ENERGY GeoHackathon
Society of Petroleum Engineers

SPE International
SPE Europe Region

GEOHACKATHON CLOSE OUT PRESENTATION

Team ERCE

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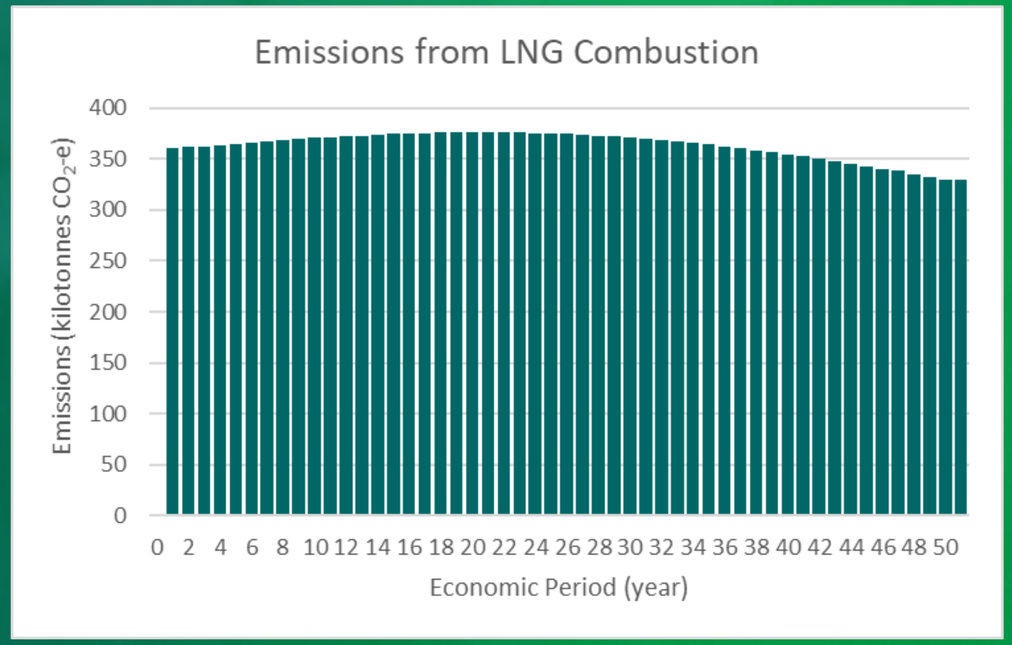
#DatafyingEne

1. Recommendations

- The FDP will satisfy 80 MW and 100 MW demand location requirements for 50 years

Summary of Results

No of Existing Wells	10
No of New Wells	6
CAPEX (MM€)	125
OPEX (MM€) [20 years]	212
OPEX (MM€) [50 years]	589
Project Duration (yrs)	50
LCOH (€/MW) at end of life [20 years]	13.8
LCOH (€/MW) at end of life [50 years]	11.5
NPV (MM€) [20 years]	2,542
NPV (MM€) [50 years]	1,578
Total terawatt-hours over Project Lifetime (TW.hrs)	9.3
Avoided Fossil Fuel Emissions (Gtonne)	0.02



Time Series GHG Emissions Savings over Project Lifetime

2. Short background of the project

- Two locations (D1, D2) have a demand of 80 MW and 100 MW thermal output respectively.
- Within the surrounding area of interests (AOI) measuring 12.5km by 12.5km, 12 pre-existing wells consist of:

(a) 3 producers (P01 to P03),

(b) 3 injectors (I01 to I03), and

(c) 6 exploration wells (E01 to E06)

- The team was given a budget for data purchase of EUR120,000, with each well log or well test costing EUR10,000 and EUR15,000 respectively.

