MKR Cleanwater GmbH
Rappenfeldstr. 4
86653 Monheim

info@mkr-cleanwater.de
www.mkr-cleanwater.de
Tel.: +49 (0) 09091 50 00 0

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 is a valuable organic fertilizer, but it incurs high transport and storage costs and affects 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 500 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

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MKR Metzger developes industrial recycling technology since 1990

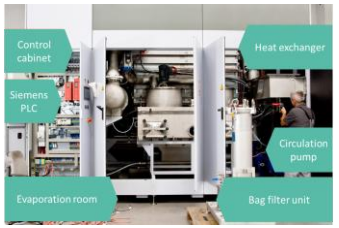
2009/10 Project start digestate evaporator

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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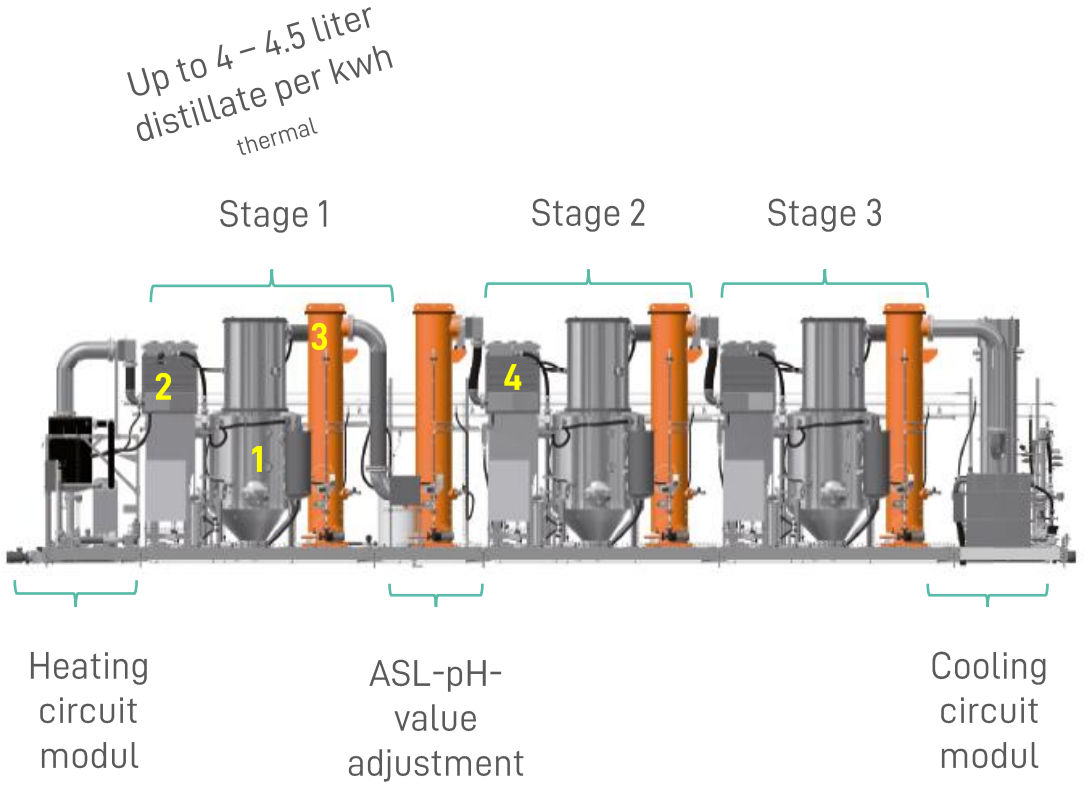
Thermal Evaporator Operating Principle (Overview)

- 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.



