



Waste



## PROVIDES AN INNOVATIVE SOLUTION FOR THE WASTEWATER TREATMENT PLANT OF THE CITY OF SAINT PETERSBURG

### CONTEXT

The central station of Saint Petersburg has a capacity of 2.3 million Equivalent Habitant. It Produces 175 tons of sludge per day, over 64 000 tonnes of dry matter per year incinerated on site.

### PROBLEMS ENCOUNTERED:

This WWTP has 10 centrifuge decanters for dewatering sludge before incineration.

After a decade of operation and new connections, sludge dewatering has become insufficient. Hydraulic overload of centrifuge decanters requires the operator to work more often with at least 9 of the 10 centrifuges installed.

This poses two problems:

- 1-A risk of inability to dewater if one centrifuges fails
- 2-A decrease of dryness before incineration increasing the energy consumption of the drying step

This is coupled by an excessive operating cost of dehydration due to the use of a

maximum of centrifuge decanters. This leads ultimately to increased polymer and electricity consumption.

### SOLUTION

ADEQUATEC proposed to thicken a part of the sludge before the dehydration step to reduce the hydraulic loading of centrifuges. Result

The number of operating centrifuges has been lowered to 5 units making available half of the park and reducing both the risk of failure and operating cost. The final dryness of sludge has been significantly improved thanks to the fall of the hydraulic load on centrifuges in operation. An annual saving of 15,750 tonnes of CO<sub>2</sub> could be achieved.

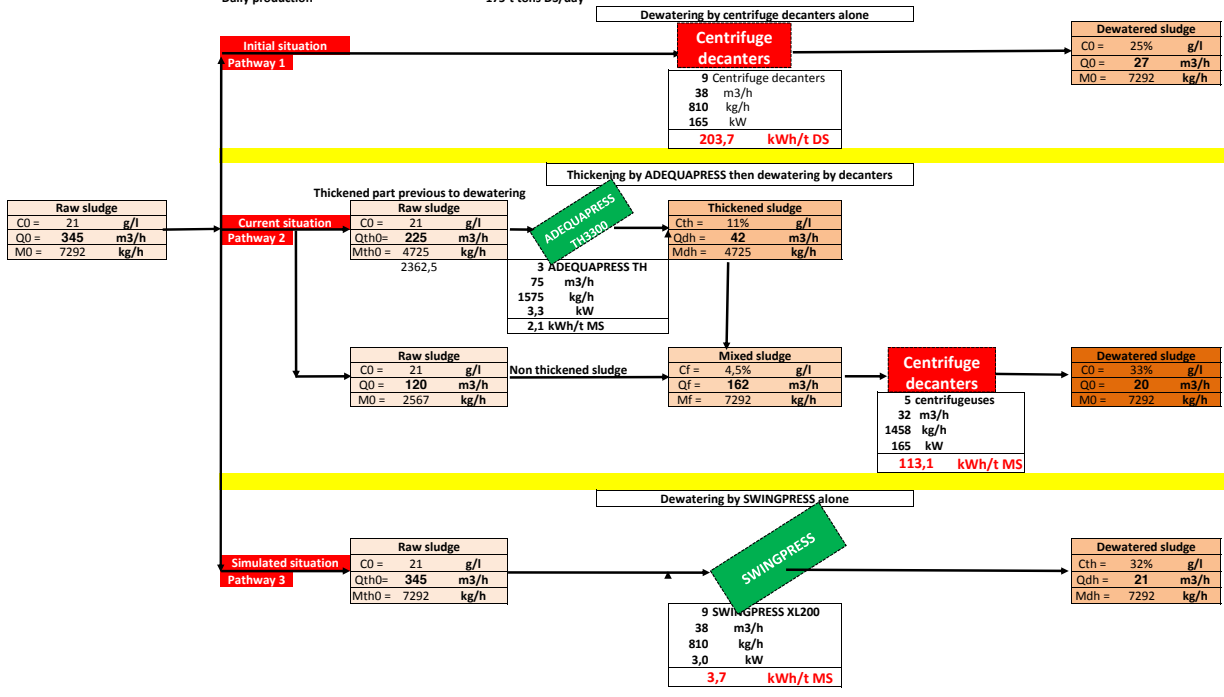
### PATHWAY 3

We simulated the replacement of centrifuge decanters by SWINGPRESS screw presses much less energy consuming. Saving energy is more important and the Carbon equivalent reduction reached 18 975 tonnes of CO<sub>2</sub>.

