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Special – Nuclear in the energy transition

Rapprocher - Débattre - Fraterniser

Grammar for a coherent energy transition in Europe

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Political and ideological opposition is so fierce that a European energy union may seem impossible. Yet it is a prerequisite for economic, technological and industrial sovereignty. However, for it to become a reality and work, it needs to move beyond slogans, posturing and injunctions and instead focus on managing all the carbon-free sources on the electricity market.

This article was written before the conflict between Russia and Ukraine. The war, which is likely to be long, and the preparation for a sustainable peace increase considerably the need for energy security in Europe. We must rethink the objectives of the energy mix and the role of nuclear alongside renewable energies and gas. The events show to what extent these challenges are crucial in a changing world. France and Europe must articulate geopolitics and "geoenergy". Particular attention should be given to the choice of cooperation with other regions of the world. These major topics will be at the heart of the 20th edition of Les Entretiens Européens next October.

summary

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1- The Green Deal: between fantasy and reality

"Lead the way in the fight against climate change (`disruption' would be a more accurate term), become the world's first climate-neutral continent by 2050": the European Member States have ratified the Green Deal's objectives[1]. They will struggle to achieve them… Everyone knows that despite a slowdown in the rise of emissions due to the Covid-19 pandemic, the levels of greenhouse gases in the atmosphere reached a record high in 2020, and the trend continued in 2021. Yet, last April, the Member States revised their intermediate target for cutting greenhouse gas emissions upwards; it now aims to reduce emissions by 55% by 2030 compared to 1990 levels, even though no commitments have been met since COP 21, and we are still emitting CO_2 in increasing amounts! According to Petteri Taalas, Secretary-General of the World Meteorological Organisation, "*we are way off track*", and the world is looking at a 16% increase in its greenhouse gas emissions by 2030, leading us inexorably towards global warming of 3 °C, which will create major upheaval.

2- Reviewing Europe's goals

The CO_2 generated by energy use is responsible for around 60% of the problem. This can be explained by our huge reliance on fossil fuels (72% for primary energy) and insufficient electricity production. The objectives of halving our energy consumption by 2050 and promoting carbon-free electricity – while reducing the share of nuclear to 15% (vs. 25% today) and increasing that of renewables to 80% (100% by 2100!) – are completely unrealistic[2].

This winter has been marked by growing demand for natural gas in Europe and worldwide, and a structural decline in supply. This partly explains the current energy crisis and the soaring prices (which, let's not forget, climbed to €350/MWh at the end of 2021). The war in Ukraine is exacerbating the situation, with the threats to Russian gas supplies to Europe.

But the gap between supply and demand does not explain everything. There is also a big problem with regulation. In Europe, the market price of electricity is based on the cost of the final kWh required to meet demand, regardless of the other kWh supplied, even if they are the majority – first of all, renewables, which have priority on the grid, followed by nuclear, coal and gas. Thus, the sharp increase in prices can be explained by the decision to prioritise renewables in line with the Green Deal and the Energiewende in Germany, and to offset their intermittency with coal and gas. Therefore, our dysfunctional electricity market is perhaps the main reason we don't have a steadily growing supply, as it discourages nuclear generation and penalises state-owned companies like EDF.

What we should be doing then is not so much reducing our consumption (Europeans are not prepared to forego their comfort or their jobs) but producing energy differently, slashing the share of fossil fuels and substantially increasing that of carbon-free electricity to restore growth and address changes in our lifestyles and in industrial and tertiary production processes.

So, the solution is not to increase the share of renewables and reduce that of nuclear power, but to increase both since they produce little or no CO_2[3], and to reduce (and decarbonise) fossil fuels given that gas produces 10 or even 20 times more, and coal and oil produce 40 times more! But who wants to go without oil? No-one… As for coal, Germany is recommissioning coal-fired plants, France has approved an increase in the number of operating hours permitted, and Poland, which is reliant on coal, will require support (as its nuclear, wind, solar and water power sources are insufficient). The Poles never wanted to be reliant on the Russians, from whom Europe imports gas on a massive scale. The future European energy mix, containing an even larger amount of Russian gas than that which Germany hoped to supply via Nord Stream 1 and 2, could be called into question with the war in Ukraine[4].

It is surprising that the Commission, which has just issued a statement in view of this new context[5], does not even mention nuclear energy, and instead advocates hydrogen (!)

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[1] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_fr

[2] *See the proposals we sent to the European Union Presidency in December 2019 following the 17th edition of the Entretiens Européens in Helsinki on the topic "A new energy era underpinned by nuclear revival": A contribution for a revision of the European energy strategy.*

[3] *53% of the funds allocated to energy firms under the recovery plans drawn up by G20 countries have been invested in projects that use fossil fuels.*

[4] *In 2019, the European Union imported 440 billion cubic metres of natural gas. Over 37% (166 billion) came from Russian gas pipelines. Nord Stream 2 should have added 63 billion cubic metres to the supply already delivered by Nord Stream 1, which has been in operation since 2012. The war has disrupted Germany's plans, which seeks alternative suppliers and speaks of developing coal production rather than keeping its nuclear power plants running.*

[5] *See the Communication to the European Parliament, the Council and the Committee of the Regions, 8 March 2022, "Joint European Action for more affordable, secure and sustainable energy".*

3- Revisiting the incoherent French legislation

Allow me to point out that France's energy mix consists of almost 65% fossil fuels and 25% electricity[6]. Nuclear power accounted for 67% of electricity production in 2020 but just 17% of final energy consumption (renewables, including hydropower, accounted for 19%). Its roadmap for successfully transitioning to a low-carbon economy by 2050, and therefore reducing its greenhouse gas emissions by a factor of six, is set out in the energy transition act (PPE[7]). The energy transition act has the same failings as the European strategy: it proposes a 50% reduction in final energy consumption compared with 2012, and the national low-carbon strategy (SNBC) suggests that nuclear power should account for 0 to 50% of electricity production (with 12 reactors being decommissioned following those at Fessenheim) and renewables 50 to 100%. This new model would have major adverse effects.