Material Flow and Energy Flow

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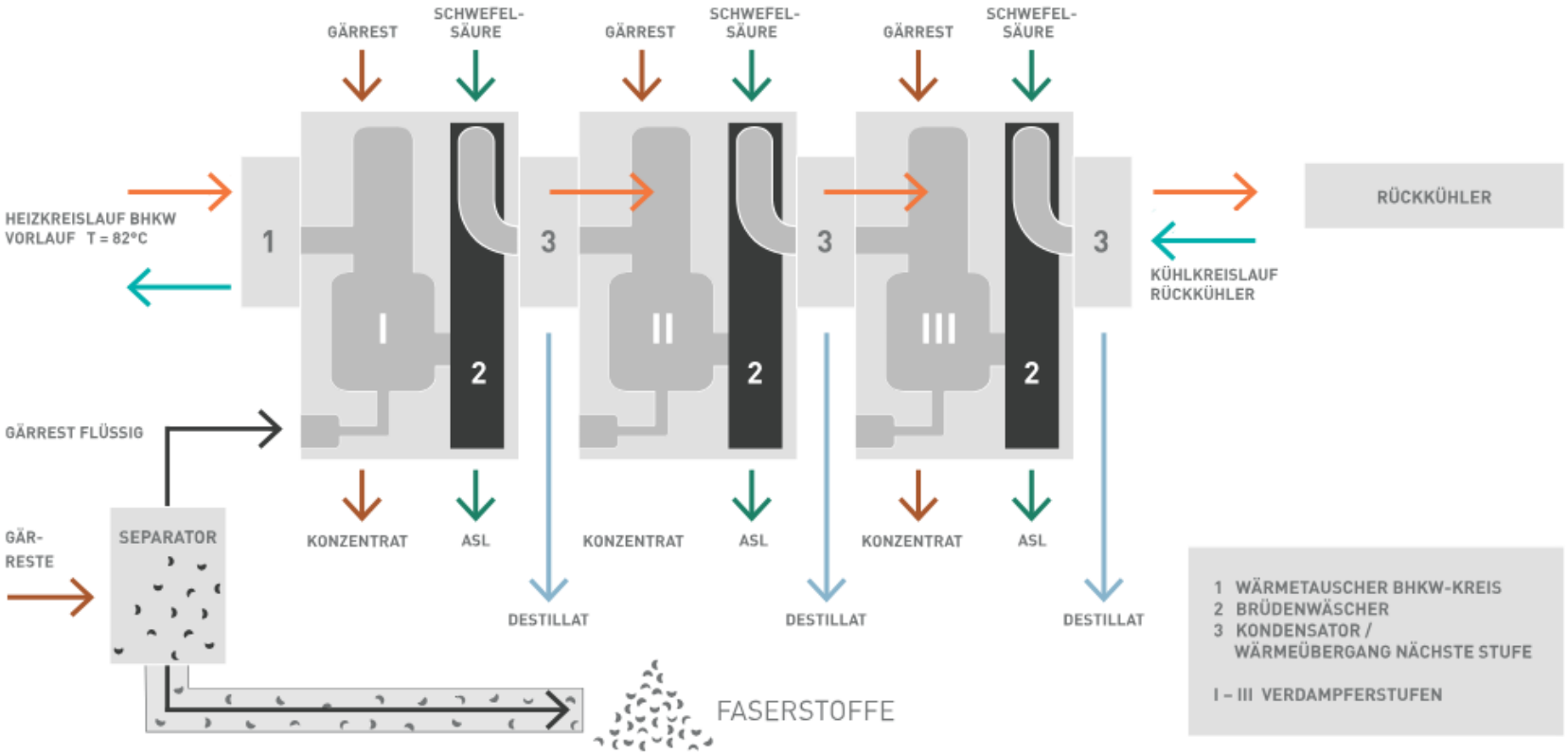

Advantages

MKR Cleanwater GmbH
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86653 Monheim

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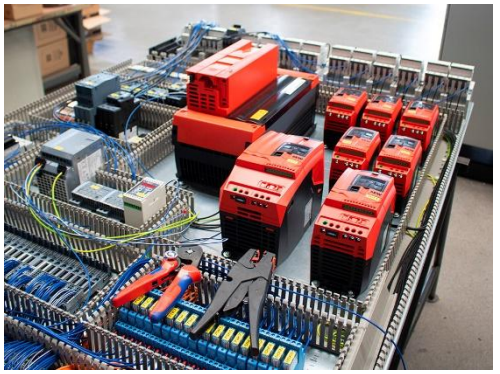
www.mkr-cleanwater.de
Tel.: +49 (0) 09091 50 00 0

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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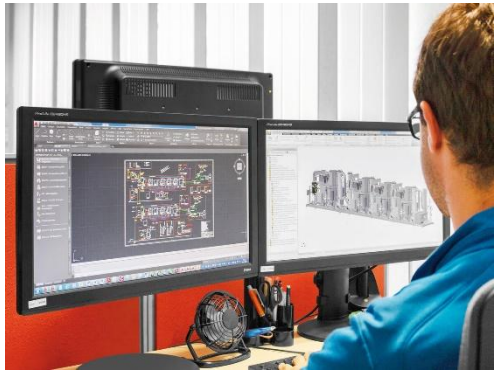
- The evaporator system automatically adjusts to the available heat, it works from **65 - 85 °C thermally highly flexible**.
- **User-friendly** control and **remote maintenance** via VPN connection.
- Know-How for odorless distillate in **dischargeable quality**.
- Decades of experience in the treatment 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.



