

EU taxonomy: spotlight on nuclear and gas

The proposed addition of nuclear and gas activities to the EU taxonomy, a system to define climate-friendly investments, has triggered many different reactions. In two articles, Maureen Schuller and Gerben Hieminga explain what the taxonomy is about, why nuclear and gas are controversial, as well as the implications for the green bond market

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Concerns remain regarding the 'do no significant harm' aspect of nuclear waste

The past years' trail of regulatory developments in the field of sustainability has made it abundantly clear that climate change has top priority in Europe. The [EU taxonomy regulation](#) is probably the most far-reaching piece of evidence of the block's efforts to guide investment towards environmentally sustainable activities, while avoiding greenwashing in the process. However, the European Commission's recent plans to accept certain nuclear energy and fossil gas activities as environmentally sustainable has raised questions about whether the bar set by the taxonomy will still be high enough.

The EU taxonomy regulation came into force on 12 July 2020 as a unified classification system for the determination of economic activities that would qualify as being environmentally sustainable.

The EU taxonomy identifies the following six sustainability objectives:

1. Climate change mitigation.
2. Climate change adaptation.
3. Sustainable use and protection of water and marine resources.
4. Transition to a circular economy, waste prevention and recycling.
5. Pollution prevention and control.
6. Protection and restoration of biodiversity and ecosystems.

An economic activity is considered environmentally sustainable, and thus taxonomy aligned, if it meets the following criteria:

1. The economic activity contributes substantially to one of the environmental objectives identified.
2. The economic activity does not significantly harm any of these environmental objectives.
3. The economic activity is carried out in compliance with the minimum safeguards.
4. The economic activity complies with the technical screening criteria, defining the 'substantial contribution' (SC) and 'do no significant harm' (DNSH) standards.

Three types of environmentally sustainable activities are distinguished:

1. Low-carbon activities that, by themselves, contribute substantially to the taxonomy's objectives.
2. Transition activities that have no feasible low-carbon alternatives but do support the transition to climate neutrality.
3. Enabling activities that help other activities make a substantial contribution to the taxonomy objectives.

The climate delegated act of 4 June 2021 defines the technical screening criteria for economic activities contributing substantially to the climate change mitigation and climate change adaptation objectives and is applicable since 1 January 2022.

The role of energy activities within the EU taxonomy

According to the European Commission, energy use is responsible for 75% of the greenhouse gas (GHG) emissions in the EU. Hence it is not surprising that energy activities play a prominent role in the climate delegated regulation.

Energy activities contributing substantially to the climate change mitigation objective

1 Low carbon activities that contribute substantially

Electricity generation from:	Cogeneration of heat/cool and power from:	Production of heat/cool from:
4.1 Solar photovoltaic technology	4.17 Solar energy	4.21 Solar thermal heating
4.2 Concentrated solar power energy		
4.3 Wind power		
4.4 Ocean energy technologies		
4.5 Hydropower		
4.6 Geothermal energy	4.18 Geothermal energy	4.22 Geothermal energy
4.7 Renewable non-fossil gaseous and liquid fuels	4.19 Renewable non-fossil gaseous and liquid fuels	4.23 Renewable non-fossil gaseous and liquid fuels
4.8 Bioenergy	4.20 Bioenergy	4.24 Bioenergy
		4.25 Waste heat

4.13 Manufacture of biogas and biofuels for use in transport and of bioliquids
 4.14 Transmission and distribution networks for renewable and low-carbon gases
 4.15 District heating/cooling distribution
 4.16 Installation and operation of electric heat pumps

2 Enabling activities

4.9 Transmission and distribution of electricity

Storage of:

- 4.10 Electricity
- 4.11 Thermal energy
- 4.12 Hydrogen

3 Transition activities (added via the complementary climate delegated act)

- 4.26 Pre-commercial stages of advanced technologies to produce energy from nuclear processes with minimal waste from the fuel cycle
- 4.27 Construction and safe operation of nuclear power plants, for the generation of electricity or heat, including for hydrogen production, using best available technologies

