

Study Committee C1

Power System Development and Economics

Paper 11149_2022

Enhancing the Green Hydrogen Business Case

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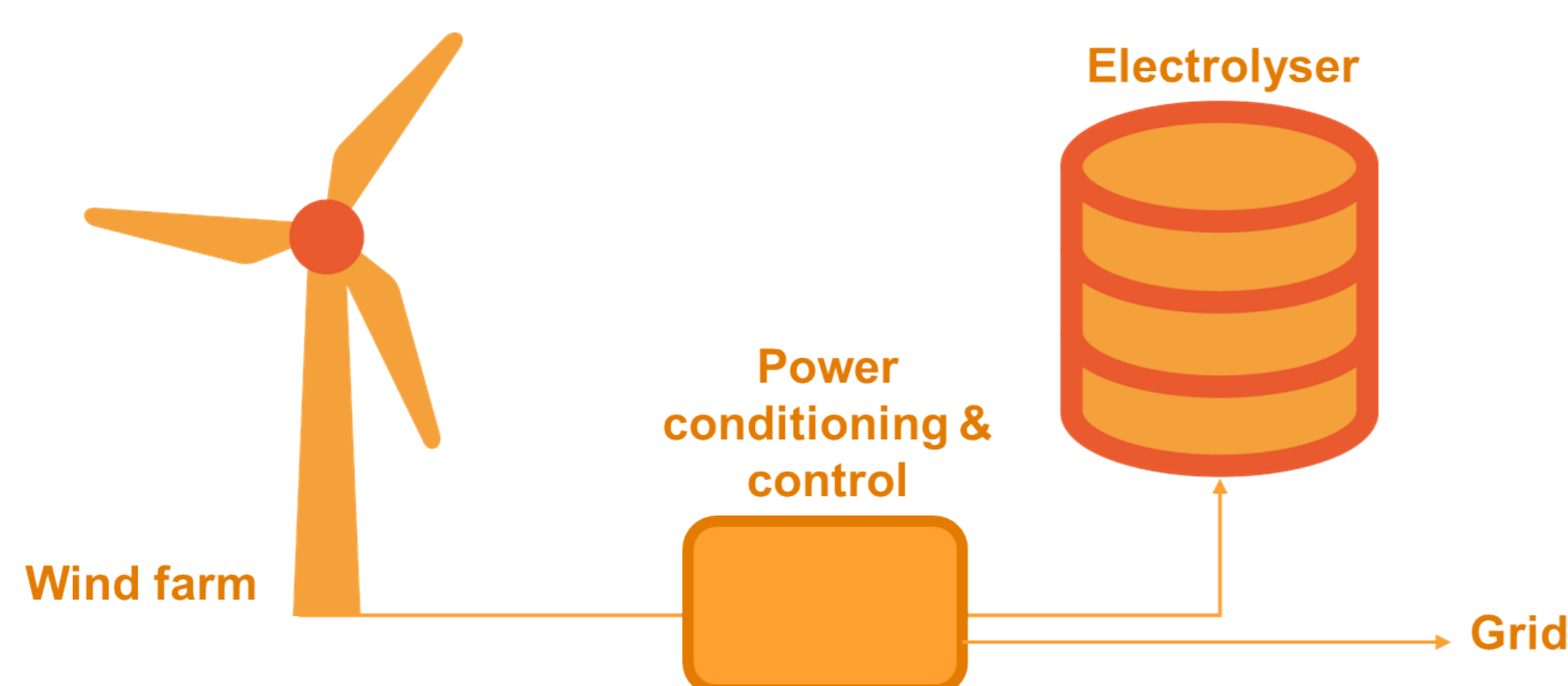
Motivation

- **Electrification of heat and transport** is vital towards a Net-Zero world
- Hydrogen will play a key role at both these areas
- However, the **production of hydrogen needs to be green**
- In this paper, investigate the hydrogen production from onshore wind
- Two business cases examined, onshore wind farms assumed to be co-located with electrolyzers
- Examined if the **presence of energy storage units** can improve the load factor of the electrolyser, and therefore the green hydrogen business case

