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In response to the climate emergency
Lancaster City Council should embrace the local energy revolution, not old, dangerous, centralised, redundant nuclear technology

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Preface

As the Lancaster City Council climate emergency resolution notes the UN's Intergovernmental Panel on Climate Change (IPCC) says we have just 12 years to make massive and unprecedented changes to global energy infrastructure to limit global warming to moderate levels. (1)

This is why many local authorities, including Lancaster, have passed 'climate emergency' resolutions calling for a reduction in carbon dioxide emissions to zero by 2030. (2)

Climate emergency resolutions are a clear declaration of the seriousness of the issue and the determination of local authorities do everything in their power to achieve reductions in carbon emissions. The number of declarations being made should be used to generate some clear policy asks of government regarding delegation of powers; creation of incentives, funding and so on that can start to unlock local action. Despite the lack of funding, local authorities across the UK are carrying out innovative projects and actions, which can inspire other organisations and authorities to take action without having to reinvent the wheel. (3)

For instance Manchester City Council has set a carbon budget; (4) Bristol has published its City Leap Prospectus designed to attract, facilitate and deliver up to £1bn of low carbon and smart energy infrastructure investment over the next ten years; (5) Brighton and Hove City Council has appointed Brighton Energy Coop as an approved contractor to roll out free solar on the city's schools; (6) Cornwall County Council was the first local authority in the country to develop its own solar farm; (7) Cambridgeshire County Council (CCC) has unveiled two landmark solar-plus-storage projects on landfill sites near Peterborough and is expecting to secure funding to build a 1MW(p) solar carport at one of its park and ride sites. (8)

Nottingham City Council is undoubtedly the leader in terms of climate action. It has an ambition to become the first carbon neutral city in the UK. It has built over 40 renewable energy projects with a capacity of 12MW. It has been carrying out dramatic green makeovers of some council houses using the Dutch "Energiesprong" system which has cut tenants' energy bills in half. Now another 150 social housing homes in Nottingham will receive new wall cladding, windows and solar panels after the local authority won £5m from the EU's European Regional Development Fund. The Council is going to trial new electric vehicle (EV) infrastructure, including battery storage and bi-directional chargers, as part of an EU-funded vehicle-to-grid (V2G) project. The Council plans to embrace a revolutionary concept of using stationary vehicles as energy stores to resupply the power grid. On average, domestic cars sit idle for 95% of the time, and this project allows them not only to be charged, but also to feed electricity stored within their batteries back to the grid or nearby buildings. The Council has introduced a Workplace Parking Levy which generates funds to invest in public transport. It is developing and expanding the City's tram network, improved cycling facilities, and invested in cycle corridors. (9)

Lancaster is home to two Advanced Gas-cooled Reactor (AGR) nuclear power stations, Heysham A and B. Heysham A began generating in 1983 (having taken 13 years to build) and is scheduled to close in 2024. Heysham B opened in 1988 (having taken 8 years to build) and is scheduled to close in 2030. (10) On 19 July 2011 the Government "designated" Heysham as a site suitable for the deployment of new nuclear reactors. Since then, new nuclear reactors have been proposed at six other designated sites, but no proposals have been brought forward for Heysham. (11)

Despite more than a decade of concerted government effort, only one of the 11 nuclear reactors (16GW) the government forecast would be on-line by 2030 has started construction, the plans for seven have collapsed and two more are in doubt. This failure is the result of the high and escalating costs of nuclear power, the unwillingness of financiers to lend money for nuclear projects, the collapse of utility interest in nuclear power, the financial failure of the two major reactor vendors, and the appalling record of the technologies chosen elsewhere. The scope for and attractiveness of alternatives is increasing. Cost-effective energy efficiency measures could more than replace the 16GW nuclear programme while the cost of renewables – offshore and onshore wind and solar PV – has plummeted and is far lower than nuclear. (12)

Here we argue that supporting the development of a third nuclear power station at Heysham would not be an appropriate response to the City Council's climate emergency declaration for three main reasons. Firstly a new station would take too long to build; secondly a new station would not be low carbon; thirdly a new station would be more expensive than alternatives and would detract from the real solutions to the climate emergency, namely a comprehensive energy efficiency programme and the development of renewable energy.

The prospects for Heysham C

On 19 July 2011 the Government "designated" or approved six National Policy Statements for Energy Infrastructure including one on Nuclear Generation. This listed eight sites in England and Wales as suitable for the deployment of new nuclear reactors: Hinkley Point, Wylfa, Moorside, Sizewell, Bradwell, Oldbury, Hartlepool and Heysham. Since then, new nuclear reactors have been proposed at six of those sites. No proposals have been brought forward for Hartlepool and Heysham. But of the six proposals only one – Hinkley Point C has started construction. It is not expected to begin generation until around 2025-27.

