STIFTUNG ZENTRUM FÜR NACHHALTIGE ABFALL- UND RESSOURCENNUTZUNG

Activity Report/Annual Report 2022

◄ Phosphorus recovery plant - plant concept

Content

Foreword by the President

Transparent reporting of environmental performance and impact

Expectations are rightly quite high for all those who take on the treatment of waste. Those who promote the fact that their activities treat waste in such a way that as many substances as possible from the waste can be returned to the cycle as recyclable materials assume a great responsibility. On the one hand towards the environment and on the other hand towards those who finance the treatment of the waste with upstream or downstream fees. Anyone who treats waste on behalf of third parties should transparently report their performance in terms of the environmental impact achieved and the associated financial expenditure.

In fact, reporting on both the environmental performance achieved and the costs should be publicly available for this purpose, without the Swiss Federal Audit Office first having to do its own research and then discovering that individual waste management facilities lack transparency with regard to the quality of material and thermal recycling. This jeopardizes trust in the industry. In addition, this makes it impossible to assess the efficiency of the resources made available for recycling and the development of the situation in Switzerland.

If you want to continuously improve your operations, you need to know what results you are achieving with your treatment processes - and where there is still room for improvement.

When it was founded in 2010, the ZAR Foundation set itself the goal of developing practical solutions so that valuable materials and energy from waste that cannot be directly recycled can be returned to the economic cycle, and so that non-recyclable (harmful) substances can be deposited in safe repositories.

Although our focus is on the development, rather than the construction and operation of facilities, it is in our interest to make the environmental performance achieved in waste treatment transparent. We now work in three competence centers on the development of processes to achieve the goals we have set ourselves. For us, it is important to be close to the facilities so that we are well acquainted with the challenges of practice, and to have contact with partners both nationally and internationally.

At the ZAR competence center at KEZO in Hinwil/ZH, we have been working on the recovery of recyclable metallic and now also mineral components from the residues of thermal waste treatment since our foundation. The publication «Industrial bottom ash processing - status and goals as of January 2020» [ZAR series #001 (zar-ch.ch)] contains a set of 13 parameters, each with actual and target values. Provided that the sampling and preparation methods (analysis methods) published by the ZAR Foundation are used, the efficiency and effectiveness of metal recovery from municipal solid waste incineration (MSWI) bottom ash can be compared and evaluated.

For many decades, sewage sludge has been used as a phosphorus fertilizer in agriculture. For years, we have known that sewage sludge is the receipt for all our societal activities. Due to the contamination with organic and inorganic pollutants, sewage sludge, which still contains valuable phosphorus, may no longer be returned to our soils as a fertilizer. After thermal treatment of sewage sludge, the phosphorus is again available to us as a resource in the form of sewage sludge ash. Because we import large quantities of animal feed in Switzerland, as well as food, more phosphorus is generated in sewage sludge, animal and bone meal than we import annually in the form of fertilizers or phosphoric acid products.

Regarding phosphorus, Switzerland›s «deposit» for self-sufficiency is in our waste.

As there are no successfully implemented and established methods for producing technically pure phosphoric acid from sewage sludge ash on the market, the ZAR competence center at KEBAG in Zuchwil/SO, together with the Spanish general contractor Técnicas Reunidas A (TR), has

developed and successfully piloted the Phos4life® process. These works were jointly financed by the Canton of Zurich and TR. Eight large sewage sludge holders from Zurich to Geneva subsequently commissioned the ZAR Foundation to investigate whether a plant for the production of phosphoric acid using the Phos4life® process can be deemed feasible at the Emmenspitz site in Zuchwil (SO).

In designing new recycling processes, it is very important to think through the entire process to the marketable product: who will demand the product, what quality must it demonstrate, etc. With the Phos4life® process, phosphoric acid is obtained from sewage sludge ash, which, as technically pure phosphoric acid, can be used in both industry and fertilizer production for high-quality products.

The energy released during thermal waste treatment contributes significantly to electricity and heat supply in Switzerland. In addition to exposing metallic raw materials in the solid combustion residues, CO_2 is also produced during thermal waste treatment, an invisible gaseous waste. Although the CO_2 emissions from thermal waste treatment, in the range of about 5% of the domestically emitted CO_2 freight, are far below the shares from transport or heating, this issue must be addressed in a targeted manner. Only waste that does not arise leads to no CO_2 emissions. Because possible visions and reality in this area will unfortunately continue to diverge in the future, we must address this issue.

In March 2022, we opened the third ZAR competence center at the KVA Linth in Niederurnen/GL to address the CO_2 issue. In collaboration with the Association of Swiss Waste Incineration Plant Operators (VBSA) and with the support of the Federal Office for the Environment (FOEN) and other partners, we want to demonstrate concretely how CO_2 can be separated from the exhaust gas stream of a thermal waste treatment plant using technical processes so that this CO_2 can be reused as a valuable resource - or bound and deposited in safe sinks according to our goals.

Franz Adam

President of the Board of Trustees

Technical Developments

KEZO Hinwil (ZH)

COMPETENCE CENTER DRY BOTTOM ASH PROCESSING

Optimization of the separation of non-ferrous metals and improvement of the melt yield of the aluminum fraction

Since its foundation in 2010, the ZAR Foundation has focused on the quality of the resulting products and thus on the return of these products to the material cycle in all its developments. Only products that can be directly returned to the material cycle provide an ecological and therefore also an economic added value. This quality standard is evident in the recovery of pure zinc from filter ash, the recovery of pure phosphoric acid from sewage sludge ash, and also in the recovery of non-ferrous metals (NFM) from bottom ash.

