

THE PROMISE OF LIQUID GOLD

In Europe, urine-separating toilets are touted as a leading technology in environmental management, but should Australia and other countries follow suit?

Sweden is the urine-separation capital of the Western world – it is leading global research into using urine-generated phosphorus for sustainability projects such as soil fertilisation.

Recycling urine could be the answer to the looming worldwide shortage of phosphorous. In fact, urine is the most concentrated source of phosphorous (about 70%) and of nitrogen in blackwater (90%).

So it makes sense to harvest and use it for environmental projects.

The stigma attached to using human waste in a treatment process is what stands against progress, but studies being conducted in Sweden, Africa, the Netherlands and now Australia are paving the way for better understanding and greater accountability.

Technology that allows urine to be separated has been used in Sweden since the 1980s. The village of Tannum in the south-west requires all new homes to be plumbed with urine-separating toilets.

These toilets assume the guise of your average, everyday flusher, but they direct urine down a second set of pipes to a holding tank, which is emptied at regular intervals by farmers who use the urine as fertiliser.

Tests continue to be carried out in Sweden. Initial problems with urine-separating toilets included stoppages in the U-bend. The function of these toilets was studied in two questionnaires, one in 1997 covering 96 households and a follow-up in 1999 covering 73.

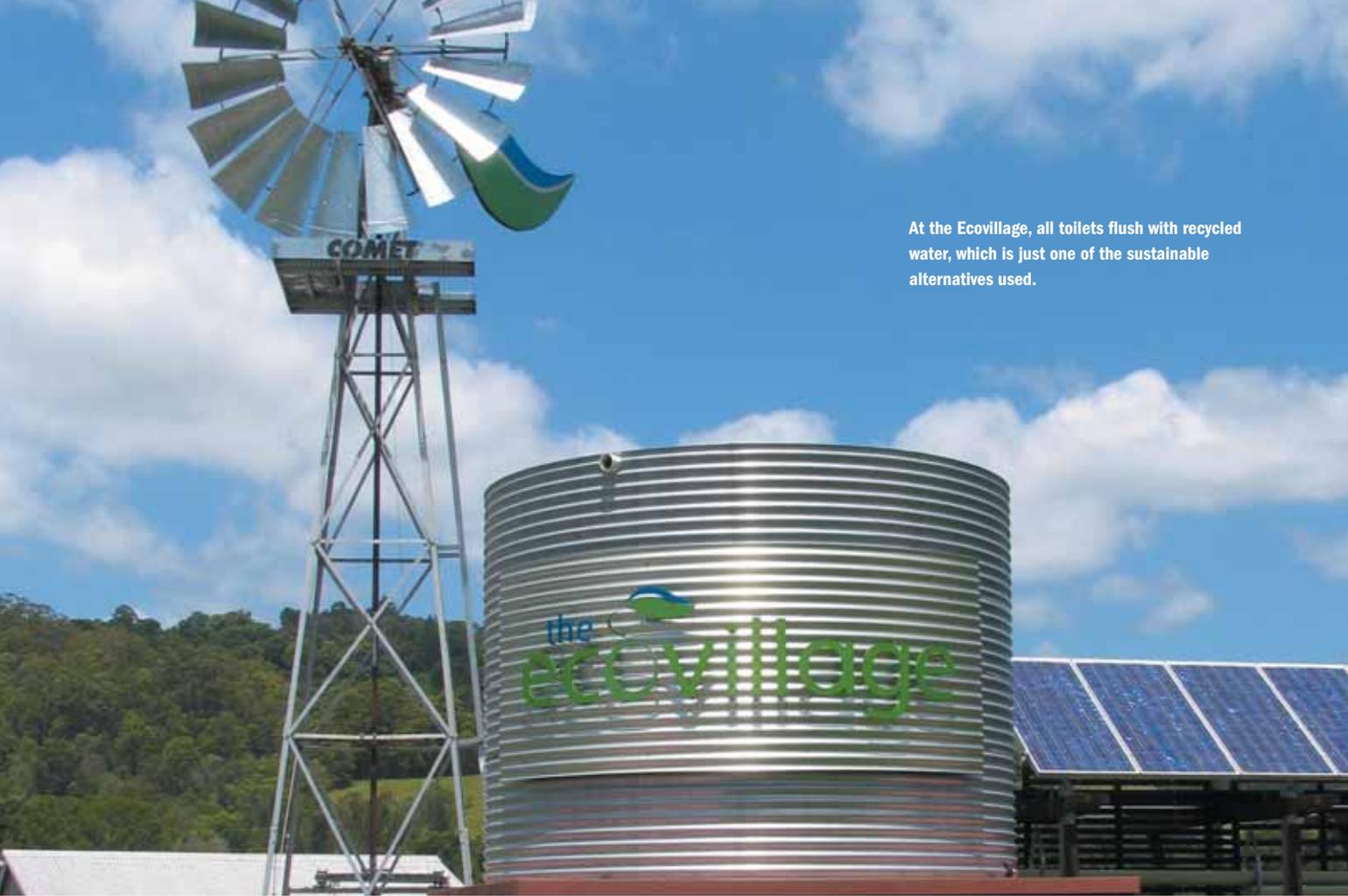
Stoppages in the U-bend were found to be a big problem, and users did not know how to clear them.

