

MANWEB Headquarters, Chester

Background

In the late 1960s the Building Services Industry was introduced to the phrase ‘*Total Integrated Design’ when the first Heat Reclaim Air-Conditioned Building in the United Kingdom was built in Chester. This approach to office building had been used before in the United States but never here.

[* This phrase was later dropped in favour of ‘Integrated Environmental Design’.]

Central to this design philosophy is permanent artificial lighting, at a high illuminance, over at least part of each floor and the assumption that land use constraints would inevitably lead to a demand for buildings with deeper plans. Office buildings in the UK up to that time had tended to be designed, perhaps wrongly, around minimum Daylight Factor. Until the concept of Daylight Factor was introduced in Schools of Architecture in the 1950s architects knew that, without artificial lighting, office workers needed to be near a window or ceilings needed to be high or both.

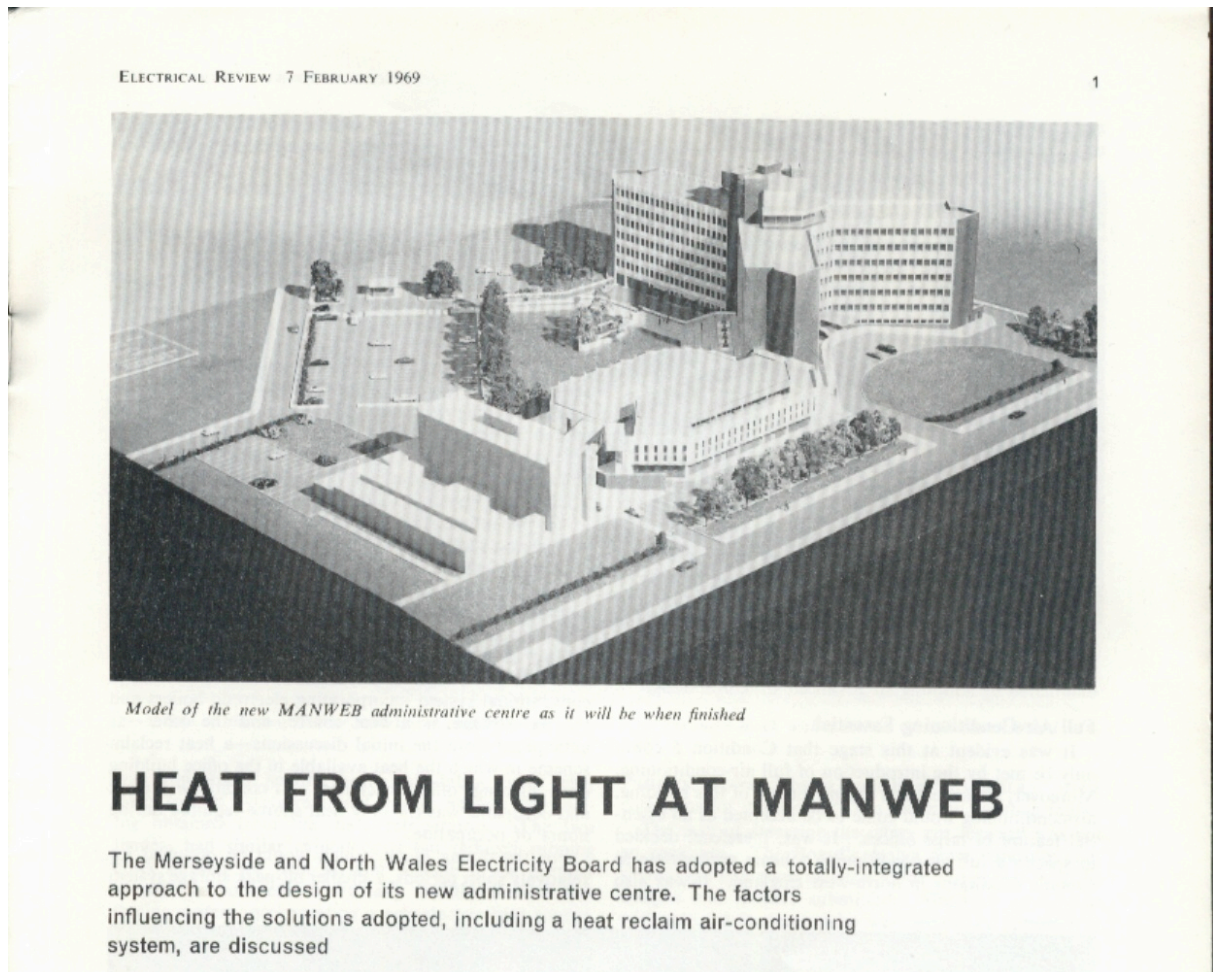
Daylight Factor was primarily introduced as a means of ensuring that schools had good levels of daylight, it was not intended for offices, but using it as a design tool led many architects to limit office widths, when lit from windows on one side, to about 6 metres. This meant that most offices buildings designed during the 1950s and early 1960s were about 14 metres wide with window to wall ratios of about 55%. Providing high levels of (permanent) artificial lighting removes these constraints and means that the building can move closer to the optimum shape (from the point of view of heat loss), which would have a square floor plan.

