OCTOBER 29, 2024

Data, PI, AI, Industry Use Cases and Connected Community

Ann Moore, Global Industry Principal, AVEVA

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Up to

73%

of all data collected within enterprises goes unused

Source: AIoT: The Key to Unlocking Business Value From Industrial Data, Forbes, 2021

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76%

of business leaders find it difficult to understand their data

Source: Data Management Poses Major Challenges and Issues for Companies: New Study, Forbes, 2022

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Connecting people to that data is key

Leveraging the cloud to empower your ecosystem securely and seamlessly across the value chain for exponential business growth

By 2025,

40%

of global organizations will have a digital platform in place for ecosystem operation, driving a 10% higher data capitalization rate than those that do not take this approach[1]

7+%

more revenue growth for companies further along in their digital transformation journey than industry peers[2]

[1]Source: IDC FutureScape: Worldwide Future of Industry Ecosystems 2024 Vendor Assessment (doc #US50217123, October 2023); [2]McKinsey

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Industry challenges

Information silos

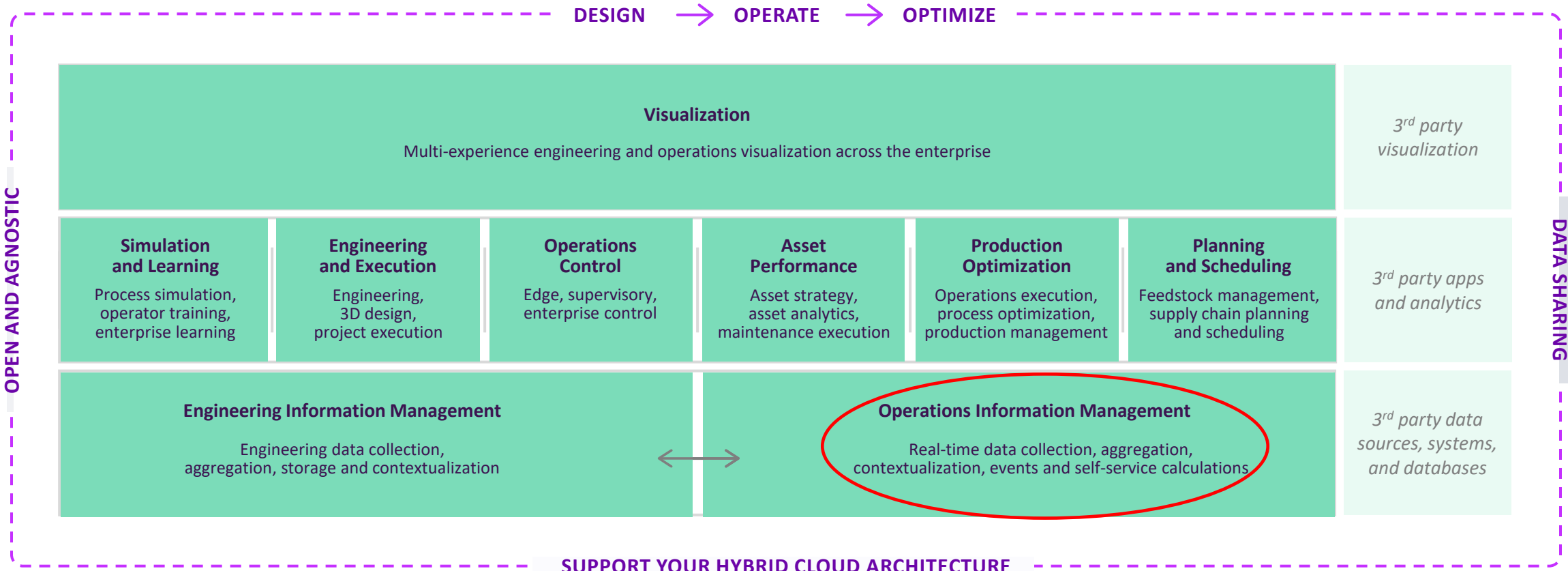Inconsistent data and slow responsiveness

Remote and virtual teams have limited access to reliable data

Difficulty understanding operational performance across sites and teams

Need to predict behaviors and outcomes for greater efficiency and sustainability

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Delivering a complete digital thread, purpose-built for industry

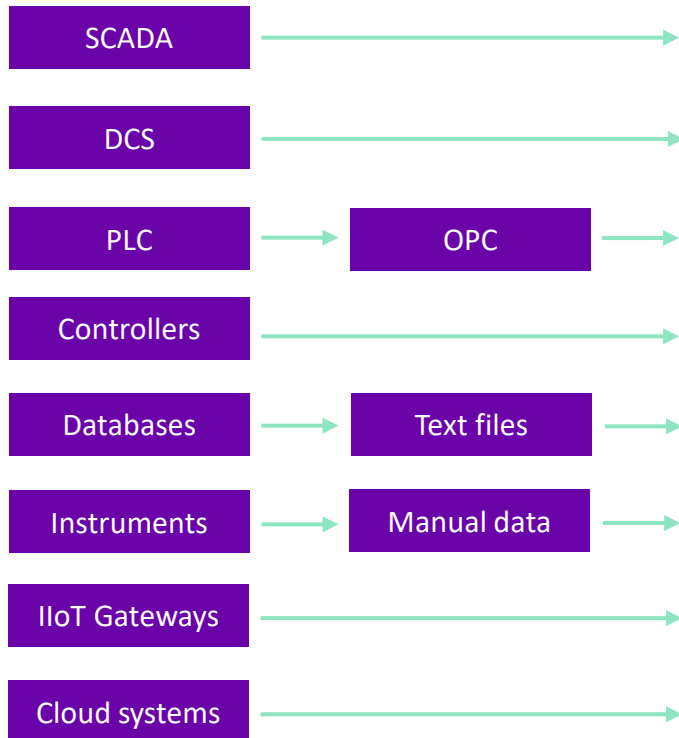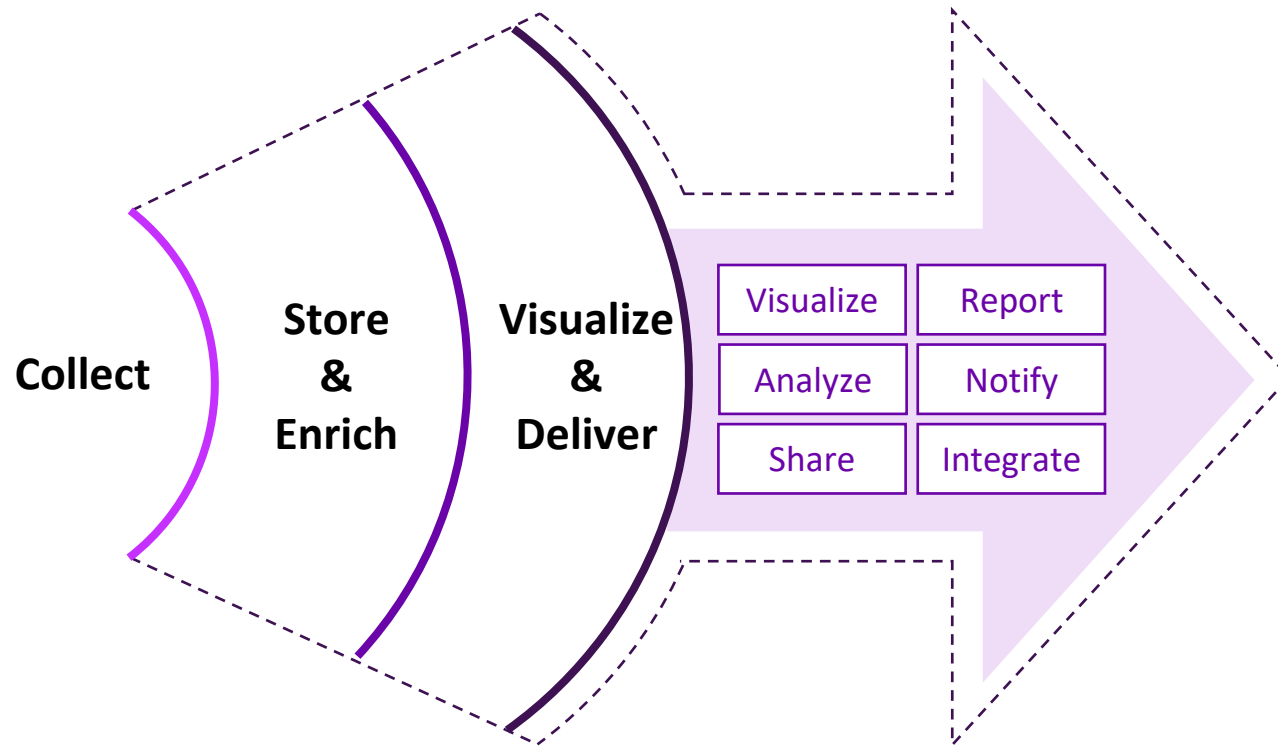## Accelerate time to value with flexible, scalable, and trusted industrial hybrid SaaS solutions

