Host in Scotland

14.00 – 14.30	Registration
14.30 – 14.35	Welcome by **Polly Purvis OBE**, CEO, ***ScotlandIS***
14.35 – 15.00	Women In Tech – **Vicky Glynn**, Product Manager, ***brightsolid***
15.00 – 15.25	International Carrier – **Cato Lammenes**, Managing Director, ***Tampnet AS***
15.25 – 15.50	- **Charlie Boisseau**, CTO, ***Commsworld***
15.50 – 16.10	Break
16.10 – 16.35	The Future of Data Centres & NCI Integration – **Mauro Leuce**, Associate Director, Building Services, ***Atkins***
16.35 – 17.00	Elastic Critical Infrastructure – **Paul Johnson**, UK Data Centre Segment Leader, ***ABB***
17.00 – 17.15	Update & Close by **James King,** Founder & Chairman**, *Host in Scotland***
17.15 onwards	Networking & Canapes

ScotlandIS

SCOTTISH FUTURES TRUST

brightsolid

WOMEN IN TECH

WHAT ITS REALLY LIKE TO BE A 'WOMAN IN TECH'

GENDER BIAS

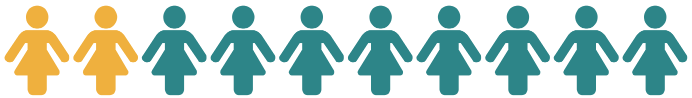
BLATANTLY AND UNEQUIVOCALLY EXISTS AND IS BAD FOR INDIVIDUALS, COMPANIES & COUNTRIES

Worldwide young women today are 33% more likely to study computer science compared to women born before 1983

There is only a gap of 7% between girls and boys who code before the age of 16. This used to be 20%

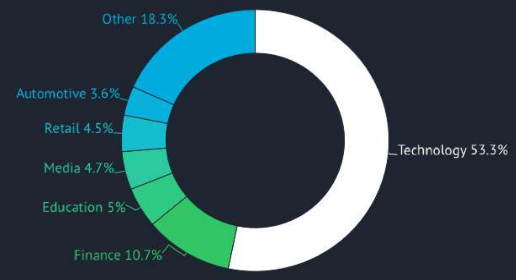
In Stem fields women only account for 15.8% employees

Only 6 countries in the world give women and men equal legal work rights



20% of women over 35 in tech are still in **junior positions**

The tech industry employs the more female programmers



There is a positive association between gender equality and per Capita GDP

IMF

“Gender equality is more than a goal in itself. It is a precondition for meeting the challenge of **reducing poverty**, **promoting sustainable development** and building **good governance**.”

Kofi Annan

WHAT IS IT REALLY LIKE…

BEING A WOMAN IN TECH?

FRUSTRATING & COMPLICATED

WOMEN IN TECH

As…

We don't like inequality

Then…

Positive discrimination is a challenge

As…

We are very individual in our opinions

Then…

No vagina 'Groupthink', we struggle with 'Women in Tech'

As…

Sexism is often hugely individualised

Then…

No collective experiences

PERSONAL TIPS

Women are not that sorry

Consider your air time… consider whether you should let someone start … rather then finish

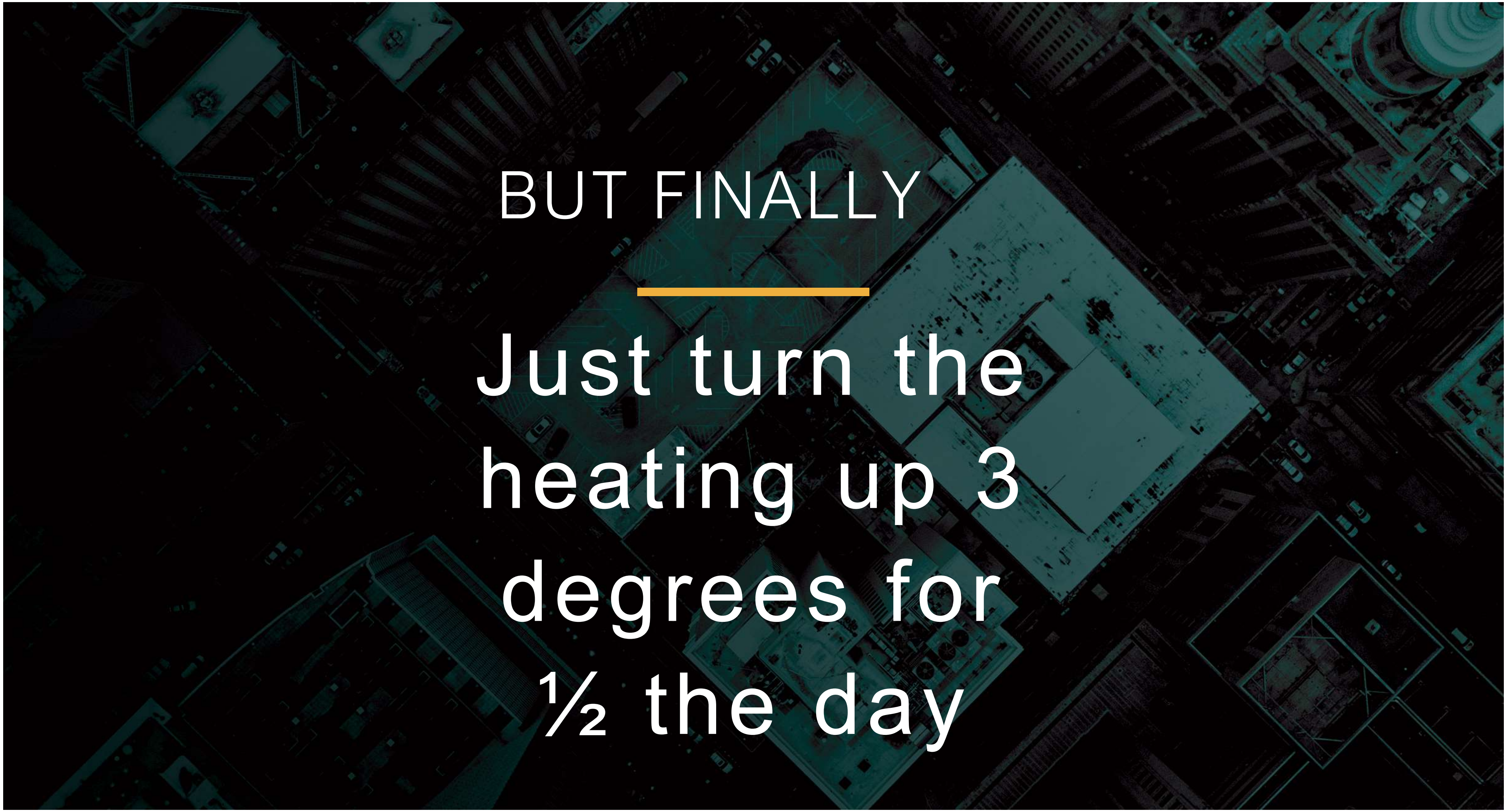
Lack of language is not lack of listening

Remove these words from your vocabulary: Bossy, Abrasive, Aggressive, Moist

Discern between the 'nod' of I am hearing you versus the nod of agreement.

Appreciate when we are looking for consensus

Agree more /
Recognise Ritual Opposition


BUT FINALLY
Just turn the heating up 3 degrees for ½ the day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INTERNATIONAL CARRIER
We deliver unparalleled connectivity for your business critical operations.
Raising the Standard

OUR BUSINESS AREAS

We deliver unparalleled connectivity for your business critical operations.

Oil & Gas

Wind Energy

Maritime

International Carrier

tampnet

KEY FIGURES

FOUNDED
2001

HEADQUARTER IN
STAVANGER

100+
EMPLOYEES

OFFICES IN ABERDEEN, AMSTERDAM, MALMØ, HOUSTON, LAFAYETTE, RIO AND SYDNEY

OWNERS
3I & ATP

650
MILLION NOK TURNOVER

350
OFFSHORE INSTALLATIONS

3 000 KM
FIBER OPTIC NETWORK

tampnet

HISTORICAL MILESTONES

2001

Statoil acquires the subsea fibre network out of Enitel bankruptcy and later establishes Tampnet

2003

Installs subsea fibre from Oseberg to Grane, completing the ring structure

Wins contract with Shell to provide communications in the Northern North Sea

2007

Wins contract with ExxonMobil

Acquires fibre network in the East of Shetland area from Shell

2009

Wins TAQA and Fairfield contracts

Wins 15 year contract with Talisman Energy

2010

New business strategy for Tampnet implemented and sales process initiated

HitecVision acquires Tampnet from Statoil

2011

Tampnet acquires North Sea Communications from TeliaSonera

Exchange agreements with BP & CNSFTC

tampnet

HISTORICAL MILESTONES

2012

EQT acquires Tampnet from HitecVision

First LTE pilot

2013

Tampnet awarded new fibre-laying contracts;

300 km with new subsea fibre to three new fields (Statoil, GDF Suez, Lundin & Total)

Commercializing LTE services

2014

Acquire US based Airtap, leading offshore broadband provider

Acquire CNSFTC from BP

2015

Tampnet acquires Broadpoint in US, and enter into a long-term roaming agreement with AT&T for the GoM region

Tampnet starts to deploy LTE in the GoM

2016

Tampnet approved by FCC in US as common carrier

Tampnet sign a MOU with BP GoM to use the subsea fibre and deploy 4G LTE on deep water assets

Tampnet awarded the subsea fibre project to the Culzean field

2018

3i Infrastructure and ATP acquire Tampnet from EQT.


tampnet
THE TAMPNET
DRIVE
DEDICATED
CARING
INTEGRITY
INNOVATIVE
RELIABLE

TAMPNET VALUES

DEDICATED

CARING

INTEGRITY

INNOVATIVE

RELIABLE

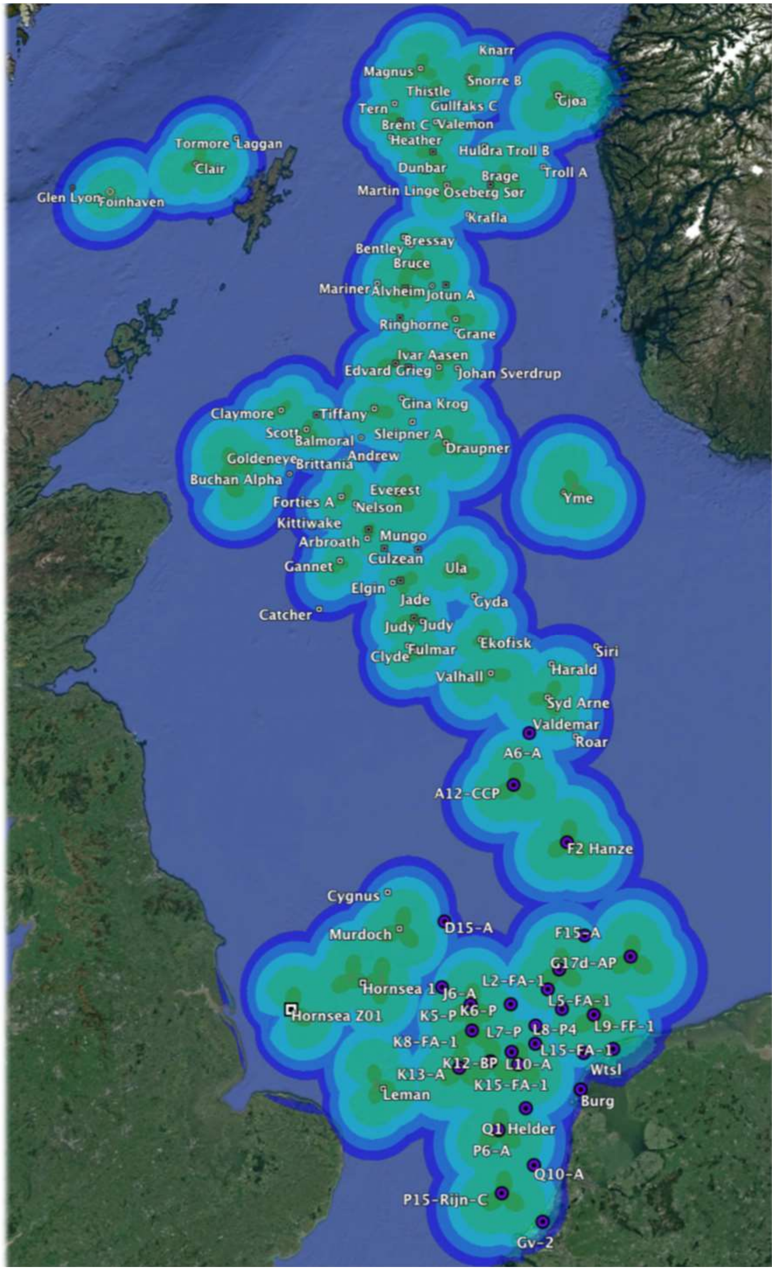
VISION & MISSION

Tampnet's **vision** is to become a global leader in providing high capacity, low latency and reliable connectivity to offshore installations, mobile rigs and vessels.

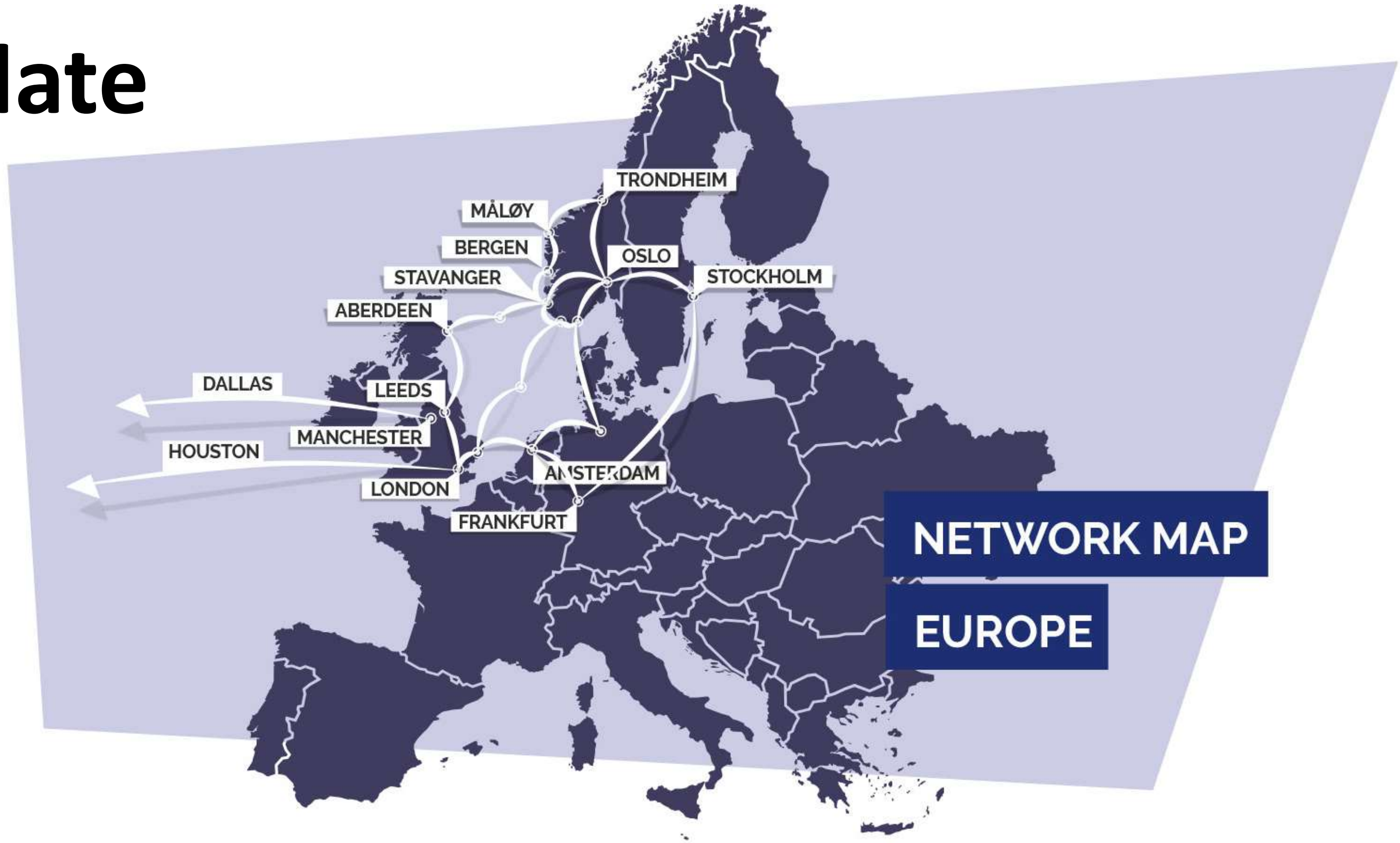
Tampnet's **mission** is to add value to our customers through connecting offshore assets to robust and reliable terrestrial network with high capacity and low latency. Our services shall enable our customers to improve on quality, health, safety, efficiency and welfare in their offshore operations.

4G/LTE Coverage 2019

- Bruce
- Clair Ridge
- Leman A
- Kittiwake
- Syd Arne
- Harding
- Magnus
- Lomond
- Draupner
- 12 x The Netherlands



Carrier Update



#2 PoP´s Stockholm
#2 PoP´s Frankfurt
#2 PoP´s Houston & Dallas

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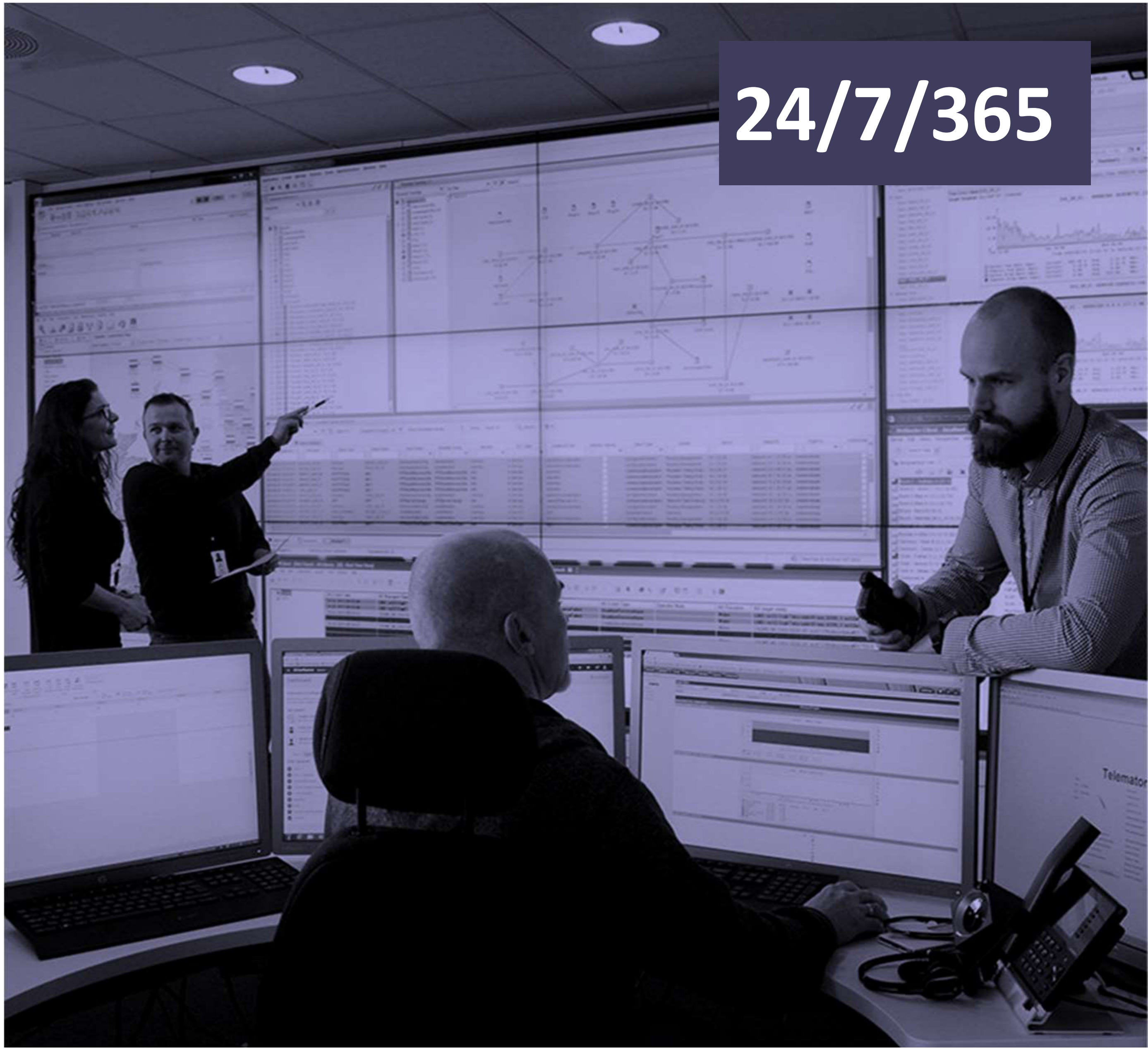
Network Operations Centre

- State of the art
- Instant response (avg 28 sec)
- Proactive vessel traffic monitoring
- Offshore dispatch within 2 hours
- Uptime higher than 99,95%
- Mean time to repair under 2 hours



