To: Development Management
Eden District Council
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From: Dr Henry Adams
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Cumbria [redacted]

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FAO Case Officer Miss G Heron

25 November 2020

Dear Miss G Heron and Development Management,

Planning application numbers 20/0787 and 20/0790 LAND EAST OF A6 SHAP
2 x Installation of a flexible gas peaking plant and associated infrastructure to support local grid and renewable energy generation

I am writing to object most strongly against the above 2 applications to install a pair of gas peaking plants, each comprising 5 gas engines, which together will result in unacceptably high carbon emissions of around **90,000 tonnes of CO2e per year** (**90 million kg CO2e pa**), which is equivalent to the production emissions of **over 11 thousand UK people**, and over two-thirds of the population of Eden District's largest town Penrith. This would make a mockery of the carbon savings that residents would make if they did the right thing to replace their gas boilers with electric-powered heat pumps – to reduce carbon emissions from burning gas!

Climate scientists state clearly that we need to reduce most of our CO2e emissions this decade, by around 10% per year for the UK, and this includes emissions from natural gas (fossil methane). So if Eden District permitted the addition of such big emissions this would make a mockery of the Climate Emergency that EDC declared, as well as its position in the Zero Carbon Cumbria Partnership. The SLDC rejected a peaking plant in 2018; so now should the EDC.

In summary, I am objecting to the use of gas peaking plants (which usually use reciprocating engines as here) because research shows that these are a very high carbon option for balancing the grid at times of peak demand, a purpose much better fulfilled by much lower carbon alternatives such as batteries, and/or even better: balancing methods that shift some of potential peak demand to other times of day when supply is higher than demand (i.e. time-shifting Demand Side Response [DSR] and Smart Grid technology with e.g. vehicle-to-grid V2G short-term storage), and with new methods for longer term storage such as cryo-batteries aka 'liquid air' storage as being built now near Manchester.

The use of Internal Combustion Engines such as reciprocating engines burning fossil fuels such as natural gas would be a very backward step, undermining the purpose of replacing natural gas boilers with heat pumps - that of reducing combustion of fossil fuels and their resulting emissions.

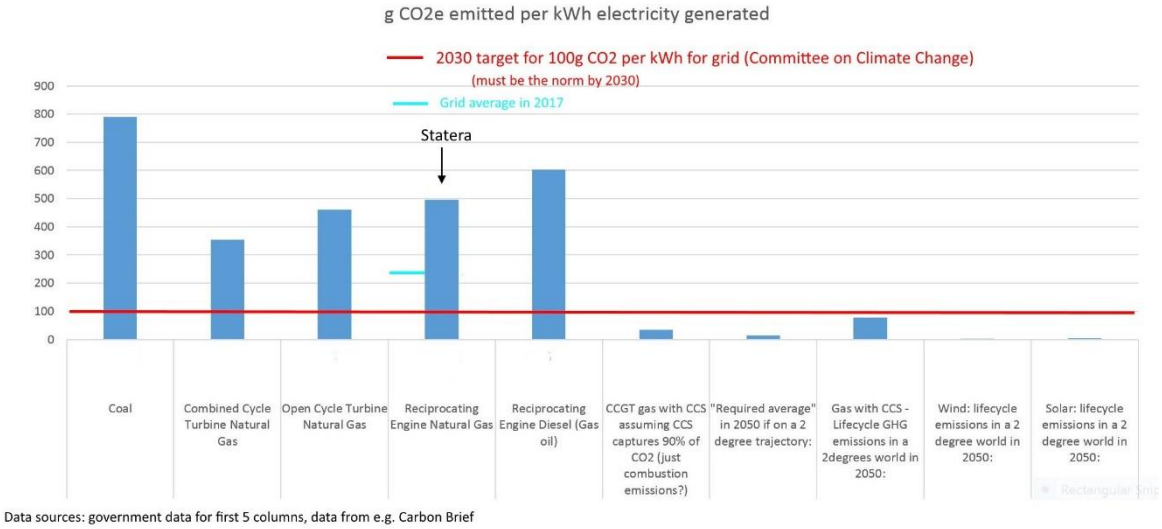
Omission of emissions: It should be clear to you now why the applicant has omitted an Environmental Statement on its CO2e emissions (and what they imply), which is a major omission – especially for such a high emissions fossil fuel burning project, and which EDC should insist it does.

