

April 9, 2012

SEMAN S.A.  
6, Parodos Grypari str.  
GR-570 10 THESSALONIKI

Attn.: Dr. K. Satsios

**Electrical Energy Optimum Management saving Project  
in Caustic Soda and Chlorine Plant**

Dear Dr. K. Satsios,

We would like to state the following relating to the electrical energy optimum management-saving project that was implemented by your company SEMAN S.A. in Caustic Soda and Chlorine Plant of the HELLENIC PETROLEUM S.A. company in Thessaloniki.

The project aims to reduce current-voltage harmonics and optimize the quality of current-voltage in the electrical installation of Caustic Soda and Chlorine Plant and, subsequently, maximize the efficiency of Electrical Installation, Motors and Power Transformers and minimize the following losses:

- Copper (Cu) and iron (Fe) losses of electric motors and power transformers.
- Distribution cables heat losses.
- Skin effect losses.
- Contiguity effect losses.
- Eddy current losses.

The main electrical loads in Caustic Soda and Chlorine Plant are two Rectifiers which are powered by the MV busbars (6,3 kV). Especially for rectifiers designed and installed harmonic reduction filters with total power 2,4MVA. Filters are tuned to the 5<sup>th</sup> harmonic current with eigenfrequency  $p = 6,0\%$  (204Hz) and can minimize a significant part of the 7<sup>th</sup> harmonic. Nominal voltage of the capacitors of filters is 8,37kVolts, to withstand the rising of the voltage generated by the coils with eigenfrequency  $p = 6,0\%$ . The rest of loads in the Plant are inductive AC motors with rated voltage 400V, which are powered by two Power Transformers 6,3 / 0,4 kV. These motors were treated with filters of total power 1,24MVA while the interventions placed as close as possible to the loads.

In a long period after the completion of the electrical energy optimum management-saving project we observed the following:



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- Discharge of electrical equipment, reduce of maintenance costs and increase of life expectancy to all electrical equipment.
- Significantly increase in the reserve of the electrical installation, as the currents were reduced significantly. This means that the existing infrastructure wiring, electrical panels can be powered by the new loads until the new reserve limit, without the need of extra cost.

The calculation method of the percentage of electrical energy saving in the electrical installation of Caustic Soda and Chlorine Plant after the electrical energy optimum management-saving project, which was completed and start in full operation in mid-April 2011, is based, apart from direct measurements of instantaneous supply currents with and without the interventions in operation, on the elaboration of an prediction algorithm of electricity consumption by daily consumption and production data of Caustic Soda and Chlorine Plant, which is extracted by methods described in detail in FEK1526 & International Bibliography.

By using the mathematical prediction model of daily electrical energy consumption for a period of 10 months after the completion of project (May 2011 - February 2012) was calculated the final percentage of electrical energy saving achieved in the electrical installation of the Caustic Soda and Chlorine Plant which is **9.8%**.

This percentage far exceeds the 6.8% that was the minimum agreed in the project contract and hence the project done inside the electrical installation of the Caustic Soda and Chlorine Plant is quite successful and has met all the initial objectives you had set.

Kind Regards,

A. Katsanikos

Northern Industrial Complex Manager