Application Case: Evaporation of Digestate and ASL Production

MKR Cleanwater GmbH
Rappenfeldstr. 4
86653 Monheim

info@mkr-cleanwater.de
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Tel.: +49 (0) 09091 50 00 0

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

Learn more:

https://refood-gaerprodukt.de/refood-asl/

Application Case:
Evaporation of Food Waste Digestate

MKR Cleanwater GmbH
Rappenfeldstr. 4
86653 Monheim

info@mkr-cleanwater.de
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Tel.: +49 (0) 09091 50 00 0

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
Thermal Evaporator

MKR Cleanwater GmbH
Rappenfeldstr. 4
86653 Monheim

info@mkr-cleanwater.de
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Tel.: +49 (0) 09091 50 00 0

	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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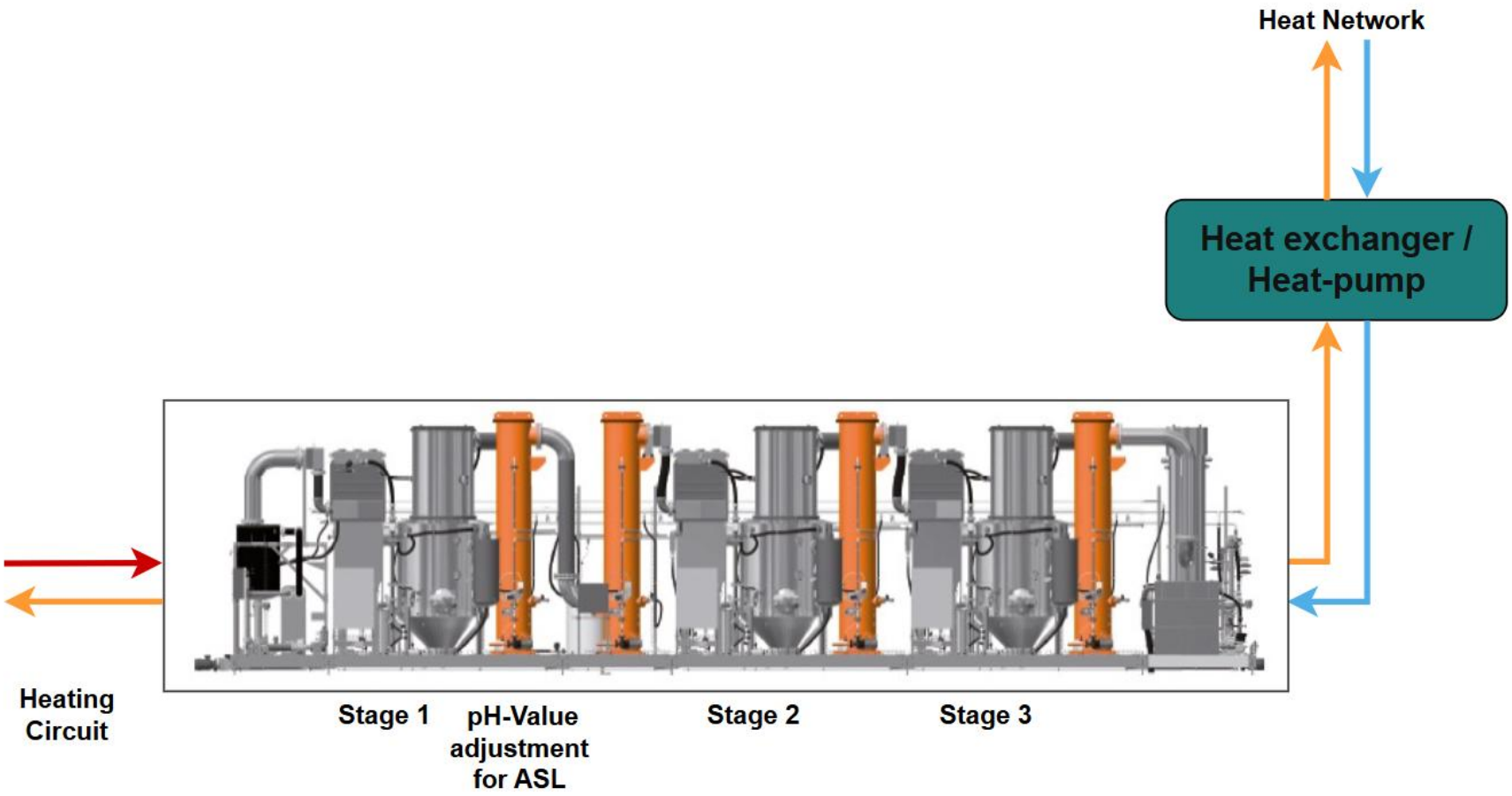
Variant: Further use of Waste Heat from the Cooling Circuit



