

GEC REVIEW OF ACTIVITIES 1982

POWER ENGINEERING

	1982	1981
TURNOVER	£689m	£531m
EXPORT SALES	£355m	£341m
EXPORT ORDERS	£857m	£434m
PROFITS	£59m	£61m

Deliveries were about the same as in the previous year for most of the businesses, but Energy Systems recorded substantially higher sales. Orders received in the year totalled twice the amount of turnover; they include a very large export content, especially for the Turbine companies, so that more than three quarters of the orders in hand at the year end were for overseas customers. Profits were about maintained by most of the businesses, but Switchgear and Power Transformers fared less well than others.

GEC Turbine Generators Ltd continued to make good progress. In Hong Kong, the first 350MW unit at Castle Peak 'A' power station achieved full commercial load in under 52 months from the Letter of Intent. At Duhva, in South Africa, the third 600MW unit was commissioned, and all three units are giving satisfactory service. At home, the first 660MW unit at Littlebrook was commissioned and has performed well. Further units were commissioned at the Isle of Grain. The contract for Castle Peak 'B' station valued at £550 million was signed, and orders were received from Edmonton Power for two 400MW units for Genesee power station. There were two small but important steam turbine orders from overseas for combined cycle. After the year end, a Letter of Intent was received from the Electricity Supply Commission of South Africa for a further six 660MW units for Station 'D' in South-Eastern Transvaal. This will increase the order book to over £1,500 million, of which almost 90 per cent is for export. The Queen's Award for Export Achievement was won for the fourth time and the third successive year.

GEC Gas Turbines Ltd improved its order intake from overseas, including contracts from the Middle East for large mobile generating units and an important order from Bangladesh for a 90MW combined cycle unit – the largest yet to be exported from Britain – incorporating

a 60MW gas turbine, waste heat boiler and 30MW steam turbine. In the North Sea, two single-lift power generation modules were completed for Conoco for installation in the world's first tension leg platform. The company has now supplied over one-third of the total aero derivative gas turbines worldwide for offshore duty and is the world's leading supplier of large mobile generating units.

turbine was launched with the sale of two machines for combined heat and power installations in Holland and West Germany. The Queen's Award for Export Achievement was won for the fourth time.

Napier Turbochargers Ltd achieved higher export sales in a generally static market. Investment in novel product and process technology resulted in the release of new high performance turbocharger models to operate with the emerging generation of fuel efficient diesel engines.

GEC High Voltage Switchgear Ltd substantially improved its order intake, helped by contracts placed by the CEGB for equipment for the 2000MW hvdc cross channel link, and for the 420kV gas-insulated switchgear connecting the terminal with the UK supergrid. Large export orders were obtained in Nigeria, and smaller, but technically important orders, were won in Venezuela, Paraguay, Zimbabwe, Bangladesh and Australia. The first 145kV-rated SF6 switchgear in the UK was commissioned at the London Electricity Board's City Road substation. Although factory output was lower, there has been an improving trend in cost control and productivity, justifying substantial investment in machine tools and in other modern equipment.

GEC Distribution Switchgear Ltd was adversely affected by reduced orders for its traditional range of 11kV switchgear. As the year progressed, order input improved with the introduction of a new range of vacuum

switchgear from 11kV to 36kV. Over two-thirds of orders received were for export, and additional efforts are being made to obtain still more orders from abroad.



A compressor package for an offshore gas production platform near Bombay. The package, built in Japan, incorporates two 13,300kW gas turbines supplied by GEC Gas Turbines Ltd, Whetstone, Leicester.

Ruston Gas Turbines Ltd's margins were maintained through improved productivity. The entire output went abroad or was for North Sea application; ten 3MW mobile generating sets were shipped to Saudi Arabia, India and the Far East. Contracts worth £30 million were secured for the supply of 67 Ruston TB5000 generating sets, each rated at 2700kW, for the Siberian gas pipeline. The new 8500 horsepower 'Tornado' gas

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GEC Power Transformers Ltd had a difficult year in a period of low demand but is beginning to benefit from lower production costs resulting from capital investment in new plant. More export orders were secured, including one for 14 trackside transformers for the first stage electrification of the railway system in Zimbabwe which was delivered in a very short time; orders for transmission units were received from Venezuela and Zimbabwe. Home business included two large saturated reactors for compensation in the CEBG cross channel link and three 60MVA 132/11-11kV system transformers for the London Electricity Board Leicester Road substation.

GEC Distribution Transformers Ltd increased its export order book following successful bids to overseas utilities for bulk order contracts, but the home market remains depressed.

GEC Rectifiers Ltd delivered equipment early for the Tsuen Wan extension of the Hong Kong Mass Transit Railway to enable this section to be opened six months ahead of schedule. Rectifiers forming part of the 'JET' fusion experiment under construction at Culham Laboratory were completed, and work is proceeding on the main rectifier inverter for a prototype aerogenerator for the Orkneys. A substantial contract has been received for the manufacture of control equipment for the CEBG cross channel link.

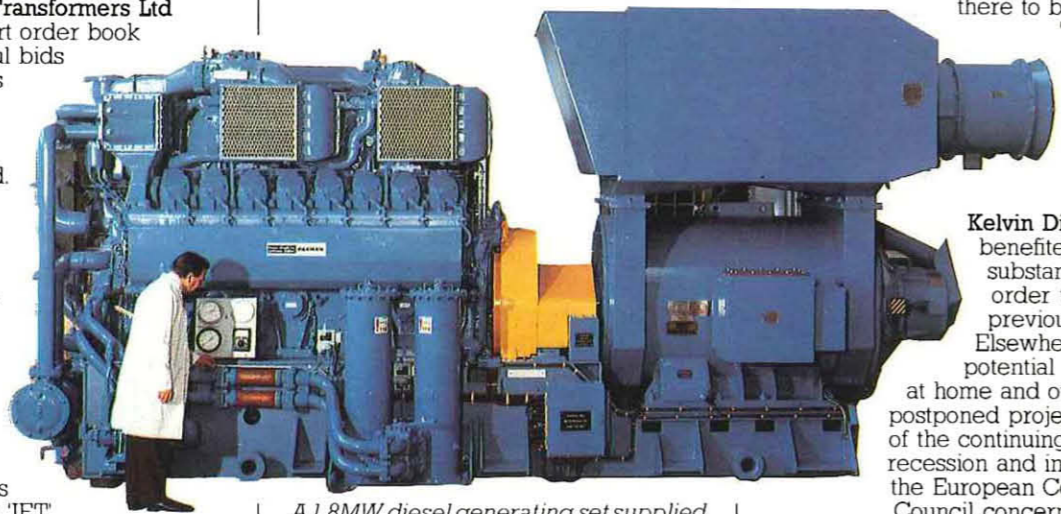
GEC Energy Systems Ltd is completing contracts on the AGR stations at Hartlepool and Heysham 1. New work has been undertaken for additional fuel storage facilities at these stations based on experience of the dry stores at Wylfa, which has attracted overseas interest. Contracts involving other reactor equipment have also been obtained on the new AGR's at Heysham and Torness. New business in alternative and renewable energy systems is being developed.

The Micanite & Insulators Company Ltd suffered from the severely depressed UK market for high voltage insulation materials. Development has continued on new mica products for heavy electrical applications. Sales of the environmentally more acceptable biodegradable dielectric fluid 'Midel' have increased, and a large order has been received from the British Sugar Corporation; licences to overseas manufacturers are under discussion.

GEC Reinforced Plastics Ltd had another successful year, benefiting from new automatic plant which will also enable the product range to be extended. With orders for valve structures in connection with the CEBG cross channel link and increased orders for components used in defence applications, the order book now stands at a high level.

INDUSTRIAL

	1982	1981
TURNOVER	£359m	£366m
EXPORT SALES	£156m	£144m
EXPORT ORDERS	£194m	£171m
PROFITS	£44m	£42m



A 1.8MW diesel generating set supplied for emergency use in BP's Magnus oil field in the North Sea. The set comprises a Valenta diesel engine made by Paxman Diesels Ltd, Colchester and an alternator manufactured by GEC Large Machines, Rugby.

