Enhancing Energy Efficiency at GSK with Decision Intelligence

Decision Lab:
Joshua Liu – Principal Technology Strategist
Jacob Whyte – Simulation Consultant

GSK:
Giovanni Giorgio – Environmental Modelling Manager
Anjli Pankhania – EM-SM Data Improvements & Environmental Engineer

Agenda

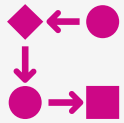
- Overview
- The problem
- Methodology
- Demo
- Project successes

Decision Lab company profile

- Developers focus on decision intelligence
  - Established the Athena platform with a distinct USP on Human Automated Teaming and UX


Machine Learning


Optimisation


Simulation


Data Science

- Delivery of Artificial Intelligence solutions
  - Technology and innovation demonstrators (TRLs 1-4)
  - Bespoke commercially viable tools for industry (TRLs 5-7)
  - Partner enablement software at enterprise level (TRLs 7-9)

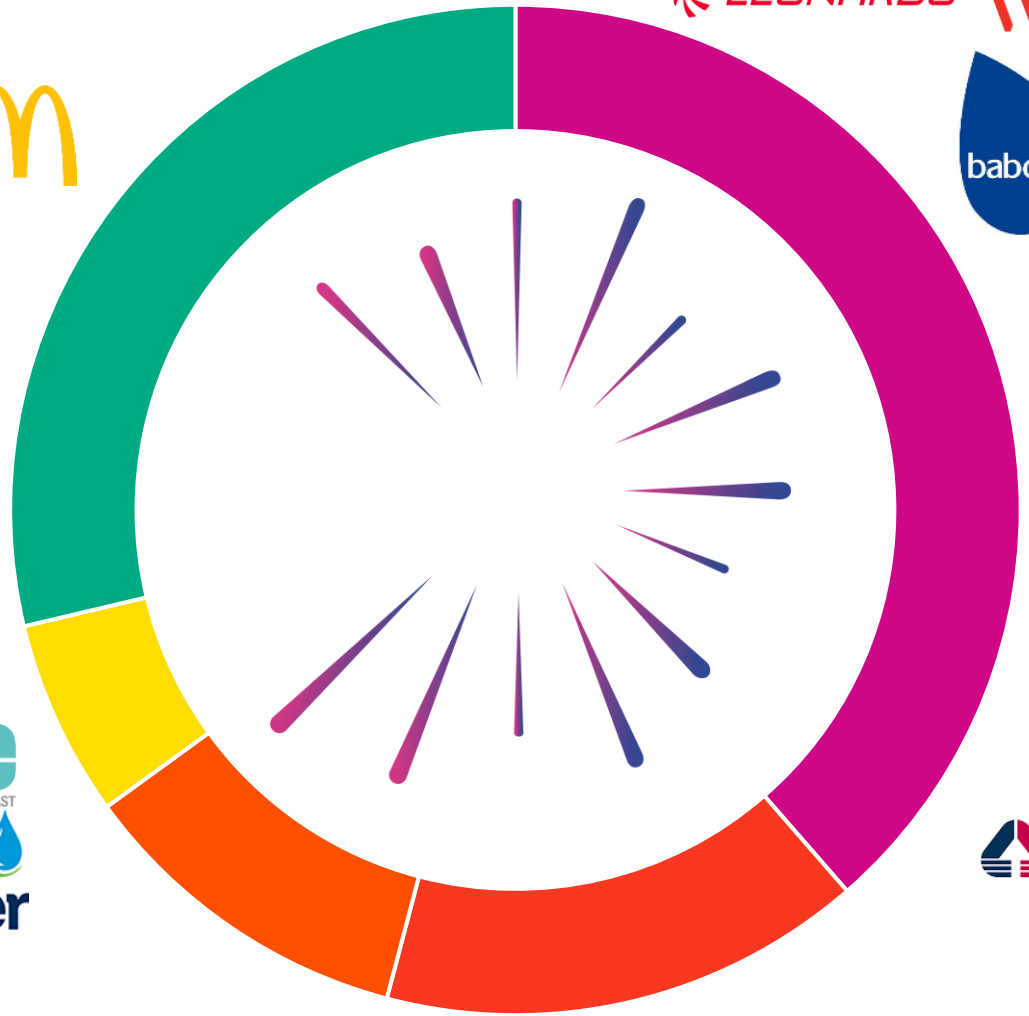
Citation ISO Certification
Integrated Management System
ISO 9001: 2015
ISO 14001: 2015
ISO 45001: 2018
REGISTERED
Certificate No:396182022

