GREENPEACE

Relaunching nuclear construction: a wrong turn for the climate

A comparative analysis of the impact of three investment scenarios on reducing greenhouse gas emissions: renewable energies, energy efficiency retrofitting, and a programme to build six EPR 2 nuclear reactors

REPORT

September 2023

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Summary

To comply with the Paris Agreement and maintain global warming at below 1.5°C, **80% of the reductions in greenhouse gas emissions needed in France must be achieved in the next 12 years**[1]. The French programme to relaunch the construction of new nuclear reactors, which require at least 15 years to build, will likely have no short- or medium-term impact on efforts to decarbonise our energy mix. Greenpeace compared the potential impact on these efforts by 2050 of six EPR 2 reactors with that of a comparable financial investment in the renovation of energy inefficient (or 'draughty') homes, and a programme to build renewable combined wind power/solar panel infrastructure. Results are edifying. A public investment of €85 billion by 2033 in the renovation to high energy-efficiency (HEE) standards of draughty homes **would remove six times more CO_2 emissions by 2050** than the EPR 2 construction programme. Such an investment would also **lift nearly 12 million people out of energy poverty** in one decade. Investing €52 billion in a combination of onshore wind and large-scale solar infrastructure[2] would **remove four times more CO_2 emissions than an investment of the same sum in the construction of six EPR 2 reactors by 2050, and triple** electricity production. Far from a wise choice for the climate, scaling up nuclear power is the slowest option, with the least short-, medium- or long-term impact on efforts to decarbonise energy mixes.

Keywords:

Nuclear - Sobriety - Energy efficiency - Renewable energies – Energy efficiency retrofitting - Thermal retrofitting - Photovoltaics (PV) - Wind turbines - Solar energy - EPR 2 - Energy poverty - Draughty homes - Climate - Energy mix

[1] Greenpeace France, Engager la France sur une trajectoire climatique +1,5 °C - Quels objectifs climatiques la France doit-elle adopter pour être sur une trajectoire compatible avec un réchauffement climatique limité à +1,5 °C ?, Juillet 2023 [in French]
https://cdn.greenpeace.fr/site/uploads/2023/07/Engager-la-France-sur-une-trajectoire-climatique-1.5%C2%B0C-1.pdf

[2] 60% onshore wind and 40% commercial rooftop solar panels

Glossary

Capital expenditure (CAPEX)	CAPEX refers to investment spending on long-term, fixed assets.
Levelised cost of electricity (LCOE)	LCOE represents the total cost of an energy production asset over its lifetime. Expressed in euros per MWh, LCOE is used to compare the cost of different electricity production technologies.
Draughty homes	Homes with an energy efficiency rating of F or G (the two lowest scores on a scale of A to G) are considered to be energy or thermal 'sieves' ('*passoires*') in France.

Abbreviations

HEE (BBC in France)	High energy-efficiency building
(DPE)	Energy performance rating
EEA	European Environment Agency
EDF	Electricité de France, the state-owned electricity utility
EPR 2	Evolutionary Power Reactor 2: a third-generation pressurised water nuclear reactor capable of generating 1,600 MWe and modelled on the EPR reactors built in Taishan (China) and Olkiluoto (Finland) and those under construction at Hinkley Point (England) and Flamanville (France).
GHG	Greenhouse gas
PV	Photovoltaic (panels)
RTE	(Réseau de transport d'électricité) French energy transmission network

Illustrations

Introduction

Decarbonisation needs to happen now, not in 20 years. IPCC scientists repeat this on end, and the growing number of extreme climate events leaves no doubt: we need to decarbonise our societies now, and not wait for solutions in far-off potential technology.

In July 2023, Greenpeace published a letter demonstrating that **80% of the reductions in greenhouse gas emissions needed in France to achieve carbon neutrality and cap global warming at 1.5 °C as stated in the Paris agreement** must be achieved in the next 12 years[3]. There is a pressing need to decarbonise our energy mix, two-thirds of which comes from fossil fuels. Why? Because the direction and pace of greenhouse gas emissions is what matters. Once emitted, greenhouse gases remain in the atmosphere and continue to warm it for decades. Therefore, we need to avoid the accumulation of these gases today, rather than continue down the road of colossal CO_2 emissions with the intention of drastic cuts 20 or 30 years from now based on hypothetical plans to build and bring online a new kind of nuclear reactor: EPR 2.

