

Maximising Energy Efficiency in Data Centre Design

SEAI EXEED

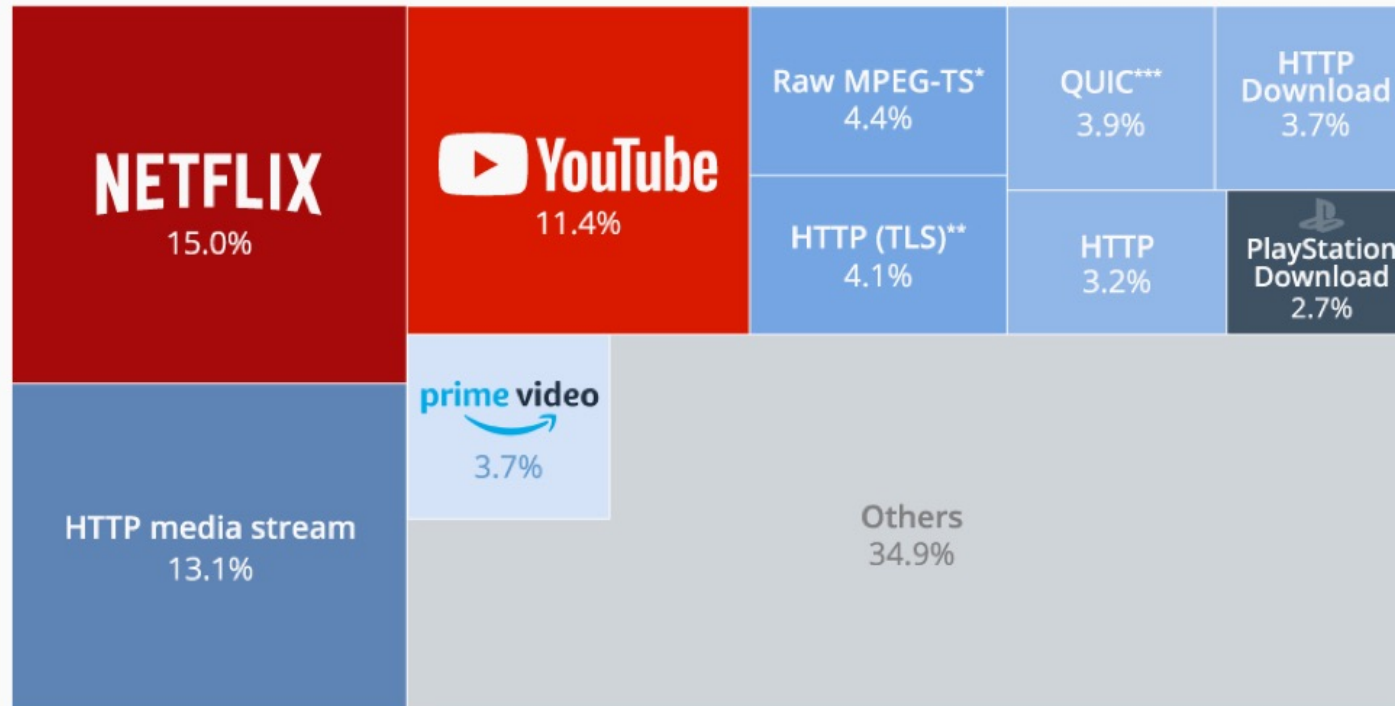
8th May 2019

David McAuley



Netflix is Responsible for 15% of Global Internet Traffic

Distribution of worldwide downstream traffic, by web application



* Digital container format for the transmission and storage of audio, video, and data.

** Security protocol

*** Network protocol designed to speed up online web applications



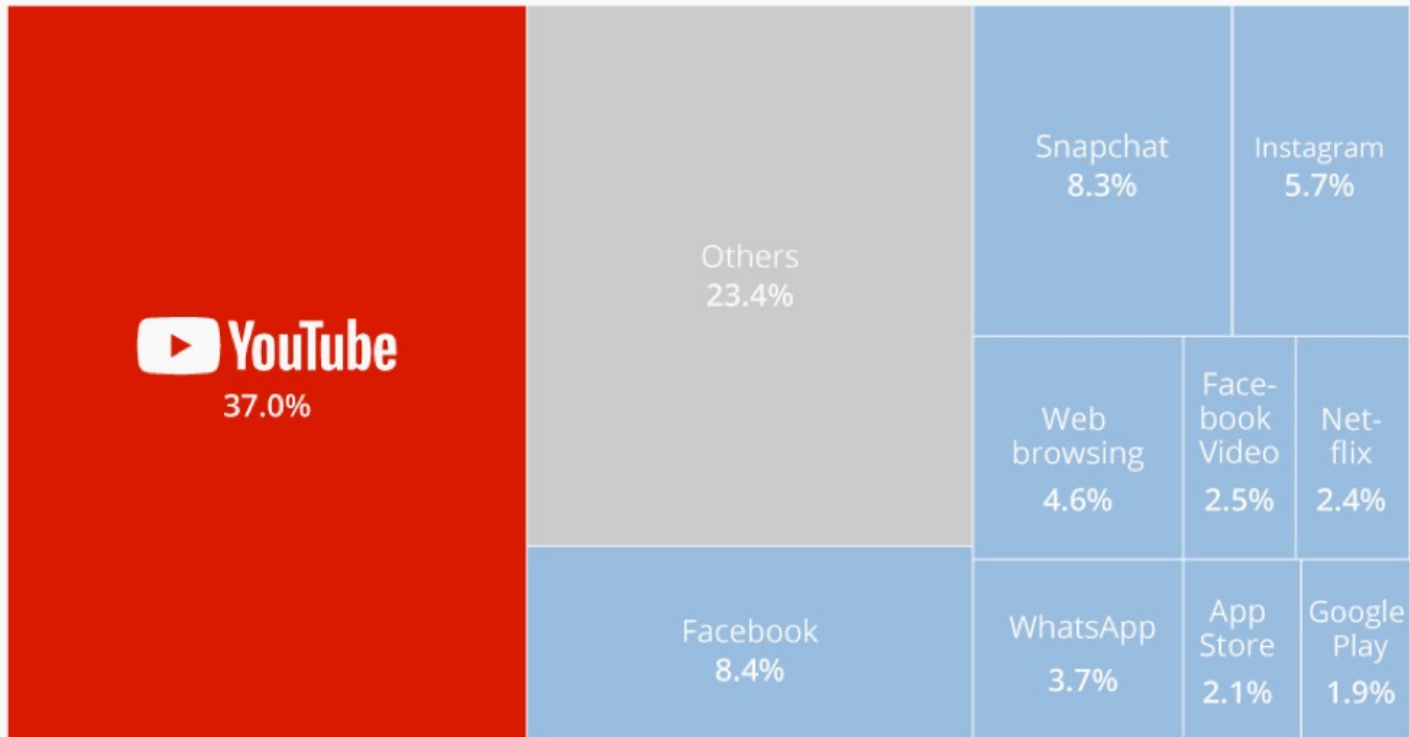
@StatistaCharts

Source: Sandvine | The Global Internet Phenomena Report

statista

YouTube is Responsible for 37% of All Mobile Internet Traffic

Share of global downstream mobile traffic, by app



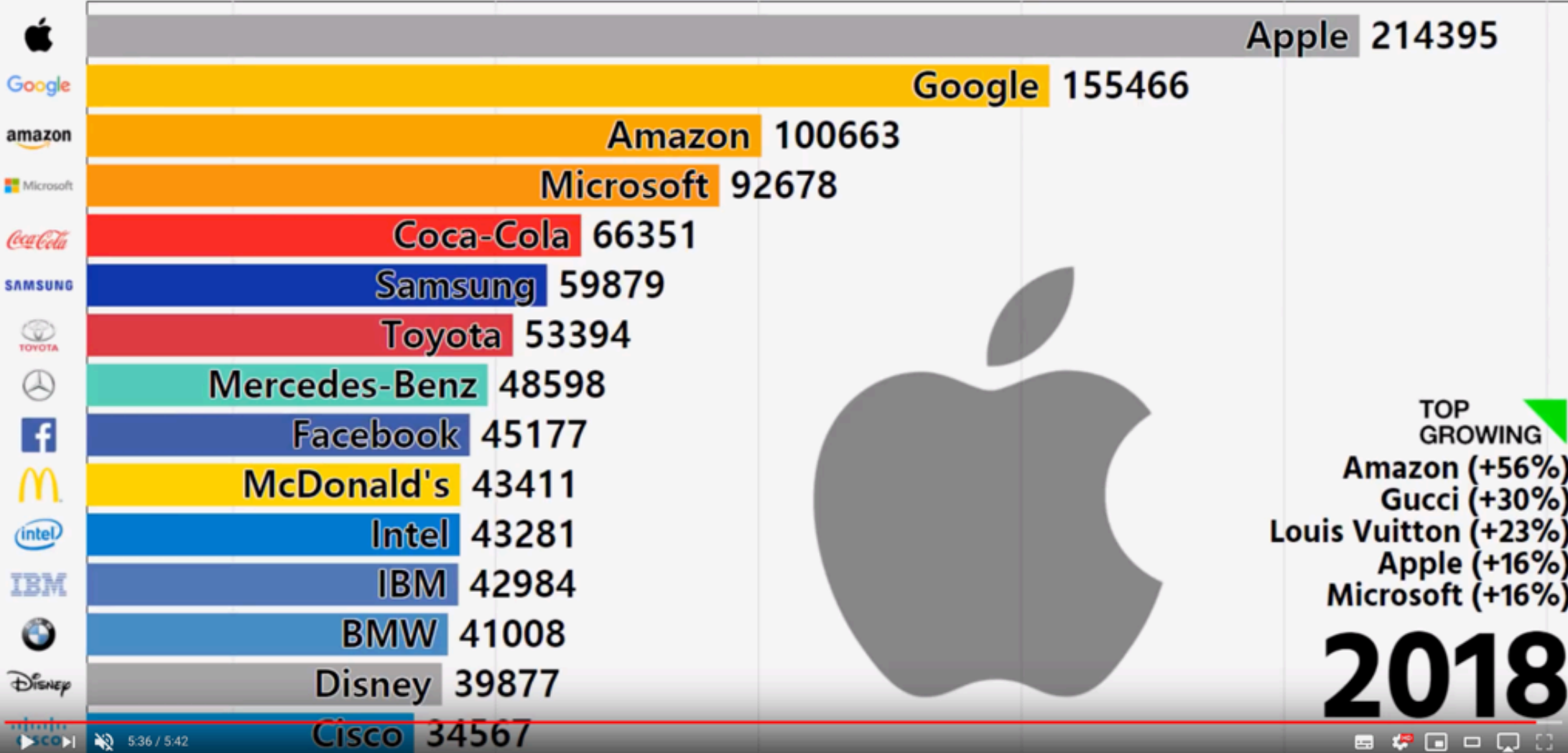
@StatistaCharts

Source: Sandvine | The Mobile Internet Phenomena Report (February 2019)

