

# Switzerland - Current status and outlook for the world-wide first national implementation of mineral phosphorus recovery

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## Summary

The current Swiss infrastructure and the technical and institutional developments related to the implementation of phosphorus recovery in 2026 are presented. A material flow analysis scenario based on these data indicates that Switzerland will become net exporter of Fertilizer and phosphoric acid and reduce landfilled P by 70%.

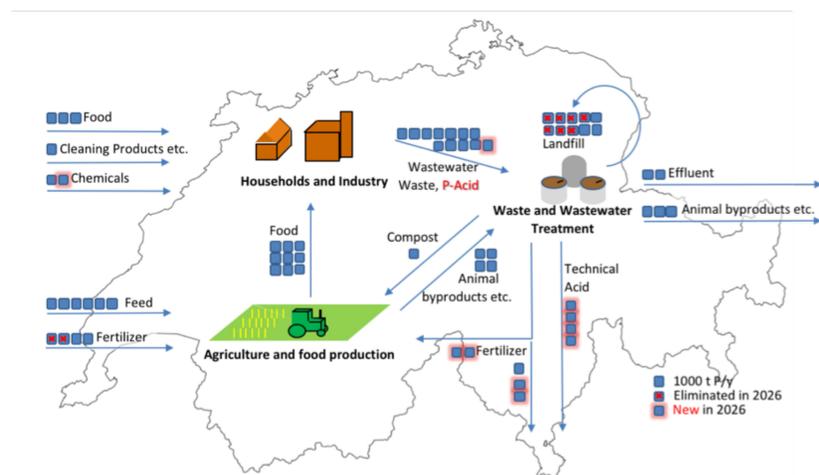


Figure 1: Current Swiss P-Flows and projection for implementation until 2026. Current state adapted from Mehr, Jedelhauser & Binder (2018).

## Background

In 2016, Switzerland was the first country in the world to introduce the obligation to recycle phosphorus from sewage sludge (potential 6'000 t P/y; see Figure 1) and meat and bone meal (potential 1'200 t P/y). Within a transitional period of 10 years the phosphorus should be recycled. A prediction of the results of the implementation based on these developments will be made and consequences will be discussed.

Today sewage sludge is mainly mono-incinerated (3'800 t P/y; Figure 2), but also co-incinerated in municipal solid waste incineration plants (800 t P/y) or dried and subsequently incinerated in cement works (1'400 t P/y). Slaughterhouse waste is mostly exported, but about 1'200 t P/y, including the category 1 material, is processed to meat and bone meal, dried and incinerated in cement works. The MSWI co-incineration is gradually being replaced by mono-incineration and mono-incineration of the meat and bone meal is planned. This disposal transition will thus gradually increase the fraction of phosphorus in form of mono-incineration ash suitable for recovery.

### Swiss phosphorus network

The Swiss phosphorus network ([www.pxch.ch](http://www.pxch.ch)) started by organizing the European nutrient event in Basel in 2017. The network supports the implementation of phosphorus recovery in Switzerland's different language regions. It provides neutral and publicly available information for all concerned parties in collaboration with associations and authorities. It also brokers contacts within Switzerland and with the rest of Europe.

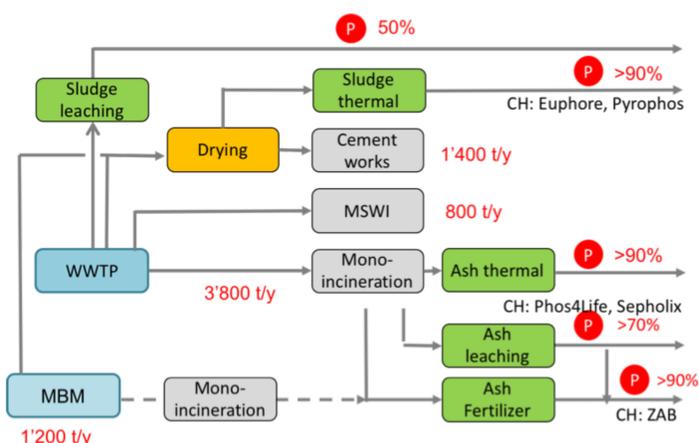


Figure 2: Volumes of current Swiss disposal routes (Source: Swiss Federation of Waste Disposal Providers, VBSA). Possible phosphorus recovery routes with yields and Swiss demonstration projects indicated.

