

The European Union has put aside more than €770 million in aid to help the accession countries of eastern Europe shut down their dangerous nuclear power plants, and to upgrade plants that are capable of attaining western standards. But the problem facing these countries goes further than many had anticipated, and a large number of unsafe reactors are still operating for a complex set of political, technical and economic reasons.

Environmental groups such as Greenpeace claim that the EU money has been diverted into extending reactor lives instead of shutting them down. Other environmentalists claim that the funding has simply been used as a means to tide over the West's nuclear industry, increasingly unwelcome in its own backyard. Even the European Court of Auditors, the European Union's financial watchdog, has questioned whether the money has been wisely spent.

Last November a damning report by the Court of Auditors concluded that the EU's programme to improve safety at nuclear power stations in eastern Europe had been so badly run that it was impossible to judge whether the programme had any effect. The report went on to say: 'Programmes at the power plants that posed most safety problems were the ones that made least headway.'

It states: 'Disparate and frequently changing staff numbers employed by the unit responsible for the programmes, the inadequate tools for managing the projects and monitoring the related accounts, and the lax management prevent the Commission from ensuring that the operations are monitored satisfactorily, problems are dealt with swiftly and the quality of the services provided by contractors is checked.'

The report also notes that the volume of contracts concluded without invitations to tender having been issued accounted for almost one third of the total. It also accused the European Commission of continuing a 'confused' intervention strategy towards the old-design reactors, decommissioning and dismantling, and waste treatment.

The EC responded by pointing out that it was merely charged with trying to assist countries and could not be expected to solve the problem.

A spokesman says: 'If all the nuclear installations were to be brought up to EU standards, this would cost up to €24.7 billion, far more than the EU had at its disposal.'

That figure gives some indication of the scale of the problem facing the accession countries, which have been told that they must shut down or upgrade their nuclear reactors to a safe level before they can join the EU.

The state-run nuclear industry in the former Soviet bloc was closely controlled by the Russians. They provided the technical support and detailed design know-how. When their troops pulled out, so did much of this exper-

Shut down

Although €1.9 billion has been spent on more than 700 most dangerous plants are still operating - Pete Sawyer



Time for change: eastern European countries will have to shut down or upgrade their nuclear power stations

tise. On top of this, a cash crisis precipitated by the harsh reality of 'real' economics has put an immense strain on the countries' ability to pay for technicians and essential equipment.

Some countries are in a better position than others, at least from the point of view of the EU. Romania adopted modern Canadian pressurised heavy water technology for its 620MWe reactor at Cernavoda, which came onstream in summer 1998.

Slovenia, which has a Westinghouse-designed 620MWe pressurised water reactor

(PWR) at Krsko, is also considered by the EU to be up to standard, although there is concern about waste storage. The Czech Republic and Hungary are well on their way to upgrading their nuclear power plants. But Lithuania, Bulgaria and the Slovak republic are hampered by the fact that they inherited some of the very first commercial Soviet reactor designs - they have been told by the EU to shut these plants down.

But the problem is not just technical. It is also one of economics. Many of the former Russian satellites rely heavily on nuclear power to supplement a general lack of indigenous energy sources. Bulgaria, the Slovak republic, Slovenia and Hungary depend on nuclear power for more than a third of their electricity needs.

Lithuania has by far the greatest dependency on nuclear power in the world. Its two RBMK reactors provided three quarters of

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before joining the European Union, but this is proving harder and more expensive than originally thought

Lithuania's electricity needs in 1998, supplying just under 14 Twh, with enough for export to neighbouring Belarus.

That should earn the fledgling democracy much-needed foreign currency. But in a complex deal nothing short of blackmail, Russia has agreed to continue to supply the reactor with fuel only as long as Lithuania continues to supply cheap electricity to Belarus, which is behind with its payments. The fuel would be expensive to fabricate in the west.

The RBMK is the oldest Soviet reactor design and is considered by nuclear safety experts to be the most dangerous. It is the same basic design as that which precipitated the 1986 Chernobyl disaster in Ukraine when a reactor exploded, sending radioactive dust over Ukraine, Belarus, Russia and parts of western Europe.

The design has a graphite moderator with fuel tubes and coolant tubes passing vertically

through the graphite. It has the advantage that reactors can be refuelled while they are on-line. However there is no containment structure should an accident occur, and if the water coolant is lost, the power increases dramatically. Both of these design flaws were important factors in the Chernobyl disaster, although the force of the explosion at Chernobyl was such that it is highly unlikely that even western-style containment would have prevented the release of radiation into the environment.

