LÄCKEBY PRODUCTS

CASE STUDY

Project:	**Ryaverket, Functional test**	**Plant:**	**Ryaverket, Gothenburg**
Product(s):	**Heat Exchanger Air/Water**	**Date:**	**2009-12-01**

Background:
1995 Ryaverket was rebuilt and by this time 3 pcs. Of Läckeby Products Heat Exchangers for Air/Water type VLV 500-36 was installated. The calculated energy recovery was 120 kW per unit. The plant has been running since and by the end of 2008 we was contacted to perform a functional test. The outcome of that test was that the heat exchangers are giving the heat recovery that has been calculated but the control of the process could be improved. The intention with the visit in the end of 2009 was to follow up the test performed during 2008.

Process description:
The heat exchangers are installed after the blowers and the operation of the blower are controlled to keep a predefined pressure in the aeration system.
The water side on the units the outlet water from the sludge/water heat exchangers to the digesters. The water is then preheated before it returns to the district heating system.

In order to avoid that air above 70℃ reaches the d iffusors a emergency cooling system is installed. This means that when the air temperature after the heat exchangers goes over 70℃ the heat recovery is disconnected and the emergency cooling circuit is commected to the water circuit in the heat exchanger. The cooling water is treated waste water and is having a much lower temperature than the return water from the sludge/water heat exchangers. This water is going back in the treated waste water system which means that no energy is recovered.

Installation advantages:
Energy recovery:
So far during 2009 Ryaverket has being able to recover an average effect of 174 kW from the heat exchangers. With an energy price of 0,42 SEK/kWh this means a cost **saving of 640.000 SEK/year (64.000 EUR).** With an estimated energy price of 0,35 SEK/kWh since 1995 the total cost saving would be 6.935.000 SEK (693.500 EUR) if the same energy recovery as 2009 is used. Of course the investment cost should be deducted but that is estimated to around 10-15% of the total cost saving.

Minimal maintenance:
The customer informed that the heat exchangers has only been opened for cleaning **one time since 1995** which means that the maintenance cost is neglectable.

Reduced ageing on the diffuser rubber membranes:
The lowered temperature on the air means a reduced ageing effect on the rubber membranes in the diffusors but how big this effect is can not be calculated. The customer though explained that when the membranes where changed during 2006 to 2009 the condition was not critical while other swedish plants has changed as often as

every 5th year (Läckeby Products comment). Since the diffusors was installed 1995 and 1996 **the lifecycle of the membranes is at least 10-14 years.**

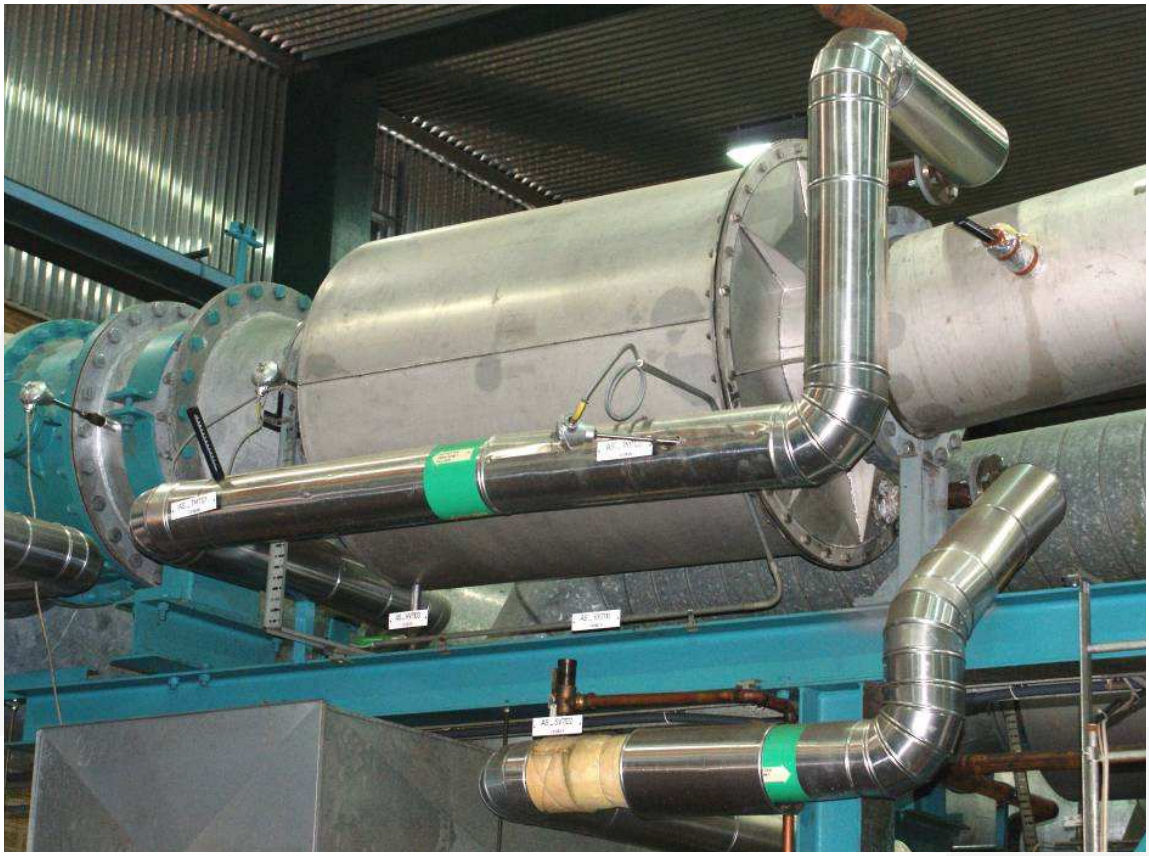
Discussions and conclusions:
The customer has before our meeting discussed certain changes. One conclusion has been that they today measure the temperature directly after the heat exchangers instead of just ahead of the diffusors. Since an additional cooling of the air appears through the piping system they have discussed measuring the temperature ahead of the diffusors and in that way avoiding to run the emergency cooling system and instead getting a more frequent heat recovery.