Challenging trade-off effect

In the separation of non-ferrous metals (NFM) from bottom ash using an NFM separator (induction separator, eddy current separator), the demands for pure metals and the highest efficiency of NFM separation mutually hinder each other, i.e. if one wants to separate NFM that are as pure as possible, this is at the expense of NFM separation efficiency, and vice versa.

However, the purity of NFM and the efficiency of NFM separation have already been significantly improved in dry discharged bottom ash. This is due to the fact that the NFM are not surrounded by a mineral non-conductive layer in the bottom ash water. This mineral layer reduces the separation force on the NFM.

The NFM fraction contains metals such as aluminum, copper, lead, zinc, tin, gold, silver, palladium, etc., which all react very differently to the induction field of the NFM separator. In simplified terms, it can be said that induction separation depends on both the electrical conductivity and the density of the respective NFM, and the separation force correlates with the product (multiplication) of the electrical conductivity with the density of the NFM. Since aluminum has a density that is seven times smaller than gold and the electrical conductivity of gold is only 20% higher than that of aluminum, significantly higher forces act on aluminum than on a gold or copper particle. This makes aluminum much easier to separate than the other noble metals. If one wants to separate the noble metals or at least part of them with the NFM separator, the NFM separator must be set very «sharp», which in turn leads to the separation of bottom ash along with the NFM.

The ZAV Recycling AG sets the NFM separator for the fraction below 15 mm in such a way that the content of bottom ash in the NFM is about 10-15%. With the subsequent density separation on the separation tables, the bottom ash is assigned to the aluminum fraction, since the density of aluminum and bottom ash is almost identical. This yields very clean non-ferrous noble metals (heavy NFM), but enriches the aluminum fraction with bottom ash, resulting in a bottom ash content of up to 20% in the aluminum and correspondingly reduces the aluminum yield in the smelting process.

Therefore, when setting the NFM separators, one must always decide whether a clean aluminum with a minimal bottom ash content is required or a maximum yield of noble NFM. The setting always remains a compromise, to the detriment of the quality of the aluminum fraction, due to the yields.

An aluminum fraction with an increased content of bottom ash leads to a higher specific energy consumption, higher logistics effort for aluminum production, and reduced melting capacity of the aluminum plant. If the bottom ash content in aluminum exceeds a certain value, direct processing for the aluminum smelter is no longer economically viable.

Post-cleaning as a solution

To counteract this trade-off effect, i.e. to further increase the yield of heavy non-ferrous metals from the bottom ash and to reduce the bottom ash content in the aluminum fraction, the solution of post-cleaning the aluminum fraction with a non-ferrous metal separator is necessary. The

fact that the proportion of non-ferrous metals in the bottom ash (< 15 mm) is less than 5% means that only a small mass flow with correspondingly small non-ferrous metal separators needs to be post-cleaned.

The following results were achieved with post-cleaning experiments of the aluminum fractions 1-4.5 mm, 4.5-8 mm, and 8-15 mm with the laboratory non-ferrous metal separator:

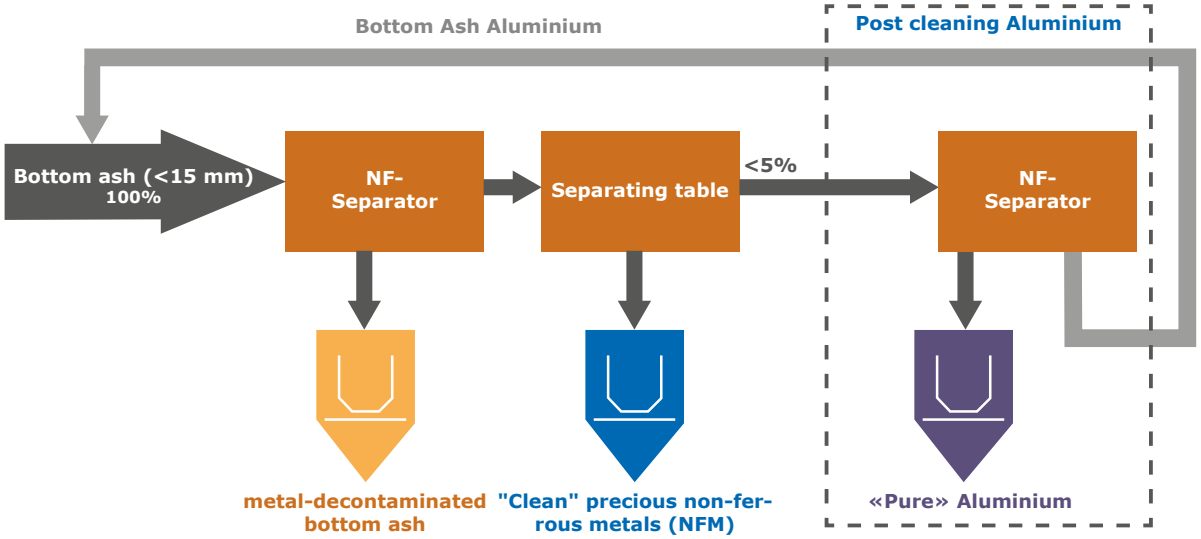
- Bottom ash content in the cleaned aluminum fraction: < 5%
- Aluminum content in the bottom ash fraction: 20-30%

The experimental results were surprising in that it was not possible to further reduce the aluminum content in the post-treated bottom ash. When the adjustment of the non-ferrous metal separator was optimized with the aim of reducing the aluminum content in the bottom ash, the bottom ash content in the aluminum fraction increased again to over 5%.

