



Reducing energy consumption with IBM LinuxONE Emperor 4

IBM LinuxONE Emperor 4 is designed to dramatically reduce energy vs. an equivalent x86 infrastructure

Government and industry organizations are becoming increasingly concerned about the cost and reliability of energy supplies and seeking ways to reduce overall energy consumption with IT and data center solutions.

Focusing on data center solutions is an essential step towards achieving reduced power consumption.

Making more efficient use of compute, memory, and data I/O resources through Linux workload consolidation can lower energy consumption, floorspace and overall costs. Workloads may be consolidated to server hardware that requires a smaller number of physical systems with higher energy-efficiency.

IBM LinuxONE is an enterprise-grade Linux® server that can run RHEL, SLES, Ubuntu, and community editions of these distributions, with a unique architecture designed to meet the needs of mission-critical workloads for regulated industries. It brings together IBM's experience in building secure, resilient, and scalable systems, with the openness of the Linux operating system.

IBM LinuxONE is a platform designed to support massive server consolidation projects, that can result in significant cost and energy savings.

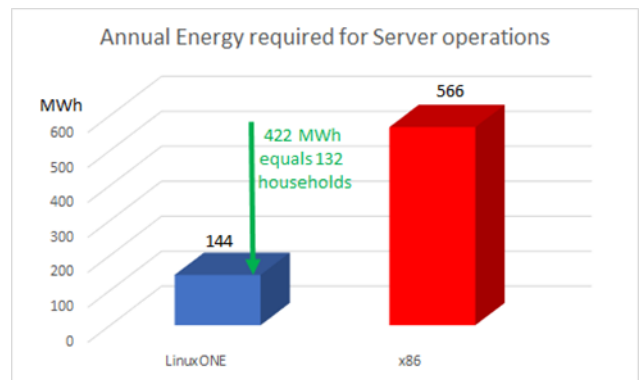
Good workload candidates include:

- Data management platforms for traditional SQL databases and newer data analytics platforms
- Hybrid cloud platforms for modern organizations looking to drive seamless integration of its on-prem and off-prem environments
- Containerized platforms such as Red Hat Openshift
- Application environments, such as Temenos and Finacle. See more information at:

<https://www.ibm.com/partnerworld/systems/linuxone/isv-partner-ecosystem>

Consolidating Linux workloads on 5 IBM LinuxONE Emperor 4 systems instead of running them on compared x86 servers under similar conditions can reduce energy consumption by 75%, space by 50%, and the CO2e footprint by over 850 metric tons annually.¹

Based on an IT Economics study, an IBM LinuxONE Emperor 4 can reduce the CO2e footprint by approximately 75% each year versus compared x86 servers running the same Linux workloads under similar conditions.² In that US-based case, it takes 39 x86 servers with 2072 cores to deliver the same results as a single IBM LinuxONE Emperor 4 with 125 cores, saving 422 MWh of electricity. The energy saved is equivalent to the annual electrical energy required by 132 2-person German households in 2019, based on official average consumption data.³



¹ Compared 5 IBM Machine Type 3931 Max 125 model consists of three CPC drawers containing 125 configurable cores (CPs, zIIPs, or IFLs) and two I/O drawers to support both network and external storage versus 192 x86 systems with a total of 10364 cores. IBM Machine Type 3931 power consumption was based on inputs to the IBM Machine Type 3931 IBM Power Estimation Tool for a memo configuration. x86 power consumption was based on March 2022 IDC QPI power values for 7 Cascade Lake and 5 Ice Lake server models, with 32 to 112 cores per server. All compared x86 servers were 2 or 4 socket servers. IBM Z and x86 are running 24x7x365 with production and non-production workloads. Savings assumes a Power Usage Effectiveness (PUE) ratio of 1.57 to calculate additional power for data center cooling. PUE is based on Uptime Institute 2021 Global Data Center Survey (<https://uptimeinstitute.com/about-us/press-releases/uptime-institute-11th-annual-global-data-center-survey>). CO2e and other equivalencies that are based on the EPA GHG calculator (<https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>) use U.S. National weighted averages. Results may vary based on client-specific usage and location.

² IBM Machine Type 3931 Max 125 model consists of three CPC drawers containing 125 configurable cores (CPs, zIIPs, or IFLs) and two I/O drawers to support both network and external storage. 39 Cascade Lake and Ice Lake x86 servers configured to provide same performance. Annual energy required for server operations was 143,962 KW for IBM Machine Type 3931 with 125 cores and 566,448 KW for 39 x86 servers with 2072 cores, so the CO2e footprint would be 62.5 metric tons for IBM Machine Type 3931 and 245 metric tons for x86 servers. CO2e and other equivalencies that are based on the EPA GHG calculator (<https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>) use U.S. National weighted averages. Results may vary based on client-specific usage and location.

³ Using latest available data published by the Federal Statistical Office of Germany (Statistisches Bundesamt) <https://www.destatis.de/EN/Themes/Society-Environment/Environment/Environmental-Economic-Accounting/private-households/Tables/electricity-consumption-private-households.html> as of 15 July 2021 for the average consumption data for German 2-person households in 2019 of 3196 kWh / year.

IT Economics experiences with deployed workload consolidations have shown that clients achieved substantially improved performance through higher utilization of compute, memory, and I/O resources on LinuxONE.

Based on a typical hypothetical client configuration, we calculated that 149 cores of commercial database running on the equivalent of 13 x86 servers (16 physical servers in total) could be consolidated onto 10 cores running on one LinuxONE system, reducing database license requirements by 87% on LinuxONE for the same workload due to the high core consolidation ratio. Using these consolidation results, it may be extrapolated that energy consumption and greenhouse gas (GHG) emissions versus compared x86 could be reduced by as much as 70% in emission-heavy geos.⁴

Typical client configuration study		
70% energy reduction (extrapolated)	87% SW license reduction	15:1 x86 to LinuxONE core ratio

Continuing in this tradition, IBM LinuxONE Emperor 4 is designed to dramatically reduce the energy consumption and carbon footprint of enterprises throughout the entire product lifecycle.

Read the product carbon footprint report at this link:
<https://www.ibm.com/downloads/cas/2JBPXBMK>

Learn more about LinuxONE here:
<https://www.ibm.com/linuxone>

For an individual assessment of energy and cost savings for your IT environment contact the IT Economics Team.

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IBM LinuxONE Emperor 4 has been named a winner of the 2022 SEAL Sustainable Product Awards⁵, honoring innovative and impactful products that are “purpose-built” for a sustainable future.



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Actual costs and performance characteristics will vary by client. The actual throughput or performance that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput or performance improvements equivalent to the data used in the study.

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⁴ This is an IBM internal study designed to replicate a typical IBM customer workload usage in the marketplace. Results may vary. Based on 149 cores of Oracle running on 16 x86 machines (5 Dell Xeon, 3 HPE Opteron, 8 Oracle SPARC) totaling 192 cores at 45% average utilization and IBM LinuxONE III LT1 with 10 IFLs and 1.8TB RAM at 85% utilization. Total x86 rating of 9.3Kw from IDC and LinuxONE 2.8Kw from IBM ResourceLink. Commercial database license count based on 1 license per core (0.5 on x86) (<https://www.oracle.com/a/ocom/docs/corporate/oracle-software-licensing-basics.pdf>).

⁵ 2022 SEAL Sustainability Product Awards (<https://sealawards.com/sustainability-award-2022>)