RIPTIDE

Energy Efficiency in Trading Floors

Relocate high-performance trading PCs from open-plan offices to an energy-efficient data center to improve reliability, workspace flexibility, and noise reduction.

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Introduction

A typical trading workstation is often equipped with multiple monitors, high-performance computers or workstations, and additional peripherals that consume a considerable amount of energy. The energy consumption of such a workstation can range from 700 to 1,400 watts or more, depending on the exact hardware configuration and the number of monitors. When very powerful computers are used, as is often the case in trading environments, the CPU and graphics card alone in a single computer can consume this amount of power. And where there is high power consumption, significant heat dissipation and associated noise emissions are not far behind.

The cooling systems in office spaces are generally designed to enhance the comfort of the occupants rather than efficiently supply cool air to a multitude of computers. This brings us to the topic of this document, which compares energy efficiency when operating multiple computers in an open-plan office versus using KVM remoting technologies as e.g. the very energy efficient Weytec components to relocate them to a separate server room.

Energy Efficiency

Energy efficiency means that a system or device consumes as little energy as possible to deliver a certain performance or function. It focuses on optimizing the use of energy while minimizing losses. Consequently, energy efficiency helps conserve resources, reduce costs, and protect the environment by lowering energy consumption and the associated emissions.

Energy Efficiency of a Data Center

The energy efficiency of a data center is crucial for lowering operational costs and minimizing environmental impact. Modern data centers rely on a combination of advanced cooling systems, energy-efficient hardware, and sustainable energy utilization concepts to optimize the PUE (Power Usage Effectiveness) value and reduce overall energy consumption.

Cooling Efficiency in Data Centers

Data centers are optimized for dissipating the heat generated by IT equipment. They use specialized cooling systems such as hot/cold aisle containment, precise airflow control, and often technologies like liquid cooling. This significantly reduces the energy required for cooling.

Calculation for a Data Center

The PUE value is a measure of the efficiency of a data center.
Modern, energy-efficient data centers achieve PUE values between 1.1 and 1.5, where a PUE of 1.0 represents a theoretical 100% efficiency (only IT power consumption, without additional cooling).

The formula for calculating Power Usage Effectiveness (PUE) is:

$$PUE = \frac{Total\ Facility\ Energy}{IT\ Equipment\ Energy}$$

Explanation of the formula:
Total energy consumption of the data center: This is the total energy consumed by the data center, including energy for IT hardware (servers, storage, network devices) and all additional infrastructure (cooling, lighting, UPS, etc.).
Energy consumption of IT components: This is the energy used exclusively for operating IT devices.
The PUE ratio indicates how efficiently a data center uses energy. A lower PUE value means higher efficiency, with more energy being directed to IT equipment rather than auxiliary systems.

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Energy Efficiency of an Office Space

The energy efficiency of an office space is determined by various measurements and indicators that represent energy consumption relative to space utilization and the building's energy characteristics. These include methods such as "energy consumption per square meter," "lighting and heating usage," or "heat demand and cooling demand." Combining these methods provides a holistic evaluation of an office space's energy efficiency.
In the case of a trading floor with numerous electrical consumers, cooling demand is a significant factor.

Cooling in Open-Plan Offices

In standard office buildings, air conditioning is designed for human comfort, often resulting in less targeted cooling control. Cooling and air circulation are rarely optimized to specifically dissipate heat from computers. Moreover, less advanced technologies are typically used, leading to higher energy consumption.

Calculation for an Office Space

A direct PUE value for an open-plan office is generally not calculated or used, as PUE is a metric specifically developed for data centers to evaluate the efficiency of their energy usage. In open-plan offices, the energy consumption for IT devices is lower relative to total energy consumption, and energy for heating, ventilation, air conditioning (HVAC), and lighting plays a significantly larger role.

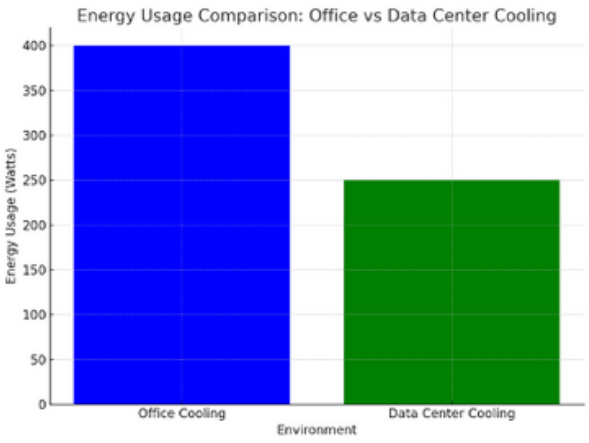
An average PUE value for offices is therefore rarely defined, as efficiency metrics for this type of building focus more on total energy consumption per square meter (kWh/m^2) or other sustainability metrics. If PUE were applicable, it would often exceed 2.5 or even 3.0.