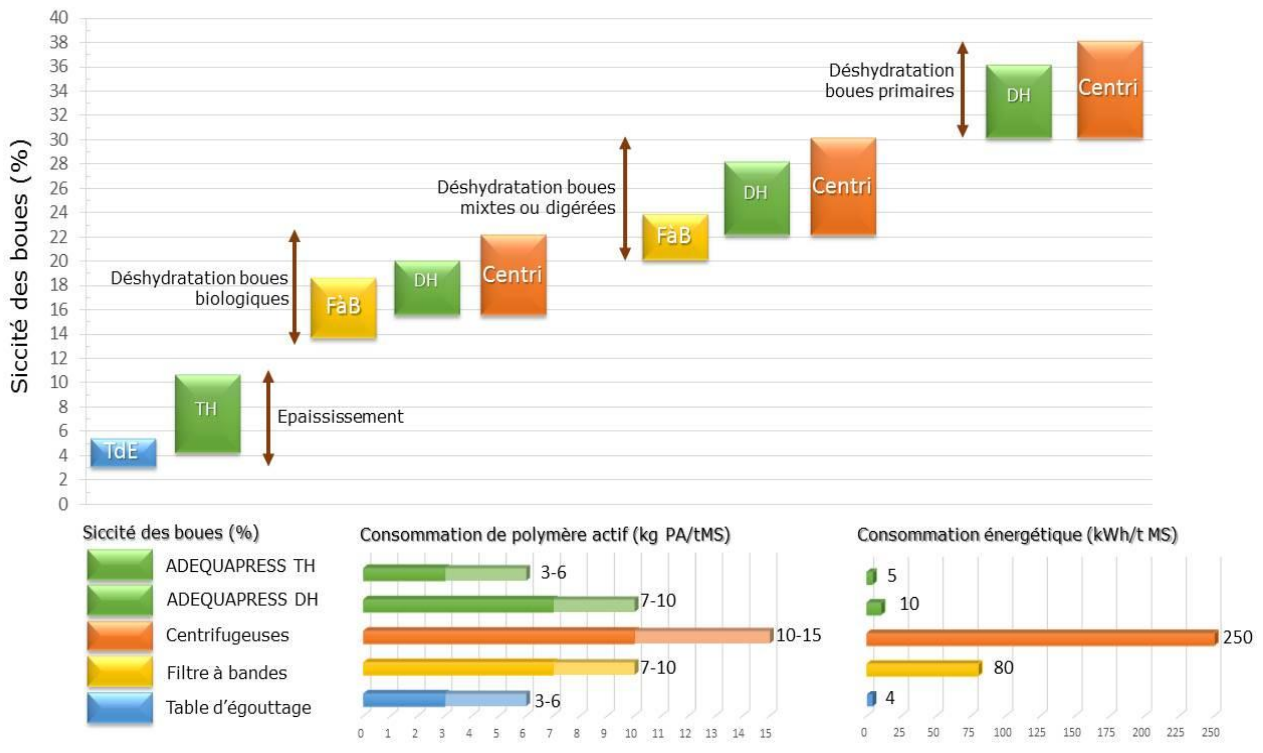
The results are summarized in the table below:

	Pathway 1	Pathway 2	Pathway 3	
	9 Centrifugeuse decanters	ADEQUAPRESS + 5 Centrifugeuse decanters	9 SWINGPRESS	Unit
Electric power for dehydration	1 620	919	135	kW
Electric power for sludge drying	8 750	6 629	6 836	kW
Total installed power	10 370	7 548	6 971	kW
Yearly electric consumption	90 592	65 937	60 898	MWh
CO2 Equivalent	57 888	42 133	38 914	tonne CO2
Reduction in CO2 imition / Pathway 1		15 755	18 975	tonne CO2
Reduction in CO2 imition / Pathway 1 (%)		27%	33%	%