The turnover of most of the businesses was slightly down on last year, except for Traction which was able to increase its exports. The order book at the year end showed some advance on the previous year end, with the export content rising from 50 to 58 per cent. Substantially lower profits on Large Machines were offset by a recovery in Small Machines. Traction and Industrial Gears did better, and Diesels about the same as last year.

GEC Diesels Ltd and its overseas subsidiaries, which are reported on separately in the overseas sections, achieved in aggregate results similar to last year on sales which were slightly higher. In general, the overseas companies fared better than the UK companies whose increased exports were more than offset by depressed home demand. Government spending curbs had an adverse effect, directly and indirectly, on many projects involving

diesel engines in the naval, marine, fishing, military, traction and industrial fields.

Dorman Diesels Ltd fared worse than in the previous year, principally because of the very poor home market. Exports improved as the result of aggressive selling efforts, with large orders from Cuba and substantial business obtained in Australia. The unsettled situation in Iran, however, prevented the continuation of the high level of business achieved there in the previous year. Action has continued to reduce costs and improve competitiveness by further restructuring of the business; consolidation of facilities at Lincoln has enabled one of the plants there to be closed.

The year ended with a slightly higher order book than a year ago.

Kelvin Diesels Ltd benefited from the substantial Burmese order taken in the previous year. Elsewhere, several potential customers at home and overseas postponed projects because of the continuing world recession and indecision by the European Community Council concerning

fishing limits. The company obtained a larger portion of the available business as a result of the renowned reliability and economic fuel consumption of its engines. Prospects now seem to be brighter in the traditional markets, and efforts are being made to penetrate new territories, particularly in Central America.

Paxman Diesels Ltd reported much lower sales and margins with a depressed domestic market exacerbated by Government spending curbs. Capacity has been scaled down and manning levels brought into line with expected future demand. Manufacturing times have been improved and cost savings achieved by capital investment in a new crankcase machining facility. Prospects for overseas business are now better for naval and industrial applications, and orders have been received recently for Oman, Iran, The Seychelles and Portugal.

Ruston Diesels Ltd produced results not very dissimilar to the previous year. New business came in well, boosted by a major order from Iraq valued at over £60 million for 69 medium sized power stations. Orders for marine applications were hard to obtain because of the

THE CHAIRMAN'S STATEMENT

In another reasonably successful year, turnover, exports, orders and profits were all higher, underlining the strength of our operating units even in unfavourable conditions.

In recent years, much of our growth has resulted from more business in overseas markets, through companies we have acquired abroad and from higher exports from the United Kingdom. Fundamentally, our total effort relies heavily on the skills of our people in the United Kingdom, backed as they are with resources of plant, equipment, research laboratories and money to finance their creativeness. Whilst we continue to strive to do more business abroad, we must maintain our full participation in the industrial and commercial activity of the United Kingdom. Indeed, we need the support of buyers in the home market to operate our equipment and so provide the proof of its performance usually necessary to sell it overseas. Our foreign customers, especially governments, national agencies and utilities, want to be assured that our products enjoy the acceptance of our own authorities when they consider whether to buy from us or our foreign competitors.

On the whole, the United Kingdom State owned enterprises, with whom we enjoy good relationships, have, with few but notable exceptions, acted responsibly in placing orders wherever possible with home manufacturers. But we sometimes wonder whether they, and government departments, act wisely when, in their role as purchasers, they tend - in a surfeit of what is mistaken for "fairness" - to favour weaker companies beyond their deserts. GEC has played a leading role in rejuvenating the United Kingdom electrical and electronics industry and has merited better than the treatment occasionally meted out to it in such matters. Other countries allow the best indigenous man to win.

Last fiscal year, we paid £143 million to H.M. Inland Revenue in Corporation Tax alone. This is quite apart from the direct taxes we pay to local authorities, the VAT we pay to H.M. Customs & Excise, and the taxes we pay to foreign governments on the profits we make abroad. And we will be due to pay Corporation Tax of £179 million on the United Kingdom profits to 31st March, 1982. From every £1 of our profit, we pay a much higher percentage to the Exchequer than any of our major home competitors. It is irksome that these are the very competitors who benefit from discriminatory action taken at our expense.

The "demerging" of some parts of our company into separate, independent

public companies was intended, inter alia, to overcome that disadvantage. But our managers prefer the advantages of being part of a group large enough to be acknowledged internationally as of major importance; for the present, further consideration of any major demerger has been deferred.

Like others, we have had to cope over the years with an increasing tendency to governmental interference. The number of people in official capacities with no industrial experience, who believe they



Reliance Systems Ltd, Wellingborough is having much success with its popular SL-1 private automatic telephone exchange. Some of Britain's major companies have installed or ordered the exchange which caters for up to 5000 extensions. The picture shows the SL-1 switchboard.

know how British industry should be organised and operated, continues to grow. We have a responsibility to our shareholders and our employees to resist arbitrary interference by the State on matters outside the practical knowledge and experience of its functionaries who should be devoting themselves to managing better the affairs which constitute their proper business. We are confident that British common sense will prevail but Ministers need to be more watchful in protecting companies and individuals against this trend, not least as it is the taxpayers who always have had to foot the heavy bills for such Government interference.

If we can hope to manage the problems created by our home bred bureaucracy, a potentially more dangerous breed flourishes in Brussels.

Insidiously, the officials of the Commission of the EEC try to reduce European industrial concerns to the status of puppets to dance the Brussels tune. With them, the idea of standardisation has run amok, and the contents of the draft 5th Directive and the Vredeling Proposals relating to employee participation and consultative procedures, when not totally irrelevant, ignore important national differences of approach. These bureaucrats pose a threat which should be taken seriously, lest the freedom of producer and consumer to operate in a more or less true market environment be lost for ever.

The problems raised by the present high level of unemployment remain a cause for concern. Improved productivity and the exploitation of new technology will bring about far reaching changes in the patterns of education, training, work and leisure. In the neighbourhoods where our factories are situated, we are giving full backing to schemes of training and re-training, youth opportunities, and job creation. We also support the recently published report of the Manpower Services Commission Task Group about integrated schemes for training 16 and 17 year-olds. We support, too, the Teaching Company and similar ideas which enable young people not only to learn skills but also how business functions. In these activities, we work not only with the full co-operation of all concerned in the factories, but also the Manpower Services Commission, local authorities and, most particularly, schools and universities.

As the economy improves, it should be possible to consider some increase in public spending to improve the country's infrastructure; we do not see such infrastructure expenditure as unacceptably inflationary if the money is used wisely and the public sector matches the improvements in efficiency seen in the private sector. But we cannot expect to see again what used to be called 'full employment'. The maintenance of stability in the community requires a steady change in attitudes and the evolution of new social patterns. To think out how to control this process is surely a subject on which the efforts, ingenuity and brains of our national and political institutions should be concentrated.

Our Vice Chairman, David Lewis, retires from the Board following the Annual General Meeting. He has played a major role in the development of our Group and the conduct of our affairs over a period of twenty years. It is impossible to exaggerate the value of his wisdom and counsel to the Company and to the industries of which it is part.

continuing worldwide slump in shipbuilding. Delivery of the new range of RK270 engines commenced in the UK, and some kits for these engines were despatched to Alco in the United States for completion and delivery from there. The first delivery was also made, to a UK ship operator, of the new AT350 engine for which further orders have been received. The volume of new business will be increasingly influenced by the market's acceptance of these two new engines.

