
Connected Mobility and The Circular Sustainable EV Economy Framework

Batteries, EVs, and the power grid

John Matranga, AVEVA Connected Mobility Segment

AVEVA

Sustainability's importance continues to rise globally

Customers & Partners

99% of Fortune 500 CEOs believe sustainability will be important to the future of success of their business; **80% of FTSE signed up to Race to Zero**
Accenture/UNGC CEO Study



Employees

64% of millennials will not take a job from a company that lacks strong corporate sustainability practices
Cone Communications



Sustainability impacts stakeholder decision-making

Investors

450 financial firms from across 45 nations representing **\$130 trillion in assets** have joined **COP26 Glasgow Financial Alliance for Net Zero**



Governments/Civil Society

The world needs **US\$ 1 trillion** each year until 2030 to make the UN SDGs a reality. That's 3% of global GDP or 1% cent of global wealth

UN Global Compact



We are committed to lead by example and have aligned on our first public pledges

Exemplifying environmental stewardship and ethical business across our value chain

Enabling a culture of inclusivity, wellbeing and opportunity for our employees and communities

Transforming the energy efficiency, circularity, traceability and resilience of worldwide industries via our secure software

Demonstrating Climate Leadership

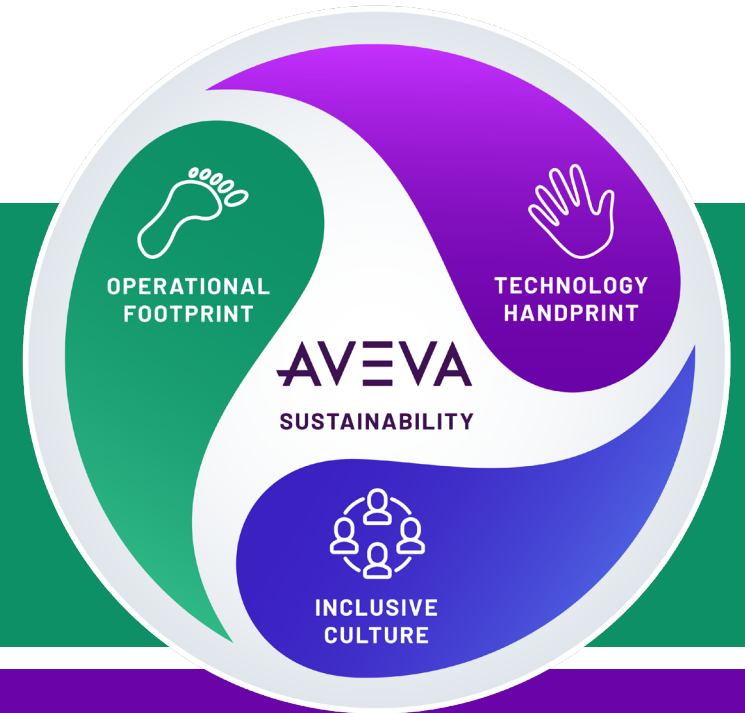
- Achieve net zero emissions across operations (Scopes 1 & 2) by 2030
- Achieve net-zero emissions across our value chain (Scopes 1, 2 & 3) no later than 2050
- Set reduction targets across all scopes in line with 1.5 degree C emissions scenarios

Advancing Women in Technology

- 30% leadership roles held by women by 2030
- 40% management roles held by women by 2030
- 50% women hires by 2030
- <1% gender pay parity gap by 2030

Accelerating our Sustainability-related R&D and Driving Sustainable Business Outcomes

- 15-30% savings in energy costs
- 9-15% reduced CO₂ emissions
- 20% improvement in Clean H₂O Production



AVEVA's software helps industries to optimize the engineering and operation of assets based on their sustainability priorities



Low Carbon Transition

AVEVA software enables acceleration in low-carbon energy transition by speeding up engineering for projects on renewables, hydrogen and carbon capture storage and supporting advanced energy and material efficiency in operations.



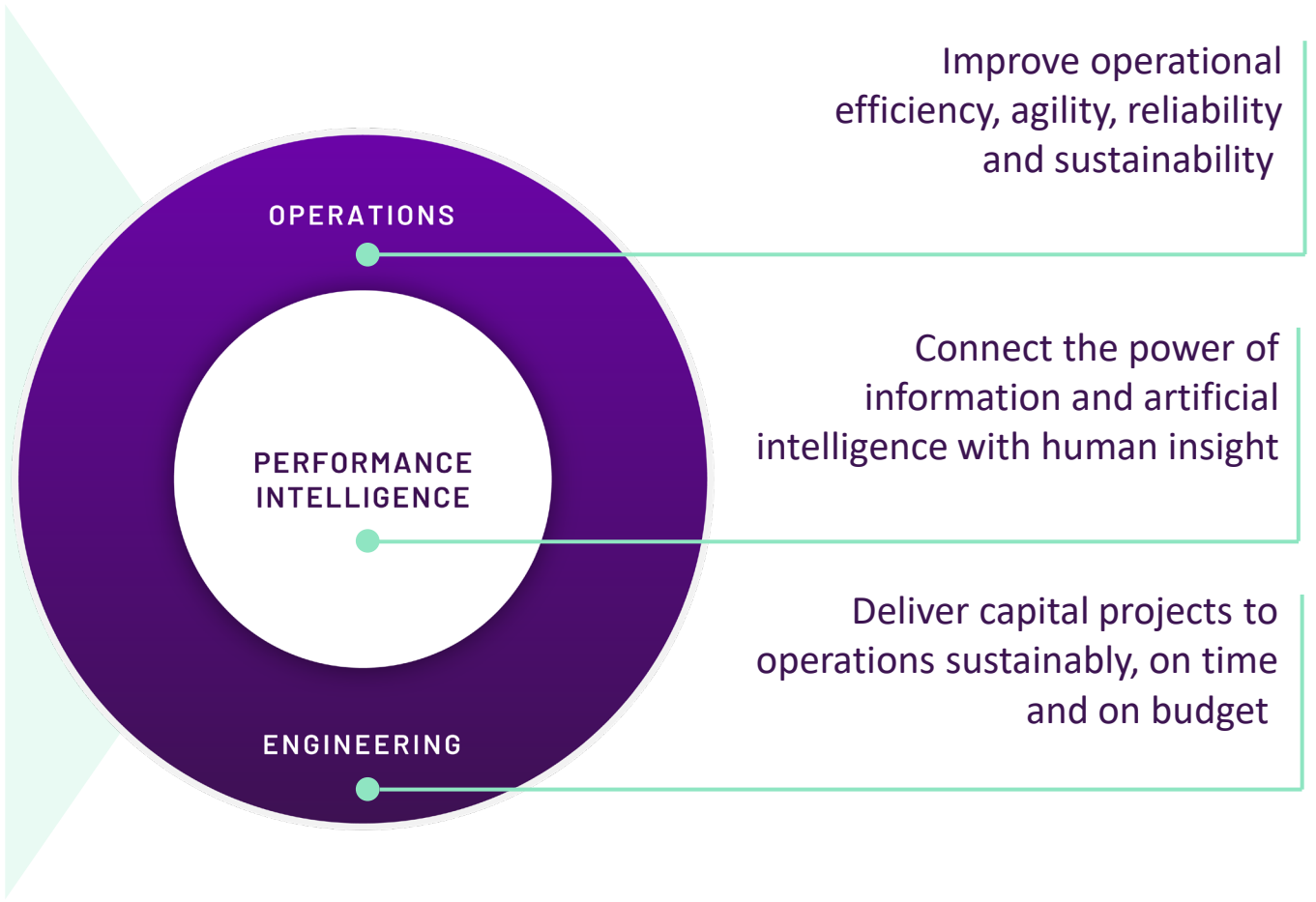
Circular Economy

AVEVA software supports a more circular economy by increasing material utilization and minimizing waste in industrial operations, extending overall asset life and supporting design processes to produce materials tailored for circularity.

