Siemens Xcelerator at Smart Infrastructure

Thomas Kiessling, CTO

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Global trends are changing our markets – structurally and profoundly

#Digitalization

#Globalization

#Urbanization

#ClimateChange

#DemographicChange

#FlexibleWorking

#PhysicalDistancing

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Market drivers for sustainable infrastructure

Sustainable energy transition

Sustainable communities

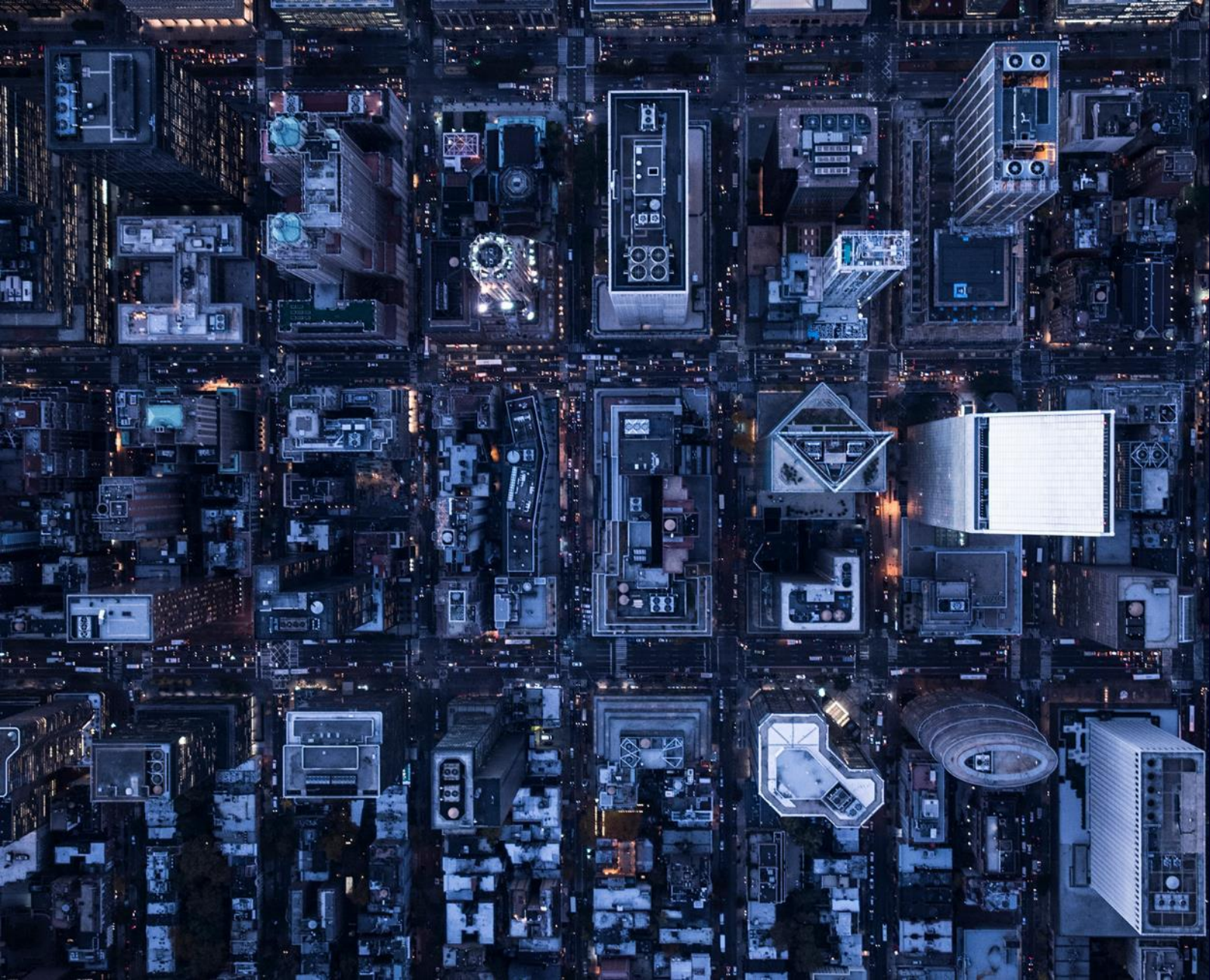Transition from fossil fuels (~80% today) to renewable energy

Move to an all-electric world, growing electricity demand (+20% by 2030), due to growth in electric mobility and digitalization

Creating communities that adapt to climate change and people's needs for better health, comfort and productivity

Making buildings more human-centric and sustainable – consuming 40% of energy demand, with 1/3 wasted

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The journey to autonomous buildings

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Challenges

68%

of the world population projected to live in urban areas by 2050.

Source: United Nations

SIEMENS

Challenges

90%

of people spend
almost all day indoors.

Source: United Nations

SIEMENS

Challenges

40%

of all energy is used by buildings.

(Thereof ¾ in building operation, ¼ in construction)
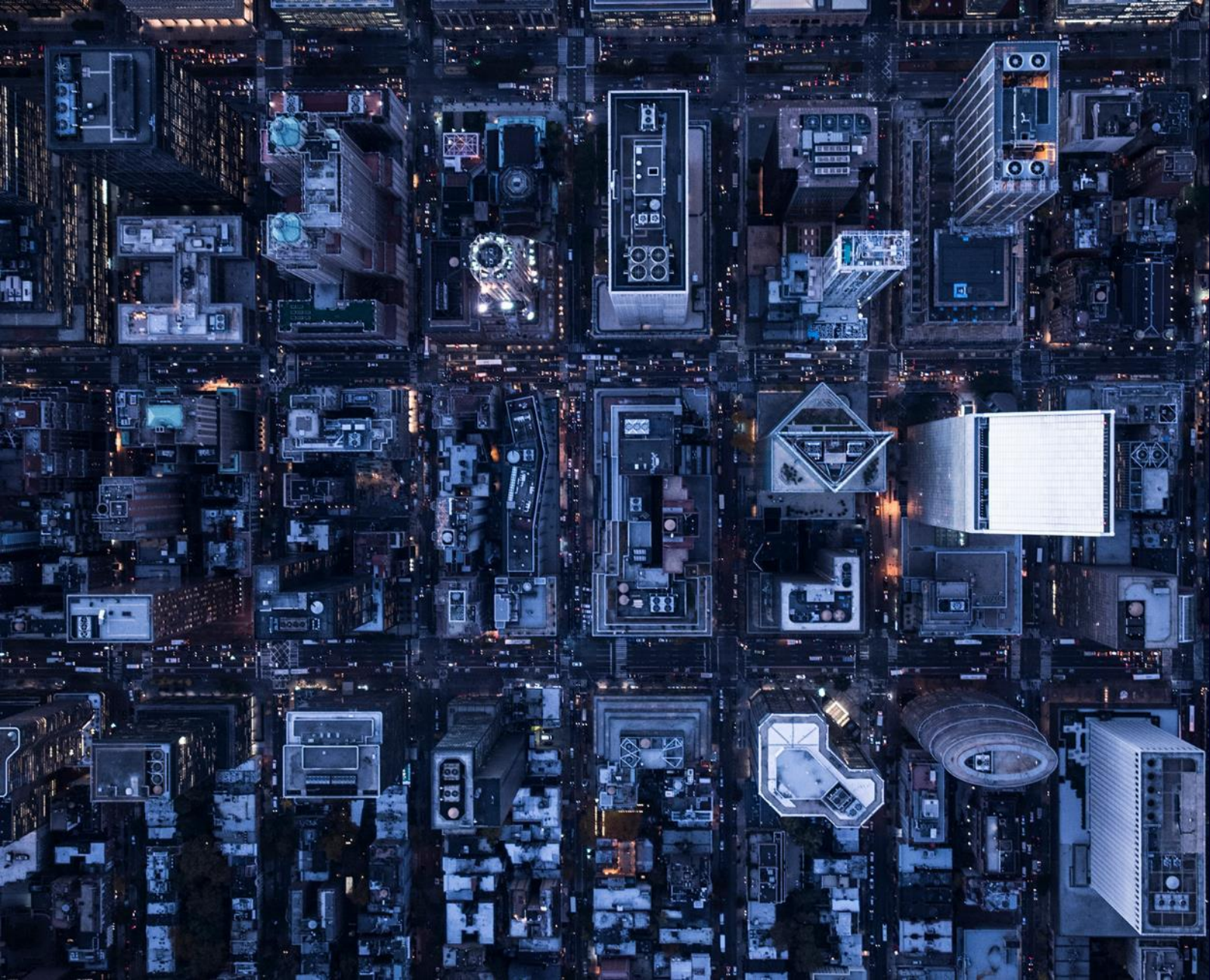
Source: Alliance To Save Energy (ASE)

SIEMENS

Challenges

27%

of global CO_2 emissions are caused by building operations.

Source: architecture 2030

SIEMENS

Challenges

The global building floor area is expected to

double

By 2060.

