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MKR Evaporation Systems

ROBUST. SAFE. FLEXIBLE. EFFICIENT.

- → Heat driven Systems
- → Hybrid Systems with Heat Pump
- → Electric MVR Evaporators

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Digestate and slurry are valuable organic fertilizers, but transporting and storing them is costly and can affect the nutrient balance of soils. Evaporators are an innovative and ecological solution for the treatment of digestate from biogas plants, pig slurry or any liquid media.

With MKR Cleanwater's evaporators, you can solve these problems and obtain clean water and a mineral fertilizer at the same time.

Waste heat and hybrid system DV:

Two sizes: 180 kW_{th} and 550 kW_{th}, with 1–4 stages each.

Maximum efficiency of 4 stages: 4.3 litres of distillate per kWh of heat.

Electric evaporators (Mechanical Vapour Recompression):

Several sizes, with distillate production rates ranging from 0.3 to 2.0 m^3/h.

Power consumption is approx. 40 kWh_{el} per m^3 of distillate.

History

MKR Metzger develops industrial recycling technology since 1990

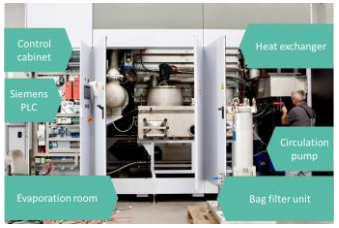
2009/10 Project start digestate evaporator

First pilot projects based on existing industrial evaporators

2012/13 first practical plants single-stage, approx. 2000 m^3 reduction

Since 2016/17 multi-stage evaporators with >20,000 m^3/a reduction per line

Starting in 2024 adapting electrical MVR evaporation systems for pig slurry and other thin organic media with ammonia recovery



Today

Active throughout Europe, mainly residual /food waste plants and farm manure plants.

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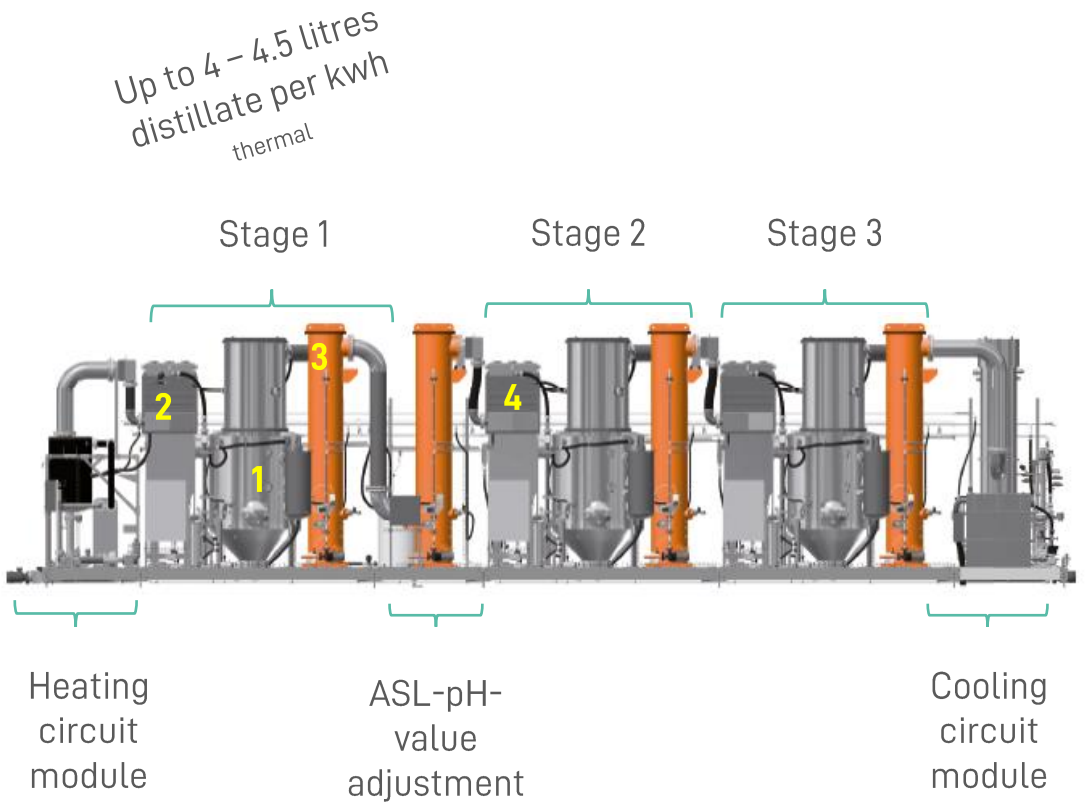
Operating Principle (Overview)