Electricity generation from:	High-efficiency co-generation of heat/cool and power from:	Production of heat/cool from:
4.28 Nuclear energy in existing installations		
4.29 Fossil gaseous fuels	4.30 Fossil gaseous fuels	4.31 Fossil gaseous fuels in an efficient district heating and cooling system

Low carbon activities

To give an idea, the climate delegated act identifies no less than 25 environmentally sustainable activities for the energy sector, of which 21 contribute substantially to climate change mitigation (see Figure). These include electricity generation from renewables, such as solar, wind, geothermal or hydropower. For instance, electricity generated via hydropower, geothermal energy or renewable gas is only considered to contribute substantially to the climate change mitigation objective, if the life-cycle GHG emissions from the generation are lower than 100gCO₂e per kWh.

Enabling activities

In addition, the climate delegated act distinguishes four enabling activities for the energy sector. The transmission and distribution of electricity is one of them. A substantial contribution to climate change mitigation is delivered if the transmission system is the interconnected European system. Otherwise, 67% of the newly enabled generation capacity in the system should be below the generation threshold of 100gCO₂e per kWh, measured on a life-cycle basis over a rolling five-year period. Alternatively, the average system grid emissions factor should be below 100gCO₂e per kWh over a rolling five-year period.

Doing no significant harm to other environmental objectives

Economic activities contributing substantially to the climate change mitigation objective are solely taxonomy compliant if they also meet the ‘do no significant harm’ criteria set by the climate delegated act for the other five environmental objectives. To make sure no significant harm is done to the climate change adaptation objective, physical climate risks (eg wildfires, flooding, etc.) material to the activity have to be identified via a robust climate risk and vulnerability assessment (CRVA) proportionate to the scale of the activity and its expected lifespan. Adaptation solutions are implemented to reduce the most important physical climate risks. To avoid doing harm to a transition to the circular economy, several energy activities should (where feasible) use equipment and components of high durability and recyclability, that are easy to dismantle and refurbish. In turn, when it comes to avoiding significant harm to ecosystems an environmental impact

assessment (EIA) or screening has to be completed. Where such an EIA has been carried out, the required mitigation and compensation measures for protecting the environment should be implemented.

How will nuclear power and natural gas fit in?

On 2 February 2022, the European Commission adopted the [draft complementary climate delegated act](#) defining the technical screening criteria for certain nuclear and gas activities that were not included in the [climate delegated act](#). Nuclear energy was first left out because of the need for a more in-depth assessment of the 'do no significant harm' aspects of nuclear waste. Also, natural gas was subjected to further evaluation of its decarbonisation merits before being included. However, to accelerate the shift away from more harmful fossil energy sources towards renewables, six nuclear power and fossil gas-related activities will now be added as transitional, if the complementary climate delegated act becomes final.

Transition activities related to nuclear power

Nuclear activities encompass, for instance, the construction of new nuclear power plants for energy generation, using the best available existing technologies, with a construction permit issued by 2045. They also include lifetime extension modifications of existing nuclear installations authorised by 2040 at the latest. Electricity generated by nuclear energy is subject to the life-cycle GHG emissions threshold of 100gCO₂e per kWh also applicable to several renewable energy sources. However, to address environmental safety concerns, the technical screening criteria for nuclear energy do stretch beyond the applicable EU legal requirements on radioactive waste management. Not only do low-level waste disposal facilities have to be operational already, EU member states should also have detailed plans in place to have disposal facilities for high-level radioactive waste in operation by 2050. In addition, the technical screening criteria explicitly prohibit the disposal of radioactive waste in other member states, unless there is an agreement and the other member state has a suitable disposal facility in place.

Transition activities related to fossil gas

Electricity generation via fossil gas can also contribute substantially to climate change mitigation if the life-cycle GHG emissions are lower than the threshold of 100gCO₂e per kWh. However, to speed up the transition away from solid fossil fuels, the technical screening criteria also permit certain fossil gas activities not restricted by this threshold. For fossil gas-related generation facilities with a construction permit granted before the end of 2030, a cap of 270g CO₂e per kWh for direct GHG emissions applies. Otherwise, the annual direct GHG emissions should not exceed an average of 550kg CO₂e per kWh of the facility capacity over 20 years. In this case, the facility should replace a more polluting plant, leading to a lifetime reduction in GHG emissions of at least 55%. Besides, it should be designed to switch to full use of renewable or low-carbon resources by 2035.

