HOW DO WE DO MORE WITH LESS?

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The continued drive for increased data center capacity is showing no signs of slowing down, subsequently requiring more resources to keep pace. The struggle to put in place adequate resources in terms of specialist labor and materials has several negative consequences for planned projects, including slipping project ready-for-service dates, increased budgets, and challenges controlling those budgets. Quality has suffered as inexperienced labor (design and construction) have to be trained on the job, and time schedule expectations have to be reset to enable projects to be finished. Growing concerns about climate change and the overall impact of construction and industry practices means that organizations can no longer ignore their overall environmental impact and carbon footprint.

Doing the math, continuing to build and operate the data centers as we are currently doing it, will not be possible. But what are the alternatives?

Four dimensions need to be considered:

- Energy source
- Cooling efficiency
- Building design
- Delivery process

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THE ENERGY SOURCE

Data centers are already consuming 2% of global electricity production, making an obvious contribution to the overall CO2 emissions. The pressure to migrate to renewable energy sources is likely to increase and therefore, selecting locations providing that availability is going to be essential for long term operational stability.

THE COOLING EFFICIENCY

The challenge is not only to lower the CO2 emissions by migrating to renewable energy sources, but also to optimize the data center efficiency reducing the amount of energy consumption. Current air-cooling systems do not only come to their limits due to the increasing power densities in the racks, but also require significant white space, consequently increasing the building costs. Alternative approaches, such as passive water-cooling systems are much more efficient. Water cooled doors cooling the racks at the source, not only increase the cooling efficiency, but also allow higher power density up to 3.3 times more. Furthermore, they do not require the extensive white space of air-cooled systems, consequently reducing the overall building volume. Projects have shown us the potential to reduce the building size by up to 50%.

THE BUILDING DESIGN

Conscious use of recyclable building materials has further ability to reduce CO2 emissions during construction. Simple steel construction, inspired by the design of high bay warehouse solutions in Germany, can achieve 50% lower environmental impact (greenhouse potential) over the entire life cycle (20 years), and 73% lower environmental impact (greenhouse potential) of building execution (harvesting of resources, transportation, construction).

THE DELIVERY PROCESS

Looking deeper into the building design and project execution, we have seen how steel lends well to standardization and off-site prefabrication. By combining this material with modular building design, it is possible to reduce construction time on site and reach a better deployment efficiency. In combination with lean construction methodology and extreme scheduling, further economic benefits can be reached: reduced risks, lower investment, and shorter ready for service time.

IN CONCLUSION

Data centers can be built and operated with a step change lower impact on the environment, reducing up to 50% the global warming potential, by:

- Using renewable energy
- Passive cooling solutions
- Design automation, optimization, and prefabrication.
- Supply chain automation and optimization
- Extreme scheduling and workflow optimization

In the projects of NDC Data Centers, we have further found, that this has amazing economic effects. As a review report by the Fraunhofer Institute for Building Physics IBP showed:

- Operational cost can be reduced up to -48%
- Lifecycle costs can be reduced up to -50%

Building a data center with significant savings in time and costs without compromising quality and environmental impact is possible, especially if the various approaches are addressed in a holistic, whole-system design.

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AREA	FEATURES	BENEFIT
Technology	Water cooling	High density without additional HPC cooling system Compact room configuration
Project management	Integrated project development (IPD)	Solution/customer oriented execution process
Design process	Digitalization	Reduction in development time and resources
	Modular design	Incremental growth and optimization of working capital in accordance to usage
Selection of material	Life cycle assessment of selected material (Cradle to cradle)	Usage of material with highest level of recyclability
Execution Construction	Prefabrication, Skid - Design	Reduction in installation time Reduction in qualified labor force and travel cost on site Reduced testing process on site
	Extreme Scheduling	Expedition in time, transparency in progress and quality