Global Trend and Challenges to Internet Data Centre: High Energy Efficiency Strategies

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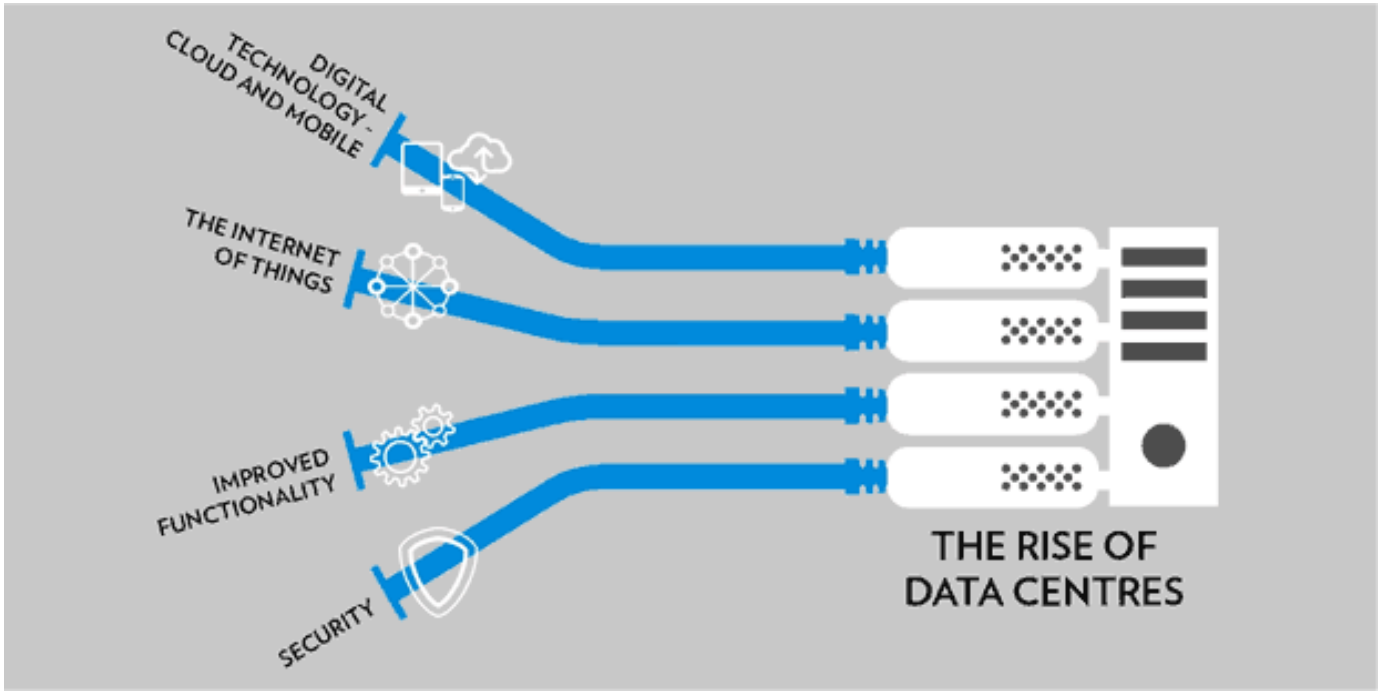
OVERVIEW

RISE OF INTERNET DATA CENTRES

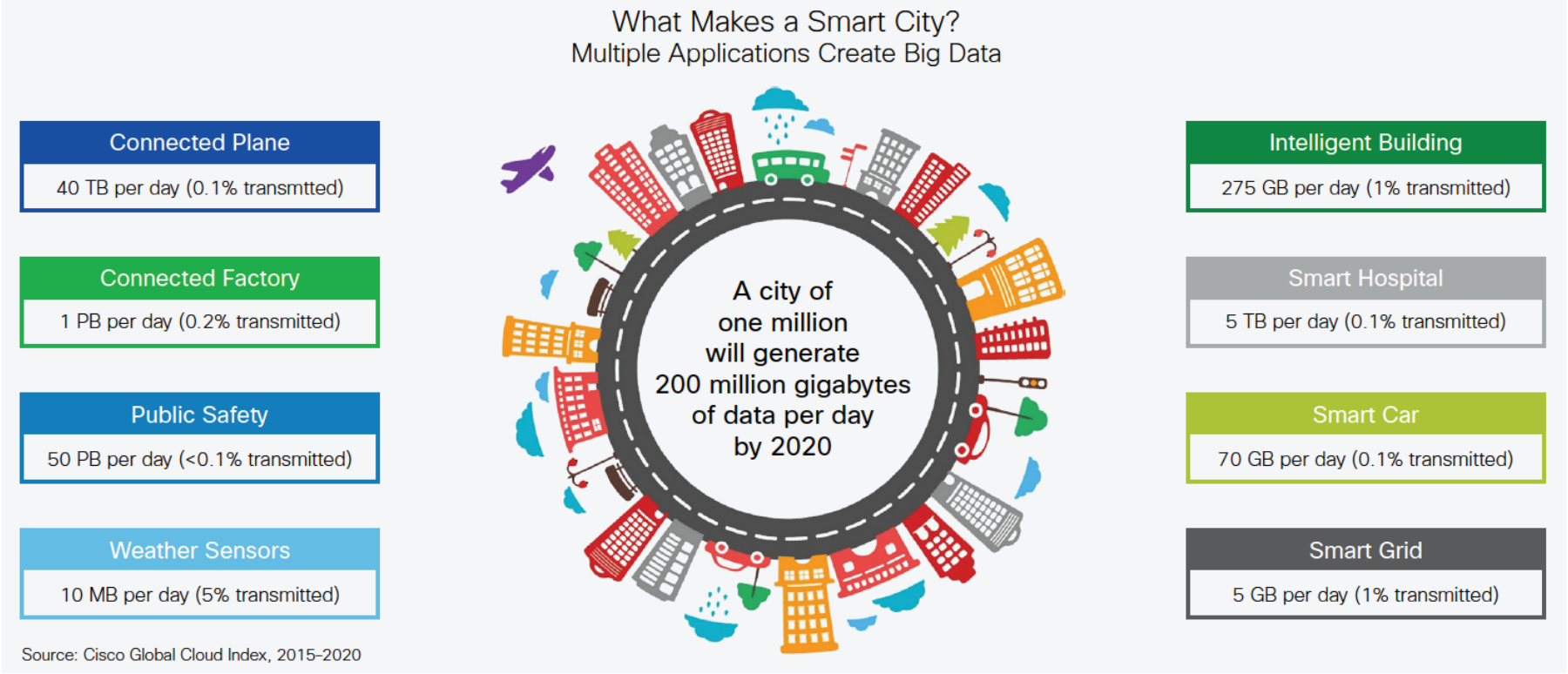
The Rise of Internet Data Centres (IDCs)

