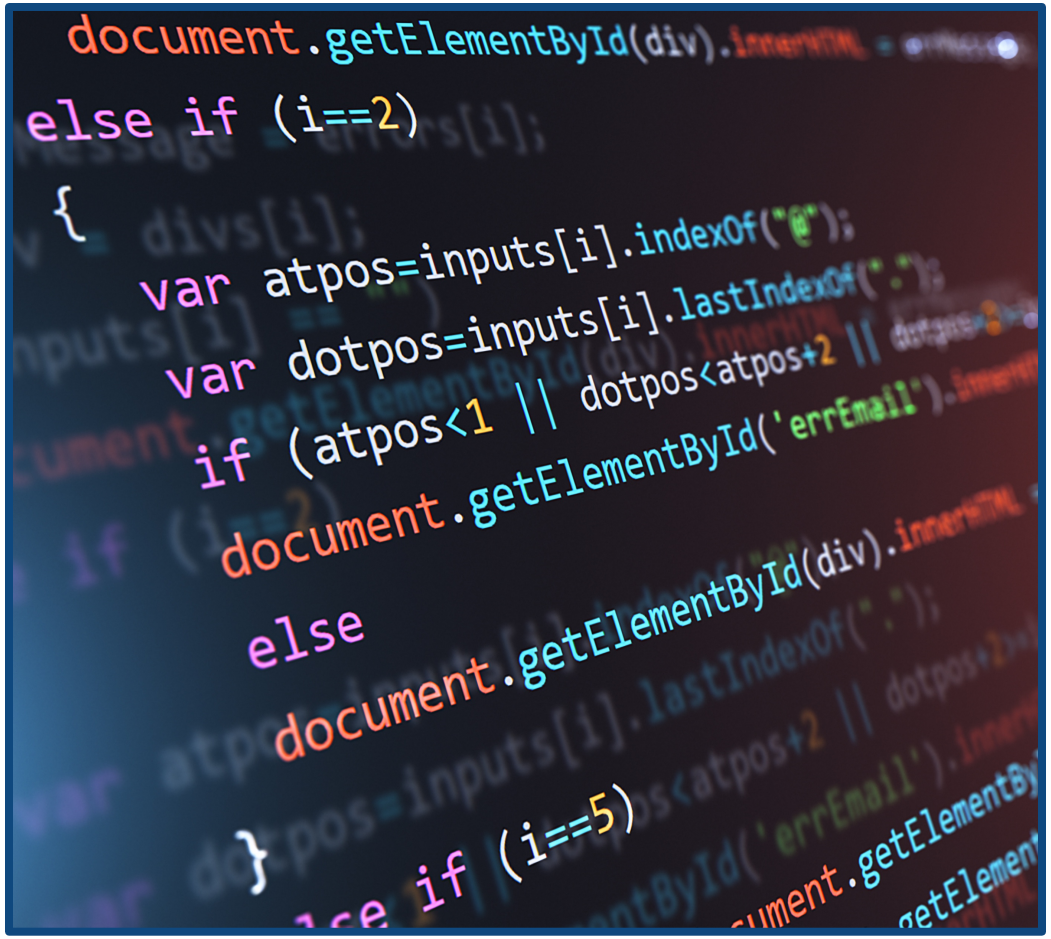
On the precipice of catastrophe

- ✓ The imminence of the energy transition was clear after my experience at ExxonMobil Australia.
- ✓ Literature review informs the need for rapid transformation as economic models predict unfavourable consequences if no swift action.
- ✓ Sustainable investment is driven by Net Present Value (NPV) analysis and the ability to generate returns for investors.
- ✓ Sustainable technologies have seen significant cost reductions over the last decade improving the feasibility of the transition.
- ✓ However, there are educational disparities between policy makers, government, private companies, stakeholders and voters.

Empower users to influence policy

- ✓ The reasons creating these issues is the sophistication and inaccessibility of energy modelling.
- ✓ Energy modelling usually requires:
  - Proprietary data.
  - The understanding of LP, Integer LP, MIP and/or NLP optimisation techniques.
  - Access to expensive commercial solvers.
  - A thorough understanding of energy systems, mathematics, economics and finance.
- ✓ This complexity creates difficulties in evaluating energy investment, policy and their alignment to the United Nation's Sustainable Development Goals and Paris Agreements.
- ✓ My proposed solution is to develop an accessible, scalable energy system modelling tool.
- ✓ The product will remove this sophistication and enable users to model their own energy systems to inform investment and policy.

Product development is in full flight



- ✓ A comprehensive literature review on energy, emissions, the economy, policy, obstacles, challenges and energy modelling to frame the problem and address the needs the product will fulfil.
- ✓ An exploration of best practise software development. The project makes use of several technologies: Version control using Git and GitHub, Python 3.7.6, Anaconda, PyPI, IBM ILOG CPLEX Optimization Studio, Yapf and Python APIs.
- ✓ An adaptation of the OseMOSYS methodology, formulated in GNU Mathprog and integrated into Excel and Python. The objective function of the OseMOSYS methodology minimises total discounted costs over the forecast period.
- ✓ The creation of the GOCPI package distributed by PyPI. The Navigation and Energy Systems classes enable the user to create scalable energy systems through the CreateModelFile and CreateDatafile functions. Terminal commands convert these files into an lp-format suitable for CPLEX.

However, the road will be long and hard

- ✓ The development of a data case based on the New Zealand energy system. Data is publicly available from MBIE and government institutions.
- ✓ The adoption of forecasting methodologies to project the needs of energy systems in future years. These include methods common in financial services and data science.
- ✓ Adjustments to the objective function to address carbon pricing initiatives.
- ✓ The creation of user interfaces to display the outputs of the energy system and make comparisons to align with the United Nation's Sustainable Development Goals (UNSDG) and Paris Agreements.
- ✓ Improve the functionality of the GOCPI package by developing classes, functions and documentation to support the modelling of energy systems and package distribution.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