



Judit Lienert, biologist
and Novaquatis project
manager

A Good Idea, but Surely No Takers!

Right? No, wrong! According to our studies of user attitudes in pilot projects involving public buildings and private households, and among farmers, many people approve of NoMix toilets and urine-based fertilizers. However, NoMix toilets have a number of weak points which would need to be remedied by the sanitary industry before large-scale implementation can be recommended.

The innovation “NoMix technology” is not being tested out of sight at wastewater treatment plants, but in private bathrooms. For this reason, people’s initial reaction to urine separation is often: “It’s a good idea, but nobody would want a NoMix toilet!” When it is explained that urine is recycled to produce fertilizers, they may object: “Farmers are opposed to the idea, and nobody would buy the vegetables.” Our aim was to find out precisely what the public thinks of NoMix toilets and urine-based fertilizers.

Are NoMix Toilets Accepted in Public Buildings? In Switzerland, NoMix toilets have already been installed in several public buildings. We therefore conducted a survey of 1249 users of these facilities at a vocational college and at Eawag. In both cases, acceptance levels were very high: 72% liked the idea of urine source separation, and 86% would move into an apartment fitted with a NoMix toilet [1]. For the majority of respondents, the NoMix system was equivalent to a conventional toilet with regard to design, hygiene and odour (Fig. 1). In most cases, behaviour

was adapted to the requirements of the NoMix toilet: 72% sat to urinate and 58% disposed of toilet paper in a separate bin. This resulted in a saving of 84 litres of water per 100 usages (as calculated in [1]).

Marked differences were, however, observed between user groups. For example, the hygiene and odour of NoMix toilets were rated as poorer than for conventional toilets by, respectively, 32% and 50% of Eawag staff, but only 17% of Eawag visitors. We suspect that the Eawag staff may have been influenced by unhappy memories: they recalled the unpleasant odours in the bathrooms associated with technical hitches involving the urine tank and maintenance of the waterfree urinals.

If acceptance and behavioural adaptations are to be promoted, clean toilets are an essential requirement. However, it was also

Fig. 1: Assessment of NoMix toilet design, hygiene and odour by 534 users at a vocational school and 715 people at Eawag [1].
Blue: NoMix better than a conventional toilet; yellow: both the same; orange: NoMix toilet inferior.

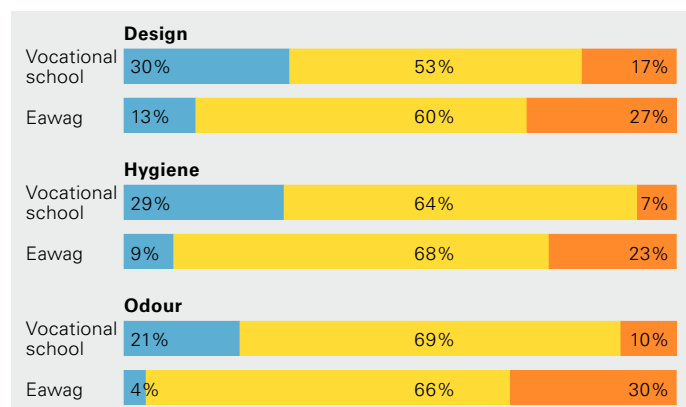
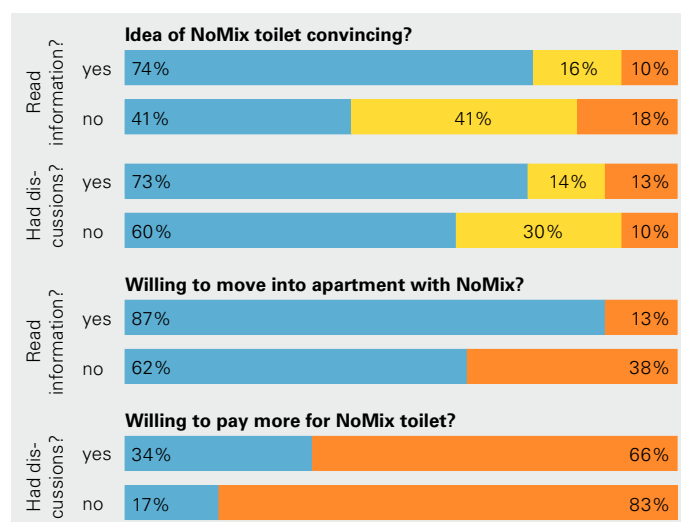


Fig. 2: Correlation between acceptance of the NoMix toilet and how well informed users are about the NoMix technology [1]. 480 respondents at a vocational school and at Eawag were asked whether they had read our information material and discussed the NoMix toilet with other people.
Blue: yes; yellow: don't know; orange: no.





