PIU Energy Policy Review

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1. Effects of the Electricity Act 1989

For over a century the UK electricity industry, both before and since the 1989 Electricity Act, has maintained national security of supply at a remarkably high level, currently around 99.8 per cent.

Prior to the Act, the industry was “engineer-led”. Thereafter, for the first time in fortythree years, it became “market led”. Had this applied only to the retailing of the electricity in succession to the fourteen nationalised Area Boards I would probably not have made this submission.

While marketing of electricity and even the load despatching function of the National Grid seem to have reached unprecedented heights of sophistication I am deeply concerned about the apparent disappearance of pre-1989 central engineering planning and control of design and construction of new power stations, the decommissioning of obsolescent units and extensions to the nation’s electricity system as a whole. From an electrical engineering viewpoint we are fortunate to possess this totally integrated, monolithic system of world ranking scale, second to none.in quality.

Prior to 1989 these central engineering control functions were the responsibilty of the Chief Engineer’s Departments of the Central Electricity

Generating Board, the South of Scotland Electricity Board and the North of Scotland Hydro-Electric Board. They would liase with each other wherever necessary. As it can take ten years, including public enquiries, between a decision to build a power station and its entry to national grid service, staff with years of experience and engineering judgement were essential. But a nationwide system demands a continuous and fully coordinated engineering approach to ensure reliability of supply and optimisation of construction and operating costs.

2. Past examples of central planning.

Immediately after nationalisation in 1947 UK electricity was faced with an unprecedented expansion of demand, the necessity to build new plant to meet it and to replace old plant. To both speed the process and optimise costs the size and steam conditions of all steam turbines greater than 10 MW output rating were standardised at 30 MW and 60 MW. Over the next few years the range was extended by addition of 100 MW units followed by 200MW, 500 MW and 600 MW units as fast as technical development allowed. Indeed with hindsight it was rather too fast, with consequent teething troubles at every step upward. However, this was not size for the sake of size. It had been established by experience that, all other things being equal, each doubling of unit rating reduced capital cost in £ per kW by 20 per cent. The advance of the technology also permitted higher steam temperatures and pressures enabling higher overall thermal efficiencies. An engineer-led organisation is as cost conscious as any other in an economic, competitive field.

At the same time there was a co-ordinated approach to siting. The biggest and most efficient coal fired units were sited as near as possible to the cheapest coalfields, Particularly the East Midlands where large rivers such as the Ouse and Trent provided adequate condenser cooling water supplies, a need which had originated with James Watt’s improvements to the Newcomen engine. Ferrybridge power station at the junction of the M1 and M62 motorways was an exception to the general rule at this time, in that it was near cheap coal but required cooling towers. Similarly, oil fired stations were sited alongside oil refineries or deep water ports.

Every power station was graded by “merit order” according to its fuel cost per kWh taking overall thermal efficiency into account. The lowest fuel cost station (hydro -electric if available and with enough water for continuous running) would be the first choice for connection to the national grid and the rest followed in ascending order of fuel cost.

As the national grid was operated by the CEGB and the Scottish Boards the question of ease of load despatching and other grid-friendly characteristics would be taken into account from the beginning as the UK electricity system was to all intents and purposes vertically integrated. Any commercial undertaking large enough to justify having its own power station could only connect it to the Grid with the agreement of the CEGB or its Scottish counterparts.

Today it appears that any electricity generating company can apply to the
National Grid Company for permission to install two way interconnection facilities and apart from environmental consent by the Department of Trade and Industry for stations above 50 MW, or the local District Council for stations below 50 MW, and the installation of NGC approved connection methods, there appear to be no central engineering system planning constraints whatever.

3. Kyoto and the drive to renewable sources of energy

The Kyoto agreement has provided a focus for the growing interest by some of the lay public in environmental issues of which an increase in the installation and use of renewable energy generated electricity is one. What is surprising and to an engineer deeply concerning, is that a giant privatised organisation such as UK electricity supply, supposedly freed by privatisation from all but the intervention of a commercial Regulator, should find itself the centre of, and its long term planning distorted by, a heated political debate about which type of plant it should be installing or decommissioning during the next ten, twenty or even fifty years And being saddled, without the option, with responsibility for the load despatching of a system, committed politically through Kyoto and no prior central engineering consultation, to installing many hundreds and ultimately thousands of small, unpredictably available wind turbines, the planning control criteria for each being virtually reduced to whether District Councillors think its appearance fits the landscape.

I have used “wind turbines” as synonymous with “renewable energy” simply because their technology, although not economically competitive without subsidy, is of the only “renewable” type commercially available in large quantities even if in electrically tiny units of around 1 MW compared with the standard 600 MW units of the large steam power stations. The other “renewable” is hydro-electric power which in our geographically small country has long since been developed to its economic limit, very useful though it is.

4. “Renewables” and the threat to system stability.

Seminars and individual technical papers have been presented in recent years in which members of the major engineering Institutions have discussed legitimate engineering concerns concerning the effect of the increasing numbers of wind units on the quality of electricity supplied from the UK system. Quality involves control of voltage, frequency, and reactive current and, above all, continuity of supply. There are numerous issues. One is the necessity of matching the electrical generating capacity of every wind turbine connected to the grid with an equivalent “spinning reserve” of fossil fuelled, nuclear or hydro powered generators. This arises due to the fact that annual wind availability in the UK prevents wind turbines from generating more than 30 per cent of their designed maximum annual kilowatt hours capability. Another is the risk of creation in the transmission system of instabilities affecting electricity quality. Major interruptions of supply caused by a sudden cessation of wind over large areas are another concern the enormous increase of complex electronic and other electrical products used by consumers, domestic and industrial, throughout the UK calls regulation of electricity supply. For example the appearance of voltage harmonics in the system would be unacceptable to many consumers, and indeed any variation in the quality criteria mentioned above. Frequency instability affects the time keeping of every synchronous electric clock in the land.

There is thought to be a level of MW installation above which these potentially serious problems become operationally unacceptable but papers by members of the major Institutions suggest that much more study is required to establish that level. Meanwhile from where can we look

for an answer? Privatisation seems unfortunately to have removed the central engineering planners whose job it once was to settle these matters before the public was presented with a major problem.

The smooth planning and operation of the UK electricity supply system is pre-eminently an engineering matter, of which the details are a closed book to a lay public which has neither qualifications nor inclination to open it. But increasingly large numbers of the public, most with Parliamentary voting rights, seem determined to usurp the planning and plant selection functions of the engineers. Yet most have difficulty in distinguishing between a kilowatt and a kilowatt-hour. As one amiable and otherwise intelligent pro-wind turbine demonstrator told me the other day when I posed this question “I must admit I have difficulty in getting my head round it!”

Yet the Government appears to be subjecting the industry to pressures from well intentioned lay groups simply because of their voting powers and forgetting that a highly technical business such as electricity supply, especially when it is producing the domestic and industrial lifeblood of the country, can be market led into deep trouble and surprisingly quickly.

5. Recommendations

I strongly recommend that the Ministerial Energy Policy Advisory Committee contains from now on an effective proportion of high level engineers with system planning and operation experience. Also that a Standing Technical Committee for National UK Electricity Planning is established.