# Breaking the reuse barrier

Golfcourse in Hawaii irrigated with recycled wastewater

There are good reasons to make more use of wastewater reuse, but exploiting this potential needs greater acceptance by politicians and the public. **BILL McCANN** looks at attempts to overcome such barriers.

**In a paper 'Global challenges for wastewater reuse' provided as background to this article, two eminent water specialists asked why the concept of wastewater reuse had not yet been embraced and supported wholeheartedly by the public and politicians. They went on to suggest that the key for the future was to look at the bigger picture in which reclamation and reuse would be incorporated into mainstream thinking on any sustainable and integrated water resources management policy.**

The experts, Takashi Asano, Emeritus Professor at the University of California, and Akissa Bahri, a Research Director on water affairs in Tunisia's Ministry of Agriculture, are by no means alone in this concern over the acceptance of reuse. Indeed they are amongst a worldwide body of water experts actively working to correct this situation. Numerous papers list the many good reasons for grasping the unexploited potential of reuse, and on this aspect Asano and Bahri note: 'The incentives for a wastewater reuse programme make perfect sense to technical experts – a new water source, water conservation, economic advantages, environmental benefits, government support, and the fact that the high cost of wastewater treatment makes the product too valuable to 'throw away' or dispose.' Then there is the continuing train of research projects that seek to describe the many barriers to greater acceptance and identify ways to break those barriers down.

Probably the most well known and comprehensive of current research efforts into the barriers and ways of overcoming them is the European Union's Aquarec project. This €3.38M, three year programme began in March 2003 and, according to project manager Thomas Wintgens, is on track in meeting a large number of defined intermediate objectives (see box – Aquarec deliverables).

The project's objectives are being pursued by no less than 17 separate research teams spread across Europe and including one team in Israel and another in Australia, where a national project with the same aims, OzAquarec, is under way in parallel with the international collaboration.

### Aquarec objectives

- Provision of policy guidelines and water quality standards for wastewater reuse
- Collection and validation of best management practices
- Development of reference manuals and step by step guides for future end-users
- Evaluation, selection and standardisation of technological concepts and components for wastewater recycling
- Integration of various activities towards sustainable wastewater recycling world-wide

This is a global issue with no lack of incentives to solve the perceived problems.

What they all seek, according to the Aquarec project specification, are 'strategies, technologies and management practices for local, safe, publicly acceptable, economically feasible and sustainable reuse of treated wastewater for urban, peri-urban and agricultural use'.

Within Aquarec this global aim is defined more specifically in five sections (see box – Aquarec objectives) which the research teams are tackling through nine work packages.

Prior to Aquarec and over the period since about 1994 EU research funding has backed nine or ten other so-called research, technological development and demonstration (RTD) projects, all bearing to greater or lesser degree on the reuse issue.

Over approximately the same period there has been a very considerable expansion of wastewater reuse. One of the core papers presented at an Aquarec/OzAquarec international conference in Wollongong, Australia in February recorded that only a handful of reuse projects existed in Europe in the early 1990s – and they were 'mostly incidental, i.e. related to the proximity of the wastewater treatment plant to the point of use'. Now, the conference was told, there are over 200 and many more in an advanced stage of planning.

Asano and Bahri indicate the same trend in their paper, listing many developing and established schemes in countries on most continents.

**Deliverables of Europe's Aquarec project**

WP2: Report on the definition of key quality parameters Month12 (M12)
WP4: Report on the survey on conducted feasibility studies M12
WP1: General maps on water supply & demand M12
WP5: Conference proceedings on public consultation M12
WP3: Knowledge Network "Wastewater Reuse" M12
WP7: Report on water treatment matrix of current technologies M12
WP8: Simulation software for reuse systems M12
WP9 Draft of Technology Implementation Plan M18
WP5: First draft of public consultation guidelines M18
WP6: Review report on water management survey M18
WP8: Report on validation of simulation software M24
WP1: Report on the water supply & demand indicators M30
WP6: Water reuse system management manual M30
WP8: Design support software for water reuse M30
WP2: Guideline for quality standards for water reuse in Europe M30
WP4: Handbook on feasibility studies for water reuse systems M30
WP7: Proposal of standard treatment in water reuse systems M30
WP5: Published guidelines on stakeholder engagement M34
WP3: Report on integrated water reuse concepts M36
WP9: Final project report M36
WP9: Technology Implementation Plan M36

Aquarec researchers have listed 3000 worldwide.

