Jacobs Challenging today. Reinventing tomorrow.

Your partner for successful project execution

We do things right.
We challenge the accepted.
We aim higher.
We live inclusion.

Why BeyondZero®?

BeyondZero℠

"We believe our enduring commitment to BeyondZero, and our culture of caring will make our people and communities safer and healthier, and this is fundamental to our success"

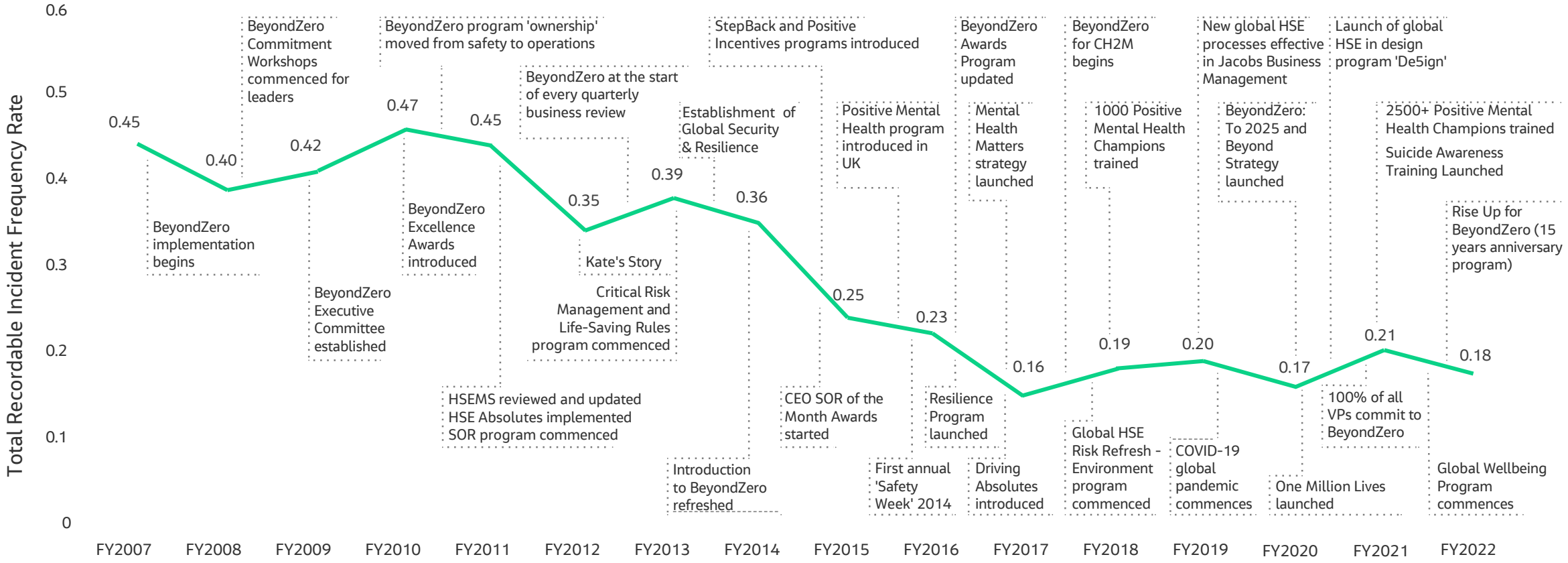
Jacobs Chair,
Steve Demetriou

- Work must be healthy, safe, and secure for our people and our planet
- Goes beyond our workplace into our daily lives, creating a safer and healthier future for our families and communities

BeyondZero Principles:

- ✓ Empower and motivate each other to take action
- ✓ Strive to recognize and understand risk at all levels of our business
- ✓ Expect our people to demonstrate a visible commitment and responsibility for creating a safe, secure, and healthy environment
- ✓ Extend BeyondZero to everyone we encounter including our business partners, clients, families, and neighbors