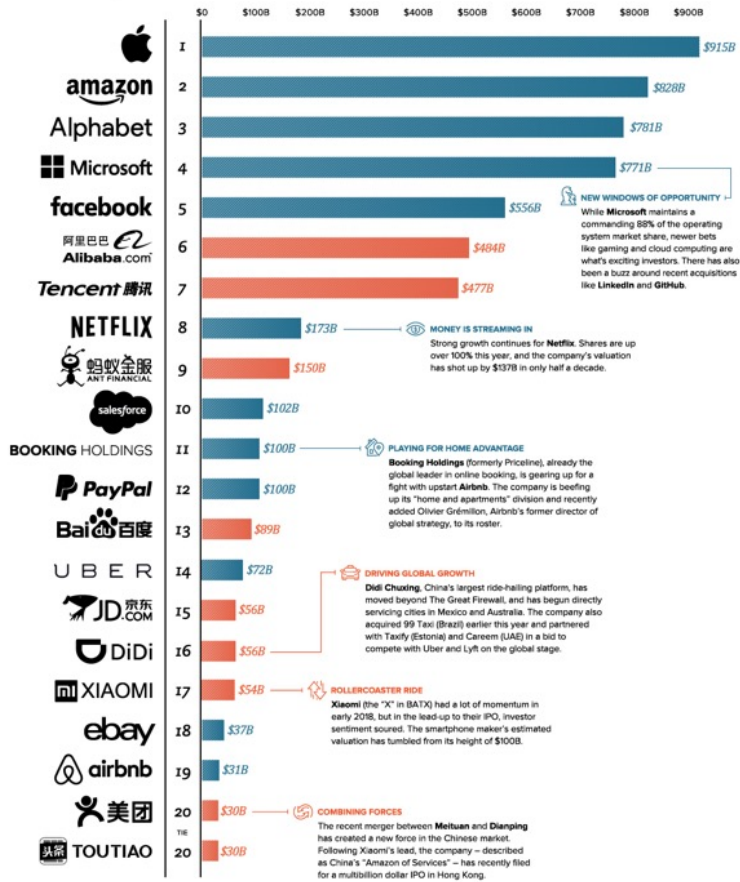
statista

Top 15 Best Global Brands Ranking

Brand Value \$m
0 50000 100000 150000 200000 250000



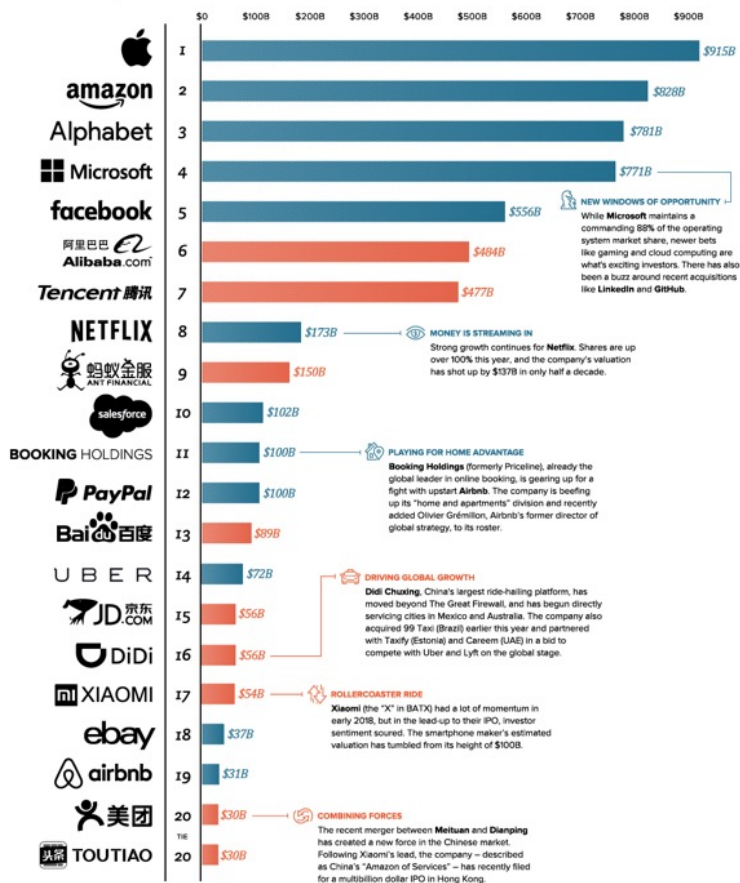
Top 20 Internet Leaders (Valuation, 2018)



SOURCE: Klener Perkins Caulfield & Byers Internet Trends Report 2018, Forbes, Company Reports

visualcapitalist.com

Top 20 Internet Leaders (Valuation, 2018)



NEW WINDOWS OF OPPORTUNITY
While Microsoft maintains a commanding 88% of the operating system market share, newer bets like gaming and cloud computing are what's exciting investors. There has also been a buzz around recent acquisitions like LinkedIn and GitHub.

MONEY IS STREAMING IN
Strong growth continues for Netflix. Shares are up over 100% this year, and the company's valuation has shot up by \$137B in only half a decade.

PLAYING FOR HOME ADVANTAGE
Booking Holdings (formerly Priceline), already the global leader in online booking, is gearing up for a fight with upstart Airbnb. The company is beefing up its "home and apartments" division and recently added Oliver Grémion, Airbnb's former director of global strategy, to its roster.

DRIVING GLOBAL GROWTH
Didi Chuxing, China's largest ride-hailing platform, has moved beyond the Great Firewall, and has begun directly servicing cities in Mexico and Australia. The company also acquired 99 Taxi (Brazil) earlier this year and partnered with Taxy (Estonia) and Careem (JAE) in a bid to compete with Uber and Lyft on the global stage.

ROLLERCOASTER RIDE
Xiaomi the "X" in (BATX) had a lot of momentum in early 2018, but in the lead-up to their IPO, investor sentiment soured. The smartphone maker's estimated valuation has tumbled from its height of \$100B.

COMBINING FORCES
The recent merger between Meituan and Dianping has created a new force in the Chinese market. Following Xiaomi's lead, the company -- described as China's "Amazon of Services" -- has recently filed for a multibillion dollar IPO in Hong Kong.

SOURCE: Klavier Perkins Caulfield & Byers Internet Trends Report 2018, Forbes, Company Reports

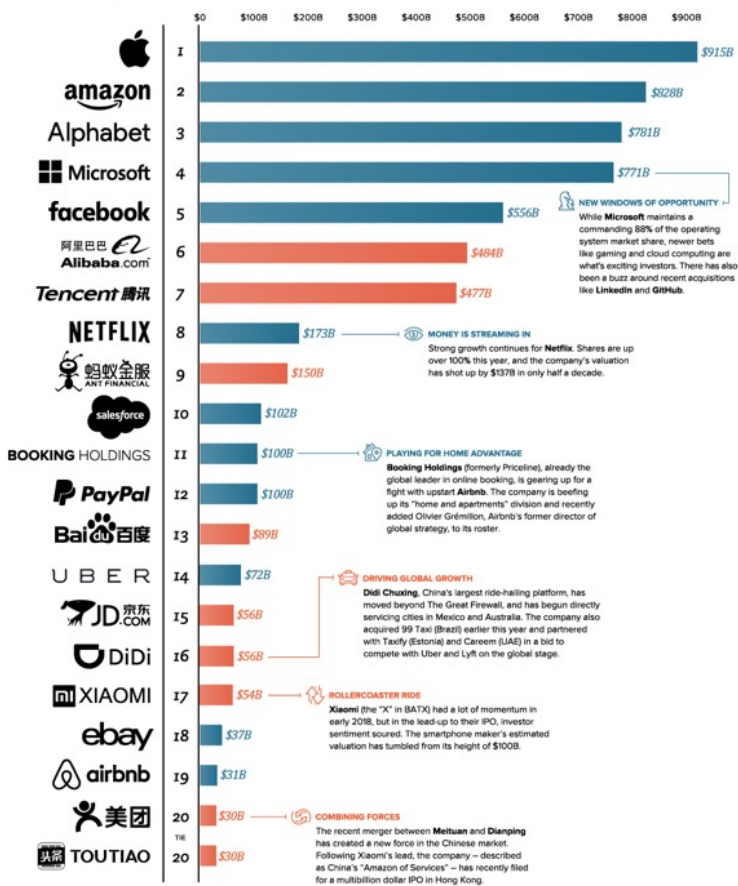
amazon



Google

Microsoft

Top 20 Internet Leaders (Valuation, 2018)



SOURCE: Klavier Perkins Caulfield & Byers Internet Trends Report 2018, Forbes, Company Reports

amazon



Google

Microsoft



Keppel Data Centres



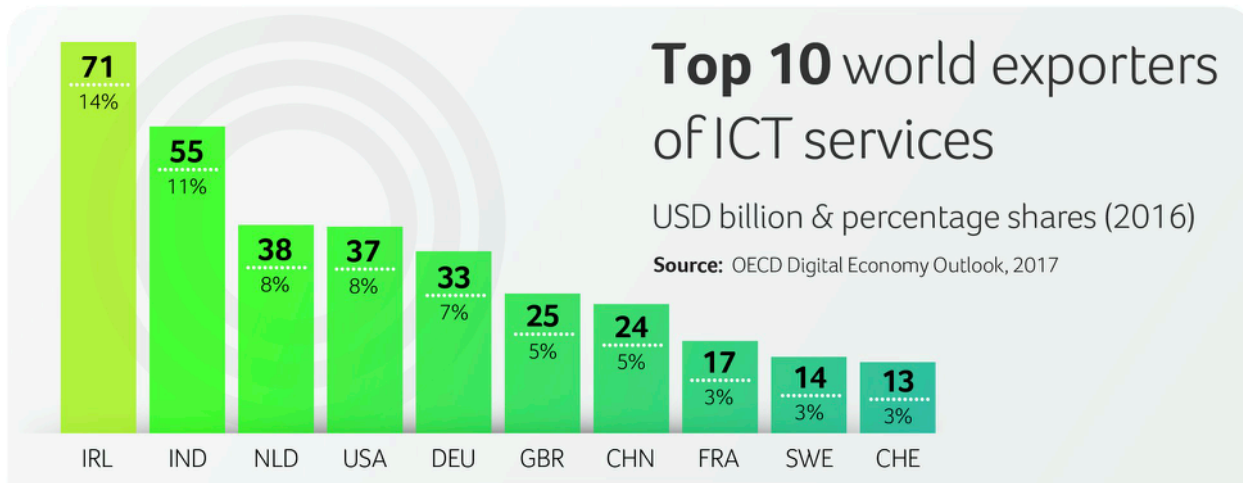
interxion™



Top 10 world exporters of ICT services

USD billion & percentage shares (2016)

