P. T. INDOCEMENT TUNGGAL PRAKASRA, TBK

Change Mode Operation of Tie bus to Normally Closed (NC) for Sharing Load of Transformers and Install Capacitor Bank to Improve Power Factor

SUMMARY OF THE OPTION

Indocement is one of the largest cement producers in Indonesia, established in 1985 and currently operating 12 plants located in different areas. Implementation Tie bus from normally open to close open has been done, but the electricity transfer from old panel to new panel needs the right time, because it must shutdown the total electrify on that area including the director's PT. Indocement room. There is no cost saving but simplified trafo maintenance, Hence, with maintenance, trafo can be efficient and has reduced electricity but the result is not yet evident until connected to the new panel. With the maintenance, the trafo efficiency resulted in saving of electricity. Even though this has not been proven with calculations, as it still awaits the observation results on the new panel.

The feasibility study shows that the installation of the capacitor bank at power factor in plant 6# can increase energy use to 3 MVA and thus, with this increase, the energy can be used for other equipments, automatically. Therefore, the prediction of cost saving from ele ctricity can be raised by more than 11 billion rupiahs. Even though, the installation of capacitor bank, cannot be implemented considering the high cost, it is the main priority for the management.

KEY WORDS

Indonesia, Cement, Electricity, Transformers, Capacitor bank, Tie Bus

OBSERVATIONS

Electrical energy consumption at the electrical supply system at line #6 is higher than required because electric energy for all line production of cement plants are supplied by Indocement power plant (as main supply) and the rest by PT Perusahaan Listrik Negara (Persero) (PLN) as backup. The Indocement power plant consists of diesel generation and co-generation with total installed capacity at approximately 300 MW, however, PLN supplies around 20 MW. Electric energy supply for Indocement has a system voltage of 33 kV, 3-phase, 50 Hz.

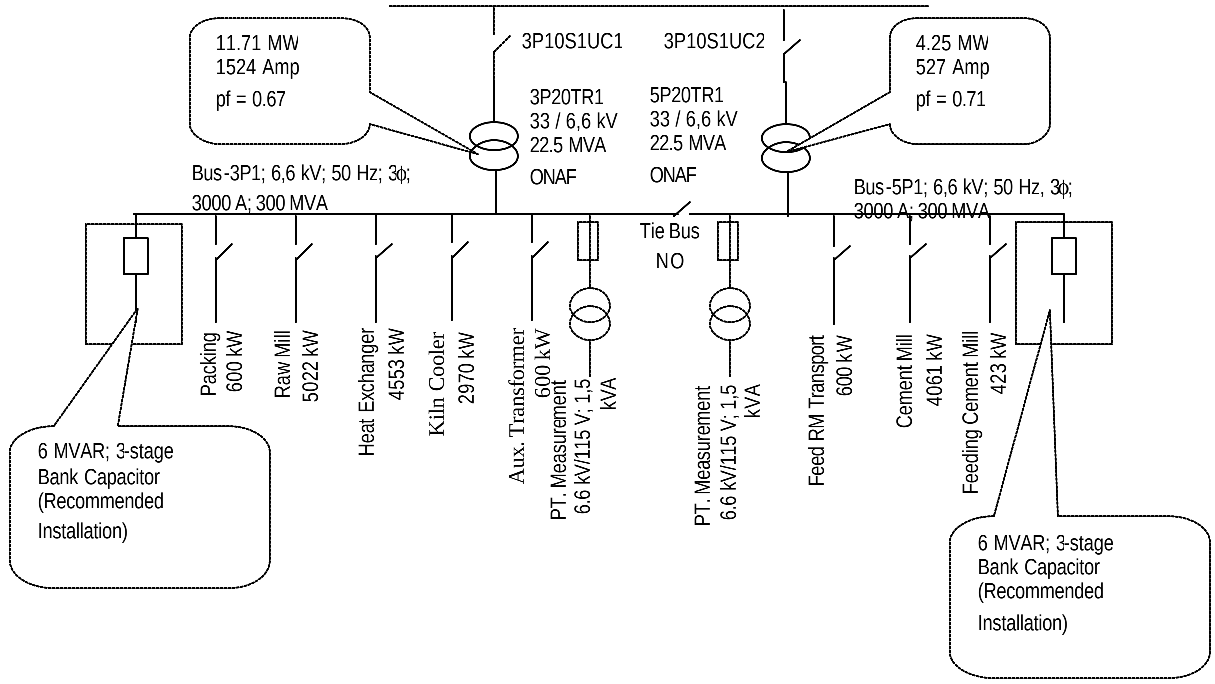
The power supply for Plant #6 cement line is distributed from two feeders; 3P10S1UC1 and 3P10S1UC2, through two steps down transformer (33/6.6kV), each of which has 22.5 MVA of installed capacity. Furthermore, the total installed load for this line is approximately 35.38 MW, however its actual load is approximately 15.96 MW and power factor 0.68 for normal operation. The simplified diagram for the line # 6 cement plant is shown in Figure 1.

