

The European Commission has made it clear that it intends to limit capacity payments in Europe, and its most controversial proposal is to prevent capacity payments to high-carbon power plants.

The Commission has proposed to prevent capacity payments being paid to power plants with a carbon-intensity of over 550gCO₂/KWh. This 550g is not an “emissions performance standard”, and does not necessitate the closure of power plants, it simply prevents capacity payments to high-carbon power plants, representing an investment criteria meant to ensure coherence with the EU’s other investment and environmental criteria.

Sandbag believes that this proposal will limit the most damaging capacity payments. However, we are concerned that capacity payments will fund investment to meet stricter “BREF” pollution limits, keeping existing high-carbon power plants open longer. This is because of a 5-year derogation for existing plants, which means the threshold will come into force from around 2023, compared to investment which must have happened for the new limits in 2021. Therefore, the 5-year derogation for existing plant should be removed.

As well as analysing the 7 key reasons for having the 550g limitation, this report also contains evidence on:

- Why capacity markets need to be limited (see box 1)
- What power plants are covered in 550g? (see box 2)
- Case study of the UK capacity market? (see box 3)
- Should there be a derogation for high-carbon, ultra-peaking plant? (see box 4)

The 7 key reasons why a 550gCO₂/KWh threshold will limit the most damaging capacity payments are:

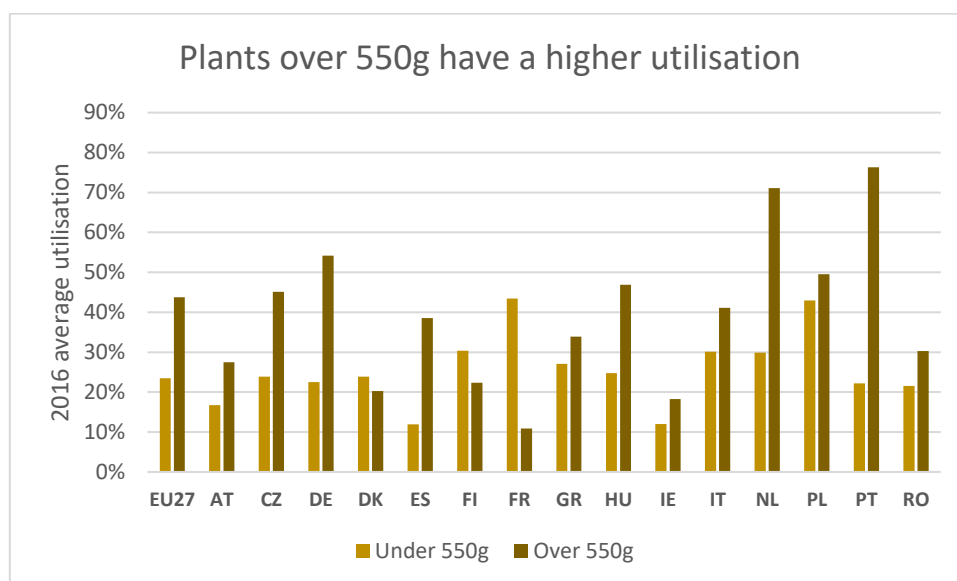
- 1. The European Investment Bank has not been able to invest in projects over 550g, ever since 2013¹.** The Commission’s proposal would align the carbon threshold for EIB investment with that for capacity payments.
- 2. Existing power plants over 550g are seeking capacity payments to invest in pollution upgrades to stay open longer.** In 2021, new strict air pollution rules under BREF will come into force. Our “Lifting the Dark Cloud” report published last year², showed that for more than 90% of hard coal and lignite plants, their 2013 emissions rates did not comply with the BREF levels. The equivalent proportion for gas plants would be very low. This means many coal plants have an important decision to make: do they invest to stay open, or do they close? If capacity payments are paid to invest into old coal plants, crowding out new investment, this would really set back Europe’s electricity transition and result in stranded assets in the long-run.
- 3. Power plants over 550g sell more electricity, therefore have less need for capacity payments.** We analysed ENTSOE hourly unit generation data from 2016, and there is a stark difference between the utilisation of power plants *under* 550g and *over* 550g³. The average load factor for power plants under 550g was 23%, compared to 44% for over 550g. This was true in almost every country. (Note: only 1/30th of Poland’s capacity was defined as <550g, so its high load factor is rather inconsequential). There is no indication that

¹EIB Group Sustainability Overview (2013) www.eib.org/attachments/thematic/eib_group_sustainability_overview_2013_en.pdf

² See “Lifting Europe’s Dark Cloud”, co-authored by Sandbag, link [here](#).

