DATA CENTER
IN
URBAN CONTEXT

XINGYU HE

Data Centers 2020

David Chernicoff, November 12, 2015

Ask the data center industry, and the future is simple: ever-bigger and more power-hungry facilities that centralize more and more business processes by providing Everything-as-a-Service to a business community that continues to look for the slightest competitive advantage that can be gained from service-provided technologies. But the reality may not be quite so clear. External factors, driven by technological and societal pressures, will reshape the future of the data center in ways the industry may not be expecting. There is little question that the greening of the data center is an issue that, while seemingly driven by societal pressures, is seen as one that impacts the corporate bottom line. Regardless of the type of data center involved, being able to deliver IT workloads more cost effectively is a goal of IT, and improved energy efficiency while reducing environmental impact meets both business needs and those of society. What is most interesting, however, is that more energy efficient technologies are not being used to reduce the power requirements of existing data centers, but, in most cases, being used to increase data center densities, allowing more work to be done for that same amount of power.

Power politics

Data Centers require a never-ending, unimaginably large flow of electricity. To put it in perspective: if the Data Centers in the "Cloud" made up a country, that country would be among the top 5 energy users in the world. By 2020, this consumption is expected to multiply fifty times over. Completely external issues to the data center are going to have a significant impact on power. Driven by a political agenda in the US, the cost of power is likely to increase sharply as existing power resources are put in a vise. Coal-fired power plants will need to be replaced with more environmentally friendly sources of energy. Unfortunately, the technology to replace coal as an energy source either does not exist, or is not exploited, so data centers will have to optimize their operational efficiency as much as possible. The cost of power will necessarily increase, meaning the cost of delivering services will increase. And this increased cost will apply to all kinds of data centers, no matter what form they take in future. Given that data centers will always require power, their owners are making efforts to plan for the increase in power costs by future-proofing their power supplies. This can only realistically be achieved by signing contracts that guarantee power costs from 10 to 25 years, but not everyone can get this kind of power contract. They are only available to a very limited subset of data center operators, generally on the scale of Facebook, Amazon, Google, Microsoft and Apple.Politics may also have a say in the location and operation of data centers. After the level of access to customer data by the security services was revealed, organizations are increasingly wanting to keep data located in their home state, and the European Union has invalidated the Safe Harbor agreement, under which US cloud providers were trusted to comply with European privacy rules.

Data repatriation

In the short term, data will be "repatriated" to where it seems to be safer, but in the longer term, some arrangement will replace the Safe Harbor arrangement, and this will affect any new facilities that are deployed. Privacy polices could become a confusing morass, driven by court decisions and political needs, and this may even slow the growth of the Internet of Things (IoT). With the trend towards moving data storage to the cloud for every type of device, the information that can be gleaned from that data on individuals, their behaviors and their lives is immense. The privacy requirements for maintaining that data will affect where data can reside and how it will be handled. Privacy polices could become a confusing morass, driven by court decisions and political needs, and this may even slow the growth of the Internet of Things (IoT) and its supporting infrastructure.It is entirely possible that the future of data centers is one where there are only large-scale operations, with just about everyone else moving from their own data centers to either services on demand or colocation providers. Most businesses should focus on their core business, and generally this is not providing data center services.

Online movie provider Netflix is seen as a proof of concept for the future picture of how data centers will be used: it moved its entire IT operation into the cloud on Amazon's AWS service. However, while the core of Netflix's streaming services, along with its entire operational IT load, has been moved to AWS, it is important to note that Netflix elected to continue to deploy its own content delivery network (CDN), putting its own equipment in "edge" data centers for the final delivery of its service to customers. The Netflix Open Connect CDN uses appliances that maximize the streaming experience of Netflix users by caching content at locations closer to the end consumer of the service. Netflix has partnered with hundreds of ISPs across its service area to place these appliances at their location and offers an open peering policy with its interconnection locations. This moves the cached content closer to the end consumer and allows the ISP to have better control over bandwidth consumed by the streaming service. The key here is that Netflix maintains overall control over content delivery, with greater control over the cost and performance of that delivery, that Netflix hardware is being deployed into the ISP's data centers, and that the AWS cloud is not the only point where end-user requests are being served. Without the existence of these smaller ISPs to host its appliance, Netflix would have to take a different approach to its CDN.

Look to the edge

The point here is that the future of data centers isn't tied up in large, centralized facilities. The nature of net-based services is that they need to be relatively close to the consumers of those services. Whether you are considering IoT, streaming content, or any type of network-delivered services, you must be aware of latency, connectivity and network bandwidth availability. By moving these capabilities to the edge, you address the plethora of issues that these technologies bring up. But you also have to reimagine what you think of as a data center. Looking forward, very dense, small-scale facilities, which bring data and services down to a local level, could address many of the potential political, technological and societal issues that the data center faces. Personally, I believe that edge data centers will be the single biggest growth area in the next five years. The edge data center doesn't take a single form, but is designed to suit the needs of those consuming its services. It might be what we think of as a normal data center, just in smaller form when compared with the core data centers that ultimately host the services. It could be a containerized data center, moving a full set of data center services in a form that is easy to transport and expands the footprint of a data center provider to an underserved area. Or it might look nothing like what we think of as a data center.

Self contained box

It could be a self-contained box installed at a local PoP or access point that acts as a cache point for services, allowing small numbers of local users to get high-speed services without relying on a long backhaul that can be expensive to use with high levels of bandwidth. New vendors are appearing with their own takes on what an edge data center should be, with a significant focus not only on smaller versions of the traditional data center model, but also innovative takes on smaller installations that can be deployed in non-specialized environments to deliver the necessary services. Some are proposing that this go even further, with combined heat-and-compute servers, from players such as Germany's Cloud&Heat, which can be placed in the basement of multi-tenant buildings, where their waste heat can warm the building. Distributing cloud servers to provide heat in living rooms has also been proposed by Qarnot in France, Nerdalize in the Netherlands, and Exergy in the US. The bottom line is that while large cloud facilities get bigger and more commoditized, so-called edge computing will be scaled to meet the needs of users and may change how we see the data center.

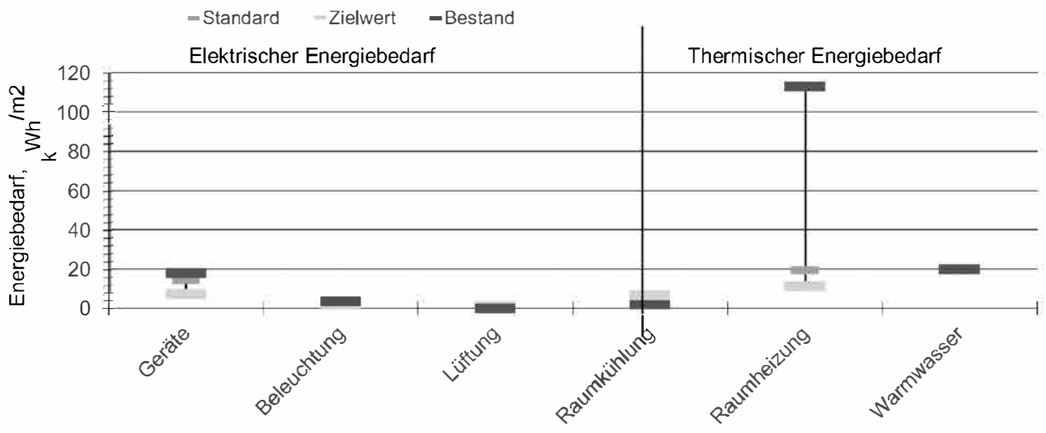
Waste Heat

Urban Info-Infrastracture

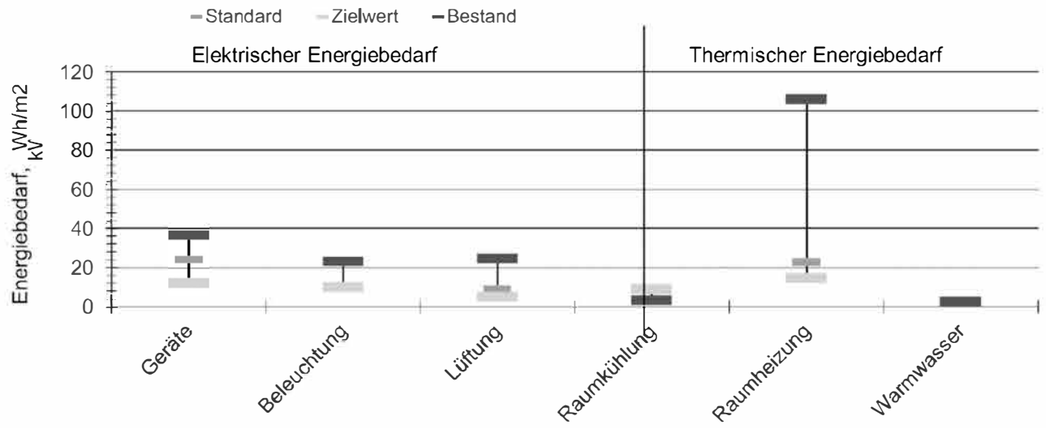
Google’s data centers in Dalles, Oregon, generate huge amounts of waste heat. GOOGLE

Site : Familiengarten in Bullingerstrasse

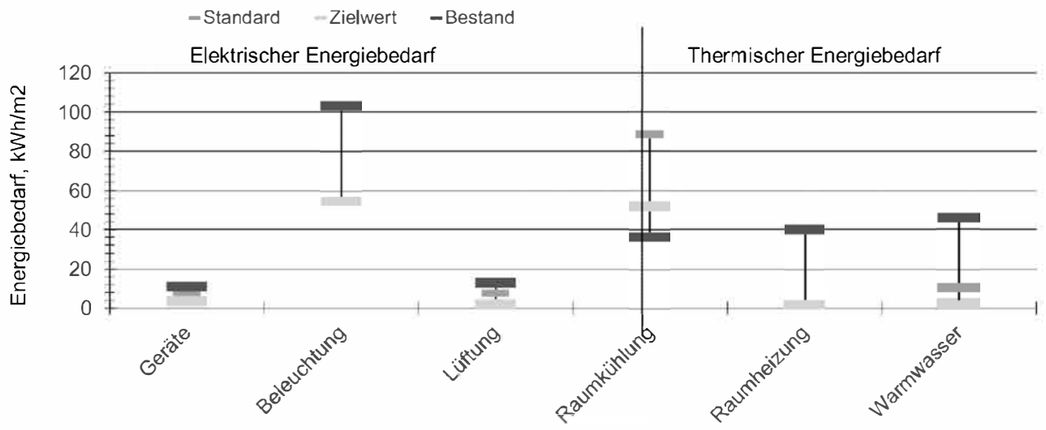
Source: SIA 2024

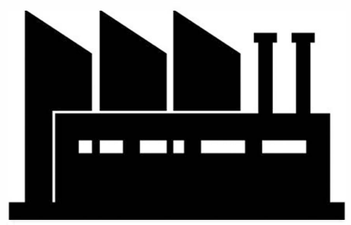


MFH



Public Function

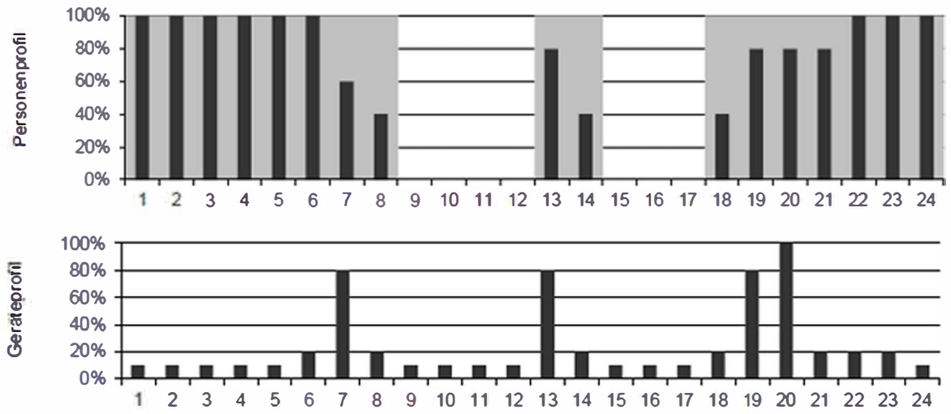




Factory

Annual Heating and Hot Water Demand of Different Function

Source: SIA 2024



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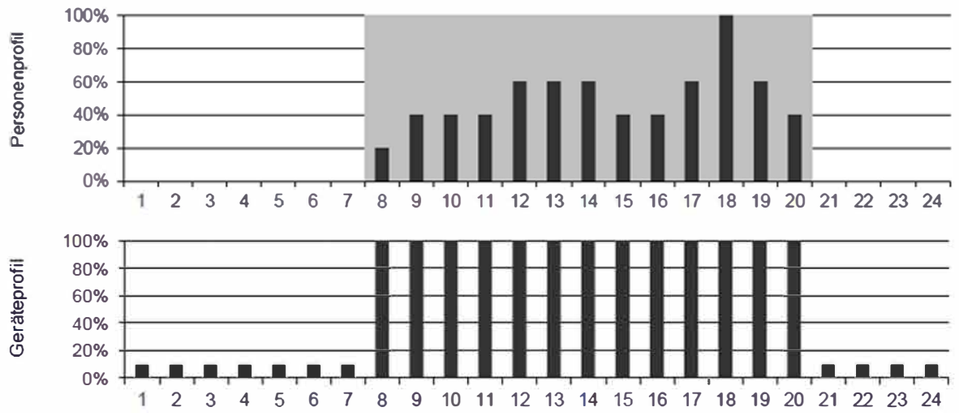