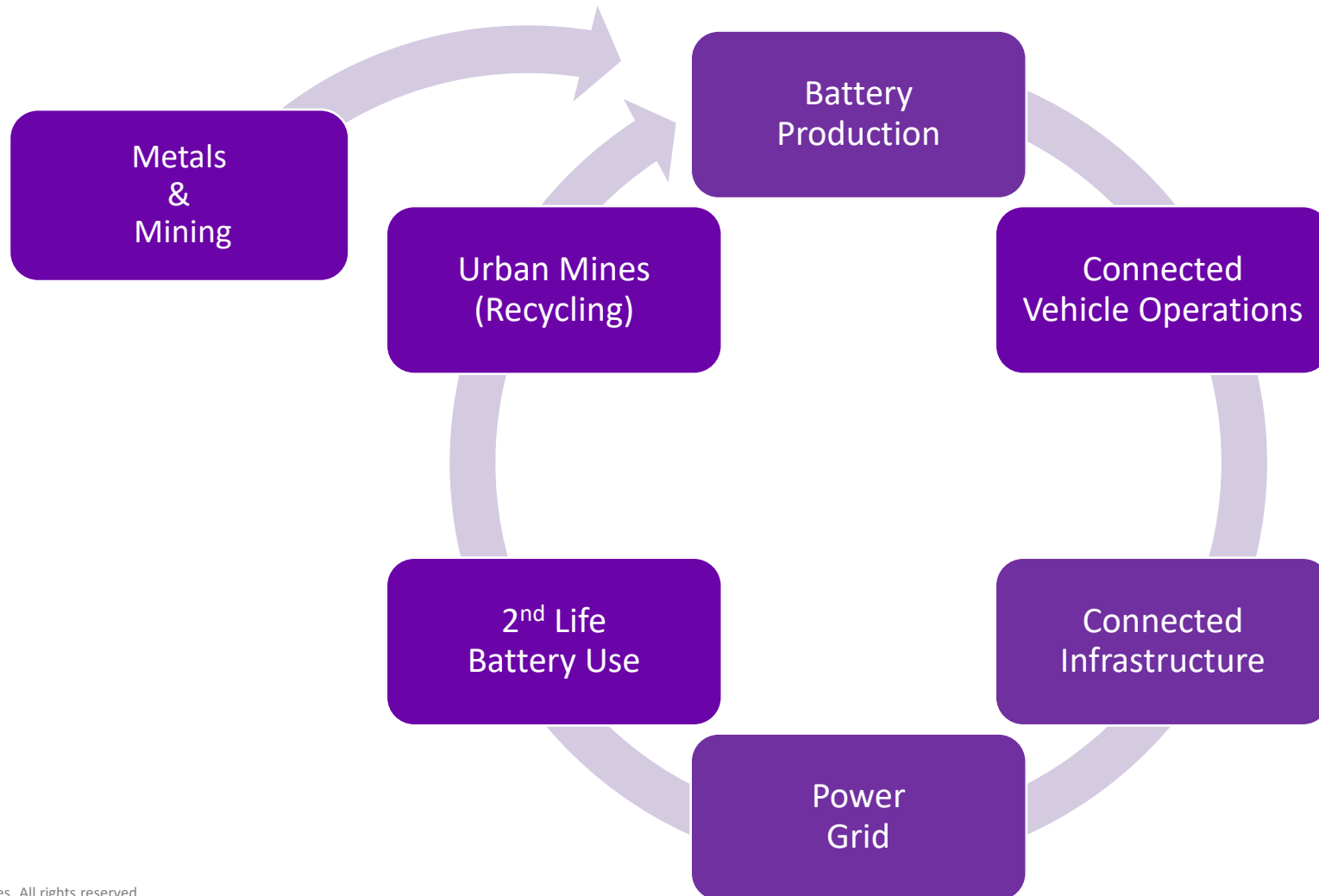


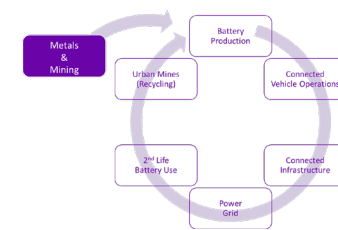
Resilient Infrastructure

AVEVA enables resilient operations for cities, companies and organizations with software to optimize services and visualize operations, boosting efficiency and adaptability of everything from water processing to transport to emergency services.



Battery Value Chain Circular Ecosystem





Metals and mining EV imperatives

Innovation for electrification of mines and rare earth extraction/refinement demand

$$\text{Energy Load} = f(\text{production schedule, production ops, EV SOC})$$

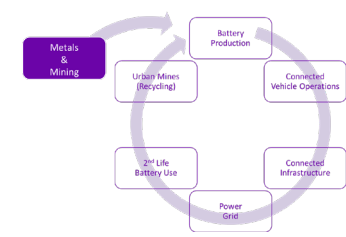
Industry demands

- Step change in rare earth mineral demand.
- Growth of new mine locations close to battery plants.
- Electrification of transport equipment in underground mines progressing
- **Energy Load = $f(\text{production schedule, production ops, EV SOC})$**

Imperatives

- Greater complexity of electrified transport equipment driving greater automation due to more technical needs of the equipment and the connection to production schedules.
- License to operate within the community greatly impacted by environmental, health, and safety concerns
- Local mine power supply management even more critical by electrified transport equipment shift





Where do mining companies find value?



Process productivity

- Remote operations
- Real-time / condition process monitoring
- Ad-hoc visualization / real-time trending
- Material flow, pacing, & supply chain
- Autonomous Operations



Energy & water

- Real-time energy & water monitoring
- Reduce fuel / coal / propane consumption
- Mobile equipment fuel efficiency



Asset reliability

- Improve uptime & reduce unplanned downtime
- Real-time equipment monitoring
- Condition-based maintenance
- Predictive and prescriptive maintenance



Environment health & safety

- Real-time environment, health, & safety monitoring
- Governmental regulations
- Accidents & incidents
- Compliance & audit



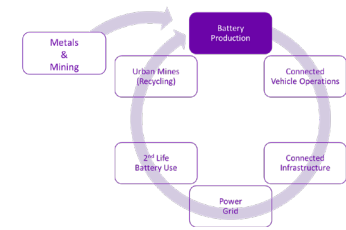
Quality assurance

- Real-time monitoring
- Root-cause analysis & prevention of excursions
- Genealogy / product history
- Yield improvement