Tampnet Core Network

Key Differentiators

- Unique Diversity
- Low Latency
- High Capacity
- Cloud provider online

New for 2018

- Link to Houston
- Link to Frankfurt

Planned 2019

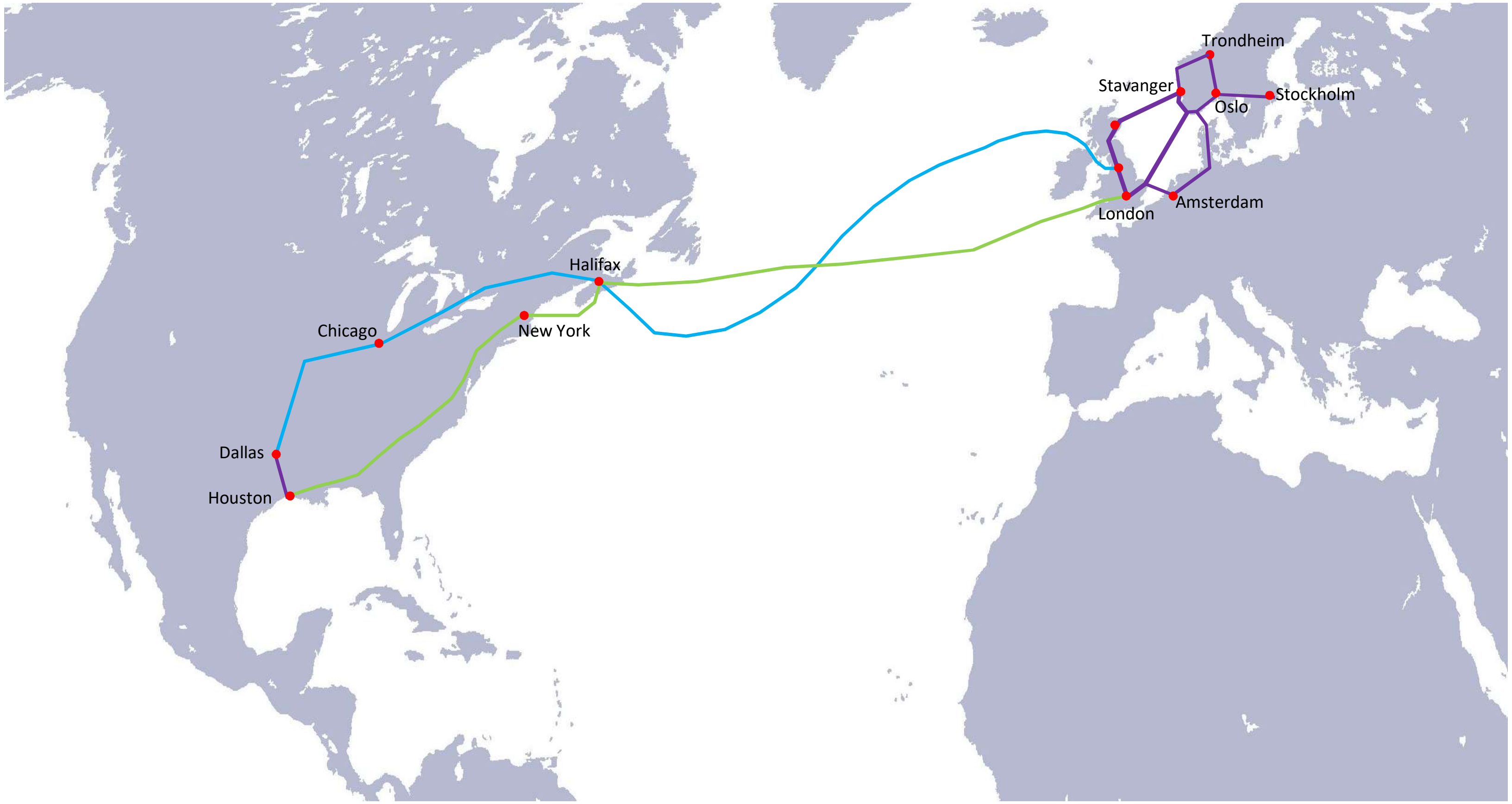
- Frankfurt- Stockholm (new unique route)
- Dublin
- Egersund – Aberdeen
    - New Fibre

Transatlantic Network

London-
Houston:
96ms

Stockholm-
Houston:
116ms

Frankfurt-
Houston:
107ms



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Products

Wholesale Capacity

Available Now

- 10G to 100G
- OTN
- Encryption

Fibre Solutions

Available Now

- Dark Fibre
- Bright Fibre
- Submarine & Terrestrial Builds

Managed Connectivity

Available Now

- Direct Access to Public Cloud
- DC -Connect
- EoMPLS
- IP Transit

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IP Transit & Internet Product

New customers signed for Internet Service from Tampnet!

- London Internet Exchange – Norwegian Internet Exchange and Netnod Stockholm
- **AMS-IX**
- **DE-CIX** soon online
- Capacity 100Mb to 10Gig
- Tier1 provider
- **LINX – Edinburg 2018**

IPv4 ~140.000
IPv6 ~ 23.000

IPv4 ~170.000
IPv6 ~ 24.000

netnod

IPv4 ~75.000
IPv6 ~ 13.000

tampnet

Selected Data Centres

Green Mountain

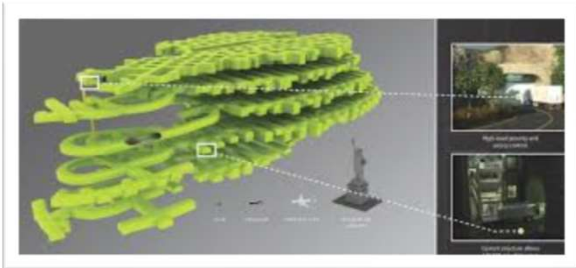
- Two data Centres located on Norway’s western coast
- Tier III certified by Uptime Institute
- One facility is in former NATO facility and other is near Hydro Power facility

Bulk N01 / Kristiansand

- Located near two Tampnet CLSs on direct fibre to Oslo
- Strategic location on National Grid (3600 MW available)
- Containerized design for extreme hyper-converged uses
- Master plan calls for 500 Hectare campus
- 2N + 1 to London – Amsterdam - Frankfurt

Lefdal Mine

- Located 250km North of Tampnet’s Karsto CLS
- 120,000 square meters of data hall space
- Built into former mine complex
- Powered and cooled by water



THANK YOU FOR YOUR ATTENTION

—

Cato Lammenes, Managing Director

cl@tampnet.com

Cell: +47 930 88 839

TAMPNET.COM

The Future of Data Centres & NCI Integration

07 March 2019 – Edinburgh – Host in Scotland

Our vision

We strive to be the premier engineering solutions partner, committed to delivering complex projects from vision to reality for a sustainable lifespan.

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Member of the SNC-Lavalin Group

Increased geographic reach

- An established and balanced footprint
- Greater "at-scale" European and Middle Eastern presence

APPROXIMATELY
50,000
EMPLOYEES

SPEAKS
70
LANGUAGES

WORK FROM OFFICES IN OVER
50
COUNTRIES

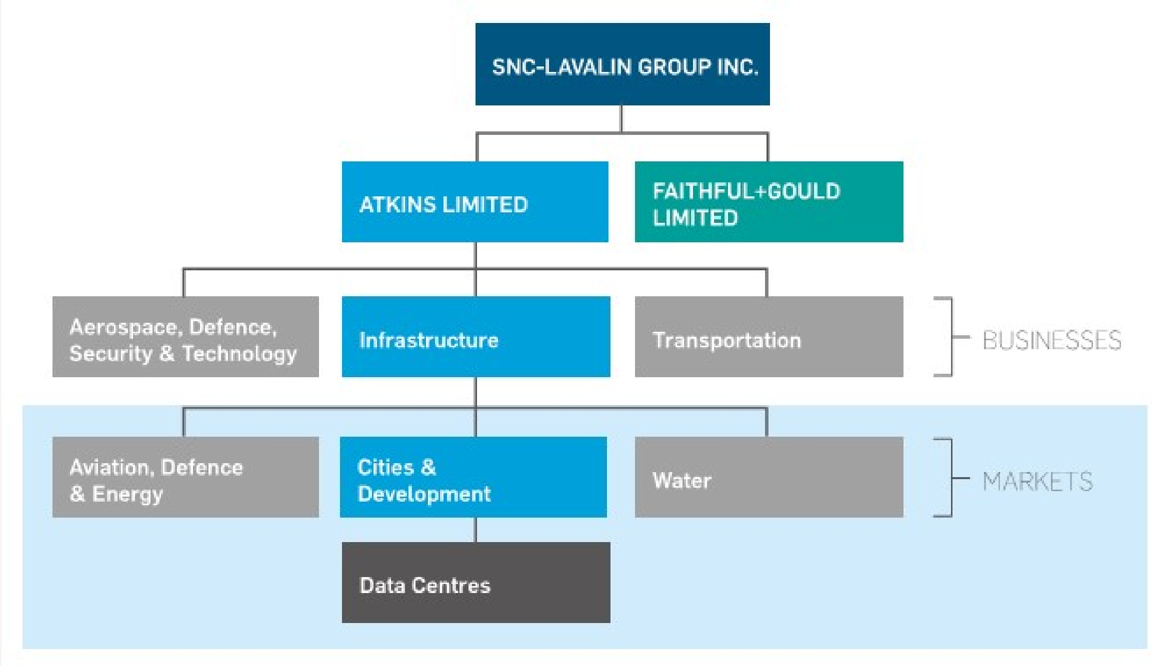
REPRESENTS SOME
130
NATIONALITIES

- Atkins Energy segment allocated 41% Europe, 46% North America, 9% Middle East & Africa and 4% Asia Pacific
- Atkins segmentation based on fiscal year ended March 31, 2016 applied to twelve month period ended September 30, 2016
- Pro forma financials based on SNC-Lavalin fiscal year ended December 31, 2016 and Atkins twelve month period ended September 30, 2016

Enhanced value-chain

A more comprehensive end-to-end service offering

- Capital
- Consulting & Advisory
- Digital & AI
- Design & Engineering
- Procurement
- Construction & Project Management
- Operations & Maintenance
- Sustaining Capital



Data Centres play an important role in the Energy market, stimulating investments in Renewable Energy, in the power Grid and challenging its robustness due to the dynamic effect of large connected loads

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National Critical Infrastructure and Climate Change Plan

Are we ready?

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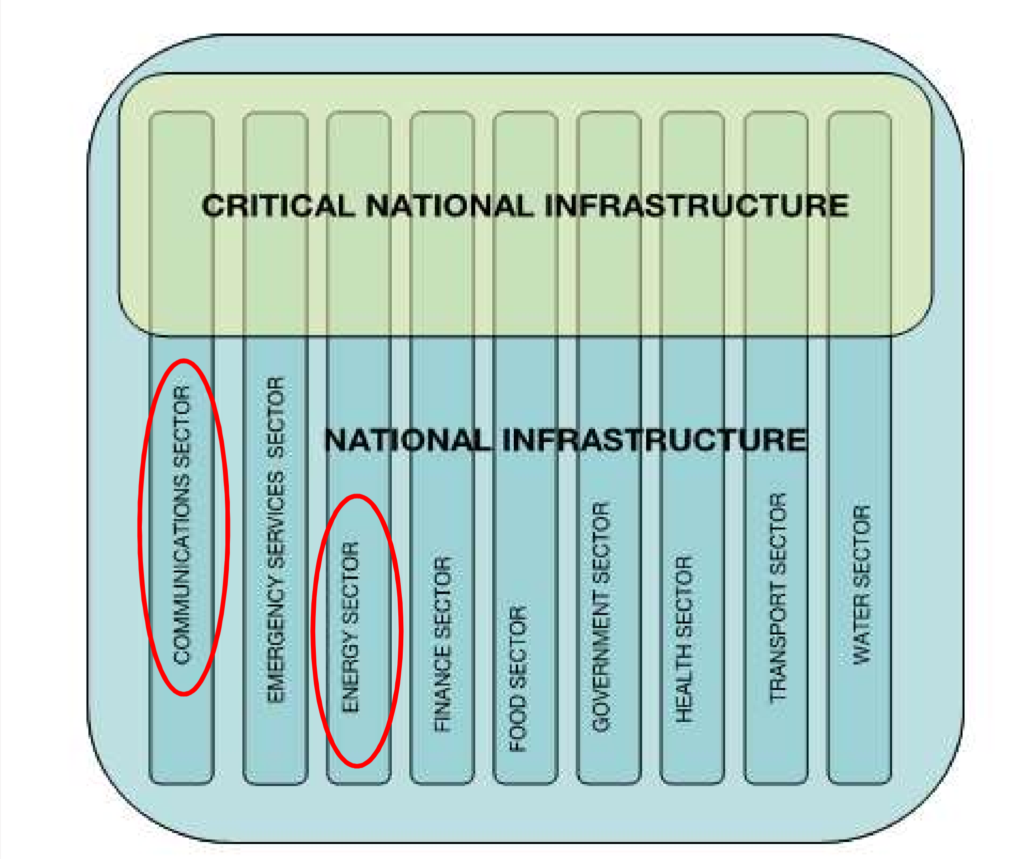
Critical Infrastructure

2011 – Preparing Scotland

› The strategy focused on Scotland's contribution to infrastructure security and resilience with a specific interest on NCI assets.



https://www2.gov.scot/Resource/Doc/346469/0115308.pdf

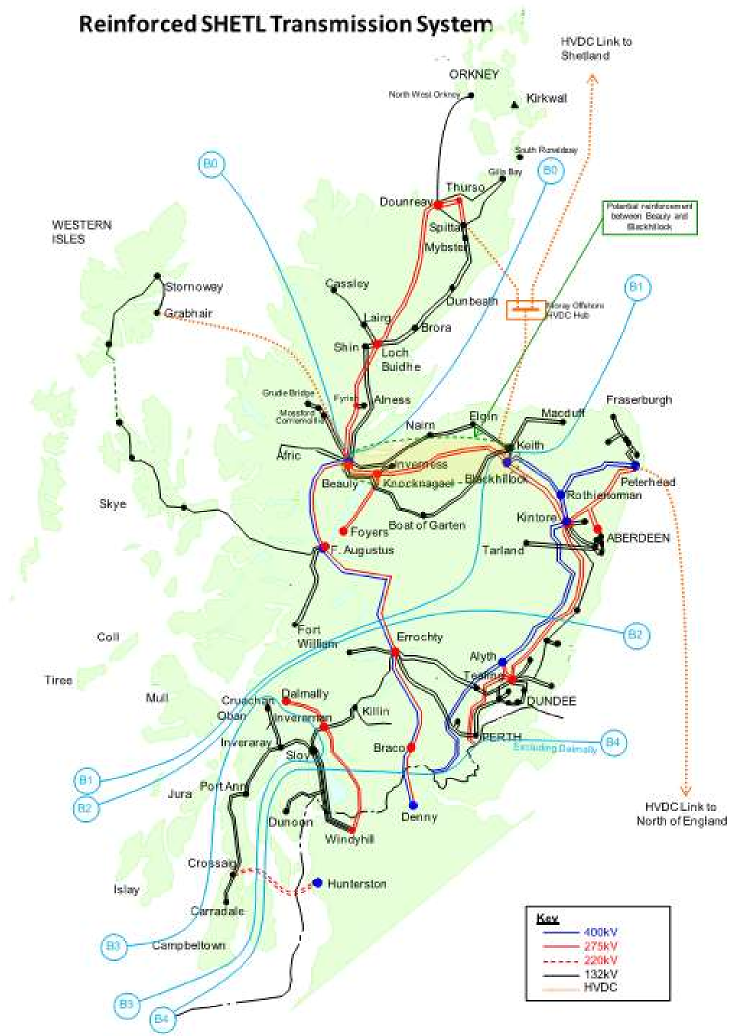
HV Infrastructure Reinforcement

2012 – ENSG (now SSF)

- The ENSG was jointly chaired by the Department for Business, Energy and Industrial Strategy (BEIS) and Office of Gas and Electricity Markets (Ofgem). **Its broad aim was to identify, and co-ordinate work to help address key strategic issues that affect the electricity networks in the transition to a low-carbon future.**
- ***HV Transmission Lines Reinforcement***
- Under the Gone Green 2011 scenario 12 about **6.3GW of new generation** would be connected by the end of 2020 in SHETL's area. This includes
  - 3.5GW of onshore wind
  - 2.2GW of offshore wind
  - 0.6GW of marine generation.

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/48274/4263-ensgFull.pdf

OUR ELECTRICITY TRANSMISSION NETWORK:
A VISION FOR 2020



Energy Strategies

2017 – UKERC

- **UKERC welcomes the Scottish Government's energy and climate policy ambition**, and applaud the valuable lead it is taking on energy. This has the potential to bring economic and social advantages.

Key Elements:

- ***Bio-Energy***
- Renewable generation tends to be located in different places from fossil fuelled generation; power flows on the network change as a result, giving rise to a possible need for ***network reinforcement***.
- the Plan envisages a need for £7bn spending on transmission networks by 2032
- ***Resilience and Grid Stability***

UKERC
UK Energy Research Centre

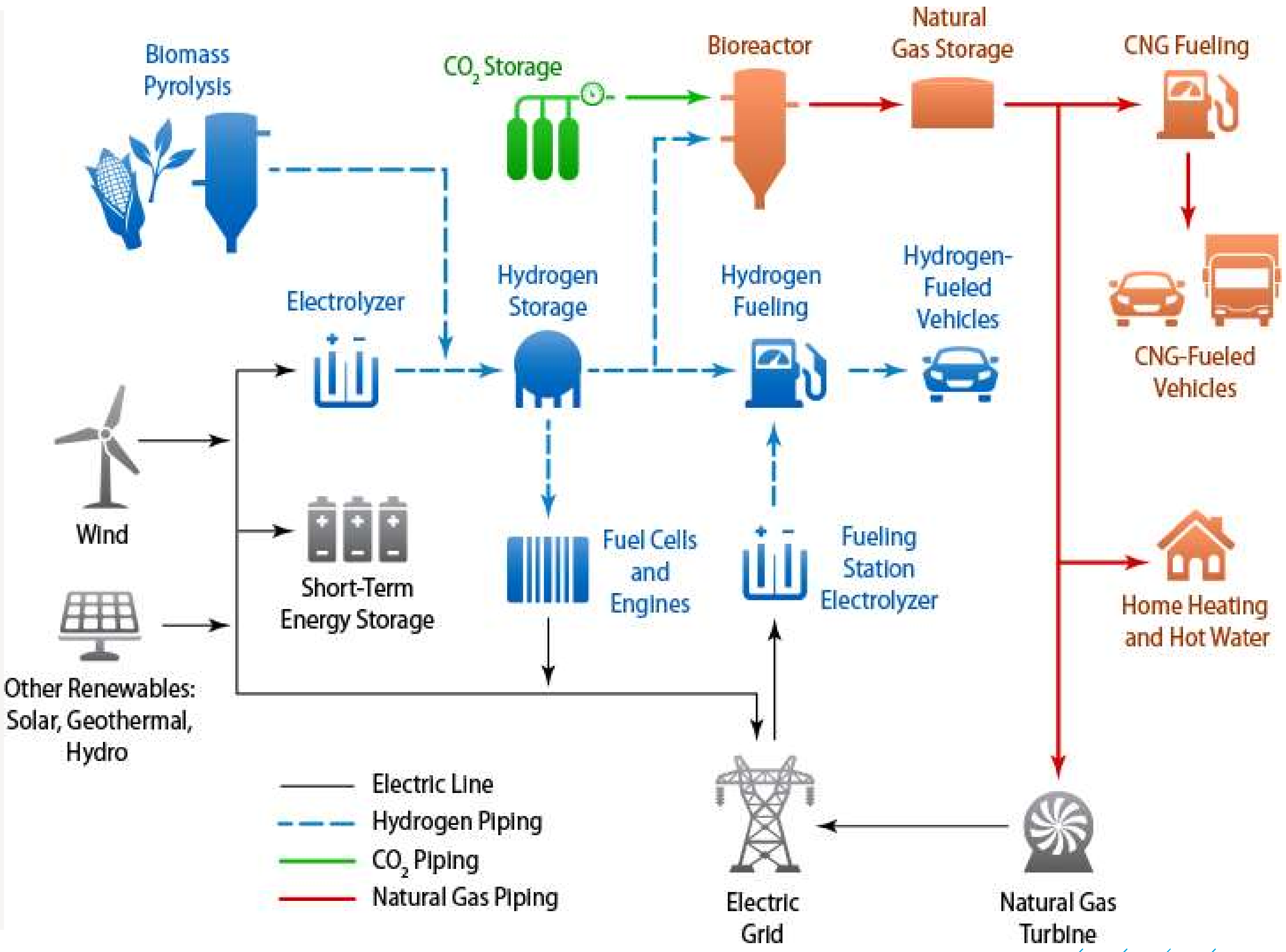
'Scottish Energy Strategy: The Future of Energy in Scotland' Scottish Government, Edinburgh

Consultation response by the UK Energy Research Centre (UKERC)

http://www.ukerc.ac.uk/asset/0E390E4B-94DF-4C9C-AE9EF53CA25077BF/

“Green” Generation Network

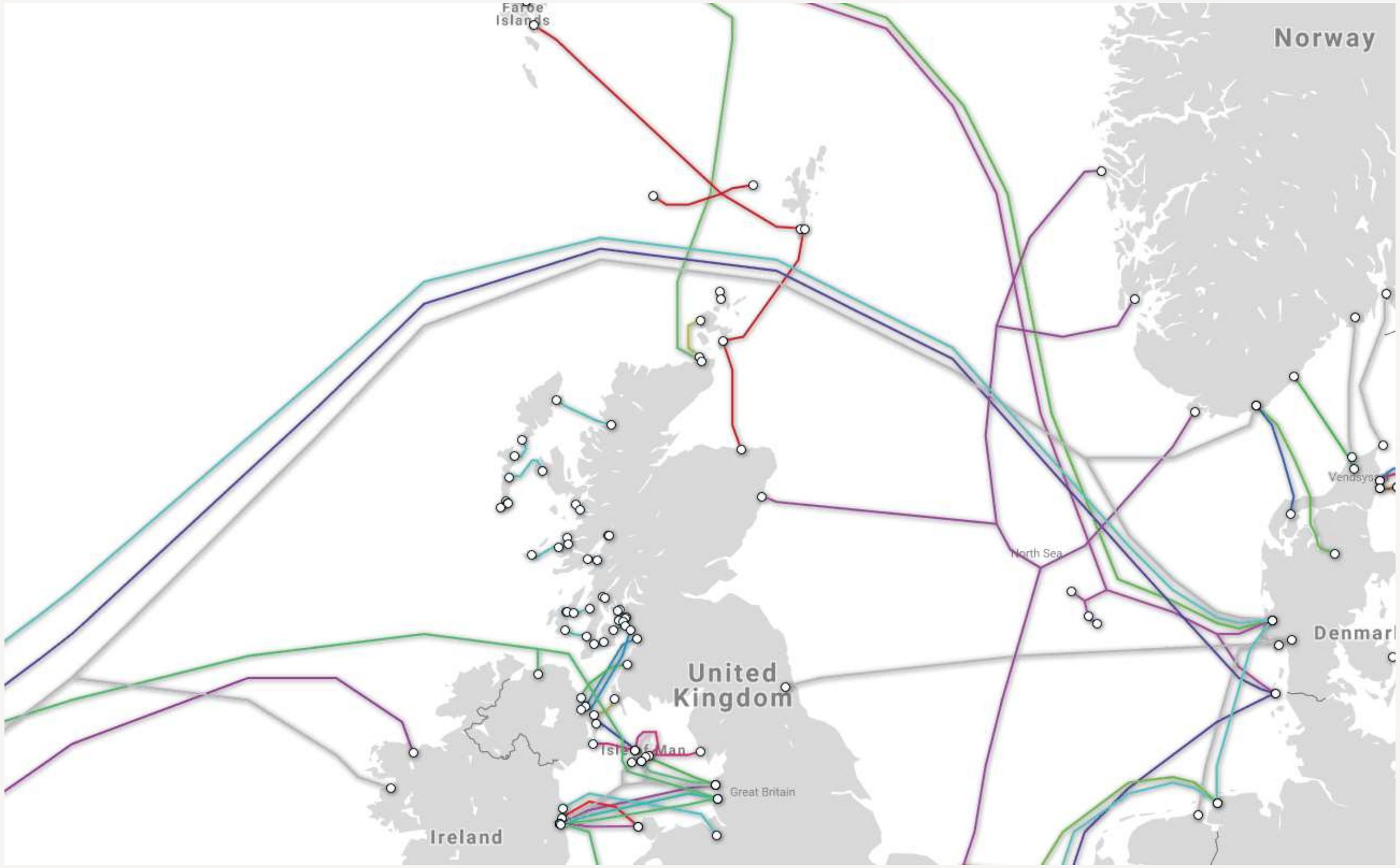
- ***Bio-Energy***
  - ***Biomass***
  - ***Pyrolysis***
  - ***Anaerobic Digestion***
  - ***Natural Gas***
- Wind Farms
- Solar
- Hydro
- ***Resilience and Grid Stability***



https://www.nrel.gov/hydrogen/renewable-electrolysis.html
The National Renewable Energy Laboratory is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

Fibre Availability

- Scotland mainly connected to O&G Dedicated Fibre SubSea Networks
  - *FARICE-1*
  - *SHEFA-2*
  - *TampNet O.S. FOC*
- Any future development?



https://www.submarinecablemap.com/#/

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Data Centres and their impact on NCI and Environment

What next?