The controversies on nuclear energy and fossil gas

When it comes to the EU taxonomy, perhaps little has caused as much controversy thus far than the idea of accepting nuclear energy and fossil gas activities as environmentally sustainable. While for nuclear energy the environmental benefits as a clean source of energy are commonly acknowledged, the idea that nuclear waste can be disposed of without doing environmental harm elsewhere in the process is still far from commonly accepted. Instead, the use of fossil gas may indeed speed up the transition away from more polluting energy resources, such as coal, but it is

not free from GHG emissions. As such, some – including the platform on sustainable finance – do fear that considering these activities as environmentally sustainable will undermine the taxonomy.

Implications for the green bank bond market

The differences in opinion regarding the role of nuclear energy and fossil gas in greening the economy also raises questions regarding the enthusiasm of investors to finance these transitional activities. A case in point is the open letter published by the Institutional Investor Group on Climate Change (IIGCC) in January stressing the difficulties for investors to stay aligned with the EU's 2050 climate neutrality ambitions, in the event that fossil gas is included in the EU taxonomy.

Besides, some investors and investment funds explicitly exclude fossil gas and nuclear energy activities from their investable universe and may continue to do so irrespective of the inclusion of these activities in the taxonomy. In line with the recommendation of the platform of sustainable finance, the final draft complementary climate delegated act now makes a better distinction between nuclear and fossil gas-related activities vis-à-vis other taxonomy aligned disclosures. This does give investors the tool to still assess the taxonomy compliance of their investments, excluding nuclear and fossil gas.

There could be opportunities in the green bond market, albeit not that likely in practice

Nonetheless, the inclusion of nuclear and fossil gas activities as environmentally sustainable within the scope of the EU taxonomy could be supportive to the broader acceptance of these activities as sustainable. This could also offer new growth opportunities for the green bond market. At this point, the financing of nuclear energy projects by means of green bond issuance is still a novelty. Canadian nuclear power provider Bruce Power was the first example of a company issuing a green bond for the purpose of funding the lifetime extension of its nuclear assets in November last year.

To what extent we will also start seeing such examples in the market for green bank bonds remains to be seen. Renewable energy projects are for banks the second-largest use of proceeds category after energy-efficient buildings, judging their euro green supply. However, the existing sustainable bond frameworks of banks would at this stage typically not facilitate proceed allocations towards nuclear or fossil gas related activities. In fact, in many green, social or sustainability bond frameworks nuclear and/or fossil fuel-related activities are part of the exclusionary criteria applied to the use of proceeds.

Even if a bank's lending criteria were to allow exposure to these activities, for instance subject to the strict provisions of the draft complementary climate delegated act, the financing by banks of nuclear and fossil activities via green bonds may still not become overwhelming. In this regard, it will also be interesting to see how further discussions regarding the EU Green Bond regulation evolves. Under the European Commission's proposals, the use of proceeds of EU green bonds have to be taxonomy compliant. However, there are members of the [European Parliament](#) that would prefer nuclear and fossil gas activities to be excluded from Europe's future gold standard for green bonds.

With the jury still out on the ultimate impact of the complementary climate delegated act on the financing of nuclear and fossil gas activities, we don't see any need at this point to increase our euro sustainable bond supply estimates for banks of €75bn for 2022.

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Europe conflicted over role of nuclear and gas in future power system

The inclusion of nuclear and gas-fired power plants in the EU taxonomy depends on political choices about Europe's future power system. Different countries take very different positions...



A nuclear power plant Dukovany, Czech Republic

Gas and nuclear make up 42% of today's European power mix

Gas and nuclear power plants play a pivotal role in Europe's current power system. They each provide about a fifth of annual power generation, contributing a combined total of 42% of Europe's power mix today.

The future role of gas and nuclear power highly depends on political choices about Europe's future power system. Nuclear power plants are usually very large and capital-intensive projects that take years to develop and built. To a lesser extent that also holds true for large-scale gas-fired power plants. Hence, these projects are only realised with strong political support.

