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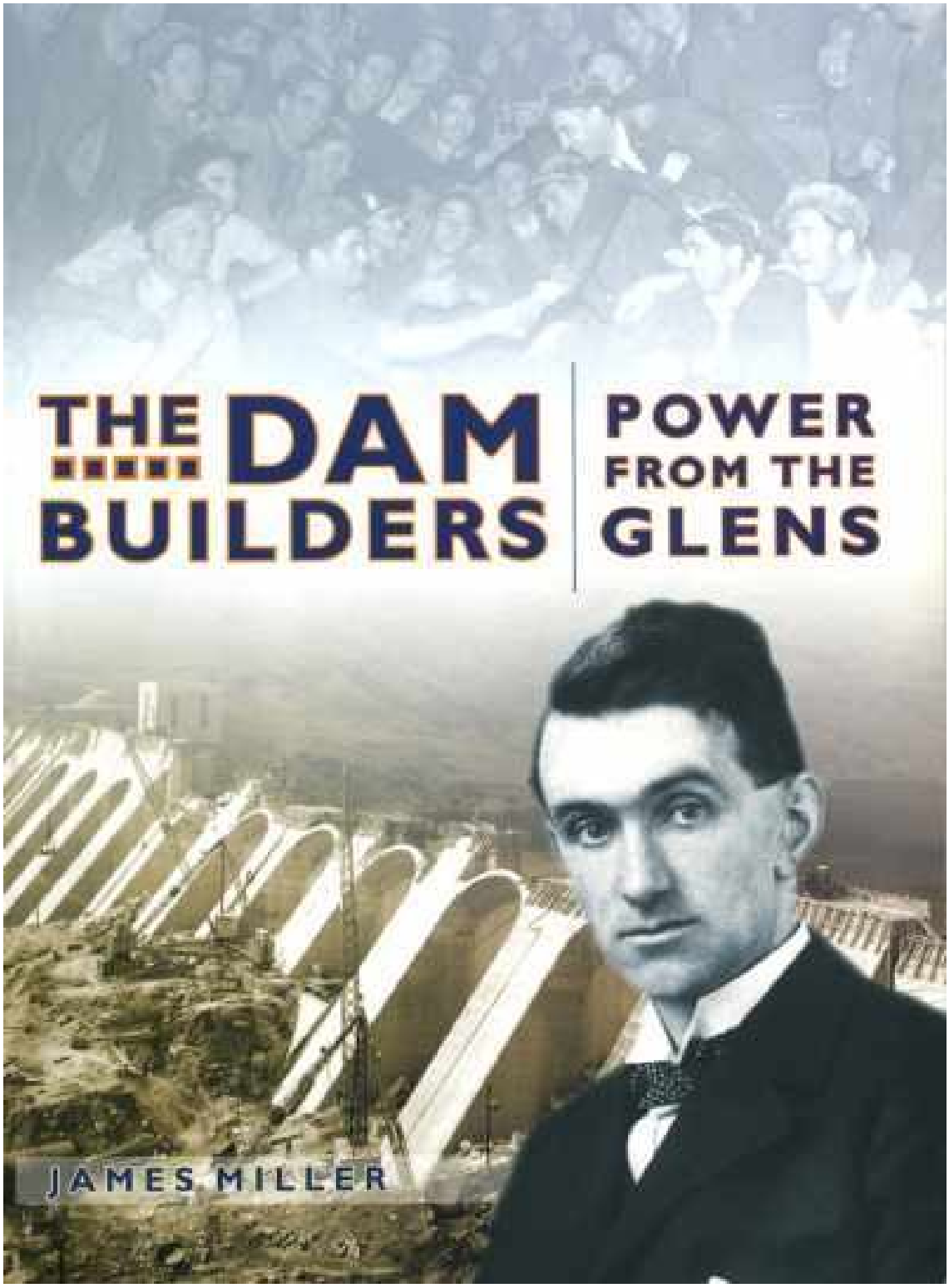

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The Dam Builders

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Vast in size but thinly populated, the Highlands evoked opposing views in all who were concerned in the 1930s for their future. For many they were 'the last great wilderness in Europe', some 16,000 square miles of magnificent mountains, sprawling moors, mysterious glens and a wealth of wildlife that included the red deer, the golden eagle and the wildcat. For others the landscape represented a man-made wilderness, the sad result of decades of oppressive landlordism, evictions and social deprivation from which the only escape had been and still was emigration. Between 1921 and 1951 the population of the Highlands and Islands fell by around 15 per cent, from 371,372 to 316,471. The land was being emptied of its inhabitants, and what to do to reverse this trend was the subject of many books, articles and reports, often peppered with such loaded phrases as 'the Highland problem' or 'the Highland question'.

Life in the Highlands had never been easy - the thin soil and the harsh winters saw to that - but surely something could be done. The Highlanders were an enterprising, intelligent people; they had proved their abilities time and again in every corner of the Empire, but somehow on their home ground they remained acquiescent and, the occasional land raid apart, not nearly as troublesome to politicians as their urban relatives.

Tourism, forestry, fisheries, improved transport and the development of cottage industries were among the favoured options. The Forestry Commission, established in 1919, had planted thousands of acres with conifers in Argyll and the Great Glen, where Neil Gunn saw them in 1937 and considered their green spires. 'What he [the Highlander] wants now - where the spirit has been left in him to want anything constructive - is hope for the future, and these new forests along the banks of the Canal and on both sides of Loch Lochy were somehow like a symbol of a new order. The trees were full of sap, of young life, green and eager, larches and other pines, pointed in aspiration and with an air about them not of privilege but of freedom'.

The Second World War brought men and women once again from the glens to serve the country, and added another set of names to the memorials in every parish, but it also gave impetus to a sense that something had to be done and to a feeling that from the all-consuming effort of war would emerge a new future.

Industry in the Highlands had always been small and local in scale. Some processing of primary produce - the turning of grain into whisky and wool into tweed, the curing of fish - was established and significant; but the Highlands had no coal, apart from isolated mines at Brora and Machrihanish, and it was accepted that large-scale manufacturing belonged elsewhere, in the lowland cities where the labour force, markets and infrastructure favoured a concentration of effort. In the last decade of the nineteenth century, however, the potential of the region for water power had been realised. The North British Aluminium Company, formed in 1894, looked to the Highlands for a reliable supply of electricity, essential in the relatively new technology of converting raw bauxite to aluminium, and found it at Foyers on the south side of Loch Ness. Up to 19,000 kW of electricity were needed to convert four tons of bauxite to one ton of pure metal. Construction of the first major hydro-electric scheme in Britain began in 1895, and the smelting plant produced its first metal the following year, some 200 tons but already 10 per cent of the world output at that time. By 1900 production at Foyers had risen to over 1,000 tons, as the world demand for aluminium rose.

Scotland's first hydro-electric plant for public supply had been installed at Greenock in 1885, only four years after the first in Britain opened in Godalming, Surrey. The Greenock experiment ran for only two years but it had been enough to show the potential of hydro-electicity as a clean source of energy for daily activities. The next place to benefit from hydro-electric power was the village of

Fort Augustus; in 1890 the Benedictine monks installed an 18 kilowatt turbine in one of the burns supplying their abbey at the southern end of Loch Ness and distributed the excess energy to their secular neighbours. The hotels and houses of the village were to have the benefit of this local supply until nationalisation of the industry in 1948. In 1896 the Fort William Electric Light Company began to operate two turbines at Blarmachfoldach on the Kiachnish River to supply light to the town. Another local scheme, this time at Raven Rock in Glen Sgathaich, to the north of Strathpeffer, was built in 1903 with funding from Colonel E W Blunt-Mackenzie, husband of the Countess of Cromarty, and brought power to Dingwall and Strathpeffer. This enterprise was later transferred to a larger power station at the Falls of Conon on Loch Luichart. The coming of the new source of light was a wonder of the age. 'On Monday evening', reported the North Star in Dingwall, 'the electric light was turned on in the premises of Baillie Frew, jeweller, by his niece, Miss Christine Frew. The glitter and dazzle of the jewellery, caused by the numerous arc lamps, attracted great attention.' An ironmonger's and a bookseller's shop were also illuminated. Blair Atholl received its first hydro-electricity supply in a similar way in 1910 when the Duke of Atholl built a 130-kilowatt generator on the Banrie Burn, a tributary of the Tilt, to supply his castle and the adjoining village. Beyond the ends of the wires strung in these isolated localities, the people still depended on the oil lamp and the kitchen range and, in the countryside, were to do so for around another fifty years. These small beginnings had, however, been literally a glimmer of the future.

The aluminium industry continued to grow. A village grew up at Foyers to house the staff of the plant beside Loch Ness. The British Aluminium Company decided to expand its facilities and initiated an extensive scheme in the Loch Leven area that was to create the industrial village of Kinlochleven, with its smelting plant and the associated hydro-electric works drawing on the abundant water of Rannoch Moor. A dam was built across the Blackwater River to turn it into an eight-mile long reservoir whose waters were then led down the mountainside into a power station above Kinlochleven. Construction began in 1905 and was complete four years later. As a major undertaking in remote mountain country, with the creation of a new loch and the redirection of existing water courses, it was a forerunner of what was to come.

It also marked the end of a more primitive era: the Blackwater Dam, 3,000 feet long and 90 feet high, in its time the largest in Europe, was the last large construction project built by the hard labour, unassisted by machinery, of itinerant Irish navvies. The Kinlochleven project also attracted a large number of labourers from the Hebrides, so many in fact that foremen or 'gangers' had to have a command of Gaelic.

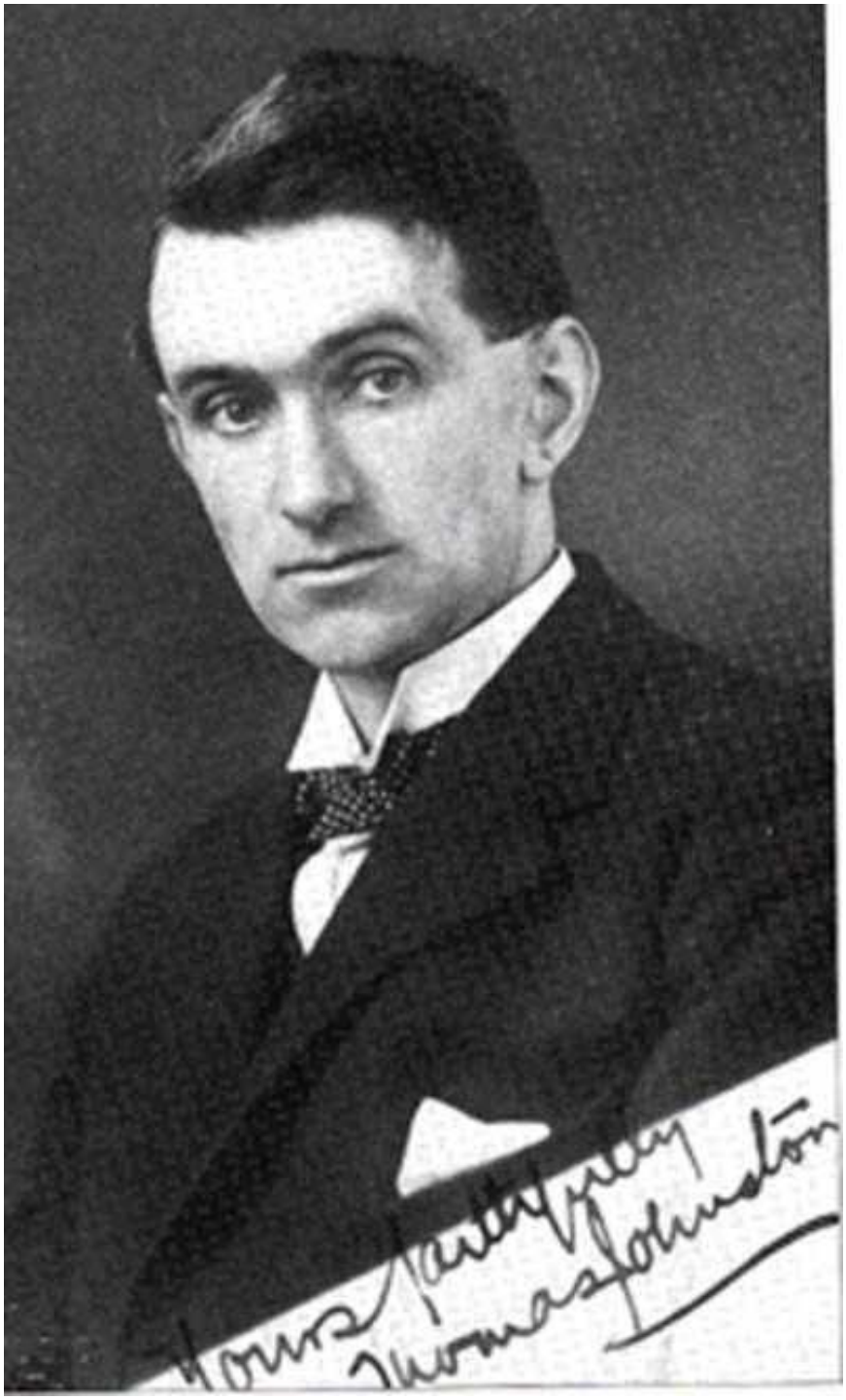
The navvies lived in shacks with tarred canvas roofs and slept in bunks, sometimes shared by three men, arranged in tiers around the flimsy walls. Cooking was done in frying pans on a stove in the centre of the muddy floor, and light was provided by naptha-burning lamps. There was almost no law and order among the 3,000 workers beyond what men could exert with their fists, and the only diversions were drinking and gambling. It was less a life than an existence. The highest paid workers, the hammermen, earned sixpence and an hour, with rises to sevenpence-ha'penny for overtime and ninepence on Sundays. Drilling the rock was done by teams of five; one man, the holder, sat gripping the steel drill between his knees while his four companions struck it in rotation with sledgehammers until they had driven a hole four or five feet deep. Dynamite was then packed in the hole and the rock blown apart. Only the contractors knew what the work was intended for; the workers did not know and they did not care. Life in the camp rolled relentlessly and violently on without contact with the native Highlanders: the navvies were 'outcasts ... despised ... rejected ...forgotten'. A small graveyard with cement tombstones lies on a hillock a little to the west of the dam, the last resting place of some twenty of the navvies. The work camps associated with

the later hydro-electric schemes had their share of violence, drinking and gambling but they were a world away from what the earlier workers had endured.

The First World War brought about a massive rise in the demand for aluminium and the Blackwater Reservoir had to be expanded to cope with the extra electricity requirement. Five hundred British troops and 1,200 German prisoners of war were brought in to build a five-mile aqueduct to lead water from Loch Eilde Mhor into the Blackwater. The British Aluminium Company set in train another development in 1924. Called the Lochaber project, it continued until the end of 1943. The main elements of this scheme were a 900-foot dam to divert water from the upper reaches of the Spey into Loch Laggan which, in turn, fed water through a tunnel to Loch Treig. A fifteen-foot diameter pressure tunnel was driven fifteen miles under the Ben Nevis Massif to emerge at the head of a steel pipeline 600 feet above a power station in Fort William. The original plan to build an extra power station at Kinlochleven had to be shelved when Inverness County Council, in whose territory lay the Spey and the Laggan, refused to allow its resources to be piped across the county boundary to Kinlochleven in Argyllshire.

There were several schemes in the 1920s and 1930s to generate power for public use. The Clyde Valley Company's power stations on the Falls of Clyde opened in 1926. The chief technical engineer on this scheme was Edward MacColl who was later to bring his expertise to the Hydro Board. A larger scheme in Galloway was built between 1931 and 1936. In the Highlands the main effort was made by the Grampian Electricity Supply (acquired by the Scottish Power Company Ltd in 1927) and involved tapping Lochs Ericht, Rannoch and Tummel, with extra feed from Lochs Seilich and Garry, to generate electricity to serve a wide area of the central, southern Highlands and the Central Belt. The power stations opened in 1930 and 1933. The hydro-schemes of the inter-war years established the pattern that was to be followed after 1945. They all employed large numbers of men - for example, 3,000 at the height of the Lochaber project - who lived in work camps and used technology to allow them to build and drill in the harsh landscape. Compressed air drills were deployed on boring out the pressure tunnel under Ben Nevis, and the workers had electrical power from a temporary generating station on the River Spean.

The Grampian scheme showed how Highland water could be harnessed for the public good and the Cooper Committee, sitting during the early years of the Second World War, looked with approval on its achievement. Not everybody was happy about the ambitions of the Grampian company and when, in 1929, they first put forward plans to develop the waters of the river system that discharged through the Beauly River into the Beauly Firth they met with considerable opposition. This plan would have involved the lochs of Affric, Mullardoch and Monar but it was rejected by the House of Lords, after strong arguments from A. M. MacEwan, the Provost of Inverness, and the Mining Association. Their combined opposition was based on the destruction of the beauty of this area of the Highlands and the fact that there were not enough consumers to benefit from the power to be generated.



Tom Johnstone in younger days (photo courtesy of Mrs Ann Yule)

Tom Johnston was both a socialist and an unrepentantly patriotic Scot. By the end of the First World War he was a leading figure in Labour politics. In 1922 he was elected as the Independent Labour Member of Parliament for West Stirlingshire but he lost the seat within two years when Ramsay MacDonald's Labour government fell to the Conservatives. A by-election a few weeks later brought Johnston back to the House of Commons; and in Ramsay MacDonald's second Labour administration between 1929 and 1931 Johnston briefly held Cabinet rank. He was returned to Westminster again in 1935.

On the outbreak of the War in 1939 Johnston was appointed Regional [sic] Commissioner for Civil Defence in Scotland. Then, in February 1941, Winston Churchill summoned him to Downing Street. Johnston compared an interview with Churchill to being like a rabbit before a boa constrictor. When the Scot said he wanted to get out of politics to write history, Churchill gave a disdainful snort and said Johnston should join him and 'help .... make history'. The Prime Minister then laid his cards on the table: he wanted Johnston to be Secretary of State for Scotland. If Johnston felt himself to be like a rabbit, he remained a canny rabbit and agreed to take the post on certain conditions. The most important of these was that he could try out a Council of State comprising all five surviving former Secretaries of State and that whenever they agreed on a Scottish issue Johnston could look to Churchill for backing.

'I'll look sympathetically upon anything about which Scotland is unanimous,' Johnston records the Prime Minister as saying. 'What next?'

Johnston said he wanted no payment for the job as long as the War lasted. 'Right!' agreed Churchill. 'Nobody can prevent you taking nothing.'

