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CO_2 Emission Reduction through Optimization of Fuel Control

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Abstract: *Indonesian government publish a regulation regarding fuel control in power plant, PERMEN No.12/2012 subsection 2 point B. Power plant in Indonesia must be modify production technology and optimize production system to achieve optimum fuel consumption. Based on these regulation, operation process in ignition system must be modified. The current research aims to build better operation process through optimization in fuel control to obtain optimum fuel consumption and reduce CO_2 emission. This research shows that PT PJB Gresik power plant support Indonesian regulation and care about decreasing CO_2 emission. The ignitor burner modification has been successfully implemented and provide financial benefits of Rp 508,388,400 per year and reduction of NO2 emissions by 0.0327 tons, SO_2 emissions by 0.0014 tons, particulate emissions by 0.0019 tons and CO2 eq emissions by 28.39 tons in 2018.*

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I. Introduction

Gresik power plant is using high speed diesel, residual oil, and natural gas as a fuel in boiler combustion. Residual oil and natural gas are the main fuel, and high speed diesel as secondary fuel is used in ignition starting of boiler. Ignition process is the time-dependent process of starting with reactants and evolving in time towards a steadily burning flame [1]. The ignition process is an extremely important in combustion [2]. Fuel combustion process largely dependent on ignition process so that the process must be optimum [3].

Daily operation of Gresik power plant refer to daily operation planing or demand from load control center. One of the most important property of a power plant is the load change capability [4]. To change power plant load, increasing main burner supply to boiler are necessary. Optimum ignition are needed in load change process toobtain optimal parameter at the time of load changing and avoid excessive fuel use. Excessive fuel use will increase CO_2, SO_2, and NO_x emissions [5].

Indonesian government published a regulation about fuel control in power plant, PERMEN No.12/2012 subsection 2 point B.Therefore, power plant in Indonesia must be modify the production technologies and optimize production system to achieve optimum level of fuel control. Based on these regulation, operation process in ignition system must be improved. The paper will describethe better operation process to optimize fuel control by using optimum fuel control, hence,the fuel consumption and CO_2 emission can be reduced. This program exhibit PT PJB Gresik power plant support Indonesian regulation and care about decreasing in CO_2 emission.

II. Methods

This implementation was carried out on PT PJB Gresik Power Plant, Gresik, Indonesia focused on fuel control in power plant by optimizing burnerignition system. The logic diagram of ingnitor system is shown in Figure 1. The description of Figure 1 as follow:

- Ignitor system on Digital Control System Central Control Room (DCS CCR). If HSD pressure above 2.5 kg/cm^2 on pressure switch (PS 25-25), value for ignitor permit command will be activated. If HSD pressure below 1kg/cm^2 on pressure switch (PS 25-24), value for trip valve state will be activated, so ignitor cannot permit. Manual select of pressure switch logic is necessary to maintain ignitor in permit state after being off.
- Modification wiring logic for normally open switch and normally close switch on local P&ID to support logical change operation on pressure switch local box.