One of Asano/Bahri's listed countries, Australia, is described as '...80% arid and semi-arid, with 90% of the precipitation falling in the tropical north where only 10% of the population lives. Average annual precipitation is 534 mm; less than 250 mm/yr falls in the arid and semi-arid regions.' They go on to say that, in 2000, about 11% of all the treated wastewater was being reused. Andrea Schaefer, leader of OzAquarec, told *Water21* recently that this figure is increasing very rapidly 'due to government pushes.'

All this illustrates that, where the resource pressures are sufficient or where cost advantages are apparent, reuse is already forging ahead, evidently overcoming the many obstacles and the missing standards and guidelines of good practice that the research is addressing. As Asano and Bahri say, 'In cities and regions of developed countries, where wastewater collection and treatment have been the common practice, wastewater reuse is practised with proper attention to sanitation, public health and environmental protection.'

This is not so in the developing world where irrigation with poor quality or even untreated wastewater is a major health risk and one reason why the World Health Organization is working to develop realistic quality guidelines to cover this practice.

Further up the quality scale, the developed countries are equally in need of the standards and guidelines that Aquarec and similar projects are now developing. In Andrea Schaefer's words: 'Many trace contaminants are potential health and environmental risks via various pathways. There is a vast number of uncertainties. We simply do not know what the consequences of our actions are.'

Central to the direction of the research is the fact that, as the perceived institutional barriers are overcome and reuse is brought into the mainline thinking on resource management, the raised profile will bring reuse more fully into the public consciousness.

When Asano and Bahri bewail the 'lack of wholehearted support from the public and politicians' and when Thomas Wintgens, in introducing Aquarec, includes lack of public acceptance and lack of awareness amongst the obstacles to reuse, they are looking rather more to the future than reflecting what has happened to date. After all, as the former say: 'To date the major emphasis of wastewater reclamation and reuse has been on non-potable applications such as agricultural and landscape irrigation, industrial cooling, and in-building applications such as toilet flushing in large commercial buildings.' In the Wollongong paper previously mentioned agricultural irrigation and urban and environmental applications are said to account for 81% of projects in Southern Europe. In Northern Europe industry and urban and environmental uses take even more – over 84%. Aquifer recharge is of growing interest and this applies in Europe, the USA and elsewhere.

The point is that none of these applications implies much, if any, public involvement or awareness. The overt nuisances arising when the other – solid – component of wastewater is recycled are not present so the public protests attracted by that exercise are not, on the whole, seen when high quality effluent is recycled to agriculture or industry or municipal public use.

When it is introduced into the domestic arena, whether for garden use or flushing the domestic toilet, awareness rises and public acceptance becomes an issue.

That trend - to awareness, resistance, protest - can be expected to rise as reuse of any type becomes more common but especially when domestic applications are in prospect. It is then that the products of the current work will be invaluable in offering assurance that risks are being minimised by adherence to agreed policies, standards and principles of best practice.

But, as Aquarec researchers are quick to point out, while establishing this framework of sound standards and guidelines is important, the crucial matter is that they are built into legislation. Thomas Melin, co-ordinator of the Aquarec studies, says it does not matter a great deal if the legislation is national or supra-national so long as it is there to stifle uncertainty and provide security for suppliers and users alike. Another Aquarec collaborator, Paul Jeffrey of the UK's Cranfield University puts it rather more colourfully: 'The point is not really the international or consensus nature of standards that is important, it is their legal standing. Without legally binding standards, we are hostages to fortune.'

Melin reinforces that argument by pointing to the USA and Israel, both countries where strong legislative frameworks have been in place for many years. In the USA, where the modern approach to reuse began, full legislative coverage has been in place since the 1960s. 'Without that', says Melin, 'none of the huge high water quality recycling projects would have even been initiated. That legislation provided security and ensured the elimination of the discussion of standards that would have to be met.'

In the case of Israel, where most

of the wastewater is recycled to agriculture, the legislative background is possibly even more crucial. 'The entire agricultural export industry depends on it. An epidemic that could be linked to a lack of legislation on quality standards would be an immediate catastrophy.'

