Nominal Economic Benefits from AGF deriving from Energy Production and Solids Disposal Reduction

Overview

The following analysis derives the economic benefits from installing the AGF process in a nominal treatment plant. We show the basic operational improvement for a one million gallon per day plant. The benefits of AGF derive from increased conversion of solids to gas. There are two main benefits of this: increased energy production and decreased solids disposal costs. The operational performance is then applied to a nominal 10 mgd plant.

The following analysis addresses two options for installing the AGF technology. The first option is just to attach the flotation unit to an existing digester. The second option is to also install the pasteurization process. This second step further increases total volatile solids destruction and, most importantly, produces a Class A solids residual. By producing such a residual, the disposal costs are reduced to zero since there is currently a demand for such solids.

Nominal Performance Parameters for a 1 MGD Plant

A 1.0 mgd treatment plant will generate 1,870 pounds per day of total thickened solids. The total thickened solids will be 80% volatile. Therefore, each 1.0 mgd treatment plant will generate 1,500 pounds per day of volatile solids.

The destruction of each pound of volatile solids will yield 8 cubic feet of 1000 Btu methane gas or 8000 Btu's. That is equivalent to 2.35 Kwh. (1000 Btu = 0.293 Kwh). At a conversion efficiency of 33% in a microturbine, the power generated from the destruction of each pound of volatile solids is equal to 0.78 Kwh. At a value *5 cents* per Kwh the gas value from the destruction of one dry ton of volatile solids destroyed is 0.78 Kwh * 2000 * 0.05 = $78.00 / dt

The cost of solids disposal is approximately $35 per wet ton. A belt press produces 16.5% dry solids, an AGF belt press produces 18% dry solids, and a high solids centrifuge produces 24% solids. The dry solid disposal cost is as follows: (dt is dry ton)

Belt Press $ 212.00 / dt
AGF Belt Press $ 194.44 / dt
HS Centrifuge $ $145.83 / dt

A simple and underestimate of the marginal economic benefit for the AGF process is the sum of the energy income plus the obviated disposal costs per ton of volatile solids destroyed. This is (78+212) or $290/dt. However, in fact, AGF will also reduce all of the residual solids handling since they are made amenable to greater solids concentration. By installing the pasteurization step, all solids disposal costs are removed, so the marginal economic benefit of pasteurization needs to incorporate the total flow values.

Application of Unit Production Values to a 10 MGD Plant

The following table presents the cost associated with the conversion of dry solids to gas and the disposal of the residual for a 10 mgd wastewater treatment plant. The table compares a Conventional anaerobic process to the two options for AGF: AGF and AGF with Pasteurization. We indicate the costs as a function of Belt Press and Centrifuge since it is commonly thought that there is significant economic benefit from producing higher solids concentration for subsequent disposal.

	Conv.	AGF	AGF Past	AGF- Conv	Past - Conv
Plant Size (mgd)	10	10	10	0	0
Influent VS (dt/d)	7.5	7.5	7.5	0	0
% VS to Gas	50	72	80	22	30
VS (dt/d) to Gas	3.75	5.4	6	1.65	2.25
VS (dt/d) Disposed	3.75	2.1	1.5	-1.65	-2.25
Energy Value (¢/Kwh)	5	5	5	0	0
Energy Value ($/dt/d)	78	78	78	0	0
Press Disposal Cost ($/dt)	212	194	0	$ (18)	$ (212)
Cent Disposal Cost ($/dt)	145	145	0	0	$ (145)
Energy Produced per day(Kwh)	5850	8424	9360	2574	3510
Disposal Cost Press ($/d)	$ 795	$ 407	$ -	$ (388)	$ (795)
Disposal Cost Cent ($/d)	$ 544	$ 305	$ -	$ (239)	$ (544)
Energy Income ($/d)	$ 293	$ 421	$ 468	$ 129	$ 176
Net Cost with Press	$ 503	$ (14)	$ (468)	$ (516)	$ (971)
Net Cost with Centrifuge	$ 251	$ (117)	$ (468)	$ (368)	$ (719)

It is apparent from the above that there are significant benefits from each option of AGF. But by going to Class A there is a huge reduction in disposal costs. This step effectively suggests that the cost of centrifuges can be forgone through the progression to Class A.

The cost for the AGF pasteurization system for a 10 mgd plant is approximately $1.5 million. (This cost should not be used as a multiplier for mgd since cost of flotation units is non-linear, the larger the less expensive per unit volume.) The capital cost per Kwh is $1,500,000 / 3510*365 or $1.17 / kwh. The capital cost per Kwh of the AGF pasteurization, if power production facilities do not exist and are installed, is $1,500,000 / 9360*365 or $0.44/ Kwh. This is competitive with current best technology for wind turbines.

Please note that these are just some of the operational benefits, they do not address several other advantages of AGF. These include the reduction in capital costs if a plant needs to increase its digestion capacity. Other benefits include process stabilization, reduction in polymer costs, reduction in belt press labor hours and maintenance.