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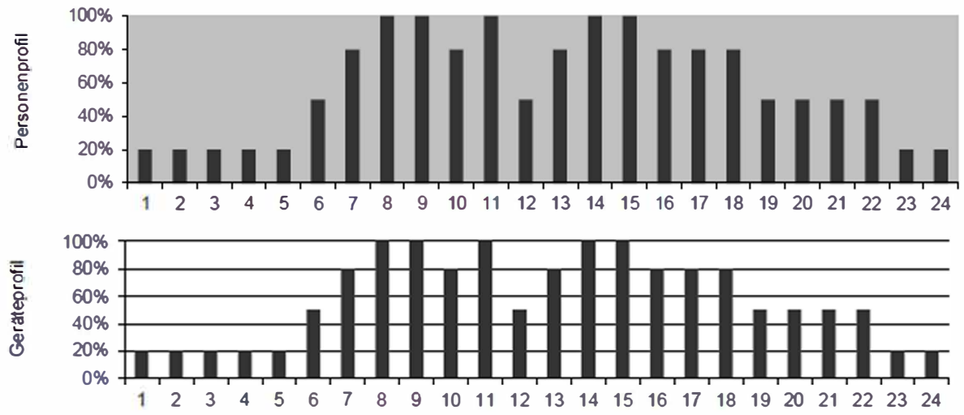
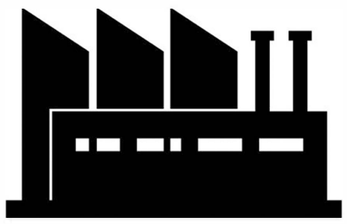
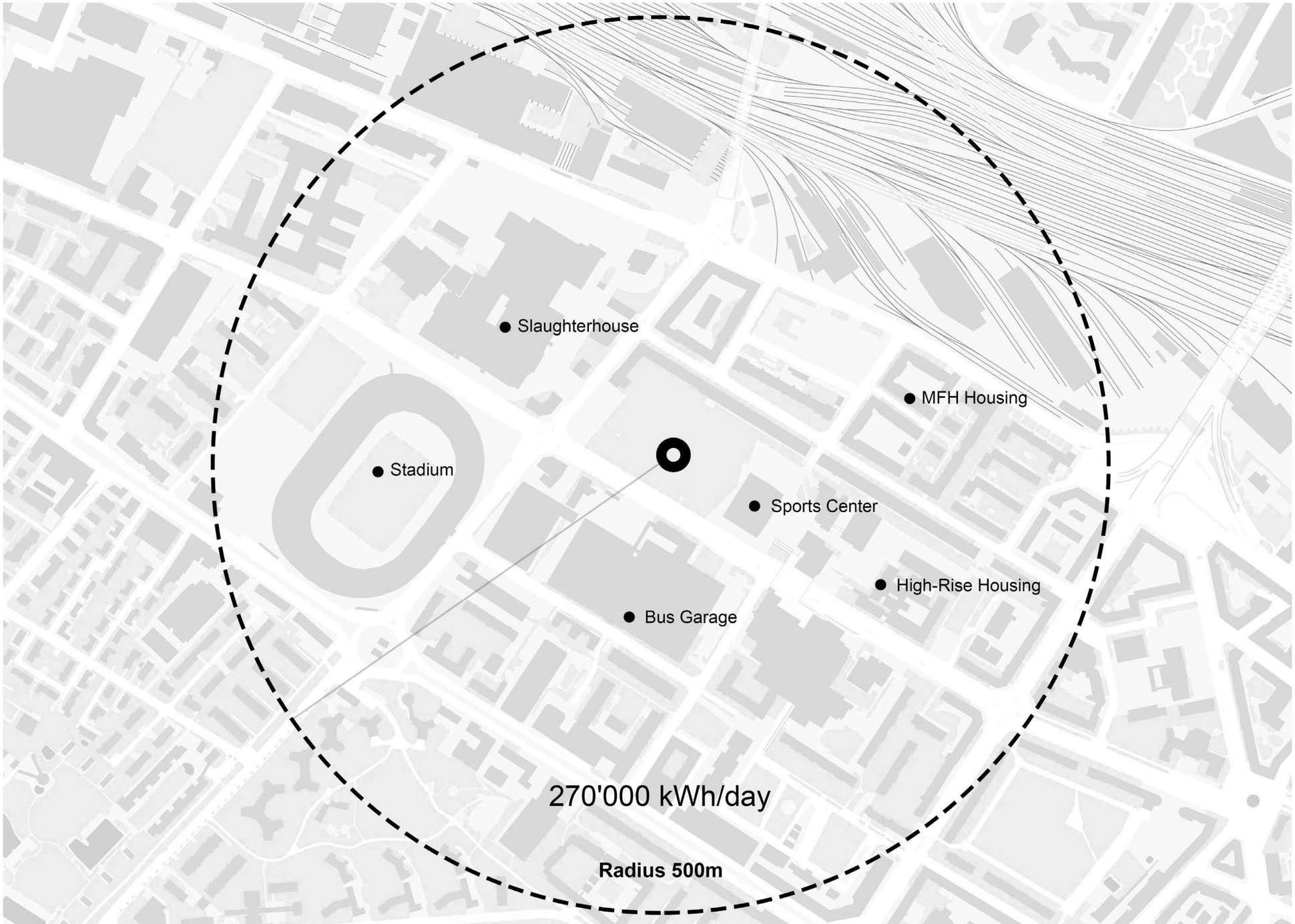