Our BeyondZero Journey



About Us

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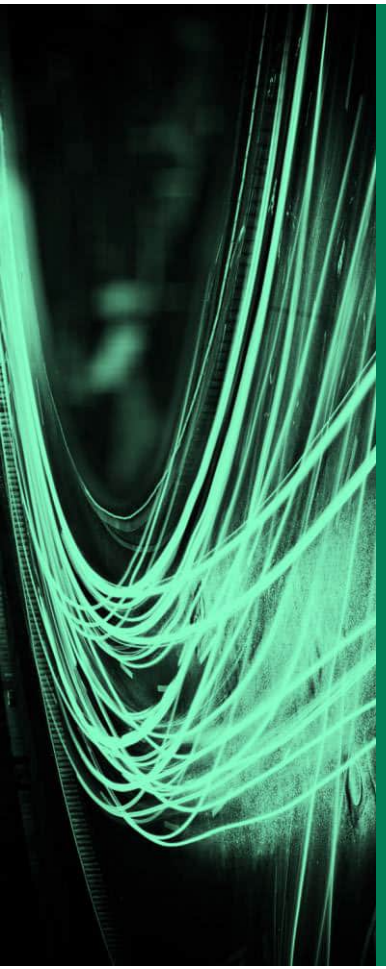


Accelerating the future

At Jacobs, we're challenging today to reinvent tomorrow by solving the world's most critical problems for thriving cities, resilient environments, mission-critical outcomes, operational advancement, scientific discovery and cutting-edge manufacturing, turning abstract ideas into realities that transform the world for good. With $16 billion in revenue and a talent force of more than 60,000, we provide a full spectrum of professional services including consulting, technical, scientific and project delivery for the government and private sector.

We help make the world smarter, more connected and more sustainable, supporting better outcomes for Advanced Manufacturing, Cities & Places, Energy & Environment, Health & Life Sciences, Infrastructure, National Security and Space.

Engineering News-Record 2023 Rankings

#1 TOTAL DESIGN

#1 MANUFACTURING

#1 SOLAR POWER

#1 PROGRAM MANAGEMENT

#1 SEMICONDUCTORS

#1 SEWAGE & SOLID WASTE

#2 AUTO PLANTS

#2 ELECTRONIC ASSEMBLY

Jacobs by the numbers

40+ COUNTRIES

60K+ TALENT FORCE

400 OFFICES

$27B IN BACKLOG

$16B ANNUAL REVENUE

$2.5B CLIENT SAVINGS

13.5M+ METRIC TONNES CO_2 AVOIDED FOR CLIENTS

$7.7B ESTIMATED ESG-RELATED REVENUE

Net zero CARBON FOR OPERATIONS AND BUSINESS TRAVEL

Industry-leading ESG status:

- Placed in the **Dow Jones Sustainability World Index** 2022
- Placed on **CDP's "A List" for Climate** in 2022
- Gold medal in the **EcoVadis Sustainability Ratings 2022**