Johnston said later that he was 'bundled out, a little bewildered', and miserable at the thought of the commuting he would have to endure between London and his beloved homeland; but he was also pleased that he had been given a unique opportunity 'to inaugurate some large-scale reforms .... which .... might mean Scotia Resurgent'. As he strode down Whitehall he was already listing the projects he was itching to start, and they included 'a jolly good try at a public corporation on a non-profit basis to harness Highland water power for electricity'.

Johnston's Council of State was officially named the Scottish Advisory Council of ex-Secretaries. The other members were Lord Alness, Sir Archibald Sinclair, Sir John Colville (later Lord Clydesmuir), Walter Elliot and Ernest Brown, and, by Johnston's account, they got on well, despite representing widely varying points on the political spectrum, and proposed projects and reforms in quick succession that laid the basis for post-war reconstruction in Scotland in a broad sweep of public life.

In 1938 Johnston had voted against the Caledonian Power scheme, sharing the opinion of many Highlanders that a private firm should not be allowed to take over a national resource. Johnston's view of hydro-electricity, in keeping with his socialist principles, was that public resources should be handled by publicly owned corporations. He had been impressed by the work of the Tennessee Valley Authority in the United States

The Cooper Committee was appointed in October 1941 to consider anew the potential for hydro-electricity generation in the Highlands. This body's official name was the Committee on Hydro-Electric Development in Scotland but it quickly became known by the name of its chairman, Baron Cooper of Culross. The other members of the Cooper Committee were the Viscount (William Douglas) Weir, Neil Beaton, the chairman of the Scottish Co-operative Wholesale Society, James Williamson, the chief civil engineer with the consultants to the construction of the Galloway hydro-electric scheme in the 1930s, and John A Cameron of the Land Court.

Although 'handicapped by war conditions', the Committee examined every aspect of its remit throughout the first half of 1942. At the beginning Lord Cooper was sceptical of the Committee's ability to come up with much to supersede earlier work but, as the data accumulated, he became an increasingly enthusiastic supporter of hydro-electricity.

On its peregrination around the country, the Committee met Evan Barron, the editor of the Inverness Courier, and Barron impressed on them the need for a quid pro quo if Highland water were to be harnessed. In their final report the Cooper Committee recognised that the 'portion of the area popularly designated the Highlands has for long been a depressed area and will remain so unless vigorous and farsighted remedial action is taken in hand without delay'. The Committee looked long and hard at not only the potential for hydro-electric development in the Highlands but also at some of the likely results of such development.

'We accordingly recommend', wrote Lord Cooper and his colleagues, 'that there should be created a new public service corporation called the North Scotland Hydro-Electric Board to be responsible for the generation, transmission and supply of power in all the parts of the Highlands currently outside the "limits of existing undertakers"'. (In time, with the nationalisation of electricity in 1948, the whole of the Highlands and Islands came under the aegis of the Board.)

As the Cooper Committee had been gathering its evidence, Tom Johnston had asked Evan Barron to come down to St Andrew's House to talk about how hydro-electricity might be made acceptable in the Highlands. Although the Courier editor was politically much further to the right than the Secretary of State, the two men respected each other highly and maintained a close friendship.

Barron repeated his assertion that Highlanders would agree to hydro-electricity development only if they were to benefit directly from this surrender of their resources. Johnston responded by passing to Barron a draft copy of the Cooper Committee's report with the warning not to publish it: Johnston is reported to have said, 'If anything appears about the Cooper report before Parliament gets it, Scotland will have another secretary of state next week'.

In a long leader in the issue of the Courier on 23 January 1943 Barron gave his opinion of the Hydro-Electric Development (Scotland) Bill under the headline Hope for the Highlands. The introduction of the Bill based on the Cooper Committee findings, he wrote, 'is the most hopeful thing for the Highlands which has happened for many a day'. The water resources of the Highlands were to be developed in the interests of the native Highlander.

Barron called on Highlanders to see that the Bill became law more or less as it stood and put their water resources 'forever beyond the reach of the clutching hands' of outside companies. Now, said the Courier, the State had the chance to undo the ill-treatment meted out to the region for the last 150 years.

The Bill recognised the broader role of the Board. The profit from the sale of surplus electricity to the Central Electricity Board for the national grid would be ploughed back into reducing the costs of distributing power to the more remote, low-populated areas of the Highlands for 'the economic development and social improvement' of the region. In May 1943 the Courier was pleased to say that Tom Johnston had 'earned the gratitude of all who love the Highlands'. The Hydro-Electric Development (Scotland) Act became law in August. Writing of the opponents of the Act, Johnston returned to the rhetoric of his younger days:

I knew most of the nests from which the corbies would operate; the colliery owners had retired from the struggle, and their shareholders wanted no notice taken of the pit bings and so stopped talking about how the hydro schemes would destroy amenity. A few shameless twelfth of August shooting tourists, who themselves took care to live in the electrified south for eleven months in the year, moaned about the possible disappearance in the Highlands of the picturesque cruisie; and I had one deputation whose spokesman was sure we were engaged in a conspiracy to clear Glen Affric of its

crofters and its sheep; in response to enquiries, he had not been up at Glen Affric himself, and he really was surprised to learn that there were neither crofters nor sheep in the Glen for these many years past.

In September the names of the first members of the Board were made public. The Earl of Airlie was appointed chairman, with Edward MacColl as deputy chairman and chief executive. After his success on the Falls of Clyde scheme, MacColl, whose forebears came from Melfort in Argyllshire, had been appointed engineer for the Central Scotland District of the Central Electricity Board and had overseen the construction of the first regional grid in Britain. He brought a vast experience of the technical aspects of electricity generation and distribution to the Board, and added to this formidable expertise a flair for innovation. The other three members were Neil Beaton, who had already served on the Cooper Committee; Hugh Mackenzie, the Provost of Inverness; and Walter Whigham, a director of the Bank of England and the representative of the Central Electricity Board. (Whigham was soon to resign through ill health and his place was filled by Sir Duncan Watson, a Scottish engineer.)

The Earl of Airlie seems at first glance to have been an unlikely choice for the figurehead of a new public corporation. He was the twelfth member of his family to hold the Airlie title, had been educated at Eton, had won the Military Cross in The Black Watch during the First World War, owned around 40,000 acres, was Lord Lieutenant of Angus, a member of Angus County Council and a staff officer at Scottish Command HQ. The good-natured Airlie had, however, been Tom Johnston's second-in-command when he had been in charge of civil defence, and the two men obviously felt that they could work well together.

Two sub-committees of the Board were set up - the Amenity Committee under the chairmanship of Colonel the Hon Ian Campbell and including Lady MacGregor of MacGregor, the only woman in the upper echelons of the Board; and the Fisheries Committee with Colonel Sir D W Cameron of Lochiel in the chair. The registered office was established in Edinburgh, and the Lord Lyon King of Arms granted the Board its own coat of arms in 1944. The shield bore a winged thunderbolt emitting forked flashes of lightning suspended above a cruisie-lamp, the ancient form of domestic illumination. These symbols, encapsulating the Board's aspirations, were supported by two rampant stags on either side of a fir tree and a rock from which water gushed. The motto was in Gaelic: Neart nan Gleann, the power of the glens.

The shield of the North of Scotland Hydro-Electric Board as depicted in wrought iron on the gates of Invergarry power station. (author)

The Board benefited in its early decades from the calibre of the almost handpicked senior staff - 'men steeped in their subject', according to Hamish Mackinven. Edward MacColl selected Angus Fulton, as enthusiastically in favour of hydro-electric development as himself, as his chief civil and hydraulic engineer; and wooed David Fenton back to Scotland from the English Midlands to be his commercial engineer. Thomas Lawrie became the Board's secretary on its inception. W Guthrie was appointed as the first chief electrical engineer and A N Ferrier as the chief accountant.

Inverness Town Council organised a conference in August 1943 where representatives from all the Highlands and Islands local authorities could discuss the implications of the new Act. Fearing that once again Highland resources might be exploited for the benefit of others, the so-called Scottish Local Authorities Hydro-Electric General Committee that emerged from the conference resolved to 'watch the interests of the area'. For example, John Murray, the Provost of Dornoch, while calling for a bold policy to take advantage of the new source of energy and expressing confidence that industry would follow power, was concerned that the remote places wouldn't be forgotten.

In March 1944 the Board published its development programme and listed no less than 102 projects, ranging in size from small local ones to giant schemes covering whole series of glens. At one end of the spectrum lay the streams draining into Loch nan Gillean, near Plockton, calculated to be capable of generating four million units (kilowatt hours per year), the streams on Islay and Jura (five million units), two streams on the north side of Loch Nevis (five million units), and streams in Arisaig (six million units). The biggest schemes pinpointed the Affric-Beauly river system (440 million units), the Orrin-Conon and the Garry Moriston systems (each 350 million units), and the Tummel-Garry system (300 million units). It seemed as if every corner of the Highlands and Islands were included, from the burns on Shetland to those draining the Mull of Kintyre. The impressively ambitious programme recorded a total potential output of 6,274 million units of electricity per year, considerably more than the 4,000 million units per year estimated by the Cooper Committee. Edward MacColl pointed out in an address to the Institution of Engineers and Shipbuilders in Scotland that the programme did not include 'a substantial amount of power still available in the form of high-head run-off schemes' with little or no storage capacity in the form of lochs. He also conceded that not all the schemes in the list of 102 were economic, although in the future when coal became scarce or dear they might become viable.

The prospects were, however, exciting enough. Just before the War finished, the Ministry of Information made a film to show how good it would be to have power in the Highlands. The film showed a pair of Clydesdales and a horse plough ploughing on a very barren bit of ground. This was supposed to show worthless ground that was to be recovered. Everyone was supposed to get power for nothing. The idea was that the people coming home from the War would get better things. Of course there was no power then; unless you lived on an estate where there was a water turbine or a generator, it was the Tilley lamp, double-wick lamps and candles.

The Scottish branch of the Association of Scientific Workers, a body firmly in favour of centrally planned, publicly owned advancement, hailed the Board's development programme by issuing a brochure, Highland Power, which made direct reference to the Tennessee Valley Authority and stated that the proposed developments offered 'a golden opportunity to test a new approach to British social and economic problems'. Other bodies more concerned with what might result when a great concrete dam was thrown across a glen also soon made their voices heard. In the summer of 1944 the Association for the Preservation of Rural Scotland protested that areas of outstanding natural beauty, such as Glen Affric, Glen Garry and Loch Maree should be safeguarded.

The schemes in the counties of Perth, Dunbarton, Argyll and Inverness were already being surveyed and planned in the spring of 1944 and the Board published the details of its first construction projects on 3 July. There were three - Loch Morar, Lochalsh and Loch Sloy, costing a total of £4.6 million and aimed at generating an estimated 136,000 units of electricity. Two were mainly of local significance: the Morar scheme proposed a dam and power station on the Morar river to provide power to the Mallaig and Morar area; and the Lochalsh scheme comprised a dam on the Allt Gleann Udalain and a power station near Nostie Bridge to meet local power needs. The third scheme, the

one at Loch Sloy, was by far the largest of the three, a major enterprise involving the construction of a power station on the shore of Loch Lomond, four miles north of Tarbet, to be fed from a dam at Loch Sloy in the hills overlooking the outfall.

As 1944 wore on, opposition to the Board's proposals grew louder and more public. Letters began to appear in newspapers. R. Gilmour probably spoke for many when he wrote from the Lochboisdale Hotel on South Uist to say that the Board's intentions should be made 'crystal clear' to the people and that industrial factories were not desirable in the Highlands and Islands. At a public meeting in Pitlochry, a motion was passed to express 'grave concern' about the proposals to create dams on the Tummel and the Garry and drown parts of the river valley. A committee was formed to oppose the Tummel-Garry scheme; the charge that the large landowners in Perthshire lay behind the opposition was rebutted. A few spoke up in support of the development, pointing out that a new loch might enhance rather than destroy the scenery, and someone using the soubriquet 'Beauty Lover, Perth' wrote 'We want Scotland to be a place where we can get a job after the War'. The Hydro-Electric Board Amenity Committee met the Pitlochry Amenities Preservation Committee in Fisher's Hotel in the town to hear the local objections in detail, while other gatherings of the objectors took place in bars and hotels around the county. The owners of the salmon fisheries appealed in vain to Perth Town Council for financial support in their campaign. Perth County Council received a report on the likely effects of the scheme. Loch Tummel was predicted to rise seventeen feet and submerge 770 acres, some buildings would go under, and the new loch behind the proposed dam at Pitlochry would drown 165 acres.

The members of the Board took to the road on the public relations offensive. Edward MacColl protested that confidential Board information was being used by anti-hydro agitators. In Pitlochry, Board member Neil Beaton declared that work on the schemes would employ 10,000-12,000 Scots in the construction phase, that the dams and power station would provide up to £30,000 per year to the Perthshire rates bill, that a permanent staff of fifty would work in Pitlochry, and that hydro-electric schemes had brought about a rise in tourism in the Tennessee Valley, Switzerland and other countries. Beaton also gave voice to a matter hanging in every mind in late 1944 ... What was the position of Scotland before the War? A large section of the people were unemployed ... Many of these were fighting and unfortunately dying that Scotland might continue to live in freedom. Were these brave men and women to come back to the old conditions .... ? Lord Galloway, the chairman of the Association for the Preservation of Rural Scotland, countered that the pre-war hydro projects of the Grampian Electricity Company at Rannoch and Tummel Bridge had employed mainly Irish labour, that the rates bill would not counteract lost tourist revenue, and that the permanent jobs resulting from the Pitlochry works would not compensate the families whose land would be flooded.

The Local Authorities Committee was also raising doubts about the schemes. Some of these focused on who should control local water resources. Dunbarton County Council opposed the Loch Sloy scheme, the first Board project, because it might need Loch Sloy for domestic water. Inverness County Council lamented the lack of information available from the Board on its plans for their area: a dispute between Inverness Town Council and the Board over who should have control over Loch Duntelchaig, whether the waters of this relatively small loch a few miles south of the town should be part of a hydro-electric scheme or reserved for domestic use, was to run for many months before it was settled in favour of the Council just before Christmas 1945.

In April 1945, the Board published its first Annual Report covering the period between its inception and December 1944, a modest eight page document in a brown cover, priced 6d. It summarised the progress so far; the approval of the Development Scheme by the Electricity Commissioners and its

confirmation by the Secretary of State; the collation of existing rainfall records - they were found to be inadequate; the establishing of automatic river flow recorders on the Tummel and the Conon, with observers taking manual readings on four more; the collection of geological data in relation to the siting of dams, power stations, tunnels and aqueducts; and the publication of the first constructional and distribution schemes. Surveys were proceeding on more distribution schemes as quickly as the wartime staff shortages would allow.

Under the heading 'Future Policy' the Report stated that all the schemes for the supply of ordinary consumers in the Board's district appeared to be uneconomic. 'In the aggregate, when they are carried out, the annual loss will be very large and it will have to be covered by profits earned in other directions.' This meant selling electricity to the areas of high demand in the south. 'Projects of the same exporting type as the Loch Sloy Scheme are required and are being prepared, which will harness the undeveloped resources of the Highlands and help to pay for the many uneconomic distribution schemes there, and to finance a "Grid" in the North of Scotland District.' The intention to develop economic schemes before working on uneconomic ones for Highland use aroused the ire of some Board-watchers. It was against the terms of the Act's social clause, in the opinion of the Inverness Courier, which clearly stated the Highlands had first claim on power from the glens. Lord Airlie said power had to be made available to redevelop postwar Lowland industry but arguments that economic schemes had to have priority in order to subsidise the others cut little ice beyond the Highland Line and words such as 'betrayal' began to appear in the editorials of Highland newspapers.

In its first sixteen months, the Board's total expenditure amounted to almost £137,000. This was met by temporary loans from Scottish banks. All during its life the Board never received a penny in subsidy from public funds, as Tom Johnston and many others always stressed, although under the terms of the 1943 Act the Treasury guaranteed the Board's borrowings.

Objections to the Sloy scheme, from local authorities and from individuals, forced the holding of a public inquiry which got down to work in Edinburgh between Christmas and Hogmanay in 1944, with John Cameron, KC, as chairman. To Cameron's regret, the business took as long as six days (some later inquiries were to take considerably longer) but the outcome was a victory for the Board. In recommending that the scheme go ahead Cameron did, however, remind the Board that it should be better prepared to argue its case in future. Dunbarton County Council's objection that it might need Sloy for its own purposes was dismissed, along with other fears over the appearance of pipelines, the power station and spoil disposal. As Secretary of State, Tom Johnston happily gave the scheme the green light and, after resting before Parliament for the statutory forty days, it became finally clear to proceed on 28 March 1945.

The strong feelings of opposition seem to have been assuaged somewhat by publication of the Board's distribution schemes for Highland areas. The Gairloch-Aultbea distribution scheme, made public in December 1945, promised lines running from the power station on the River Kerry to bring electricity to some 1,500 people in an area of 180 square miles around Loch Maree and Loch Ewe. Consumers within a reasonable distance of the power lines would be given free connection. The charges for electricity were likely to be 5d (2p) per unit for lighting, three farthings (0.21p) for cooking and heating and a halfpenny (0.14) for other uses. The distribution scheme for Skye, published in February 1946, aimed to serve over 10,000 people in an area of 690 square miles, from a power station on the Bearreraig river and from a submarine cable across the Kyle of Lochalsh.

On 11 June 1945, Margaret Johnston, the Secretary of State's wife, inaugurated the Loch Sloy scheme by cutting the ceremonial first sod on the site of the temporary diesel power station by Loch

Lomond. In keeping with the scale of the enterprise, the 'sod' was a strip of turf twelve feet wide and 100 feet long, and the 'spade' was an eighteen-ton bulldozer rejoicing under the name of 'Red Lichtie'.

The crucial factor in the viability of a hydro-electric scheme is the amount of water available and the vertical distance, the 'head', through which it can be induced to fall to reach the power turbines. The hills to the west of Loch Lomond had plenty of water in the 1940s. Around Loch Sloy rain fell on average on 230 days in every year, to a measured annual depth of some 120 inches. The loch had been surveyed in 1937 and the results of this earlier investigation were revived and modified by the Board engineers in 1944. Before the work began, Loch Sloy was a modest mile or so long, a shallow body of brown, peaty water nestling 780 feet above sea level between the bare rocky slopes of Ben Vane and Ben Vorlich. Very few people lived in the surrounding hills. At the east end of the loch a burn gushed out through a gorge suitable for a dam and coursed down to swell the Uglas Burn on its steep descent to Inveruglas Bay and the waters of Loch Lomond some 600 feet below. To swell the size of the primary reservoir, a series of tunnels and aqueducts were constructed to divert water from other burns in the surrounding moorland. Loch Sloy, originally enjoying a catchment area of six and a half square miles, finished up draining some twenty-seven square miles spread over the hills where the three counties of Dunbarton, Argyll and Perth met. The loch rose 155 feet in height and doubled in length, making its surface at its maximum over 900 feet above the turbines it was designed to feed.