³ We use the following ENTSOE fuel classifications for our split: “over 550g” = “Fossil Brown coal/Lignite”, “Fossil Coal-derived gas”, “Fossil Hard coal”, “Fossil Oil”, “Fossil Oil shale”, “Fossil Peat”; “under 550g” = “Fossil Gas”

the merit order will switch – it would currently need around €30/t to switch from coal to gas, a price that is not envisioned even after the EU Emissions Trading System (ETS) reform process.



As well as looking at load factor, we looked at how much capacity was peaking (defined here as running <1500 hours). We found only 7% of lignite plants and 11% of hard coal plants operated a peaking regime in 2016, compares to 33% of gas plants.

<i>ENSTO-E classification</i>	<i>% of EU-27 capacity peaking in 2016</i>
"Fossil Lignite"	7%
"Fossil Hard coal"	11%
"Fossil Gas"	33%
"Fossil Oil"	84%

- 4. Power plants over 550g contribute disproportionately to CO₂ emissions.** Following on from above, because high-carbon plants have a higher utilisation, the capacity contributes disproportionately: a 1GW hard coal plant has x4 the CO₂ of a gas plant, and lignite is x7 that of a gas plant. Oil has carbon emissions less than a gas plant because of its low load factor.

<i>ENSTO-E classification</i>	<i>Average 2016 load factor</i>	<i>Approximate average carbon intensity</i>	<i>Resulting CO₂ emissions per MW</i>
"Fossil Lignite"	58%	1100g	5590t
"Fossil Hard coal"	41%	900g	3230t
"Fossil Gas"	23%	400g	806t
"Fossil Oil"	3%	700g	184t

5. **Power plants over 550g contribute even more disproportionately to air pollution.** The difference between coal and gas is even bigger for air pollution. Coal, unlike gas, emits lots of deadly SO₂ and dust emissions. Europe's coal plants were responsible for around 23,000 premature deaths in 2013, due to their SO₂, NO_x and dust emissions, according to a report called "Europe's Dark Cloud", co-authored by Sandbag in 2016⁴.
6. **Capacity payments to power plants over 550g are fossil fuel subsidies.** The Commission should not allow countries to implement new fossil fuel subsidies, when the EU (through the G7) has already committed to phase out fossil fuel subsidies by 2025⁵.
7. **Power plants over 550g are generally less flexible, and so less able to contribute to system security.** The table below – from a research paper by Agora Energiewende⁶ - outlines differences in the flexibility of different fossil power plant technologies. It shows hard coal and lignite power plants – even state-of-the-art – are much less flexible than OCGT and CCGT gas power plants. This is true for all four key flexibility metrics.

Comparison of most commonly used and state-of-the-art power plants for each generation technology with regard to flexibility Table 1

Property	OCGT	CCGT	Hard coal-fired power plant	Lignite-fired power plant
Most commonly used power plants				
Minimum load [% P_{Nom}]	40–50 %	40–50 %	25–40 % ^a	50–60 %
Average ramp rate [% P_{Nom} per min]	8–12 %	2–4 %	1.5–4 %	1–2 %
Hot start-up time [min] or [h]	5–11 min ^b	60–90 min	2.5–3 h	4–6 h
Cold start-up time [min] or [h]	5–11 min ^c	3–4 h	5–10 h	8–10 h
State-of-the-art power plants				
Minimum load [% P_{Nom}]	20–50 %	30–40 % (20 % with SC ^d)	25 ^e –40 % ^f	35 ^g –50 %
Average ramp rate [% P_{Nom} per min]	10–15 %	4–8 %	3–6 %	2–6 ^h %
Hot start-up time [min] or [h]	5–10 min ⁱ	30–40 min	80 min–2.5 h	1.25 ^j –4 h
Cold start-up time [min] or [h]	5–10 min ⁱ	2–3 h	3–6 h	5 ^k –8 h

⁴ See "Europe's Dark Cloud", co-authored by Sandbag, link [here](#).

⁵ See article in [Guardian: G7 Nations pledge to end fossil fuel subsidies by 2025 \(May 2016\)](#)

⁶ See Agora Energiewende's paper entitled "Flexibility in Thermal Plants" [here](#), table from page 48.

BOX 1: Why do capacity payments need to be limited?