Amid a drive on the part of the French government and EDF to invest billions of euros in the construction of six new-model EPR 2 nuclear reactors, Greenpeace compared the different impacts on efforts to decarbonise the energy mix of three comparable investment scenarios: the installation of combined wind and solar capacity; renovations to improve the energy efficiency of draughty homes, and a new era of nuclear power with the construction of six EPR 2 reactors.

We use the figures currently announced by the French government to base our calculations of variables such as the deadlines and costs involved in a programme to build six EPR 2 reactors. This €52 billion estimate – the equivalent of €17 billion per pair of reactors, with the first EPR 2 reactor scheduled to come on line in 2037 and another every two years – does not include financing costs and will necessarily be higher. This figure is also excessively optimistic in light of the industrial fiasco that

[3] Greenpeace France: Engager la France sur une trajectoire climatique +1,5°C - Quels objectifs climatiques la France doit-elle adopter pour être sur une trajectoire compatible avec un réchauffement climatique limité à +1,5 °C ?, July 2023 [in French]
https://cdn.greenpeace.fr/site/uploads/2023/07/Engager-la-France-sur-une-trajectoire-climatique-1.5%C2%B0C-1.pdf

the EPR model became, with its systematically extended and inflated deadlines and construction costs, in France and elsewhere. To date, the Flamanville EPR project is twelve years behind and, including financing costs, will cost over €20 billion – six times more than the €3.3 billion initially planned. While the costs and calendar announced by the French government and EDF appear largely underestimated, the focus of this report is elsewhere, and we have therefore used these official figures in the calculations presented herein.

The costs of renovations to improve energy efficiency in homes and of building wind and solar infrastructure are based on public data from sources documented and analysed in detail in the appendices of this report.

We used conservative estimates based on the least favourable conditions for the development of onshore wind and commercial rooftop solar power and based on the best conditions for the development of new nuclear. These estimates reflect a potentially far more extensive trend, and still, the results of this study are edifying.

Part one of this report compares the different impacts on decarbonisation of a financial investment that covers the construction of six EPR 2 reactors and the same investment in a combination of wind (60%) and solar (40%) power. A spreadsheet is included to simulate different scenarios by adjusting variables such as the date a reactor comes on line and costs.

Part two of the report calculates the investment needed to effectively renovate every draughty home in France and lift nearly 12 million people out of energy poverty within a decade. We assess the annual savings in electricity consumption and the volume of CO_2 emissions (in tonnes) that would be avoided thanks to these renovations, and compare the benefits derived from investing the same amount in a programme to build six EPR 2 reactors.

This report seeks to enrich the debate on France's future energy policy by assessing the real **impact of different measures available to address the climate emergency, which for Greenpeace is inseparable from the social and environmental emergency.**

Background

According to the world's scientists, the window we have in which to cap global warming at 1.5°C is closing by the day, and the massive and rapid decarbonisation of our energy mix an absolute necessity. This starts with the global restructuring of society across all activity sectors, together with sobriety plans, energy savings, efforts to enhance energy efficiency and the construction of low-carbon, renewable energy infrastructure that can massively and rapidly reduce greenhouse gas emissions.

Given the design, building and commissioning delays seen in the industrial fiasco surrounding EPR reactors, these new reactors cannot be expected to have any positive effect on reducing the carbon content of the energy mix before 2037 (at best). Despite this, EDF and the French government are willing to invest tens of billions in this programme. Is this really a wise choice?

On 10 February 2022, French president Emmanuel Macron, campaigning for re-election, delivered a speech in the eastern French town of Belfort in which he announced a desire to relaunch a programme to build new EPR 2 nuclear reactors. Since, members of the government majority have acted as if the announcement were confirmed, but no official decision has been made to relaunch a nuclear building programme in France – or not. The apparatus of the French government has thus set in motion the nuclear steamroller, flouting consultations organised by the National Public Debate Commission, and simultaneously passing a bill (No. 2023-491)[4] to accelerate procedures to build new nuclear facilities near existing nuclear sites.