Although the Loch Sloy scheme was fairly straightforward on paper, problems arose during construction and taught a few valuable lessons. It was planned to come on stream in 1947 but the difficulties of construction in the immediate postwar years caused major delays. There were acute shortages of almost everything - steel, cement, equipment, timber and men. The shortage of timber led to the use of steel shuttering. The weather remained atrocious - only three weeks without rain were to be recorded during the entire three years of dam construction - and the perpetual rain, sleet and driving winds sapped the will of many workers. The weekly average precipitation during 1947, 1948 and 1949 was 2.75 inches, and 'severe gales occurred with disheartening frequency'. On top of this, the accommodation was rough, and the food became another deterrent. The Irish navvies at Kinlochleven in 1909 may have roughed it out, but this was the 1940s and expectations were higher. Lorries bringing materials took time to negotiate the single-track road winding along the shore of Loch Lomond.

Preliminary work took up most of the first two years of the scheme. An access road was driven up the steep valley of the Uglas to the slopes of Ben Vorlich, where part of it around the east side earned the nickname of 'the Burma road'. The camp and workshops had to be built, a bridge had to be put up to carry the West Highland railway line over the pipeline to the power station, a 3,600 kW diesel generator had to be installed to provide power for the construction. Portland cement was available only in bags, which took considerable handling. Sand had to be towed in barges up Loch Lomond from Balloch, twenty-two miles away; and of course the sand had to be unloaded into five-ton lorries for the journey up the access road to the batching plant beside the dam. A conveyor belt system was erected to carry crushed stone from a quarry on Ben Vane across 1.75 miles of rugged moor to the same batching plant. In the batching plant, the sand, cement and stone were mixed in careful quantities to produce the concrete that was then swung in ten-ton skips on an electrically driven overhead cableway to the site for pouring on the dam. All of this became standard procedure on future schemes.

The figures convey something of the scale of the work. The dam was not as large as some that would be constructed later, but to make room for its foundations 36,000 cubic yards of peat and

sandy soil, and 56,000 cubic yards of rock had to be scraped or blasted away. The dam itself, designed by James Williamson to be economical with materials, still had thirteen massive buttresses soaring rib-like from the floor of the gorge and consumed 208,000 cubic yards of concrete.

The main tunnel was driven from four entry faces. Drilling the fractured schist with compressed-air powered bits was an arduous task. An advance of 64 feet became the weekly norm but in one glorious seven-day burst 103 feet of rock was carved out. The workers seem quickly to have acquired expertise for, when the four tunnels linked up, the error in alignment was less than one inch. The completed tunnel was ten thousand feet long with a maximum diameter of 15 feet 4 inches. To make this hole through Ben Vorlich's innards, the men had removed 180,000 tons of rock and fired off 220 tons of gelignite.

All the tunnels designed to carry water were equipped with surge shafts, vertical tunnels often with subsidiary expansion chambers, to accommodate sudden changes in water level as the load varied on the turbines in the power stations. The surge shaft at Loch Sloy was drilled out and lined with concrete to leave a space 26 feet in diameter and 273 feet high. The main tunnel led fromn the dam to the valve house on the edge of the brae overlooking Loch Lomond. Here the water flow was channelled into four steel pipelines that dropped steeply down the hillside to the power station. Built in situ by Sir William Arrol and Co., the pipelines, 3,500 tons in total weight, was designed to accommodate a flow of up to 220,000 tons of water per hour. The steel was accordingly graded in thickness and carefully welded in Arrol's workshops in Glasgow to make pipe sections to cope with pressures double the expected 400 pounds per square inch. The pipe sections were brought to the site by rail and hauled up the hillside to be laid on massive supporting blocks of concrete and concrete piers before being welded in place.

While all this was going on, the power station itself was being built by Hugh Leggat Ltd. The laying of the foundations for the turbines required the excavation of 37,000 tons of rock and earth. Progress was slow, bedevilled by the same problems that beset the other components of the scheme, but finally in 1948 the installation of the English Electric turbines went ahead. The four 32,500 kW generating sets, the most powerful so far deployed in Britain, were not all finally in place until nearly the end of 1951.

Electricity from Loch Sloy was destined to feed into the nation grid at Windyhill on the fringe of Glasgow. The erection of the steel pylons, the towers, to carry the high voltage, 132 kV power lines across the countryside was almost as much a feat as the building of the dam and tunnel. Some vehicles fell victim to the peat bogs, and pack horses were brought in to help carry at least a little across the moors. Payne summarises the conditions in which the work was completed: 'Working from sunrise to sundown in incessant rain, paid about £8 for a seventy-hour week, with thirty shillings a week lodging allowance, the labour force was exceptionally volatile: no less than 1,285 men were taken on during the course of the two-year contract to keep a squad of 200 going.'

As the Sloy scheme was slowly becoming a reality, the Board was facing a severe test to the east. Unlike the Sloy development, which was designed to supply Glasgow with electricity and which was being built in a relatively deserted spot that excited few passions, the Tummel-Garry scheme was sited in the heart of beautiful countryside with many historical associations. Hamish Mackinven considers opposition to the scheme to have been one of the three periods of greatest danger in the life of the Board. Some of the reasons for this have been mentioned already: Pitlochry feared for the damage to its tourist trade, large landowners did not want anything to threaten their interests in salmon fishing, and the slowly growing environmental lobby wanted to preserve the beautiful scenery in central Perthshire. Perth and Kinross County Council, led by the provost, G. T.

McGlashan, expressed its unanimous opposition in March 1945 and criticised the Board for failure to keep the public informed about its intentions and to respond fully to the Council's repeated requests for information. The councillors included Lord Mansfield, who referred to the Board's 'miserable policy of secrecy', and Lord Kinnaird, who said the Council had been profoundly shocked to learn the Tummel-Garry scheme had been scheduled so soon in the Board's programme. In the Perthshire Advertiser the editor said the Council was bound to oppose the scheme but the paper's columnist, Neil Johnson, took a dissenting view: writing that the Board offered reasonable hope for an end to the chequered economic history of the Gaels, he said it '.... has to shoulder a stern business proposition .... shorn of that inane impractical romance which would seem to malign the judgement of those whose creed is the preservation of the beauty of the ... glens and straths at all costs'.

The Tummel-Garry scheme was vital to the Board's programme. Designed for a capacity of 150,000 kW, the scheme was to provide energy principally to the Central Electricity Board but also to the Grampian Company and the city of Aberdeen, all sources of revenue that would enable the Board to proceed with smaller, loss-making schemes. The public inquiry opened in the august surroundings of Parliament House, Edinburgh, on 25 April 1945, with John Cameron, KC, once again in the chair. On this occasion he had Sir Robert Bryce Walker and Major G. H. M. Broun-Lindsay to assist him. A procession of advocates represented the twenty-five formal objectors whose complaints were almost all on amenity grounds and subjected Board witnesses to searching and at times hostile questioning. The same level of antagonism had also been found 'on the ground'. In Pitlochry only one hotel had been willing to offer accommodation to Board engineers when they were completing surveys. Lord Airlie was seen as a traitor to his class and his son was blackballed by the Perthshire Hunt.

Airlie lamented the parochial attitude of the objectors. He was severely shaken by the tone of the cross- examination he had to undergo at the hands of some of the lawyers. Edward MacColl was unfortunately too ill at the time to attend the Inquiry. Other Board representatives were subjected to hostile questioning. Tom Lawrie, the secretary of the Board, was asked if visitors to Pitlochry would be coming 'to view your dam or to damn your view'. Lawrie said they would come anyway and reminded the Inquiry that the Tennessee Valley Authority schemes attracted two million tourists a year. An advocate, speaking on behalf of Atholl Properties Ltd, regretted that the scenic beauty of Pitlochry would be converted into cash to provide electricity for Orkney. Another, acting for the National Trust for Scotland, added two cutting lines to a well-known Jacobite song:

Cam ye by Atholl lad wi the philabeg,
Doon by the Tummel and banks o' the Garry,
Saw ye the lads wi their bonnets and white cockades
Leaving their land to follow Prince Cherlie.
Saw ye the lads wi their cusecs and kilowatts
Leaving the rivers defaced by Lord Airlie.

The Board stuck grimly to its guns and argued constantly that their plans for the Tummel-Garry were being carried out in the national public interest. The Inquiry dragged to a close just as VE Day was being celebrated and finally it was victory for the Board as well. Approval of the scheme finally came through towards the end of August when the Secretary of State released the order for the work to start. Rumblings of opposition continued: Perth and Kinross County Council confirmed their resentment of it by twenty-eight votes to eleven in October 1945 and a motion was brought before Parliament a month later to annul the Secretary of State's order. The latter was defeated, signalling it was now too late for the objectors to win the day.

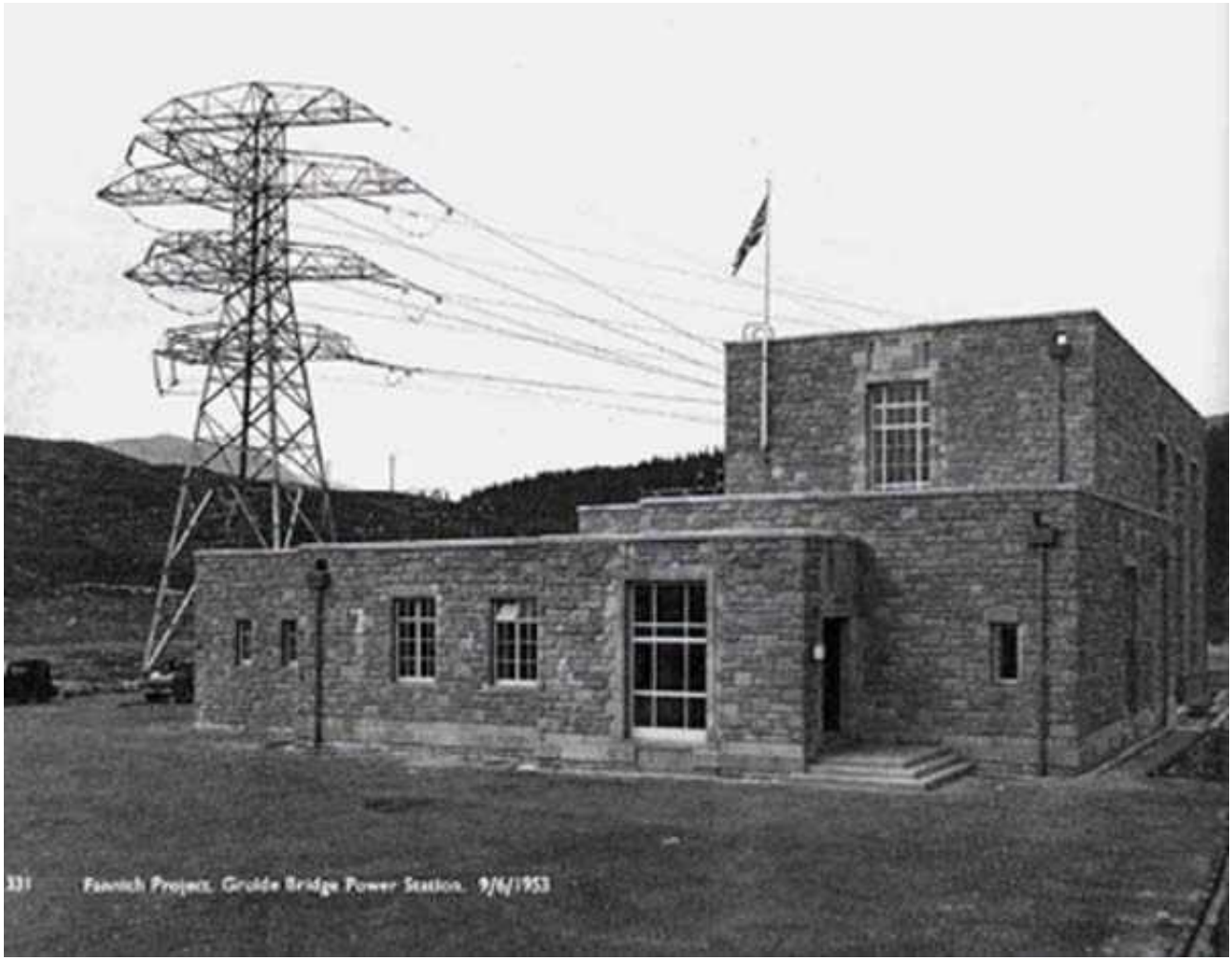
The Board bought the Fonab estate, where the dam was to be, and German prisoners of war had been drafted in to widen the roads and do some of the preliminary construction work. All the activity seemed to jerk Pitlochry into ambition: it applied successfully for burgh status shortly afterwards and gained a new twelve-acre recreation ground in 1948 at the Board's expense to replace the one about to go under water, just as work was beginning beside the Tummel beyond Clunie Bridge. In 1949, an article in The Scots Magazine noted that the 'more enterprising' of the village's hotel-keepers were drawing attention to their proximity to the hydro-electric scheme.

The psychological bruising he had received during the Public Inquiry proved too much for Lord Airlie. He probably realised that he did not have the power to protect the Board from its enemies and see its development programme to fruition, and he resigned after Tom Johnston agreed to become the chairman. The change of command took place on 1 April 1946. Johnston was to remain as unpaid chairman of the Board until 1959, years during which the organisation he had brought into being grew to become a major feature of Highland life.

The Countess of Airlie was the guest of honour at the inauguration of the Tummel-Garry scheme on 25 April 1947. Some three hundred people braved the snow and heavy rain to see the ceremony. The Vale of Atholl Pipe Band marched. Tom Johnston regretted the delay in the start of the scheme, pointed out yet again the benefits that would ensue (including £160,000's worth of rates relief to Highland counties), and promised that the Board would do its best to get rid of the scars on the landscape. The Countess then set in motion a cement mixer to create the first foundation block for the new dam. A time capsule containing the front pages of that day's newspapers, coins ranging in value from a ha'penny to half a crown, the Airlie coat of arms, a copy of the Hydro-Electric Development Act, and a description of the Tummel-Garry scheme was prepared for entombment in the concrete. Provost McGlashan recalled how the Council and the Board had not been seeing eye to eye two years before and how he could hardly have imagined he would be speaking this day in the enemy camp. But that was the way in British public life, he said; opponents shook hands after a severe fight and became better friends than before. 'We as a County Council have now established a most friendly relationship with the Board,' he concluded. The Perthshire Advertiser had already noted in a leader that the Scottish Tourist Board did not fear damage to amenity, adding wryly that this was possibly because its president was none other than Tom Johnstone, before going on to state a belief that 'even in their unbecoming infant shape' the dam and the power station 'will be an asset of tourism'.

Hatchets buried in Perthshire, the Board moved on. Details of further construction schemes emerged apace from 16 Rothesay Terrace in the succeeding twenty years. In February 1945, along with the Tummel-Garry scheme, the Fannich scheme, the first of the developments set to take place in the centre of Ross-shire (costing £6.45 million) was announced; and in September 1946 the Affric-Cannich scheme (£4.8 million), so contentious before the War when it had been the subject of a private initiative, was laid before the public. In this new incarnation Loch Affric itself was to be left untouched and the main reservoir for the scheme was to be made at Loch Mullardoch in Glen Cannich to the north. From Mullardoch a tunnel would lead the water down to Loch Benevean at the east end of Glen Affric. Benevan would be dammed but its level would rise only about twenty-five feet and it would not change much in appearance. The Benevean water would then be fed through a tunnel to a power station at Fasnakyle on the floor of Strath Glass. Although several properties would be drowned in the enlarged Loch Mullardoch, only one house in Glen Affric would be submerged, and generally the scheme met with wide approval. The Inverness Courier noted that two thousand men would be employed on the construction and that the County Council

coffers would receive some £10,000 in rates instead of the paltry £300 the glens were affording at present.



Grudie Bridge power station, June 1953 (NOSHEB)

Between 1945 and 1969, when work began at Foyers on the last of the 'big' hydro schemes, ten major development projects were largely accomplished. The Highlands acquired over fifty dams of varying sorts, almost as many power stations, and many miles of pipeline, tunnel and aqueduct. Some old lochs had been enlarged, drowning many acres of land, and some new ones had been created; and the glens and moors had been strung with a network of power lines under files of pylons, marching in spaced columns.

All the hydro schemes consisted of the main elements of dam, aqueduct, pipeline, tunnel, power station and transmission system in varying combinations. In each one the most obvious and impressive features, as far as the public was concerned, were the dams. The largest dam is the one on the east end of Loch Mullardoch. With a length of 2,385 feet and a height of 160 feet, it needed 286,000 cubic yards of concrete to complete the two long wings of wall meeting on a small island at the outlet from the loch. Mullardoch is a mass gravity dam, depending on its bulk simply to sit in place, holding back the some seven and a half million cubic feet of water accumulated in the enlarged loch behind it. The second biggest dam, a twin structure on the Orrin River built in the

third phase of the Conon Valley scheme, is also a mass gravity dam; at 167 feet it is slightly higher than Mullardoch but is only 1,025 feet long.

Anyone pausing at the Aultbuish Inn on the long, lonely road across the heart of Ross-shire between Garve and Loch Broom will find the western horizon ruled off by the concrete wall of the Glascarnoch dam built across the Glascarnoch River. It required 186,000 cubic yards of concrete to make the 1,753 foot length of this view-blocker that sustains the artificial 4.5 mile-long loch behind it, but much of its structure was made with earth fill. Its companion dam, on the Strathvaich River, another tributary of the Blackwater a few miles to the north-east, is also an earth-fill dam, with a concrete core, a type of construction clearly seen from its gently sloping sides. The Quoich dam is another rockfill giant, 1,050 feet long and 125 feet high; it penned back the water of Loch Quoich and raised the surface by 100 feet, increasing the area of the loch from three to seven square miles, and necessitating the building of two more dams at the west end to stop the water spilling in that direction.

The most elegant of the major dams is also one of the most remote. Tucked away at the head of Glen Strathfarrar, twelve miles west of Struy Bridge, the Monar double-arch dam, the first of its type in Britain, is a relatively thin, concrete wall, gently curved from base to spillway and more spectacularly bowed from end to end. The narrow, steep-sided shape of the gorge where the River Farrar flowed east from Loch Monar allowed this design which needed only 36,000 cubic yards of concrete and cost nine per cent less than a mass gravity design doing the same job.