In order to maintain the quality of the aluminum fraction at a high level and not to lose the proportion of aluminum in the post-treated bottom ash, it is essential to return the post-treated bottom ash to the prepared bottom ash stream smaller than 15 mm.

Since the mass flow of the return will be < 5%, there will also be no major capacity loss of the plant.

▼ Concept for the cleaning of aluminum in bottom ash




SYSTEME
hasler

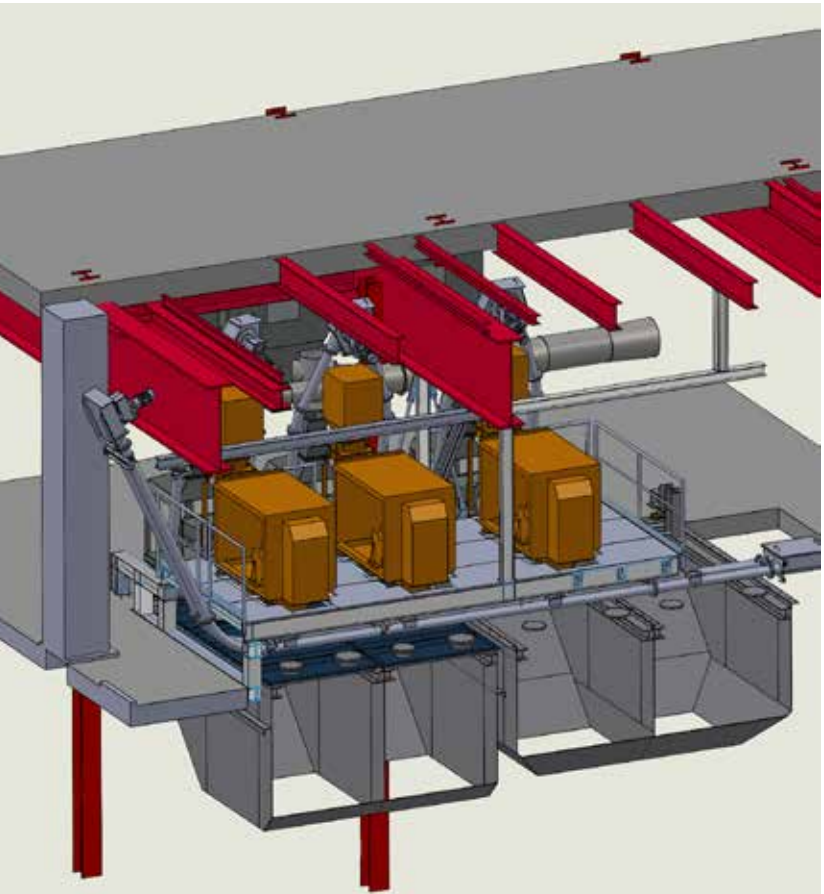
Concept and layout of the post-cleaning

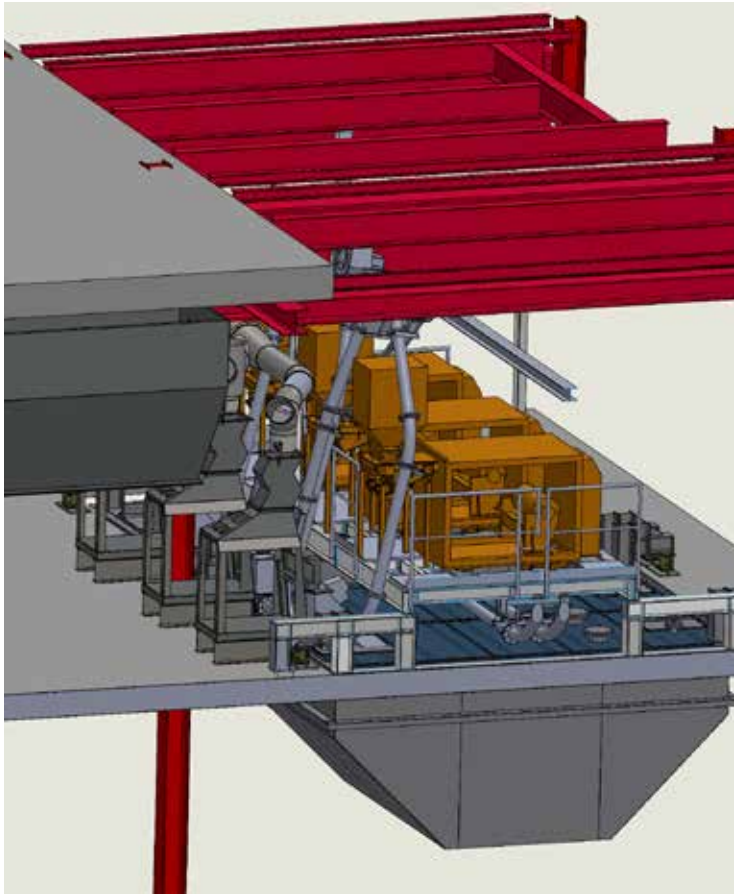
A simple integration into the existing plant of ZAV Recycling AG was found for the cleaning of the aluminum fractions 1-15 mm. The light fraction after the sorting tables is transported into the small NE separators› silos using small tube chain conveyors. The cleaned aluminum fraction falls freely into the existing aluminum silos, and the re-cleaned bottom ash with the remaining aluminum is returned to the processing plant. The plant is expected to be operational in the second half of 2023.

