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DATA CENTERS: ANTICIPATING AND PLANNING DIGITAL STORAGE

WITH THE EXPLOSION OF THE DIGITALIZATION OF THE ECONOMY AND DATA EXCHANGES, THE HEALTH CRISIS HAS CONFIRMED THE GROWTH OF THE SPATIAL AND ENVIRONMENTAL FOOTPRINT OF DATA CENTERS IN THE PARIS REGION (ÎLE-DE-FRANCE), AS EVERYWHERE IN THE WORLD. WHEREAS LOCAL ADMINISTRATIONS ARE SEEKING A BETTER COMPREHENSION OF DATA CENTERS, EXPERIMENTS CONDUCTED IN EUROPE MAKE IT POSSIBLE TO ENRICH REFLECTIONS ON A HOSTING STRATEGY ADAPTED TO THE ÎLE-DE-FRANCE.

Since the late 2000s, local administrations and managers of European transmission and electricity distribution networks have had to deal with ever-growing requests for siting and connection. In 2020, Dublin outstripped Paris in the leading quartet of cities hosting this industry[1]. London, Dublin, Frankfurt and Amsterdam are each planning to dedicate 1,000 MW (1 GW) to data centers before 2023[2]. Particularly concerned by this growth, the Île-de-France now has a third of all the data centers in metropolitan France, that is, some 120 infrastructures set up according to economic opportunities and the availability of land and energy, with no overall coordination. For the public actors and electricity operators, the concern is to better anticipate and plan digital storage, without putting the brakes on the region's economic attractiveness. In Europe, some countries are more proactive than others in terms of regulating siting and energy consumption. Confronted with this constant growth, several territories have already sounded the alarm. Several metropolitan regions, Amsterdam and Stockholm in particular, have imposed heavy restrictions, while others, like Dublin, have opted for less regulation.

SPECIFIC ISSUES ACCORDING TO THE ACTORS

Rises in the data center industry's electricity consumption heavily disturb distribution and transmission system operators. The massive growth in connection requests raises major problems. Over-reservation of electricity capacity disturbs the energy balance of the territories, sometimes creating use conflicts, even shortages. It is also the timescale and scheduling for strengthening infrastructures (networks and substations) that do not always suit an industry in a big hurry... As for

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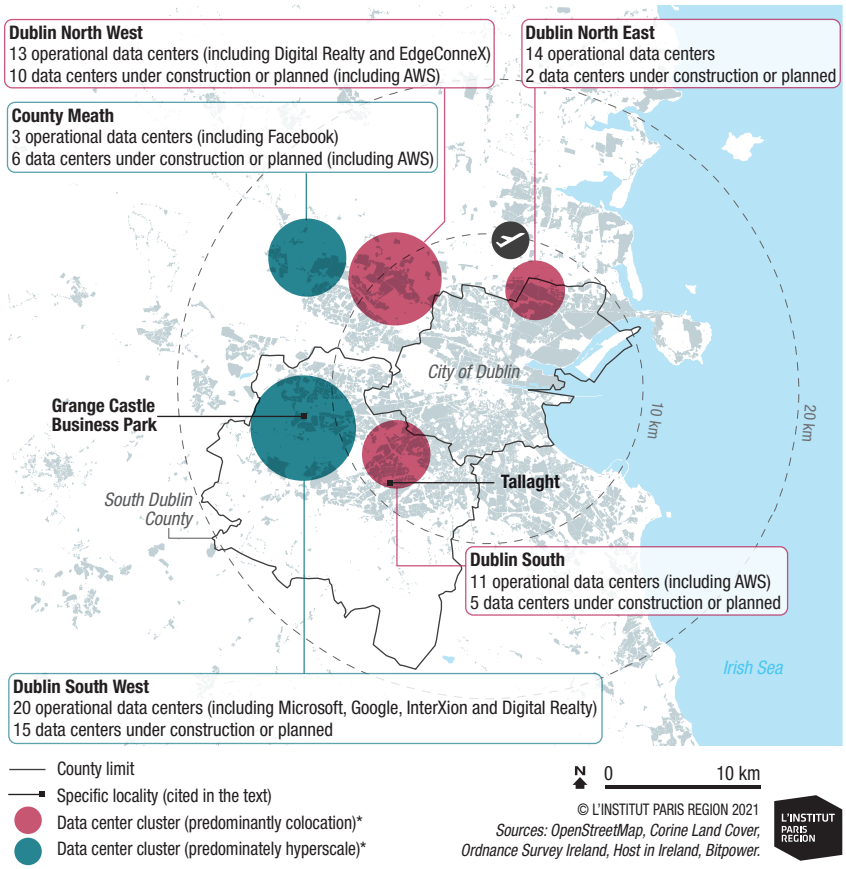
In Dublin, hyperscale actors in the conurbation