- Digital Technology – Cloud and Mobile
- The Internet of Things (IoT)
- Improved Functionality
- Security



The Rise of Internet Data Centres (IDCs)

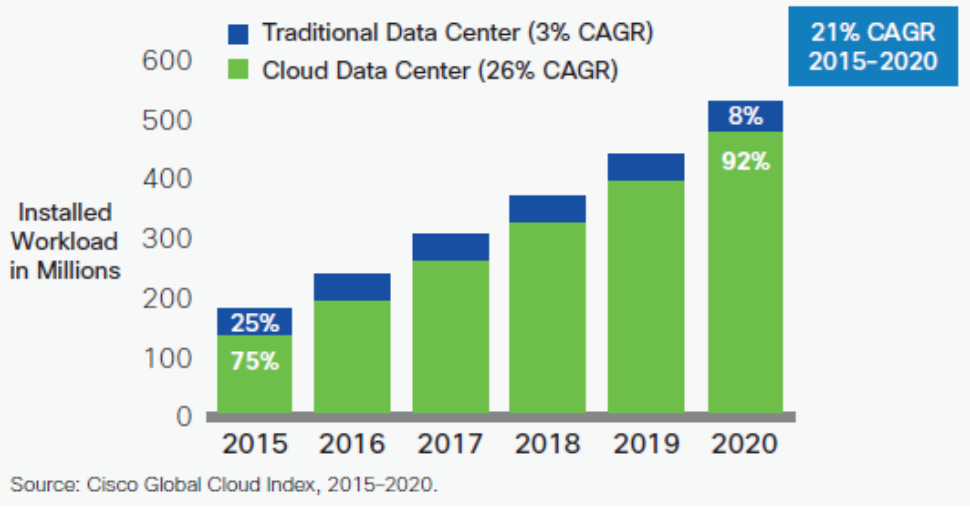
- Global visualization and big data

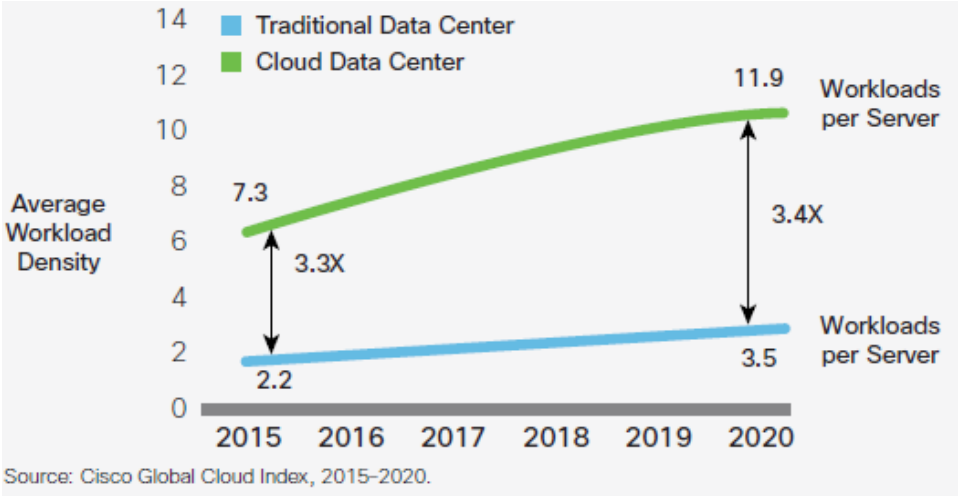


INTERNET DATA CENTRE (IDC) DEVELOPMENTS IN THE WORLD

Higher workloads in IDCs

- Workloads: By 2020, 92 percent of workloads will be processed by cloud data centers or IDCs.
- Workload density: grow from 7.3 in 2015 to 11.9 by 2020