KPIs & reporting

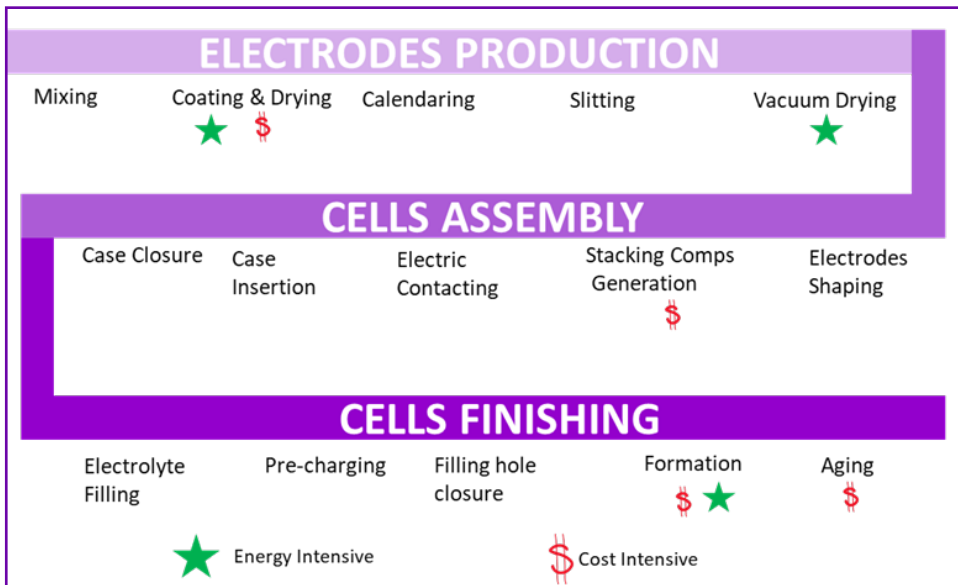
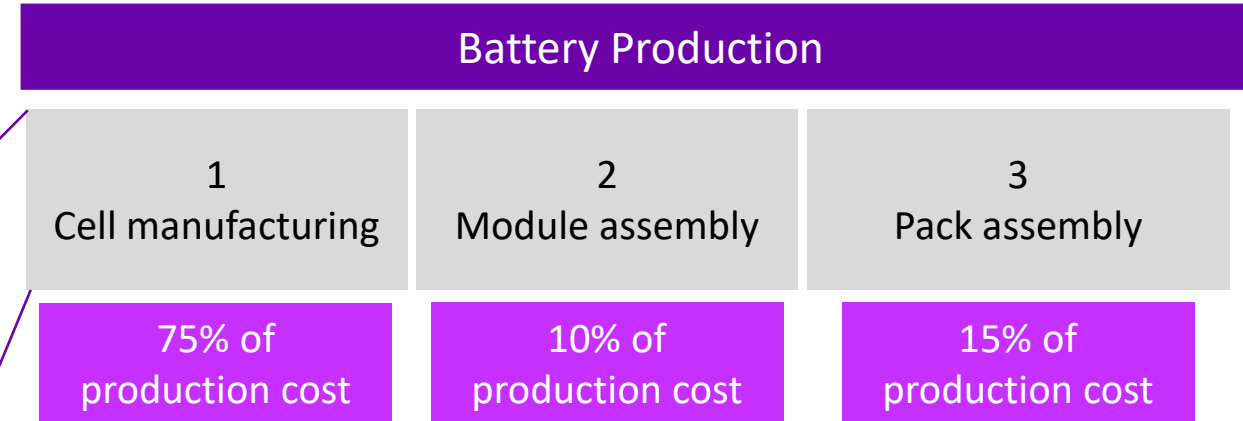
- Plant-wide to enterprise visibility
- Common definitions & calculations
- Benchmarking & comparison
- Dashboards & KPI reporting



Battery manufacturing – a hybrid process

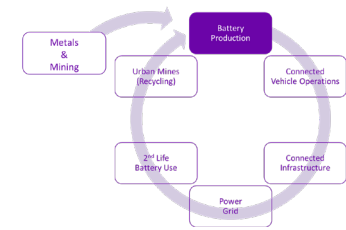
Industry demands

- Steep production rate growth
- New product introductions
- Shared IP (Intellectual Property) with partners
- Limited access to production data
- Product quality is imperative and uncertain



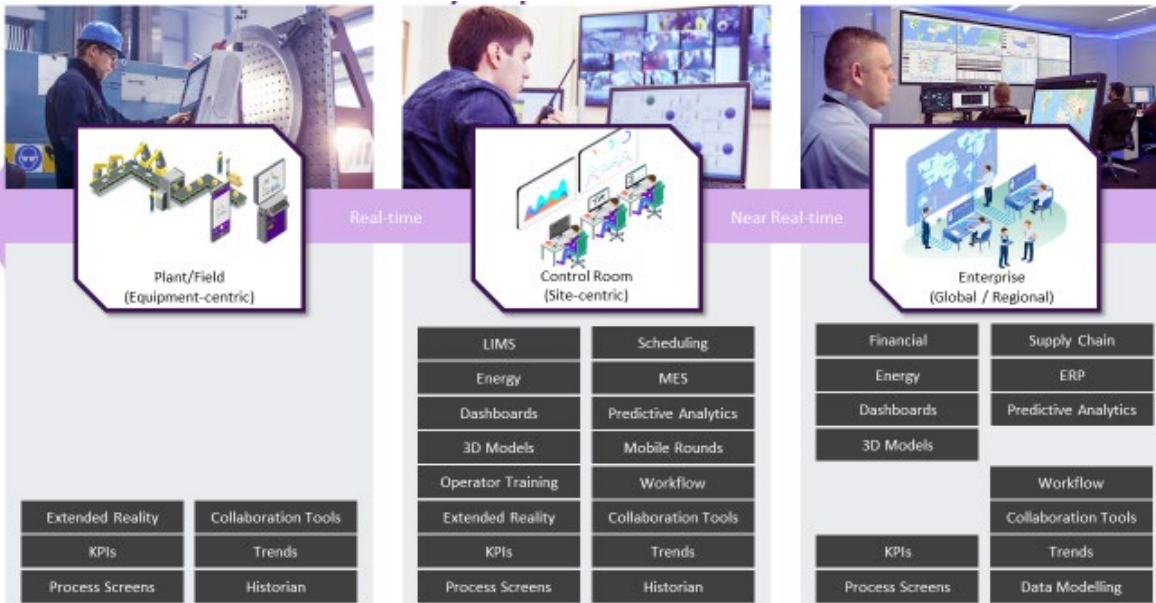
Segment imperatives

- Drivers of quality, low waste, energy management, environmental impacts
- Hybrid manufacturing – Batch (refine materials), Continuous (application), Discrete (cells, modules, packs)
- Data context with volumes and types due to hybrid process
- 20%-30% % of batteries produced are Scrap
- Recalls happen and are expensive
- Fluctuations in quality are usual, more recurrent in ramp-up
- Supply Chain Integration for track and trace



Where do battery manufacturing companies find value?

Production management, ramp, scale, enterprise, quality



1. Increase efficiency

- Track equipment OEE and troubleshoot reductions, Minimize machine cycle time variation, Reduce lubricant consumption, Leverage machine data for Kaizen exercises, Optimize machine settings for machine availability

2. Optimize Production

- Visualize pareto charts for downtime causes, Review prior shift performance and issues at start-up meetings, Provide operational performance to production planning, Increase MTTR and minimize MTBF

3. Energy Monitoring

- Ensure energy consumption correlates with production schedule, Support minimization of energy consumption

4. Asset health and maintenance

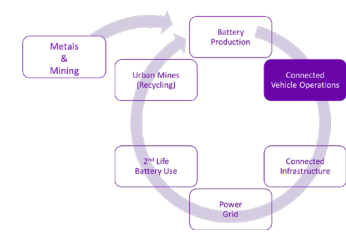
- Collect data for vibration analysis, Monitor electricity, Transform equipment maintenance from reactive to predictive, Monitor tool wear for optimized replacement

5. Inline Quality Monitoring

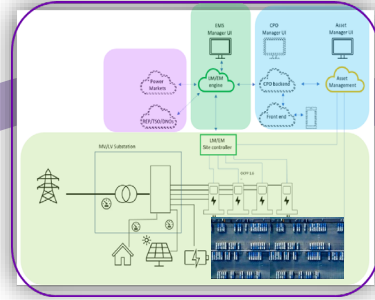
- SPC in-line at line and off-line are recommended to decrease uncertainty and variability in intermediate steps, avoid end-of-line failure, increase yields of top-grade products, Aveda specialty chemicals applications specialize in slurry extraction processes used in anode production, tracking of purity and particle size