Jacobs Lines Of Business/Operating Units

Jacobs

Divergent Solutions

People & Places Solutions

Advanced Facilities

Federal & Environmental Services

Energy & Power

Buildings & Infrastructure

Global Business Units

Advanced Facilities Markets

Life Sciences

Electronics

Specialized Manufacturing

Data Centers

EV, PV & Batteries

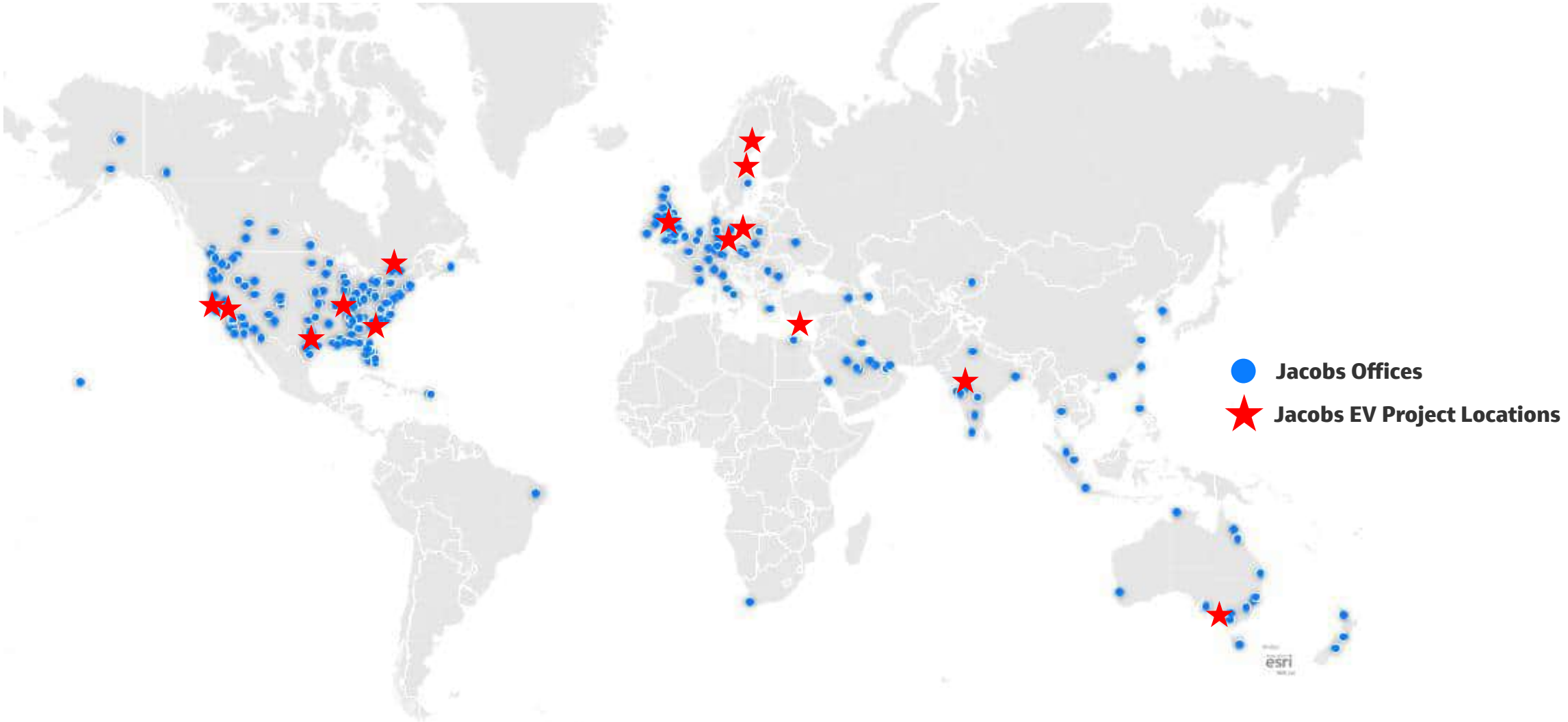
Advanced Manufacturing

Battery Cell Manufacturing & Electric Vehicle (EV) Experience

- Supporting Global EV& Battery Manufacturers
  - Delivering three of the **largest Battery Cell Plants**, for a total of 350 GWh
  - Completed four of the **largest EV Manufacturing Plants** totaling 25 million square feet
- Manufacturing Optimization Expertise

Working together with our client, we delivered an EV manufacturing and battery plant in North America in 18 months