Proposed Nuclear Station	**Technology Proposed**	**Developer**	**Construction start expected**	**Commercial operation forecast**
Hinkley Point C	2 x 1600MW EPRs	EDF 66.5% CGN 33.5%	First concrete 2019	End of 2025 with risk of 15 month delay
Wylfa Newydd	2 x 1350MW ABWRs	Horizon Nuclear Power – wholly owned subsidiary of Hitachi, Ltd	Work suspended January 2019	Not Known
Moorside	3 x 1150MW AP1000s (but could be replaced by 2 x 1400MW APR1400	NuGen (was owned by Toshiba –deal to sell it to KEPCO fell through)	Plans scrapped. NuGen being wound up	Not Known
Sizewell C	2 x 1600MW EPRs	EDF 80% CGN 20%	2021	2031
Oldbury B	2 x 1350MW ABWRs	Horizon Nuclear Power – wholly owned subsidiary of Hitachi,	Work suspended Jan 2019	Not Known
Bradwell B	2 x 1000MW UK HPR1000	CGN 66.5% EDF 33.5%	No defined timeline; began GDA process in Jan 2017	Not Known

Taken together with the overarching NPS for Energy (EN1) (13), the Government says the current nuclear NPS (14) sets out the need for nuclear power, whilst also providing planning guidance for developers and for the Planning Inspectorate and Secretary of State in their consideration of applications.

Yet when the Government first endorsed Hinkley Point C, (HPC) it was projecting an increase in electricity consumption of 15% by now, whereas in practice we are consuming 15% less than a decade ago. In other words it made a 30% error – there is, in fact, no need for Hinkley Point C. This is despite a 13% increase in GDP over the last decade. HPC is only due to deliver 7% of consumption.

The UK's energy statistics for 2017 confirm the continuing trend of falling energy consumption. Primary energy consumption has now fallen by 19% since the start of the century. This has happened even though our overall wealth as a nation has grown over that period by well over one-half. In other words we have succeeded in decoupling growth in living standards from growth in energy consumption. (15)

There has been a consumption revolution over the past decade prompted by vastly improved electricity efficiency in industry, in consumer white and brown goods, and in areas like lighting, where household consumption has dropped from 20.7 TWh (terawatt hours – a billion units of electricity) in 2007, to 19.3TWh by 2010 and 14.2TWh by 2016. This trend is set to continue. By 2025 LEDs will probably have replaced most CFLs and incandescent light bulbs, and LEDs themselves are becoming more efficient.

Nuclear power plants take too long to build

According to the International Atomic Energy Agency (IAEA) the global average time to build a nuclear power station is 7.5 years. (16)

Hinkley Point C was first proposed as a site for a new nuclear power station in 2008. (17) Since then the project has seen huge delays and price escalation even before construction started. The station is not expected to start generating electricity until 2025 – 27, assuming it is built on time. So the whole process will have taken almost 20 years. It was originally expected to be generating electricity by 2017, but construction had not even started by then. (18)

In 2005 construction started on the first EPR – the same reactor type as Hinkley Point C - at Olkiluoto 3 in Finland, with an estimated start date of 2010. Under the latest schedule, fuel will now be loaded into the reactor core in June 2019, with grid connection to take place in October, and the start of regular electricity generation scheduled for January 2020. (19) Not only has the project taken three times as long to build, but it has also seen costs balloon. In 2012 the project was already expected to cost about €8.5 billion, nearly three times the reactor's original €3 billion price tag.

The second EPR, being built at Flamanville in Normandy, has not fared any better. Construction started at the end of 2007 and was slated to end in 2012, at a cost of €3.3 billion. On current estimates it will cost €10.9 billion (20) and it could be delayed until as late as 2022. While construction has almost finished, substandard quality welds were discovered in February and April 2018. (21) EDF Energy is also going to have to replace the pressure vessel lid in 2024. (22)

Lancaster City Council has resolved to make the Council's activities net-zero carbon by 2030. Clearly a new nuclear power station could not be built in time to play any role in achieving that. At the time of writing Theresa May is moving to enshrine a net zero emissions target into UK law, setting a goal to effectively end greenhouse gas emissions by 2050. The Committee on Climate Change will soon advise on the sixth carbon budget (covering the years 2033-2037). Currently the 5th Carbon Budget has been set to achieve a 57% reduction in emissions by 2030 relative to 1990, but this was set on the basis of achieving only an 80% reduction by 2050. The next target will have to be much closer to the Scottish target of 70% by 2030 (to achieve net zero carbon by 2045). In other words the bulk of greenhouse gas emissions reductions will have to be achieved well before any new nuclear power stations could be built at Heysham. (23)

