Blackouts: Do liberalisation and privatisation increase the risk?

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December 2003

This paper was commissioned by EPSU www.epsu.org

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1 Introduction

Electricity blackouts can be serious events that cause human suffering and economic disruption. Even in the best-run systems, there will be a risk of black-outs because of human error and extreme weather conditions. However, it is important to designate a security standard that strikes a good balance between security and cost and that this standard is maintained. For example, in Britain, the standard for generation is that there should be enough generating capacity that there should only be blackouts due to shortage of generation in 8 winters per 100 years. There is no performance standard for the networks despite the fact that blackouts due to network failure are much more common than those due to generation shortage.

The traditional, publicly-owned, monopoly cost-plus system was generally effective at meeting the required security standard. Because, for private companies, profit was regulated and for publicly owned companies, profitability was not the key objective, there was no incentive not to spend enough money on investment and maintenance to ensure the designated standard was met. Companies could be given a duty to ensure the security of the network and to ensure there was enough generation capacity.

This system was criticised as being inefficient because there was no profit-driven motive to minimise costs: any savings the company made were passed on to consumers. The liberalised model addresses this problem by making generation a competitive activity and by introducing incentive regulation for the monopoly network. Under incentive regulation, companies can keep cost savings as extra profit. It was assumed that a combination of market forces for generation and regulated performance targets for networks would be sufficient to prevent deterioration in system reliability.

There are serious grounds to suggest this will not be the case. Activities in the electricity industry are now being bought and sold frequently and there must be a risk of a 'take the money and run' philosophy. Cutting back on maintenance may not be reflected in poorer performance for several years, by which time, ownership of the facility could have changed more than once. For example, in Britain, the Eastern distribution network has had five owners in only eight years, while ownership of some power stations has changed three or four times in the same period. Currently in Britain, about 40% of the generation capacity is owned by companies that are bankrupt or close to bankruptcy. This is clearly not a recipe for responsible stewardship of long-lived assets.

For a more detailed discussion of the potential problems, it is necessary to consider generation and network activities separately.

2 Network activities

In some respects, liberalisation does not fundamentally change the way in which network activities operate. They remain regulated monopolies. However, under the EU Directive, they must be effectively fully separated from the competitive activities generation and retail supply. Distribution and transmission companies should have no commercial interests in the competitive activities, generation and retail supply. The network companies are often unknown to consumers. So the chain of responsibility that existed in the old system is broken that meant that electricity companies had a direct responsibility to the final consumer.

There is at least one other important change in the nature of the transmission and distribution activities. Transmission and distribution companies now have to deal with multiple users of their system who they have no influence or control over. While the electricity industry for a given region was controlled by one company or two cooperating companies (a generation and transmission company, and a distribution and retail supply company), potential system problems could be more

easily avoided. Transmission and distribution companies have limited scope to order generators or retailers to carry out actions to ensure system security.

The change in the new system that was meant to address the alleged inefficiencies of the old system, the introduction of incentive regulation, may also be its weakness. Under incentive regulation, companies are allowed an approved level of investment and expenditure on operations and maintenance (O&M), typically for a five year forward period, and if they can make savings on these allowed levels, they can keep the savings as additional profit. This creates a strong incentive on companies to make such savings to increase their profits regardless of whether there will, in the long-term, be a detrimental effect on service.

Experience in Britain with the privatised company that owned and operated the rail network is particularly bitter. When the rail industry was privatised in Britain, a similar structure was adopted as for the electricity industry. The network (the rails) was owned by a separate company with no interests in operating train services. The company underinvested and did not maintain the network properly. By the time the problems were apparent, so much damage had been done that it will take many years of high prices and poor service before the problems are solved. High priority programmes to expand and upgrade the network have had to be abandoned. While the company involved was bankrupted, this did not mean that the costs of this failure fell only on shareholders. Consumers and taxpayers have had to pay large sums of money to administrators who are now running the re-nationalised assets trying to make it a viable concern again