On 30-November 2016, the Commission proposed a **carbon intensity threshold for capacity market payments** on “the Internal Market for Electricity”⁷ released alongside the Clean Energy Package. It says:

“Generation capacity for which a final investment decision has been made after [OP: entry into force] shall only be eligible to participate in a capacity mechanism if its emissions are below 550gr CO₂/kWh. Generation capacity emitting 550gr CO₂/kWh or more shall not be committed in capacity mechanisms 5 years after the entry into force of this Regulation.”

The rationale for this proposal, is that the Commission is concerned about **capacity markets looking like fossil subsidies**. On launching the proposal in November 2016, two Commissioners said:

*Margrethe Vestager, European Commissioner for Competition*⁸: **“Capacity mechanisms...must not be backdoor subsidies for a specific technology, such as fossil fuels”**

*Miguel Arias Canete, EU climate action and energy commissioner*⁹: **“[The mechanisms] mustn't serve as an excuse to subsidize high-polluting generation assets that would counteract our decarbonization objectives”**

We believe the Commission is right to say capacity payments need to be limited.

- **Capacity mechanisms are most-often not needed.** Maximising interconnection and demand response, and putting new investment in storage on a level playing field, are often enough to ensure capacity mechanisms are not needed, and are a far cheaper way to achieve system adequacy. Also, other market design changes like spikier wholesale prices, better balancing and optimised interconnection, will also reduce the need for capacity mechanisms. When capacity mechanisms are needed, they should be temporary in nature.
- **Capacity payments are increasing pollution.** Paying fossil power plants to stay open longer will increase CO₂ and air pollution – not just plant-by-plant, but also system-wide.
- **Capacity payments are bringing in new investment into dirty fossil plants.** The investment is often for upgrading polluting, high-carbon plants – not just new coal power plants – especially to comply with new BREF air pollution limits effective in 2021.
- **Capacity payments are an intervention, leading to distortions in key policies.** Paying fossil power plants to stay open longer is distorting the Emissions Trading Scheme, distorting wholesale electricity markets, and distorting electricity border flows. Even capacity mechanisms between countries are so uncoordinated that they create distortions.
- **Capacity payments are crowding out new investment.** Paying old fossil plants to stay open is crowding out new investment which is urgently needed to modernise the electricity system – not only to reduce air pollution and CO₂, but also increase flexibility and reliability.
- **The design of capacity mechanisms favours – often accidentally – conventional generation.** Capacity markets are generally designed around large, conventional generators. It is simply impossible to design a market which puts conventional generators, foreign generators, aggregated demand response and distributed batteries all on a level playing field – their demands are so different. The problem of putting new and existing capacity on a level playing field is riddled with even more complications.

⁷ See European Parliament and Council Regulation on the Internal Market for Electricity http://eur-lex.europa.eu/resource.html?uri=cellar:9b9d9035-fa9e-11e6-8a35-01aa75ed71a1.0012.02/DOC_1&format=PDF

⁸ Quoted in Commission's [Press release](#) on “Sector Inquiry report gives guidance on capacity mechanisms”

⁹ Quoted in [Platts](#).

BOX 2: What power plants are covered in 550g?