The Labour government of Clement Attlee, elected in 1945, made nationalisation of the country's larger industries a major part of its policy. The Central Electricity Board had been formed in 1933 on completion of the first national grid to operate all power stations, apart from those owned by the various town and city councils in Britain. The nationalisation of the electricity industry was placed under the direction of the Minister of Fuel and Power, Emmanuel Shinwell, MP for the Seaham district of Durham, a fiery left-winger who, in his earlier days, had been one of the Red Clydesiders. The North of Scotland Hydro-Electric Board feared that it would have to surrender its generating functions to the Central Electricity Board, an arrangement that would effectively reduce the Hydro-Electric Board to merely a distributing authority and bring an end to the ideal of using the Board as an instrument of economic regeneration in the Highlands. During 1945 and the early months of 1946, the two Boards argued over details of pricing and supply: some of the disputes related to technical matters but, on the issue of price, the Hydro-Electric Board adamantly resisted supplying the CEB at a rate that would reduce their income and endanger the development of uneconomic hydro-electric schemes in remote parts of the north.

Emmanuel Shinwell came up to Pitlochry to meet Tom Johnston on the site of the Tummel-Garry scheme. At the same time Herbert Morrison, Lord President of the Council, and the man in charge of the overall nationalisation policy, visited Loch Sloy. It was a perilous moment for the Board. After the traumatic Tummel-Garry inquiry, it was once again under threat, and this time the threat could result in its emasculation. Shinwell, Johnston and their respective advisers talked through the matters at stake. Hamish Mackinven takes pleasure in telling what happened next: 'The two old boys (Shinwell and Johnston) said to their officials they were going for a wee walk. They were both ex-Red Clydesiders, they had known each other for many years, they were both steeped in political guile. They wandered away down by where Loch Faskally would one day form. They were dressed the same way - black coats with velour collars, homburg hats. None of the nail-biting officials waiting and watching could hear a word that was being said. They came back and Shinwell said, "I've decided the Board will retain its autonomy". That was it - and I often think that the birch trees by the loch when they are whispering in the wind are recalling that private conversation'.

In May 1946 Shinwell told the Cabinet his decision and, in the following January, the Bill for the nationalisation of the electricity generating industry established that the North of Scotland Hydro-Electric Board would be given responsibility for the whole of the north of Scotland, an area of 21,638 square miles with a population of 1,165,608 people and including the cities of Dundee and Aberdeen. The Grampian Electricity Supply Company and all the smaller private and municipal generating operations would be swallowed by the Board, whose borrowing facilities were to be increased from £30 million to £100 million.

The debate over nationalisation was given extra point by the severity of the winter in 1947. Crippling frosts settled over the Highlands and ice floes with seals aboard were observed in the Beauly Firth. Electricity supplies from the coal-burning stations were disrupted, and troops were deployed in February to move coal from the pitheads. When the temperature in Perth dropped to 12 degrees Fahrenheit, parts of the Tay froze and workmen had to resort to picks to break frozen snow from the pavements, the Perthshire Advertiser carried a leader on the vital importance of the hydro-electric schemes. Schools were closed, travel was disrupted, the harbour at Perth froze into immobility, and fifty sheep died when a south-bound train was trapped by a blizzard at Dalwhinnie.

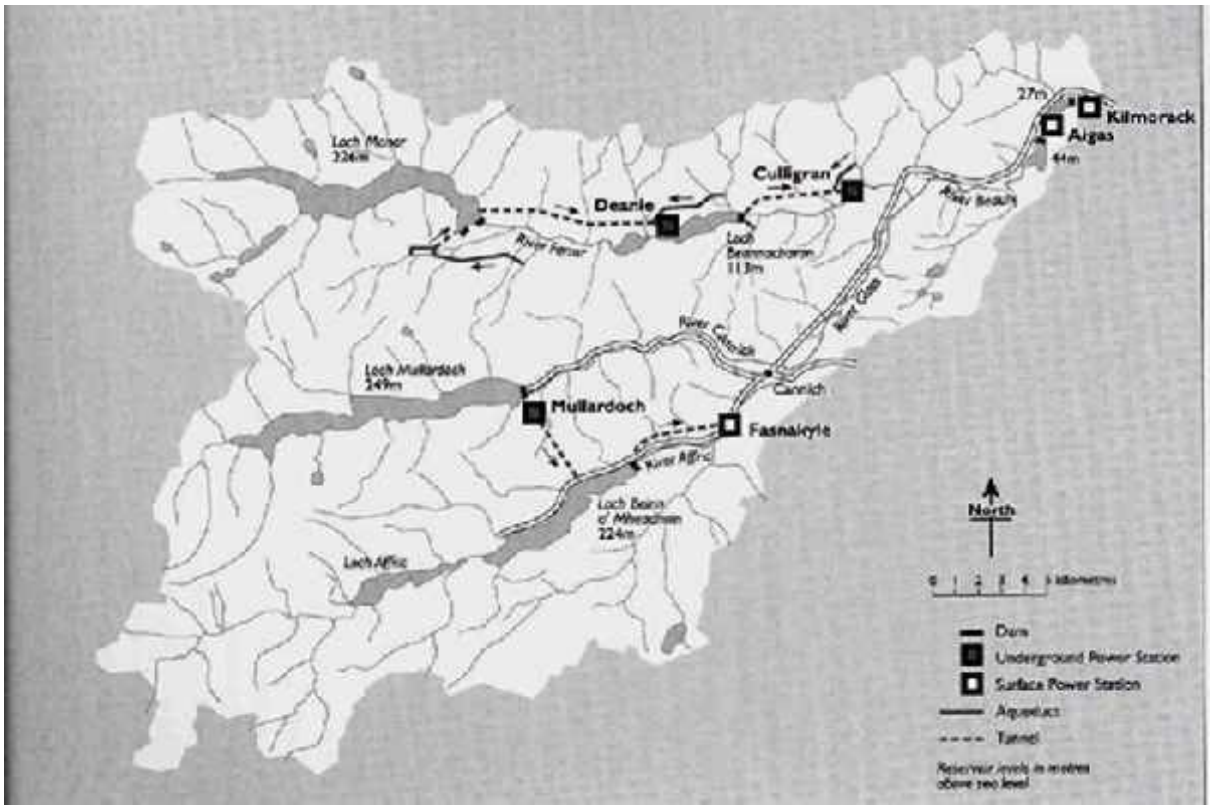
In the midst of this austerity and finger-pinching cold, the prospect of cheap, abundant electricity from their own lochs and rivers sent a wave of anticipation across the Highlands and Islands. The excitement was encouraged of course by the Board, who mounted exhibitions about the new source of energy and whose switch-on ceremonies were already becoming a familiar event in village life.

On Tuesday 6 May 1947, Lady Mackenzie, the wife of Sir Hugh, threw the switch at Kyleakin that provided a small part of Skye with its first public electricity supply. 'Slowly but surely', cheered the Inverness Courier, 'electricity is being brought to remote glens and to the islands of the West, and that cannot fail to arrest depopulation and to make a positive contribution to the development of the Highlands. Sir Hugh said that his wife had asked him to appeal to 'the ladies of Skye' to make the best use of electricity. He also informed his audience that £2,000's worth of electric cookers had been sold in Mallaig. Five houses in Kyleakin received electricity at once and more than twenty others were wired and eagerly waiting to be connected. Poles were being erected along the coast to bring current to Broadford. An exhibition of appliances was mounted for three days and a Miss Scott, described as the Board's cookery demonstrator, showed the housewifes of Kyleakin how to use an electric cooker to grill steak and liver, and bake cheese scones, date slice and drop scones. The submarine cable from Kyle of Lochalsh was designed to bring power to 85% of the Skye people, but Edward MacColl happily announced after the opening ceremony that the Electricity Commissioners in London had just approved the Storr Lochs generating scheme. The details were published a month later. A dam was to be built at the north end of Loch Leathan, whence a pipe would convey the water to a power station near the mouth of the Bearreraig River. The project would cost £247,000 and would provide 5.5 million units per year to supply the island's 10,500 inhabitants.

At the end of May, Mrs Johnston was the central figure in another ceremony - the inauguration of the Glen Affric scheme. It was a glorious day, the sun shone and the trees were splendidly green. Close to four hundred people came to watch the proceedings and were entertained before and after the high point by the pipes and drums of the Queen's Own Cameron Highlanders. The Rev Angus Macleod opened the ceremony with a prayer and, after speeches by Edward MacColl, Tom Johnston and Cameron of Lochiel, Mrs Johnston pressed the switch on the Union Jack-draped table to fire a symbolic blast of explosive. A puff of rubble rose into the air from the banks of the river. Along with the other pupils at Struy school, Archie Chisholm, then about thirteen years old, was taken on

an outing to see the ceremony and recalls the pile of quarry dust and the puff of smoke when the gelignite charge was fired. Luncheon was then served for around two hundred guests in the canteen and recreation hall of the newly erected workcamp, big enough overall to accommodate two thousand men and put up in a week. The menu featured Strathglass salmon, and Lord Lovat and Sir Murdoch Macdonald, MP, delivered speeches.

It was a moment for relaxation and celebration. The Board had survived the difficulties of its early years and could now get on with its aims. The shot heard in Strathglass that Friday could fairly be claimed to be the starting gun for the first major experiment in Highland development for many a long year.



Affric/Beauly

Many found vacation jobs on the schemes. They said that it rained all day, every day, in the mountains. They were not provided with any raingear, and slipped and slid as they helped others to push large pipes up the mountain to a prepared trench.

Throughout the whole period of the construction of the schemes, the workforce was fluid. Men came and went. Gangers tried hard to keep good men in their squads but finally there was nothing a foreman could do to stop one of his workers picking up his cards and his gear and going down the road.

The surge of construction in the Highlands influenced youngesters and showed them new possibilities, new career opportunities. As a schoolboy from Gairloch, boarding on the east coast in Dingwall as was then the norm for many from the West Highlands during their secondary education, Roy Macintyre saw the work at Grudie Bridge, Glascarnoch, and in his native district. 'All this activity in our own area interested me as a boy. It was something completely new and it sowed the seed in my mind of becoming a civil engineer. One of the engineers on the Kerry Falls scheme at Gairloch was a young fellow called Roy Osborne. He became friendly with my sister and

subsequently they married. I remember him taking me up to the Falls and I was thinking they were great guys who had the chance to be involved in this kind of work. I went to Glasgow University and did civil engineering. At that time it was a sandwich course and we used to find work in the summer, from May to September. In my first year, the summer of 1954, I got a job with Duncan Logan Ltd and of course being a first-year student I guess I was a bit of a liability, with no practical experience. I remember I was given £1 a week and I think they paid my digs in Dingwall, and I got a job as a student engineer on the Meig Dam. At first it was a steep learning curve but as the weeks passed I became more useful, I learned to do setting out - in reality I think I learned more in a few weeks there than I learned in the first year at University. I loved it and got to know the men and the activity. The whole thing was fascinating to me.

I was a pretty green engineer at first but you didn't take long to pick things up. The engineer on the Meig was an interesting fellow called Tom Critchley, an Englishman who had come up to Gairloch, giving up his career to start a crofting life. He was probably a bit of an idealist and I don't think he would have stuck it long, but fortunately Willie Logan arrived in Gairloch almost in the same year and needed an engineer, a site agent, to look after the works. Tom started a career with Logan that was to take him to many different dams. When I was on the Meig, Tom was the agent there; he had an assistant, Jack Forsyth, who had been at the Kerry Falls, and Tom and Jack were very helpful to a young fellow. I was given a lot of help and a lot of rope as well. Maybe they were at the age when they were glad to have a young fellow take on the graft of setting the thing out as it involved humping up and down the hills quite a lot.

'Life on the dam was great. We had our own canteen there, and there were a couple of ladies who served the meals. I stayed in Dingwall and I used to travel up every day. I got a lift from a Czech who was the site agent at the Luichart power station. His name was Wilson, which must have been anglicised, and he was a character, close on seventy years old at the time. Then I would walk from Luichart power station up the other side of the river where they blasted a road to the main dam in the Strathcarron valley. The camp was down at the power station.'

When the workforce of Duncan Logan Ltd started to build the Meig dam they had to make do with little equipment. the firm was young then. Machinery and cranes were expensive. Shifts could last 16 hours.

They had two cranes but they could have done with another one as the furthest away part of the dam was beyond the reach of the crane and the concrete had to be shovelled from man to man.

The Meig Dam in 2001 (author)

The Orrin dam was tackled next. That was easier. By that time the firm had more equipment and more men.

Laying the Allt a Fainich aqueduct on the Orrin scheme, August 1956 (NOSHEB)

A rock fault in the Orrin tunnel (NOSHEB)

The Hydro Board published two major new projects in 1948. In February the Highland papers carried the details of the Glascarnoch scheme, aimed at tapping the water resources in 345 square miles in central Ross-shire to produce 280 million units of power a year. Estimated to cost £8.5 million, the scheme would create four power stations and six dams, and involve the Conon, Meig, Bran and Glascarnoch rivers and parts of the drainage areas of the Carron and the Broom. The level of Loch Fannich would be raised and new lochs would appear in Strath Vaich and in the long valley of the Glascarnoch beside the main road from Dingwall to Ullapool.

The Moriston-Garry scheme was published in the following May and, to the satisfaction of the editor of the Inverness Courier, involved no diversion of water from the Loch Ness catchment area. The West Highland Power Bill in 1928 and the Caledpnian Power Bills in the late 1930s had all sought approval to develop the Moriston-Garry basin but had been defeated in Parliament; the older schemes had considered it necessary to divert water from Loch Quoich to the west, thus threatening the Ness with reduced flow and a danger of drought in summer. The new plans preserved the eastward flow of the river drainage and also promised to drown less land. In Glenmoriston only one house attached to the sawmill at the Blairie estate would be submerged, and the family who lived there told the Courier that they had no obection to moving and were looking forward to being nearer a place with more community life. Reservoirs would be created - in Glenmoriston and at Dundreggan. A large dam would be built at the east end of Loch Cluanie, extending the length of the loch by three miles. Here one lodge and one cottage would be submerged. Dams would also be constructed on Loch Loyne and Loch Quoich, and Loch Garry would be doubled in length. The raising of Loch Quoich would flood over a number of cottages and two lodges, of Loch Loyne one

house that had stood empty for decades, and of Loch Garry a cottage and an empty mansion house. The whole scheme would cost almost £13 million. In the summer of 1952, the design of the scheme was simplified to save steel and cement, both commodities in short supply, and a lower dam at Dundreggan was dispensed with.

The Highlands received a further filip when the contracts for parts of the two schemes were awarded to a local contractor - Duncan Logan Ltd. This family firm had been founded in 1895 in the village of Muir of Ord at the west end of the Black Isle peninsula in Ross-shire. Duncan Logan, the founder, was a stone mason who acquired ownership of the Tarradale quarry and became the biggest house builder in the area. Those who remember him recall a man who worked hard and expected his employees to do the same.

The firm grew slowly for many years - the turnover in 1934 was £25,000; the payroll in 1939 had fifty people - but Willie Logan, Duncan's son, took over the reins and proved to be a dynamic, almost buccaneering expansionist. Willie was born on Christmas Day 1913 and he joined his father's business after he left Dingwall Academy,. the local secondary school, in 1932. His academic career had been fairly undistinguished but he had ambition and a remarkable mental facility with numbers and detail. He was also fired by a desire to work and succeed, and he drove the company to take on more and more contracts. His restless enthusiasm was almost an embarrassment to his fellow directors, reported one observer, but it endeared him to his ever-growing workforce, many of whom had been his schoolmates, and made him a hero in Ross-shire. It was said that he was an interesting person, full of go and vim, that he could be quite hard if he thought he wasn't getting the co-operation he wanted, but he stood by his men. They had great faith in him and he knew his foremen. Workers said that he would never ask anybody to do anything that he wouldn't do himself.

Willie Logan was a man of huge energy, and prepared to take a chance even although there was risk involved.

Willie's brother, Alastair, ran the quarry near Beauly that supplied the huge quantities of sand and aggregate needed on the schemes.

Willie Logan never seemed to rest and wise employees knew to look busy themselves whenever he was around. He had an abrupt, fast way of talking and would reel off an instruction or an order, leaving a man having to ask a colleague what had been said.

Logan's fame rested on very Highland foundations. Teetotal and non-smoking, he was an elder in the Free Church and no one in the firm was allowed to work on the Sabbath. This observation of the holy day caused some controversy whenever there was a delay in completion of a job, but by and large he was admired for his steadfast adherence to principle. In the 1950s the Highlands still cared about these traditions.

He lived in a large house in Dingwall - the beautifully laid-out garden was pointed out to visitors - but his main church was the Free Church in Muir of Ord, where he had gone as a boy. At the time of one of the dam contracts, on a Sunday, water started to leak into a site to be concreted on Monday morning; something had happened to one of the submersible pumps and the place flooded. They sent for the engineer who came out in his own car and collected one of Logan's vans at the yard to bring up a new pump. The engineer happened to pass the church as the congregation was assembling and, on Monday, he was called into Willie Logan's office to explain this breach. "Man," Willie was reported as saying, "could you no' have taken a machine that didn't have my name on it?"

Although some necessary jobs were done discreetly on the Sabbath, by and large Willie deserved the congratulations extended to him at the opening of the Orrin dam in April 1959 for 'having accomplished the huge construction in three years and ... without Sunday labour'. In the construction of the Orrin the men had set a record for laying 4,528 cubic yards of concrete in five days; Willie had forbidden an attempt at a seven-day record because 'from the outset we wished to uphold our Highland heritage and programmed this contract on a "no Sunday" basis'. At the luncheon after the ceremony, further praise came Willie's way and he replied, saying that it would be vain of him to try to conceal his pride over the firm's achievements. Their earth-moving fleet, he said, was the best in Scotland, if not in Britain, and in the next three weeks the entire operation would be moving to South Wales to fulfil an excavation contract.

Opening of the Orrin Dam (courtesy of Dingwall Museum)
left to right - Provost Sandy Macrae, Dingwall; Sir John Macleod, MP for Ross and Cromarty; Mr William Logan; Sir John Stirling of Fairburn; ? and ?

The first contract completed by Logan for the Hydro Board had been the construction of the small scheme on the Kerry Falls near Gairloch. There were about 60 men working at the peak. The concrete was mixed by hand and placed by wheelbarrow. There was a weir at the top of the glen on the loch, and then a canalised river to the intake weir, and then a pipeline down to the power station. The top weir was just to give a little impounding to the loch. The lower weir was to create a catchment pond to guide the water to the pipeline. It took between two and three years to complete.