The Merseyside & North Wales Electricity Board (MANWEB), decided around 1965 to centralise much of its administration and close a number of Regional Offices. Land was available adjacent to the existing Chester Regional Office in Sealand Road and it was decided that the new Headquarters Building should be connected to the existing office, which would then become the Computer Centre.

Design Philosophy

An early decision was taken that the new building should consist primarily of open- plan offices and studies of such offices in Europe led to the conclusion that the optimum minimum width was about 25 metres if good acoustic conditions were important. Many other parameters, including Local Planning Office requirements that a large slab block should not be built parallel to Sealand Road because of the housing opposite, led the designers to conclude that the best solution was for a seven storey T shaped building whose wings were all offices 30 metres long by 18 metres wide. The final solution consisted of a seven storey Y shaped building whose floors were 30 metres long by 17 metres wide. The Y shape was chosen because of the advantages it gave to the occupants in terms of view and the lack of overshadowing to the houses opposite. Using post-tensioned beam construction allowed a shallow ceiling to floor finish depth and this false-ceiling space provided an ideal return-air path.

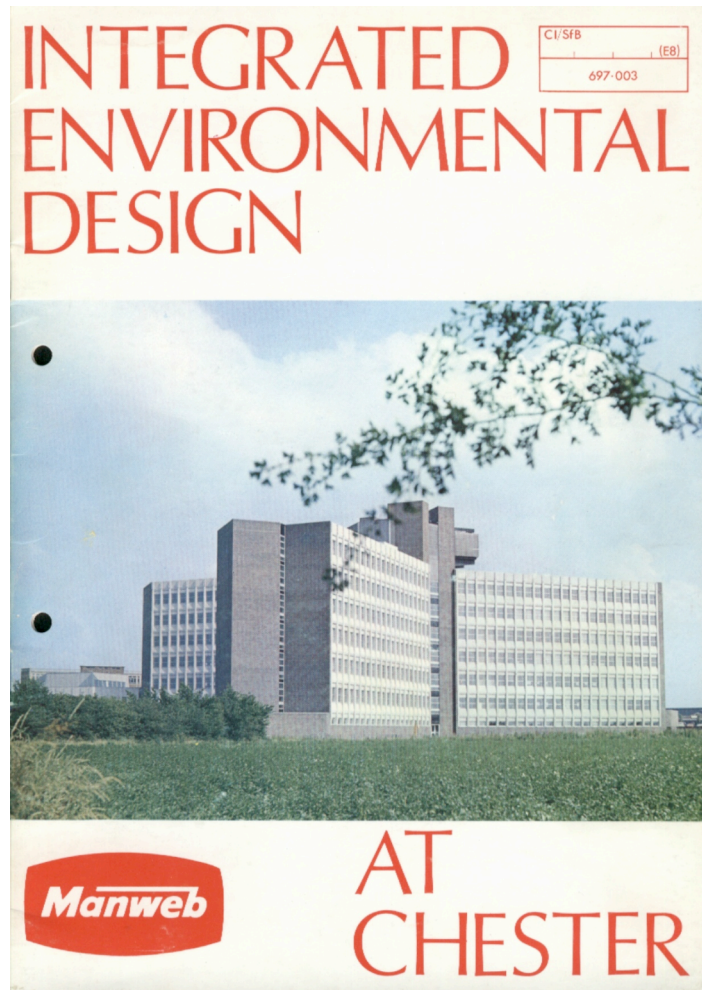
In 1966 very few office buildings in the United Kingdom had air-conditioning but MANWEB took the decision, which proved to be correct, that this was the way forward in office design and this, coupled with, for then, high levels of insulation and high lighting levels led to the consideration of Heat Reclaim. Good practice at the time recommended light levels of about 350 lux for offices but the then IES (Illuminating Engineering Society) Code suggested that levels should be higher where there was a lack of daylight. However, much research work was being carried out on optimum lighting levels for standard office tasks at that time, notably at the Building Research Station in Watford and at the Electricity Council Research Centre in Capenhurst, Wirral, and this research was suggesting that anything from 1000 to 1500 lux was probably ideal.



