ENERGY

Enormous solar parks create trouble for Denmark's power grid

Drifting clouds create "effect splash" and challenge the security of supply. At the same time, increasingly large facilities are being planned.

The Vandel facilities in Billund are among Europe's largest solar parks with their almost 300 MW. It is built on an abandoned NATO airstrip and produces approximately 160 GWh of electricity a year. *Photo: BeGreen*

Ellen Synnøve Viseth Journalist

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- If you had asked me three years ago, I would have said that we could handle a lot of sun. Denmark has had solar cells on roofs for many

years. But I have become wiser, says Klaus Winther.

He is director of system operations in Denmark's Energinet, equivalent to Norway's Statnett, and recently visited Oslo. He then said that the Danes are now in a challenging situation, due to a lot of solar energy in the grid.

- Drifting clouds challenge security of supply

Denmark already has solar parks of 300 MW. In a few years, you will see plants that are twice as large, and a plant of 600 MW will be problematic to handle with today's management systems, says Winther.

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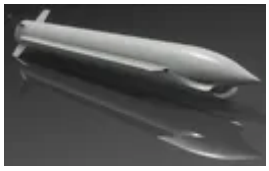


Already today, the largest solar parks are causing problems. They are directly connected to the transmission network, and cause large fluctuations on days with slightly cloudy weather.

- Drifting clouds challenge security of supply. We see that it occurs both in the north and the south at the same time; Denmark is not bigger. That gives a few hundred megawatts of fluctuation between the stations, Winther explains.

He says that solar plants with a total output of several gigawatts are being established, and that the Danish politicians would still like to develop more.

- But you have to recognize that it causes technical problems, says Winther.

Frequency and balance

The frequency in the power grid must always be 50 Hz. This means that the

view more

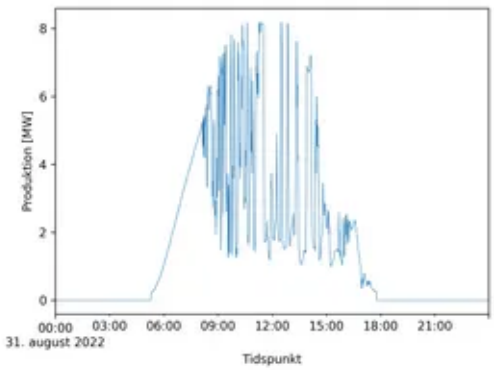
One plant takes the entire power reserve

31 August was such a summer day with many drifting clouds in the sky. Winther shows the production curve from this day at a specific plant in Jutland. It looks like a heart rhythm measurement of a person with a severe heart attack.

- Production varies during the day. 300 megawatts is a fairly large cut-off, so everything we had of fast power reserves was eaten by this one plant, says Winther.

- Is it reasonable for one solar cell manufacturer to cost the system so much money, asks Winther.

He says that Energinet is now spending an "unmanageable amount of money" on supporting the power system.



That's how jagged the production curve of a large Danish solar energy plant was on a slightly cloudy day in August this year. *Illustration: Energinet*

Energinet currently has 100 MW of fast reserves (aFFR), but will have to buy more. As electricity prices have increased, such power reserves have also become extremely expensive in the last two years.

Energinet will also tighten the requirements for activation time for the fast power reserves from fifteen minutes to five minutes.

Gives impact splash

This summer was the first time that solar energy had a major impact on the power system in Europe. There were a number of hours and days with extremely negative electricity prices, all the way up to Norway. One day in June, Dutch electricity customers were paid NOK 4.76/kWh for using electricity.

- The Danish power grid has at times been among the worst balanced in Europe, says Klaus Winter, director of system operation at Danish Energinet. *Photo: Ellen Synnøve Viseth*

- In April, we saw a marked shift: prices were high in the morning and evening, but lower during the day, says Winther, who believes these changes will only be even stronger next year.

All this solar energy presents challenges for Energinet's control centre. One of the problems is power that ripples uncontrollably around the power system, i.e. *power ripple* .

This problem also spills over the border into Germany.

- It is not reasonable. Energinet has at times been among the worst in Europe to balance the power system, says Winter.

Difficult to predict sun and clouds

One problem is that Energinet is unable to predict *when* the effects will occur.

- Wind is light: We have good wind forecasts and can predict the wind strength 48 hours in advance with a high degree of certainty. It doesn't disappear in seconds either, but dabs off over a few minutes. Therefore, the system can handle a lot of wind, says Winther.

With the sun it is different:

- It is difficult to predict how the cloud cover will behave on a summer day. Suddenly a cloud comes out of nowhere. We have been involved in research together with the Danish Meteorological Institute, but we have not found a good model to predict the cloud cover a quarter of an hour ahead, says Winther.

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New players behave differently

En annen ting som er vanskelig å spå, er hvordan moderne forbrukere og produsenter oppfører seg. Winther sier at de som nå monterer solenergi, kommer fra andre bransjer og ikke nødvendigvis agerer som de gamle kraftselskapene.

– Vi har sett mange timer med negative priser i sommer. Det var ikke et problem før, fordi våre prognoser sa hvordan aktørene kom til å oppføre seg. Men det er ikke innlysende lenger, sier Winter.

Han sier at noen lar solcellene produsere til negativ pris, fordi det gis «perverse insentiver» i form av kraftkjøpsavtaler som gir fastpris per produsert megawattime, uansett spotpris.

– De har en interesse av å kjøre alltid, og de er heller ikke interessert i å delta i regulerkraftmarkedet eller balansemarkedet. De er heller ikke fleksible. Derfor er det i mine øyne uhensiktsmessig, sier Winther, som legger til at slike avtaler nå er på vei ut.

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Strøm-apper endrer forbruket

Samtidig har mange dansker nå installert en app der de ser strømprisen neste dag.

– Det gir en dynamikk i etterspørselen som vi ikke har hatt før, og som gjør det vanskelig for oss å forutse forbruket.

Til sammen skaper dette et skrikende behov for ny teknologi som automatisk kan styre innmating, utkobling og spenningsregulering i nettet.

Winther tror batterier er den beste løsningen på solcelle-problemet, men at Danmark så langt har få og små batterier i nettet. Han mener også at det kan bli nødvendig å stille høyere krav til hvor hurtig solcelleanlegg skal rampe.

Er flere solparker svaret?

En mer overraskende løsning på problemet kan være å bygge *flere* store solcelleparker.

– Det krever at alle anlegg er like store. Ett anlegg på 600 MW er en utfordring, men har vi ti anlegg på 600 MW, er utfordringen mindre, gitt at de er riktig plassert. Så når vi har den fulle utbyggingen, tror jeg vi er på et bedre sted. Men inntil da blir det vanskelig å balansere systemet.

Både Energinet og Statnett jobber med digitalisering og automatisering av spenningsregulering og balansering. Men enn så lenge er driften av kraftsystemet «forbausende manuell», ifølge Maria Brekke Langum, direktør for Landssentralen i Statnett.

Hun viste på møtet til at nye utenlandskabler, nedleggelse av kjernekraft i Sverige, og mye ny vindkraft i både Sverige, Finland og Norge stadig endrer det nordiske kraftsystemet.

– Det finnes ikke lenger noe normalt flytbilde, sa Langum.

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