

High savings potential through the use of PURION H systems with legionella prevention

Single-family house: up to € 875 savings potential
p.a.

Multi-family house: up to 2,181 € savings potential
p.a.

September 2022

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Exploding prices and uncertainty in gas supply require the realisation of savings potentials in hot water supply

Overview: Initial situation and objective

Initial situation

- Sharp rise in gas prices
- Uncertainty about gas supplies in winter/ danger of rationing
- Hot water production and supply associated with high energy consumption
- Hot water circuits usually operated at $\geq 60^{\circ}\text{C}$ temperature to ensure thermal disinfection, e.g. for legionella prevention (cf. DVGW worksheet W551 p. 9).
- Energy source for hot water production and supply is often natural gas



Hot water preparation associated with high costs/ and uncertainties

- Temperature reduction in principle also possible according to DVGW recommendations ¹

Objective for a solution

- Reduction of energy consumption through the use of natural gas by lowering the temperature in the hot water circuit
- DVGW-compliant procedure for temperature reduction in water circuits with simultaneous legionella prevention and other biological loads¹



Realisation of substantial (financial) savings potentials

¹ cf. DVGW Code of Practice W 551 p.9-12

High savings potential through fused temperature reduction in hot water circuits

Overview: Procedure and results

Procedure

- Temperature reduction in the hot water circuit by 20 degrees
- Every 2 weeks 1 day temperature increase to ensure thermal disinfection

Installation of a special PURION H UV system (up to max. 90°C) for continuous UV-based disinfection of the circulating hot water (installation after the boiler in the riser pipe).

Summary Result

DVGW-compliant safety concept to prevent legionella and other biological contamination¹

Single-family house: per year (!) up to **€ 875 savings potential** taking into account running costs for the PURION UV system.²

Multi-family house: per year (!) Up to **€ 2,181 savings potential** taking into account ongoing costs for the PURION UV system.²

¹ cf. DVGW Code of Practice W 551 p.9-12

² cf. the following illustrations on premises and calculation

Special PURION amalgam technology enables safe use in hot water up to 90 °C - conventional UV systems can only be used up to 40 °C

Overview PURION H UV systems

PURION 1000 H



Flow rate:

- Up to 1.5 m³/H

Field of application:

- Individual household
- Detached house

PURION 2500 H



Flow rate:

- Up to 5 m³/H

Field of application:

- Apartment house

PURION 2500 DUAL H



Flow rate:

- Up to 10 m³/H

Field of application:

- large apartment building

PURION DVGW



Flow rate:

- Up to 4.0 m³/H

Field of application:

- large apartment building


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Savings potential for single-family house: basic premises for scenario calculations - market prices for energy costs based on current values

SFH Savings potential: Premises

Procedure Cost comparison	Basic premises		Costs PURION UV technology (gross)		
			Element	unique	r.h. p.a.
Savings through: <ul style="list-style-type: none"> Lowering the temperature in the water circuit by 20 °C Every 2 weeks temperature increase by 20 °C <p>vs.</p> <p>Costs by: Disinfection by PURION UV system (H series)</p> <p> If thermal disinfection is not possible due to complex piping or outdated equipment, UV disinfection is the only alternative.</p>	Power supply UV lamp:	Electricity - 0,45 €/ kWh	UV system PURION 1000 H 42 W (OTC)	673,54 €	
	Energy source hot water:	Gas - 0,30 €/ kWh	Installation	150,00 €	
	Efficiency hot water heating	80%	Spare lamp		105,50 €
	Temperature difference with UV disinfection technology	-20°C permanent +20°C every 2 weeks ²	Current 42 W		165,56 € ¹
	Persons per UV system	5 (single-family house)	total	823,54 €	271,06 €
	Energy saving for hot water supply in the circuit per day	-2.0 kWh			

¹ Assumptions: Continuous operation and 0.45 cents/ kWh

² This refers to a temperature increase to the former level ≥60°C.

UV technology for legionella prevention is advantageous in a purely economic assessment with conservative calculation - amortisation already after 1 year

Overview amortisation calculations

Bills based on premises - to be adapted for concrete application

Hot water consumption per day (litres per person) & temperature difference C°	40	50	60
	-20 C°	-20 C°	-20 C°
Joule/watt second per day to achieve temperature difference	-3.344.000	-4.180.000	-5.016.000
Kilowatt hour per day (kWh)	-0,929	-1,161	-1,393
Provisioning expenditure per day (kWh)	-2,0 ²	-2,0 ²	-2,0 ²
kWh per year net (efficiency 100%) ¹	-998,8	-1077,9	-1157,1
kWh per year gross (efficiency 80%)	-1.248,4	-1.347,4	-1.446,4
<i>of which kWh Provisioning expenditure Cycle</i>	-852,5	-852,5	-852,5
Cost savings Provision of circuit p.a.	-255,75	-255,75	-255,75
Cost saving per person p.a.	- 118,78 €	- 148,48 €	- 178,17 €
Cost saving per plant/year	- 849,66 €	- 998,14 €	- 1.146,61 €
Variable costs per year	271,06 €	271,06 €	271,06 €
<i>dav. Spare lamp</i>	105,50 €	105,50 €	105,50 €
<i>dav. Electricity</i>	165,56 €	165,56 €	165,56 €
Surplus energy savings vs. variable costs per year	-578,59 €	-727,07 €	-875,55 €
Payback period in years	1,4	1,1	0,9

¹ Considering a temperature increase on one day every 2 weeks: Savings potential only considered for 341 days


² This refers to the reduction of the energy required to maintain the reduced base temperature in the hot water circuit.