Factory

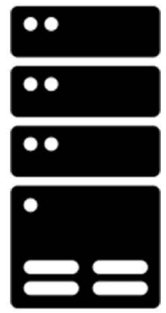
Diurnal Energy Load Profile



5000 MFHs

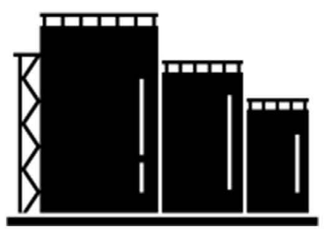
Heating Demand 120kwh/m2a

Hot Water Demand 20kwh/m2a



5000 m2 Rack Area

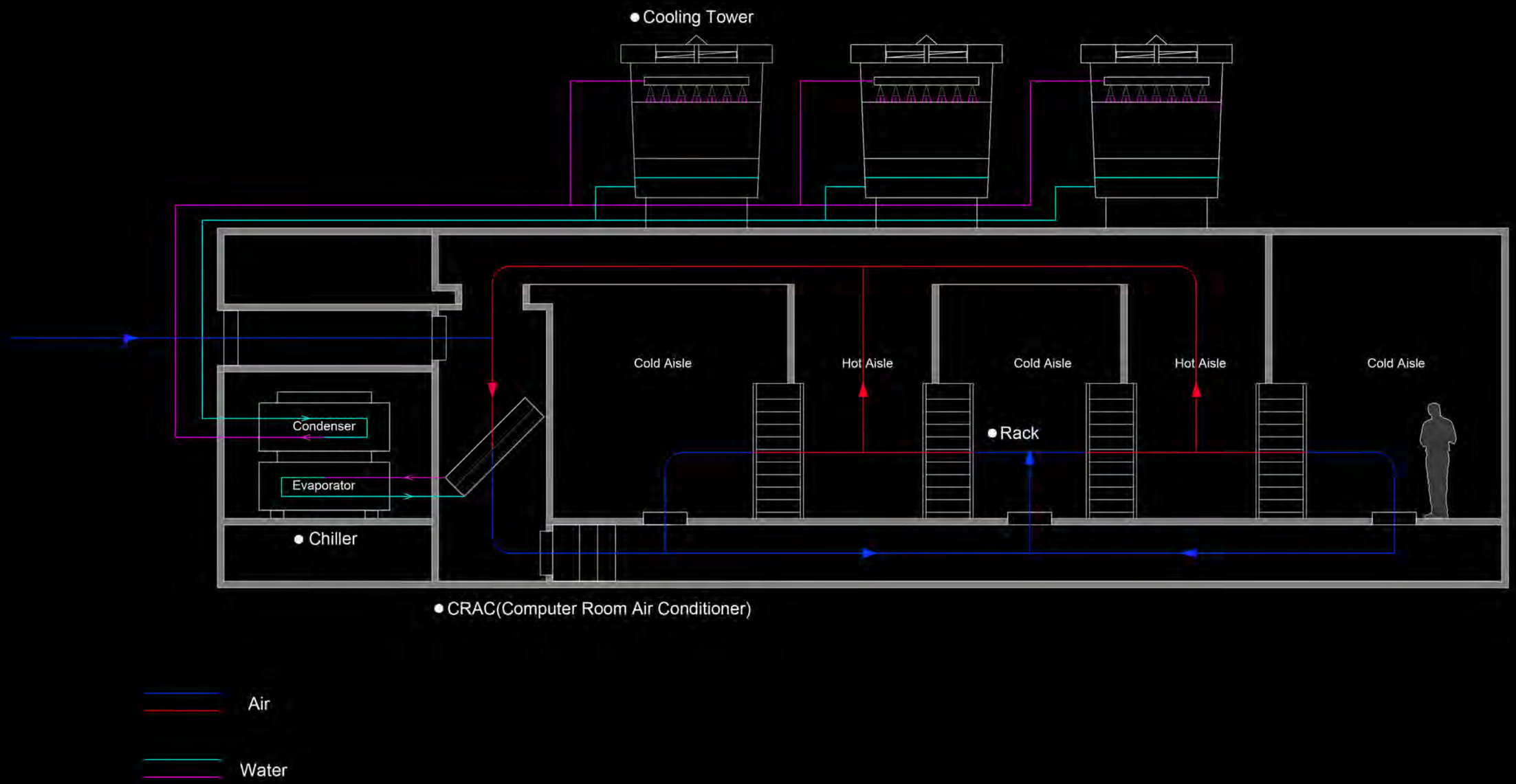
Power 15kw/m2



10 Thermal Tanks

R 4.5m H 40m,, 80kwh/m3, 5 days

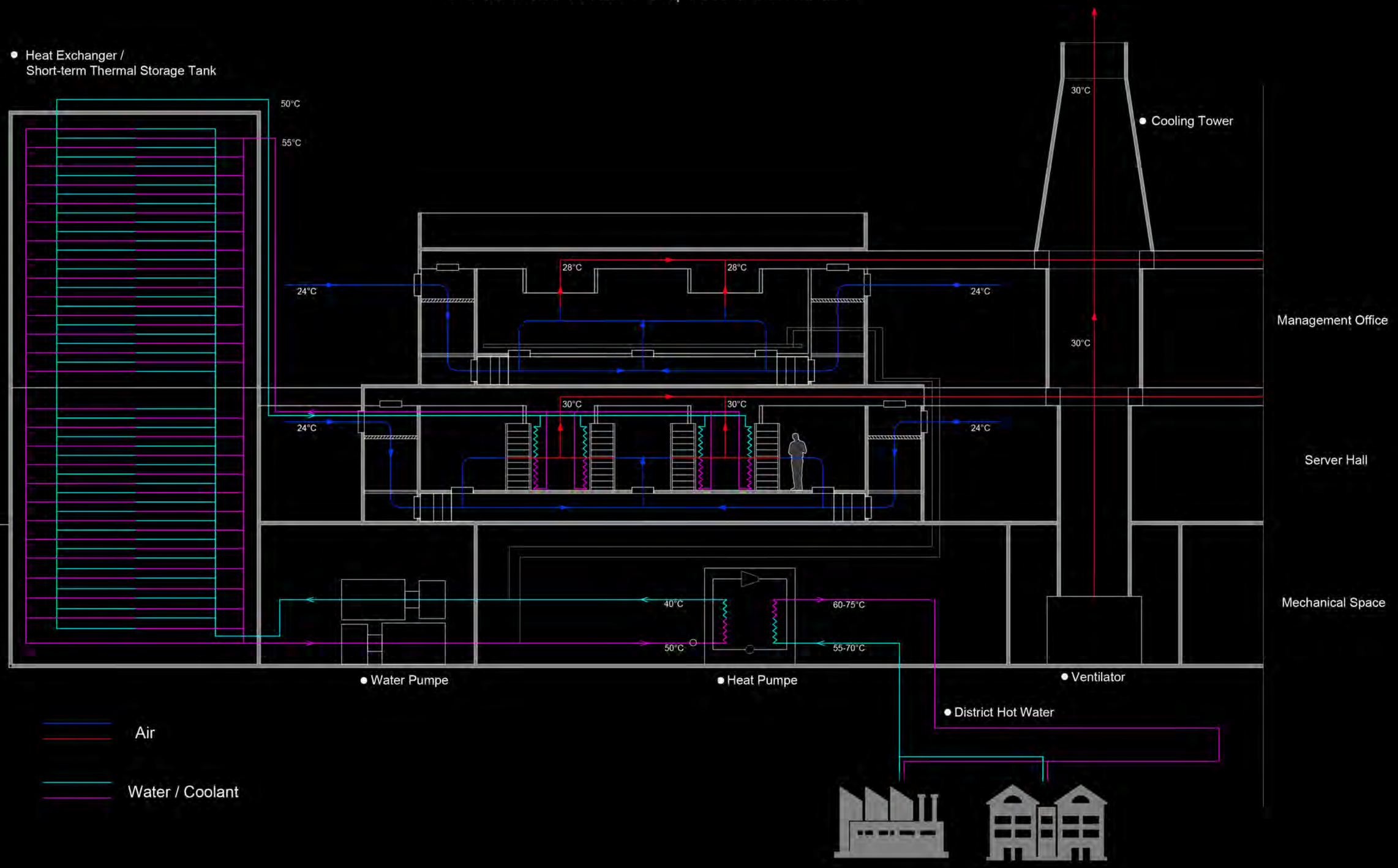
District Heating/Hot Water Scheme & Dimensioning



Conventional CRAC Cooling Scheme with Chiller

Summer

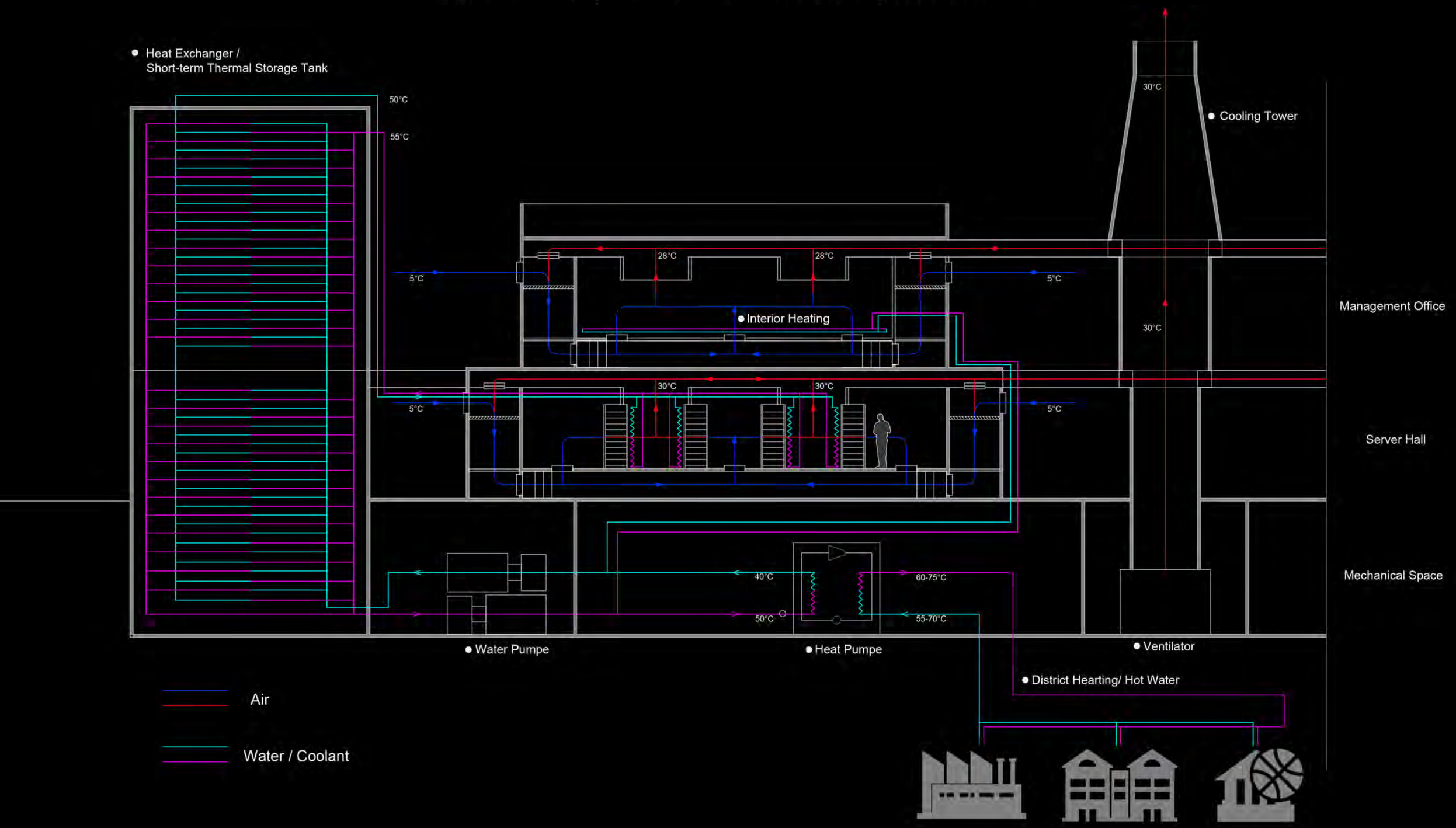
District Hot Water + Improved Ventilation