We expect the following results from this plant expansion:

- The quality of the aluminum fractions can be improved by increasing the melt yield by at least 15%. This will increase demand for these aluminum products.
- Thanks to the re-cleaning of the aluminum fraction, the first NE separator of the fractions 1-15 mm can be set much sharper, resulting in even more precious NEM being separated. The associated increase in the bottom ash content from 10-15% to over 25% does not have a negative effect due to the now possible re-cleaning.
- We estimate that this will reduce the residual metal content (according to the ZAR method) in the processed bottom ash from 0.5% to 0.25%. By reducing the residual NEM content in the processed bottom ash by 50%, the heavy metal load on the landfill is reduced, increasing the environmental benefit. By returning additional metals to the metal cycle, we expect to save about 50 kg CO2eq per ton of bottom ash.

▼ Aluminium post-treatment - Layout





Determining the NFM content in the raw bottom ash in the Canton of Zurich

The experiments and evaluations of the project for determining the NEM content in the raw bottom ash, under the leadership of Engineer Stefan Skutan, are being monitored by AWEL and the Zurich Waste Recycling AG. The work has not yet been completed during the reporting period. The final report is expected to be completed in the second half of 2023.

New concept for the new processing line 15-30 mm

As mentioned in the 2021 annual report, a new second processing line for the bottom ash fraction 15-30 mm must be built in connection with the capacity increase of the ZAV Recycling AG processing plant from today›s 100,000 t to 200,000 t of dry bottom ash per year. The commissioning was planned for the second half of 2022. However, due to delivery delays of plant components, the line can only be put into operation in the first half of 2023. We regret this very much, as this means that first experience values for the applied new concepts will only be available at the end of 2023.

Bottom ash utilization - first steps

IIn the reporting year 2022, the three Swiss cement manufacturers were provided with initial, processed material samples of bottom ash with corresponding declarations for various possible uses.

The aim is to further develop these material samples together with the user so that they can be used as raw materials. Optimization measures and framework conditions for a product for use in the cement plant were defined with one cement manufacturer. The ZAR foundation is now trying to implement these measures accordingly, so that initial large-scale experiments with the modified product can take place in the cement plant.

Carbonation of bottom ash

In the experiments carried out by ETH Zurich and neustark ag, Bern, on carbonation of bottom ash, it was once again found that the bottom ash product is very heterogeneous. The test procedure for determining the CO_2 storage potential, derived from experience with recycled concrete, quickly reached its limits as it could not be demonstrated with sufficient reproducibility. We expect the work to be completed this year and reliable information can be provided on the following questions:

- What is the CO_2 storage potential in the four bottom ash fractions of ZAV Recycling AG?
- What is the influence of carbonation on the leachate values of the bottom ash fractions?
- What are the differences between natural and forced carbonation?

Based on this information, the further procedure will be defined.

Team KEZO/ZAR, Hinwil

Daniel Böni
Managing Director
Fabian Di Lorenzo
Project Manager for Metallic Raw Materials
René Weber
Engineering
Peter Schellenberg
Process Optimization

KEBAG, Zuchwil (SO)

HYDROMETALLURGY COMPETENCE CENTER

SwissZinc

The technical foundations were developed in the past year. However, there are still open questions to be clarified on the legal and organizational level, so the decision to build a SwissZinc plant at the Emmenspitz site in Zuchwil is expected to be made in the course of 2023.

Phosphorus Recovery

The feasibility of the Phos4life® process for treating 40,000 t/a of sewage sludge ash (SSA) was evaluated at the Emmenspitz site (Zuchwil, SO) and deemed feasible. There, the operation of KEBAG provides renewable energy in the form of steam and electricity as well as good transport links by road and rail. In addition, the KEBAG team already has years of experience with a plant based on the same technology (FLUREC process), which can be leveraged for the future Phos4life® operation. The required space and logistics areas could be provided in an appropriate manner, allowing for the construction of a Phos4life® plant starting in 2027. However, prior to this, the dismantling of existing buildings on the site that will no longer be needed after the new KEBAG Enova waste-to-energy plant is commissioned or can be relocated to another location must be completed. This means that a phosphorus recovery plant at Emmenspitz can only begin operating from 2030 onwards, and therefore the current legal deadline for implementing phosphorus recovery by January 1, 2026 would not be met.

The necessary operating resources as well as the resulting products and residues can be delivered and removed in an appropriate manner. Overall, Phos4life® will move about 175,000 t/a of goods, more than half of which will be transported by rail, making it a climate-friendly mode of transport. The preliminary environmental impact assessment by the Canton of Solothurn was successfully completed, all relevant environmental regulations were complied with, and environmental and safety risks were minimized as much as possible through suitable technical measures.