The CO2e emissions from the gas peaking plants

Carbon intensities compared (gCO2/kWh) (= kgCO2/MWh)

In 2018 I produced the chart below, which compares the carbon intensity of gas peaking plants ('Reciprocating Engine Natural Gas', with black arrow labelled 'Statera') with a variety of other electricity generating methods, and with the 2030 target of 100g CO2 per kWh:

The carbon intensity of gas reciprocating engines in grams CO2e emitted per kWh of electricity generated as compared with coal, other fossil fuels, wind and solar, the grid average in 2017 and CCC's target for 2030 of 100g CO2 per kWh



Data sources: government data for first 5 columns, data from e.g. Carbon Brief

The carbon intensity figure for gas reciprocating engine peaking plants of **500g CO2 per kWh** (a government figure) is very obviously high carbon, being around 60% of that of coal, 5 times higher than the Committee on Climate Change target for 2030 of 100g CO2/kWh, and in magnitude around 100 times that of clean green renewables such as wind and solar.

Also the following chart shows that the 500 gCO2/kWh is over double the average carbon intensity of UK's grid over the last 3 years:

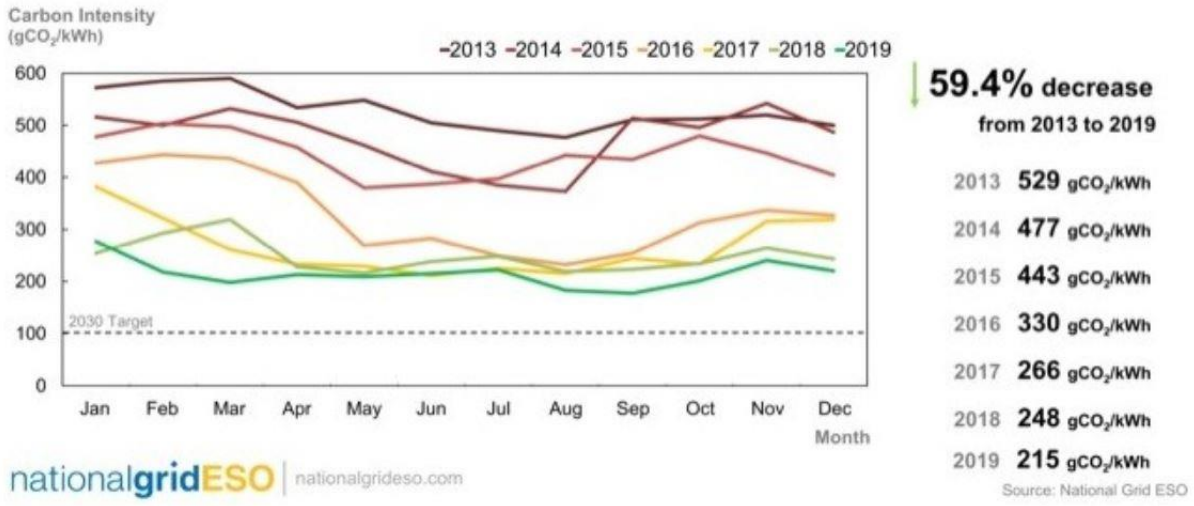


Chart source: ESO data shows record breaking year for Britain's electricity | National Grid ESO
https://www.nationalgrideso.com/news/eso-data-shows-record-breaking-year-britains-electricity

It is clear that the carbon intensity of gas peaking plants is unacceptably high, especially when we have much lower alternatives for balancing the grid such as batteries and demand-side response.

Note that the CCC's 2030 target of 100gCO2/kWh relates to the unamended original 2008 Climate Change Act, which was for a path slightly above 2 degrees C, and thus above a path compliant with the temperature goals statement of the 2015 Paris Agreement. The UK grid carbon intensity should thus be aiming to be well below 100g by 2030 if possible – by both exclusion of coal and also reductions in gas use for electricity generation.

Carbon emissions per year

In my opening paragraph I wrote that the pair of gas peaking plants, each comprising 5 gas engines, together will result in unacceptably high carbon emissions of around **90,000 tonnes of CO2e per year** (**90 million kg CO2e pa**), which is equivalent to the emissions of **over 11 thousand UK people**, which is over two-thirds of the population of Eden District's largest town Penrith. The simple calculations for these figures are given in the appendix below. The applicant expects to run these inefficient plants for 46% of the year. This is an unacceptably long and inappropriate summed-duration for such peaking plants, especially when they are of such high carbon inefficiency. The purpose should be occasional brief backup.