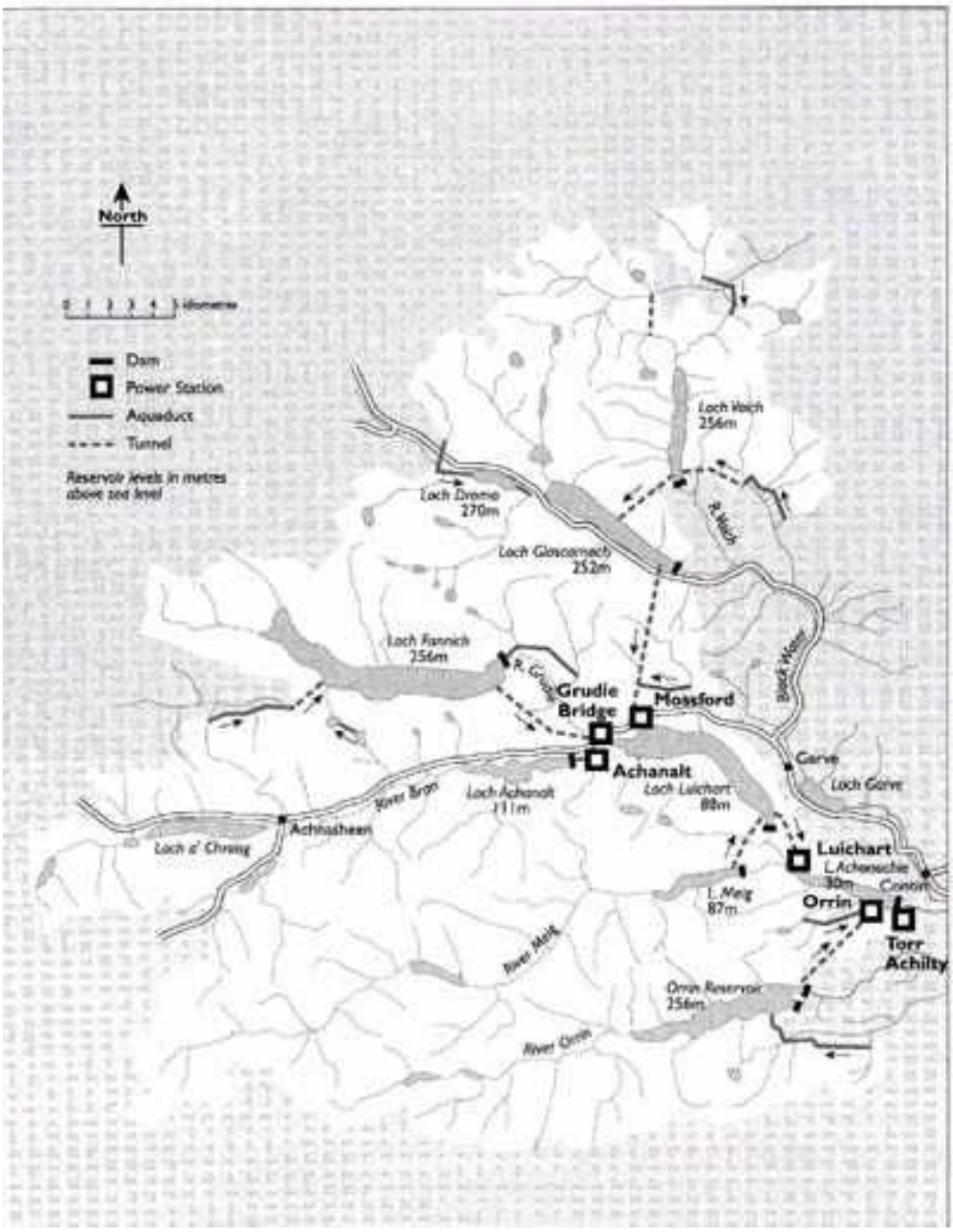
The mainly local workers lived in ex-army wooden huts on a site close to the intake weir. This camp was run by Willie Logan's wife, Helen, setting a pattern for the years ahead.

The Kerry Falls scheme opened in May 1952. Small it may have been but it had its share of problems. The workers cut the main telephone cable to Iceland, which happened to run down the glen, and a GPO engineer was sent from Dingwall at as high a speed as possible along the single-track road along Loch Maree. The excavation for the intake weir uncovered a pothole in the stream bed that proved to be some twenty feet deep and took several days to empty of gravel before it could be filled with concrete. The route of the pipeline down the glen was altered to save some trees which later blew down anyway. The sections for the pipeline were made in Motherwell and welded in situ, after being lined with bitumen in a machine designed for the job by Willie Logan himself.

The pipeline following the Kerry river, Gairloch, from the reservoir to the power station, May 1951 (NOSHEB)

In the decade after 1949, the Hydro Board awarded contracts worth over £8 million to Logan. A quarter of this sum formed the firm's wage bill, a measure of the contractor's importance to the Highland economy. Willie Logan admitted that the first contracts from the Hydro-Electric Board had given him the experience and the self-confidence to expand the firm; the same self-confidence,

he asserted, had been 'also released in hundreds of my fellow countrymen'. It was said that Tom Johnston had originally invited Duncan Logan Ltd and R. J Macleod, another contractor with a strong Highland connection, to tender for Board projects to counteract what was felt to be overpriced bids from the big southern contractors: Roy Osborne remembered handling tenders in the offices of Halcrow the consulting engineering firm and finding that bids from Duncan Logan Ltd and R. J Macleod were between 40 and 60 per cent less than the others.



Map of hydro schemes in Conon Valley area

The competitive pricing paid off. Throughout the early 1960s the Logan operation included contracts for the Gartcosh strip mill, the Dunbar cement works, the new Ness Bridge, a NATO fuel

dump on Loch Ewe, the Corpach pulp mill, the Tay road bridge, and innumerable roads and housing schemes. As the head of the enterprise, Willie's bulky, square-cut, bald-headed figure often featured in the Scottish press, usually as the man from the Highlands who was scooping all the big boys from the south for lucrative and prestigious contracts.

Roderick John Macleod, or 'RJ' as he was almost universally known, was actually born in Canada but he lived for a while at Elphin in Sutherland, and his mother ran a cafe in Ullapool. After his Highland childhood he worked for the Aberdeen contractor William Tawse Ltd before setting up on his own, with a headquarters in Glasgow. R J had been the resident engineer on the road along Loch Lomond and through Glencoe before the War and later he started his own firm.

The Hydro Board's first projects to be completed were two small, local ones - at Morar, and at Nostie Bridge near the Kyle of Lochalsh. They came into operation on Tuesday 21 December 1948 and made electricity available to the country between Mallaig and Lochailort, and to a large area of Wester Ross and a part of Skye. Catherine Mackenzie, the widow of a crofter, performed the opening ceremony by throwing a control switch on the turbine at Morar. 'Gun tigeadh solus agus neart dealan dhionnsuidh gach croit' (Let light and power come to the crofts') she was reported to have said in Gaelic, and she added 'Electricity means new hope for the Highlands. Thank God for it!' Tom Johnston was delighted and told the press it was an end to the old argument that oil lamps were good enough for the crofters.

The large schemes took several years to complete, bedevilled as they still were by labour problems, shortages and bad weather. Two years after Mrs Johnston had fired the shot by the River Glass, work was progressing in Glen Cannich and Glen Affric at a rate that allowed prediction of completion by the end of 1950. (It was, in fact, to be another three years before the Duke of Edinburgh was to perform the official opening.) The original intention to build two power stations had been changed in favour of only one, at Fasnakyle. In June 1949 the great dam at Mullardoch, the largest the Board was to build, and the Benevean dam were slowly being assembled: two-thirds of the tunnel between Mullardoch and Benevean had been excavated, and the other main tunnel, from Benevean to Fasnakyle, was 80 per cent complete.

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March 1951 saw publication of more hydro-electric schemes for the Highlands. The £8 million plan to build a dam on Loch Shin, to be the Board's most northerly hydro-electric project, was revealed at the beginning of the month; and some ten days later the third phase of the Conon basin schemes, the construction of a £3.5 million dam on the Orrin river, was announced.

Power from Glen Affric flowed into the Highland grid for the first time on 19 July 1951 when Sir Hugh Mackenzie switched on the first of the three 22,000 kW turbines in the Fasnakyle power station. The completion of the Benevean dam and successful preliminary tests made possible the

historic moment, although its significance was tempered somewhat by the fact that the dam at Mullardoch was still to be finished and the turbines could not yet be brought into full operation.

It was over a year later, in October 1952, that the Duke of Edinburgh performed the final opening ceremony of the Glen Affric scheme. Under a sky threatening drizzle, the Duke drove from Balmoral to Fasnakyle and arrived too early, a little to the discomfiture of the officials. He walked through the cheering crowd, entered the camp dining room through the wrong door and approached the Lord Lieutenant of Inverness-shire and Tom Johnston from behind.

Concrete is not very exciting to most people. Redolent of urban utilitarianism, it symbolises the very antithesis of beauty. Yet its properties make it an invaluable building material and most of the dams were built with its grey masses, by the ton.

One of the main tasks was making concrete. Samples were taken and six-inch cubes made. They were cured and kept in conditions of temperature and humidity similar to those of the dam, tunnel lining, wherever the concrete was, and then crushed and destructively tested in a big machine that put a force of seventy to eighty tons on the cubes. The factor of safety the engineers were seeking was concrete strong enough to withstand a force of probably 3,000 pounds per square inch at twenty-eight days.

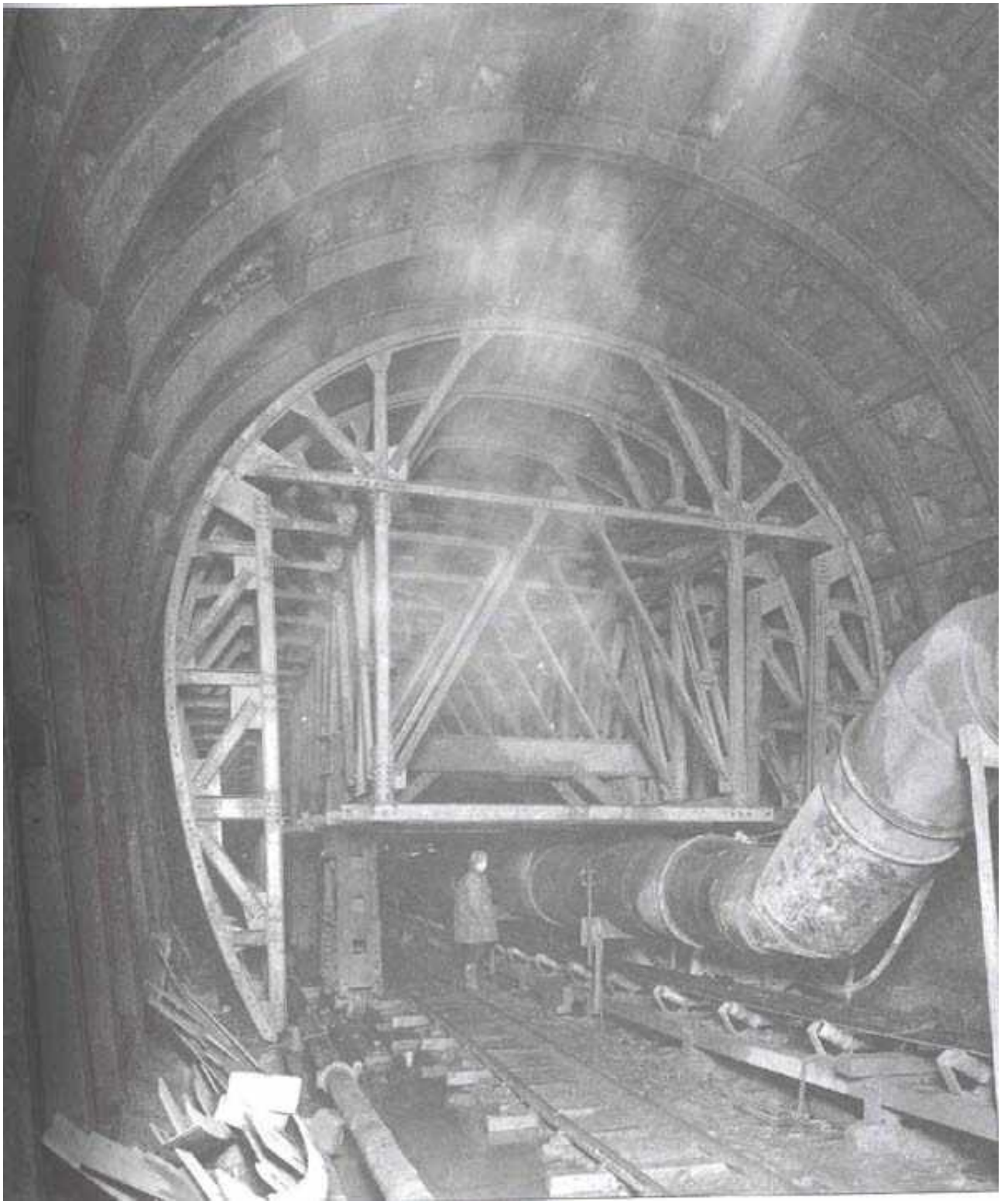
The weather affected the setting, the curing, of concrete, and if concrete is not treated properly in its first seven days, if it is not protected from extremely low temperatures, if it is allowed to freeze, and concrete can actually freeze in its first days when it has a lot of water in it, that destroys it completely, and it will never get any strength at all. Even if it does not freeze, low temperature will mean that it takes longer to achieve the required strength. In winter, allowance must be made for the fact it gains strength more slowly. Significant loads that, at an early age, in summer, a load can be put on it in certain circumstances after three days, in winter it could be seven or fourteen days. The need to wait until concrete set properly often caused some argument between the contractor's engineers, keen to proceed as quickly as possible, and the consulting engineers who wanted things to be according to the specification. The men mixing the concrete were always tempted to add more water as it made the mixture flow more easily but this carried the risk of later segregation and a weakening of the setting compound.

Another factor that affects the strength of concrete is honeycombing. In theory, there should not be any but in practice it is sometimes difficult to prevent the grey mass from hardening around pockets of trapped air, resulting in a weak structure. It can also be impossible to spot until it is too late.

The ratio of aggregate - sand or gravel - to cement in the mixed concrete is also a crucial factor; the more cement, the stronger the result. Other problems arise from the fact that as concrete hardens it shrinks and generates heat. This rise in temperature in large masses of concrete can be high enough to crack it, and sets a limit on the amount of fresh concrete that can be laid at one time. To allow faster laying, American engineers developed a system whereby they could circulate iced water in pipes through newly laid concrete - the pipes would eventually be grouted up - but this technique was not used in the Highland dams.

The Board was always looking for innovations in dam design and construction that could cut the high costs. Mitchell Engineering Ltd introduced the Trief cement process in the building of the Cluanie dam in Glenmoriston in 1953, and also made use of pre-cast blocks on two dam faces. The Trief process, named after its Belgian inventor, Victor Trief, used waste slag from blast furnaces to replace in part the amount of Portland cement in its concrete mix. Lorries brought loads of slag

from Colville's steelworks in Glasgow to the dam site where it was ground into a wet, creamy slurry at the rate of 170 tons a day. This slurry was then pumped to the batching plant to be mixed with sand, aggregate and cement to produce the final concrete. There were many advantages to using Trief cement; it can withstand the cycle of frost and thaw, is more resistant to water erosion and shrinks less as it sets.



Horseshoe travelling shutter in the Clunie tunnel, December 1948 (NOSHEB)

The need for economy dictated that the Loch Quoich dam be made by the rockfill method. This technique, in which the dam is built up in layers of locally quarried compacted rubble around a concrete core, needs less cement than the traditional mass gravity design, and very little shuttering. When it was completed, the Quoich dam became the largest one of its kind in Britain and its rubble downstream face reminded one observer of 'a gigantic drystone syke'. The upstream face was covered in twenty-feet square concrete slabs, between twelve and fifteen inches thick, to create a waterproof skin. The rockfill structure ensured a massiveness not found on more conventional dams: the rubble fill forms in cross-section an immense triangle, 290 feet thick at the base, narrowing to a roadway at the top. The rock was laid in layers according to size and vibrated to pack it down - the ground shook. The Vaich dam in the Conon Valley scheme was built with earthfill around a concrete core.

The tunnellers at Cannich broke the record for Great Britain and Europe for the amount of rock taken out in one week. The week's record is recorded for a drive of 126 feet. In all, over three million tons of rock were excavated to drill the fifteen-foot tunnel through the three-and-a-quarter miles between Mullardoch and Benevean, and 253 tons of gelignite were fired off.

Keeping the tunnel on the right course underground was the responsibility of the engineers. Now it is done with lasers but on all the major hydro-electric schemes the engineers stuck to what was called the theodolite and candlepot system. Accurate observations from the original baseline determined the position of entry to the tunnel and the angle at which the drillers had to excavate. At regular intervals, usually every 300 feet, a steel plate was embedded in the floor with the precise tunnel centre line engraved on it, and above each of these floor markers a wooden strap was fixed to the tunnel roof. A chain was hung from the centre of the strap and at its end burned a candle in a metal tube. By aligning at least two candles and a third at the centre of the face, the day-to-day drilling of the tunnel could be kept on course both horizontally and vertically by the crew. The rate of progress in excavating a tunnel was such that a new candlepot marker had to be put in place more than once a week.

Boring through bedrock required hardly any shoring up of the exposed walls, a feature that risked the occasional rock fall but generally allowed fast progress. Tunnels had, however, to be scaled, trimmed to the right size, after the engineers measured the diameter and found that it was not quite big enough to accommodate, say, a three foot concrete lining. The trimming was done by hand tools.

Sometimes a guest was invited to perform the completing blast, such as in the main Fannich tunnel on 3 March 1950 when the wife of J. Guthrie Brown, a partner in the consulting engineering firm of Sir Alexander Gibbs, fired the last shot. The destruction of the last rock wall about one and three-quarter miles inside the mountain was heard as a dull rumble. The two tunnels met with an error of less than one and half inches. Sir Hugh Mackenzie, for the Hydro Board, cut a tartan ribbon across the adit entrance and led a party of visitors through the tunnel, through the newly blasted and tidied hole and on for another mile until they emerged south of Loch Fannich.