Other problems that may be cause problems to system reliability are contracting out of major activities and cut backs to training. These may lead to skilled workforces being eroded. These problems are discussed in detail in 'Restructuring and outsourcing of electricity distribution in EU' by Stephen Thomas and David Hall.[1] The UK Skills Dialogues programme looked at the skill needs for the gas, water and electricity industries[2] and found a number of problems, for example:

- difficulty across the gas, water and electricity sectors in attracting young people into the industry to replace the aging workforce;
- the short-term regulatory framework of investment and contracting in the gas and water industries acts as a disincentive to invest in skills and training; and
- there are concerns that poaching is a disincentive to investment in training.

To deal with the potential problems, countries in the EU are introducing performance standards for the system that distribution and transmission companies must meet.[3] For example, faults leading to a loss of supply must be rectified within a specified time. These performance standards raise a number of issues:

- Will it be possible to find a set of indicators that are comprehensive enough to ensure they really reflect system performance? It may be possible for a company to carry out measures that ensure performance standards are met but do not ensure good system performance;
- Will inadequate investment and maintenance be picked up quickly enough by the performance indicators before significant damage is done to the system? As was demonstrated with the British rail network, the costs of rehabilitating a damaged network can be huge. If a company under-invests or maintains equipment badly, serious damage may be done before it is picked up by the performance standards;
- What sanctions should be taken against companies that fail to meet standards? If fines are not substantial, companies may find it more profitable to pay the fine than to rectify the problem. If fines are substantial they may jeopardise the ability of the company to rectify the problem. It will also take strict regulation to ensure that fines do not ultimately end up getting paid by consumers rather than the company shareholders.

These problems are now being addressed in Britain by a new programme, the 'information and incentives' programme.[4] This will try to measure the real reliability of networks rather than through imperfect indicators. It will require new equipment to be installed to monitor the network fully. Under this scheme, the income a distribution or transmission company will receive will vary according to how reliable the system is. This new scheme is still at an early stage and we will have to await its implementation to see if it can solve the three issues listed above.

The CEER has set out a framework for providing incentives to network owners to invest in and maintain networks to a sufficient standard.[5] It advocates a market based approach and its overarching principle, it states 'a key focus should be on the ability of signals emerging from trade to highlight the need for new investment.' However, it seems highly questionable whether market signals can provide investment (and maintenance) signals in time.[6]

While there have been huge changes to Europe's electricity industry, reforms to most European electric systems are still far from complete. Separate transmission companies have been being created in most countries. A strong transmission network is key to the reliability of electricity systems and a major failure in the transmission system could lead to major national consequences. Regulation of transmission needs therefore to be particularly strict, monitoring closely to ensure that promised investments are carried out and that any savings the company makes in O&M costs will not jeopardise security standards.

A number of countries in Europe have taken deliberate decisions to keep, or to bring the transmission network into public ownership. For example, in the Netherlands, the transmission network is now owned by a new nationally-owned company, TENNET. In other countries such as Finland, Sweden, Norway, France, Italy, Greece and Ireland the transmission system is still either publicly owned or publicly controlled. By owning (or controlling) the system, governments will be able to ensure that its development is not subjected to the vagaries of corporate finance and fits in with national priorities.

Distribution is, in economic terms, a much larger activity, perhaps representing five times the turnover of transmission. Failures in the distribution system are likely to have less widespread consequences than a transmission system but can nevertheless be serious. Distribution remains largely integrated with retail supply and only in Britain, has there been a corporate separation of distribution and retail supply. As with transmission, strict performance indicators and close monitoring to ensure that agreed investments are carried out must be imposed.

Overall, there must be confidence that the reformed regulatory systems have the resources, capability and political power to enforce their decisions so as to prevent deterioration of the networks in a restructured electricity industry.