DESIGN → OPERATE → OPTIMIZE

OPEN AND AGNOSTIC

DATA SHARING

Visualization

Multi-experience engineering and operations visualization across the enterprise

3rd party visualization

Simulation and Learning	**Engineering and Execution**	**Operations Control**	**Asset Performance**	**Production Optimization**	**Planning and Scheduling**
Process simulation, operator training, enterprise learning	Engineering, 3D design, project execution	Edge, supervisory, enterprise control	Asset strategy, asset analytics, maintenance execution	Operations execution, process optimization, production management	Feedstock management, supply chain planning and scheduling

3rd party apps and analytics

Engineering Information Management

Engineering data collection, aggregation, storage and contextualization

←→

Operations Information Management

Real-time data collection, aggregation, contextualization, events and self-service calculations

3rd party data sources, systems, and databases

SUPPORT YOUR HYBRID CLOUD ARCHITECTURE

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AVEVA PI System

Operations data sources

Standardization

Data consumers

SCADA

DCS

PLC → OPC

Controllers

Databases → Text files

Instruments → Manual data

IIoT Gateways

Cloud systems

Collect

Store & Enrich

Visualize & Deliver

Visualize	Report
Analyze	Notify
Share	Integrate

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AVEVA PI Data Infrastructure

A transformational new hybrid offering

Aggregate data from the edge,
multiple plants/sites and the cloud

Easily scale data storage capacity
in the cloud

Share real-time data securely to support
remote monitoring & users

Integrate seamlessly with CONNECT
analytics & visualization services

Share & protect operations data between
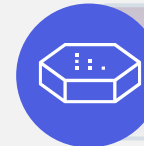other CONNECT users and partners
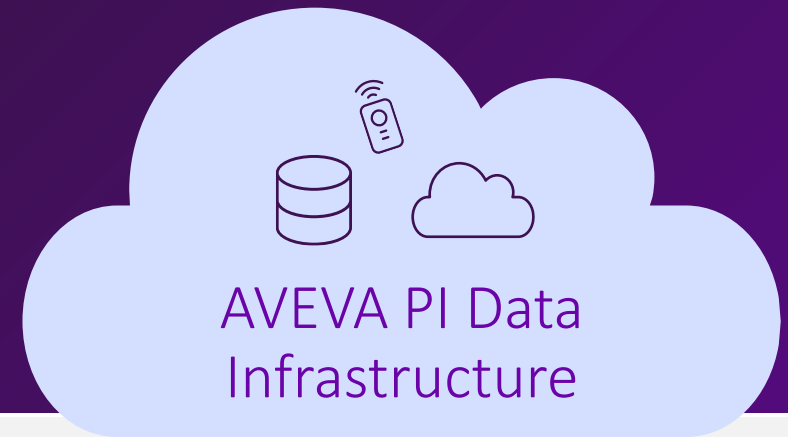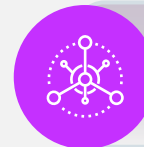
AVEVA PI Data Infrastructure
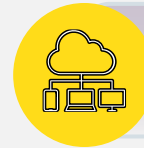
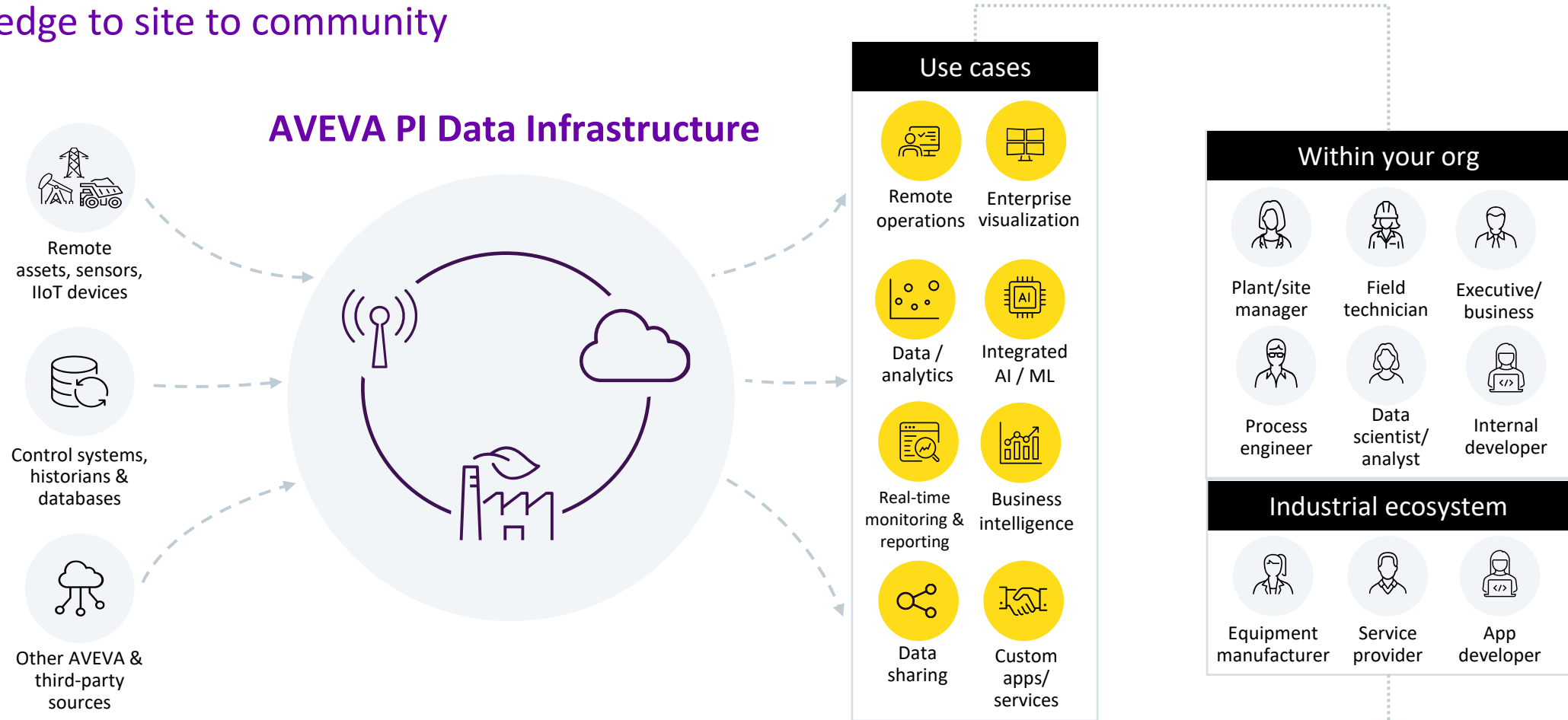- CONNECT visualization
- CONNECT data service
- AVEVA PI Server
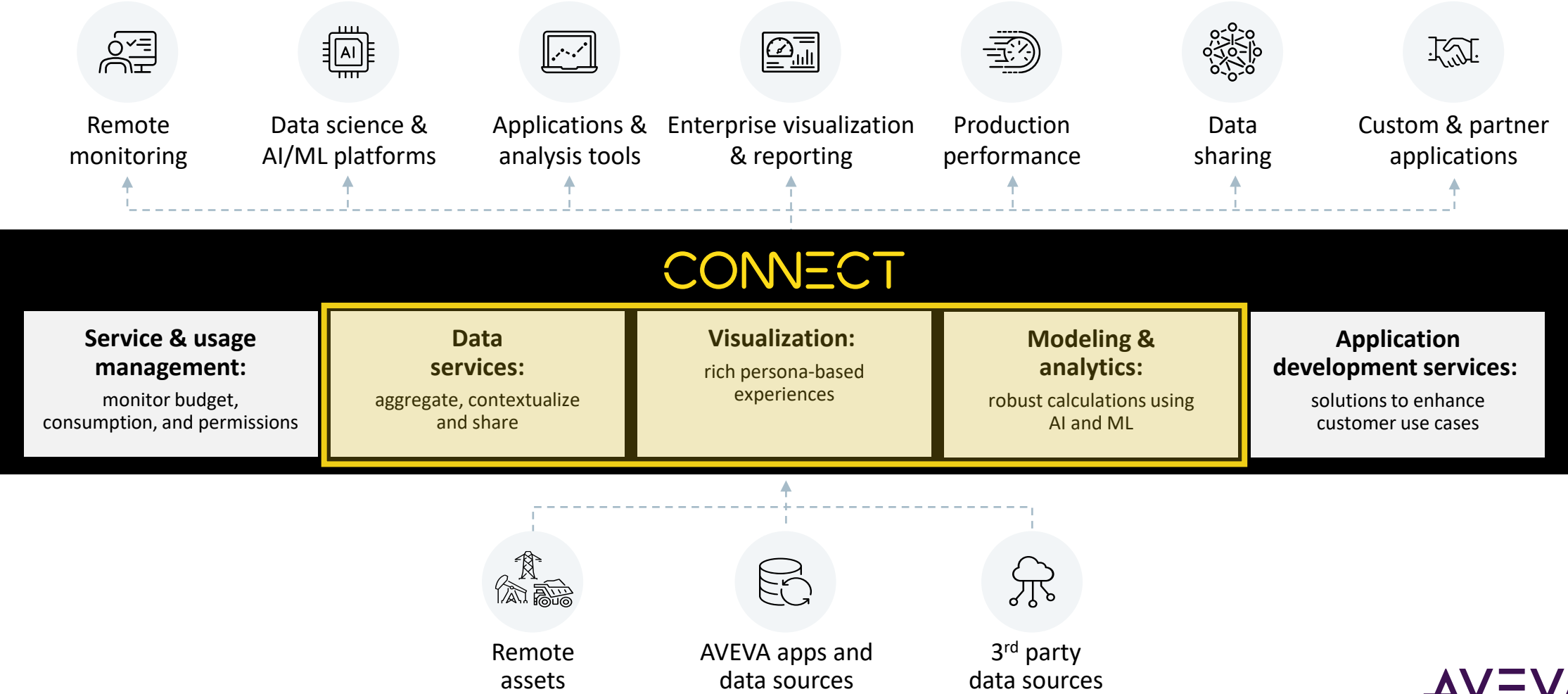- Edge Data Store
- AVEVA Adapters, PI Interfaces, PI Connectors

