

CHICKEN ABATTOIR

BACKGROUND

The company produces fresh and frozen whole chicken; fresh and frozen chicken pieces, chicken offal, and poultry feed meal. The water, energy, and waste streams were investigated, and a number of potential cleaner production options have been identified from the walk through assessments.

This Chicken abattoir is a family owned business established in Polokwane. There are 400 people working in double shifts of 40-45 hours per week. These employees process 195 000 chickens per week. The annual turnover is R300 million. Customers are retailers, wholesalers and locals. The management sees room for Cleaner Production improvement in the water onsite.

The breeding time of the chicken is 7,5 weeks, after which the chickens are sent to the abattoir. This is considered the time for 1 cycle.

CHALLENGE

NCPC-SA conducted a CP assessment of the Chicken abattoir which included quick scan and walkthrough to identify the key areas with Cleaner Production opportunities. From the quick scan, key areas identified with CP opportunities were on the water onsite and energy usage.

WATER

Cooling Tower Anti-Scalant Addition

The cooling tower runs on 2 cycles of concentration at present and uses 8,42m³/h of water, which is 200m³ water a day. For both of these cycles the cooling tower evaporates 4,2m³/h or 100m³ water per day. The blow down rate is 4,2m³/h water or 100m³ water per day.

By adding an anti-scalant to the cooling tower you will improve the cycles of concentration to 5 and decrease the water usage to 5, 26 m³/h (126m³ water per day). With 5 cycles the cooling tower will still evaporate 4,2m³/h water (100m³ water a day), but the blow down rate will be reduced to 1,05m³/h (25m³ a day). This will result in a saving of 75m³ water a day.

Addition of the anti-scalant will make the use of a softener unnecessary. The anti-scalant removes the disadvantages that the salt has on the water. The high salt concentration in the water results in a very high sodium level, which is bad for the water from a cleaner production point of view. Because the anti-scalant negates the need for the softener and the salt not only will the water quality improve in terms of Cleaner Production, but also the addition of salt is not needed anymore. This is a saving of 800kg salt a month or R4800/month. In addition there will be a saving on the water going through the softener to absorb the salt. 800kg salt requires 8m³ water; therefore there will be a saving of 8m³ water a month on the softener.

SOLUTION

Reducing the cost of water

The cost of water can be reduced in two ways;

1. Install a RO (Reverse Osmosis) Plant (which has already been implemented).
2. Install a Baleen Filter + UF (Ultra filtration) + another RO plant + Filter press.

The first suggestion has already been implemented by the company. Over and above the RO Plant, it is suggested that the company also installs a Baleen Filter, a UF, another RO plant and a Filter press. This way a reduction on water costs is possible because you can re-use part of the water that is pumped by the borehole pump. The total purchasing costs of the Baleen Filter, UF, RO and Filter press are R2 600 000. If repayment is effected over a period of 5 years, the repayment is R61.173/month for the Baleen group and R14 116/month for the already purchased RO plant. Adding the monthly repayments (which will last 5 years) and the running costs results in a total cost of R90 089/month. Dividing the total costs (R90.089) by the amount of water that goes through the RO plant and the Baleen Filter group (759KL x 30) will result in a cost of R0.25/KL of water. Compared to the R2.90/KL of pumped water this makes a huge difference in costs. (See calculation below)

| Water costing | |
|---------------------------------------|--|
| Option 1 (already implemented) | Option 2 |
| RO Plant: R600.000 over 5 year | Baleen + UF + RO + R2.600.000 over 5 year |
| Earn to repay period: R14.116/month | Earn to repay period: R61.173/month |
| Running cost: R6.500/month | Running cost: R8.300/month |
| | |
| | 8400m ³ /month (280m ³ /day) |
| | 75289,00 |
| | 8300,00 + |
| | 6500,00 + |
| | <u>90089,00</u> rand/month |
| 759m ³ /day x 30= | 90089,00 / 22770000 = 0,025 rand/KL |
| | compared to R2,90/KL from the pumped water |