- At the heating circuit module, the heat is taken from the CHP circuit, and the evaporator stage 1 is heated with steam (65°C) under vacuum already.
- Digestate from the process tank (1) is fed over the heat exchanger (2) of stage 1. The energy input causes the boiling point to be exceeded and water vapour to be generated.
- The vapour is fed via the vapour scrubber (3) for nitrogen fixation (ASL) to the heat exchanger (4) of stage 2. Here the steam heats the fermentation residue from stage 2, condenses in the process and is withdrawn from the system as distillate.
- From now on, the steps are repeated until the cooling circuit module, where the steam from the last stage condenses out.



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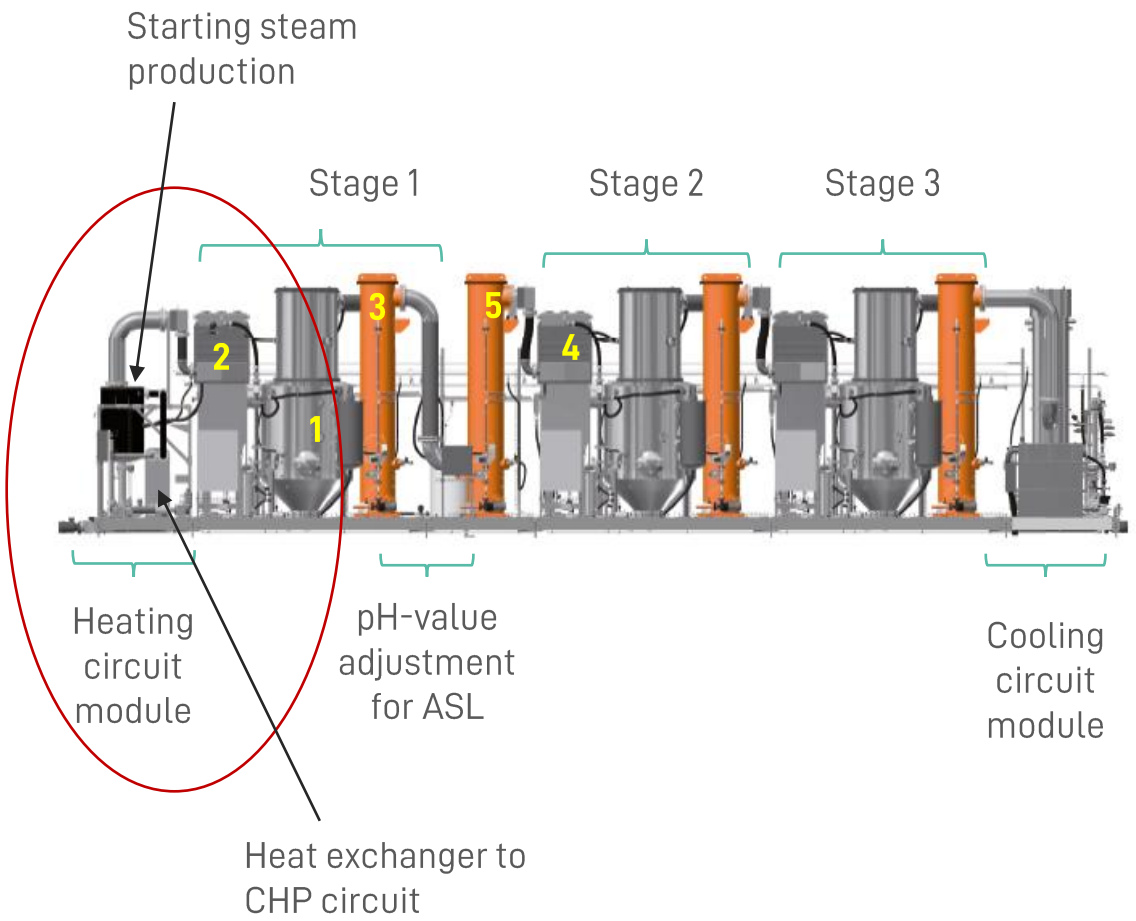
Operating Principle

Heating circuit and evaporation stage 1:

A starting steam of approx. 70°C is produced under vacuum. This starting steam is directed to the heat exchanger (2) of the first evaporator stage.

The digestate is in the process tank (1) and is circulated over the heat exchanger (2) with a pump. In the heat exchanger, the start steam heats the digestate. The start steam condenses and is fed back into the heating circuit module.