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Hybrid data infrastructure

from edge to site to community

AVEVA PI Data Infrastructure

Remote assets, sensors, IIoT devices

Control systems, historians & databases

Other AVEVA & third-party sources

Use cases

- Remote operations
- Enterprise visualization
- Data / analytics
- Integrated AI / ML
- Real-time monitoring & reporting
- Business intelligence
- Data sharing
- Custom apps/ services

Within your org

- Plant/site manager
- Field technician
- Executive/ business
- Process engineer
- Data scientist/ analyst
- Internal developer

Industrial ecosystem

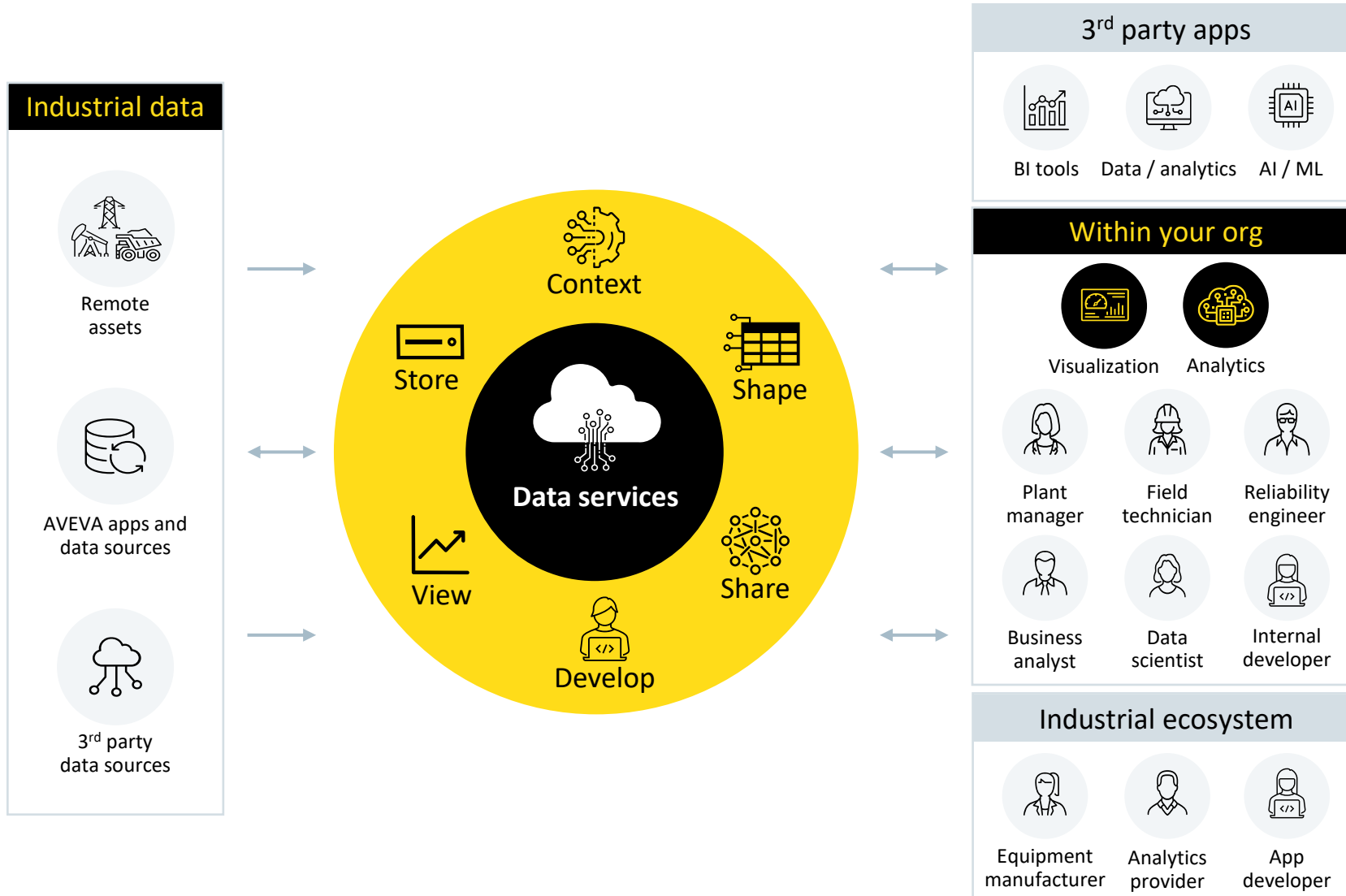- Equipment manufacturer
- Service provider
- App developer

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CONNECT, our industrial intelligence platform

## Open and neutral, providing rich data insights for your unified industrial ecosystem

| Remote monitoring | Data science & AI/ML platforms | Applications & analysis tools | Enterprise visualization & reporting | Production performance | Data sharing | Custom & partner applications |

CONNECT

| **Service & usage management:** monitor budget, consumption, and permissions | **Data services:** aggregate, contextualize and share | **Visualization:** rich persona-based experiences | **Modeling & analytics:** robust calculations using AI and ML | **Application development services:** solutions to enhance customer use cases |

Remote assets   AVEVA apps and data sources   3rd party data sources

AVEVA

CONNECT data services

Industrial data

- Remote assets
- AVEVA apps and data sources
- 3rd party data sources

Data services

- Context
- Shape
- Store
- View
- Share
- Develop

3rd party apps

- BI tools
- Data / analytics
- AI / ML

Within your org

- Visualization
- Analytics
- Plant manager
- Field technician
- Reliability engineer
- Business analyst
- Data scientist
- Internal developer

Industrial ecosystem

- Equipment manufacturer
- Analytics provider
- App developer

Aggregate, contextualize, and share real-time industrial data

- Build and manage a central data repository for BI, data and analytics, and AI / ML tools

- Securely share your industrial information with authorized users, extending the use of your existing data beyond your organization's four walls

- Enable 3rd-party providers to access real-time industrial data for customized services and applications

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CONNECT visualization - Industrial AI Assistant

Leveraging the power of Generative AI in CONNECT
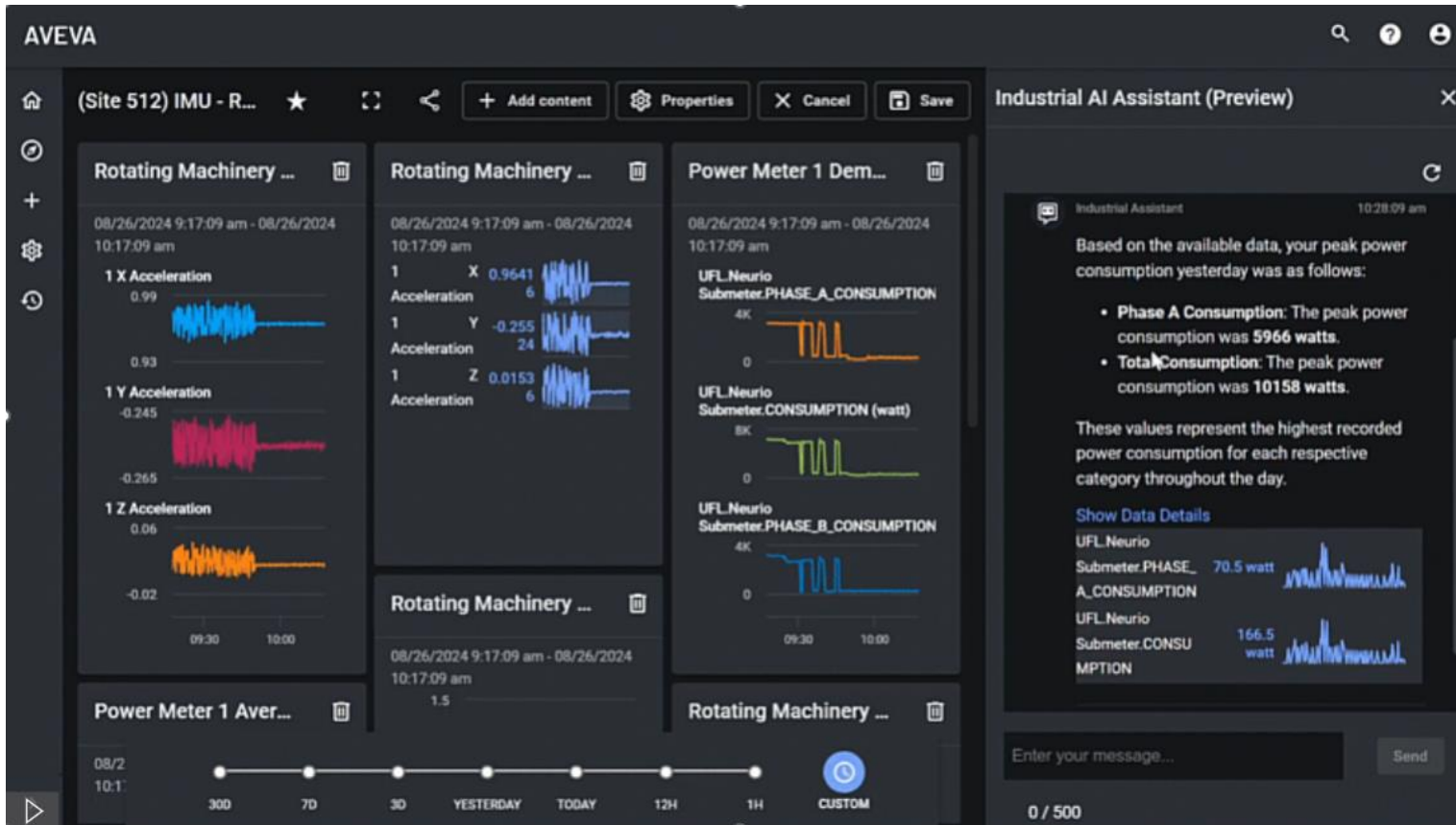
- Integrate the power of Generative AI with your industrial data.