After the 5 year repayment period only maintenance costs and running costs will remain, thus the cost of water will be minimal

ENERGY

A very good way for the company to make use of the energy from the chicken litter is to digest it in a bio-digester to produce methane. The methane has two purposes. It can be used to heat the boilers in the factory. Because of unavailability of the capacity-data of the boilers actual savings were not calculated. But the cost to convert the coal-boilers to methane-powered boilers is not high. The methane can be used to drive a power generator for electricity generation. The investment will be higher but it is still considerable. Whether this gives a good financial result or not, depends on the subsidies which can be given by Eskom for this project.

The electricity usage in the farm is 784,96 MW/year. The electricity usage for 1 cycle (7.5 weeks) is then 113,22 MW. The total cost is R270 400,06/year or R3900/cycle. The electricity bill can be reduced by producing methane using the bio-digester.

870ton/year or (72.5/month) coal is used to heat the farm houses. The total cost of the coal used is R733 149/ year (R 61 095,75 /month). There is much heat loss at the boilers which should be reduced. Using chicken litter mixed with coal as an energy source can reduce the amount of coal used. An alternative to coal is to generate CH₄ using a bio-digester, which can be used to feed the boilers. This will reduce the amount of coal 420 tons/year and which will result in fewer expenses and Cleaner Production.

Wood shavings are used as bedding for the chicken. The total cost is R1 904 307/year or 44895ton/year.

After every cycle the wood shavings removed with the chicken litter. So every new cycle new wood shavings are used. The wood shaving soiled with chicken waste is known as "Chicken litter" and can be used in the digester to form methane. The cost of 1 m³ of wood shavings is R 127,88. The money generated by the production of methane is likely to be more than R600 000. The latter amount is equivalent to what the company earns by selling the chicken litter. The R600 000 is 31,5 % of the total input of the wood shavings. The rest of the percentage is gone.

During transportation of chickens to the abattoir there is a casualty of 4% in the summer and during the winter there is loss of 8%. There are pigs at the Chicken abattoir as well. The pigs eat the chicken viscera and blood, although the quantity is unknown. However, the pigs produced 1149,75 tons/year of pig litter. The pig litter is energy rich and can be used for the bio-digester to generate methane.

RESULTS

Based on a detailed evaluation of the quick scan results, the CP assessment identified the following projected savings.

| Proposal: Invest in an bio-digester including a Power Generator: | | | |
|---|-------------------------|--|----------------------|
| Electricity produced by the anaerobic Digestion Generator: (Methane) | 4.400 MWH= | 4.400.000 | KWH/year |
| | | | |
| | Year | Month | |
| Electricity Bill savings: | ZAR 755.627,02 | ZAR 62.968,92 | |
| This reduced annual Energy Bill will be: | ZAR 1.297.117,38 | ZAR 108.093,12 | |
| Investment Methane Generator (500KWH) | ZAR 7.200.000,00 | | |
| Investment Bio Digester | ZAR 2.500.000,00 | | |
| Total: | ZAR 9.700.000,00 | Pay off/month over 10 years with an interest of 14,5%: | ZAR |
| If subsidized by Eskom DSM-program: | 50,00% | Of the Generator | |
| Investment Methane Generator (500KWH) | ZAR 3.600.000,00 | | |
| Investment Bio Digester | ZAR 2.500.000,00 | | |
| Total: | ZAR 6.100.000,00 | Pay off/month over 10 years with an interest of 14,5%: | ZAR 96.554,94 |
| Electricity Bill savings/month: | ZAR 62.968,92 | | |
| Coal savings: | ZAR 35.000,00 | | |
| Total savings: | ZAR 97.968,92 | | |
| Unsubsidized this project will cost: | -ZAR 55.569,27 | For the first 10 years. After that there will be only maintenance costs for the | |
| When the Generator is subsidized the company will achieve an annual saving of: | ZAR 1.413,98 | For the first 10 years. After that there will be only maintenance costs for the | |