After decades of reliance on nuclear-fuelled electricity production without planning for the replacement of the country's current fleet of 56 ageing reactors, France's leaders are now faced with the challenge of securing the nation's energy supply and the pressing need to decarbonise its energy mix. France lags behind in the development of renewable energies[5] such as wind and solar power, which are now the fastest and cheapest way to generate electricity worldwide – ahead of nuclear[6].

[4] https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000047715784

[5] France is the only country in the European Union not to have achieved its own objectives for developing renewable energies by 2020.

[6] Mycle Schneider, The world nuclear industry status report 2022, résumé en français, Chapitre « Le nucléaire face aux renouvelables », p. 30. https://www.worldnuclearreport.org/IMG/pdf/wnisr2022-re_sume_-fr.pdf

The industrial and financial challenges it involves makes relaunching the nuclear sector a dangerous endeavour. In this report, Greenpeace focuses on an argument frequently advanced by the government to justify a programme to build EPR 2 reactors: nuclear power as a way to decarbonise our energy mix and a vital solution to the climate crisis.

In this study, Greenpeace compares the impact on reducing greenhouse gas emissions of three different ways of spending these billions of euros: in new renewable wind and solar energy infrastructure; in the construction of six EPR 2 reactors; and in an ambition plan to upgrade the energy efficiency of draughty homes.

1 – Onshore wind and photovoltaics cut CO_2 emissions much faster than nuclear power

1. Background – Nuclear, wind and solar power

Given the design, building and commissioning delays on these hypothetical new EPR 2 reactors in France, **no positive effect on decarbonisation can be expected from new nuclear before 2037 at best.** Nuclear power will have no impact on reducing CO_2 emissions for the next 15 years at least – a period crucial in achieving the goals of the Paris Agreement.

Onshore wind and solar power, on the other hand, are technically, economically and operationally mature sectors that offer much shorter development, construction and commissioning times than before. The Law of 10 March 2023 on accelerating renewable energies is designed to speed things up further, with the aim of mass-scale production boosted by the greater affordability of these technologies (in the last decade[7], the LCOE cost[8] of solar energy has dropped 85%[9]; the same cost of wind power 50%[10]). Between 2010 and 2022, wind power generated an additional 1,793 TWh of electricity worldwide; photovoltaics produced an extra 1,258 TWh. Nuclear power generation, on the other hand, declined by 76TWh[11]. **This means that renewables far outstrip nuclear power in global electricity production.** Renewables are the **fastest and cheapest way to generate low-carbon energy worldwide.**

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[7] According to the WNISR 2022, "The annual LCOE analysis last updated by U.S. bank Lazard suggests that between 2009 and 2021, commercial solar PV costs fell by 90% and wind costs by 72%, while new nuclear power costs increased by 36%" [I used the quote from the original English report here but had to modify it slightly to translate the French]. See Mycle Schneider, The World Nuclear Industry Status Report 2022, summary in French, Chapter on nuclear versus renewable energies, p. 31 [in French]

[8] The levelised cost of energy (LCOE) represents the total cost of an energy production asset over its lifetime. Expressed in euros per MWh, LCOE is used to compare the cost of different electricity production technologies.

[9] International Renewable Energy Agency: Renewable power generation Costs in 2022, Table H.1 Total installed cost, capacity factor and LCOE trends by technology, 2010 and 2022, p. 15
https://mc-cd8320d4-36a1-40ac-83cc-3389-cdn-endpoint.azureedge.net/-/media/Files/IRENA/Agency/Publication/2023/Aug/IRENA_Renewable_power_generation_costs_in_2022.pdf?rev=1ae772b0f1ef4c2580bfe4bc620973b9

[10] The IPCC Sixth Assessment Report: Climate Change 2022: Mitigation of Climate Change. Summary for Policymakers, Working Group III Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Figure SPM.3 | Unit cost reductions and use in some rapidly changing mitigation technologies, p. 15.
https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_SummaryForPolicymakers.pdfdf

[11] Our world in data, graph Electricity production by source, world
https://ourworldindata.org/grapher/electricity-prod-source-stacked?time=2010..latest

2. The study: introduction and methodology

Greenpeace looked at the volume of greenhouse gas emissions potentially avoided between now and 2050 by **investing the same amount** in a **programme to build six EPR 2 reactors** as announced by the French government and EDF, OR in the **construction of combined onshore wind and commercial rooftop solar capacity** – the two most rapidly installable technologies in a context of supply security issues.