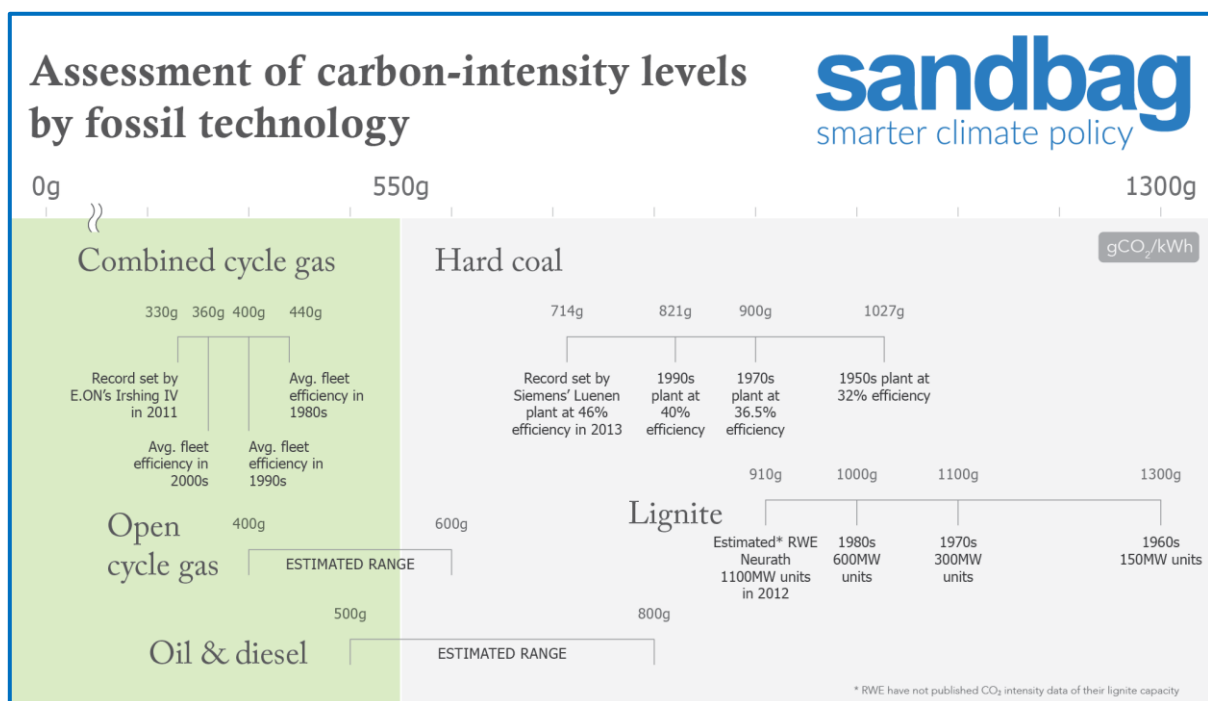
The carbon intensity threshold proposed is 550gCO₂/kWh. Interestingly, the carbon intensity refers to the electricity generated (MWh), rather than capacity (MW) paid for by capacity payments.

Sandbag has assessed the range of carbon intensity of each technology from a variety of academic and industry sources, and summarised them in the graphic below. What technologies would 550g cover?

- ✓ **All lignite and hard coal power plants** (also peat and oil shale). Includes biomass cofiring (an efficient 800g hard coal plant running on 20% zero-rated biomass would still be 640g). This clearly shows that this measure is not one directed towards one specific energy option, but rather seeks to limit pollution from a variety of highly carbon emitting sources.
- ✓ Almost all oil and diesel (excepting very efficient, modern plants, of which there are few)
- ✓ Occasional OCGT (open cycle gas plants). Their very peaking (inefficient) role means their practical running may exceed 550g, even though their “nameplate” carbon intensity is likely below 550g.
- × **All CCGT** (combined cycle gas plants)
- × Almost all OCGT
- × Very modern oil or diesel power plants.

There are very few plants in the range 450g to 700g range. So, if not 550g, the only discussion points are: should it be lower than 450g to include gas plant, or should it be higher to include hard coal?

We argue no to both, based on the evidence at the start of this report.



BOX 3: Case study of the UK capacity market

UK coal power plants have so far been paid £453m in capacity payments to 7 coal plants in 4 years.

		Coal capacity payments £m				
Plant	Owner	2017/18	2018/19	2019/20	2020/21	TOTAL
Drax	Drax	£8	£24	£22	£25	£78
Ratcliffe	Uniper	£6	£35	£32	£41	£114
West Burton	EDF	£12	£26	£0	£29	£67
Cottam	EDF	£12	£34	£0	£0	£46
Aberthaw	RWE	£10	£29	£27	£33	£99
Fiddlers ferry	SSE	£9	£26	£0	£0	£35
Eggborough	EPH	£13	£0	£0	£0	£13
TOTAL COAL		£70	£173	£81	£128	£453

These payments have undoubtedly kept coal plants open longer than they otherwise would have. Both Eggborough and Fiddlers Ferry were due to close March 2016, and have now been extended to 2018, and even have the potential to stay open until 2020.

However, because of a €30/tonne CO₂ price, UK coal plant run peaking only (19% utilisation in 2016, compared to 43% for gas); also with a government committed to a 2025 coal phase-out, utilities are not looking to capacity payments to fund investment in large abatement equipment to stay open and creating a future carbon lock-in.

Slowly, new capacity is undercutting coal. Also, 3 out of the remaining 7 coal power plants have already been replaced with a variety of technologies: 501MW of battery, 1566MW of peaking gas and 333MW of CCGT.

