endura technologies

Towards a more ***sustainable*** data center

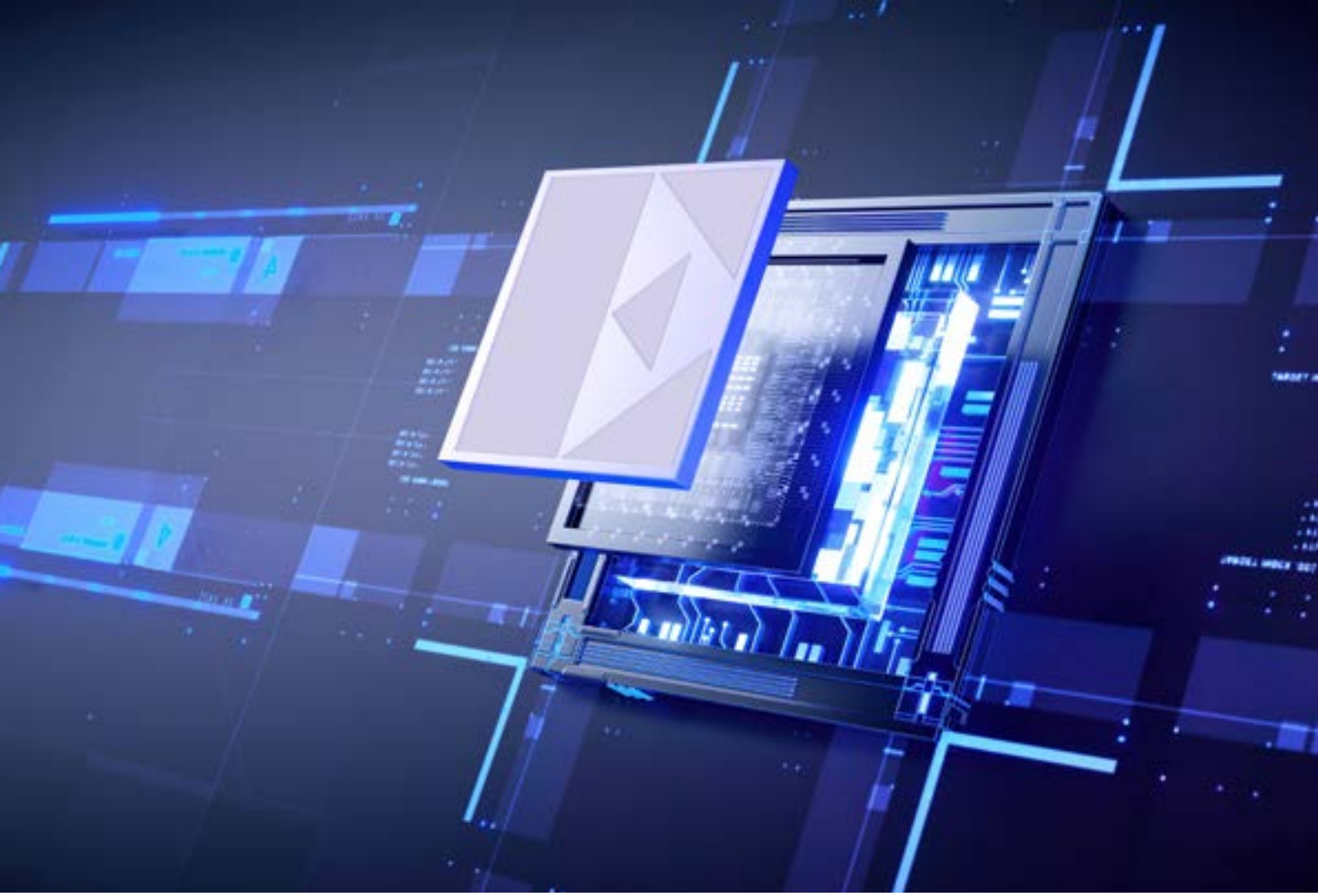
The data center industry faces pressure to improve sustainability from multiple sources — including government, financial markets and corporate clients.

INTRODUCTION

Data centers are some of the most energy intensive facilities, consuming 10-50x more electricity per square foot of floor space compared to the average office building. Electricity is the single largest expense line item for data center operators, accounting for over 60% of total annual operating expenses. Recent advances and widespread adoption of artificial intelligence, combined with decreasing efficiency gains of Moore's Law, is setting the stage for data center energy consumption to skyrocket going forward.

Over the last decade there have been significant advancements in the energy efficiency of compute processors, but almost no advancement in the energy efficiency of the power delivery/management chips that power these processors.

Endura Technologies has developed an entirely new architecture for power delivery and management that significantly reduces wasted power (reduction of losses in power conversion) through large efficiency gains in power delivery coupled with "point of load" power delivery which eliminates system losses such as PCB routing, passive components, etc. All inefficient systems, generate heat which further compounds the overall system power usage due to required cooling apparatus necessary not only increasing the electricity cost but also reducing the footprint for additional compute.