For efficiency analyses in office environments, alternative approaches are often used, such as "Energy Use Intensity (EUI)" or "Green Building Standards."

COMPARISON OF ENERGY EFFICIENCY

There are still ways to compare the energy consumption of IT devices in different environments, particularly regarding the cooling efficiency of data centers versus office spaces.

As previously mentioned, the PUE is a measure of data center efficiency. If a similar value were calculated for an office, it would often be much higher, as a large portion of the energy is used for comfort cooling rather than for cooling IT devices.



The electrical energy used for cooling in an office space versus in a data center is reverse proportional to the difference of the temperature hub between the office space and the data center, as expressed by the following formula: ($P_{el.\ Office}=P_{el.DataCenter}*(\Delta t_{DataCenter}/\Delta t_{Office})$) [1]

In a practical example assuming a temperature hub of 4°C of the cooling system in the office space and a temperature hub of 16°C in a data centre, the electrical energy used for cooling in an office space is four times higher, than in a data centre.
So if a high performance cooling system for a data center has a Energy Efficiency Ratio (EER) of 20, it would be an EER of 5 for an office space.

Some studies estimate that operating a computer in a data center compared to an office space can yield efficiency gains of between 20% and 40%, depending on specific conditions. This is also due to the significant efforts made in recent years to improve the efficiency of data centers.

COMPARISON CALCULATION FOR A TRADING PC

The efficiency differences for a trading PC when operated in a standard office environment versus a data center primarily depend on cooling infrastructure and energy management strategies. There is no universal formula, as each comparison must be evaluated individually. Every server room has its own PUE, varying workloads, and different cooling technologies. Similarly, office environments differ in design, density, insulation, and cooling efficiency.

[1]:If the total cooling energy needed in the data centre and in the office space is constant

Here is a rough analysis based on experience and the improved efficiency of data centers in recent years:

Cooling Requirements:

In the Office:
The air conditioning in an office is not specifically optimized for dissipating heat from computers.

A standard work place as displayed in the introduction has a thermal load of about:

- Screens (6x) 90 W
- Keyboard 10 W
- Telephony system 20 W
- Lights 100 W
- Environment 100 W
- Human 140 W
- PCs (3 x standard) 540 W

Removing the PCs to the data center would remove 520W from the thermal load in the office space (540 W from the PCs – 20W added from the remoting HW)

For a trading PC generating up to 800 watts of heat, the cooling energy consumption in the office could easily add another about 150-200 watts, depending on room size and air conditioning efficiency.

So the electrical power needed to cool down such a work place in the office space with the Energy Effincy Ratio (EER) of the previous page, would be

- In the configuration as above ~200 W
- Equipped with two trading PCs ~412 W
- With the PCs moved into the data center ~96 W

In the Data Center:
With specialized cooling techniques such as hot/cold aisle containment and efficient airflow management, the same computer in a data center would require significantly less cooling energy:

- PCs (3 x standard) incl. remoting HW ~28 W
- Trading PCs (2 x) incl. remoting HW ~81 W

So the energy saving in the above example is in between 35% (~ 76 W) and 57% (~235 W).

