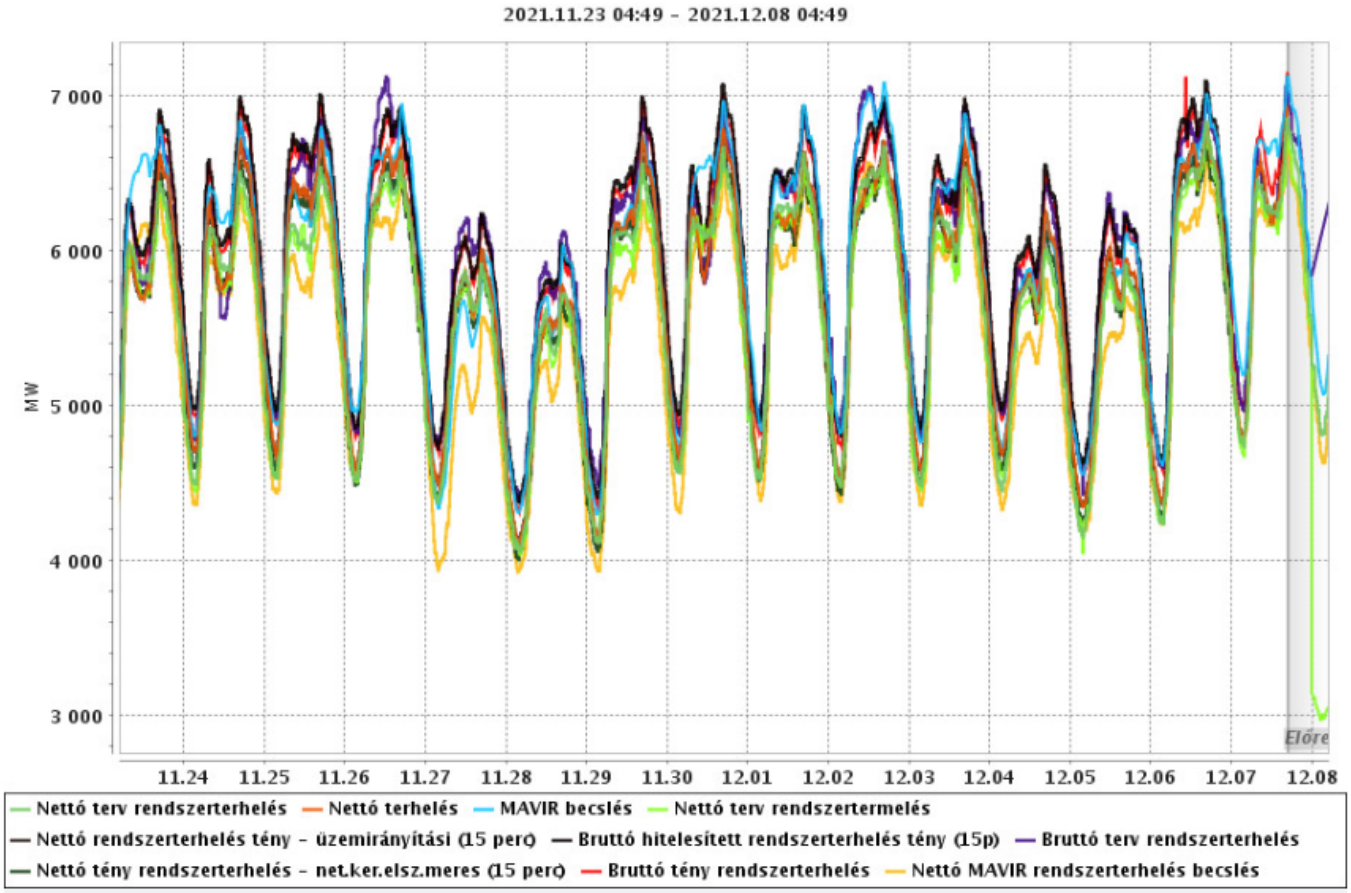
Blackout in Spain

Yesterday's power cut in Spain has highlighted the problems facing the European electricity grid, which will become increasingly serious unless meaningful action is taken, and will affect more and more regions and countries. Let's start with a brief, albeit rather superficial, explanation of how the electricity grid works.

The grid is effectively driven by consumption; in other words, it is a sort of *'pipe'* into which exactly as much energy must be fed as is drawn out at the other end – that is, consumed. Whenever we switch on the washing machine at home, the air-conditioner starts cooling, or the heat pump has just finished heating, our household's consumption is constantly changing. These fluctuations add up and balance each other out at both city and national levels, resulting in a national consumption curve.



