

Bamberg, Sept. 10th 2014


Dear Dr. Nickel,

We herewith confirm that on Bamberg WWTP two ultrasound reactor modules of Ultrawaves High Power US-technology are working continuously since year 2004 to improve anaerobic sewage sludge digestion performance.

We are evaluating the performance of anaerobic sewage sludge digestion system on Bamberg WWTP - based on mass balances - for more than 20 years. Installation of the Ultrawaves HPUS technology resulted in an increased volatile solids degradation and increased biogas production: The energy recovery due to electrical utilization of biogas from anaerobic sewage sludge digestion was improved from conventionally 65% to ca. 85% (related to the energy consumption on Bamberg WWTP).

In year 2010 the combined heat and power station (CHP) was renewed on Bamberg WWTP so that energy recovery was increased to more than 100%. *In other words:* On Bamberg WWTP more electrical energy is produced by anaerobic digestion of the "own" sewage sludge (without feeding any co-substrates to the AD) than energy is consumed by wastewater treatment. Therefore, Bamberg WWTP is the first WWTP in Germany which is operating energy autarkic.

Best regards, Entsorgungs- und Saubetrieb
der Stadt Bamberg - Klärwerk
LA.



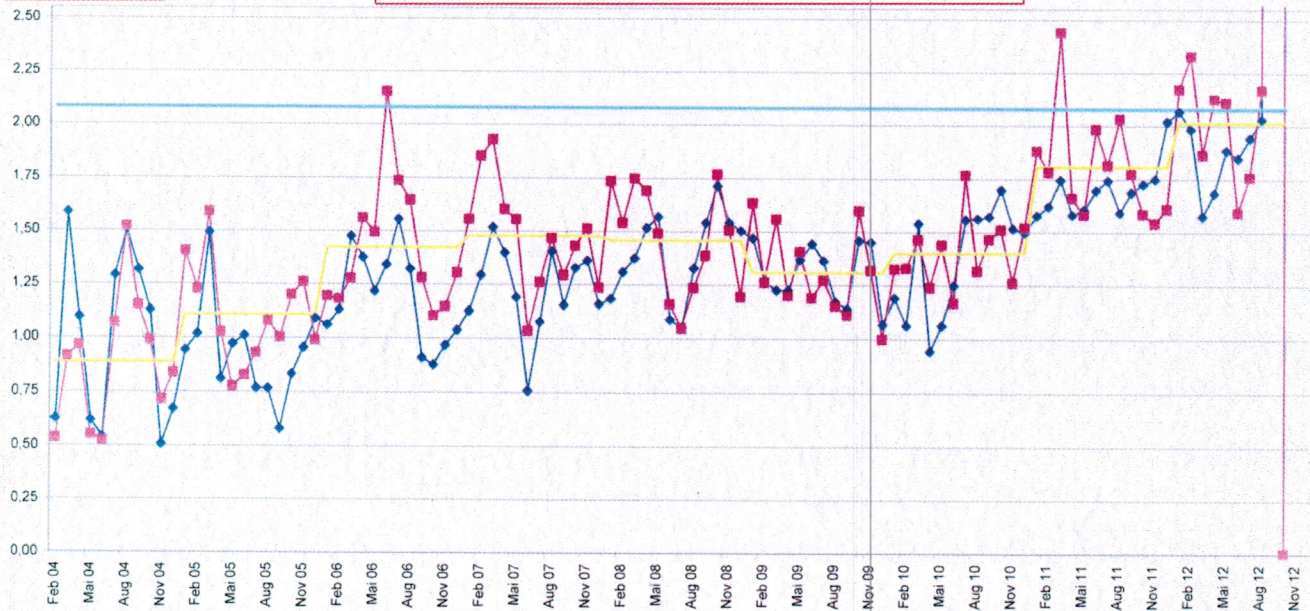
Dipl.-Ingenieur Wolff - Plant Manager of Bamberg WWTP

Bamberg WWTP
Energy production per people equivalent (PE)

- Specific energy production per PE (for COD average)
- Specific energy production per PE (for BOD₅ average)
- Monthly average value a year (for BOD₅)
- Theoretical maximum value ($\eta_{\text{electr.}} = 38\%$)

Theoretical maximum value energy production: 2.08 kWh/PE a month,
(see UBA 2008 (PE for BOD₅))

kWh/PE x month

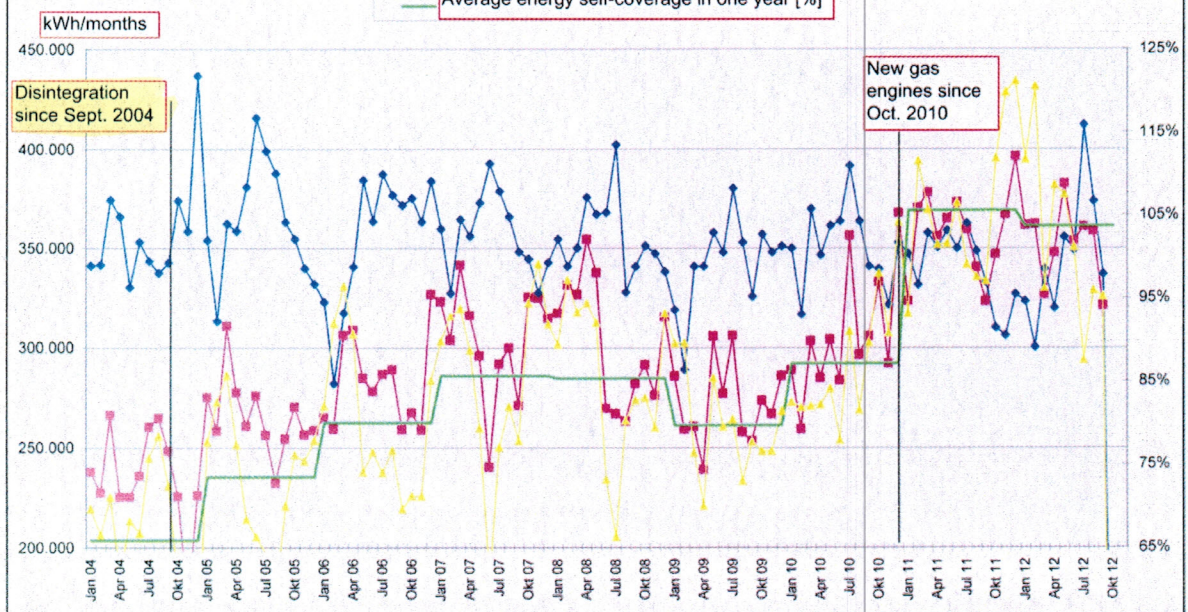


23.10.2012

Figure: Energy production per people equivalent (PE) on Bamberg WWTP

Bamberg WWTP
Energy demand and production

- Energy production [kWh/months]
- Energy demand [kWh/months]
- Energy self-coverage [%]
- Average energy self-coverage in one year [%]



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Figure: Energy demand, energy production and energy self-coverage of Bamberg WWTP