Nuclear Power is not low carbon

Mark Z. Jacobson, director of Stanford University's Atmosphere and Energy Programme says: "*There is no such thing as a zero or near-zero-emission nuclear power plant*". With construction taking anything up to 10 to 15 years longer than renewable projects the emissions not saved over those years should be taken into account. Jacobson's paper cites the Olkiluoto 3 reactor in Finland, the Hinkley Point nuclear plan in the UK and Vogtle 3 and 4 reactors in Georgia, among others, as examples of projects for which planning began in the past decade and whose entry into commercial operation is still far from complete. Utility scale solar or wind schemes take about 2-5 years to begin commercial operations – nuclear effectively emits 64-102g of CO_2 per kilowatt-hour of plant capacity just from

grid emissions during the wait for projects to come online or be refurbished, compared to wind or solar farms. (24)

Jacobson argues that even existing plants emit carbon dioxide due to the continuous mining and refining of uranium needed for the plant. However, all plants also emit 4.4g-CO2e/kWh from the water vapour and heat they release. This contrasts with solar panels and wind turbines, which reduce heat or water vapour fluxes to the air by about 2.2 g-CO2e/kWh for a net difference from this factor alone of 6.6 g-CO2e/kWh.

All energy sources produce some carbon emissions during their life cycle. There will be CO_2 emissions generated to make the steel to build wind turbines for example. It can be quite complicated to work out the life cycle emissions for nuclear power. Professor Benjamin Sovacool, now at Sussex University, has looked at 103 different studies and concluded that the mean value is about 66 grams of carbon dioxide for every kWh produced by nuclear power. This compares to about 9g for wind, 32g for solar and 443 for gas. This puts nuclear as the third highest carbon emitter after coal-fired plants and natural gas. (25) If a large programme of reactors were built around the globe, life-cycle emissions would increase as the quality of uranium used decreased, making it necessary to use more energy to get the uranium out of the ground. (26)

New nuclear costs more and detracts from cheaper alternatives

The commonly quoted additional cost to consumers for Hinkley Point C is £30 billion (27) Professor Steve Thomas et al say this is the net present value (discounted) of the total subsidy to Hinkley to be paid by consumers over the 35 years. The actual additional cost to consumers could be as much as £100 billion in today's money. The high price made the deal so unpopular even with nuclear power enthusiasts that the government determined that new financial models would be needed that would appear to produce lower prices. In fact the only way the strike price can be significantly reduced is by reducing the risk to the developers and financiers, which will reduce the cost of capital at the expense of consumers and taxpayers. The record of large reactors is so poor in terms of cost and lead-time, it is hard to understand why the UK is still pursuing this option. It is still likely it would be cheaper for consumers if Hinkley Point was abandoned and penalties paid, while the other projects can all be abandoned at no additional cost to the public – all expenses incurred by the developers to date have been at their own risk. (28)

"*New nuclear power seemingly represents an opportunity for solving global warming, air pollution, and energy security*," says Mark Jacobson. But it makes no economic or energy sense. "*Every dollar spent on nuclear results in one-fifth the energy one would gain with wind or solar* [at the same cost]." (29)

Prices of renewables have fallen sharply in the past few years, for example, the cost of offshore wind fell from about £140/MWh to £57.5/MWh in only four years with every prospect that prices will fall further. (30) If the Government were to lift their block on onshore wind farms to help meet the UK's ambitious climate targets energy bills could be cut by £50 a year compared to a high-gas energy mix according to new research commissioned by the trade body, RenewableUK. The analysis undertaken by Vivid Economics shows that growing onshore wind from 13GW today to 35GW by 2035 would reduce the cost of electricity by 7%. Onshore wind is expected to be cheaper than gas-generated electricity because of plummeting turbine technology costs and the rising cost of carbon emissions. (31)

Energy efficiency should also be at the top of the list to replace a new nuclear programme. In the past decade, UK electricity demand has declined significantly despite the lack of a strong energy efficiency programme. This will have the double benefit of reducing consumer bills and hence fuel poverty as well as reducing greenhouse gas emissions. If natural gas is to be replaced as the primary space heating fuel by electricity or hydrogen, it is essential if this is to be affordable that the heating load is minimised. Recent work by the UK Energy Research Centre has shown that currently cost effective investments in energy efficiency could save around a quarter of the energy now being used. This is equivalent to more than the output from the whole of the Government's originally planned 16GW of new nuclear, could be more rapidly and reliably delivered on time and to budget. (32)