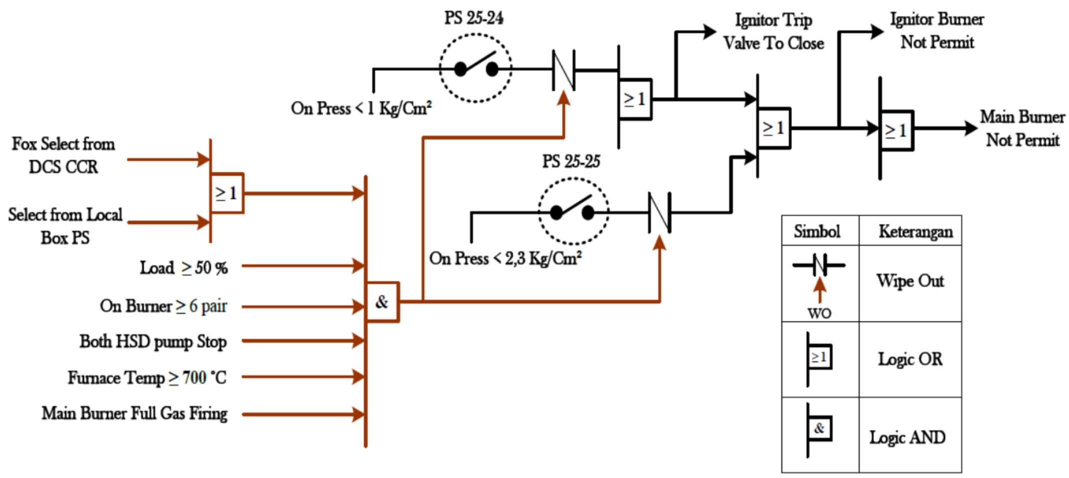

Figure 1 . Modified logic diagram at DCS CCR

III. Results and Discussions

This program have been successful implemented as shown in Figure 2. Installation manual control at local panel is necessary. From this program saving amount increased and total pollution decreased as fuel used are reduced. Saving amount can be calculated from:

HSD Fuel Saving:
1350 * 7.691 = 8.133.750,00 IDR/month/unit, 2 unit = 20.765.700,00 IDR.
With assumption: fuel saving = 45 * 30 = 1350 liter/month and HSD = 6.025,00 IDR/liter
Auxiliary Power:
Auxiliary power of pump = 15 kWh * 24 * 30 = 10.800 kWh
Electricity/kWh = 1.000,00 IDR
Electricity saving: 10.800 * 1000 = 10.800.000 IDR/month/unit, 2 unit = 21.600.000,00 IDR
Total saving = 42.365.700,00 IDR/month
From implementation of "Operation Pattern Modifications in the 3-4 PLTU Burner Ignitor", it can reduce the emissions. To calculate the conventional emission reduction and greenhouse gas, emissions data performance tests before and after the program is required.

For conventional method the emissions and greenhouse gas emissions can be calculated as follow
Emission = energy consumption (KWh) * emission conversion (gr/KWh)
Table no 1 shows greenhouse gas reduction, and table no 2 shows conventional emission reduction after implementation of this program.

Table no 1: Greenhouse Gas Reduction

Year	Production (GW)	Energy Need BBr (HSD)_kCal	CO_2 eq emission (ton)	CO_2 eq Reduction (ton)
2017	1,853.91	150,558,284	134.69	-
2018	1,657.25	151,117,759	106.10	28.5885

Table no 2: Conventional Emission Reduction

Year	NO_2 emission	NO_2 Reduction	SO_2 Emission	SO_2 Reduction	Particle Emission (ton)	Particle Reduction (ton)
2017	0.1540	-	0.0065	-	0.0088	-
2018	0.1213	0.0327	0.0051	0.0014	0.0069	0.0019

Power (load) change in power plant 3-4 using fuel oil (HSD) as the ignitor before burning the main fuel. When there is no ignition / load change, HSD oil pump is still running so that HSD oil is circulated back to the HSD service tank. This is not efficient because the ignitor system continues to operate even though HSD is not used. Solution from this research, ignitor system will be standardized or turned off. The problem for this solution is whether or not the main burner (gas) can turn on without lightening from the ignitor system if it enters the boiler combustion chamber. From research, ignition of the main burner gas can be ignited with the combustion chamber temperature in the boiler under normal operating conditions.

The next problem with the proposed solution is the main burner ignition cannot be done if the ignitor is not in the permit position (not in normal position). To handle this problem, a modification of the logic is done on the P & ID ignitor burner system.

The innovation in the ignitor burner system of PLTU 3-4 PJB Gresik Generation Unit has been successfully implemented by producing financial benefits of Rp 508,388,400 / year and reduction of NO2 emissions by 0.0327 tons, SO2 emissions by 0.0014 tons, particulate emissions by 0.0019 tons and CO2 emissions eq amounting to 28.39 tons in 2018.

IV. Conclusion

The ignitor burner modification has been successfully implemented and provide financial benefits of Rp 508,388,400 per year and reduction of NO2 emissions by 0.0327 tons, SO2 emissions by 0.0014 tons, particulate emissions by 0.0019 tons and CO2 eq emissions by 28.39 tons in 2018.

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