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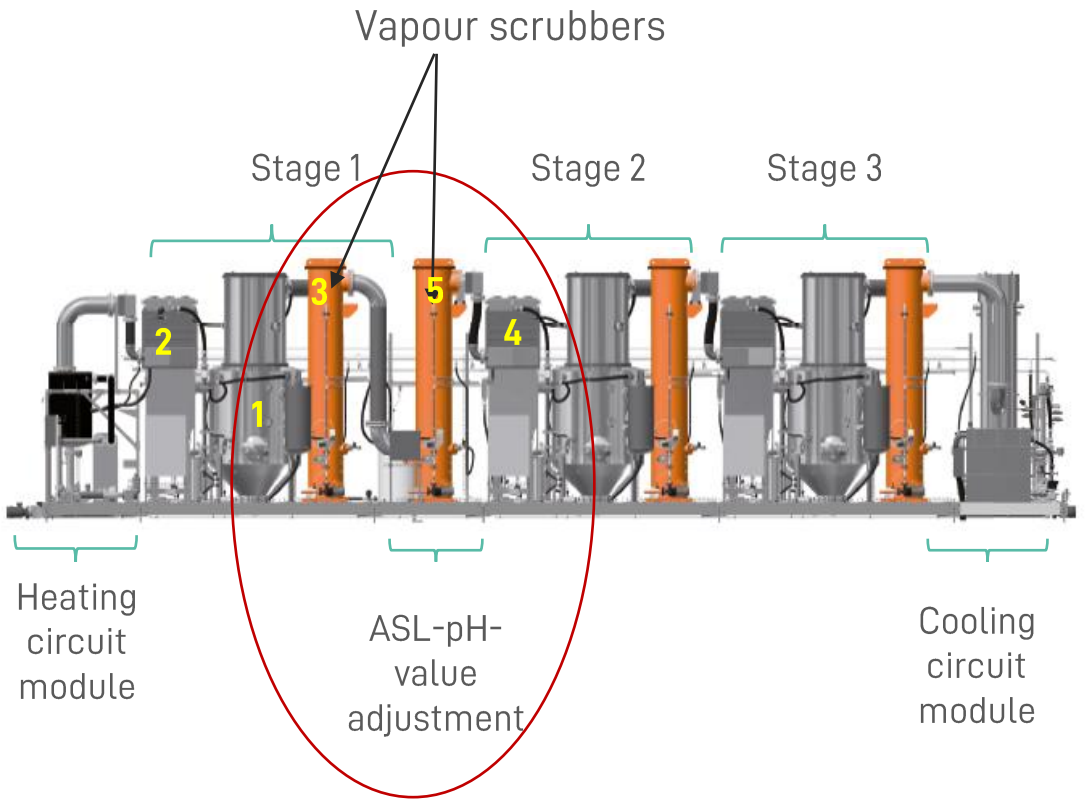
Operating Principle

Evaporation stage 1 and vapour scrubber:

The vapour (from the digestate) that has now been produced in evaporator stage 1 is fed through the vapour scrubbers (3+5).

Here, the ammonia contained is bound with sulphuric acid and pumped out of the plant as mineral fertiliser ASL (ammonium sulphate liquid).

After the vapour scrubbers, the vapour is fed to the heat exchanger of the 2nd evaporation stage (4). Here, this 1st stage vapour heats the digestate of the second evaporator stage, cools down, condenses and can then be pumped out of the plant as liquid distillate.