3 Generation

The issues with generation are very different. In the past, generation was a regional or national monopoly and it was easy to impose a requirement that the company should maintain enough plant to ensure that there is sufficient generation capacity. If generation is made a market, there must be free entry and exit for generators and no company can be given a duty to ensure there is sufficient capacity. Supply will be sufficient to meet demand only if enough power stations are profitable to meet demand. Power stations that lose money will be closed down. There seems to be no reason why this happy coincidence should always apply. To meet demand securely, it is necessary to have available power stations that might only be required once or twice a decade. If there is a run of warm winters, these rarely used power stations will not be required at all, will lose their owners money and are likely to be closed down.

In most markets there are cycles of overinvestment (when there is insufficient capacity and prices are high) followed by underinvestment (when there is over-capacity and prices are low). For most products, this does not matter. If prices are forced down by over-capacity, producers and users can use the extra capacity to build up cheap stocks and if prices are forced high by under-capacity, users can run down their stocks and can often use substitutes. New capacity can generally quickly be built in response to shortages. Clearly this does not apply to electricity, which cannot be stocked, for which there are generally no substitutes and where new investments in power stations may take more than five years to be completed.

Generating companies usually profit from shortages of capacity. The price will be forced up by shortages and their profits increased. In the case of California, it seems that some companies deliberately created a shortage by withholding capacity. This has also happened in Britain although with less severe consequences. However, it does not require corporate malpractice for shortages to be created. If demand is growing, no generating company has a responsibility to build the required new capacity. The generators' responsibility is to maximise profits for their shareholders. Building new generating capacity is economically risky and will tend to reduce the price of power paid to companies' existing power plants.

The logic of the EU reforms is that the companies that generate electricity should not only not own the network, they should also not be involved in selling electricity to final consumers. If the generation market is dominated by 'integrated' companies, the wholesale market will be largely meaningless because generators will generate power for their own consumers and bypass the wholesale market. However, the EU has not enforced the logic of its reforms and in many EU countries, generation and retail supply are fully integrated. This has already happened in Britain where, initially generation and retail were kept separate. However, following a reversal of government policy on this in 1998, the industry is now dominated by just six companies that generate electricity and supply to their own final consumers.

The

A major objective of the electricity reforms, the creation of a strongly competitive wholesale electricity market, will be lost if integration of generation and retail supply becomes the rule. However, one advantage of this type of integration is that integrated companies will have an incentive to have enough capacity at their disposal to ensure their own customers are supplied. However, it is questionable whether replacing a properly regulated monopoly with the type of unregulated oligopoly described above is really in the interests of consumers.

The European Commission is increasingly emphasising the need for super-national markets and ultimately a single European electricity market. It stated recently 'The objective is quickly to achieve a simple, objective, transparent, non-discriminatory trading system reflecting costs in order to create a real internal energy market instead of fifteen liberalised but still overfragmented markets.'[7]

A competitive wholesale electricity market must not only lead to prices that reflect the production costs, it must also generate sufficient investment in new capacity to ensure the security of supply. If a competitive and sustainable wholesale electricity market that meets these requirements is not achievable, retail competition and de-integration of the network activities are pointless. It would be better if this was acknowledged now rather than trying to pursue an unachievable dream that will end up as an uncompetitive oligopoly.

Table 1 Generating capacity adequacy in the UCTE region January 2003 (GW)

	Installed capacity	Guarantee capacity	Load	Remaining capacity	% Remaining capacity/ Load	Net export capacity	Net import capacity
Austria	16.9	12.4	8.4	4.0	48		
Belgium	15.6	12.9	12.3	0.6	5	5	4
France	111.2	83.1	71.1	12.0	17	9	0
Germany	108.3	79.3	73.4	5.9	8	10-15	10-15
Greece	10.1	7.0	7.5	-0.5	0	0.5	1
Italy	79.6	52.3	51.2	1.1	2	0	6.5
N'lands	20.1	17.1	16.4	0.7	4	4	4
Portugal	9.6	8.2	7.0	1.1	16	1	1
Spain	54.4	39.9	33.4	6.5	19	2.5	2.5
Switz	18.1	13.1	9.1	4.0	44	3-6	3-6
Czech	15.3	10.5	8.8	1.7	19	3	3
Hungary	7.8	6.0	5.1	0.9	18	1	1.5
Poland	34.2	27.9	20.8	7.1	34	2	3
Slovakia	8.0	5.1	4.1	1.0	24	3	3
Slovenia	2.7	2.2	1.8	0.4	22	1	0.5