GEC Traction Ltd again increased its turnover, with exports accounting for over two-thirds of sales. Equipment entered service on the Hong Kong Mass Transit Railway extension to Tsuen Wan, on Kowloon Canton Railway's new inner suburban service, on Vicrail's new Melbourne suburban trains, and on Rio de Janeiro's latest suburban rolling stock. All major orders received were from overseas, mainly repeat equipment for Hong Kong's two electrified systems and South African Transport Services. A Letter of Intent was received from Korea's Seoul Metropolitan Subway Corporation for 134 underground train sets incorporating the latest electronic control equipment, confirmed by a contract in May 1982; this is the largest single order for traction equipment ever received in the UK. An order from Brazil for 35 new electric locomotives was confirmed. Heavy capital investment in engineering and production resources continues, including a new engineering development laboratory incorporating comprehensive and sophisticated test facilities.

GEC Engineering (Accrington) Ltd again improved its results, with substantial work on aircraft components offsetting the expected decline in general engineering lines. Strong efforts are being made to exploit the company's traditional skills to attract more work in the fields of space, defence and nuclear engineering.

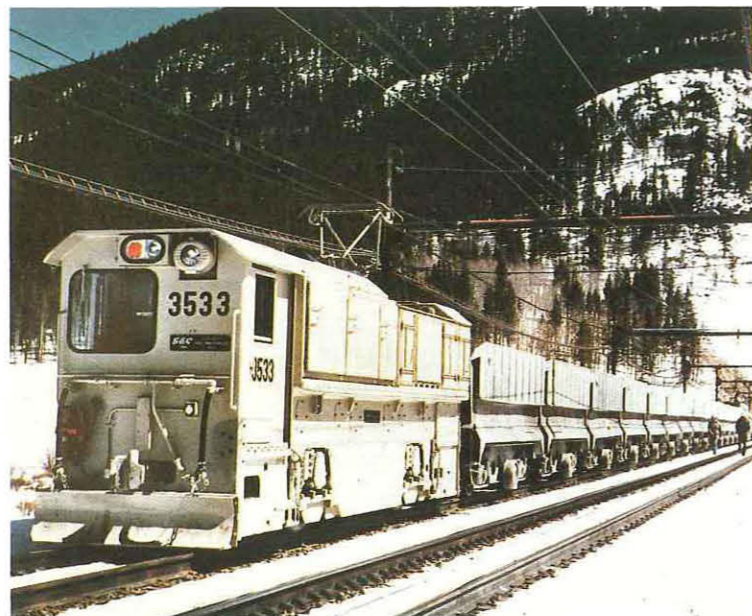
GEC Large Machines Ltd was adversely affected by poor productivity and technical problems which led to changes in management. During the year, major sub-contracts were received to supply 67 generators for the Siberian gas pipeline and for 63 generators for diesel power stations in Iraq, the main contractors being Ruston Gas Turbines and Ruston Diesels respectively.

GEC Small Machines Ltd improved its efficiency as a result of measures taken to bring capacity into line with demand,

to improve productivity and to reduce overheads. Developments are in hand to rationalise and improve the product range, and to achieve the continuing reduction in unit costs needed to compete successfully.

Witton Kramer Ltd had a less satisfactory year due to the recession in the steel, crane and mining industries combined with de-stocking in its established export outlets.

GEC Marine and Industrial Gears Ltd produced better results from a slightly lower turnover. Order input increased on the previous year, mainly from overseas navies.



Dual voltage, thyristor-controlled mining locomotives in use in the Rocky Mountains of the United States. The locomotives, commissioned in 1981, were made by GEC Traction Ltd.

GEC Foundries Ltd did better in difficult trading conditions. Sales of components and new tooling improved in the Moulded Plastics Division, helped by the introduction of new automatic moulding facilities.

The Express Lift Company Ltd performed satisfactorily, despite a period of short-time working. The intake of home and export orders has now improved, and new contracts include 14 lifts for the Misr Bank in Cairo and 20 lifts and two escalators for Royal London House. Construction of the 427 ft high lift test tower at Northampton has recently been completed, and the installation of development equipment is now taking place.

GEC Claudgen Ltd earned better margins than last year, notwithstanding reductions in local authority spending on traffic signs. Good sales were achieved

for custom-made long-life fluorescent lighting at home and overseas, including lighting in one of the Palaces of HRH The Ruler of Qatar. An additional small manufacturing unit was opened during the year.

Woods of Colchester Ltd improved its margins, and although exports were 20 per cent higher than in the previous year, sales continued to be adversely affected by the low level of activity in the UK construction industry. New product development has been accelerated, and with orders beginning to increase in the last quarter of the year, and reasonable chances of securing several major outstanding projects, prospects are brighter.

Keith Blackman Ltd increased its output at Arbroath, where the construction of a new factory has commenced. Development has been completed of a further range of centrifugal fans which will be complementary to the already successful Series 28 type being made at Rugby.

Greenwood Airvac Ventilation Ltd was not insulated from the serious recession in the building construction industry, but the level of enquiries has improved, and better results are in prospect.

Parnall & Sons Ltd was again affected by the low demand for office furniture; sales were somewhat lower than last year, but profits improved a little. New products have been well received but no appreciable pick-up in demand is expected.

ELECTRONICS, AUTOMATION & TELECOMMUNICATIONS

	1982	1981
TURNOVER	£1419m	£1235m
EXPORT SALES	£440m	£327m
EXPORT ORDERS	£482m	£483m
PROFITS	£210m	£160m

Telecommunications' turnover was up by nearly a third, and many of the electronics and automation businesses also recorded material increases in sales. Avionics, Communication Systems, Space and Defence Systems and Electrical Projects all substantially increased their export sales. There was a fall-off in the rate of export orders received for Avionics and for Space and Defence, but Communication Systems, Radar Systems and, particularly, Electrical Projects considerably increased the size of their order books. Orders in hand at the end of the year for

the whole group were nearly 15 per cent higher than at the end of the previous year. Profits reflected the increase in sales and some improvement in margins, but Computers and International Marine made less than in the previous year.

Marconi Avionics Ltd achieved further sales growth, increasing the export proportion from 40 to over 50 per cent. Substantial progress has been achieved with airborne interception radars for RAF Tornados and for export, and with mission avionics for airborne early warning Nimrods. The first of a new kind of holographic head-up display developed for the United States Air Force has been handed over, and a contract has been won to develop a new range of air data computers for large numbers of USAF and US Navy aircraft. Sales of thermal imaging and other electro-optical equipment were again higher, and home and export sales have been made of a privately developed multi-mode radio for military aircraft. The first flight of a Jaguar aircraft, under the sole control of the advanced 'fly by wire' system, emphasises the company's world lead in automatic flight control.

Marconi Communication Systems Ltd recovered from the poor performance of the previous year and increased its sales by 20 per cent. Home orders remain depressed although the BBC has ordered new long wave transmitters for Droitwich. A collaborative agreement with Mitsubishi has led to orders for Intelsat satellite earth stations for Hong Kong and Bermuda. The company supplied much of the mobile equipment for the automatic radiophone service in London and Southampton and expects the spread of this service to other parts of the country. Good progress has been made on design and manufacture of the new Kilostream and Megastream equipment for British Telecom which should lead to first deliveries in 1982.

Marconi Radar Systems Ltd had better results despite the cancellation of substantial Royal Navy business. Although there is a shortage of work for immediate delivery, the order book is at a record level because of substantial long term development contracts for new products due to be manufactured in the second half of the decade. Orders for more immediate delivery include the updating of air traffic control systems at home and overseas and the first orders for MARTELLO 3-D radars, worth £10 million; the latter should open up the export market for this novel system. The company was chosen, on the merits of its technical presentation, to provide a new lightweight SEAWOLF tracking radar for the Royal Navy. Twelve complete ships' systems were supplied for fast strike craft in the Middle East, and there are

prospects of further orders. TEPIGEN, an imagery system for trainers and simulators, has been sold in the USA; this technique forms the basis of a ship handling simulator for the University of Wales. Development of a new product line for airfield surveillance radars has been completed and sales prospects are good.

Marconi Space & Defence Systems Ltd has pursued the expansion of its export business and its products have now been sold in 45 countries. Orders totalling £45 million have been secured for the communications payload for the next United Kingdom defence satellite and for the business systems payload for the European Space Agency L-Sat programme. The company has been made prime contractor for the lightweight and heavyweight underwater missiles which will enter service with the Royal Navy during the '80s. The initial contract, worth £500 million, is expected to be followed by even larger production orders.