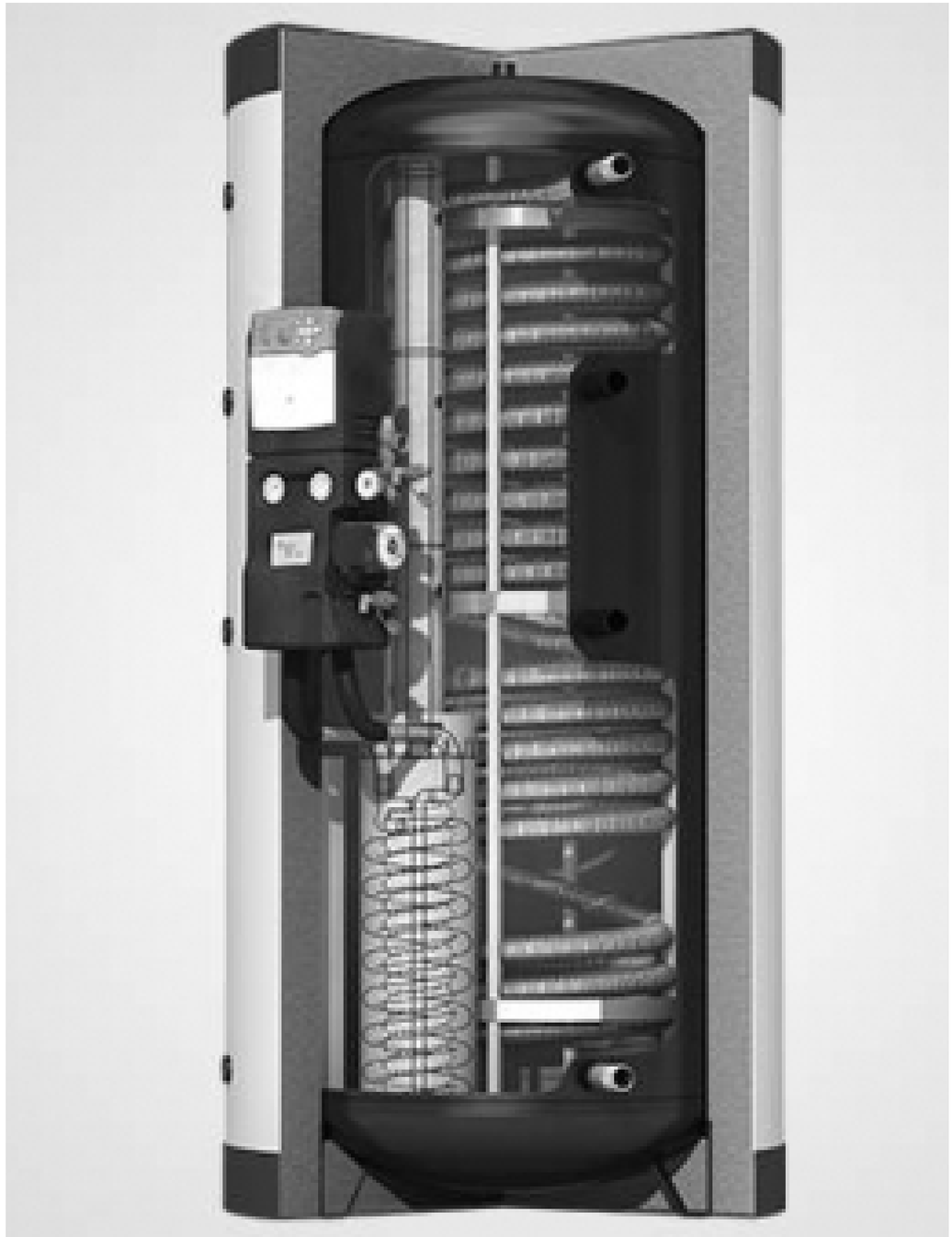
Proposal Hybrid Cooling Scheme

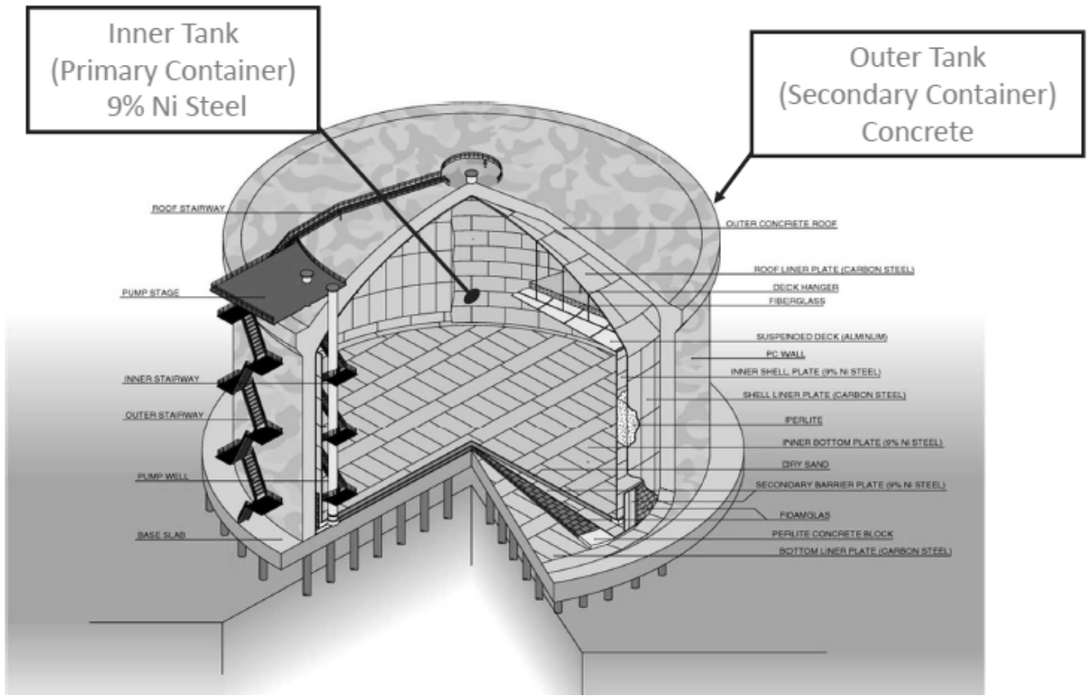
Winter

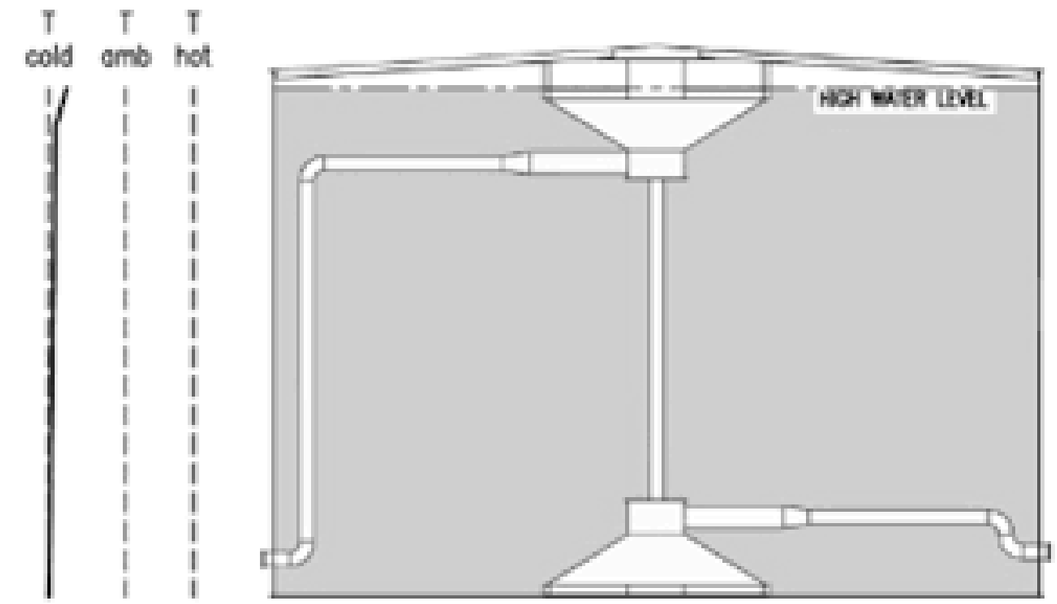
District Heating/ Hot Water + Interior Heating+ Return Air