Three scenarios for the future power system

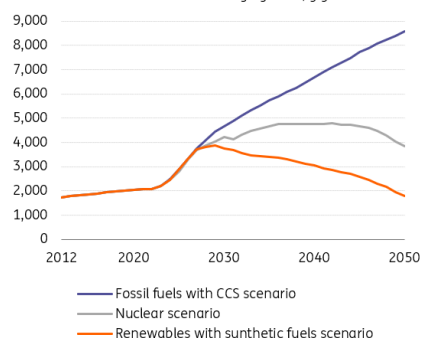
Bloomberg New Energy Finance (BNEF) made this point vividly clear in its 2021 New Energy

Outlook. BNEF defined three scenarios based on different political choices for power generation technologies in the global power grid. All three scenarios reach the 2050 net-zero emissions target and limit global warming to the Paris Climate goal of close to 1.5 degrees celsius. But they do so with different power-generating technologies.

Development of nuclear and gas-fired power plants under three scenarios for the power system in a net-zero economy

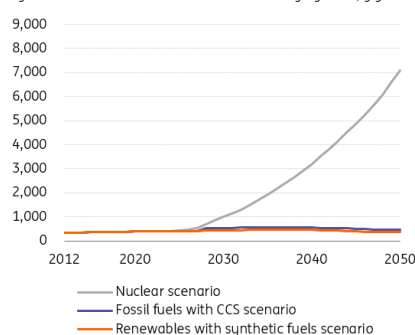
Gas continues to thrive in a CCS world, but act as transition fuel in a renewables world

Cumulative installed global capacity of gas-fired power by BNEF scenario to reach a net zero economy by 2050, gigawatt



Nuclear can grow if governments deliberately invest in this technology

Cumulative installed global capacity of nuclear power, in gigawatt by BNEF scenario to reach a net zero economy by 2050, gigawatt



Source: ING Research based on BNEF

1 Scenario 1: gas-fired power plants with carbon capture and storage

In this scenario, power generation continues to rely on fossil fuel power plants, notably gas-fired power plants as most coal plants are phased out. [Carbon Capture and Storage \(CCS\)](#) is applied to reduce the emissions of gas-fired power plants. In this scenario, the global fleet of gas-fired power plants increases fourfold, but the fleet of nuclear power plants remains constant as gas-fired power plants provide baseload power and act as a backup in times when the sun is not shining and the wind is not blowing.

2 Scenario 2: nuclear power plants

In this scenario, most power generation comes from carbon-free nuclear power plants, requiring a fourteenfold increase in the installed capacity of nuclear power plants. Gas-fired power plants act as a transition fuel in this scenario. Installed global capacity of gas-fired power plants more than doubles up to 2035 to meet growing power demand, which cannot yet be met with nuclear power as it takes time to expand the nuclear fleet. After 2035, nuclear power becomes the main energy source and gas-fired capacity stays constant for a couple of years before it starts to decline.

3 Scenario 3: renewables with synthetic fuels

Renewables are the main energy source in this version of a net-zero economy. Synthetic fuels such as hydrogen or methanol provide a backup energy source to generate power at times when renewables cannot deliver because the wind is not blowing or the sun is not shining. Like in the 'gas

with CCS scenario', there is no need for more nuclear power plants as 'clean' gas-fired power plants that run on synthetic fuels provide electricity when renewables fail to do so.

Of course, these three scenarios depict extreme worlds. In practice, it is likely that the transition towards a net-zero economy involves a mixture of renewables, synthetic fuels, [CCS](#) (Carbon capture and storage) and nuclear power.

Nevertheless, these scenarios clearly show that the development of nuclear and gas-fired power plants that meet the taxonomy's criteria highly depend on [policy and technological developments](#). Political choices play a crucial role. Think of long-term policy targets for the future power and energy system, subsidy schemes for the capital expenditure to build nuclear power plants (capex) or to cover the operational costs during the lifetime (opex), research and development budgets to foster innovation in CCS, [small nuclear reactors](#) and [nuclear fusion](#), and public co-financing of CCS infrastructure.