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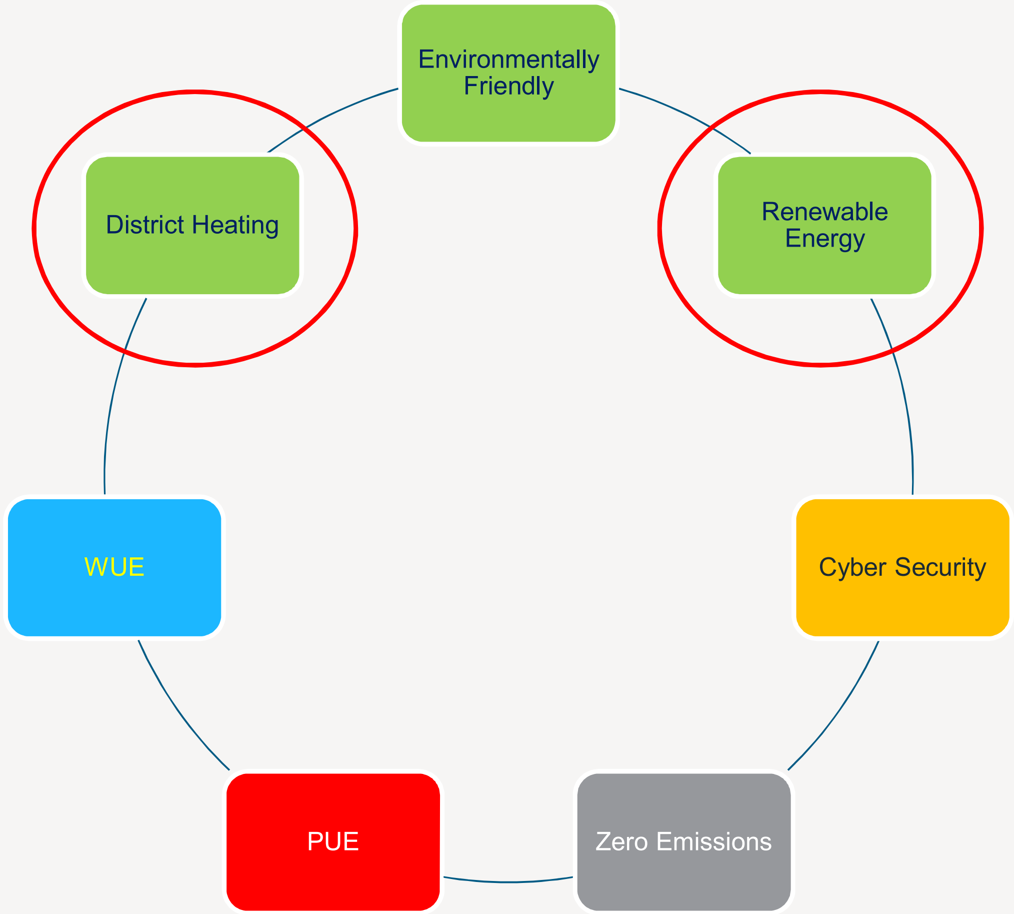
Data Centre Design Trends

Environment and Energy Saving Measures

- *AI Algorithms to control:*
  - *cooling optimisation*
  - *Data reduction analysis*
  - *Electrical faults prediction*
- *Move Add Changes (MAC) Operations by Robotics, AR and VR.*

Current Market Policies

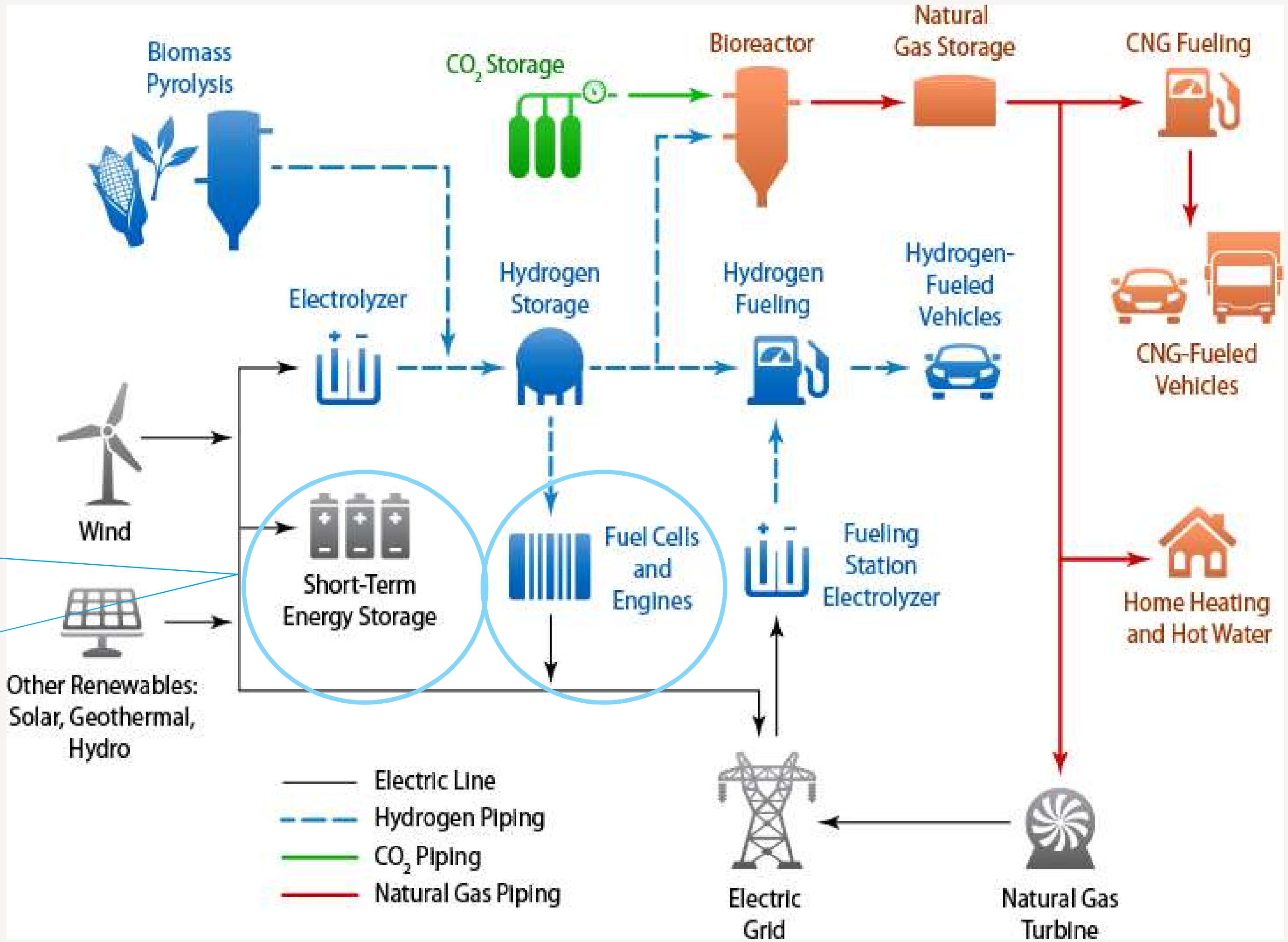
- JRC GPP for Data Centres
- NIS Directive
- FCA/BoE Operational Resilience
- Heat Networks (Billing and Metering) regulations



Integration in Green Networks

Short-Term Energy Storage (UPS Batteries)

or Fuel Cells (on Site Generation) offered by modern Data Centres Power Systems



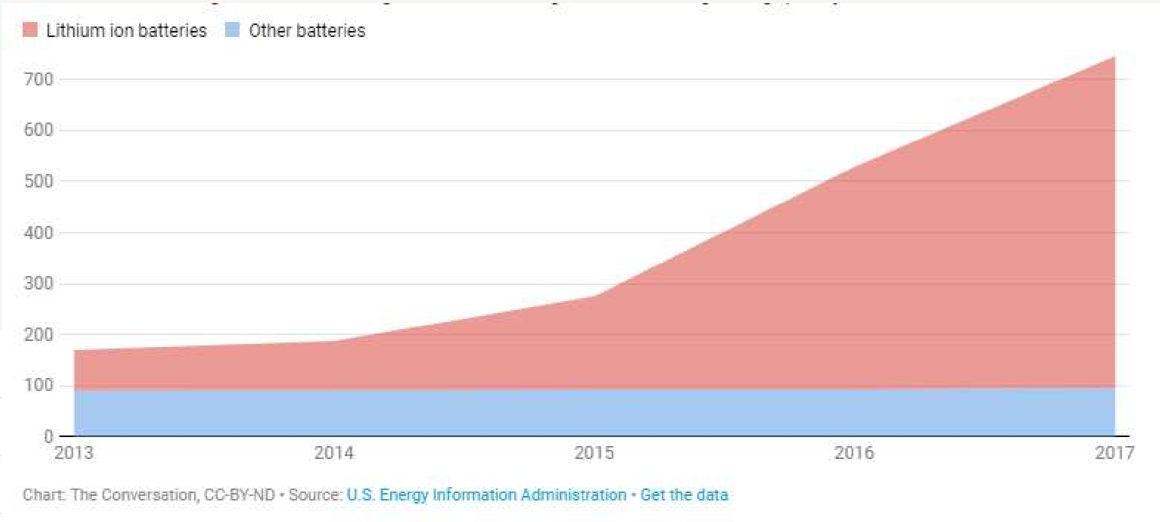
Grid Connected Battery Storage Systems

This is what a 5-megawatt, lithium-ion energy storage system looks like. Pacific Northwest National Laboratory

Grid Connected Battery Storage Systems

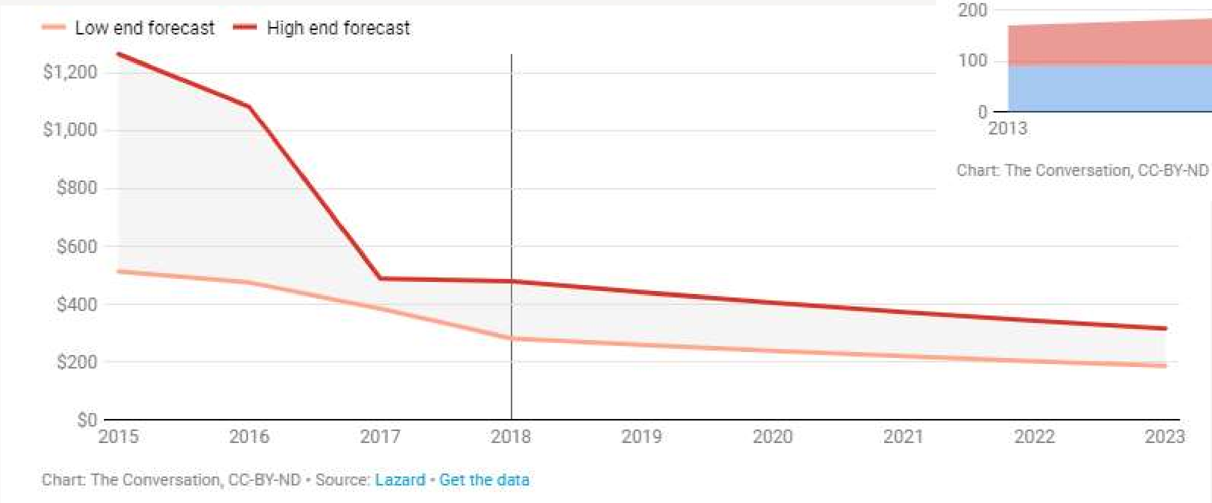
NeoEn-Tesla – 100MWh Battery Storage Plant in South Australia

The Li-ion Battery Advent



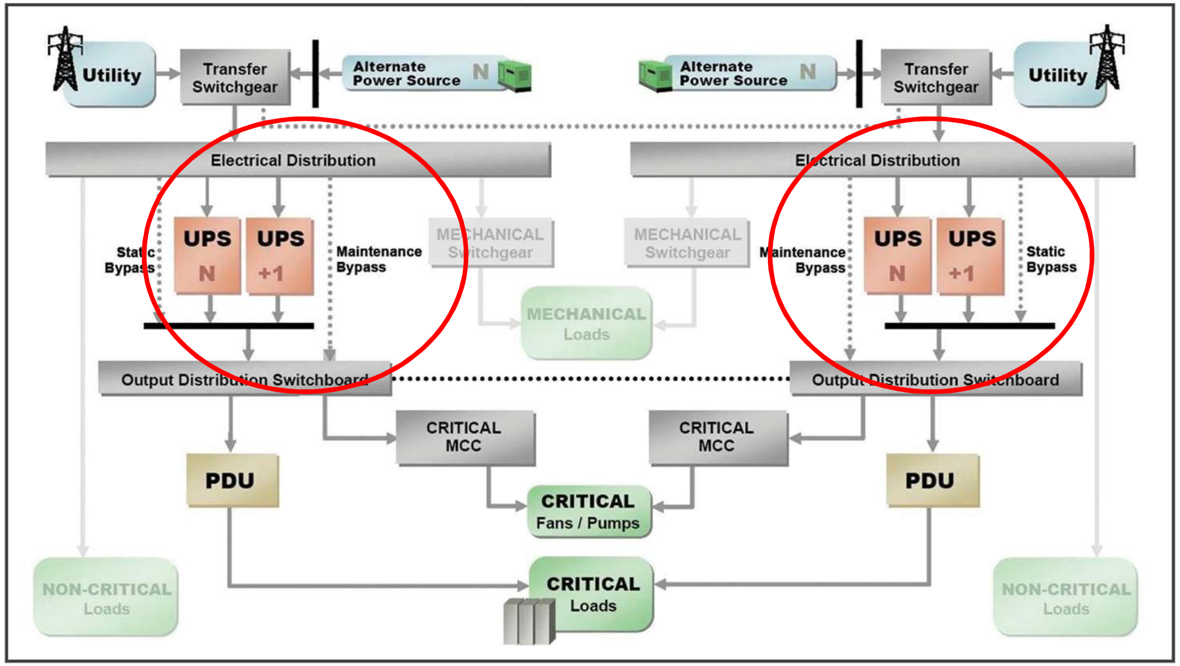
The amount of storage utilities are using, measured in megawatt hours

Grid-scale lithium-ion battery costs per kilowatt hour



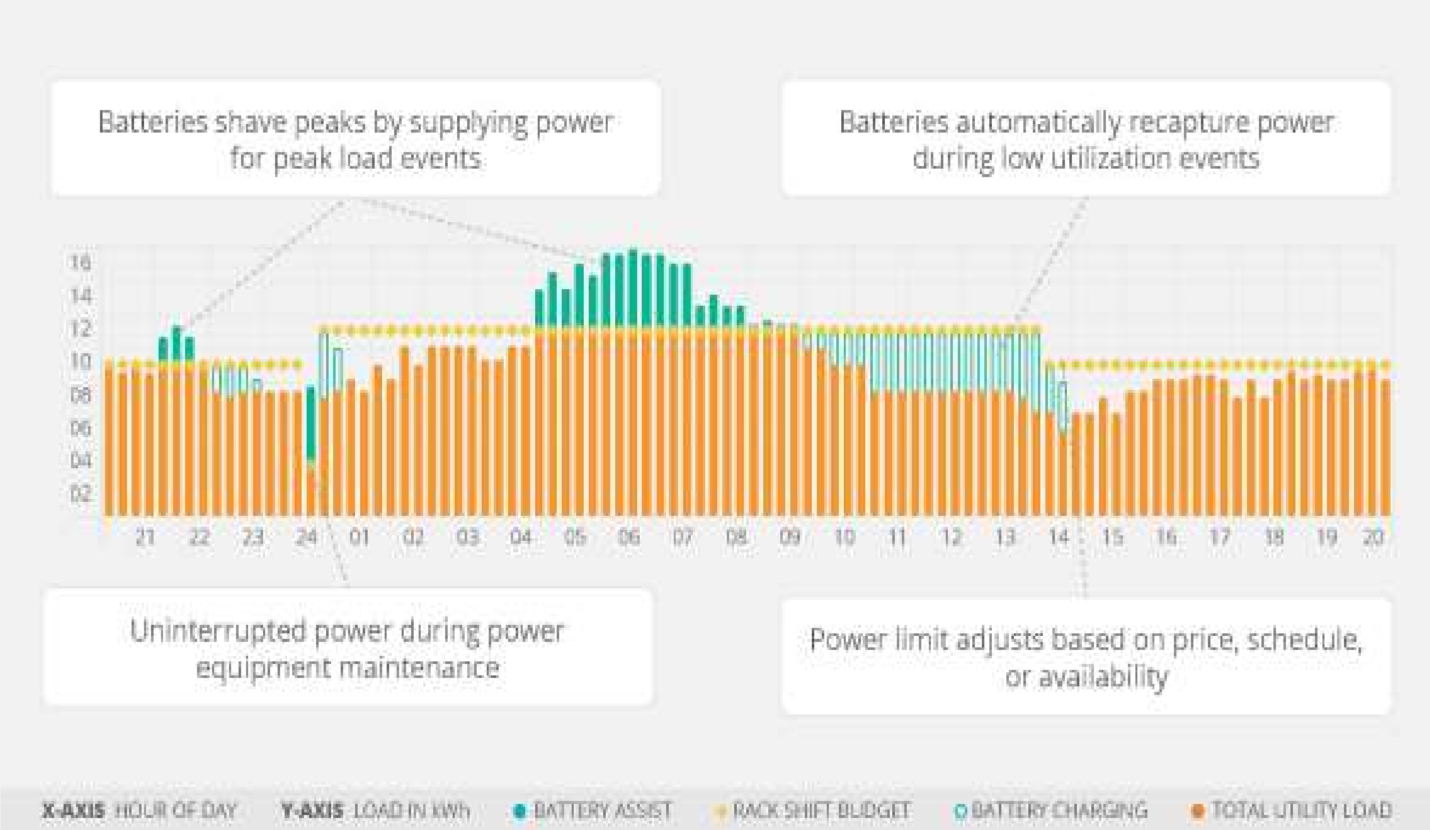
DC UPS Grid Connected Solutions

- **Catalysts**
  - Energy Smart Systems
  - SDP (Software-Defined Power)
  - Grid Connected UPSs
- **Energy Storage**
  - UPS Li-ion Batteries



DC UPS Grid Connected Solutions

- **Catalysts**
  - Energy Smart Systems
  - SDP (Software-Defined Power)
  - Grid Connected UPSs
- **Energy Storage**
  - UPS Li-ion Batteries
- **Peak Shaving/Lopping**



Hydrogen Fuel Cells

The New Back Up Generators?