It is unacceptable that the applicant did not provide figures for carbon emissions for this high carbon project, and did not explain how the gas plants could possibly be acceptable when we have to urgently and steeply reduce such emissions, including from gas combustion. The EDC should not even consider such applications without a climate impact assessment.

There is also no explanation as to why batteries with DSR methods would not achieve the required grid-balancing. And the reasons stated for the need for the peaking plants are incorrect. For example electric cars would assist grid-balancing (with V2G and a Smart Grid), not increase the demand peaks so requiring more capacity for grid-balancing. Also Heat Pumps are unlikely to increase demand peaks as Jaki Bell explains in her excellent objection statement.

The gas peaking plants go in the opposite direction we need to go in order to comply with the temperature goals of the 2015 Paris Agreement, which require an urgent and rapid reduction in the burning of gas – as stated in the study '**Natural Gas and Climate Change**' by climate scientists Professor Kevin Anderson and Doctor John Broderick of the Tyndall Centre for Climate Change Research, Manchester.[1]

Professor Kevin Anderson states that "If the EU is to transform its energy system to align with the Paris temperature and equity commitments, it cannot continue with business as usual and must instead initiate a rapid phase out of all fossil fuels including natural gas. This needs to begin now and be complete within the coming two decades."

The report states that "Current levels of emissions will use up the EU's 2°C carbon budget in under nine years". I'll add that the UK's carbon budget for any good chance of keeping average global temperature rise below +1.5 degrees is now close to zero. We cannot possibly increase burning of fossil gas, as gas peaking plants will do, and in a very inefficient way.

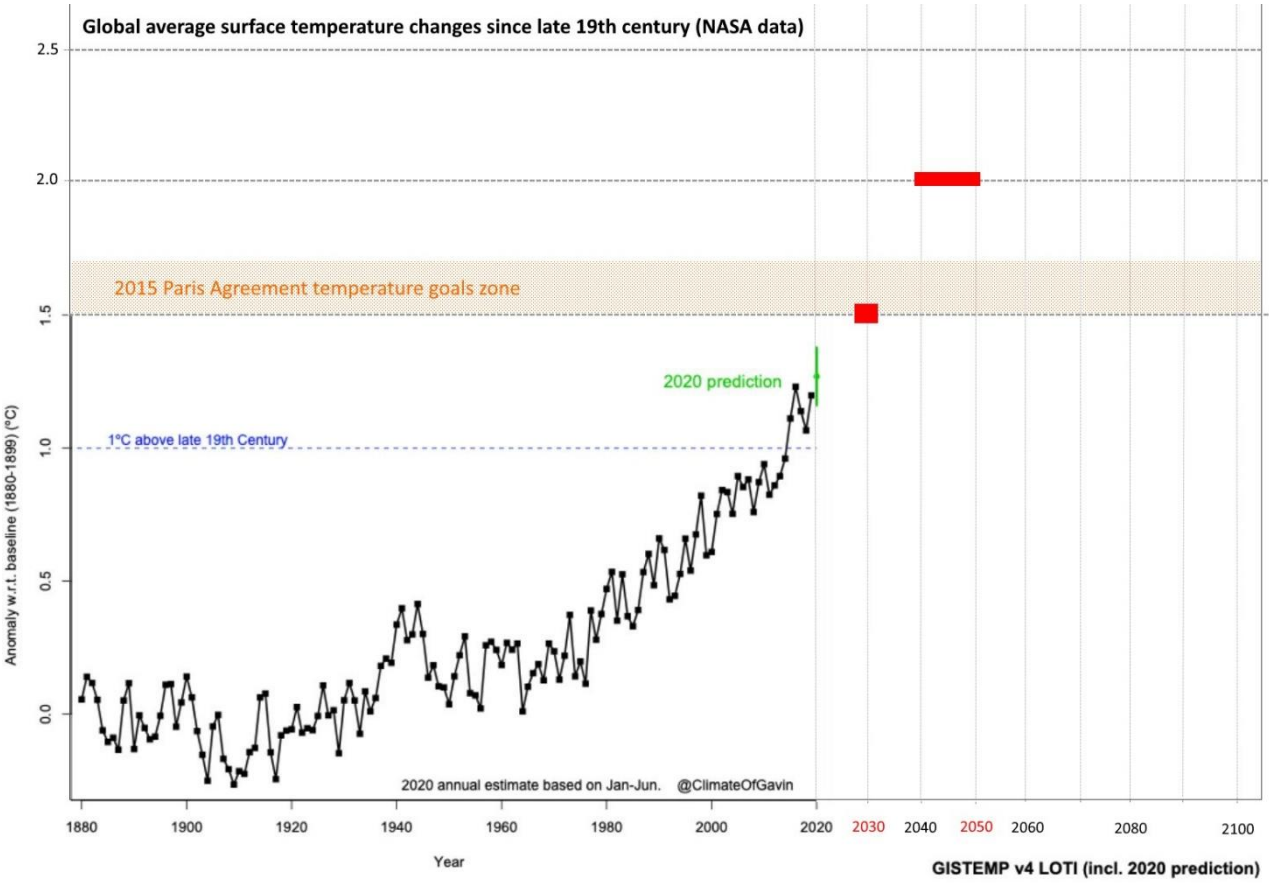
[1] '**Natural gas and climate change**' (pdf) via www.foeeurope.org/NoRoomForGas 17oct17, released 7nov17, by Prof Kevin Anderson, University of Manchester & Uppsala University & Dr John Broderick, University of Manchester & Teesside University - commissioned by Friends of the Earth Europe. via www.foeeurope.org/NoRoomForGas - '**Natural gas and climate change**' (pdf) 17oct17, released 7nov17, by Prof Kevin Anderson, University of Manchester & Uppsala University & Dr John Broderick, University of Manchester & Teesside University - commissioned by Friends of the Earth Europe. [Further info in References & below]

