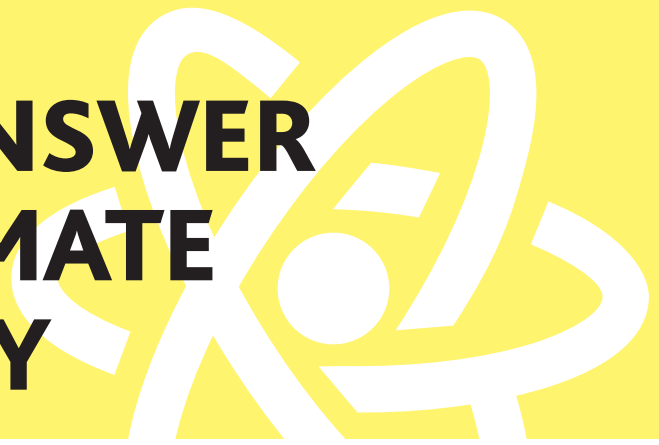


NUCLEAR

NOT THE ANSWER TO THE CLIMATE EMERGENCY



Nuclear power currently generates 10% of the world's electricity, but just 2-3% of total global energy consumption. At present, it saves just 2.5% of the world's greenhouse gas emissions, assuming that it is used to replace an average energy mix that does not include nuclear.

In France, nuclear power represents less than 25% of final energy consumed. Electricity production causes just 5% of greenhouse gas emissions. Going forward, everybody can agree that this already low level of emissions needs to be reduced further, whatever decisions are made. It is worth reiterating that the sectors that emit the most in France are transport, agriculture, construction and industry.

The existence of a climate emergency has now been proven beyond all reasonable doubt. While the Paris Agreement lays down the target of limiting global warming to +2°C or +1.5°C, current trajectories may take us to increases of +6.5°C or even +7°C by 2100. This decade is going to be critical in drastically curtailing greenhouse gas emissions, raising the question which levers can be activated to reduce the footprint of our energy consumption, amongst other things. A growing number of people have highlighted the "low-carbon" nature of nuclear power, which has been put forward as a quick-fix solution to bring CO2 emissions down dramatically.

However, studies have increasingly demonstrated that a 100% renewable electricity mix is a technically feasible and financially accessible possibility to help meet our climate targets. These studies include the ADEME (French Environment and Energy Management Agency) scenario, the study by researchers of the CIRED in 2020 and the joint report by the International Energy Agency (IEA) and RTE of 2021.

The debate in France today on choosing the electricity mix is set against the backdrop of an ageing production infrastructure that is earmarked for replacement. So, what electricity mix is the answer? And does the country need to build new nuclear reactors in order to have decarbonised electricity?

In cooperation with

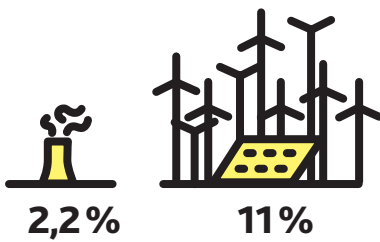
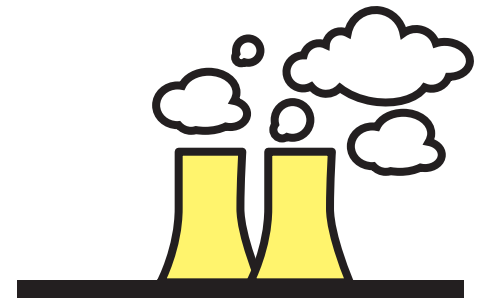
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The Réseau Action Climat (Climate Action Network) France brings together non-governmental organisations engaged in fighting climate change



Nuclear – low carbon, but slow and full of risks



GLOBAL FINAL ENERGY CONSUMPTION (AIE, 2018)

Nuclear power plays a tiny role internationally and **is currently on the decline compared to renewable energies**. Nuclear power represents just 2.2% of final energy consumption (IEA, 2018), while renewable energies account for 10% to 11% of the same global consumption figure.