Sludge treatment  
 Saint Petersburg Central WWTP  
 Capacity : 2 300 000 Inhabitant Equivalents  
 Annual sludge quantity 63 875 tons DS/year  
 Daily production 175 t tons DS/day



Process efficiency



### Carbon Balance

Saint Petersburg Central WWTP

	Pathway 1	Pathway 2		Pathway 3	Units
	Initial situation	Current situation		Simulated situation	
<b>Master data</b>	Dewatering	Thickening	Dewatering	Dewatering	
WWTP capacity as PE	2 350 000	1 520 000	2 350 000	2 350 000	PE (population equivalent)
Average sludge concentration	21	21	44.5	21	g DS/l
Daily sludge production	175 000	113 400	175 000	175 000	kg DS/day
Yearly sludge production	63 700	41 278	63 700	63 700	ton DS/year
Weekly sludge production	1 225 000	793 800	1 225 000	1 225 000	Kg DS/week
Sludge dryness	25%	11%	33%	32%	%
<b>Sizing</b>					
Operation number of days per week	7	7	7	7	days/week
Operation hours per day	24.0	24.0	24.0	24.0	hr/day
Operation hours per week	168	168	168	168	Hr/week
Mass flow rate	7292	4725	7292	7292	Kg DS/hr
Hydraulic flox rate	347	225	164	347	m3/hr
<b>Model</b>	DN600	TH3300	DN600	DH3400	
<b>Technology</b>	Centrifuge decanter	ADEQUAPRES	Centrifuge decanter	SWINGPRESS	
Number of units in operation	9	3	5	9	
Unit mas flow rate	810	1575	1458	810	Kg DS/hr
Unit hydraulic flow rate	39	75	33	39	m3/hr
<b>Unit installed power</b>	205	3	205	300	kW
<b>Unit specific installed power</b>	253	2.1	141	4	kWh/ton of DS
Peripheral equipment installed power (Approximately)	10	3	10	10	KW
Dewatering total installed power	1935	18,9	1075	117	kW
<b>Total installed power for dewatering</b>	<b>1935</b>	<b>1094</b>		<b>117</b>	<b>kW</b>
<b>% of dewatering installed power reduction</b>		<b>43%</b>		<b>94%</b>	<b>%</b>

	Pathway 1	Pathway 2		Pathway 3	Units
	Initial situation	Current situation		Simulated situation	
<b>Master data</b>	Dewatering	Thickening	Dewatering	Dewatering	
Polymer treatment rate	11	2,5	7	7	kg AM/t DS (AM= polymer active matter)
Polymer consumption of each step	80	12	51	51	Kg AM/hr
<b>Total polymer consumption for dewatering</b>	<b>80</b>		<b>63</b>	<b>51</b>	<b>Kg AM/hr</b>
Dryness	25%	33%		32%	%
Humidity	75%	67%		68%	%
<b>Operating yerly balance</b>	Pathway 1	Pathway 2		Pathway 3	
Dewatering yearly power consumption	16 904	9 556		1 022	MWh
Dewatering yearly polymer consumption	701	549		446	tons AM
<b>Total power consumption per year</b>	<b>16 904</b>	<b>9 556</b>		<b>1 022</b>	<b>MWh</b>
<b>Carbon balance</b>	Pathway 1	Pathway 2		Pathway 3	
Dewatering power carbon equivalent	2 946	1 665		178	tons of carbon
Polymer carbon equivalent	155	121		99	tons of carbon
<b>Carbon equivalent of WWTP sludge dewatering</b>	<b>3 101</b>	<b>1 787</b>		<b>277</b>	<b>tons of carbon</b>

	Pathway 2	Pathway 3	Units
<b>Saved carbon emission per year</b>	<b>1 314</b>	<b>2 824</b>	<b>tons of carbon/year</b>
<b>Saved CO2 emission per year</b>	<b>4 130</b>	<b>8 876</b>	<b>tons CO2/yaer</b>
<b>% carbon emission reduction compared to Pathway 1</b>	<b>42%</b>	<b>91%</b>	<b>%</b>

