Energy in the UK

The following is a write up of the discussion which took place on 27th September. The discussion was led by Charles Scott, ARCST, BSc, MIMech E, FICE, a retired consulting engineer, and Martin Veart, BSc (Geology), currently studying for an MSc at Heriot-Watt. Both have had a vast experience in the energy industry.

They decided to present this paper for discussion as a result of their concern at the lack of understanding of energy matters, both among politicians and the general public. Energy is a difficult and complex subject but it requires a better understanding of the whole range of sectors to ensure that the correct decisions are taken for the future of the country.

The U.K. Government has made two major policy decisions in the past two years which in the coming years will have a massive impact on all energy sectors and in particular the electricity sector. The policies are:-

- A proposed target of 80% reduction in carbon dioxide emissions from all energy sources by 2050 relative to 1990 emission levels.
- A firm commitment that all cars and vans will be electrified by 2040.

Both are commendable ideas to reduce greenhouse gas emissions, but a plan for achieving them while clearly defining the cost implications for the economy is essential.

Many propaganda pronouncements on energy have been made by politicians over recent years, which should be challenged. Two of these are:

"Scotland will be producing all its energy from renewable sources by 2020" (Announced in 2013)

"Scotland is on target to provide all its energy from renewable sources by 2030." (Announced in 2017)

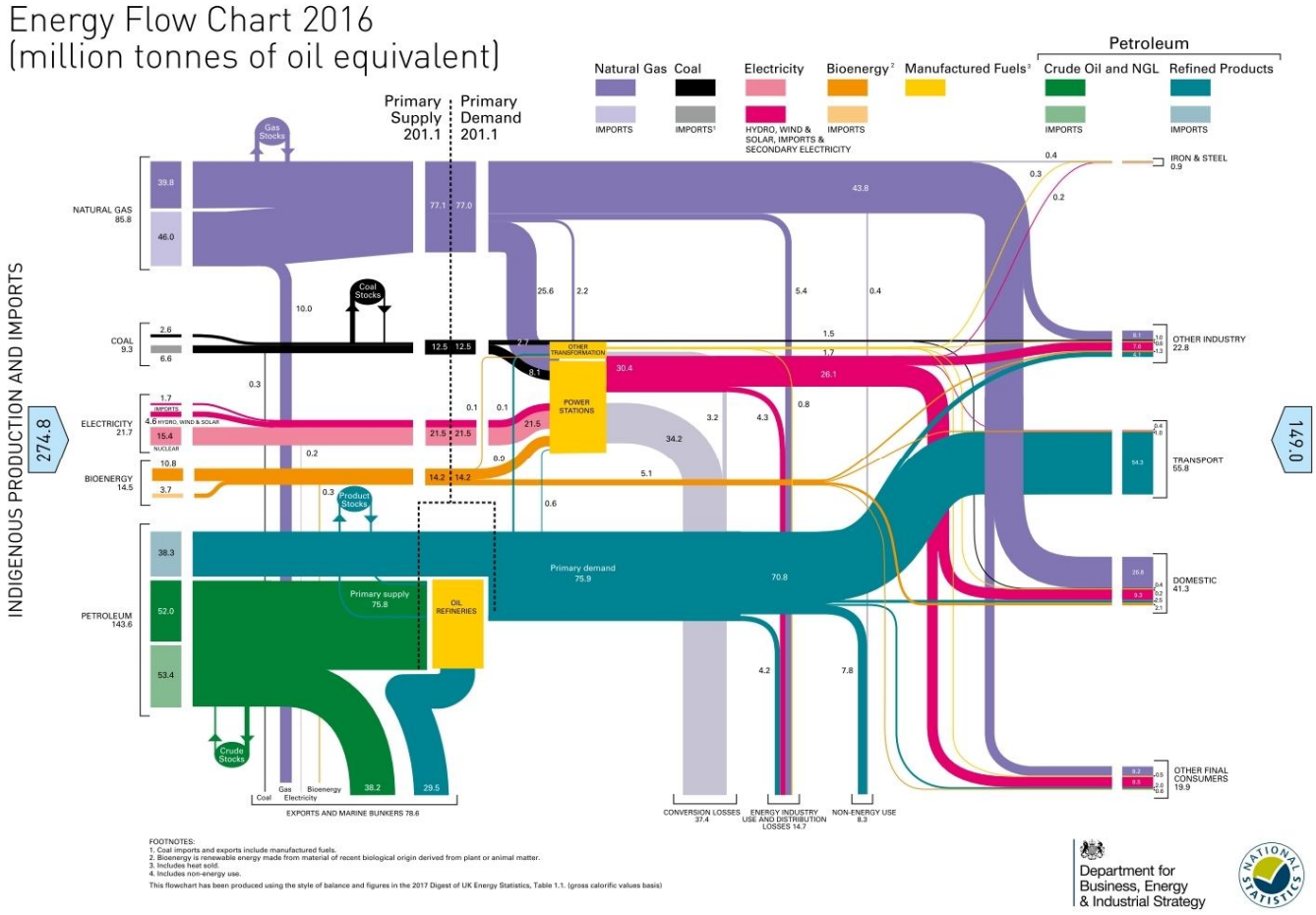
We must challenge them and ensure that evidence based data is put before the public with the help of independent and expert advisors.

Martin talked about the importance of oil and gas today and their importance in the future for the UK economy. Charles talked about the changes in the electricity system since the 1990s. Using a PowerPoint presentation he showed that:

- 99.94% of scientists who have published articles on the subject believe that recent climate change is caused by greenhouses gases released by humans.
- Our use of oil in the UK did not really start till about 1975 but grew rapidly and already peaked in about 1997. By 2013 it had tailed off.
- Natural Gas followed a similar pattern.
- Nuclear energy has played a small but increasingly important role.
- Renewables are in their infancy right now.
- Our total energy usage is about half what it was at its peak, though increasing recently since we are coming out of the financial meltdown.