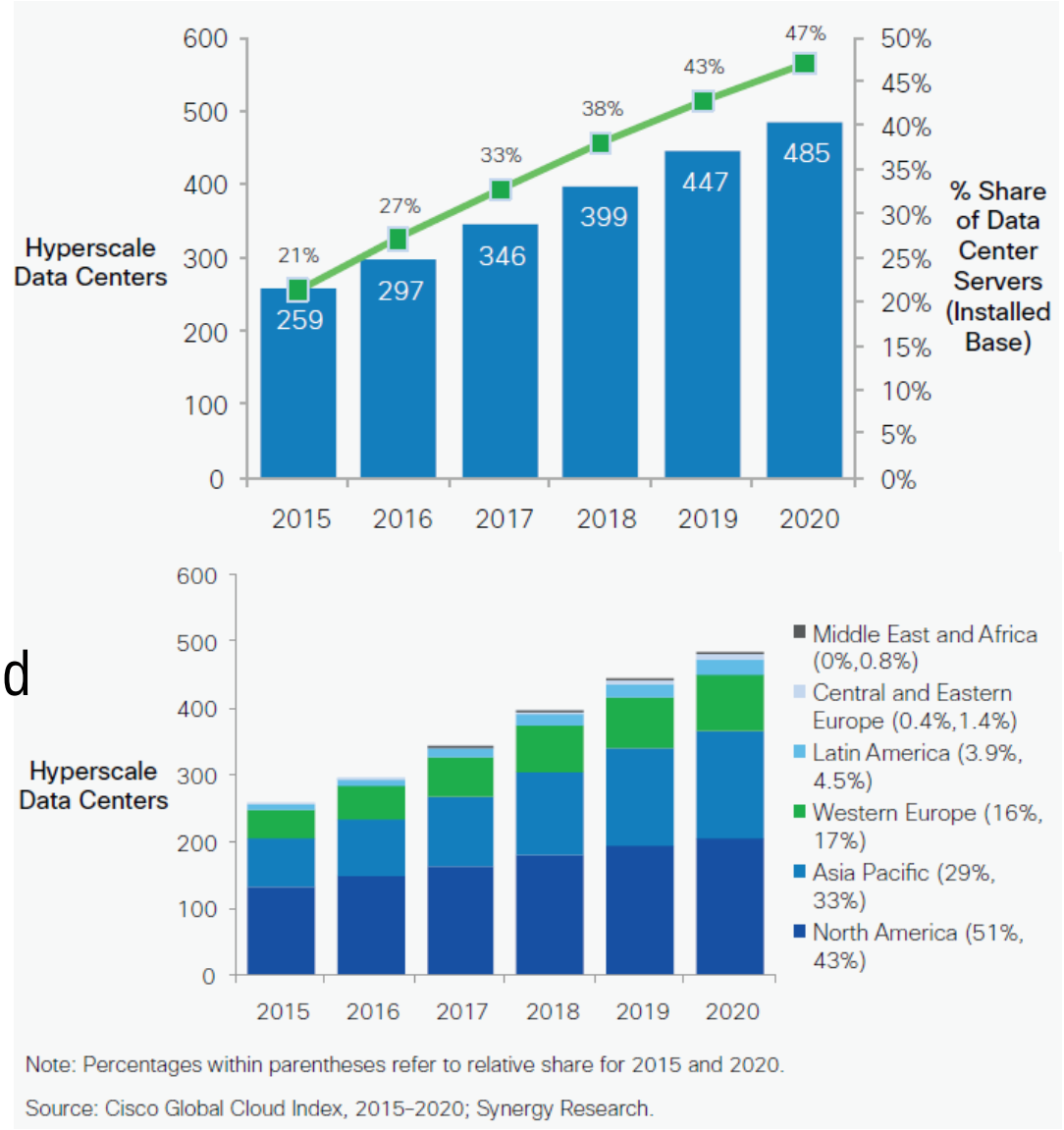




INTERNET DATA CENTRE (IDC) DEVELOPMENTS IN THE WORLD

Hyperscale IDCs

- Hyperscale data centers will grow from 259 in number at the end of 2015 to 485 by 2020.
- They will account for 83 percent of the public cloud server installed base in 2020 and 86 percent of public cloud workloads.



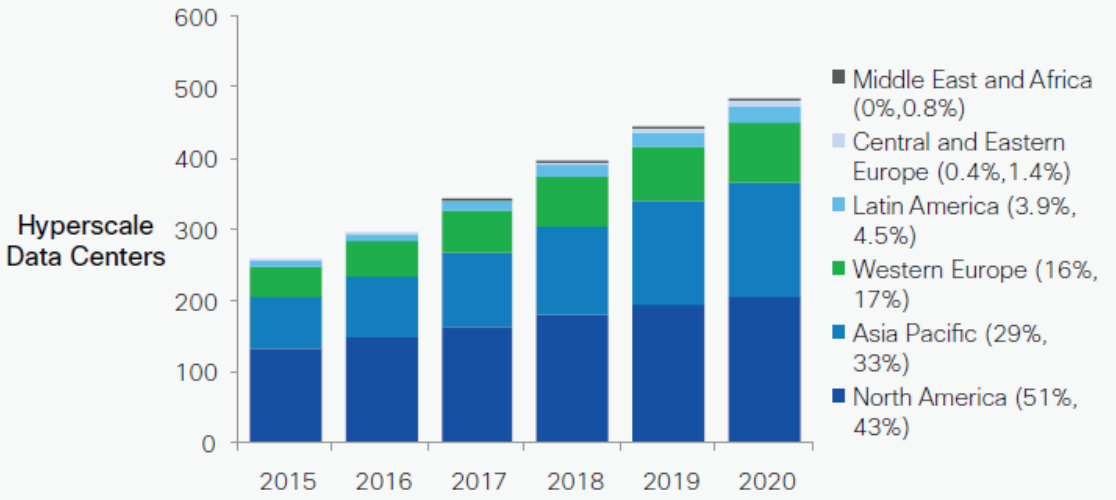
INTERNET DATA CENTRE (IDC) DEVELOPMENTS IN THE WORLD

Hyperscale IDCs

- They will represent 47 percent of all installed data center servers by 2020.
- Mainly located in North America, Asia and Western Europe.

By 2020, Hyperscale Data Centers Will House:		Today:
47%	of all data center **servers**	21%
68%	of all data center **processing power**	39%
57%	of all **data** stored in data centers	49%
53%	of all data center **traffic**	34%

Source: Cisco Global Cloud Index, 2015–2020.