## Demonstrating and evaluating recovery technologies for Switzerland

As shown in Figure 2 there are five types of processes that can be used to recover the Swiss phosphorus. For each group there are two to five European processes/ companies that have reached at least pilot stage. Five main demonstration projects are pursued in Switzerland (Table 1), and others are pursued by ARA Berne and HES-SO.

Last autumn the Canton Zurich initiated information exchange to elaborate a basis for the decision making regarding the P-recovery implementation. Plant operators responsible for the treatment of over 60% of the Swiss sewage sludge took part in this platform responsible for the "Process Technology Market Analysis" (VTMA). The five Swiss demonstration projects as well as Ecophos and Extraphos were evaluated through questionnaires and a hearing. The final report (L. Morf, 2018) is available for download on [www.pxch.ch](http://www.pxch.ch).

The VTMA study concluded there is not yet enough available information for choosing appropriate technologies today. The stakeholder groups are very dynamic and plan to develop the different processes further for a new VTMA in 2020. Among the key requirements identified by VTMA were coordination of disposal capacity and clarification of the financing of the phosphorus recovery. The Federal office for the Environment (FOEN) was asked to define technology requirements (e.g. yield) and on what terms P-recovery abroad is allowed.

Cost of disposal is about 80 EUR/t of dewatered sludge today and this will increase by between 0 EUR/t to 45 EUR/t according to the last estimations (Sources: VTMA, Pyrophos, P-REX).

Table 1: Swiss Recovery technology demonstration projects. See also [www.pxch.ch](http://www.pxch.ch).

Name (contact)	Process	Product	Characteristics
Euphore (ERZO)	Thermal treatment of sludge in kiln respectively fluidized bed	Ash as fertilizer raw material.	Low cost, but must fulfil Swiss fertilizer regulation
Pyrophos (CTU)	Ash leaching followed by purification by liquid- liquid extraction	Technical grade phosphoric acid	90% of P, Fe and inerts recovered
Phos4Life (AWEL, Zürich)	Ash leaching followed by precipitation with calcium hydroxide	Calciumphosphate for fertilizer	Will use onsite precipitation capacity. Leaching still in lab
Sepholix (CIMO)	Co-incineration of sewage sludge and MBM, acidulation and granulation of ash to fertilizer	Triplesuperphosphate or NPK fertilizer	Finished fertilizer for Swiss partners or export

## Scenario of phosphorus flows

Based on the current infrastructure, the development of the projects and the discussions during the VTMA we estimate a possible implementation scenario (Figure 1):

- The co-incineration in MSWI would mostly be replaced by mono-incineration.
- The dried sludge incinerated in cement works would previously be leached to fulfil the recycling obligation. Part of the current volume would instead be thermally processed, perhaps with Euphore/Pyrophos.
- A large leaching plant will process most of the mono-incineration ash. A smaller leaching plant will be built at the CIMO site.
- ZAB would become the largest fertilizer producer of Switzerland, processing about 2000 t P/y. The remaining MBM would also be processed to fertilizer.

The products will fall into three categories:

- Fertilizer for the domestic market (2'000 t P/y)
- Fertilizer/fertilizer raw materials for export (2'000 t P/y)
- Technical grade phosphoric acid for export (4'000 t P/y)

Thus, Switzerland would become a net exporter of fertilizers. The amount of landfilled phosphorus would be reduced drastically (by about 70%).

## Conclusions and Outlook

Switzerland has eight years before the implementation deadline loosely formed stakeholder groups with technically viable demonstration projects that can likely be implemented to fulfil the obligation on time.

The effect of the transition on Swiss disposal in cement works is yet unclear and will depend on the success of compatible recovery technologies and requirements from the FOEN.

The recovery will massively diminish the phosphorus lost to landfill and cement, which will instead likely be mainly exported as fertilizer and phosphoric acid. This development will depend on decisions of federal authorities, e.g. on the recycling fertilizer limits (FOAG) and conditions for export of sewage sludge ash for recovery (FOEN).

### Mineral Recycling Fertilizer Category

In 2017 the Swiss Federal Office of Agriculture (FOAG) defined a new fertilizer category for mineral recycled fertilizers. These have a higher nutrient content than current recycling fertilizers such as compost and therefore the allowed pollutant limits per amount of dry matter is higher. The category will thus facilitate the recycling of phosphorus into agriculture. However, due to the ALARA approach used, the limits are considerably lower than in the upcoming European fertilizer regulation and might complicate international trade in recovered phosphorus. The limits are due for publication end of 2018 ([www.pxch.ch](http://www.pxch.ch)).