AGRICULTURE

Photovoltaic win–win

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Credit: laboratory/Alamy Stock Photo.

With the cost of photovoltaics falling and installed capacity increasing rapidly, there is a real need for research into the impacts of large-scale solar installations. Solar arrays compete with agriculture for land, but this can be minimized by intermingling solar panels with agriculture in what has been termed agrivoltaic systems.

Elnaz Hassanpour Adeh, from Oregon State University, and co-workers used a field experiment to investigate the impact of a six-acre agrivoltaic solar farm on microclimatology, soil moisture and pasture production.

They find that significant differences in mean air temperature, relative humidity, wind speed, wind direction and soil moisture are caused by the panels. Pasture under solar panels experienced a significant increase (up to 90%) in late-season biomass. This net yield benefit was largely due to increased water-use efficiency in the shaded areas that left water stored in the soil available throughout the entire growing season. This study shows that, at least in semi-arid pastures with wet winters, solar deployment can reduce pasture water demand, thereby increasing yields while generating power. *AB*

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EMISSIONS TARGETS

Action needed on NDCs

Energy Policy **126**, 238–250 (2019)

National climate action plans and voluntary emissions reduction commitments referred to as Nationally Determined Contributions (NDCs) are the cornerstone of the Paris Agreement. Thus, it is paramount to understand whether individual countries are on track to meet the targets set forth in their NDCs.

By comparing emissions under current policies to those associated with the achievement of their NDCs, Michel den Elzen of PBL Netherlands Environmental Assessment Agency and colleagues offer an assessment of all G20 economies. They find that six members (China, India, Indonesia, Japan, Russia and Turkey) have current policies that put them on track to achieve their 2030 NDC targets, three countries have insufficient information available or disagreement on policy scenario projections, and the remaining seven members require further action to meet their stated targets. Australia, Canada, South Africa, the Republic of Korea and the United States require substantial new and enhanced policies to make progress towards achieving their 2030 NDC targets.

Although previous research suggests that NDCs, even if fully implemented, are unlikely to achieve the collective Paris goals, this assessment suggests that there are many countries who may also fail to meet their own commitments. *AY*

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WATER SECURITY

Shifts in storage

Hydrol. Earth Syst. Sci. **22**, 5935–5946 (2018)

Credit: age fotostock/Alamy Stock Photo.

Changes to the hydrological cycle are expected to affect water security. Water storage consists of blue water (surface water) and green water (that stored in soil), but how water will be distributed between them in the future is unclear. A shift to more extreme precipitation could influence storage, and Joris Eekhout of the Soil and Water Conservation Research Group, Murcia, Spain, and colleagues applied a hydrological model, coupled with a soil erosion model, to study these effects. They investigate the Segura River catchment, southeast Spain, for the periods 2031–2050 and 2081–2100 under RCP 4.5 and 8.5.

The results show redistribution in the future with less green water, which causes greater plant water stress and necessitates more irrigated agriculture. The shift to blue water storage, with greater runoff into streams and reservoirs, will also increase soil erosion and overall reduce water security. The authors attribute the change to increased extreme precipitation and a decreased frequency of precipitation. To ensure water security, adaptation should consider increasing soil and reservoir storage capacity through sustainable land management. *BW*

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PHYSICAL OCEANOGRAPHY

Greenland Sea convection

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Dense water formation in the Nordic Seas is a key component of the Atlantic Meridional Overturning Circulation. Convection in the Greenland Sea, for example, is thought to represent a significant proportion of dense water production, but large variability has been observed in recent decades. Using various hydrographic measurements, Ailin Brakstad from the University of Bergen, Norway, and colleagues further quantify the temporal variability of wintertime open-ocean convection — and subsequent dense water formation — in the Greenland Sea from 1986 to 2016.

Shallow convection (<300 m) is found to have dominated from 1988 to 1993, linked to a near-surface freshening that enhanced the stability of the upper water column, thereby inhibiting convection. After 1993, however, a transition to deep convection (500–1,000 m) occurred due to an increase in near-surface salinity and weaker stratification. As a consequence, a new class of less-dense intermediate water was formed, becoming the primary product of convection in the region, with an estimated 0.6 Sv produced annually. These results highlight increased understanding of dense water production in the Nordic Seas, with implications for quantifying future AMOC variability under anthropogenic forcing. *GS*

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