But the transition is slow. The UK capacity mechanism has many flaws, which means it is still the subject of a Commission enquiry into state aid¹⁰. On top of these concerns:

- The CM contracts all capacity 4 years in advance. This is not suited for demand response. Also, it is not suited for batteries which take only 6 months to deploy¹¹ and the cost of batteries is very unknown 4 years hence.
- The CM contracts too much capacity – last year the Government increased the capacity by 1GW to gold-plate the system.

The UK capacity payments for coal will need to be phased out. But, unlike elsewhere in Europe, a €30/t carbon price and a coal phase-out means – even when capacity payments are paid to keep them open – their generation (and emissions) will be relatively small, and no money will be spent investing to keep them open in the future.

¹⁰ Tempus Energy, a UK-based company with an innovative demand-side management and trading platform, has taken the Commission to court to demand an in-depth investigation into whether the UK scheme breaks state aid rules. See <http://energypost.eu/capacity-mechanisms-dg-competition-dg-energy-clash-future-eu-energy-market/>

¹¹ <https://www.bloomberg.com/news/articles/2017-01-30/tesla-s-battery-revolution-just-reached-critical-mass>

BOX 4: Should there be a derogation for high-carbon, ultra-peaking plant?

High-carbon ultra-peaking plants may warrant an exemption to 550g.

This is because their running is so low that it does not fit the description of the 550g plants in this paper:

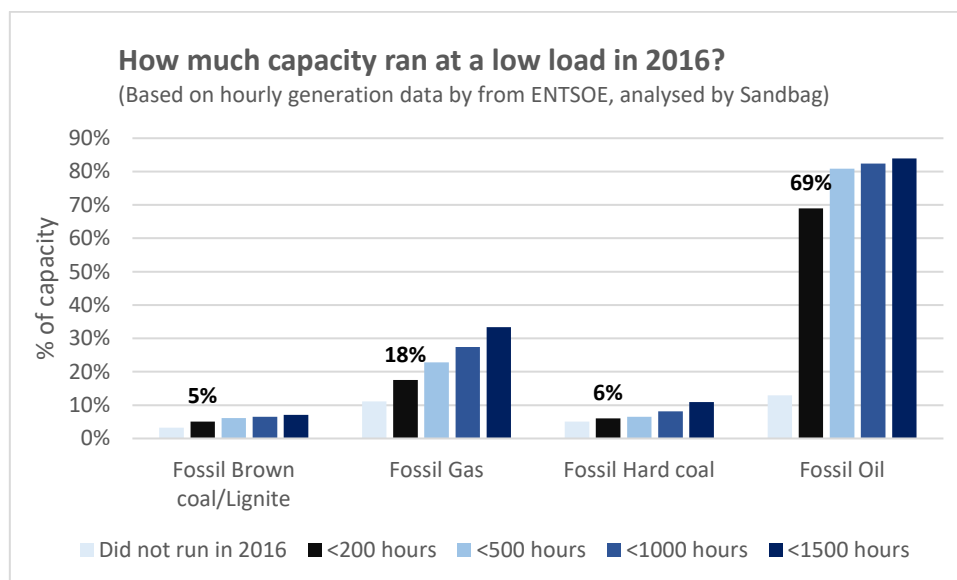
- **The capacity payments most likely will not be used for investment.** Under BREF, there are more generous limits for plants that run less than 1500 hours per year, meaning low-load factor plants would not need investment.
- **They get minimal revenues from the wholesale power market, so sometime need additional revenues to remain open.** Although the average load factor for plant over 550g plant is 44%, there is some plant operating very few hours.
- **This means they also do not proportionally contribute to large increases in CO₂ or air pollution.**
- **They are often more flexible.** Because they run a low load factor, they are used to starting up and shutting down, and therefore are often more flexible than many plants over 550g.

Interestingly, there is a precedent for 500 hours: it is the derogation level for the Medium Plant Combustion Directive, where all plants under this do not need to comply with any limits. 500 hours is 12% of all the hours in winter, which goes beyond the threshold of “ultra-peaking” plant.

We analysed ENTSO-E data to see how many hours power plants ran in 2016.

If a derogation were to be agreed, we suggest it should be for plants committed to constraining their generation **below 200 hours**:

- A limit of 200 hours would include 69% of the EU-27’s oil plant capacity, 18% of the gas plant capacity (which would capture most of the open cycle gas), 6% of hard coal plants and 5% of lignite plants.
- When a plant is operating less than 200 hours, their wholesale revenues are extraordinarily low, and it is clear that there is a case to top this up with capacity payments.



About this briefing

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