WIND CAN DISPLACE FOSSIL FUELS

DR GORAN STRBAC, PROFESSOR OF ELECTRICAL ENERGY SYSTEMS AT IMPERIAL COLLEGE AND DIRECTOR OF SUSTAINABLE ELECTRICAL ENERGY AND DISTRIBUTED GENERATION CENTRE AT BERR, TALKS TO REALPOWER ABOUT THE CHALLENGES OF INTEGRATING A LARGE WIND PORTFOLIO INTO THE NATIONAL GRID.

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RealPower: Professor Strbac, what are in your view the key challenges we face in integrating a significant proportion of wind power in the UK electricity system?

Professor Strbac: In the short term, we will need to resolve a number of key questions associated with electricity transmission investment, access and pricing both on and off-shore and get wind power connected. In the medium term, once a significant proportion of electricity is supplied by wind, we will be facing issues associated with balancing of demand and supply.

TRANSMISSION

RealPower: Looking first at the short term network issues, how much will the current Transmission Access Review redress the balance in terms of enabling speedy access of wind energy to the grid.

Professor Strbac: In the context of onshore transmission, there needs to be a fundamental change in thinking: generators should share access. This is something not supported by current arrangements and the purpose of TAR should be arranging shared access. In the final TAR report published in July this year, this comes out as the key question. Our transmission network is being built so it can accommodate almost instantaneous access to all generators. But, if we are adding 30GW of wind, perhaps we shouldn't build a network that can accommodate 100GW, if the demand will peak at 60GW. What should happen is that on windy days wind generation should have access – otherwise we are wasting wind and not displacing fossil fuels. Regarding offshore wind, we are concerned that the latest Policy Statement proposes to treat onshore and offshore transmission networks differently in the context of compensation that generators may be entitled to receive due to unavailability of transmission network. We do not believe that there is sufficient justification for the unequal treatment of on- and offshore generation with regard to compensation. SEDG work demonstrates that if this position is maintained, this proposed arrangement is likely to unfairly discriminate against offshore wind.

BACKUP

RealPower: Professor Strbac, in relation to the medium term wind integration challenges, there are currently different views on how much thermal plant back up we would need to add to UK's power system if there is a large proportion of wind energy capacity installed. For instance, a recent contribution from the National Grid suggested that in the case of complete build out of Rounds 1, 2 and 3, totalling 33GW of wind capacity, we would need to add 7GW to 10GW of new thermal plant.

Professor Strbac: There are some important things to remember here, first of which is that we don't need to build a system from scratch. If we integrate a large wind portfolio into the grid we will be able to retain capacity. In that scenario we will have wind displacing energy, if not necessarily displacing much capacity - our studies show that wind can take out between 10% to 20% of corresponding thermal plant. But, the point of wind is that it is very good at displacing fossil fuels, and this is a job it can do well.

RealPower: You research also seems to suggest that there could be benefits to managing demand instead of commissioning thermal back up plants.

Professor Strbac: Yes, and in that sense I don't see the question of back up as a very big issue. It is important to understand that we are building wind farms to displace fuel and not to provide supply reliability. In other words, the question of decarbonising our electricity supply, needs to be looked at in conjunction with, yet separately from the question of balancing the grid. We can manage peak demand either by plant on the system or by working with users in a way which would encourage them to switch off when peak demand conditions coincide with low wind power outputs. SEDG analysis demonstrates that there will be a relatively small number of occasions when such demand reductions would be required. So, it is conceivable that it could be cheaper to have demand reduction services offered by a few large users then providing this backup through thermal plant with very low utilisation factors. Effectively, this would create

competition between users and suppliers. In future, the introduction of smart metering and widespread application of demand response, will play a huge role in providing 'demand side back up' for wind energy.

RealPower: Your research has also highlighted an interesting parallel between wind's and nuclear's effect on the energy system.

Professor Strbac: Both wind and nuclear take out, or displace, more energy from the system then they bring in capacity. Wind displaces fossil fuels, but capacity needs to be retained to balance the grid, or manage peak demand. Nuclear, on the other hand, runs at 85% utilisation factor, which is above the system average of 55%, thus reducing other plants' average load factors, while not being able to retire the same amount of capacity. To say that nuclear doesn't have integration costs is incorrect. So, when people talk about system costs or capacity costs of wind, there needs to be a realisation that these would apply to nuclear also, although the magnitude of these costs for wind are likely to be higher than for nuclear.

BALANCING

RealPower: Research done by SEDG also point out to a different potential problem: in large wind penetration scenarios there could be a of surplus of wind energy on the system. You have been looking at ways to manage this excess generation, and also at Danish experiences in dealing with the problem.

Professor Strbac: We could conceivably have a low flexibility generating system, which could, for instance, consist of CCGT generators, a large portion of nuclear and a large share of wind. Now in that kind of system, particularly when low system demand conditions coincide with high wind power output regimes, we may have a surplus of electricity and we would potentially need to shed wind. That was a sort of problem faced by Denmark a number of times in the past, which they resolved by passing on the surplus electricity to Norway, by giving them electricity for free! At the same time Norway would balance its grid by reducing output from its hydro stations. The problem for Denmark was that when they faced a shortage of electricity they would buy it back from Norway, but at a premium cost. In effect, they were exporting at 0 Eur per MWh and importing at, let's say, 50 Eur per MWh.

RealPower: The solution here seems to be in finding ways of using wind energy to contribute to heat or transport.

Professor Strbac: Correct, and this is what Denmark has done by utilising wind energy surpluses as part of CHP generation. They have changed a law forbidding electricity to be used for heating, and have started using the surpluses mentioned to heat water in the hot water tanks already installed to provide backup in case of CHP plant failure. So now, on windy days some of CHP plant gets switched off, as they would not find it profitable to burn gas while getting nothing for their electricity production, and wind is used instead to heat the water for the community heating system. They have demonstrated that you can displace some of the energy supplied by gas for heating, by electricity generated from wind (when you have a surplus). Since this was done electricity prices in Denmark haven't dropped under 25 Euros per MWh. So the game we need to push is increasing electricity demand but reducing fuel use elsewhere, for example in heating or transport. UK can learn for this experience, as shifting non-electricity energy into the electricity sector could reduce costs of managing the real time balance between supply and demand, in a system with significant contributions from wind and nuclear.

RealPower: Finally, work of SEDG has been focused at quantifying system costs. It seems that many projections on the economics of wind are quickly dated by the fluctuating prices of fossil fuels and commodities such as iron and steel. For instance, a BWEA submission to the House of Lords in July pointed out that, taking costs of carbon mitigation into account, wind is now cheaper then either gas or coal.

Professor Strbac: We need to understand that there will be system costs of integrating wind into the grid and that the job of the energy markets is to allow all mitigating options to be considered. Recent increases in costs of various commodities including energy affect different aspect of the wind roll out programme. In 2002 our analysis suggested that a system with 20% contribution from wind would add only 0.3p/KWh on the users' electricity bill, when compared with a gas based generation system. But, the fact is that then the cost of oil was a third of what it is now and the cost of steel has doubled. Due to rising energy prices the wind story looks even better now than five years ago. And if we are looking at the long term and consider energy security, wind can clearly make an important contribution.

GORAN STRBAC

Goran Strbac is a Professor of Electrical Energy Systems at Imperial College, London. He is also the Director of the BERR Centre for Distributed Generation and Sustainable Electrical Energy, the Convener of CIGRE International Working Group on Economics of Integration of Distributed Generation and a member of the Executive Team of the IEE Professional Network on Power Trading and Control. He is a co-author of three books and has published more than 100 scientific papers.