The climate context

In 2015 the UK government signed up to The Paris Agreement on climate change. The most important part is the **temperature goals statement, and is for nations to be, I quote:** "holding the increase in global average temperature **to well below 2 degrees C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 degrees C above pre-industrial levels**". We are now at 1.1 to 1.2C.

Keeping below 1.5C is especially important for low-lying coastal areas and islands already vulnerable to flooding associated with sea-level rise, and also to hotter and poorer nations who've contributed least to emissions but are already suffering the most.

This graph plotted from NASA data shows changes in average global temperature from 1880 to this summer:



The orange band shows the Paris temperature goals which we need to keep below, or at least try not to exceed.

This graph makes clear that if we don't make most of our emissions reductions towards net zero ***this*** decade **by 2030** we will cross 1.5C as soon as around 2030 if not before, which is what climate scientists predict, and is shown by the red square.

Also if we continue on our present fossil-burning course to 2050 before we make a sudden major reduction, ~~as the report recommends,~~ we will not just fail to meet Paris goals but will also risk crossing +2 degrees C at between 2040 and 2050, as shown by the red band, with the loss of all coral reefs and other dreadful results.

Much of the quantity of carbon dioxide, once emitted, stays in the atmosphere for many decades, or even centuries or longer. This means that the heating effect is related ***not*** to the rate of emissions at that point in time, such as at 2050, but the ***accumulated*** emissions ***up to*** that point in time. This is an *additional* reason why most of the emissions reductions to net zero must be made as soon as possible this decade and not left until near the 2050 UK Net Zero target date.

The United Nations Environment Program states that the world now needs to reduce emissions by **7.6 per cent per year this decade**, and Professor Anderson calculates that for the UK this means **by 10% per year this decade** for reasons of equity.

The gas peaking plants would add substantial emissions just at a time we need to steeply reduce them. They are obviously incompatible with meeting the Paris temperature goals target.
And their purpose for balancing the grid can easily be fulfilled by batteries with Demand Side Response and longer-term storage methods if also required.

Low to zero carbon alternatives for balancing the grid

The most obvious alternative to the gas peaking plants is battery storage [see text box below]. These are very good for short-term grid balancing, and especially so if combined (more in the future) with time-shifting of energy consumption using Smart Grid and for example Vehicle to Grid (V2G) with electric cars/vehicles, and a number of other methods I wish I had time to summarize.