Model of proposed MANWEB HQ depicted in Electrical Review

If we put together all the chosen parameters for this building : deeper offices with mainly permanent lighting, a higher light level at 1100 lux, high insulation standards and a reduced window area (40% glass to wall ratio), the calculations show that the building heats itself. In fact, the 'Balance Point' for this building was calculated to be -4°C , this means that whenever the outside temperature is above -4°C the building needs cooling.

Much was made in the Local and National Press about this building which was ‘Heated by the Lights and Occupants’ including a two page spread in no less than the Financial Times. In fact, it had been calculated that Office Machinery and Air-Conditioning Plant contributed about 40% of the heat requirement but that was rarely mentioned! As with St George’s School Annexe described earlier, the contribution from the body heat of the occupants was only about 15%.

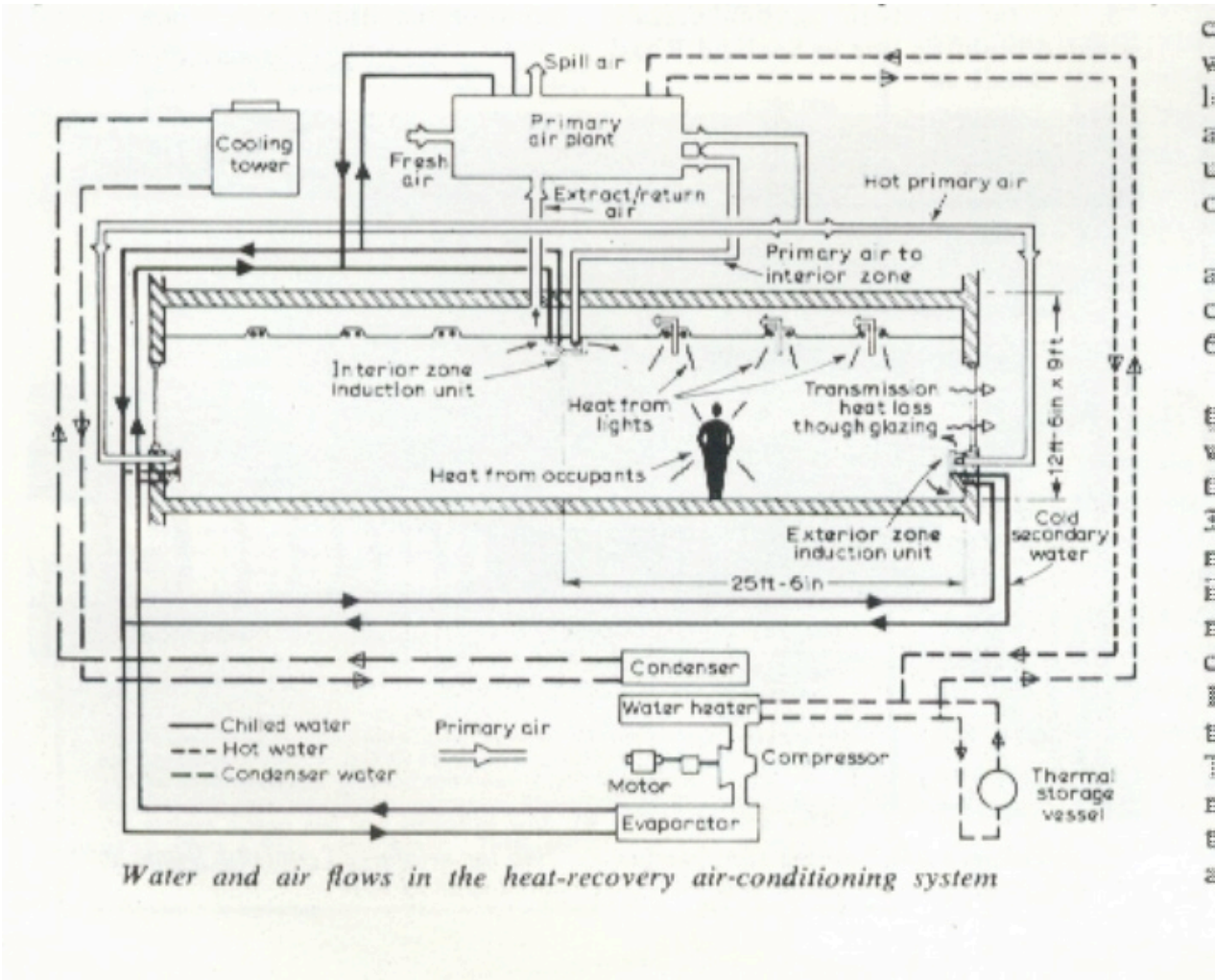


Promotional Brochure

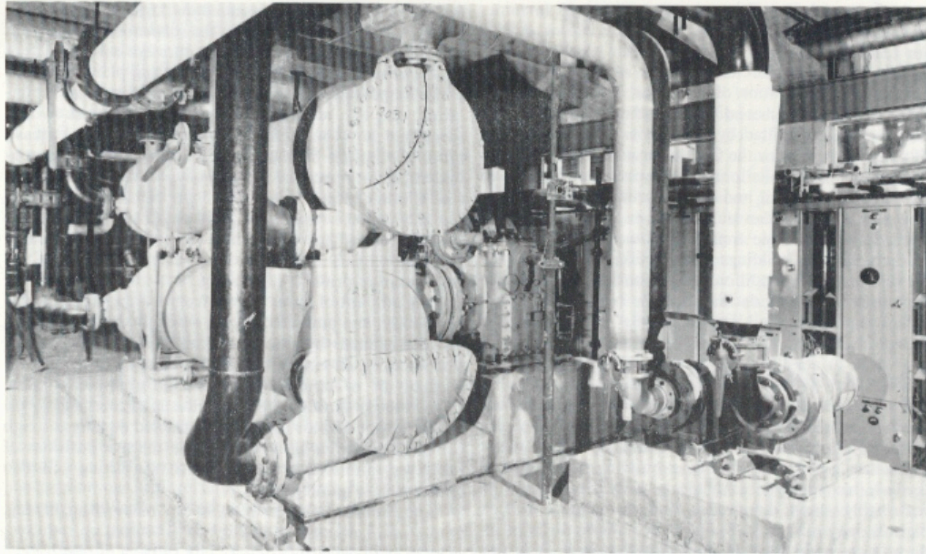
Operation

The Building Services in this building were primarily designed to remove heat from where there was too much of it and either use this heat where there was a shortage or just get rid of it. This was made easier by the use of ‘Double Bundle’ condensers, which meant that the excess heat could be sent either to the roof-top cooling tower (one circuit) or to the main heater batteries (second circuit). Two large hot water storage vessels in the plant room stored heat when there was no demand for it in the building and it was only when these were up to temperature that heat was dumped at the cooling tower. These storage vessels were then able to provide a base heat supply for morning start up. In very cold weather and particularly for Monday mornings, there were two electrode boilers, each rated at 625kW, which could be used to heat the storage vessels but these were rarely necessary.