- Quickly find and summarize information by asking a digital intellect natural language queries through a chat interface.

- Fast onboarding to supplement SMEs and non-SMEs.

- Model is never trained using data from the customer's account.

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CONNECT modeling & analytics (AVEVA Advanced Analytics)

Self-service AI/ML for operationalized process improvement
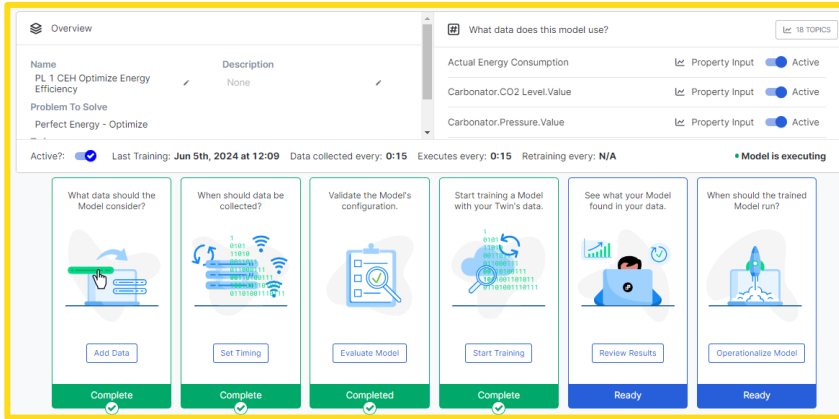
Pre-built libraries assist domain experts in developing, training and operationalizing models using a step-by-step approach.
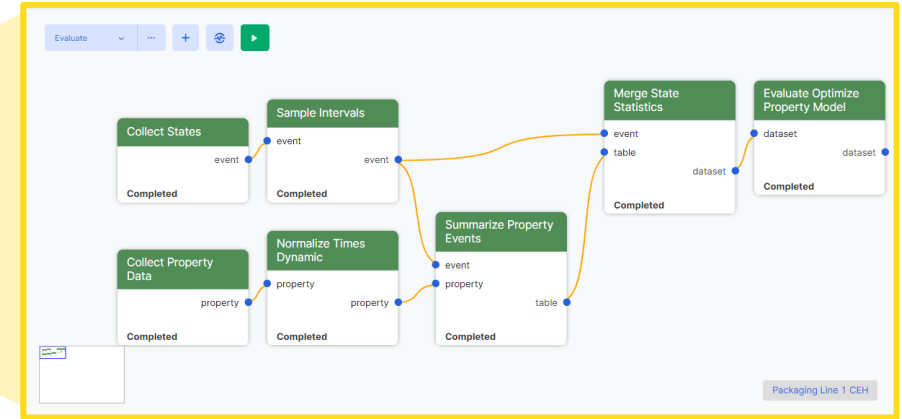
Workflows support calculation threads and a scalable Model Factory providing statistical algorithms.

Analytics

Data services

CONNECT PI Agents

AVEVA PI Server

Operational data with asset context

Results and recommended actions

Display results and recommendations to Operations in PI Vision.

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Transitioning to PI DI with CONNECT unlocks data agility

Unified operations data on a single, secure cloud-based platform featuring powerful analytical tools

AVEVA PI System Data

- Smart Meter Data
- DER Data
- Grid-Edge/IoT Data
- EV Charging Data

Data Services
Visualization Service
Advanced Analytics

CONNECT

Analytics · Visualization · Data

Data Lake
AI/ML Platform
Analytics
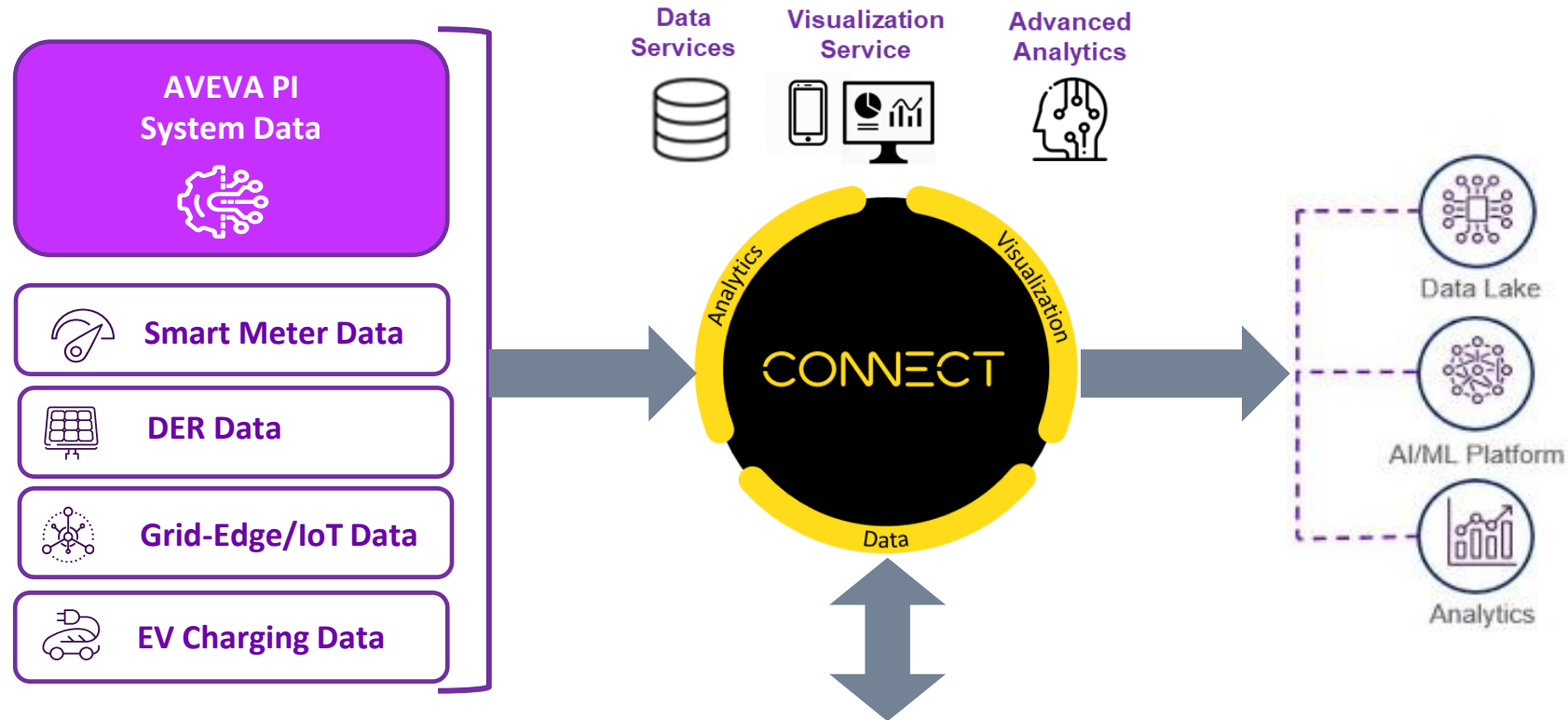
All Operational Use Cases Supported by a Single Source of Truth

Meter Data Quality · Network Model Validation · Aggregate Asset Analytics · Alarm/Event Analytics · Fault/Leak Location
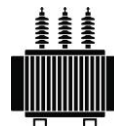
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Connected Infrastructure and Value Chains (Public-Private Partnership)

Government | Regulator | Partners | Academia

Connected Communities

Clean Energy & Water Value Chains → Industrial Innovation Ecosystems → Smart Multi Modal Transport