The UK has 173 oil, 115 gas and 37 condensate fields. Since 2014 54 oil fields and 31 gas fields have been closed with a 27% cut in employment from 450K in 2014 to 30K in 2016 not including churn. At the same time the cost per barrel reduced from $29.30 to $16.00. In the 1990s we were net exporters of oil. We are now importing almost as much energy as we produce.

Wind and solar energy are primary sources of supply as is the gas used in a domestic gas boiler since the energy is consumed directly. Gas and coal burnt in a power station is a primary energy supply while the electricity produced is not and the energy produced must be less than that burnt to comply with the laws of physics. While our energy consumption is fairly static we are producing much less and now importing about as much as we use (about 100Mtonnes per annum). We were shown an energy flow chart for 2016 shown below.



The USA uses less energy per person than it used to, down from about 20 to 16 tonnes per person per year. The UK is about half that while China is ramping up its usage. Kenya meanwhile uses very little, about 0.3.

Currently in the UK we produce 39.8 mtonnes, import 49.7 and use 9 equivalent from coal. We lose a lot of gas when turning it into electricity.

Residential power consumption has surges as we would expect when people are getting ready for work in the morning and also in the early evening. This is mainly space heating which is predominantly gas. The electricity demand peaks differently, in the middle of the day and at about 8pm. The electricity supply is fairly constant with slow rises and falls in demand while the low grade heat which can be turned on and off supplies the peak demands.

This leaves us with the energy dilemma, balancing the three requirements of Energy Security, Energy Equity and Environmental Sustainability.

Charles then addressed the question of supply.

He said we need to electrify homes and transport. From 1926 – 1990 the energy industry was controlled by the government. Since 1990 when the industry was privatised energy has been cheap since we were relying on existing power stations with little investment for the future. He made 3 points.

1. Objectives for the system are dictated by the public good.

2. Markets work best when competition by cost/quality doesn't apply.

3. Markets tend to want to increase sales whereas with energy we want to reduce consumption.

We need security of operation. So far we have had no major blackouts but in recent years there has been talk of this happening. We used to have reserves of energy but now we have been importing from Europe more energy than we previously held in reserve. Subsidies cannot be part of a privatised market. The current electricity system is unstable. Our energy input to produce electricity is 9% oil 43% gas 21% nuclear 9% bio energy and 9% offshore/ wind farm/solar. As coal is phased out gas will be 51% of the mix. We are going to be relying on interconnectors with Europe and Iceland for our energy security and have to find 95 Giga watts of energy by 2035. Hinkley point will account for 1.7. That is the scale of our problem and we need to tackle it by building new gas power stations between now and 2025. The table below shows usage of electricity in 1990 and 2016 and projected to 2035 for residents and road transports together with power station production levels.

	1990	**2016**	**2035**
Residents	78	68	69
Road Transport	108	108	97
Power Stations	203	77	37

18 years is a very short time scale and we need to be building 3 or 4 new power stations every 3 or 4 years. It is difficult to get cost data for energy Wind is good but we need backups for when it doesn't blow. For the foreseeable future this needs to be gas. This needs to be taken into account for the cost of renewables in the UK.

One factor is that nuclear is very expensive to build but it will last longer and the cost per kilowatt is low. France and China are charging more than 6% to develop nuclear but the government could borrow at 2.6% if they funded the plant. We need an agency set up to build our power stations which would then be rented out to the private sector who would pay us 4p per kilowatt. National grid would need to take control of distribution. It is essential that we put our best brains to use on the energy problem. If we don't invest in nuclear energy we are putting our energy security at risk. In both parliaments too much policy is being decided by politicians who don't know what they're talking about and are complacent about their ignorance.

The floor was opened to questions

Q When electric cars are not in use could they be used for load balancing?

M – In theory yes but this would need a smartgrid with systems integrated and talking to each other, a technology which is in its infancy.

C – Once we have electrified all the cars we will need to replace the £28bn. Tax take for the government £80bn. Is required for all the wiring needed and if all cars and vans are electrified we would need to produce 18GW of electricity to power them.

Q. –What abut decentralisation of energy for efficient use of energy?

M. - Efficiency is OK but cost is the problem.

Q. What do you do with nuclear waste?

C – Candu in Canada has built 6 plants that can burn waste fuel. We had planned this for Sellafield and it should have been built by now.

Audience – The waste is still radioactive.

C – The government did investigate after Chernobyl and our plants are OK. 18K people died after the Tsunami in Japan but all because of the Tsunami, none from radiation.

Q. – What shortfall in generating capacity are we going to suffer? What about the grid.

C – We need an energy authority

M – Plan is to have interconnectors

C –If other countries run out of power they will cut us off. The USA and Canada do not have electricity production in the private sector.

Q. – The questioner challenged the basis of the cost analysis and said the 25 years for turbines is only a planning restriction. The time could be extended. Why are we subsidising nuclear power which is a mature technology. Should we not be co-operating with other countries.

C- If we built nuclear power stations at 2.5% interest borrowing rates then it is self financing.

Q – Residential Heat and Power Get rid of large peaks using storage. District heating is getting more important

Q – Near Lockerbie there is a small plot of energy efficient houses that use little or no energy. Should we not require all houses to be built with this technology?

Some local authorities are already doing this. There is inertia in new technologies.

C -We recommend that government make decisions to insulate houses to Swedish standards.

Ross Finnie gave a vote of thanks to the speakers and all who asked questions.