6. Scaleup and fleet wide management

- Repeatable/Scalable MES with Model Driven MES, AI analytics, quality control, cross site scaling, value chain optimization, sustainability, flexibility for new chemistry and processes, recycling



Connect vehicle operations for OEMs



EVSE Charing & Switchgear



Power Control Center



Call Center



Power Grid



Subject Experts

Unified Data & Functions



Residential



Industrial



Commercial & Fleet

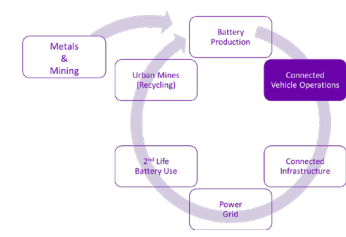
Industry demands

- Electrification transition
- Energy company opportunity
- Rapidly changing market
- Agility is key
- Time to market is everything

Segment imperatives

- Prosumer centric thinking
- Internal visibility
- Scale & AI/ML mandatory
- Visibility for CoE and company innovation
- Integrated supply chain

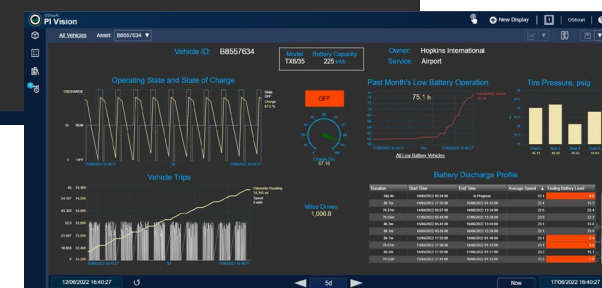
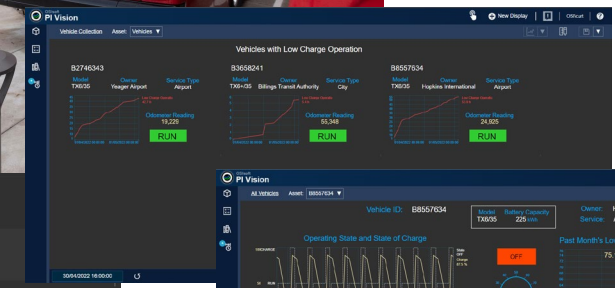




Connected vehicle operations value areas

Selected Use Cases – Data Management & Data Ecosystem

- Industrial and Transit use cases
 - Battery performance testing and validation
 - Powertrain performance testing and operations
 - Duty-cycle simulation, pilots, and services
 - EV charger testing, simulation, integration to site
 - On-vehicle technology development, testing, and Operations
- Integration with operating constraints
 - $\sum Energy\ Need = f(equipment, duty\ cycle, SOC)$
 - Optimize for Routes, Production, Demand Charges, Real-time prices, etc.



Connected Infrastructure

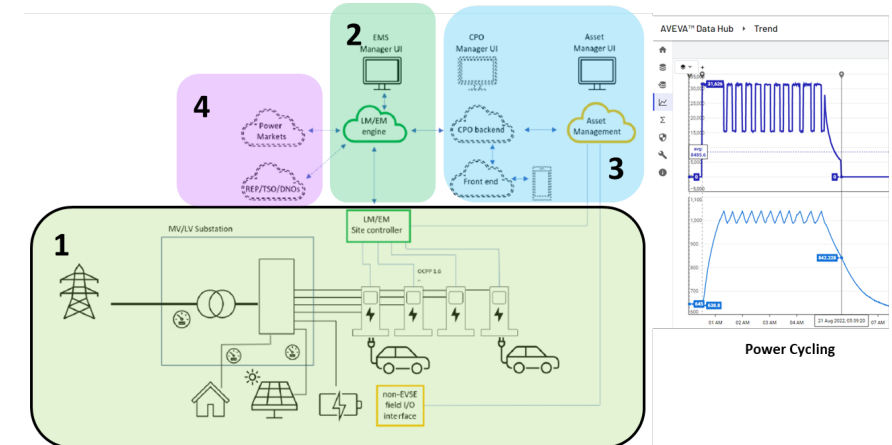
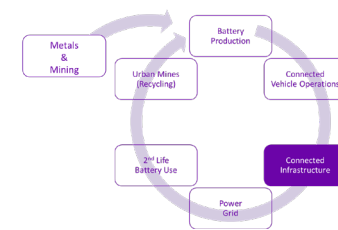
Overview of the charge point operator role of EV infrastructure

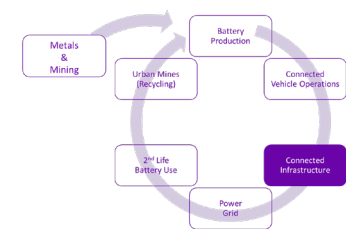
Industry demands

- Electrification of everything
- Transformation of oil industry to energy industry
- Prosumer centric services
 - own the consumer and their operational value
- Charge Point Operator Growth
- Changing face of the CPO

Segment imperatives

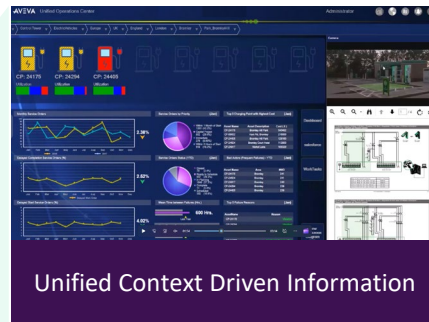
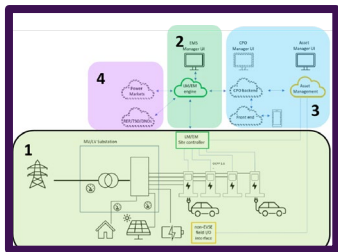
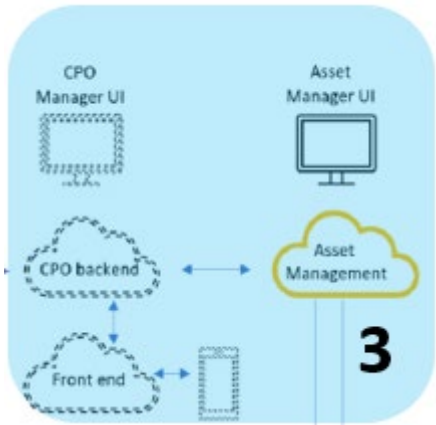
- Customer support needs
- Self-service user access
- Diverse asset data sets
- Seamless integration with enterprise systems
- Ability to share data
- Future proof systems
- Flexibility
- Security of investment
- Time to market



