puters where microcircuits, even if they are not actually cheaper than transistors, offer cheaper design because fewer circuits are needed. The telecommunications field is likely to follow, although in Britain this will involve winning over the General Post Office, which is still wedded to conventional technology for most applications. After that, much wider markets may be opened, in radio, colour television and even motor cars. Much will depend on the price of integrated circuits—their reliability is already proved. But price is falling rapidly, from about £1·5 for each component a year ago, to £1 each today, and perhaps £0·5 each next year. Apart from the understandable desire of manufacturers to encourage the use of microcircuits, it is also the case that the productive capacity already in operation is far greater than present demand justifies. There may therefore be an element of dumping in the rapid decrease in prices, as a discouragement to other firms to enter the field. As the price falls and technology advances, it becomes increasingly hard for new entrants to the industry to justify their capital expenditure. Companies now planning an investment in microcircuitry, for instance, would probably do better to forget it.

A very large investment has been made in the Southampton factory of ASM; £4 million has already been spent, and another £11 million is to come. The result is the largest semi-conductor and integrated circuit factory in Europe, built, ASM hopes, just in time for the boom in microcircuitry which it believes is on the horizon. Although the market is worth only £5 million in Britain this year, ASM believes it will be worth £20 million by 1970 and £50 million in 1975. Already the market in the United States is worth $200 million, and ASM hopes to break into it through agreements between Westinghouse and Philips (the parent company of Mullard). Particular emphasis is being placed in the development of exceedingly fast digital circuits. Dr F. E. Jones, managing director of Mullard, stresses how difficult it is to attack the American market—first, it is necessary to obtain type approval from an American manufacturer and then it is necessary to bypass the Buy America Act, which discriminates in favour of the home producer.

Would a reorganization of the British electronics industry help British companies to become competitive? Mr Ronald Grierson of the Industrial Reorganization Corporation certainly believes so, and favours a merger which would produce two companies in the microcircuitry field. ASM has had talks with the IRC, and is now waiting for a review of the industry which IRC is producing. Not all is going IRC's way at the moment, however, and the take-over bid by GEC for Associated Electrical Industries is turning into a real battle. What seems logical to outsiders may not always be agreeable to those in the industry.

First AGR for Scotland

THE Nuclear Power Group last week won the contract for Hunterston B nuclear power station. The contract, which was awarded by the South of Scotland Electricity Board, is for a 1,250 MW(e) station to be sited next to Hunterston A, which is a 300 MW Magnox station. SSEB will be paying £87·5 million for the station, and in addition will have to pay the initial fuel charges. The price announced shows only a modest reduction from the price for Hinkley Point B, which was negotiated between TNPG and the Central Electricity Generating Board. TNPG says that the price for Hinkley Point B at the corresponding stage was £90 million.

It is hard to see how this tallies with the information given to the Select Committee on Science and Technology by Mr S. A. Ghalib, managing director of the Nuclear Power Group. Mr Ghalib explained that for direct replication of a design, a cost reduction of 10 per cent could be expected. For a development of the design, he went on, even greater savings could be achieved, and he quoted the difference between the Dungeness B contract, awarded to Atomic Power Constructions, and Hinkley Point B. If Hunterston B is to be a direct copy of Hinkley B, the SSEB should therefore have been expecting a tender of about £81 million; if it is not a direct copy, but a development, then by Mr Ghalib's argument the price should have been even less. Both stations are the same size and type; Hinkley will come into operation in 1972, and Hunterston in 1973.

The contract also makes Colonel O. W. Raby's remarks to the Select Committee look a little ill-judged. Colonel Raby, who is managing director of Atomic Power Constructions Ltd, claimed that his consortium could have undercut TNPG on the Hinkley contract if it had been allowed to tender. Despite this claim, APC has failed to win the Hunterston contract. There may be special difficulties in the Hunterston contract which have increased the price, but neither TNPG or SSEB has yet indicated any.

The contract leaves Nuclear Design and Construction, Ltd, the third consortium, very much out in the cold. Without an order for three years, NDC must now be favourites for the role of odd man out if the number of consortia is reduced to two. There are now talks of an amalgamation between APC and NDC, but both consortia claim that the Hunterston contract has nothing to do with it.

The end product seems likely to be that Scotland will generate electricity only marginally more cheaply than is possible at Hinkley Point B. The Hinkley price is quoted as 0·476*d*. per kWh; assuming that fuel and site costs are comparable at Hunterston, generation costs would be almost identical. This must be a very tentative conclusion, however, since both SSEB and TNPG are uncommunicative about exact costs. Both will be earnestly hoping that the price increases which have been a feature of the Dungeness B contract will not repeat themselves at Hunterston. At least the Hunterston design will incorporate proved design features, so it may be possible to avoid escalation. The station will have two reactors enclosed in prestressed concrete vessels with integral boilers and gas circulation. This design has already been used by TNPG at the Oldbury Magnox station which comes into operation late this year. Each reactor at Hunterston will supply steam at conventional temperature and pressure to a 660 MW turbo-alternator. The reactor

will use enriched uranium in the form of uranium dioxide, and the design provides for the reactor to be refuelled on power by a single charge machine. Work will begin on the Hunterston site immediately.