Ruedi Keller, Zurich

"Are you satisfied with the NoMix toilet?" A survey of Eawag staff.

noted that acceptance, behaviour and perceptions can be influenced by sound communication and by discussions with other people (Fig. 2).

These findings are confirmed by a representative survey conducted on our behalf at the Basel-Landschaft Cantonal Library in Liestal, which involved 501 users (study not yet published). This building is fitted exclusively with NoMix toilets.

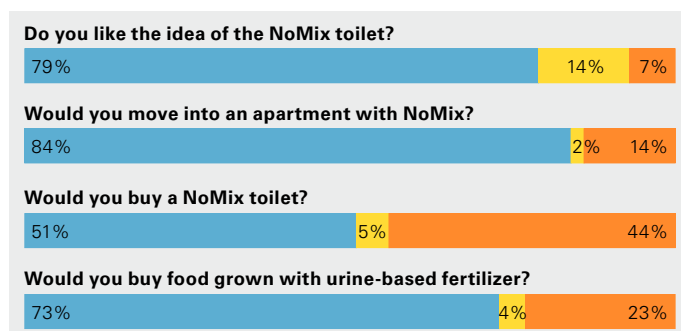
Would the Swiss Use NoMix Toilets at Home? Initial evidence suggesting that NoMix toilets would also be acceptable in private households under certain conditions was provided by a citizen focus group study involving 44 volunteers (Fig. 3) [2]. The participants had first familiarized themselves with the idea of urine source separation using an interactive computer tool [3] and visited a NoMix toilet at Eawag. One important point discussed was the increased need for maintenance arising from the fact that precipitation of the salts in urine leads to clogging of drainage pipes (cf. article by Kai Udert on p. 11) [4]. Most people would be deterred by this problem.

Research was taken a step further with the installation of NoMix toilets in four private apartments. The residents' reactions varied widely: while some were sceptical, others approved of the NoMix toilet on environmental grounds and found its use unproblematic. Several residents noted that increased cleaning efforts were required. Other objections raised were that some men would not sit down or that the sitting position was uncomfortable. Children in particular found it difficult to aim correctly, leading to a greater need for cleaning (this was also the case in public buildings). These findings would need to be supplemented by studies on a broader scale, but this is not possible in Switzerland due to the lack of large implementation projects involving private households.

What is the Situation in Other Countries? Across Europe, a number of NoMix pilot projects – some on a relatively large scale – have been carried out in private households. In Sweden, more than 135,000 urine-diverting toilets have been installed since 1990 – mostly very simple systems for remote holiday homes [5]; thousands of NoMix toilets have also been installed in eco-villages and municipal pilot projects. Pilot projects are increasingly being conducted in the Netherlands, Austria and Germany. Urine source separation is also an attractive option for fast-industrializing countries such as China (cf. article by Tove Larsen on p. 26).

In 2003, 88 apartments and a school in the Austrian city of Linz were fitted with NoMix toilets [6]. These were rated as less comfortable to use than conventional toilets by around 50% of the residents. Nonetheless, 69% of the men frequently or exclusively sat to use these toilets. Additional cleaning efforts were reported by about 65%, which also matches our own findings. Overall, a third of the respondents were very, a third moderately and a third

Fig. 3: Views of 44 focus group participants on the NoMix technology [2]. Blue: yes; yellow: don't know; orange: no.



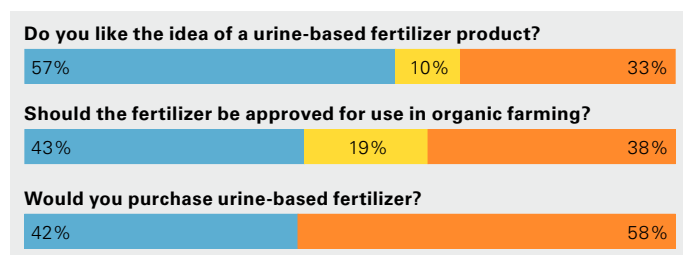


Fig. 4. Views of Swiss-German farmers on urine-based fertilizer [8]. Questionnaires were sent to 467 farms, and responses were received from 127. Blue: yes; yellow: don't know; orange: no.

not satisfied with the NoMix toilet. Half would change back to conventional toilets if they could.

As in Switzerland, project managers in Austria and Sweden [7] noted that levels of acceptance and motivation to use the NoMix toilet in a seated position were higher when people were well informed and appreciated the (environmental) benefits of the entire scheme.

Would Farmers and Consumers Accept Urine-based Fertilizers?

