^{by} John Wilson, Lead Process Engineer, Totaltime Energy & Engineering Ltd and Sean Prior, Energy Manager at Alfa Energy



The turbulent area of energy price increases is here. If you are following the energy market developments closely, you are aware that it's been here for almost a year. But never have been energy prices and security of supply scenarios discussed in such abundance than in light of the sanctions imposed on Russia, and the Europe-wide aim to wean the countries off the Russian gas.

Whilst the UK's dependency is marginal, the wholesale energy market is affecting the UK prices and consumers, forcing the government to rethink energy supply and publish the British Energy Security Strategy policy paper¹ with plans to boost home energy production and reduce dependence on expensive fossil fuels.

John Wilson and Sean Prior, EMA Members and ESOS Lead Assessors, share their opinion on what the supply solution could be at the start of this energy transition.

New Energy Crisis – Thoughts and Solutions

John Wilson, Lead Process Engineer, Totaltime Energy & Engineering Ltd



The environmental imperative is well established and today few would doubt the science. Unfortunately, the environment has become a religion with public and politicians disbelieving the facts and ignoring observations which do not support the latest creed. Two decades ago, "renewable heating and transport" meant wood stoves and bio fuels. Now, those are frowned upon despite still being zero carbon renewables, electric vehicles and heat pumps are in favour instead, and will no doubt remain so until other realities unfold. In many articles I read, some by energy professionals, containing the terms "kilowatt" and "kilowatt hour", it becomes clear the writer cannot clearly distinguish the terms. That's like a transport expert unable to distinguish the terms "mile" and "mile per hour", it's worrying.

I know about Cambo and Jackdaw gas fields, having done work relating to both projects. They both received a fierce resistance to their approval and are now shelved in the interest of CO₂ reduction. Looking for others on the internet I find an article in The National² newspaper referring to 29 new oil and gas projects and complaining that the UK is letting Scotland down by failing to cancel them; they are not shelved yet but the article reflects the political climate. The article claims the projects will cause lifetime emissions of three times the UK annual figure. Put another way, this means that those projects alone could supply the UK total carbon-based energy demand for three years.

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The national net zero target does not alter the fact we need oil and gas right now, and if civilization survives, we will continue to need it for many centuries to come, albeit (hopefully) in much smaller amounts. Why do we suffer such a lapse of logic as to discontinue our own oil and gas production to buy the same commodity from elsewhere? By shelving our projects, we just reduce competition and force up the price. It's not the extraction that causes the

¹https://www.gov.uk/government/publications/british-energy-security-strategy/british-energy-security-strategy ²https://www.thenational.scot/politics/19819842.plans-29-new-north-sea-oil-gas-projects-pipeline-despite-cambo-delay/ pollution, it's not the oil companies, it's us driving the children to school rather than letting them walk, it's us heating the house when we could wear a jumper, it's us taking a bath or a shower before we really need one. Whatever the demand is, it will be met by someone, somewhere on the planet. But if demand exceeds supply or threatens to do so, the price increases steeply.

Low-Cost Solutions

The first immediate thing we can do is to point out the above to the public, then ask them to economise as we did in the 70s when OPEC restricted the supply and increased prices during "The Energy Crisis". The public recently accepted Covid restrictions surely, they will accept request to switch off unnecessary lights, don't boil when simmer will do, don't overfill the kettle, switch the shower to 1 not 2 and be quick, don't use a stove ring or burner bigger than the pan, and various others. It's simpler than Covid-19 rules.

The second immediate step is to allow the "oven ready" oil and gas projects to go ahead, and looking to the slightly longer term to stop vilifying the oil companies and create a climate in which they wish to invest in the UK rather than elsewhere. Another slogan for the public with that finger-pointing logo "Why do we have oil and gas companies? Because you demand the products". No demand would mean no oil and gas production.