Lithuania's two 1,500MW reactors at Ignalina, close to the country's south eastern border with Belarus, are 'stretch' versions of Chernobyl's reactors. They are the world's largest nuclear reactors and were among the last RBMKs to be built. Ignalina unit 1 started producing commercial electricity in 1985.

Soon after the country gained indepen-

dence in 1991 the Swedish government stepped in to assess the safety of Ignalina 1 and 2. The result has been a steady programme of safety improvements at the plant, initiated by the Swedes, and latterly funded by the Nuclear Safety Account (NSA) and the European Bank of Reconstruction and Development, which granted €33 million.

The Lithuanian government has set up a new western-style nuclear regulatory body, Vatesi. However the fundamental flaw of the RBMK design – the lack of proper containment – cannot be so easily rectified. And it is this that has led to the EU demanding the plant be shut down.

A feature of the RBMK reactor is that the graphite moderating block becomes distorted over time. This 'gap closure' eventually leads to rupturing of the fuel rods and it only takes ten such ruptures to cause an uncontrollable reaction. To be safe the graphite should be re-channelled every 15 years or so, well before 'gap closure'.

Ignalina 1 is due for rechannelling, but the NSA agreement forbids the rechannelling of the reactor, as it would prolong its life. Caught between a rock and a hard place, the Lithuanians are, in the words of environmental consultant Antony Froggatt, an expert on eastern Europe, 'operating the reactor to the wire'.

Ignalina has been beset with operating difficulties. Unit 1 had to close down temporarily in May 1999 because it failed to meet requirements for a new safety licence. Last October the Lithuanian parliament ratified the government's energy strategy that calls for the closure of the first unit at Ignalina by 2005.

Unit 1 was supposed to be closed in 1998, with unit 2 following in 2002. Unit 2 is now unlikely to close before 2009.

The cost of closing unit 1 is estimated at approximately US\$2.5 billion (€2.54 billion) while projections for a full decommissioning of the plant could run as high as US\$4 billion, for which Lithuania says it wants financial support.

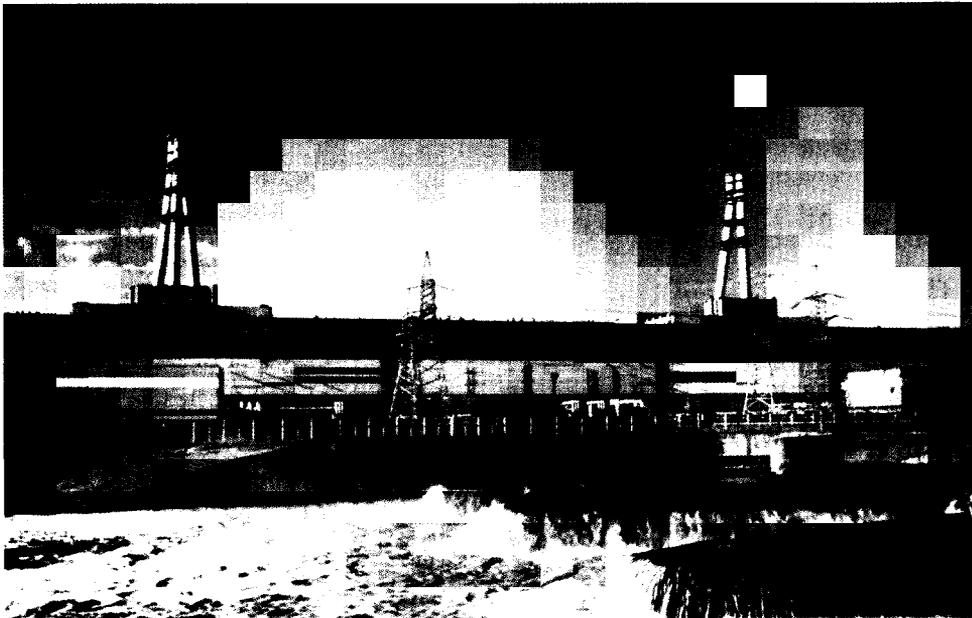
But how the country will make up its energy needs when the reactors finally close is a moot point. Lithuania is faced with a difficult problem: give up its primary power source for a faster road to Brussels or remain self-sufficient in energy and incur further wrath – albeit half-hearted – from the EC. There is always cheap Russian gas, imported via Poland, but for strategic reasons that is considered unsatisfactory.

There are even suggestions for geothermal energy plants in the west of the country. But for now, Ignalina is the only show in town.

