1. Introduction

A Robust Multivariable Controller configuration was implemented on Co-Generation Boiler, Steam Turbines and auxiliary boilers, to minimize Fuel Consumption and optimise both Steam production & Power Generation. By adjusting HP & LP Steam production to the demand, reduction in Steam Waste and Fuel Gas requirement resulted in savings of €1.3MM per year from Year 1. Moreover the successful technology transfer to in-house personnel has ensured these benefits are sustained in the long term.

2. Challenges

Balancing a refinery's demand for Steam with its production can be difficult. Changes in the demand caused by downstream operation and particular upsets on the external providers of Steam to the steam network can cause big disturbances to the Network itself and therefore to the Power Generation. The above, together with extremely fast process dynamics, requires accurate disturbance measurement and fast and precise control. IPCOS was asked to improve the Steam Network & Power Generation performance by reducing the energy waste and stabilizing pressure of the HP, MP and LP headers at a refinery in Italy.

3. Results

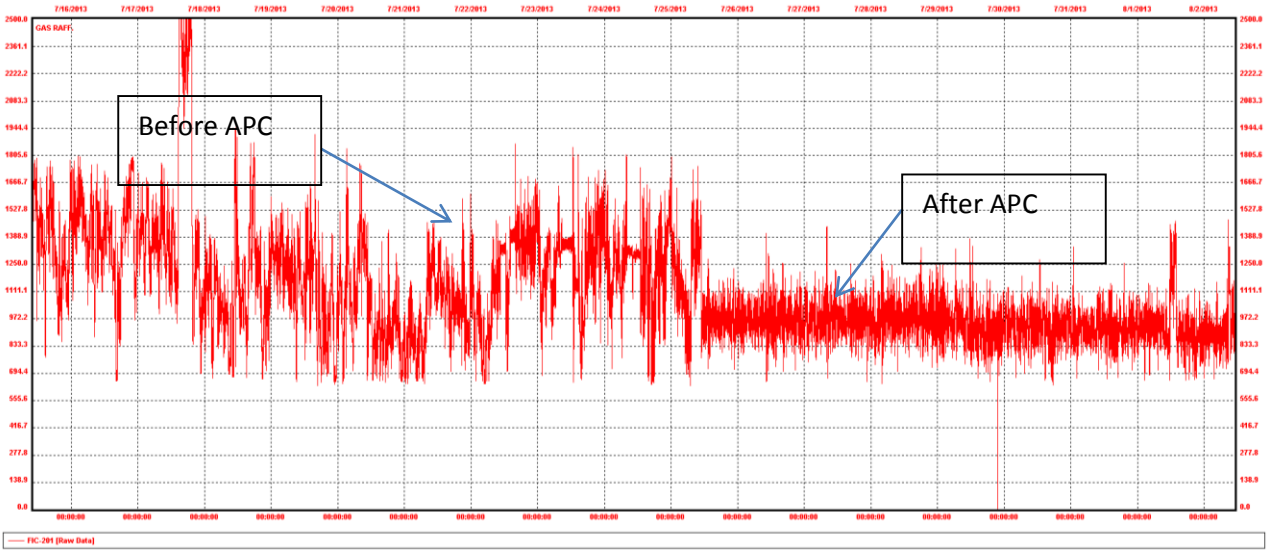
Working with refinery personnel, the team designed a single DMCplus multivariable controller, separated into several sub-controllers. HP & LP Steam production had to be managed dynamically to match demand. An APC system with a rapid response was required, so the execution time was set to 10 seconds; that way the controller was able to control HP & LP Steam Network pressures including the Feed-forward action coming from the produced and used steam measurements. Three Sub-controllers were implemented: Co-Generation, Steam Turbines and Auxiliary Boiler. The APC system was designed to be flexible when controlling HP Steam Network pressure, by using Co-generation Boiler, Steam turbines or Auxiliary boiler as primary Manipulated Variables. The final controller had 10 manipulated variables, 5 disturbance variables and 23 controlled variables.

The improvement with the controller can be clearly seen in the smoother operation of several variables and the reduction in Fuel Gas usage and LP Steam Venting.