So far, Europe is far from united on its future power system

The key insights from BNEF's global energy transition scenarios also hold for continents and countries.

In Europe, the current focus is on increasing the share of renewables in power grids and on paving the way for synthetic fuels to act as a backup power source from 2030 onwards (BNEF's renewables with synthetic fuels scenario).

According to the International Energy Agency, renewables account for 41% of today's power mix in Europe, up from 24% in 2010. If this trend continues, gas and nuclear power are likely to play a limited role in the future.

But whether renewables and synthetic fuels can be the dominant power source of a net-zero economy is a topic of [intense debate](#). The fact is that member states themselves design the policies that shape their future power systems. And they are far from united when it comes to the role of nuclear and gas-fired power plants.

In 2000, **Germany** reached an agreement with the four nuclear power plant operators to shut down the country's nuclear power plants after they had generated a certain amount of electricity (Atomkonsens). However, in 2011, shortly after the nuclear disaster in Fukushima, the Bundestag, the German federal parliament, decided to quickly shut down eight nuclear power plants and close the remaining nine at specific times ([Atomausstieg](#)). The [last three nuclear power plants](#) will be turned off by the end of 2022.

The new coalition brought forward the aim to close all coal-fired power plants from 2038 to 2030. Gas-fired power plants are likely to be needed during the phasing out of coal and nuclear power plants and the build-up of renewable capacity and a [hydrogen economy](#). In the longer term, gas-fired power plants will also need to be phased out to reach a net-zero economy. Or abatement technologies like CCS should be installed.

France takes a very different stance. President Emmanuel Macron this month [called](#) for a 'renaissance' and 'rebirth' of the French nuclear industry to transition to a net-zero carbon economy. He aimed to start the construction of six nuclear plants by 2028 and called for the option

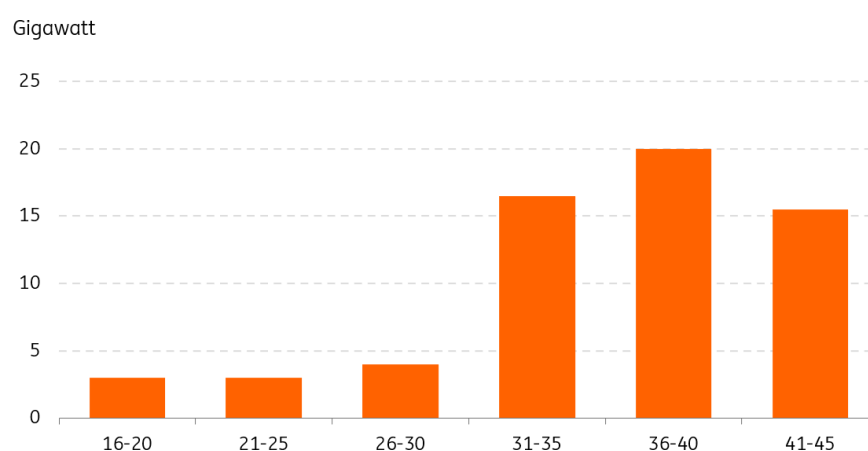
to build eight more.

France is a nuclear powerhouse. As of today, a total of 56 nuclear power plants provide around 70% of France's power supply. But the fleet is old and currently 10 plants are closed for maintenance, down from 17 in 2021.

One new reactor is under construction in the northwestern town of Flamanville, but it has faced severe [setbacks](#). It was supposed to be completed in 2012 at a cost of €3bn, but won't open until at least 2023 with the bill ballooning to almost €13bn.

The French nuclear fleet is ageing

Age of nuclear power plants in France in years based on gigawatts of installed capacity



Source: ING Research based on BNEF

Belgium and the United Kingdom also have a considerable amount of nuclear power in their power mix. **Belgium** wants to [close](#) its two remaining old nuclear power plants by 2025. The **United Kingdom**, like France, is considering [extending](#) its nuclear fleet.

Gas-fired power plants are compliant with the taxonomy only if CCS is applied...