Forrás: MAVIR

This is what it looks like in Hungary; the daily fluctuations are clearly visible, as are the weekends when consumption drops, and changes in the weather can also be tracked on the graph. In summer, when we turn all our air conditioners up to maximum, this is just as evident on the curve as the spike in electric heating during the colder months.

This demand curve must be met by the supply of electricity. There is a constant level of consumption that is always present on the grid; this is largely met by the Paks nuclear power station. Nuclear power stations are only capable of very minimal fluctuations in output, and even these can only be achieved very slowly, so they are connected to the grid *'continuously'* , as shown in blue at the

bottom of the graph.

A very good friend of mine (Balázs Köszi!) writes that this claim has already been disproved, *“That’s not true; Paks is already being ramped up and down regularly by as much as 150–200 MW. As for the French, the output of every unit can fluctuate dynamically. New power stations must comply with European Utility Requirements; they must be able to reduce output by 50% at a rate of 3% per minute. That’s actually quite fast. Nuclear power stations are also capable of output fluctuations, but they typically generate power continuously.”*

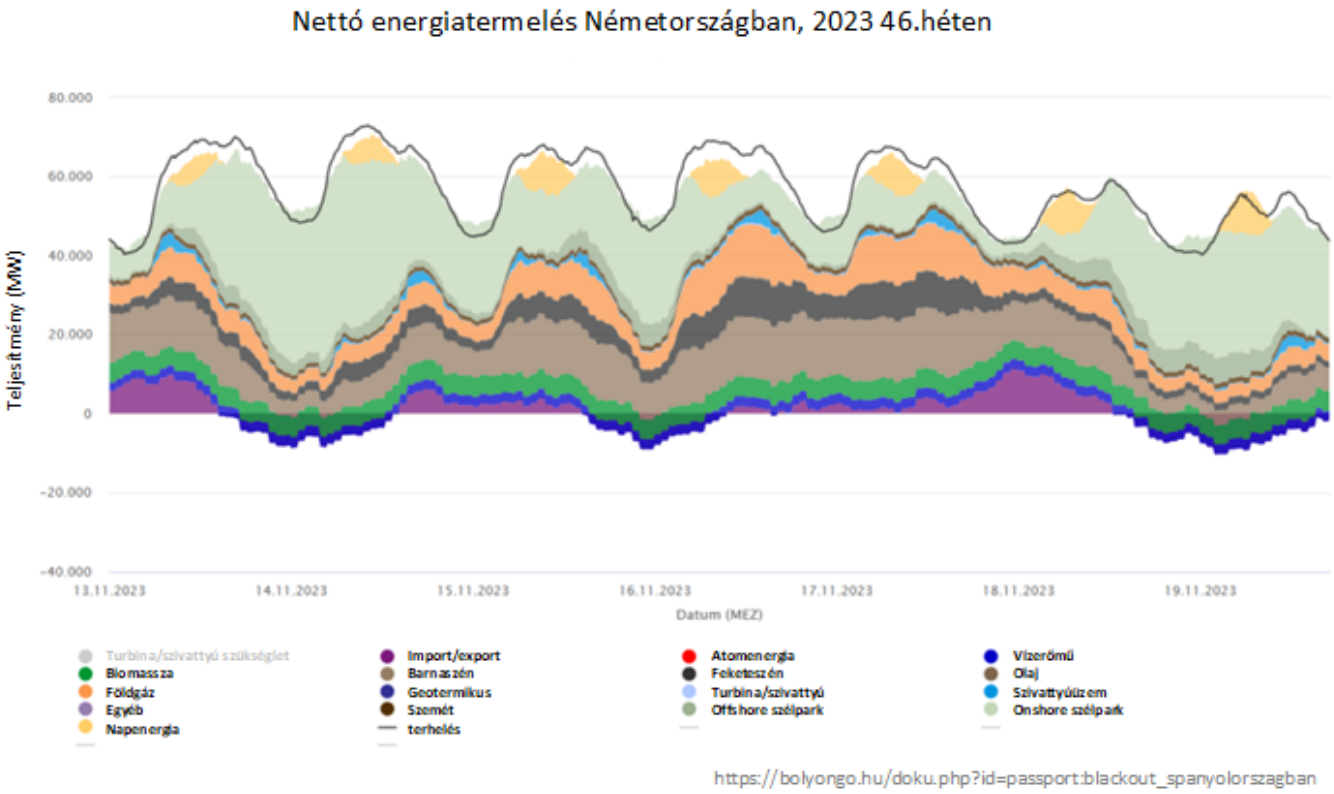
Next come the high-capacity coal-fired power stations, which can vary their output, but only slowly. Then come the smaller power stations, the combined-cycle gas turbine plants, and gas engines, which can adjust their output relatively quickly and dynamically, thereby flexibly bridging the gap between base-load operation and the required output.