[electricity-specific emission factors - Ecometrica](#)

\*\* source : <http://ecometrica.com/assets/Electricity-specific-emission-factors-for-grid-electricity.pdf>

Russian Federation  
Russian Federation

Polyacrilamid polymer

0.174 kg C/kWh or tons C/MWH \*\*  
0.639 kg CO2/kWh

0.221 kg C/kg PA  
0.810 kg CO2/kg PA

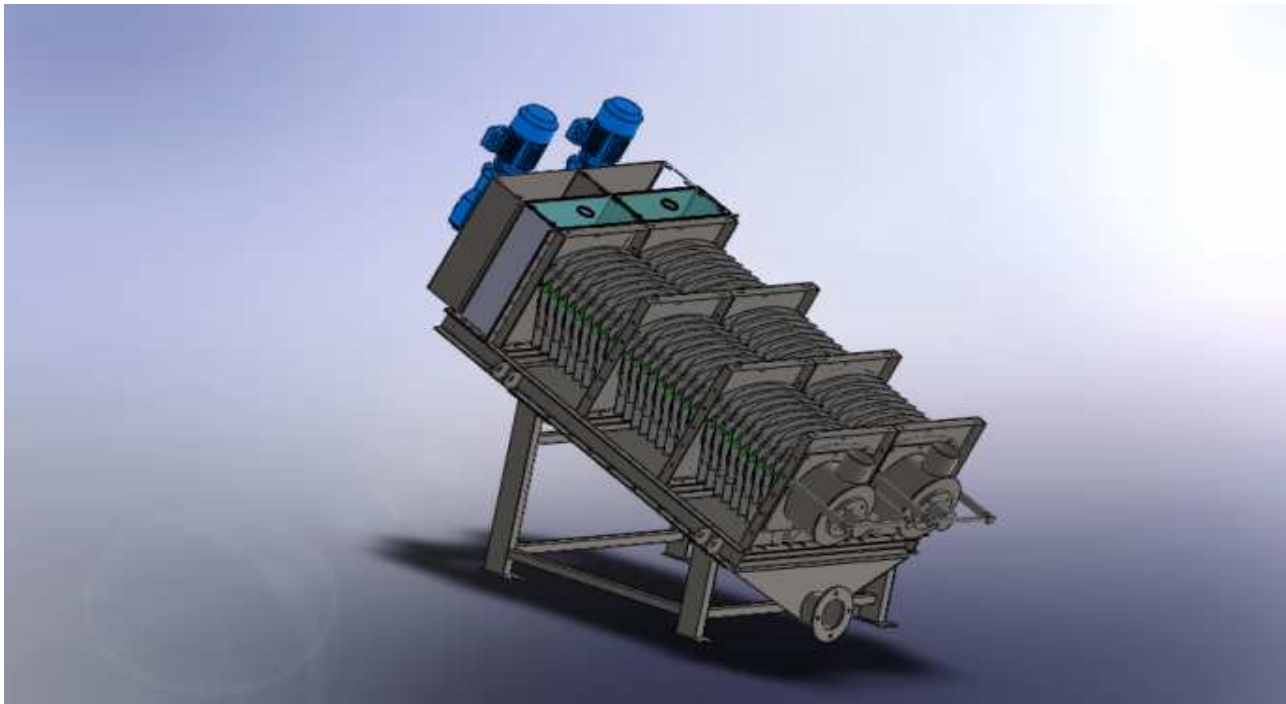
## Saint Petersburg (2006)



- 2 300 000 EH / Veolia Water
  - Boue biologique
  - Concentration des boues: 5 g/l
- **3 x ADEQUAPRESS TH 3300**
  - Performance: 110 m<sup>3</sup>/h
  - Siccité finale: 8%
- **80 tMS/jour (24h/24) – 8%**



### SWINGPRESS DH8200 - 500 kg DS/hr - 3 kW



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