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Heat driven Evaporation combined with Heat Pump

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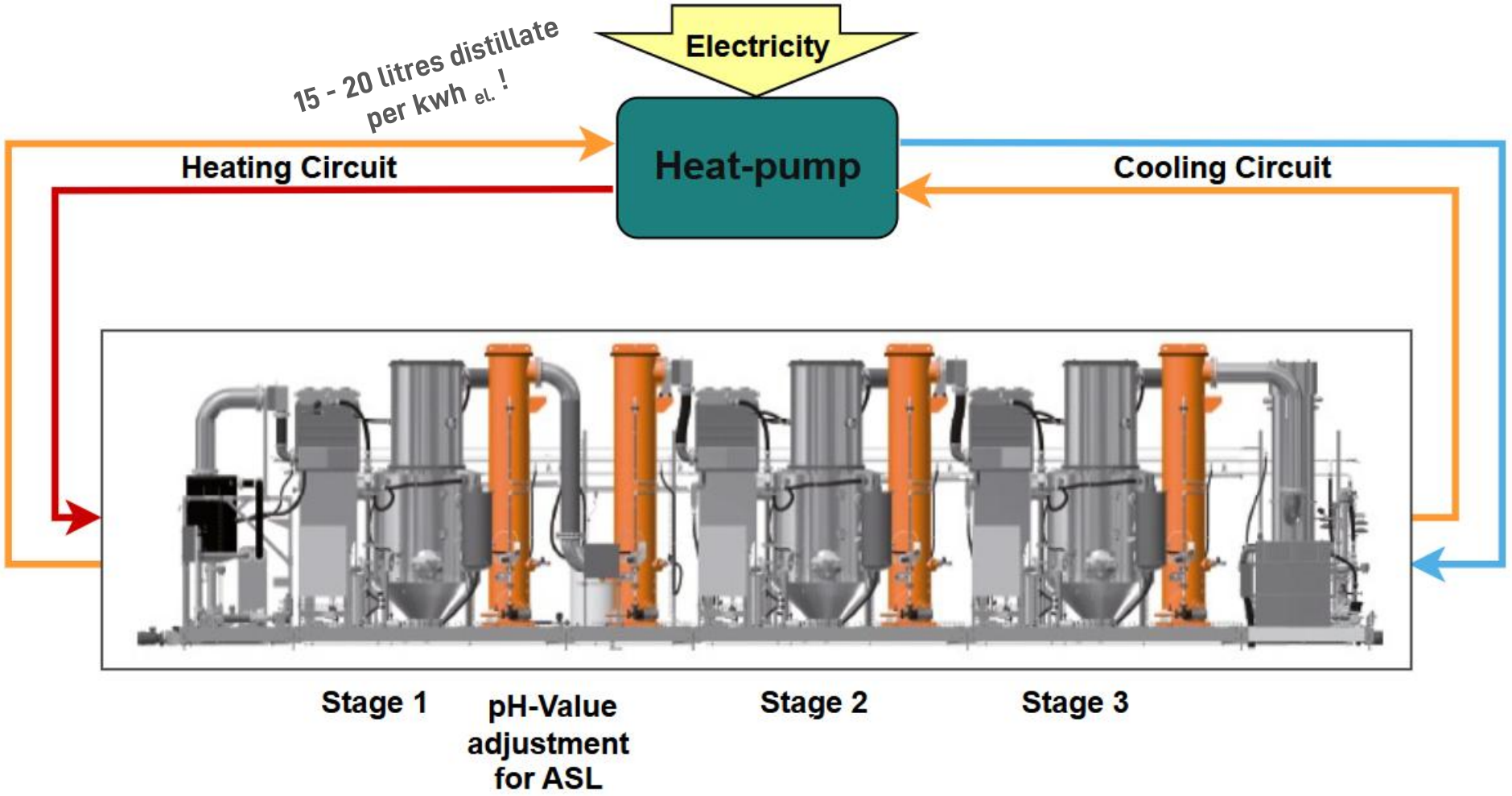

