Ensuring a sustainable future for humanity is incumbent on solving the need for efficient (low cost and minimal waste) industrial scale energy and production, while responding to global warming. Bio-Electrochemical Carbon Capture (BECC) has the potential to capture and utilize atmospheric CO₂ to produce Valuable Bioproducts using solely water and renewable energy, and by engineering an artificial light harnessing pathway cell metabolism can be further enhanced.

Going into this project we had three key aims:
1. Verify the ability of an engineered light harnessing pathway to enhance cell metabolism
2. Model dynamics to guide optimization, discover bottlenecks and assess performance
3. Test solutions to bottlenecks, and iteratively improve performance

**INTRODUCTION**

**METHODS**

To assess microbial carbon utilization potential, we used a dual chamber H-Shaped reactor with gaseous CO₂ as the carbon source in minimal media. While light with intensity of that at sunrise, was used to assess the effect of the artificial photosynthetic pathway. To ensure a constant voltage we designed and tested a voltage regulator. To guide and accelerate electrode design we modelled cathode chamber electrodynamics using a top-down approach, both on the meso and macro-scopically. Thus, allowing simultaneous optimization of both biological and materials aspects within the limited timescale provided.

**ENGINEERING A LIGHT HARNESSING PATHWAY**

**MODELLING TO CHOOSE THE ELECTRODE MATERIAL**

**ENHANCING THE ELECTRODE MATERIAL**

**CONCLUSION**

By engineering a light harnessing pathway and using modelling to guide electrode design and enhancement we more than tripled growth per unit current, increasing the Viability of BECC.