The Nuclear Power Group is now in the happy position of having won contracts for at least £180 million worth of work. Power stations built by the group have generated a quarter of the world's nuclear electricity, and the group has the unique distinction of having successfully exported British nuclear technology, in the building of the Latina 200 MW station in Italy. (The other British export was to Japan, and is better not mentioned.) The group is bound to regard this latest order as a guarantee that it will still be in business after the Select Committee on Science and Technology publishes its report on the British nuclear power industry at the end of this month.

Redeploying Scientists

A TRENCHANT defence of the British Government's interventionist policy towards industry was given by Mr Anthony Wedgwood Benn, Minister of Technology, when he spoke at Imperial College on October 17. Mr Benn at first seemed eager to show how unexceptional intervention in Britain is—"The great military–industrial complex in the United States," he pointed out, "constitutes a public sector of formidable proportions which makes even the most radical British interventionist look like an amateur."

Despite its mildness, however, government intervention was inevitable and essential. In the computer industry, the ministry and NRDC had made available substantial amounts of money, and the next stage of the ministry's policy towards computers would concentrate on applications. Mr Benn hesitated to say where the British computer industry would have been without government support. The ministry's policy towards shipbuilding was openly interventionist, and the aid made possible by the setting up of the Shipbuilding Industry Board would only be made available to yards that would toe the government line by reorganizing or regrouping. In nuclear power, the task of finding the right industrial structure to allow Britain to cash in on the tremendous investment in civil research and development was almost a classic. Mr Benn gave away little of the Government's attitude towards the Atomic Energy Authority, merely observing that, having solved many of the technical problems it had set out to solve, it now faced some unresolved choices about its future.

Mr Benn did say something about his attitude towards the Government research establishments. There were two approaches, he thought; one would be to group the establishments under some sort of Technological Authority working closely with industry, and identifying and pursuing goals less expensive and more relevant than the US space programme but capable of establishing a tradition of excellence. The other would simply be to say that the establishments had outlived their usefulness, and run them down sharply, closing many in the process. But neither of these approaches would in fact be adopted—instead the ministry intended to pursue a carefully phased programme designed to break down the barriers separating research from production. The integration of research and production had proved to be the secret of industrial success abroad, Mr Benn thought, and it must become a major policy objective in Britain, too. "It would be quite wrong to find work inside Government establishments for its own sake just to keep scientists and engineers employed."

This aim might involve Government laboratories undertaking contract research from industrial firms on a basis of confidentiality. Alternatively, intimate connexions might be developed between establishments and the new large firms which will emerge—the Gas Turbine Establishment at Pyestock and Rolls Royce was an obvious example of this approach. Finally, the ministry would try to make it easier for people to move between the establishments and industry. "What we are engaged on is not just an attempt to transfer the emphasis from defence to civil work—although we are doing that—nor even to change the emphasis between intra-mural and extra-mural—though we shall do that as well, but to secure a re-distribution of more of our qualified scientists and engineers from research, wherever it is done, into design development production, marketing, and above all management."

More Money for Innovation

THE National Research Development Corporation is learning to live with wealth. Three years ago its borrowing powers were limited to £10 million; they were then increased to £25 million, and a few months ago to £50 million. Last week the Minister of Technology was talking of increasing them yet again. But all this has not gone to the corporation's head, as its annual report for 1966–67 shows. It is the mixture as before—the development of inventions from industry, universities and government laboratories, with a liberal sprinkling of ideas from private inventors, some amusing, some improbable and some downright eccentric. What, for instance, is one to make of a semi-automatic jelly tester?

Increasingly, though, the corporation is becoming involved in industry's own problems, which call for commercial as well as technical judgments. This year 69 new projects have been taken on, against 28 for the 9 months covered by the last report, and the expenditure on development projects is up, to £3·65 million. Exploitation receipts are also up, from £430,000 to £793,000, and the total income is £1,307,000, against total outgoings of £4,705,000. As well as the 69 new projects taken on, support was continued for 115 existing projects. The corporation seems so far to have produced only one real money spinner—perhaps surprisingly it comes from the Medical Research Council and the University of Oxford. It is cephalosporin *C*, the antibiotic which the corporation has supported since 1952. Of the total income of the corporation, £493,000 came from overseas, and cephalosporin accounted for two-thirds of this. The corporation should be grateful to Professor Abraham and Dr Newton of the Sir William Dunn School of Pathology at Oxford, who discovered and isolated cephalosporin. The corporation continued to support the development of hovercraft, and records with pleasure that a patent dispute in the United States was resolved in favour of Mr Christopher Cockerell, the British inventor of the hovercraft.

There is one new idea in this year's report. The corporation is supporting a project which enables a