The methodology and reasoning behind our study are examined in detail in Appendix 1[12].

The spreadsheet tool created for this study can be used to perform sensitivity analyses by adjusting certain variables to see how they affect the reference scenario. The spreadsheet is available in Appendix 2[13]. For example, calculations are based on the hypothesis that the average carbon content of electricity mixes in Europe will change. Avoided emissions can therefore be assessed based on the year in which the nuclear or renewable asset comes on line.

[12] Appendix 1: Méthodologie et calculs des différents scénarios
[13] Appendix 2 : CalculEmissionsEvitéesEPR2 vs PV + éolien

3. Results

A €52 billion investment to build six EPR 2 reactors, with the first two operational in 2037 and 2039 and the others every two years after that, as announced in the 'standard' scenario presented by the French government and EDF, would prevent **24 million tonnes of cumulative C02 emissions** between now and 2050 **and produce a cumulative total of 530 TWh of electricity**.

The same amount invested to build renewable energy infrastructure based on 60% wind and 40% solar PV would prevent **102 million tonnes of cumulative CO2 emissions** between now and 2050 **and produce a cumulative total of 1,538 TWh (see Appendix 2).**

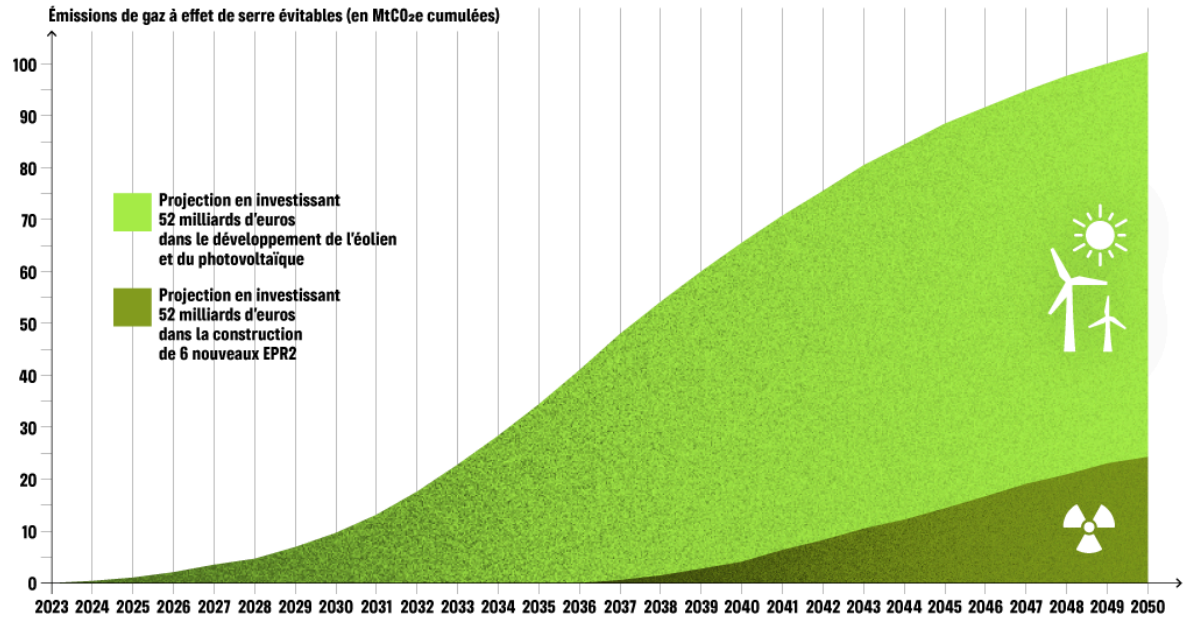

Figure 1: Avoidable greenhouse gas emissions by 2050 based on a comparison of the same sum invested in the development of wind/solar infrastructure versus a programme to build six EPR 2 nuclear reactors

[Avoidable greenhouse gas emissions, in cumulative MtCO2e]

[Projection with an investment of €52 billion to develop wind and solar power]

[Projection with an investment of €52 billion to build six new EPR2 reactors]

4. Sensitivity analysis

The spreadsheet tool (in Appendix 2) can be used to adjust the following variables:

- investment costs and load factors in the three sectors (nuclear, onshore wind and solar)
- European energy mix objectives for 2030 and 2050
- the wind/solar ratio
- the date the first EPR 2 enters service

The results derived from adjusted variables are available in a table in Appendix 1.