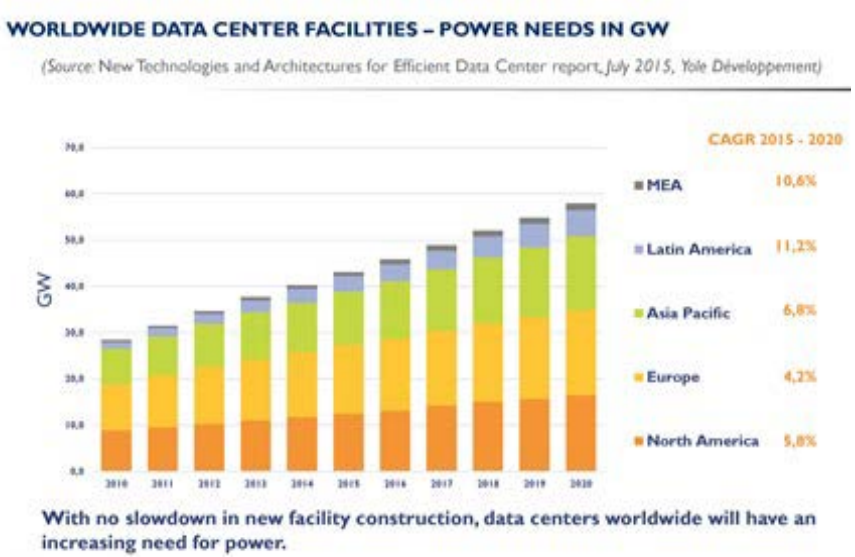
Note: Percentages within parentheses refer to relative share for 2015 and 2020.

Source: Cisco Global Cloud Index, 2015–2020; Synergy Research.

INTERNET DATA CENTRE (IDC) ENERGY CONSUMPTIONS

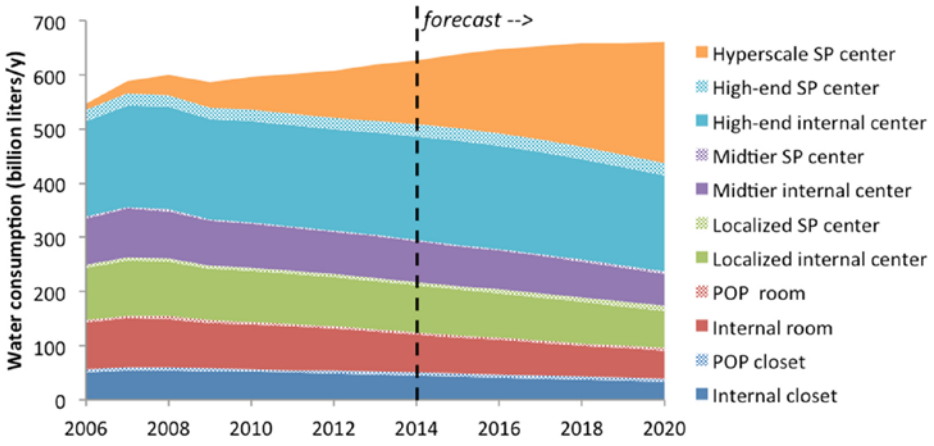
Electricity

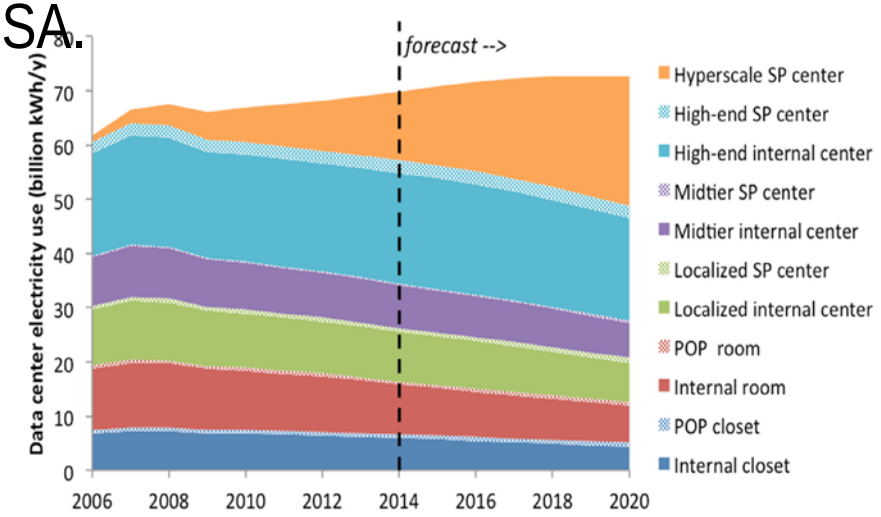
- The electricity capacity for IDCs will increase around 25-30%, comparing 2020 to 2016
- For the cases in USA, electricity consumption of hyperscale IDC double, comparing 2020 to 2016



Water

- Total water consumption in IDCs in USA.





STANDARDS AND INDICATORS OF ENERGY EFFICIENCY IN IDC

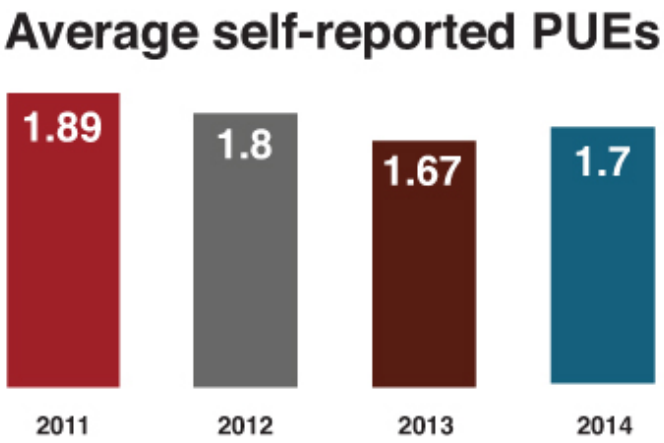
Standards and certification systems

Standards	• Singapore Standard SS564:2010 Green Data Centers • ASHRAE 90.4-2016 and TC 9.9
Regulations	• IT Service Management System (ITSMS) ISO/IEC 20000 • Benchmarking for Data Center Infrastructure –US DOE
Certification systems	• LEED for data centre • Energy Star • BREEAM