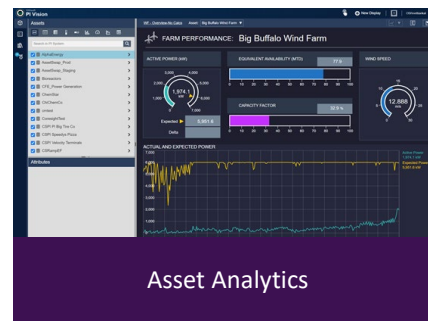


End to end operations management for CPO

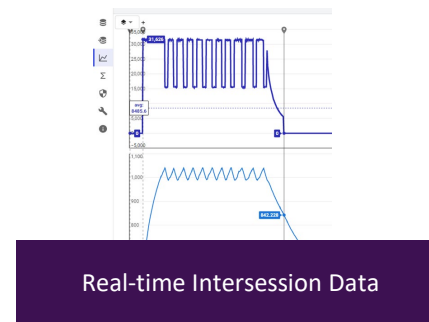
Integrated end to end solution



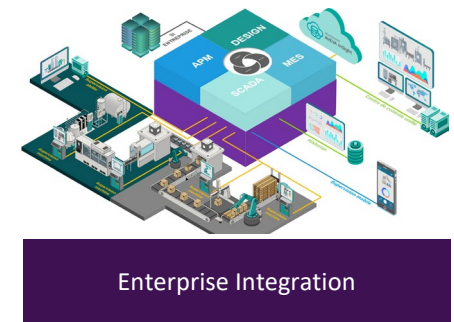
Unified Context Driven Information



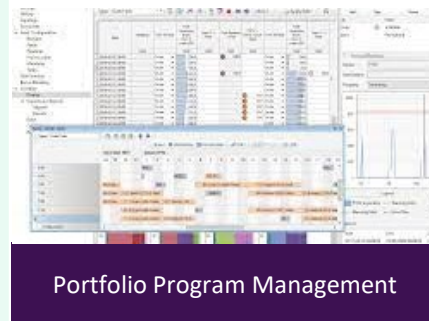
Asset Analytics



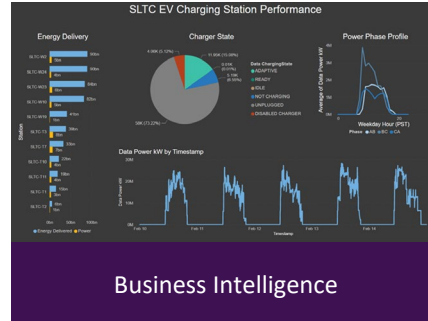
Real-time Intersession Data



Enterprise Integration



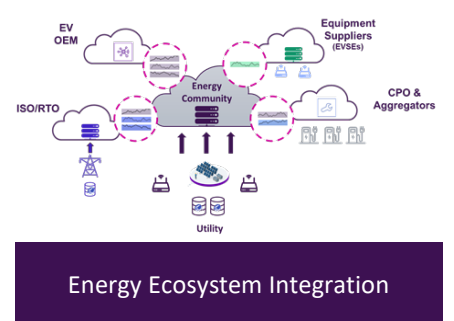
Portfolio Program Management



Business Intelligence

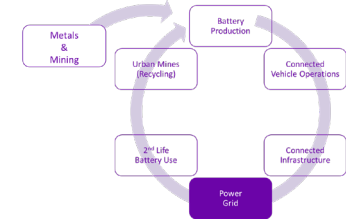


AI Performance Management

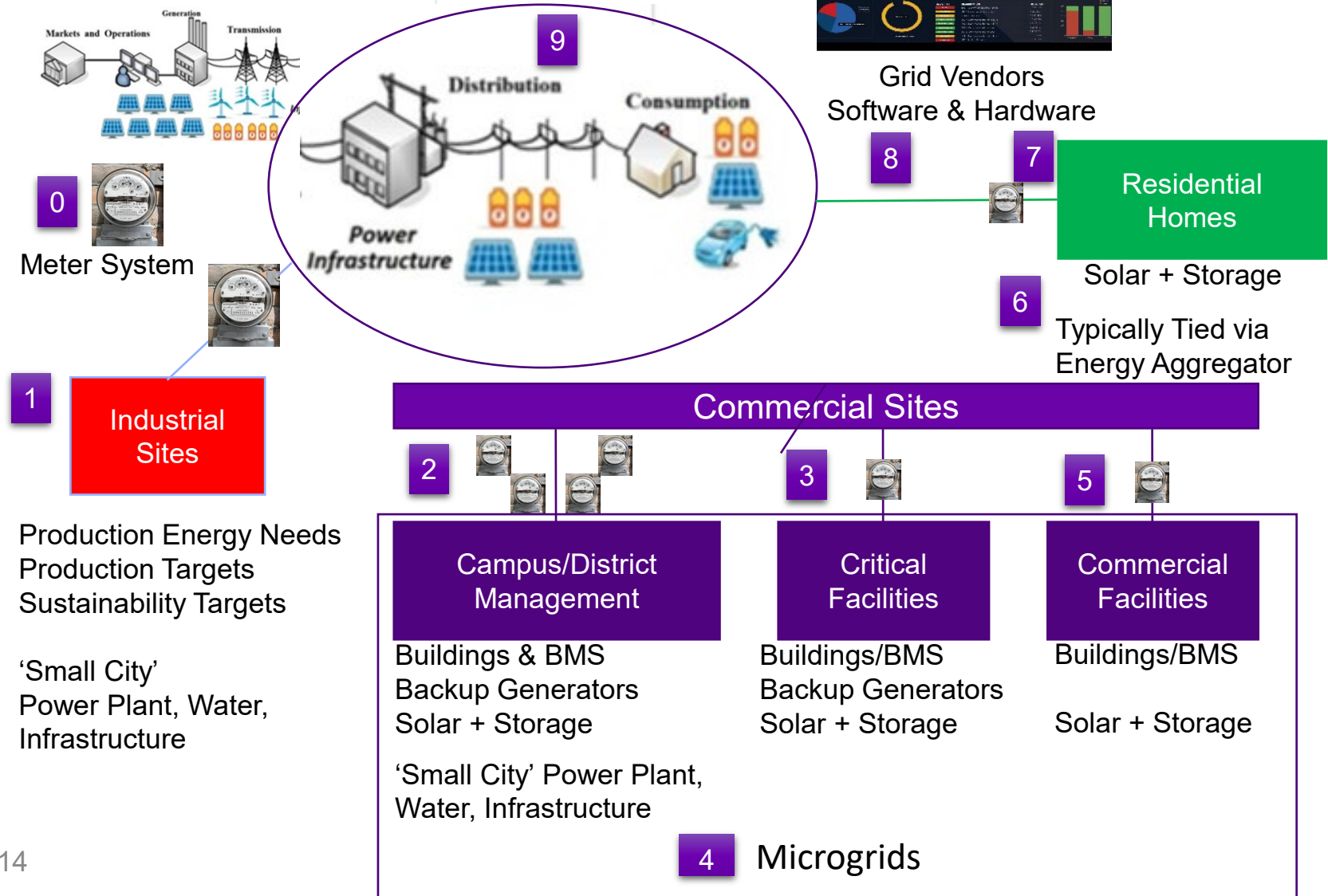


Energy Ecosystem Integration

Model-driven forecasting and health predictors to reduce OpEx, CapEx, customer churn



Power Grid Dynamics

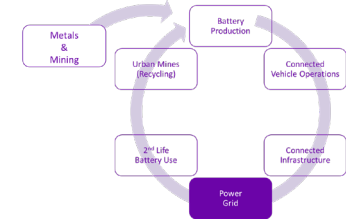


Industry demands

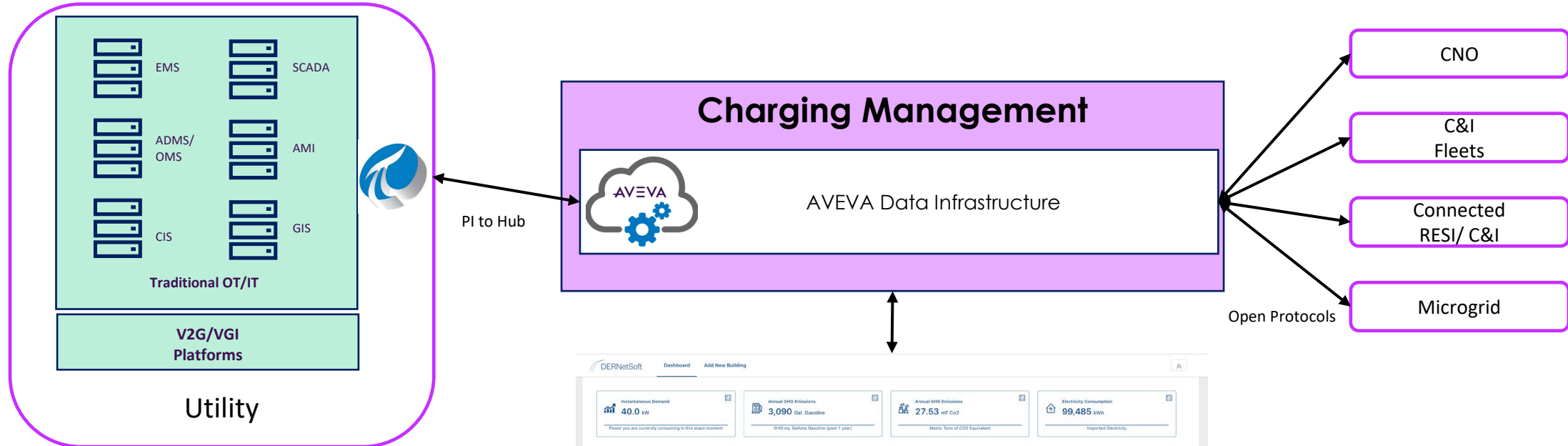
- Beneficial electrification
- Market enablement of DERs
- Grid stability
- Competitive pressures
- Electrification opportunity