The taxonomy provides two criteria for gas being labelled sustainable. Here we discuss the first criterium which has to do with the life-cycle emissions of the gas-fired power plant. It implies that new gas-fired power plants can only be built if they apply the most advanced technology of CCS. We will discuss the second criteria in the next section.

From the technical screening criteria, it follows that the life-cycle emissions from gas-fired power plants must be less than 100 grams of CO₂ per kilowatt-hour (g/kWh) in order to comply with the taxonomy. Life-cycle emissions provide good insights into the environmental impact of gas-fired power plants and other power sources as they apply a cradle-to-grave approach. This contrasts targets for direct or so-called end-of-pipe emissions (see next section).

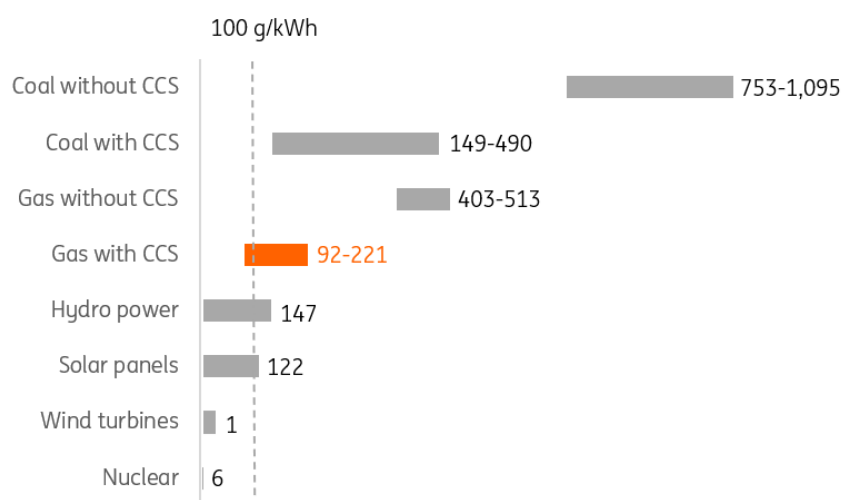
[Research by the UN](#) shows that meeting the 100 g/kWh life-cycle target is quite a challenge. In

fact, it is impossible for unabated gas-fired power plants without [cogeneration](#) that have carbon emissions of 400 to 500 g/kWh. It can be done by applying carbon capture and storage, but only under ideal conditions as emissions from abated gas-fired power plants range from 92 to 221 g/kWh.

Note, however, that gas-fired power plants that meet the technical screening criteria are 'quite clean'. They produce ten times fewer emissions than unabated coal-fired power plants and four to five times fewer than unabated gas-fired power plants. They even come close to the emission levels of 'the worst-performing' solar projects.

The carbon emission norm of 100 g/kWh is ambitious for gas-fired power plants, even those with CCS

Lifecycle greenhouse gas emissions in g/kWh of CO2 equivalents



Source: ING Research based United Nations Economic Commission for Europe

...or if the energy content of gas is fully used

The second criterium of the taxonomy's technical screening criteria is about the direct or end-of-pipe emissions of the gas-fired power plant. These should not exceed 270 g/kWh.

This too is quite a challenge to meet. [Experts](#) indicate that it only applies to gas-fired power plants that utilise the energy content of the gas inputs to the max. Think of the most efficient gas-fired combined heat and power plants ([CHP plants](#)) that use the residual heat and steam to increase the efficiency of the turbine. If the remaining heat is further utilised, for example by heating houses through low-temperature district heating grids ([cogeneration](#)), the norm might be met. This indicates that unabated gas-fired power plants can only be compliant with the taxonomy as long as the energy content of the gas inputs is fully utilised.

The inclusion of nuclear and gas-fired power plants in the EU taxonomy has kept the minds of many busy. And it is likely to do so as long as governments take a different stance on the role of nuclear and gas-fired power plants in their transition plans towards a net-zero economy.

Nevertheless, the EU taxonomy sets the bar high for these technologies. The norms for gas-fired power plants, for example, can only be met if the latest and least polluting technologies and system-integrating possibilities are applied. In that respect, the taxonomy takes a sustainability approach, even if these technologies are viewed by many as less sustainable compared to renewables.

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