CHEMICAL INITIATIVES
TAKING THE INITIATIVE

EFFLUENT REDUCTION PROJECTS SULPHURIC ACID PLANT

BACKGROUND INFORMATION

- Sulphuric acid plant in Umbogintwini .
- Double absorption plant, capacity of 550MTPD.
- Built by Simon Carves in 1973.
- Side stream plants such as:
  - Liquid SO_2 Plant,
  - Liquid SO_3 and
  - Oleum plant.

PRESENTATION OVERVIEW

SECTION A

- Water consumption in acid plant.

SECTION B

- Effluent generation from the acid plant.

SECTION C

- Effluent reduction projects.

OBJECTIVES

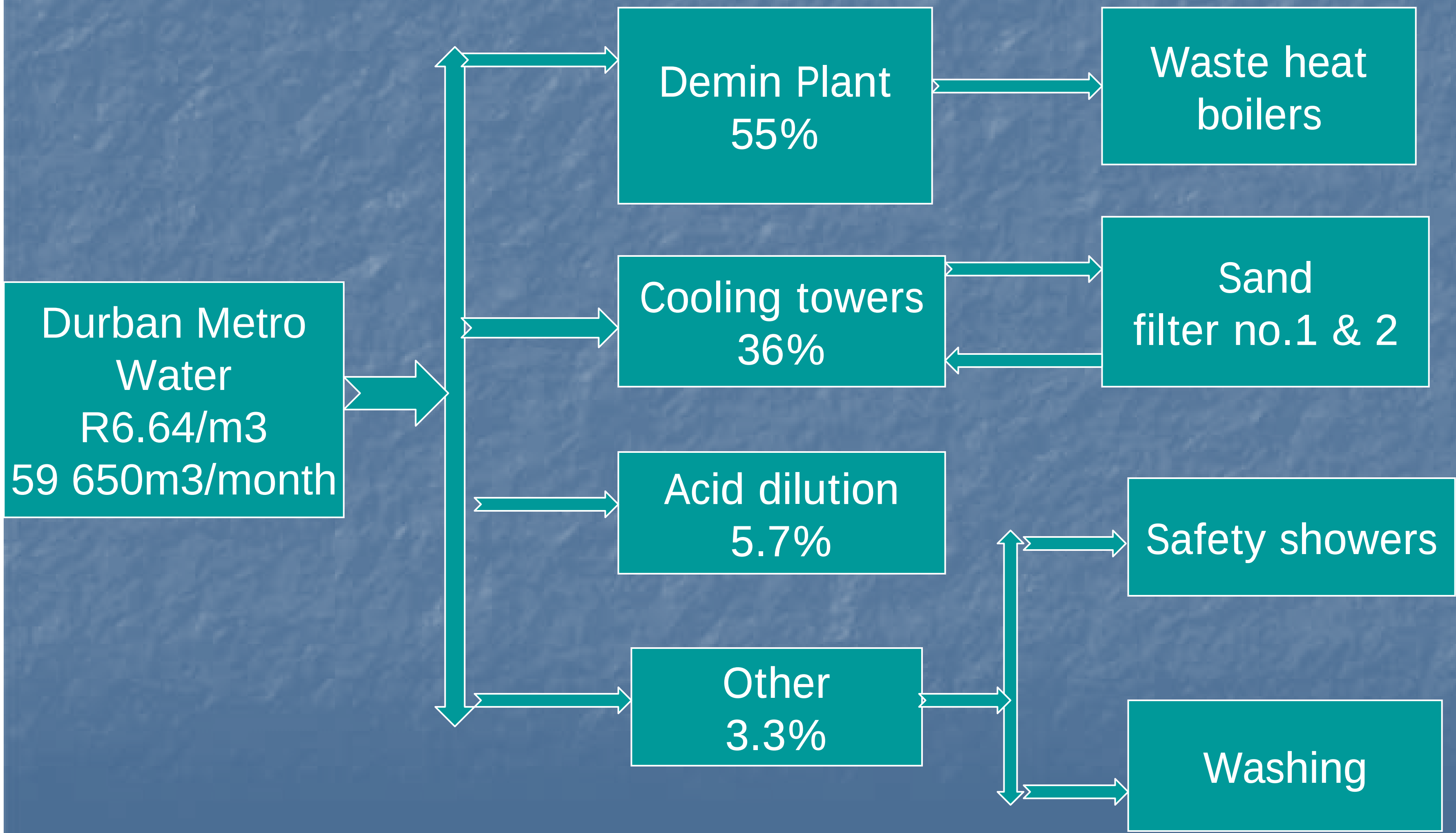
- Conduct a total water balance to identify:
  - Projects on sustainable development of water resource,
  - Projects on minimizing water consumption and
  - Projects on minimizing environmentally pollution loading.