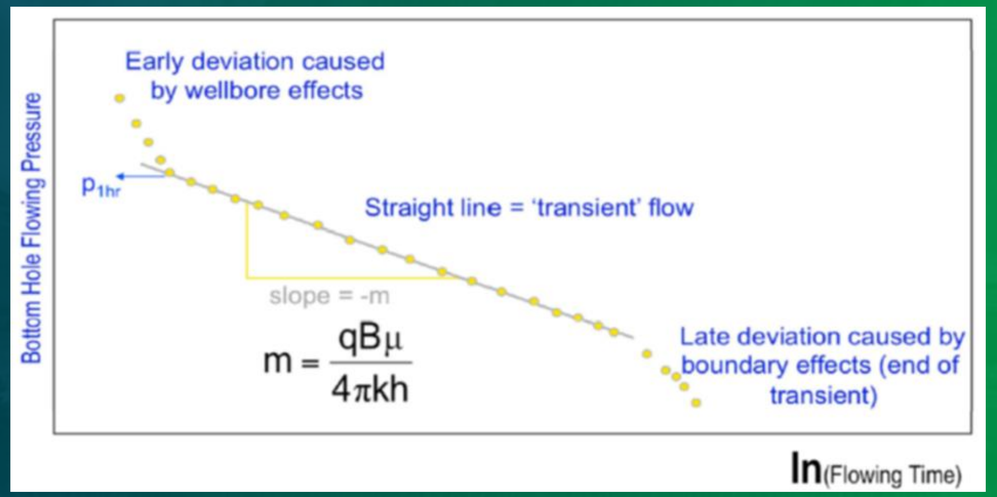
- Exploration wells prioritised because these wells could be converted to producers/injectors without incurring drilling costs.
- Producers and Injectors were considered as interchangeable, and properties assumed close enough to one another such that one well per doublet needed to be analysed.

3. Information that was used

- Data was purchased from all six exploration wells, with an even split of well test data (E02, E04, E06) and well log data (E01, E03, E05)
- Wells within the doublet with the smallest Euclidean distance from any demand location was selected, resulting in well logs purchased for I02, I03, and P01. An additional well test was purchased for P01, which was centrally located among the operating doublets.
- More well logs were purchased as they were cheaper; the Kozeny-Carman equation was used to correlate evaluated porosity to permeability through the application of a correlation constant (β).
- β is obtained from P01, which is centrally located and is the only well where both data sets were purchased.

$$k = \frac{n^3}{(1-n)^2}\frac{d_m^2}{180}$$

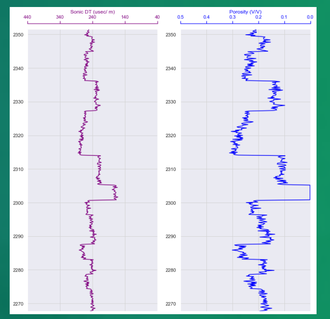
Kozeny-Carman equation

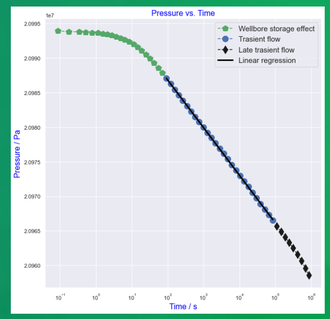


Permeability Modeling using Straight Line Transient Flow

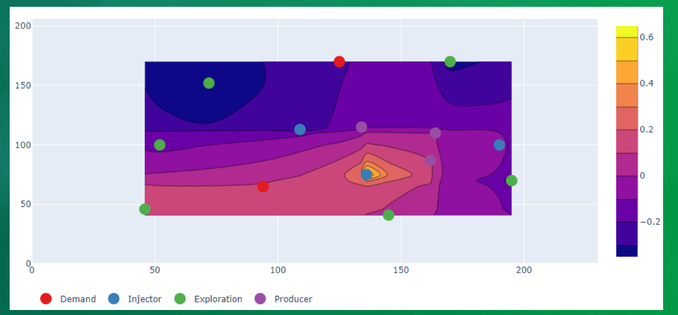
4. Methodology

Input Data	*Purchase Well logs & well tests*
Static Properties	*Interpret Porosity with Wyllie Eqn and Permeability using Drawdown*
Fairway Map	*Identify drill sweet spots*
DARTS	*Base case simulation*
Reiterate	*Change Flow Rates and Well Location*
Support Vector Classification (SVC) Model	*Redistribute determined wrt demand location*
Economic Analysis	*CAPEX, OPEX, LCOH, NPV*
General ML Model	*High-Grade best-case development scenario*