Source: architecture 2030

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The impact of buildings on the energy transition is huge

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Why we are uniquely positioned
to support our customers' digital and sustainable transformation

1 Strong global presence and trusted partnerships

| €3.2bn | Service business |
| 10k | Service technicians in 300 locations around the globe |

2 Well positioned to enable customer's sustainability goals

| €4bn | Energy savings under guarantee for customers |
| >25 | Years of offering energy and performance services |

3 Pioneer in infrastructure digitalization

| 3.2m | Devices connected to our cloud platform |
| >150 | Digital applications and offerings |

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Trends and challenges in buildings

People

30%
of office space will be consumed as flexible space by 2030

62%
see improving the well-being of occupants as strategic objective

Business

50%
of experienced facilities staff will retire over the next decade

74%
of building owners believe building design and management help attract talent

Environment

75%
of commercial buildings are energy inefficient

30 – 40%
Energy efficiency savings potential

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Digitalization will be the primary enabler to handle the challenges in buildings

75%

of companies see digitization as a key driver of change processes in buildings[1]

1 ZIA-CREM-Study 2020

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″Building X

…combines the physical and digital worlds in a single source of truth…

…to accelerate **Sustainability, Experience & Performance in buildings…**

…with AI-enabled applications, open platform, and connectivity solutions.

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Realizing building operations twin with Building X

Digitize

- Your data in one platform
- Seamless user experience
- Enabling 3rd party integrations
- Ecosystem through open APIs

Optimize

- Your work with an evolving set of applications
- To achieve your business goals

Connect

- Your buildings to the cloud securely
- Keep them up-to-date
- Flexible and extendable solution for future needs

Explore

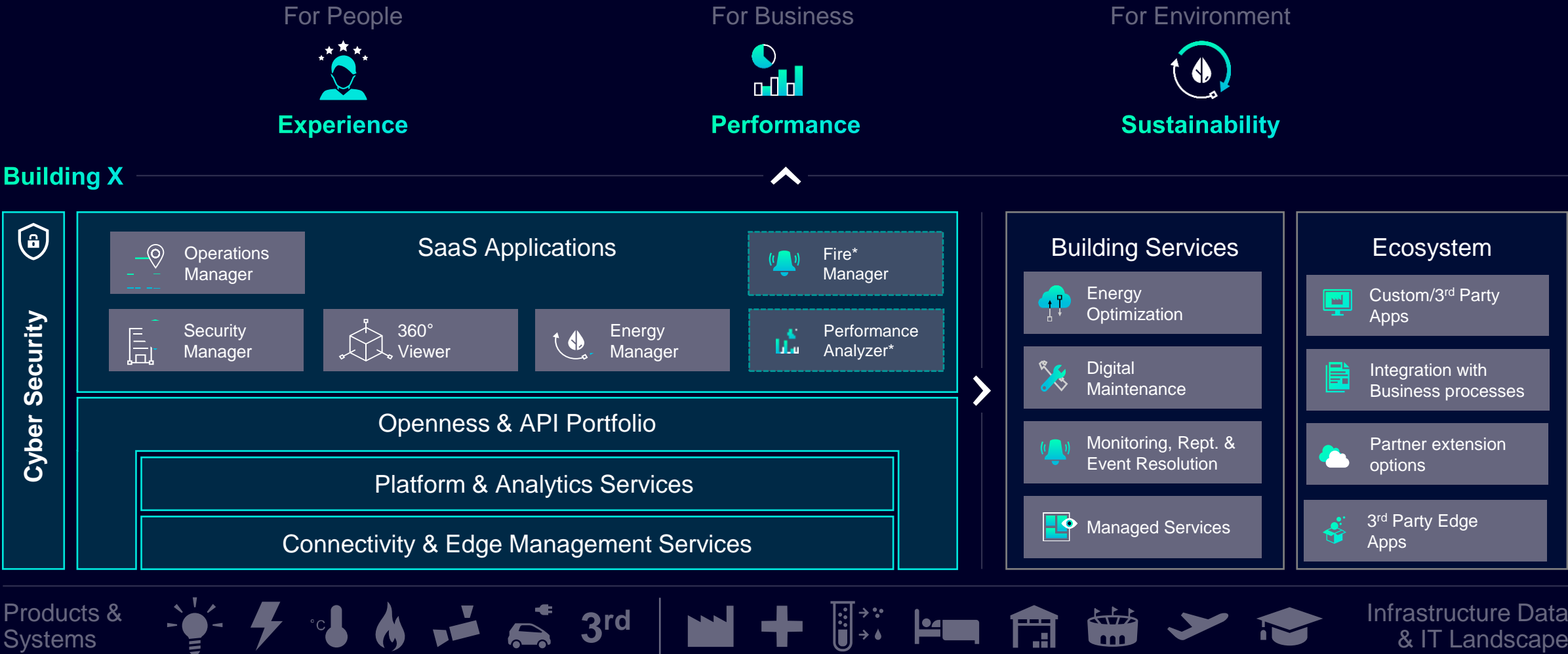- With powerful analytics solutions
- Gain new insights
- Identify efficiency and business opportunities
- Make smart data-driven decisions

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Building X: AI-enabled applications, platform and connectivity for future-proof buildings enabling digital services

For People

Experience

For Business

Performance

For Environment

Sustainability

Building X

Cyber Security

SaaS Applications

- Operations Manager
- Security Manager
- 360° Viewer
- Energy Manager
- Fire* Manager
- Performance Analyzer*

Openness & API Portfolio

Platform & Analytics Services

Connectivity & Edge Management Services

Building Services

- Energy Optimization
- Digital Maintenance
- Monitoring, Rept. & Event Resolution
- Managed Services

Ecosystem

- Custom/3rd Party Apps
- Integration with Business processes
- Partner extension options
- 3rd Party Edge Apps

Products & Systems

3rd

Infrastructure Data & IT Landscape

- *Not part of June release

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How do I meet our emission targets?
Sustainability Manager

How can I improve operational efficiency and reduce total costs?
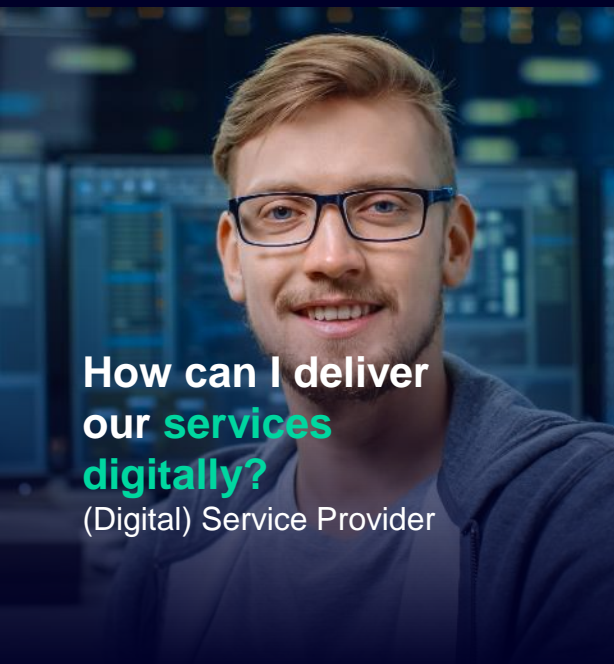Building Operations/Technical FM

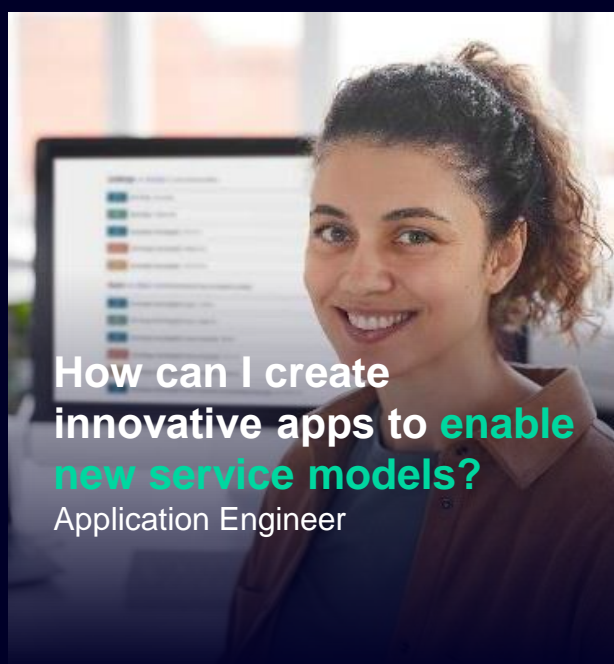**How can I create a secure environment for employees?**
Security Manager

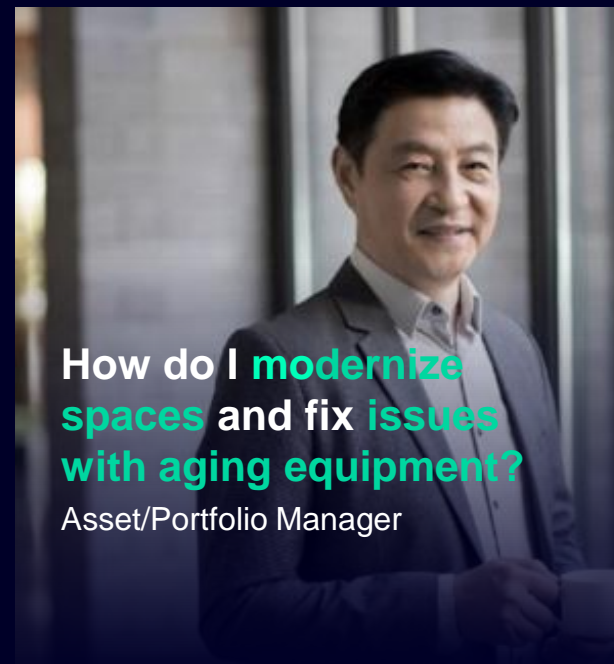**How can I keep our IT systems secure and future-proof?**
IT Manager