At world level, the future for nuclear is looking less bright than once it did, with an ageing infrastructure, few new reactors being built and falling investment levels. It is a slow solution to set in place, as it takes on average 10

to 19 years to get a nuclear project up and running (according to the IPCC) from making the decision to starting electricity production, without any certainty as to when operations will actually get underway (of the 52 reactors currently being built throughout the world, 33 are behind schedule, according to the World Nuclear Industry Status Report). These lead times are too long, as **climate change calls for solutions that will start to make a big difference in the next 10 years**.



ACCORDING TO THE IPCC

The role of nuclear in remaining below the +1.5°C global warming increase mark by the end of the century fluctuates enormously, with scenarios assuming a nuclear share of anywhere between 1% and 39% of electricity production by 2050. In more than half of the scenarios, the share of nuclear falls, and nuclear is disappearing altogether by 2100 in around 10 of them (out of a total of 89 scenarios). In most scenarios, on the other hand, **renewable energies represent at least 67% of electricity production** (not including biomass) and solar and wind power alone account for 55% of the median electricity mix in 2050.

The IPCC ranks nuclear far behind renewable energies and lower energy consumption under the Sustainable Development Goals, in view of the high costs, need for considerable public support (verging on monopolistic conditions), the problem of waste management, the impact on water resources, pollution from uranium mines, the risk of proliferation and the difficulty of ensuring the full independence of the supervisory authorities in the face of economic and political pressure.

Nuclear – more sensitive to climate, natural and geopolitical risks, with environmental risks that go beyond the climate

Given its complexity and the imperative need for constant compliance with highly stringent safety levels, nuclear is sensitive to a great number of risks, concerning the climate and nature (water stress or rising water levels, for instance) and of political nature (unstable regions, terrorist threats).

The question of **water stress** is of particular relevance. **In France, nuclear power accounts for 30% of drinking water consumption, making it the second-largest consumer after agriculture.** The wastewater is not only hotter, but is also polluted by radioactive and chemical waste (although thresholds have been set, this is effectively a right to pollute). An increasing number of reactors need to be shut down during heat waves, while the longer-term risk of global water shortages is increasingly significant, particularly in regions such as India, where many power stations are currently being built.

Other natural risks exist, such as **risks of flooding seismic risks** (even in France where, according to the French Radioprotection and Nuclear Safety Institute (IRSN), five power stations are located in areas of “moderate to average” seismicity: Chinon, Bugey, Saint-Alban, Cruas and Tricastin). **Due to shortcomings in general maintenance, there are regular earthquake resistance incidents in the nuclear infrastructure.** The condition and proper functioning of the facilities therefore necessitate constant investments in

maintenance, which can be undermined by the poor economic health of the operator or by disturbances resulting from a geopolitical crisis or a large-scale pandemic (many maintenance operations had to be postponed during the first lockdown period in France, leading to a tense situation on the electricity network). These operations and outages are often impossible to predict.

Quite apart from the sensitivity of nuclear power to external risks, **it intrinsically produces waste that is impossible to manage for the entire length of its life cycle**, from the minute it is taken out of the ground at mining sites (with negative consequences for ecosystems and pollution of water resources). The vast majority of this waste cannot be recycled: in France, nearly 1.5 million m³ has been generated to date (not including mining waste) and at global level, this figure is as high as 6 million. However, **the question of the safe storage of this waste has not yet been satisfactorily answered** and it should be stressed that radioactive waste is a problem for thousands of years (and hundreds of thousands of years in the case of “high-level” waste). On top of this, there is also the question of local democracy when storage sites are forced upon communities that do not want them. **All of this waste management process has a cost and it can only rise**, yet it is anyone’s guess how much money the operators have put aside to deal with it.



Uranium mining also brings up **questions of human rights**, as mines are often located on the land of native populations and/or ethnic minorities (Touaregs, Aborigines, Native Americans, etc.) and can feed into a diplomacy of complacency with authoritarian regimes.