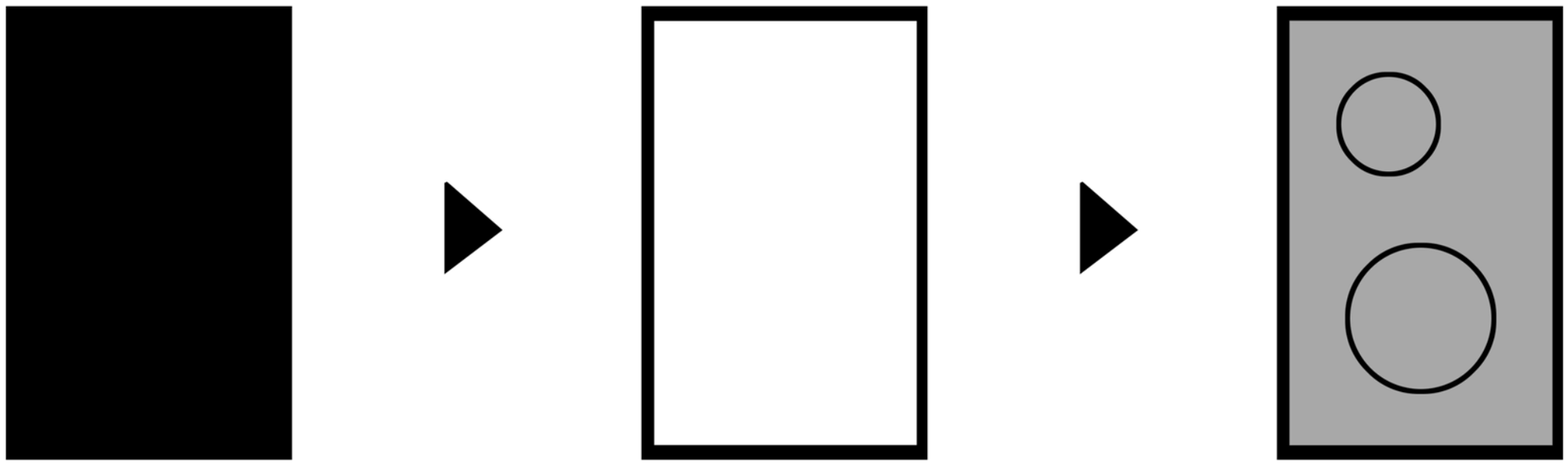
Proposal Hybrid Cooling Scheme



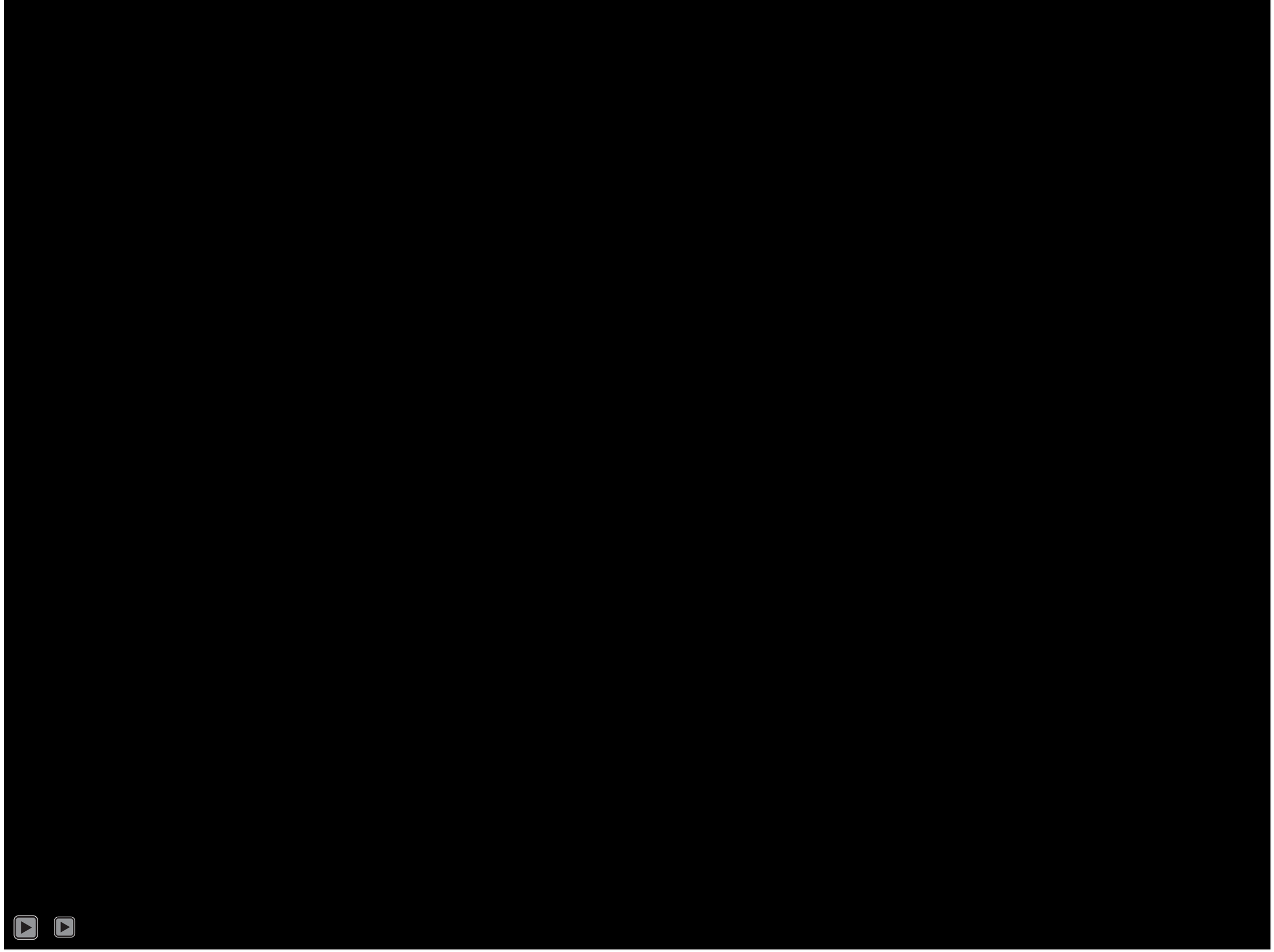




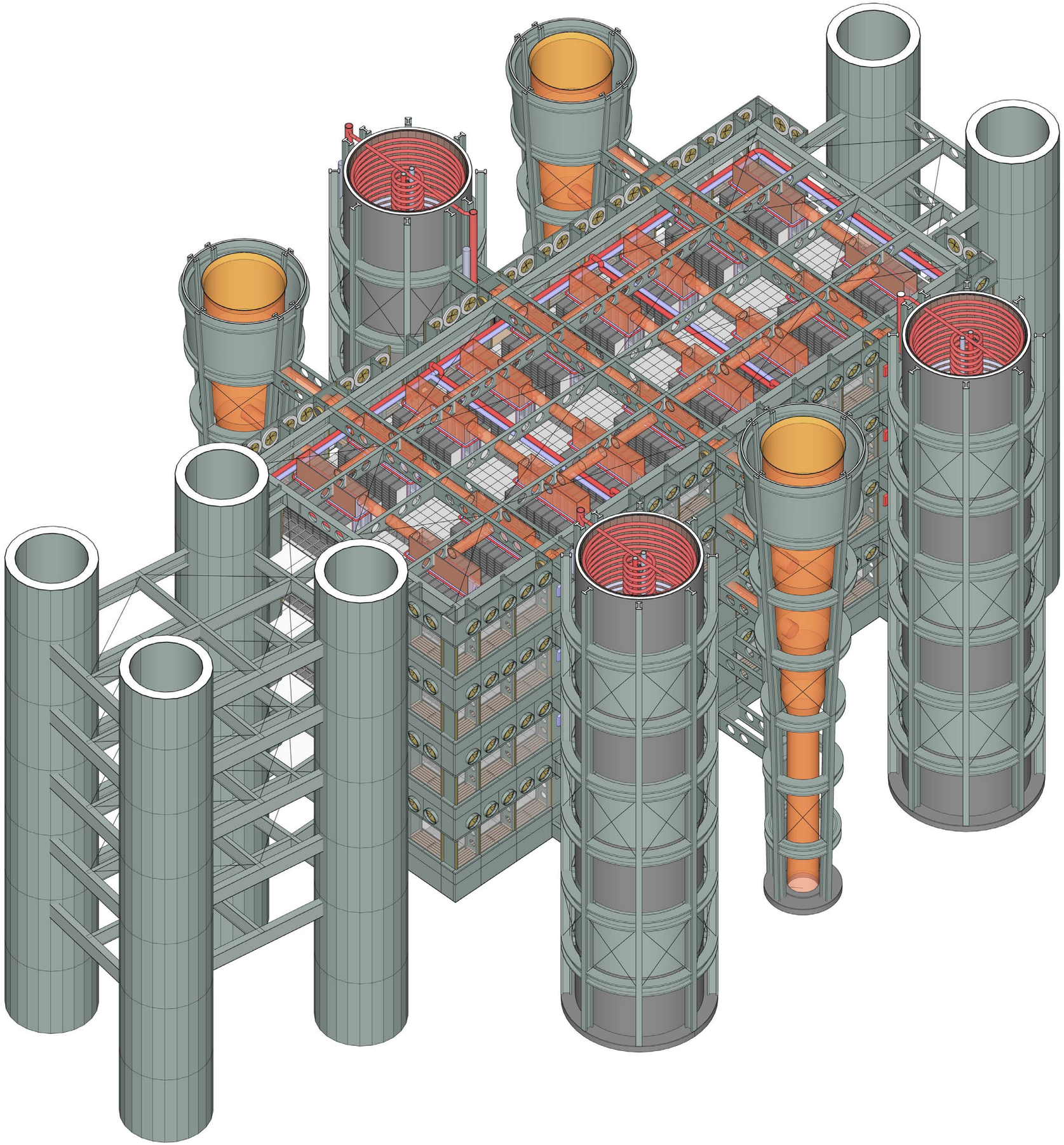
Heating System Concept



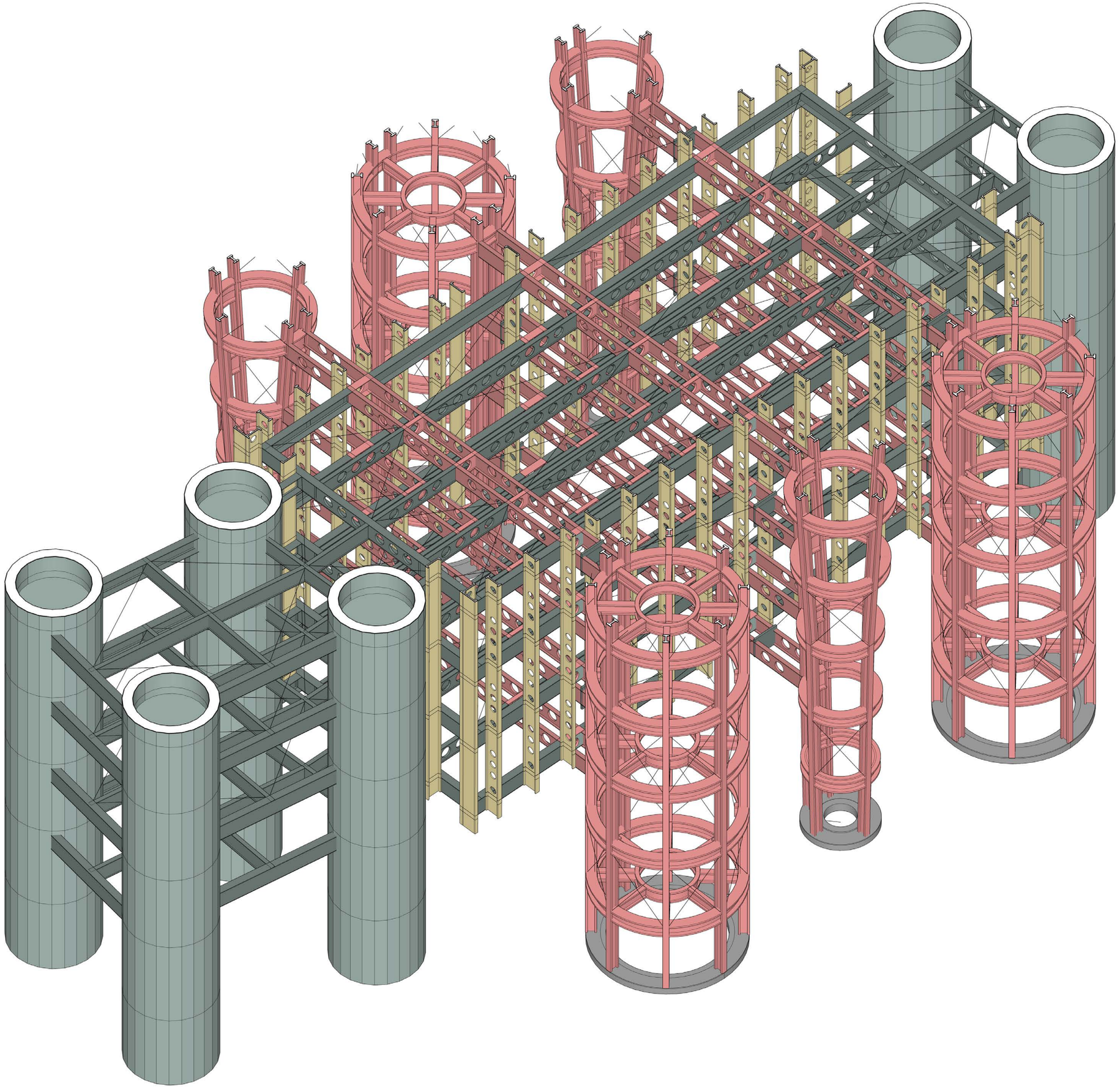
Structure System Concept



Cooling System Video



Overview



Structure System

Adjustable Air Inlet Unit

Static Louvers

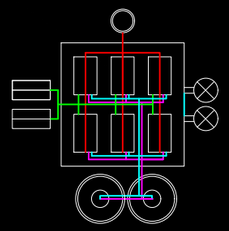
Filter

Fans

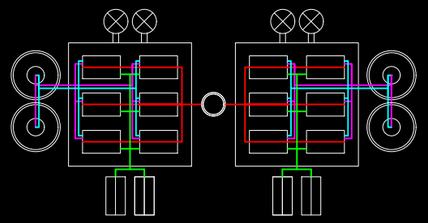
Floor Consrtuction

1st Floor

Raised Floor	900mm
Concrete	150mm
Corrugated Floor Decking Panel	150mm
Thermal Insulation	150mm
Reflective Steel Panel Ceiling	900mm



1-a



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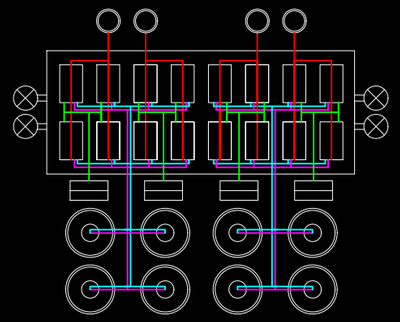

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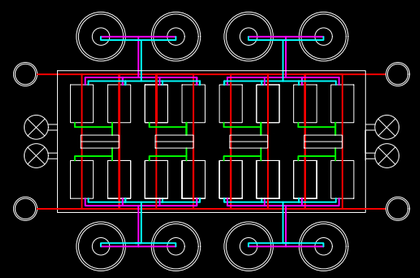

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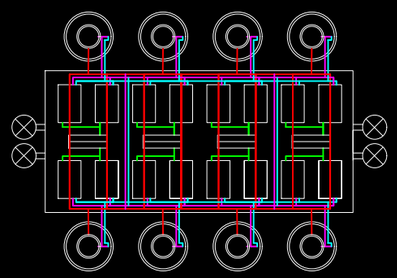

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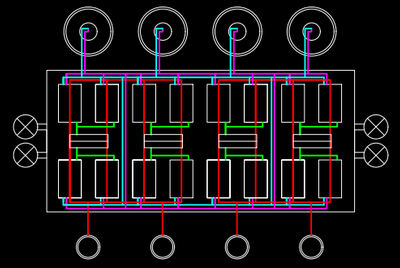

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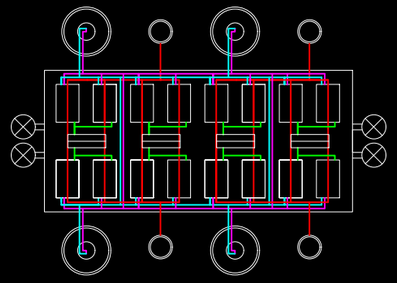

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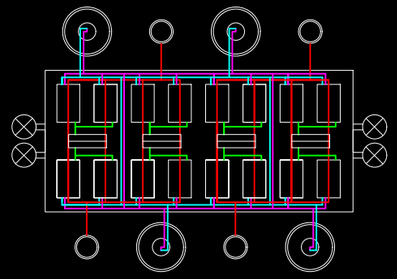

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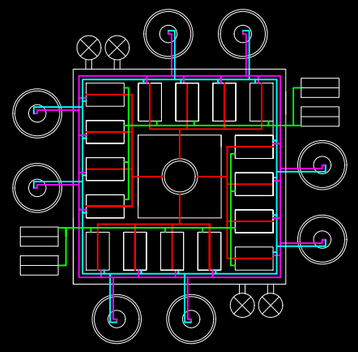

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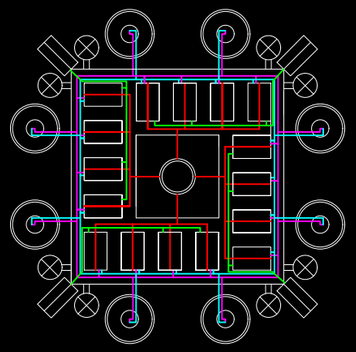

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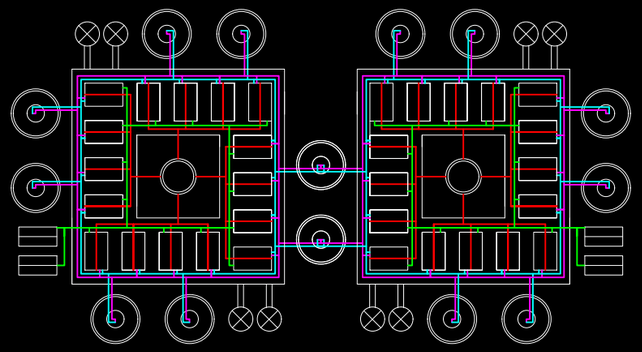