How can I deliver our services digitally?
(Digital) Service Provider

How can I create innovative apps to enable new service models?
Application Engineer

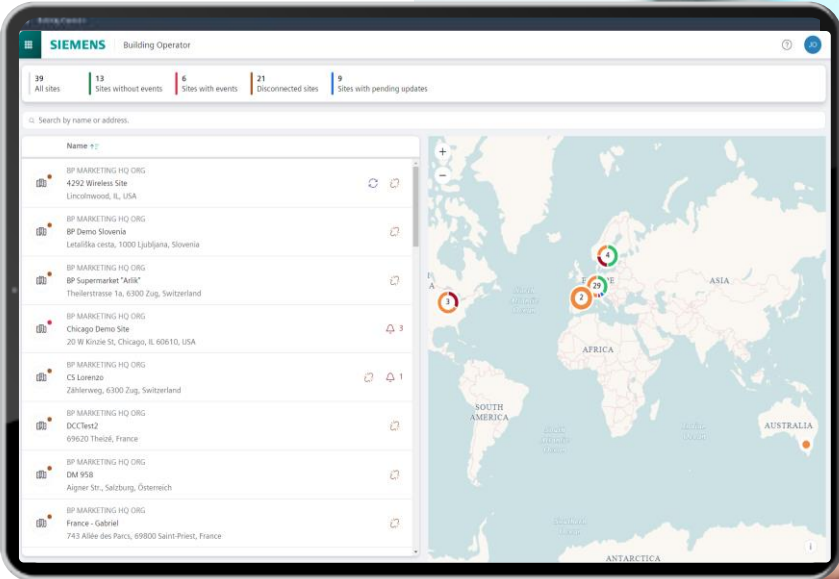**How do I modernize spaces and fix issues with aging equipment?**
Asset/Portfolio Manager

How can I accelerate the digital transformation of our organization?
CEO

SIEMENS

> # *With Building X, I can spot inefficiencies and resolve issues before they occur.*
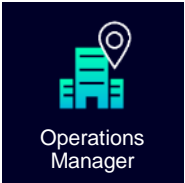
Facility Manager

Remote is smart
Save time and expenses by securely monitoring and controlling multiple sites remotely.

Stay alert
Take immediate action when safety thresholds are reached or when budgets are projected to be exceeded.

Bring energy efficiency to a new level
Benchmark buildings to identify outliers and check detailed consumption per building.

Plan smarter, avoid surprises
Explore a location in a virtual 3D environment before maintenance interventions to inspect assets remotely and reduce unexpected delays.

Energy manager

Operations Manager

360° Viewer

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Digital services enable holistic view of "symptoms"

360°

Maximize uptime due to faster reactivity time

Minimize total cost of ownership

Predictability of OPEX

Unable to satisfy setpoint

Chiller runtime >12 hours

Fan consuming excessive power

Fan running excessively

SIEMENS
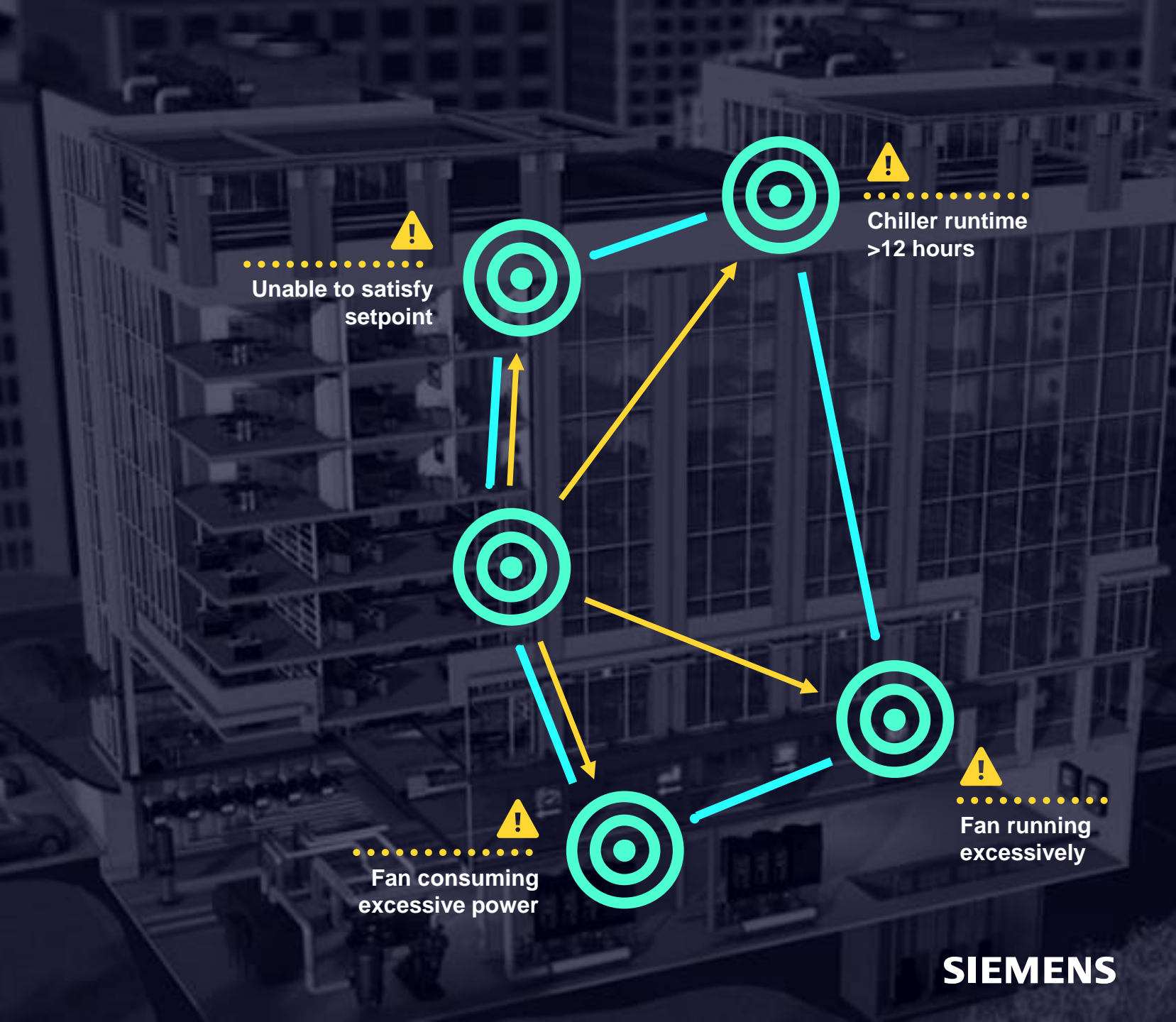
Ensure smooth operations after identifying inefficiencies in your energy consumption

Always **be up-to-date** with regards to the systems' status and health in all your buildings.

Save time and travel expenses by digitizing your activities and **solving the issue remotely.**

No delays! 3D representation of your building in 360° Viewer helps you better plan your maintenance operations and reduce delays.