- Reduce the effluent volume hence costs.

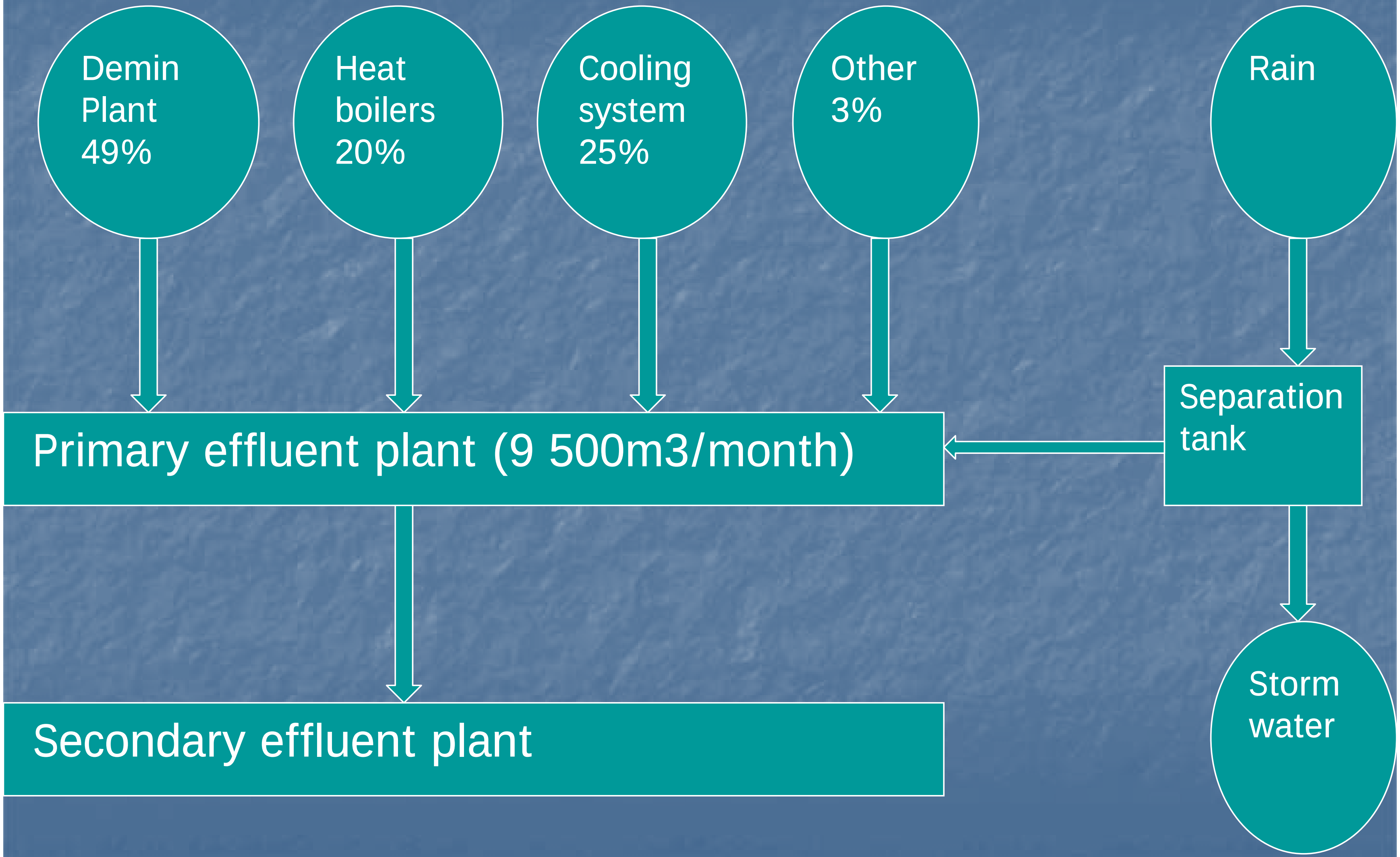
WATER IS A LIMITED RESOURCE

- Water of “good quality” is becoming a scarce resource.
- Water costs are rising faster than inflation.
- Discharge standards are becoming increasingly stringent.
- Treatment costs are rising faster than water costs.
- Industrial water reuse/recycling is neccessary