The objectives must be reviewed... as Emmanuel Macron's statements in Belfort in favour of nuclear power[8], inspired by the scenarios produced by RTE[9], encourage us to do and, it has to be said, as do the crises themselves. These crises are not just impacting the economy, they are forcing us to reopen the debate on the European electricity market and build a carbon-free, stable and controllable base.

4- Reducing the carbon footprint and increasing our electricity production

There is no concrete strategy for halving our energy consumption, and someone needs to explain how to decouple GDP from energy demand and still restore growth. Even if we can reduce our total consumption by 1% per year (which will mean making a huge effort to improve our energy efficiency), we will have to produce a lot more electricity. In fact, we are going through what I would call a "new electric era" in transport, construction and agriculture, not to mention the digital sector (which alone will account for 14% of total electricity consumption), and in the future, the low-carbon hydrogen economy – if it happens – will use a tremendous amount of electricity[10].

In France, it is astonishing that the "Climate and Resilience" bill fails to address new needs when the majority of uses are still non-electric, be it in the construction industry for the production of heat (essentially gas and oil) or the transport industry (90% oil). Needs have been underestimated and we have very little information on the anticipated growth rate, which nonetheless has a major impact on energy consumption. Overall final energy consumption totalled around 155 Mtoe (1800 TWh) in 2019, including 473 TWh of electricity (for a production of 538 TWh). All the scenarios show a big rise in electricity consumption. Assuming a growth rate of 1% per year by 2050, as predicted in RTE's "central scenario" (and providing that energy consumption falls by 1%/year and the share of fossil fuels decreases by 30% by 2050), electricity production should be increased by around 240 TWh to meet consumption demands of approximately 710 TWh, excluding exports. EDF Chairman Jean-Bernard Lévy has even spoken of 2% growth per year for 30 years, which would bring us to 900 TWh[11]. Which, incidentally, would increase our supply security and enable us to continue exporting to our neighbours.

Allow me to point out that electricity is the only energy form with a positive balance of 2 billion. This allows us to reduce our overall bill, which amounts to 41 billion, thanks to the low variable costs of our generation system (especially nuclear and hydropower plants), which make it particularly competitive. This year, for the first time ever, the destabilisation of our generation system (inadequate wind energy facilities and lack of wind, simultaneous shut-down of 17 reactors for Covid-delayed maintenance work or for a ten-year inspection under ASN supervision to extend the life of the reactors, closure of Fessenheim, etc.) has forced us to import electricity, including coal- and lignite-generated electricity from Germany, and to bring our thermal power plants back into operation at the end of summer. That's really not normal. Forcing businesses to reduce their energy consumption will hinder France's reindustrialisation. And households will face fuel poverty unless we produce more electricity at affordable rates.

[6] *The remaining 10% consists of thermal renewables.*

[7] *PPE: the multi-annual energy plan* - https://www.ecologie.gouv.fr/programmations-pluriannuelles-lenergie-ppe

[8] *See the article by Claude Fischer Herzog, Une relance du nucléaire en France : un choix de société qui nous engage [Nuclear revival in France: a societal choice that involves us all], 13 February 2022,* www.entretiens-europeens.org

[9] https://assets.rte-france.com/prod/public/2021-10/Futurs-Energetiques-2050-principaux-resultats_0.pdf

[10] *See the proceedings from the 18th edition of the EEN in Helsinki, "A new energy era underpinned by nuclear revival".* www.entretiens-europeens.org

[11] https://tecsol.blogs.com/mon_weblog/2021/11/jean-bernard-l%C3%A9vy-pdg-dedf-pr%C3%A9voit-une-croissance-de-la-consommation-d%C3%A9lectricit%C3%A9-de-2-par-an-pendan.html

5- Nuclear electricity, a public service that must be officially recognised as such

Nuclear energy is not just another commodity. It is a public service, and governments should recognise it as such. In fact, to qualify as a public service, electricity must be continuously accessible to all, including households and businesses, and it must be priced affordably. Intermittent renewable energy does not meet these requirements. Nuclear is the only energy source that does.

At the Entretiens Européens in October 2021[12], we, together with the CLEEE – which represents major gas and electricity consumers in the industrial and tertiary sectors – suggested that nuclear electricity, and the companies tasked with providing a continuous electricity supply for all, should be recognised as SGEIs (Services of General Economic Interest) in the Member States that so wish. To effectively regulate these companies, which offer significant economies of scale and a deferred return on investment, they must be exempted from the general competition rules in force within the European market and allowed to work together and pool their depenses. This would require co-responsibility between national governments and the EU. The principle of co-responsibility is recognised in the Lisbon Treaty further to the Herzog report (2004) and the Mario Monti initiative (2007).