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Savings potential of multi-family house: basic premises for scenario calculations

- market prices for energy costs based on current values

MFH Savings potential: Premises

Procedure Cost comparison	Basic premises		Costs PURION UV technology (gross)		
			Element	unique	r.h. p.a.
Savings through: <ul style="list-style-type: none"> Lowering the temperature in the water circuit by 20 °C Every 2 weeks temperature increase by 20 °C <p>vs.</p> <p>Costs by: Disinfection by PURION UV system (H series)</p> <p> If thermal disinfection is not possible due to complex piping or outdated equipment, UV disinfection is the only alternative.</p>	Power supply UV lamp:	Electricity - 0,45 €/ kWh	UV system PURION 2501 H 106 W (OTC)	1.045,41 €	
	Energy source hot water:	Gas - 0,30 €/ kWh	Installation	150,00 €	
	Efficiency hot water heating	80%	Spare lamp		152,32 €
	Temperature difference with UV disinfection technology	-20 °C permanent +20 °C every 2 weeks	Current 106 W		417,85 € ¹
	Persons per UV system	12 (apartment building)	total	1.195,41 €	570,17 €
	Energy saving for hot water supply in the circuit per day	-4.8 kWh			

¹ Assumptions: Continuous operation and 0.45 cents/ kWh

² This refers to a temperature increase to the former level ≥60°C.

UV technology for legionella prevention is advantageous in a purely economic assessment with conservative calculation - amortisation already after < 1 year

Overview amortisation calculations

Bills based on premises - to be adapted for concrete application

Hot water consumption per day (litres per person) & temperature difference C°	40	50	60
	-20 C°	-20 C°	-20 C°
Joule/watt second per day to achieve temperature difference	-3.344.000	-4.180.000	-5.016.000
Kilowatt hour per day (kWh)	-0,929	-1,161	-1,393
Provisioning expenditure per day (kWh)	-4,8 ²	-4,8 ²	-4,8 ²
kWh per year net (efficiency 100%) ¹	-1.953,6	-2.032,7	-2.111,9
kWh per year gross (efficiency 80%)	-2.441,9	-2.540,9	-2.639,9
<i>of which kWh Provisioning expenditure Cycle</i>	<i>-2.046,0</i>	<i>-2.046,0</i>	<i>-2.046,0</i>
Cost savings Provision of circuit p.a.	-613,80	-613,80	-613,80
Cost saving per person p.a.	- 118,78 €	- 148,48 €	- 178,17 €
Cost saving per plant/year	- 2.039,18 €	- 2.395,53 €	- 2.751,87 €
Variable costs per year	507,17 €	507,17 €	507,17 €
<i>dav. Spare lamp</i>	<i>152,32 €</i>	<i>152,32 €</i>	<i>152,32 €</i>
<i>dav. Electricity</i>	<i>417,84 €</i>	<i>417,84 €</i>	<i>417,84 €</i>
Surplus energy savings vs. variable costs per year	-1.469,01 €	-1.825,35 €	-2.181,70 €
Payback period in years	0,8	0,7	0,5

¹ Considering a temperature increase on one day every 2 weeks: Savings potential only considered for 341 days

² This refers to the reduction of the energy required to maintain the reduced base temperature in the hot water circuit.

Appendix

Exemplary detailed illustration Calculation method explains annual imputed cost savings per PURION UV system

Example: Calculation path 60 litre daily consumption p.p.

Bills based on premises - to be adapted for concrete application

- Heat capacity water: 4.18 J/(g K)
- 60 litres of water: ~ 60,000 g.
- Temperature difference 20 °C: ~ 20 K

$$\begin{aligned}\text{Energy demand} &= \text{heat capacity} * \text{mass} * \text{temperature difference} \\ &= 4.18 \text{ J/(g K)} * 60,000 \text{ g} * 20 \text{ K} \\ &= 5.016.000 \text{ J} \\ &= 5,016,000 \text{ Js}\end{aligned}$$

$$\begin{aligned}\frac{5,016,000 \text{ Js}}{3,600 \text{ s/h}} &= 1393.3 \text{ Wh} \\ &= 1.393 \text{ kWh}\end{aligned}$$

Additional supply expenditure 2 kWh/ day = 730 kWh/ year
(Reduction)

Required energy at 80% efficiency = $((1.393\text{kWh} + 2\text{kWh}) * 341) / 0.8$
(reduction) = 1,446 kWh/ year (of which $2*341\text{kWh}/0.8 = 852.5 \text{ kWh}$ provision)

Cost saving provision circuit = $852.5 \text{ kWh/h} * 0.30 = 255.75$

Cost saving per person = kWh/ year * energy costs gas
 $= 593,5 \text{ kWh} * 0,30 \text{ €}$
 $= 178,05 \text{ €}$

Cost saving per UV system = Cost saving per person * Number of persons per UV system + Savings on provisioning
 $= 178,05 \text{ €} * 5 \text{ persons} + 255,75 \text{ €}$
 $= 1.146 \text{ €}$