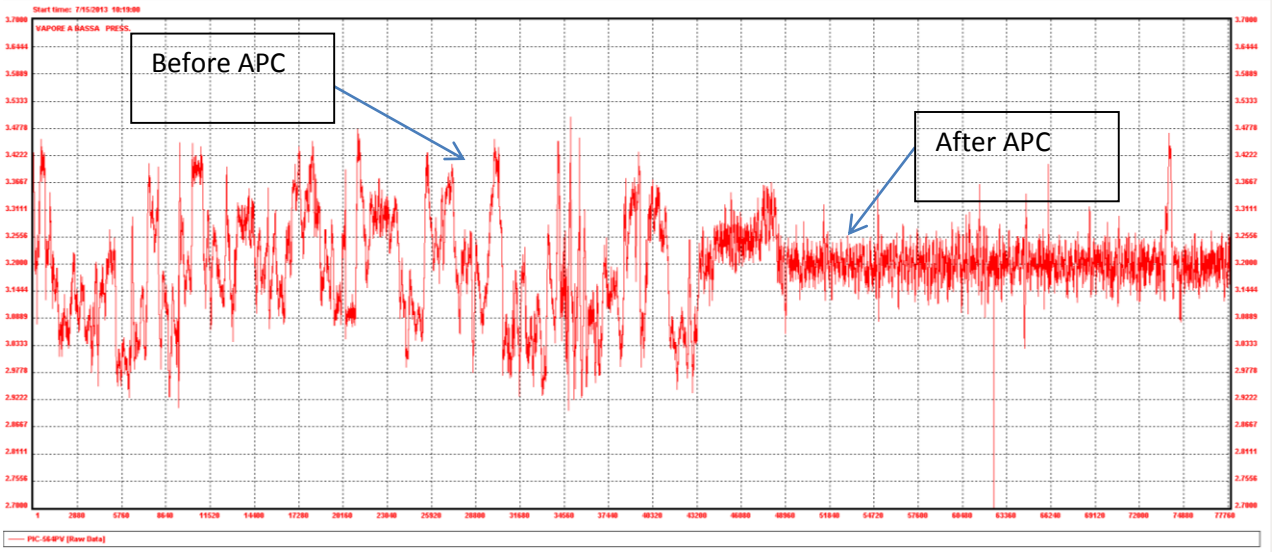
A summary of the savings is presented in the table below.

Description	**Savings €/yr**
Fuel Gas Consumption Reduction	961,497
LP Steam Vent Reduction	403,100
Total	**1,364,597**

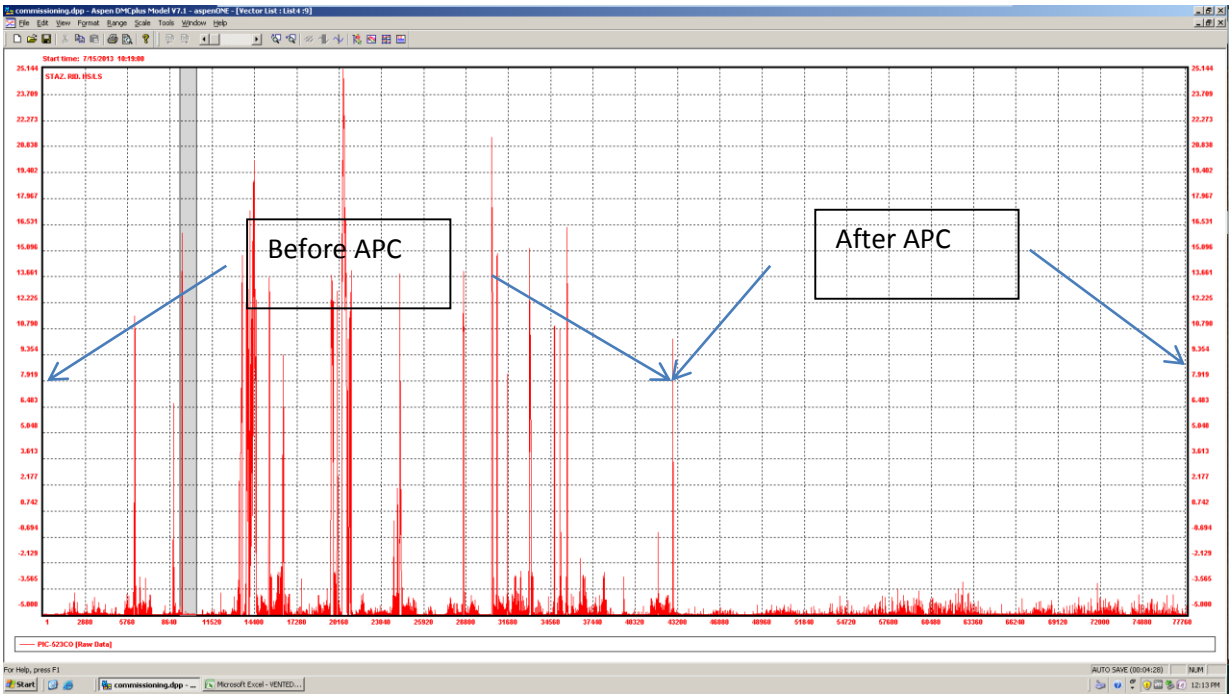
Fuel Gas Consumption Reduction



LPS Network Pressure control



HPS/LPS Let-down Reduction



As seen above, better control of LP Steam network pressure and a Reduction in HP Steam let-down are achieved, this directly optimizes the Power generation.

4. Conclusion

Even for very fast process dynamics with lots of disturbances, APC is a good candidate and can provide proper control and optimization.