PUE DEVIATIONS

In some situations the power usage effectiveness (PUE) calculated by the RenewIT tool can be higher than the one expected by the user. This is because the actual server consumption calculated by the tool can differ from the expected consumption by the user. In this document it is explained how the energy consumption by the servers is calculated. Initially, the IT load profile used in the RenewIT tool is a real profile, so it dynamically changes during the day. The following graph shows the difference between a real HPC IT load profile and an ideal one. Notice that the average value of both of them is the same: 90 %.

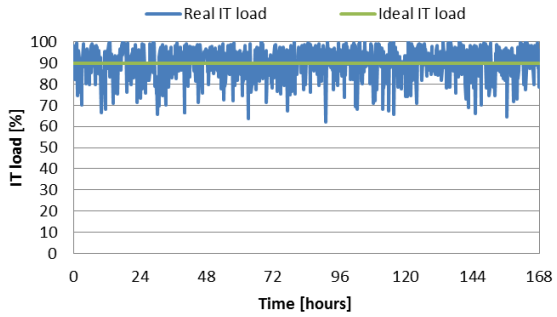

Figure 1 Real and ideal HPC workload profile during a week.

Then, this IT load affects the energy consumption of the servers and here is where there is the major difference between the methodology followed by the RenewIT tool and the standard one. In the reality, 90% of CPU usage (main requirement of HPC) doesn't mean 90% of the total server energy consumption, as can be seen in Figure 2. This phenomenon has been studied and the relationship between IT load (HPC, web and data) profiles and server consumption is well-known for different server architectures.

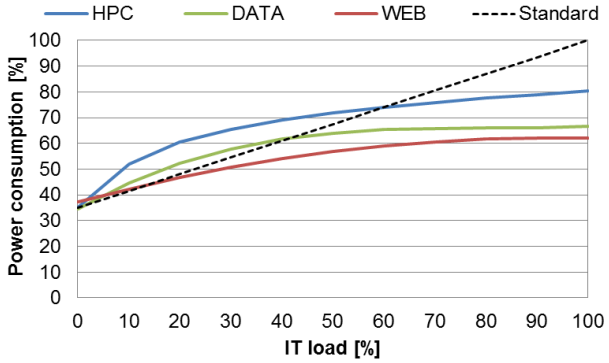

Figure 2 Relation between IT load and IT server consumption for different IT workloads.

Thus, the following graph shows the server consumption, both the ideal (or expected) and the real power consumption. Then, what happens is that the user thinks that the IT racks consume 90% but in the reality it is only 80%. Since the installation is design to fulfil the ideal consumption, the results from the RenewIT presents lower energy consumption and higher PUE values.

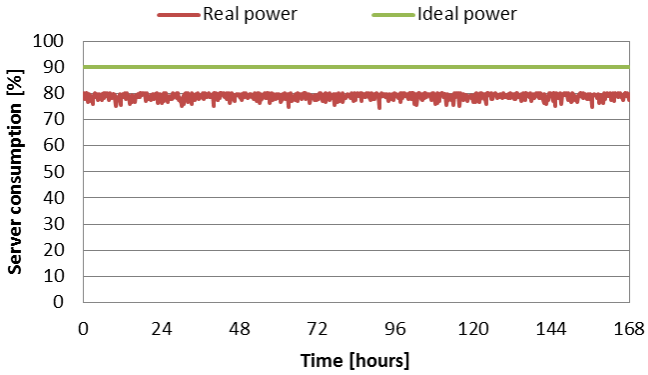

Figure 3 Real and ideal server power consumption during a week.

In the reality this phenomenon happens but, the data centre operator, when detects that the real IT consumption is lower than the expected it has a clear option: install more servers or replace old servers to more energy density servers. For better understanding, here an example is showed, assuming the same cooling consumption:

Assuming a Data Centre with the following boundary conditions:

- HPC workload profile
- 100 kW of Installed IT capacity

	Ideal case	Real Case
IT Load [%]	90	90
IT server consumption [%]	90	79
IT server consumption [kW]	90	79
Cooling consumption [kW]	50	45
Electrical losses [kW]	5	7
Total consumption [kW]	145	131
PUE	**1.61**	**1.66**