- Hydrogen: 1 liter = 0.07kg = 0.78Nm^3
- *Diesel: 1 liter = 0.85kg = 0.001m^3*

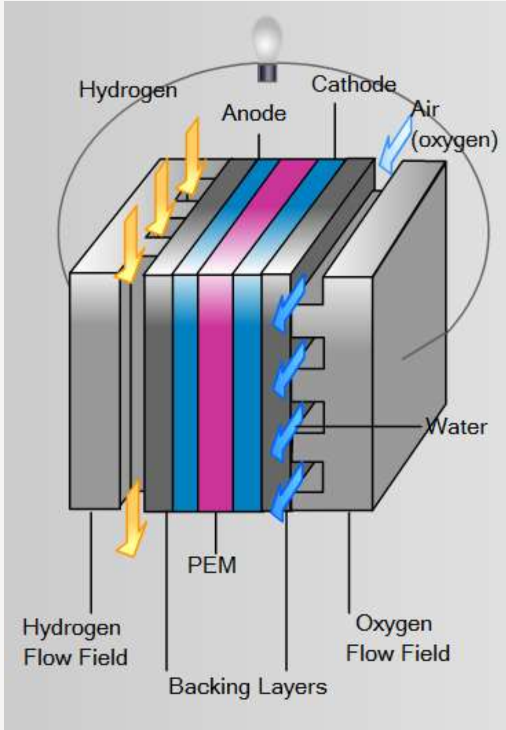
- 1MW Hydrogen Fuel Cell: 750 Nm^3/hr
- *1MW Diesel Generator: 250 l/hr*

- **1MW HFC Containers (x2): 60m^2**
- 1MW Diesel Genset Container: 18m^2

- Key Positive Factors:
- DC Output
- Fuel cells have no moving parts. They are thus much more reliable than traditional engines.

Water + Electricity = Hydrogen

Hydrogen + Oxygen = Electricity + Water Vapor

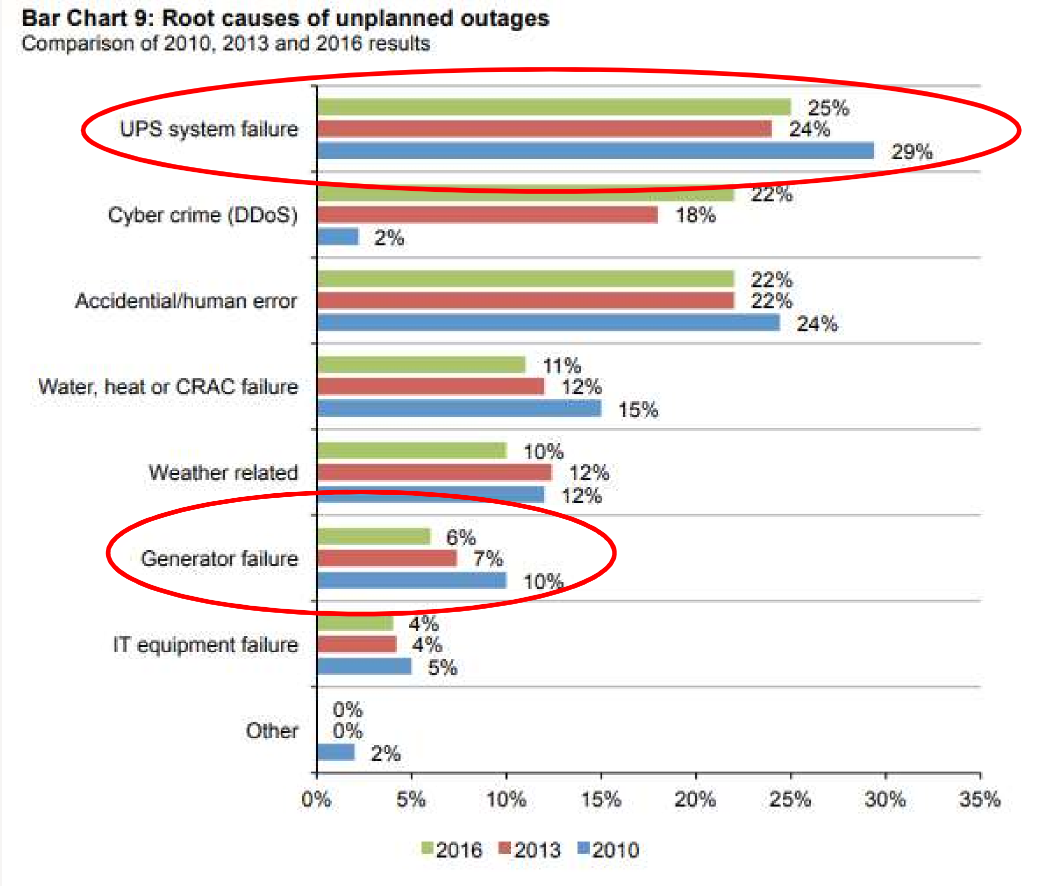


Hydrogen Fuel Cells Data Centres

https://blogs.microsoft.com/green/2017/09/24/redesigning-datacenters-advanced-energy-future/

Risky Business?

- Fire and Recycle Issues associated with Li-Ion Batteries
- Hydrogen Production and Storage
- Ponemon Institute 2016 (Failure Rates)
- According to Uptime Institute *Tier Standard: Topology*, **the only reliable source of power for a data center is the engine- generator plant**. This is because utility power is subject to unscheduled interruption even in places with reliable power grids.



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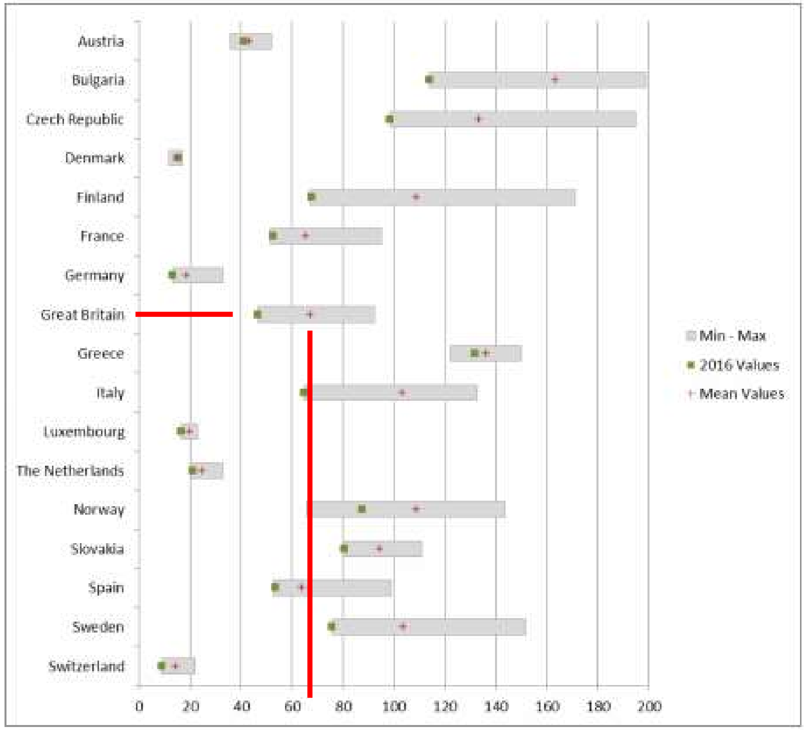
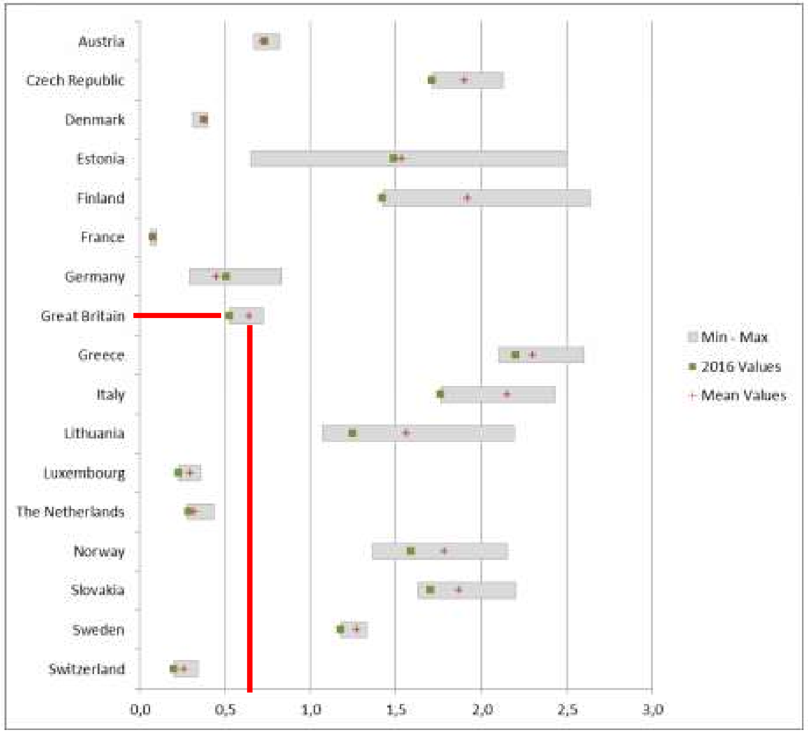
Grid Power Quality

› Unplanned SAIDI including Exceptional Events

› Unplanned SAIFI including Exceptional Events





https://www.ceer.eu/documents/104400/-/-/963153e6-2f42-78eb-22a4-06f1552dd34c

SAIDI (System Average Interruption Duration Index)
SAIFI (System Average Interruption Frequency Index)

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Summary:

- Data Centres are becoming integral part of the NCI
- Grid Power Quality and Grid Reinforcement
- Sustainable alternative to Back Up Diesel Generation
- Energy Storage Systems
- Radical New Design of Data Centres

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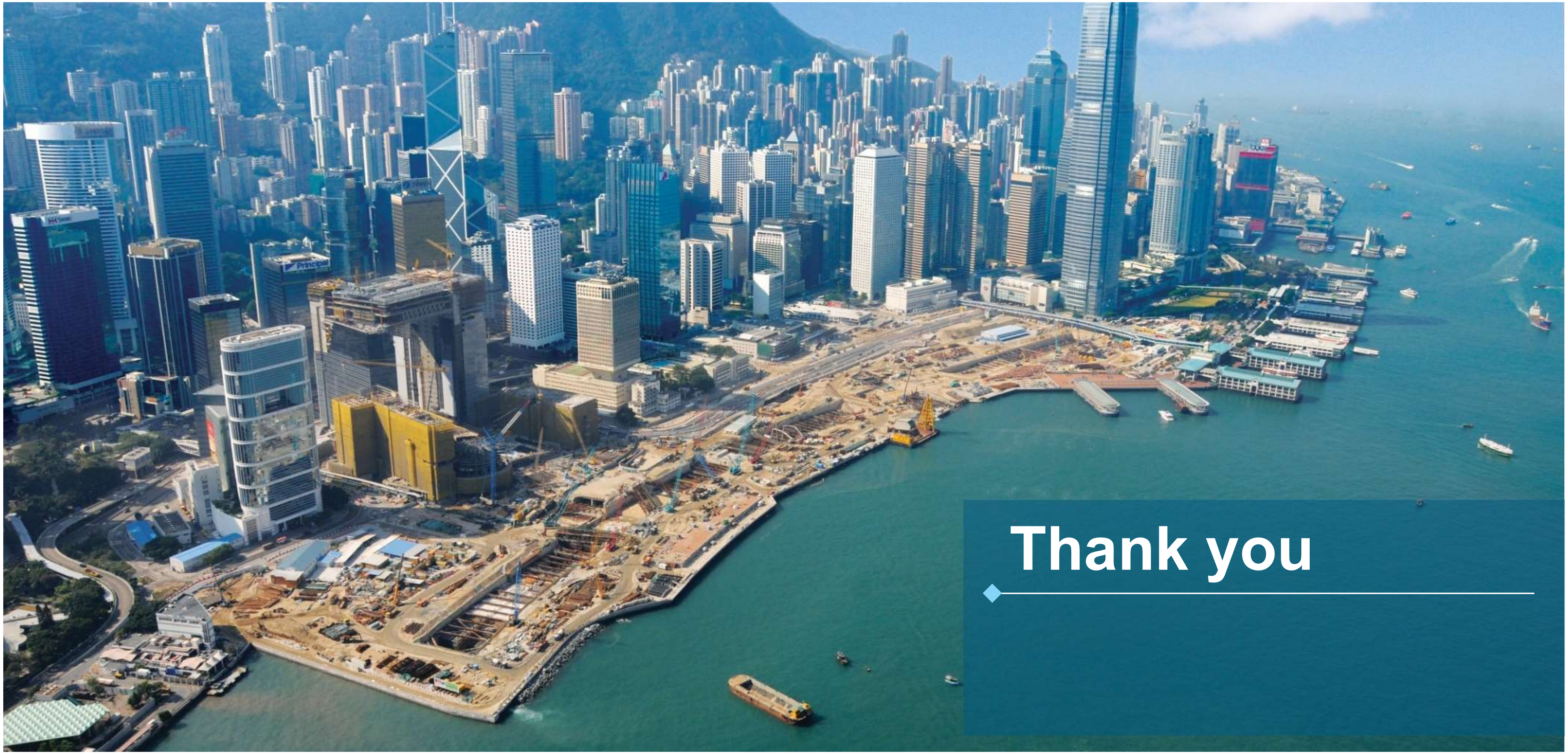

Thank you

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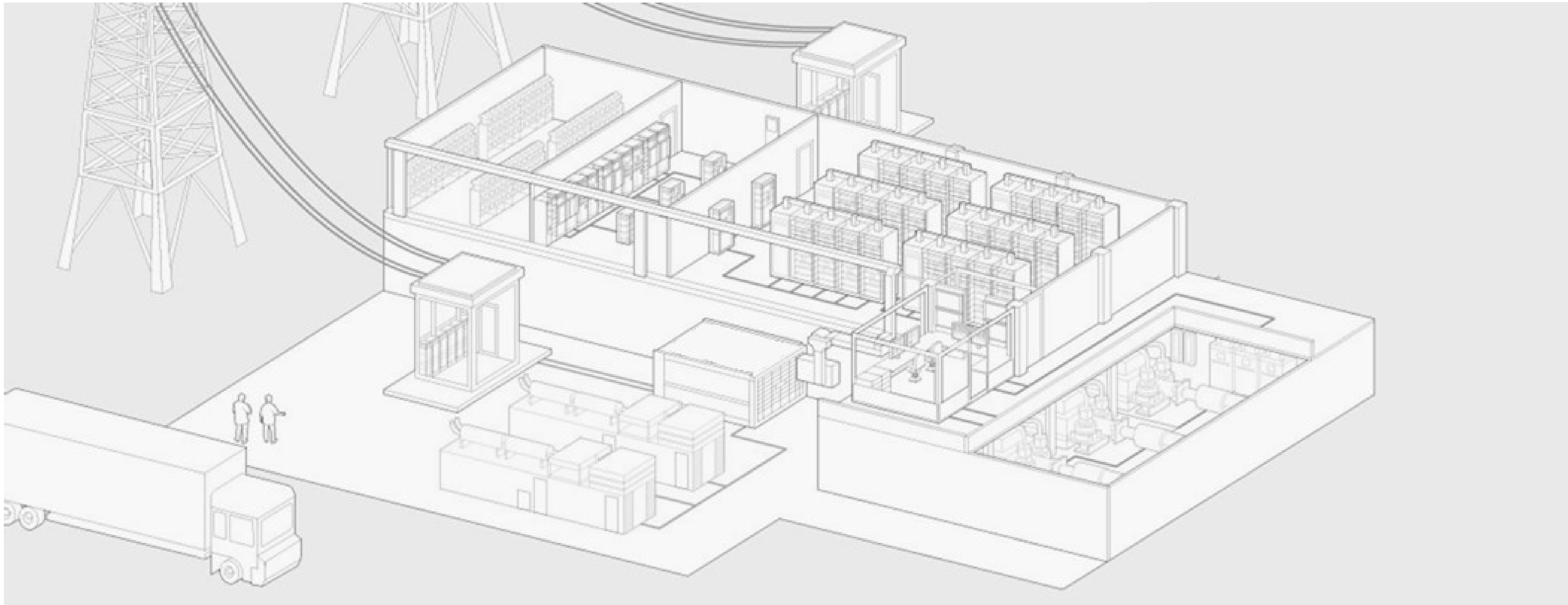
MARCH 7, 2019 | HOST IN SCOTLAND - EDINBURGH

Elastic Critical Infrastructure

Intelligent data needs intelligent power

Why Elastic?

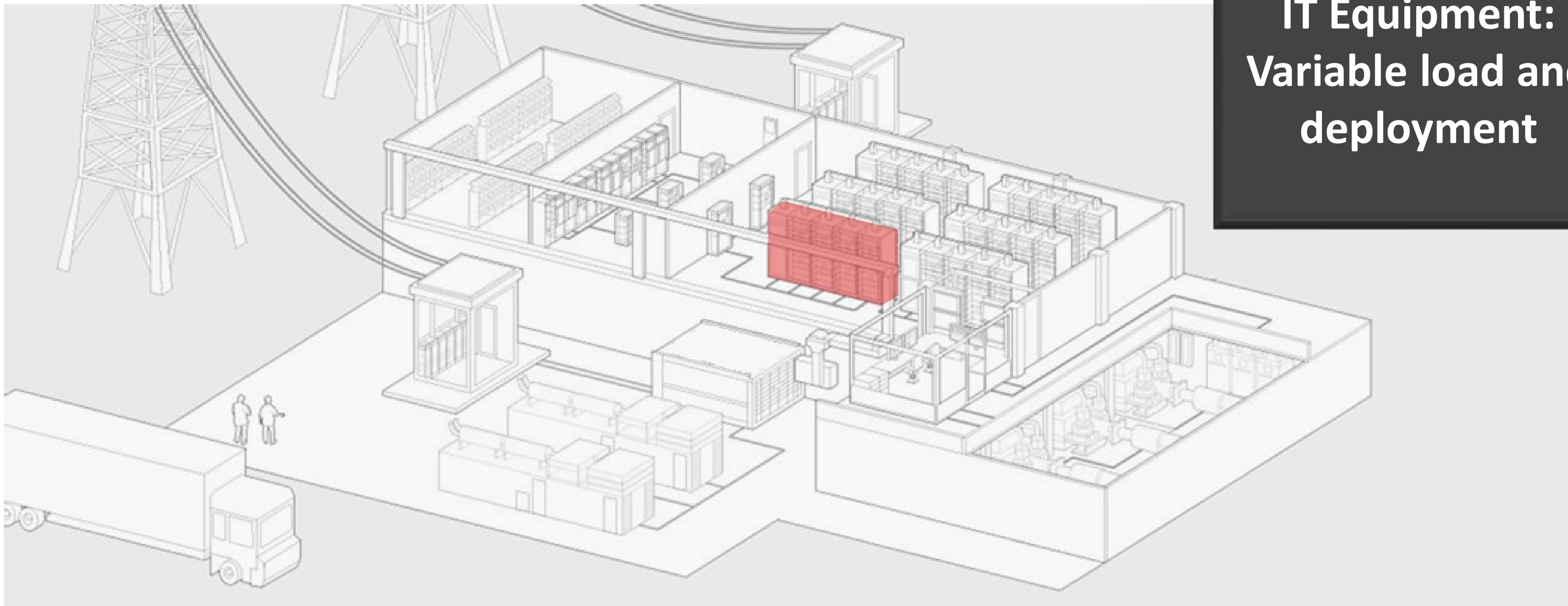
Elastic Critical Infrastructure



ABB

Why Elastic?

Elastic Critical Infrastructure

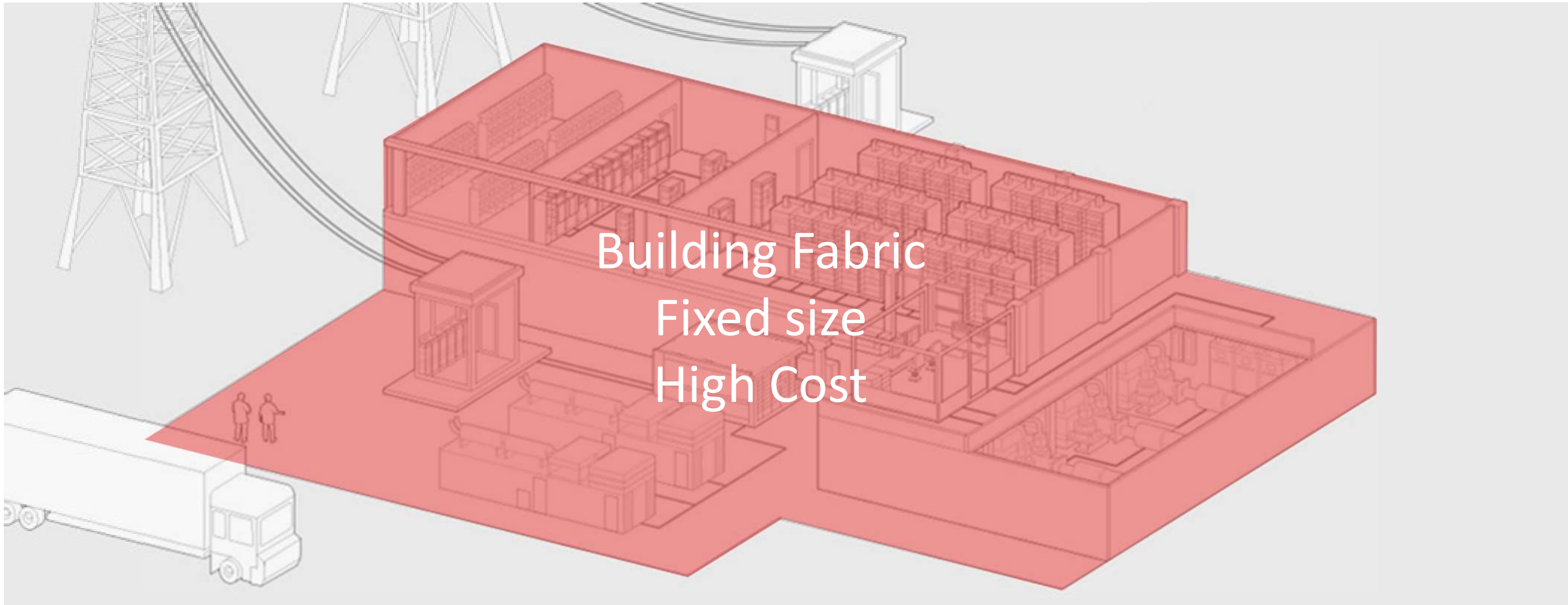


IT Equipment: Variable load and deployment

ABB

Why Elastic?