If they still fail to do so, there is always the option of imports, meaning energy can be purchased from abroad to fill the gaps. This energy supply operated reliably for a good decade, until the real supply nightmare arrived: renewable energy.

Solar farms, domestic balcony power stations and wind farms are feeding increasing amounts of electricity into the grid, which, on the one hand, is an extremely welcome development as we become more environmentally conscious, but on the other hand – from the grid’s perspective – it is a disaster in itself.

This is because the amount of energy on the grid continues to be determined by demand, whereas renewables bear no relation to this; their output is determined primarily by the weather. Obviously, to a certain extent, these fluctuations can be – and indeed must be – compensated for.

The figure below shows Germany’s weekly energy production curve. Week 46 falls in mid-November; by which time solar energy (yellow) is no longer significant, but wind energy practically dominates the mix, and the other forms of energy generation essentially adjust to this in order to fill the area beneath the upper black curve — consumption.



The purple section at the bottom of the graph, and the band below 0, indicate the level of exports/imports, which is a very problematic area in many respects. On the one hand, it is expensive; on the other, the same weather conditions typically prevail in all neighbouring countries, meaning they have wind and solar power available during the same period.

Let’s pause here for a moment before turning to the events in Spain.

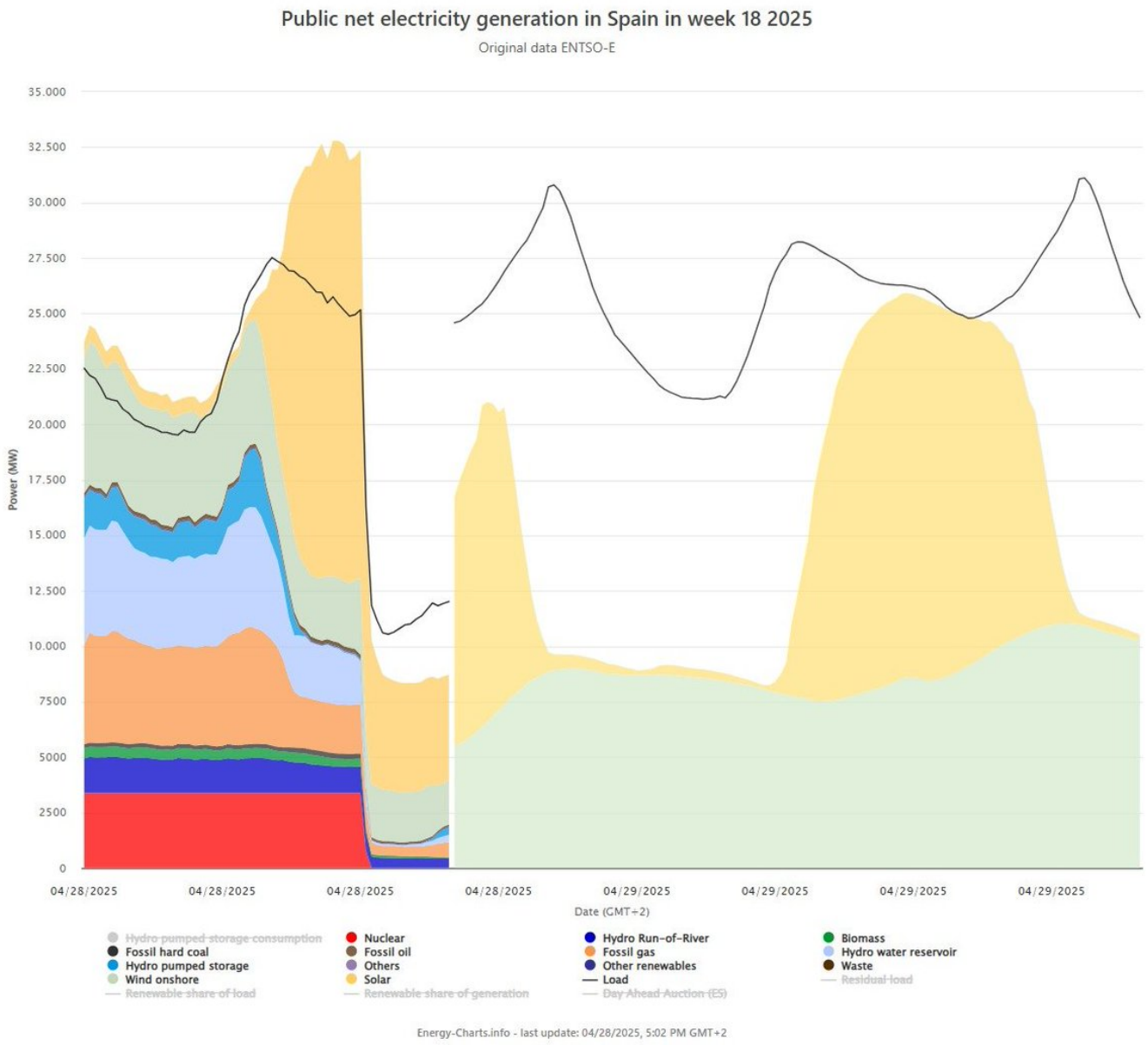
What happens when there is too much renewable energy – more than the grid can handle? Yes, indeed, it follows from the above that too much energy is just as much of a problem as too little. One could try to export it, but of course the sun shines just as brightly in the neighbouring country, so it is unlikely that they would need the energy.