JOSCAR REGISTERED

CYBER ESSENTIALS PLUS

ADS MEMBER

Sectors and Clients 2023-24



DECISION LAB

GSK company profile

A global biopharma company, focussed on innovation

86 Manufacturing sites and 70,000 employees worldwide

130 countries+ who receive GSK medicine

Diverse portfolio including Vaccines, Respiratory, Oncology, HIV +

Turnover of £34b in 2023

GSK sustainability ambitions – Net Zero

- 100% imported renewable electricity by 2025 and 100% renewable electricity (imported and generated) by 2030
- 80% absolute reduction in greenhouse gas emissions from a 2020 baseline by 2030
- Investment in nature-based solutions for the remaining 20% of our footprint by 2030
- Net zero greenhouse gas emissions across our full value chain by 2045

Project summary

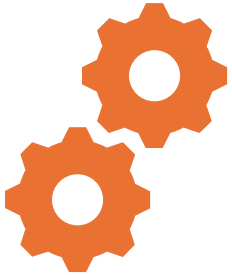
Objectives:

- Design, develop and deploy a novel forecasting and simulation model.
- Better understand the financial and the environmental effect of GSK's production plan at their Irvine site.

Achieved by:

- Leveraging historical energy consumption data and production schedule to build a relationship between the production plan and energy.
- Exploring the impact of altering production plan and/or adding more renewable energy sources to the site's energy generation infrastructure.

Methods to integrate



Create a time series model in Python to analyse and establish a baseline for current energy consumption under fixed manufacturing plan

Utilise the results within an AnyLogic simulation model to assess the impact of adding additional energy source on site operations

Able to run ‘what-if’ scenarios where alternative manufacturing plan is selected and consider ‘unexpected failure’ scenarios