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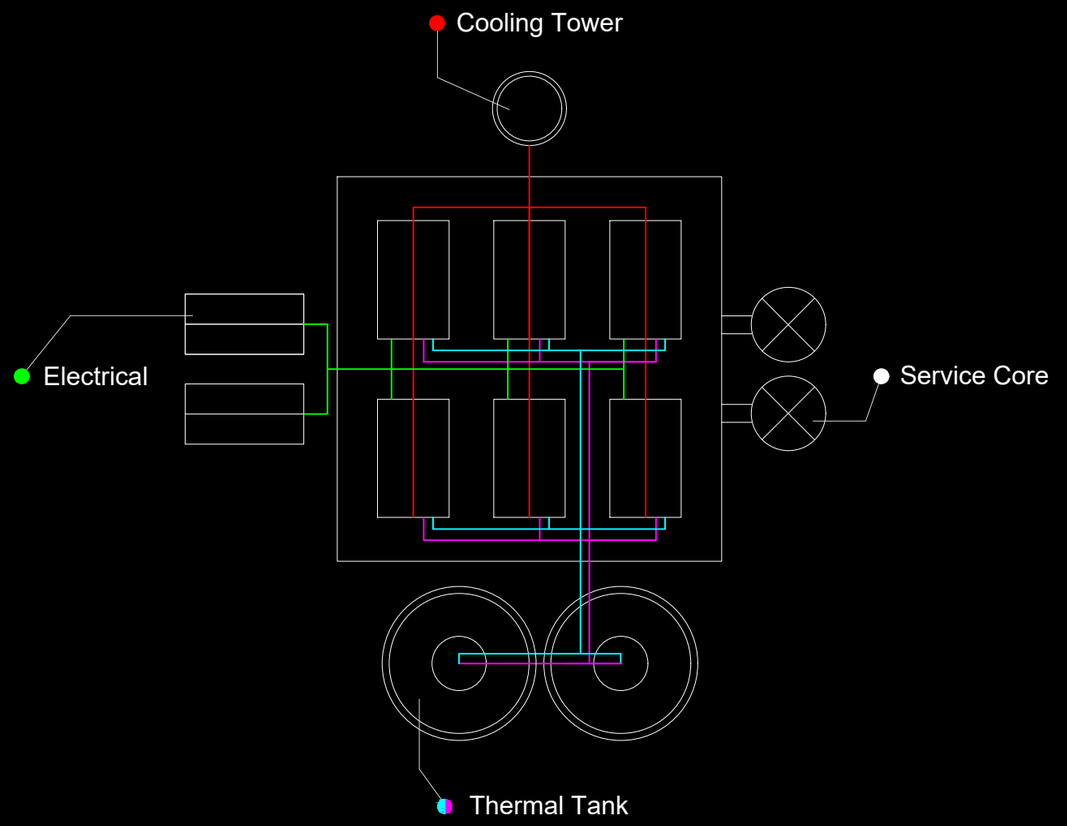

Possible Scheme


Herdernstrasse
RESTAURANT
Schlachthof
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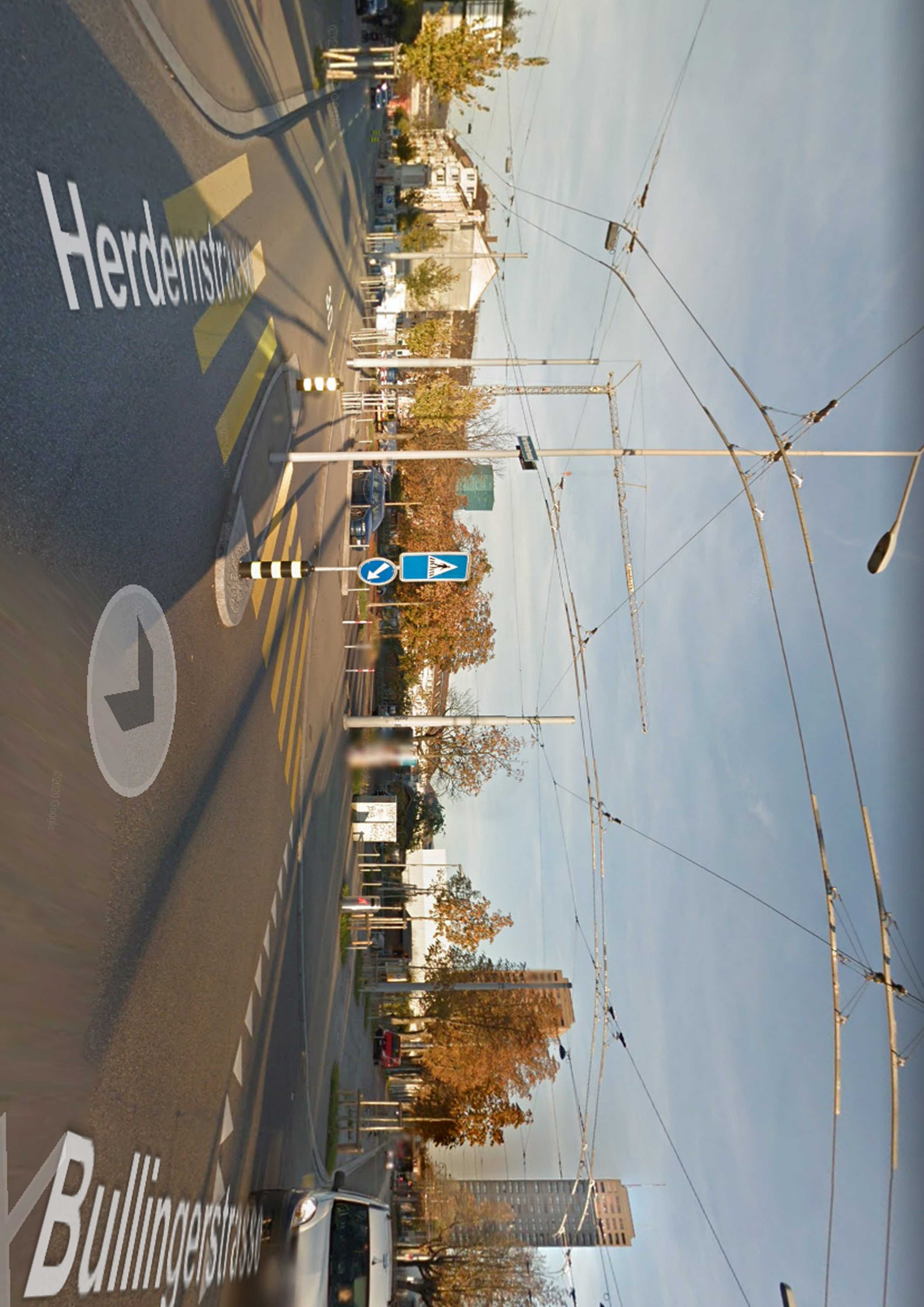
Herdernstrasse
Bullingerstrasse


GRATIS
ANGEBOT
PUPPE
20
20
Büningerstrasse
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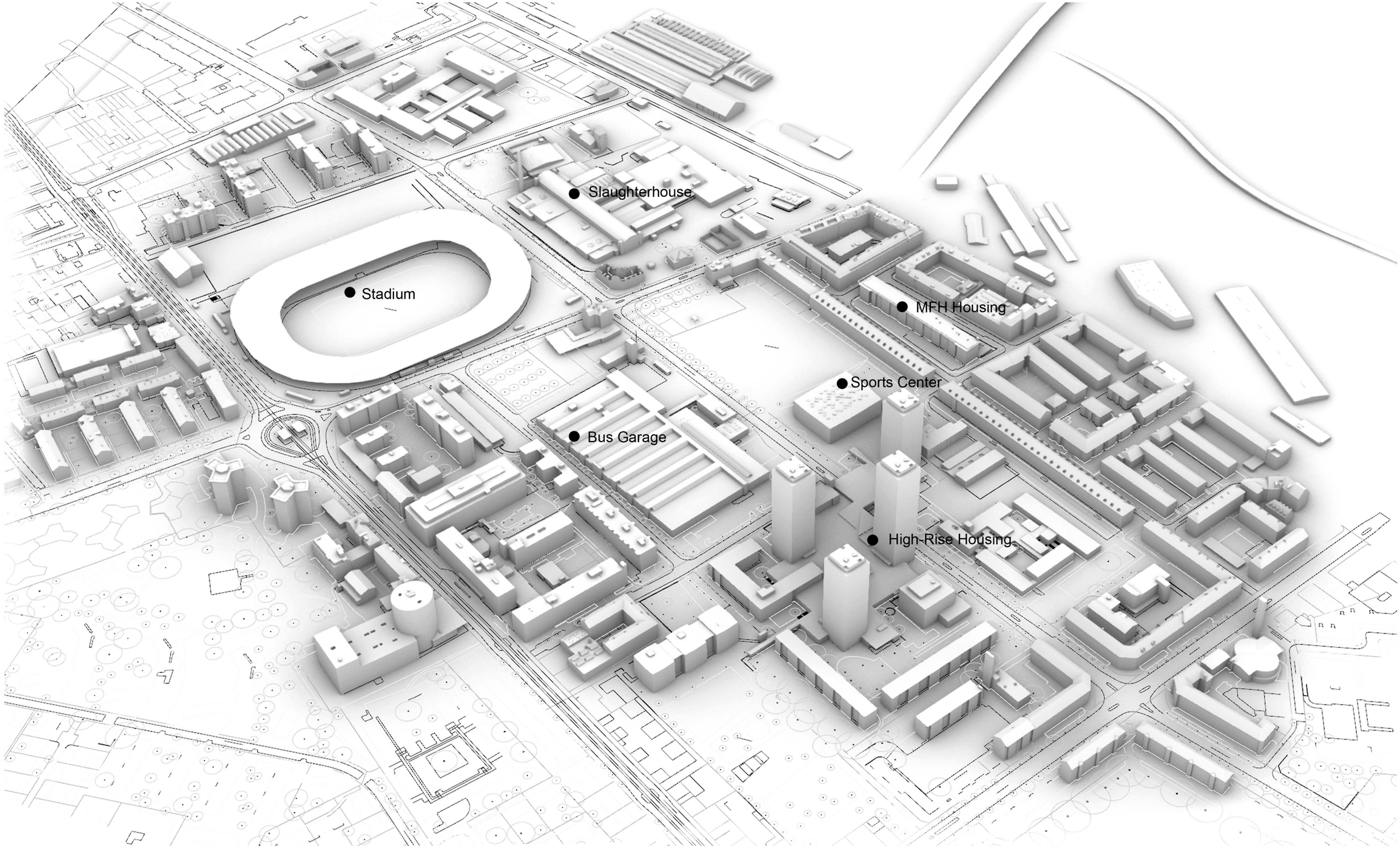