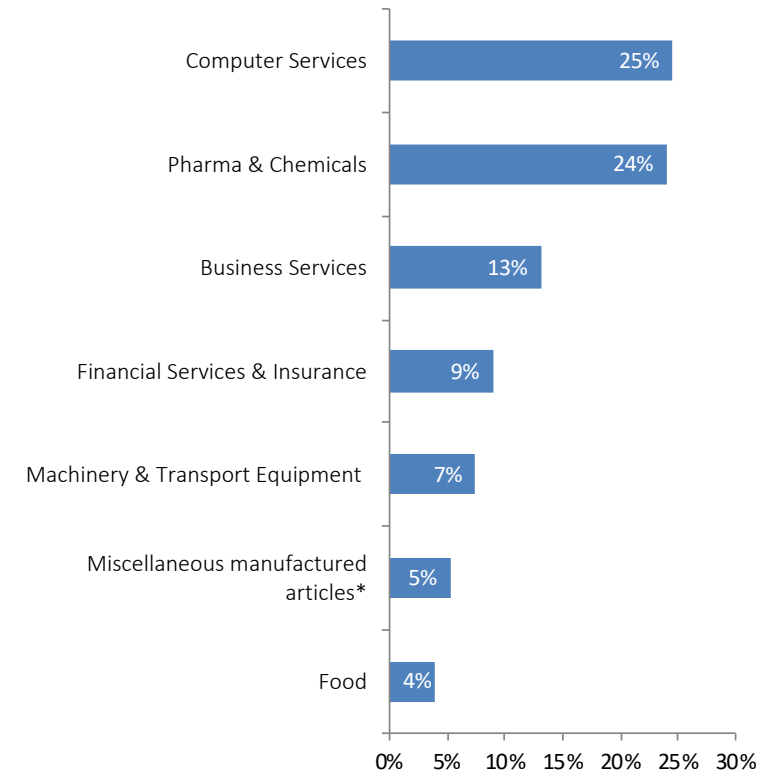
Source: OECD Digital Economy Outlook, 2017



Ireland. Right place Right time



Composition of Total Exports 2017



Industry Reports

Ireland's
Data Hosting
Industry
2017

"Irish Data Centres, an Industry of Substance"

Host In Ireland bitpower energy solutions

Ireland's
Data Hosting
Industry

2018 Q1
Update

"Irish Data Centres, an Industry of Substance"

Host In Ireland bitpower energy solutions

Ireland's
Data Hosting
Industry

2018 Q3
Update

"Irish Data Centres, an Industry of Substance"

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Ireland's
Data Hosting
Industry

2018 Q2
Update

"Irish Data Centres, an Industry of Substance"

Host In Ireland bitpower energy solutions

Ireland's
Data Hosting Industry

2018 Q4 update

"Irish Data Centres, an Industry of Substance"

Host In Ireland bitpower energy solutions

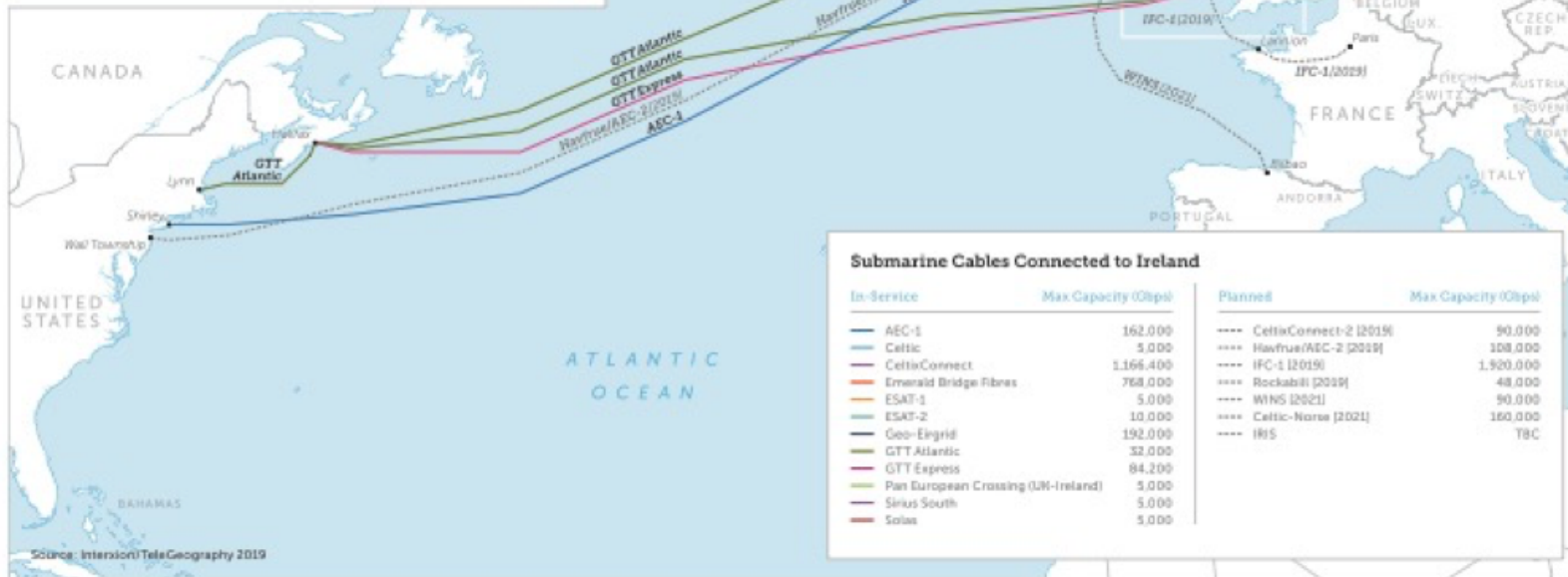
Ireland's
Data Hosting Industry

2019 Q1 Report

"An Industry of Substance"

Host In Ireland bitpower energy solutions

www.bitpower.ie

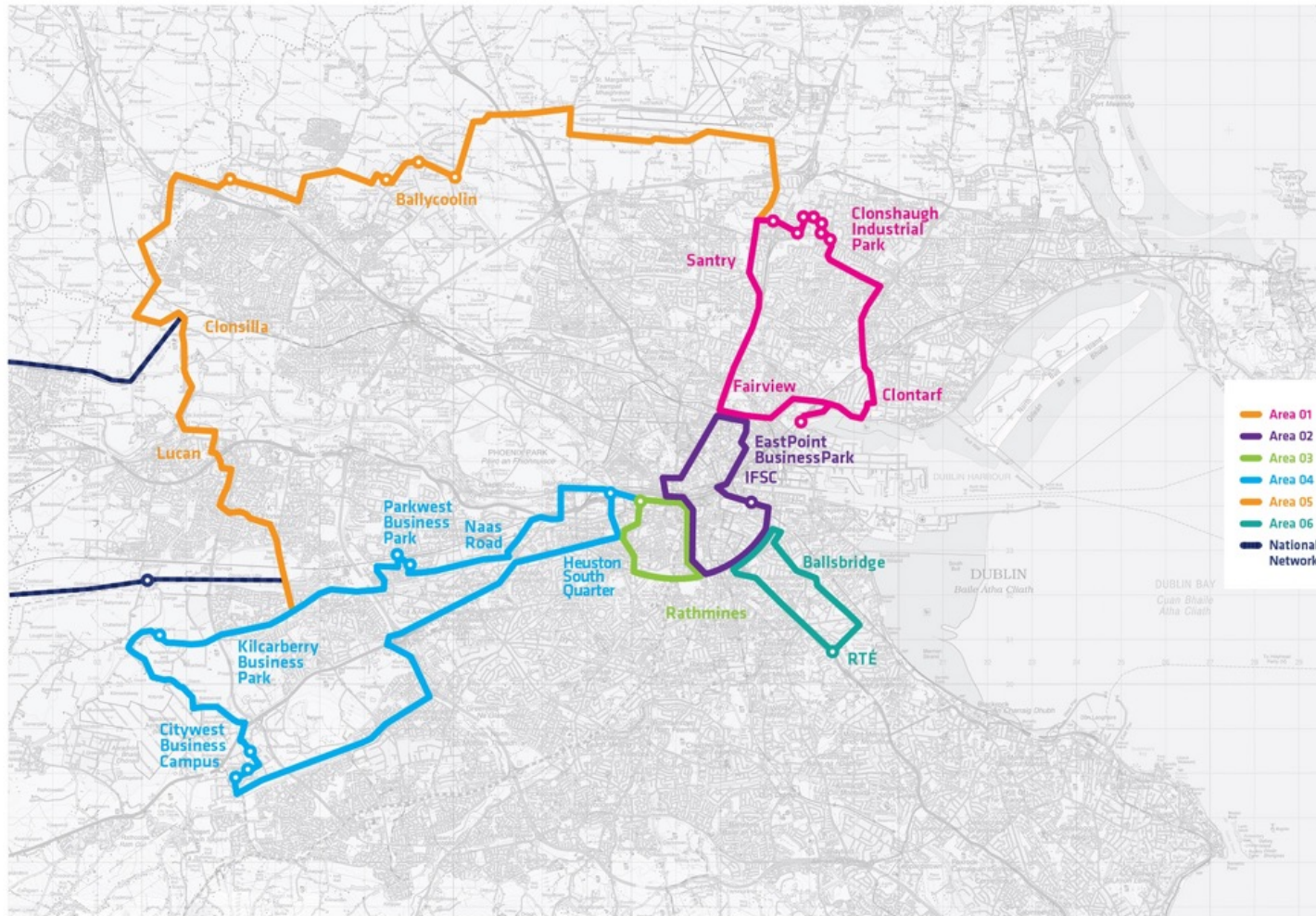


Submarine Cables Connected to Ireland

In-Service	Max Capacity (Gbps)	Planned	Max Capacity (Gbps)
ASC-1	162,000	CelticConnect-2 (2019)	90,000
Celtic	5,000	Havfrue/ASC-2 (2019)	100,000
CelticConnect	1,166,400	IFC-1 (2019)	1,920,000
Emerald Bridge Fibres	768,000	Rockabill (2019)	48,000
ESAT-1	5,000	WINS (2021)	90,000
ESAT-2	10,000	Celtic-Norse (2021)	160,000
Geo-Egrid	192,000	IFS	TBC
GTT Atlantic	32,000		
GTT Express	84,200		
Pan-European Crossing (UK-Ireland)	5,000		
Solas	5,000		
Sirius South	5,000		

