



# From collapsed coal mines to floating solar farms, why China's new power stations matter

Hamid M. Pouran

The University of Wolverhampton, Wulfruna St, Wolverhampton, UK



## ARTICLE INFO

### Keywords:

Floating solar farms  
China Energy Policy  
Innovation in solar energy  
Water

## ABSTRACT

Inauguration of the world's largest floating solar power plant on a collapsed coal mine exemplifies China's commitment to transition to a low carbon economy. This 70 MW project covers more than 63 ha of the flooded area and can provide electricity for 21,000 homes. It also demonstrates China's ambition to amend its fragile environmental status namely air pollution, which claims 1.6 million lives every year. Soon after the completion, many countries expressed interest in building similar power stations, and within few months some companies released innovative products tailored specifically for improving the efficiency of floating solar power plants. China has a unique capacity to implement new ideas, scale them up and commercialise efficiently and now its self-declared war on pollution in 2014 seems to be reshaping the world energy landscape. China's plan to build 1 GW floating solar farms on abandoned coal mines present a stark contrast to the current environmental policies of the government of the United States. The innovative thinking behind these projects suggests that not only this country is taking the lead in renewable energies, but it is moving beyond speed, efficiency and mass production, and becoming a hub for innovation in green energy technologies.

## 1. The world's largest floating solar farm

Huainan is a city of Anhui Province in the eastern region of China and is known for its coal industry. This city has recently attracted the world's attention by opening a new chapter in China's transition to a low carbon economy. In 2017, the biggest floating solar power plant in the world was inaugurated in the vicinity of Huainan, on a flooded area once used for coal mining. The project belongs to China Energy Conservation and Environmental Protection Group (CECEP) (China Energy Conservation And Environmental Protection Group, 2018), a state-owned energy conglomerate and a renewable energy project developer.

The government has supported this project aiming to mitigate the damages that overexploitation of coal mines has done to this region. The total surface of the flooded area is 148.4 ha. This 70 MW project is comprised of almost 194,700 solar panels and 52,000 float parts, to keep the islands on the water. The power plant is made of 13 float islands, and the capacity of the largest one is approximately 8.5 MW. Fig. 1 shows the aerial view of the construction of the world's largest floating solar power plant (Credit Google Earth Pro, 2018) and Fig. 2 provides some technical information about the lake and plastic floats used in this project (Hydrelio® Floating Solar System and Ciel & terre, 2018). The total surface of the floating power plant is 63.6 ha. The solar

islands are anchored to the silty clay soil of the bottom of the lake, which has the maximum depth of 14.0 m. To tolerate water level variations in different seasons, that is less than 4.0 m, and withstand hydrodynamic impacts of external factors, e.g. wind and rain, the float parts are stabilised using helical anchors.

The costs of building floating solar power plants are higher than their ground-mounted peers. Several factors influence financial requirements of the projects, which include the location of the water reservoir and the logistics, characteristics of the water body for example; depth, water level variations, soil/bedrock and the type of floats used to support the PV modules. Anchoring or stabilizing the floating power plants, in a way that is compatible with the dynamic nature of the reservoir yet provide long-term reliability constitutes a notable part of the expenses. For the Anhui project in China, which is a shallow water body the total anchoring costs were around 10 USD/kW. For this large-scale floating power plant, the local manufacturing facilities and labor force were used, and the anchors were installed from 4 to 15 m underwater. In Japan the anchoring price is substantially higher and the aim is to reach 30 USD/kW or less. The up to date estimate of the floating solar farms costs based on the technology used in Anhui spans from 0.85 to 1.20 USD/Wp. This is based on the assumption that the float parts are manufactured locally and the logistic impacts for this large plastic parts are reduced to minimum. For example a 1 MW sets of

E-mail address: [h.pouran@wlv.ac.uk](mailto:h.pouran@wlv.ac.uk).

<https://doi.org/10.1016/j.enpol.2018.09.010>

Received 31 May 2018; Received in revised form 24 July 2018; Accepted 9 September 2018  
0301-4215/ © 2018 Elsevier Ltd. All rights reserved.

