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# 1 Design of a solar panel alignment mechanism



The analysis and design of a cantilever beam with a range of assumptions and scenarios, multiple variations are included for comparison.

## 1.1 Definition

The problem as stated is that static solar panels do not collect an optimum amount of solar energy throughout the year due to the changing position of the sun, we are to design a method of improving the level of sunlight an array of solar panels receive by orientating their position in line with that of the optimal direction to collect solar energy.

## 1.2 Assumptions made

It is to be assumed that the solar panels (Photo-voltaic cells) are to be installed on a residential property's roof, with given power output of 3.5-4 kwp for an array of 16 panels, it is assumed the most obvious design is to make use of linear actuators, and a electronic controller to synchronise their operation.

The assumed location is Knutsford Cheshire for weather and positioning details.

## 1.3 Specification

- Location: Knutsford, Cheshire.
- Linear actuators are to be used.
- 15m Wide x 4.5m area from ridge to gutter.
- Roof pitch 28°.
- Roof alignment 135° from north. (due south-east).
- Solar position tracking system.

## 1.4 Conceptual designs

## 1.5 Selected final design

## 2 Research on current solar panel technology

In flat-panel photovoltaic (PV) applications, trackers are used to minimize the angle of incidence between the incoming sunlight and a photovoltaic panel.

This increases the amount of energy produced from a fixed amount of installed power generating capacity. In standard photovoltaic applications, it is estimated that trackers are used in at least 85% of commercial installations greater than 1MW.

Photovoltaic power generation is done by employing panels composed of a number of cells containing photovoltaic material (often silicon).

This photovoltaic material then converts solar radiation into electric current.

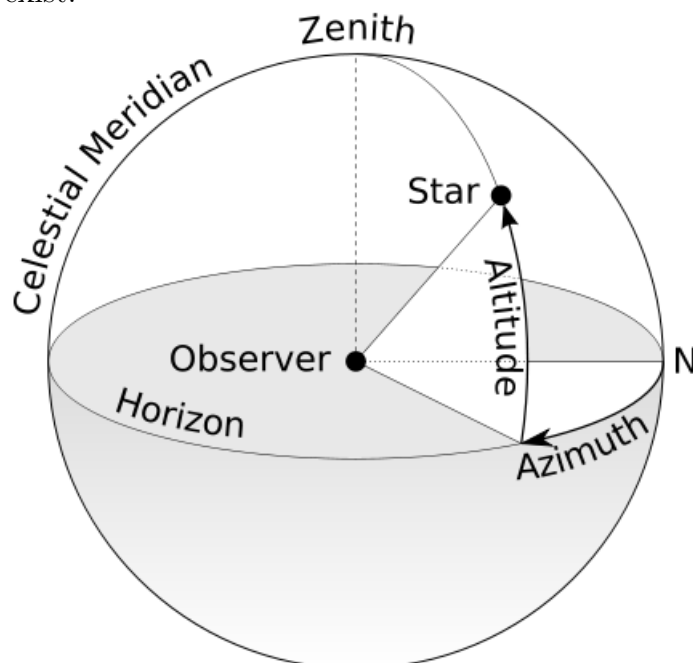
While solar tracking is essential for both CPV and CSP to deliver power it is not the case for PV. The reason for choosing tracking on a PV installation instead of just having a fixed installation is an increased energy output during the day.

Whether it is feasible to install a tracker is thus dependable on whether the increased energy output (kWh) weights up the additional cost of the tracking system.

Return on investment of the tracking part in a solar tracking system is approximately 4-5 years.

## 3 Research of optimum solar tracking paths.

It has become apparent with our research that there is a predefined system for tracking the sun, moon and other celestial bodies from a fixed point on earth, using the concept of a dual angle system utilizing a horizontal turned angle known as an azimuth, and a vertical angle more common to us described as altitude, this system can in effect be used to track the suns "flight" path across the sky relative to the solar panels, and it is anticipated the programming of the controller to take an input related to the angles would be fairly similar, indeed pre-established systems already exist.



## 4 why solar energy

### Clean Power

There is a growing demand to find greener ways to power the world and minimise greenhouse gas emissions. The sun is a natural power source that will keep on shining for an estimated 4 billion years.

Solar power systems are a sustainable way to convert the energy of the sun into electricity. The expected lifetime of a solar tracking system is 25-30 years.

In recent years the world solar market has experienced high growth rates. The increase has especially been fuelled by high government subsidies in countries around the world. Especially Germany has been leading the way with high subsidies. This has resulted in Germany being the country in the world with most installed PV.

Due to the economic crisis many countries are cutting back on subsidies, but at the same time the prices on most solar energy technologies have fallen considerably. Because of this and because of the political focus on renewable energy, high growth rates are also expected in the future solar market.