But the fact remains that we must be able to sell nuclear electricity at market cost, and not allow traders to line their pockets at the expense of state-owned companies like EDF, by buying its nuclear electricity for a fixed price of €42 per megawatt hour, below what it actually costs – which is an totally "*toxic*" approach according to Jean-Bernard Lévy. It has created excessive debt, which has excluded all possibility of investment in EDF, just when it has to renew its nuclear plants and invest in renewables.

However, the purpose here is not to pit renewables against nuclear energy. **The main question is how to strike a balance between the two sources.** And it requires a truthful answer. Studies, such as that conducted by the OECD Nuclear Energy Agency (NEA), have shown that if the share of intermittent renewables is above 30% (40% at most), energy security is no longer guaranteed[13].

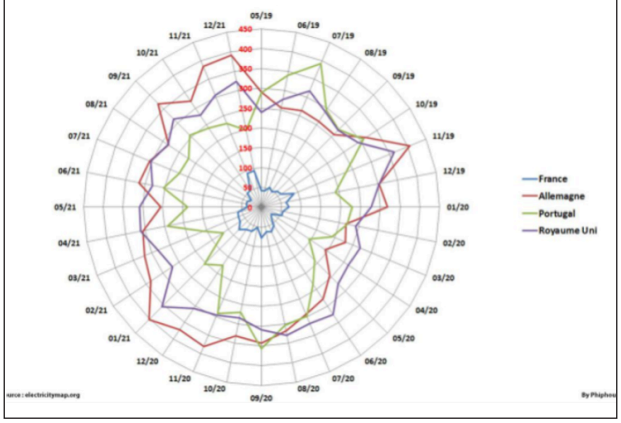
6- The German model, if applied to Europe, will destroy the system

The German model, which they want to impose on every country in Europe, is not reproducible: Germany decided unilaterally to phase out nuclear power, and it can develop its renewable sources because other Member States aren't! In fact, if the German model were enforced across Europe, it would destroy the system because we would have to deal with potential blackouts whenever the wind dropped or the sun failed to shine. Unless, on top of the renewables fleet, we had a fossil fuel fleet of equal power output! The storage of electricity to balance production with consumption is hampered by numerous technical, regulatory and economic obstacles.

More fundamentally, the German model is more than questionable: Germany has spent €535 billion on a transition that has led to widespread fuel poverty (6.9 million German people can no longer pay their electricity bills) and painful corporate restructuring (RWE and Wattenfall have laid off 6,900 people). In addition, the country has become the biggest polluter in Europe in terms of CO_2 emissions, with coal accounting for 58% of final energy consumption (source: EEA). Most of the coal is brown coal (lignite), which is highly polluting. And I have already mentioned the pernicious effects on the European system, which are the reason behind the soaring prices we are witnessing now. I will come back to those later.

Comparison of CO2 emissions in g per KWh between France, Germany, Portugal and the United Kingdom over the last 32 months

Source: electricitymap.org



RTE tells us that it is impossible "to achieve carbon neutrality without significantly developing renewable sources", but I would agree with the IPCC that it is impossible to cut carbon emissions without nuclear energy. And my question is, why replace a carbon-free, stable and controllable energy source with another carbon-free energy source that is intermittent and incapable of ensuring grid stability?

As for France, considering that we can hardly increase hydroelectric production (60 TWh, i.e. 11 to 12% of the mix), is it credible to aim for 50% intermittent renewable energy generation by 2050, as proposed in the RTE/IEA report? This would mean increasing fivefold the current output of 45 TWh, raising major social acceptability and cost

[12] The 19th edition of the Entretiens Européens took place on 13 and 14 October 2021 in Brussels and addressed the following topic: "Promoting nuclear projects in Europe and their financing". See the presentation by Frank Roubanovitch, Chairman of the CLEEE. www.entretiens-europeens.org

[13] NEA (2019). The costs of decarbonisation. "System Costs with High Shares of Nuclear and Renewables", OECD, Paris.

implications for the grids. And the system would be only relatively efficient: we have invested €150 billion in renewables over 10 years, and according to Philippe Charlez (an engineer and an editorial writer at Valeurs Actuelles), they work one day out of five, or one day out of ten depending on the time of year. €150 billion! That could pay for three fleets of six EPRs! Of course, nuclear generation is costly. It requires substantial investment and the return on investment is slow, the construction costs are high, and the financial risk is considerable, as we saw with Flamanville. However, forgive me for pointing out that the €20 billion invested in the EPR is equivalent to three years of tax for renewables. I would also add that it is a prototype, which will serve as a blueprint for the mass construction of EPRs in the future, thereby considerably reducing costs; not to mention their lifespan (60 to 80 years), which – compared to that of wind turbines for example – is an advantage that should be taken into consideration when calculating costs.

7- Promoting and financing nuclear projects

We are going to have to invest in renewing the fleet: the figures being mooted range between 500 and 800 billion in Europe, and at least 100 in France. It's too easy to say that "the Member States will just have to pay", or like some, that the Commission should have budgeted for this in its recovery plans[14]. Even France has not made provision in its recovery plan for financing nuclear energy, besides the few million allocated to research into SMRs. **The nuclear industry must be exempted from the competition rules so that it can receive state aid.** The comparison with financial support granted to renewables is not convincing at all. Europe is paying a high price for the decision to prioritise intermittent renewable energy generation and set binding production targets, which the European Union has increased repeatedly since the 3 x 20 climate and energy package[15]; the exemptions made for renewables are having many negative effects on the markets. They are responsible in particular for spot price volatility (take for example the growing hike in gas demand and prices that we are seeing at present). Financial support, taxes and other subsidies must be stopped, as they create distortions that are detrimental to the market and to Europe's electricity supply.