Source: http://www.ucte.org/pdf/Publications/2002/Forecast_2003_2005.pdf

Notes

1. Data are available only for countries that are members of UCTE and exclude Finland and the UK.
2. The data are forecasts for 11.00AM, the third Wednesday in January 2003 (assumed peak demand time) and were published in December 2002.
3. All countries are winter-peaking systems.
4. Net transfer capacities are estimated from a graphical presentation.

Table 2 Generating capacity adequacy for Nordic Region 2003/04 (MW)

	Finland	Denmark	Norway	Sweden	NORDEL
Available capacity	13500	7730	22600	27400	71230
Peak demand (1 in 10 winters)	14300	6830	23200	28800	73130
Actual maximum demand, 2003	11613	6082	17260	23301	58246
Net estimated trade capacity	800	470	600	1400	2230
Imports (from outside NordPool)	1560	1950	50	1200	4760
Exports (to outside NordPool)	60	1950	50	1200	3260
Imports (from inside NordPool)	0	3720	5595	9625	
Exports (to inside NordPool)	700	3680	6315	9365	

Source: http://www.nordel.org/Content/Default.asp?PageID=157

Notes

1. Available capacity excludes reserves and unavailable capacity.
2. Import and export capacities are gross capacities

4 International experience with blackouts in 2003

4.1 Major blackouts

In the summer of 2003 a series of major blackouts affected OECD countries: USA and Canada in August, followed by UK, Sweden and Denmark and finally the whole of Italy in September 2003. This followed on from were massive blackouts in California in 2001, and in Auckland, New Zealand in 1998.

In addition, France, Ireland, Japan, Netherlands, and New Zealand have all issued official warnings over the possibilities of power cuts during the course of 2003, due to anticipated shortages of power capacity for a variety of reasons: in France it was due to nuclear plants being closed because the hot summer made it difficult to cool the reactors; in Japan it was due to the closure of nuclear plants for refurbishment to meet safety standards; in New Zealand, due to capacity shortages expected as a result of shortage of gas supply; in Ireland and Netherlands the warning was related to general lack of generating capacity.[8]

The blackouts of 2003 and their predecessors involved failures of networks and/or capacity shortages. There are common features of some of the factors involved. The UK blackout in London was caused by component failures and errors in a local distribution system. The following discussion concentrates on the USA blackout and to a lesser extent the Italian blackout.

Table: OECD – major blackouts in 2003 and earlier*

Country	2003 blackouts	Pre-2003 blackouts
USA	New York, Toronto, 14 Aug 2003	California: 2001 blackouts and cutoffs
Denmark & Sweden	Stockholm, Copenhagen 24 Sept 2003	
Finland	Helsinki	
Italy	Whole country, 28 Sept 2003	
UK	London,	
New Zealand	-	Auckland 1998: series of blackouts

* excluding direct storm damage Sources: press reports etc

4.2 Factors

4.2.1 Stresses of trading electricity over long-distance transmission lines

The USA blackout on 14th August involved a failure of the networks to cope properly with trips and loss of generators. "…First Energy's problems began when an alarm system used to alert control room operators stalled. Then, First Energy's main computer system and back up servers began to fail, slowing the operators' ability to respond to events. Finally, due to heavy load demands, three of First Energy's high voltage transmission lines sagged into overgrown trees causing them to trip out of service." [9]

The transmission system of the USA was not designed to cope with large amounts of power traded over long distances in competitive markets, which is what has started happening under liberalisation, as owners of generating assets use trading to obtain the best price and so maximise the returns on their investment. On 14 August the system was unable to deal with the problem events that occurred, when "so many safety systems of so many utilities in so many states failed to detect the warning signs—voltage spikes, power surges, and increased volatility in operating frequencies—that typically disconnect a utility from the grid, isolate the transmission disturbance, and minimize loss of service to customers" [10] .

