**JOHN TULLOCH – WRITTEN EVIDENCE ESI022 – UK ENERGY SUPPLY AND INVESTMENT**

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5. **A1. About the author:**
6. Power station electrical engineer. Retired after 40 years with SSE, including 21 years at Lerwick Power Station (diesel) and 12 years in SSE’s renewable energy division, in a variety of technical, engineering and managerial roles.
7. Now based in Argyll, I have serious reservations about Government energy policy and the potential consequences for consumers (I am one), who will have to pay for the subsidies needed to achieve ‘net zero’.
8. For avoidance of doubt, I am acting exclusively as a concerned private individual with considerable, relevant experience of the industry.
9. ***Main Question: Is the Government’s energy strategy delivering investment in an energy supply that is resilient, affordable and in line with achieving net zero emissions? If not, what should be done?***

**Response:**

**M1.** The first part of the question is answered by the [Parliamentary Public Accounts Committee’s verdict](https://publications.parliament.uk/pa/cm5802/cmselect/cmpubacc/642/summary.html) (*Ref.1*) on the government’s *‘Net Zero’* plans:

*“The government has unveiled a plan without answers to…. how it will fund the transition to net zero,….deliver policy on and replace income from taxes such as fuel duty, or even a general direction of travel on levies and taxation….. has no reliable estimate of …..the (likely) cost (to) British consumers, households, businesses and government itself.”*

**M2.** The PAC also dismisses the Climate Change Committee’s (CCC) analysis:

*“HM Treasury was reluctant to be drawn on the future costs of achieving net zero, cautioning that while the Climate Change Committee has provided estimates, they contain ‘heroic assumptions’ with errors potentially compounding over very long periods.”*

**M3. Key Point 1. Clearly, the Government’s strategy cannot be said to be “*delivering investment in an energy supply that is resilient, affordable and in line with achieving net zero emissions.”***

**What should be done (or not done)?**

**M4.** Government’s strategy, essentially, involves converting most, if not all, energy use to electricity or hydrogen produced by wind farm-powered electrolysis, implying a secure national electricity grid will be imperative.

**M5.** The grid is analogous to a colossal super-tanker whose multiple source power system, weight and momentum prevent it from ever losing power or being capsized or blown off course by the grid equivalent of rip tides, storms, or sudden, fierce gusts of wind.

**M6.** This is achieved by using ***“synchronous generators”*** i.e. all locked together, electrically, so that if one fails or there is a sudden change in demand, the combined, rotating weight *(“inertia”)* of all generators and their ability to adjust output compensates for the change, maintaining stable supply voltage and frequency to users. This arrangement has ensured security of supplies for many decades.

**M7.** We meddle with that at our peril.

**M8. New era.** Siren voices now sing of a new era in which fossil fuel and nuclear energy sources are replaced by renewable energy. Government has responded with its *‘Net Zero 2050’* policy and renewable energy has been promoted as the primary means of achieving it.

**M9.** Alas, renewable energy has many problems:

1. The generators are ***“asynchronous***” i.e. not electrically locked into the grid and so cannot contribute stabilising rotational inertia.
2. They can only ever supply the energy available from nature at any given time. Their output is thus unpredictable and unreliable.
3. The true, net cost to consumers, including essential additions (storage, stability, transmission and “*constraint”* costs), is high.

**M10.**

**Key Point 2. *Thus, renewables are unable to supply rotational inertia or output variation in response to unexpected events e.g. transient power surges, plant failures, etc., elsewhere on the grid. We are replacing stable, adjustable plant with a source of instability.***

**M11.** This is technically acceptable in relatively small measure, provided there remains enough unused, synchronous capacity in the grid. However, as more asynchronous power sources are connected, the grid progressively loses inertia and additional, dispatchable capacity must be kept running (***“spinning reserve***”) to accommodate variations in renewable output and the abovementioned risks to stability and security of supply.

**Key Point 3: *A fleet of synchronous generators must thus be maintained and run inefficiently (part-loaded) adding to the true cost.***

**M12**. Alternatively, some form of system storage is needed i.e. [pumped storage hydro](http://www.scottishenergynews.com/platform-scotland-still-needs-investment-in-baseload-electricity-generation-says-former-scottish-power-chairman/) (*Ref.2*), batteries, water tanks, hydrogen, smart grids/electric car batteries and other *‘Heath Robinson’* arrangements are needed, adding massively to the already [high cost of renewables](https://www.ref.org.uk/ref-blog/365-wind-power-economics-rhetoric-and-reality) (*Ref.3*).