Operations Manager

360° Viewer

SIEMENS
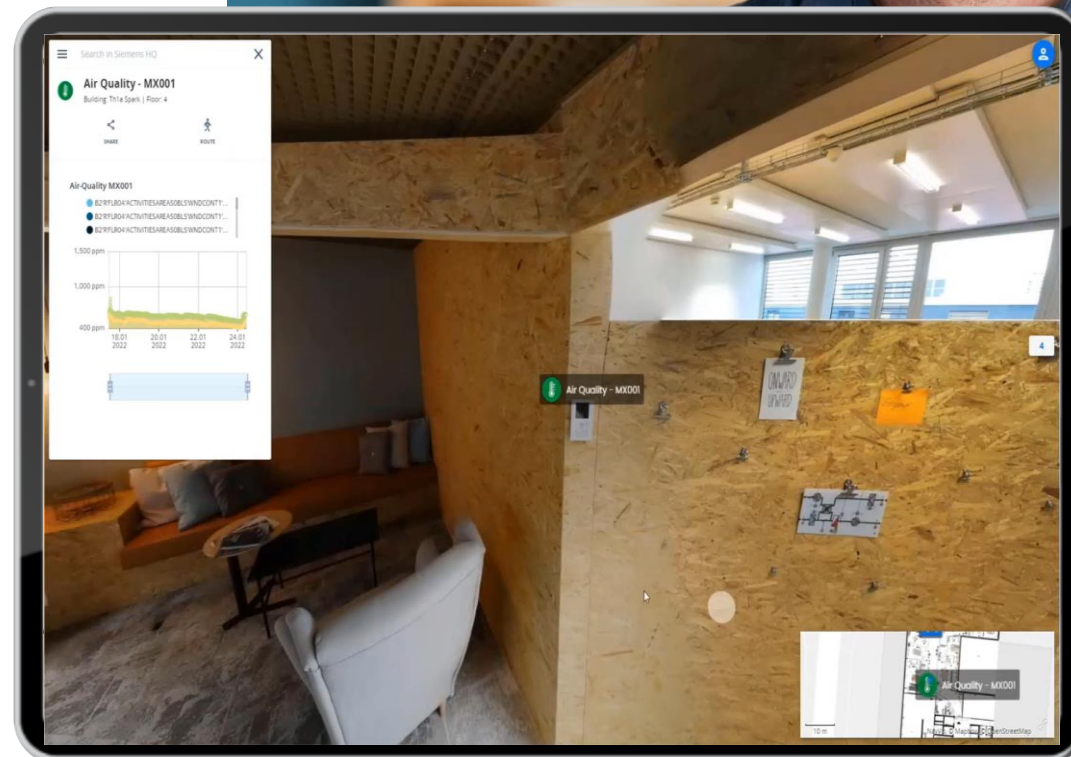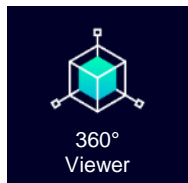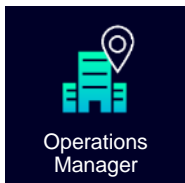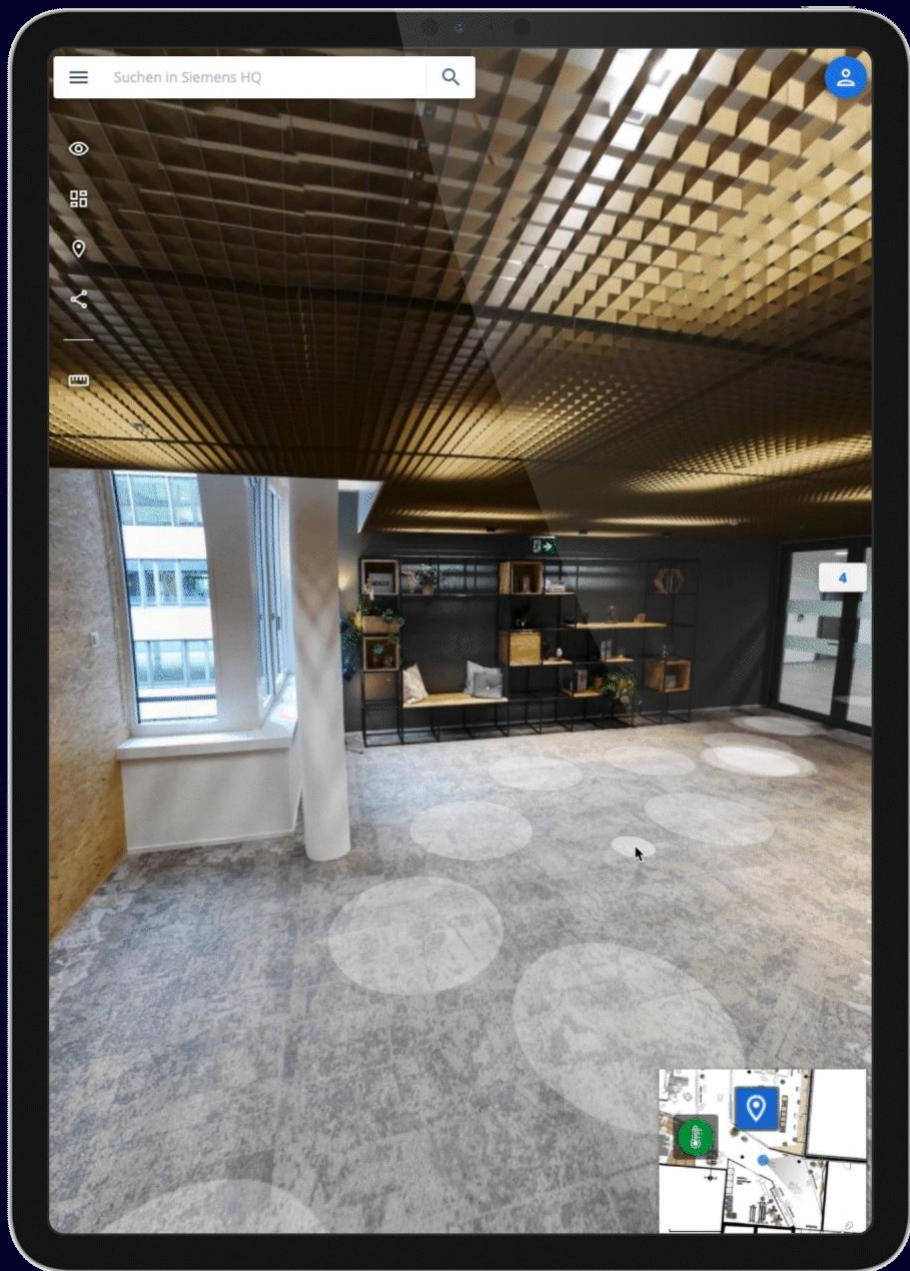
Access your building data

from design to operational face with one click!

Check the site **before you visit**

Navigate in the buildings to **identify the device locations**

Monitor the real-time data & dashboards

Act fast to **solve the issues faster** & easier

360°
Viewer

SIEMENS
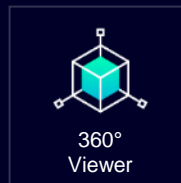
> **I love that Building X allows me to keep my finger on the pulse and demonstrate our progress at any given time.**
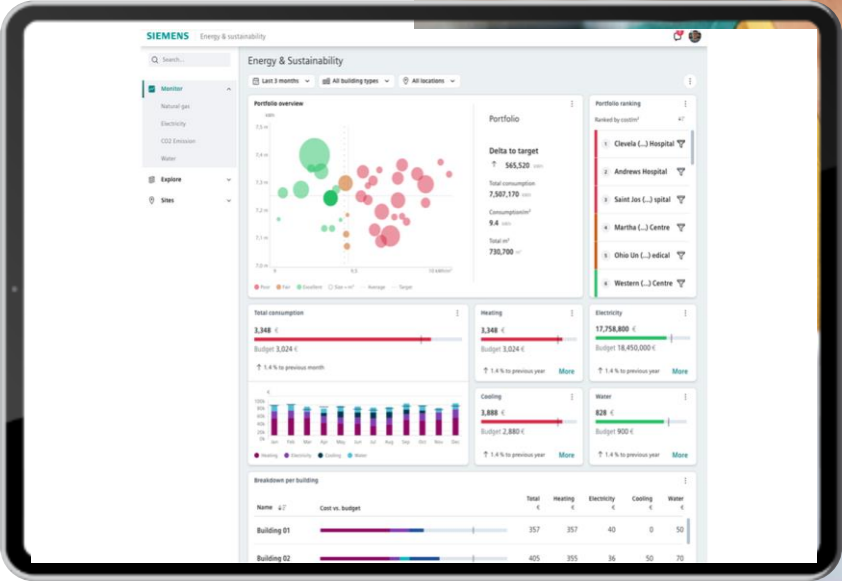
Good-bye manual data consolidation
with all data in a single, reliable source.

Spot inefficiencies faster
thanks to up-to-date data, intuitive reports and crystal-clear dashboards.

Precise data for sound reporting
that demonstrates the impact of my work to my stakeholders.

My business goals within reach
with AI-based analytics that improve our energy and sustainability efficiency.

Energy manager

Sustainability Manager

SIEMENS

Make data-driven decisions by using accurate sustainability data

Access consumption and **CO_2 emission data** in near real-time for your **entire portfolio** in a consolidated view.

Easily **compare energy consumption** and related **CO_2** and **water** usage between **buildings**, and over time.

Leverage **AI-based forecasting and notifications** to be alerted to **potential budget overruns** and take action.

Use the power of data to **trigger** required optimization activities with operational teams and contractors.