The most sensitive variable is a delay in the entry into service of the first EPR 2 reactor, followed by an increase in CAPEX[14]. The two variables together yield spectacular results: **avoided GHG emissions derived from renewable energies** would double in comparison to nuclear if EPR 2 reactors came on line two years later and CAPEX increased by 35%.

Note: these calculations are based on a simplified methodology and exclude certain factors, including: **the cumulative effect of avoided greenhouse gas emissions, financing rates, operating costs[15], network management costs or compensation for variability in renewables.**

[14] See glossary.
[15] The impact of these costs is examined in detail in Appendix 1.

5. Conclusions

Even if we take the best case scenario for new nuclear (in which costs are controlled, deadlines are met, load factors are optimistic, the reduction in the cost of renewables slighter and in which calculations do not include the cumulative effects of GHG emissions or operating and financing costs, both of which are much lower in the case of renewable energies), and based on the same amount invested, the installation of 60/40% wind/ solar renewable energy infrastructure would prevent **four times more cumulative CO2 emissions by 2050** than the construction of six EPR 2 reactors. the renewables infrastructure would **also produce three times more electricity** in total over the entire period.

The positive advantage of a wind/solar mix over six EPR 2 reactors in terms of avoided CO2 emissions **could double in the event of even a moderate deviation** from stated reactor deadlines (e.g. an over two-year delay), or costs (an overrun of 35% or more). In this case, a wind/solar mix would prevent **eight times more cumulative CO2 emissions by 2050 than would six EPR 2s** and produce five times more electricity in total over the entire period.

As a reminder, the Flamanville EPR project has run at least 12 years over schedule at a cost 479% higher than planned.

2 - An investment in energy efficiency retrofitting: €85 billion would lift nearly 12 million people out of energy poverty in a single decade

1. Background – Draughty homes

- **Key figures**

Homes deemed 'draughty' are properties with an energy performance rating of F or G (A being the most energy efficient, G the least).

In France, according to the latest estimates (2022), nearly one in five homes – over five million in total[16], in which live more than 12 million people – are considered to be draughty.

- **A public health problem**

Inhabitants of draughty homes are considered to be 'energy poor'. Sub-standard insulation in homes creates detrimental living conditions: discomfort in hot summer weather and in winter due to ineffective heating, as well as/or energy spending that is unbearable for low-income households.

Illustration 1 - Poster for an information campaign by the Fondation Abbé Pierre, a French housing charity

© Fondation Abbé Pierre

[16] It should be noted that the actual number of draughty homes in France is a matter of debate. While France's Ministry of Ecological Transition puts the number of draughty homes at 5.2 million, other studies indicate far more: two authors specialised in energy transition, Robin Girard, a research professor at Ecole des Mines, and Yassine Abdelouadoud, an independent researcher, put the number at 7 million, while Olivier Sidler, a European specialist in ultra-high energy-efficient buildings, proposes similar figures. This report uses the official Ministry figures (for the economic costing of the six EPR 2 reactors as well).

An impact study conducted by Fondation Abbé Pierre on [17] how energy poverty affects health has shown that a lack of heating worsens the health of low-income households, who must regularly choose between being warm, eating, taking proper care of themselves, or paying the rent.

In older homes, humidity and age can deteriorate lead-based paints. The ingestion of paint dust and flakes is particularly harmful to young children: in 2013, over 5,300 children in France suffered from lead poisoning, a condition that causes serious and irreversible developmental disorders. In substandard homes (600,000 in France) and makeshift housing (85,000 tents, huts and caravans), water infiltration, poor ventilation and insufficient – or no – heating generate excessive humidity and the development of mould can worsen or give rise toallergies and respiratory conditions.