High oil and gas prices are selfcorrecting because when the price is high, new projects become economic and the companies are prepared to invest if they are permitted to do so. If we allow them to develop in the UK, we will be paying our own people and saving the transport costs and emissions due to importing from other countries, some of whom have, let's say, unfriendly foreign and social policies which we would not support. BCM is being flared. Iraq is seeking partnerships for projects to reduce flaring, with a positive attitude to oil and gas the UK and devolved government politicians might help



Long-Term Solutions and Investment

Around the globe much gas is being flared for disposal purposes. It's an abominable waste. One reference³ stated that 50 billion cubic metres (BCM) is flared annually. That is about the same number of kilograms of gas generating about 157 million tonnes of CO, and wasting about 625 billion kWh of energy. Averaged over a year, that is enough to continuously generate about 30 GW of electrical power. Despite this, Iraq has recently imported gas to fuel its own power generation, presumably due to infrastructure availability. So, one medium-term solution could be to support projects which bring some of that gas to the market.

The European TAP pipeline project, part of the Southern Gas Corridor creates a route for gas from the Caspian Sea to reach Europe. A step in the right direction. It's most of the way to Iraq where 17 BCM of that 50 facilitate them. Perhaps a future leg of the Southern Gas Corridor could draw from Iraq and nearby to keep the main line full as the current sources deplete. Projects which cross countries need huge effort to get the necessary agreements.

We are developing carbon capture and reinjection projects. The technology opens the possibility of putting some of the carbon currently being emitted elsewhere in the world back in the ground as well as using the energy currently being wasted. Longer-term energy storage options need to be developed and implemented to cover the long dark calm cold winter periods of low renewables and relatively high demand. Numerous technologies exist or have been proposed, none appears as most favourable. Development of technology and projects is required.

Short-term output swings from renewables are a challenge to





addressed. Electrolytic processes such as batteries and electrolytic hydrogen production have inherently very rapid response times. Both these could be engineered to peak lop renewables output, batteries could also fill the dips, but the engineered solutions do not seem to exist. Another area for development.

"Nuclear fusion power is always 30 years of development from being realised" but if it is realised, it can provide a lasting clean nuclear solution which can work alongside renewables. There are various projects around the world which continue to show promising progress, ours is the JET project in England. We could ensure that the project progresses as quickly as possible and is not constrained by any resource or regulatory issues.

We do not need to and should not eliminate the internal combustion engine to meet target zero. Biodiesel from vegetable oil is less favoured because it encourages replacement

plantations, waste cooking oil is a feedstock which does not have that disadvantage but is only available in tiny amounts. The UK produces enough to generate about 230 MW of heat continuously, or enough to fuel about 200,000 cars out of the 39 million road vehicles on UK roads. Not good, but there are various technologies which can produce liquid fuels from solar energy by biological means, and liquid fuels can also be synthesised using renewable energy. We should pursue these as vigorously as the shift to EVs. Perhaps best done in cooperation with countries with high levels of sunlight and available land area.

There are still few roofs in the UK and elsewhere carrying solar panels. Infrastructure bottlenecks and other issues which currently limit solar deployment should be addressed. There are also opportunities to use off-grid solar for water heating and space cooling. These could usefully be supported alongside continued

support for insulation and other energy efficiency improvements to buildings.

If we exclude the CO₂ emissions by other countries associated with our consumption, e.g. of products from China, the UK is only responsible for about 1% of the world's CO₂ emissions. The success or failure to mitigate climate change is almost entirely out of our hands. We should ensure that we have the resources of every type to cope with effects of climate change and sea level rises, since they are likely to occur whatever the UK does.

Author's Profile:

John is a process engineer (CEng, FIChemE) and ESOS lead assessor, also a science geek who has always had a strong interest in energy, energy economy and the environment. The last 37 years of his working life has been in the UK's (mostly) Oil and Gas industry working mainly in technical roles. Lately, John has taken on some work in energy and emissions' reduction.

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For the Greater Good of Britain

Sean Prior, Energy Manager at Alfa Energy



I strongly believe that the U.K. should utilise the natural resources at our disposal to fund the transition to low and zero carbon technology and achieve energy security. That resource is of course shale gas and oil as well as nuclear energy and a host of technologies bundled together under the renewables or green branding. Shale gas is a critical element. It can have a short-term impact. Keeping lights on and people warm. Plus, it can provide the investment pot for nuclear and alternative energy solutions.