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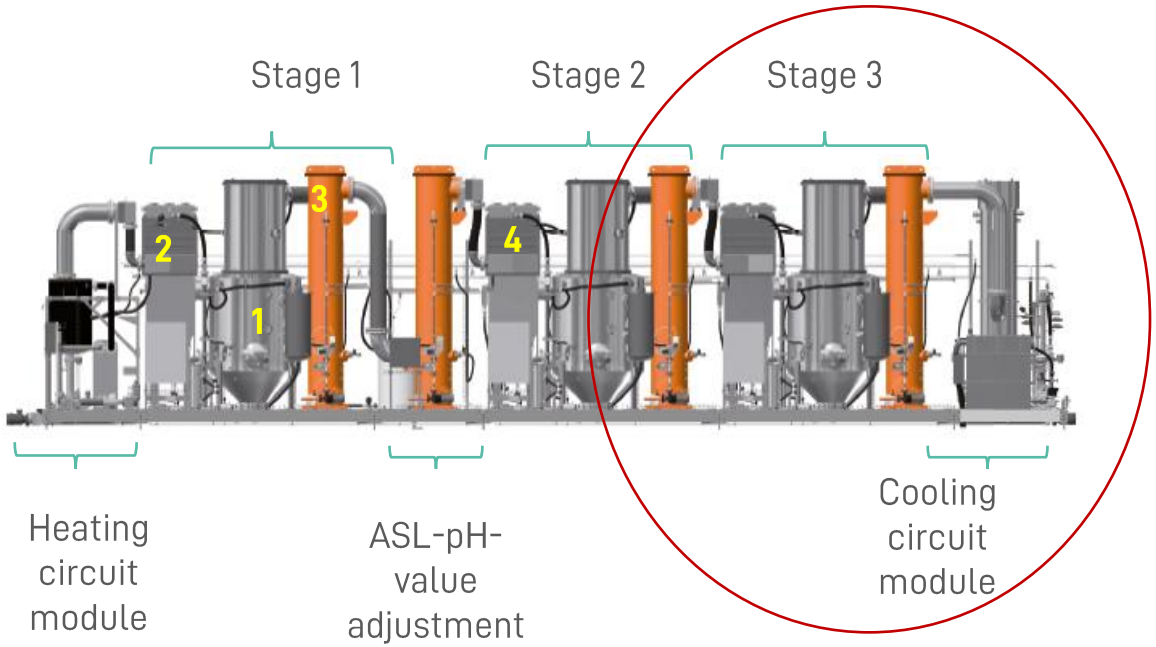
Operating Principle

Evaporation stage 2, further stages and cooling circuit:

The same process now takes place in the second evaporator stage as in the first evaporator stage. Water vapour is produced from the fermentation residue, washed in the vapour scrubber and this water vapour releases its heat energy at the heat exchanger of the next stage and condenses out. This heats the fermentation residue of the next stage again.

After the last evaporation stage, the cooling circuit module follows. Here, the steam from the last evaporator stage is cooled. The steam condenses into distillate and can be pumped out of the system.

In the meantime, 4-stage vacuum evaporators can be operated according to this scheme.



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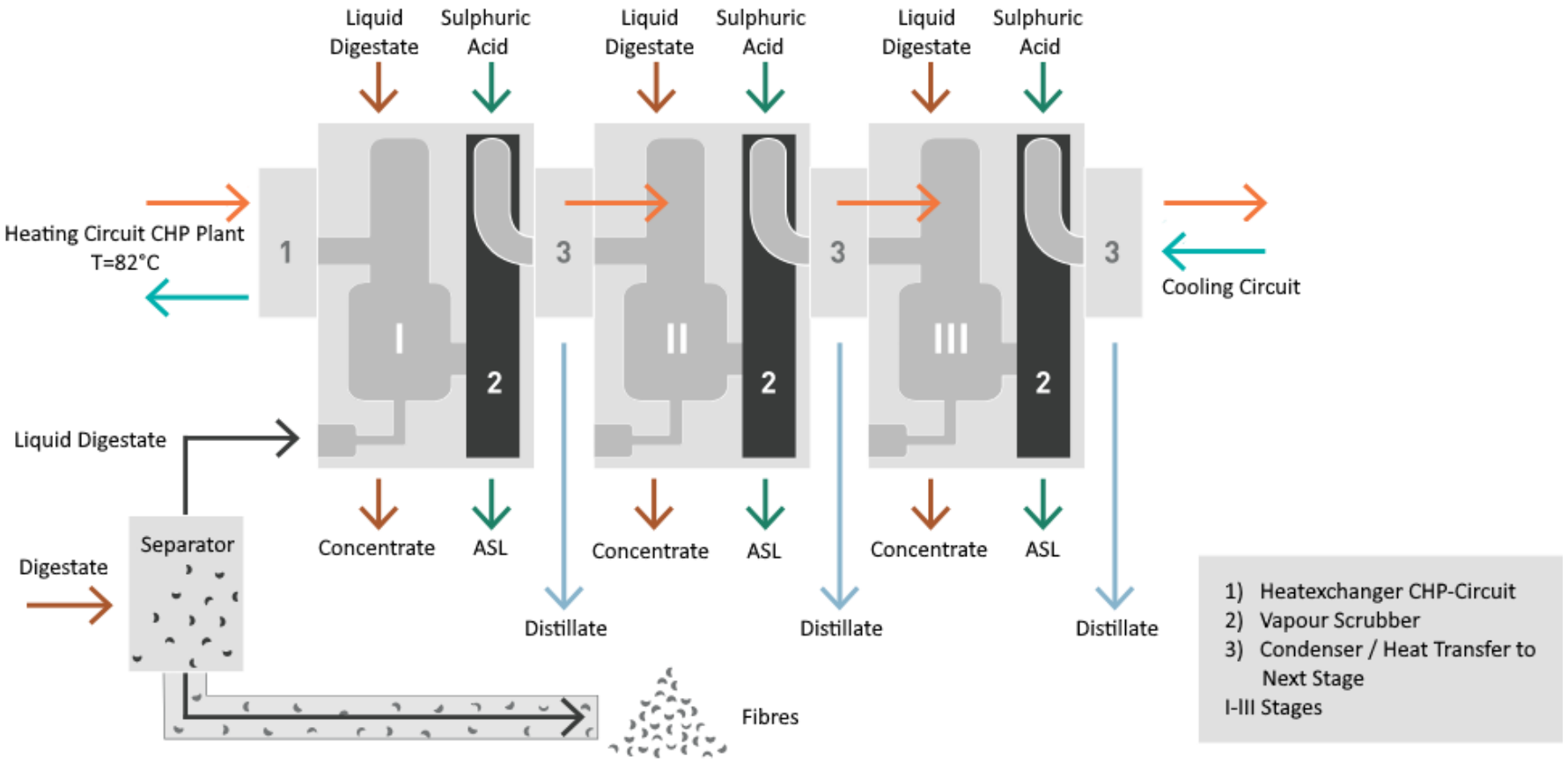
Mass and Heat Flow