The following observations were made:

- The data collected during the in-plant assessment included the installed load and actual load for both the incoming feeder and the outgoing feeder
- A few issues that were identified during the in-plant assessment of the electrical supply system at line # 6 include:
- The 22.5 MVA Transformers are operated separately as the Tie Bus which connects bus bars 3P1 and 5P1 is in normally open (NO) mode. This setup may cause inefficiency due to load imbalances on the transformers.

- Power factor from the Power Plant is 0.95, but the incoming feeder of line # 6 is only 0.68, at a total load of 15.96 MW. This condition is due to the fact that equipment for power factor correction, like bank capacitors, are not installed.
- Under low loads (i.e. then only a few motors are running), the power factor of each feeder is higher than 0.80. For example; the raw mill feeder has a power factor of 0.81 when its load is 428 kW, and the aux. transformer feeder has a power factor of 0.82 if its load is 194 kW.

Figure 1. Incoming Feeder 33 kV; 3f ; 50 Hz, from Indocement Power Plant



OPTIONS

There are several options available to optimize the electric energy consumption in Plant #6:

1a. Installation of Tie Bus to allow sharing between two transformers and to improve power factor

An estimated 198,000 kWh p.a. can be saved by installing a Tie Bus to allow load sharing between the 22.50 MVA transformers. The load of each transformer is expected to be around 11.70 MVA (52% loading), meaning it will operate at its highest efficiency.

1b. Installation of capacitor bank to improve power factor.

An estimated 12 MVAR is required to improve the power factor from 0.68 to 0.95 by installing two capacitor banks. Each capacitor bank is to be installed at one of the two incoming feeders. The bank is rated 6 MVAR, 6.6 kV, 3 phases, 3 stages of each. When implemented, the benefits through power factor improvement will be as follows:

- Distribution loss reduction along electrical line distribution is estimated at 672,000 kWh p.a., assuming current distribution losses are 1% of total power consumption.
- Under normal operation (15.96 MW), line #6 requires 23.47 MVA at power factor 0.68, but will require only 16.80 MVA at power factor 0.95. This means that a large power capacity (6.67 MVA) can be made available for other purposes.

The Tie Bus modification from normally Open to normally Close has been done. The new panel of Tie Bus has just been constructed, the electricity transfer from old panel to new panel need the right time, because it must shutdown the total electricity on that area including the directors PT. Indocement room. Connection cost for new panel is about Rp. 200,000,000 = US $ 21,739

Figure 2. Modification tie bus the NO to NC

OLD & NEW PANEL (Single Line Diagram Plant No. 6)