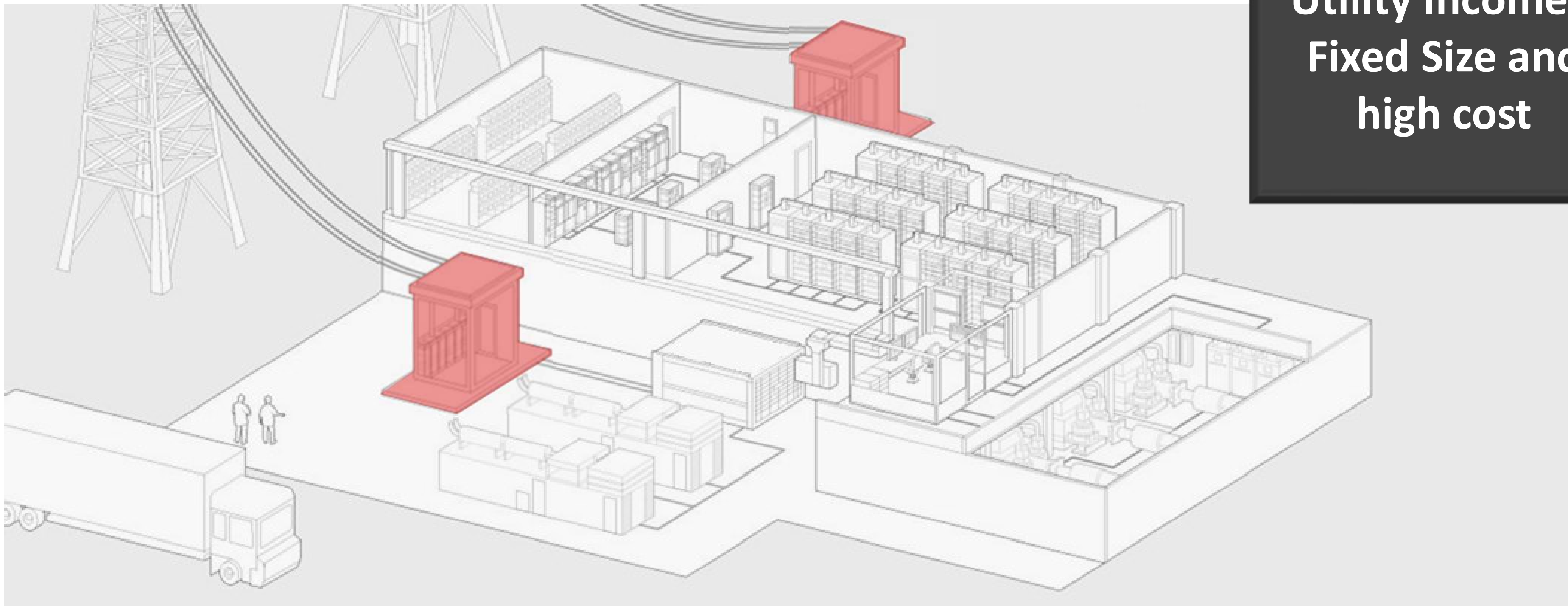
Elastic Critical Infrastructure



ABB

Why Elastic?

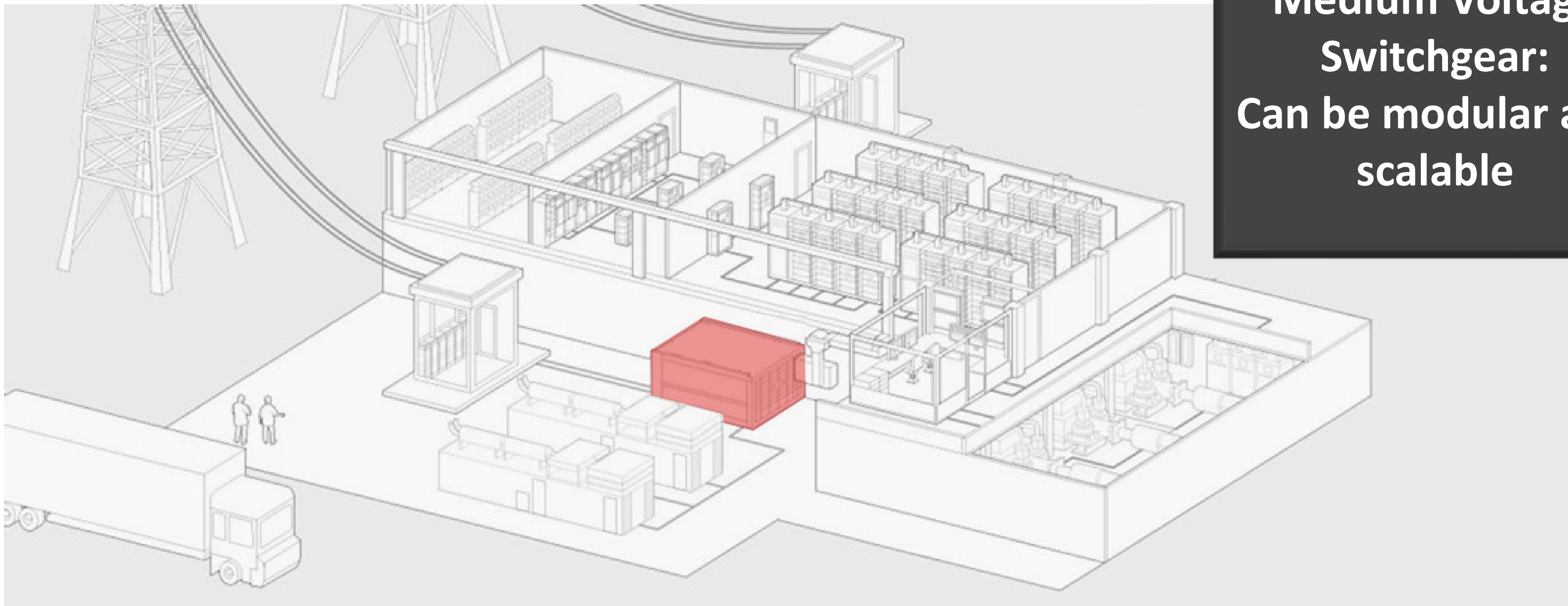
Elastic Critical Infrastructure



Utility Incomer: Fixed Size and high cost

Why Elastic?

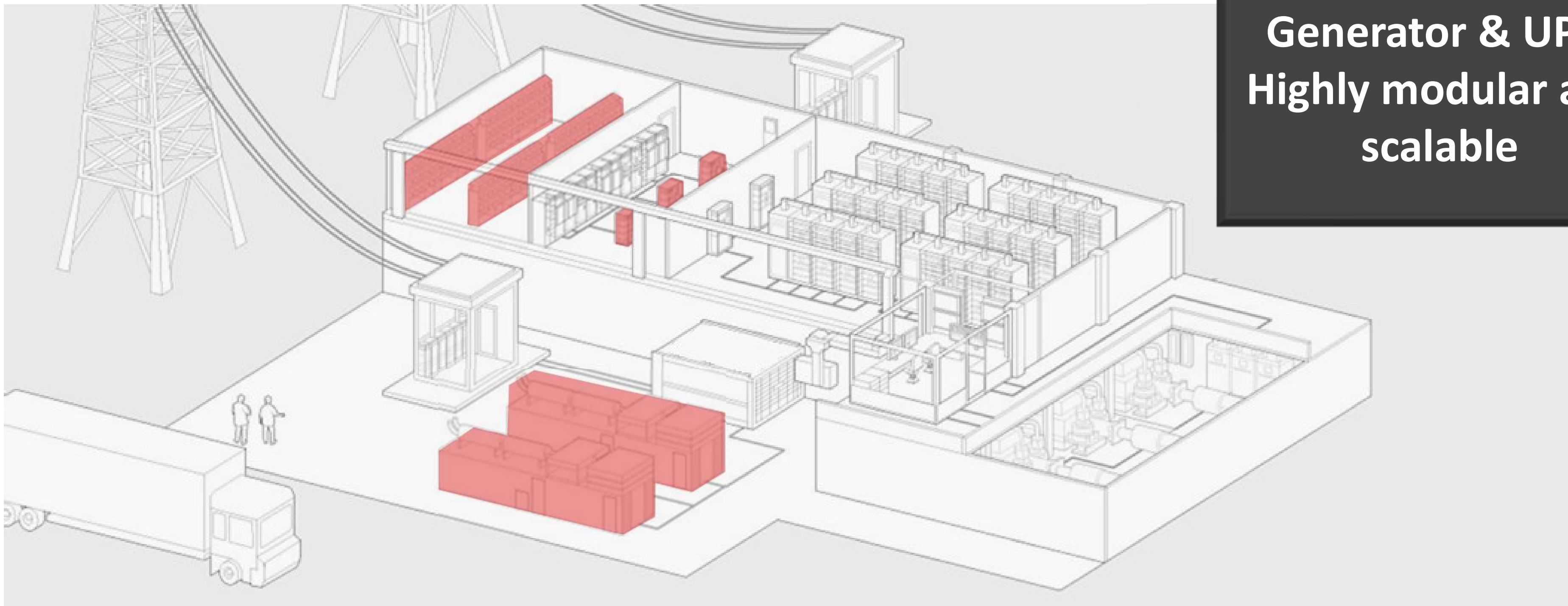
Elastic Critical Infrastructure



Medium Voltage Switchgear:
Can be modular and scalable

Why Elastic?

Elastic Critical Infrastructure

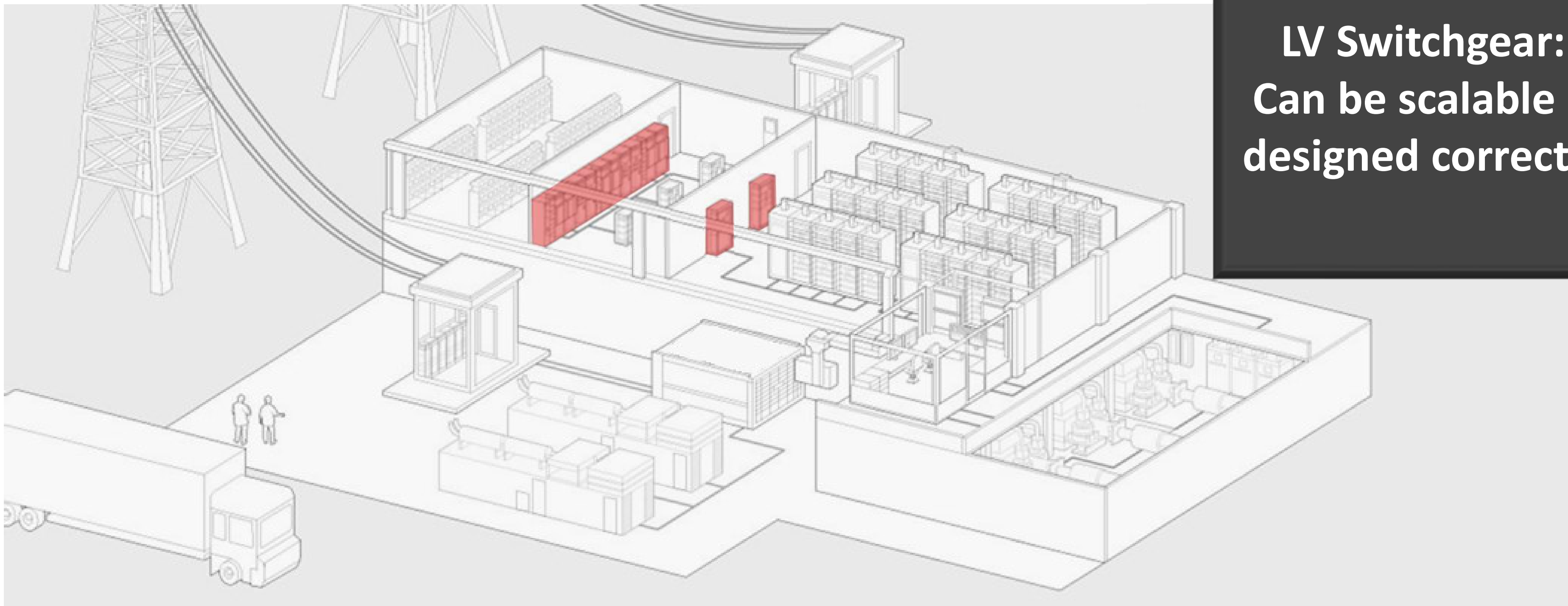


Generator & UPS: Highly modular and scalable

ABB

Why Elastic?

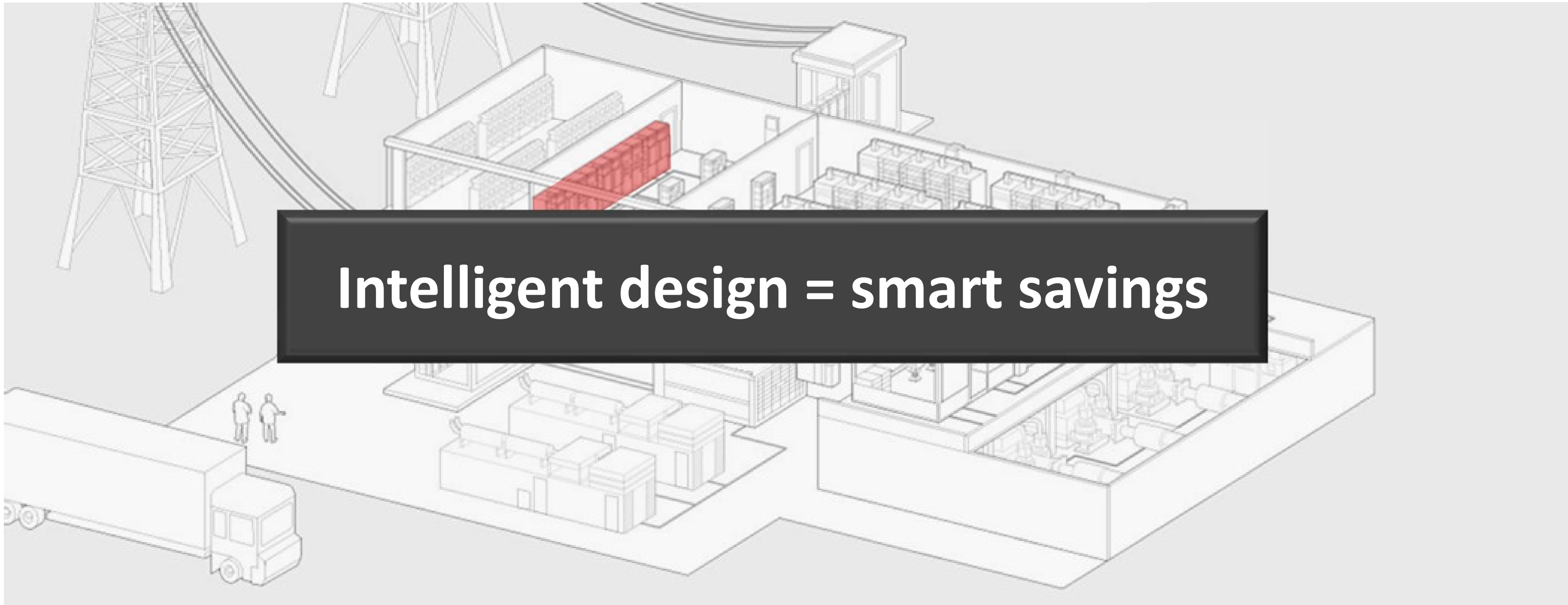
Elastic Critical Infrastructure



LV Switchgear: Can be scalable if designed correctly

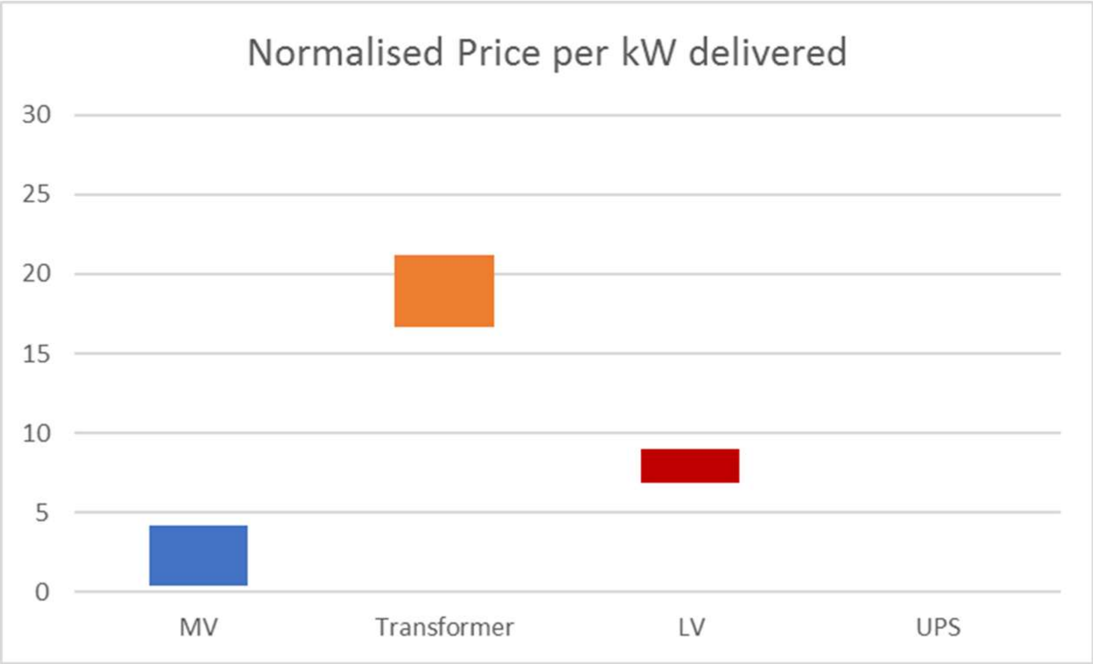
Why Elastic?