Secondly, and most importantly, that resource should be exploited by a U.K. sovereign wealth fund (SWF). The reason for this is simple. The whole country should benefit from, and indeed the whole of humanity hugely benefits from, cheap abundant fuel and heat. There are undoubted health benefits from living in well heated homes that are damp free. In addition, there are undoubted benefits from the wealth that industrialisation has brought humankind. There are down sides but the benefit of the ability to learn is that we can do things better.

For me, energy management has always been about doing things better. The comparison between Norway that has a sovereign wealth fund to manage the exploitation of oil wealth and the U.K., which does not, is stark. There are of course huge differences between the two countries. However, the U.K. sold much of the oil when prices were low, the tax yield was still lower. Oil companies were the principal beneficiaries. Norway did not.

The level of taxation on the commodity should be set to guarantee borrowing repayments. Like a war bond that pays investors a guaranteed dividend for 100 years. The SWF would invest in a range of U.K. owned and manufactured technologies that make the U.K. energy secure, produce cheap emission free power and heat for U.K. businesses and homes. The funding would support centralised, de-centralised energy production as well as insulation and demand management programmes. Over time, all U.K. generation would come under the SWF or it could be a funder and beneficiary of power purchase agreements. The SWF would be open to all investors and should be focused on small private U.K. investors who can buy shares and hold stock paying a dividend for up to 100 years. Individual private or corporate shareholdings would need to be restricted to a maximum, so no one individual or group hold too much influence or corrupt intent over the SWF policy and outcomes.

The fuel and electricity should not be exported, unless U.K. demand is met and the base price of fuel or electricity has not exceeded a cap. Onshore fuel and generations assets should be exploited by U.K. onshore industry, commerce and domestically for the benefit of all. This is unabashed. I do not approve of or want to see the impoverishment of the British people due to the abject failure of heavily regulated energy markets and environmental policy. My premise is that the U.K.'s energy policy and environmental policy have failed. The U.K. has lost its energy security and the public is paying the price. We have a legacy of high taxes on energy. We export manufacturing and fiddle statistics to achieve carbon reduction and now net zero on paper. The U.K. imports high emission LNG to the detriment of the exchequer and the environment rather than use the U.K.'s resources. Solar panels and wind farms are built with public subsidy, but their environmental impact is high. The energy generated does not negate their environmental impact and energy used in the production, and little or no thought is given to the decommissioning or recycling of these technologies.

The cash a SWF would generate should be invested in renewable technology made by U.K. headquartered and on shored technology and manufacturing companies. Again, this is unabashed. If a company benefits, and why should they not, pay a little tax in the U.K. Secondly, the U.K. needs a level of skilled technologically advanced manufacturing to be resilient, viable and to provide a solid base for economic growth.

Companies need to pro-actively consider technology like evaporative cooling, air and water source heating, thermodynamic solar arrays, natural lighting and provide evidence for ruling out their use before considering more energy intensive solutions.

Small Modular Reactor (SMR) nuclear technology is necessary. We have to get over our fear of the Windscale era cold war nuclear technology. There is a core nuclear industry in the U.K. However, the U.K. needs a cheap reliable source of energy. SMR's can be rolled out in the shorter term and rely on passive safety system that will alleviate problems seen in the past. The industry is developing reactors that are fuelled on existing nuclear THE EMA MAGAZINE • ISSUE APRIL-JUNE 2022

10

waste. The technology cannot simply be dismissed. It has to be a part of the national plan. The technology is zero emission at point of use. It can be zero emission to build, install and decommission as well but we will need to put the effort in. A variety of scaled nuclear projects will go some way to alleviating the problem of balancing the grid with wind and solar assets' intermittent energy production. There will be a need to prevent undue subsidy of wind or solar. If those are not feasible nuclear is the choice. If wave is reliable and cost effective a mix of wave and nuclear should be considered.

Planning and nimbyism must be overruled. If we do not, we run the risk of log jamming nuclear technology, for example, in the planning process until 2050. That is not to say that we only look at nuclear technology. Offshore wind must be costed and considered as should wave technology.