This stress has been observed before in the USA. In August 1999: "A series of wholesale trades nearly caused the Tennessee Valley Authority (TVA) system to collapse …, as a grid that was built to exchange power among a relatively small number of large monopoly generation utilities was bombarded with

unanticipated transmission demands that complicated flows in ways for which the system was not designed. In 2000, 180 wholesale transactions were rejected to preserve reliability. The alternative could be blackouts caused by load imbalances." [11]

The report by Swiss authority SFOE identified some of the same factors as causes of the Italian blackout of September 2003: lines clashing with trees, and an increased use of inter-connections and long-distance transmission which increased the complexity, vulnerability and instability of electrical systems even at night during a period of minimal demand. [12] It identified a simple conflict: "The underlying causes of the incident that occurred on 28 September 2003 are the unresolved conflict between the trading interests of the involved countries and operators and the technical and legal requirements for safe and reliable operation of the networks." [13]

UCTE, the European transmission grid body, also made a number of observations highlighting the stress on international transmission systems, the lack of spare capacity, and the lack of enforceable standards. Firstly, it noted that the tripping of the connection lines had consequences for neighbouring countries' grids that were interconnected, and that there was a possible lack of regional cooperation; secondly, it observed that the Italian blackout "results from already well-known and still unsolved structural issues transmission system operators (TSOs) are facing in Europe"; thirdly, it commented that UCTE had "have repeatedly warned over the especially tense situation in Italy with a structural dependency on bulk electricity imports". Finally it called for European-wide regulation using enforceable enforceable security and reliability standards. [14]

4.2.2 Lack of incentive to invest in network

Under a liberalised system "few companies want to spend money on assets where the return is low or uncertain, especially if the market is unwilling to compensate for reliability private companies". The earlier regulated system in the USA provided a more reliable investment climate, according to credit rating agency Standard and Poor (S&P): "Cost-of-service, rate-of-return environments generally supported credit quality, while the newer competitive environments have heightened credit risk". [15]

As a result, investors are unwilling to finance private investments in networks. In the USA, S&P warn that if companies "make, or are forced to make, large infrastructure investments in transmission upgrades without clear assurances about capital recovery, credit quality will suffer." [16] The same is true in Europe: the European Investment Bank (EIB) states that the private sector cannot be seen as a major source of funding for investment in networks: "it should be recognised that the bulk of finance, notably for major cross-border projects, will have to come from public sources (whether via grants or guarantees)…. the role and responsibility of governments remain crucial in this respect".[17] The reliability of an electricity system remains fundamentally a public good.[18]

The lack of incentive to invest in extra capacity also affects publicly-owned electricity companies operating under commercial rules in a liberalised environment. In New Zealand, the government warns of possible power cuts this year although a state-owned generator, Genesis, is operating below peak capacity: Genesis says "it does not keep enough coal on hand to maintain supply in dry years when hydro lakes are low […] because its primary goal is to make a profit and return a dividend to the Treasury".[19]

4.2.3 Underspend on systems and training

The factors identified by the official enquiry into the USA blackout included: inadequate tree-cutting, inadequate operator training, failure to ensure operation within secure limits, failure to tell neighbouring systems about emergencies, failure to see what was happening in other regions, failure and lack of backup of computer systems.[20]

Some of these factors have already been observed in European systems and elsewhere. The problem of training, for example, identified as a key issue by the USA report, is now a problem throughout Europe. A report on training in the UK noted that the utilities had been cutting their labour force and failing to train new entrants, so *"their remaining workforce has been steadily moving towards retirement. This pool of*

skilled and industry-knowledgeable workers will soon be lost to the Utilities, with no stream of young people to take their place." There was also a shift in employment of workers from the utilities themselves to contractors: but contractors, under pressure to cut costs: "*are not investing in skills to the extent of the pre-liberalised Utilities, and the sustainability of the industries is threatened"* [21].

