

Verified operating data

Two reference plants with DV vacuum evaporators and at least 54 laboratory evaporation tests since 2013



Reduce.
Recover.
Reuse.

How we calculate. Measured values and design values are kept separate. Every statement gives its period, data basis and reference basis. We calculate conservatively: anything we cannot clearly assign counts against us. Exceptions are stated explicitly. We only state technical availability as defined in VDI 3423.

Reference plants	Reference Plant Western Germany	Reference Plant Switzerland
Medium	Digestate from food waste, restaurant waste, flotation sludge and grease trap contents	As Western Germany, plus rumen contents from a slaughterhouse
Evaporator	2 DV lines, three-stage each	1 DV4000, four-stage
Heat source	CHP	CHP
Commissioned	Line 1 April 2019, line 2 2020	2020
Data basis	Remote monitoring, 07/2023 to 08/2025	Operator reports 08/2025 to 01/2026, daily data 06/2026 to 10/2026

Before the investment

K-00 Since 2013 we have documented at least 54 laboratory evaporation tests for more than 30 clients in eight countries, on food-waste and residue digestate, energy-crop digestate, slurry, poultry-manure digestate and RO concentrate. In addition, there are 504 samples from 19 operating plants with 2,514 measured values for distillate and ammonium sulphate solution.

K-01 A laboratory test on 2 litres of your sample shows, before you invest, which evaporation ratio your medium allows, which material the evaporator needs and whether the upstream separation is sufficient.

K-02 Thin liquid fractions such as filtrate after flocculation or the liquid fraction of pig slurry reached 1:10 to 1:15 in laboratory tests. For separated digestate, our standard test stops at 1:2, which is the test endpoint, not the limit. In extended tests on food-waste digestate, 1:3 to 1:4 was reached.

K-03 We also say no: in several laboratory tests we advised against evaporation or limited the evaporation ratio.

K-04 The laboratory test also checks the upstream process chain. If it shows that a second separation stage is needed after the first, this is clear before the investment, not during operation.

K-05 What determines the type of evaporator and the material is the chloride content of the concentrate. It equals the chloride in the feed times the evaporation ratio: 1,000 mg/l in the feed becomes a calculated 10,000 mg/l in the concentrate at 1:10. We concentrate digestate in the vacuum evaporator (DV) at a lower temperature up to 15,000 mg/l chloride in the concentrate, in the neutral to alkaline range; this is proven in operation. For more than 15,000 and up to below 30,000 mg/l, we use MVR evaporators in highly corrosion-resistant materials and keep the pH of the concentrate at 8 or higher. Which evaporator and which material fit a specific case is decided per project, based on the laboratory test.

K-15 Before Reference Plant Western Germany was built, we evaporated its digestate in our laboratory to a ratio of 1:2.5 in 2018. Since the first line was commissioned in April 2019, the plant has reached around 1:3 in operation. The laboratory test was therefore on the safe side.

Technology

K-10 DV and MVR evaporators share the same core components: forced-circulation falling-film heat exchangers, the same control concept and the same vapour scrubber principle. They differ in how energy is supplied and in operating temperature. A laboratory test therefore shows how your medium behaves in the evaporator and during cleaning, for both designs. For thin liquid fractions up to 2.2 % DS, the MVR test unit adds continuous operation on your site.

K-13 At Reference Plant Western Germany, the three stages of the DV lines evaporate under vacuum at around 50 to 63 °C. At these temperatures, far less fouling builds up on the heat exchangers. This is why the DV can also handle digestate with a higher share of organic matter and dry solids, up to 4.5 % DS in the feed.

K-06 For distillate to be discharged to a watercourse, the post-treatment after the evaporator is matched to the discharge permit. Two operating plants with a permit (COD 200 mg/l, BOD5 40 mg/l, NH4-N 10 mg/l) use biological post-treatment. At the first, COD in laboratory samples from 2015 to 2019 had a median of 32 mg/l and was below the limit in 67 of 68 samples; NH4-N was below 10 mg/l in 59 of 69 samples. At the second, NH4-N was below 10 mg/l in all 19 laboratory samples from 2014 to 2016, with a median of 0.95 mg/l. Nitrogen is the value for which the ongoing analyses most often show that readjustment is needed.

In operation

K-07 Remote monitoring data from Reference Plant Western Germany, which has two DV lines, both multi-stage vacuum evaporators, show a technical availability as defined in VDI 3423 of at least 95 % in the 2023/24 evaporation season (October to February) and at least 88 % in the 2024/25 season. The calculation is conservative: every minute with an active common fault signal counts as downtime, even where the cause lay outside the plant, such as a lack of heat.

K-16 From August 2025 to January 2026, the four-stage Reference Plant Switzerland was in operation for almost 90 % of the time. Within this operating time, it was evaporating 93 % of the time; the remainder was cleaning and maintenance. The only exclusions are the CHP replacement with rework of the heating network in November and the Christmas holidays.

K-17 Daily operating data from Reference Plant Switzerland over 51 complete operating days (26 June to 3 October 2026, each from 08:00 to 08:00) show that the evaporator was evaporating 82 % of the total time. Cleaning accounted for 4 %, start-up and shut-down for 2 %, and standby and other stops for 12 %.

K-08 The same distillate output per line, two different designs: a three-stage DV line at Reference Plant Western Germany and the four-stage DV4000 at Reference Plant Switzerland each produce around 40 m³ of distillate on a full operating day. The four-stage plant needs around 350 kW of heat for this, the three-stage line around 490 kW. Reference Plant Western Germany runs two lines in parallel and reaches around 80 m³ of distillate on days when both run at full load. The number of stages depends on how much heat is available on site.

K-18 At full load of 350 to 370 kW heat, the four-stage evaporator at Reference Plant Switzerland produced 4.5 to 4.7 litres of distillate per kWh of heat (design value 4.3 l/kWh) in 2026.

K-09 The two DV lines at Reference Plant Western Germany, which treat food-waste digestate, are cleaned chemically (CIP) every 240 operating hours, which in practice means about every two weeks. One cleaning cycle, including rinsing, takes around 9 hours; during the evaporation season, cleaning therefore accounts for around 2.5 % of the time. How often cleaning is needed depends on the medium and on operating experience: Reference Plant Switzerland, which also treats food-waste digestate, cleans weekly.

K-11 At Reference Plant Western Germany, which treats food-waste digestate, the biogas plant staff are on site Monday to Friday in two shifts and look after the evaporators alongside their other duties. In the 2023/24 evaporation season, more than half of the distillate was produced at night and at weekends, with nobody on site. During these hours the lines were evaporating 83 % of the time.

K-12 If heat is briefly unavailable, a DV line waits in idle mode for an adjustable time, typically 60 to 90 minutes, and carries on evaporating as soon as the heat returns. If no heat comes, the plant shuts down automatically. After pauses of up to eight hours, a line at Reference Plant Western Germany is evaporating again after around 70 minutes on average and reaches 90 % of its output after around 80 minutes. This allows the evaporator to follow a flexible CHP operating schedule.

K-14 At Reference Plant Western Germany, which treats food-waste digestate, the DV lines reduce the volume that has to be stored and spread by around two thirds: around 3 m³ of digestate becomes around 1 m³ of concentrate. The rest leaves the plant as distillate and as ammonium sulphate solution (ASL).