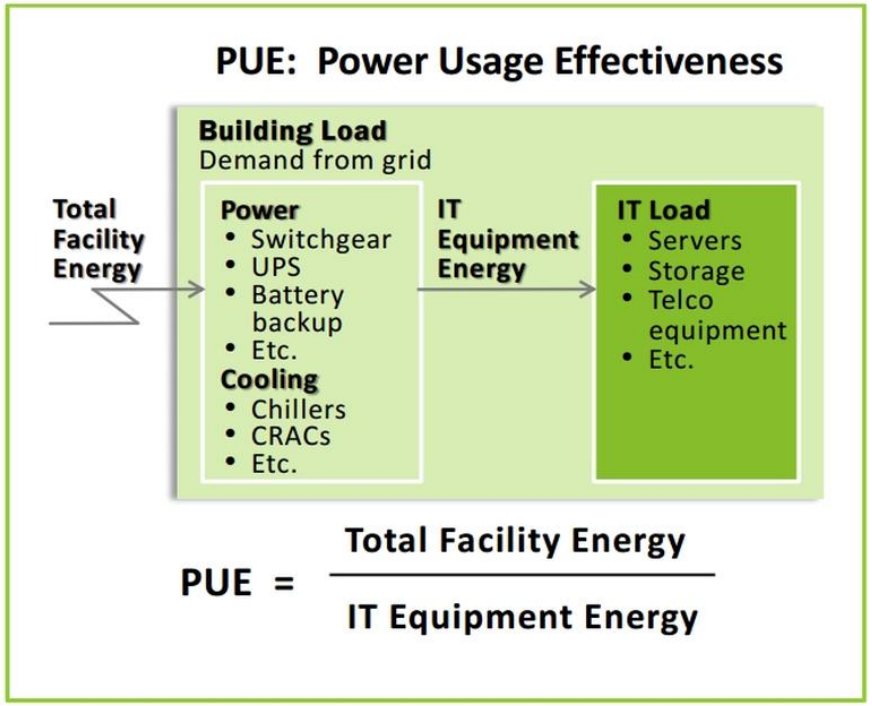
STANDARDS AND INDICATORS OF ENERGY EFFICIENCY IN IDC

Indicators for energy efficiency

- Power Usage Effectiveness (PUE)



Source: Uptime Institute Data Center Industry Survey 2014



PUE	DCiE	Level of Efficiency
3.0	33%	Very Inefficient
2.5	40%	Inefficient
2.0	50%	Average
1.5	67%	Efficient
1.2	83%	Very Efficient

STANDARDS AND INDICATORS OF ENERGY EFFICIENCY IN IDC

Indicators for energy efficiency

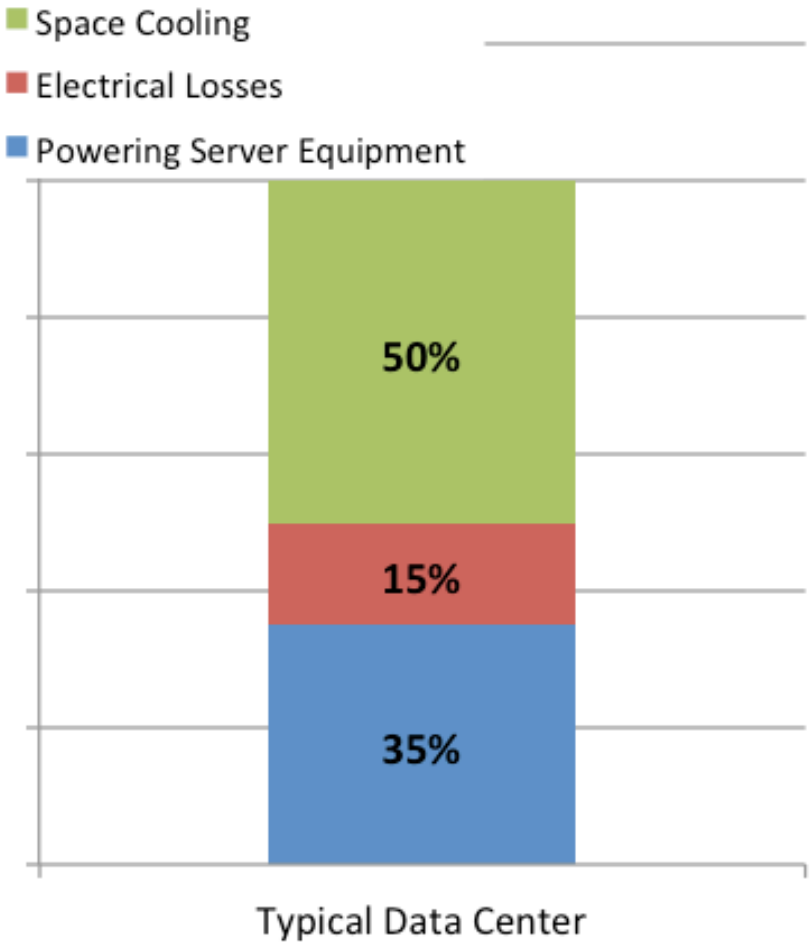
- PUE-Limitaions
  - Not measure in carbon intensity or water usage
  - Not consider the differences in IT equipment of T1/T2/T3/T4
  - Not consider the IT load changes
  - Not consider the efficiency of IT components themselves
  - Not consider usage of renewable energy or waste heat