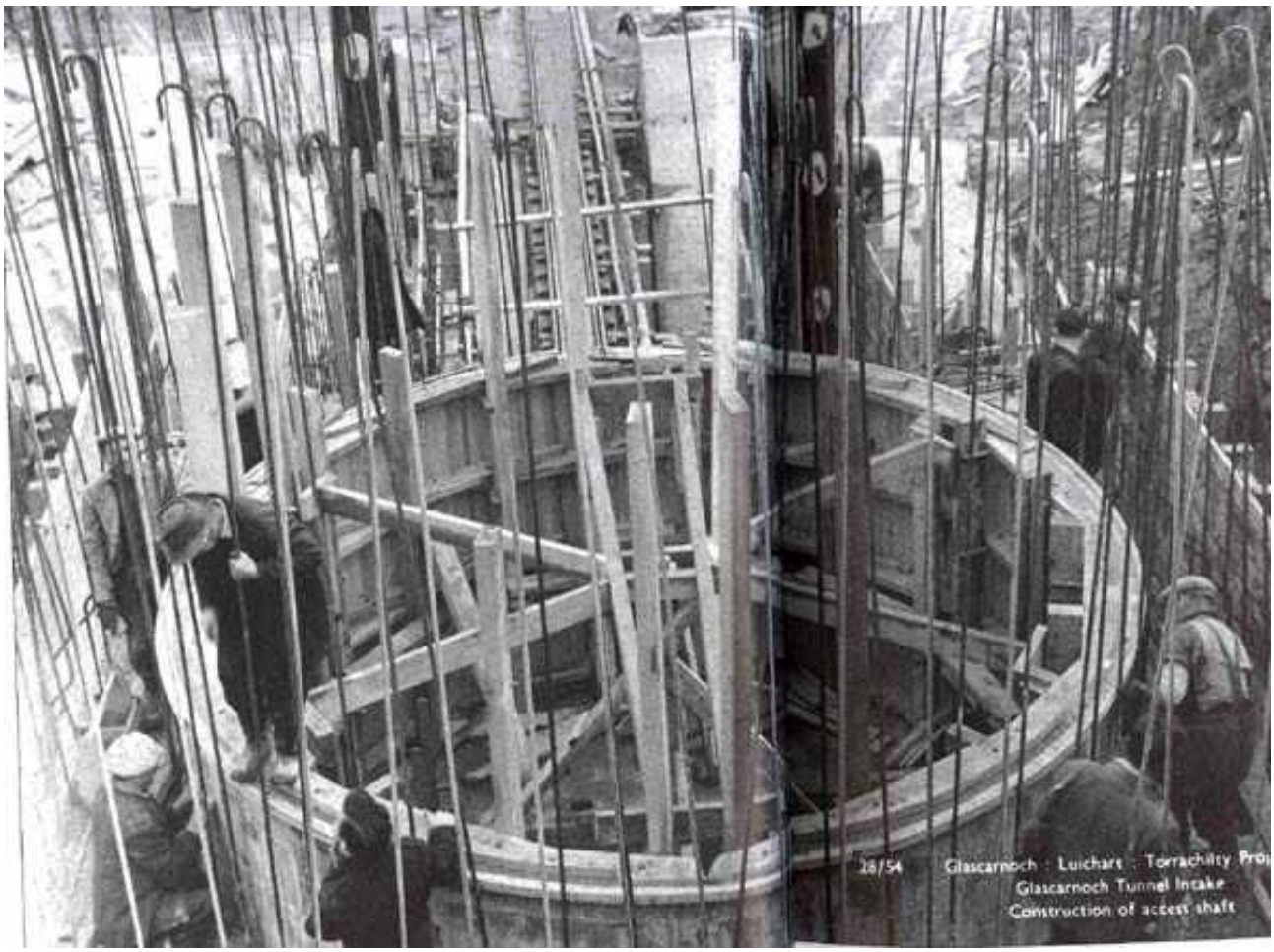
Five months later, the Fannich scheme was the scene for a more spectacular holing through. The tunnel to carry water from Loch Fannich to the Grudie Bridge power station was excavated three and a half miles up the gradient until all that remained of the bedrock was a plug between the end of the tunnel and the bed of the loch. The last charge was designed to blow away the plug and allow the loch water to flow down the tunnel. Shortly after midday on Thursday 7 September, Lady MacColl pressed the button to complete the firing circuit.

Just before this, her husband had addressed the assembled guests. He predicted they would see a water spout rise up in the loch about 100 yards out and added that he shuddered to think what might happen if this did not materialise, that some of them might land in Loch Maree. The Courier correspondent went on: '[The party] heard two muffled explosions and watched the loch's surface, already ruffled by a strong westerly wind and driving rain, lift at one spot to a height of almost sixty feet. When the water spout receded the only sign which remained of the explosion was a gravel-coloured patch of water upon which floated a number of dead brown trout which, however, were soon picked up by marauding gulls.'

The event, baptised by the junior engineers as 'operation bathtub', had demanded careful planning. The plug left at the end of the tunnel was fifteen feet thick and a special sump had been excavated so that, when the 400 tons or so of rock were blown to smithereens, the fragments would fall out of the way. Steel and concrete bulkheads had been placed in the tunnel 500 feet down from the intake to contain the inward rush of Loch Fannich water. When the scheme was completed and the turbines at Grudie Bridge were ready, the bulkheads were removed to allow the water to flow on its full journey.

The Glascarnoch tunnel was holed through on 30 October 1954, a successful end to two years of drilling by A and M Carmichael. The five-mile tunnel was the longest to be finished without adits at that time and had required the shifting of 183,000 tons of rock and the firing of almost half a million pounds of explosive. Sir Hugh Mackenzie fired the last shot from a switch on a table draped in a Mackenzie tartan rug and set up at the south tunnel entrance, five miles from Garve on a steep hillside overlooking the head of Loch Luichart. The explosion, two and a half miles inside the hills, was heard nine seconds after the switch had been depressed. Wearing helmets and oilskins, the party walked into the tunnel and took a train to the explosion site. As they rode for twenty minutes to reach the spot, the ventilating pumps laboured to extract the dust and fumes and by the time they arrived the air was clear: it was 'a somewhat eerie experience' recorded one observer. The north and south drives had met exactly.

Glascarnoch tunnel. Start of walls and arch lining using a 200 foot telescope steel shutter, August 1956 (NOSHEB)



Constructing the access shaft to the Glascarnoch tunnel intake, September 1956 (NOSHEB)

Home for most of the workforce, at Cluanie as on the other schemes, became the camp - a village of timber or corrugated-iron Nissen huts, thrown up on a level patch of ground like a frontier settlement in some wild gold rush. Most of the buildings were for sleeping quarters but beside them might stand the post office and savings bank, a shop, the kitchen and the wet and dry canteens, a theatre-cinema, a first-aid hut, and an array of offices and workshops. The accommodation for the women workers was nicknamed the hen-house at one scheme. A typical sleeping hut would have iron beds arranged dormitory-fashion on either side of the interior space, with perhaps a few cubicles at one end. Each man had his bed and a locker. Toilet arrangements, at least on the earlier schemes, could also be basic: a few Elsan chemical closets side by side with no partitions was one arrangement. At the workplace even this modicum of comfort was foregone and men had to make do with a plank over a pit which, if nothing else, did much to enhance a sense of balance. It wasn't surprising that a handy clump of trees would commonly be pressed into service.

The work camp at the Glascarnoch dam, February 1953 (NOSHEB)

Constructing the Wester Aultguish work camp on the Glascarnoch scheme (NOSHEB)

At Cannich, the men were issued with one clean sheet every week. The old bottom sheet was taken off for the laundry, the old top one put underneath, and the new one became the new top sheet. The camp at Cannich stood where the village is now. It is recalled as being all Nissen huts, like a military camp. Only the women who made up the catering staff had wooden huts. The Nissen huts were heated by steam pipes that ran around the curving wall but it was not always very effective, especially if your bed was at the end far from the boiler. It didn't matter all that much. The men coming off their shift were usually so tired that they lay down to sleep and that was it. If it was cold you could throw an extra jacket on the top of the bed.

The cubicles offered a little more privacy. They gave a man his own space, or at least a space shared only with one other fellow, a bit more room and even a wardrobe for his clothes. There was a waiting list for cubicles but, if you stayed in a hut long enough, you could be assigned a bed in a coveted cubicle, even if the wall wasn't closed all the way up to the ceiling of the hut and the noise was just as loud.

An engineer at Mullardoch waistdeep snow (Don West)

A Polish cook feeding a sheep at Mullardochin

The engineers and higher-ranking staff usually had their own accommodation, a feature some workers recalled as being like the separation of officers and men during the War. At Cannich, some engineers lived in Corriemonie Lodge and had a water turbine for power. The middle-ranking engineers stayed in a wooden hut and had their own club, nicknamed the gin palace. Some rented houses locally.

The food at Cannich was provided by the Highland Catering Company. The meals were of a high standard: breakfast, a packed lunch, or soup and sandwiches if you were in camp in the middle of the day.

Paddy Paterson helped with the catering in a number of camps - Fannich, Glascarnoch, Glenmoriston - where his parents ran the operation. They took on the contract directly from the Hydro Board when the Fannich Scheme began. They used local suppliers, William Low and Lipton, and the local Dingwall butcher.

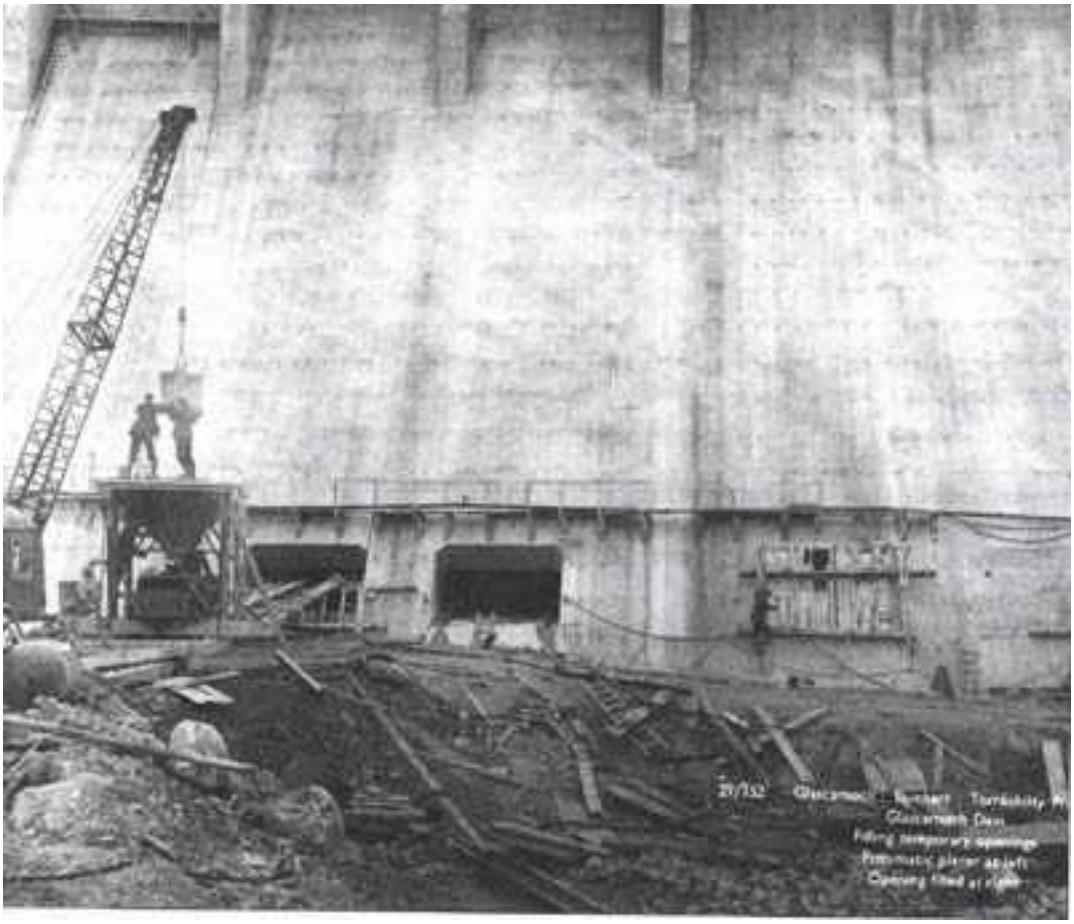
The kitchens were all modern, electrified, and some had diesel burners. There was no scarcity of fuel. Staff numbers totalled about forty or fifty, mostly female, apart from the porter and the chef, and were both local and from further afield. They lived mainly on the premises, in special quarters. A thousand mouths had to be fed,The Dam Builde requiring about forty gallons of soup, loaves by the dozen from a local baker, and milk by the churn. A sum was deducted at source from the men's wages for their keep. It ranged from 25 to 30 shillings a week. That got them all their food.

Life in the camps revolved around sleeping and eating but there were diversions laid on to provide a modicum of entertainment during the off-duty hours. In keeping with the almost all-male environment the entertainment could be pretty rough. For a start, there were usually wet and dry canteens, the former liberally stocked with bottled beer. The camps on the Logan work sites were run by Willie Logan's wife, Helen, and were generally 'dry', in keeping with the boss's teetotal principles; some drinking still went on but not with the contractor's consent.

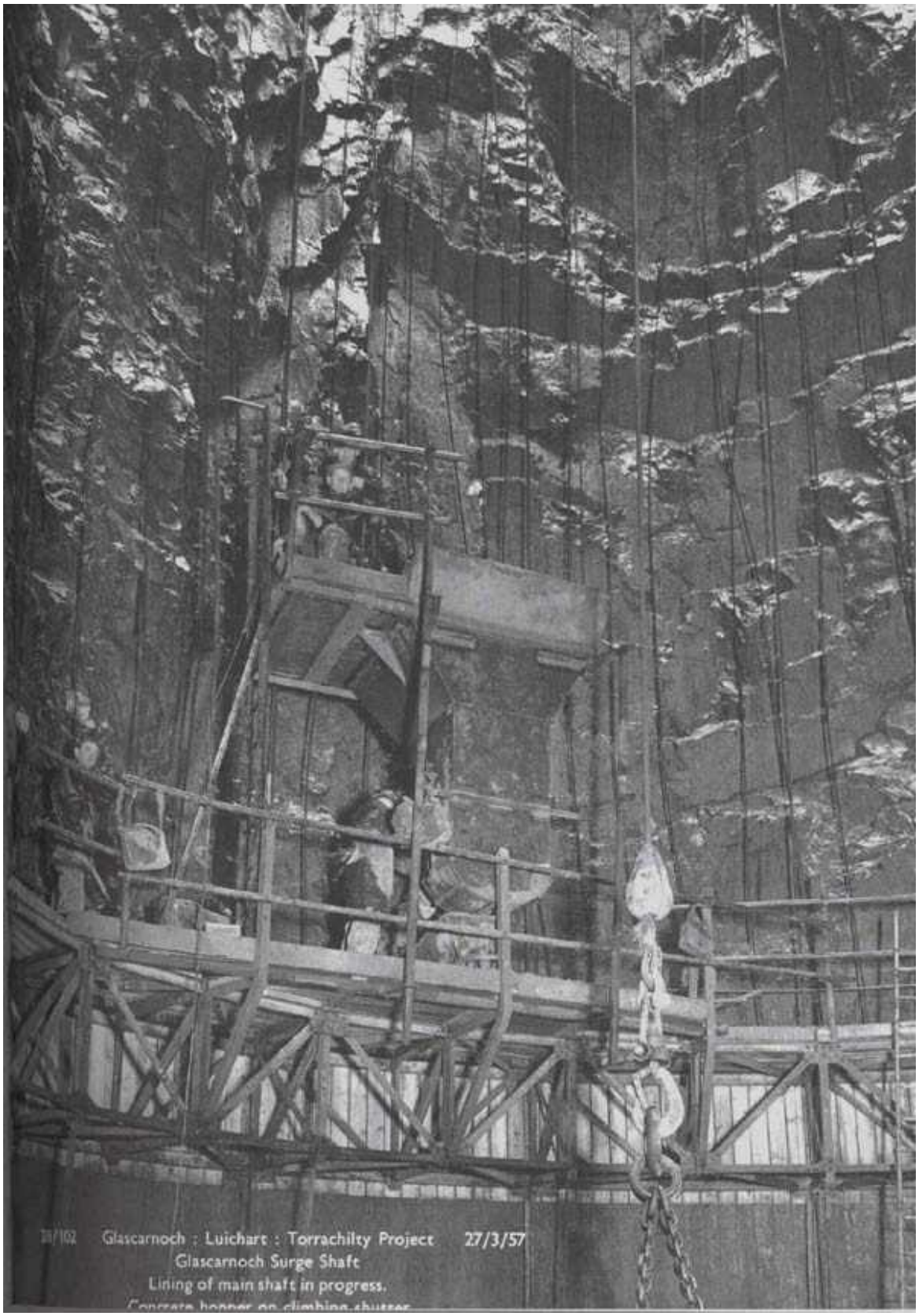
A trickle of offenders from the camps added some colour to the roster in Inverness Sheriff Court. A Glasgow labourer was sentenced to twenty-one days for stealing an electric guitar from the Cannich camp cinema and sending it, wrapped in two British Rail carriage blinds, also stolen, to his girlfriend in the south. Three cases were dealt with early in December 1949. When Thomas Jamieson, a ganger from Auchtermuchty, pled guilty to fighting with a foreman in the Affric tunnel and attacking a locomotive driver, a breach of the peace for which he was fined £10, his solicitor stated that this was a common case for Cannich. John Watt Bruce of Gardenstown got into a fight in the dry canteen in defence of the reputation of two women and, as no drink was involved, was fined only £1. Ernest Stewart, from Kincardine O'Neil, was fined £5 for borrowing a jeep without permission to drive from Cozac to Cannich, and the Sheriff added another £1 fine as Stewart did not have third-party insurance.

Injuries and deaths happened on almost all the hydro-electric schemes; the building of Glascarnoch dam was among the few exceptions where there were no fatalities.

Excavating the foundations for the Glascarnoch dam, March 1954 (NOSHEB)



Filling the temporary openings at the base of the Glascarnoch dam, April 1957 (NOSHEB)



Glascarnoch: lining the main surge shaft with a climbing shutter and a hopper of concrete, March 1957 (NOSHEB)

In the early days, health and safety standards were lower than they became, and were often largely ignored. Every man had to look out for himself and use his common sense. Even when hard hats became available, many chose not to wear them - one man said they were like paper anyway.

Three men lost their lives when two huts in the Glascarnoch work camp caught fire at four in the morning on 27 April 1953. The others in the hut tried to fight the blaze but failed to stop it leaping to other buildings. The Dingwall fire brigade took forty minutes to negotiate the thirty miles of single-track road to the scene. Some workers lost all their possessions but others managed to stagger out with their belongings to the safety of the braes. The fire was caused by an electrical fault. It would have been worse but for a workman who got a digger and took the end off the hut to let the men out.

The Glascarnoch dam nearing completion, June 1957 (NOSHEB)

The notoriously unpredictable Highland weather caused some accidents and a few deaths. In June 1953, on Coronation Day, it snowed up at the Cluanie dam site and an elderly worker succumbed to hypothermia. More often the weather simply added to the list of discomforts the men had to endure.