WATER CONSUMPTION



EFFLUENT GENERATION SOURCES



EFFLUENT REDUCTION PROJECTS (Implemented)

- Replacing co-current with counter current demin plant (2007),
- Automating boiler blowdown system (2007),
- Optimizing sandfilter backflush system (2005),
- Re-using the cooling tower blowdown (2006) and
- Recycling the condensate(2007).

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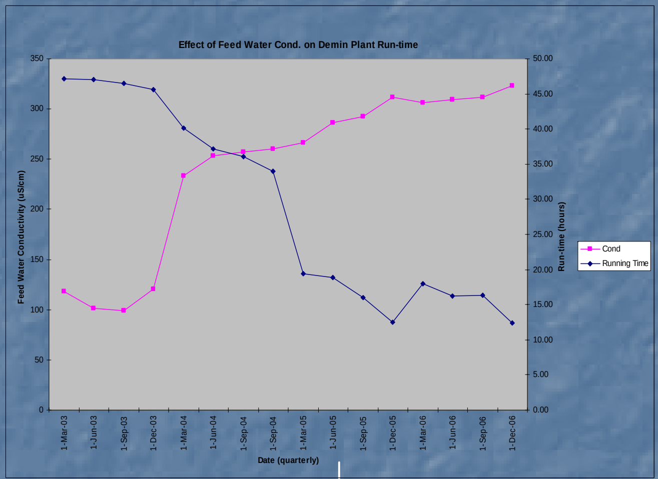
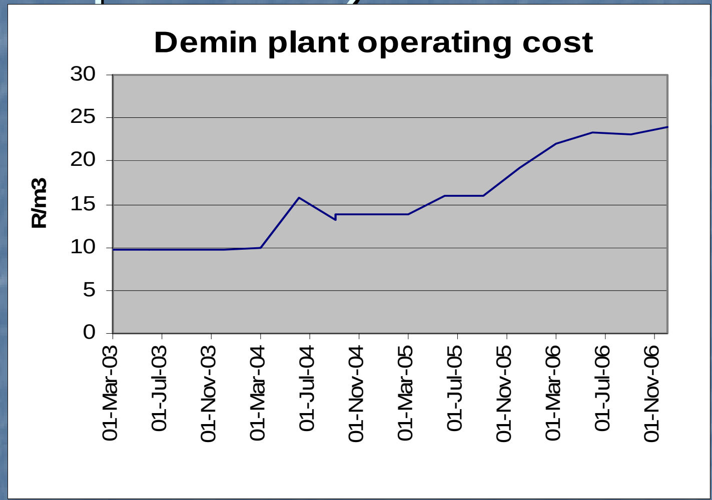
Total expenditure:	R3,5m
Payback period:	17 months
IRR (Nominal):	70%
(Real):	61%
NPV:	R7.96m

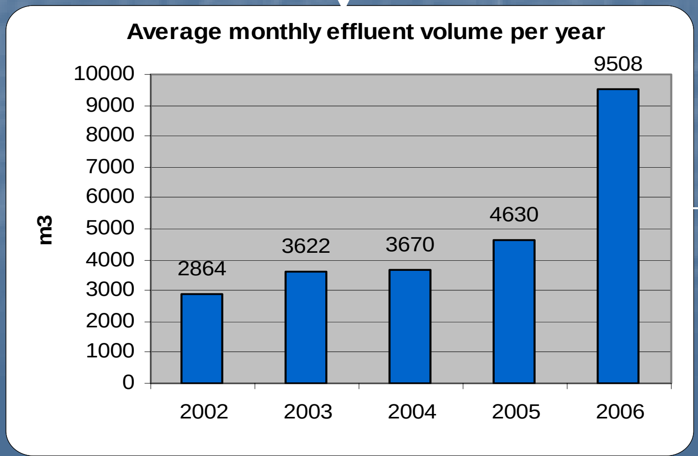
1. REPLACING CO-CURRENT WITH COUNTER CURRENT DEMIN P SHORT COMINGS OF CO-CURRENT DEMIN PLANT