The problem of poor tree-cutting was also noted by a report into power cuts in the UK following a severe storm in October 2002, which suggests that the storm had worse effects in Eastern region partly because of the company's failure to carry out routine tree cutting work.[22]

Underspend on maintenance was also identified as a factor in the Auckland, New Zealand, blackout of 1998 which disrupted the city. An official enquiry attributed the problems to the distributor's failure to maintain crucial cables, influenced by the wish to achieve commercial targets for its (public sector) owners.[23]

4.2.4 Shortage of generating capacity: planning, gaming and other reasons

Many of the blackouts are either caused by, or started by, shortages of generating capacity. As the table below shows, many countries in the EU have low reserve generating capacity. This low reserve then leaves less margin in event of failures: the Sweden/Denmark blackout was caused by two nuclear plants going offline, and the network failing because the connection to Germany for alternative sources of electricity was not available. [24] The danger of blackouts in other countries has arisen because of weather conditions, safety requirements, or other factors.

Wholesale markets may make countries more vulnerable, because they provide incentive and opportunities for generators to profit from shortages. The California crisis of 2001 was a result of the operation of a wholesale market in which the generating companies were 'gaming the system.[25] Other states in the USA concluded that this was a danger of liberalisation itself: in 2000, electricity markets had been liberalised in 25 states, but by June 2003 this number had fallen to 18 in reaction to the failure of California's system. [26]

Sweden/Denmark

4.3 Responses

4.3.1 More long-distance transmission capacity?

A conclusion drawn by some organisations is that the long-distance transmission system needs modernisation and extension, requiring large amounts of investment. This seems to be the main response of the USA government, and European bodies. For example, the UCTE recommends "Removing administrative barriers for the construction of transmission infrastructure" ; the EC's DG TREN also believes that "Europe needs more infrastructure for competition and security of supply reasons…TSOs must be either instructed or incentivised to make the necessary investments";[27] and the EIB declares itself ready to finance whatever expansion is required. [28]

4.3.2 Less trading, more decentralisation

A different approach advocated by environmentalists is to reduce the risk posed by long-distance transmission and trading, and instead develop electricity systems that are more decentralised. Instead of increased public investment in cross-border transmission capacity, policies should concentrate on reducing demand, which will of itself improve the adequacy of existing levels of capacity, and by promoting more decentralised generation near the point of consumption, which reduce the costs of transmission across high-voltage grids.[29] This has also been advocated in the USA as an alternative to investment in transmission lines.[30]

4.3.3 Tighter regulation

The National Electricity Reliability Councils's (NERC) conclusion from the report on the USA-Canada blackout on 14th August was firm: "As unfortunate as the blackout was, our analysis indicates that it was also

preventable and clearly demonstrates the immediate need for mandatory standards." [31] The UCTE took the same view after the Italian blackout 9see above): "the transformation of UCTE rules into a set of enforceable common security and reliability standards, to be observed by TSOs and network users." This approach appears to propose a very strong form of regulation for network operators.