Severe frost in the snow-laden winter of 1955 made concreting impossible and brought work to a halt across the Highlands: the Mitchell company in Glen Moriston paid off 600 Irishmen who went home until conditions improved. Logan paid off 300 men but the tunnellers at Invermoriston kept going, warmed in the depths of the mountain. Some men working on a head pond were cut off for a week and are said to have augmented their supplies with fresh venison from the local herd. The frost lasted for around two weeks.

And of course there was the rain - at times it must have seemed incessant. In December 1954, ten inches fell in twenty-two hours at Quoich. One month there was more rain than London gets in a year. But there were also days of brilliant sunshine.

Throughout the late 1940s and 1950s electricity came to community after community. 'In the village of Tomich in Glen Affric every house is either supplied or ready to be connected' reported the Inverness Courier on 12 October 1948. 'Housewives ..... have not been slow to take advantage of the benefits of electricity. Already the latest domestic electric cookers are being used in 20 per cent of the houses..... Other electrical appliances ordered or in use include irons, kettles, immersion heaters, washing machines and refrigerators.... In Cannich the first all-electric hotel in the area is now operating.' The hydro power station was not yet in operation and the power came from a temporary 3,800 kW diesel generator operated by the Board primarily to supply the work camps and machinery.

The Hydro Board shop, selling appliances and collecting consumers' bills, was to become a standard fixture in every high street north of the Highland Line; they sold over £1 million worth of appliances in 1960. The Board staged an Electrical Economy Exhibition and a display on agriculture in Inverness in April 1952, in collaboration with the quaintly named Electrical Association for Women who hosted a lunch in the Caledonian Hotel on the first day, and welcomed 10,000 visitors in the first week. To promote new equipment for hotels and guest houses in ports between Oban and Ullapool, the Board launched a floating exhibition on a chartered motor yacht, the Western Isles, in the autumn of 1964. An exhibition of appliances ran in the Corran Halls, Oban, for three days in May 1965.
Highlanders also had to learn to cope with another new phenomenon, one that was to become a standard occurrence in the winter months - the power cut. From the start, however, the Board's linesmen made great efforts to keep the electricity flowing.

Demand for electricity was growing in the Highlands and Islands at a rate above 10 per cent per year in the early 1950s. In 1954, the Board calculated that it had spent almost £118.5 million on building power stations and distribution schemes. By 1959, after fifteen years of Board activity, it was estimated that 90 per cent of the Highlands had been electrified and that one quarter of the region's water resources was involved in power generation. The number of consumers passed the 400,000 mark in 1961 and 422,300 in 19764

When the Board celebrated its twenty-fifth birthday in August 1968, it could point to a list of achievements that boasted fifty-six major dams, fifty-four main power stations, almost 200 miles of tunnel, 400 miles of road either built or reconstructed, and over 20,000 miles of power line, all representing a total investment of £310 million. Electricity now reached some 96 per cent of the premises in the Board area. The activity continued to expand - 10,000 new consumers were connected in 1970-71, but by then the work of the Hydro Board was coming under serious scrutiny and its future was being closely questioned.

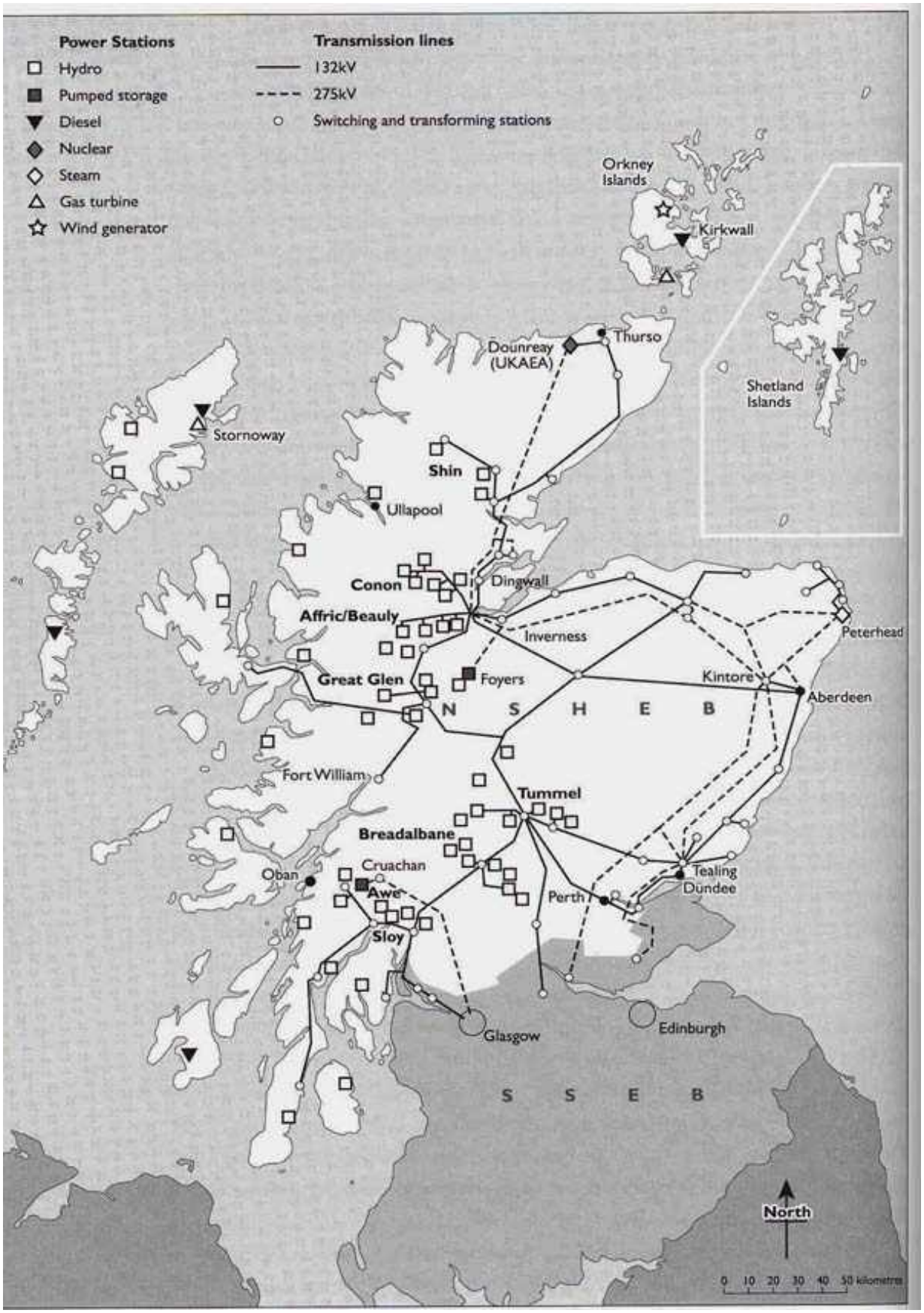
At the end of the Second World War, the national grid did not extend into the Highlands apart from one 132 kV line linking the Grampian company's Rannoch-Tummel scheme. There were several local distribution networks in towns and villages but these were isolated from each other. The Hydro-Electric Board, therefore, had as one of its primary tasks the construction of a distribution network to carry electricity to consumers scattered throughout the Highlands and to the national grid.

A classic shot of a cooker being delivered to a crofthouse somewhere in the Highlands (NOSHEB)

One local supplier of electricity was Campbell brothers in Dingwall. Ben Bentley joined the firm at the end of the War. He was the third person in Dingwall to have a TV. Apparently the best seller in those days was an Ecko which cost £30. A lot of money in those days.

The use of electricity before the Board schemes came on line was sporadic and sometimes parsimonious. In the early 1940s there were only five 100-watt street lamps illuminating Maryburgh at night and only a minority of private houses enjoyed a supply. Villagers were therefore thrilled to have electric lights hanging in their rooms for the first time and a ready supply of convenient energy for household appliances. The people who had to adjust most were those who lived in the old black houses on the islands, but they adapted very quickly. One day the house would be wired and the next day they would have an electric cooker.

By 1960 the Board had built 4,100 miles of high voltage and 1,600 miles of low voltage line at an average cost per consumer connected of £262.



Map showing power stations and transmission lines.

By 1960 it was estimated that a quarter of the Board's consumers were being supplied on an uneconomic basis and that the Board was losing a further £1.75 million in maintaining the service. The Board stuck to a tariff system that the majority of their customers could afford, although consumers did not always appreciate their good fortune.

The Board brought a new prosperity and a benefit to the social wellbeing of the Highland communities.

Some folklore and expressions of popular humour have survived from this time. On the wall of an abandoned house near the Orrin dam I chanced on the following verse:

Doon the glen came the Orrin men,
they looked like ballet dancers;
one in ten were time-served men
the rest were bloody chancers.

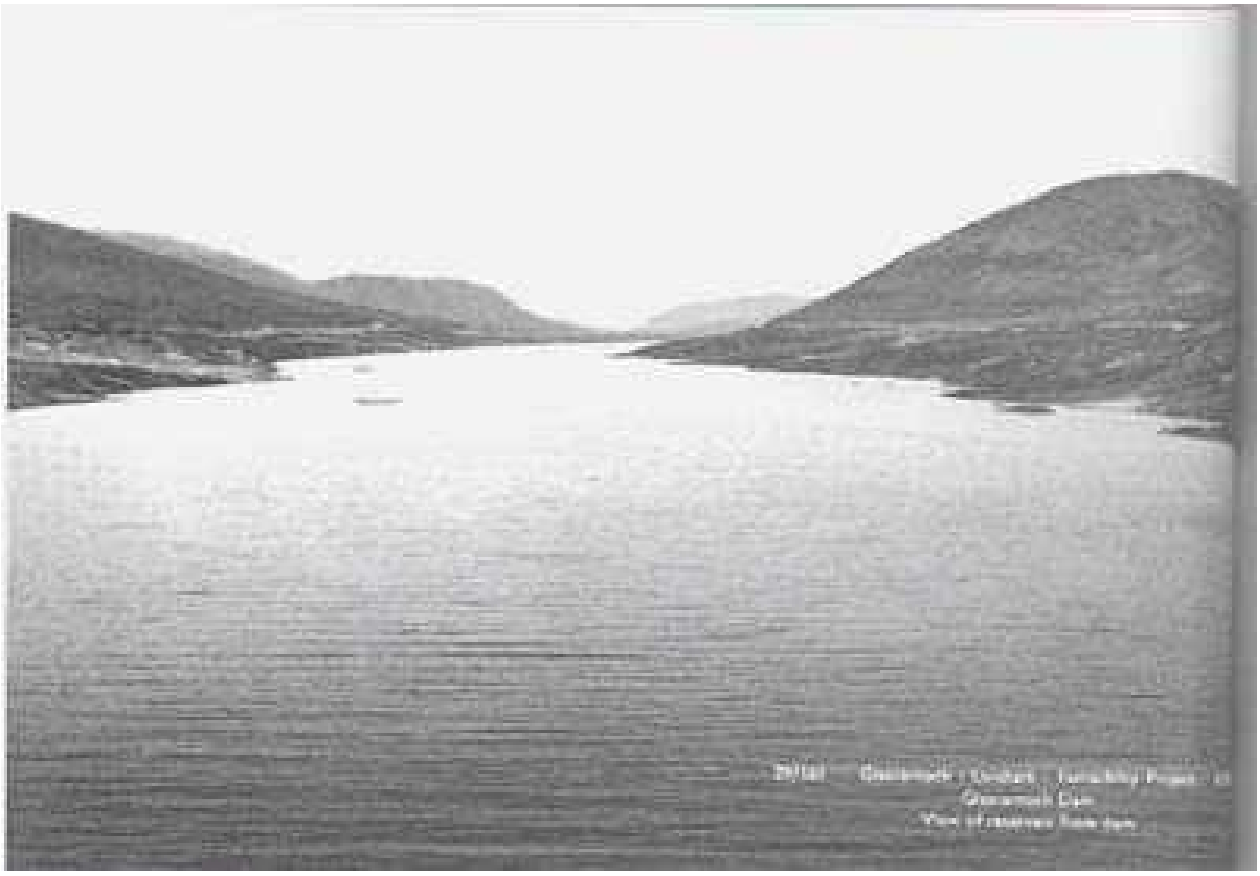
It was almost inevitable that the legendary figure, the Brahan Seer, should be credited with predicting at least one or two aspects of the electrification. The prophesy 'The day will come when North Uist will be encircled with steel' is held to refer to the building of the distribution lines; and 'A loch above Beauly will burst its banks and destroy in its run a village' was claimed to have been fulfilled when exceptionally heavy rain in 1967 caused the Torr Achilty dam to overflow and the flood caused considerable damage in Conon Bridge. This prophesy was referred to by Sir Edward MacColl in his speech at the opening of the Affric scheme in May 1947, causing mirth when he added that the engineers had been instructed to use extra cement.

Right from the beginning the Board was conscious of the need to cope with the importance of salmon fishing in the Highland rivers. The 1943 Act that brought the Board into being made regard for fish stocks a requirement and the Fisheries Committee, with Colonel Sir D W Cameron of Lochiel in the chair, was established from the start especially to advise on this issue. The plans for each scheme included provision for compensation water, as the amount of flow left in a river system to maintain the fish population was termed. Fishing owners and others were to claim that the fishing in some waters deteriorated after the Board had constructed a scheme on a river system but, in the absence of good 'before and after' data, these claims were to be rarely upheld.

In some places the schemes increased the range of the salmon. Before the construction of the Loch Luichart dam, the Falls of Conon had proved an impassable barrier to the fish but the installation of a fish lift allowed salmon access to the loch and the upper stretches of the river Bran for the first time. A fish lift or fish pass was included in the plans for many of the dams, perhaps the most common design being the one named after its inventor, Joseph Borland. In this device the migrating salmon are attracted by the water flow into a chamber at the level of the tailrace, a sluice gate is then closed, and the water is allowed to rise in a tunnel until it reaches the level of the upstream reservoir, carrying the fish up with it. The Clunie and Pitlochry dams were fitted with long fish passes or ladders, essentially a series of pools connected by short tunnels through which the fish can swim past the dam. Smolts migrating downstream can, amazingly enough, pass through turbines unscathed but in the larger schemes screens were placed to guide the young fish to the safer fish pass.

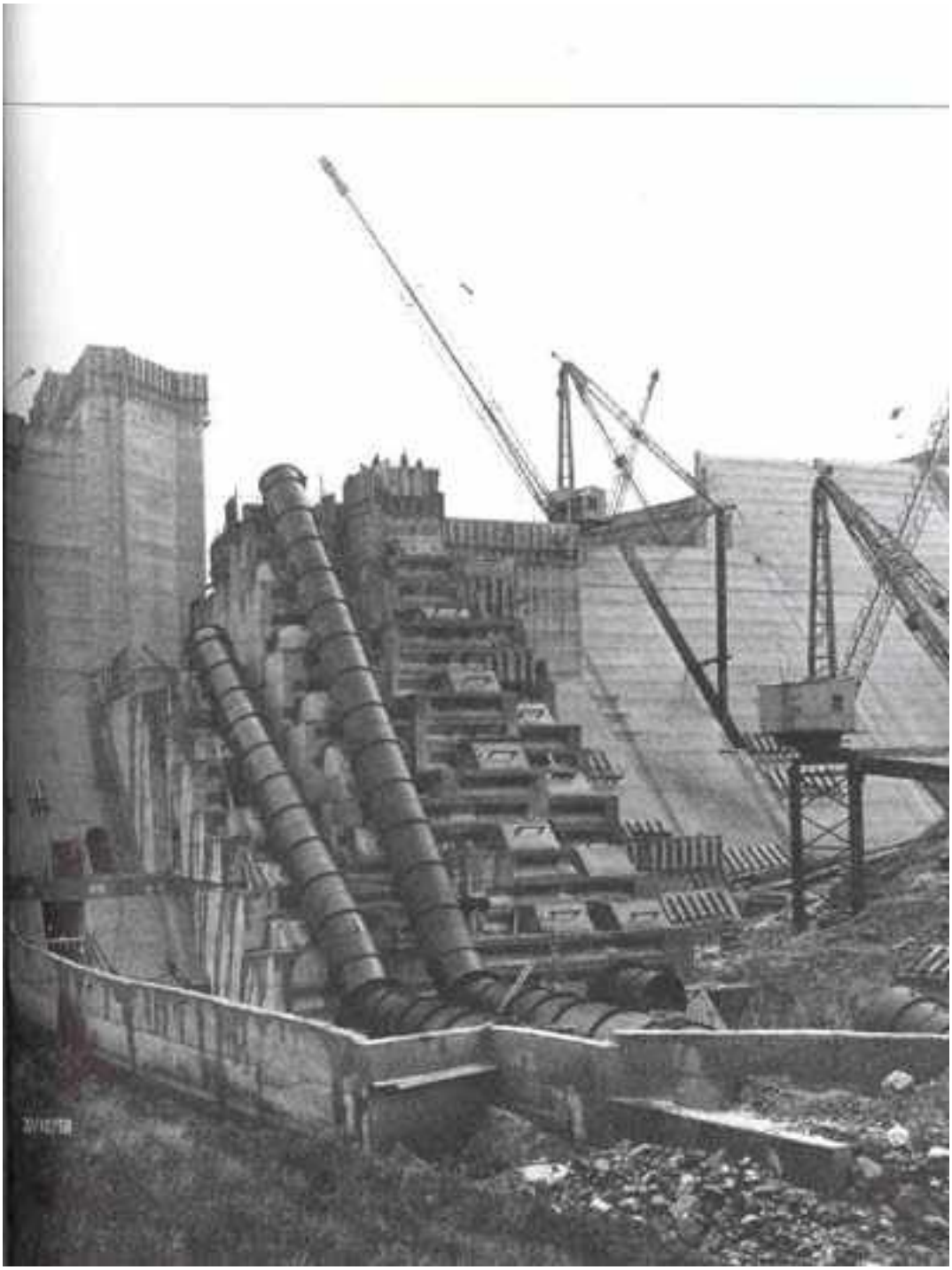
The Board also went to considerable lengths to ensure that spawning beds were adequate, or it undertook stocking.

The fears that the hydro schemes would desecrate the landscape and bring disaster on the Highlands tourist industry have never been realised. Few could claim that a dam such as Glascarnoch right beside the main road between Dingwall and Ullapool is an object of beauty, but it is just about the only structure of its kind. Other large dams, such as the Mullardoch, are tucked away in remote glens and are probably seen by only a few hardy hillwalkers and local people.