Research Questions

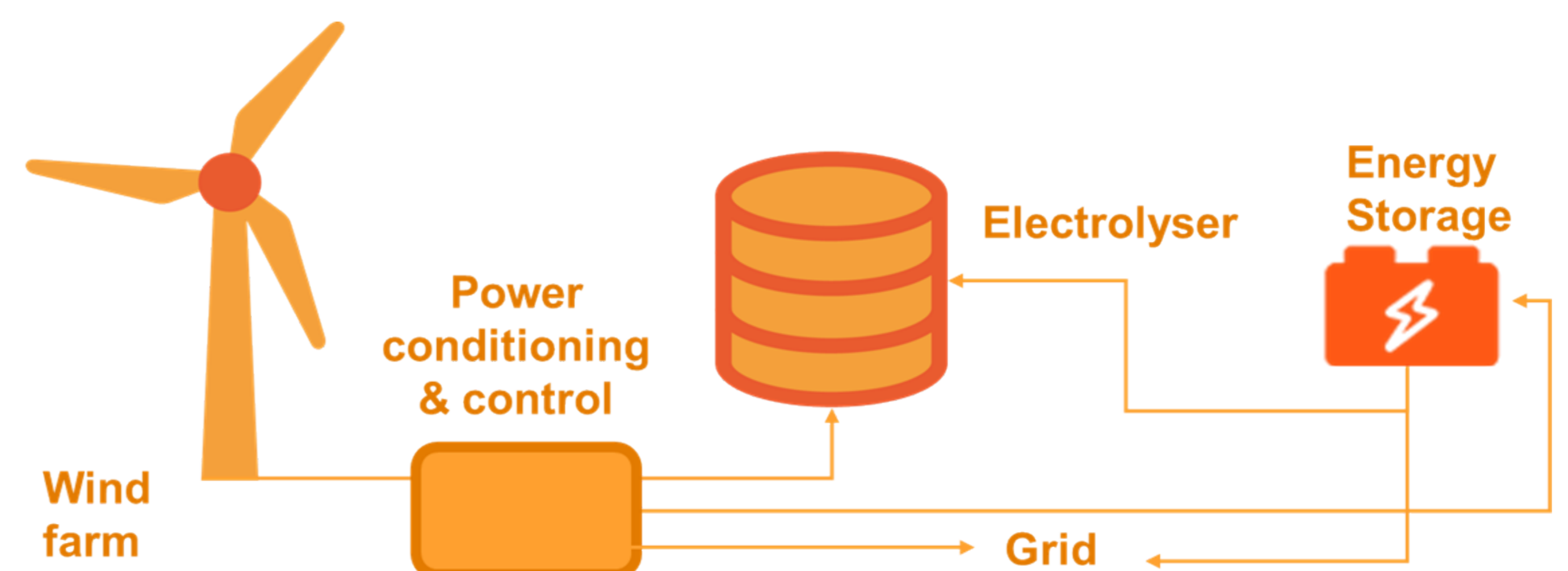
1. If there is a wind surplus, is it used to store energy to the energy storage unit or is selling energy to the grid prioritised?
2. Does a wind deficit mean the energy storage unit will prioritise sending energy to the electrolyser or sell it to the grid?
3. What is the impact of hydrogen price magnitudes on the above?
4. Does the presence of the energy storage unit increase the load factors and the revenues of the wind farm coupled with the electrolyser?

Method/Approach



Overall:
The existing energy storage unit of GEM Storage LCG model will be used as an electrolyser, which will charge (i.e. produce hydrogen) and discharge (i.e. sell / release the hydrogen) at different power rates. ESS energy tank will be sufficiently large to allow multi-day (multi-week) operation without discharging.

