associated with the switching of the thyristors of an SVC (about 4 ms), since STATCOM uses IGBTs, which provide a much faster switching.

From the operator's point of view, a solution for compensating reactive power without mechanically switched components is preferred, which means either using the SVC or the STATCOM, depending on each particular case.

Despite having been shown that the dynamic behaviour of STATCOM was far better than that of the SVC, the company decided to install an SVC, basically due to the cost of the initial investment.

4. Conclusions

In normal conditions but working at about 30 MW below the nominal power (83 MW) and with an SVC we can conclude briefly that:

The total harmonic distortion in voltage is also found in the working conditions in which the measurements have been made, below the established limits (<1,5%). The maximum value at the measuring point is 3,18% which, doing the approximate correlation established by the short circuit capacity ratio, corresponds to 0,99% at the Substation of Carregado, for an average furnace power of about 30 MW.

It should be noted that, similar to what is feared to happen with the flicker, levels of harmonics would be modified to the extent that the power of the furnace is modified, possibly exceed 1,5% for a power of 83 MW; this will always depend, of course, on the behaviour of the SVC at this level.

Harmonic voltage distortion rates for individual harmonics are below the established value (individual harmonic voltage of odd order < 1,0%). The maximum distortion rate, 2,96% at the measuring point, was obtained for the 5^{th} harmonic. The impact on the Substation of Carregado would be 0,92%, value close to the maximum (1%) established; therefore, with the furnace working at nominal power there is a good chance that the value of 1% will be exceeded.

As seen before, the harmonic distortion of the current is dependent on the impedance to each harmonic, which in turn varies, at each moment, with the quantity and type of scrap. This harmonic distortion in current results, as can be seen in the graphs, much higher than the established levels, with distorting rates of the individual harmonics also high. (Total minimum current distortion >6%). The maximum current distortion reaches values that at first glance seem unbelievable.

The unbalance, with a maximum value of 0,53%, is within the specified limits, the same can be said of cosφ, although with certain oscillations that make that during the times when the furnace does not work the cosφ turns out to be very low.

The levels of flicker, both P_{lt} and $P_{st95\%}$ are, for the power to which they were determined, below the maximum levels ($P_{st95\%}$<1,1) established by EDP in the Carregado Substation.

It should be noted that, by contract, the power of the arc furnace for which the measurements were made was approximately 37 per cent of the rated power required; therefore, it is to be feared that $P_{st95\%}$ Flicker daily values exceeding 1,1 (at the Substation of Carregado) will occur when the furnace operates at its nominal power (83 MW) always depending, of course, on the behaviour of the SVC at nominal power, behaviour which is unknown.

After the numerous analyses carried out, it can be concluded that basically both devices are able to do the same function. However, from the results of the simulations, it has been found that at lower voltages than those of the normal range of voltage regulation, the STATCOM can generate more reactive energy than the SVC. This is due to the fact that the maximum capacitive power generated by an SVC is proportional to the square of the system voltage (constant susceptibility), while the maximum capacitive power generated by a STATCOM decreases linearly with the voltage (constant current). This ability to provide more reactive capacitive power during a disturbance is an important advantage of STATCOM over the SVC.

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