Structure

Cycle

Manufacturing plan cycle

Shift

Single manufacturing units

Machine

Energy usage electricity & steam

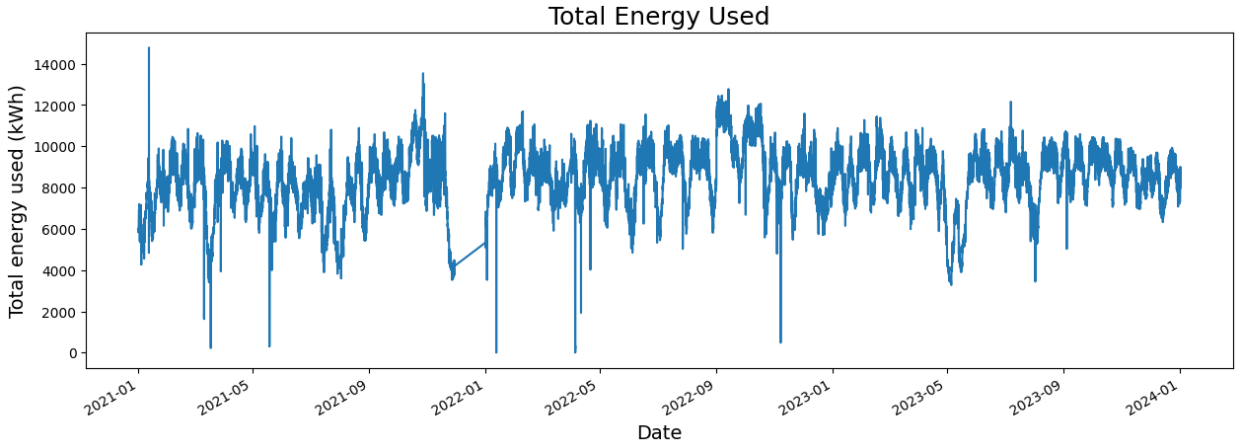
Alternative energy

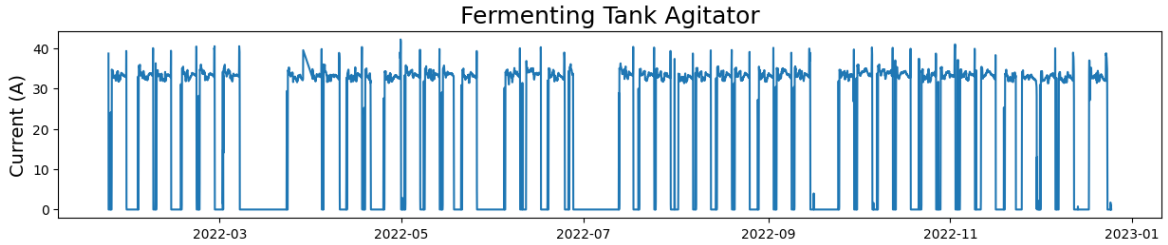