Table: Diagnoses and recommendations of various parties

Author(s)	Source	Diagnosis	Recommendation
Claude Turmes, MEP	Why Europe will face more US-style blackouts - background paper by Claude Turmes, MEP and rapporteur on the electricity liberalisation directive Oct 2003	Italy: 1. June blackout - excessive demand, inadequate cooling water; 2. September blackout: bad management system; structural dependence on imports.	Energy efficiency and demand reduction; accelerate new cogen and renewable capacity which needs less water; encourage decentralised generation; stronger regulation. Avoid nuclear investment; avoid instability and costs of long-distance transmission; halt TEN investments.
DG TREN, European Commission	1. The US blackout - Lessons for Europe. Presentation at European Energy and Transport Forum 26 September 2003 by William Webster, DG TREN Electricity and Gas Unit William.Webster@cec.eu.int 2. European Energy and Transport forum WG3 "Infrastructure" Brussels 20.11.2003 by Patrick Rousseaux ibid.	USA: Fragmentation of responsibilities, lack of investment in grid, vertically integrated companies. Italy: loss of capacity from France. UK: operational failure. Sweden-Denmark: plant tripped, imports not available	1. Allow more transmission lines, more generating plant, less government interventions. Instruct or incentivise TSOs to invest. 2. More coordination, binding EU rules on cross-border networks.
Burns, Potter, Witkind-Davis, NRRI (USA)	After the Lights Went Out, NRRI September 2003	USA: underinvestment in transmission system, poor coordination	Greater federal-state cooperation, stronger regulation of operators
Council of European Energy Regulators (CEER)	Lessons that should be drawn from the recent incidents in electricity supply and suggestions for guaranteeing an adequate electricity supply in liberalised markets. Note by the Council of European Energy Regulators (CEER) Rome, 5 Oct 2003	Lack of interconnection makes system vulnerable to capacity losses; long-term investments penalised by short-term strategies in market; poor cooperation between TSOs;	More generating capacity; improve cooperation between TSOs; modernisation of transmission systems; stronger regulation of liberalised market; demand management
Bundesamt für Energie BFE (Swiss)	Report on the blackout in Italy on 28 September 2003 November 2003[32]	Lines clash with trees; high electricity imports; "the unresolved conflict between the trading interests of the involved countries and operators and the technical and legal requirements for safe and reliable operation of the networks."	Create single separate national transmission company; comprehensive and binding regulations governing cross-border network operation.
UCTE (Union for the Coordination of Transmission of Electricity)	27.10.2003 | "Interim Report of the Investigation Committee on the 28 September 2003 blackout in Italy"[33] See also Press Release Monday 29 Sept 2003 After The Italian Nation-Wide Black-Out On 28 September 2003	Inadequate generating capacity in Italy; inadequate cross-border transmission capacity; tree-cutting practices; market cross-border trading places severe strain on cross-border transmission systems.	Europe-wide regulatory framework; enforceable security and reliability standards for TSOs and network users; easier construction of transmission lines.

5 Conclusions

- The restructuring of the electricity industry should be subject to public interest considerations. There needs to be regulatory machinery which can limit market forces and commercial considerations by reference to public interest issues (i.e. not just competition policy), even though it involves limiting the management of the companies.

- There should be a public interest re-assessment of the use of cross-border transmission lines for electricity trading. If generating capacity and system reliability can be more effectively met by national measures, then further cross-border transmission capacity for trading may be unnecessary. The facilitation of trading should not by itself be a justification for such investment.

- Transmission operators should be subject to stringent security and reliability standards, enforced by a regulatory authority with a public interest mandate, and/or through public ownership of the grid.

- Regulators should impose strict conditions on distribution companies as part of their license:
  - requiring companies to demonstrate how their future investment and maintenance plans will assure reliability, and monitoring these programmes to ensure the companies' compliance.
  - an obligation to employ and train a skilled workforce to carry out the work
  - a prohibition on contracting-out of core functions, including network maintenance and customer service

- Regulation of distribution and transmission should be based on open and public procedures which encourage and address representations from stakeholders and citizen groups

A) Annexe: The risk of blackouts in Britain in the winter of 2003/04

There has been publicity this autumn (2003) about the risk to electricity supplies in Britain this winter posed by a shortage of generating plant. At this stage, it is not possible to say whether there will be blackouts this winter. This will depend on a number of factors, particularly the weather: in cold winter days, electricity demand may be 10% more than on an average winter day. It would not be sensible to try to build so much generating capacity that there could never be a shortage of generating capacity, no matter how severe the weather. A balance must be struck that weighs the costs of a risk of a shortage against the costs of providing additional generating capacity. In Britain, for many decades, the risk level that government has required the electricity industry to meet is that there should be enough electricity generating capacity to meet demand in 92 winters out of 100. In a number of these 92 winters where there are not blackouts, voltage may have to be reduced at times to maintain supplies.

