Comparing StratoSolar to other sustainable energy plans for the UK

In Dr. David MacKay's book, Sustainable Energy-without the hot air, he examines how to meet the UK energy needs of 2050 with sustainable energy sources. By adopting a mostly electricity based approach, he looks at plans that provide 70 kWh/d/person as opposed to the 125 kWh/d/p total energy demand of today's UK. One of those plans, plan M, and a map of the UK showing the scale of the plan M choices is shown below. These illustrations are directly from the book. This illustrates the large scale of the impact on the landscape of even a moderate plan. Plan M would not make everybody happy as it contains substantial amounts of clean coal and nuclear power, and relies on substantial imports of solar power from deserts. Without nuclear power or solar power imported from the desert, wind power would have to be expanded substantially and would cover most of the UK land area and coastal waters. The UK has no easy clean energy choices.

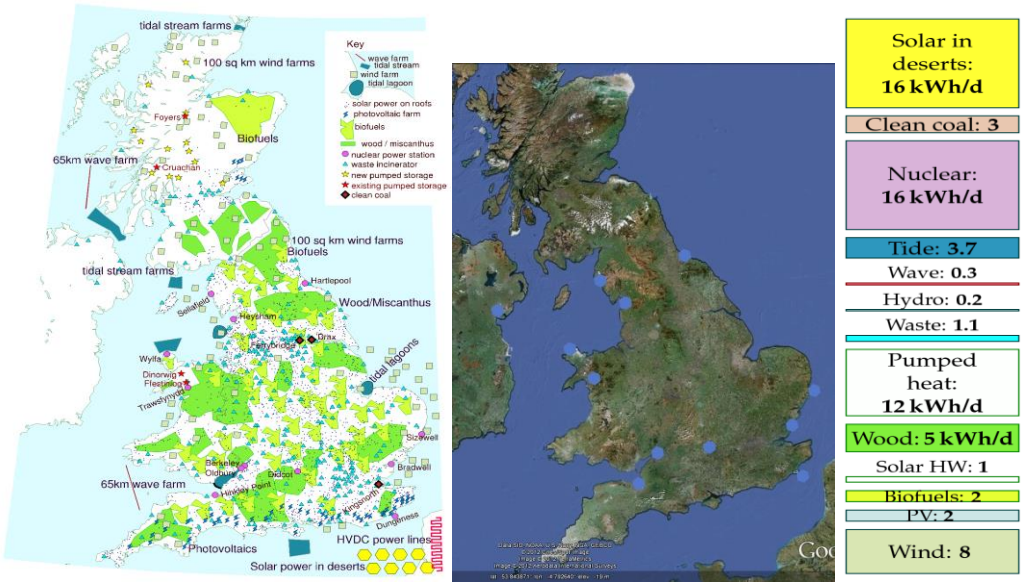

Figure 1 Plan M map, StratoSolar map, Plan M details

Alongside the plan M map above is a map that shows a StratoSolar solution providing similar power for the UK. It shows 11, 60 GWp nameplate capacity plants, positioned over the existing nuclear plant sites shown in plan M and one plant in Ireland. This StratoSolar plan is conservative and assumes 15% efficient PV panels, with platform PV arrays providing 100 kWh/d/p. By 2050 PV panels should exceed 30% efficiency and this PV array area would actually supply over 200 kWh/p/d. If demand reduced to the 70 kWh/d/p of plan M, only one third of the area shown would be needed. That could be four, 60 GWp plants rather than 12.

Gravity energy storage integrated with the platforms would provide nighttime electricity. Rather than the plan M approach of relying on wood and bio-fuel, StratoSolar would use its very cheap electricity to manufacture affordable synthetic fuels using feed stocks of hydrogen, nitrogen and CO_2. Hydrogen is provided from electrolysis of water. Nitrogen and CO2 are captured from the atmosphere and used with hydrogen to make synthetic liquid fuels. These synthetic liquid fuels would provide transportation fuels.

Stored hydrogen could provide some seasonal winter electricity generation at affordable prices, based on the very cheap electricity from PV generation. The electrolysis and liquid fuel synthesis plants would be located near the StratoSolar plants and would have a very small land footprint.

Overall the land impact of a StratoSolar solution is small. The land use under the arrays would be treated similar to exclusion zones around nuclear plants today, though a StratoSolar accident would cause very little collateral damage and would not have the long term contamination damage possible with nuclear power. The actual land occupied by tether anchors and deployment and maintenance facilities are less than 1 km^2/array or less than 1% of the array area.

The biggest practical economic impact is the restrictive zoning in the exclusion zone, which may relax over time with confidence gained from safe operational experience. There is an impact on airspace, but with modern warning systems based on transponders and GPS, this should be negligible. There is a visual impact, but with clouds and haze, this will be less than one might expect. Compared to the alternatives that Dr. David MacKay outlines, the environmental and aesthetic impact is small, and the StratoSolar solution is also considerably cheaper. Daytime electricity by 2050 should cost less than $0.02/kWh. The UK would also be completely energy independent.