Energy manager
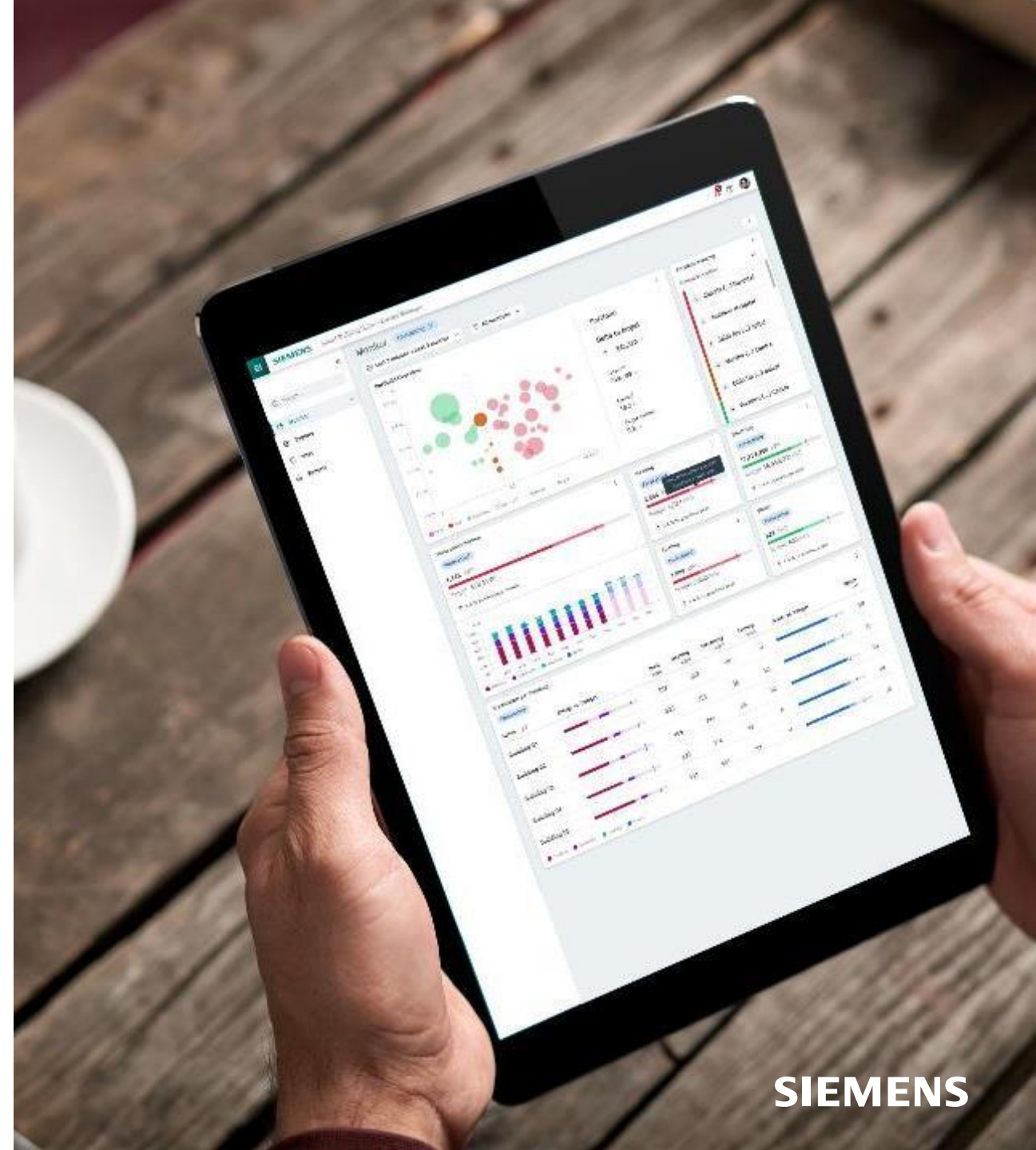
SIEMENS

Building X Demo

SIEMENS

"
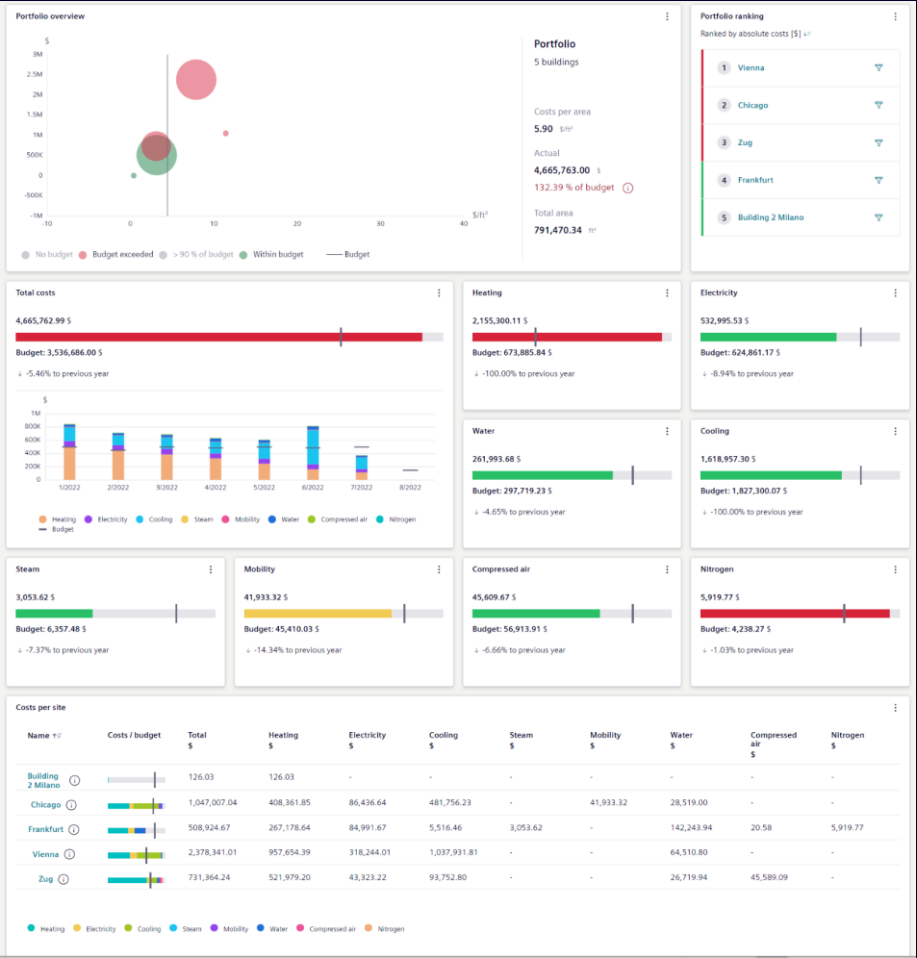
With Building X I will be able to address customer needs for highly customized, tailored solutions utilizing their building and equip-ment data. Thanks to the Building X portfolio, this can now be done cost effectively and in less time than ever before.

– Thomas Naylor I Cloudline Solutions

SIEMENS

"

Building X will not only help us
modernize our buildings but also
support our company to reduce
its costs, increase our efficiency
with its cybersecure solutions
while overall making us
ready for future challenges.

– Ville Kautto I SYK

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Accelerate the energy transition

Siemens Grid Software

SIEMENS

Path to a carbon free energy system
Energy consumption outlook per sector in Germany (TWh)

Industry

2019	2030	2045
701	678	612
214	297	400

Mobility

2019	2030	2045
796	639	376
	80	163

Buildings

2019	2030	2045
1.029	880	613
262	279	260

Net electricity consumption

+100%

2019	2030	2045
507	722	993
	67	154
	655	839

Legend: ■ Fossil energy ■ Biofuels ■ H₂/PtL/PtG ■ District heat ■ Ambiant heat ■ Electricity ■ Electricity for H₂/PtL/PtG ⌐ Int. transport ■ Other

Legend with LaTeX: Fossil energy, Biofuels, H_2/PtL/PtG, District heat, Ambiant heat, Electricity, Electricity for H_2/PtL/PtG, Int. transport, Other

SIEMENS

Demand and Generation in 2030 and beyond for Germany

Demand increase

40% increase by 2030, 100% by 2045
Net electricity consumption[3]

		993
		154
	723	
	68	839
507	655	
2019	2030	2045
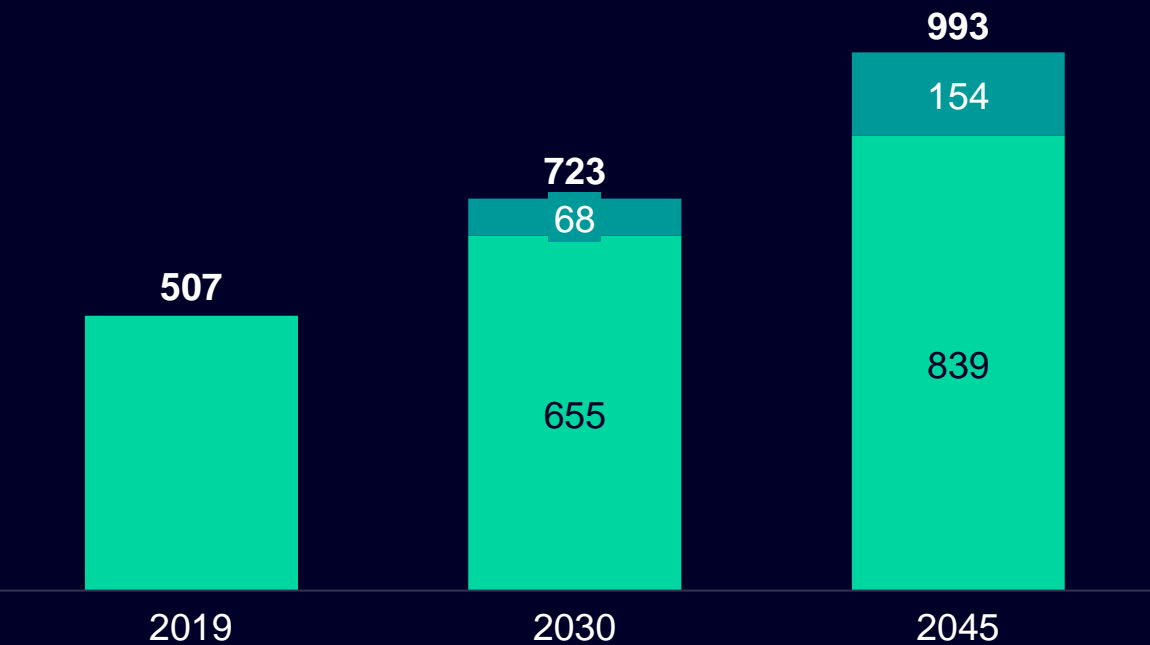
- Electricity for H_2 and PtL/PtG
- Direct electricity consumption