Marconi Instruments Ltd produced better results, largely as a result of the success of several new products at home and overseas. Further products will be launched during the current year, thus providing the basis for continued growth.

Marconi International Marine Company Ltd had a difficult year reflecting the severe recession in the world shipbuilding and shipping industries; although turnover was about maintained, with exports accounting for over two-thirds of total sales, profit margins were lower.

Easams Ltd recorded better margins whilst maintaining order intake and turnover, of which exports accounted for over two-thirds. The Tornado contracts still constitute a major part of the business on hand but major orders were obtained for a replacement gas grid control system for three of the regions in the United Kingdom, and a currency dealing room, with its communications, for an overseas bank.

McMichael Ltd has maintained its fast growth rate. The purchase of the Sefton Park Laboratories will facilitate the continuing development of new communications equipment and new digital and signal processing devices for defence and civil applications. New orders for civil products, of which half are for export, have contributed towards a record order book.

GEC-General Signal Ltd increased its sales. Work on British Rail's major resignalling contract for Edinburgh and East of Scotland was completed and good progress made on the London Victoria and Anglia West schemes; a new contract for Anglia East has been

received. Train describers for the London Victoria system and extensions to the London Bridge system were successfully commissioned, as were substantially the Liverpool Street and the Euston to Rugby systems. In Brazil, commissioning commenced of the supervisory and control centre for the Rio-Sao Paulo resignalling contract, and equipment is being manufactured for the steel railway signalling system.

GEC Traffic Automation Ltd achieved better margins, but sales were lower as a result of reduced local government expenditure. Export orders have improved, helped by demand for the new microprocessor traffic light controllers. Other new products include an electronic parking meter and an intelligent magnetic card reader, both operating with magnetically-encoded credit cards.

Picker International Ltd, formerly GEC Medical Equipment Ltd, achieved better results with higher sales of X-ray diagnostic equipment, and is arranging its facilities to take advantage of its new role as part of the worldwide Picker International organisation.

GEC Electrical Projects Ltd made sound progress, and this trend is expected to continue in the current year. The company considerably increased its order intake, with exports accounting for 80 per cent of new business, and received the Queen's Award for Export Achievement 1982. A major order was secured for the electrical and automation system for a new steelworks in Mexico. A new Electrification Services Division set up during the course of the year made a major contribution to the input of new business from export markets in the Middle East. The scope of the Aviation Division has been extended from airfield lighting and ground visual aids to the undertaking of turnkey contracts to incorporate electrical, mechanical and navigational aids equipment for new airports overseas.

Hall Automation Ltd, which received the Queen's Award for Technical Achievement 1981 and the Design Council Award 1982 for the CompArm Paint Spraying Robot, has been transferred to Rugby to be more closely associated with the Factory Automation Systems Technology (FAST) Division of GEC Electrical Projects. The range of robotic equipment offered by the company is to be extended.

GEC Industrial Controls Ltd maintained its position in a difficult year, with higher order intake including major business for motor control gear for power stations at home and overseas and a doubling of the rate of order intake for the GEM 80 microprocessor-based industrial control system which is being increasingly specified in industrial applications.

During the year a new range of AC variable speed drives was launched, and a multi-axis numerical controller for lathes. Development continues to extend use of this numerical controller with other machine tools.

GEC Mechanical Handling Ltd achieved slightly better results and the order intake was much more satisfactory, with a high export content. In addition to securing orders for its conventional business, the association of this company with the Aviation and Factory Automation Systems Technology Divisions of GEC Electrical Projects will open up opportunities for new business.

GEC Transportation Projects Ltd continued with railway electrification work in Brazil and is assisting railway authorities in Zimbabwe and Mexico with their first main line railway electrification projects. Following the year-end, major contracts were signed for the Seoul Metro in the Republic of Korea and for the Recife Suburban Railway in Brazil, of value £190 million and £40 million respectively. Prospects for railway electrification and mass transit systems around the world remain good.

GEC Telecommunications Ltd again achieved substantially higher sales reflecting the introduction of new products and capital investment in modern production facilities. Orders received also increased, particularly for transmission systems and subscribers' apparatus.

Good progress continued throughout the year with increased output of Crossbar and TXE4 telephone exchange systems and the development and early production of System X for the UK. Three more System X exchanges, for which GEC was the main contractor, were brought into service at Woodbridge, Arrington and Cambridge. Tenders for System X were submitted to a number of overseas countries.

The better rate of orders for transmission equipment is due to the demand from British Telecom for its expansion and modernisation programme and to an increase in export business from countries such as the United Arab Emirates (UAE), Hong Kong, Indonesia, Brazil and Zimbabwe. The contract with the UAE will expand its national micro-wave-radio system to provide an additional colour TV channel. The two major communications contracts for railway authorities are for a 300 km system for the National Railways of Zimbabwe, and for iron ore transportation in Brazil. In the UK, two major transmission networks were successfully completed by the target dates. The world's first 140 Mbit/s 11 GHz microwave-radio system was installed in record time against an accelerated British Telecom ordering

programme to provide the first direct digital transmission circuits between London and Birmingham. A new nationwide microwave-radio system covering some 1,720 route miles was completed on schedule for the national distribution of the ITV2 television service to all parts of the UK.

GEC Information Systems Ltd, a new management company, has been formed to co-ordinate the GEC effort in the field of information technology, including the 'electronic office'. The company brings together the Private Systems and Telephone Divisions of GEC Telecommunications Ltd, GEC Computers Ltd, Reliance Systems Ltd and GEC Viewdata Systems. The wide product range of these companies, together with A B Dick Ltd, enables GEC Information Systems to provide integrated information networks based on voice and data switching systems, computers, word processors and local area networks.

The Private Systems Division's sales of SL-1 and CDSS-1, the stored-program controlled digital PABXs, increased considerably, and the expanding order input included a third contract from British Telecom for approximately 3,000 CDSS-1 systems. Further developments will enable both systems to switch voice and data to form key elements of the 'electronic office'.

More new products incorporating advanced electronic technology were launched in the Telephone Division, and major contracts from British Telecom included electronic plan systems.

Reliance Systems Ltd, in depressed market conditions, increased its market penetration with the digital SL-1 PABX, and introduced more new products including fire alarm control boards, fire extinguishing systems, Restcall communication systems and the Loudspeaker-call Mark II. The GEC Viewdata Systems viewdata bureau continued to enlarge its facilities, and a new specialised system was introduced for currency dealers.

GEC Computers Ltd experienced a sharp slowing down in business, but the new GEC 4090, the most powerful British minicomputer at present available, was successfully launched. Deliveries have commenced of a new version of GEC 4080M (a rugged computer already available for use in airborne systems) for use in Project Wavell, the Army's information system for command and control on the battlefield.

Associated Automation Ltd's orders for coin-operated telephones have been declining, and, with no prospect of ongoing business on a viable basis, production will cease when existing commitments have been discharged.

COMPONENTS, CABLES & WIRE

	1982	1981
TURNOVER	£441m	£464m
EXPORT SALES	£125m	£124m
EXPORT ORDERS	£125m	£96m
PROFITS	£43m	£39m

Higher turnover in most of the Component businesses was offset by a lower value of sales of some Cable and Wire activities as result of a combination of a fall-off in demand and a marginally lower average price of copper. Export orders received were generally higher, especially for Telephone Cables.

The Component companies achieved a reasonable increase in profits, but the Avery businesses continued to be adversely affected by the necessarily drastic measures of reorganisation and by a costly programme of new product development. Lower profits were earned on wiring cables; the results of the Wire businesses remained unsatisfactory.

English Electric Valve Company Ltd again recorded satisfactory results with good growth in millimetre and high power magnetrons, airborne radar travelling wave tubes, image intensifiers, vidicons, leddicons and duplexers. During the year, a liquid crystal display facility, known as LUCID, was acquired.