If a technology consumes more energy and emits more emissions over

their productive life cycle than they generate in heat and power, they must be ruled out. This can be reviewed periodically and as the market drives technological advances a technology should be reassessed. The same goes for the schemes like the river Severn Barrage, stalled tidal project. This needs to be reviewed and work begun if it passes the test.

This would take a national plan, national legislation. Everyone would benefit from the Sovereign Wealth Fund. The gas and power generated can still be marketed and sold using the existing model. Competition can drive down retail price. The SWF could pay for, at a basic level, insulation for all homes; not just the homes of special interest groups like the over 80s or unemployed.

However, it would be important that the SWF is an independent body, subject to House of Commons scrutiny and established by parliamentary legislation, but free from direct political control and no subject to the Party mire. The national plan could simply state:

Goal by 2030,

- Extract shale gas & oil.
- Build SMR power station by 2025-2030.
- Construct Hydrogen infrastructure by 2025-2030.
- Tender process for U.K. companies manufacturing renewable heat and power solutions and low-cost insulation by 2023-2025.
- Phase I installs of low / zero emission heating in all new builds.
 - Training of the workforce in the use of refrigerants and installing renewables must be encouraged. Apprenticeships open to all ages, including manufacturing apprenticeships where the SWF would be used to set wages at average U.K. earnings during training, partly through NI and tax exemptions whilst training for employers and staff.





Phase II 2030 - 2050

- Roll out of replacement of domestic heating systems with renewable heating technology. Natural replacement cycle as gas boilers fail and renewable technologies are used to replace them. Tendering process to benchmark technologies at natural gas boiler and existing HVAC technologies.
- Measures must include insulation, practical measures for replacing natural gas boilers over time. Thermodynamic solar arrays, a heat pump solar thermal hybrid can do this across the U.K. Older homes may need low temperature or additional radiators. The installation costs are lower. They will produce low temperature hot water even on the coldest U.K. day and they do not need to be installed on roofs which would reduce the installation costs.
- The national plan must reimagine transport. Crucially, not by taking a stick to everyone enjoying the freedom of a drive in the family car. Rather by building the infrastructure to replace traditional internal combustion engines (ICE) with hydrogen fuel cells and ICE engines as well

as electric battery engines. The U.K. can have a green hydrogen produced by electrolysis using nuclear fuel, wind, and wave technology. The cars can be manufactured at existing U.K. based plants working with existing companies if they use U.K. registered companies to pay a share of tax. For fans of mass transit, hydrogen trains and buses already exist, and a heat pump fireless steam engine has already been designed.

- The construction of decentralised SMR nuclear reactors would facilitate the decentralisation for the grid and negate the need for the wholesale replacement of the national grid at vast expense.
- The adoption of SMR technology and Hydrogen gas generation will mean that furnaces, steel working, the chemical industry, aluminium smelting, and manufacturing would be viable.

U.K. companies should be protected from dirty imports. A focused sales taxes, assuming VAT is scrapped, or import duties would need to be applied to manufactured goods that cannot prove the provenance of their renewable power and heat, and the provenance of their recycled raw materials and plastics. A sales tax on goods could be applied on a sliding scale. For example, goods manufactured in a sweatshop with wages at subsistence levels and poor or dangerous working conditions, which utilises fuel and power that emits more than the U.K. average would pay the highest rate of sales tax or import duties.

My last point is that every paragraph can be robustly contested, objected to, equally supported, and trumpeted. The point is, as free Britons in a free society we must debate openly and freely. There must be no room for threats, cancelations and twitter hate storms. I am strongly of the view that constant 'stick' and high taxation is not the way to achieve the migration to environmentally friendly fuel and power. The above is a practicable route to achieving readily available cheap energy and heat that will allow the economy and people to thrive in the U.K and around the world. This model is not perfect, but we can get it done.

Author's Profile:

Sean has worked in the energy demand management industry for nearly twenty years, and is currently a ESOS lead assessor for consultancies such as Alfa Energy.