interxion

Source: Interxion/TeleGeography 2019



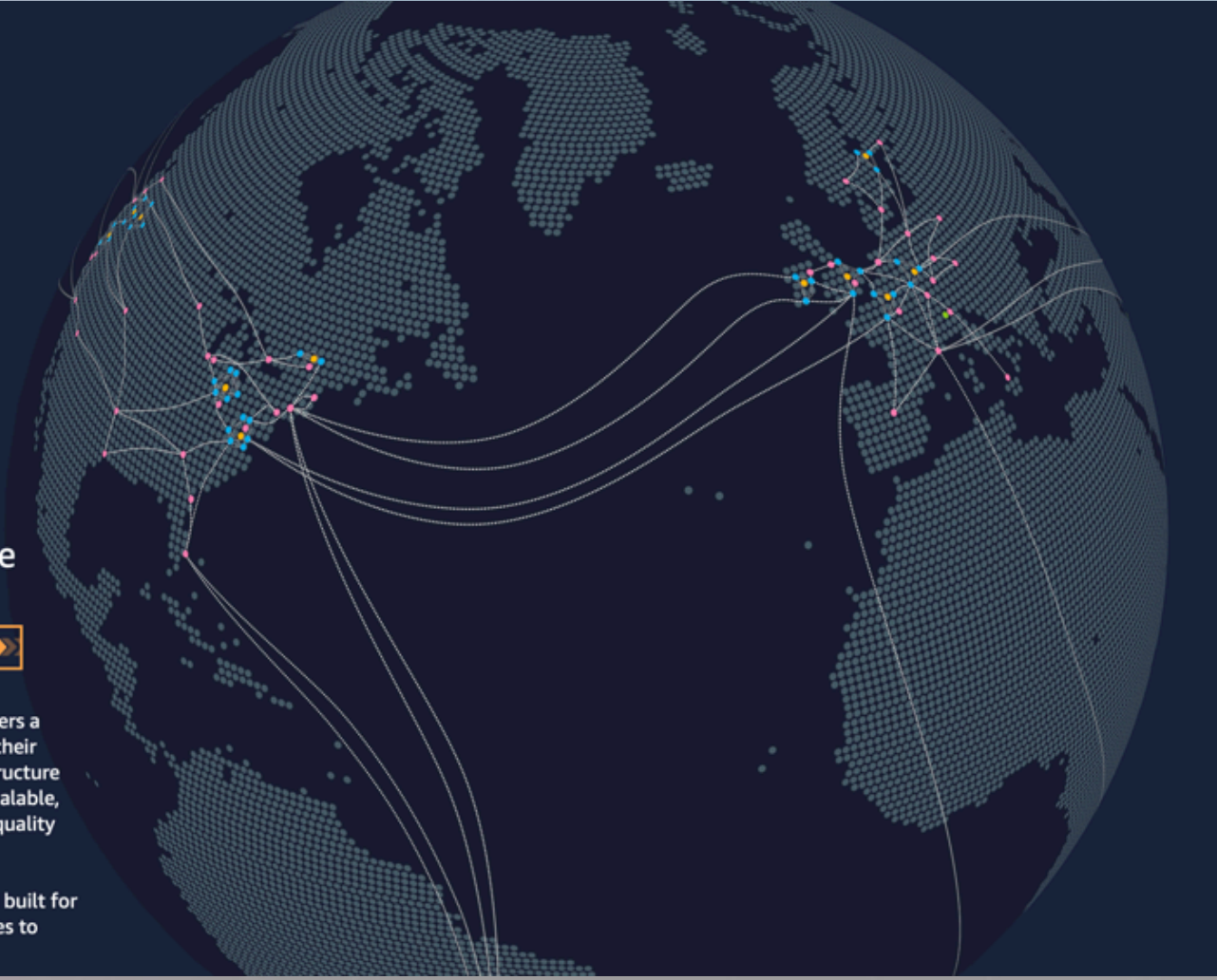


The Most Extensive, Reliable and Secure Global Cloud Infrastructure Available

SEE HOW WE DO IT >>>

The Amazon Web Services (AWS) Global Infrastructure delivers a cloud infrastructure companies can depend on—no matter their size, changing needs, or challenges. The AWS Global Infrastructure is designed and built to deliver the most flexible, reliable, scalable, and secure cloud computing environment with the highest quality global network performance available today.

Every component of the AWS infrastructure is designed and built for redundancy and reliability, from Regions to Availability Zones to networking links to load balancers, routers and firmware.



<https://infrastructure.aws>



<https://infrastructure.aws>

Sustainability & CSR

	RE 100	CDP	SEAI LIEN	SEAI Agreement	CDP	Nasdaq	SGX	FTSE4Good	GREENPEACE
Amazon							✓	✓	
Apple	✓		✓				✓	✓	
Facebook	✓		✓				✓	✓	
Google	✓	✓	✓	✓			✓	✓	
Microsoft	✓	✓	✓	✓	✓		✓	✓	
Digital Realty		✓			✓			✓	
Equinix	✓	✓	✓		✓	✓			✓
Interxion		✓	✓	✓					
Keppel DC			✓	✓		✓			

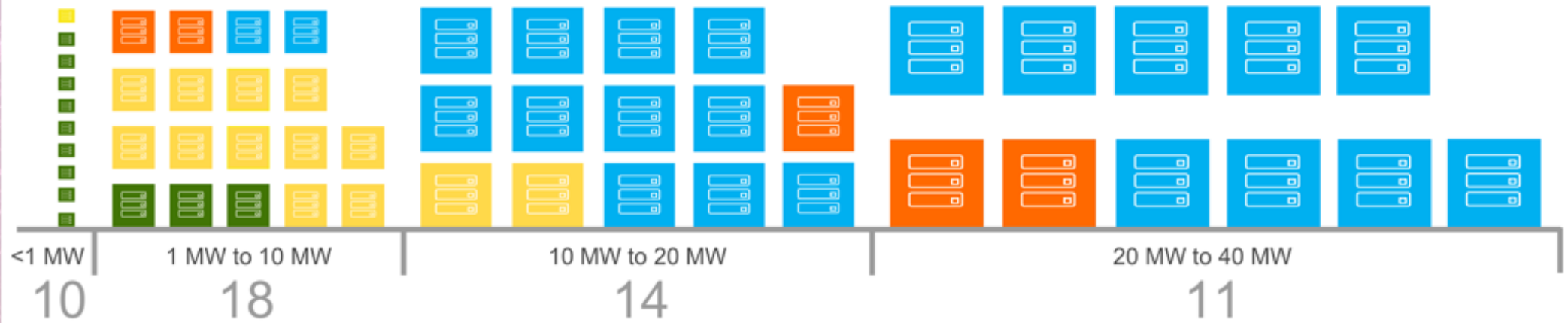
	RE 100	CDP	SEAI LIEN	SEAI Agreement	CDP	Nasdaq	SGX	FTSE4Good	GREENPEACE
IBM			✓	✓					
eBay	✓			✓	✓				
Intel		✓	✓	✓	✓	✓			
Siemens		✓							✓
Schneider		✓							✓
BT Group	✓		✓	✓		✓			✓
Colt Tech.					✓				
Commscope					✓				
Dell EMC				✓	✓				
Verizon					✓				
VMWare	✓				✓				
Vodafone				✓	✓				
Adobe Sys.	✓								✓
Cisco Sys.									✓
HP	✓			✓					✓
Rackspace	✓								✓
Xerox				✓	✓				✓

Scale of Data Hosting facilities

Ireland Hosts Commercial Data Centres of all Sizes

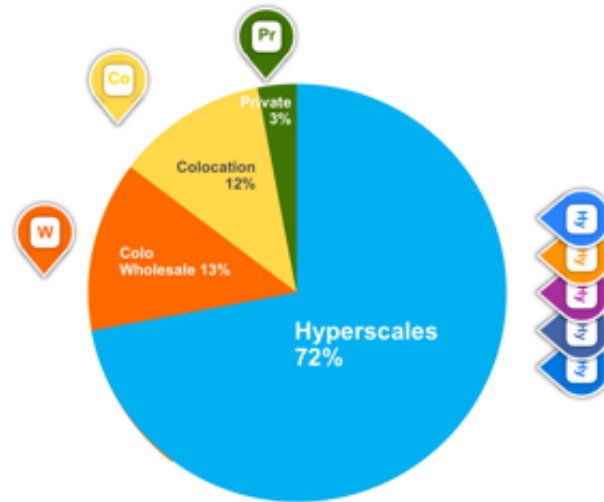
Fifty-Three operational data centres in Ireland by end Q1 2019

53



Data Centre Types

Operator business model



There were fifty-three data centre facilities in operation in Ireland in Q1, 2019.

Hyperscales continued to dominate in terms of scale, with 72% of the MW capacity.

Colocation wholesale trend continues.

Metro Dublin Area

County Meath
Clonee
Local Authority: Meath County Council

2
Facilities

Operational 2019 Q1: 56 MW
Construction: 20 MW
Planning Permission: 36 MW
Planning Application: 0 MW
Masterplans: 56 MW

Dublin North West
Blanchardstown / Ballycoolin / Dublin 15
Local Authority: Fingal County Council

12
Facilities

Operational 2019 Q1: 107 MW
Construction: 16 MW
Planning Permission: 148 MW
Planning Application: 0 MW
Masterplans: 38 MW

Dublin North East
Clonsilla / Dublin 17
Local Authority: Dublin City Council

11
Facilities

Operational 2019 Q1: 117 MW
Construction: 25 MW
Planning Permission: 25 MW
Planning Application: 16 MW
Masterplans: 0 MW

Dublin South West
Grange Castle / Profile Park / Dublin 22
Local Authority: SDCC

14
Facilities

Operational 2019 Q1: 214 MW
Construction: 66 MW
Planning Permission: 122 MW
Planning Application: 60 MW
Masterplans: 10 MW

Dublin South
CityWest / ParkWest / Dublin 24
Local Authority: SDCC

9
Facilities

Operational 2019 Q1: 108 MW
Construction: 30 MW
Planning Permission: 96 MW
Planning Application: 0 MW
Masterplans: 0 MW

Map Legend

- Hyperscale
- Co-Location
- Colocation Wholesale
- Private Data centres
- Edge Data centres

Map shows operational and known planned facilities.
Callouts in blue refer to operational facilities.

Q1 2019

Masterplans
Estimated
235 MW

Planning Applications
Currently in the Planning Process
140 MW

Planning Permission
Approved
446 MW

Construction
Projects currently in Development
172 MW

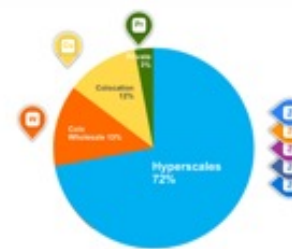
Data Centre Capacity
Operational in 2019 Q1
600 MW
Includes 20 MW Private



Digital Hosting Q1 2019 Update

Data Centre Types

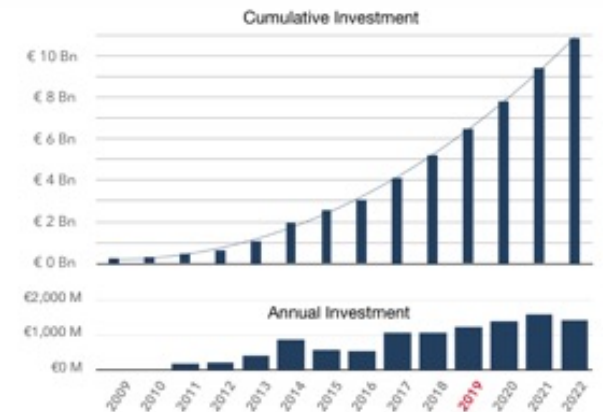
Operator business model



There were fifty-three data centre facilities in operation in Ireland in Q1, 2019. Hyperscales continued to dominate in terms of scale, with 72% of the MW capacity. Colocation wholesale trend continues.