Source: BCG analysis

Generation

3x increase of capacity needed by 2045
GW

		621
		88
	384	230
	74	
	140	70
225	98	180
2019	2030	2045

- Natural gas
- Coal
- Lignite
- Nuclear
- Solar PV
- Wind offshore
- Wind onshore
- Other

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Key priorities for the energy grid to enable 1.5°C target

Until 2030

Increase the low emission share of electricity generation to	**72%**
Reduce the energy intensity by	**33%**
Multiply investments in advanced clean technologies by	**x 2.8**

Increase of investment in energy systems by

2% of GDP

Source: IEA

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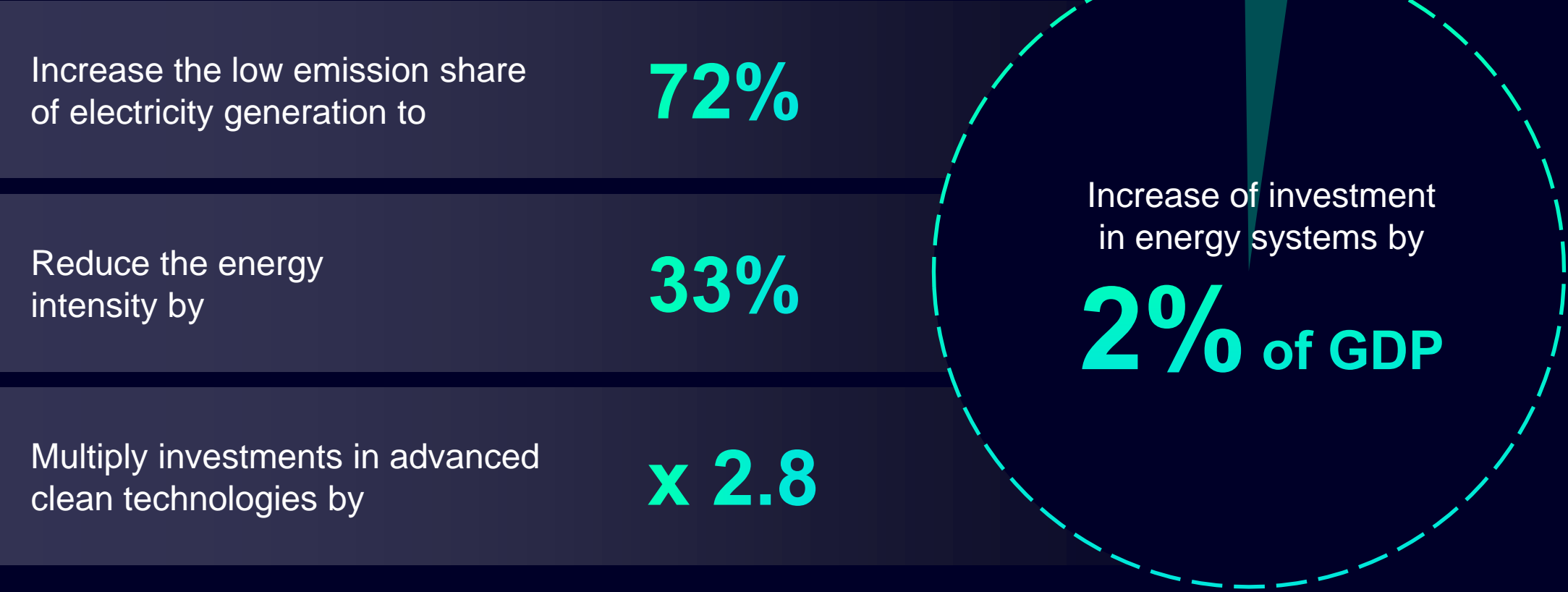
Addressing today's energy challenges

1.8 m people

faced extended outages in Florida after Hurricane Ian due to aging transmission

5x electric vehicles

increase from 2020 to 2025

€2.3 bn

Congestion management cost in Germany in 2021, over €800m in renewable energy sources curtailed

**2x Demand &
3x Supply**

Unpredictable **consumption**

(EV, weather, …)

Net Zero targets

Total cost of revamping energy system in Europe into net zero is
less than cost of **Marshall Plan**

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What are grid operators' priorities?

Market drivers

Transmission

- Large scale renewables growth
- Drop of system inertia and reactive power imbalance
- Limited grid capacity and expensive redispatch

Distribution

- Integration of DERs
- Dynamic and complexity of power and market flows
- Limited visibility, automation and resources

Priorities

Compliance

Acceptance

Resilience   Efficiency
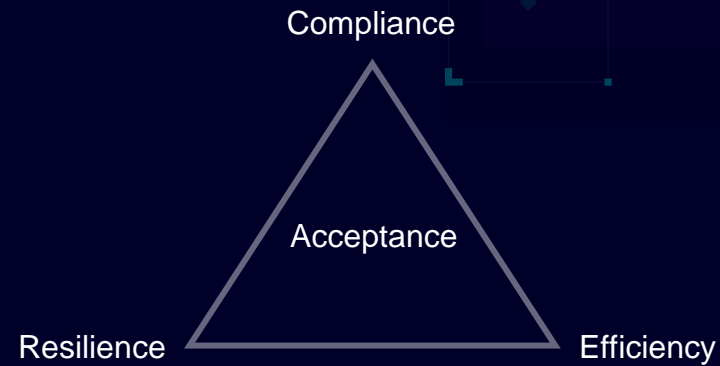
+ Optimal planning under uncertainty

+ Cybersecurity

+ Grid digitalization

Digitalization trends

- IT/OT convergence
- IoT and AI as an enabler for analytics and transparency
- Increasing automation and information exchange
- Adoption of cloud
- Cyberthreats

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It's time to flip the switch on the energy transition

DER_Hosting

From slow manual decisions …

… to maximum capacity boost

Flexibility

From pure CAPEX investments with limits …

… to adaptable and open incl. SaaS tools

Last_Mile

From blindfolded LV management …

… to AI-enabled optimized grid

Next_Level_Grid

From manual intervention …

… to self-healing and automation

… and turn visions into reality!

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Grid Software

Plan - Operate - Maintain

- Planning
- Operations & Control
- Grid Edge
- Optimization & Maintenance
- Consulting
- Meter Data Management

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The Grid Software Suite
Rethink Grid Management and Grid Software

PSS®ODMS, PSS-E, PSS®CAPE, Spectrum Power™: Single source of truth

PSS®E Cloud: 30x speed increase

New EnergyIP®: 85% reduction of clerical tasks with new UX

Refactored PSS®CAPE protection planning with 6x speed increase

30% more power over the same line with dynamic line rating: combine SIGUARD DSA and Spectrum Power™

...

CRM

Protection

GIS

Billing

Asset Management

Outage Management

Grid Planning

LV Situational Awareness

Workforce Management

Data Exchange and Integration

Algorithmic and Analytic core

...

Digital Twin

Network Model Management

Data Management

...

Meter Data Management

SCADA

EV charging

DMS

DERMS

...

Field connectivity

Additionally, cloud-native: lower TCO with EnergyIP® MDM SaaS

Reduce technical losses by 0.3-0.8% using smart meter data in grid planning – combine EnergyIP® MDM and PSS®Sincal

Interoperable

Modular

Open

Resilient & Cybersecure

Collaborative

SIEMENS

What customers can expect from working with Siemens Grid Software

Enabling 7x DER integration while delivering on grid operator priorities

Technical losses	Non-technical losses	Reduce SAIDI	Customer Satisfaction	Decrease OPEX	Return on Invest	Regulatory Compliance
Using smart meter data for advanced grid planning to reduce technical losses	**Protect and increase revenue** using smart data: Recovery of non-technical losses	**Reduce time for trouble-shooting** by locating faults faster, reducing SAIDI	**Zero customer complaints of inaccurate bills** due to high meter data quality	**Reduce effort for data collection** & model creation, keeping planning, operations & maintenance synchronized	**Increase of energy supply** without capital invest	**Increase of power flow** with dynamic stability analysis
-0.3 to -0.8%	5 to 10%	-3 to -5%	Invaluable	-60% **effort**	+10% **energy supply**	+30% **power flow**

Cybersecurity

on all levels with Defense-In-depth approach: Siemens cyber security framework, based on IEC 62443 and IEC 62351 and international security standards like NERC CIP, BDEW Whitepaper, ISO 27001 …

The benefits stated on this slide are indicative and vary depending on your individual situation.