Endura Technologies

50%
LESS POWER

75%
LESS SURFACE AREA

50%
REDUCE TOTAL BoM COSTS

20%
BOOSTING OVERALL PERFORMANCE

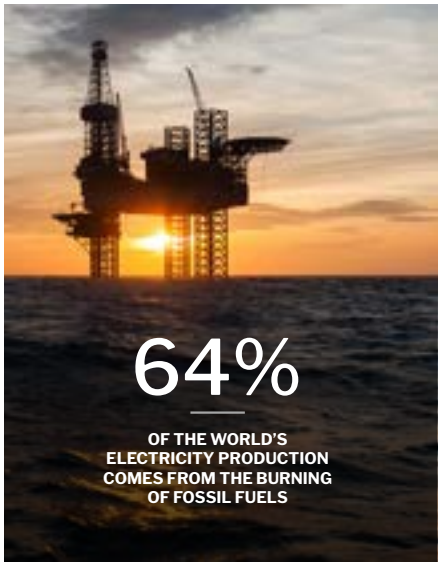
Endura is a pioneering SoC (System-on-Chip) IP/architecture company with disruptive power delivery solutions targeted for data center, automotive, and others advanced chips. Endura has an advanced power delivery and management architecture that significantly improves system-level energy efficiencies. Endura's patented "Bypass Dual Duty Cycle Control" BDCC, architecture eliminates routing losses, reduces heat dissipation, and reduces the number of supporting passive components. The result is a system (Compute SoC plus companion power solution) that can consume 50% less power, occupy 75% less surface area on a PCB board, and reduce total BoM costs by 50%, all while boosting overall performance by 20%.

Endura's architecture can be applied to power management chips or embedded with processor modules or integrated as on-chip IP for point-of-load energy delivery as needed to be used in a variety of applications ranging from smartphones, PC and Notebooks, Automotive Radar/Lidar, to base stations, but the benefits of Endura's technology shine brightest in the data center setting. Endura's power solution for data center are used in a variety of data center sub-systems including powering compute (CPU/GPU), powering optical connectivity (DSP phys), and powering storage solutions (DDR and SSD modules). Customers with large data center operations are coming to Endura to reduce the electricity consumption and heat dissipation of their compute systems, both of which result in significant operational cost savings and environmental benefits.

A problem set to get exponentially worse over the coming decades

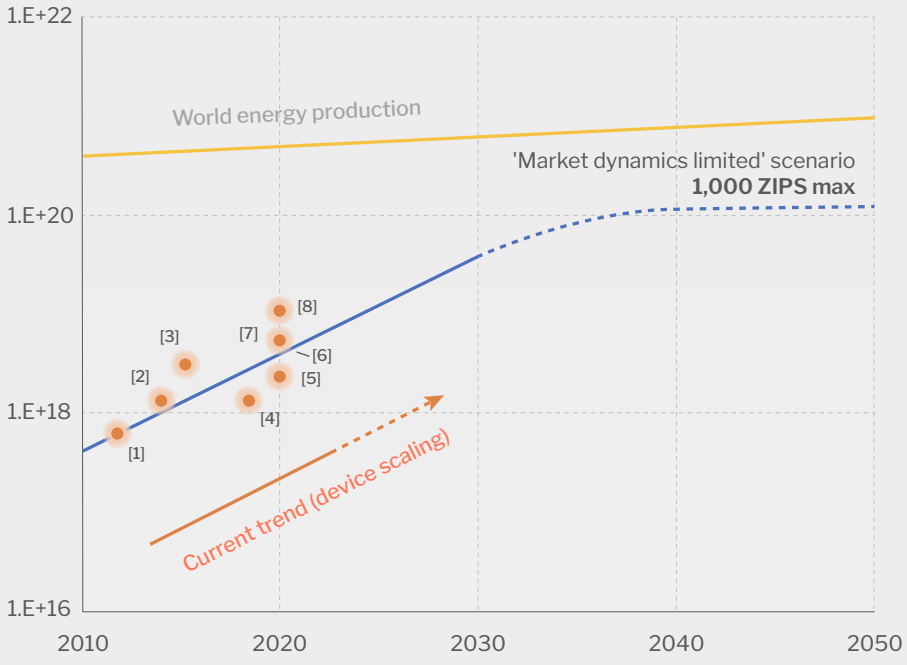
According to the International Energy Agency (IEA), globally data centers consumed 205 terawatt-hours (TWh) of electricity in 2020. They accounted for ~1% of the world's total electricity consumption.[i] This figure is dramatically higher in developed markets. According to a comprehensive study conducted by the European Union, data centers are responsible for 3% of all electricity consumption in the EU.[ii] Artificial intelligence and other advanced forms of compute is driving explosive growth in data center electricity consumption, based on a recent analysis by OpenAI, the amount of compute used in AI training is doubling every 3.4 months.[iii] **A recent paper from MIT stated, *"the energy requirements of current natural language processing models continue to grow at a rapid, unsustainable pace."***