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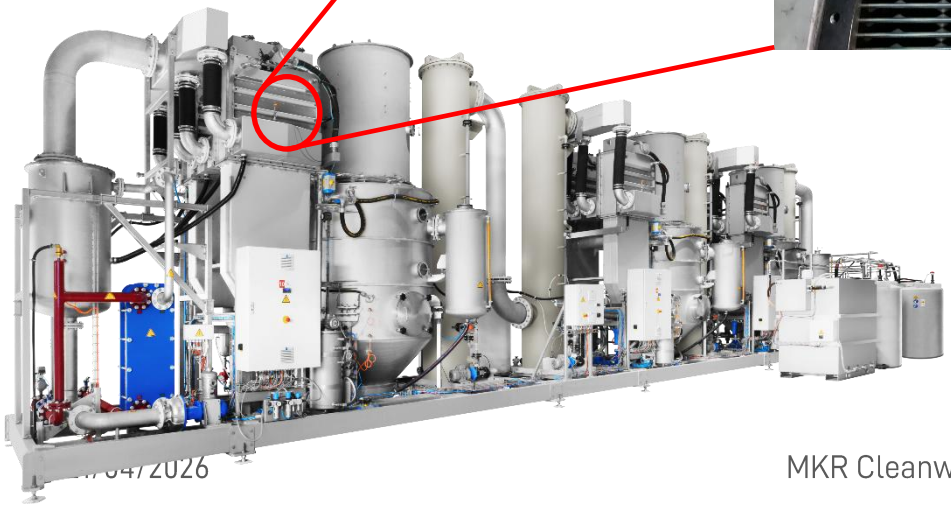
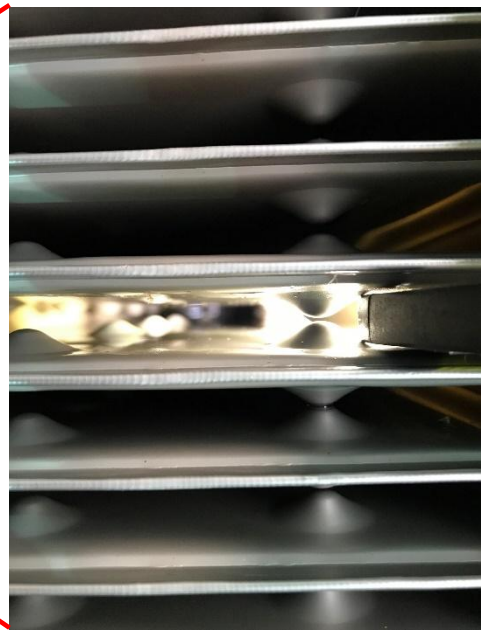
Some Insights: Heat Exchanger