Excessive national debt and the spectre of another financial crisis due to the sustained rise in inflation – which means that interest rates are going up – are forcing States to mobilise funds by "reassuring" investors and providing them with labels and guarantees. The capital costs for nuclear projects are very high, and it can take up to ten years before private investors see a return on their investment. These are important variables, which must be taken into consideration. Therefore, investors want cooperative partnerships so they can pool their commitments, as well as long-term contracts guaranteeing that prices keep pace with costs. They also want European "sustainable finance" labels so they can include these projects in their balance sheets. And the projects have to exist!

8- A taxonomy that encourages Member States to take responsibility

That is the whole point of the taxonomy, which, as we all know, has been the subject of some extremely lively political battles in the past year, with the anti-nuclear lobby pressing to exclude nuclear generation from the list of activities eligible for "green" funding (an inappropriate term!). The battle will not be over until the second delegated act is adopted, and it will take several more months of heated debate – some say at least six – before the matter is finally settled (as the text has to be ratified by the European Parliament and the Council). However, on 31 December, the Commission announced that nuclear power and gas will be included in the taxonomy, and it confirmed this on 2 February, 2022[16]. This decision should not be dismissed out of hand. It resulted from a very hard-won compromise, reached despite the reticence (to put it mildly) of the Germans, Austrians and Luxembourgers – led by Claude Turmes – who are prepared to go to the Court of Justice to contest it. It would take 20 Member States and 65% of Europe's population to block the text, which is unlikely to happen in the Council. However, the European Parliament has four (or even six) months to rule on the issue, and it is still unclear what it will decide.

The power plant Flamanville 3 – EPR – Source : EDF

[14] *See the article by Dominique Fillon* https://www.lemonde.fr/idees/article/2022/01/18/la-commission-europeenne-clairement-sous-influence-allemande-apparait-duplice-sur-la-question-du-nucleaire_6109879_3232.html

[15] https://ec.europa.eu/clima/policies/strategies/2020/index_fr.htm

[16] https://ec.europa.eu/info/publications/220202-sustainable-finance-taxonomy-complementary-climate-delegated-act_en

Investors and businesses operating in the sector are waiting in the starting blocks; they are ready to commit, despite the limitations of the text. Paradoxically, the conditions governing the issuing of labels are less restrictive for nuclear than for gas. I was afraid that the Commission would override the Member States in choosing which technologies to certify (SMR vs. EPR for example), but not at all. The controversy surrounding the definition of nuclear energy (sustainable or temporary) has grown. Obviously, nuclear energy is a recent technology, whose applications in numerous sectors (healthcare, space, hydrogen, etc.) make it an energy of the future[17]. Which the European Commission recognises in its own way, as it plans to encourage Member States to work on closing the nuclear cycle with generation 4 (for implementation in 2050), and subsequently with ITER. Hence the 2040 deadline for deciding to extend the fleet and the 2045 deadline for approving the construction of third-generation EPRs (which would mean they would reach the end of their life in 2145). Is it really too soon?

On the contrary, I think it is a strong incentive for the Member States. They must now step up to the plate and "set the ball rolling", to quote the CEO of EDF, which will give confidence to industrial and financial stakeholders. I would add that, where national legislation is inadequate, the taxonomy offers the perfect opportunity to review it. For example, French legislation is not conducive to long-term nuclear generation: 12 plants will be shut down by 2035, ten-year inspections will be required to keep the others in operation, the Astrid project has been discontinued, production is restricted to 63 MG... It has to be changed! And the French government can do that, the Commission can't make its choices for it!!

A delegation of young people from the PNC 2100 group, led by Claude Fischer Herzog. They visit the 485 m underground galleries of the industrial center for the geological disposal of radioactive waste, CIGEO, at Bure.

Projects must be accompanied by radioactive waste management plans, which is perfectly legitimate and is in keeping with the 2011 directive, amended in 2016 and ratified by the Member States! The countries out in front should be able to help those who are lagging behind. France's circular economy model, in which waste is reprocessed by Orana and the residue is then placed in geological storage, is very interesting[18]. While I'm on this subject, let me say how pleased I am that the CIGEO project led by ANDRA has been officially recognised as being of public benefit[19]. That's another positive sign.

9- Combining attractive financing plans

In Europe, ten countries have projects in the pipeline. Make no mistake, the Member States will be competing fiercely for those investment euros! I am among those who believe that the taxonomy will make the investment race even tougher, but the industry could also engage in a kind of emulative rivalry that would make it stronger. That said, **the taxonomy will not offset the necessity of market reform. Neither will it establish quality standards for projects and financial arrangements** to lower financing and production costs and bring selling prices down. This is a matter for national governments, which must forge alliances and partnerships with each other and with European investors.