Segment imperatives

- Bi-directional power flow visibility
- Dynamic integrated planning
- DER & EV visibility
- Real-time operation – scale
- Consumer energy services – Prosumer
- Dynamic pricing



Dynamic grid and managed charging value areas



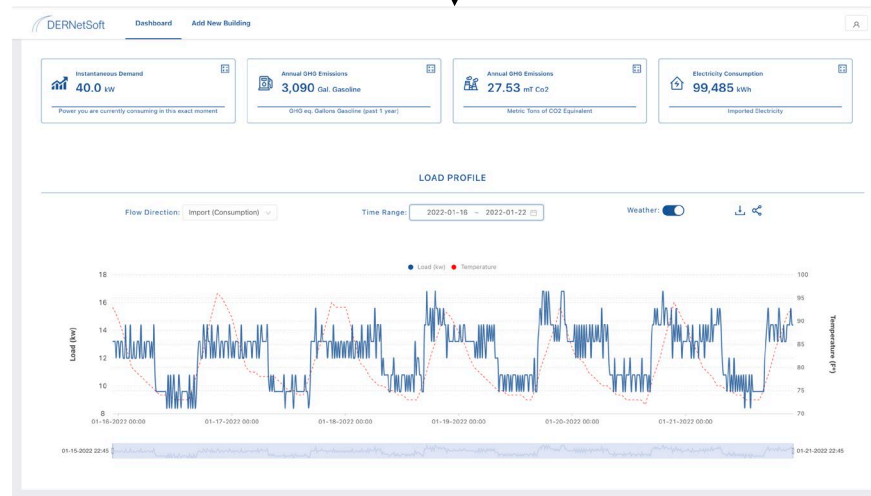
Locational Demand Operation

- Local System Spikes
- Fleet Management/Balanced Charging
- Fixed Battery & Solar
- Mixed Levels of Charge Management

Grid Integration

- Aggregation
- Peak Demand Management
- TOU/Dynamic Prices Management
- Demand Response
- Frequency Regulations
- Local DER Nanogrid Management

© 2022 AVEVA Group plc and its subsidiaries. All rights reserved.



End Use Customer

- User Management & Prosumer
- Sustainability Reporting
- Site Energy Management
- C&I Submetering/chargebacks
- Fleet charging dynamics

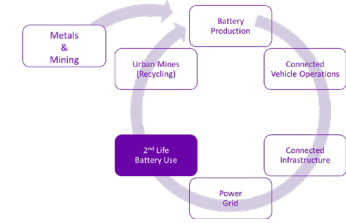
Ecosystem Integration

- Utility – DER/EV Visibility & Operations
- Market Interfaces
- System of Record for Transactions

Asset Health

- Supply Side Assets
- Charing infrastructure





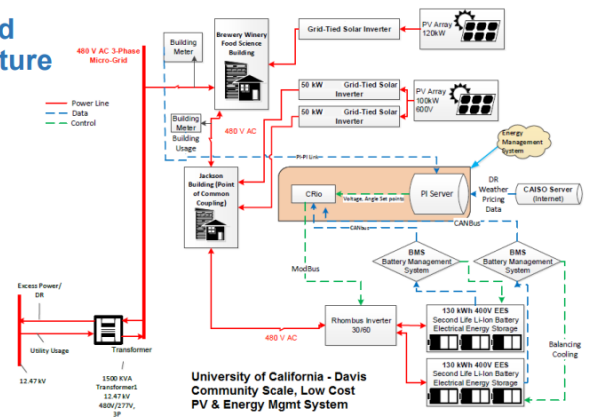
2nd Life Batteries – Prosumer Energy

Industrial Production & Prosumer Site

Rooftops Optimized for Capture of Solar Energy & Rainwater



Microgrid Architecture



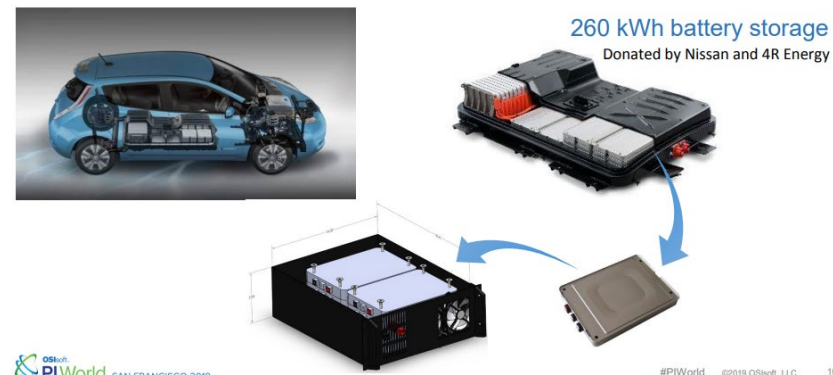
Industry demands

- Hockey stick still to come
- Consolidation of startups
- Pilot projects underway
- Battery management & system level integration
- Interconnect agreements

Segment imperatives

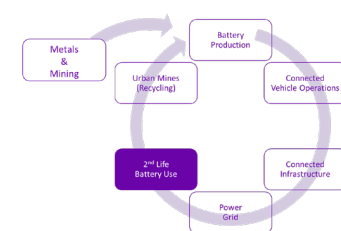
- Fleet wide dynamics
- New algorithms = more value
- Growing ecosystem of data provides monetary value