The idea of recycling urine to produce a fertilizer was surprisingly well received by farmers (Fig. 4), whose attitudes were studied via a mail survey [8]. The farmers attached the greatest importance to the absence of micropollutants: 30% of the respondents were concerned that the fertilizer could contain residues of pharmaceuticals and hormones.

Consumers' attitudes appear to be even more favourable, provided that health hazards can be ruled out. A majority of those surveyed in the focus groups (Fig. 3) and at the Cantonal Library in Liestal would be willing to purchase food grown with urine-based fertilizers. A majority of the 501 respondents at the Cantonal Library would also use a urine-based product on their own balcony or in the garden. However, just under a third of this group was opposed to urine-based fertilizers, mainly because they aroused disgust and might contain pharmaceuticals or pathogens.

Few comparable studies are available internationally. In Sweden, urine-based fertilizers were well accepted. Here, urine was stored for purposes of hygienization, but not treated. In most cases, a farmer was prepared to spread the urine, or it was used by residents in their own garden. The odour was rarely found to be troublesome during application of the fertilizer, and hardly any concerns were expressed about consuming urine-fertilized vegetables [7].

Next Steps. We now know that the public has very positive attitudes towards the NoMix technology. However, NoMix toilets have certain drawbacks which may be problematic in everyday use. The introduction of NoMix toilets in private households is therefore a delicate enterprise, which has to be managed extremely carefully. Household users need to be aware of possible drawbacks from the outset and should give an undertaking that they will accept these [4]. Direct contact with the residents

is very important, to ensure that problems can be addressed immediately. The installation of NoMix toilets in public buildings is less problematic – if cleaning and maintenance are carried out by internal staff.

The dilemma we now face is that further development of the NoMix technology requires large-scale pilot projects, but NoMix toilets are not yet fully comparable to conventional toilets. Widespread introduction of an immature technology can lead to a backlash, destroying its prospects altogether. If the technology is to be advanced, the sanitary sector would need to improve the NoMix toilets. But large companies are reluctant to make major investments in the absence of a potential market. Accordingly, wastewater professionals, as well as authorities, developers and policymakers, need to demonstrate to the sanitary industry that genuine interest exists in this technology [9]. Since the public is willing to contribute to the development of this innovation, we take the view that – even with today's imperfect NoMix toilets – the process of implementation can be launched, provided that such pilot projects are carefully supervised. ○ ○ ○

- [1] Lienert J., Larsen T.A. (2006): Considering user attitude in early development of environmentally-friendly technology: A case study of NoMix toilets. *Environmental Science & Technology* 40, 4838–4844.
- [2] Pahl-Wostl C., Schönborn A., Willi N., Muncke J., Larsen T.A. (2003): Investigating consumer attitudes towards the new technology of urine separation. *Water Science and Technology* 48 (1), 57–65.
- [3] www.novaquatis.eawag.ch/deutsch/lernspiel_de.html
- [4] Lienert J., Larsen T.A. (submitted): Pilot projects in bathrooms: a new challenge for wastewater professionals.
- [5] Kvarnström E., Emilsson K., Richert Stintzing A., Johansson M., Jönsson H., af Petersens E., Schöning C., Christensen J., Hellström D., Qvarnström L., Ridderstolpe P., Drangert J.-O. (2006): Urine diversion: one step towards sustainable sanitation. *EcoSanRes Publications Series Report 2006-1*. www.ecosanres.org/news-publications.htm
- [6] Starkl M., Binner E., Fühacker M., Holubar P., Koeck S., Lenz K., Mascher F., Ornetzeder M., Pollak M., Haberl R. (2005): Nachhaltige Strategien der Abwasserentsorgung im ländlichen Raum – SUS-SAN. Endbericht Forschungsprojekt des Bundesministeriums für Land- und Forstwirtschaft, Wien, www.wassernet.at/article/archive/5688/
- [7] Johansson M., Jönsson H., Höglund C., Richert Stintzing A., Rodhe L. (2001): Urine separation – closing the nutrient cycle. Final report on the R&D project: Source-separated human urine – a future source of fertilizer for agriculture in the Stockholm region? VERNIA Ecology & Stockholm Water Company, Stockholm.
- [8] Lienert J., Haller M., Berner A., Stauffacher M., Larsen T.A. (2003): How farmers in Switzerland perceive fertilizers from recycled anthropogenic nutrients (urine). *Water Science and Technology* 48 (1), 47–56.
- [9] Larsen T.A., Lienert J. (2003): Societal implications of re-engineering the toilet. *Water Intelligence Online* March 2003. www.iwaponline.com/wio/2003/03/default001.htm