Wind turbine & solar

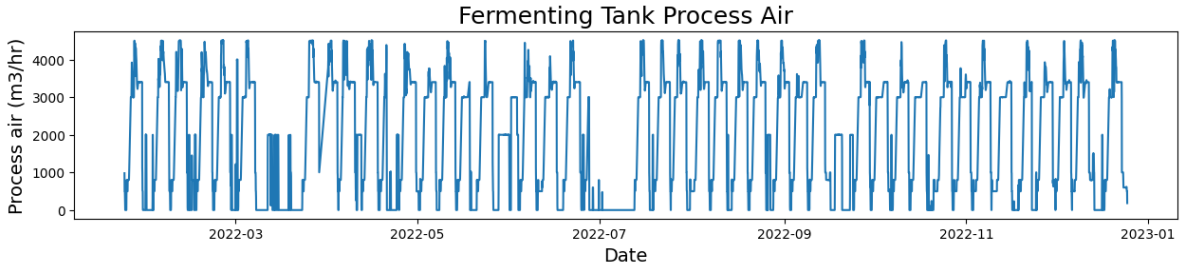
Steam generation

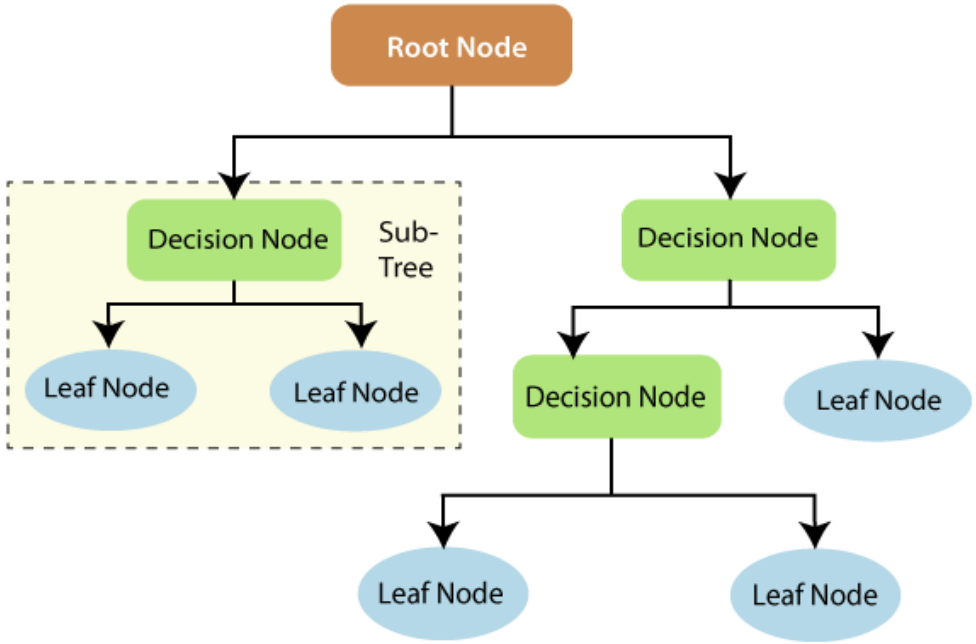
Gas & electricity

Machine usage & Energy consumption







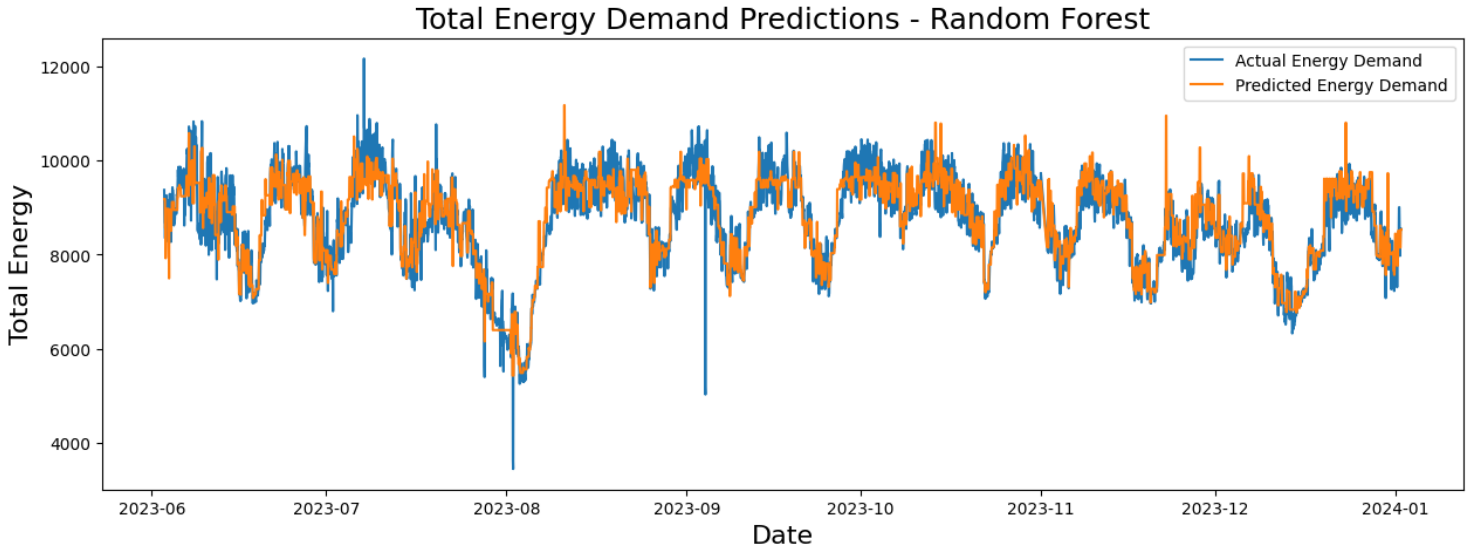