** According to* "Ireland's Data Hosting Industry," *by Bitpower and Host in Ireland, November 2020. Data competed by our own research. The list of data centers is not exhaustive and the predominance is estimated.*

the public actors, they assert their determination to better oversee the siting of these private actors. It is moreover interesting to see that the countries that best meet this challenge – digitizing the territories (place of the GAFAM[3], digital sobriety, financial contribution of the private actors to strengthening public infrastructures, etc.) – are those that have begun a concerted approach between actors in public urban planning and energy. Dublin, Amsterdam and Stockholm are among the European cities in which the data center market is the largest and most competitive. In each of these cities, the measures vary under the effect of regulations caught between local and national, even European levels for electricity regulations.

IN DUBLIN, MEASURES FAVORABLE TO THE STORAGE INDUSTRY AND ADMINISTRATIONS IN THE BACKGROUND

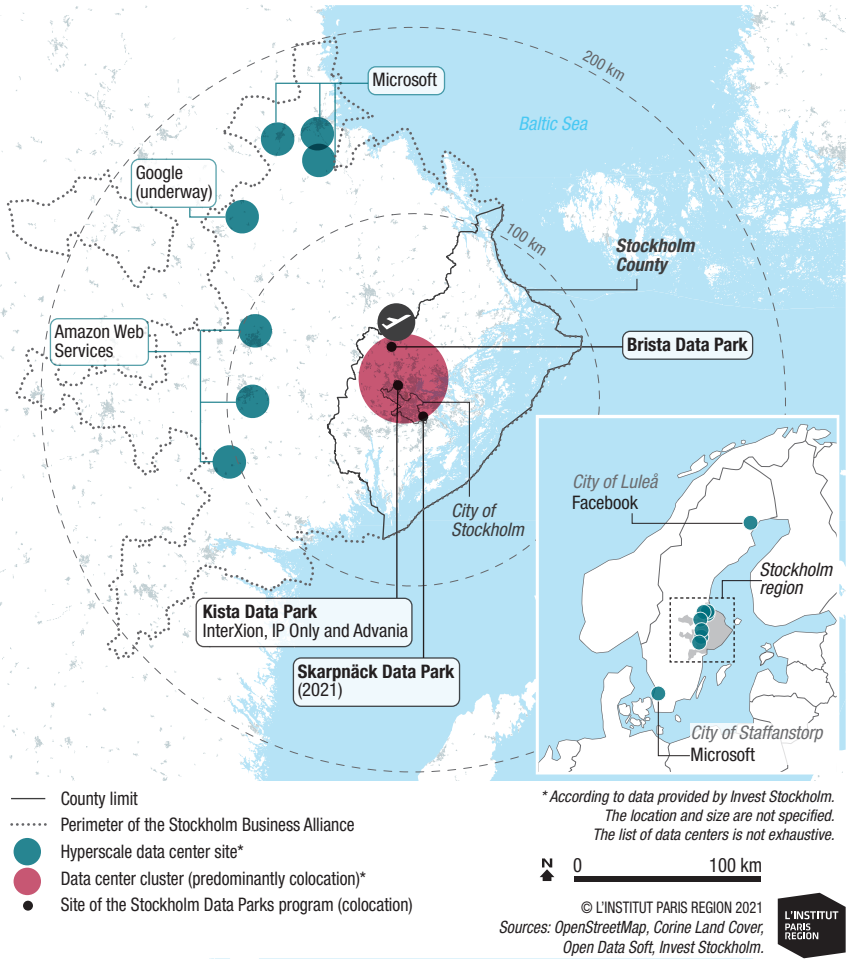
Specialized in digital technologies since the 1960s, Ireland applies a policy geared toward export and foreign direct investment. 25% of the European data center market is concentrated in the capital, Dublin. Ireland is an entryway for the United States in the European data market. With weak latency (that is, a short transit time), very attractive energy prices and corporate tax rates, as well as an enormous optical fiber network, the colocation[4] data center market has been structured there since the early 2000s. In the Dublin metropolitan region, data centers are organized into clusters all around the city, which included every data center scale, notably numerous hyperscale facilities. These infrastructures of over 10,000 m2 of surface area, near the conurbation, remain rare elsewhere in Europe.