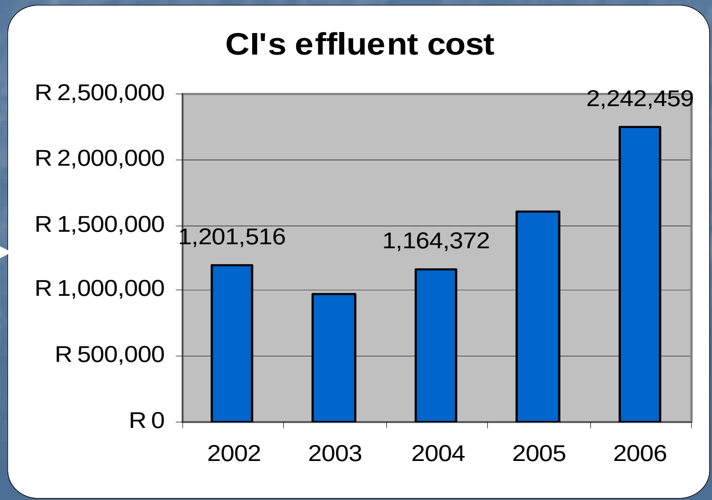
(i.e. As water quality deteriorates, it underperforms)



1. MORE REGENS
2. HIGH EFFLUENT
3. MORE CHEMICALS



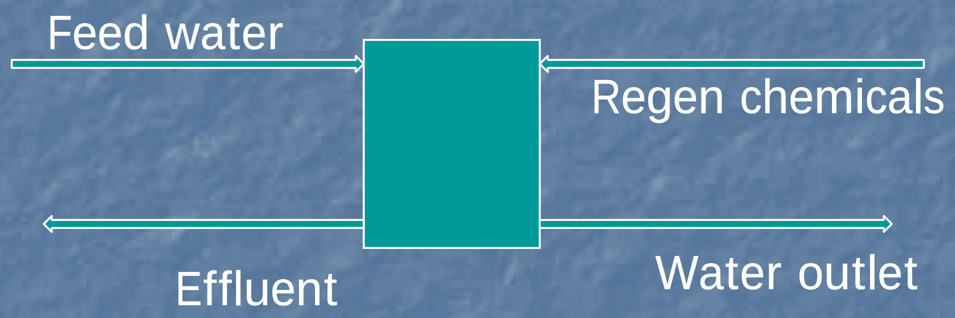




CO-CURRENT SYSTEM V/S COUNTER CURRENT SYSTEM

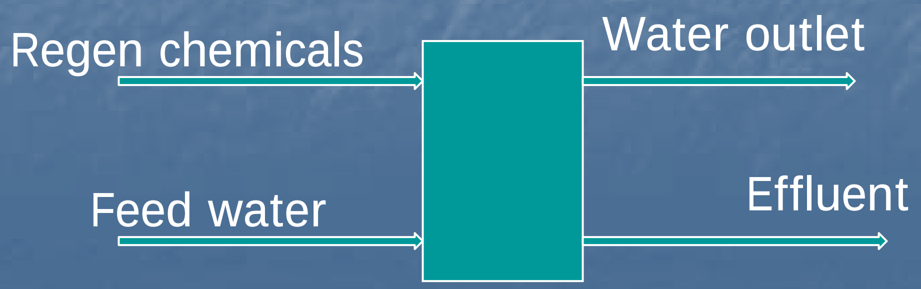
A. CO-CURRENT SYSTEM

- Uses regen chemicals less effectively as it comes into contact with heavily saturated resins firsts



B. COUNTER CURRENT SYSTEM

- Enables the regen chemicals to contact the least saturate resins first.