Second Life Li-Ion Batteries



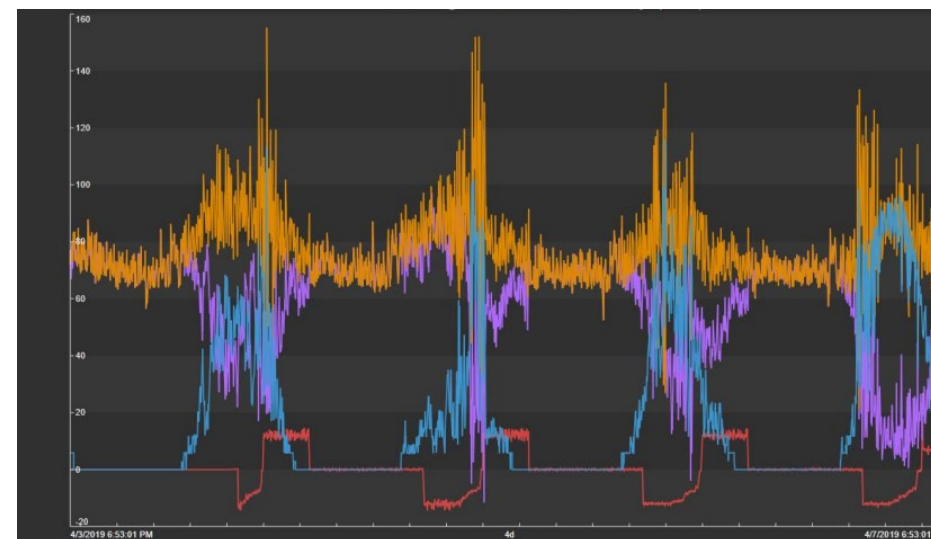
Battery Energy Storage System

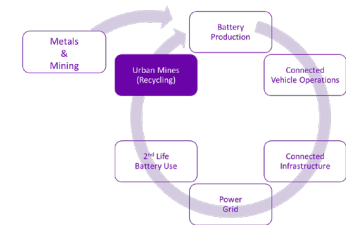




Value in energy and 2nd life battery use

- Local Microgrid integration
- Grid side integration
- Cell/pack level monitoring for reliability, safety, availability
- Project planning, sizing analysis
- Financial analysis - pre-project, operational, validation phases
- Asset monitoring and management
- Fleet level monitoring and management
- Data viability and integration for customer support
- Data sharing for grid interaction and aggregation management
- PPA compliance reporting
- PPA shadow settlement for technical and commercial losses
- Sustainability goals tracking
- Etc





Urban Mines (Recycling)

Process scale up and intensification

Industry demands

- Startup dominated
- Hockey stick still to come
- Process intensification from lab to process
- Value Chain Connection
- Supply chain connections

Segment imperatives

- Original chemistry impact
- Operations management
- Quality management
- KPI calculation
- Rollup and scalability - plant and business
- Integration with BI and analytics
- Remote monitoring and collaboration
- Knowledge retention

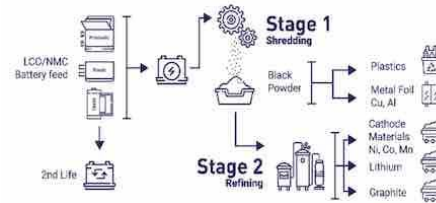


Figure 5 – Process flow diagram showing Front-end Shredding and Beneficiation circuit in the top right



Figure 6 – Shredder feeding into – Primary Classification Circuit (foreground -red) removes and bags plastics and Cu/Al metal foils

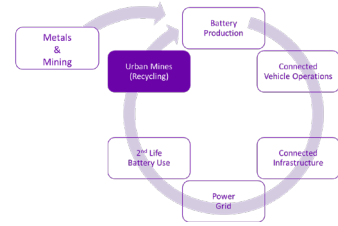


Figure 7 – Black Mass (Powder) Vacuum Dryer, Condenser and Electrolyte Recovery Circuit



Figure 8 – Primary Leach Tanks in Hydrometallurgical Refinery Section of DP

Where do recycling companies find value?



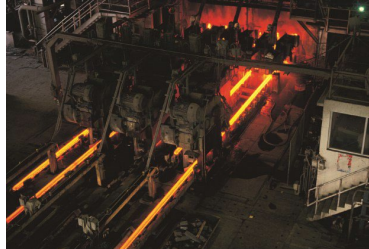
Process productivity

- Remote operations
- Real-time / condition process monitoring
- Ad-hoc visualization / real-time trending
- Material flow, pacing, & supply chain



Energy & water

- Real-time energy & water monitoring
- Reduce energy consumption
- Reduce demand spikes



Asset reliability

- Improve uptime & reduce unplanned downtime
- Real-time equipment monitoring
- Condition-based Maintenance
- Predictive / Prescriptive Maintenance



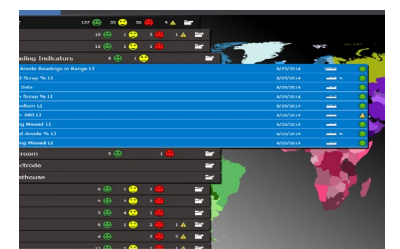
Environment health & safety

- Real-time environment, health, & safety monitoring
- Governmental regulations
- Accidents & incidents
- Compliance & audit



Quality assurance

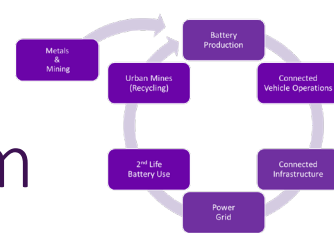
- Real-time monitoring
- Root-cause analysis & prevention of excursions
- Genealogy / product history
- Yield improvement



KPIs & reporting

- Plant-wide to enterprise visibility
- Common definitions & calculations
- Benchmarking & comparison
- Dashboards & KPI reporting