If the 2017 electricity projections were on the order of 1,000 MW of extra capacity needed by 2024, they are nearing 1,500 MW today. This growth raises a genuine challenge for the electricity network operators who are expecting a rise in consumption of 20 to 57% in the next decade. Ireland's ambition is to meet 70% of the additional electricity demand through renewable energy sources, which is far from being obvious, because this requires a radical energy transition and large-scale means to implement it. Certain actors are calling on greater accountability from the sector, suggesting a financial contribution from the data center operators to strengthen the electricity network.

In Ireland, as elsewhere, the strong increase in the electricity demand has created destabilization. Consequently, in 2016, the Grange Castle Business Park experienced a shortage in electricity, due to massive digital consumption. Natural gas had been used, pending the strengthening of the infrastructure. The distribution and transmission system operators were mobilized to ensure solid energy planning for the years to come, with notably, the establishment of specific contractual and regulatory measures (flexible demand) with the aim of avoiding electricity over-reservation.

Ireland imposes few or no restrictions in terms of urban planning rules. Since 2018, data centers have been on the "strategic infrastructure" list, facilitating the sector's development. The aim of this measure is to reduce timeframes, legal actions and the number of planning authorities involved in the building permit approval process. The local and regional level is consequently circumvented, leaving the administrations in an uncomfortable position. Faced with this proactive hosting strategy, an increasing number of actors (region, think tanks and environmental agencies) are militating for a

In Stockholm, colocation concentrated in the conurbation and hyperscales dispersed in the region




Fanny Lopez

better pooling of energy and land resources, as well as for the development of urban heating networks supplied by data centers, like the Amazon Web Services site in Tallaght, the county town of South Dublin, about 15 km west of Dublin.

Most of Dublin's data centers were developed around the optical fiber network that circles the capital. The county of South Dublin has several zones in which the giants of the digital industry are sited, on former industrial zones or farmlands. Their spectacular development has continued, affecting energy and the environment, which sometimes creates problems. The Grange Castle Business Park is one of the largest data center clusters in Europe, with its colocation actors but also hyperscale data centers that offer Cloud services[5]. Microsoft, present since 2007, has had numerous extensions since, and Google developed in a neighboring park. An extension of the zone's perimeter is underway. In the same county, enormous Amazon Web Services warehouses (about 30,000 m2) have been built, at a stone's throw from the center of Tallaght.