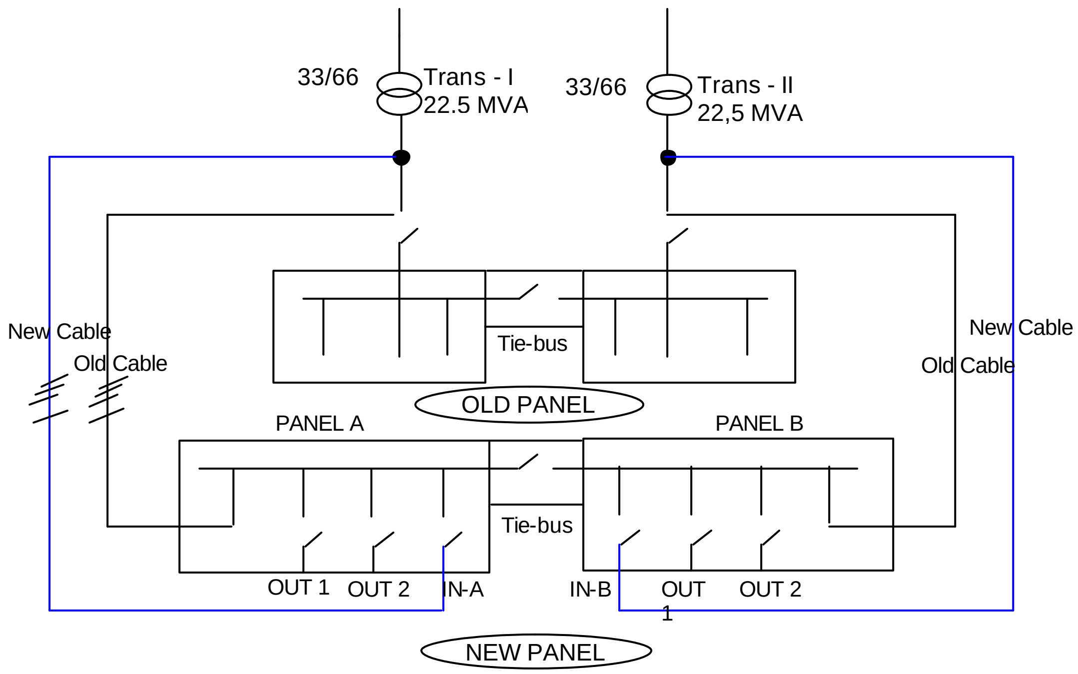


Figure 3: OLD & NEW PANEL FOR TIE BUS

RESULTS

Even though there is no implementation of power factor on plant 6, the case study has already resulted with the following:

Financial benefits

- Investment: US $170,000 (1US $ = Rp 9,200.00), of which the connection cost for new panel about Rp. 200,000,000 or US$ 21,739
- Annual cost savings: Rp 10,342,000,000 = US$ 1,124,130

- Payback period: 43 days or 1.5 month (plant operation = 300 days)

Environmental benefits

- Annual electricity savings: 2,700 kW (3 x 1000 kW x 0.9 (1MV = 0.9 MW) or 3 MVA (Feeder-I: ± 2.5 MVA; 6.6 kV Feeder-II: ± 0.5 MVA; 6.6 kV)
- Annual GHG emission reduction: 24,349 tCO_2/yr, Calculations are as follows:
- 3 MVA x Hour x Day x Emission Factor x cos φ $\sqrt{3}$ = 3 x 24 x 300 x 0.724* x 0.9 x 1.73

*sourced from UNEP GHG calculator: www.uneptie.org/energy/tools/ghgin/

FOR MORE INFORMATION

GERIAP National Focal Point for Indonesia
Dr. Ir. Tusy A. Adibroto or Msi Widiatmini Sih Winanti
BPPT - Jl. MH Thamrin 8, BPPT II building 20th floor
Jakarta Indonesia
Tel: +62 (21) 316 9758/68; Fax: +62 (21) 316 9760;
E-mail: tusyaa@ceo.bppt.go.id
widiatmini@yahoo.com

GERIAP Company in Indonesia
Team Leader: Gunawan Purwadi
General Manager
PT. Indocement Tunggal Prakasa.Tbk
Tel: head office +62 21 2512121; plants +62 23 8752812; +62 231 343760; +62 518 61000
Fax: head office +62 21 5701693; Plants +62 21 8752956; +62 231 343617; +62 518 61090
E-mail: Gunawan@indocement.co.id