The M-O Valve Company Ltd also produced good results. With the continuing miniaturisation of electronic circuits and the extension of microprocessors into telephone and computer networks, there has been a rapid increase in demand for surge arresters. Sales of reed relays were at their highest ever level and the order position remains healthy. Advanced developments in microwave tubes should result in substantial new business.

Marconi Electronic Devices Ltd began production in August 1981 of CMOS integrated circuits at its new Lincoln factory. The building and commissioning of a new production facility took only ten months. Very complex circuits are now being widely used in industrial and military systems, and demand has continued to increase both in Europe and the United States. As a result, MEDL and its sister company in the United States, Circuit Technology Inc, have achieved worthwhile growth. The contract for thyristors for the CEGB cross channel link more than offset the lower level of orders received by the Power Division for general industrial use.

W & T Avery Ltd had a difficult year. Demand for weighing machines remained low and price competition was severe, particularly in the retail trade. Capacity and manning levels were reduced in line with market requirements and the service

organisation was improved and modernised. Orders, sales and margins are improving following the introduction of new products and the better utilisation of production resources. The programme launched in September 1981 to introduce 22 new products in 12 months is on target. The latest machine, the 'Avery Commander', an advanced retail electronic scale, has been well received by UK and overseas customers.

Oertling Ltd had a rather unsatisfactory year, in which a substantial improvement in export orders was insufficient to compensate for the fall in business at home. Two low cost electronic balances and two high resolution electronic top pan balances were introduced.

Avery Denison Ltd's results improved after a poor start, following a major reorganisation of production resources and some success in overseas markets.

Driver Southall Ltd improved its viability following the closure of manufacturing facilities in Bolton, Ruislip and Horsham. The business is now operating from two sites; at Dewsbury, the Avery Parsons Division concentrates on equipment for the bulk extraction industries such as coal, cement and iron ore; and the Walsall unit specialises in check weighing and packaging machines for the food and pharmaceutical industries. Orders in hand are at a better level, largely due to important business for tea weighing and packaging machines for Russia.

Stanton Redcroft Ltd's order input and performance started to improve in the latter part of the year.

Avery Hardoll Ltd again showed improvement. A new microprocessor-based electronic petrol dispensing system has been introduced, and other new products are under development.

Pump Maintenance Ltd's performance improved somewhat in the second half as a result of increased productivity and cost savings. Computerised systems are being upgraded in order to improve customer service and protect margins.

GEC Measurements Ltd had a good year. The availability of new protective relay and energy management products recently introduced, combined with a healthy order book, strengthens the company's position in a competitive market.

Satchwell Control Systems Ltd achieved better results. The continuing recession in new building construction was offset by increases in orders for the microprocessor-based BAS700 building energy management system. New

products aimed particularly at export markets will be introduced in 1982.

Satchwell Sunvic Ltd recovered well from the previous year through major cost reductions and the introduction of new products, the most successful being an electronic central heating programmer.

Salford Electrical Instruments Ltd made further progress helped by higher sales of telephone loading coils and natural



In the middle of the Antarctic wastes a member of the British Transglobe Expedition carries out repairs to one of the snow-mobiles using a "Solon" soldering iron made by GEC-Henley Ltd, Gravesend.

gamma mining electronics to overseas markets; but component sales were lower. The company won the Queen's Award for Technical Achievement 1982.

Londex Ltd maintained its performance. An upturn in the level of orders towards the end of the year, and the introduction of products previously produced at other GEC units, enhance the company's prospects.

Salplex Ltd advanced the development of its multiplex wiring system for motor vehicles. A development contract to wire two BL Princess cars was satisfactorily completed during the year, and negotiations are proceeding with major vehicle manufacturers to incorporate the device in volume production motor cars.

Telephone Cables Ltd again made progress. 50 per cent of total sales were to customers overseas, with major contracts in Brazil, Malaysia and Nigeria. The installation of new plant which combines processes previously carried out separately, has improved productivity. Sales of optical fibre cables increased substantially, including cable for a monomode system for British Telecom which demonstrated unrepeated transmission over 30 KM of fibre.

AEI Cables Ltd maintained its results by concentrating on the more technically advanced cables such as those with improved fire retardance properties, and by obtaining a major 33kV submarine cable contract for the North of Scotland Hydro-Electric Board. This cable will be laid during the summer of 1982 and will supply power from the Scottish mainland to the Orkney islands.

In the wiring cables sector, results were depressed by poor demand for cable for housewiring and industrial uses. Cables containing optical fibres have been developed for several military and industrial control applications, and the range of such specialised cables has been widened.

GEC-Henley Ltd did better, helped by a 20 per cent increase in exports. The company continued its programme of introducing new and modified products in the cable accessories and distribution fusegear fields. Better margins on the new products made an important contribution to the outturn. The market, however, remains very competitive, and falling oil prices are reducing the purchasing

power of major export customers in Nigeria and the Middle East.

Frederick Smith and Company experienced a very difficult year aggravated by a continuing poor demand for rolled copper rod and other copper products. The first phase of the modernisation of the Trafford Park works, to reduce costs and improve quality, has been completed. A new process for the production of mineral insulated cables has been developed and introduced.

Rodco Ltd, in which Pirelli General plc is a partner, completed the construction of its £12 million continuous copper rod casting and rolling mill at Skelmersdale. Commissioning started in March 1982, and the first good rod was made within fifteen months of work starting on site.

GEC Optical Fibres had a successful first year with demand increasing rapidly in the telecommunications sector. A substantial investment has been made in

automated plant for manufacturing monomode optical fibre to provide very high signal handling capacity over distances several times greater than is possible without repeaters with other forms of optical fibres or coaxial cables.

F D Sims Ltd and **Kent Electric Wire Ltd** increased their sales substantially following the closure of the LEW factory and the transfer of production plant. Despite good co-operation by the employees at both locations, production efficiency did not improve quickly enough to overcome the extra initial costs of introducing new product types into manufacture.

Vactite Ltd experienced difficult trading conditions with a reduction in the sales of specialised wires and cables to the aerospace and defence sectors. For most of the year the demand for overhead line conductors was low but improved in the last quarter, due mainly to a major contract for a new design of aluminium and aluminium alloy conductor for the CEGB.

GEC Fusegear Ltd had many of its workforce on short time due to a continuation of depressed markets and de-stocking by distributors. Measures have been taken to bring capacity into line with expected future demand, to improve manufacturing techniques and to accelerate new product development.

The integration of **GEC Distribution Equipment Ltd** and **GEC Fusegear Ltd** into one business is taking place, and this should lead to better overall performance.

GEC Distribution Equipment Ltd continued to make steady progress through improved productivity and further development of its product range. The new class M80 range of low voltage switchgear has been ordered for the Drax, Heysham and Torness power station projects in the UK and Castle Peak 'B' in Hong Kong.

Redring Electric Ltd continued to grow, helped by products such as electrically heated showers and the automatic electric kettle 'Autoboil'. Other new products are being developed, the latest of which is the first ever microprocessor-controlled electrically heated shower.

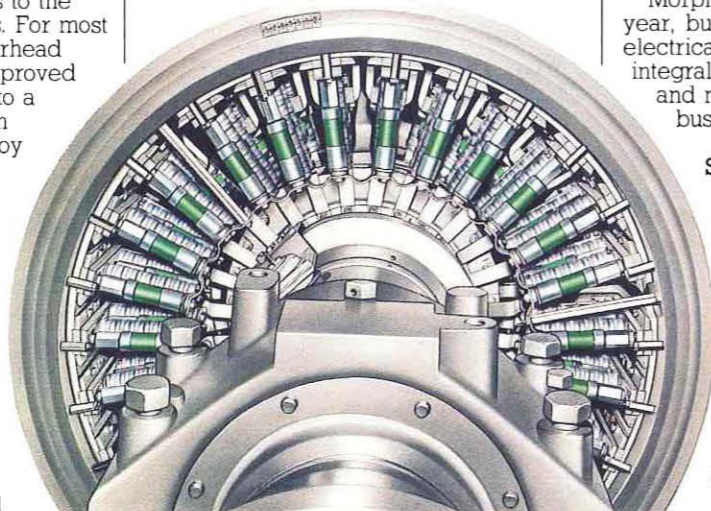
Walsall Conduits Ltd and **GEC Walsall Ltd** turned in satisfactory results in the light of the continued recession in the UK building and construction industry.