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Electrical Driven Evaporators (Mechanical Vapour Recompression)

MKR Cleanwater GmbH
Rappenfeldstr. 4
86653 Monheim

info@mkr-cleanwater.de
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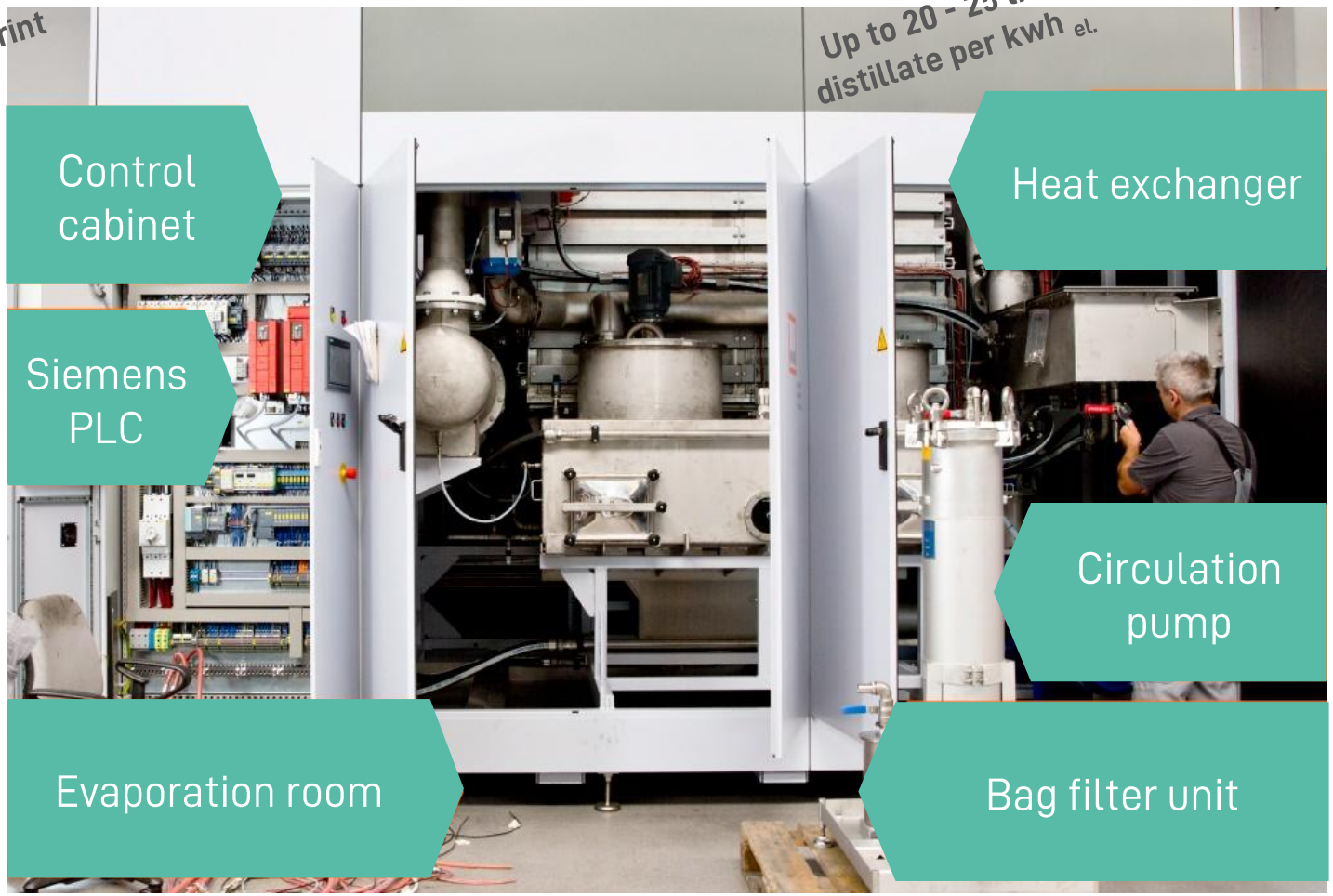
Tel.: +49 (0) 09091 50 00 0

Small footprint

Up to 20 - 25 liter distillate per kwh el.