ADVANTAGE OF COUNTER CURRENT OVER CO-CURRENT D.PLANT

- COUNTER-CURRENT SYSTEM OVER CO-CURRENT SYSTEM
  1. Less regeneration chemicals consumption
  2. Less effluent generation.
  3. Effective resins exchange rate

- USE OF RIVER WATER

  1. Saving feed water cost (R. water: R3.24 & DBN metro water: R6,64)

- USE OF DEMIN WATER IN REGEN CYCLE.

  1. Avoid polluting resin layer & therefore increase in plant run time

- ADDITIONAL WATER TREATMENT EQUIPMENT

  1. Sand-filter: remove Suspended solids from the water
  2. Carbon filter: decrease organic loading from the water
  3. Degassing tower: removes CO2 from de-cationised water

PERFOMANCE COMPARISON

PLANT PARAMETERS	counter current	co- current
Effluent generation per year(81%)	17 133 tons	92 008 tons
Electrical consumption per year:	96 855 Kwh	96 855 Kwh
Caustic consumption per year:(60%)	55 tons	140 tons
Sulphuric acid consumption per year: (67%)	72 tons	221 tons

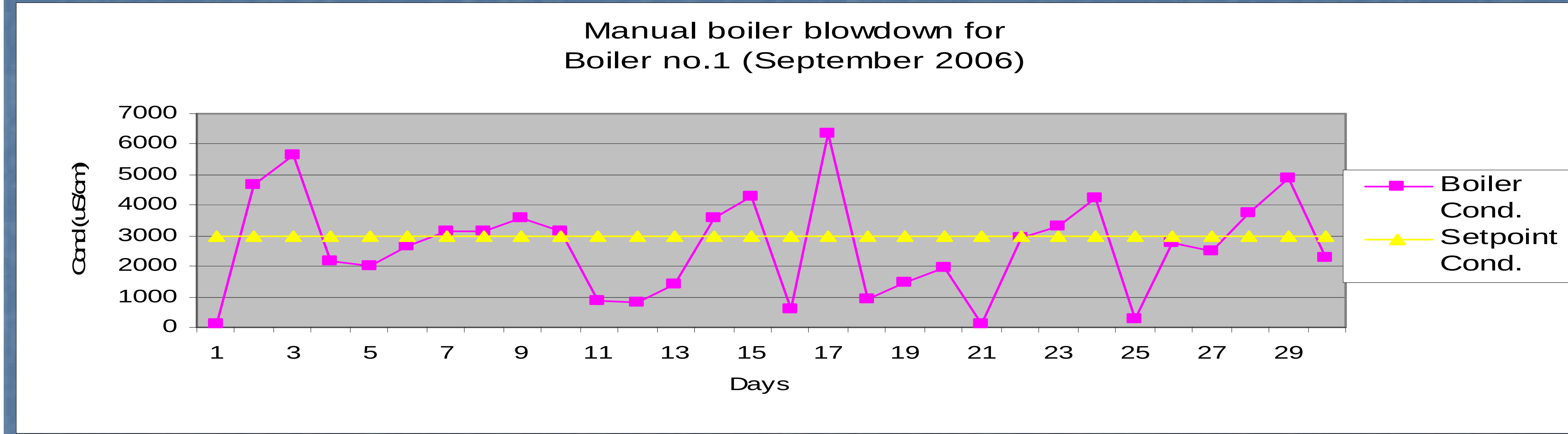
2. AUTOMATING THE BOILER BLOWDOWN SYSTEM

Shortcomings of manual over automatic blowdown system.