Elastic Critical Infrastructure



Price variance

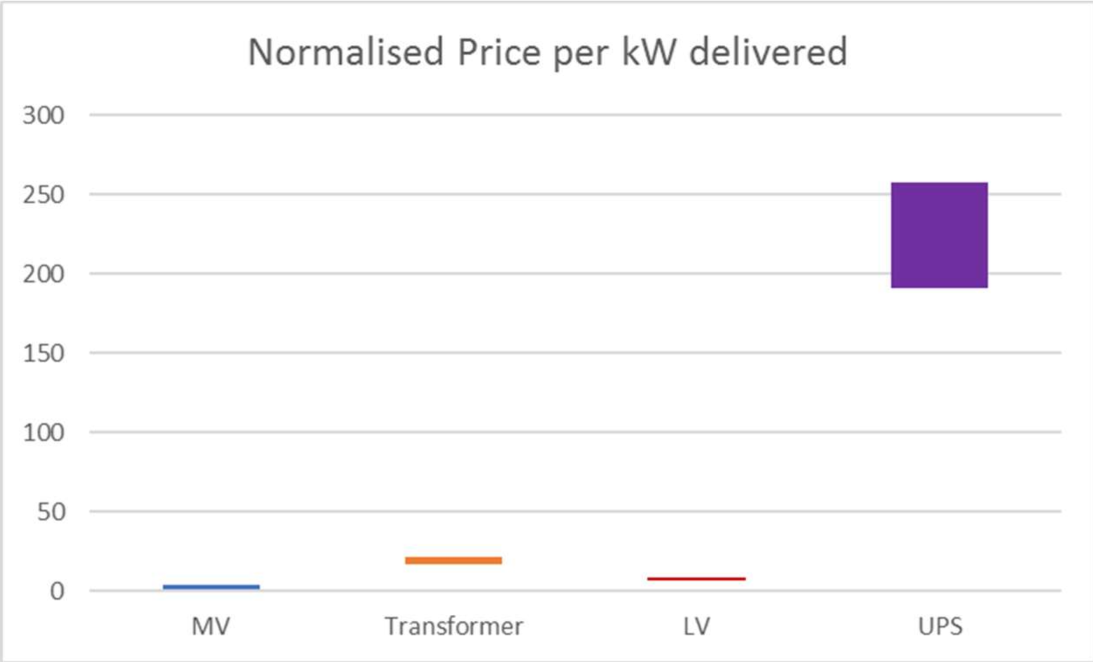
Elastic Critical Infrastructure



Per kW of power delivered, not considering redundancy, there is little variation in LV switchgear and Transformer pricing in terms of normalised cost per kW

Price variance

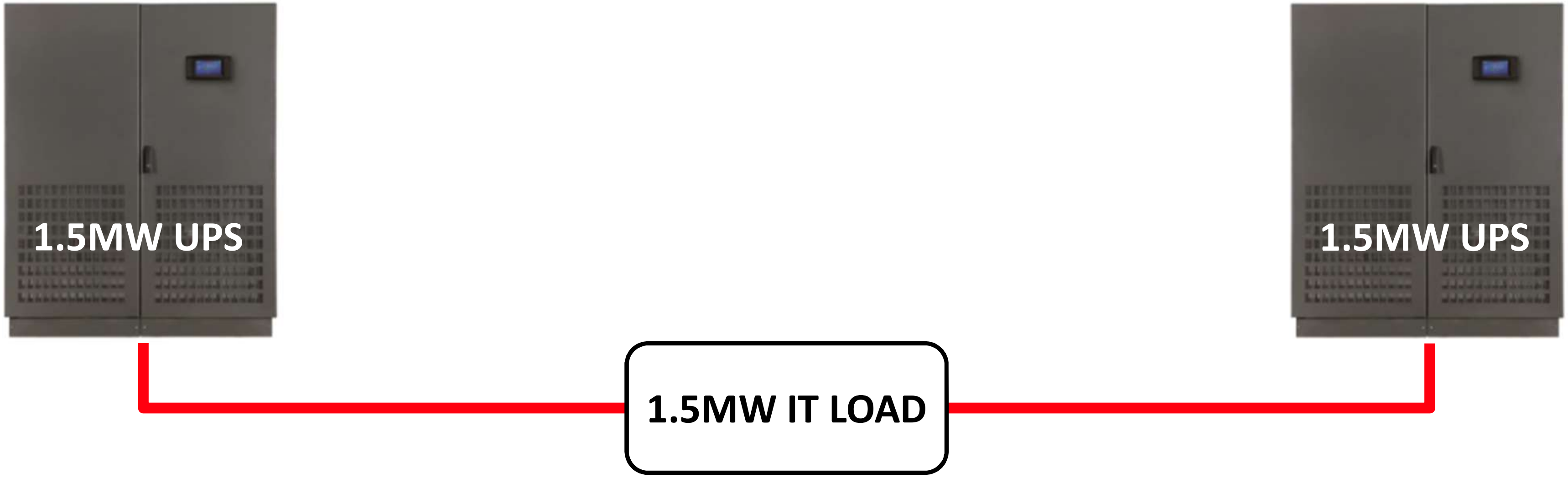
Elastic Critical Infrastructure



However UPS has a very high cost per kW in comparison to LV and MV infrastructure, although cost per kw is reasonably consistent

Architectures: 2N System

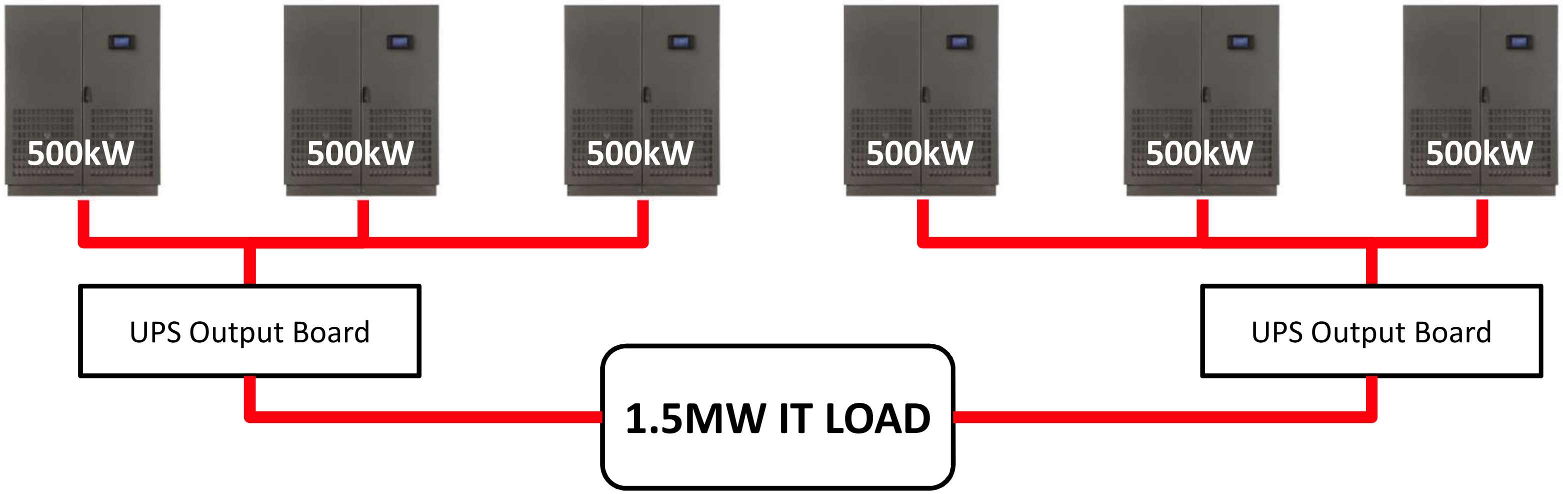
Elastic Critical Infrastructure



Maximum 50% utilisation factor

Architectures: 2N System

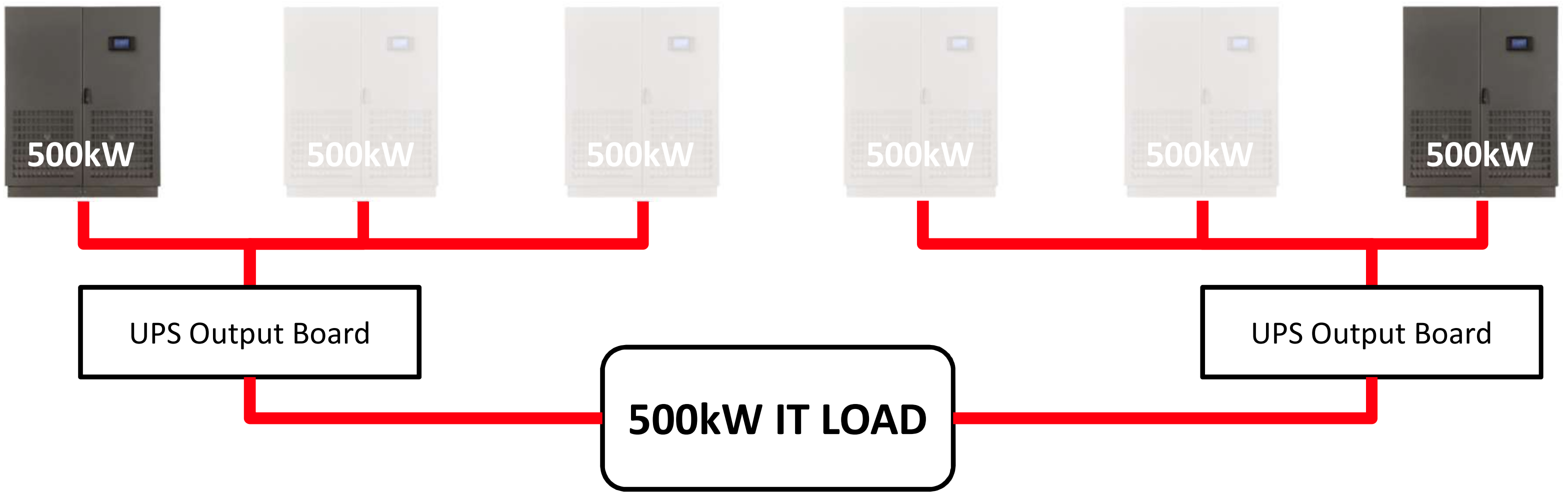
Elastic Critical Infrastructure



Smaller blocks = better utilisation?