The industry calculates how much plant is needed to meet this standard using statistical calculations that take account of the variability of the weather and the breakdown rate of power plants (a proportion of generating capacity will inevitably not be available due to breakdowns). Traditionally, it has been thought that it was necessary to have a generating capacity of 20% more than forecast peak demand to meet this standard. In the centralised monopoly system that existed in Britain prior to 1990, it was relatively easy to ensure this standard was met. The monopoly generator (the Central Electricity Generating Board or CEGB) had a duty to build enough plant to ensure this standard was met and it was also obliged to offer this plant to the system operator (also the CEGB) for service if it was technically possible at peak times.

In the privatised competitive system, these conditions do not hold. There are many competing generating companies and in a market with free entry and exit, no single generating company can be given the duty to ensure there is sufficient capacity available: if there is not free entry and exit, there is not a market. The duty of the companies is to make money for their shareholders and plant are built or shut down according to their expected profitability, not their role in keeping the lights on. With a standard of 92 winters per 100, logically, the last plant on the system (the plant with the highest marginal cost) will not be needed in most years and will receive no income. It is hard to see why companies would maintain a plant in service that would earn little or no income in 11 years out of 12.

So far in Britain, the high wholesale electricity price and other factors have meant that it has been profitable for generators to maintain more plant in service than was necessary to fulfil the national security standard. However, in the past 2-3 years, wholesale prices have fallen and much of the surplus capacity has been retired or mothballed. In November 2003, the National Grid Company, the system operator, estimated that the surplus of plant registered and maximum demand (expected to be 55.5GW) was 17.7%, suggesting that the risk that supply would be insufficient to meet demand would be higher than the specified 8 in 100 standard.

Three other factors should be mentioned that may mean the risk is higher than is apparent from this figure. First, a significant proportion of Britain's generating capacity is owned by companies that are technically bankrupt. British Energy (with about 9GW of plant) and BNFL (with about 3GW of plant), the two nuclear companies are both technically bankrupt. A number of fossil-fuel generating companies are also bankrupt or near-bankrupt, including the owners (AES) of the largest coal-fired plant in Europe (Drax, 4GW) and the owners (AEP) of two other 2GW coal-fired plants. There can be no guarantees that plant owned by bankrupt companies will be available this winter.

Second, owners of power plants cannot be compelled to make them available at peak times. Because power generation is now a free market, shortages of power will lead to higher prices, to the advantage of generating companies. In the past in Britain, competing generators have been found guilty of withdrawing plants at peak times to force up prices. How far this is price manipulation and how far it is reasonable profit-maximising strategy is hard to determine, but there is clearly a risk that generators (especially those desperate for cash) will withdraw plant at peak times to force up the price.

Third, the low wholesale prices that have prevailed over the past few years have led generators to cut back on maintenance in order to maintain their profitability. This will ultimately be reflected in plant reliability and the assumed breakdown rate may be too low, again increasing the risk of blackouts.

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[2] The British government, as part of its 'Skills Dialogues' programme published a report in 2002 on future skill needs in the gas water and electricity industries.
http://www.dfes.gov.uk/skillsdialoguereports/docs/SD_10_Gas_Water__Elect.pdf

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[4] For an account of the UK information and incentives programme, see
http://www.ofgem.gov.uk/temp/ofgem/cache/cmsattach/189_19dec01.pdf .

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