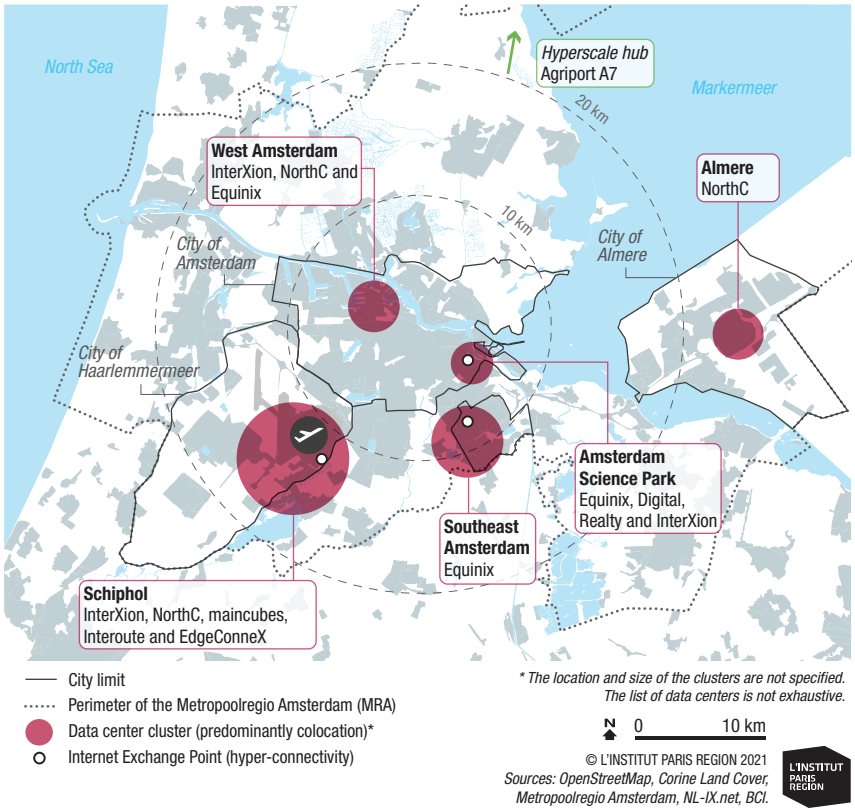
IN THE STOCKHOLM REGION, STRONG LOCAL PLANNING TO MASTER SUPPLY CHALLENGES

Another European mecca of the digital industry market, 60% of the Nordic colocation market is concentrated in Sweden's capital. This attractiveness is based on the cold climate (which lowers the amount of the bills for the electricity needed for cooling), the availability of land and the attractive price of electricity, combined with low taxes on electricity and a large quantity of electricity from renewable or "carbon-free" energy sources, the latter from nuclear power plants.

The siting of data centers in Stockholm began about 15 years ago. With 30 or so companies connected to the urban heating and cooling networks, Stockholm has become the world leader in the large-scale reuse of heat. With the exception of Facebook's hyperscale, in the northern part of the country, the majority of very large data centers were built in the Stockholm region, in a radius of about 200 km around the capital. Several rural towns host very large buildings (Google, Amazon Web Services and Microsoft). Since 2017, these hyperscale data centers have benefited from the same tax reduction as other industries that are strong electricity consumers, which has intensified the GAFAM's investments in the region.

There is a marked electricity imbalance in Sweden between the production (in the north, with hydroelectricity and wind farms) and the consumption regions (in the south, where the demographics are the highest). Stockholm is the country's largest urban conurbation and the greatest electricity consumer. Many urban projects underway require large quantities of energy (electrification of transportation, widening of the metro network, residential construction, etc.), whereas the current load on the network is already very high. In this context, the arrival of new data centers is complex. The same is true for the region's rural communes, where there is no unanimity about the installation of these infrastructures. Today, work on strengthening the network has begun, but it is a long process, and the network's capacities cannot be expanded indefinitely. The question of the limit of the data center sector's growth is being raised for this country, which has an ambitious climate plan. In order to meet the new connection demands and maintain the current balance, the network operators

In Amsterdam, colocation data center clusters linked to hyper-connectivity



have set up rate and contractual measures to lower the data centers' consumption at peak periods, but also to produce and store electricity using their backup infrastructures and batteries.

In Sweden, the national and regional planning levels are relatively limited, whereas local public authorities are strong. Urban planning is often closely linked to electricity planning, following the example of the data parks in Stockholm, which bring together municipal public companies. The strength of the local public authorities has made it possible for the region-capital to acquire exemplary control of the sector.