MVR Evaporators
Operating Principle

MKR Cleanwater GmbH
Rappenfeldstr. 4
86653 Monheim

info@mkr-cleanwater.de
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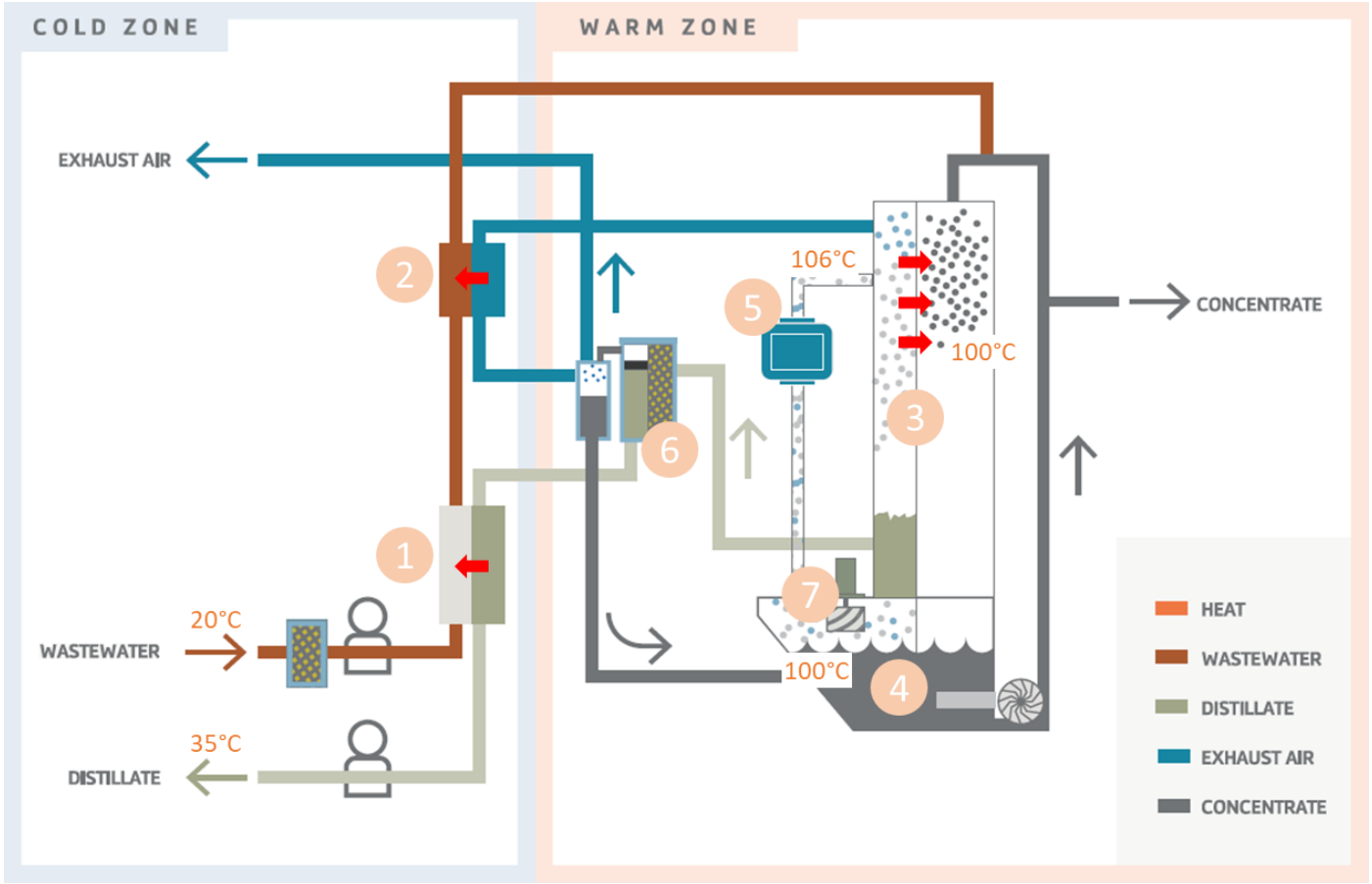

The slurry goes through three heat exchanger (1,2 & 3) to the process tank (4). Here it is circulated and heated by the main heat exchanger (3).

The steam (7) is compressed (5) (approx. +200mbar) and has now a temperature of about 106°C.
On contact with the heat exchanger (3) the steam condensates and becomes distillate(6).