Overall Efficiency

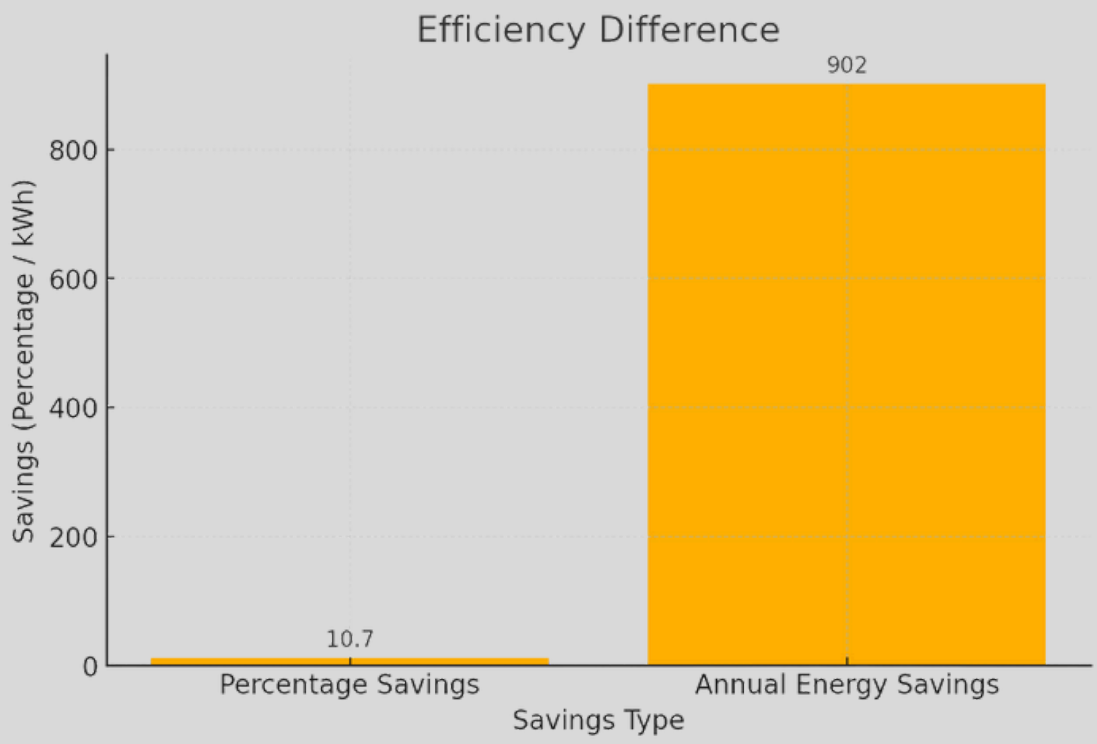
I**n the Office:** The total energy consumption of the trading PC could be approximately 960watts (800 watts for the PC + 160 watts for air conditioning).

In the Data Center: Energy consumption could be reduced to around 857 watts (800 watts for the PC + 40 + watts for cooling of the PCs + 17W for the remoting HW (incl cooling)).

Efficiency Difference

P**ercentage Savings:** In this example, operating the trading PC in a data center would save about 103 watts, resulting in an efficiency improvement of approximately 10.7%.

Annual Savings: Assuming the trading workstation operates 24/7, the annual energy savings could be around 902kWh (103 watts × 24 hours × 365 days). This would also lead to a reduction in operating costs.



Efficiency Improvement & Annual Energy Savings: The bar chart highlights the annual energy savings of 902 kWh achieved in the data center setup and the 10.7% energy efficiency savings in the data center.

FURTHER CONSIDERATIONS

Reliability and Failover: In addition to energy efficiency, data centers often provide higher failover capabilities, which can be crucial for a trading workstation.

Workspace Utilization: Using Weytec technologies allows trading workstations to be easily integrated into shared desk concepts, optimizing workspace utilization and overall space requirements.

Cost Advantages: Electricity costs in a data center may be lower, especially if the center relies on renewable energy or particularly favorable electricity rates.

Space Requirements: Operating high-performance hardware is often easier in a data center, especially when office space is limited and centralized management is preferred.

Noise Emissions: High-performance computers generate significantly more noise than small office computers or laptops. If these computers are located off-site, this source of noise is eliminated.

CONCLUSION

Trading workstations are inherently energy-intensive due to their high performance requirements, making cooling a critical factor in managing energy consumption and operational efficiency. Over time, even small improvements in cooling efficiency can lead to substantial energy savings and reduced operational costs. Data centers offer a centralized and efficient solution for managing the heat generated by such systems, leveraging advanced cooling technologies and waste heat management strategies to minimize environmental impact and energy use.

The exact energy savings achievable depend on a variety of factors, including the type of cooling system employed, external environmental conditions, the number and type of devices in use, and the overall efficiency of the cooling and computing technologies. Accurate assessments often require sophisticated tools like Computational Fluid Dynamics (CFD) simulations, which model airflow and thermal dynamics to optimize cooling configurations. These simulations, while powerful, are typically complex and tailored to the specific requirements and constraints of individual projects. As such, investing in advanced cooling strategies and analytical tools can provide long-term benefits in energy efficiency, sustainability, and cost-effectiveness.

ABOUT RIPTIDE

RIPTIDE Trade Solutions LLC is based in Zug, Switzerland.
With decades of relevant professional industry experience, the team at RIPTIDE recognized a crucial need in the market for tailored, high-quality solution engineering and project consulting services within the trading IT sector.

Our team's deep understanding of trading workplaces makes us your ultimate partner in success. Our goal is to transcend the traditional consultancy role, positioning ourselves as your dedicated partner in navigating the dynamic landscape of front-end trading workplaces and back-end trading infrastructure.

INTERESTED IN FINDING OUT MORE? LET'S CHAT

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