The technically pure phosphoric acid obtained can be sold through two independent channels. On the one hand, due to its high purity, P4L acid can be used directly in the chemical and technical industry both domestically and internationally. On the other hand, the domestic production of a high-quality phosphorus fertilizer, known as triple superphosphate, from P4L acid and animal/bone ash is an additional option. This enables the production of a high-quality phosphorus mineral fertilizer that offers significant ecological advantages over conventional mineral fertilizers, especially lower uranium and heavy metal contents.

To further develop the project, a sponsoring organization is needed to address further project planning, questions about organizational form and operating models, and participation in higher-level strategic planning at the national level. These steps are to be initiated in 2023 and developed jointly with the continuing interested project partners, so that this forward-looking «flagship project» can be successfully implemented in line with the circular economy.

FLUWA platform/ activities «filter ash»

The exchange of experiences within the «FLUWA platform» was successfully continued at three events in 2022. Measures to optimize existing systems were discussed and have already been successfully implemented in the routine operation of some plants. Further optimizations are planned and will be carried out promptly.

For the city of Vienna with its five waste incineration plants, a joint study with the Technical University of Vienna was conducted to investigate the feasibility of a central filter ash treatment plant. The technical feasibility was successfully demonstrated. The city of Vienna is currently conducting a more detailed examination of the concept before a definitive implementation is decided.

Team KEBAG/ZAR, Zuchwil

Dr. Stefan Schlumberger
Head of Hydrometallurgy Competence Center

Dr. Andreas Bernhard
Development Engineer

Fine Gozdzik
Chemistry Lab Technician

▼ Phosphorus Recovery Plant - Plant Concept

KVA Linth, Niederurnen (GL)

CO_2 COMPETENCE CENTER

The goal of the ZAR CO_2 Competence Center is to create nationwide usable know-how for the separation, transport, and utilization (CCU) or storage of CO_2 (CCS) in Swiss waste-to-energy plants. In addition, a pioneering project will be developed at the KVA Linth in Niederurnen GL.

The opening event for the new competence center, located at the KVA Linth, was held on March 28, 2022. Daniel Marxer started his work as a project engineer for the competence center in July 2022. In the second half of the year, the organization was completed, and the team for the competence center was defined, with roles distributed.

Financing has been secured for the period 2022-2025 (see page 18, project contributions). An advisory group for the CO_2 competence center was convened, and its first meeting held. It will have a steering role and provide support in planning upcoming activities during periodic consultations. It will also contribute to risk assessment through workshops. The following members were recruited for the advisory group:

BAFU

Sophie Wenger, Climate Policy Section

BFE

Dr. Valentin Gischig,
Energy Research and Cleantech

VBSA

Peter Steiner, Vice President

Dr. Robin Quartier, Managing Director

Stéphane Zermatten, Board Member

ETH Zürich

Prof. Dr. Marco Mazzotti,
Dep. of Mechanical and Process Engineering

KVA

Urs Brunner,
Chairman of the Executive Board, VfA Buchs (SG)
Daniel Baillifard,
Directeur général, Satom (Monthey)

Hansjörg Ittig
Plant Manager,ACR (Giubiasco)

ZAR

Walter Furgler, Managing Director KVA Linth, Head of Competence Center

Dr. Leo Morf, Head ZAR Technical Advisory Board

Daniel Böni, Managing Director KEZO / ZAR

The work packages for the period of 2022-2025 were refined and coordinated with the advisory group. The existing international network from the previous years› work of KVA Linth with involved parties such as suppliers, authorities, universities, and testing centers was further expanded. In 2022, trips were taken to Canada and Norway, and a conference was attended in Bremen.

The competence center is well integrated into national activities through BAFU. Already, a seat was taken in the national working group for CO_2 capture and storage, and participation was made in a stakeholder event between Norway and Switzerland in Oslo under the leadership of BAFU.

The engineering of the plant at the KVA Linth site was organized, and work is set to begin in early 2023.

First subprojects were organized for process monitoring.

- UniSieve, a company based in Zurich, is developing a membrane technology for CO_2 capture and will test it with a pilot plant on real KVA exhaust gas at KVA Linth starting in mid-2023. Membrane processes potentially offer advantages, such as a low space requirement, but are not yet commercially ready for the present purpose due to technological maturity.
- A feasibility study is being conducted for another capture process, the Hot Potassium Carbonate (HPC) process. Discussions are ongoing to build a pilot plant at KEZO using this technology if the feasibility study is promising. The HPC process mainly requires electricity as energy input and little or no heat. It offers advantages, especially due to the use of less hazardous chemicals, but has not yet been commercially used for combustion exhaust gases.

- A project to implement CO_2 capture from the entire flue gas stream using amine scrubbing is underway in Horgen (Entsorgung Zimmerberg). This project is also accompanied by the competence center. The amine scrubbing currently is the most established process and is already in commercial operation at a waste incineration plant in Holland.

To expand the expertise, the competence center organized a training course at the Technology Center in Mongstad (TCM). The TCM in Norway has more than ten years of operating experience with amine scrubbing. Training packages have been organized so far for the analysis of pollutants after amine scrubbing and for assessing the composition of KVA exhaust gas.