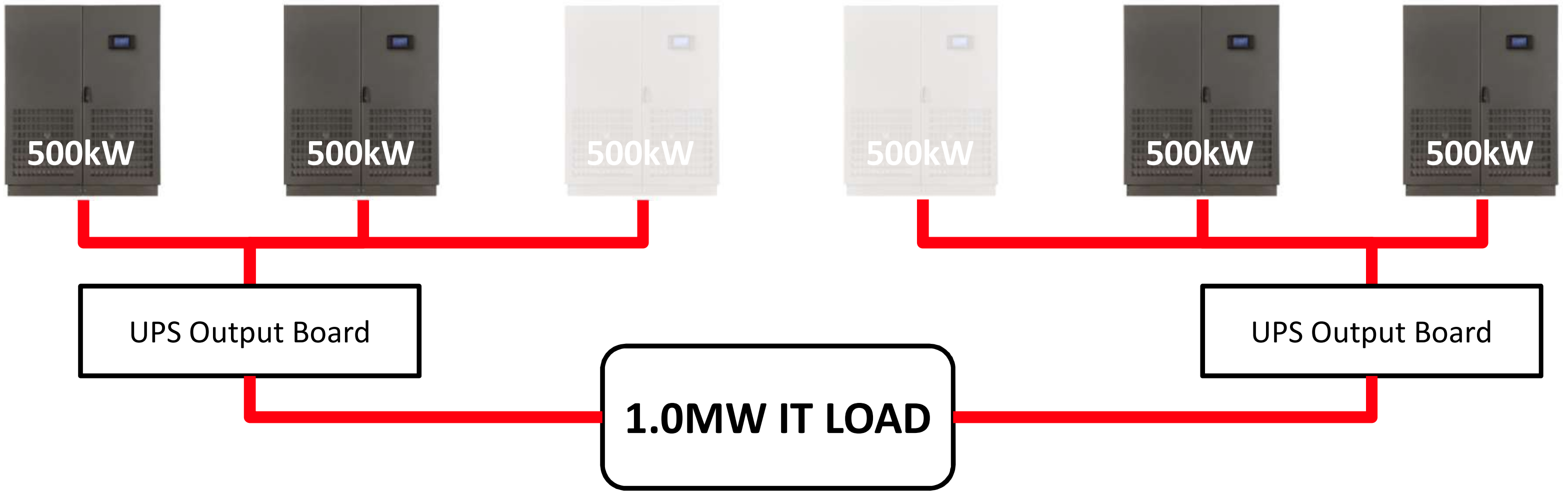
Architectures: 2N System

Elastic Critical Infrastructure



Architectures: 2N System

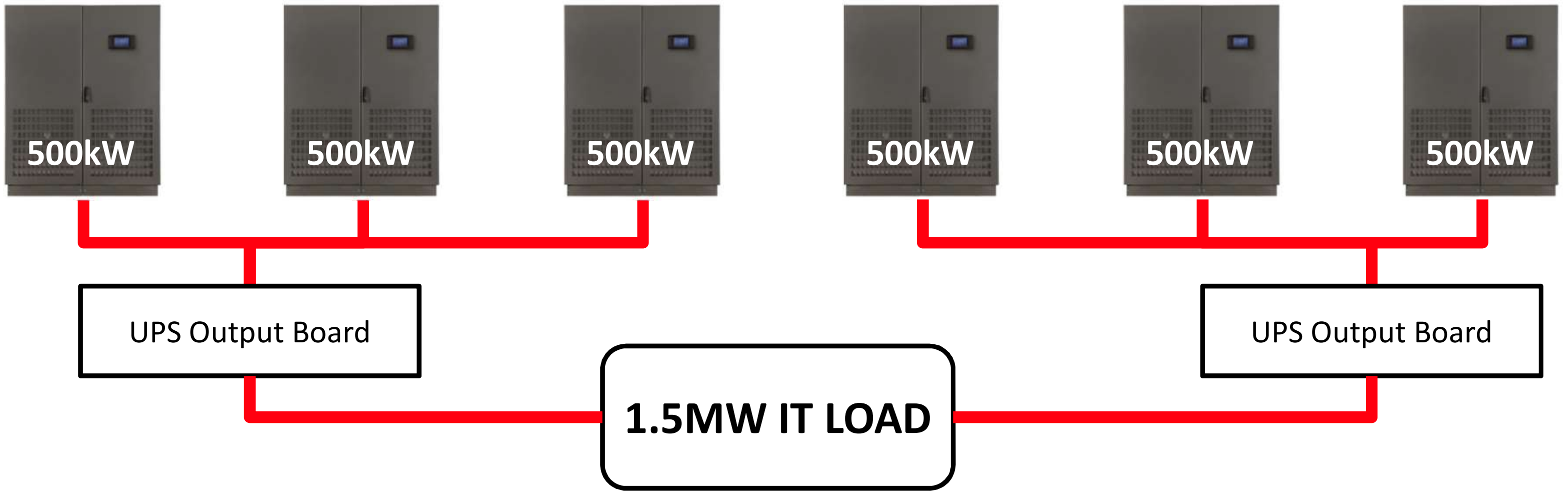
Elastic Critical Infrastructure



ABB

Architectures: 2N System

Elastic Critical Infrastructure



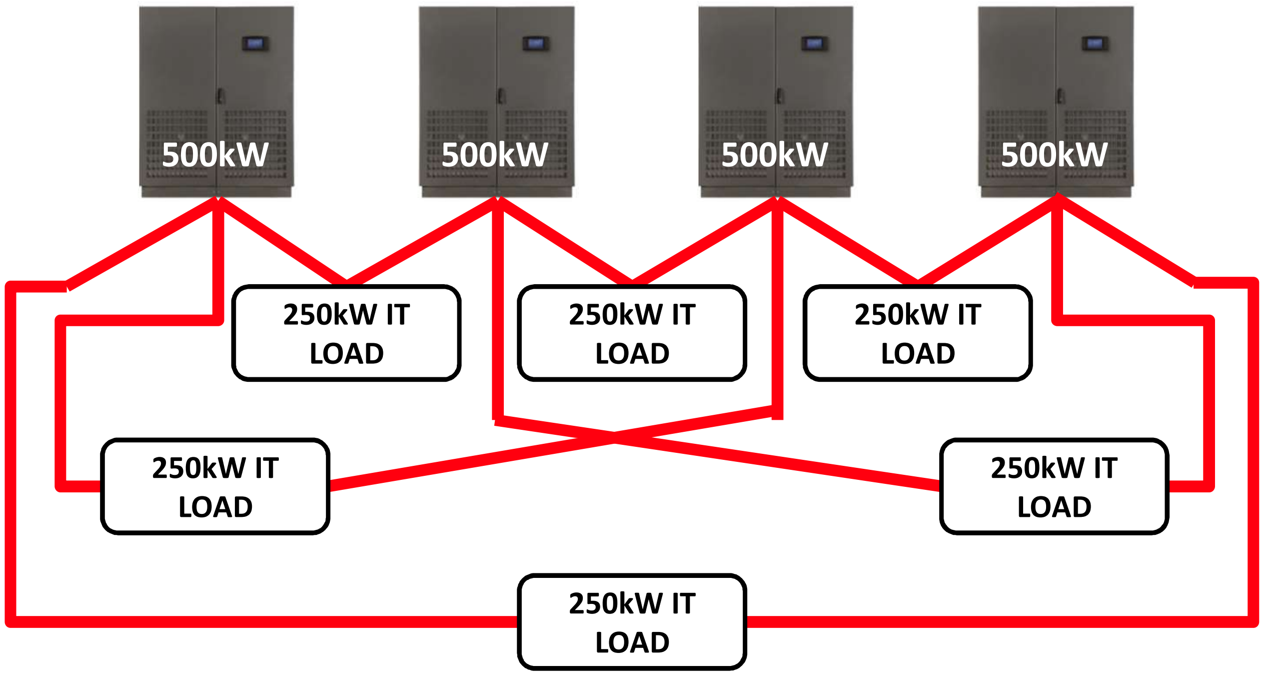
Maximum 50% utilisation factor

Architectures: Distributed Redundant

Elastic Critical Infrastructure

Divide the load into smaller groups

<u>66% utilisation</u>

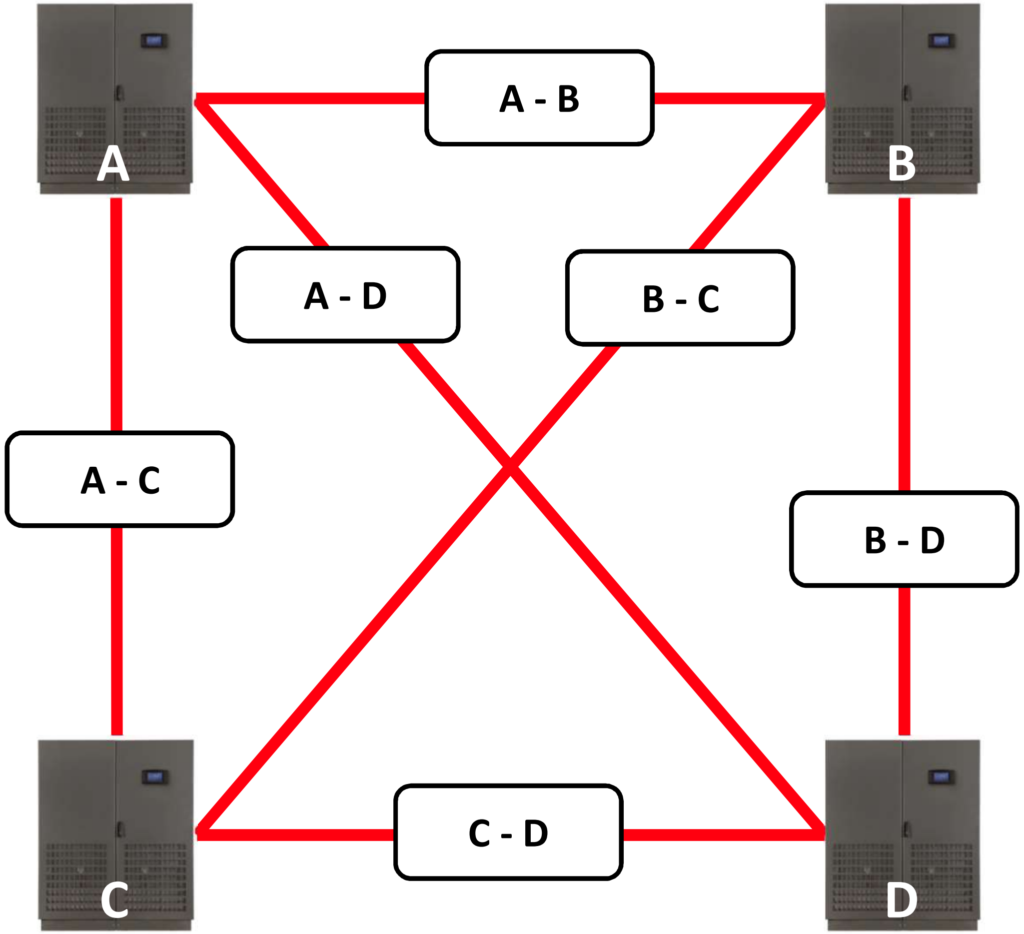


Architectures: 2N System

Elastic Critical Infrastructure

<u>4 to make 3 Dist Red</u>

- UPS = 1.5x load
- UF = 66.6%
- 6 load groups

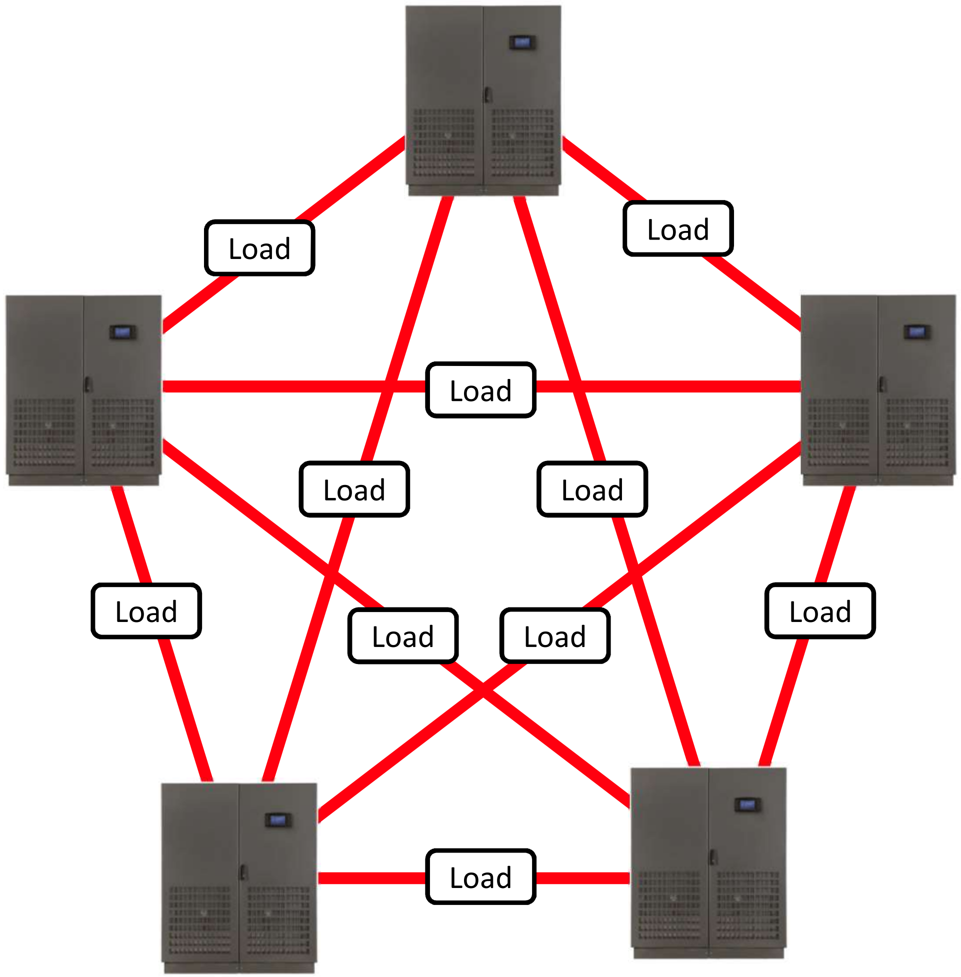


Architectures: 2N System

Elastic Critical Infrastructure

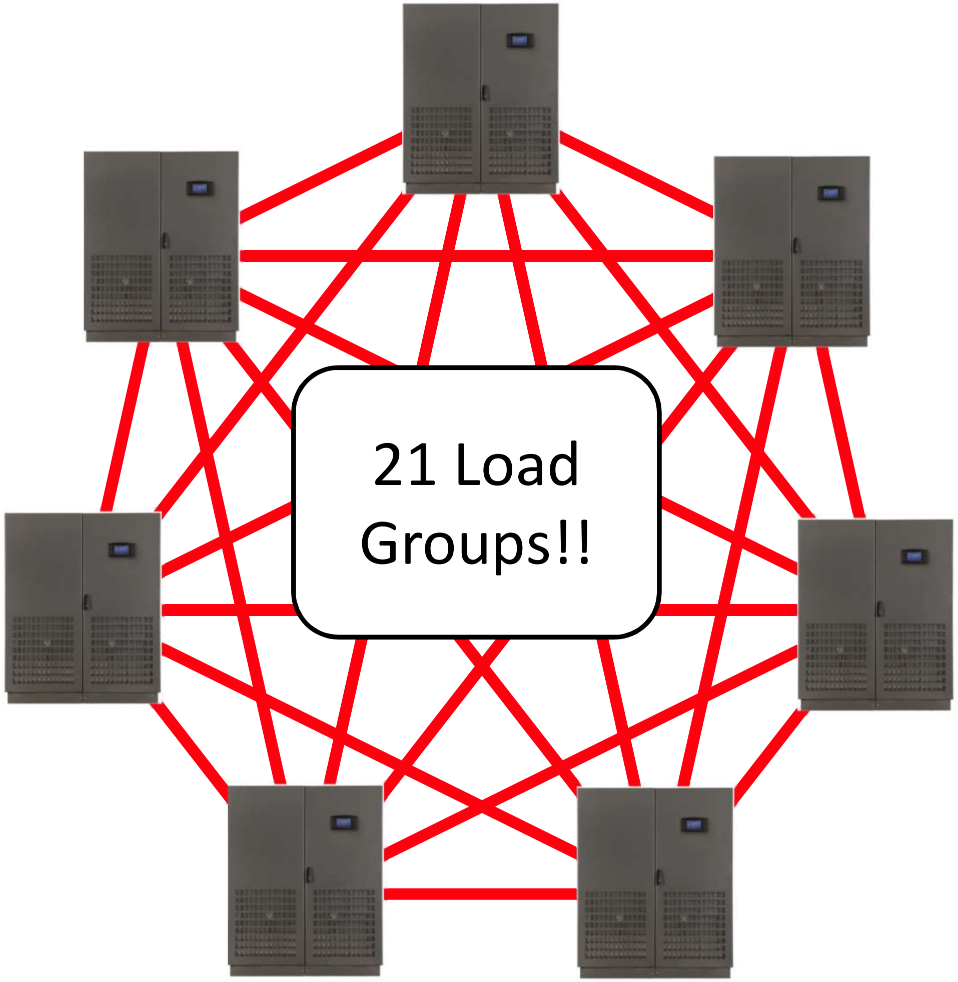
<u>**5 to make 4 Dist Red**</u>

- **UPS = 1.3x load**
- **UF = 75%**
- **10 load groups**



Architectures: 2N System

Elastic Critical Infrastructure



<u>7 to make 6 Dist Red</u>

- **UPS = 1.17x load**
- **UF = 86%**
- **21 load groups**

Architectures: Distributed Redundant

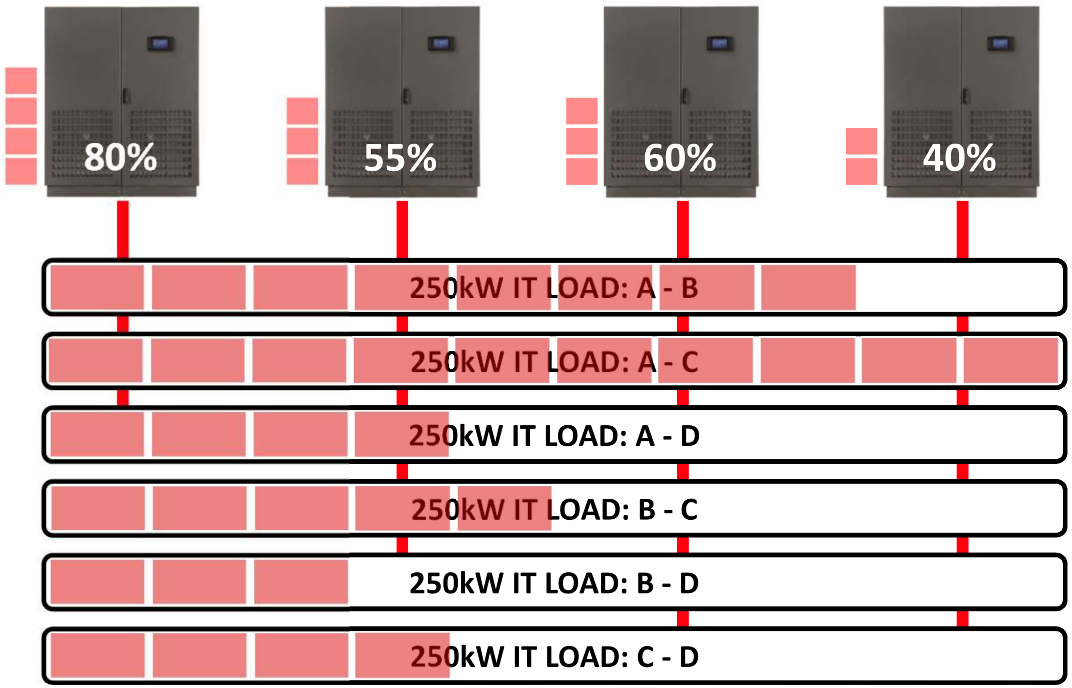
Elastic Critical Infrastructure

Demand on UPS systems varies as IT load changes

Architectures: Distributed Redundant

Elastic Critical Infrastructure

…but with varying loads you could end up with stranded capacity once the building is full



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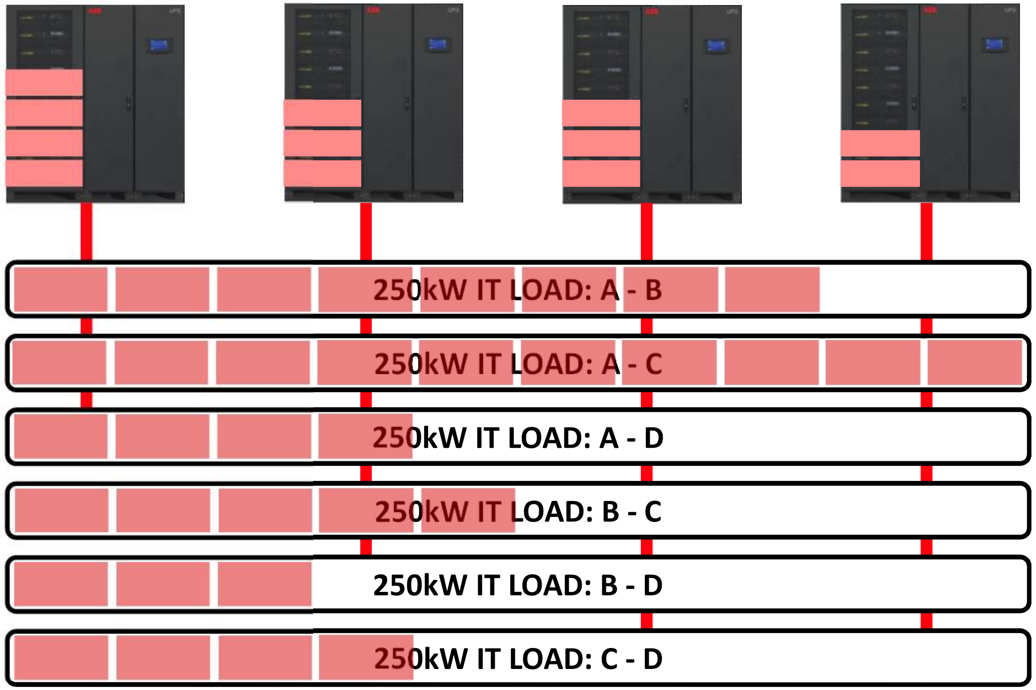
Architectures: Distributed Redundant

Elastic Critical Infrastructure

Utilising modular or scalable UPS can alleviate stranded capacity in UPS systems by right-sizing



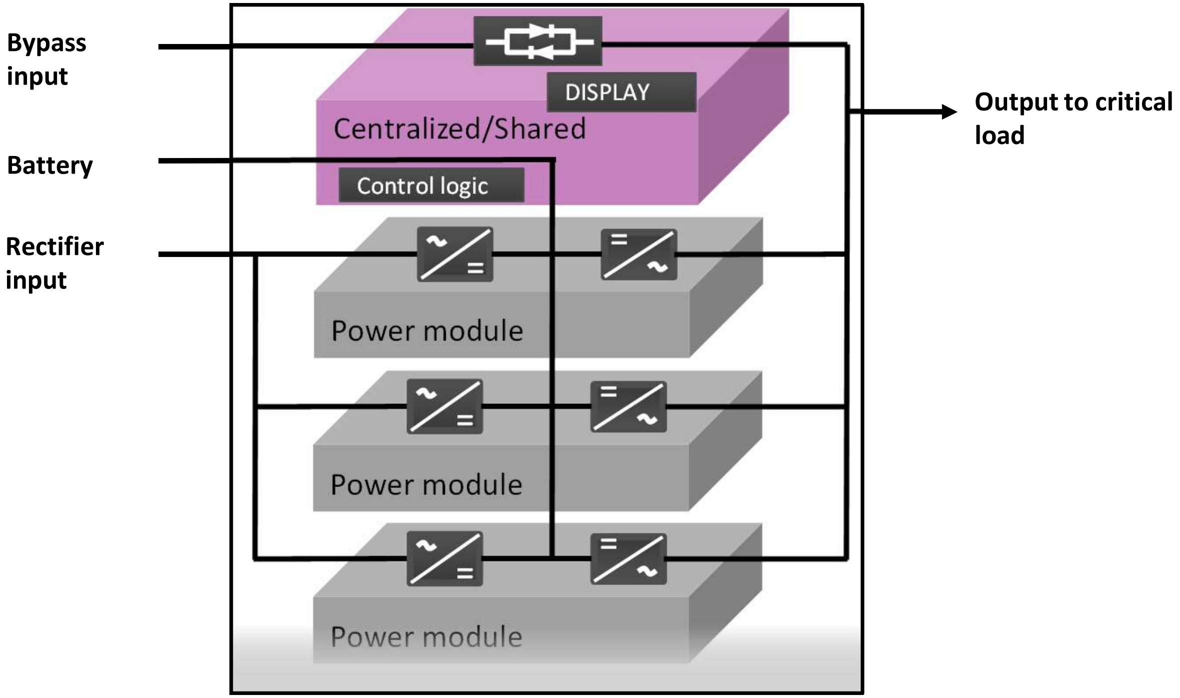
ABB

Modular UPS — Centralized architecture

Elastic Critical Infrastructure

Centralized Modular UPS

- Traditional modular UPS design
- Centralized control logic, static switch etc., in UPS frame, shared by all power modules
- Active UPS frame design – similar to system control cabinet (SCC)
- Several single points of failure

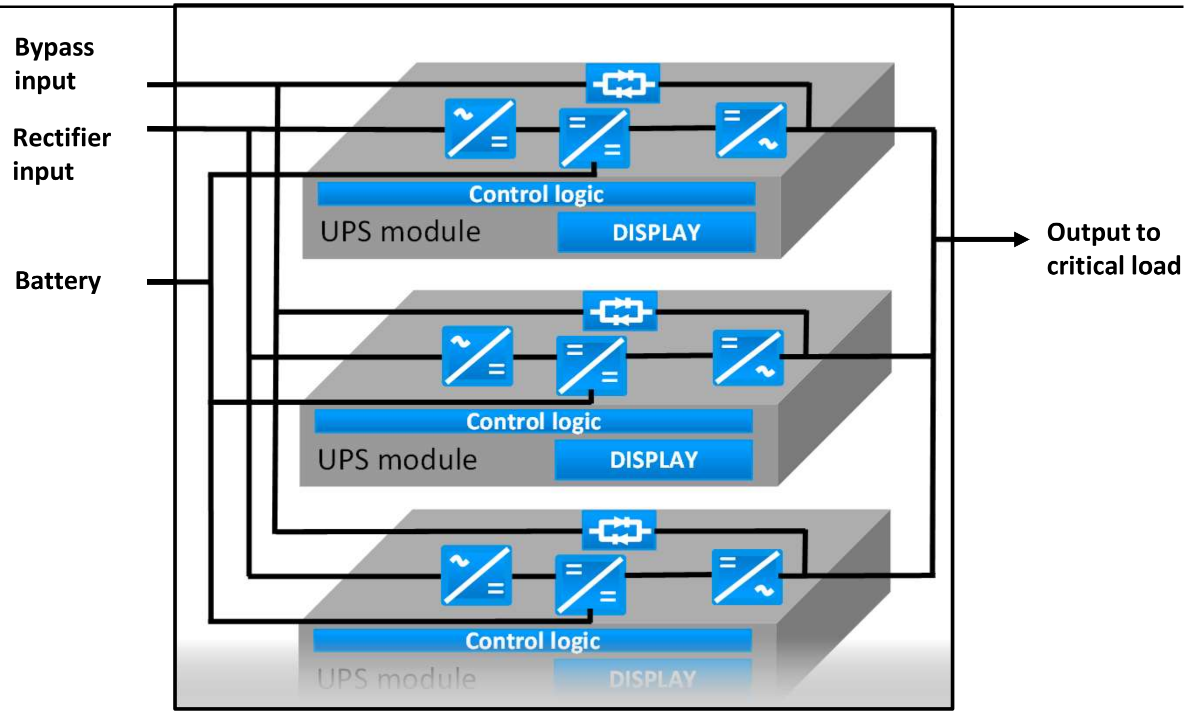


Modular UPS — Decentralized Parallel Architecture

Elastic Critical Infrastructure

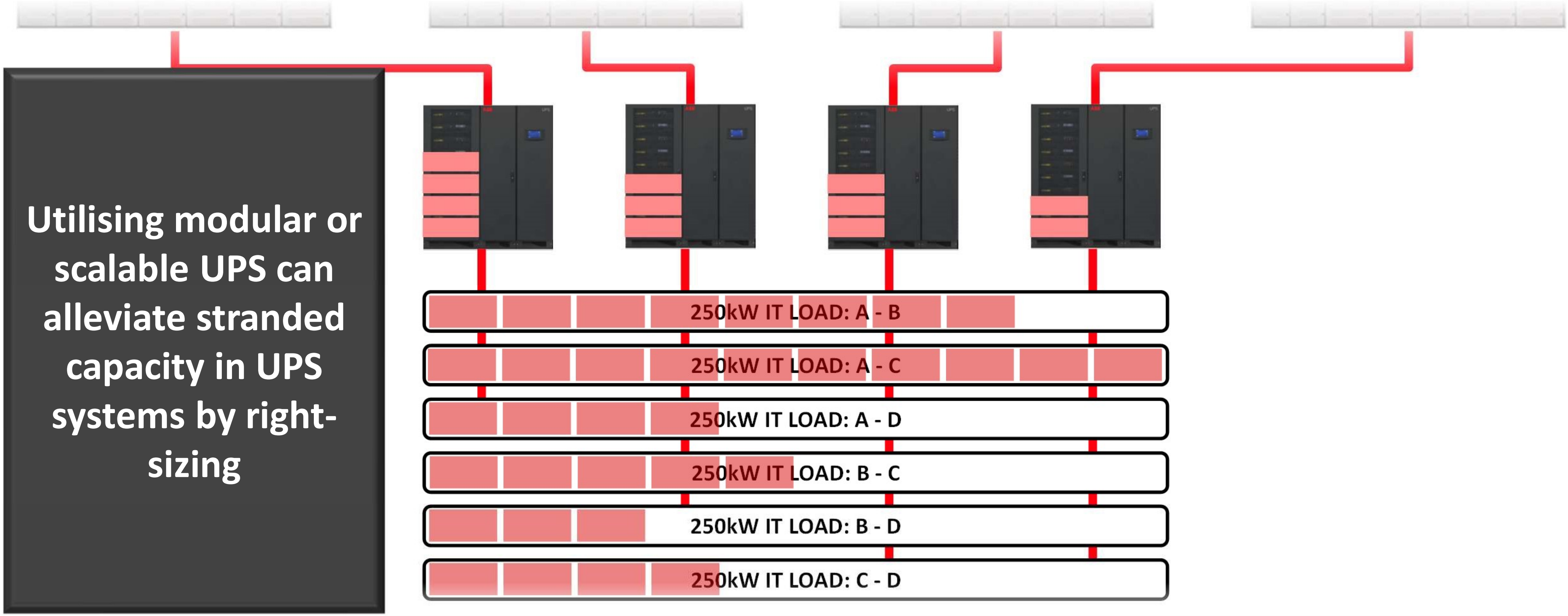
Decentralized Modular UPS

– Latest generation modular design
– Decentralized control logic, static switch etc., separate in each power module
– Active power module is a complete UPS
– Passive frame design – no shared components
– High availability
– Any UPS can be the logic leader (multi-master system)
– Eliminates single points of failure



Transformer: Fault levels

Elastic Critical Infrastructure



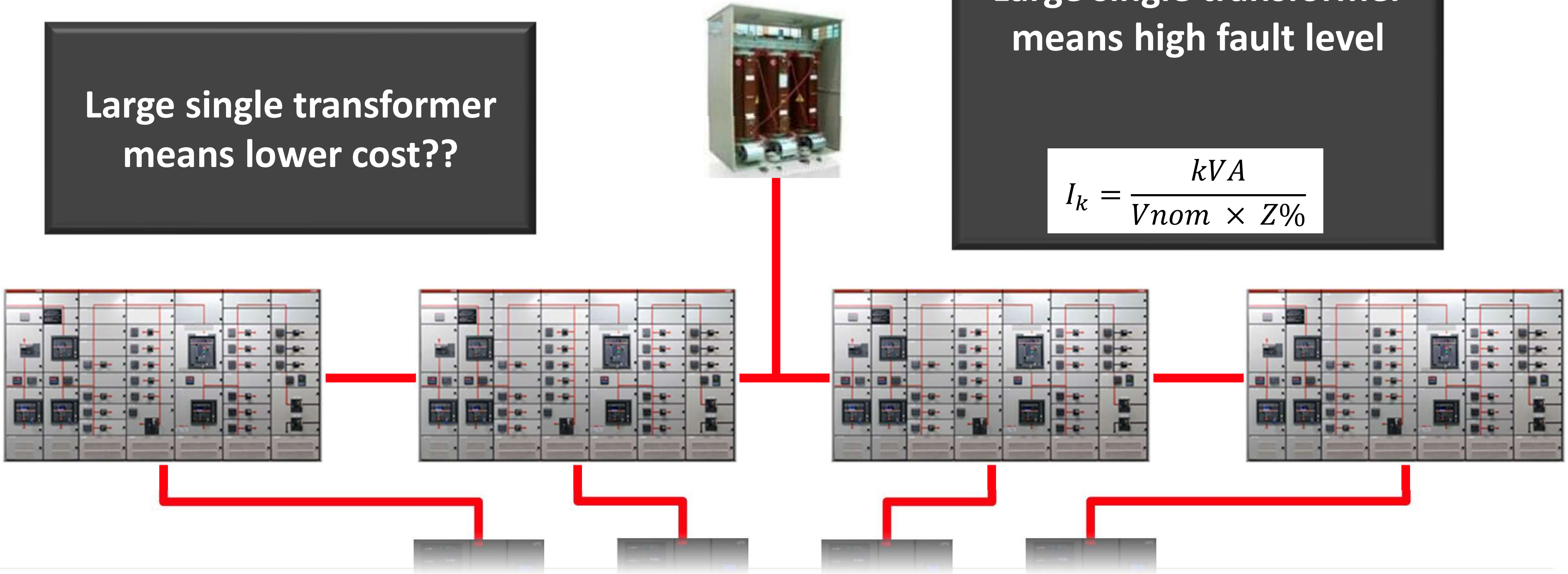
Transformer: Fault levels

Elastic Critical Infrastructure

Large single transformer means lower cost??