Though these lower carbon methods are for short-term storage and grid-balancing, other methods are being developed for long-term storage such as gravity-based methods (raising & lowering a heavy weight in a mine-shaft) and Cryo-batteries: the 50MW/250MW liquid air storage plant being built near Manchester by Highview which will store enough power for supplying roughly 50,000 homes for five hours (1 of 4 of these that will be able to store more than 1GWh in total). [link in appended references]

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I most strongly endorse the objection statement by Jaki Bell, which has a more comprehensive coverage than I have had time to make in the short time I have had available, and I am relieved to read it covers points very well that I had wanted to make but don't have time to do so, as well as points I hadn't thought of. I also endorse the professional report by Tom Bradley (with Frankie O'Keeffe), and other climate-based objections I have read.

There is no way that these gas peaking plants can be justified, and the applications must be rejected on climate grounds, with full use of climate statements in local and national (e.g. NPPF) planning policy guidelines, and reference to the Paris temperature goals statement and climate science.

Yours sincerely,

Dr Henry Adams
Consultant Ecologist, Kendal, Cumbria

Appendices then References below

Appendix

The following text box on batteries has been copied and pasted from my 2018 objection letter to SLDC for Statera's application for a gas peaking plant near Kendal:

BATTERIES are better for grid balancing

Recent reports show that batteries will do the same task of balancing the grid (providing for peaks in demand) as "gas peaking plants" but without the high carbon intensity.

My collation for this was over-winter 2017-18 and since then I expect there are even more publications on this topic because this field is changing so rapidly both in information, technology and costs (towards batteries and away from gas, though at this moment Statera have chosen gas here).

A 2016 report by the UK's **National Infrastructure Commission (NIC)** favours batteries and other storage for grid-balancing, as opposed to numerous small fossil fuel power stations (I presume it means gas peaking plants) together with demand flexibility via a smart network. This followed on from the government's 2015 report 'Towards a smart energy system' which contains an infographic advocating a smart network to reduce the costly "need" for gas peaking plants ("need" being government's word not mine; the scenario has shifted more to batteries since 2015). [20]

The Queen's University Belfast (QUB) have been doing comparative research into batteries versus gas-burning for grid stabilisation and their findings are summarized within an article in Current News: "… recent research from Northern Ireland's Queens University Belfast (QUB) finds that battery-based energy storage can provide inertial response for system reliability much more efficiently, at a lower cost and with substantially reduced emissions than a much larger quantity of thermal generation. …". The 17jan18 article is **Energy storage 'digital inertia' could stabilise the grid better than thermal generation** – Marek Kubik (*Market director at Fluence*) in Clean Energy News [Fluence is a joint company owned by Seimens and AES)] [5]
Because this work appears to be a collaboration with industry it must be "taken with a pinch of salt".
But in essence it shows that batteries can be very good at showing very rapid corrective responses to rapid supply frequency drops (RoCoF's = Rate of Change of Frequency) that can be damaging to the grid and consumers, and can supply Enhanced Frequency Response (EHR) (means response within 0.5second of a RoCoF) as well as Fast Frequency Response (FFR) (within ?30seconds) (or that is my quick interpretation as a non-grid-expert!).
This is a slightly different response than providing electricity over a longer period. Information elsewhere though does shows that 50MW batteries can supply electricity over a duration of, or up to, 4, 8, 10 hours.

In Ireland: '**Centrica's 100MW proposal pits battery against gas turbine'** - By David Pratt 9 Jan 2018 [6]
Note: in that case it's an OCGT not a gas reciprocating engine – but both are high carbon. Though gas turbines have lower carbon intensities than gas reciprocating engines in the above chart, if they are ramped up and down as "gas peaking plants" this significantly reduces their efficiency, and carbon intensities are increased (CCGT suffers especially in this way - only being efficient if run at "high utilization rates" as base-load. Also they have higher capital costs). Disappointingly climate change and carbon emissions seem hardly mentioned as a factor for deciding between the two options.