- **Greenhouse gas emissions that contribute to global warming**

According to the French Ministry of Ecological Transition and the former Ministry of Energy Transition, the construction sector is the second largest source of greenhouse gas emissions. Alone, it accounts for 27% of CO2 emissions and nearly 45% of final energy consumption[18].

The government has provided resources for thermal retrofitting under the France 2030 scheme[19], but this funding inadequately addresses the urgency of the climate and health crises and the pace at which draughty homes need to be renovated, or 'retrofitted', to improve their energy efficiency. Last October, when the French National Assembly approved a €6.85 billion increase in spending on energy efficiency retrofitting to a total of €12 billion per year, the government used Article 49.3 of the French Constitution to revoke the measure (along with others).

[17] Fondation Abbé Pierre, Liens entre précarité énergétique et santé : analyse conjointe des enquêtes réalisées dans l'Hérault et le Douaisis, November 2013 [in French]
https://www.fondation-abbe-pierre.fr/nos-actions/comprendre-et-interpeller/limpact-de-la-precarite-energetique-sur-la-sante
[18] Ministère de la Transition écologique et de la Cohésion des territoires et ministère de la Transition énergétique, La rénovation énergétique, 2 February 2023 [in French]
https://www.ecologie.gouv.fr/renovation-energetique
[19] France 2030 is a €54 billion government-backed investment plan aimed at boosting France's lagging industrial sector by investing heavily in innovation and support for the environmental transition.

2. The study: introduction and methodology

Greenpeace led a study to calculate the public cost of retrofitting all draughty homes to bring them to high energy-efficiency (HEE) standard[20], along with the avoided greenhouse gas emissions and energy savings (electricity, wood, fuel oil and fossil fuels) that these renovations would generate.

The methodology and detailed findings are available in Appendix 1.

3. Results and conclusions

Overall findings are as follows:

The total cost of the renovation work necessary to retrofit all draughty homes in France to HEE standard by 2033 is approximately **€169 billion**.

Total public spending needed to retrofit all draughty homes in the next decade amounts to nearly **€85 billion (see Appendix 3[21]).**

Currently, the pace of retrofitting is far too slow and available resources inadequate. In 2022, France's national housing improvement authority reported that in total only 66,000 homes had been retrofitted (to quasi-HEE standard), and not all of these were draughty[22].

A much stronger thrust to improve home energy efficiency, first and foremost in draughty homes, is necessary to spur a genuine energy transition, reduce our greenhouse gas emissions and wasteful use of energy, and quickly lift out of energy poverty the 12 million occupants of these homes.

[20] In addition to energy performance, HEE certification encompasses how well a building is sealed. That said, renovations to HEE standard can be said to confer an energy efficiency rating of A or B.
[21] Spreadsheet – Calculation of reductions in CO2 emissions based on different renovation scenarios.
[22] Agence nationale de l'habitat, Plus de 700 000 logements rénovés en 2022 : l'activité de l'anah se poursuit à un très haut niveau et confirme la tendance engagée en 2021, communiqué de presse, 24 January 2023 [in French]
https://www.anah.fr/presse/detail/actualite/plus-de-700-000-logements-renoves-en-2022-lactivite-de-la nah-se-poursuit-a-un-tres-haut-niveau-et-confirme-la-tendance-engagee-en-2021/

To achieve this, **the number of draughty homes retrofitted to HEE standard every year must increase from a few hundred thousand in 2022 to 700,000 per year by the end of the decade** (in 2029 or 2030). At this increased pace, all draughty homes in France could be renovated by 2033, with multiple benefits for people and society as a whole.