Producing electricity from renewable sources also has an environmental impact through its use of materials, but the risks are lower. It is, however, important to continue to **develop the recycling** of wind turbines and solar panels and to **reduce overall energy consumption to lessen the effects on the environment.**

The consequences of past nuclear accidents are still evident today. 35 years on, entire areas of the Chernobyl region are still contaminated. It will take centuries for the radioactivity to leave the soil. 10 years after the Fukushima incident, the nuclear fuel is still having to be kept cool. There is still more than 1 million tonnes of contaminated water present on the site.

In France, a nuclear accident is by no means an idle hypothesis: figures have been put to such a scenario by the IRSN (as much as 430 billion euros for a major accident) and the country’s nuclear safety authority has for several years been planning “post-accident” scenarios for the management of contaminated land.



Nuclear – more expensive than the alternatives

Studies, including the one by CIRED researchers in France (published in November 2020), show that while a **fully renewable system would not bring about any extra costs should the price of renewable energies fall, the costs of nuclear power have risen steadily.**

In France, historical nuclear (the cost of electricity produced by “existing power stations”) rose from €49.60/MWh in 2010 to €62.60/MWh in 2014 (which can be imputed, amongst other things, to standardisation, renovation work, waste treatment and dismantling).

New nuclear (from power stations under construction) will push these costs up, given that the EPR reactor at Flamanville, which was budgeted at 3.3 billion euros in 2006, could end up costing a total of 19.1 billion euros,

according to an evaluation carried out in 2020 by the Court of Auditors that included the additional costs incurred. The Court of Auditors estimates the electricity production cost from the new reactors to be within a range of 70 to 90 euros, on the basis of the construction costs of the EPR, which are constantly being adjusted upwards.

By way of comparison, wind and solar power currently cost between 50 and 65 euros per megawatt-hour.

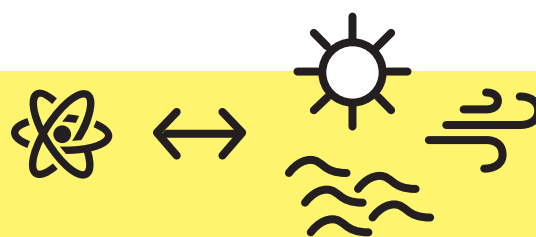
Moreover, the study carried out by three CIRED researchers showed that the costs of a 100% renewable electricity system would not be higher than they are today and that storage would represent just 15% of the total cost (without import/export or any change in electricity demand).



Renewable energies, furthermore, generate an added value of two euros for every euro invested, 80% of which remains in France and feeds into the local economy, with additional savings in fossil energy imports. **In France, renewable energies accounted for nearly 90,000 jobs in 2018** according to the IRENA and the sector grows by nearly 5% every year worldwide. By way of comparison, a million euros invested represents 16 jobs in construction, 14 in renewable energies and just six in the nuclear sector or coal.

At crunch time, what are the alternatives?

The question of what our energy future should be must be addressed in the framework of a democratic debate, as discussions at the moment will determine our electricity mix for the coming decades, EDF is trying to bulldoze its way through with preparations for the construction of six new EPR reactors and Emmanuel Macron has decreed that the decision will not be made until 2023. The project would represent investment of at least 47.2 billion euros, for electricity production that will not be up and running until 2036 at the very earliest, assuming everything goes to schedule. **In any of the scenarios, the share of renewable energies will need to be ramped up, therefore investment needs to start now,** as the major deployment of renewable energies is the most effective way of bringing down our emissions between now and 2030. It is also critically important to invest at the same time in **energy sobriety,** for instance through high-performance refurbishments.



The energy transition must be carried out at local and regional level, with local projects, and these must be carried out in consultation with the various actors. It is the network that allows energy to be transported from where it is produced to where it is needed. And it is at the local level that changes, such as closing down power stations and retraining the employees, must also be anticipated.

A 100% renewable scenario is technically feasible, will create jobs, is more resilient in the event of crisis and faster to implement. It will be better integrated at local level and will allow the citizens to take back ownership of the energy system. It is therefore a credible scenario and should be included as such in a genuinely democratic debate that must be held before any decision is made.