**M13.**

**Key Point 4. All these schemes will be installed and operated by the generation and transmission operators, adding greatly to the profits of the very people government and Ofgem have chosen to advise them on how to achieve *‘Net Zero’*.**

**M14.** The Committee might find it illuminating to inquire:

*”What would be the cost of the energy storage needed to ensure security of UK supplies for one week of low wind in winter, even, at today’s prices?”*

**M15.**

**Key Point 4: The colossal expansion of electrical demand envisaged by electrification of heating and transport cannot be supplied by renewable energy at affordable cost.**

**Reliable, predictable (“dispatchable”), synchronous generation will be essential to maintain grid stability, security of supply and affordability.**

**M17. Potential Solutions:**

**Key Point 5: There is little capacity to expand conventional hydro, leaving two main routes, nuclear and fossil fuel.**

**M18.** If we are not to use coal, then lower emissions gas would be the fossil fuel alternative. However, it is currently expensive, due to a range of factors, including:

1. Loss of production due to a pandemic-related gas price collapse,

 leading to supply shortages in the economic recovery;

1. Green policies such as the banning of shale gas extraction,

 discouraging offshore investment and the closure of our main gas

 storage facility;

1. **Low wind** in Europe added to demand for gas generation.

**M19.**

**Key Point 6.  *[Average CO2 emissions of imported LNG is three times that of domestically-produced gas:](https://www.shetnews.co.uk/2022/02/22/is-there-a-case-for-cambo-rosebank-or-glendronach/) (Ref.4)***

*“This is where the first climate-relevant metric should be considered in the context of Cambo, Rosebank and Glendronach: domestically produced gas would have an average carbon intensity of around 22 kgCO2/boe, compared to the average LNG import, which has a carbon intensity of 59 kgCO2/boe – almost three times higher. That’s the average, and doesn’t account for the increasingly extreme events that we see on the volatile global LNG trading markets.”*

**M20.** Clearly, the banning/discouragement of domestic gas production is damaging to both CO2 reduction aspirations and affordability (lower supply means higher prices).

**M21.**

The International Agency has highlighted the [vast expansion of mining](https://www.iea.org/news/clean-energy-demand-for-critical-minerals-set-to-soar-as-the-world-pursues-net-zero-goals) (*Ref.5*) required to ensure the availability and cost of minerals essential for electrification”

*“Today, the data shows a looming mismatch between the world’s strengthened climate ambitions and the availability of critical minerals that are essential to realising those ambitions,” said Fatih Birol, Executive Director of the IEA.”*

The necessary minerals for electrification are likely to become extremely expensive, potentially, threatening the feasibility of the entire project and even, ‘Net Zero’ itself.

***M22. Policy Outcomes:***

1. A much larger ‘carbon footprint’ than necessary
2. *Unnecessarily high prices of gas and electricity.*
3. *Excessive dependence on foreign sources, notably, Russia, a hostile, aggressive, geopolitical adversary.*
4. *Far from banning imports, we fear Putin will retaliate against sanctions by cutting gas supplies!*
5. *Longer term, dependence on another hostile, aggressive, geopolitical adversary, China, to supply minerals essential for future energy supplies.*

**Future Strategy.**

**M23.** Summary:

1. ***Fossil fuels are essential*** and domestic production must be encouraged. Demonisation must end.
2. ***A fully costed road map***, including **the *true costs of renewable energy*,** is urgently needed.
3. ***Utilities’ vested interest*** is in growing their business. We should be circumspect about their advice.
4. ***Target date is 2050*, not 2030.** Ill-considered, precipitate action, now, will undermine overall progress.
5. ***Gas is less CO2-emitting*** than other fossil fuels.
6. ***EU: “gas is a green transition fuel”.***
7. ***Domestically-produced gas*** ***is vastly more CO2-efficient*** than importing and would help ensure adequate, lower-cost supplies for homes and industry.
8. ***Nuclear is the only realistic route*** to replace natural gas for power generation. Everything else implies unaffordable cost.
9. ***SMRs (small, modular reactors)*** have all the technical/economic advantages of large nuclear (e.g. Hinckley Point) over renewables, cost much less and are easier and faster to build and commission.

***M24. Conclusion:***

1. ***No. The government’s strategy is not “delivering investment in an energy supply that is resilient, affordable and in line with achieving net zero emissions.”***
2. ***It is achieving the diametric opposite, endangering the ‘Net Zero’ aim.***
3. ***It is imperative that we immediately change policy preference to domestic gas production and nuclear SMRs.***
4. ***We must ensure that we are never again dependent on hostile, geopolitical adversaries for our essential supplies.***
5. **Supplementary Questions.**

**Question 1**:

***To what extent are the causes of recent rises in energy prices likely to be long-term features of global energy markets? Are the Government’s policies for reducing the impact of higher energy prices on consumers sustainable and in line with long-term energy objectives? If not, what alternatives are there?***

* 1. This depends entirely on how long the West (UK, EU and US) is prepared to be dependent on and held to ransom by hostile, aggressive, geopolitical adversaries like Russia.
	2. Current high energy prices are a supply v demand issue likely to prevail for some time. More storage is fine however gas must be available to fill it.
	3. **Short term:** Negotiate (temporary) alternative sources of supply – US, Qatar, Australia, etc.
	4. **NB.** The above options involve **excessive CO2 emissions** versus domestically produced gas (order of 3 times higher, see main question response) whereas onshore shale gas can be connected to the gas grid directly from wells.
	5. **Existing bans on shale gas must be reversed** and investment in offshore fields and substantial, new gas storage encouraged.
	6. **Investment in nuclear, especially,** **SMR-based plants** which can be designed to produce power, heat, or a combination of the two is also essential.
	7. **Medium Term:** Apart from alternative imports, the above suggestions will take time. Serious planning is urgently required to match anticipated future gas/electricity demand with supply.
	8. **The discredited Climate Change Committee cost analysis** should be disregarded and a new, rigorous investigation undertaken.