A public investment of €85 billion by 2033 for the HEE retrofitting of all draughty homes over a ten-year period would:

- **prevent more emissions (more than 156 MtCO2eq) by 2050** than a slower pace of retrofitting over 30 years to bring draughty homes to HEE standard over the same period. **Implementing this solution instead of investing €52 billion (excluding financing costs) to build six EPR 2 reactors would prevent six times more greenhouse gas emissions by 2050** (156 MtCO2eq instead of 24). The calculations appear in the spreadsheet in Appendix 3.
- **gradually reduce greenhouse gas emissions caused by draughty homes, to 20.2 MtCO2eq/year in avoided emissions from 2033 onwards.** This represents 5% of all current greenhouse gas emissions in France.
- **lower electricity consumption by more than 19 TWh per year** – the approximate annual output of two EPR 2 reactors.
- **in a decade, lift out of energy poverty and increase the well-being of nearly 12 million people**, who would no longer suffer from cold, humidity and even mould…in their home.
- **bring down household energy bills**.
- **improve France's trade balance** by cutting down on fossil fuel imports and energy waste.
- **enable savings on public health spending.**

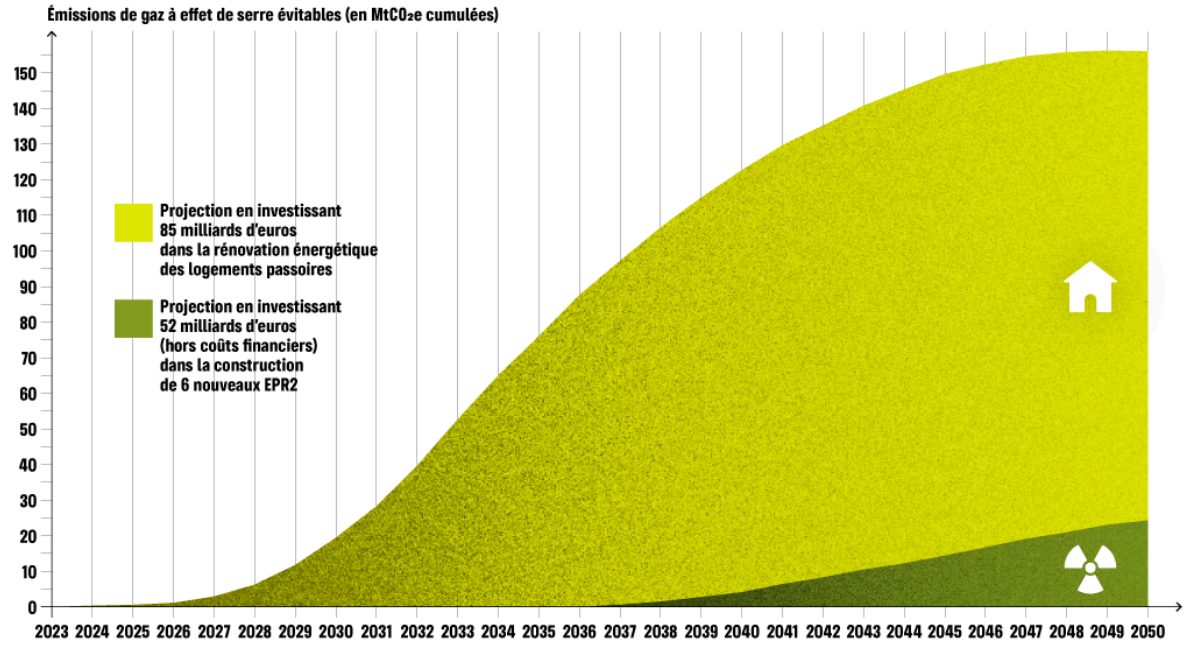

Figure 2: Avoidable greenhouse gas emissions by 2050 based on a comparison of the same sum invested in improving the energy efficiency of draughty homes over ten years versus a programme to build six EPR 2 nuclear reactors

[Avoidable greenhouse gas emissions, in cumulative MtCO2e]

[Projection with an investment of €85 billion in the energy-efficiency retrofitting of draughty homes]

[Projection with an investment of €52 billion (excluding financing costs) to build six EPR2 reactors]

Conclusions

Even if we take the best-case scenario for new nuclear, and based on the same amount invested, the installation of combined renewable wind/solar infrastructure would **prevent four times more cumulative CO2 emissions by 2050** than the construction of six EPR 2 reactors and **produce triple the amount of electricity** in total over the entire period.

The most sensitive variable in this comparison is a **delay in bringing the first EPR 2 reactor on line, followed by an increase in building costs**. When both variables are combined, the advantage of renewables in preventing greenhouse gas emissions is even more spectacular. Given the highly conservative data used for these calculations, and the **systematic extension of deadlines and cost overruns already witnessed for EPR construction**, the ratios above are only a partial indication of the difference in impact these technologies could have on the decarbonation of France's energy mix.

