SECTION 7 AIR HEATING, HEAT RECOVERY, VAPOUR BARRIERS

LESSONS

1. Use energy efficient plant
2. Ensure proper design of insulation and vapour barriers
3. Ensure specific contract management of the installation of the vapour barriers. A single puncture or inadequate fixture will cause nuisance, repairs and unnecessary cost.
4. Ensure good pool acoustics are a requirement of the design brief.

5. Do not reinvent the wheel. Learn and benefit from the experience of others who have previously done what you are now trying to do.

Technical issues

Swimming pool buildings differ from other buildings in one very important aspect - they contain a large surface area of heated water that evaporates as it attempts to saturate the air in the space above the water, which unless controlled by a ventilation system can rise to 100% humidity. This has a significant effect on the selection of appropriate materials, construction systems and the use of appropriate heating and ventilation systems.

Insulation and vapour barriers

To minimise the amount of evaporation and to provide comfortable conditions for swimmers, pool buildings are held at a higher temperature than other air-conditioned buildings. Pool hall temperatures need to be several degrees hotter than normally air-conditioned building. If not there is a significant increase in heat lost from the pool water and overall a significant increase in energy cost.

For energy efficiency, the high internal temperature requires greater attention to the amount and detail of the insulation than in a conventional building. The importance of this is compounded by the high humidity caused by the evaporation of pool water. The amount of water is small when compared to the pool volume but the effect it can have is large.

The high humidity in pool halls requires construction methods and details that are quite different to that necessary in conventional buildings. If not detailed and constructed correctly condensation will occur in large volumes, often in concealed spaces, that can cause a real nuisance to the building occupants and can cause a real threat to the durability of the building components. A classic example was at one pool in the study where the manager was reputed to have had to position his rubbish tin to catch the drips coming through the ceiling from the plant room above until condensation problems were remedied. In pools outside the survey there are examples where ceilings have collapsed because the accumulation of water over time has either overloaded the fixing or has rusted the fixing to the point of failure.

There is no rocket science involved in getting the detail right. However, there are too many examples of building designers getting the insulation and vapour detail dreadfully wrong. In one pool in the survey the designer assumed that a so called wet store room [a space that was intended as a store for wet goods where they could be dried] did not require insulation. The room was not insulated and at times in winter the condensation is so great that it virtually rains inside the room. The selection of pool designers with a depth of experience in pools is of fundamental importance. It is my opinion that most of the vapour barrier problems I saw were the product of inexperience or insufficient attention to the construction detail.

A related issue is the acoustic insulation within a pool hall. The large planar water surface provides a very good reflecting surface for sound. This, coupled with the large planar surfaces of hard materials invariably surrounding a pool, is a recipe for very noisy environments in pool halls. We are all aware of the noise within an indoor pool. At one of the facilities in the study ear plugs were issued to pool staff due to the excessive noise due to poor acoustics.

Acoustic insulation materials invariably have thermal insulating properties. If the acoustic materials are not installed correctly in relation to the vapour barrier on the inside of the hall thermal insulation, then the acoustic insulation will compromise the vapour barrier. At one pool [outside the study], condensation within the acoustic insulation caused the fixings for the acoustic insulation panels to corrode. After a while, the heavy panels started falling from the ceiling into the pool and onto the surrounds. The solution required a complete reconstruction of the whole pool roof. Once again, relevant experience is of paramount importance.

Heating and ventilation systems

In the operation of pools, the cost of energy is generally the second highest – the highest being the cost of labour. There have been many surveys by the Energy Efficiency Conservation Authority [EECA], and others, of the cost and amount of energy used in pools and these invariably show that there are large differences between the costs of energy at different pools. Energy costs at the Nae Nae pool have averaged 30% of the total operating costs over each of the previous seven years.

From the surveys, there are examples of inefficient pools where the energy cost is more than double that at similar pools with efficient plant. A reduction in operating cost requires investment in energy efficient plant – but the payback on an investment in energy efficiency can be very high. One of the facilities reviewed were able to demonstrate an annual saving of $60,000 in energy costs after refurbishment of the original heat recovery system.

In national terms, the amount of energy wasted in inefficient pools is so high that the government funded EECA use swimming pools as an example of the appropriate use of their funding assistance using their Crown Loan Scheme. With this scheme, EECA provide interest free loans (subject to some basic conditions being satisfied) for the cost of the energy efficient components of plant installed in swimming pools. This extends to the cost of pool covers that have been demonstrated to be one of the most cost-effective investments when reducing energy cost with simple payback periods as low as two years.

Other examples include the Kaiapoi and Timaru pools where EECA funded the marginal cost of energy efficient heat pump plant with simple payback periods of less than four years. These two pools are have been audited by EECA and are demonstrably energy efficient with low energy cost. The detail of this is available from EECA in *energy-wise Case Study – 7*. At Timaru it was estimated that an investment of $75,000 would give a payback of $25,000 per annum. When subsequently audited it was found that the payback was over $35,000 per annum. At Kaiapoi an annual saving of $32,000 was achieved with an investment of $72,000.

In view of this, it is inexcusable that local authorities delete heat recovery systems due to cost, particularly when they should be setting an example to the community in energy conservation.

Despite this, there are too many examples of energy efficient plant being replaced with conventional plant so that the design team can be seen to stay within a project budget. Subsequently, energy efficient plant is justified by a simple cost benefit exercise – and is added to the completed project at significantly greater cost than if installed initially. An example of this is the Upper Hutt pool where energy efficient plant is being retrofitted at significantly higher cost than if fitted as originally designed. The pool has thus operated for several years at an unnecessarily high cost and now has to pay a premium to have efficient plant added.

Summary

- The selection of a pool design team must include the selection of engineers and architects fully experienced in the design of energy efficient pool heating plant and appropriate pool building.
- The selection process must include discussion with referees from previous pools about the performance of the designers and their designs
- It is foolishness in the extreme to omit energy efficient plant when the savings accrue forever.
- There are good designs out there – talk to the owners and the designers.