Radom WWTP’s sludge line optimisation

Marek Góźdź
# Calendar of modernisation of sludge line

<table>
<thead>
<tr>
<th>Stage</th>
<th>Time Period</th>
<th>Description</th>
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<tr>
<td>Stage I</td>
<td>2003 – 2009</td>
<td>Design and realisation of dewatering and drying plant</td>
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<td>2009 – 2015</td>
<td>Operation of dewatering and drying plant</td>
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<tr>
<td>Stage II</td>
<td>2012– 2015</td>
<td>Optimisation of Stage I</td>
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</table>
Stage I — drying plant

Sludge line status before drying plant project:

- mechanical dewatering up to 20 – 25% d.m.
- no digestion
- high organic matter content approx. 70 %
- amount of sludge – 80 – 90 t/d (dewatered)
- tannery production influence the sludge quality
- problems with dewatered sludge management
Technology:

- medium temperature one belt dryer (max 130 C)
- direct drying (no heat exchangers)
- product cooling on the belt
- granulate recirculation - d.m. content in dryer inlet min. 60% independently of d.m. content after mechanical dewatering
- no sticky phase
- sludge distribution system resistant to clogging
- no need for emptying the dryer during long operation breaks
- ATEX compatibility.
- fast start and stop (5 – 15 minutes)
- low operation and maintenance costs
- low energy costs
- no inertisation
- stainless steel (all elements with contact with sludge and wet air)
Stage I – drying plant
7 years operation experiences:

- easy to operate – no extra personnel.
- minimum maintenance – no heat exchangers cleaning, automatic belt cleaning system
- automatic mode – operation, start and stop
- necessity of high safety rules (CO measurement calibration, dust measurement maintenance)
- easy and fast start and stop
- sludge inside dryer during long operation breaks (5 months)
- resistant to foreign elements in sludge
- resistant to sludge d.m. content after mechanical dewatering
- specific thermal energy consumption – 0.8 kWh/kg H₂O
Dry sludge not digested
Stage II – modernisation of sludge line

- The main goal was to lower the cost of electrical and thermal energy consumption

- The amount of natural gas consumption in the dryer is proportional to amount of evaporated water, so you can save thermal energy by drying higher dewatered sludge

- Digestion lowers the amount of sludge dry matter to be dried

- Digested sludge can be higher dewatered

- Biogas produced in digestion process is source of electrical and thermal energy
Option 1

Higher dry matter content in dewatered sludge – up to 30 d.m. - new dewatering system
Option 2

Preliminary sludge drying in hybride dryer (solar drying + heat from heat pumps) up to 27 – 28 % d.m.
Existing belt presses dewatering.
Option 3

Methan digestion, biogas production, electricity production, heat utilisation for digestion and drying. Existing belt presses dewatering.
Option 4

Methan digestion, biogas production, electricity production, heat utilisation for digestion and drying. New dewatering system – higher dry matter content, up to 30% d.m.

- Option 1 + Option 3
Option 5

No process changes, base option.
Stage II – modernisation of sludge line

Option 6

Mono sludge incineration plant, utilisation of all heat for drying process
Stage II – modernisation of sludge line

OPTIONS COSTS COMPARISON

<table>
<thead>
<tr>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3</th>
<th>Option 4</th>
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<tbody>
<tr>
<td>Investment Costs in MLN PLN</td>
<td>29</td>
<td>41</td>
<td>36</td>
<td>44</td>
<td>56</td>
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<tr>
<td>15 Years Operation Costs in MLN PLN</td>
<td>58</td>
<td>76</td>
<td>73</td>
<td>62</td>
<td>85</td>
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<tr>
<td>Total Costs in MLN PLN</td>
<td>87</td>
<td>118</td>
<td>73</td>
<td>62</td>
<td>85</td>
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Option 4 was chosen for realisation:

- **Reduction of thermal energy consumption:**
  - flue gases from gas motor directly transmitted to the dryer
  - reduction of water to be evaporated by better dewatering
  - reduction of dry matter amount by digestion

- **Reduction of electrical energy consumption:**
  - production of electrical energy from biogas, covering 30 – 60% of total WWTP’s needs
Stage II – modernisation of sludge line

- Biogas Motor
  - el. energy
  - biogas

- Belt Dryer
  - flue gases
  - granulate

- Digester
  - hot water

- Dewatering
  - dewatered sludge (30% d.m.)
Stage II – modernisation of sludge line

View of new sludge line
Stage II – modernisation of sludge line

View of new sludge line
SUMMARY

There are many elements affecting the best option choice:

- sludge amount and existing status of sludge line – different for each WWTP
- variable situation on dry granulate market
- variable situation on natural gas and electrical energy market price
- legislation changes
2 years of operation experiences:

- high operation costs and maintenance problems of gasmotor
- necessity of high level of siloxan removal (extra cost)
- easy and economic dryer operation with flue gases transferred from gas motor
- idea of biogas transfer directly to the dryer – low operation and maintenance costs
- problem of transport of high dewatered sludge
- problem of long distance transport of dried sludge
THANK YOU FOR YOUR ATTENTION

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