is well printed and has 155 figures. Only a few minor errors have been detected.

The book would probably be of greatest interest to the non-specialist physicist and to the chemist and metallurgist who wished to perceive the rapid advances of semiconductor physics and technology in the perspective of contemporary science. Some idea of the anticipated demand can be seen from the publication data which indicate a printing of twenty thousand copies.

R. E. Burgess

ECONOMICS OF ATOMIC ENERGY

Economics of Atomic Energy

By Mary Goldring. (The Atoms for Peace Series.) Pp. viii+179. (London: Butterworths Scientific Publications, 1957.) 15*s*.

IT may come as a surprise to many people to learn that one of the best places to site a nuclear power station is at Niagara Falls where all available water is now used for generating electricity. The nuclear power station could operate there on almost 100 per cent load factor, and be used for pumping water back up the Falls. The water could then meet the peak demand for electricity in Ontario Province by installation of further hydro-electrical equipment. A somewhat similar concept is in mind in the recent decision to site one of the new Central Electricity Authority nuclear power stations in North Wales.

If the general public feels disturbed at the possible despoliation of the countryside, however, they may perhaps find some comfort in reading the first chapter of this book by Miss Goldring. It gives a delightful account of how a large nuclear power station such as Calder Hall or a large plutonium-producing factory such as Windscale is a most novel and remarkable installation. Virtually nothing goes in through the factory gate after building has finished, nothing appears to come out; there may be chimneys but no smoke emerges. It is remarked even that birds can be seen sitting on the top of the chimneys at Windscale though anybody who has seen these chimneys may feel that some poetic licence has crept in. It is a fact, however, that virtually nothing is brought into a nuclear power station, and only at rare intervals is waste fuel taken out in a lorry. In theory, the factory could be almost automatic in operation. Pictures of recently ordered Central Electricity Authority nuclear power stations show most elegant structures; even chimneys have disappeared. Even grid lines taking electricity from the power station could be placed underground at some extra cost.

Miss Goldring describes in some detail the various atomic factories which exist in the United Kingdom and gives a basic account of atoms, and the problems of using radioactive materials. Following this she discusses, in a most interesting chapter, the scale of investment which a country needs in order to enter the nuclear energy industry on a sufficient scale. She remarks that the United States, Britain and France are all spending about 0·6 per cent of their national income on atomic energy and she points out also that the minimum capital needed to start a nuclear energy industry is about £100,000,000. Much of the expenditure has been for military purposes in the case of the United States, the U.S.S.R. and the United Kingdom, but the fact that this expenditure has been made has enabled these powers to build factories which can have a civilian as well as a military application. The investment is probably not much less even if the military application is foregone. She points out, in particular, that the smaller industrialized countries are likely to have some difficulty in entering the nuclear energy industry entirely on their own; though, for a small country, Sweden is making rapid strides in this field just as it has in the aircraft industry. Although the non-industrialized countries and the comparatively small countries are unlikely to be able to develop atomic power on their own, there is great national prestige attached to the subject of nuclear energy and most of them will form atomic energy commissions. In due course these will be able to discriminate between various reactor designs and advise power companies on the installation in their country of small nuclear power stations. These will have been purchased from highly industrialized countries with a large nuclear energy industry. Miss Goldring notes, however, that it will be much cheaper for a very long time to come to use diesel engines of comparatively low capital cost, except in those cases where fuel is extremely expensive because of high transport costs. This fact is beginning to become more generally appreciated even in those circles where two to three years ago nuclear power was looked on as something which would end all misery and poverty. It is important to remember that the capital needed to exploit electricity or other sources of power is far greater than the capital cost of the power plant itself.

The author comments on the need for atomic power and points out, as many others have done, that atomic energy is very badly needed in Britain and also Japan. In fact it is among the highly industrialized countries, except the United States and the U.S.S.R., where the need is really urgent. The United States has large and cheap sources of coal, oil and natural gas, and the U.S.S.R. has no overall fuel problem. In the extreme west of Russia, however, fuel supplies involve high transport costs and here it may possibly pay to develop nuclear power in the next ten to fifteen years.

The author has a chapter on the cost of atomic power and in general she tends to follow the views that have been expressed by the United Kingdom Atomic Energy Authority; though she does conclude this chapter with the remark, "this is a subject on which it is possible to have more than one opinion". She gives a critical discussion of the costs of natural and enriched fuels.

On the subject of nuclear power station exports Miss Goldring is once again extremely realistic. She recognizes that the actual business is not likely to be large in terms of numbers of large nuclear power stations. Most industrialized countries will tend to build either a complete power station under licence or manufacture most of the components themselves.

Finally, the author gives an excellent review of relations with industry in the field of nuclear power, though she avoids the difficult question of exactly what these relations should be.

This is an entertaining book, and a few technical errors do not affect the main arguments. For the general public as well as the specialist it is well worth reading since the author has studied and appreciated the intricacies of a very complex subject.

J. V. Dunworth