Supporting EV & Battery Projects Globally

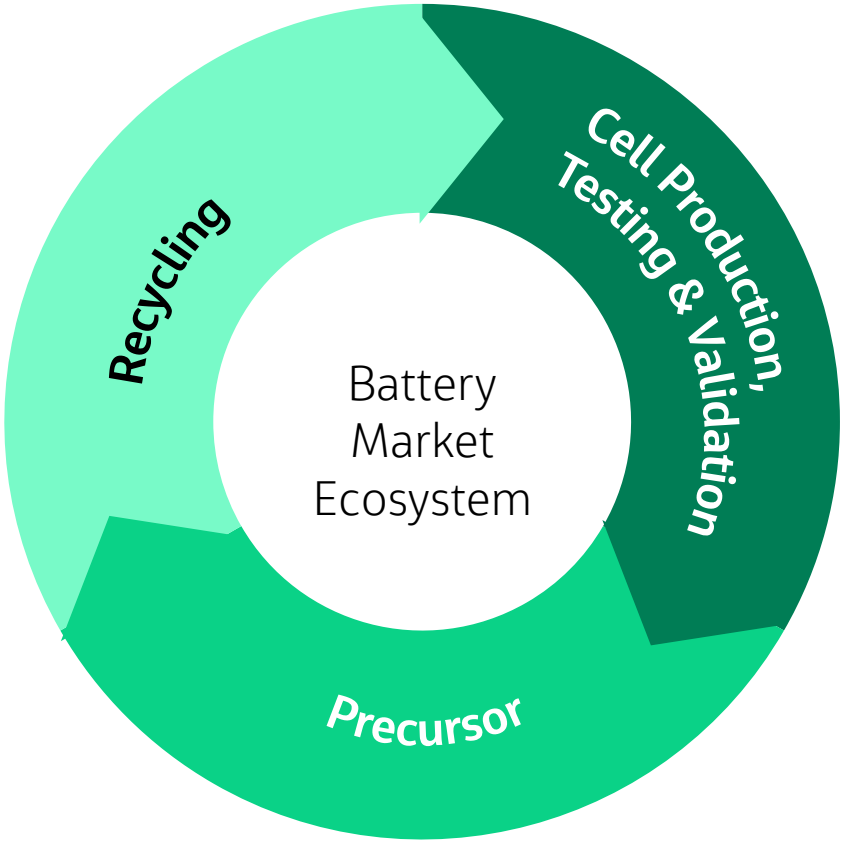


60,000+ employees | 40+ countries | 400 offices

Experienced in All Areas of the Battery Market Ecosystem

For Lithium-Ion, Solid State, and Next Generation Batteries

- R&D Facilities
- Pilot Plants
- Production Plants
- Gigafactories
- End-of-Life Facilities



Capabilities – EV & Battery Manufacturing

Facilities Design & Build

- Site Selection and Master Planning
- Environmental & Permitting Support
- Architectural
- MEP
- Civil
- Structural
- Design for Manufacturing
- Concurrent Process and Facilities Design

Mechanical & Process Engineering

- Process supporting utilities design
- Process liquid and gas delivery systems
- Refrigeration systems
- Dry and Clean Rooms
- HVAC design

Machine Design

- Custom machine design
- Roll-to-roll web systems
- Material Handling Automation
- Load measurement systems
- Mechanical positioning & handling systems
- Static/dynamic/thermal FEA

Electrical

- Power engineering analysis and design
- Grounding

IT and Analytical Services

- Network design and engineering
- Cyber security
- Predictive and analytical modeling
- Operational decision support tools
- Industry leading partners

Instrumentation

- Data acquisition & processing
- Signal conditioning

Control Systems

- Distributed PLC systems
- ISA instrumentation specifications

Software

- Custom application development
- Commercial off-the-shelf integration
- Web-based and real time applications
- State-of-the-art collaboration tools

Construction and Integration Services

- Construction management
- Procurement
- Hardware build-up
- Pre-installation integration/testing
- Software development

Manufacturing Engineering

- Lean manufacturing/optimization
- Industrial engineering
- Launch and operations support
- Material and logistics support
- Process design and optimization

Operations

- Enterprise O&M
- Technical Support

Robotics

- Tooling design
- Robot programming
- Training

Maintenance

- Process assessment
- Preventive maintenance
- Predictive technology
- Reliability analyses

Startup & Commissioning

- On-site startup & commissioning
- Staff augmentation during ramp up

Safety

- System safety design/analyses
- Fire Suppression Systems
- Occupational/construction safety
- Facility siting
- HAZOP & PHA – design for safety

Structures

- ASME pressure vessels
- ANSI B31 piping
- Flexibility and finite element analysis
- Structural dynamics
- Hardened structures
- Special movable structures
- Concrete, steel, composites, and specialty alloys

Project Examples

New Gigafactory for Next-Generation Lithium Battery Cells

Northeast United States

Jacobs is currently designing a new gigafactory in North America for a confidential client. This client produces a next-generation battery cell with innovative quasi-solidstate technology for improved safety and performance. The 10 GWh plant has a unique battery cell process that we are scaling from pilot to large scale manufacturing.

The project efforts include:

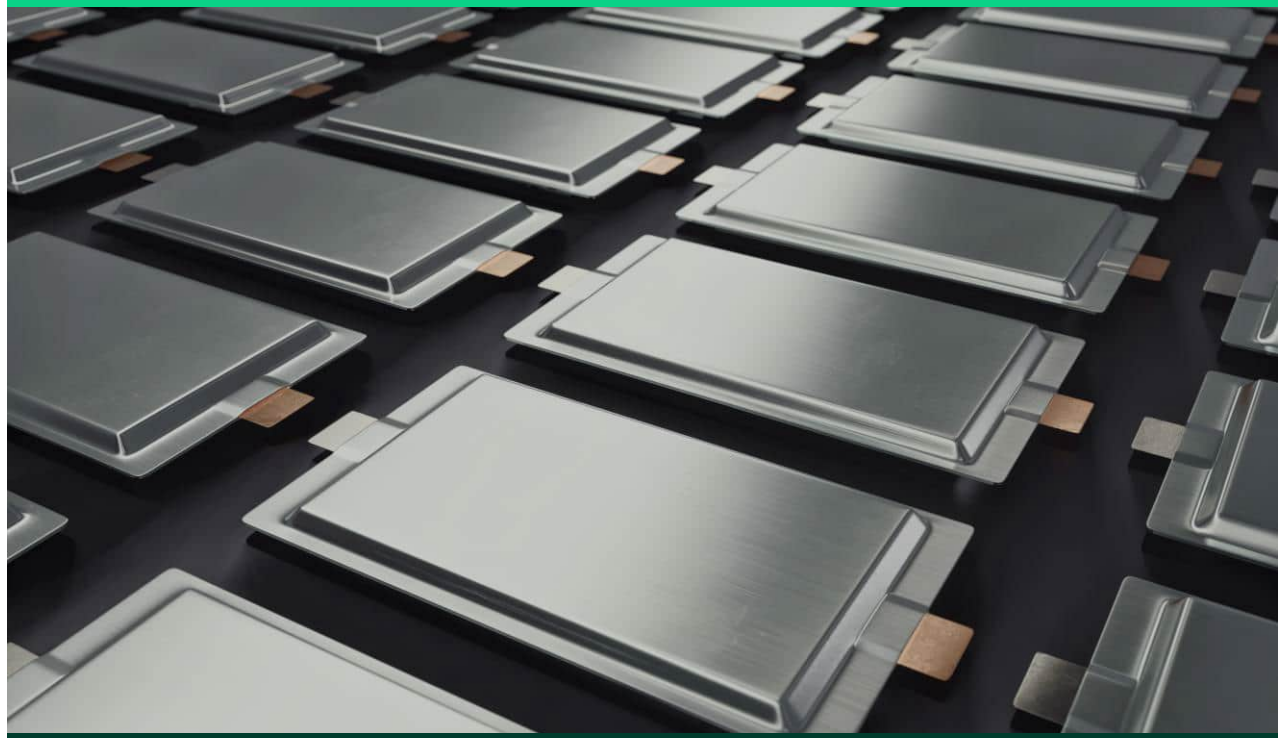
- Concept Design
- Site Selection
- Schematic Design

Jacobs is providing the following services:

- Architectural / Structural
- Civil / Land Development
- Industrial Engineering
- Mechanical / Electrical / Plumbing
- Process / Controls
- Equipment Specifications
- Bid Analysis

Key Drivers

- Speed to market
- Specialized resources
- Ability to 'right size' team



Project Facts:

- Client: Confidential
- Client Products: Next-Generation Lithium Battery Cells
- Capacity: 10 GWh and scalable for future growth
- Project Duration: 2023 - Ongoing

European Gigafactory for Battery Cells

Northern Europe

Project Description

Expansion of a large-scale lithium-ion battery factory designed to manufacture batteries for electric vehicles and energy storage solutions.

- Full site expansion design for all buildings, including all ancillary buildings such as energy recovery, can stamping and warehousing
- Clean and dry rooms, utilities (spaces for compressed air and nitrogen handling), piping and relevant instrumentation, wastewater pre-treatment and storage areas, fire safety systems, HVAC, electric energy distribution and generation systems, an IT network and its relevant interfaces

Services Provided by Jacobs

- Integrated Design services including Basic and Detailed Design
- EPCm Cost Estimation
- Design Coordination
- Risk assessments
- Constructability reviews
- Constructability and Maintenance Optimization
- Providing Clean and Dry room contracting options
- Supporting cost optimization sprints

Value Added

- We challenged the ISO-Standards for Clean and Dry rooms to reduce cost
- We reduced building volume/ footprint, as well as downstream/formation and Ageing / Can stamping, Warehousing within the sprint activities to support the cost saving initiatives
- We planned in 4D, combining program planning with our 3D model

Project Facts:

- Client: Confidential
- Client Product: Lithium-Ion Battery Cells
- Size: Total Assembly Building Area 1,500,000 m^2 (16,150,000 SF)
- Capacity: 61 GWh
- Project Duration: 2021 - Present

New Lithium-Ion Battery Gigafactory and R&D Center

Northern Europe

Project Description

This new 50GWh gigafactory will produce battery cells for use in pure electric cars and will be one of the largest cell production facilities in Europe.