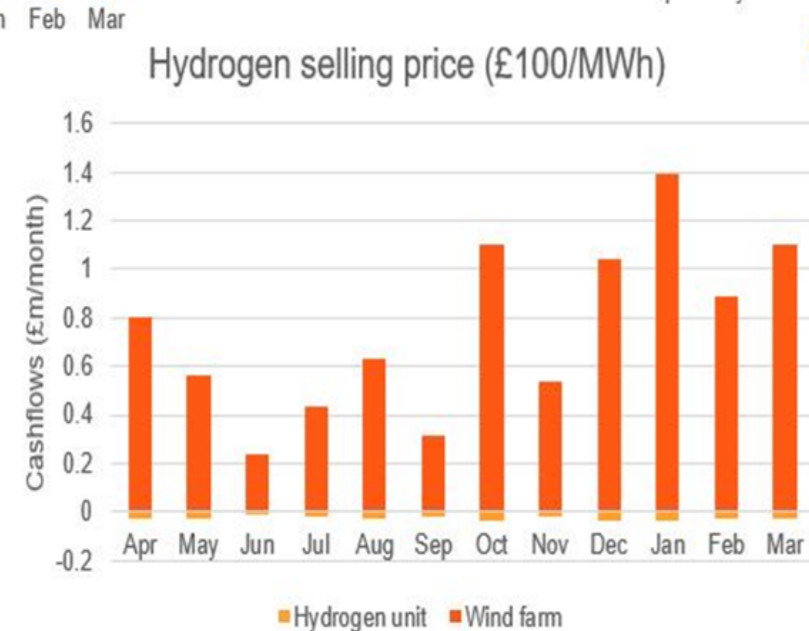
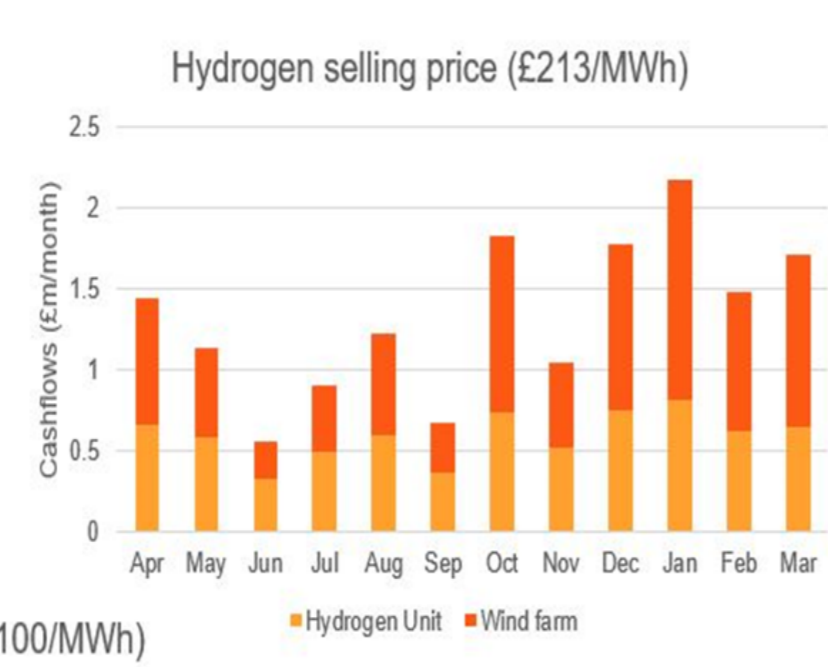
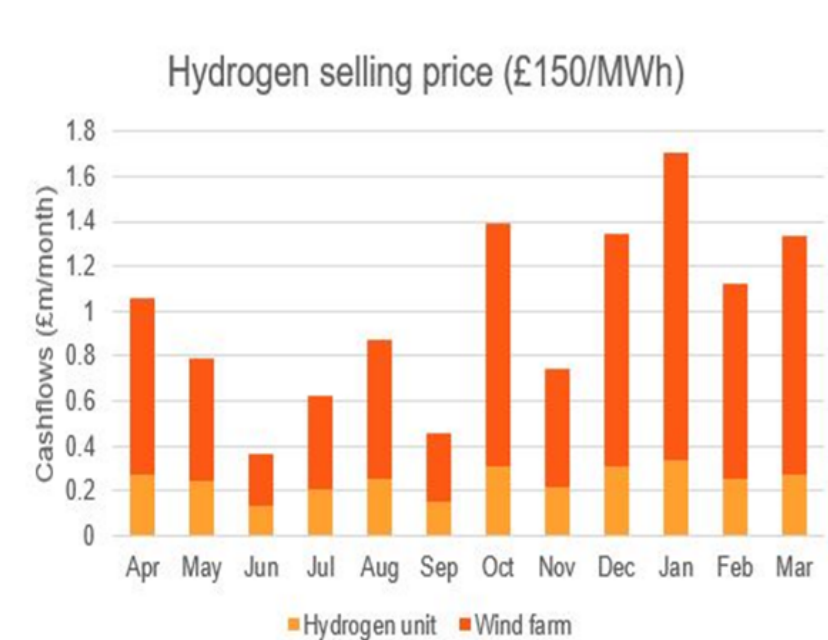
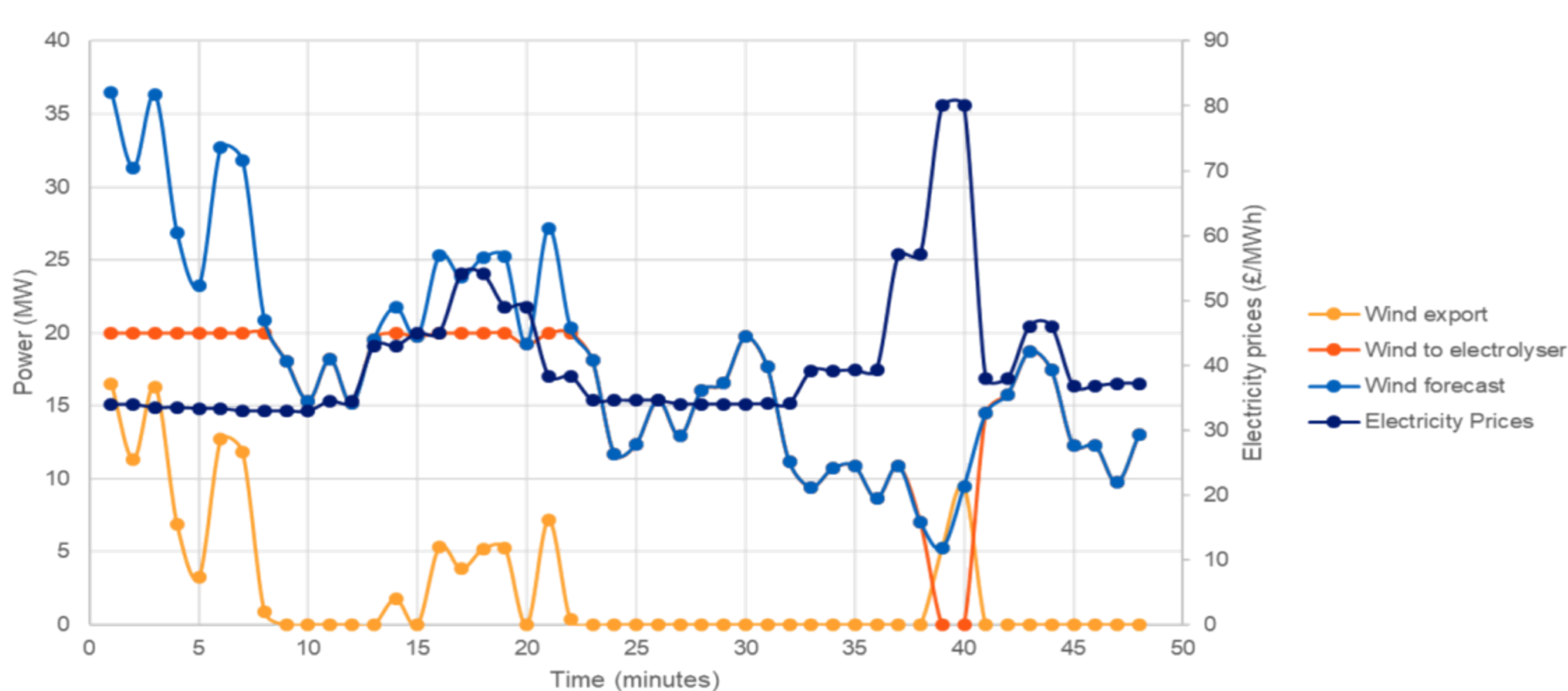
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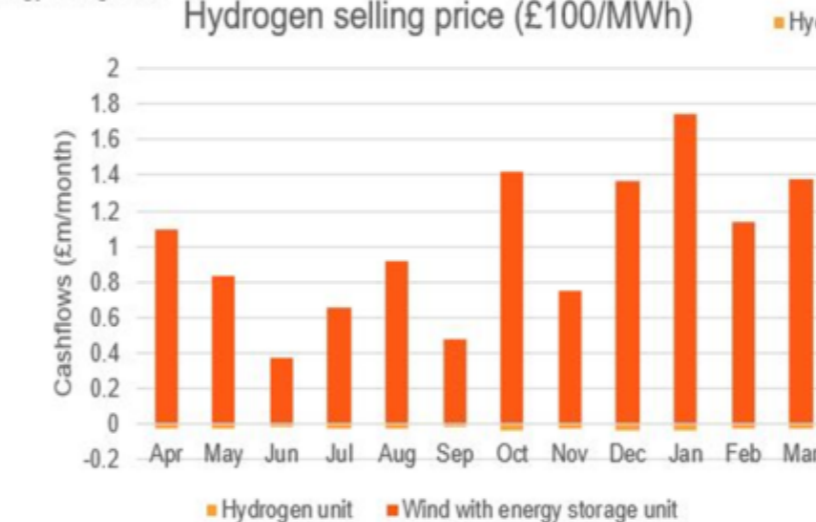
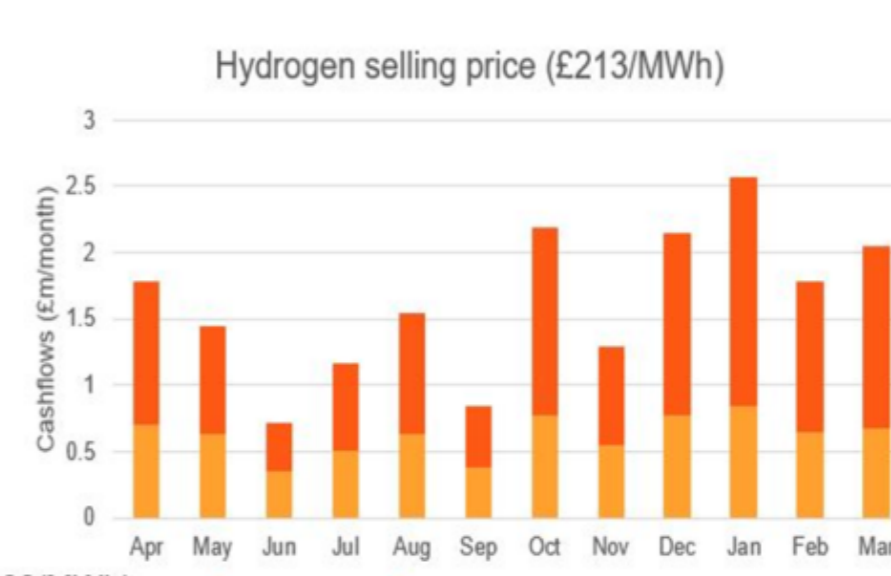