Many advocates of new nuclear construction call for a "balanced energy policy" and promote the idea that 'we need every energy technology' in order to successfully tackle the climate change problem. This idea suggests that we have infinite amounts of money to spend on energy projects, which is obviously nonsense. Resources are scarce, so we need to make choices. Because climate change is a serious and urgent problem then we must spend our limited resources as effectively and quickly as possible - best buys first, not the more the merrier. For each pound we spend we need to buy the maximum amount of "solution" possible. (The "least cost" solution) Investment in more expensive nuclear power will, in effect, worsen climate change because each pound we spend is buying less solution than it would do if we were to spend it on energy efficiency and renewables. (33)

Amory Lovins of the Rocky Mountain Institute points out that a kilowatt-hour from a new nuclear power station costs at least three times as much as saving one through efficiency measures. Thus every dollar spent on efficiency would displace three times more coal or gas than a dollar spent on new reactors. But, perhaps more importantly, the savings from spending on efficiency can go into effect much more quickly, because it takes so long to build reactors. (34)

National Infrastructure Assessment

The UK's first National Infrastructure Assessment advised the Government not to agree to support more than one nuclear power station beyond Hinkley Point C before 2025. The Commission said:

"*The UK can and should have low cost and low carbon electricity, heat and waste. Ten years ago, it seemed almost impossible that the UK would be able to be powered mainly be renewable energy in an affordable and reliable way. But there has been a quiet revolution going on in this area*." (35)

The Committee on Climate Change (CCC) has said that "*If new nuclear projects were not to come forward, it is likely that renewables would be able to be deployed on shorter timescales and at lower cost.*" (36)
A careful reading of the evidence produced by the CCC completely upends the former received wisdom that renewable energy could not, on its own, achieve the UK's long term carbon emission reduction targets. The old argument that large quantities of nuclear power are necessary has been quietly side-lined. Rather, the evidence presented by the CCC says that not only can renewables do the whole job, along with energy efficiency, on their own, but they can do things much more cheaply than either nuclear power or carbon capture and storage. (37)

The CCC argues that investment in renewable energy will save consumers money, whilst investment in nuclear power and carbon capture and storage will cost a lot more. The CCC estimate renewable energy resources to be very large - 29-96 of GW of onshore wind, 145-615 GW of solar power and 95-245 GW of offshore wind. Using the lower end of the range, the electricity would be enough to provide all of the electricity needed for a net zero energy economy in the UK. That's not even counting other renewable energy sources, including biomass and marine renewables. (38)

Cornwall Insight – an influential energy consulting firm - says wind and solar capacity could replace the need for additional nuclear power in the UK. It says that meeting UK's fourth (2023-27) and fifth (2028-32) carbon budgets without commissioning new nuclear capacity is a real possibility. Not only this, but the forecasts predict that meeting these targets can be achieved at a lower cost compared to developing a new fleet of reactors. Continual improvements to the development and operation of renewable technologies such as wind and solar see them become increasingly cost-effective, allowing the UK to meet its targets without the need for additional new nuclear capacity. (39)

Ben Hall, head of new business at Cornwall Insight, said its latest forecast marked a "*notable shift away from previous thinking*" that new nuclear would be needed to meet climate targets in the UK. Wind and solar are increasingly competitive on costs and could well negate the need for new nuclear capacity, he argued. (40)

It is also worth noting that the National Infrastructure Commission chief economist James Richardson has urged caution over the idea of relying on small modular reactor (SMR) technology to replace

cancelled and decommissioned nuclear power projects. He says the industry has failed to deliver on technological promises in the past. "*You have to have a degree of caution with new nuclear technology*," he said. "*We have been promised things time and time again and typically the industry tends to be more expensive and take longer than planned. I would be cautious against SMRs, they are a question for the 2030s*." (41)

Even existing nuclear could be phased-out

The Energy and Climate Intelligence Unit says if the UK's nuclear regulator find that cracks, like the ones found in the core of the UK's oldest AGR reactors at Hunterston B in Ayrshire, are worse than expected, a mixture of renewable generation technologies – onshore wind, offshore wind and solar PV – would be the lowest cost option, with cumulative savings to 2035 up to £18 billion compared with natural gas-fired power stations. (42)