We also discussed a solution where an additional heat exchanger is installed on the common pipe (all three systems connect into one common pipe) which would mean that the heat recovery always will be active although they can operate the emergency cooling when needed. In this case a cost estimation of this system has to be compared with the additional heat recovery that can be done.

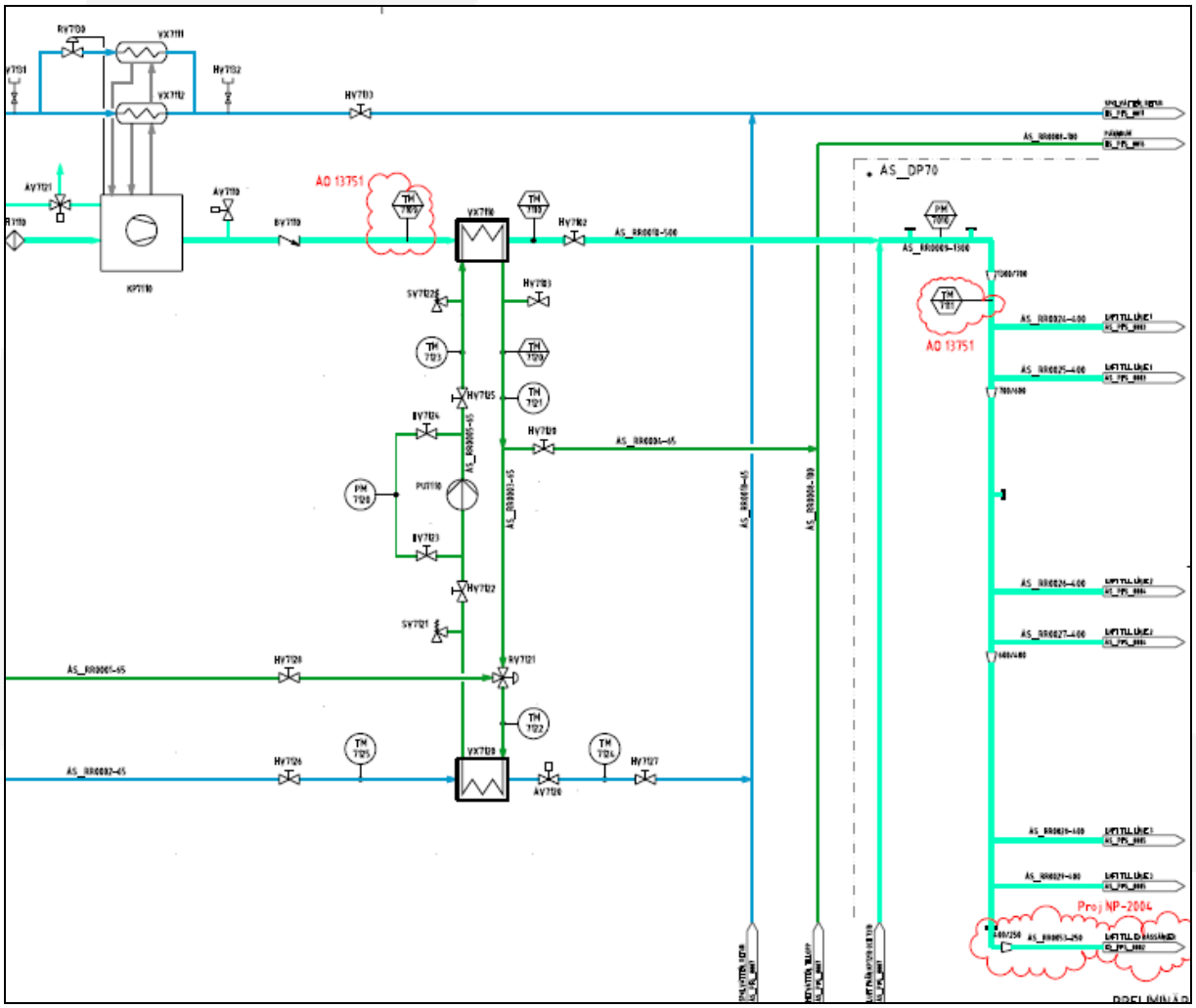
Pictures:

1) All three air systems with air/water heat exchangers installed

2) One out of three air/water heat exchangers



3) One out of three air/water heat exchangers



4) Process flowchart on the aeration system including energy recovery