Renewables

Desalination

Government

Equipment Manufacturer

Truck

Marine

Grid Operation

Service Provider

Supplier

Ports

Utilities

Performance Analytics Provider

Critical Facilities

Treatment

Asset Onwer & Operator

Rail

Airports

AVEVA
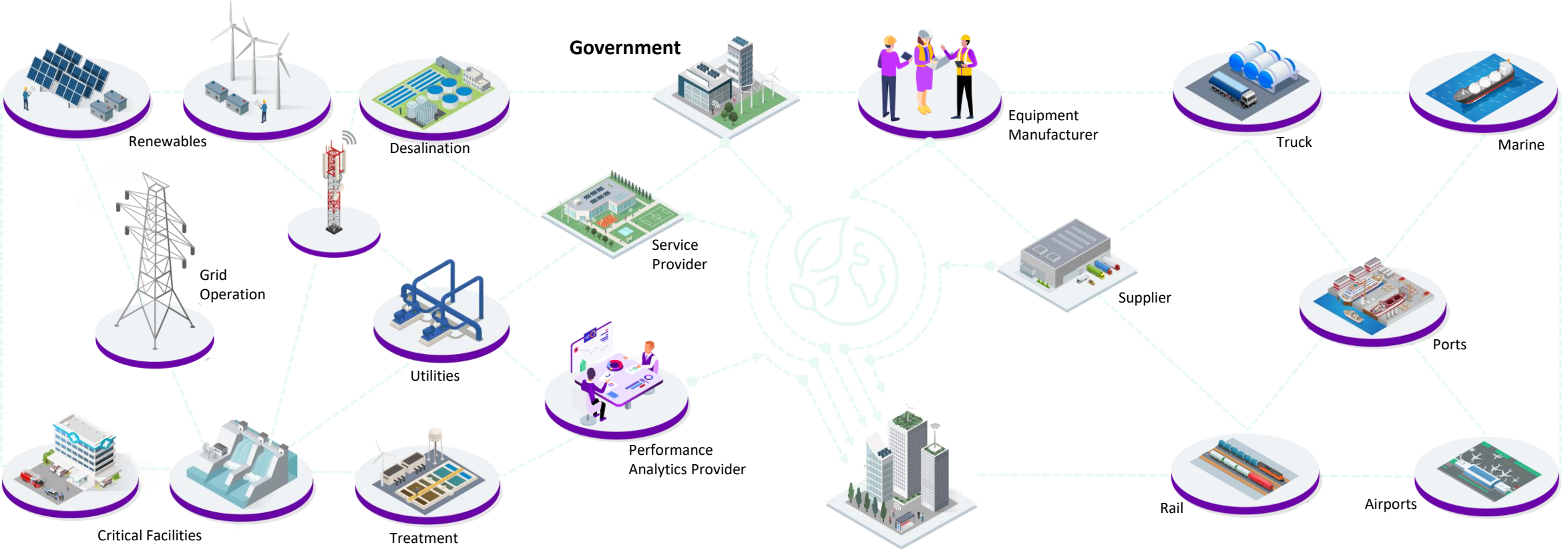
The next energy–enabled growth cycle

Electricity has been a fundamental enabler of economic growth throughout the 20th and 21st centuries, driving innovation, productivity, and the advancement of society

Electrification

1930 – 1950

- <10% of farms in the U.S. were electrified in 1930s growing to ~75% by the 1950s in Oregon[1]
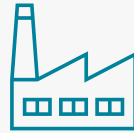
Industrialization

1950 – 1970

- World GDP increased by 2.5x

- Oregon's domestic and commercial energy consumption soared as the BPA and public and private utility firms promoted the use of electricity[1]

- The aluminum industry prospered and aluminum smelters grew in Oregon. Timber industry was a huge economic force.
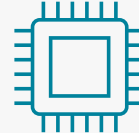
Digitalization

1980 – Today

- Software and internet account for +20% of GDP growth in the US

- Oregon's "Pacific Wonderland" reputation and resources drives shift from extraction industries to environmental recreation and technology

AI Revolution

Now and Next

- Accelerated energy transition for economic development and national security

- Semiconductor manufacturing and data processing technology

1. The Oregon History project

AI is Driving a Third Wave of Data Center Growth
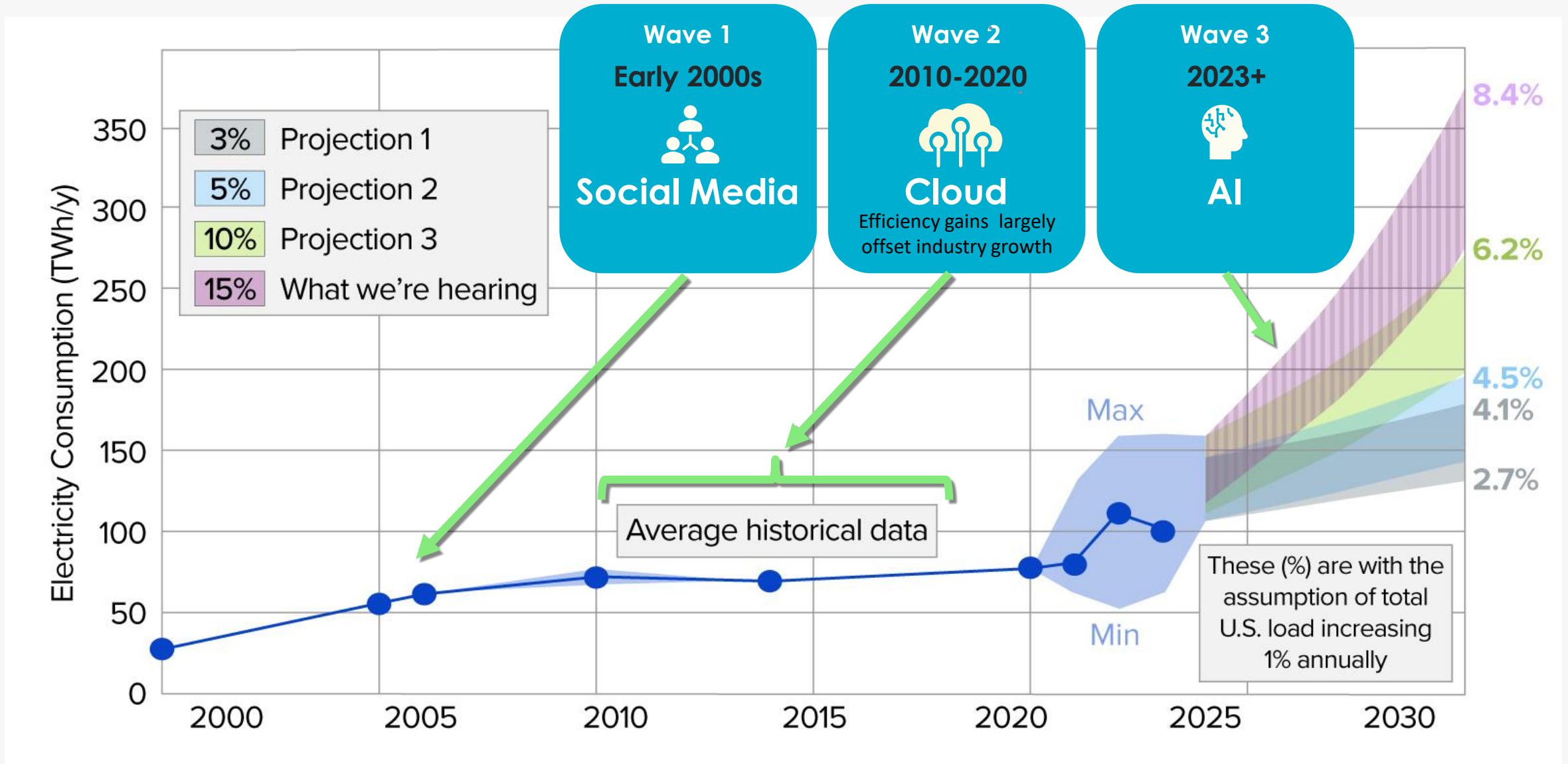
Data issues dominate challenges of AI Adoption

What do you see as the biggest challenges of AI adoption in your organization today?

Data issues (access, format, integration, privacy, governance) | 65%

Lack of appropriate skills | 43%

Understanding the business case | 40%

Need to upgrade legacy equipment | 37%

Lack of C-suite support | 32%

Understanding the technology | 31%

Fear of a lack of management control | 19%

Fear of bad decisions/embedded bias in algorithms | 12%

Workforce Resistance | 4%

Ethical Concerns | 4%

No Current Challenges | 3%

MANUFACTURING LEADERSHIP COUNCIL
NATIONAL ASSOCIATION OF MANUFACTURERS

Did you know that over half of U.S. climate events since 2000 were water-related?

According to the National Oceanic and Atmospheric Administration, the U.S. has endured 385,706 climate events since the year 2000, resulting in a total damage of US$558.34 billion.

What's the breakdown for water events? 197,970 events (or 51%) were water-related.

These water events, totaling US$454.06 billion in damages,

Regional Shares of Damages (U.S.)