STANDARDS AND INDICATORS OF ENERGY EFFICIENCY IN IDC

Indicators for energy efficiency

- other indicators
  - Carbon Usage Effectiveness (CUE)
  - Mechanical Load Component (MLC) (by ASHRAE 90.4)
  - Electrical Loss Component (ELC) (by ASHRAE 90.4)
  - Data Center Productivity(DCP) (by Green Grid)
  - Data Center energy Productivity (DCeP) (by Green Grid)
  - Corporate Average Data center Efficiency (CADE) (by Uptime Institute and McKinsey)
  - Performance per Watt (PPW) (by JouleX)

POTENTIAL ENERGY EFFICIENT TECHNOLOGIES IN IDC



Efficiency Strategies

Space Cooling
- Outside air economizers
- Expanded temperature setpoints
- Efficient cooling equipment
- Consolodation (hot/cold aisles)

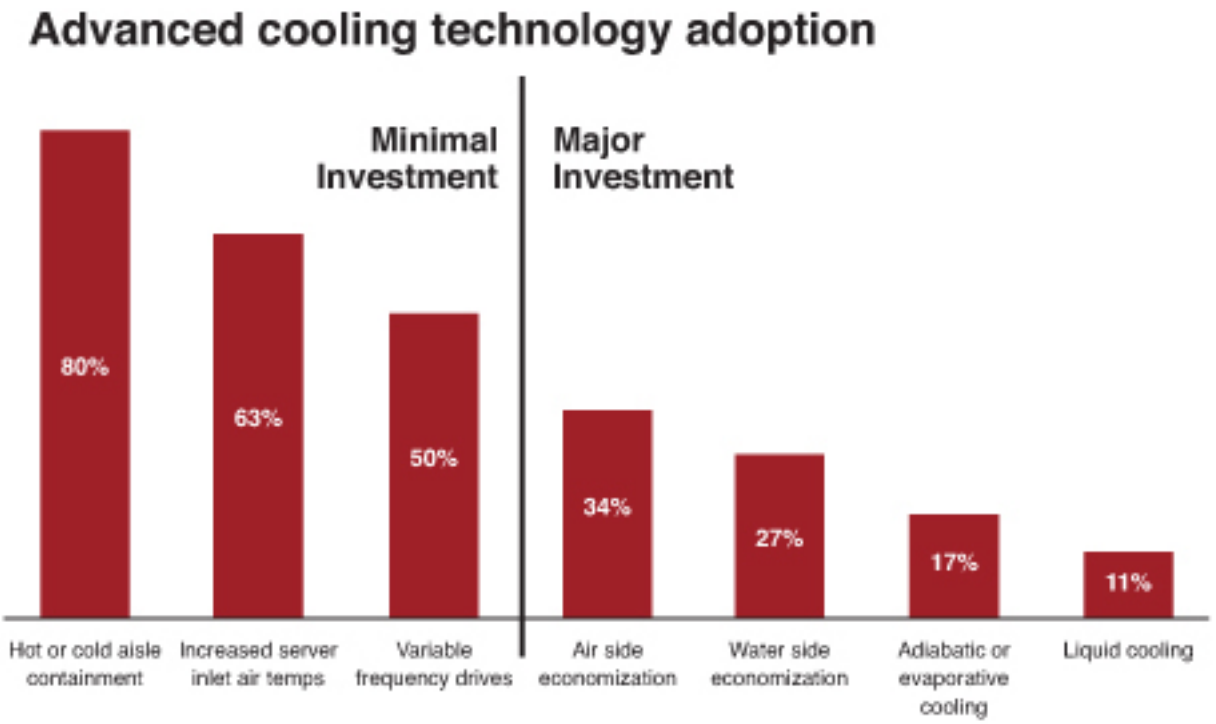
Electrical Losses
- Efficient hardware with VSD fans
- Optimized power distributiuon - invest in efficienct power supplies and voltage regulator circuitry

Powering Server Equipment
- Virtulaization

POTENTIAL ENERGY EFFICIENT TECHNOLOGIES IN IDC

Cooling systems

- Even though understood the importance of efficiency, more IDCs are tackling inefficient cooling systems in IDCs, when considering investment