A G Hackney & Company Ltd maintained its position; a decline in export sales in the second half of the year was offset by a improvement in demand from the home market.

CONSUMER PRODUCTS

	1982	1981
TURNOVER	£277m	£290m
EXPORT SALES	£20m	£26m
EXPORT ORDERS	£19m	£23m
PROFITS	£11m	£13m

Turnover in Furniture declined by one-third, but the sales of most of the other businesses were higher than in the previous year. The profits of **Cannon** and **Xpelair** showed a satisfactory increase, and those of **Hotpoint** a considerable advance, but **Osram** could do no better than break even and **Schreiber** sustained a substantial trading loss augmented by costs incurred in reducing capacity.



Type "GS" fuse links mounted on the rotor of an alternator exciter in a power station. The fuse links are fast acting and are capable of withstanding up to 6,000 times the force of gravity. The fuse links are made by **GEC Fusegear Ltd, Liverpool**.

Osram (GEC) Ltd suffered from the recession at home and abroad. Streamlining of facilities took place during the year, and with the introduction of new products – notably further energy-saving and higher efficiency discharge lamps, new fluorescent fittings and an improved design of street lighting lantern – the business is better placed to take advantage of any improvement in demand.

GEC (Radio & Television) Ltd was affected by the fall-off in demand in the second half of the year, but the introduction of a new range of colour television receivers and an addition to the video recorder range should improve prospects.

Cannon Industries Ltd again improved its results through the successful introduction of a wide range of gas built-in cooking appliances supported by a vigorous marketing campaign.

GEC-Xpelair Ltd consolidated its position as a leading producer of extractor fans. Increased competition from established and fresh sources is being successfully countered by newly designed products and more modern manufacturing plant and techniques. The DX100 fan, launched towards the end of the year, is gaining wide market acceptance throughout Europe.

Hotpoint Ltd had a much better year. Economies introduced two years ago and refrigerators available from a new production facility combined to produce good results. A new factory in Rhyl, North Wales, for home laundry products incorporating the latest microprocessor technology was completed and is now being equipped for production.

Morphy Richards Ltd had a better year, but since its business in small electrical appliances was neither an integral or essential part of the large and more successful **Hotpoint** business, it was decided to sell it.

Schreiber Industries Ltd had another very poor year in the slack furniture trade. Although capacity has been drastically reduced at some considerable cost, and new products introduced, much higher sales and stringent operating economies are necessary to restore the equilibrium of this business.

OVERSEAS

	1982	1981
TURNOVER	£1333m	£797m
PROFITS	£86m	£66m

The figures shown for the overseas subsidiaries have been converted into sterling at the exchange rates ruling on 31st March. The results for North America are considerably affected by the sterling rate of exchange, which was twenty per cent weaker at the end of 1982 than at the end of 1981. The commentaries on the individual subsidiaries are based on the results in their respective local currencies. The turnover figures benefit from the inclusion for the first time of the **Picker** businesses, with sales of £25 million in Europe and over £300 million in North America. Sales of the subsidiaries in Australia and of **Alco Power** and Canadian **Marconi** in North America showed appreciable increases. In North America, apart from **A B Dick** which did not fare much better than break-even, most of the subsidiaries increased their earnings considerably, with Canadian **Marconi** and **Alco Power** showing the greatest improvement. Although **Picker International** contributed to the profits, its results were affected adversely by reorganisation. In Australasia and in Asia, most of the businesses achieved better results.

In Europe, a reasonable increase in profit in **Marconi Italiana** was more than offset by deterioration in the results of the **A B Dick** subsidiaries and a loss by the **Picker** subsidiary in Germany.

EUROPE

	1982	1981
TURNOVER	£212m	£150m
PROFITS	£12m	£13m

Vynckier NV of Belgium was affected by the serious economic recession in the building industry, the major outlet for **Vynckier's** electrical installation equipment, but was able to counter the effects of a reduced home market and price restraints by increased exports, new product lines, and further gains in productivity obtained with the co-operation of the workforce. The German and Dutch subsidiaries similarly operated in adverse market conditions, but the French unit had a satisfactory year with its pre-packed domestic installation materials for the do-it-yourself market.

GEC Composants SA of France experienced cost increases as a consequence of the weakening of the franc. Nevertheless, it expanded its fluid control business, especially with French-speaking Africa, and continued to expand the sales of products sourced from **GEC** in the UK, notably protection relays, vacuum contactors, semi-conductor devices and surge arresters. The installation activity in thermo-control equipment which had become unviable, was closed.

Société des Moteurs Baudouin SA of France achieved a higher volume of orders for diesel engines, including the first production order for engines for military vehicles. The year's figures were affected by the costs of restructuring the company, but the consequent reduction in operating costs, together with the benefits of new investment in machine tools, is improving efficiency and increasing competitiveness.

Marconi Italiana SpA did well in civil and military activities and in export markets. The introduction of new products in the civil telecommunications field is playing a major part in the company's continuing expansion, notwithstanding Italy's economic problems.

Norsk Marconi A/S faced continuing recessionary conditions. New activities included the successful marketing of instrument landing systems in the UK and the launching of data peripheral equipment in Norway.

GEC Distributors (Ireland) Ltd obtained some contracts of noteworthy volume and generally broadened its electrical wholesaling business.

THE AMERICAS

	1982	1981
TURNOVER	£768m	£357m
PROFITS	£40m	£25m

A B Dick Company's results were affected by lower sales and margins as a consequence of the downturn in office equipment business. There was a further slackening of demand for the established offset printing, mimeograph and spirit machines, and copier sales were well down despite the good acceptance of



A B Dick of Chicago, USA is one of few companies in the world which manufactures selenium drums for use in most xerographic copying machines. The company produces drums for copier manufacturers in several countries.

the new high speed machine. To help counter lower sales and pressure on margins, employment levels were reduced and other economies made. On the electronics side, sales of word processing equipment continued to grow and deliveries of ink jet printers increased substantially. Good progress has been made in the development of new electronic products. The immediate prospects for a material recovery in the sector of the marketplace in which the company operates are not bright.

Scriptomatic Inc of Philadelphia had a very difficult year with its addressing equipment in depressed markets in the USA and Europe. Cost cutting measures were implemented but could not fully offset the effects of the reduced level of activity.

Alco Power Inc enjoyed further growth, increasing its overseas sales of engines for diesel traction uses and extending its penetration of a slack domestic market. The first of the RK270 diesel engines was delivered, and development of the RK270 spark-fired engine was completed. Work was also advanced on two new versions of the **Alco** engine, one a fuel-efficient model and the other capable of burning residual fuels. Continuing capital investment is supporting growth and reducing manufacturing costs.

Cincinnati Electronics Inc, acquired at the end of the previous financial year, made a substantial advance in its business in defence electronic equipment for military communications. A considerable order book is being built up and several important development contracts give confidence that there are opportunities for further healthy growth.

Circuit Technology Inc's year was satisfactory, and steady growth is being maintained.

Electric Machinery Industrial Controls Corporation made steady progress until the down-turn in the US economy caught up with the company in the latter months of the year. Despite the introduction of new products, some economies of operation are having to be effected.

EEV Inc and **EEV Canada Ltd**, which handle the sales of **English Electric Valve Company** products, doubled their sales of UHF television klystrons and isocons. **EEV Inc** sold the first large screen display, used by **CBS** during the election of Governor and State Assembly Representatives for the State of Illinois.

The English Electric Corporation assisted in the winning of further contracts for rectifier substations for transit authorities in New York, North Indiana and Philadelphia, and for marine propulsion gears for the US Coastguard and US Navy. The components trading activities also made headway.