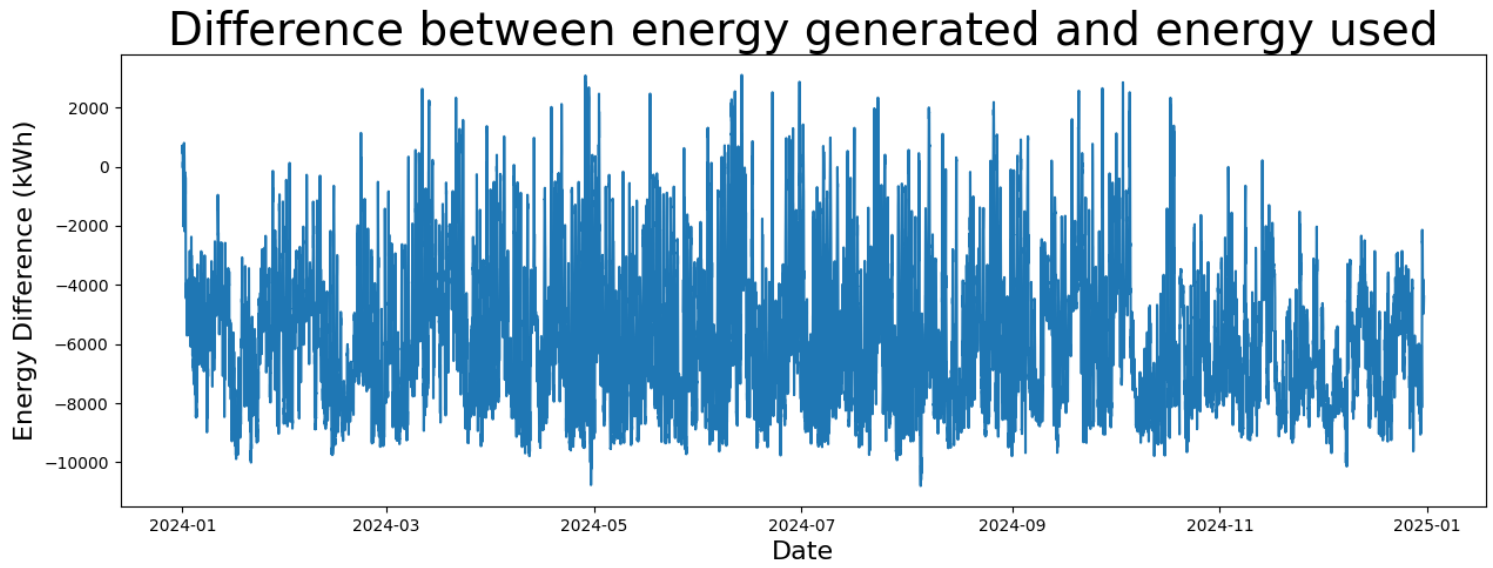
Random Forest Regressor

- Classification models
- Discrete, distinct categories

Evaluation

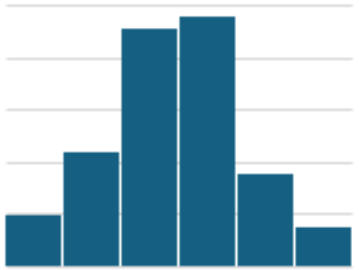
- Predict accuracy
- Energy usage & insight