MVR Evaporators
Operating Principle

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86653 Monheim

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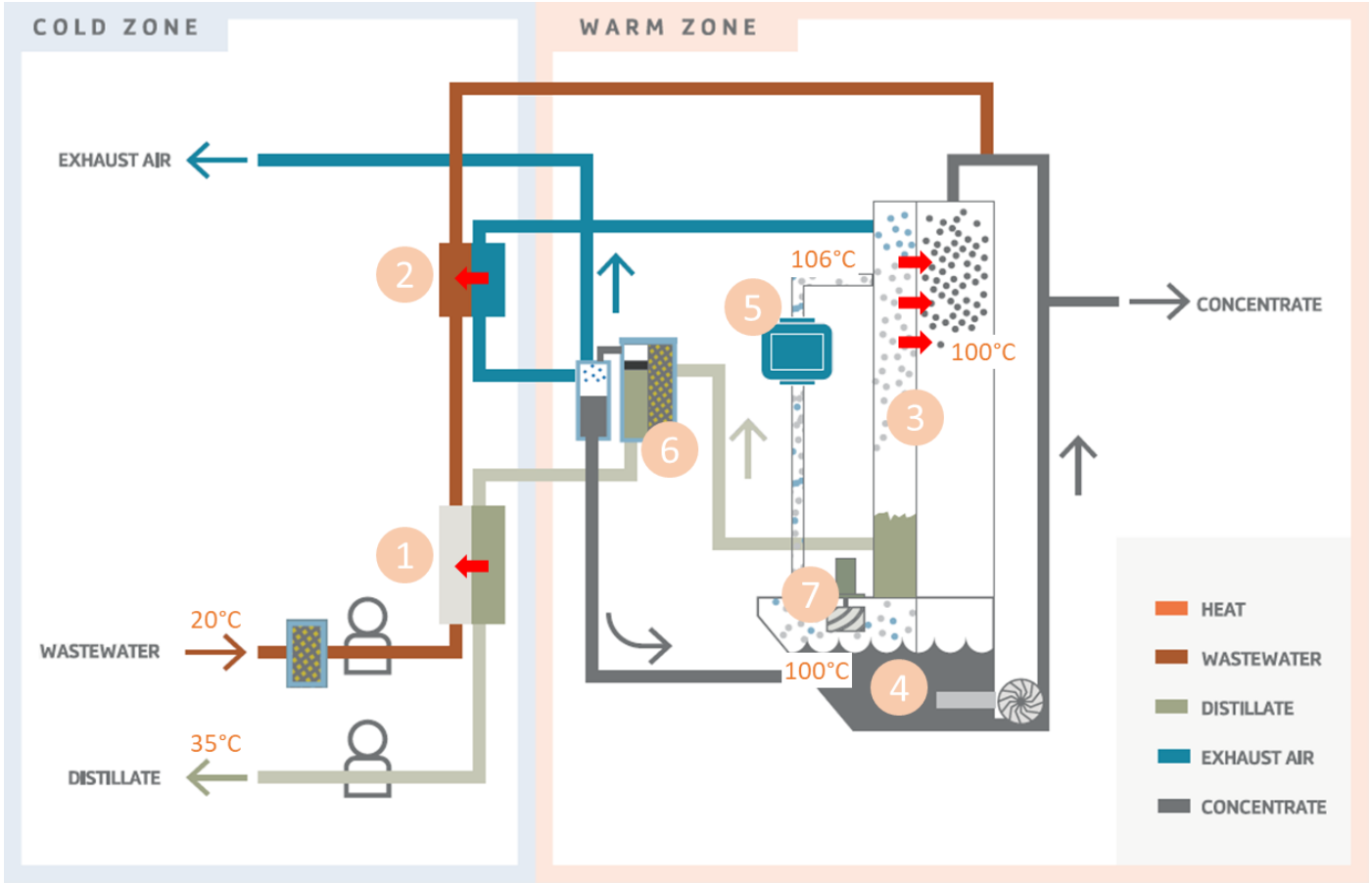

For media containing ammonia, a vapor scrubber is installed to remove ammonia from the vapor before condensation at the heat exchanger (3).

The exhausted air (via heat exchanger 2) and the distillate (via heat exchanger 1) leave the evaporator.
The concentrate (from tank 4) is pumped regularly out of the machine.