The Stockholm Data Parks program is an initiative that brings together the electricity operator Ellevio and the City of Stockholm and its municipal companies: the urban heating and cooling supplier Exergi, and Stokab, the public supplier of dark fiber (unused fiber installed but not yet activated, often seen as a potential capacity criterion of the telecommunication infrastructure network). As of today, the program proposes three parks of several hundred hectares. This initiative has made it possible to control the expansion of mid-sized (over 5 MW) colocation data centers by offering them attractive conditions: renewable energy at negotiated rates, connection of the building to the fiber, rapid and accompanied authorizations, free use of the city's cooling network when the data center is billed at over 10 MW... In exchange, the data centers contribute to the local energy system via heat recovery equipment that has been made available to them.

IN AMSTERDAM, RENEWED PLANNING FOR DIGITAL STORAGE

The Dutch metropolis was the first to have curbed the growth of data centers in 2019, with a moratorium prohibiting new installations for the duration of one year. The cities of Amsterdam and Haarlemmermeer, a few kilometers southwest of the capital, consequently stopped the development of this industry in order to draw up a roadmap for the next decade.

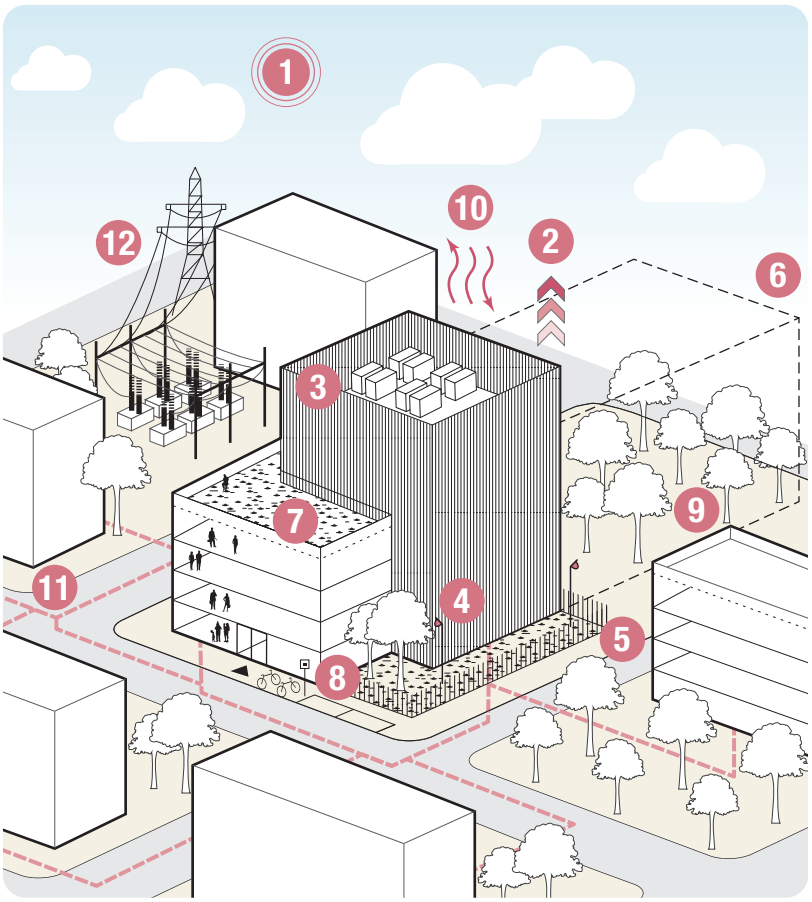
Hosting about 75% of the data centers in the Netherlands, the Amsterdam metropolis is a worldwide leader in hosting colocation infrastructures, with advantageous taxation and "hyper-connectivity."[6] The metropolis has three high-speed network Internet Exchange Points, including that of Science Park, a mixed science campus. According to a study conducted for Metropoolregio Amsterdam (MRA), Amsterdam is the largest data center hub in Europe. Heavily supported by the public actors, the national strategy recommends priority development within the Amsterdam metropolis, but also in that of Rotterdam-The Hague. The development of data centers outside Amsterdam and Haarlemmermeer is equally recommended, as well as on the western coast, where offshore wind farms could be developed.