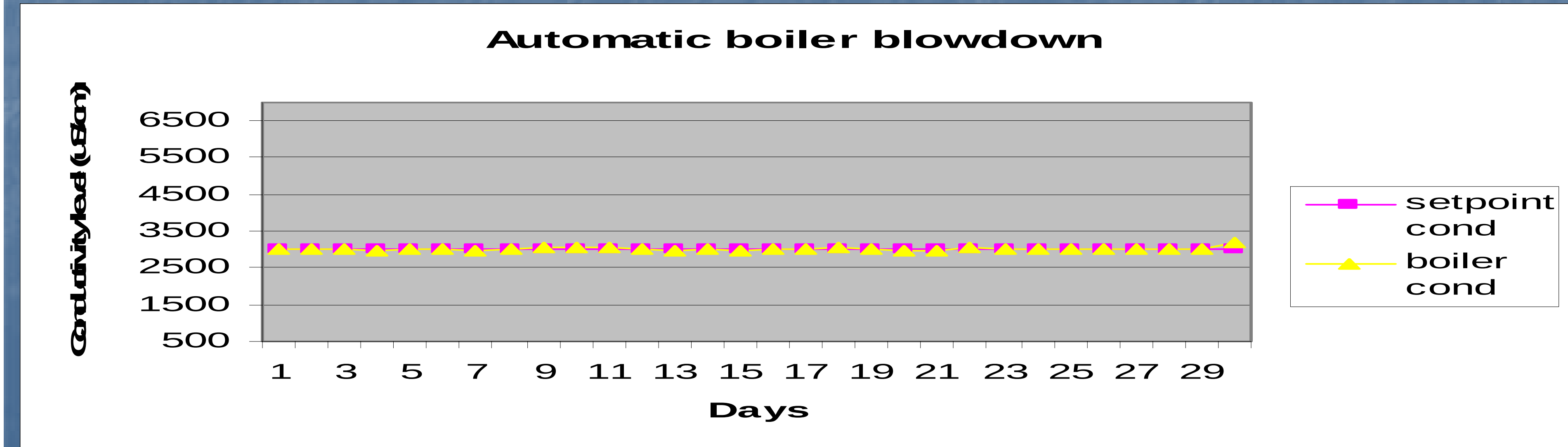
- Dumping unnecessary water to effluent,
- Dumping unnecessary treatment chemicals to effluent and
- Increases the scaling potential of the boiler tubes.
- Energy savings from the blowdown effluent

Boiler water control: Manual V/s Automatic blowdown system

1. Boiler water TDS trends from manual boiler blowdown system.



2. Boiler water TDS trends from Automatic boiler blowdown system.



COST BENEFIT ANALYSIS

Component	Manual (Per Month)	Automatic(Per Month)	Savings (Per Month)
Effluent Cost	R 42 048 (2628m^3)	R 3 248 (203m^3)	R 38 800 (2425m^3)
Chemical Cost	R 4 880	R 376	R4 504
Feed water Cost	R47 304 (R18/m^3 of Demin water)	R 3 654	R 43 650
TOTAL	R 94 323	R 7 278	R86 954

Scale formation on the tubes

Main causes for the boiler failure

- Demin plant underperforming resulting in ions slipping (Chlorides, Sulphates, etc) through to the boilers.

- Demin plant was underperforming due to change in feed water chemistry over the past six years (Conductivity used to be below 100uS/cm but was run at 300uS/cm).

- Demin plant offline resulting in untreated water used in the boiler and therefore running the boiler at high TDS ----→ scale formation ----→ insufficient heat transfer ---→ tube collapsing.

- Poor control of TDS/Conductivity in the boiler (Manual blowdown system) ----→underblowdown-----→ scale formation ---→ insufficient heat transfer ----→ tube collapsing.

EFFLUENT REDUCTION FROM COOLING TOWER

- Cooling tower blowdown is +/- 80m3/day.

- Investigated the re-use of CT blowdown to the following areas,
  - Acid dilution in the FAT and D&I Pump tanks,
  - 76% acid dilution,
  - Preparation of ATH slurry,

- After a thorough quality impact evaluation, it was decided to use the effluent for ATH slurry preparation.

- The effluent reduction achieved from this project was 18m3/day.