Marconi Avionics Inc substantially increased its business in the manufacture of head-up display equipment for three types of American military aircraft. Other activities included the design and supply of avionics test equipment. The CO₂ laser manufacturing capability, established last year, has been expanded.

Marconi Electronics Inc had a good year based on the introduction of new products in its Instruments division. An automatic test equipment division has been created in California, and is already securing orders.

Picker International Inc, one of the world's largest medical electronic businesses, introduced a new computerised tomography system and a digital radiography system which operates without the X-ray film of conventional radiological diagnosis. In nuclear magnetic resonance (NMR), the business of Thorn-EMI was acquired and is being linked up with Picker's own research and development programmes in this interesting field. The company's leading position with this new imaging concept has enabled it to embark on the construction of twelve pre-production systems for installation in clinical research institutions throughout the world.

Ruston Gas Turbines Inc commissioned extended test facilities at its Houston plant. The effects of reduced requirements for Mexico were relieved by new business from Alaska, Ecuador, Venezuela, Malaysia and Australia.

AEI Telecommunications (Canada) Ltd again maintained its level of business despite the continuing recession in Canada, and is increasing its investment in new designs for future production at its Winnipeg factory.

Canadian Marconi Company, in contrast to the recessionary trend in the Canadian market, achieved new record performance levels in domestic and export markets. The new Radar Division will supply the Canadian Navy's requirements for its DELEX (Destroyer Life Extension) programme from a plant recently opened near Ottawa. Substantial orders were received from the USA for the AN/GRC-103 military radio set, and for vertical scale engine instrument systems for the Black Hawk helicopter programme.

GEC Canada Ltd contributed towards the gaining of a further turbine generator contract, progressed in the development of the market for traction drive inverters, and enjoyed growing success with its high voltage control gear. Additional facilities in Toronto have been acquired to increase the Canadian content of local sales and to rationalise the activity.

GEC Diesels Inc delivered a contract for ten large Ruston diesel engines, all now installed in one multi-purpose ferry, but found new business hard to come by in a depressed market for engines and spare parts. Emphasis is being placed on increasing the local content of sales and the development of export business.

AUSTRALASIA

	1982	1981
TURNOVER	£176m	£136m
PROFITS	£15m	£10m

GEC Australia Ltd had a year of expansion in all of its divisions except lamps and lighting, in which, late in the

year, there were signs of improvement through operating economies, an accelerated programme of product development and more stability in lamp prices. The Projects Division enlarged its manufacturing facilities to develop its drives business for the mining and manufacturing industries. Considerable progress was also made in the build-up of the division's digital activities; important orders were received for control equipment for power station applications and a further train indicator system using digital techniques. The Electronics Division had particular success with its professional video sales and, with the expansion of its other activities, it has established a new production facility. Industrial Products Division achieved better margins and is continuing to benefit from the product development programme of the last two years. The Heavy Engineering Division had to contend with low priced imports, especially of transformers, but the Electrical Wholesale Division increased its business and is moving towards an adequate return on capital.

Avery Australia Ltd had a difficult year but commenced the introduction of a range of new products from the UK.

GEC Diesels Australia Ltd, in a year of good progress, was particularly successful in selling Dorman standby generating sets and Baudouin marine engines.

GEC (New Zealand) Ltd ended a year of further growth in most sectors by winning a major contract to supply the greater part of the New Zealand Post Office's requirements for private telephone exchanges with the new UK stored programme control digital equipment which will include a sizeable local content.

ASIA

	1982	1981
TURNOVER	£149m	£126m
PROFITS	£15m	£13m

The General Electric Company of India Ltd experienced gradually improving industrial relations and productivity in its major factories, enabling the Transformer and Switchgear Division greatly to improve its performance. New product developments in vacuum and flameproof switchgear and moulded case circuit breakers are bringing new opportunities for growth, the rate of which is currently restrained by the cash shortage of the State Electricity Boards. The Motors Division suffered from the recession in the agricultural sector but is increasing its market share of industrial machines. The Furnace Division has been established as the market leader in its range and is planning to add new

types. Steps were initiated at the year end to reduce GEC India's interest in its wholly owned subsidiary, Genelec Ltd, to 33 per cent to comply with the Indian Government's requirements.

The English Electric Company of India Ltd's new fusegear factory near Bangalore came fully on stream; this enabled a major re-layout of production of protection relays, control panels and cubicle gear in the Madras factory to be undertaken. Activity increased in all products. Protection equipment for the first 400kV system in India was successfully tested. Static high impedance busbar protection equipment for HV/EHV outdoor substations was developed and will be used in conjunction with India's first 500MW turbine generators.

The General Electric Company of Bangladesh Ltd played a key role in the successful negotiation of a turnkey contract for Bangladesh's first combined cycle power station using GEC equipment, and providing the company's Projects Division with erection work for the next two years. The Chittagong factory achieved a record level of production and introduced new sizes of centrifugal pumps.

Johnson & Phillips (Pakistan) Ltd had a poor year in depressed market conditions made worse by the opening of the local market to overseas suppliers through foreign aid loan agreements. The re-design of the transformer range was completed, and good progress was made in the development of 500MVA 11kV oil circuit breakers.

The General Electric Company of Hong Kong Ltd increased its engineering trading sales, which partly offset the reduction in project completions. The company increased market penetration in several areas with products sourced from the UK.

The General Electric Company of Malaysia Sdn Bhd has introduced an overhaul and service workshop in support of the expanding diesel engine business. The Communications Division also laid plans to introduce local manufacturing content, and progress towards other manufacturing ventures with Malaysian partners was made in pursuit of the Malaysian Government's declared wishes.

The General Electric Company of Singapore Private Ltd's manufacturing activities, which were set up in the early stages of Singapore's industrialisation and are relatively labour intensive, are being phased out as tariff protection has been removed and the products cannot survive the competition of imports. But increasing success in the projects business has left the company with an improved order book.

AFRICA

	1982	1981
TURNOVER	£28m	£28m
PROFITS	£4m	£5m

L H Marthinusen Ltd, without the loading of the coil work for South African railways which it has enjoyed in previous years, did not maintain its market position. Management changes are being made.

South African Scale Co (Pty) Ltd is introducing several UK Avery products to complement its own increasing manufacturing activity which achieved notable improvement in productivity.

GEC Zambia Ltd lacked sufficient stock of goods to sell, but performed creditably within the limit of its opportunities. Zambia is critically short of foreign exchange and has severely restricted the issue of import licences.

GEC Zimbabwe (Pvt) Ltd is supplying equipment for the railway electrification contract in which GEC is the major participant. It also obtained valuable contracts for power transformers of UK supply and has begun to operate in the telecommunications field. The pace of business development is restricted by the insufficiency of foreign exchange to meet the country's needs.

ASSOCIATED COMPANIES UK

	1982	1981
TURNOVER	£151m	£142m
PROFITS	£3m	£1m

The figures given above show the GEC share calculated by reference to the GEC interest in the equity of the Associated Companies.

GEC-Hitachi Television Ltd increased its output and margins improved as a consequence. The rationalisation of production moved further forward with the introduction of three new chassis designs, and additional investment in assembly plant helped to reduce unit costs.

National Nuclear Corporation Ltd is proceeding with the commissioning of the existing Advanced Gas Cooled Reactor (AGR) stations at Hartlepool, Heysham I and Dungeness, and with the construction of the new AGR stations at Heysham II and Torness. The reference design and pre-construction safety reports for the Pressurised Water Reactor (PWR) have been submitted to the CEGB. Work continues on the design for a Commercial Fast Reactor (CFR).

Ruston Bucyrus Ltd's sales declined for the fourth year in succession, affected by the continuing depressed state of the construction machinery industry at home and abroad. Economies achieved in overheads and by short-time working enabled a slightly better than break-even result to be achieved.