Studies found that 76% of stoppages largely consisted of precipitation – mainly calcium and magnesium ammonium phosphates – forming on hairs and fibres. These stoppages could be cleared easily with a mechanical snake or caustic soda.

The remaining 24% of stoppages consisted of pipe wall precipitation, which could also be cleared with caustic soda. The following recommendations were derived from the studies:

- Flow from the urine bowl should not be hindered by anything (hair, fibres, etc);
- A mechanical snake can be used to clear the urine U-bend;
- Men should be able to stand up to urinate, otherwise their participation will drop;
- The flush should use little water;
- The toilet should contain no corrodible metal in contact with the urine mixture.
- In terms of pipes, the following recommendations were made:
 - Installations must be watertight (pipes should be welded or similar);
 - Horizontal pipes should have a slope of at least 1% and a diameter greater than 7mm (preferably 110mm), because sludge continuously precipitates from the urine mixture;
 - The system should not be ventilated – if correctly constructed, the total ammonia emission stemming from collection,





At the Ecovillage, all toilets flush with recycled water, which is just one of the sustainable alternatives used.

transport and storage will be less than 1%;

- The tanks should be filled from the bottom and have the main hose close to the incoming pipe. (These recommendations are also being used for the Australian EcoVillage project to be discussed.)

Flash forward to 2005 and the studies continue unabated.

One project in Denmark demonstrates a potential for developing urine-separating toilets, and from an agricultural point of view the separated urine is comparable to liquid manure.

The project at Svanholm Gods, an organic farming collective, tested residents' urine for nutrients, pharmaceutical residue, and natural and artificial female sex hormones, to determine agricultural and environmental suitability.

Svanholm Gods is Denmark's largest producer of organic vegetables and has more than 100 residents.

Two urine-separating toilets were installed and urine was collected in a tank of 10,000L. The project aimed at determining whether the urine could be collected, stored and used in a way that allows its risk-free use in agriculture.

- The conclusions of this study were that:
- Urine-separating toilets can be used without any problems in a community that widely

- supports the environmental project;
- There is potential for developing urine-separating toilets with lower water consumption;
- From an agricultural standpoint, urine is comparable to liquid manure;
- There must be no cleaning agents or plastics that might release organic, xenobiotic substances into the urine.

The main point is that urine-separating toilets can work in communities that support the project; the technique is thought to be impractical for suburban households.

However, schools, office blocks and buildings, airports and shopping malls could consider it.

In Australia various types of waterless urinals have become fashionable, but studies into separating units are in their infancy.

One such study is being undertaken in Currumbin, Queensland, at a 144-lot development called The EcoVillage, which has a core philosophy of sustainable living.

The dwellings have high thermal efficiency, self-sufficiency in potable water from a rainwater tank and part sufficiency in energy from solar hot water and grid connected photovoltaics.

Sales and marketing manager Kerry Shepherd says Currumbin Valley was chosen

for its good rain catchment so that the community would be self-sufficient in water.

"It has lived up to its reputation – and our desires – by providing much rain," Kerry says.