The United Kingdom has passed a bill that facilitates the financing of new nuclear reactors through a Regulated Asset Base (RAB) model. It has already used this approach to fund major infrastructure projects such as water supply networks, with high fixed costs. Under this mechanism, funding from investors is reviewed periodically by an independent regulator, which analyses actual expenditure against forecast expenditure and guarantees the contract over the long term. These costs are then recouped from customers, which provides for a return on investment. This mechanism would be better than the Contract for Difference (CfD), under which the companies involved in the project receive a guaranteed electricity price over a very long period (35 years). But they have to be willing to take a risk and wait to get a return on their investment[20]. Given the current state of the market, the European Commission's Directorate-General for Competition – which makes sure that financial arrangements are compatible with competition rules and grants exemptions if necessary – has agreed to the arrangements proposed by the Member States, the CfD for Hinkley Point,

[17] *See the 2020 Entretiens Européens on "Nuclear energy and its innovations for a sustainable recovery" and the presentations made by Claude Fischer Herzog and NEA Director-General William Magwood, "Integrating nuclear power over the long term":* www.entretiens-europeens.org

[18] *See* Supplément des Entretiens Européens, *"Gestion des déchets nucléaires. La solution existe. Manque le courage de la décision", April 2022.*

[19] https://www.andra.fr/avis-favorable-sans-reserve-de-la-commission-denquete-la-declaration-dutilite-publique-de-cigeo

[20] *See the presentation by Oxford-based economist Dieter Helm at the 2021 Entretiens Européens:* www.entretiens-europeens.org

and the Russian loan for PAKS 2 in Hungary. The problem is that there have been very few projects. The taxonomy should encourage projects, and the European Commission has no reason to reject the associated financial arrangements.

In France, they are talking about six EPRs, the Court of Audit has mooted a figure of 30… The RAB model will be all the more advantageous because the simultaneous construction of several EPRs will enable economies of scale, and because the companies will have to commit to standardising equipment, including the reactors. In addition, the nuclear industry – which employs 220,000 people in a variety of skilled jobs ranging from welder to engineer and researcher – must invest in training and research if it is to meet the challenges it faces[21].

10- Building a controllable base to offset renewables: nuclear or gas? Germany's economic interests

The 2050 target of net-zero carbon emissions, with renewables making up 80% of the energy mix, is made less achievable by the fact that intermittent renewable sources will have to be backed up by a continuous basic energy source... If it's not nuclear it will be gas, which is cleaner than coal but emits more greenhouse gases than the nuclear energy used to generate electricity and in various other applications – not to mention the methane leaked during its extraction and transport.

Yet Germany has already shut down 11 nuclear plants, including three in December, and has decided to shut down the remaining three by the end of 2022. It has reopened several coal and lignite mines and is building new thermal power plants, which it has promised to close by 2030 to achieve 100% renewable energy! A model which I maintain is not transferable unless you want to destroy the entire European system! It does not take into consideration the assets and history of each country... and would strip them of their sovereignty regarding energy policy.

Yet Belgium is following the same path, having voted to shut down its seven nuclear reactors by 2025 and replace them with nine gas-fired power plants. With the war in Ukraine, Belgium, whose gas was to be transported from Russia via Germany through the Nord Stream 2 pipeline, and via southern Europe through the Turkish Stream, should urgently reconsider its position.

These countries are committed to decarbonisation and are lecturing others based on the anti-nuclear ideology of their governments (or societies). But I suspect that these "phase-outs" might be driven by more trivial factors, namely the huge economic benefits of these countries' gas projects, which raises the spectre of a new renewable/gas energy mix being imposed on countries that have not opted for nuclear.

Other countries, on the contrary, have chosen nuclear over gas or coal These include the Netherlands,

[21] *See the Excell plan in France, led by EDF and GIFEN (the trade association of the French nuclear industry). See also the presentation by Bertrand Charmaison, director of I-tésé (CEA) at the 2021 Entretiens Européens 2021, in which he points out the disconnect between the drop in funds allocated to nuclear R&D in the EU (Euratom) budget and the fact that investment in nuclear R&D is picking up in many parts of the world, especially the United States.*

which built its energy economy on natural gas after discovering some very large gas fields in 1965. This enabled it, among other things, to connect 98% of households to the gas grid. Due to the earthquakes triggered by the extraction process, they are now planning to install 7 GW of nuclear capacity from 2025. Poland – which does not want to become even more reliant on Russian gas – plans to reduce the share of coal in its energy mix (80%) by building a fleet of six nuclear reactors.

Two of the four nuclear reactors currently being built in the European Union and almost all of the projected reactors are located in eastern Europe, in Hungary, the Czech Republic, Bulgaria, Romania and Slovakia.

The Olkiluoto EPR commissioned on March 12, 2022

In Finland, the Olkiluoto EPR is about to go online. It will be Europe's first operational EPR (there are two in Taishan in Chine). With a production capacity of 1,650 megawatts, it should cover around 15% of energy consumption needs in the Scandinavian country, which has decided to increase the share of nuclear to 50%.

11- Nuclear states must work together and go on the offensive

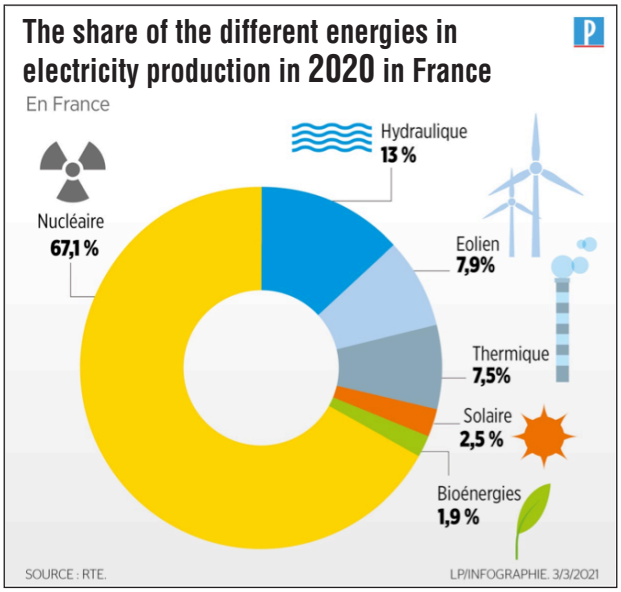
How can we make it easier for States that continue to opt for nuclear energy to cooperate on R&D and training projects, and to pool the costs of building new plants?