This energy would need to be stored, but on such a scale, this is no trivial task. There are, for example, so-called pump-turbine installations, mainly in Austria, which are capable of pumping water from lower reservoirs to upper ones, thereby consuming electricity, and then, by switching to turbine mode, feeding the electricity back into the grid; however, there are very few of these, and their capacity is also limited. This is why, in certain cases, a country producing a surplus may pay another country to take its excess energy (which it can then buy back later at a good price).

Something I haven’t mentioned yet is that there is a very small margin for manoeuvre in the grid’s performance, which is determined by the grid frequency. Ideally, this is 50 hertz (Hz), but it can be *‘extended’*, meaning it can fluctuate between 49.95 and 50.05 (this fluctuation itt can be seen at). If the value is above 50.01, there is over-generation; if it is below 49.99, there is under-generation. Based on this, various compensation systems (PRL, SRL, MRL) intervene to stabilise the grid frequency. Perhaps I could put it this way – at the risk of causing some confusion – that the pipe mentioned at the start of this post is made of rubber; that is, a hose which, by expanding or contracting, allows some leeway for the passing energy.

So let’s finally take a look at what happened in Spain!

Obviously, I don’t know the exact causes; the investigation will determine **why it happened** it did. What is evident from the graph is that **what happened**.



The amount of solar power (yellow) simply skyrocketed just before the blackout, rising significantly above the level of consumption (black). In such situations, the surplus energy should be either exported or stored at lightning speed, but in this case that did not happen. It is clear that grid participants are trying to curb their output, but as the amount of solar energy cannot be regulated, this inevitably *‘overwhelmed’* the grid.

The grid frequency shot up due to overproduction; the protection systems kicked in, tripped the circuit breakers and disconnected the generators from the grid. I’ll explain once more why the operators were unable to intervene in the process; unfortunately, I still do not know.

What’s more, an interesting secondary effect can also occur during an outage. Turbines and generators – and perhaps even wind turbines – generate energy using rotating parts, and these have a certain inertia. If the operators are skilled – and they really are skilled – they can even manage to bring the machine back online after a potential outage (this isn’t always by the book, but as I said, they know what they’re doing). Solar farms convert the direct current they generate into alternating current using so-called inverters, and synchronise it with the grid frequency. There are no moving

parts here, just electronics; in other words, if one ‘drops out’, it stays that way until it receives a command to reconnect. If a large number of inverters fail simultaneously, this can result in a serious domino effect; in other words, a great deal of energy can be lost from the grid all at once.

However, it must be recognised that the uncontrolled presence and spread of renewable energy will, unfortunately, lead to increasingly frequent grid collapses. The solution is obvious, but expensive:

- Much more storage capacity must be incorporated into the grid
- Renewable energy producers must also be subject to strict grid control. Given today’s communication capabilities, it would not be impossible to incorporate a form of remote control into the management of all solar and wind power plants. Yes, even in domestic balcony solar power systems.
- P2G. Energy – particularly surplus energy – could be converted into gas. There is an entry on Wikipedia about this itt can be found at (I wrote it).

Ez egy elfeledett sarka a netnek, örülök, hogy sikerült elvetődnöd ide!

Továbbra is keresek megjelenési lehetőséget az írásaim számára. Ha esetleg van ötleted, oszd meg velem! Elérhetőségeim az Impresszumban találhatók.

A passport.blog jelenlegi egyetlen megjelenési lehetősége a Facebook. Ha értesülni szeretnél az új bejegyzésekről, kövesd a Bolyongó Facebook oldalt.

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Sources

Wikipedia: Netzfrequenz
Fraunhofer: Wege Towards a climate-neutral energy system: The German energy transition in the context of social behaviour
Natér: A AN EVALUATION OF ELECTRICITY SUPPLY IN HUNGARY FROM A CLIMATIC PERSPECTIVE

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