Department	School of Engineering and the Built Environment
Supervisors	Dr Firdaus Muhammad Sukki
Project Title	The feasibility of Space-based Solar Power for Terrestrial use

PROJECT DESCRIPTION

Space based solar power has been a theoretical concept for over 50 years, but recently there has been a new wave of research due to declining cost for both solar technology and space launches. The current negatives of ground-based solar such as weather dependency, energy storage, and area of panels in high-density zones can all be solved by moving this power production to space.

The aim of this project is to tnvestigate and analyse the feasibility of a space-based solar power system for use as a reliable, and renewable, source of constant power generation.The main areas of this research could be broken down into two key areas - scientific knowledge and costing. The knowledge focuses on the theory and *if/how* it is possible, whereas the costing focuses on whether it is economically viable enough to be useful. This project would focus on the feasibility of the system as a whole, by analysing the key areas listed below.

Key research areas:

- Long range wireless power transfer (energy transmitters and receiving array).
- Energy production (Efficiency, sizing).
- Solar panels in space (layout, materials, and structure, manufacture, fragility, comparison of different PV technologies).
- Costing (rocket launches, maintenance, manufacture, cost ratios, payback).
- Environmental impact (LCA, carbon emissions, comparisons to ground-based solar).
- Market demand and timescale of project

Wireless power transfer is likely the area that requires the most research, as its still a very much theoretical technology, with only a handful of practical investigations worldwide. This would be a great area to investigate through laboratory testing, with different WPT systems used to compare. Accurate costing data could be gathered from estimates, but ideally it would be collected from space based solar companies or scientific institutions such as the ESA or NASA. Ideally, this project would focus on Scotland and the UK, but this depends on the amount of local data available and may not be worthwhile due to the potential costs of the system being too high for one particular country.

Perspective applicants are encouraged to contact the Supervisor before submitting their applications. Applications should make it clear the project you are applying for and the name of the supervisors.

Academic qualifications

A first degree (at least a 2.1) ideally in relevant discipline such Electrical & Electronics Engineering, Mechanical Engineering, Renewable Energy, or Materials Science. An MSc in a relevant subject is highly desirable with a good fundamental knowledge of chemistry, opto-electronics and heat transfer.

English language requirement

IELTS score must be at least 6.5 (with not less than 6.0 in each of the four components). Other, equivalent qualifications will be accepted. Full details of the University's policy are available online.

Essential attributes:

- Experience of fundamental engineering, particularly in chemistry, opto-electronics and heat transfer.

- Competent in programming language, e.g. MATLAB/Simulink.
- Knowledge of CFD is advantageous.
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:
Have a knowledge in ray-tracing software such as ZEMAX, APEX or COMSOL.

Indicative Bibliography	Leet W. Wood, Alexander Q. Gilbert, Space-based Solar Power as a Catalyst for Space Development, Space Policy, Volume 59, 2022, 101451, https://doi.org/10.1016/j.spacepol.2021.101451. Nicholas Proctor, Ensieh Shojaeddini, Angel Abbud-Madrid, Peter Maniloff, Ian Lange, Feasibility of space solar power for remote mining operations, Acta Astronautica, Volume 186, 2021,Pages 183-189, https://doi.org/10.1016/j.actaastro.2021.04.001.
Enquiries	For informal enquiries about this PhD project, please contact Dr Firdaus Muhammad Sukki (f.muhammadsukki@napier.ac.uk)
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