In the field of heat integration, we joined the project «Process Integrated Carbon Capture (PICC)» of the Lucerne University of Applied Sciences and Arts, which is funded by the Federal Office of Energy. In the project, pinch analyses are used to optimize the heat integration for KVA Linth, the wood-fired power plant of Energie Ausserschwyz AG in Galgenen, and the sewage sludge incineration plant in Werdhölzli. Based on the results, the impact of large-scale CO_2 capture implementation on the Swiss energy system will be modeled at ETH Zurich.

Initial discussions on the use of CO_2 were held for collaboration with Prof. Markus Friedl from OST University of Applied Sciences in Rapperswil at the Institute for Energy Technology. His group is intensively involved in Power-to-X applications.

Work Packages	Q3 22	Q4 22	Q1 23	Q2 23	Q3 23	Q4 23	Q1 24	Q2 24	Q3 24	Q4 24	Q1 25	Q2 25	Q3 25	Q4 25
AP1: Establishment of the CO_2 Competence Center ZAR	■	■	■											
AP2.1: Risk analyses				■	■	■	■	■	■	■				
AP2.2: Environmental risks & environmental monitoring			■	■	■	■	■	■	■					
AP2.3: Process Monitoring	■	■	■	■	■	■	■	■	■	■	■	■	■	■
AP3: Optimzation AGR				■	■	■	■	■						
AP4.1: Heat Integration		■	■	■	■	■	■	■	■					
AP4.2: Utilization						■	■	■	■	■	■	■	■	
AP4.3: Storage			■	■	■	■	■	■	■	■	■	■	■	
AP5: Engineering CCU/CCS KVA Linth			■	■	■	■	■	■	■	■	■			
AP6: International Logistics & Transfer			■	■	■	■	■	■	■	■	■	■		
AP7: Legal and regulatory requirements						■	■	■	■	■	■	■		
AP8: Financing					■	■	■	■	■	■	■	■		
AP9: Communikation	■	■	■	■	■	■	■	■	■	■	■	■	■	■

▲ Work packages in the CO_2 Competence Center with indicative timeline.

▲ Walter Furgler and Daniel Marxer visit the Norwegian Technology Center Mongstad. On the right side of the picture is Anette Knarvik, process engineer at Equinor.

Team KVA Linth/ZAR, Niederurnen

Walter Furgler
Head of CO_2 Competence Center,
CEO of KVA Linth

Dr. Daniel Marxer
Project Engineer of CO_2 Competence Center

Stefan Ringmann
Scientific Assistant,
Head of Technology and Processes at KVA Linth

Public Relations

Competence Center KEZO, Hinwil (ZH)

Also in 2022 the interest from home and abroad was very great. Numerous delegations were welcomed and informed about the ongoing development projects but also about the 24/7 operation of the bottom ash processing at ZAV Recycling AG.

- HZI-Inova: Top Management Switzerland
- HZI-Inova: Top Management Japan
- Covanta USA
- Covanta UK
- Veolia France/Belgium
- Veolia Taiwan
- University of Pennsylvania USA

The report on the swissinfo.ch platform, a ten-language online service of the SRG for the international public interested in Switzerland, was also positive.

Link: https://www.swissinfo.ch/eng/how-the-swiss-extract-gold-from-rubbish/48126584

Competence Center KEBAG, Zuchwil

Conferences

Ecomondo, Rimini, 10.11.2022 (online-presentation)

Reports

Summary report «Round table phosphorus recovery Olten» on 15.11.2022 - Integral solution approach for the implementation of phosphorus recovery from sewage sludge and animal/bone meal in Switzerland.

Presentations for visitor groups

In addition to various meetings/presentations with cantonal and federal agencies on the topic of phosphorus, the following groups were welcomed:

- ETH Zurich, Alumni
- City of Vienna
- Wastewater treatment plants Alsace, Valeaurhin
- ICL Fertilizers (Israel, Germany, Holland)
- Hitachi Zosen Japan
- SECO, Unido Study Tour 2022 (International participants)

CO_2-Competence Center , KVA Linth

Papers/Presentations

- Exchange of experience Bavarian State Office for the Environment Augsburg
- Swissenviro Seminar NET and CCS
- 3-country conference Vienna
- BAFU symposium Bern
- VBSA symposium Olten

Trips abroad

- Norwegen – Stakeholder Event des BAFU in Oslo
- Canada - Visit of various plants, suppliers, and a trade fair. Trip organized by the Trade Representative of the Canadian Embassy in Bern.
- Denmark - Workshop on CCS at the headquarters of Ramboll in Copenhagen
- Germany - Carbon Capture Technology trade show and conference in Bremen, Germany
- Norway - Visit to a technology provider (Aker Carbon Capture), a MWIP with CCS project (Celsio Oslo Varme) and a test center for CO_2 capture (Technology Centre Mongstad
- Norway - Stakeholder Event of the FOEN in Oslo

Foundation

Excerpt from the foundation certificate

Art. 2 Purpose of the foundation

The purpose of the foundation is to promote a sustainable materials policy for the treatment and recycling of waste. It promotes the further development of state-of-the-art technology and supports the corresponding development activities which are to take place in the immediate vicinity of the waste-to-energy plant of the Zweckverband Kehrichtverwertung Zürcher Oberland KEZO in Hinwil/ZH or its legal successor. The foundation can also support the commercial exploitation of the findings.

With a broad Swiss sponsorship and cooperation with interested parties, it is intended to ensure that the knowledge gained is incorporated into plant development and plant construction in Switzerland or abroad.

The purpose of the foundation can be extended to activities with similar objectives at a later date.