An accelerated programme to replace all the lights in the UK with LEDs could cut peak electricity demand by about 8GW – almost enough to replace all existing nuclear capacity. LEDs produce less waste heat and so can sometimes cut the need for air conditioning in places such as hotels and large office buildings. Even a much more restricted national campaign that just focused on domestic houses would have a dramatic impact. If we switched the lights in the parts of the house that are in use in early evening - essentially the kitchen and living areas - we would reduce home demand by more than 50%. We could cut the typical demand for electricity to run lights from today's evening average of 180W to 80W by replacing about 21 bulbs in the typical home. The impact would reduce peak electricity demand by 2.7GW – almost the capacity of Hinkley Point C. The payback period of such a scheme is about two years at last year's LED prices. For an expenditure of around £60, the householder would typically save £30 a year. (43)

Nuclear energy use impedes renewable energy development

Renewable energy is now relatively cheap and becoming cheaper, and needs little or no public subsidy - a big contrast with new nuclear, which despite all the promised support, high consumer subsidies, public guarantees of loan funding has failed so far to generate a single kWh. And it will not until at least 2026 even if EDF's schedules for Hinkley C construction prove (miraculously in the light of recent nuclear construction history) to be achievable. EDF Energy has now indicated that households could be expected to pay about £6 a year extra on their utility bills to fund the Sizewell C project. (44)

Even if only some of the new nuclear power stations proposed come online, new renewable energy would be crowded out. This is because electricity contracts given to nuclear power give them 'dispatch priority' over renewable energy, causing windfarms and solar farms to be turned off to give priority to nuclear power. Indeed, this is already happening with our current levels of nuclear and renewables. Renewable energy generated 33% of UK electricity in 2018, a figure that, with the recently announced 'sector deal' for offshore wind, will increase to around 65% by 2030 even without any more onshore wind and solar pv. If we had 35% coming from nuclear power, there simply wouldn't be any market space for any more renewable energy. (45)
New nuclear plants would get in the way of expanding renewables, because they are inflexible and can't balance the output from variable renewables like wind and solar. We need to invest in flexible supply and demand side balancing systems, smart grids, and storage, including electrolytic 'Power to Gas' hydrogen production, using surplus renewables power, stored ready for conversion back to electricity when renewables inputs are low. Baseload plants are inefficient and cannot meet demand as needed. In fact, nuclear energy has the lowest flexibility and the worst response speed compared to all other power technologies. (46)

Nuclear power stations are not resilient to climate change Nuclear power plants function inefficiently or are forced to close during droughts and heatwaves. And many nuclear plants are located along coastlines. As seas rise, coastal nuclear power plants could be at-risk from being flooded making them inoperable. Their radioactive waste inventories, if not moved in time, could be in danger of leaking into the oceans. Using nuclear plants to address climate change involves unacceptable risks Nuclear power involves major risks, including: a higher probability of serious accidents; a mounting and

unsolved radioactive waste problem; and increased nuclear proliferation. Renewable energy risks none of these. Why replace one risk – climate change – with another – nuclear accidents and radioactive waste – if we don't need to.

Conclusion

An 'Energy Revolution' is already happening across the UK and local authorities like Nottingham, Bristol and Manchester are leading the way. Lancaster should be aiming to catch up quickly. Local government is fast becoming established as the democratic route to engaging the community in decisions about clean energy and low energy buildings – it offers the opportunity to share the benefits of the energy revolution equitably. With planning powers, a large number of public buildings, a fleet of public vehicles, and responsibility for social housing, economic regeneration, transport and social care local authorities are in a unique position to play a major role in this 'revolution' as well as being critical to delivering on carbon targets, keeping energy bills down, tackling fuel poverty, improving health and creating jobs. (47)
Supporting a third nuclear power station at Heysham would threaten these potential gains. A new station would take too long to build; it would not be low carbon; it would be more expensive than alternatives and would detract from the real solutions to the climate emergency, namely a comprehensive energy efficiency programme and the development of renewable energy.

Multinational investment bank, UBS, says large centralised power stations could be obsolete with 10 to 20 years because they are too big, inflexible, and "not relevant" for future electricity generation - it is "time to join the [solar] revolution". The UBS report follows similar analysis by other large financial institutions and energy experts including Goldman Sachs, Barclays, Bloomberg and Citigroup who expect new solar and renewable technologies to drive rapid change in large scale utility companies. (48) At the rapid rate of change in small-scale renewable and energy efficiency technologies, any proposed new nuclear reactors at Heysham would obsolete before they are built, yet consumers could still be forced to keep paying for these redundant white elephants. In addition Lancastrian citizens will have failed to benefit from the democratic gains which can be achieved if the City Council fully embraces the energy revolution now.

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