22 January 2015
Issue 400

Subscribe to free weekly News Alert

Source: Wu, Z., Hou, A., Chang, C., *et al*. (2014). Environmental impacts of large-scale CSP plants in northwestern China. *Environmental Science Processes & Impacts*, 16(10), 2432–41. DOI:10.1039/c4em00235k

Contact: wuzhiyongspecial@gmail.com

Read more about: Environmental technologies, Climate change and energy

European Commission

Science for Environment Policy

The impacts of large-scale Concentrated Solar Power on the local environment

Construction of Concentrated Solar Power (CSP) plants – electricity generation which concentrates sunlight to generate heat – can have a range of negative effects on wildlife, but these effects are short lived, new research has found. Once in use, CSP plants can even have some positive effects, reducing soil erosion, for instance.

CSP uses mirrors or lenses to concentrate sunlight from a large to small area; the light is then converted to heat and used to generate electricity. Along with other renewable technologies, CSP offers a wide range of environmental benefits over conventional energy sources, such as coal, mainly because of the reduced GHG emissions and air pollution and waste. However, CSP requires the use of large areas of land in sunny areas in order to collect sufficient sunlight to produce energy, which could have negative effects on the local environment.

Now new research has examined the potential local environmental impacts of the construction and use of large-scale CSP plants. The study site was in the arid and semi-arid region of north-western China, an area with abundant sunlight but a fragile ecosystem. The researchers focused on water consumption, soil erosion and soil temperature in particular.

Water consumption

CSP plants use water for a number of reasons, such as for steam to turn turbines, for cooling, and, especially in the arid and semi-arid conditions, to clean dust off the mirrors. Water consumption, the authors found, is highly dependent on the specific CSP technology used. For example, a 50 megawatt CSP plant using water cooling would use 1 600 000 m^3 of water annually, whereas an equivalent plant using 'dry' cooling technology, such as dry air or water-air hybrid cooling, would only use around 400 000 m^3.

Soil erosion

North-western China is particularly vulnerable to soil erosion because of its dry climate, sandy soils and strong winds. The researchers found that during CSP plant construction, damage to vegetation, construction traffic and the digging of foundations would all increase soil erosion in the immediate area. However, using computer simulations, they showed that if the solar light collectors were used as wind breaks, this could protect the soil from erosion, as they would slow winds to below the threshold speed needed for sand movement.

Soil temperature

To find out how CSP plants affect soil temperature, hourly temperature data were collected from an experimental CSP site in Yanqing, Beijing, between August 2010 and October 2013. The data were compared to nearby areas lacking collectors.

The results show that CSP structures lowered the soil temperatures by between 0.5 to 4 °C in spring and summer and increased temperatures by 0.5 to 4 °C during the winter. The authors attributed these changes to CSP altering air flows and shading, and therefore how heat moves between the air and land, although in summer shading is also likely to cause this effect. This finding could be important where land use is combined with growing crops, as plant growth can be especially sensitive to soil temperature.

While not assessed in this study, the environmental effects of raw material usage and processing of CSP plants are typically fewer than in other solar technologies, such as photovoltaics.

The researchers also discussed other potential environmental impacts, concluding that construction of CSP plants would have temporary effects on the local environment, wildlife and habitats, but pose no danger to human health. CSP sites could also be used for multiple purposes, such as agriculture. The results of this study, and similar ones, could help to inform decision makers' choices when selecting technologies and locations most suitable for CSP.