The deep divisions between those who are for nuclear energy and those who are against it are destroying an "Energy Union" that doesn't really exist anyway. We cannot force nuclear energy on countries that don't want it, but the Commission and the European Council must create an environment in which several low-carbon energy sources can exist side by side in the electricity market. And work towards a coherent common energy policy that works for all European Member States and prevents them from destroying each other's assets. The inclusion of nuclear in the taxonomy is a step in the right direction. Let's hope that the French presidency, which will be followed by those of the Czech Republic and Sweden, will make progress on these issues. An energy solidarity pact would be a good solution, in keeping with the principle of sovereignty over energy resources enshrined in the treaties (article 194 (2) of the TFEU). In accordance with this principle, the Commission must maintain a neutral technological stance to ensure that no low-carbon technologies are ruled out and that they are all included in the European Union's integrated energy system. With this in mind, the Commission's target of 15% nuclear by 2050 should be revised upwards to an indicative 25-30%, and the excessive target for renewables should be revised downwards to avoid destroying the system.

This solidarity pact could facilitate the development of enhanced or geometrically variable cooperation. As a result, nuclear states could agree to share safety costs and establish joint nuclear licences, as Scandinavian countries are doing through the KELPO project. In addition, States that have no other choice but to continue using coal and gas in electricity generation or in industry could share the costs of R&D in CCS (Carbon Capture and Storage) and of developing transport and storage infrastructure for carbon sequestration.

The EU and the IEA want to encourage States to modify their national energy systems in order to integrate them into a European low-carbon system. But imposing supranational targets for developing intermittent renewable energy generation on individual Member States is unacceptable! Different countries have different geographical and technological assets. They must be able to choose their equipment and infrastructure themselves according to their natural resources and their industrial and technological capabilities, without the threat of obstruction by other Member States.

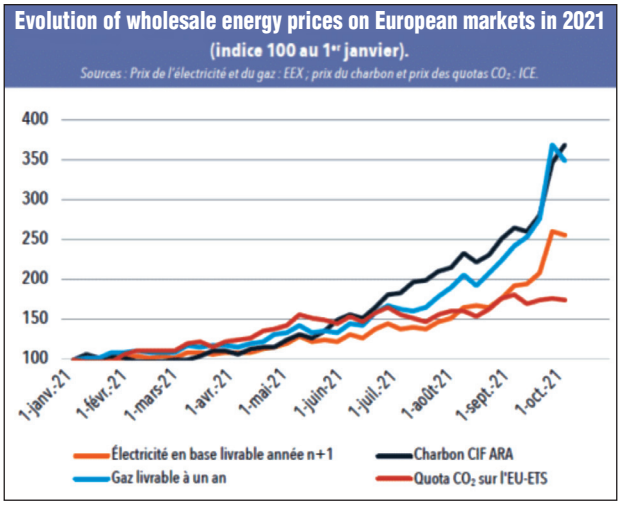
12- The harmful effects of an unequivocal energy system



IEA director Fathi Birol believes that France should increase its electricity production in line with its objectives (I agree). However, he thinks France should do this primarily by increasing the share of renew-

ables – solar and wind power – in its energy mix. They currently account for 10% (25% with hydropower and biomass). As for me, I'm not convinced that intermittent renewable energy generation is the most appropriate technology to address energy, climate and economic challenges, as an electricity market that is influenced more by weather variations than by basic energy needs is not stable and causes a lot of negative effects. There is no doubt "room for improvement", to quote the director of the IEA, but again I would argue that too much intermittent renewable energy generation will ruin our tried-and-tested economic model, as it will penalise the nuclear industry by curtailing its load factor and harming its profitability….

I think a balance should be maintained, and that we should talk about which renewable sources to include in the energy mix. Wind and solar power are intermittent, so they require an installed capacity that far exceeds power demand. The grid would also have to be reinforced, and additional, flexible means of production would be needed. At the moment, they enjoy grid priority and a guaranteed purchasing price, the difference between that and the market price being paid by the taxpayer. In short, they are beyond competition! France aims to install almost 40 GW wind power capacity and 20 GW solar power capacity over the next ten years but is restricting its nuclear load-following capability to 63 GW, which at best will enable it to offset a 20 GW power variation in a few hours[22]. This will mean relying on gas (or coal!) to keep the grid running, both of which emit greenhouse gases and other air pollutants. Not to mention the constantly fluctuating wholesale prices, which penalise the nuclear industry and companies like EDF that need stability and visibility to invest.



Today, with average electricity prices in Europe standing at €220/MWh, the French government – which always chooses purchasing power over the economy and investment – has decided to contain rising household bills by putting a lid on EDF's regulatory tariffs, thereby lowering the company's revenues. Worse still, it will have to sell its electricity off cheaply to its competitors. EDF has in fact been instructed to sell its electricity on the wholesale markets when prices are low, and has to sell it to alternative suppliers below cost price when prices are high! TotalEnergie, for example, which is already massively subsidised, will be able to develop its renewables fleet to the detriment of the investments that EDF needs to make to renew its nuclear plants. There is a similar bias when it comes to interconnections: they will only be useful if a country can take advantage of its neighbours' surplus controllable resources.