EFFLUENT REDUCTION FROM SANDFILTER BACKFLUSH

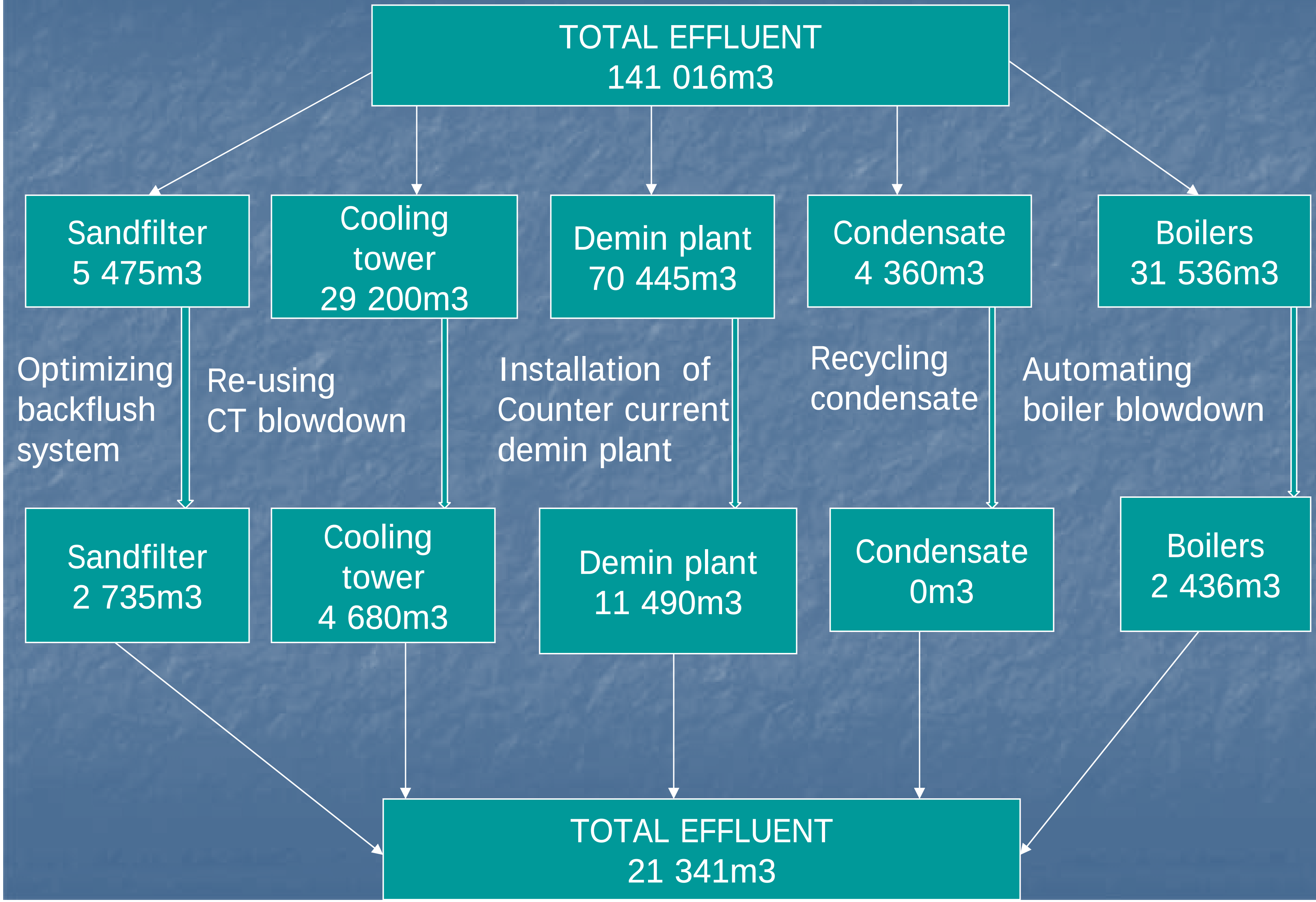
- Sand filter back flush used to be manually activated every morning for 20minutes (generating approximately 20m3 of effluent).

- Trials were conducted to establish at what Sand filter dp should the back flush takes place and for how long.

- After the trial, backflush was to be conducted at 100Kpa sandfilter dp.

- 50% effluent reduction from sandfilter backflush was incurred.

SUMMARY


TOTAL EFFLUENT 141 016m3
Sandfilter 5 475m3
Cooling tower 29 200m3
Demin plant 70 445m3
Condensate 4 360m3
Boilers 31 536m3
Optimizing backflush system
Re-using CT blowdown
Installation of Counter current demin plant
Recycling condensate
Automating boiler blowdown
Sandfilter 2 735m3
Cooling tower 4 680m3
Demin plant 11 490m3
Condensate 0m3
Boilers 2 436m3
TOTAL EFFLUENT 21 341m3

CONCLUSSIONS

- Establish water treatment plant capacity (Benchmark).
- Continuously monitoring feed water quality.
- Conduct water balance surveys on a frequent basis.

THANK YOU