Implementing ESP upgrades thru modern power supply technologies

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As a consequence from new and more strict regulations, the performance of many installed Electrostatic Precipitators (ESP's) do not meet the requirements in regards to actual emission level.

Therefore a lot of plants in which ESP's are installed need to go through an upgrade.

A retrofit project is considered as a very complicated and costly process. Loss of income due to stop of the processes as well as hiring of contractors and heavy vehicles for handling the heavy material are consequences which is normally related to high costs.

The intelligence of the ESP is coming from the control system, which manages and monitors the process of cleaning the flue gases in the ESP. The control system controls the High Voltage Power System (HVPS) which is creating the electrical field in the steel construction of the ESP and is an essential part of the design.

The following study shows that, instead of re designing and start working with re construction of the steel construction of the ESP, there is possibility to increase the efficiency in the ESP by looking into the High Voltage Power System and the Controller.

The selection of the type of ESP High Voltage Power Supply "HVPS" is critical and individual for each and every ESP / Process and highlighted in this study. HVPS shall deliver enough corona power to ESP field to gain optimum emission level.

A solution for small ESP's, with one or two fields, is to select the one optimal type of HVPS technology, i.e: Single phase conventional T/R, three phases conventional T/R, pulsing T/R OR SMPS (Switch Mode Power Supply). For bigger ESP's, to get the best technical / commercial solution, the calculation is more complex. This case study shows that for ESP's with more than one field - a combination of mentioned HVPS can be the optimal configuration.

The Master Controller for such ESP will monitor the performance of the complete installed HVPS. In this controller the settings of parameters will be set and feedback from each HV unit's controller will be delivered to the Master Controller. The Master Controller will automatically set the parameters for each controller of the respective HVPS unit required emission level for any application simple or complex ones.

The following case is a retrofit case which shows how a combined HVPS solution / an HVPS solution based on several different types of HV units makes even better than acceptance emission level and low cost retrofit ESP.

PlantType: Power plant (90% Coal + 10% Biomass).

An Electrostatic Precipitator "ESP" with two chambers and three fields for each chamber.

HVPS solution before retrofit project: Each filed had one Single-phase conventional TR (100 kV-1100 mA) with dedicated control cubicle/panel.

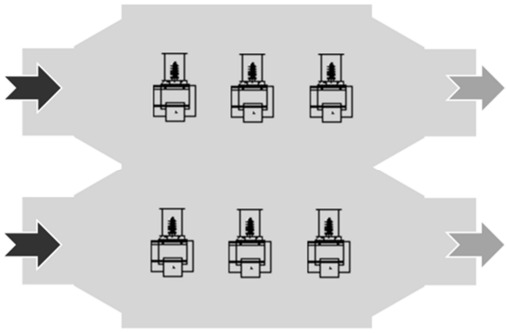

Figure 1. ESP HVPS placement before upgrading

- Emission level: 50 mg/m³;
- Retrofit Project:
- Emission level Goal: 40 mg/m³.

Regular check and cleaning of ESP construction which did not need to shut down the process for a long time.

After studying of actual performance and values of existing HVPS solution, it was decided to replace first field HVPS of each chamber to High Frequency Switch Mode Power Supply "HF SMPS".

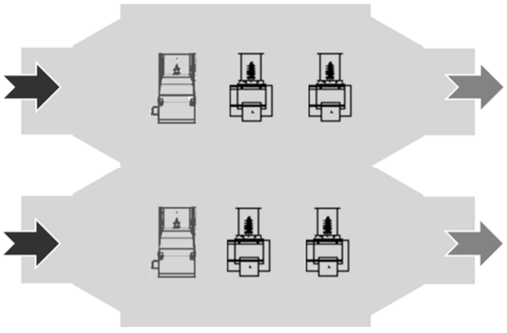

Figure 2. ESP HVPS placement after upgrading

Then run the process and following emission level is gained:

- reached Emission level: 25 mg/m³;
- actual emission level is even 15 mg/m³ less than target value so with opacity feedback to the HVPS controller there is possibility to save power consumption at 40 mg/m³.

Conclusion

In ESP retrofit project, there is no need to use only one type of HVPS technology.

A combination of HVPS technology can be used to save both significant time and cost.

There is no need to overestimate the solution and replace all existing HVPS even to a combined HVPS solution. This can be studied and find out which field is the most important one to replace with which type of HVPS technology.

Regardless what the application is, a powerful master controller can get the lead of the other HVPS to gain the optimum point of ESP performance and also save power consumption due to plant conditions.