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Siemens Grid Software accelerating the energy transition

More than
1,000
customers
in 90 countries

More than
1,300
Spectrum Power
systems in operation

More than
1,000
experts

More than **500**
Engineers

More than **230**
in R&D

Keeping the lights on for hundreds of millions of people

SIEMENS

From Egosystem to Ecosystem
Our partner network supports customer workflows end to end

Partner Categories

Portfolio partners
complement
Siemens Grid Software portfolio

Tech partners
help to build
Siemens Grid Software portfolio

System Integrators and EPCs
integrate/implement
Siemens Grid Software portfolio

Resellers
sell
Siemens Grid Software portfolio

...

Asset Management

GIS

CRM

Billing

Workforce Management

...

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Digital Twin of Transmission Grid, American Electric Power, USA

Efficient

Maintain, analyze and exchange network data across multiple domains (reducing manual efforts).

Future-proof

An up-to-date grid model enables AEP to quickly adapt to grid changes while increasing renewable capacity efficiently, safely, and reliably.

Single source of truth for model data across planning, protection, and operations departments

Seamlessly convert, manage and exchange data for a unified network model

Interoperability with various software tools (PSS CAPE, PSS-E, Asset Management, etc) through standardized interfaces

SIEMENS

EnergyIP® Meter Data Management Software-as-a-Service (SaaS) for Silicon Valley Power, USA

It's Easy
Work smarter, not harder in new user interface and customer experience with EnergyIP Mosaic®. Every day workflows made quick and easy.

Reduce IT operational costs
Reduce total cost of ownership.

$0 cost for enhancements, upgrades, and bug fixes during subscription period. Trust in security and compliance.

Increase customer satisfaction
Increase productivity with 99.99% of data issues resolved automatically and nearly zero billing complaints from data issues due to superior data quality.

85% task time reduction
Significant improvement to task efficiency in new UI. Better navigation, business monitoring, and user experience.

50 data centers
Manage 50 data centers and approximately 1% of California's total power consumption.

12 years
Loyal customer of proven EnergyIP® MDM for 12 years and counting.

SIEMENS

EnergyIP
video

SIEMENS

Grid Software Summary

We solve it with software → Can't achieve 1.5° C without it

Siemens Xcelerator Engagement Model → Open, partner driven, modular, iterative, fast, trusted partner

Enables the grid, through digitalization, to transition to 3x demand, 2x generation by 2030 → More resilient, less waste, more productive, less investment

Continuous product releases → Modular, open, based on digital twin

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Smart electrification for our future

Unrestricted | © Siemens 2022

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Path to a carbon free energy system
Energy consumption outlook per sector in Germany (TWh)

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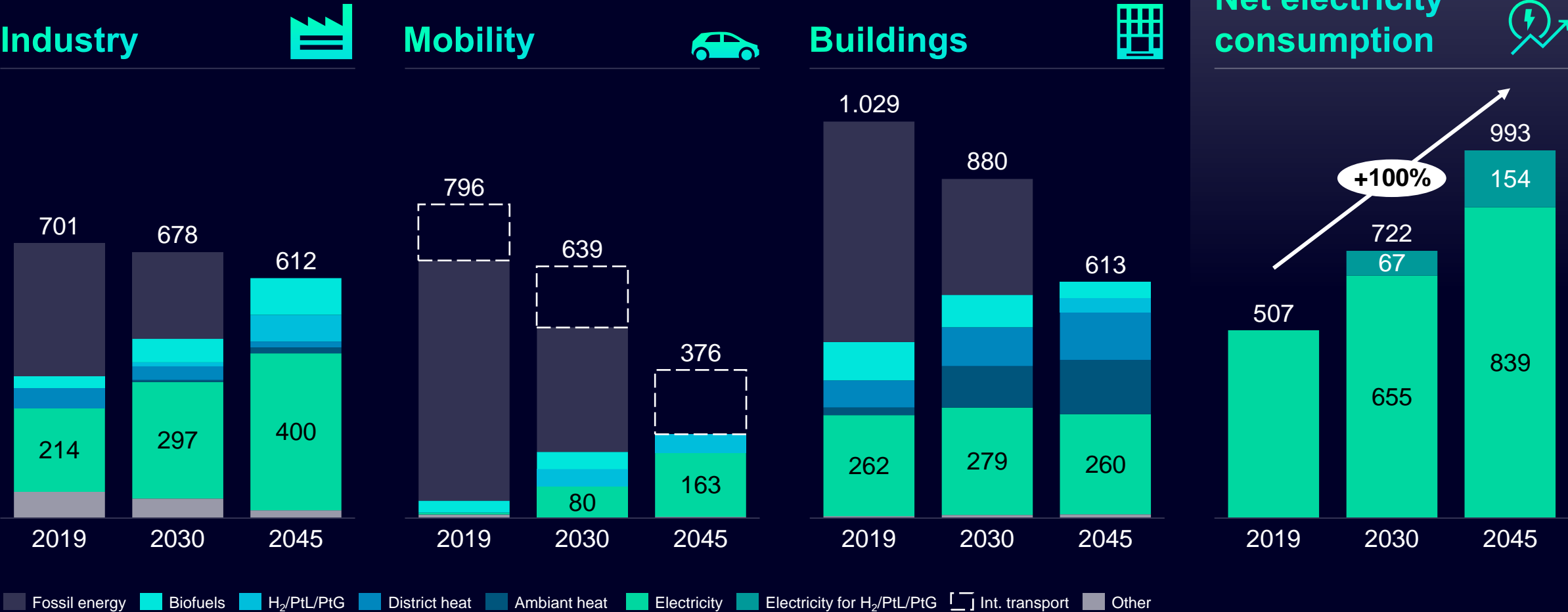
Our
electrification portfolio

01

eMobility charging infrastructure

02

Low voltage switchgear

03

Substation automation and protection

04

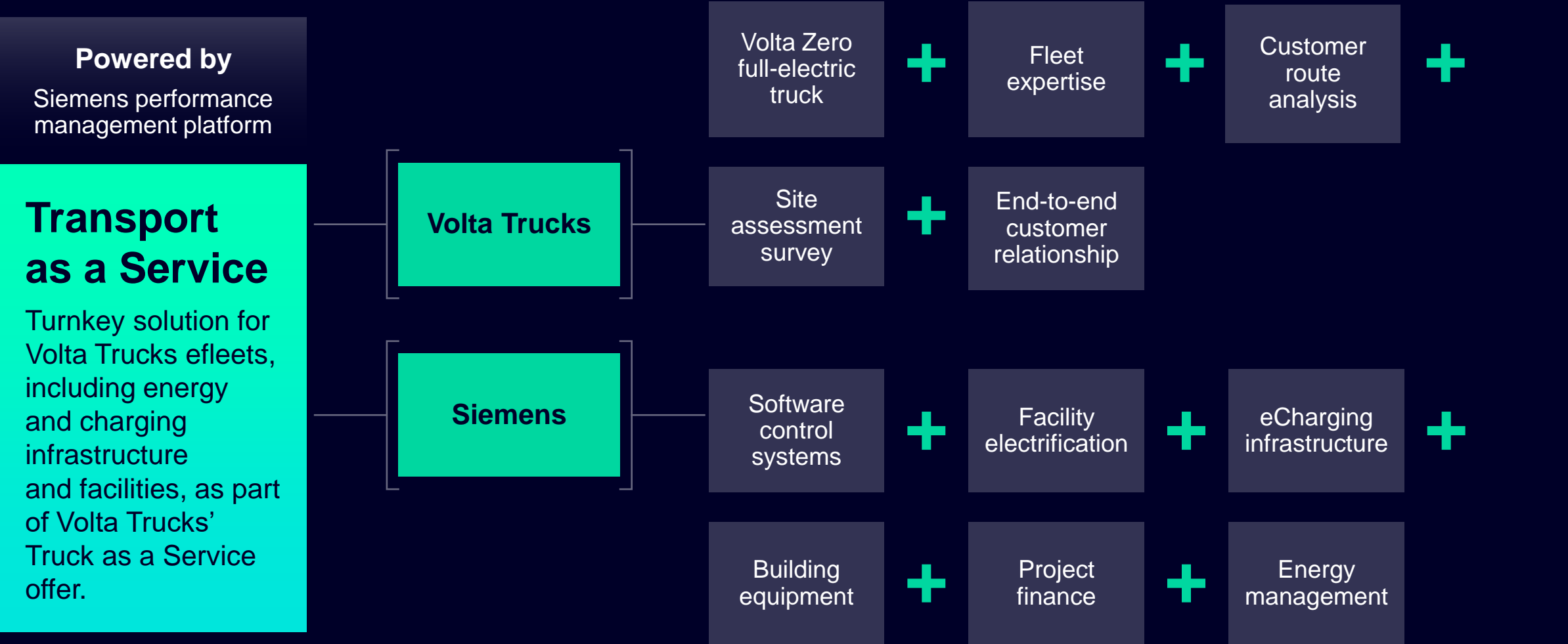Innovation: driving transformation of electrical networks with IoTization & new technologies

05

Medium voltage primary, secondary switchgear

**06**

Grid simulation, operation and control software

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Siemens partners with Volta Trucks
eTrucks running on green energy, at all times

Powered by
Siemens performance management platform

Transport as a Service

Turnkey solution for Volta Trucks efleets, including energy and charging infrastructure and facilities, as part of Volta Trucks' Truck as a Service offer.

