The Utility of the Future

Where digital and energy infrastructure combine.

Disclaimer

Approach

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About This Report

This report harvested publicly available information from white papers, academic studies, industrial publications and news articles to formulate the most commonly observed challenges, trends and drivers of each industry. The opportunities stated in this report are neither exhaustive nor exclusive. Throughout the report “analysts insights” boxes provide the reader with our informed opinion, whereas the bulk of the report represents what are largely considered mainstream views. An “Executive Track” provides succinct summaries of the major topics, specifically business related, whereas the rest of the text often meanders into relevant detailed operational factors. Feedback was provided by industry experts before the final draft was released. All sources are documented in the References section, and most are hyperlinked. Feedback on this report is welcome.

Abstract

This report sheds light on the partnership potential between Energy Utilities and Data Centers. Both industries are at crucial inflexion points. As energy utilities pivot towards sustainability, they are facing new challenges. Likewise, the digital economy is fast maturing, and digital infrastructure is moving from a luxury to a necessity. This report maps the operational challenges and changes facing both industries before highlighting potential partnership opportunities in the areas such as electricity flexibility, district heating, site location and shared operational competences. This report largely omits Edge developments, and focuses instead on the larger, more centralized elements of the data center industry.

Executive Summary

Both energy and digitalization are on everybody's minds today. Both play increasingly important roles in our daily lives, yet few realise how interdependent these industries truly are. Digitalization promises to re-align our economy around data and computation, but the digital economy of tomorrow will be built on the shoulders of today's electrical infrastructure. Fewer still can see the tremendous industrial and societal opportunities when two fundamental requirements of the digital age integrate.

Both the digital and energy infrastructure industries are at inflexion points

The energy industry is decarbonizing, and the data center industry is maturing. As intermittent renewables penetrate further into the electricity generation mix, flexibility becomes increasingly valuable. The phase out of flexible supply and inadequate storage capacities will make demand response the flexibility of the future. Hence the generation, consumption, storage and migration of energy will become crucial to balancing the energy grid of tomorrow, where yesterday's energy grid predominantly required adequate generation alone.

Data traffic is expected to grow exponentially over the next decade as digital use cases become increasingly embedded in our lives. The smart home, the office in the cloud, the autonomous vehicle, the robot operator are all becoming increasingly numerous as internet speeds improve. Internet connectivity will connect more consumers and more devices, all of which produce increasingly data and compute intensive workloads. The result is data centers are the fastest growing consumer of energy globally.

Data centers are a Power-to-Heat resource of the future

Data centers are becoming increasingly large generators of heat and they will soon account for 4-6% of global power consumption, of which one third is used for the cooling of heat. This heat is often generated in cities, where district heating demand is growing fastest, and where recovered heat can be recycled most efficiently. Additionally governments are fast realizing that the heat sector, which can account for more than a third of all CO2 emissions in some regions, must also decarbonize in order to reach the CO2 reduction targets laid out in the EU 2050 plan. For the district heating utility, the advantages include the consumption of "free/low CO2" recovered heat, and the accompanying reductions in prices.

Integration creates value across the entire Energy Sector

Grid constraints, expensive storage solutions and the phasing out of flexible fossil fuels all increase the value and viability of Demand Response as a source of Flexibility. IT shiftability and migratability are all valuable to the energy grid of the future because they are effectively forms of energy generation, consumption and storage. Ramping up computations during times of electricity oversupply, and ramping down IT loads during undersupply could provide data centers with reduced energy bills, and help bring stability to an increasingly unstable grid by stabilising both national and local energy grid constraints. Europe is currently accessing around 20GW of available Demand Response, but the European Commission places the total potential at 100GW, forecasted to rise to 160GW in 2030.