Slaughterhouse
Stadium
MFH Housing
Sports Center
Bus Garage
High-Rise Housing

Zimmerlistrasse

Eglistrasse

Eichbühlstrasse

Herdernstrasse

Hardauweg

Bullingerstrasse

Norastrasse

Herdernstrasse

N

Situation Plan

0 5 10 20 50 m

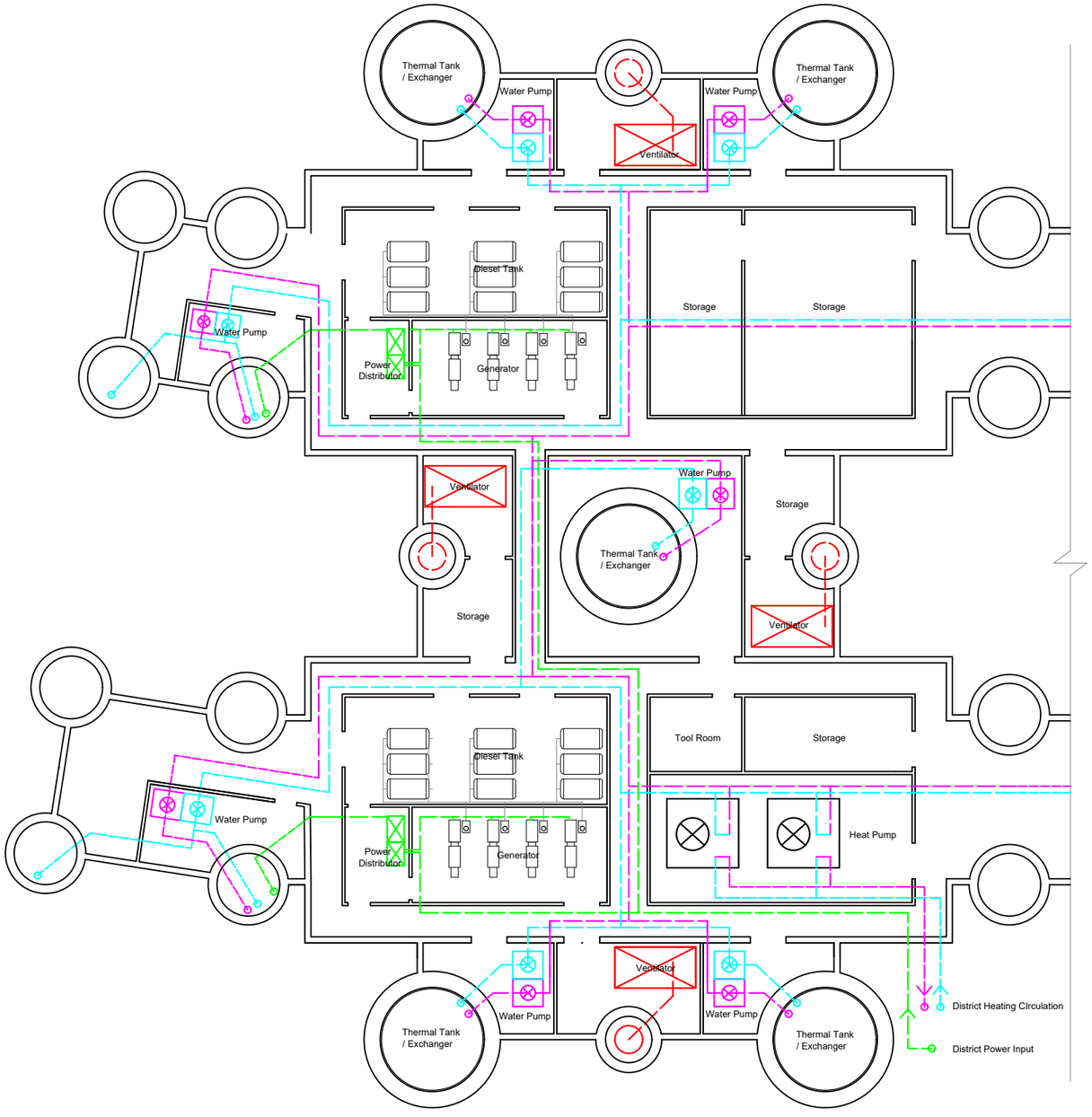
Main Entracne

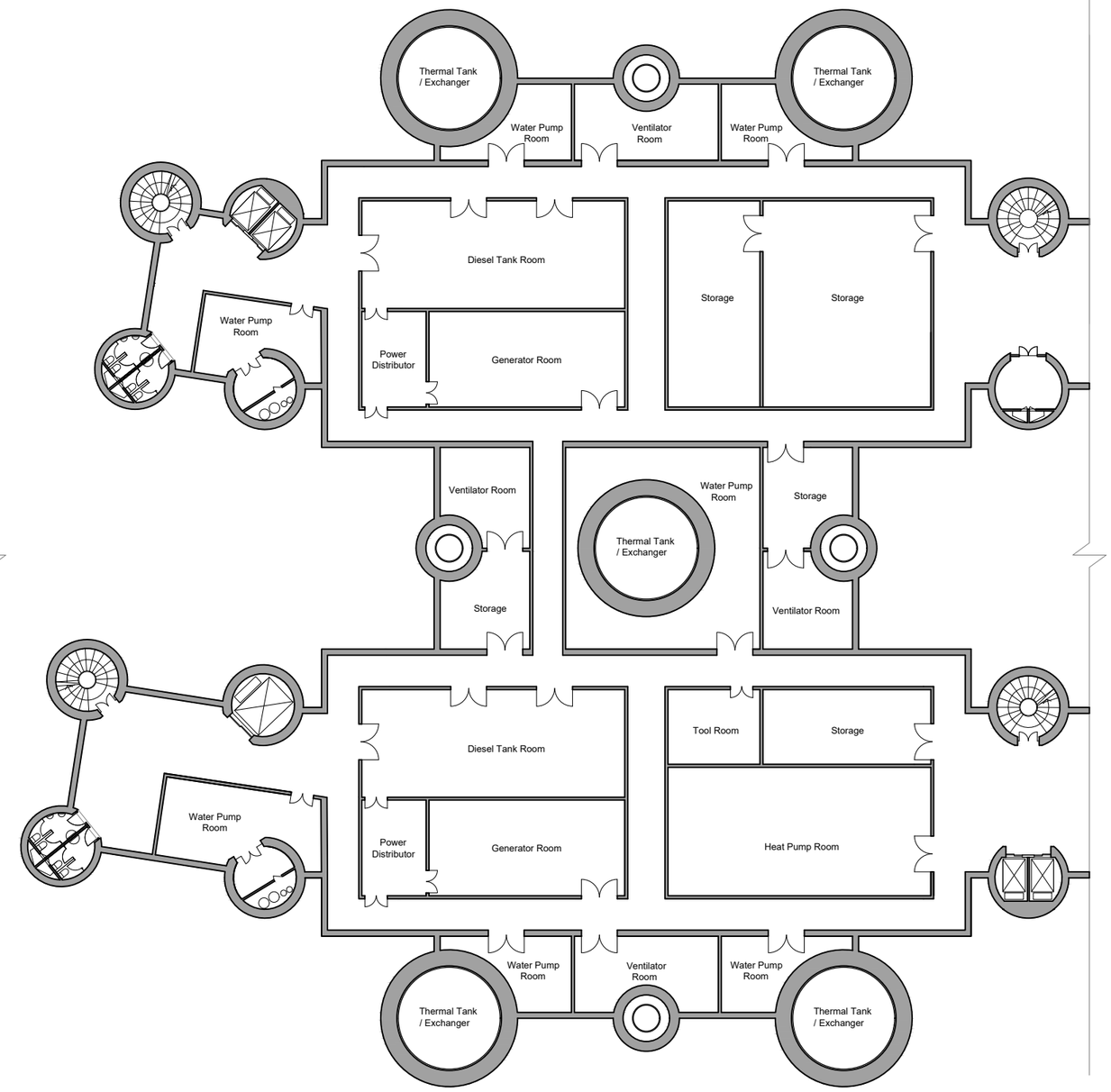
Logistic Entracne

Ground Floor Plan

N

0 2 5 10 25m





	Pipe/Cable	Vertical Ciculation	Circualtion Power /Distributor
Hot Water			
Cold Water			
Electricity			
Air			