At the end of the 2019 moratorium, the metropolis' actors are now defining their policy on data centers on several scales. For electricity, the creation of a 1 GW cluster is envisaged, to deal with the increase in energy needs in the Amsterdam metropolis by 2030[7]. Today, the MRA is solely concentrated on hosting data centers linked to hyper-connectivity and excludes the very large data centers. It also imposes requirement on energy efficiency and is reflecting on the use of waste heat[8], even if the heating network is not very developed in the Netherlands. It is Haarlemmermeer and Amsterdam that are proposing today the strictest framework for future installations of data centers, with annual electricity capacity quotas, energy efficiency requirements, land development reserved for certain sectors and an area annually capped at the scale of the

city. A great deal of research has been carried out by the City of Amsterdam, in collaboration with the electricity operators, to strengthen the network, avoid overloads and better integrate electricity infrastructures.
For the last several years, the City of Amsterdam has been committed to a better spatial insertion of data centers. Since 2013, these efforts have concerned landscape integration, architectural quality, energy efficiency and a diversity of programs (commercial, cultural, etc.), like the Equinix building, integrated into Science Park. In a city where land is becoming scarce, optimization and adaptability are of prime importance. The existing industrial zones and wastelands are also places where the greatest urban transformation is planned.

REPERCUSSIONS EVERYWHERE IN EUROPE

Resilience, climate change, carbon neutrality, limits on land cover, economic and energy transformation, evolution of mobilities, demographic changes... the European metropolises share similar challenges today. Everywhere in Europe, the data center market has comparable repercussions, even if local contexts (governance, regulations, market constraints and structure) and also energy challenges (state and territorial linking of the networks and infrastructures, available capacities, etc.) are different.
The experiences of in Amsterdam and Stockholm show the need for a vision that is not only broader and better coordinated between the various actors, but also one that is spatialized and on several scales. The definition of location criteria is a key point in a demanding development policy and one that is concerned with an economy of means connected to the proper sharing of electricity and land expenses. Depending on the size and type of data center, the installation on large unused and already urbanized plots (brownfields) is encouraged, in the same way as the integration into or proximity to an industrial zone or an infrastructure, or the proximity of an urban heating network for smaller-scale developments. The size and form of the infrastructures, landscape integration and mixed uses are at the heart of controlling the evolution of digital infrastructures, and they involve a strong public service in the same way. Despite the commitment and coordination of public actors through a spatial and energy siting strategy, the actors are structurally constrained by the limits of energy production and distribution, the timescale and timeframes for the strengthening of the networks, as well as by regulations.



Key points

The spatial integration of data centers

1. Adapting the building to the existing fabric and environment (height, shape, materiality, landscape, etc.)
2. Favoring multi-storey constructions and/or the transformation of existing buildings
3. Incorporating emerging technologies
4. Incorporating surveillance systems (cameras, etc.)
5. Incorporating boundaries (gates, ditches, etc.)
6. Defining upstream the possible extension limits
7. Favoring a mixed program (restaurants, offices, coworking, etc.)
8. Adapting the program to accessibility (parking for bicycles/cars, public transportation, etc.)
9. Limiting soil sealing to the maximum
10. Incorporating efficient and ecological cooling systems
11. Favoring energy pooling (waste heat recovery, electricity storage, etc.)
12. Taking the necessary strengthening of electricity infrastructure into account (substation)

Source: L'Institut Paris Region, 2021

Everywhere in Europe, the need is emerging on the necessity of national planning to deal with an ever-expanding digital infrastructure and whose capital resources are inversely proportional to energy and land resources, every more limited by the environmental crisis. ■

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1. According to the Knight Frank report on data centers.
2. www.dcbyte.com/knight-frank-data-centres-report/Q2-2020.
3. Google, Amazon, Facebook, Apple, Microsoft.
4. Colocation data centers host the data of several companies.
5. Services like the availability of storage space or computing power, in which software is executed in a remote data center.
6. Very high-performance connectivity.
7. Final report "MRA strategie" for data centers. www.metropoolregioamsterdam.nl/adviesrapport-over-datacenters-bouwsteen-voor-mra-strategie (in Dutch).
8. Waste heat is the heat generated by a process that does not constitute its primary goal. This heat can sometimes be recovered and recycled.

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