The large and growing size of data centers, the delay-tolerant nature of some of their workloads, and the instantaneous nature of their operations make data centers particularly applicable as providers of energy flexibility, grid stability and ancillary services. Beyond the obvious secondary revenue streams, data centers could help to further integrate renewables into the energy system. In other words, data centers could enable a fully renewable electricity mix. National Governments meet their renewable targets across both the Heat and Electricity sectors, and Local Authorities deliver cheaper, renewable energy to their residents.

"Location, Vocation, Integration" - Expanding the Opportunity beyond Energy

Hyperscale data centers face increasing pressure to deliver lower latency services. In the near future some hyperscale data centers are therefore likely to locate themselves closer to cities to solve the issue of latency. In this case, sites owned by energy utilities could be of significant value. Colocation data centers are getting larger and more numerous. Access to locations with power, fiber connection, space for potential expansion is getting more difficult. At the same time, energy utilities own significant plots of land in and around cities, where demand for colocation data centers is strongest, and where integration with district heating grids is most feasible. Data centers require locations, energy utilities own these locations. This synergy is made more opportune by the fact that energy utilities will be vacating all urban coal power plants in the next decade.

Crucially, both industries suffer from a lack of talented personnel. In fact the industries are so similar that both industries actually recruit from the same talent pools, into very similar roles. Both industries will see large numbers of employees retire within the next decade and both industries are worried about how to fill these vacancies. Here there is no secondary revenue stream, rather a consolidation and reinforcement of the primary revenue stream by pooling human resources.

Digital Infrastructure is as critical to society as Energy Infrastructure

Both industries are large, technical, complex systems who place a premium on 100% availability. Both suffer from the same forms of facility and network wide failures. Defending the entire network against downtime requires a redundant grid. The EU electricity grid is slowly becoming one redundant grid (from 27 member nation grids) and the digital grid is forming as fibres and interconnections connect increasingly redundant data centers at a global scale. Both industries deliver a similar product (critical infrastructure) to a similar customer (businesses and residents) with similar constraints (near continuous uptime). The value proposition here is shared core competences in a brand new critical infrastructure market.

The Energy Utilities of today are the blueprint of the Digital Utility of Tomorrow

There are significant societal benefits to the successful operation of both industries. While both electrical and digital power are business critical and even mission critical, digital power is not yet life-critical. The moment digital infrastructure becomes as critical to the operation of modern society as electricity, we can consider it a critical public utility. We believe the digital utility will be as critical to the 21st century as electricity was to the 20th century. Hence the development of the electric grid over the last century provides us with a blueprint for the development of the digital grid.

Capturing the Opportunity of Digital & Energy Integration

This report makes a handful of final recommendations:

- Energy services markets need to communicate better prices and value before data centers would consider providing energy services. The acknowledgement by OFGEM, the UK's energy regulator, to resolving and improving their new flexibility market is welcome news, but more needs to be done and sooner.
- Standard contracts should be created, which can act as the building blocks of any future relationship between district heating grids or distribution system operators and data centers. They are necessary given many of the above value propositions transcend typical industry boundaries. This would help solve the problem of "who pays for the CAPEX".
- Recovered heat needs to be appropriately valorized. Currently it is difficult to put a price or value on recovered heat, and in some cases recovered heat is still not considered renewable. A market for recovered heat may in the long term be the best method of incentivising recovered heat utilization. The EU's heat network decarbonization strategy should consider this.
- Data Centers should confront their aversion to complexity within the facility by bringing the energy bills under the jurisdiction of the IT staff (and away from facilities staff). This is a practical first step towards creating the competence and confidence data centers require before they can begin making data centers a source of energy flexibility.

What to expect from this report:

The contribution of this report is two-fold. The first is to map the opportunities between electrical and digital infrastructure industries. Second, this report explores a higher level, deeper connection between the electricity grid and the digital grid. The electricity grid provides us with a blueprint for the development of the digital grid, where both are vital forms of critical public utilities. Effectively this report can be used by the reader to conceptualise opportunities between both industries which neither industry could deliver alone.

Thank you.

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