We would be better advised to focus our efforts on thermal renewables to reduce our CO2 emissions. In France, they are 25 times more efficient per investment euro than intermittent renewable energy sources, and they also account for 75% of the sustainable jobs created by the renewables market[23]. Thermal nuclear energy would have a role to play: by recovering the fatal heat released by its reactors, it could meet a large proportion of urban and industrial heat requirements. More generally speaking, to achieve a fair market price, our energy and climate policy should be driven by the cost per tonne of CO2 avoided. This would put wind and solar power in their rightful place, especially as connection and backup costs must be internalised.

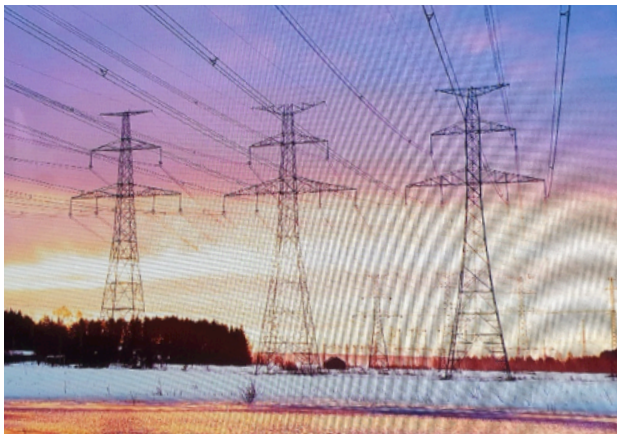
13- Coordinating the European strategy with national and local strategies to forge regional solidarity

A low-carbon policy will only be successful if it is fair and engages regional stakeholders and businesses. It should be based on increasing system decentralisation and an end-use electrification strategy that involves local and industrial stakeholders. **But consistency between the global and local levels is essential. If the "macro" policy remains unchanged, it will remove all freedom of choice from the regions.** Local initiatives will be a fallacy. Therefore, a planning system must be put in place to ensure consistency.

The challenge is primarily a democratic one. Choices engage societies. So, all the stakeholders must be involved in making them. With this in mind, we suggest setting up a network of agencies where users, producers, researchers, teachers and young people will work with the institutions to develop public policy and decide what the mix should look like in 2030 and then in 2050. At the Community level, an agency would be responsible for foresight and incentive activities to ensure EU-wide consistency and synergy.

[22] *In his Belfort speech, Emmanuel Macron proposed 100 GW of solar, 37 GW of onshore wind... and 40 GW of offshore wind with the construction of 50 farms. This proposal lacks coherence, it can no doubt be explained by the fact that onshore wind turbines are encountering more and more problems of social acceptability!*

[23] *See the article by Hervé Fischer in* La Lettre des Entretiens Européens*: "What is the right energy mix for Europe's future? - January 2021*



Redevelopment of regions reliant on fossil fuels should also be based on reskilling, with the emergence of new jobs in new electrical technologies and the consolidation of existing jobs in the nuclear industry (where there is considerable scope for innovation and for applying those innovations in other industrial sectors) through the recruitment of young people to the industrial and scientific sectors.

Instead of pitting one technology against another, they could be used together depending on needs. Nuclear energy is a necessary complement to renewables which, as we know, are struggling to get off the ground in many countries including France. In a bid to give renewable energy sources even more of a "boost", the Commission has put forward a new European directive – the Clean Energy Package – to develop Citizen Energy Communities. And through its national low-carbon strategy, the French government hopes to create stronger incentives for overcoming social acceptability issues and to accelerate decarbonisation measures in the transport and construction industries, which are also proving difficult to put in place. It also hopes to mobilise household savings, which would provide a substantial windfall of €5 trillion.

But I still maintain that the macro-objectives must be reviewed, the market must be reformed and the law must be amended, otherwise the creation of these "communities" will have a lot of negative effects. I will give just one example in France, construction. Construction accounts for 45% of our energy consumption and 25% of greenhouse gas emissions. If the option chosen is to reduce energy consumption, then the approach is all wrong. All of the policies adopted over the past ten years have failed, from the Grenelle environment act to the sustainable building plan. A carbon-centric approach would be wiser and more cost effective! We have spent billions on a renovation programme that excluded both public buildings and industrial premises… which consume the most energy. As for the private housing stock, low-income households should have been given priority. But the tax credit proved to be a boon for wealthier households… And the worst part is that we started to incur costs when we didn't have the tradespeople we needed. Skilled tradespeople, who do the majority of renovation work in France, did not have the time or the resources for training. With Covid, things just got worse… The outcome is more than disappointing: CO_2 emissions are actually increasing in the construction industry!