Similar dilemmas have confronted the Slovak Republic and Bulgaria, which operate earlier versions of the VVER reactor design – the Russian version of the pressurised water reactor (PWR). The earlier version of the VVER has given the EU greatest cause for concern. The design is considered by western experts to have serious deficiencies. Like the RBMK, it lacks a proper western-style containment.

The VVER reactors at Kozloduy in Bulgaria and Bohunice in Slovakia have a long history of safety problems. Past agreements with the EU should have seen the closure of these first-generation VVER reactors

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Going west: despite western help, Lithuania's Ignalina plant has been beset with operating problems

by this year. But, once again, the problem is how to make up the shortfall in projected energy needs.

Bulgaria's Kozloduy plant has six operating reactors that provide 42 per cent of the country's electricity. Four of the reactors are VVERs. Under EU agreements these were originally supposed to be closed by the end of last year, but are now unlikely to be retired before 2003.

The Bohunice plant in Slovakia has four reactors that provide 45 per cent of the nation's electricity – two of these reactors are the older design. The Slovak government agreed to close these units by 2000, but now plans not to close them before 2006 at the earliest. In their defence, the Slovaks point out, correctly, that the EU has no uniform standard of reactor safety.

The EU also wants to see an increase in nuclear safety for the second generation VVER reactors at Dukovany and Temelin in the Czech Republic, Paks in Hungary (which produces 41 per cent of the country's electricity), Bohunice in Slovakia, and Kozloduy in Bulgaria, as well as newly operating Mochovce in Slovakia. Modernisation programmes at these sites are well under way. The commission has estimated the cost of modernising these reactors at €4.5 billion.

In the Czech Republic, the four operating VVER reactors at the Dukovany nuclear power plant provide 20 per cent of the republic's electricity. The Czech utility, CEZ, 67 per cent state-owned, brought in western companies to help upgrade Dukovany in an attempt to address some of the design deficiencies. Siemens has supplied new instrumentation to the plant.

Westinghouse, now owned by BNFL, helped with the writing of new emergency and operating procedures. And NNC is leading a consortium that will prepare data packages needed to develop software for a simulator, that can then be used to assess operating scenarios.

The prognosis for the larger VVER pressurised water reactors is better, but in the long run very dependent on market conditions. These have a full containment structure.

Although they have some instrumentation and control system deficiencies, they come closest to western standards.

Those who work in the nuclear industry are upbeat about the prospects for these larger and more modern plants. Adrian Ham, director of British Energy's International Consultancy Services, sees a clean-out of the less desirable older plants as inevitable, but thinks the newer plants have a reasonably long life ahead of them.

'The real threat is what is going to happen to the large reserves of Russian gas. It is hanging like a sword of Damocles over all new plant,' he says. But he adds: 'The more and more dependent countries are on gas, the more strategic value there is in having nuclear in the mix.'

The medium-term danger is that with the integration of the eastern European countries into the EU, the economic landscape could change to such an extent that in the long run some plants are rendered uneconomic, and the money spent on upgrading will be wasted. Environmentalists will argue that the money

would have been better spent on decommissioning and clean-up work.

Already, as a result of the deregulation of the electricity market, plans to build new reactors in Hungary and the Czech republic have been abandoned or cut back. At Temelin in the Czech Republic the original plan was to build four VVER reactor units. In 1990 the project was halved. The two-reactor plant is finally due to come on stream next year, but it is E900 million over-budget and five years late because of the difficulties in marrying Soviet design and American (Westinghouse) technology.

Significantly, following the imposition of a market economy and a western-style safety regime in the former East Germany, an economic analysis of the costs of bringing both operating and partially built Soviet-designed reactors up to German safety standards quickly led to them being abandoned. Four first generation VVER reactors were shut down and 400 fuel assemblies were sold to the Czech Republic.

One VVER reactor was under construction at the time of reunification and the German safety authorities worked out that it would cost between DM3.7 billion and DM4.5 billion (€7.25 billion) to bring it up to scratch.

Add to that the remarkable fact that western-style nuclear liability funds, which would be used to cover the cost of decommissioning the reactors at the end of their working life, are non-existent. 'There is pressure building up from the EU to see explicit ring-fenced funding,' says Ham. 'This factor will make people look very carefully at the economics, especially if, emphasis on if, the accession countries begin to supply electricity at unrealistically low prices.'

When the reactors eventually close, it will be a cold bleak winter for the people of the surrounding towns. Not only are the plants major employers, but many also provide communal heating against the savage eastern European winters. ■

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Closing in: unit 1 at Ignalina is due to close in 2002, with unit 2 unlikely to close before 2009