Heat exchanger, two
years of operation
no fouling, fully clean





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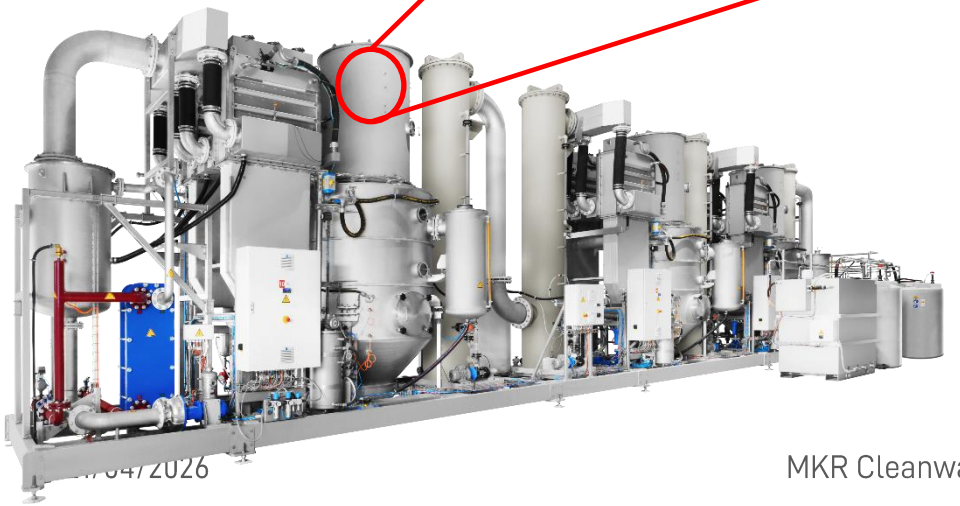
Some Insights: Demister

Demister (drop separator – part of the vapour path), two years of operation, no fouling, fully clean



Advantages

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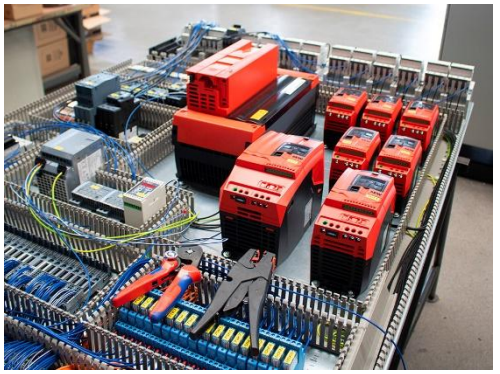
Parts in contact with digestate are made of **stainless steel**.

No brushes or moving parts in the media, means low maintenance costs!



PLC programme and control cabinet construction **completely from MKR**.

Components for sulphuric acid and vapour scrubbers **completely in PE/PP**, thus durable and no corrosion.

Know-how for odourless and dischargeable distillate.

Learn more:
www.mkr-cleanwater.com

Advantages

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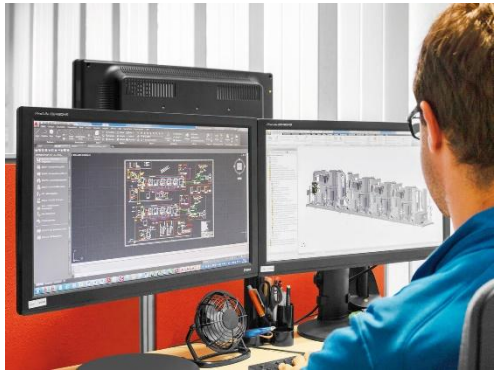
- The evaporator system automatically adjusts to the available heat; it works from **65 - 85 °C thermally highly flexible**.
- **User-friendly** control and **remote maintenance** via VPN connection.
- Know-How for odourless distillate in **dischargeable quality**.
- Decades of experience in the treatment of industrial wastewater and biogas evaporators in **practical use since 2012.**
- ASL in **mineral fertilizer quality** with pH value increase into the crop compatible range to pH 5.5 - 6.5 without additional chemicals.



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Application Case:
Evaporation of Digestate and ASL-Production

Your product:

- Ammonium sulphate liquid (ASL) from aerobe and anaerobe treatment of organic matter
- 7% ammonium-nitrogen
- 8% hydrophile sulphur
- pH value: 7
- Density: 1,25 kg/l
- Particularly sustainable production without the use of fossil fuels

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Application Case:
Evaporation of Food Waste Digestate

LOCATION:	Switzerland
MOTIVATION:	Avoid high transport costs with a special attention to emission-free operation.
INPUT BGA:	Various food waste, pig manure, slaughterhouse waste
EVAPORATOR:	DV4000 4S
START-UP:	Jan. 2020
HEAT DEMAND:	550 kW th.
DISTILLATE EFF.:	4,3 l / kWh th.
REDUCTION:	up to 20.000 m^3 /a