A public **investment of €85 billion** by 2033 in the HEE retrofitting of draughty homes **would prevent six times more CO2 emissions by 2050** than an investment of €52 billion (excluding financing costs) to **build six EPR 2 reactors and lift nearly 12 million people out of energy poverty** in a decade.

The findings of this report demonstrate the absurdity of the argument that as "a low-carbon energy, nuclear energy is vital to solve the climate crisis", repeated and magnified in public debate by industry proponents and the government of Emmanuel Macron, the objective of which is not to protect the public interest, but to buoy the nuclear industry.

Instead of immobilising billions in a sluggish, exorbitant and uncertain project to build EPR 2 reactors modelled on one of the biggest industrial fiascos in France (the EPR programme), this money must be used to finance measures that rapidly and massively curb greenhouse gas emissions in France. **In addition to having a direct impact on greenhouse gas emissions** in an upcoming decade so crucial to the climate, **the retrofitting of draughty homes and development of renewable energies** like wind and solar power will generate **co-benefits for the population**.

These include the **return on investment** to communities of renewable energies, **enhanced energy security** in the coming years (a security that could be undermined by an ageing current fleet of reactors), and **improved living standards** for millions of people lifted out of energy poverty.

Conversely, **nuclear power generates negative externalities** for society and for future generations, including **radioactive waste**, the long-term management of which is still not mastered, and **a risk of accidents**. **Such accidents are likely** to increase in an overheated world of **shifting geopolitical realities** and a multiplication of conflicts over natural resources. One example is the emergence of conflicts over **water use**, driven by the need to permanently cool nuclear reactors and increasingly complicated access to water.

These findings can be used to inform the debate on how to best invest in France's energy mix today. More than just a matter of technology, this societal decision will affect our energy security and our ability to mitigate and adapt to climate and environmental crises, as well as our ability to solve social crises.

Far less simple a decision than the nuclear industry and the government say, new nuclear, and the programme to build EPR 2 reactors, **is a wrong turn on the road** to decarbonise our energy mix and solve the climate crisis in the short, medium or long term.

Every euro invested in new nuclear is one not invested in an adequate energy transition adapted to the scale of the climate, environment and social emergencies we face.

Recommendations

- **Macron's government must abandon the idea of building new nuclear reactors and not spend resources on a technology that is too slow, too uncertain and too expensive**. Instead, money should be invested in renewables and in making systemic change across different sectors.

- France must **set ambitious climate goals** for the transition from fossil fuels, the development of renewable energies and energy efficiency retrofitting in homes so as to maintain global warming below 1.5°C:
    - **A faster transition away from fossil fuels**, with roadmaps and deadlines written into law for each (coal, oil and natural gas). No new fossil fuel infrastructure should be developed, and the government must backtrack on the floating LNG terminal project in Le Havre.

    - **Ambitious 2030 and 2050 goals to develop onshore wind and solar**, equal to or better than those of neighbouring European countries like the Netherlands, Italy, Spain and Portugal
      and in the longer term, **a 100% renewable trajectory by 2050** based on efforts to fight energy waste (sobriety, efficiency) and social justice.

    - **Public spending must be prioritised for energy efficiency retrofitting**, starting with draughty homes. A surge in HEE-standard retrofitting programmes is needed in the next few years to reduce energy waste, bring down exorbitant energy bills, and lift the 12 million occupants of draughty homes out of energy poverty in the space of one decade.

Appendix 1 – Methodology and calculations for the different scenarios [in French]

Link to Appendix 1

Appendix 2 – Calculation of avoided emissions solar and wind [in French]

Link to Appendix 2

Appendix 3 – Calculation of reductions in CO2 emissions based on different renovation scenarios [in French]

Link to Appendix 3

GREENPEACE

Relaunching nuclear production: a wrong turn for the climate

A comparative analysis of the impact of three investment scenarios on reducing greenhouse gas emissions: renewable energies, energy retrofitting, and the programme to build six EPR 2 nuclear reactors

September 2023