Lamp Component Companies were unable to offset the effect of a lower UK demand for their products and the decline



If a computer detects a fault in a printed circuit board at a new factory of GEC South Africa (Pty) Ltd at Kew, Johannesburg, a skilled operator makes a correction. Meticulous attention is given to on-the-job training for all employees.

in overseas business despite the adoption of stringent cost reduction measures and the making of structural changes.

ASSOCIATED COMPANIES OVERSEAS

	1982	1981
TURNOVER	£350m	£279m
PROFITS	£37m	£30m

The figures given above show the GEC share calculated by reference to the GEC interest in the equity of the Associated Companies.

SRA Communications AB of Sweden made heavy investments in research and development and in marketing activities. New orders booked were more than twice the record level of the previous year.

Fisher Controls International Inc recorded strong sales growth despite low demand in Europe. A world leader in process controls, the company's range of products and services includes control room instrumentation, field measurement instruments and control valves and regulators.

Cable Makers Australia (Pty) Ltd enjoyed further growth in market conditions which were buoyant for the greater part of the year.

GEC South Africa (Pty) Ltd operated in a lively economy until the last quarter. The AEI Henley subsidiary recorded a high level of order input for private telephone exchanges and has commenced local manufacture. The Machines Group had to contend with cheap imports in small and fractional motors, so that the Kwazulu factory had to be put on a short working week. A new cost-efficient range of high voltage motors has been designed and is now being tendered to mining and industrial users. The Power Group's Transformer Division improved considerably; its Switchgear Division achieved a major market breakthrough with its vacuum circuit breakers, over 1,000 of which have now been sold. The Low Voltage Division and the Traction and Signal company increased their capacity, supported by a heavy workload. Of the other parts of GEC South Africa, the Satchwell business did especially well.

Telephone Manufacturers of South Africa (Pty) Ltd achieved record sales of switching equipment and telephones to the South African Post Office and made good progress in the development of new telephones and with the introduction of a new digital switching system.

Africa Cables Ltd accompanied further growth with the commissioning of the first cable sheathing press in Africa for aluminium sheathed cables and the opening of a new high voltage development and testing laboratory. Both facilities are being used for the range of high voltage cross-linked polythene cables for which substantial contracts are held.

ATC (Pty) Ltd - formerly African telephone Cables (Pty) Ltd - had another satisfactory year's trading.

Winding Wires (Pty) Ltd, in conditions of increasing competition, extended its product range from its traditional enamelled wire to include textile covered wires and optical fibres.

Avery India Ltd operated at new record levels.

RESEARCH

The breadth of product and technological capability of the operating units is reflected in the range of research carried out in the four central laboratories. By way of illustration, a description of three current research programmes has been selected.

Novel VLSI Computer. Whilst developments in silicon integrated circuit (SIC) technology have reduced the cost of memory and logic in computers of all sizes, the full benefits of further advances in SIC technology (leading to silicon chips one centimetre square and containing 250,000 transistors) are best achieved by re-examining the fundamentals of computer design to see how future system concepts can make maximum use of the increasing chip capacity. As part of the re-examination, attention has been focused on the growing applications of 'computer vision' – the use of optical – or other – sensors, displays and sophisticated computing power to capture, process, transmit and display images. The range of applications spans medical diagnostics (processing and displaying images based on ultra-sonic, X-ray or nuclear magnetic resonance sensing), automatic visual inspection on a production line, computer-vision inputs for robots and materials handling equipment, military surveillance (radar, sonar and infra-red) and telecommunications (electronic mail, facsimile, videophone). In spite of the diversity of the applications there is a high level of commonality in the mathematical techniques which are used to describe and manipulate the images and hence in the computation which is needed. To illustrate the amount of computation, a typical image may contain 250,000 picture points or pixels and be changed 25 times per second. Manipulation of the image can require one thousand computing operations per pixel so that the total computational power required is almost ten thousand million operations per second.

To meet this need in a way which makes optimal economic use of developments in SIC technology, a novel computer architecture has been created called the GRID (GEC Rectangular Image and Data) computer. This is designed to be built from special SICs which the Company is designing for manufacture using its high performance complementary MOS on sapphire (CMOS-SOS) process. It should be possible to build a computer of the power described above on just four printed circuit cards, each measuring 12 × 9 inches.

Such a research project makes use of a wide variety of technical skills – mathematics, physics, chemistry, metallurgy, electronics, computer science and mechanical engineering. It also serves as an excellent forum for co-operation amongst, in this case, two of

the research laboratories and eight product units.

Integrated Data Networks. In the distribution of electric power around offices, factories, houses, etc, it is taken for granted that in the UK any appliance requiring no more than three kilowatts, via a 13 ampere plug and socket, will operate on simple attachment to the mains supply.

Achieving this same degree of total flexibility and standardisation is equally desirable in the converging activities of telecommunications, computing and office information systems. But it is vastly more difficult. The analogy with electrical power distribution leads to the ultimate objective of being able to attach or plug-in any kind of 'appliance' (telephone, printer, visual display unit, mass memory unit, etc) to a communication medium which will interconnect the appliances and also enable them to be connected to a variety of computing and telecommunications equipment. This ultimate aim may never be achieved, such is the wide variety of data, equipment and user-characteristics with which the communications system must cope, but progress in that direction is essential to realise the potential of office information systems.

Research towards this objective is carried out in the context of Local Area Networks (LANs). These are communications networks of intermediate length between long-haul (telecommunications) networks and internal system interconnections. They typically span ten metres to a few thousand metres and desirably should, at minimum cost, be capable of handling any desired mixture of speech, data and video signals with whatever degree of reliability and privacy the user expects.

One aspect of work on LANs is based on participation in a joint research project – called UNIVERSE – with the Science and Engineering Research Council and three universities, involving local area networks of three types coupled to computers and various work stations within the GEC laboratories which are then interconnected via a satellite link into the university networks. The main theme of the research is to determine how best to structure the data to be communicated and the hardware interface on to the LAN to give maximum system resilience (ie minimum delays in use), and also to study alternative techniques for encryption and decoding to give user-privacy.

This research, directed towards the achievement of coherence amongst many users and applications, serves the Company's product units in the telecommunications, computing, and office information systems areas in the short term. Longer term it will also be relevant to the product units serving the factory automation and medical diagnostics markets.

Materials Science. Research is carried out on metals, insulators and semiconductors – the structural materials used in the Company's products. Whilst some research is devoted to improving the understanding and control of materials (and their processing) currently in use by the GEC operating units, research is also carried out on novel materials which offer the possibility of providing new properties for the improvement of existing products and the creation of completely new ones.

For example, if some molten metals are cooled very rapidly (typically a million degrees per second), the amorphous or glassy structure of the liquid is frozen-in, because the individual metal atoms have no opportunity to move during the cooling process to take up new positions appropriate to their evolution to crystalline solid. Such glassy metals are being studied for their practical application as contact materials for semiconductor devices. There is early indication that the absence of grain boundaries in these featureless films makes them ideal as barriers to inhibit the migration of harmful metals, such as gold, into the semiconductor device material – usually silicon or gallium arsenide. Glassy metals are also of interest for their magnetic properties, and their impact on the design of power transformers is also being studied.

One of the characteristics of organic and polymer chemistry is that it is frequently possible to synthesise new families of materials with different properties (electrical, optical, mechanical) simply by making minor adjustments to the chemical composition of these complex molecules during their preparation. Research is being carried out, in co-operation with several university groups, on the properties of materials such as polydiacetylene in order to understand the physical basis for their observed electrical and optical characteristics.

Some of these materials have the property that one end of the molecule is strongly attracted to water whilst the other end is repelled. Use can be made of this characteristic to create a thin film just one molecule thick floating in a vibration-free trough of water, and then transferring that film to a solid substrate, such as silicon, to study new kinds of electronic devices. The potential applications for such structures include chemical sensors and very high density memory devices.

The common themes which run through these examples from the Company's current research programme are the establishment of research teams with the required wide competence in science and engineering disciplines, awareness of the potential relevance to product units, and close coupling into the academic research community.