

# Power Usage Effectiveness analysis and optimization in the INFN CNAF Tier-1 data center infrastructure.

*Tuesday, 10 July 2018 16:40 (20 minutes)*

The accurate calculation of the power usage effectiveness (PUE) is the most important factor when trying to analyse the overall efficiency of the power consumption in a big data center. In the INFN CNAF Tier-1, a new monitoring infrastructure as Building Management System (BMS) was implemented during the last years using the Schneider StruxureWare Building Operation (SBO) software. During this new BMS design phase, a great attention was given to the possibility of collecting several detailed information about the electric absorption of different and specific parts of the facility. In particular, all the relevant technical plants areas, consisting of 3 transformers, 2 redundant 1.4MW diesel rotary uninterruptible power supplies (DRUPS) and 6 free cooling chillers of 320 kW were evaluated for the analysis of the Power Usage Effectiveness (PUE) and partial PUE (pPUE) of the data center. Considering the annual trends of these parameters and the demands for reducing the operating costs it was clear that some improvements were certainly needed in the very short time. For this reason, a hardware upgrade of the cooling chillers and chilled water pumps distribution system was seriously considered and therefore we started the design of a new project using innovative cooling technology. We focused on chillers using the Danfoss Turbocor centrifugal compressors technology that uses magnetic levitation and an oil-free approach for obtaining the best efficiency in the HVAC (heat, ventilation and air conditioning) applications. Subsequently, we studied a solution that could easily compensate the initial investment during the first years of usage (considering the Total Cost of Ownership of the project) and that will improve the overall PUE of the Tier-1 datacenter in addition to the usage of low-GWP (Global Warming Potential) refrigerants in the chillers, according to the dictates of the Green IT program. The future realization of this important infrastructure upgrade could greatly increase the energy efficiency in our Tier-1 with a sustainable efficient solution that will bring great benefits in the maintenance costs of our center.

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**Session Classification:** Posters

**Track Classification:** Track 8 –Networks and facilities