Legend:
- Southeast
- Southwest
- Midwest
- Northeast
- U.S. Territory
- West
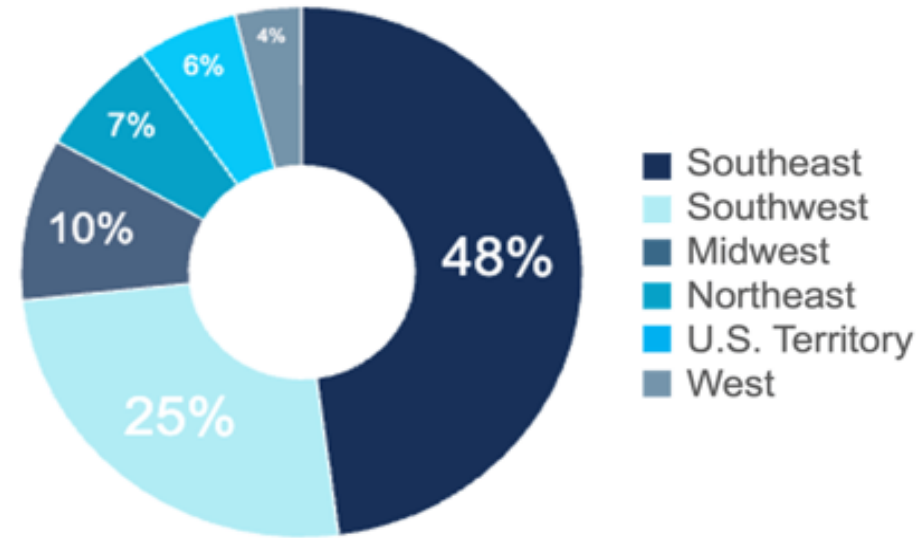
Source: The National Oceanic and Atmospheric Administration

New data dashboard exclusively for Data Navigator seat holders

BLUEFIELD DATA NAVIGATOR SEAT HOLDERS

U.S. Storm & Climate Impacts, 2000–2023

Climate Change | Wildfire Risk

Between 2017 and 2020, wildfires in California caused in excess of $55 billion in direct damage*

CALIFORNIA WILDFIRES - ACRES BURNED

Fire	Acres (Thousands)
McKinney Fire (2022)	60
Dixie Fire (2021)	1000
California Wildfires (2021)	2600
California Wildfires (2020)	4400
Kincade Fire (2019)	78
Camp Fire (2018)	153
Carr Fire (2018)	230
Mendocino Complex Fires (2018)	282
Thomas Fires (2017)	282
Northern Cal Fires (2016)	245
Soberanes Fire (2016)	132
Witch Fire (2007)	197
Cedar Fire (2003)	273
Laguna Fire (1970)	175

Billion-Dollar Weather Disasters Increasing

2023 has already set a record for billion-dollar weather disasters with 23 separate disasters resulting in $57.6 Billion in damages.

Extreme Heat
2023 and 2024 YTD has experienced record heat across the US and globally, exacerbated by the developing El Nino conditions

Wildfires
Catastrophic wildfires have been experienced across the globe, including Hawaii and Canada

Smoke Impacts
Hundreds of millions of people across North America were exposed to the worst air quality on record due to wildfire activity

Extreme Precipitation
From California to New England, record precipitation has caused areas of catastrophic flooding

SDG&E - Wildfire Risk Summary

183,000	customer accounts
3,500	miles of overhead power lines
42%	Underground infrastructure
221	weather stations
53%	of inventory trees within HFTD

64% of SDG&E's service area is in the High Fire Threat District (HFTD)

• https://www.ncei.noaa.gov/access/billions/events/US/2022-2023?disasters[]=all-disasters
• https://www.ucl.ac.uk/news/2020/dec/full-cost-californias-wildfires-us-revealed#:~:text=More%20than%208%2C500%20separate%20fires,of%20the%20US's%20annual%20GDP.

Partnerships with Research Institutions

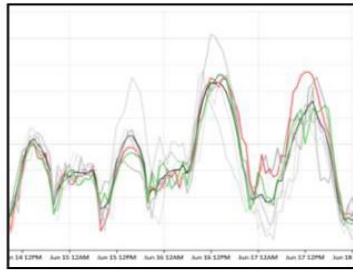Wildfire Interdisciplinary Research Center

SAN JOSÉ STATE UNIVERSITY

We teamed up with SJSU's Wildfire Interdisciplinary Research Center (WIRC) on research, publications and operations
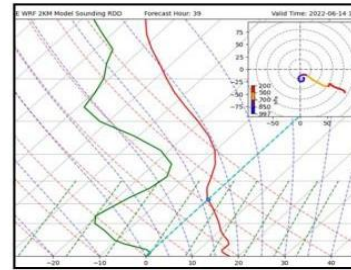
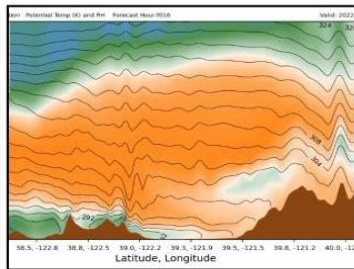## PG&E and SJSU 2 KM WRG Model Visualization Project
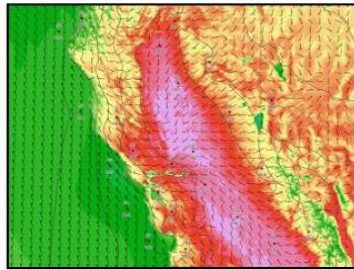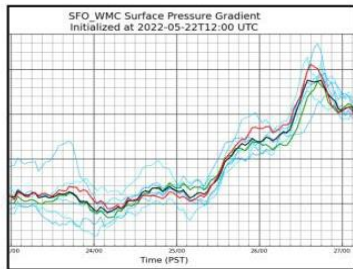

WEATHER MAPS
Selected weather maps.

POINT FORECASTS
Precip |Temp | Fosberg FWI

SOUNDINGS
Selected model station soundings.

CROSS SECTIONS
Selected cross-sections.

GRADIENTS
Selected pressure gradients.

LIGHTNING
Lightning page and archive.

- All of PG&E's high-resolution model data is now available to the public

- Researchers have access to our 30+ year climatological weather, fuels and fire occurrence datasets

- Multiple papers peer reviewed

- PG&E is a member of the Industry Advisory Board of the NSF supported Industry –University research collaborative w/ WIRC

ℹ️ View data here: http://www.met.sjsu.edu/weather/wirc-prod/

Internal

In May 2024, we filed our Climate Adaptation Vulnerability Assessment (CAVA) with the CPUC. CAVA analyzes climate-driven impacts and risks on utility operations, assets and services over the next few decades.

PG&E Climate Adaptation and Vulnerability Assessment

FULL REPORT | 2024
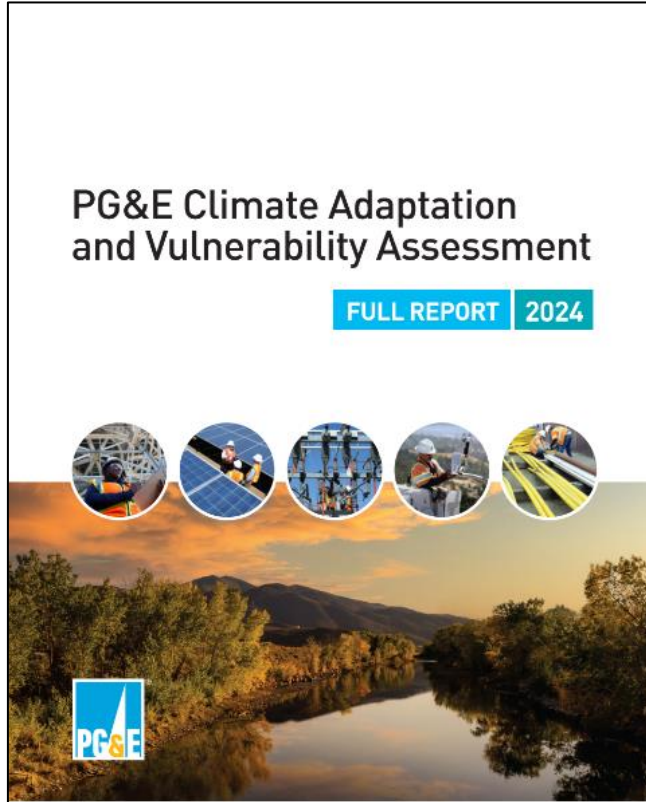
How will climate-driven natural hazards impact PG&E's ability to deliver for our hometowns?

How are the energy-related needs of our hometowns changing?

What adaptive actions are available to address vulnerabilities and build resilience?

What threats have been identified and how/where will they change?

Links:

- PG&E's Climate Adaptation and Vulnerability Assessment

- Executive Summary

Some of the measures included in this presentation are contemplated as additional precautionary measures intended to further reduce the risk of wildfires.