A demonstration project by the Department of Natural Resources and Water (DNRW) is testing urine-separating toilets as a sustainable and achievable way of nutrient capture and water conservation.

Along with developers Landmatters Currumbin Valley and design engineers Bligh Tanner it has instigated two stages: demonstrating the practicality of the principle and the beneficial reuse of urine on private and common ground.

Ted Gardner of DNRW was the brains behind the project and had been sitting on the idea for five years until a series of fortuitous events gave the green light to the EcoVillage experiment.

Between Ted and project scientist Dr. Cara Beal, extensive negotiations were conducted with the developer, residents and Gold Coast City Council.

Of the 144 homes, 108 are on a localised sewerage and water reuse supply system. DNRW got agreement from 20 of them to try out the urine-separating toilets. Three are operational and five are ready to go. Urine from the households will be collected from the UST into





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1. Urine-separating toilets are a sustainable and achievable way of nutrient capture and water conservation.

2. Urine is collected from the UST and placed in 300 to 500L flexible polyethylene bladder tank.



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an individual 300 to 500L flexible polyethylene bladder tank using a combination of stainless steel pipe and plastic hosing. The bladder will be emptied monthly by a vacuum pump-out truck and transferred to a 23,000L polyethylene rainwater tank. During stage one, urine will be trucked offsite to a local sewage treatment plant. The previous outcomes of the Swedish study (mentioned above) will be considered in the design and collection of the urine.

“One toilet has been operating for four months and it has been trouble free,” Ted says. “There has been no odour, and we chose the models that allowed men to stand up.”

(Most early models meant men had to sit down to urinate.)

“In the Swedish trials it was found that non-watertight pipes emitted serious odours, so we negated the problem of odour.

“If there has been any problem, it is to do with economy of scale. It costs a lot of money for each polyethylene bladder to be pumped out by the tanker,” says Ted. “Polyethylene, of which the bladders are made because of a PVC free policy of the Ecovillage, is also rather costly.”

(There is the perennial discussion about the effect on drainage systems due to reduced flow, but this is being monitored in New South Wales by Sydney Water.)

Yet, if the benefits Ted speaks about come to pass, then the result will far outweigh the outlay.

Kerry says there have been no problems at Currumbin Valley and residents are happy with the progress.

“We are self-sufficient in water anyway, and all toilets flush with recycled water. When approached to help out with the urine-separating program, Ecovillagers saw it as another step towards sustainability.”

The most important objectives from a plumbing perspective are quantifying the water savings and nutrient recovery per person achieved by UST, and how urine separation and reuse can be an acceptable and sustainable alternative to wastewater treatment.

The results will form the basis for future trials of urine-separating toilets. When this current trial is over, DNRW will cover the cost for anyone who wants a standard toilet reinstated.

Ted says regular home use is still some time away. However as discussion and recognition of global warming and carbon footprints continues to grow, and the joke factor in using recycled urine for fertilising crops is overcome, Australia could catch Europe in this advanced form of thinking.

“Discussion about the next stage of sustainable cities is focused on transport and food,” Ted says.

“So if I was to prognosticate, Australia will see more of this type of technology and thinking in the next decade. And if we can manage the reticulation network and solve blockage problems, we could introduce this into the normal suburban homes.”

The main problem is the infrastructure.

“We have yet to demonstrate the reliability of the long pipe runs we would need,” says Ted.

However, considering the nutrients in urine

could grow sufficient wheat to produce one loaf of bread a day per person, infrastructure changes and challenges may well be worth considering. In the meantime the first intake of urine from the EcoVillage will make its way into the first of three 23kL tanks, where pathogen die off will be tested over a six month period. Then it’s off to the local paddocks to determine the farming benefits of fertilising with urine.

This is good news for the Ecovillagers, whose goal is to educate society on the benefits of sustainable living.

“Residents here in the Ecovillage are open-minded to new and innovative things,” Kerry says.

“They are contributing to the take-up of new technologies across the board. They are also using lots of tried and tested methods that have been left behind or forgotten for no real reason – ideas that should never have been lost.

“It seems that a crisis has to hit before change can be effected. Also, the marketing of an idea plays a large part in its acceptance by the wider society.”

There is much happening in urine-separating toilet research but it will be a while before the technology is available to the wider community. 🌐

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