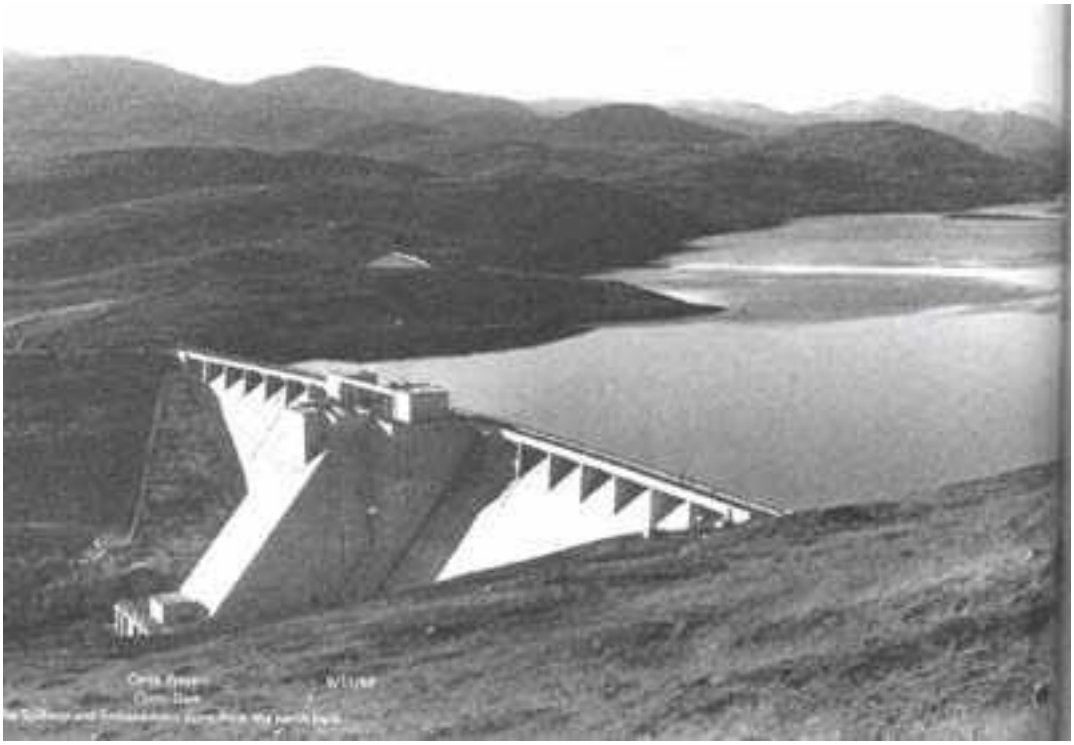


Once a river valley and now a loch; the upstream view from the Glascarnoch dam in May 1957.

Sir John Sirling of Fairburn, convener of Ross and Cromarty and whose family owned large tracts of land, including the upper stretches of Glen Strathfarrar where the Monar dam was to be built, pressed the switch to close the last gate in the Orrin dam on 4 April 1959. The Orrin river, now thwarted on its seaward journey, slowly began to swell to form the new Loch Orrin, eventually to be five miles long. The construction had taken only three years and had been carried out by Duncan Logan Ltd of Muir of Ord. The gate-closing ceremony took place before a crowd of about 100 that included the Ross and Cromarty MP, Captain John Macleod, and the provost of Dingwall, Alex Macrae, who was also a member of the Board. Lord Lovat and Sir Robert Spencer-Nairn sent apologies for their absence.



The Orrin dam under construction, showing in the centre two of the four giant pipes comprising the fish pass, October 1958 (NOSHEB)



The completed Orrin dam, November 1960. The fish pass is in the sloping concrete structure in the centre (NOSHEB).

Barely two weeks later the retirement of Tom Johnston was announced. The canny rabbit who had bargained with Churchill away back in 1941 had now reached the age of seventy-seven. His successor as chairman of the Board was named as Lord Strathclyde. Thomas Galbraith, Lord Strathclyde, already had a career in the Royal Navy behind him, a long stint in Parliament as the MP for Pollok, work as an accountant, a period as a Glasgow councillor and four years as a Minister of State in the Scottish Office.

The Board had published the details of the Fada-Fionn and the Loch a'Bhraoin schemes in March 1963. The intention behind the first was to harness the waters of two lochs, Fionn Loch and Lochan Fada, lying in a trough to the north of Loch Maree, to feed a power station near Furnace on the north shore of Loch Maree itself. To minimise the impact on the high scenic beauty of the area, the power station and aqueducts would be built underground and the transmission lines would be screened to hide them from the main road on the south side of Loch Maree. Loch a'Bhraoin, lying a short distance to the north of the Fada-Fionn complex, would be dammed and its water fed through a pipeline to a power station near the junction of the Cuileigh river with the Droma in Strath More at the head of Loch Broom. The Fada-Fionn scheme was estimated to generate 51,000 kW and the Loch a-Bhraoin scheme 14,000 kW, and together the construction was expected to cost £8.8 million.

Twelve objectors, mostly owners of estates or fishery rights in the Wester Ross area, came forward to present evidence to the inquiry. In the face of strong arguments in favour of thermal generation, the Board fought to defend its plan to develop water power. At one point an economist from Oxford University argued that the Board should never have been formed, as none of its schemes had ever been economically justified. The inquiry lasted with breaks for almost three months - it ended on 24 March 1974, and it was another twenty months before the outcome was published. By that time there had been a General Election: the Labour Party had won, and Michael Noble had been replaced by Willie Ross as Secretary of State. Some other important events had also taken place. Michael

Noble had paid tribute to the work of the Hydro Board at the opening of an international congress in Edinburgh of the International Commission of Large Dams, attended by a thousand engineers from fifty-three countries - the speech may have caused a few wry smiles in the Board headquarters. The new Labour Government had announced its intention to set up the Highlands and Islands Development Board; and both Evan Barron and Tom Johnston had died.

Highlands MPs repeatedly questioned the new Secretary of State in the House of Commons when they might expect to hear a decision on Fada-Fionn, and repeatedly Willie Ross put them off with excuses and hints. In April 1965, Ross assured the House that the Hydro Board's future was not in doubt. In October the Queen opened the Ben Cruachan scheme, and in November the new Highlands and Islands Development Board held its first meeting. Finally, on 29 November, the Secretary announced that the Fada-Fionn and Laidon schemes were not to go ahead, because it was possible to generate electricity at less cost per kilowatt by other means. He left open the possibility that the schemes might be implemented in the future, but the social clause had not been strong enough on this occasion to save the day. The leader in the Inverness Courier, now with Evan Barron's niece, Eveline, at the helm, was thankful that Tom Johnston had not shared such a narrow actuarial view. A few weeks later Willie Ross opened the Board's new £11.5 million oil-fired power station, Caroline Port B, in Dundee, and said there was still a place for hydro-electric power.

Five weeks or so before the Queen opened the Ben Cruachan power station, Tom Johnston died - on Saturday 4 September 1965 at his home in Milngavie. He was eighty-three years old. The provost of Inverness said, 'No words can say how grateful we are to him.' The Highlands suffered another loss only a few months later. On 24 January 1966 the main north daily, the Aberdeen Press and Journal, carried the shocking news that 'Willie Logan is dead, and whole of the Highlands are in mourning'. Two days before, shortly after half past ten on a misty Saturday morning, a chartered Piper Aztec carrying the contractor hit the pine-clad slopes of Dunain Hill on the western approach to Dalcross airport at Inverness. Ironically Willie Logan himself had been planning to try for his pilot's licence but on this occasion the plane was being flown by ex-Squadron Leader Peter Tunstall, who suffered injuries but survived the crash. Willie, his sole passenger, was killed. Many in the north can still remember what they were doing when they heard the news. Bill Mackenzie was shopping in Inverness and had just gone through the door of Woolworths when somebody asked him if he knew what had happened. Laurie Donald was in Glasgow at the time, working on a Logan contract, and on the Saturday afternoon the managing director of the Glasgow office telephoned with the news. The pews in the Free Church in Dingwall, reputed to seat 1,000, were packed for Willie Logan's funeral and probably a thousand more people listened to the service outside on loudspeakers.

One major part of Tom Johnston's dream for the Highlands did not materialise to the extent he hoped for, although it was not for the want of trying on the Board's part. In the end, industries sprang up only to a limited extent, as geographical realities proved stronger than the availability of electric power. With the visions of small enterprises came the idea of 'model' villages, each with some 2,000 inhabitants, in the glens. The provost of Elgin described in 1947 how such a village could be founded in Glen Affric but other members of the Local Authorities Committee scoffed at the notion. Depopulation was still continuing as the first hydro schemes were springing from the river beds - the Highlands and Islands lost almost 4,000 emigrants in the two years after the end of the Second World War. In 1950, the Board announced its intention to create a model village at Cannich - it had similar plans for Contin, Fort Augustus and Killin - where the new energy would support farms, tourist ventures and small businesses. The Board built houses in several villages but, on the whole, the thriving businesses did not appear.

From time to time it seemed as if the Board's efforts to attract industry were having some success, for example when Ferranti Ltd opened a transformer factory in Inverness and the General Electric Company were indicating an intention to set up an electric cooker assembly plant, but overall not a great deal was achieved. The population of most of the seven crofting counties, as the bulk of the Highlands and Islands was sometimes labelled, continued to fall throughout the 1950s: the 1961 census revealed a drop of 4.5 per cent, just under 12,500 people, the only area to escape this drain being Caithness where the siting of the Dounreay nuclear power station had brought about a massive influx of workers and their families and had boosted the country's population by 20 per cent.

Lord Strathclyde assured a press conference in Edinburgh at the beginning of 1966 that there was no question of the Board slacking in its efforts to improve the economic prospects of the Highlands. He was forced to admit later that year that the Board had failed to stop the drift of people from the region but argued that they had achieved results 'far beyond the dreams of the most enthusiastic supporter of the original Bill. In Birmingham in November 1967, for example, the Board mounted a campaign to attract industry but most firms did little more than express polite interest. The chief commercial officer of the Board stated, however, that since 1943 two hundred and fifty industries had started in the north and were now employing 16,000 people. In 1973 the Board conducted a dozen English businessmen on a two-day visit to the Highlands, the latest in a series of such tours. The Board's Key to Freedom campaign had its first success later that year when a subsidiary of the Morgan Crucible Company announced its plan to transfer to a new factory in Perth.

The Highlands and Islands Development Board claimed more success: its efforts to create employment had checked depopulation, it announced in June 1968. The 1971 census confirmed this, recording a population increase of 6,000 in the previous decade; good news, but the phrase 'Highland problem' was still in use. Professor Robert Grieve, the HIDB's first chairman, used the term in the organisation's first report and incidentally also acknowledged the pioneering inspiration of the Tennessee Valley Authority. The HIDB also recognised the efforts of the Hydro-Electricity Board and the latter's chief commercial officer, J C N. Baillie, joined the HIDB Board in its early years.

The Board could point to its success in tourism, an industry already worth £80 million a year by 1961. When the Board opened the doors for six days at some power stations to mark its twenty-fifth birthday, over 25,000 visitors called by. The Cruachan station welcomed 9,000 visitors in the summer of 1969, and around 10,000 were paying a call on the Pitlochry power station and fish ladder every year. Pitlochry now has a small exhibition describing how electricity is generated and visitors can also see the interior of the fish ladder, and salmon and trout passing through.

The Board attached great importance to the appearance of the schemes. Little could be done to disguise the massive intrusion of dams but the power stations and some other structures made use of local stone. This revitalised the moribund quarrying industry and the declining need for stone masons in some parts of the Highlands. James Shearer, one of the Board's panel of agricultural advisers, suggested to Edward MacColl that local stone and slate would improve the appearance of the Nostie Bridge power station and thereafter it became standard policy to use traditional materials wherever possible. Yellow sandstone from Burghead and red sandstone from the Tarradale quarries on the Black Isle were used to build in the Beauly-Affric area. The Finlarig power station was built in Aberfoyle stone, and Mossford in Tain sandstone. This approach also made economic sense: building the diesel generating plant in Kirkwall from local stone saved the considerable sum that would have been spent on importing concrete and steel. Occasionally the nod in the direction of

tradition went further: the sculptor Hew Lorimer was commissioned to carve four Celtic beasts to grace the wall of Fasnakyle.

One of the Celtic animals carved by Hew Lorimer on the wall of the power station at Fasnakyle (author).

Over half a century on from their construction, almost all the scars of the dams' birth have been obliterated from the landscape and the dams themselves have acquired a weathered look. The nine-mile road from Cannich to Mullardoch is still single-track, rising, falling, twisting to find a feasible gradient, and it still feels as remote as it did in the 1940s to the men who built the scheme. The immense concrete face of the dam still shows the shuttering lines and the marks of dumb bolts but it has also been colonised by moss and lichen, and the white concrete has become dark and discoloured.

Opinions remain divided over the environmental impact of the large schemes. Sandy Payne now looks on Monar dam, where he worked as a chainman, with mixed feelings: there is pride in having helped to build it, joy in remembering seeing eagles, greenshank and the wildness of the hills for the first time, and sadness because the dam really changed the ecology.

To older hands, a hydro-electric scheme represents the generation of power, the creation of jobs, the opening of inaccessible areas, a modernising force that breaks a landlord's grip, but to a younger generation with a more developed environmental consciousness they stand for the destruction of nature, the intrusion of 'big' business into rural areas, the erosion of indigenous cultures. There is now greater attention being paid to renewable sources of energy, as the burning of fossil fuels threatens to bring on global warming with many unforeseeable consequences, and there is much talk of harnessing wind, wave and solar power. Somehow, hydro power is overlooked in these discussions although it is clean, renewable, and releases no toxic by-products and no waste.

Ironically, the Hydro Board did experiment briefly with wind generation and a peat-fired power station in the 1950s but these proved uneconomic.

In 1989 the privatisation policies of the Conservative Government of Margaret Thatcher finally caught up with the Board. The North of Scotland Board and its South of Scotland neighbour were to be turned into two companies - Scottish Hydro-Electric plc and Scottish Power plc. At the time the North Board had 3,500 employees and an annual turnover of £348 million. During 1989-1990, SHE took over most of the property, rights and liabilities of NSHEB and became a business empowered to sell electricity to industry and regional electricity companies anywhere in the UK. Its turnover in its first year was £435.7 million, and its profit £108.7 million. In the midst of this commercial makeover, many feared the social clause - the heart of Tom Johnston's vision - would be abandoned, if not simply overlooked. SHE stated it would make 'determined efforts to ensure that [the social benefits] shall not be [lost] and pointed to flood alleviation, arts sponsorship and conversation projects as examples of its good works. In their annual report for 1996 Scottish Hydro-Electric re-affirmed its parent Board's ethos: '[Our] roots are in the north of Scotland and serving our community there is our first priority'. By 1990, however, hydro power had become only a small part of the range of the new company's activities - only 17 per cent of its electricity output came from hydro generation, against 31 per cent from oil and gas, 23 per cent from nuclear power stations, and 27 per cent from coal fired stations. Only 39 per cent of its revenue came from domestic consumers in the north of Scotland. In Peterhead it was modifying a 1,320 mW power station to burn North Sea gas and a new subsea cable was being planned to bring power from cheaper generation plants on the mainland to the Western Isles

Work on the first hydro-electric scheme to be built by Scottish Hydro-Electric began in December 2000 on the Cuileig river in Wester Ross. This is the Loch a'Bhraoin scheme revisited, a slight modification of the one included as number 77 in the Hydro Board's original list of 102 projects. The aim was to tap the water flowing from Loch a'Bhraoin down the Cuileig to join the River Broom in Strathmore, and the work was done in 2001. A weir on the Cuileig diverts water into a pipeline falling to a power station on the floor of the strath. The scheme cost £4 million and the main contractor was Miller Civil Engineering Services Ltd, with the Strathpeffer firm of Kenneth Stewart Ltd subcontracting for the pipeline.

There were many contrasts between this small scheme and the major efforts of the 1950s. The work camp was now a cluster of interconnected portable cabins. Only some forty men were involved in the construction and the turbine in the power station is remotely controlled. The pipeline is constructed from six-metre lengths of glass-reinforced plastic that were slotted together through rubber sleeves. Diggers grubbed out the trench and, depending on the amount of rock to be excavated, the pipeline was laid at a rate of up to fifty metres per day. Most of the shuttering on the weir was prefabricated and the old shuttering techniques were used only on odd corners. The environmental specification was rigorous: top soil was stripped and preserved for relaying, the pipeline is buried along almost all its length, access roads are sited so as not to impinge on the view from the Dundonnell road, the amount of compensation water is clearly laid down, and the roof of the power station is covered in soil and planted with grass. Some things were the same as always: the drenching rain, the midges, the mud. The engineers explained that construction projects now are cut to the bone and there is no room for frills in the highly competitive tendering; the old Board's attention to design and the use of local stone has gone.

There have been in recent years a number of hydro-electric generation initiatives in the Highlands. Some of these have been confronted by objections and have not proceeded, the casualty list including the Hydro Board's own run-of-river schemes for the Grudie and Talladale rivers in 1983.

The Assynt Crofters' Trust, after a long period arguing with environmentalists, opened their own scheme in 2000; this joint project between the Trust and the Highland Light and Power company of Dundee cost £500,000 and taps the discharge from Loch Poll on the Stoer peninsula. In July 2001, Brian Wilson, the energy minister and no stranger to the Highlands - he was one of the founders of the radical West Highland Free Press - announced a £250 million package to be spent over the next decade on refurbishing the hydro-electric power stations built by the Board. He declared that it was a major signal that hydro-electric power still has a huge part to play in the Government's strategy for renewable energy, the expansion of hydro being one of the great visionary acts of the post-war period.

The men and women who were intimately involved in the construction of the dams feel pride in what they did and sometimes feel that the extent of the Board's achievement is not fully appreciated now. Some see it as one of the great achievements of post-war Europe, fully comparable to other major construction programmes. Thirty-four of the Board's dams were on a scale to be included in the World Register of Large Dams, and the hydro schemes were frequently included on the programme for a state visit. Experts with a professional engineering interest came to see them, including from the Soviet Union and the United States - and, among them, came the director of the Tennessee Valley Authority, the body Tom Johnston sought in some ways to emulate. Lord Wilson, the chairman of Scottish Hydro-Electric, said on a BBC Radio Scotland programme to mark the fiftieth anniversary of the original Board in 1995, that he couldn't help feeling enormous admiration for the engineers and the workers who built the power stations in a time of grat economic difficulty, adding that the power lines across the Lecht were put in in snowstorms. It was a tremendous effort against great odds and no-one should forget what they did. When I asked Patrick McBride in Donegal if he felt he had been doing something important when he was wrestling to control the Tummel, he replied in one word:

'Definitely'