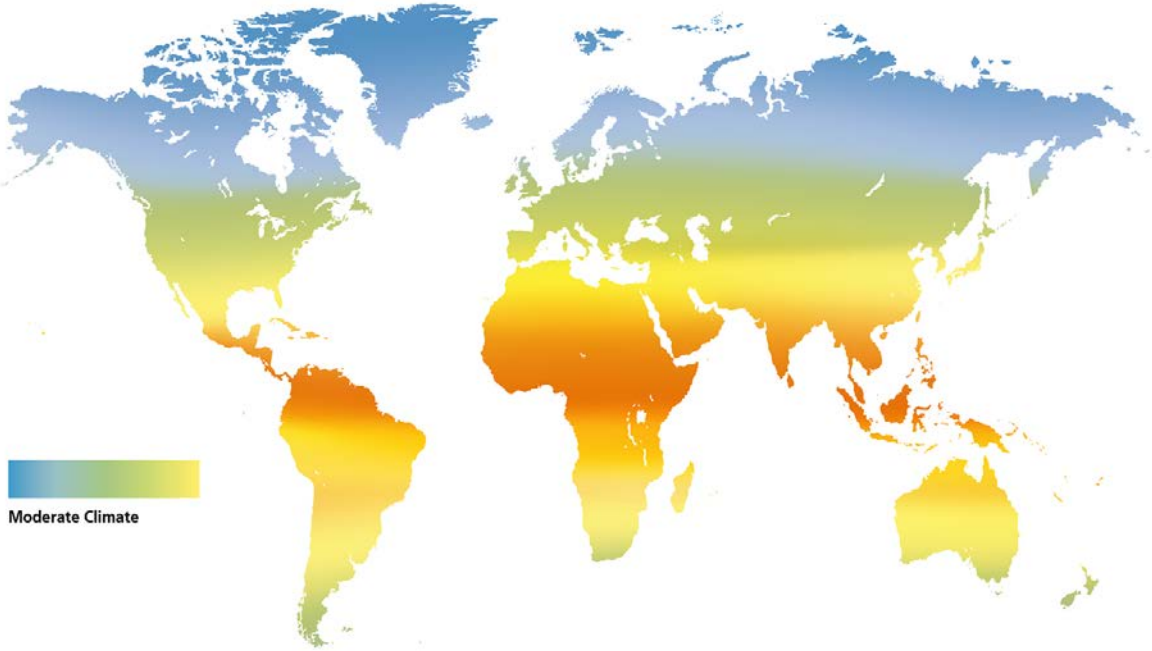


Source: Uptime Institute Data Center Industry Survey 2014

POTENTIAL ENERGY EFFICIENT TECHNOLOGIES IN IDC

Free cooling

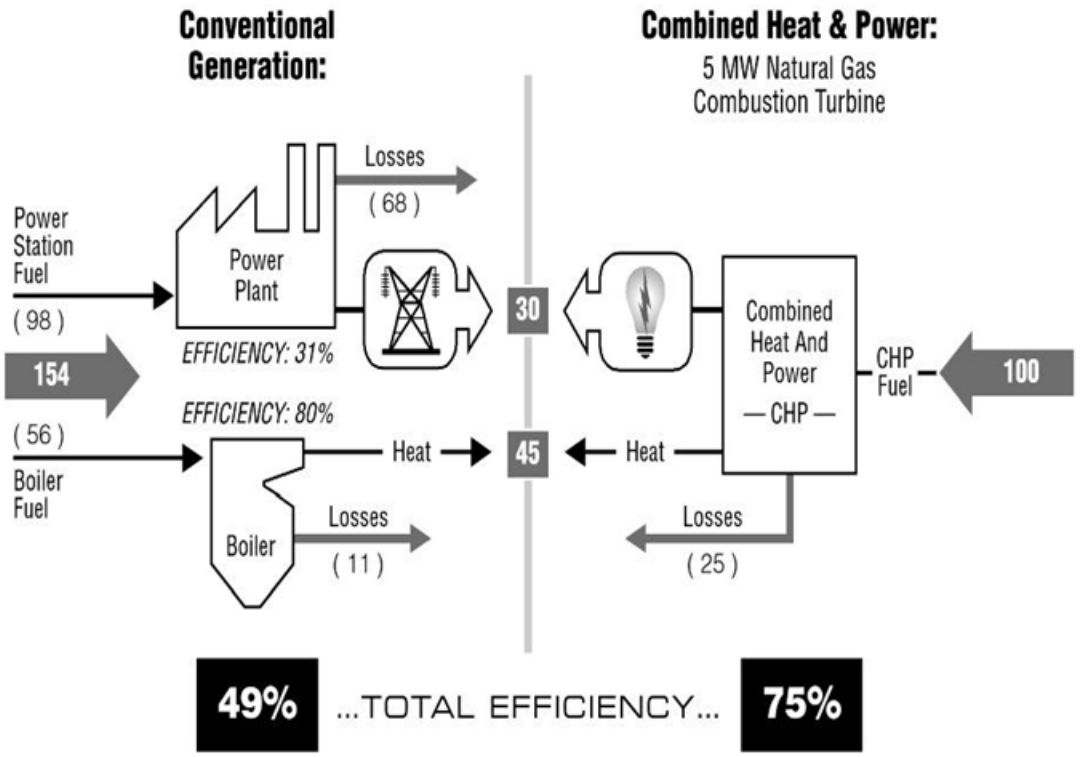
- Based on ASHRAE TC 9.9, it is possible for IDCs to utilize year-round cooling.
- Free cooling is not entirely free, since even air-side economization requires energy to move air, rotate a heat wheel, and so on.
- Annual average PUE can be reduced 20%-30%



POTENTIAL ENERGY EFFICIENT TECHNOLOGIES IN IDC

District energy system

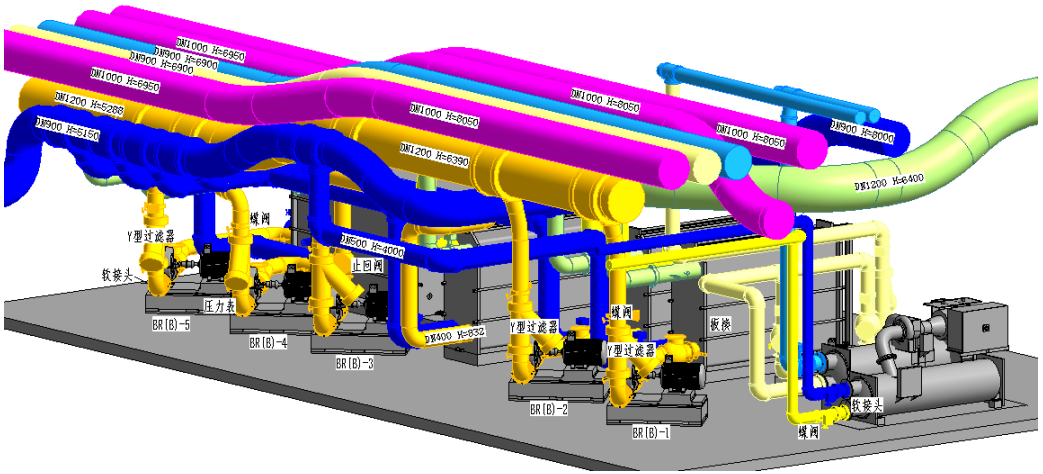
- Use cogeneration system to provide electricity, cooling to IDCs.
- The primary energy efficiency should be raise up to 70%, comparing to conventional system of 40%