Construction Investment 2009 - 2022

Cumulative and Annual investments in data centre facilities



Ireland Hosts Commercial Data Centres of all Sizes

Fifty-Three operational data centres in Ireland by end Q1 2019

53



Highlights entering 2019

The Big Picture

16
Newly Opened
Data Facilities

16 new data halls
completed since mid
2017

29
Facilities in
Development

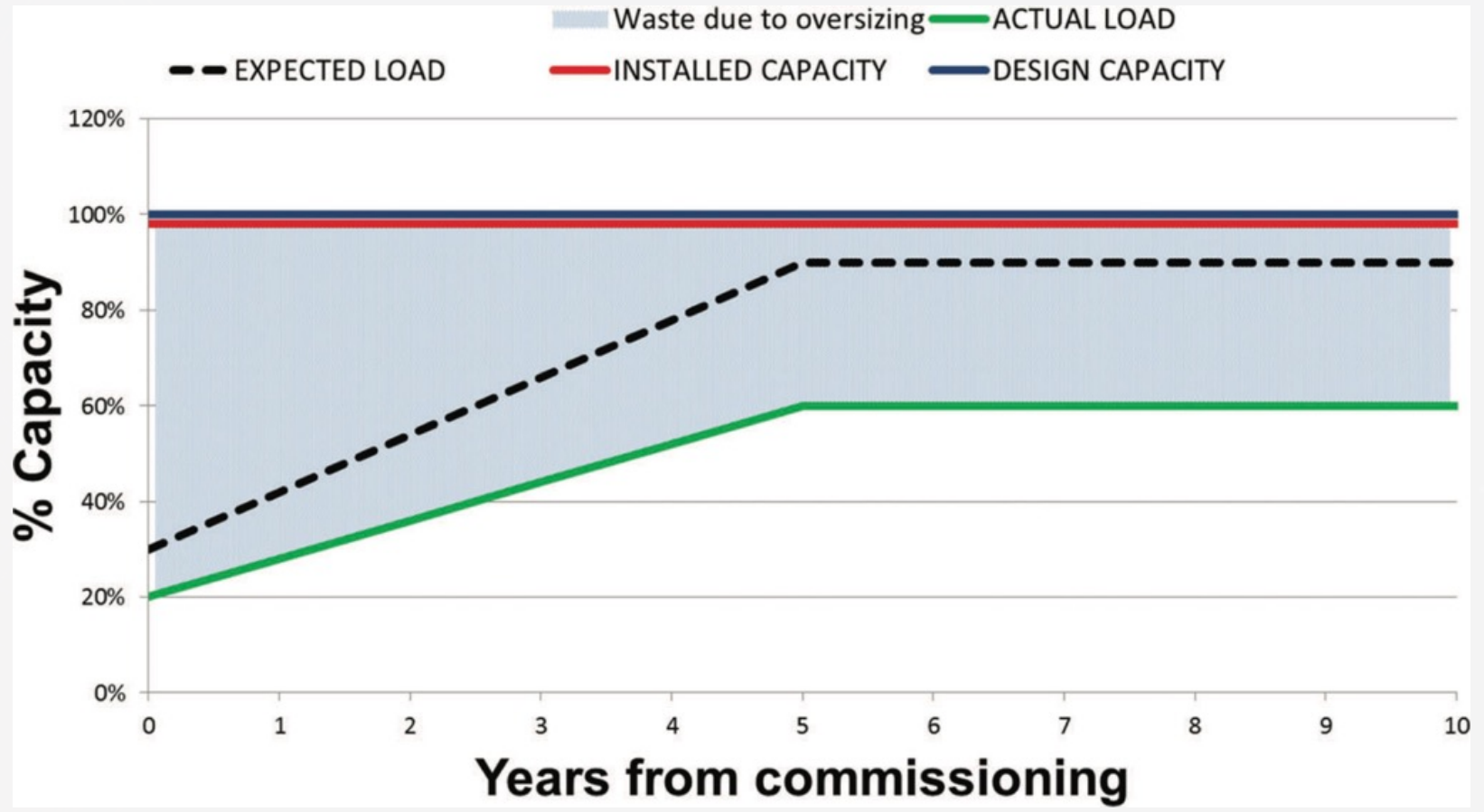
Under Construction
or with approved
planning

€1.3 Billion
Investment

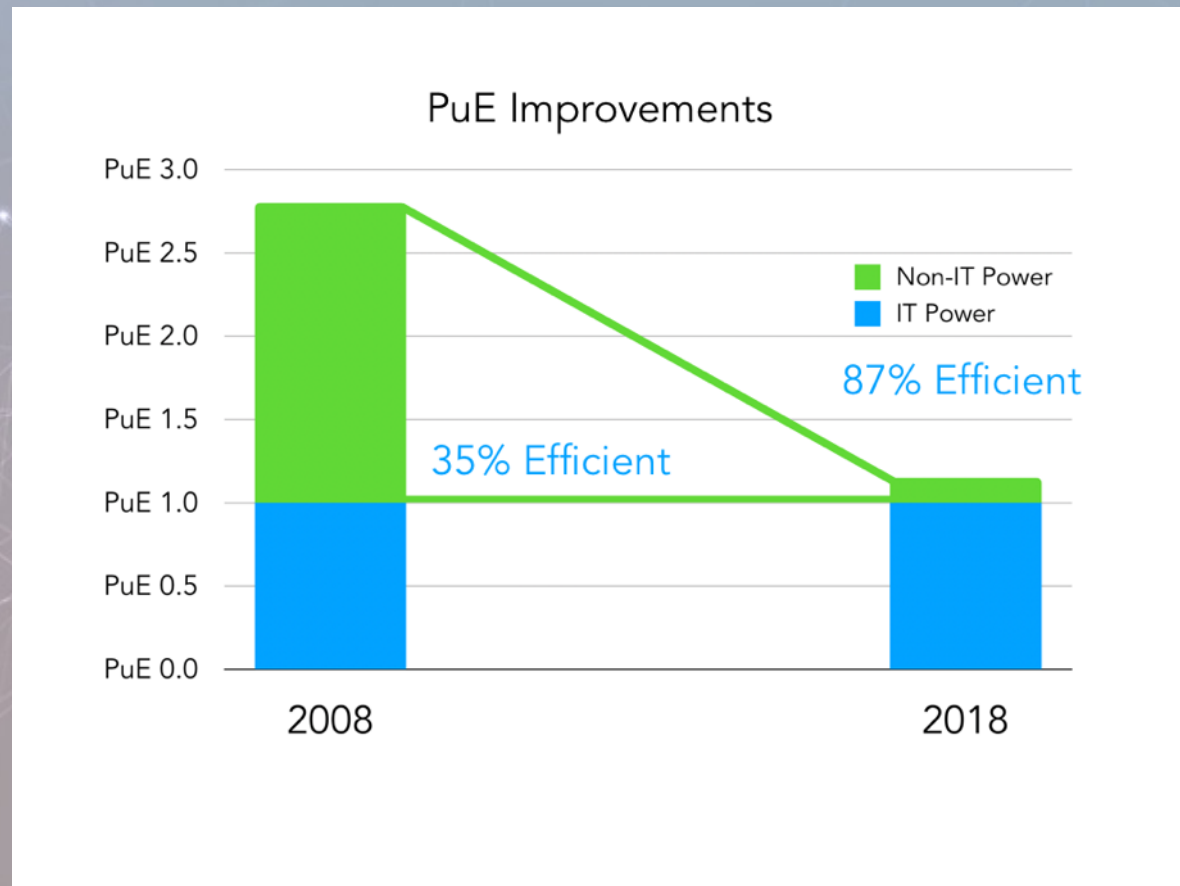
Average annual
investment
expected for
2019-2022

580 MW
Cloud & Managed
Services

Colocation, Wholesale,
and Hyperscale
Capacity



Efficiency Gains

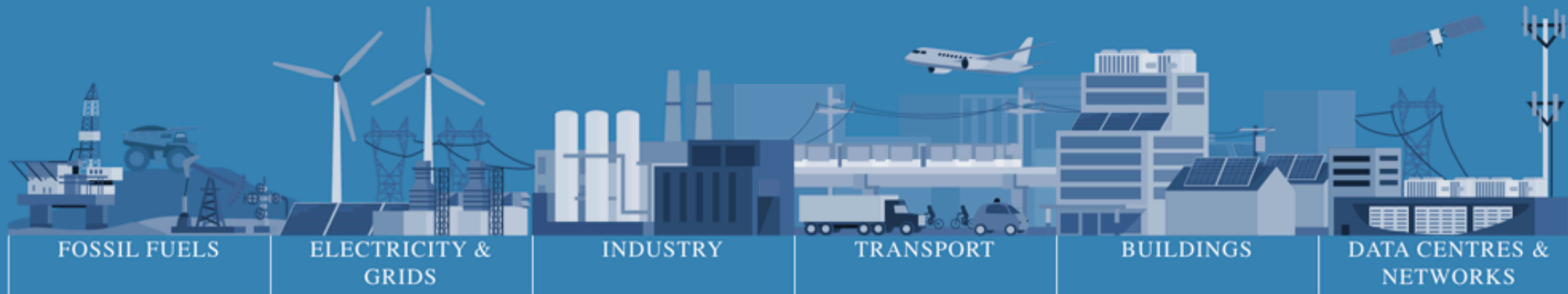




International
Energy Agency

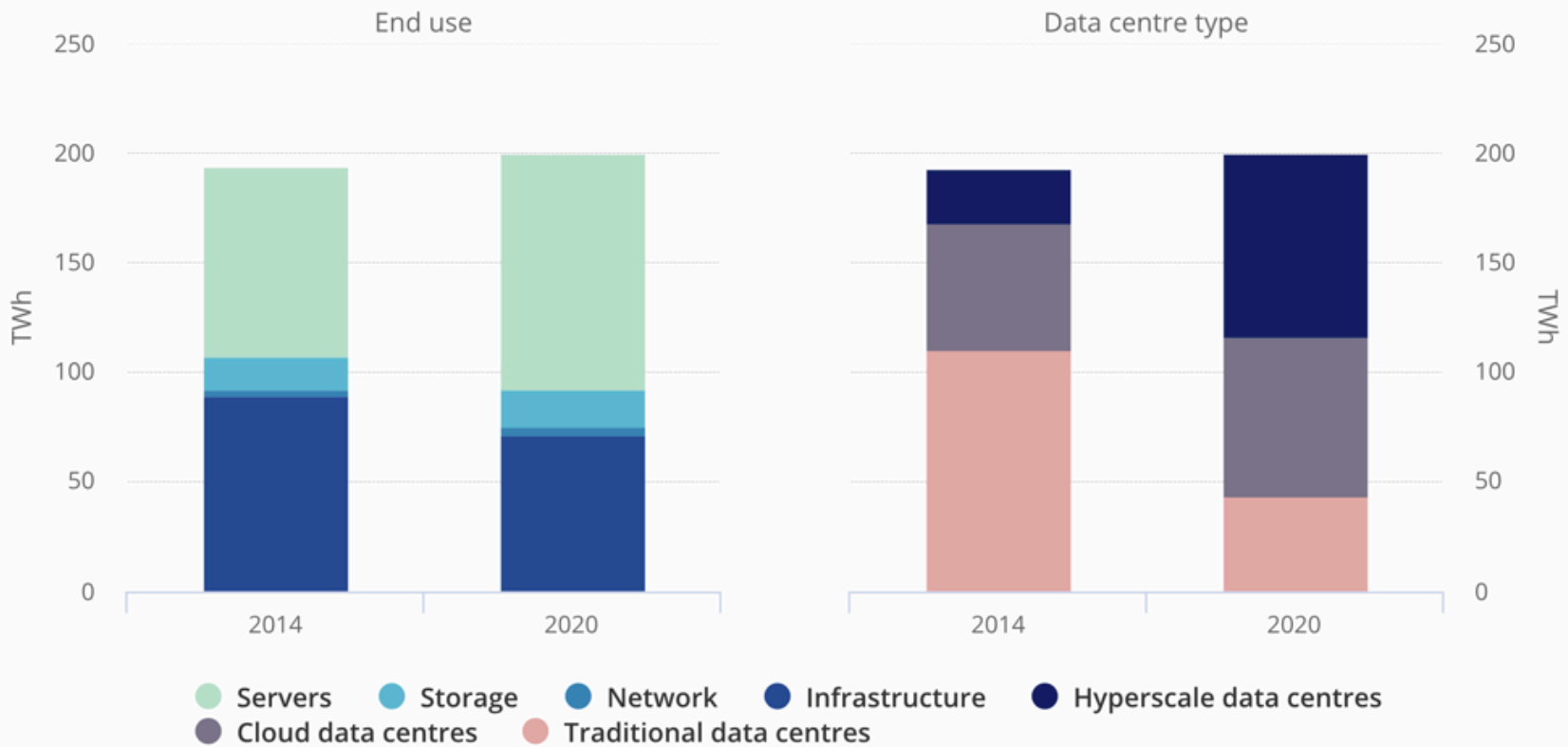
What does digitalization mean for the energy system?