We reserve the right to change the purpose of the foundation in accordance with Art. 86a ZGB (Swiss Civil Code). The foundation does not pursue any commercial purposes and is not profit-oriented.

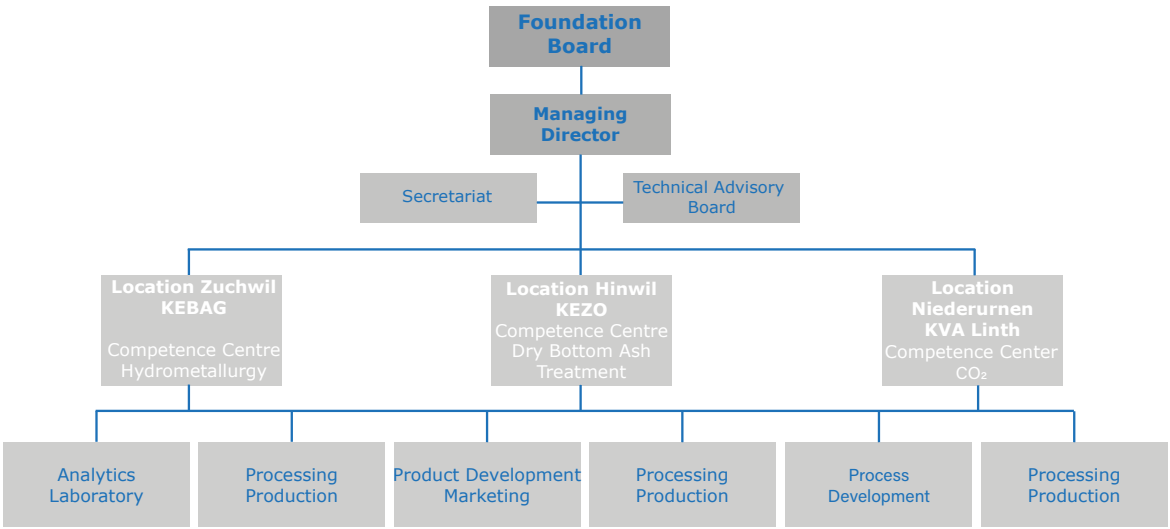
Founders

VBSA
Verband der Betreiber Schweizerischer Abfallverwertungsanlagen
(Swiss Association of Waste-processing Plants)

Kanton Zürich
Baudirektion, Amt für Abfall, Wasser, Energie und Luft (AWEL)
Department for Waste, Water, Energy and Air of the Canton of Zurich)

KEZO
Zweckverband Kehrichtverwertung Zürcher Oberland, Hinwil
(Association of Waste Disposal for the Zurich Oberland, Hinwil)

Organisation Chart



Foundation Board

Adam, Franz (Präsident)	Senior Consultant
Dr. Fahrni, Hans-Peter (Vizepräsident)	Senior Consultant
Christen, Daniel	SARS Stiftung Auto Recycling Schweiz, Geschäftsführer
Furgler, Walter KVA Linth	Managing Director
Dr. Gablinger, Helen	Hitachi Zosen INOVA AG, Director Product & Marketing Energy from Waste
Juchli, Markus	KEBAG AG, Director
Martin, Ulrich	MARTIN GmbH, Eigentümer
Morgan, Kurt	NEROS NEROS Network Mineral Resources Switzerland, Managing Director
Steiner, Peter	KVA Thurgau, Chairman of the Executive Board

Technical Advisory Board

Dr. Morf, Leo (Vorsitz)	AWEL, deputy section head, sewage sludge, Waste incineration plants, biomass power plants (with waste wood)
Bolliger, Markus	Jura Cement AG, Wildegg
Budde, Ivo	Hitachi Zosen INOVA AG
Prof. Dr. Ing. Deike, Rüdiger	Institute of Metal Technologies, University of Duisberg-Essen
Dr. Eggenberger, Urs	Institute for Geology, University Bern
Prof. Dr. Hellweg, Stefanie	ETH Zürich, Institute for Environmental Engineering, Zurich
Dr. Ing. Koralewska, Ralf	MARTIN GmbH, Munich
Dr. Liechti, Jürg	Neosys AG, Gerlafingen
Dr. Zeltner, Christoph	Stahl Gerlafingen AG, Gerlafingen

Donations

AIK Technik AG	Sursee
ERZ Entsorgung + Recycling Zürich	Zürich
Hitachi Zosen INOVA AG	Zürich
KEBAG AG	Zuchwil
KEZO Kehrichtverwertung Zürcher Oberland	Hinwil
Magaldi Industrie s.r.l.	Salerno (I)
MARTIN AG für Umwelt- und Energietechnik	Wettingen
Renergia Zentralschweiz AG	Perlen
SARS Stiftung Auto Recycling Schweiz	Bern
SATOM AG	Monthey
Verband KVA Thurgau	Weinfelden
WIEDAG AG	Oetwil a.S.
ZAV Recycling AG	Hinwil
Zweckverband für Abfallverwertung im Bezirk Horgen	Horgen

Project contributions CO_2 Competence Center

Bundesamt für Umwelt BAFU	Bern
VBSA Klimafonds	Bern
KVA Linth	Nierderurnen
KEZO Kehrichtverwertung Zürcher Oberland	Hinwil
Stiftung Glarner Kantonalbank	Glarus