Find more reference plants:
www.mkr-cleanwater.de/referenzen

Operating Data

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	DV1000 (4 Stages)	DV4000 (4 Stages)
Intake Volume Flow	1700 l/h	4300 l/h
Distillate Flow (max.)	850 l/h	2400 l/h
Vaporisation Performance	4,3 l/kWh$_{th}$	4,3 l/kWh$_{th}$
Unladen Wight	15 t	38 t
Length	15 m	27 m
Width	2,5 m	3 m
Hight	4,5 m	5,5 m
Operating Voltage	3/400 V N PE 50 Hz	3/400 V N PE 50 Hz
Temperatur Heating Circuit	70 – 85 °C	70 – 85 °C
Heat Demand (max.)	190 kW	600 kW
Dry Matter Content (Input)	3 – 4 % TS	3 – 4 % TS
Particle Size	< 250 µm	< 250 µm

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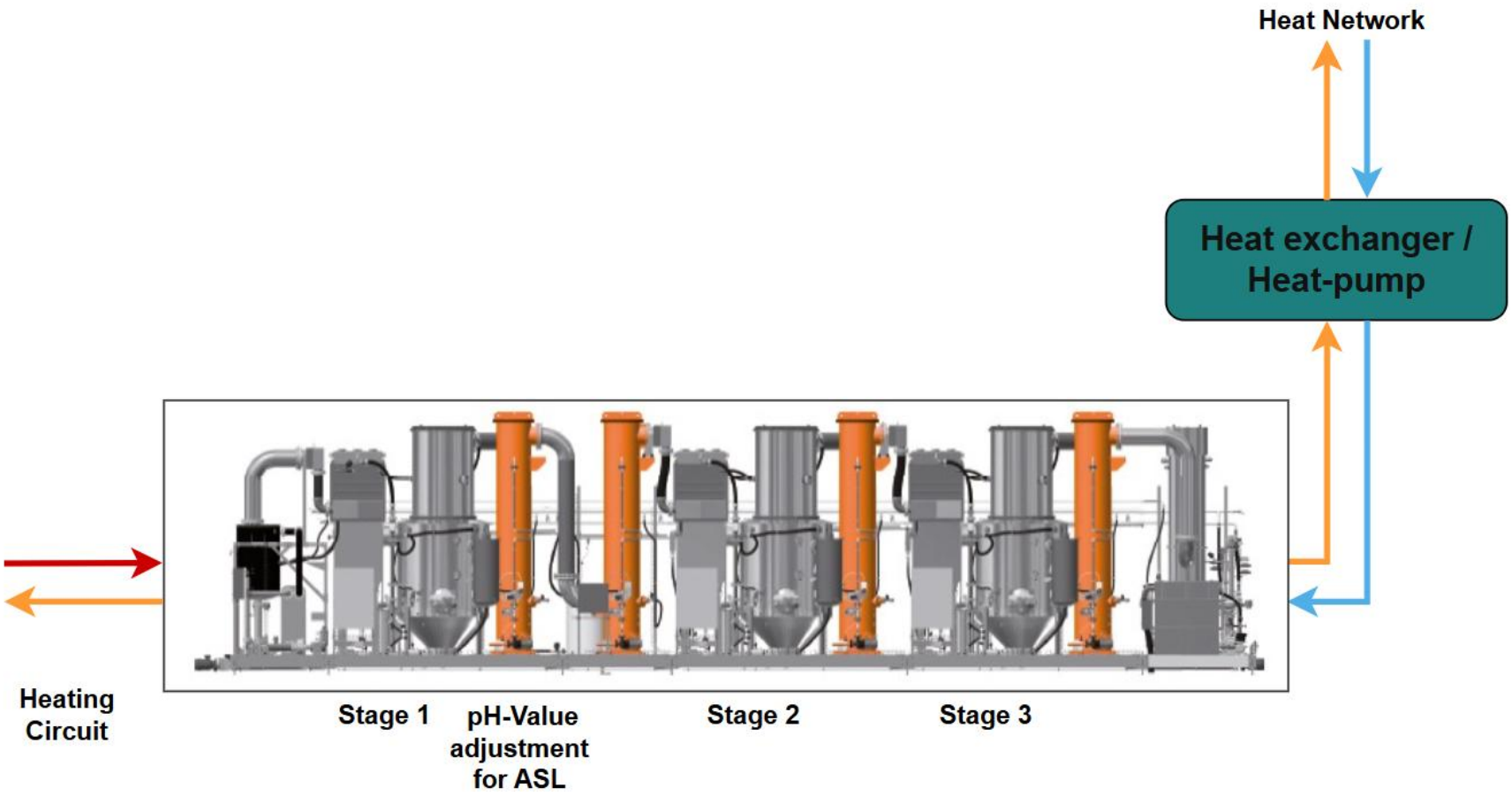
Variant: Further use of Waste Heat from the Cooling Circuit