Click on an energy system sector below to find out more.



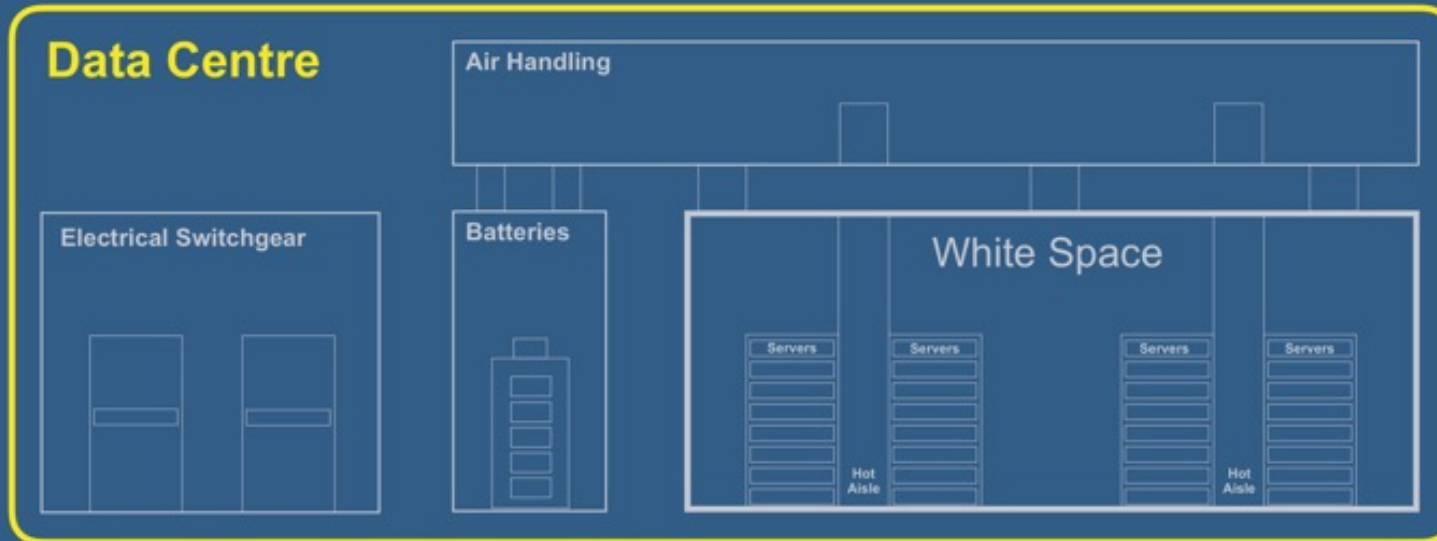


Global data centre energy demand by end use and data centre type

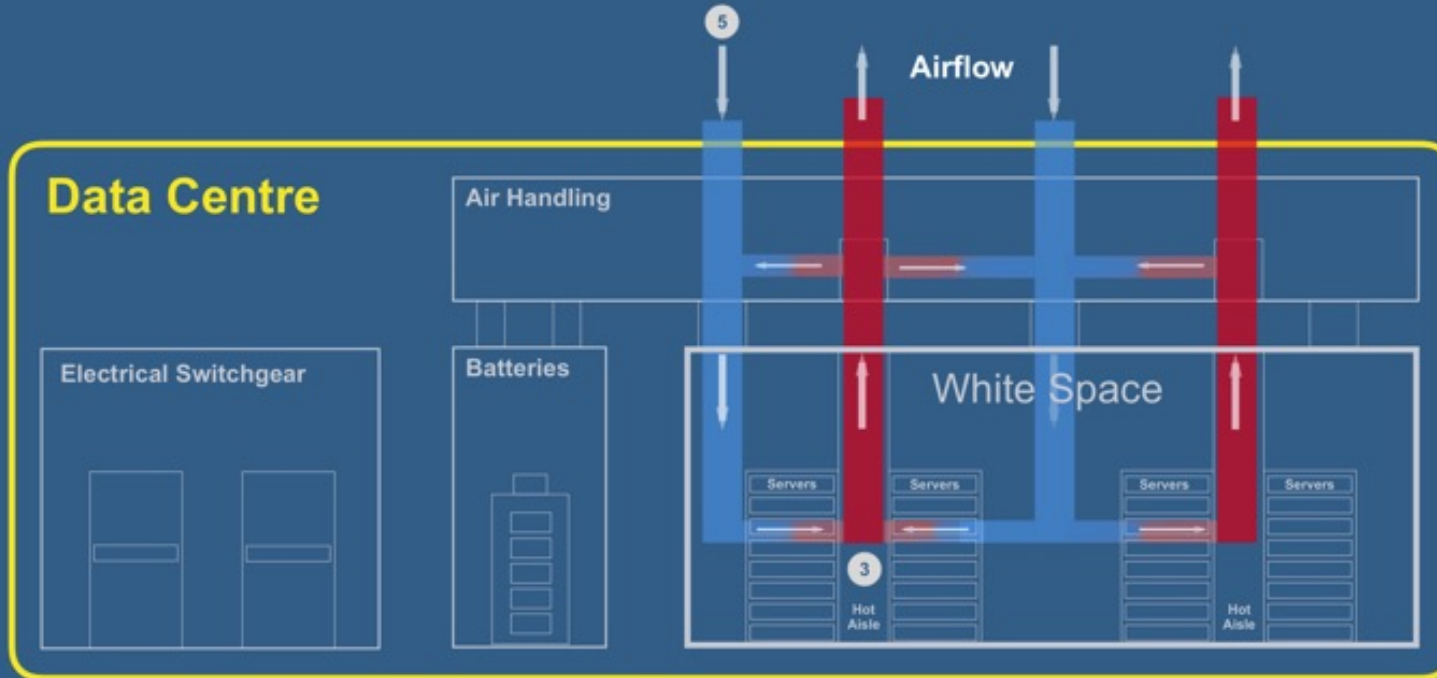


Digitalization and Energy, IEA 2017

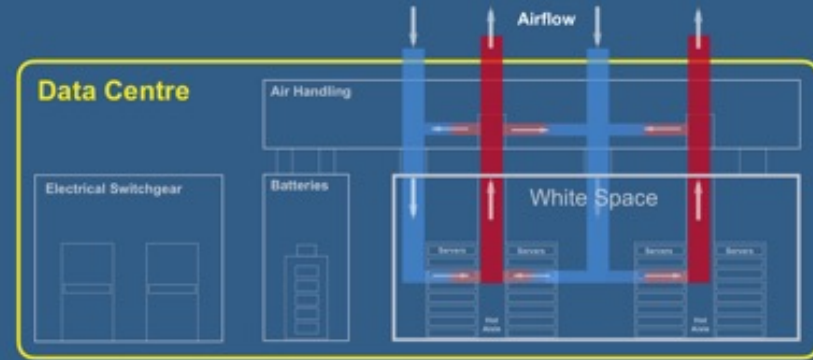
How To Build an Efficient Data Centre



How To Build an Efficient Data Centre



How To Build an Efficient Data Centre

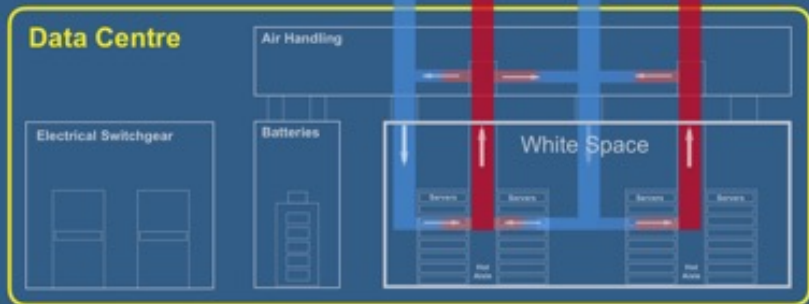


How To Build an Efficient Data Centre

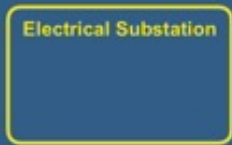


Electrical Substation

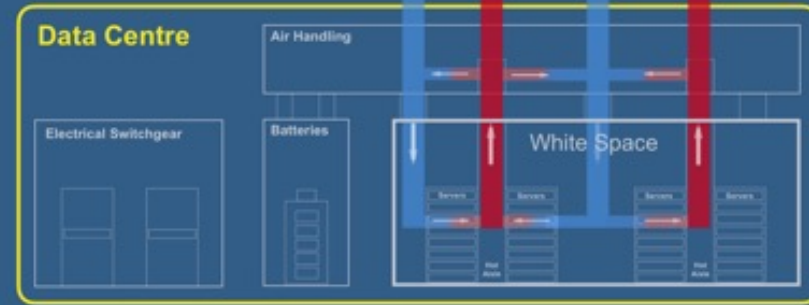
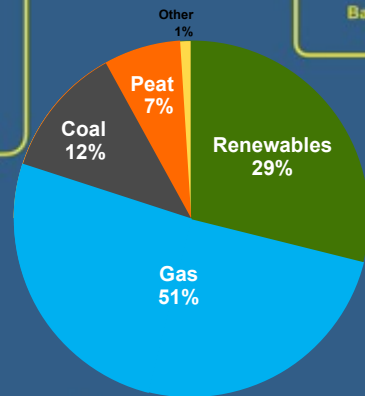
Backup Engines