Technical System Scheme

Underground Floor Plan

N

0 1 5 10 m

A

Thermal Tank / Exchanger

B

Rack

Battery

Rack

Storage

B

Cooling Tower

A

N

2nd Floor Plan

0 1 5 10 m

A

Thermal Tank / Exchanger

B

B

Repair Room

Storage

Management Office

Meeting Room

Meeting Room

Building Operation Room

Storage

Storage

LAN Room

Rest Room

Storage

LAN Room

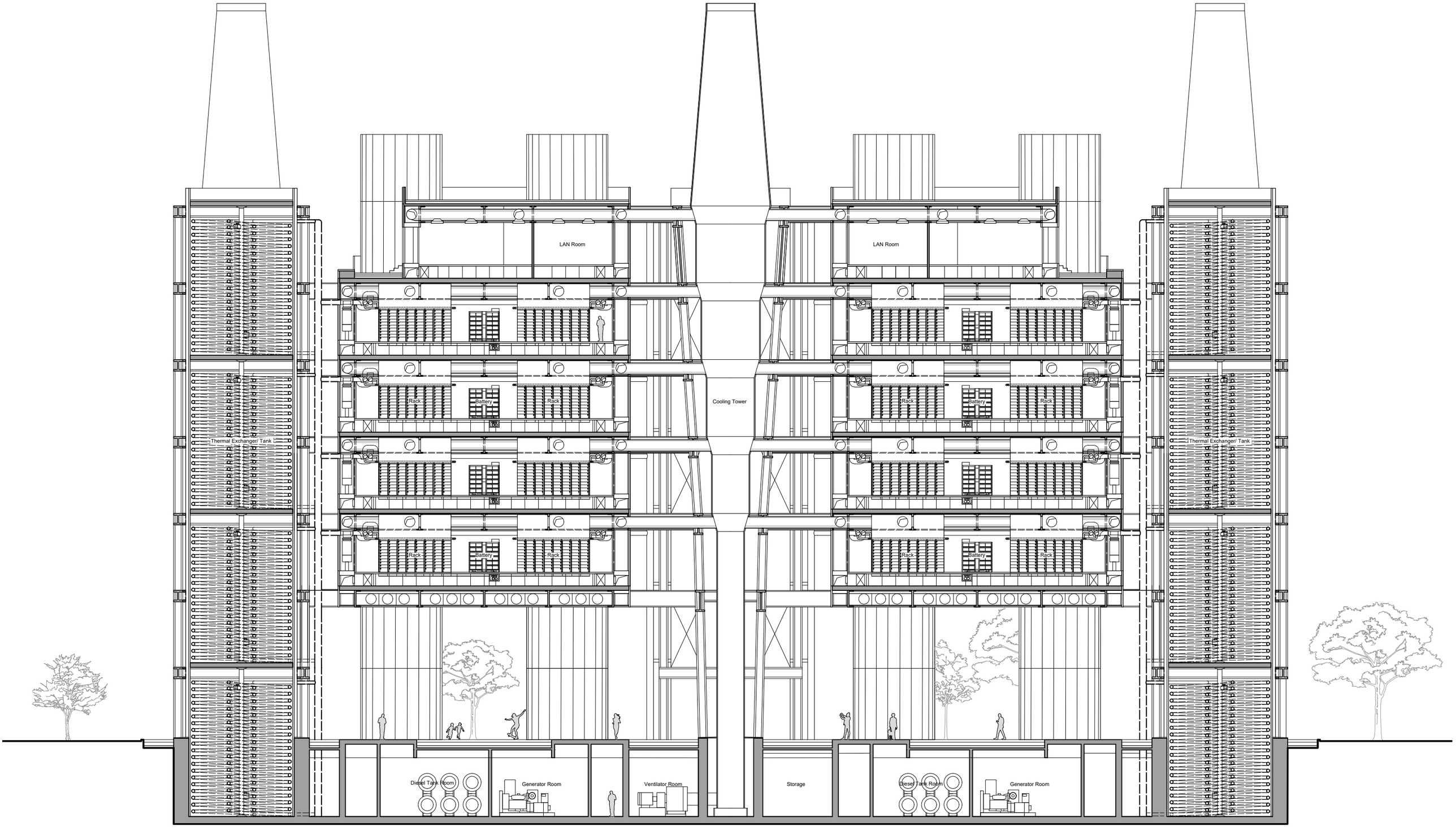
Cooling Tower

A

N

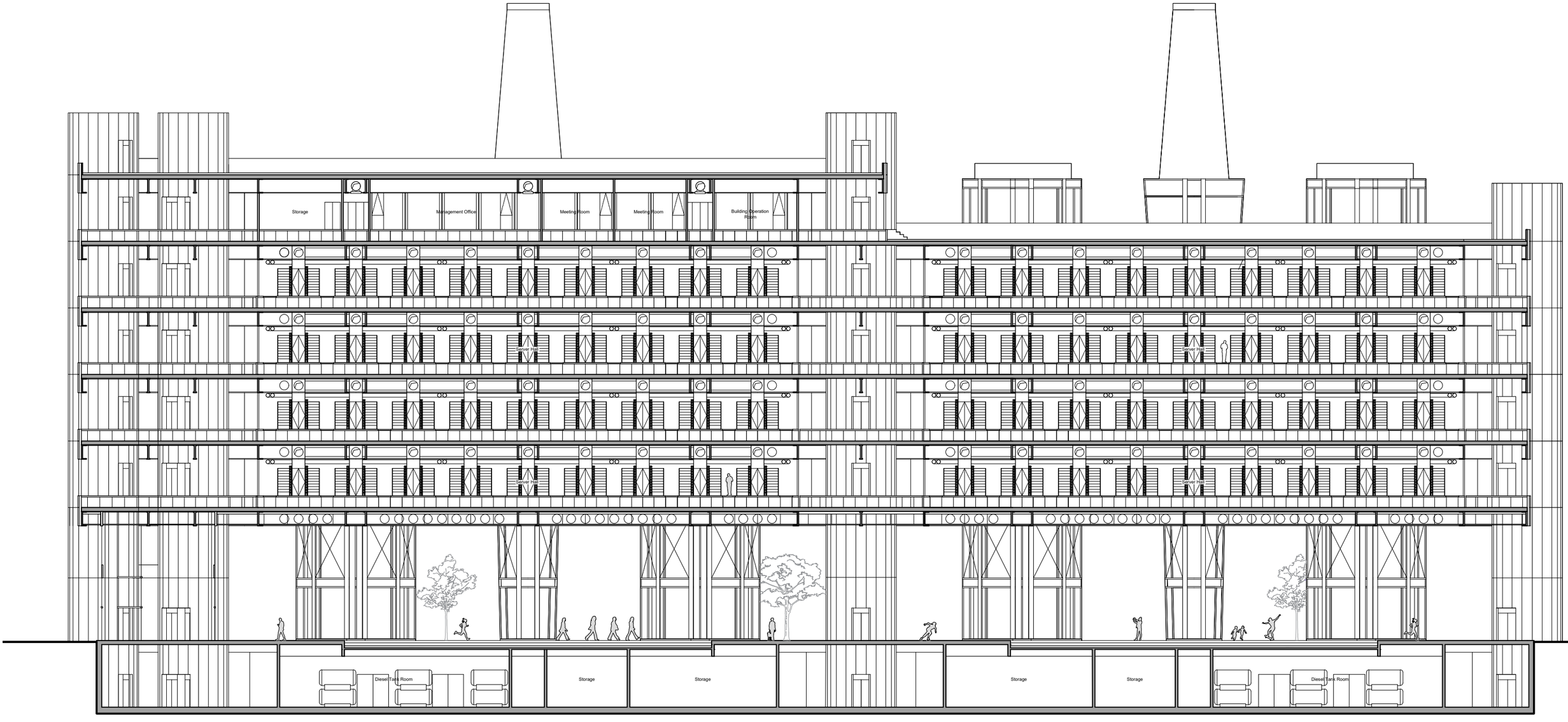
4th Floor Plan

0 1 5 10 m



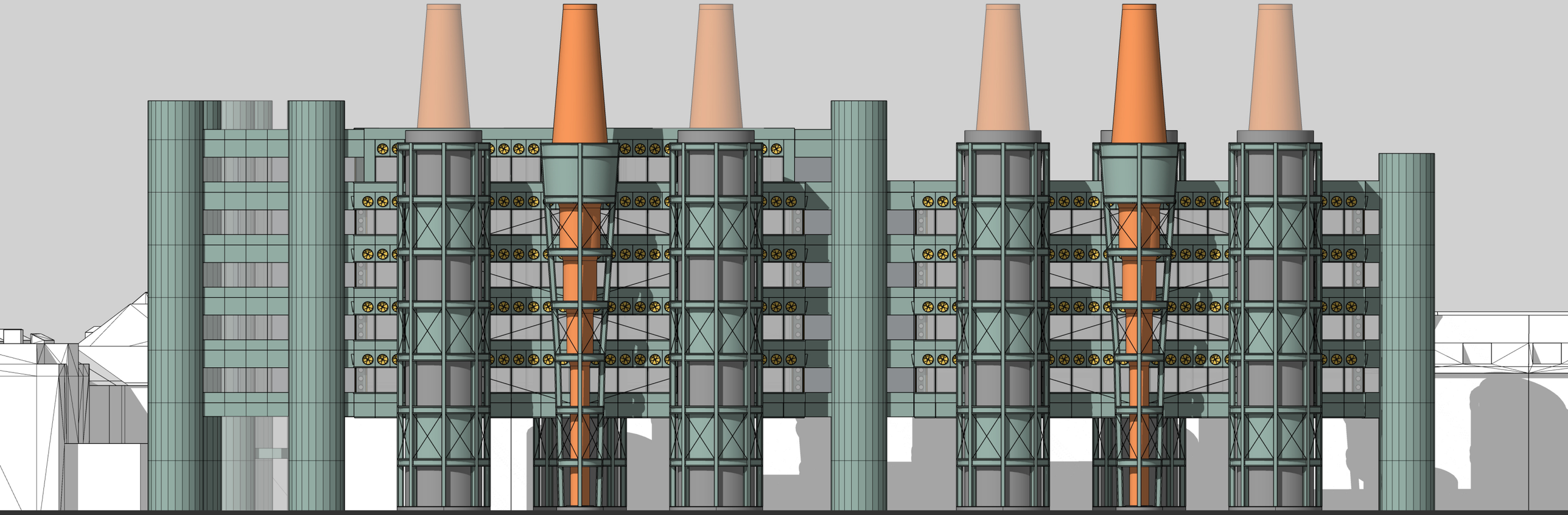
A-A Section

0 1 5 10 m

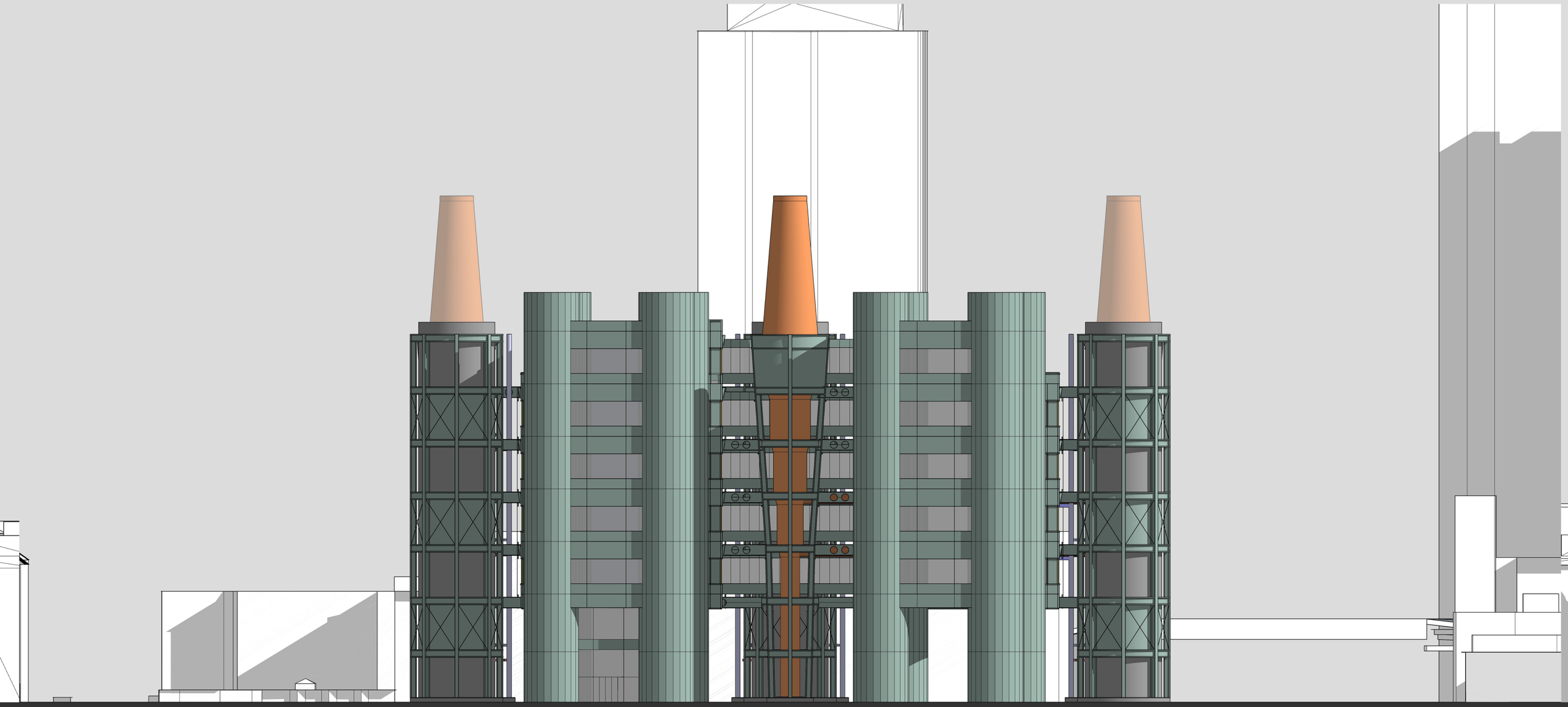


B-B Section

0 1 5 10 m

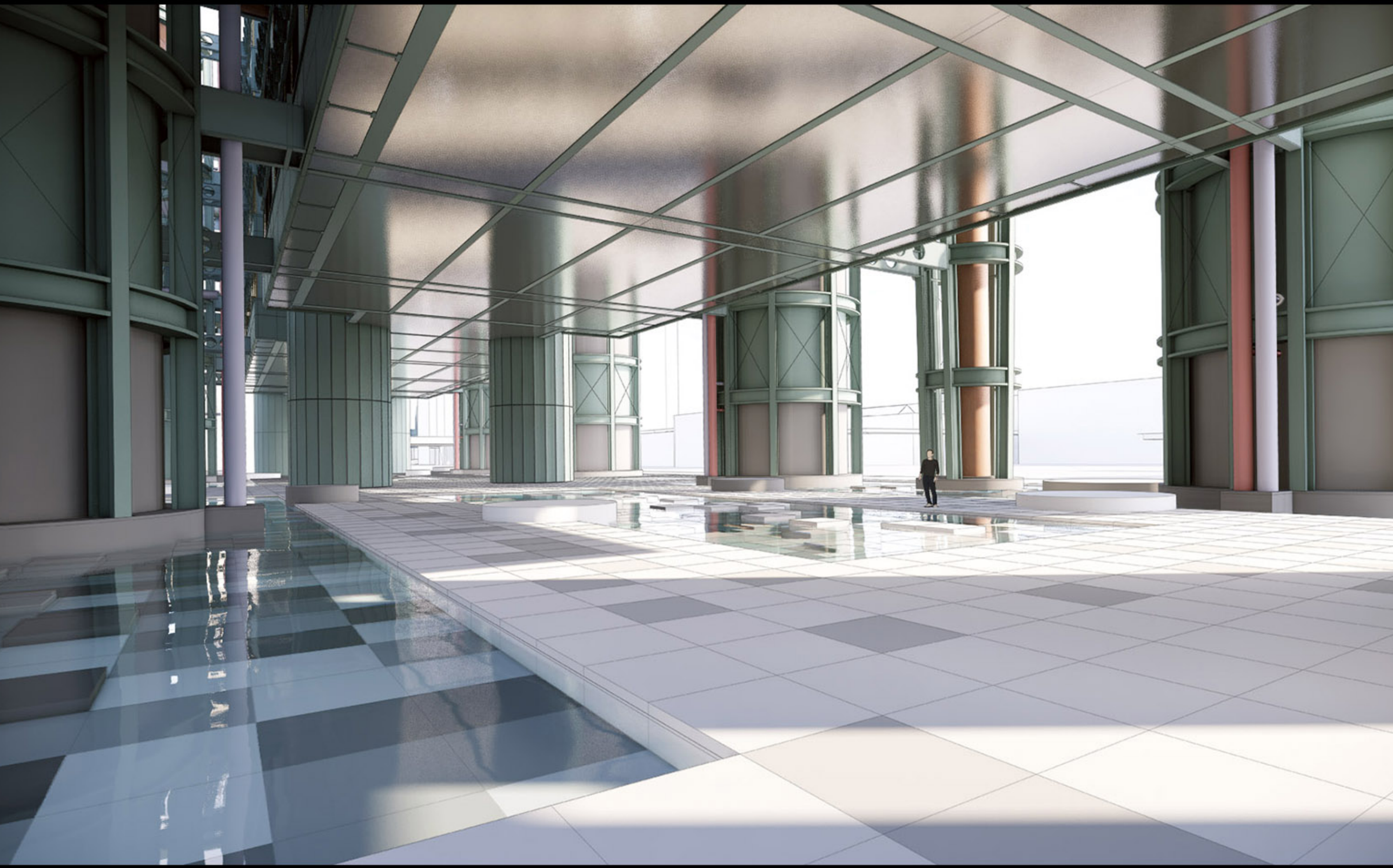


Southern Elevation



Western Elevation

Perspective Street View



Perspective Ground Floor