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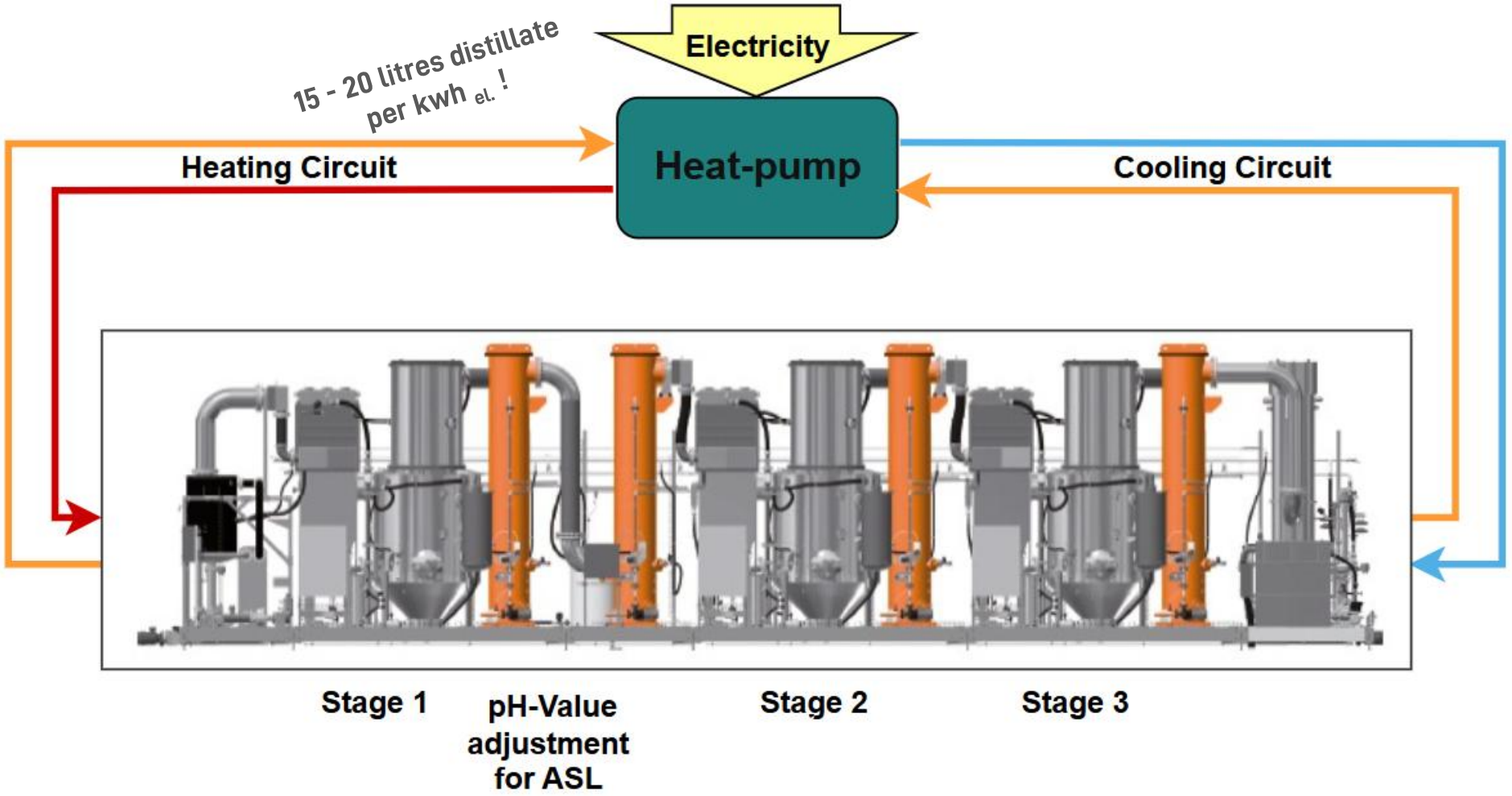
Heat driven Evaporation combined with Heat Pump



Why should you choose MKR Evaporation Technology?

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- **Robust, durable technology** made of stainless steel
- **Energy-efficient** four-stage heat driven and electrical driven systems.
- **Modular and compact design**
- The technology is based on **25 years of experience** and know-how with evaporation technology and 15 years of experience with digestate.