Large single transformer means high fault level

$$I_k = \frac{kVA}{Vnom \times Z\%}$$



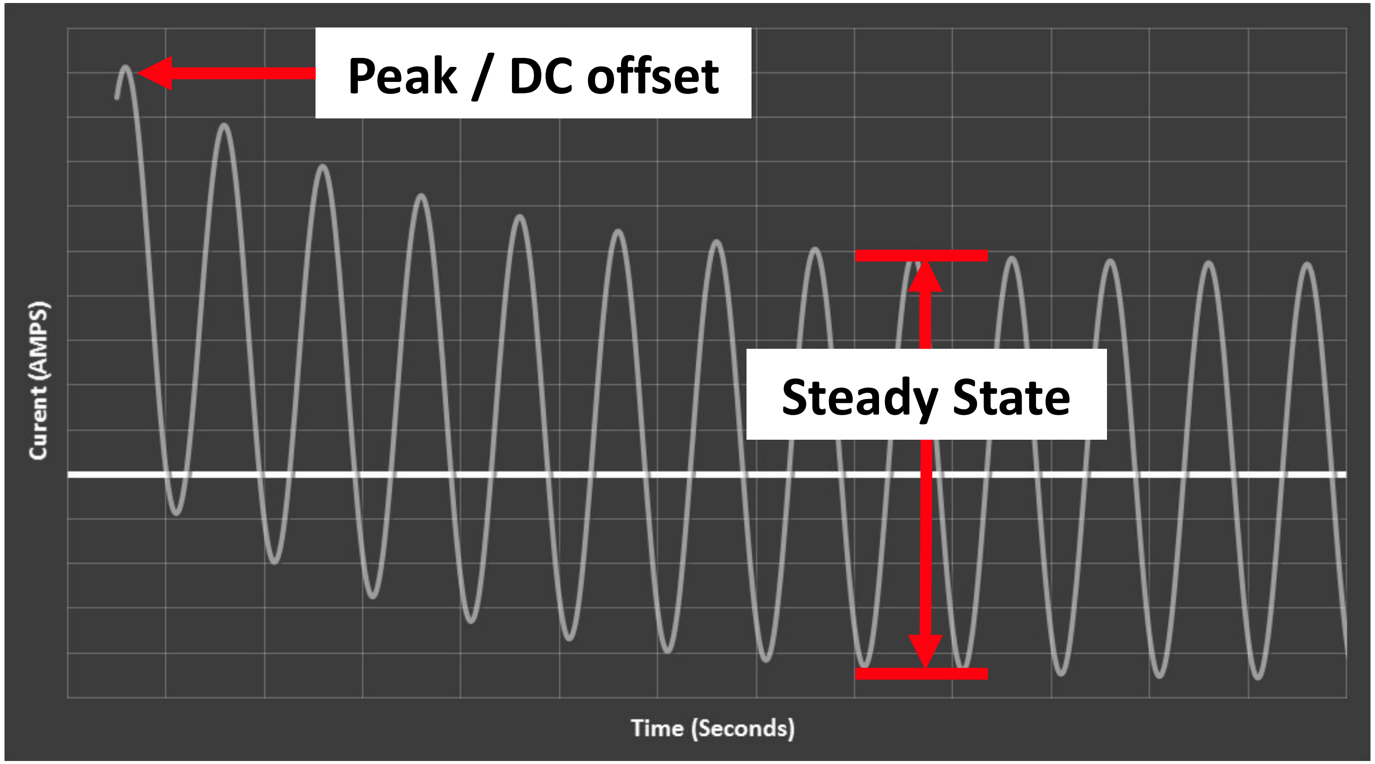
Transformer: Impedance

Elastic Critical Infrastructure

Increasing impedance of transformers is one way of reducing fault levels…

…but peak to rms ratio will increase

…and increase cost and lead time



Transformer: Fault levels

Elastic Critical Infrastructure

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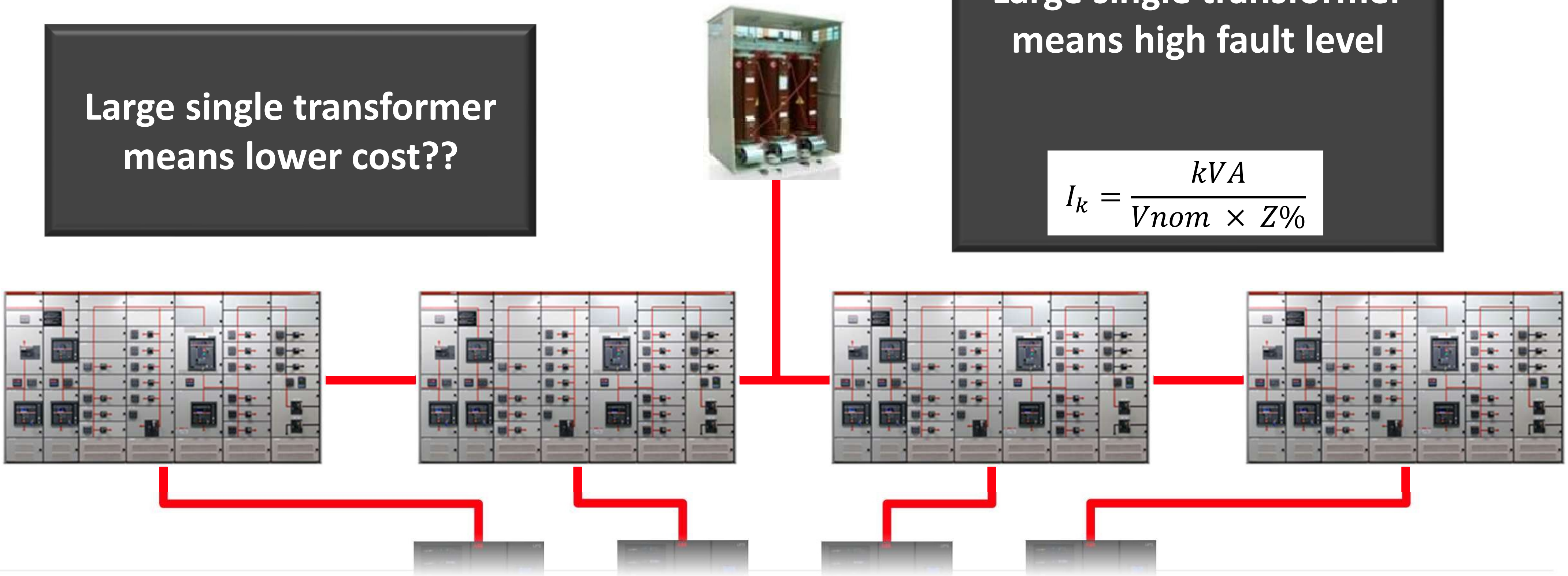
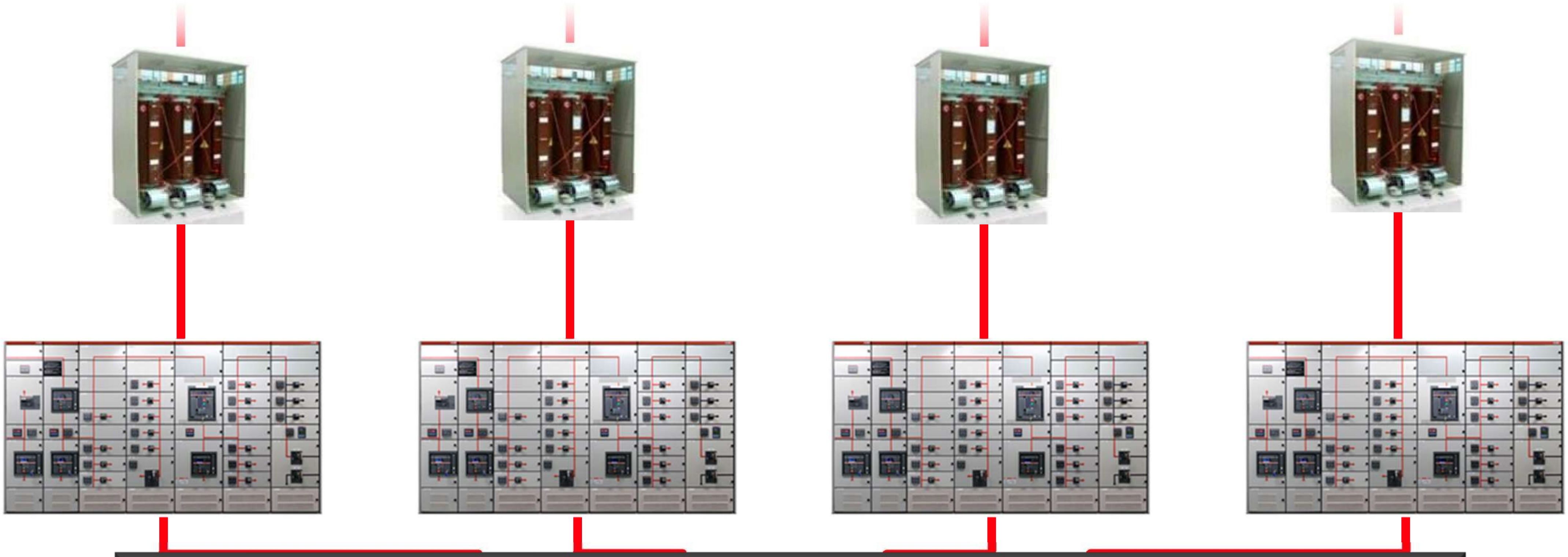


ABB

Transformer: Fault levels

Elastic Critical Infrastructure



Fault Level significantly reduced – up to 40% saving on ACB costs

By products

All-in-one Solutions for LV devices

Elastic Critical Infrastructure

Protection

- Interface relays
- Multifunctional relays
- Single protection relays

Measurement

- Current Sensors
- Multimeters
- Voltage sensors
- Network analyzer

Logic

- PLC
- Control unit
- ATS
- Synchronizer
- Synchro check

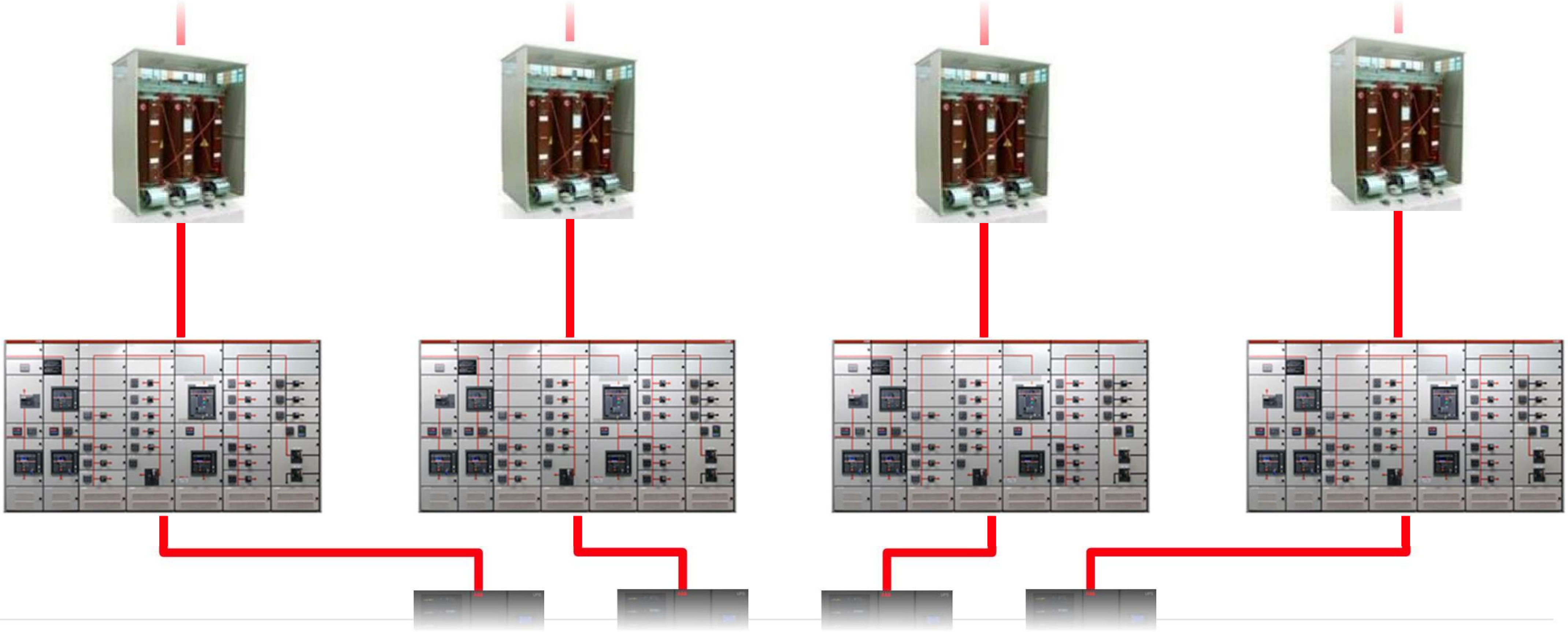
Connectivity

- Cloud gateway
- Field gateway
- Energy management platform

Embedded

Transformer: Fault levels

Elastic Critical Infrastructure

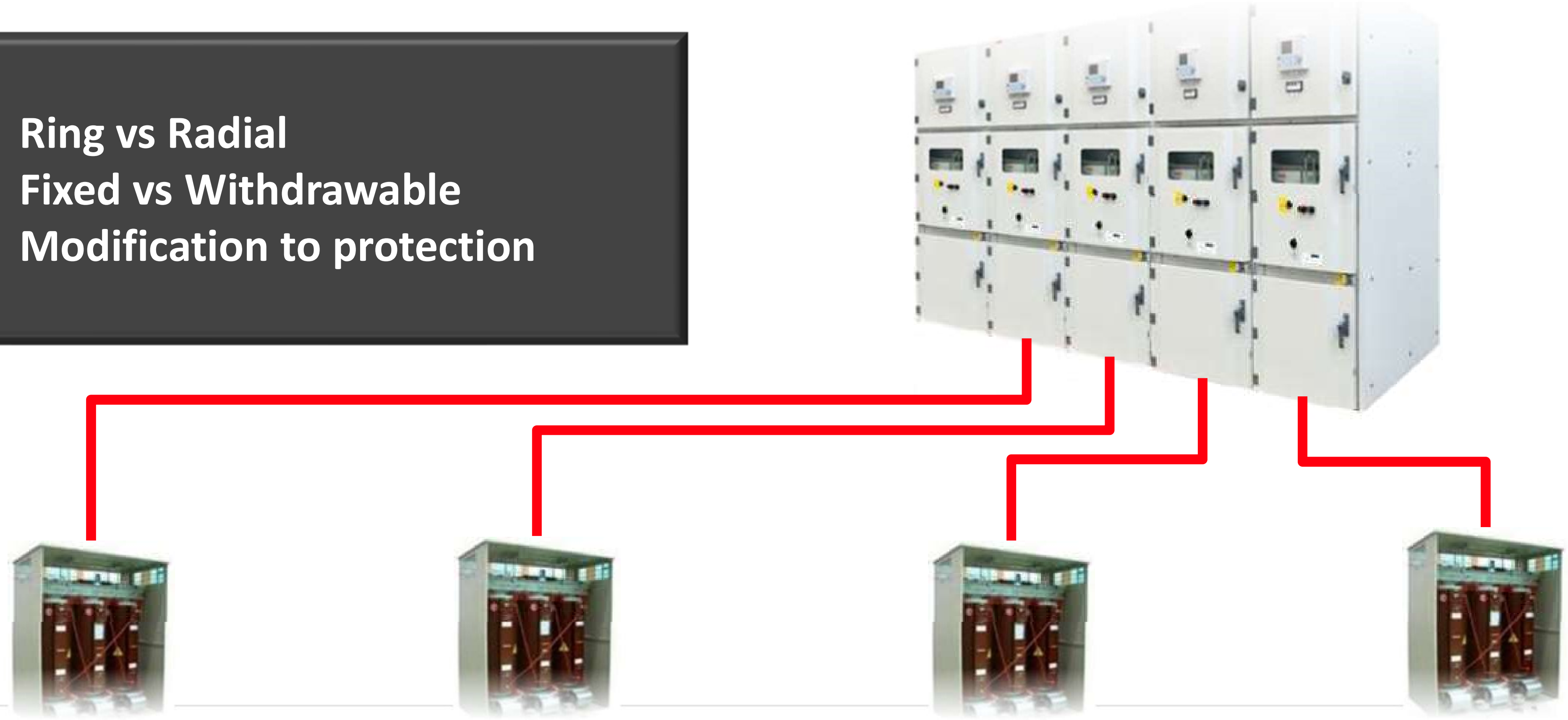


ABB

Transformer: Fault levels

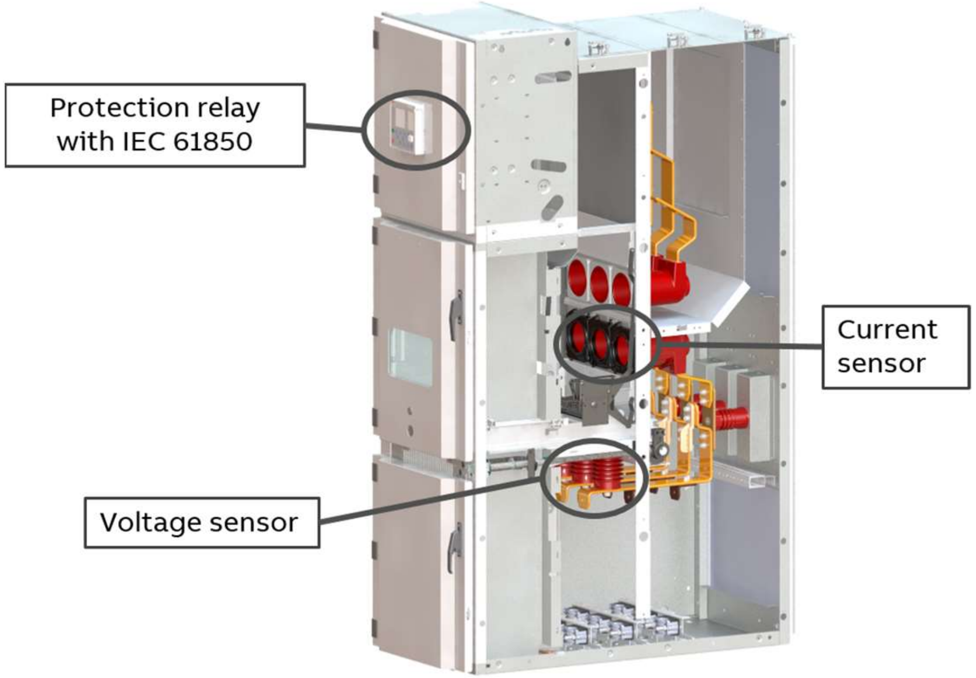
Elastic Critical Infrastructure

- **Ring vs Radial**
- **Fixed vs Withdrawable**
- **Modification to protection**



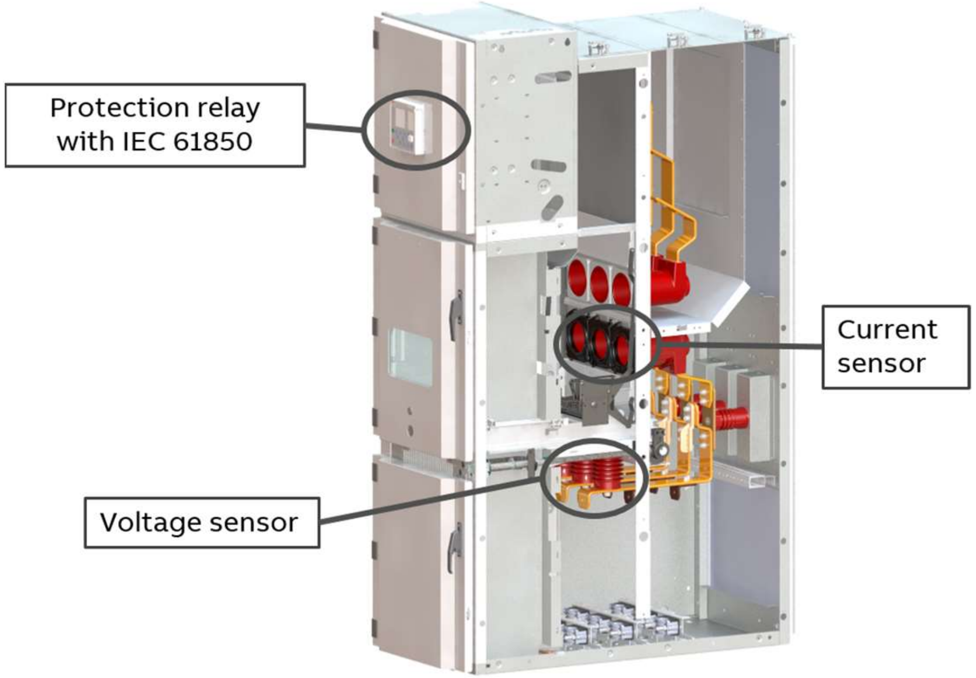
Smart assemblies, like UniGear Digital

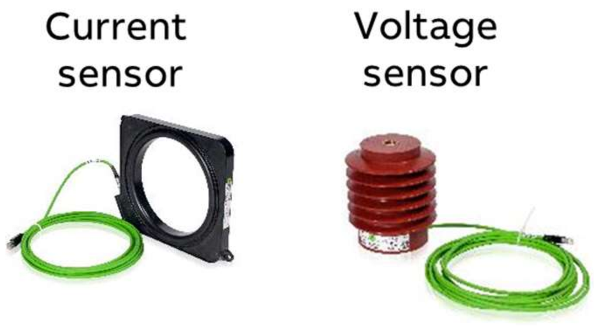
Elastic Critical Infrastructure



Smart assemblies, like UniGear Digital

Elastic Critical Infrastructure





MV sensors	Standards
Current sensors	• IEC 60044-8 (2002) • IEC 61869-10 (NEW) • IEEE PSIM Working Group • CSA Available Electronic current transformers
Voltage sensors	• IEC 60044-7 (1999) • IEC 61869-11 (NEW) • IEEE PSIM Working Group • CSA Available Electronic voltage transformers

How to make systems Elastic?

Elastic Critical Infrastructure

Standardise

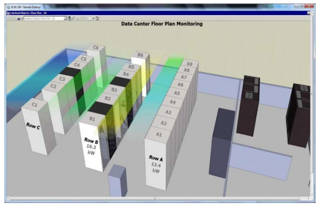
Make scalable systems

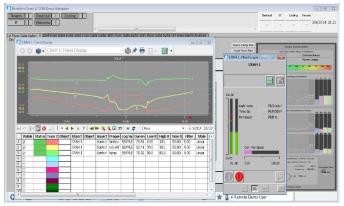
Make Smart

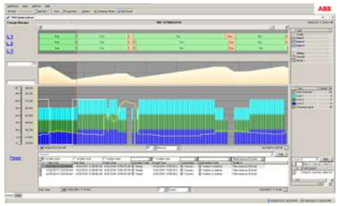
How to make systems Elastic?

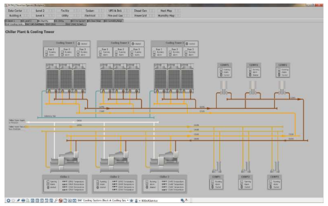
Elastic Critical Infrastructure

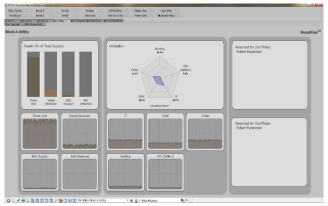
Leverage deep component visibility with automation











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