Operating Data
Electrical Evaporator

MKR Cleanwater GmbH
Rappenfeldstr. 4
86653 Monheim

info@mkr-cleanwater.de
www.mkr-cleanwater.de
Tel.: +49 (0) 09091 50 00 0

	MVR05	MVR10	MVR20
Intake Volume Flow	500 l/h	1000 l/h	2000 l/h
Distillate Flow (max.)	450 l/h	900 l/h	1800 l/h
Vaporisation Performance	25 l/kWh_{el}	25 l/kWh_{el}	25 l/kWh_{el}
Unladen Wight	4,8 t	8 t	14 t
Length	4,45 m	4,45 m	5,6 m
Width	2,35 m	2,8 m	2,8 m
Hight	3,1 m	3,1 m	3,1 m
Operating Voltage	3/400 V N PE 50 Hz	3/400 V N PE 50 Hz	3/400 V N PE 50 Hz
Dry Matter Content (Input)	< 2 % TS	< 2 % TS	< 2 % TS

Intermediate sizes available too.

Application Case
Pig Slurry Evaporation
Farm level or Decentralised

MKR Cleanwater GmbH
Rappenfeldstr. 4
86653 Monheim

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MVR Evaporator

Optional:
Phosphorous removal

Pig slurry

Pig stables
-> Secured slurry export / pickup

Nitrogen as „green“
Ammonia sulfate or Aqueous ammonia
-> high concentrated, transportable and useable in other industrie branches

Concentrated slurry – input for AD
-> only approx. 20% volume but with same energy content and lowered ammonia content

AD plant

Bio-Methane or Biogas-CHP plant
-> easy to handle nitrogen lowered feed with attractive CO2 certificate options
-> much less fermentation volume is required

Application Case
Excrement Separation with Evaporation

MKR Cleanwater GmbH
Rappenfeldstr. 4
86653 Monheim

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Urine
Wash water
Liquid phase faeces

Thick phase faeces

Biogas plant
Field Fertiliser /
Export

Distillate returns as
process water

Exhaust air

MVR Evaporator

ASL

Field Fertiliser /
Export

Distillate

Concentrate

Application Case
Evaporation of other Media

MKR Cleanwater GmbH
Rappenfeldstr. 4
86653 Monheim

info@mkr-cleanwater.de
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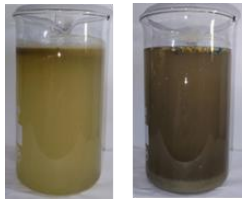
Grease separator



MVR Evaporator

Pre-treatment (if necessary)

100%

~90%

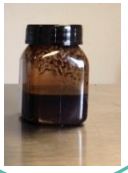
Vapor and/or destillate post-treatment

2 - 3%

Ammonium sulfate liquid

~8%

Concentrate



~ 97%

Canalisation / sewage water system / irriagtion etc.

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Advantages

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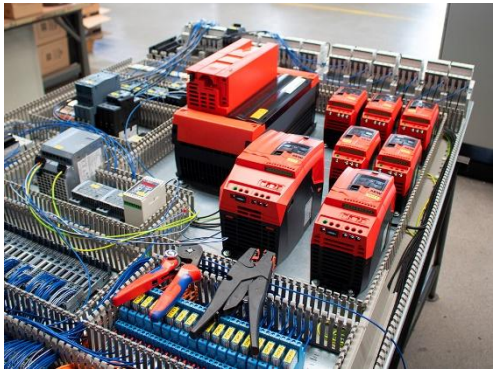

PLC programme and control cabinet construction **completely from MKR**.

Components for sulphuric acid and vapour scrubbers made of **stainless steel** as well, thus durable and no corrosion.

Know-how for odourless and dischargeable distillate.

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Advantages

- Ideal for media with low solid content
- Parts in contact with media in **stainless steel -** higher grades possible for chloride-containing wastewater
- **Modular design**, no up and down scaling of technology just more modules
- No moving parts such as brushes in the digestate - thus significantly **lower maintenance** requirements.
- **Regular automatic acid/alkaline rinsing** removes even the finest organic as well as mineral deposits
- mechanical foam breakers
- **Highest electrical efficiency** (up to 20 - 25 Liters / kwh $_{el.}$)
- **Lowest operating costs** per m³ distillate
- Only little amount of digestate in the system, approx. 500 liter per modul, therefore a **quick heat-up phase / start-up phase** for evaporators

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.

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Thank you for your interest so far.

For more information, mass balances, offers
just get in touch:

Michael Köhnlechner
Mobil: +49 172 81 80 314
Tel.: +49 9091 50 00 0
m.koehnlechner@mkr-cleanwater.de
Michael Köhnlechner | LinkedIn

Elliot Freitag
Mobil: +49 1520 9599 322
e.freitag@mkr-cleanwater.de
Elliot Freitag | LinkedIn