Internal

Connected Community: Building an industrial ecosystem

Securely share operations data in a bidirectional way across tenants with the trusted business partners
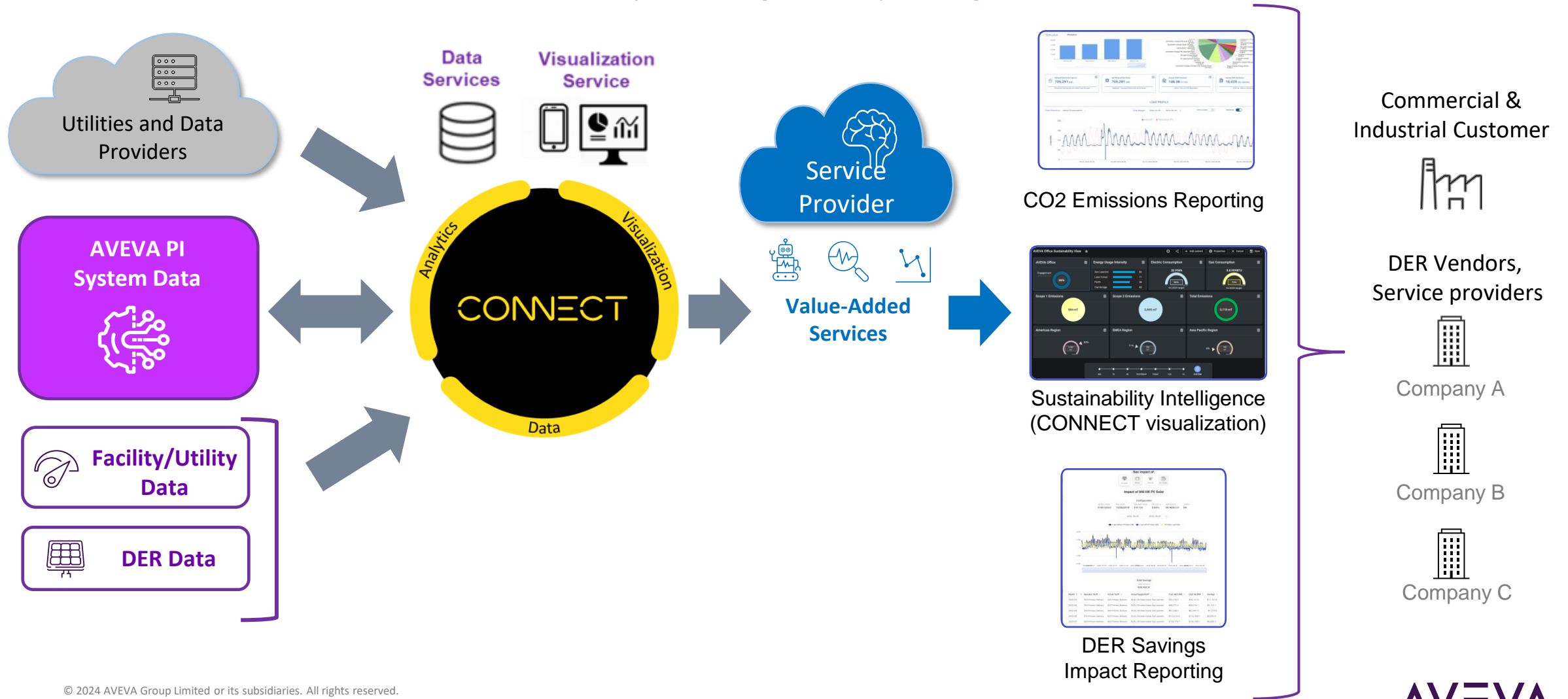

Vehicle Manufacturer

Partner apps
Customer

Customer

Aggregator

Charging Supplier

Analytics Company

Industrial Operator

Community

Service Provider

ISO/RTO

CONNECT data services
Tenant

CONNECT data services
Tenant
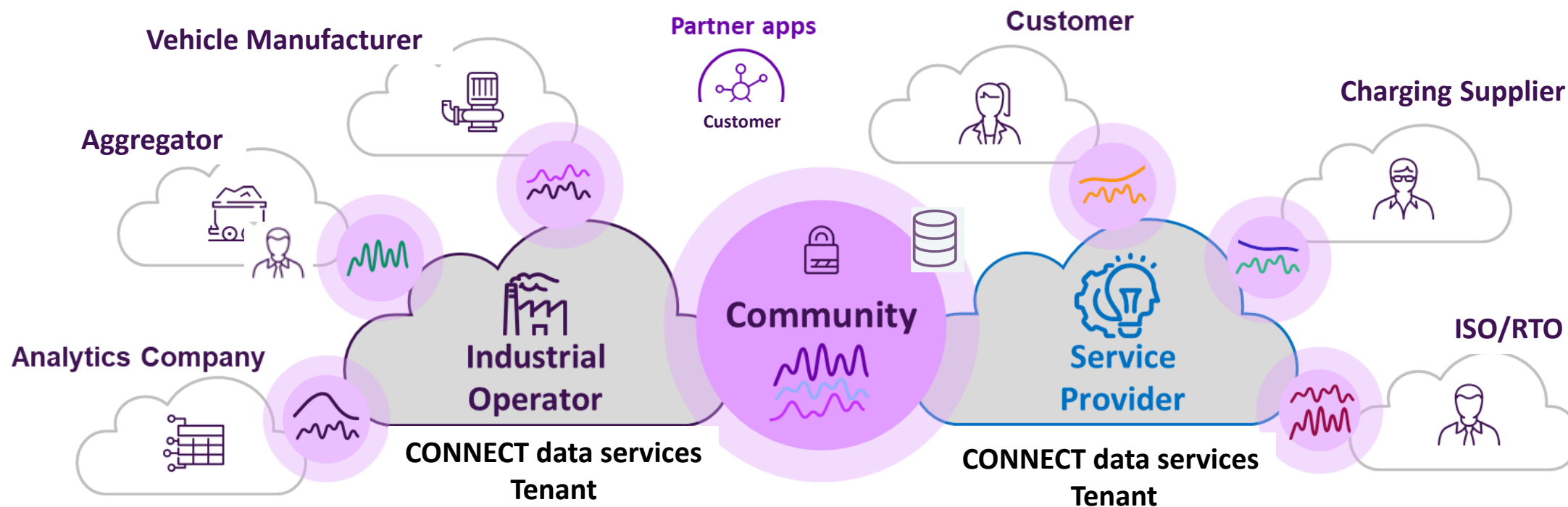
AVEVA's Industrial Cloud Platform

Powers AVEVA, Customer, & Partners
Secure data sharing
Developer-friendly
Open, flexible and scalable

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CONNECT Ecosystem

Commercial and industrial sustainability tracking and reporting

CO2 Emissions Reporting

Sustainability Intelligence (CONNECT visualization)

DER Savings Impact Reporting

Commercial & Industrial Customer

DER Vendors, Service providers

Company A

Company B

Company C

CONNECT Energy Ecosystem Community

Utility company sustainability services and reporting for their customers

Data Providers (weather, etc.)