***Question 3. What are the main international and geopolitical factors and risks affecting the security and affordability of the UK’s energy supply? How should the Government work with international partners on energy policy and respond to greater international competition for energy supply?***

**3.1**The obvious geopolitical factors are related to sources of energy and essential minerals. Our existing dependence on Russia for essential gas supplies is hugely damaging and the same may well apply in future to essential *‘green minerals’* from China.

**3.2** What will we do when China invades Taiwan or a neighbour’s territory if we are dependent on them for energy supply minerals?

**3.3** That is a clear risk attached to the renewable energy/battery route.

**3.4** Alternatives exist, namely, nuclear SMRs to produce power and/or economic heat for hydrogen production.

3.5 Brexit puts new emphasis on the importance of manufacturing costs and the effects of high energy costs on our fellow citizens will soon become apparent. We must ensure this crisis is never repeated.

**3.6** We must tailor our own climate-related actions in the context of international competition and avoid costly, unilateral, virtue signalling commitments, sticking instead to agreed, negotiated paths.

***Question 6. What should the Government do to incentivise and enable investment in, and financing of, reliable and affordable energy that is in line with its climate objectives, including net zero by 2050?***

**6.1** Adopt the recommendations made by Professor Sir Dieter Helm in his excellent 2017 report to [DECC:](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/654902/Cost_of_Energy_Review.pdf) ***[“Cost of Energy: independent review”.](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/654902/Cost_of_Energy_Review.pdf)*** (Ref.6)

***6.2*** In particular, his recommendation that the government replace the present system of *“Contract for Difference”* auctions with *“Firm Power Auctions”,* in which bidders would be responsible for providing power at the contract price and must meet any shortfall in their output from other sources or face penalties.

**6.3** This would provide clarity and transparency in an industry in which the true costs of renewables e.g. backup generation, transmission lines and their effective efficiency losses are obscured from public view by dense, bureaucratic veils.

***Question 8. What incentives could the Government provide to households and businesses to reduce demand for energy or to improve energy efficiency?***

**8.1** The more we install affordable, low emissions energy sources, the less need there will be for reducing consumption and the more uneconomic it becomes to install energy efficiency measures.

**8.2** The focus should, therefore, be on steadily improving the housing stock via new build and encouraging businesses, perhaps, via the tax system, to improve the energy efficiency of their production processes.

**8.3** We need to stop indulging fantasies and begin thinking seriously about how to achieve net zero in a realistic, affordable way.

***Question 9. What lessons are there for the UK from comparable countries in terms of securing investment in reliable and affordable energy?***

**9.1** The immediately outstanding examples are France, with its high level of investment in nuclear energy and the United States with its shale gas.

**9.2** As a result, both have greatly reduced their CO2 emissions.

**9.3** The U.S. focus on shale gas has resulted in affordable supplies of gas and electricity, 33% and 50%, respectively, of the price in this country before the present crisis, benefiting domestic and industrial/commercial consumers, alike.

**9.4** In our (UK) case, given the emphasis on net zero and the time required to install sufficient nuclear generation, a mix of gas and nuclear is required, with a steady transition to nuclear as time progresses.

**9.5** This will provide secure, stable, affordable supplies of gas and electricity for homes and businesses.

*11 March 2022*

1. **References:**

**Ref.1.** [Public Accounts Committee Report: “Achieving ‘net zero’: follow up](https://committees.parliament.uk/publications/9012/documents/159059/default/)

**Ref.2.** [Pumped storage: Sir Donald Miller, (ex-chairman, Scottish Power)](http://www.scottishenergynews.com/platform-scotland-still-needs-investment-in-baseload-electricity-generation-says-former-scottish-power-chairman/)

**Ref.3.** [Major study: Wind farm costs (UK, Denmark) Prof Gordon Hughes](https://www.ref.org.uk/ref-blog/365-wind-power-economics-rhetoric-and-reality)

**Ref.4.**[Article on domestic gas production by energy expert Daniel Gear.](https://www.shetnews.co.uk/2022/02/22/is-there-a-case-for-cambo-rosebank-or-glendronach/)

**Ref.5.** [International Energy Agency report on critical mineral availability.](https://www.iea.org/news/clean-energy-demand-for-critical-minerals-set-to-soar-as-the-world-pursues-net-zero-goals)

**Ref.6.** [DECC report by Prof Dieter Helm: “Cost of Energy Review”](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/654902/Cost_of_Energy_Review.pdf)