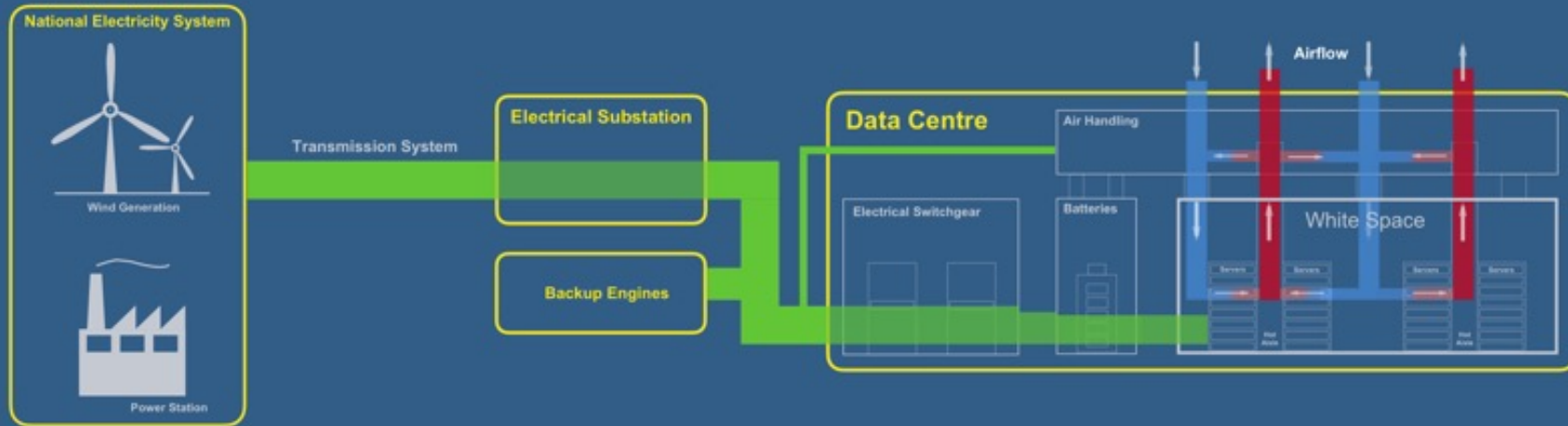
How To Build an Efficient Data Centre



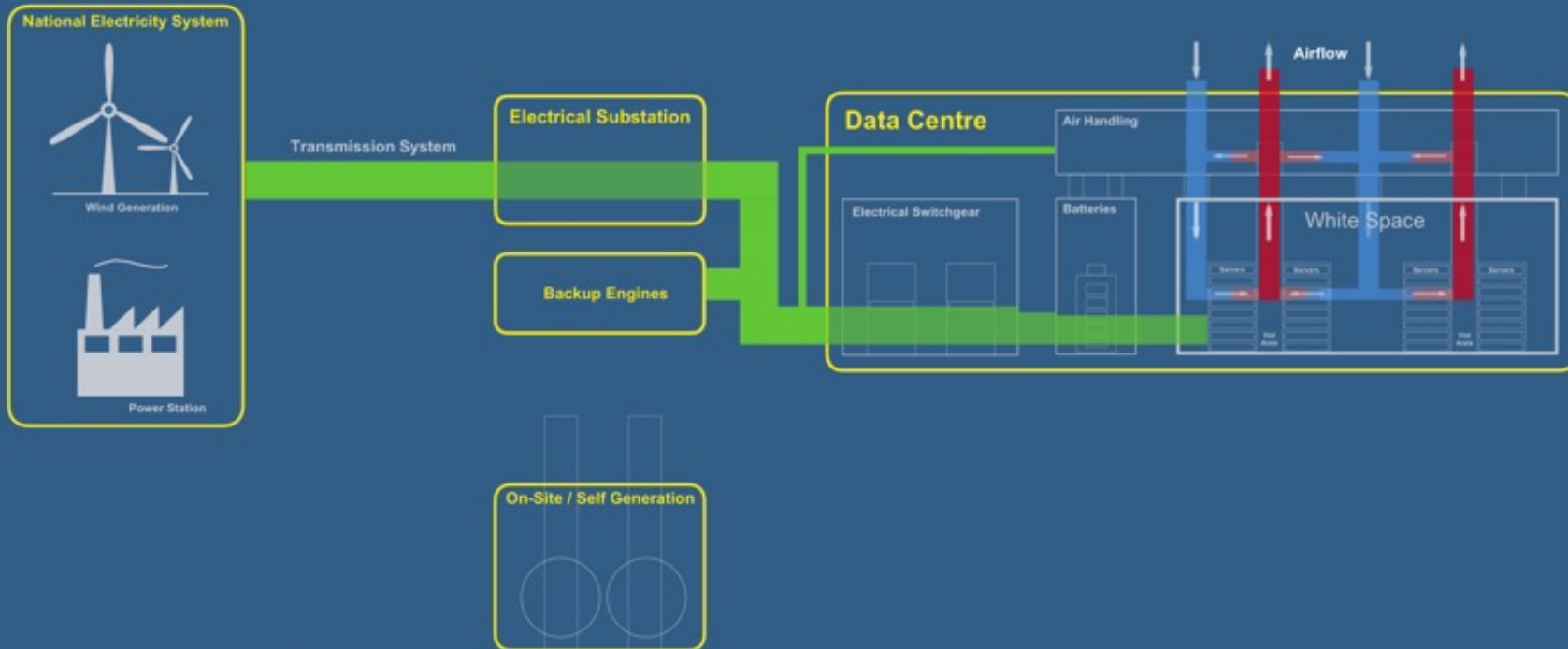
How To Build an Efficient Data Centre



How To Build an Efficient Data Centre

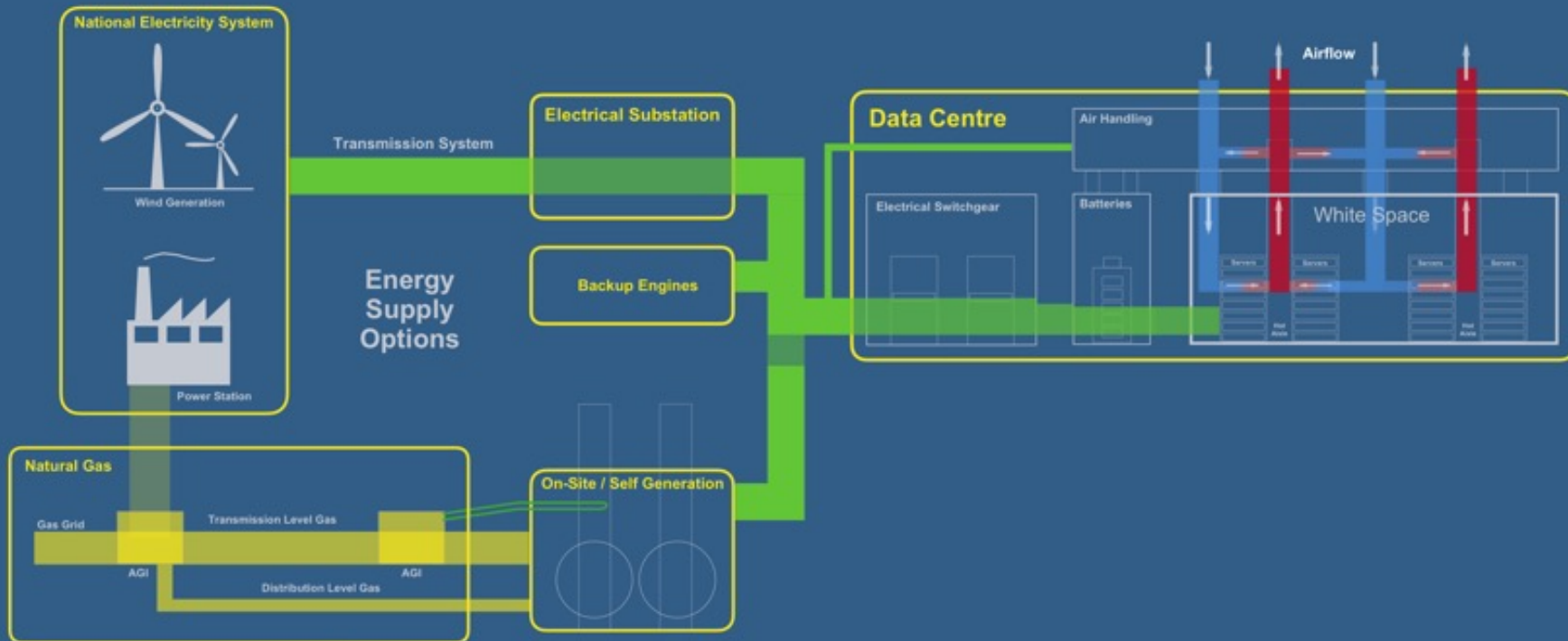


How To Build an Efficient Data Centre

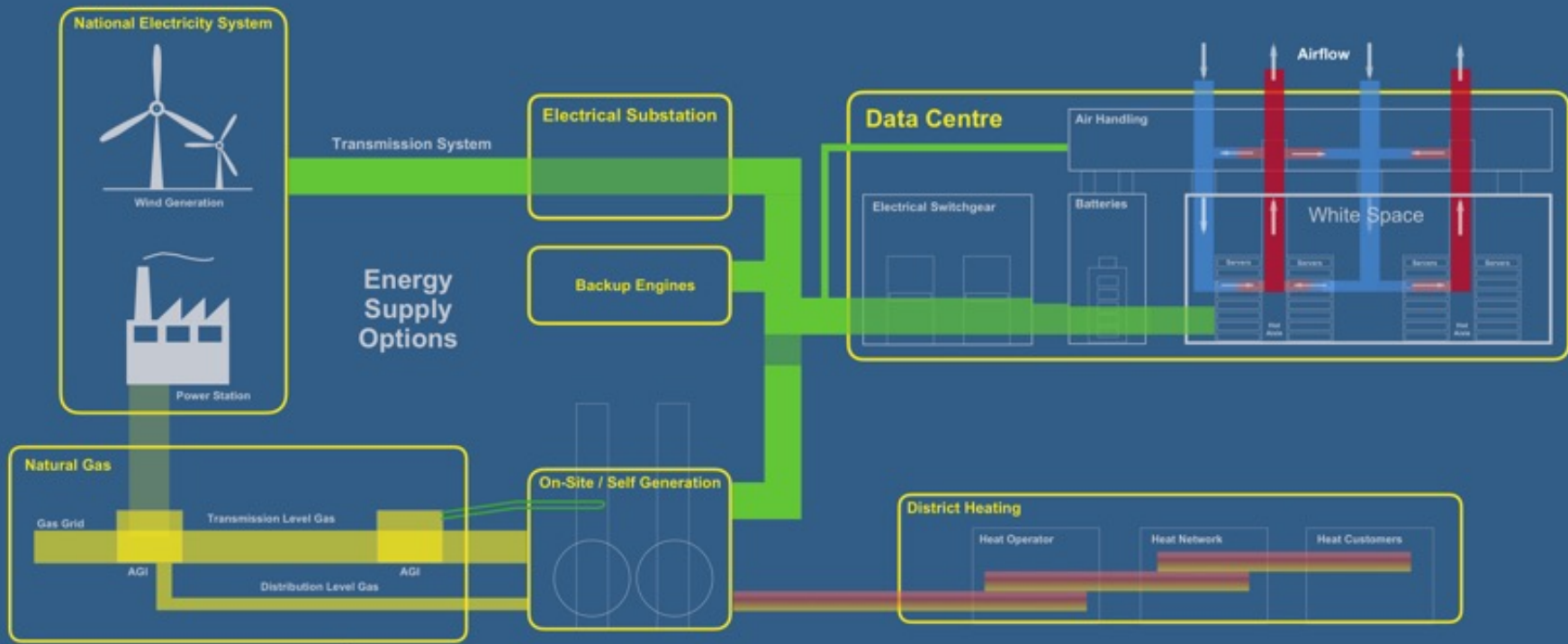


How To Build an Efficient Data Centre

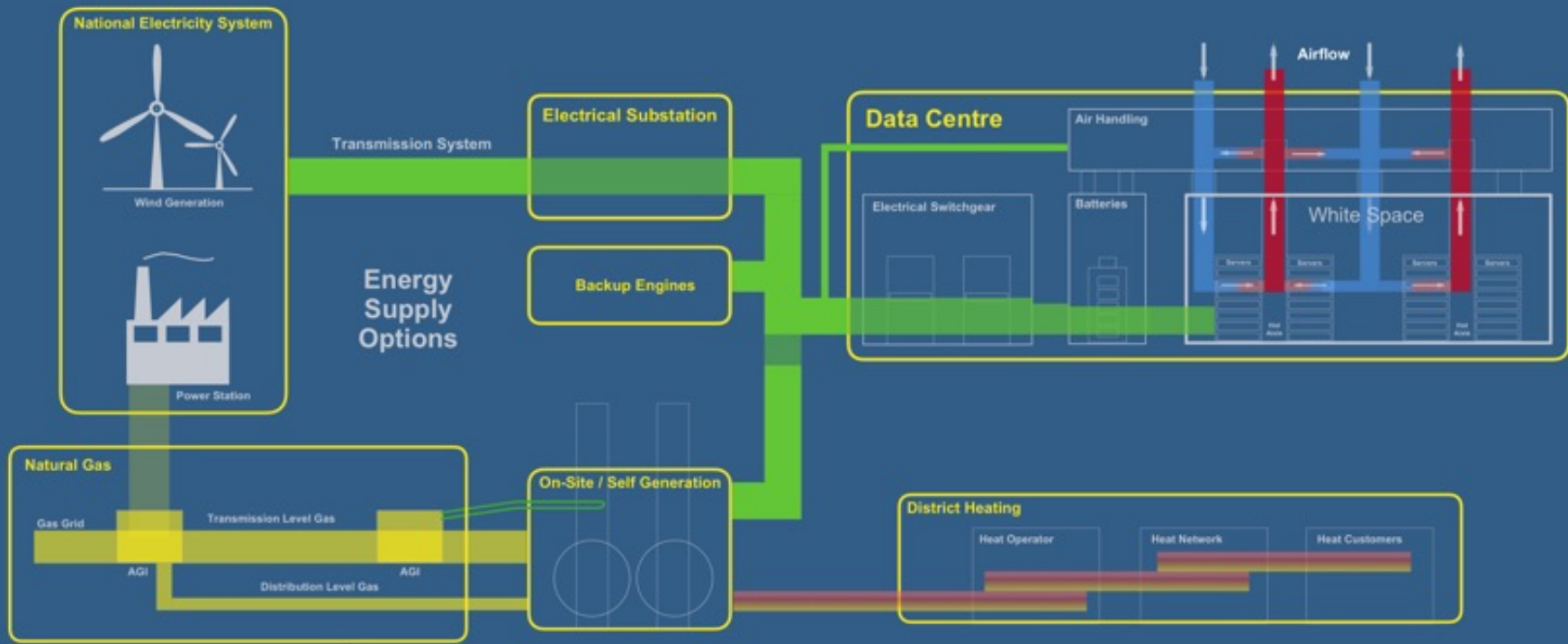
bitpower



How To Build an Efficient Data Centre



How To Build an Efficient Data Centre



How To Build an Efficient Data Centre



Transmission System

Electrical Substation

Backup Engines

Energy Supply Options

Data Centre

Air Handling

Electrical Switchgear

Batteries

Airflow

White Space