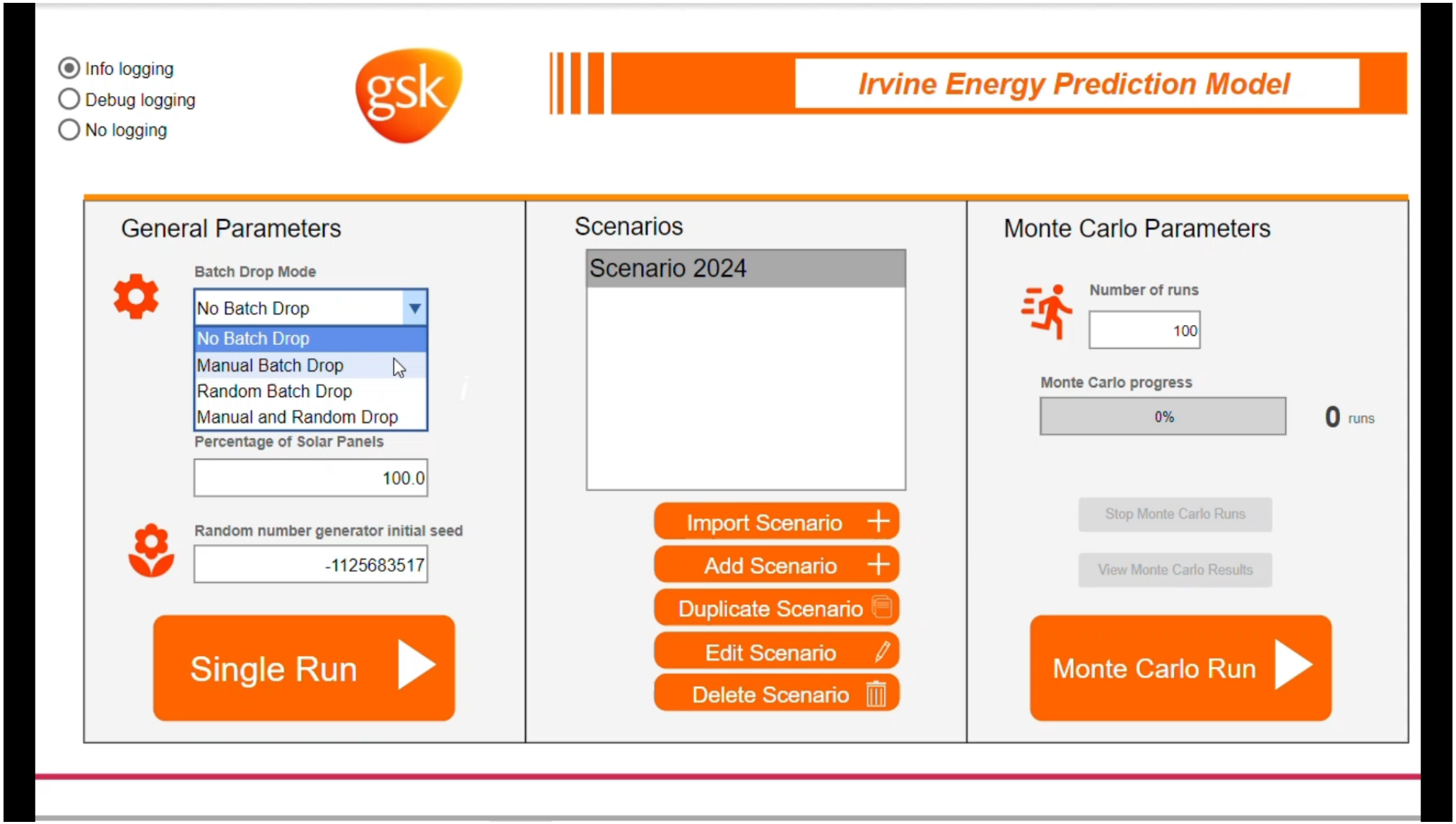


Choosing AnyLogic

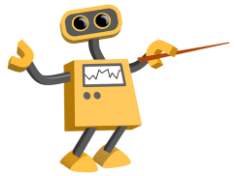
- Detailed and easy-to-use data editor
- Multiple run modes for different logic to make a more realistic model
- Pypeline to communicate with python forecasting models
- Comprehensive set of output graphs and KPI displays
- Ability to perform Monte Carlo runs



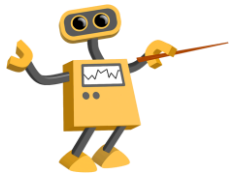
Demo


Info logging
Debug logging
No logging
gsk
Irvine Energy Prediction Model
General Parameters
Batch Drop Mode
No Batch Drop
No Batch Drop
Manual Batch Drop
Random Batch Drop
Manual and Random Drop
Percentage of Solar Panels
100.0
Random number generator initial seed
-1125683517
Single Run
Scenarios
Scenario 2024
Import Scenario
Add Scenario
Duplicate Scenario
Edit Scenario
Delete Scenario
Monte Carlo Parameters
Number of runs
100
Monte Carlo progress
0%
0 runs
Stop Monte Carlo Runs
View Monte Carlo Results
Monte Carlo Run

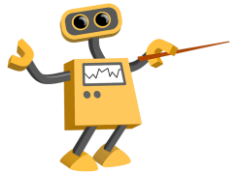
Model impacts



- Analysed and established a precise baseline for GSK's current energy consumption, enabling more accurate tracking and understanding of energy use patterns, reaching sustainability target.



- Assessed the impact of adding additional energy sources with AnyLogic simulations, which provided GSK with data-driven insights to optimize their energy strategy and improve sustainability.



- Simulated various manufacturing plans in AnyLogic, allowing GSK to predict and optimize energy usage, reduce costs, and enhance operational efficiency under different production scenarios.

Q&A

THANK YOU

Decision Lab: Joshua.liu@decisionlab.co.uk

GSK: giovanni.q.giorgio@gsk.com