For the last three decades growth in computing performance has been significantly offset by gains in processor efficiency (Moore's Law), enabling compute to scale without power consumption becoming a major issue. In recent years, as the benefits of Moore's Law has diminished leading to less efficiency gains and faster growth in data center power consumption. According to the Semiconductor Research Corporation, the current trajectory of compute related energy consumption is on pace to exceed the entire world's electricity production in the 2040s.[iv] In their Decadal Plan for Semiconductors the SRC stated; *"total energy consumption by general-purpose computing continues to grow exponentially and is doubling approximately every three years while the world's energy production is growing only linearly, by approximately 2% per year."*[v] This implies that by 2030, computing will account for over 5% of the world's total energy consumption.



Not only will increased electricity consumption have a significant impact on bottom lines of data center operators, but it will also have a significantly negative impact on the environment as well. According to the IEA, globally 64% of the world's electricity production comes from the burning of fossil fuels and electricity production is responsible for 42% of all energy-related CO^2 emissions. **Every year data centers are responsible for over 76m metric tons of CO^2 pollution. This is the equivalent to the annual carbon production of 17 million automobiles and equivalent to 245 million cross country flights across the United States.**

NEW COMPUTE TRAJECTORIES FOR >1000 ZIPS



"The energy requirements of current natural language processing models continue to grow at a rapid, unsustainable pace."
– MIT Lincoln Laboratory

The solution

Endura's power delivery architecture and chipsets have been shown to enable up to 20% power efficiency gains across multiple data center related applications. The company's technology enables multiple power rails to be optimized for each specific subsystem within a system-on-chip configuration leading to less power loss for higher compute performance. Endura's eVR™ technology enables highly efficient voltage conversion, which means less power is lost and transformed into dissipated heat during the conversion process. Endura's technology is highly scalable and the difference in efficiency relative to traditional power delivery solutions with efficiency gains relative to the existing solutions becoming greater at higher loads (amps), which is especially meaningful in the data center setting. Furthermore, by providing faster energy delivery, system performance gains are enabled which further reduces power consumption in the key parameter of compute/watt.

Power consumed by servers and the equipment needed to cool these servers, accounts for the vast majority of data center power consumption (86% of total)[vi] Endura's technology attacks both sources of consumption. For a dual-socket general purpose server, Endura can deliver a total energy efficiency gain of 9%, which translates into 55 watts of energy savings per server per year.

When factoring in additional savings for reduced cooling needs the total power savings increases 87 watts per sever per year.[vii] This delivers valuable financial benefits to their customers. Endura customers can save $129 per server per year in electricity costs, which would translate for over $10m in annual operating expense savings for a large scale data center.

Endura's technology can not only boost data center operator's bottom lines, but it can also help meet their sustainability targets as well. Data center operators are under significant pressure to improve the sustainability of their operations. In 2019 the European Union published a set of standards and regulations on servers designed to minimize the environmental impact of data centers. Some governments are actively limiting the expansion of the data center industry due to concerns around electricity consumption and sustainability. In the Netherlands, large scale data center development has been banned throughout the country with the exception of two regions, and recently local governments in those two regions have imposed a moratorium on data center development.[viii] As stated in a recent report by S&P Global ***"the data center industry faces pressure from multiple sources — including government, financial markets and corporate clients — to improve sustainability and reduce carbon emissions. A sustainability strategy is no longer a simple "nice to have" item for data center operators; in the future, it may determine whether an operator succeeds or fails."***[ix]

The electricity consumed by data centers is responsible for approximately 76 million metric tons of CO^2 production every year. This is equivalent to the emissions of 21 coal fired power plants or 17 million gas powered automobiles. **The efficiency gains from universal adoption of Endura's technology would result in a reduction of 18 TWh of annual electricity consumption and 7 million metric tons of annual CO2 pollution – the equivalent to removing 1.5 million passenger vehicles off the road or planting 68,000 trees.**[x] [xi]

Together with Endura Technologies, the data center industry is charging towards a more efficient and more sustainable future.

Towards a more sustainable future

For more information please visit *https://enduratechnologies.com* or email *info@enduratechnologies.com*

i https://energyinnovation.org/2020/03/17/how-much-energy-do-data-centers-really-use/
ii https://op.europa.eu/en/publication-detail/-/publication/bf276684-32bd-11eb-b27b-01aa75ed71a1/language-en/format-PDF/source-183168542
iii https://openai.com/research/ai-and-compute
iv v https://www.src.org/about/decadal-plan/
vi https://energyinnovation.org/2020/03/17/how-much-energy-do-data-centers-really-use/
vii https://journal.uptimeinstitute.com/data-center-pues-flat-since-2013/
viii https://www.Data centerdynamics.com/en/news/the-netherlands-hollands-kroon-wants-to-pause-hyperscale-developments/
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x https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle
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