Natural Gas

Gas Grid

Transmission Level Gas

Distribution Level Gas

AGI

AGI

On-Site / Self Generation

District Heating

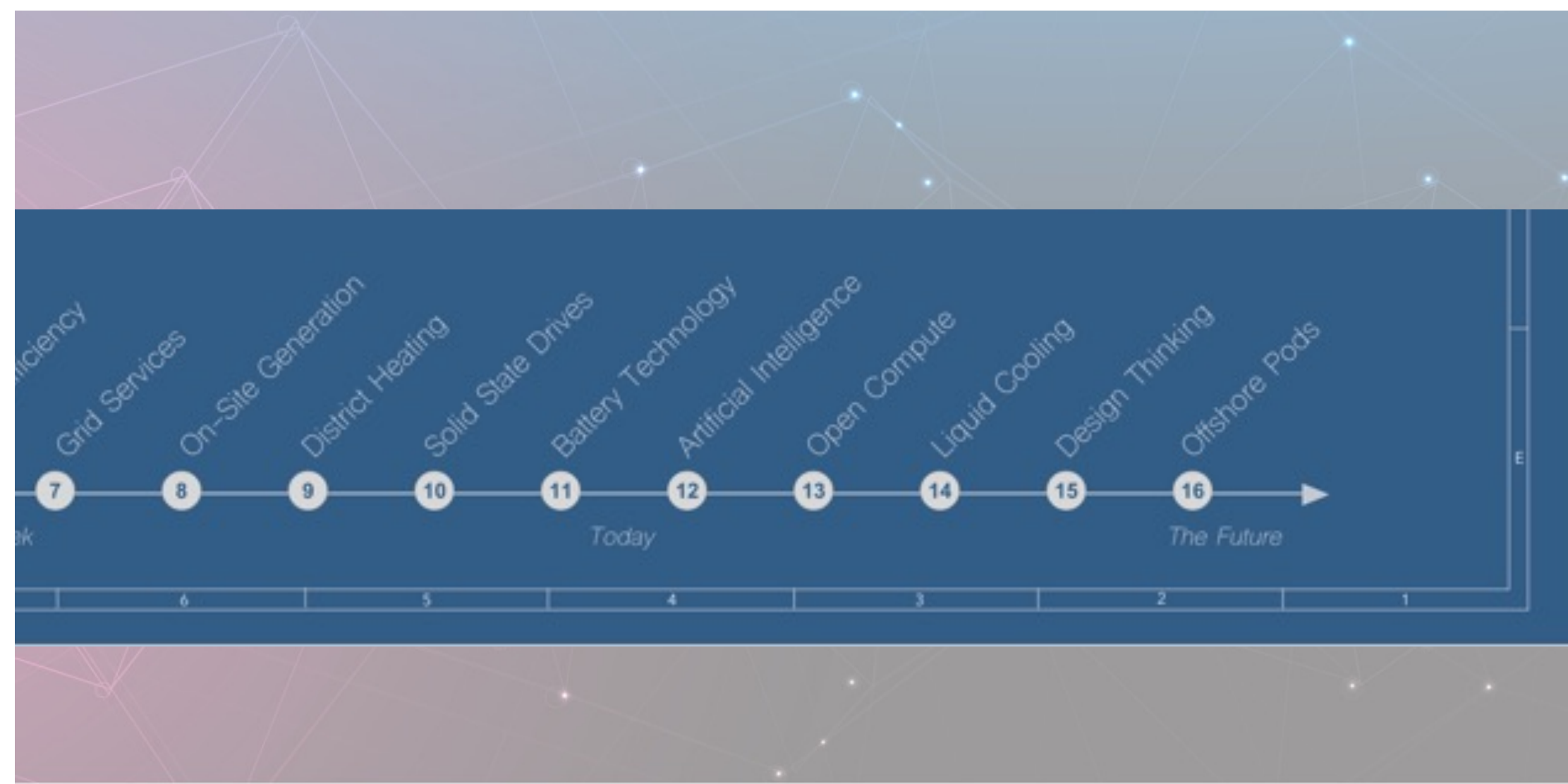
Heat Operator

Heat Network

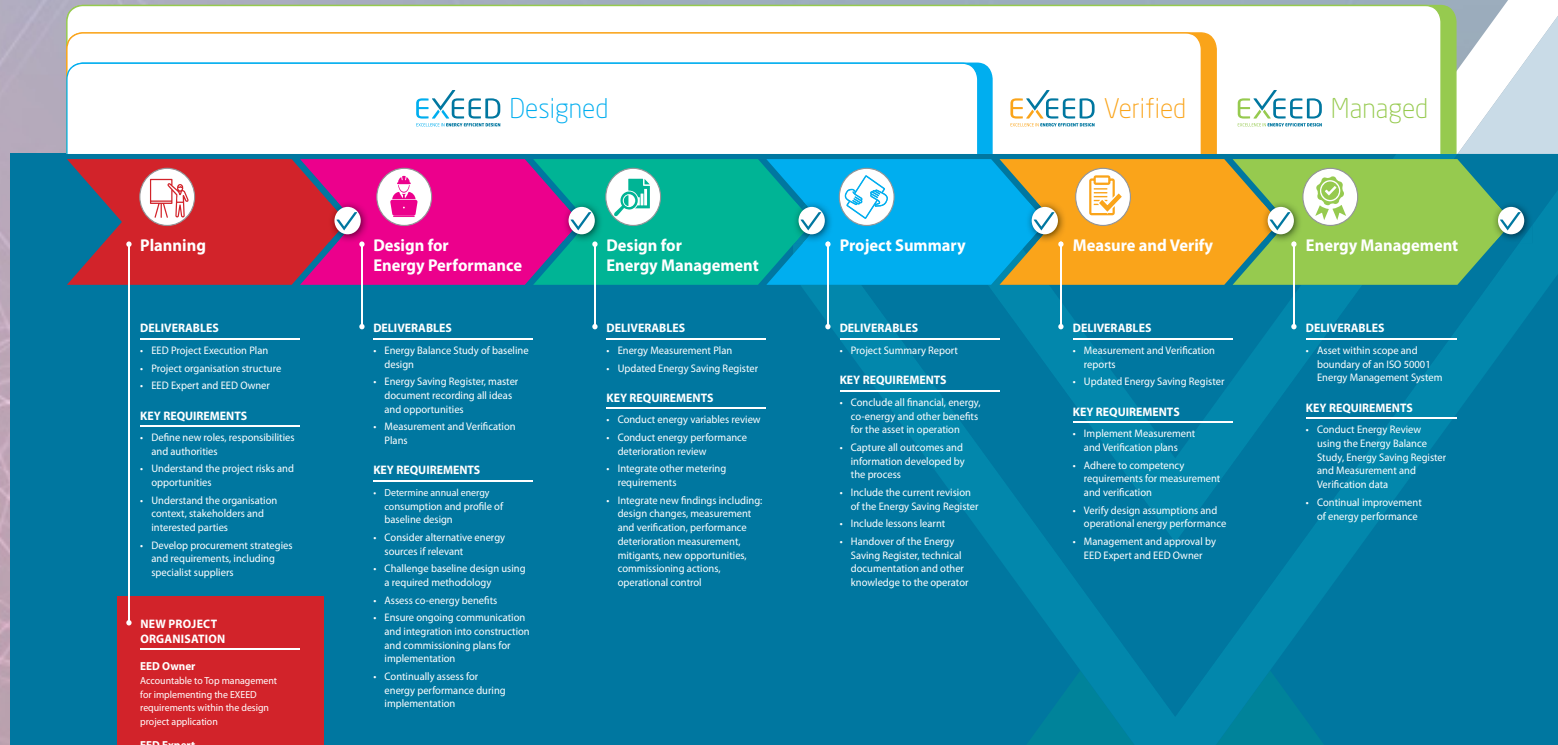
Heat Customers







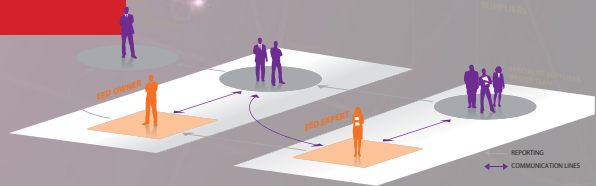
The EXEED process explained



NEW PROJECT ORGANISATION

EED Owner
Accountable to Top management for implementing the EXEED requirements within the design project application

EED Expert
Responsible for the day-to-day execution, coordination and management of the EED activities during the project lifecycle



Maximising Energy Efficiency in Data Centre Design

SEAI EXEED

8th May 2019

David McAuley