AVEVA PI System Data

Facility/Utility Data

DER Data

Meter Data

Service Provider

CONNECT

Utilities

Customer Engagement

Value-Added Services

Basic | Prosumer

Company A

Company B

Company C

- Data automation
- Insights
- Compliance
- Sustainability

- DER data collection
- DER Savings
- DER Optimization

AVΞVA
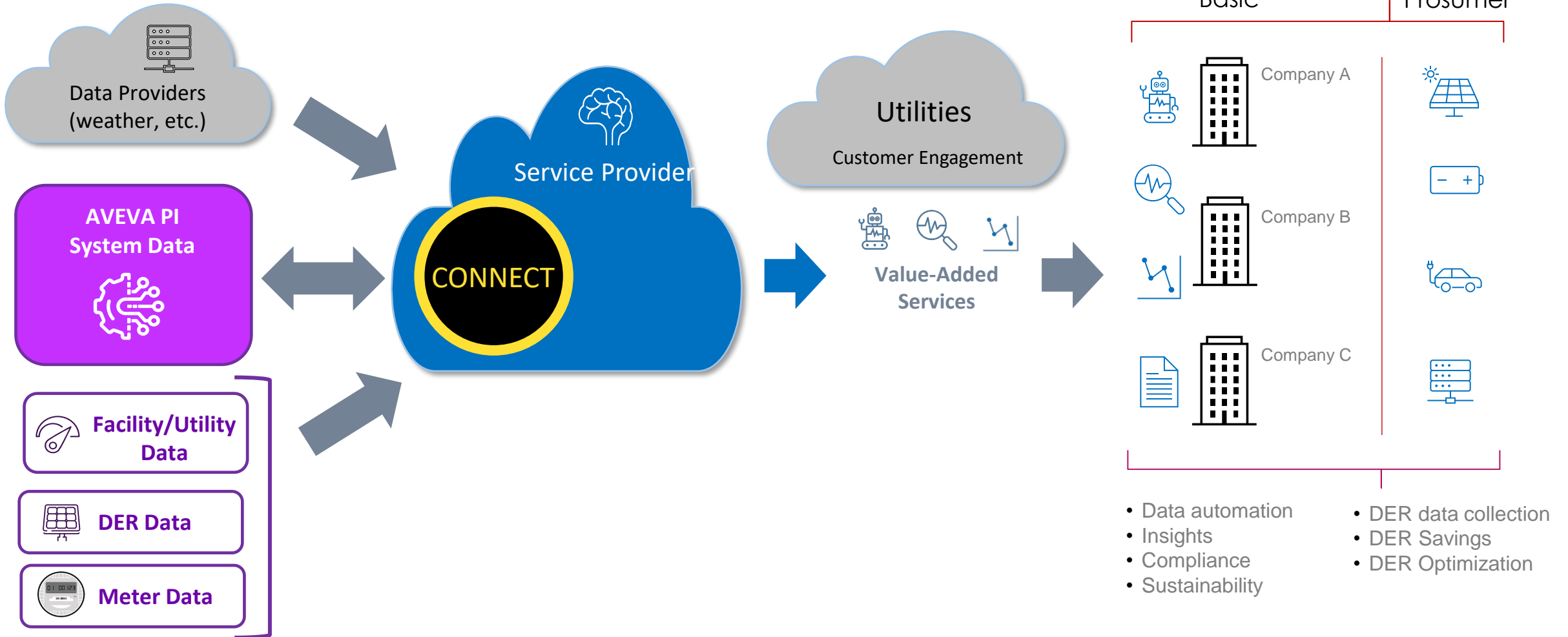
AVEVA Global Office Sustainability Reporting in CONNECT
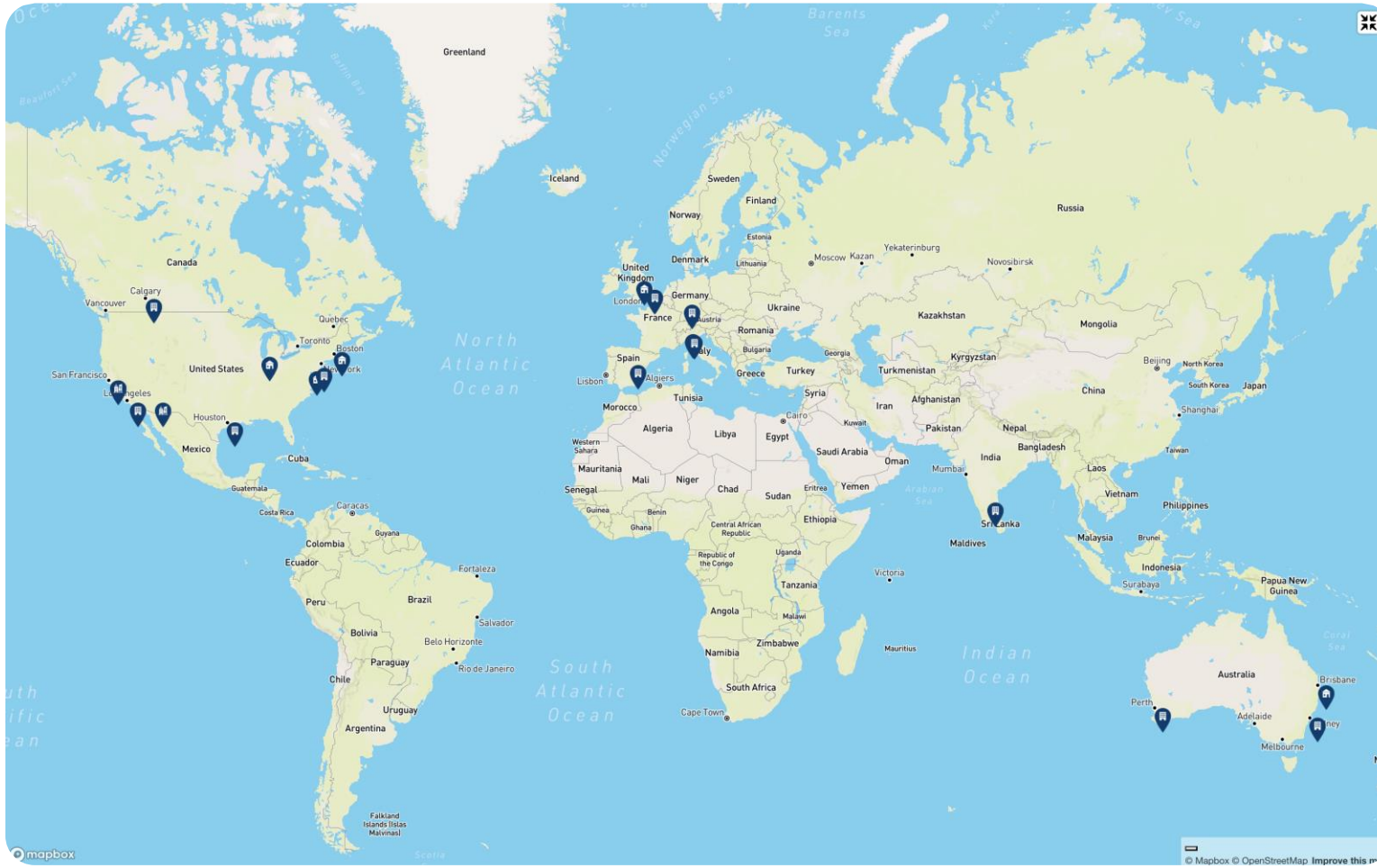
Program Rollout
- Phase 1: 20 offices
- Phase 2: 33 offices

Adoption by Regions
- Americas: 9 (65%)
- EMEA: 7 (30%)
- Asia Pacific: 4 (27%)

Energy Ecosystem Users
- Sustainability
- Real Estate & Workplace Experience
- IT
- Finance
- Service Providers

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AVEVA is helping transform American infrastructure

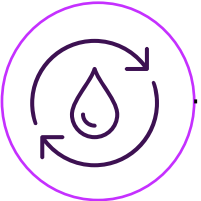**AVEVA locations**
- 🟣 R&D Centers
- 🔵 Offices
- 🟢 Training Centers

Portland, OR
We help ports such as Port of Portland implement digital solutions that improve operations and maintenance efficiency, and lower costs

Fort Collins, CO
Our software has helped manufacturers like New Belgium Brewing to decrease downtime by 50% and increase OEE

Amherst, MA
By realizing efficiency gains, schools and campuses like UMass have reduced operation costs by three percent per year

Boise, ID
For water operators like the City of Boise, digitalization means sustainable, resilient management of water and sanitation for all

National Coverage
We work with customers in every state to help modernize and digitalize America's infrastructure.
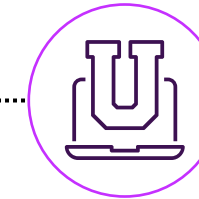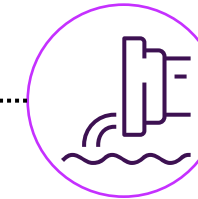
Hamptons Roads, VA
Our solutions help wastewater operators like HRSD to triage incidents quickly, safely and remotely during extreme weather events

Camden, SC
With AVEVA solutions, CosaTron are improving the safety of indoor air quality for building owners, facility managers and residents alike

San Diego, CA
We're helping companies like SDG&E to renew the electrical grid and scale new energy alternatives
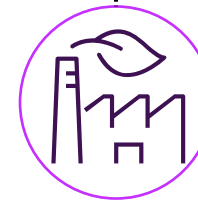
Lexington, KY
We're helping Schneider Electric transform their 62-year-old factory into one of the world's most advanced manufacturing sites

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To enable connected value chains

Government Partners Academia

Let's Collaborate!

| Clean Energy & Water Value Chains | Industrial Innovation Ecosystems | Smart Multi Modal Transport |

EDF Renewables: Expected savings of $2 million per year in reduced maintenance costs

Qatar Power and Water: $1.3 million savings on seawater margins

NIH: Significant reliability improvement and monetary savings

Nita: Cloud-enabled collaboration means workers can connect and collaborate seamlessly

Barrick Gold: 30% reduction in engine, brake, suspension failure

Yinson: Increased efficiency and sustainability

DTE Energy: Decreased outage time by ~500,000 minutes per year

Alectra: Increased power-supply reliability for customers and a safer working environment for employees

UC Davis: 46% reduction in energy-use intensity

Aker Carbon Capture: Mitigate CO2 emissions of industrial operations, improved time to market by over 50% and reduced cost of offerings by 90%

Henn: Decision time cut from 2-days to 2-minutes with data sharing across suppliers

TraPac: 10% decrease in cycle time and faster issue resolution

Energy Queensland: Increased grid reliability and resiliency

Petronas: $33 million saved in avoided downtime

Port of Portland: Reduced inventory in both electric and equipment shops >65%

DEME: Mitigated project risk and realized savings >$400,000 on one asset type alone

New Hospital of Orleáns: Improved incident response time to 5-seconds

Vattenfall: Maintenance costs cut by 1.5% in year one

TasWater: Improved critical control point breach detection from <10% to 100%

Qatar Foundation: Unified view of facilities allows substantial sustainability gains

China Ministry of Railways: Enabled business optimization and data connectivity across 1,300 platforms

Barcelona El Prat: Enabled safe operations plus scalability for growth

AVEVA

linkedin.com/company/aveva

@avevagroup

ABOUT AVEVA

AVEVA is a world leader in industrial software, providing engineering and operational solutions across multiple industries, including oil and gas, chemical, pharmaceutical, power and utilities, marine, renewables, and food and beverage. Our agnostic and open architecture helps organizations design, build, operate, maintain and optimize the complete lifecycle of complex industrial assets, from production plants and offshore platforms to manufactured consumer goods.

Over 20,000 enterprises in over 100 countries rely on AVEVA to help them deliver life's essentials: safe and reliable energy, food, medicines, infrastructure and more. By connecting people with trusted information and AI-enriched insights, AVEVA enables teams to engineer efficiently and optimize operations, driving growth and sustainability.

Named as one of the world's most innovative companies, AVEVA supports customers with open solutions and the expertise of more than 6,400 employees, 5,000 partners and 5,700 certified developers. The company is headquartered in Cambridge, UK.

Learn more at www.aveva.com

AVEVA

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AVEVA