POTENTIAL ENERGY EFFICIENT TECHNOLOGIES IN IDC

Building Information Modeling (BIM)

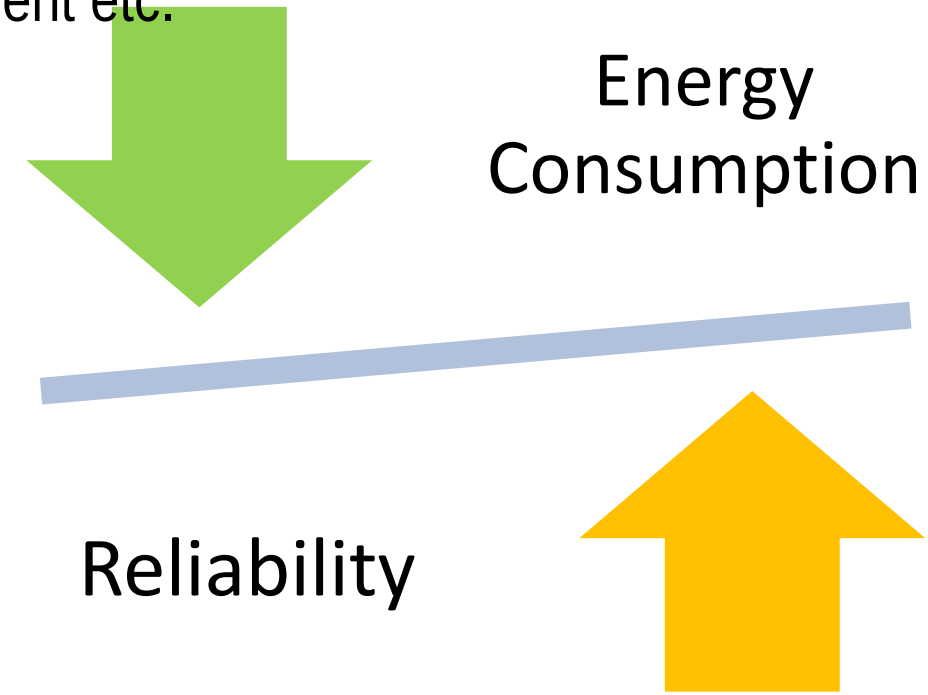
- Projects are better coordinated
- Ability to identify and assess problems faster.
- Improved management of design preparation.
- Easier maintenance.



UPCOMING CHALLENGES OF HIGH EFFICIENCY IDC

1. How to balance efficiency and reliability?

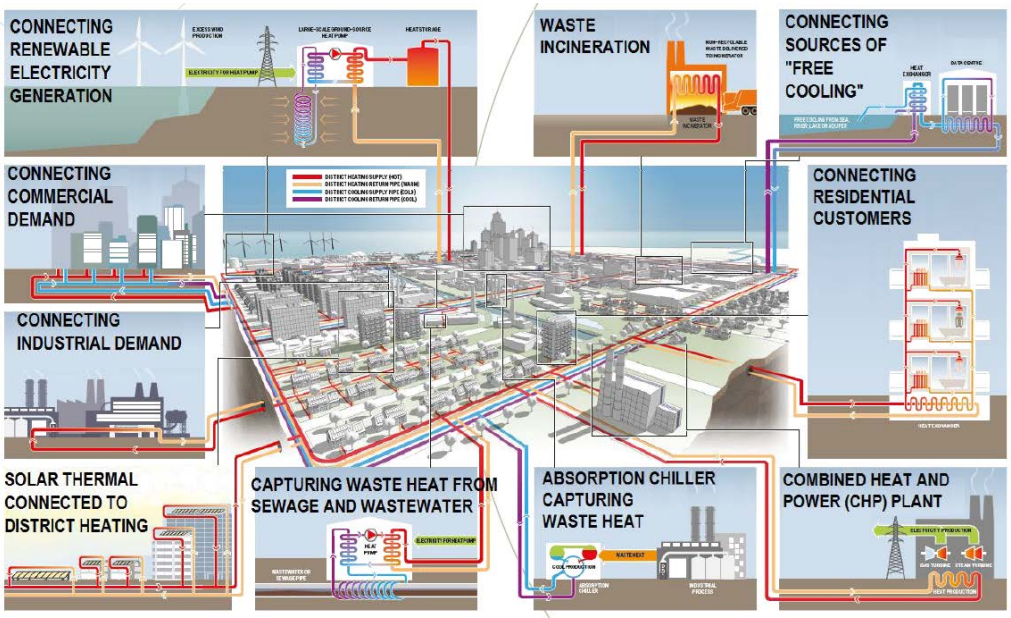
- Reliability of energy is the first priority in IDCs.
- Tier ranks of IDCs in TIA standard only consider standalone systems
- For hyper-scale IDCs, several clusters of IDC buildings are constructed together. It is possible to have shared system, including backup, cooling, thermal storage, water treatment etc.



UPCOMING CHALLENGES OF HIGH EFFICIENCY IDC

2. How to integrate energy systems in a district level (District Energy System, DES) with IDCs to increase energy efficiency?

- Development of IDCs is going to be coupled and hyper scaled for higher workloads and better supply of electricity, water etc.
- Reuse waste heat from IDCs to district heating system
- Use tri-generation systems to provide electricity and cooling to IDCs
- Use district cooling systems to provide cooling to IDCs



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Thank you very much

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