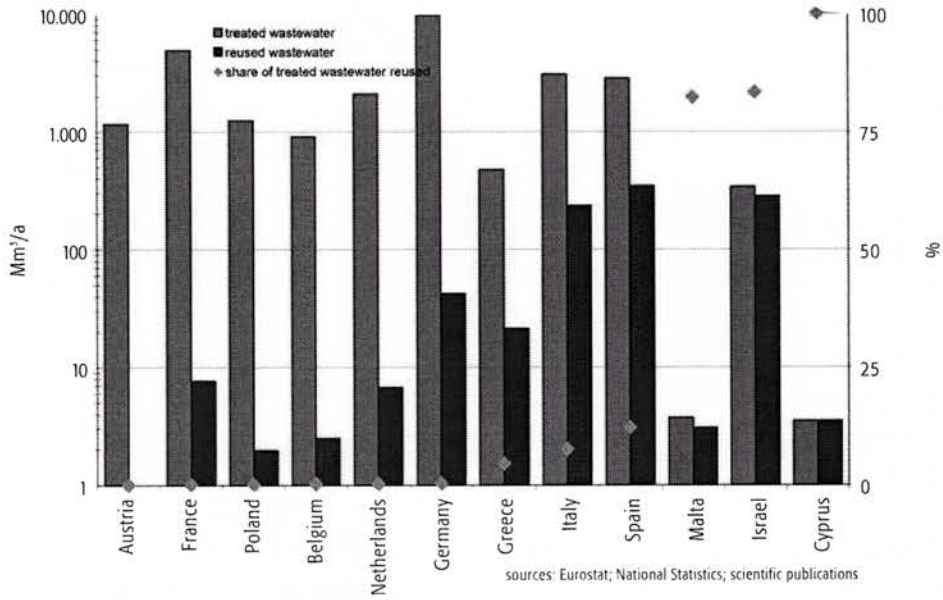
Takashi Asano makes a similar point, illustrating the force of the economic driver, in relation to the current WHO work on water quality standards for safe reuse in agriculture. Current practice sees three broad standards being applied across the world, roughly corresponding to untreated reuse as some countries are obliged to resort, despite the risks, to an intermediate quality where some treatment has been given and a level corresponding to developed world practice. This last represents an ideal associated with those fortunate societies who can afford the cost of high standard treatments that minimise risk. For the time being, and perhaps for many years, those standards will be out of reach of many developing countries but they can be used as benchmarks to be aimed for in a continuing scale of improvement.

But now, as Asano points out, these two extremes are linked by the global market in foodstuffs. Developing countries wishing to improve their economic status by engaging in this trade could have no better incentive to achieve the high quality reuse water necessary to safeguard the food quality expectations of the developed world. In his words, 'This market driver is a far better incentive than abstract intentions.'

Higher quality effluents or, at least, larger volumes of treated wastewater are, of course, becoming available all the time, not least in the EU countries where legislation has driven extensions and improvements of national sewerage and treatment systems for several decades – and the process continues as the EU extends its borders to the east.

Unfortunately Aquarec has estimated that only about 2.4% of all Europe's treated effluent is currently being reused. Amounts vary widely as the graphic shows, with only Cyprus (100%) and Malta (83%) using very significant volumes of the available output. Even Mediterranean countries with high irrigation demand, such as Spain, Italy and Greece, re-use only between 5-12% of national effluent volumes, and many other European states use 1% or less.

In comparison with Australia's 11% (and rising), Europe therefore has much scope for advance and that means removing a range of other obstacles that militate against moving reuse into mainstream resource planning.




Europe's varied approach to reuse

As Thomas Melin observes, 'The Australian advance in recycling has not happened all by itself. There has been careful preparation and regulative pressure and support. Recycled water is heavily subsidised and its use is strongly 'encouraged' by legislation, with sanctions in the form of fines imposed, for example, if anything other than recycled water is used for washing cars or watering lawns.'

Two of the more obvious practical curbs to recycling are the distance between the points of effluent output and potential application and, in other instances, the high costs and the risks inherent in laying dual supply systems for potable and recycled water. Andrea Schaefer records the former as a particular problem in Australia, a land of vast area and limited population.

Dual systems are a high cost investment, sometimes not competitive against other measures of cutting demand such as metering or leakage reduction. But here, in this highly complex issue, is the proviso that many of the experts see as the main barrier to wider recycling – the frequent failure to take all costs into account when comparing the options for integrated management.

There is no better way to illustrate this than with the example of nitrogen discharges to the Nete River, Belgium (see figure), as set out in a paper by Bixio, Wintgen, Melin and others at Wollongong. The conventional approach to lowering nitrogen input to the river would be additional treatment at the wastewater plant, reduction of the 540 tonnes a year from isolated households by installing local treatment plants, and possible curbs on agriculture to cut nitrogen input from diffuse runoff.

With reuse brought in at the planning stage, a probably cheaper and more sustainable solution might be to recycle all the wastewater plant effluent to agriculture. In addition to terminating the direct discharge from treatment plant to river, this might give the incidental advantage of reducing farm fertiliser needs and the associated diffuse nitrogen input. ●

Total nitrogen contribution, expressed in ton TN/year in the Nete River, Belgium, as shown in the paper by Bixio, Wintgen, Melin and others in Wollongong.