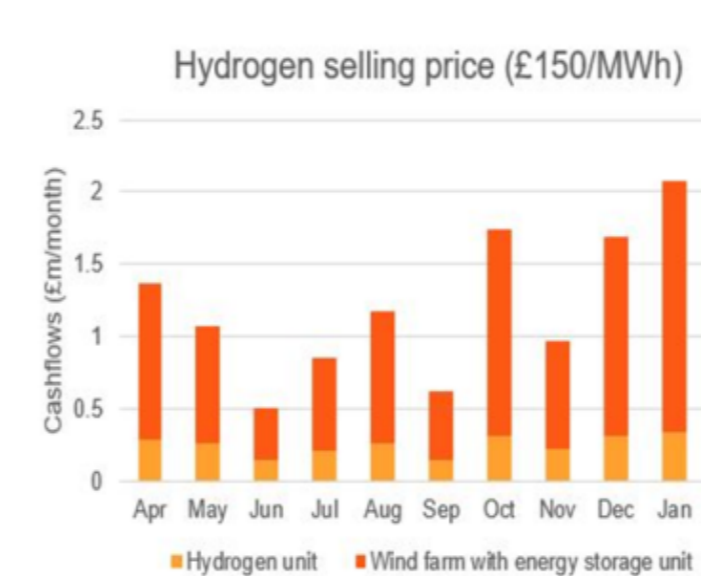
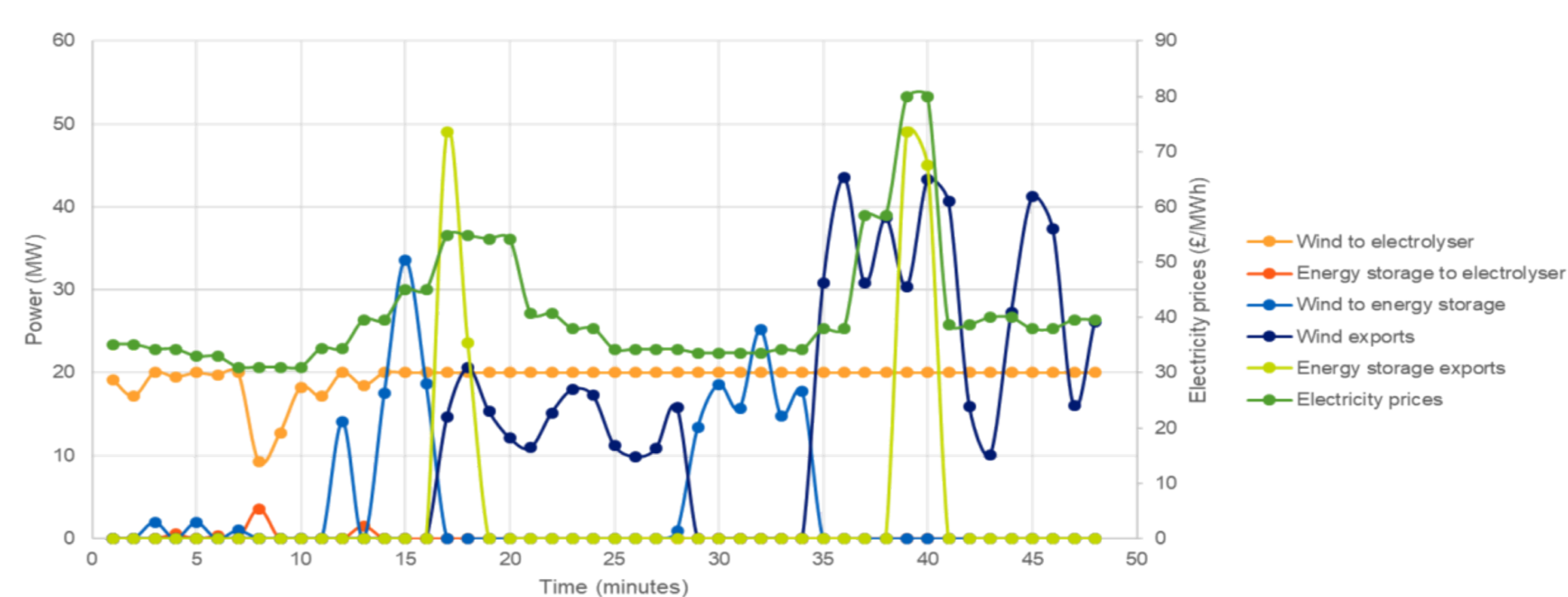
Maximise the revenue of the joint unit

Results & Discussion

Business Case 1



Business Case 2



Conclusions

When hydrogen selling price higher compared to electricity prices, electrolyser's operation prioritised.

If energy storage unit not present and wind energy is not enough to meet the electrolyser's demand, then it is assumed that the extra energy cannot be imported from the grid, since the UK grid is not decarbonised enough yet.

Overall, revenues of the joint unit depend on the size of the wind farm, electricity and hydrogen price magnitudes, electrolyser capacity and energy conversion efficiency of the energy storage unit. High hydrogen prices may encourage decision makers to prioritise wind to produce hydrogen and achieve higher overall profits.

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