And at Barrow-in-Furness:
20feb17 **Centrica to start construction of new battery storage facility at Roosecote** It's 49MW [7]

Centrica of course is in the gas industry (and wrongly finances fracking), so its backing of batteries is interesting…

Articles from the US state that batteries would soon be cheaper per unit electricity released than gas peaking plants for the purpose of grid balancing. This appears to be already happening in the UK (but via CfD auctions).
14feb18 **Solar plus storage beats out "cheap" gas to serve evening peaks** [US] By Giles Parkinson [8]

Affordable Batteries Could Eliminate New Natural Gas 'Peaker' Plants After 2025 - The Energy Mix – [9]
12dec17 **Have We Reached Peak Peaker? 'I Can't See Why We Should Build a Gas Peaker After 2025'** The trend lines aren't looking very good for natural-gas peaker plants. By EMMA FOEHRINGER MERCHANT, DECEMBER 12, 2017 [10]

Also US: **Burning the Gas 'Bridge Fuel' Myth – Greg Muttitt and Lorne Stockman - Oil Change International, November 2017** http://priceofoil.org/2017/11/09/burning-the-gas-bridge-fuel-myth/ [11] - links to pdf report. "It makes no sense to install gas today to address renewable energy-related grid stability issues that may or may not be a concern ten years from now. It is a solution without a problem. Indeed, where high renewable energy penetration exists today, such as in the U.S. states of Texas and California, gas plant utilization rates have dropped and gas demand has declined, suggesting that those systems already have more gas generation capacity than they need. …" Both CCGTs and OCGTs dismissed as peakers in here too:
Amber Lin: "Natural gas as a transition fuel: A bridge too far?," Bulletin of the Atomic Scientists, July 20, 2016. https://thebulletin.org/natural-gas-transition-fuel-bridge-too-far9671 [12]

My conclusion to this section:
In my oral presentation in January [2018] I said: "Thus why waste money building costly gas peaking plants when they will have such a limited life – to become out-competed by battery storage, then rendered obsolete by smart network methods and incompatibility with climate requirements?" To which I'll add that batteries can now be used as a viable alternative.

CO2 emissions calculations

1 tonne = 1,000 kg (metric tonne not imperial) & 1Mt=1,000,000t

Firstly the MWh electricity produced per year is calculated by multiplying the applicants figures for 4000 hours per year by the 22.5 x 2 MW of the 2 peaking plants.
The result is then multiplied by the 500 kg CO2 per MWh government conversion factor for gas peaking plants to get the total emissions per year.

The peaking plant will run for:
365x24=8760 {or if accounting for a leap year add 24/4=6hrs thus 8766}
and 4000/8760=45.66% & 4000/8766=45.63%

Carbon intensity: **500g CO2 per kWh** = **500kg per MWh** for reciprocating Engine using fossil gas.
(This figure from my 2018 chart which used a government figure for this)
It is simpler to start with the 500kg per MWh conversion factor:

For one of the 2 peaking plants:
22.5MW x 4000 hrs = 90,000 MWh per year
90,000 x 500kg = 45,000,000 kg CO2 per year = 45 million kg CO2 pa = **45,000 tonnes CO2 pa**
= 0.045Mt pa.
Over 10 years = 0.45Mt

For the 2 peaking plants together:
45MW x 4000 hrs = 180,000 MWh per year
180,000 x 500kg = 90,000,000 kg CO2 per year = 90 million kg CO2 pa = **90,000 tonnes CO2 pa**
= 0.090Mt pa.
Over 10 years = 0.90Mt

If 1 UK person produces 8.1 tCO2e pa then one of the two Shap peaking plants would emit 45,000/8.1 = emissions of 5,555 UK people, and both of the peaking plants together would emit 90,000/8.1 = emissions of 11,111 UK people.

Source: The 8.1 is from BEIS (2019) https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2017 It is production emissions per head not consumption emissions.

Note that the plant "can provide energy security to 25,000 homes across the local network" – only 5x number of people referred to above for one peaking plant, so if we compare the emissions with the savings in emissions from 25K homes – ask whether the added emissions will negate the saved emissions from replacing gas boilers with heat pumps (with adequate insulation) …

Population of Kendal is about 30,000, and of Penrith c. 16K

References and links

Links to relevant online documents by Henry Adams re Statera's planning application for a gas peaking plant at Old Hutton near Kendal. Mostly 2018.

(relevant to the gas peaking plants at Shap)

www.bit.ly/gasrecip5
Oral presentation on behalf of SLACCtt at SLDC planning committee meeting on 2nov18 re Statera's re-application for a gas peaking plant at Old Hutton

www.bit.ly/gasrecip4
SLACCtt's letter in Westmorland Gazette on Statera's proposed gas power station at Old Hutton

www.bit.ly/gasrecip2
SLACCtt's main submission document in 2018 to SLDC on Statera's re-application for a gas power station at Old Hutton

www.bit.ly/gasrecip
A hub document providing relevant links.