Financial Report

Income Statement

	2022 [CHF]	2021 [CHF]	Budget 2023 [CHF]
Income			
Donations	540 000.00	429 986.00	445 000.00
Other Income	180.00	7 937.00	1 000.00
Subsidies BAFU	100 000.00	0.00	0.00
Service revenues	782 045.37	948 668.90	747 000.00
Total Incame	**1 422 225.37**	**1 386 591.90**	**1 193 000.00**
Personnel expenses			
Wages third parties	391 039.52	438 385.75	593 000.00
AHV/IV/EO/ALV/third parties	80 925.72	102 098.01	138 000.00
Other personnel expenses	19 691.99	5 352.14	10 000.00
Training and further education of employees	0.00	0.00	4 000.00
Total Personal expenses	**491 657.23**	**545 835.90**	**745 000.00**
Other operating expenses			
Material costs	61.32	1 242.20	127 000.00
Analysis costs	15 583.01	13 259.43	66 000.00
Expenses for third-party services	16 367.81	32 921.32	20 000.00
Expenses for bottom ash	79 140.00	89 860.00	197 000.00
Expenses for new screen development	0.00	3 423.80	0.00
Expenses PHOS4LIFE	401 959.64	269 966.98	700 000.00
Expenses CSS	16 770.37	0.00	80 000.00
Expenses Projects	10 373.70	63 976.48	70 000.00
Project reserves	218 223.11	313 878.61	-950 000.00
Rent expense KEBAG	65 000.00	65 000.00	65 000.00
Administration & IT costs	11 405.74	16 404.13	15 000.00
Advertising	4 612.12	2 500.00	5 000.00
Representation expenses	1 334.98	74.59	2 000.00
Costs Board of Trustees	4 686.27	4 061.04	7 500.00
Costs Technical Advisory Board	0.00	0.00	2 000.00
Other operating costs	11 279.83	4 794.70	30 000.00
VAT from subsidies	116 221.49	0.00	0.00
Total Other operating expenses	**973 019.39**	**881 363.28**	**436 500.00**
Total Operating Expenses	**1 464 676.62**	**1 427 199.18**	**1 181 500.00**
Operating result before depreciation & interest	**-42 451.25**	**-40 607.28**	**11 500.00**
Depreciation and value adjustments	**0.00**	**0.00**	**0.00**
Operating result before interest	**-42 451.25**	**-40 607.28**	**11 500.00**
Financial expenses	**191.99**	**253.24**	**0.00**
Financial income	**0.00**	**0.00**	**0.00**
PROFIT/LOSS FOR THE YEAR	**-42 643.24**	**-40 860.52**	**1 500.00**

Balance Sheet

	31.12.2022 [CHF]	%	31.12.2021 [CHF]	%
Assets				
Cash and cash equivalents	**1 887 618.34**	**87.8%**	**1 831 417.56**	**82.7%**
Raiffeisenbank Uster, current account	1 887 618.34		331 417.56	
Raiffeisen Saving account 31	0.00		500 000.00	
Raiffeisen saving account 90	0.00		500 000.00	
Raiffeisenbank Uster, investment account	0.00		500 000.00	
Trade accounts receivable	**163 130.00**	**7.6%**	**239 896.50**	**10.8%**
Receivables donor contributions	140 000.00		175 000.00	
Receivables third parties	23 130.00		64 896.50	
Accrued income and prepaid expenses	**100 000.00**	**4.6%**	**143 114.80**	**6.5%**
Prepaid expenses TA	100 000.00		143 114.80	
Current Assets	**2 150 748.34**	**100.0%**	**2 214 428.86**	**100.0%**
Movable assets	**0.00**	**0.0%**	**0.00**	**0.0%**
iCAP 7600 ICP-OES Duo (analyzes equipment)	87 789.84		87 789.84	
Spectro Blue 138491	60 217.92		60 217.92	
Vibrating disk mill	22 109.83		22 109.83	
Value adjustments of tools and equipment	-170 117.59		-170 117.59	
Fixed assets	**0.00**	**0.0%**	**0.00**	**0.0%**
TOTAL ASSETS	**2 150 748.34**	**100.0%**	**2 214 428.86**	**100.0%**
Liabilities				
Trade accounts payable	**10 064.85**	**0.5%**	**140 050.25**	**6.3%**
Accounts payable to third parties	1 587.74		108 202.21	
Creditor FTA, value added tax	8 477.11		26 936.29	
Accounts payable KEZO	0.00		4 911.75	
Short-term interest-bearing liabilities	**0.00**	**0.0%**	**0.00**	**0.0%**
Value added / revenue taxes	0.00		0.00	
Deferred income	**1 928 864.94**	**89.7%**	**1 819 916.82**	**82.2%**
Accrued expenses and deferred income	144 795.95		254 070.94	
Deferred Projects	1 784 068.99		1 565 845.88	
Short-term liabilities	**1 938 929.79**	**90.2%**	**1 959 967.07**	**88.5%**
Endowment capital	100 000.00		100 000.00	
RESERVES				
Project reserves	154 461.79		195 322.31	
Annual result	-42 643.24		-40 860.52	
Equity capital	**211 818.55**	**9.8%**	**254 461.79**	**11.5%**
TOTAL LIABILITIES	**2 150 748.34**	**100.0%**	**2 214 428.86**	**100.0%**

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