Volta Trucks

- Volta Zero full-electric truck **+** Fleet expertise **+** Customer route analysis **+**
- Site assessment survey **+** End-to-end customer relationship

Siemens

- Software control systems **+** Facility electrification **+** eCharging infrastructure **+**
- Building equipment **+** Project finance **+** Energy management

SIEMENS

Siemens supports accelerated fleet electrification with Volta Trucks
One depot at a time
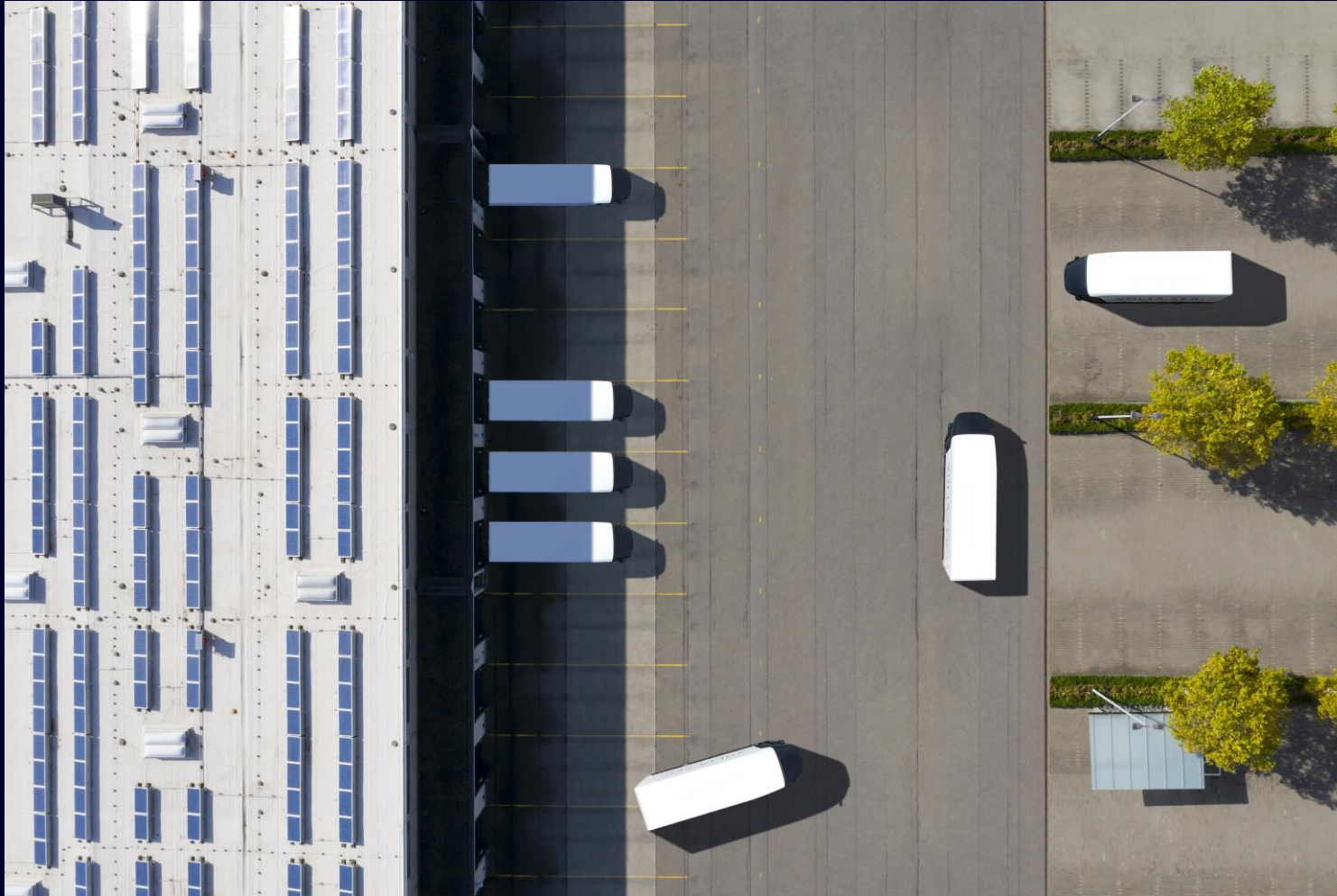
Every vehicle charged when needed (uptime and performance commitments)

100% Green energy

Turnkey infrastructure as a Service (charging, power distribution, solar/storage, 24/7 operations mgt, financing)

AI-based routing and energy optimization

Aim to scale over 100s of depots

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Questions and Answers

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BACK UP SLIDES

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All buildings can be smarter with Siemens Xcelerator
Easier, faster and at scale.

Traditional building

Automated building

Smart building
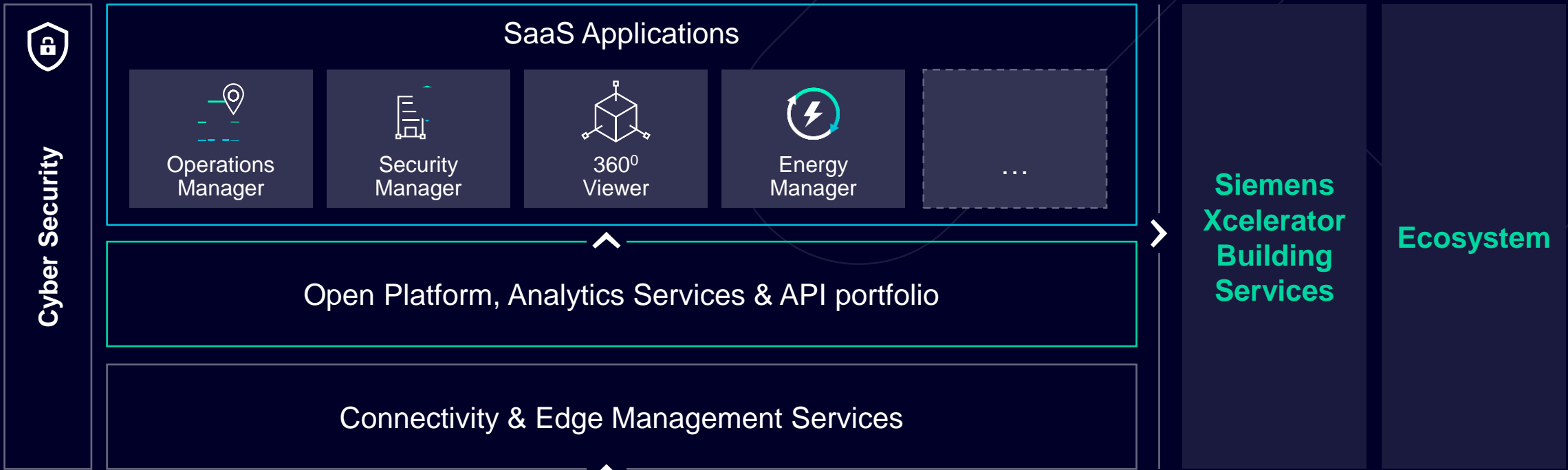
Autonomous building

From ...		To ...

- Reactive on-site service & connected remote
- On-site solutions
- Complex integration process
- Siloed domain control

- Predictive & prescriptive
- AI-enabled remote operations
- Simple & easy integration
- as a Service

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Option 2

Enhanced User Experience

Higher Building Performance

Sustainable Future

Building X

Cyber Security

SaaS Applications

Operations Manager

Security Manager

360^0 Viewer

Energy Manager

…

Open Platform, Analytics Services & API portfolio

Connectivity & Edge Management Services

Siemens Xcelerator Building Services

Ecosystem

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Enterprise solutions

Digital services

Software-as-a-Service

An opportunity for sustainable electrification

Growth in electricity consumption:
+2.8% CAGR (2020-2030)

Source: IEA Outlook

Electrification of transport:
~30% EV share by 2030 **~5%** of total electrical energy demand in 2030

Source: Alliance To Save Energy (ASE)

Increasing share of renewables including:
+800GW additional capacity by 2030

Source: Bloomberg (BNEF)

Aging grid infrastructure:
US: **60%** of the circuit breakers are over **30** years old

Source: US Dept of Energy

Need for **higher system flexibility** peak-shifting can enhance capacity up to **30%** while reducing outages by **70%**

Source: PTI Study

Digitalization, automation and sensors:
Currently **10%** of LV and **30%** of MV nodes "intelligent"

Source: Designetz Report

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Siemens partners with Volta Trucks
What's next?

Managing fleets

The strategic collaboration will lead, and actively manage customers through the design of their fleet electrification journey.

Driving sustainability

Offering ensures power distribution, renewables integration and energy services to build sustainable, eFleet hubs, with lower energy costs.

Geographical focus

Partnership will start serving commercial fleet customers in the Americas, Europe, Middle East and Africa.

Powered by data

Data-driven, turnkey management of critical assets enables scaling to robust fleet operations for Volta Trucks customers.

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