14- Reforming the energy market: the debate is on

Talks are ongoing about reforming the electricity market. The minister Bruno Lemaire would like to change a price system that favours gas, but Germany is opposed to any reform at all. As we have seen, if the price is based on the cost of the final kWh required to meet demand, once the renewable and nuclear energy have been consumed, the operating costs of gas can be recovered. France – and a handful of other States – is proposing to base electricity prices on average production costs, or on the production cost of each individual country depending on their energy mix. In this way, the price paid by French customers would be aligned with the production of nuclear electricity, which is the least carbon intensive and the least expensive! The ARENH (Regulated Access to Historic Nuclear Electricity) mechanism[24], requires EDF to sell some of its production cheaply to alternative suppliers, which are always asking for more![25] Should this mechanism be changed? Some think it should be scrapped and that EDF should be privatised and try its luck in the market[26]. Others, like the big consumers that consistently benefit from low prices, don't agree. Yet others have suggested keeping the mechanism beyond 2025 but adjusting the fixed price since, as EDF has rightly pointed out, electricity is being sold below its cost.

In addition, the European market prioritises energy demand to the detriment of the guaranteed power output that is essential to balance the grid, since energy demand must be equal to available power. Companies like EDF must maintain their controllable base to offset the lack of renewable energy if necessary, so are therefore penalised twice over. Conversely, renewable energy producers are paid even if they cannot deliver, thanks to the taxes and subsidies they receive. Lastly, as I have said before, the market discourages long-term investment, given the financial risks associated with price volatility. It is therefore urgent to discuss what kind of market reform is needed to support the huge investments required to renew the fleet.

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[24] *See Jacques Percebois and Boris Solier:* https://www.connaissancedesenergies.org/tribune-actualite-energies/reforme-de-larenh-force-majeure-et-corridor

[25] *Competing suppliers are entitled to ARENH rights proportional to their customer portfolio; they can then sell them at the price they choose to consumers that they take from EDF.*

[26] *See Lionel Taccoen* - https://www.geopolitique-electricite.fr/documents/ene-317.pdf

EDF has been weakened and its future is uncertain[27].We will need to reconsider its status. We hear mutterings of "renationalisation" and "state monopolies". No nationalisation, no privatisation! We should invent a 3rd type of company. One that would be able to fulfil its public service obligations in France and perform its public interest role in Europe to satisfy both solidarity requirements and the demand for electricity (which is an essential commodity), while at the same time continuing to pursue its business objectives in Europe and worldwide. And rather than "renationalise energy policy", we should take every opportunity to establish a pan-European industrial sector. It is the only way for France to regain its leadership in Europe, and for Europe to be competitive in a world that is experiencing a nuclear revival, and in which some countries are wasting no time in grabbing a share of the market[28].

***CFH** - February, 2022*

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[27] See the article by Jean Peyrelevade, Les Echos, *9 February 2022, EDF : « Une manipulation inacceptable » [EDF: unacceptable manipulation].*

[28] See the interviews with Ilia Rebrov from Rosatom, Zhenhua Zhang from China Nuclear Power, and John Kotec from the Nuclear Energy Institute in the United States, conducted by Jan Bartak, Chairman of NucAdvisor, at the 2021 Entretiens Européens: « The challenges of competitiveness in the European and global market: comparison of the public policies of the major powers »: www.entretiens-europeens.org

The ASCPE seminar 2022 extends Les Entretiens Européens 2021 and prepares the 20th edition on "the geopolitics of nuclear power in Europe"

Three conferences are organised by ASCPE, with GIFEN, the CLEEE and X-Sursaut during the first semester 2022 in the context of the energy crisis and the war in Ukraine, which reinforce the need for a controllable, stable and sustainable base with nuclear power.

• 1st webinar EEN March 3 : **Nuclear revival in France and Europe. Laying the groundwork for success!**

Revisiting the legislation in France and reforming the European electricity market, winning the taxonomy battle, changing the status of nuclear electricity... With **Xavier Ursat**, Executive Director of EDF en charge de l'ingénierie et des nouveaux projets nucléaires, **Massimo Garribba**, Deputy Director-General of the European Commission's DG Energy, and **Frank Roubanovitch**, Chairman of the CLEEE

The presentations allowed us to clarify the industrial, organizational and financial challenges that the construction program for new reactors in France announced by the President of the Republic poses to EDF and to the entire nuclear industry. But this French program cannot be the only one, if Europe wishes to make nuclear power an essential lever for its energy autonomy and its ecological transition.

Three points in particular were addressed which will be developed

in the next webinars and during the 20th edition of the EEN.

• 2nd EEN web seminar in May: **Involving Private Investors in the Financing of Nuclear Investments in Project Development Companies Identified by States and Companies**

The financing of nuclear projects: how to enable electricity producers to have the necessary financing to fulfill their mission, the essential nature of which is unfortunately reminded by the current context? How should European competition law be adapted to facilitate the involvement of States in these extremely capital-intensive projects that are envisaged on the scale of the century?

• 3rd EEN web seminar in June: **Cooperation and Competition in the Nuclear Industry in European and Global Markets**

Industrial competitiveness of the European Union: If the nuclear industry is an asset for the European Union, how can we promote it in the market, and develop new regulations for stable price formation favourable to investment?

• 20th edition of the Entretiens Européens Nucléaires Mid-October: **The Geopolitics of Nuclear Energy as a major issue in the current context**

Geopolitics and foresight: The current radical shift in relations with Russia, the war in Ukraine and the preparation for lasting peace have significantly increased the need for energy security in Europe. Should we not therefore rethink the energy mix targets and, if so, what place will nuclear power have, alongside RE and gas? Particular attention should be given to cooperation with the different regions of the world.

The 20th edition of Les Entretiens Européens on October 2022 as part of a geopolitical debate:

"Nuclear power at the heart of inter-state relations to meet the challenges of peace, climate and shared development in Europe and worldwide"

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