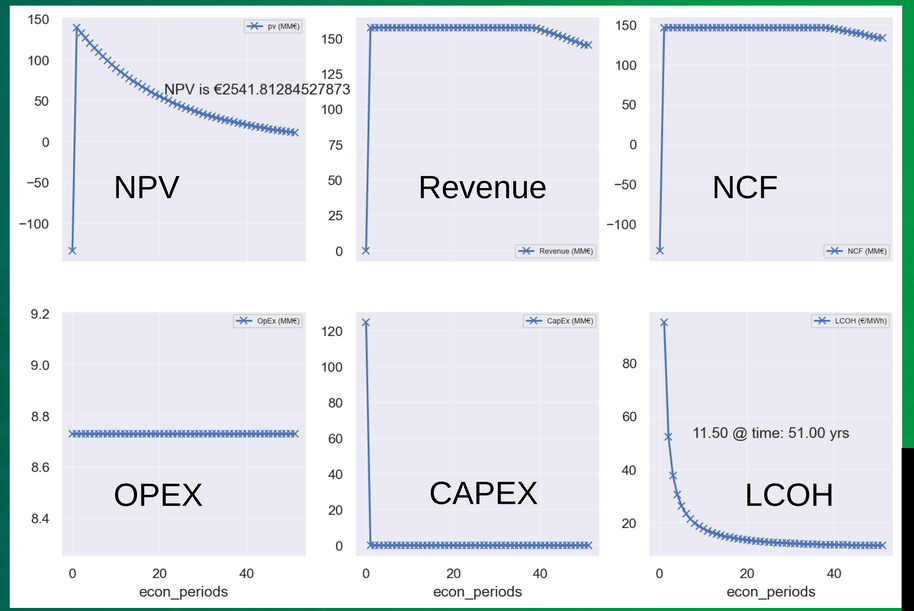




Porosity and Permeability Interpretation

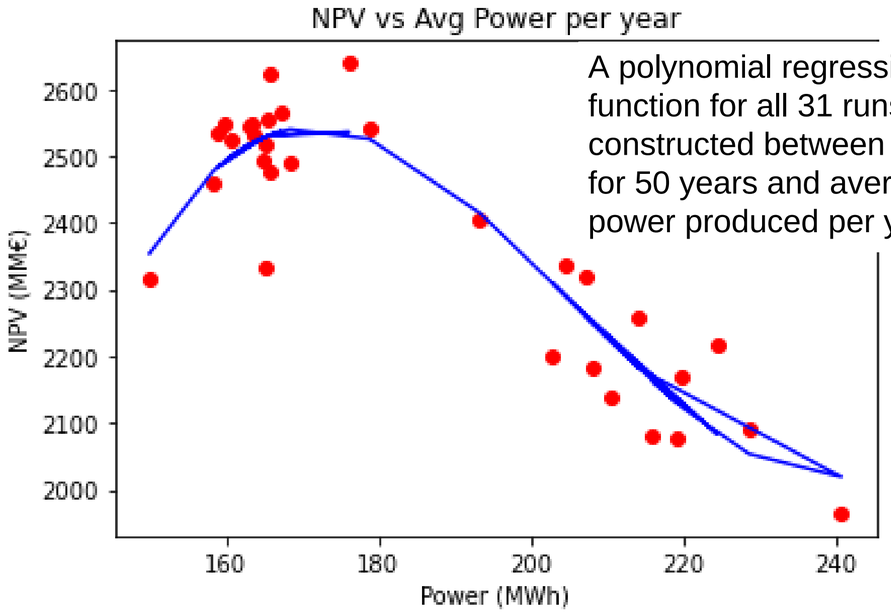


Fairway Mapping

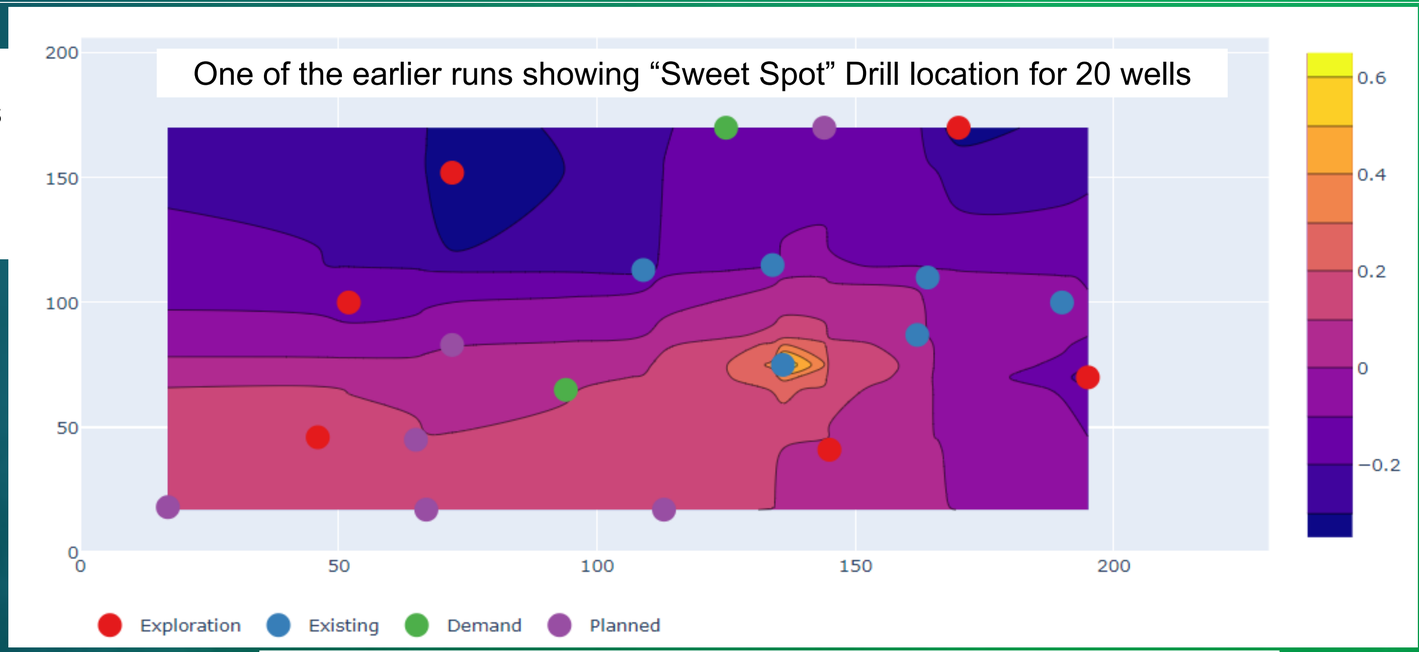


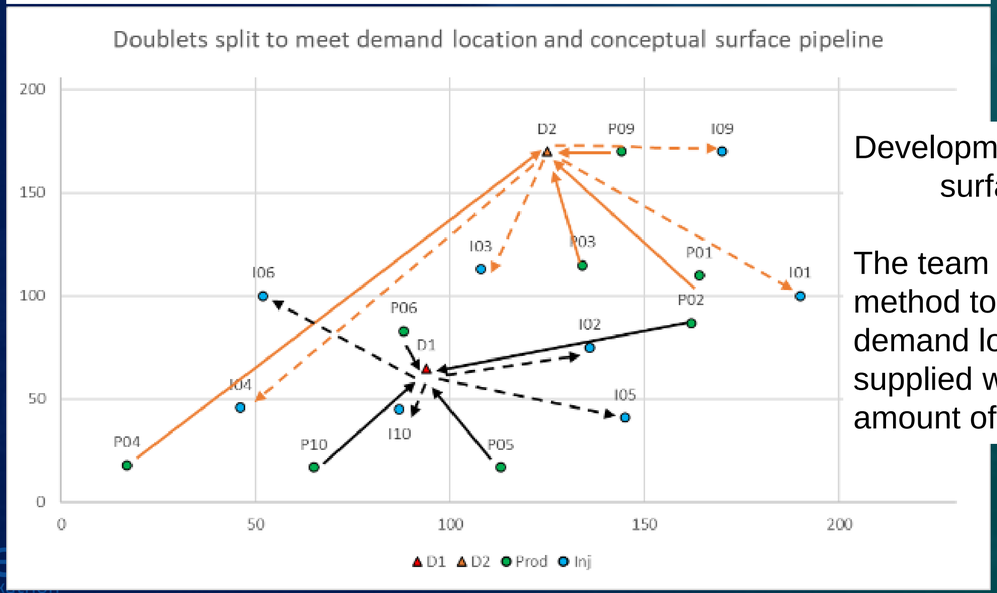
Economic Modelling

5. Results



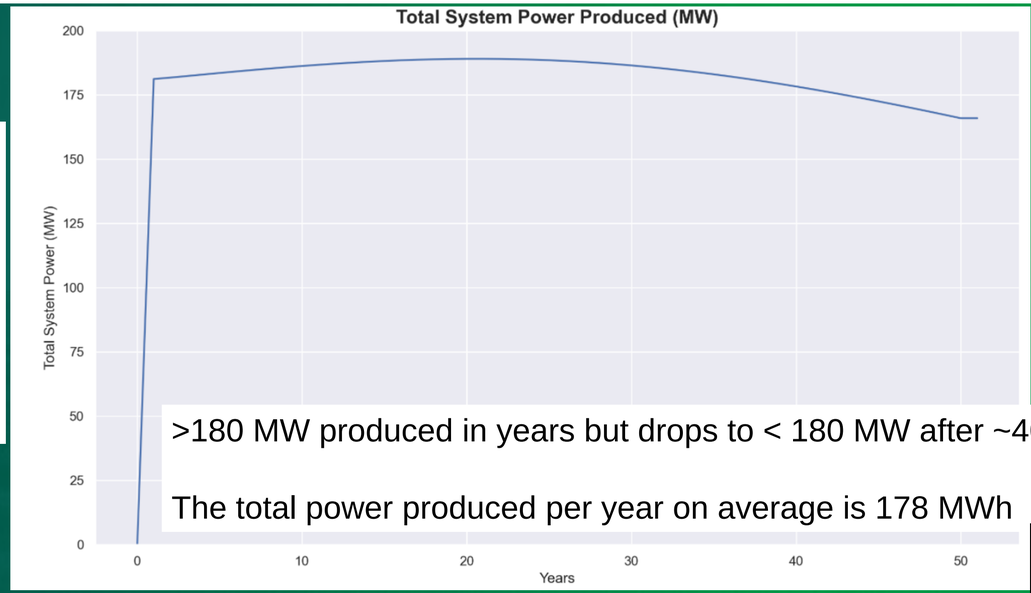
A polynomial regression function for all 31 runs was constructed between NPV for 50 years and average power produced per year





Development Plan depicting surface facilities

The team used an SVC method to ensure that each demand location was supplied with the right amount of power



>180 MW produced in years but drops to < 180 MW after ~40 years.

The total power produced per year on average is 178 MWh

6. Conclusions

Generalised Data Model

- *Using 31 DART runs, the team generated a dataset consisting of system power per year over a 50-year period, corresponding net present value and LCOH.*
- *We applied using a multivariant linear regression method, to predict optimal rate reductions needed to satisfy demand outputs, given some input well locations.*

Risks

- (a) lack of or poor reservoir (unable to meet water rate), (b) premature breakthrough, (c) sand production and (d) frequent ESP failures.

- Mitigated by (a) improved seismic mapping and well logging of reservoirs, (b) planning for workovers to replace ESPs and maintain flow rate, (c) reduce drawdown to prevent sand production and recompletion of well with sand screens