Lighting levels were designed to be controlled according to outside conditions both in terms of bright days and very cold days. On bright days, according to sensors on each elevation, the outer row of luminaires could be switched off as well as one of the three lamps in the second row of fittings. This obviously reduced the electrical load for cooling as well the load for lighting. However, the building management system was designed to over-ride this switching in very cold weather if the operation of those lights was necessary for the provision of heat. The automatic lighting control system did not always operate as expected and had ‘teething’ problems which seemed to last for most of the life of the building.



Schematic of environmental control systems



One of the two Carrier centrifugal chillers in the basement of the main block with a section of the control board on the right

Double-Bundle Condenser as depicted in Electrical Review

Update

The success of the MANWEB building led to many other Regional Electricity Boards moving their Headquarters into similar buildings and Yorkshire Electricity Board soon had a Heat Reclaim building in Leeds, quickly followed by South Western Electricity Board in Bristol. However, privatisation of the Electricity Industry in 1990 led to large scale changes and many buildings, as well as staff, were faced with redundancy. The pioneering MANWEB building was demolished following the purchase of the company by Scottish Power in 1995 despite the fact that £4million had just been spent on refurbishing and updating the air-conditioning system.

Sources

- Integrated Environmental Design at Chester; MANWEB 1973
- Heat from light at MANWEB; Electrical Review, 7 February 1969
- MANWEB Headquarters; Financial Times 2 July 1970