The EV community needs to adopt a collaborative data platform



Drivers for data sharing



Operations



Reliability



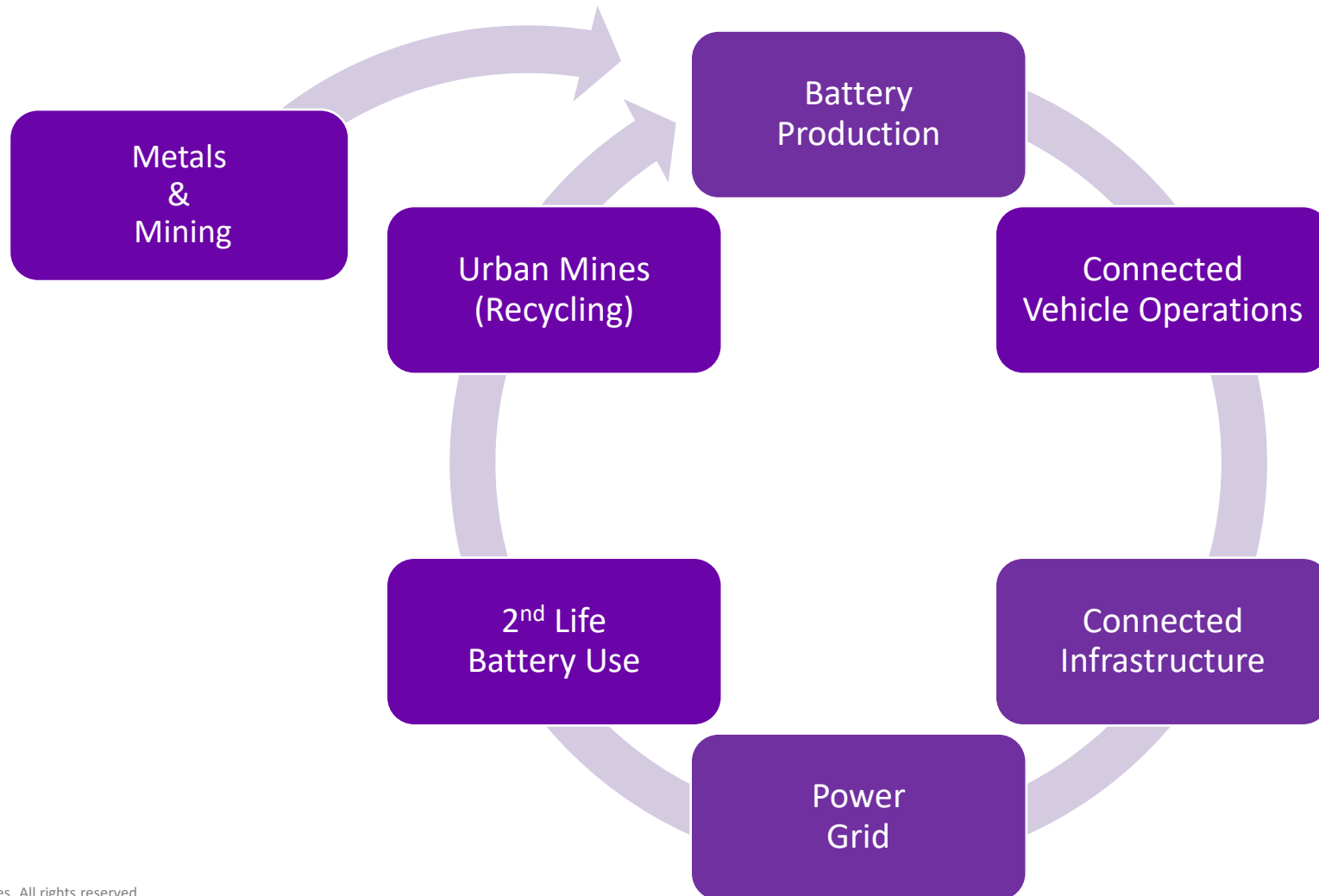
Decarbonization



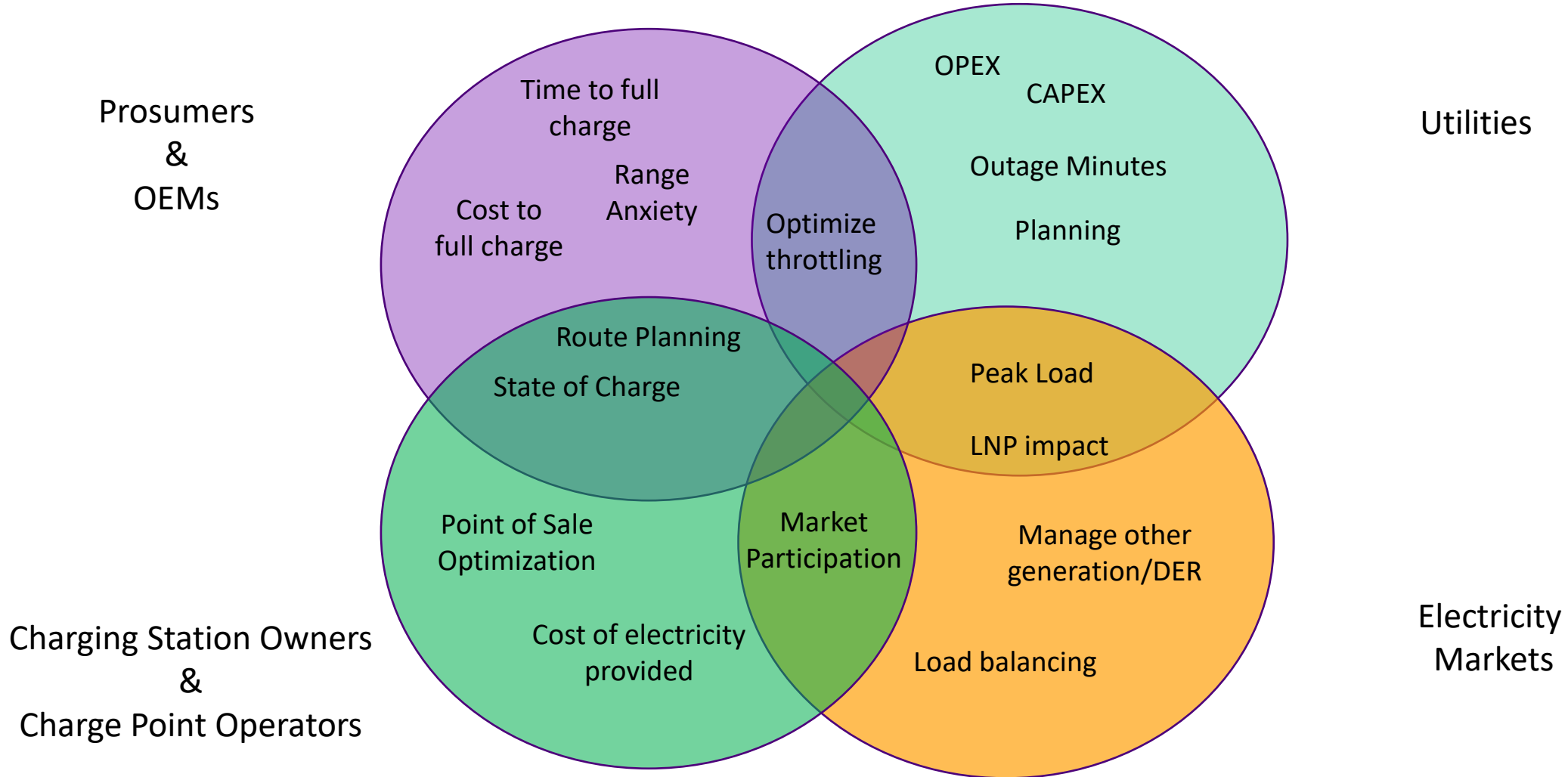
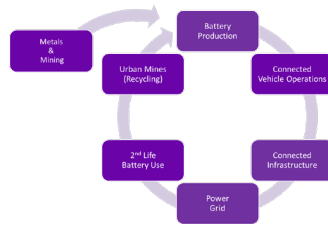
Economics

Data sharing is essential to achieving high volumes of EV adoption and keeping the power grid stable

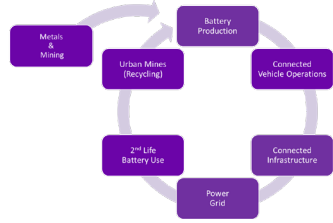
Battery Value Chain Circular Ecosystem



EV – Energy Nexus Data sharing between key stakeholders



Solution: EV community overview



How does your company fit into the Circular EV Framework?



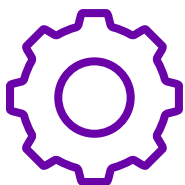
John Matranga

Connected Mobility Segment

- AVEVA
- John.Matranga@AVEVA.COM

#CircularEVEcosystem

Data Sharing for Circular EV Framework



Challenge

- Visibility of behind the meter EV assets cannot be leveraged for grid optimization.



Solution

- Find your place in the Circular EV Framework, review AVEVA best practices.
- Elevate your operational information to strategic asset status. Make data the most important asset in your company, because it is!
- Build and exchange data to build tight partnerships with the Circular EV Economy with AVEVA Data Hub Community



Benefits

- Creating a robust data infrastructure allows devices, subject matter experts, business users, applications and customers and partners to community without barriers. Providing an agile, future proof framework to take your business forward today and into the future.

Questions?

Please wait for the microphone.
State your name and company.



Please remember to...


Navigate to this session in the mobile app to complete the survey.



Thank you!

This presentation may include predictions, estimates, intentions, beliefs and other statements that are or may be construed as being forward-looking. While these forward-looking statements represent our current judgment on what the future holds, they are subject to risks and uncertainties that could result in actual outcomes differing materially from those projected in these statements. No statement contained herein constitutes a commitment by AVEVA to perform any particular action or to deliver any particular product or product features. Readers are cautioned not to place undue reliance on these forward-looking statements, which reflect our opinions only as of the date of this presentation.

The Company shall not be obliged to disclose any revision to these forward-looking statements to reflect events or circumstances occurring after the date on which they are made or to reflect the occurrence of future events.

 [linkedin.com/company/aveva](https://www.linkedin.com/company/aveva)

 [@avevagroup](https://twitter.com/avevagroup)

ABOUT AVEVA

AVEVA is a global leader in industrial software, sparking ingenuity to drive responsible use of the world's resources. The company's secure industrial cloud platform and applications enable businesses to harness the power of their information and improve collaboration with customers, suppliers and partners.

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. With operations around the globe, we are headquartered in Cambridge, UK and listed on the London Stock Exchange's FTSE 100.

Learn more at www.aveva.com