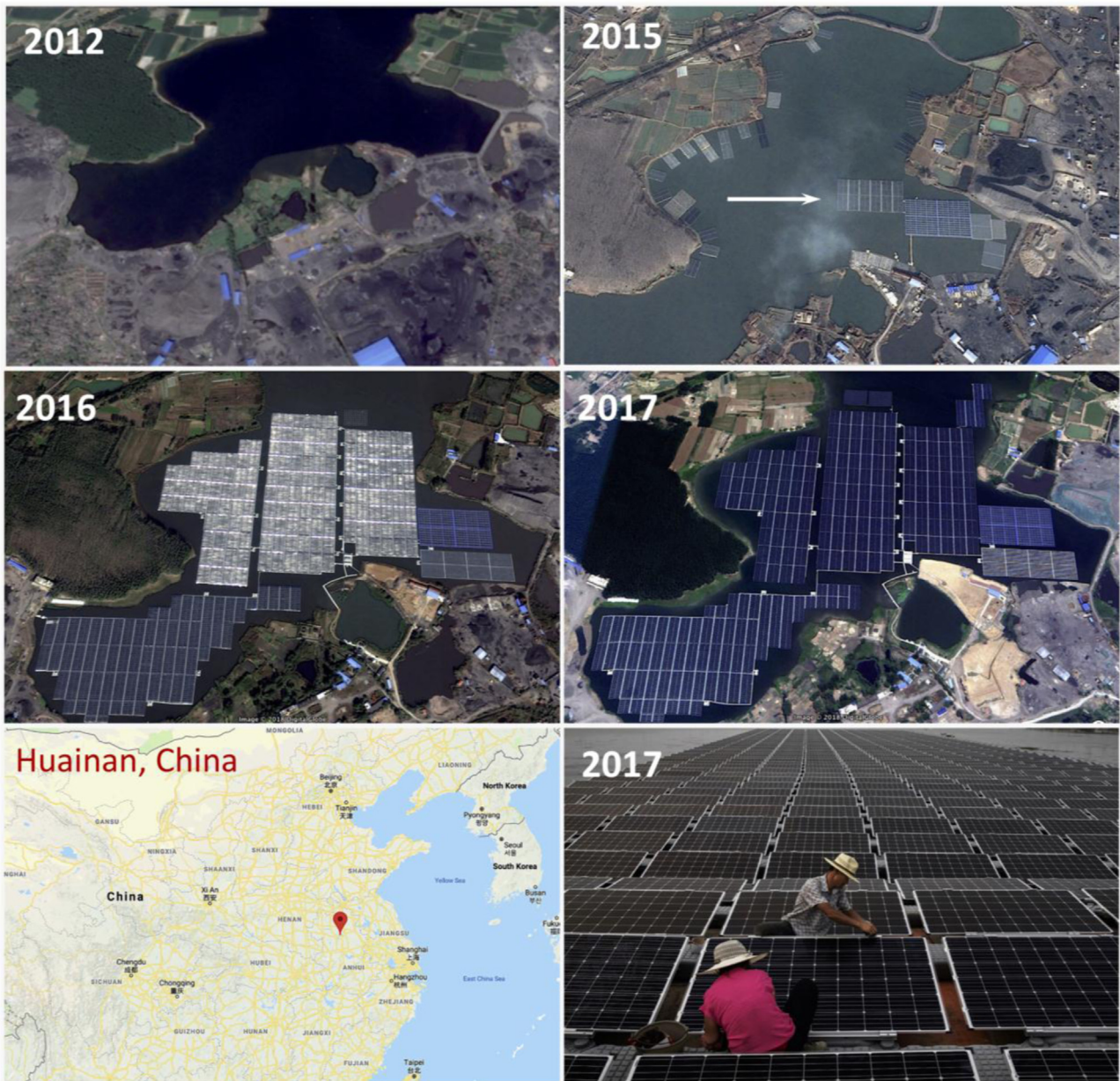


Fig. 1. Shows changes to the flooded coal mine subsidence area before and after installation of the floating solar farms (Credit Google Earth Pro, 2018 and Getty images).

the main and supporting floats needs 25 standard truck loads (Ciel et Terre International, 2018).

Existing infrastructures, e.g. grid-connection requirements would reduce the costs of building floating solar farms, and in case of flooded coal mines, there are potential co-benefits as very often coal-power plants have been built close to the mines; thus electricity transport infrastructure is there. Coal-burning power plants often have carbon footprints close to 1000 t CO<sub>2</sub>e/GWh, which is the largest compared to other electricity generation systems, and substantially higher than photovoltaic solar (WNA, 2010). In 2016 China's National Energy Administration (NEA) announced its plan for building 1 GW floating solar stations on the collapsed coal mines (National Energy Administration (NEA), 2018; NEA, 2018) (including the Huainan's project).

The NEA has expressed its support for building innovative green energy infrastructures to improve environmental quality in the coal-rich eastern province of Anhui, where overexploited coal mines have created vast reservoirs (Ciel et Terre International, 2017). The 70 MW

project can provide electricity for more than 21,000 homes (Ciel et Terre International, 2017), a number which would be significantly reduced in the next two decades as the Chinese household energy consumption is expected to double by 2040 (International Energy Agency, 2018). Shifting from coal mines to floating solar farms is much more than just embracing sustainability, it helps China to mitigate its environmental problems particularly air pollution, which is one the worst in the world and kills hundreds of thousands of people every year (Rohde and Muller, 2015).

## 2. From collapsed coal mines to floating solar farms

In 2014 Li Keqiang, Chinese Premier, announced China's war on pollution: "we will resolutely declare war against pollution as we declared war against poverty" (Ydersbond and Korsnes, 2014). In the past four decades, China has prioritised economic growth over the environment, which has made this country the worlds' biggest carbon

Download English Version:

<https://daneshyari.com/en/article/10134681>

Download Persian Version:

<https://daneshyari.com/article/10134681>

[Daneshyari.com](https://daneshyari.com)