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6nov20 **UK energy plant to use liquid air** By Roger Harrabin, BBC environment analyst UK energy plant to use liquid air - BBC News and:
“Professor [Yulong] Ding [Birmingham University] told me [David Toke]: ‘With this technology you can store gigawatts and even terrawatt hours of renewable energy for weeks or months (which can also serve short and medium term needs), and the leakage is, maybe a fraction of 1%. Nearly 60 per cent of the initial renewable electricity input can be recovered after storage. Recent developments of the system have shown that the technology can be used for combined heating, cooling and power, which can have an efficiency at least 70%’.” Is this the technology that makes 100 per cent energy from renewables the most practical solution? - 100% Renewable UK (100percentrenewableuk.org)
18jun20 **World first as liquid-air energy storage makes commercial debut near Manchester United ground -** Highview Power's 50MW/250MWh facility to be built in same village as football club's training complex after receiving £10m government grant World first as liquid-air energy storage makes commercial debut near Manchester United ground | Recharge (rechargenews.com)
World first as liquid-air energy storage makes commercial debut near Manchester United ground
Highview Power's 50MW/250MWh facility to be built in same village as football club's training complex after receiving £10m government grant … The joint venture plans to co-develop four more CRYObattery projects in the UK, totalling more than 1GWh.
And see: **Energy-Storage.news** @energystoragenw
Emissions-free technology with the capacity to change the world... News, interviews, analysis & blogs on #energystorage innovation & technologies @Solarmedialtd London energy-storage.news Joined March 2014

'**Natural gas and climate change**' (pdf) via www.foeeurope.org/NoRoomForGas 17oct17, released 7nov17, by Prof Kevin Anderson, University of Manchester & Uppsala University & Dr John Broderick, University of Manchester & Teesside University - commissioned by Friends of the Earth Europe.
via www.foeeurope.org/NoRoomForGas - '**Natural gas and climate change**' (pdf) 17oct17, released 7nov17, by Prof Kevin Anderson, University of Manchester & Uppsala University & Dr John Broderick, University of Manchester & Teesside University - commissioned by Friends of the Earth Europe. Quote from FoEE press release:
"A new study, commissioned by Friends of the Earth Europe from the Tyndall Centre for Climate Change Research and the Teesside University, shows that EU countries can afford just nine more years of burning gas and other fossil fuels at the current rate before they will have exhausted their share of the earth’s remaining carbon budget for maximum temperature rises of 2°C. Even with a managed phase-out, fossil fuels including natural gas, can have no substantial role beyond 2035 in an EU energy system compatible with 2°C. The findings are a stark reminder of the urgency with which Europe, as a region historically responsible for climate change, needs to shift to an energy system free from fossil fuels. Under the terms of the Paris climate agreement, the EU has committed to limit global warming to ‘well below 2°C’ and to ‘pursue efforts to limit the temperature increase to 1.5°C’. [2] For 1.5°C, gas and other fossil fuels would need to be phased-out even faster."
Professor Kevin Anderson, Tyndall Centre for Climate Change Research and the Teesside University said: "If the EU is to transform its energy system to align with the Paris temperature and equity commitments, it cannot continue with business as usual and must instead initiate a rapid phase out of all fossil fuels including natural gas. This needs to begin now and be complete within the coming two decades.” There are several associated pdf documents linked to from the FoEE web-page.

Studies by climate scientists conclude that natural gas cannot be regarded as a “bridge” to a decarbonized energy system in the EU or UK, and author of 1 of 2 recent such reports: Professor Kevin Anderson (Tyndall Centre) states: "If the EU is to transform its energy system to align with the Paris temperature and

equity commitments, it cannot continue with business as usual and must instead initiate a rapid phase out of all fossil fuels including natural gas. This needs to begin now and be complete within the coming two decades." [3], [4]. This negates the current directions of both the UK government and the EU Commission – who both see gas as a "bridge fuel". It is clear from the climate scientists at Manchester University's Tyndall Centre that there should be a strong presumption against any new fossil gas infrastructure that adds new GHG emissions.

END