Services Provided by Jacobs

- Integrated Concept Design Engineering Services including:
  - Best option analysis with feasibility study including utilities distribution and new material handling concept
  - "Node" design, which employed an innovative approach for welfare areas and vertical circulation
  - Detailed analyses verifying previous projects, the new client's requirements and local conditions (geology) to ensure the most optimized solution
  - Preliminary cost estimates and critical KPIs (footprint, volume) at early stage of engagement
- Integrated Basic Design Engineering Services including:
  - Multidisciplinary package of Basic Design with the contents equivalent to early Detail Design done fully in BIM environment
  - Modern, human-friendly, aesthetically attractive architecture for the facility owing to multi-level coordination

Value Added

- Co-location with the client enabled us to incorporate 'agile' design development
- Concept Design Sprint which brought together our global team to challenge how we could deliver the project with a focus on budget and outcomes resulting in an estimated CAPEX saving of 25%.
- We worked successfully against an extremely tight timeline from the start, and we handled changes that came from process equipment supplied by the client
- High flexibility in change management allowed us to maintain high speed of design development with possibility for incorporating ad-hoc changes

Project Facts:

- Client: Confidential
- Client Product: Lithium-Ion Batteries
- Size: 167,000m$^{2;}$; Capacity: 30 GWh (Ph 1) - 50 GWh
- Services: Concept & Basic Design
- Project Duration: 2022 - 2023

Lithium-ion Battery Cell Gigafactory, CAM Production, and Battery Recycling

Eastern Canada

Project Description

- We are providing engineering services to deliver multi-discipline, integrated concept and basic design for a large-scale lithium-ion battery gigafactory in eastern Canada.
- The Battery Factory will manufacture batteries for consumer and industrial products, including electric vehicles and solutions for energy storage systems.
- Phased delivery starting with Phase 1 (30GWh) – Cell Manufacturing, Cathode Active Materials Production and Battery Recycling. The schedule will focus on achieving early cell production.
- Concept design includes:
  - ✓ Select the "Best" project approach
  - ✓ Analyze multiple concept options
  - ✓ Complete viability studies
  - ✓ Prepare a Preliminary Cost Estimate (+/-50%) to confirm project viability
- Basic design includes:
  - ✓ Finalize project options and settle on a project scheme prior to the start of Detailed Design
  - ✓ Complete Specifications for Long Lead Equipment
  - ✓ Complete early detailed design for Structural Steel, prepare Material Take offs (MTO) and complete an estimate (+/-20%) and project schedule
  - ✓ Prepare discipline Basic Design Reports

Services Provided by Jacobs

- Architectural and Engineering Services including Architectural, Civil, Structural, Mechanical, Electrical, Process, Instrumentation and Controls, Fire Engineering, IT/Security/Telecom and BIM.

Project Facts:

- Client: Confidential
- Client Product: Lithium-Ion Batteries
- Size: 420-acre site, 30GWh (Phase 1) expanding to 60 GWh/year
- Services: Concept and Basic Design
- Project Duration: July 2023 - Present

EV and Cell Manufacturing Campus

Southeast United States

We joined together with a world-class design architect to provide master planning through construction administration of a 2,000-acre greenfield Electric Vehicle manufacturing campus.

The campus will boast a new 20,000,000 square feet, world-class, most advanced, energy-efficient, and resilient 24/7 manufacturing campus EV and cell manufacturing facility.

We quickly mobilized a team of 100 multi-discipline engineers, architects, planners, sustainability professionals and subconsultants from across the United States for this fast-paced, schedule-driven design project.

To maintain schedule, Master Planning and Schematic Design phases were run largely in parallel.

Phase Project Delivery Schedule

- Detailed Site Masterplan
- Schematic Design
- Construction Documents
- Permitting and Bidding
- Construction Administration

Jacobs is providing design services including:

- Project Management
- Architectural
- Structural
- Civil
- HVAC
- Mechanical
- Electrical
- Plumbing
- Piping
- Process
- Instrument & Controls
- Telecom
- Fire Protection
- Water
- Safety
- Geotechnical
- Highway
- Environmental
- Landscape Architecture
- Purchasing
- Cost Control
- Document Control
- Construction and Program Management
- BIM/Digital Delivery

Project Facts:

• Client:	Confidential
• Client Products:	Electric Vehicles and Lithium-Ion Battery Cells
• Size:	20,000,000 SF over 2,000 acres
• Capacity:	400,000 vehicles/year
• Project Duration:	August 2022 - Present

EV and Battery Pack Facility

Midwest United States

Project Description

- Provide senior-level manufacturing engineers to supplement manufacturing launch teams to support activities required to meet an aggressive production timeline of two new vehicles
- Specialized, flexible, nimble resources required

Facility Components

- Stamping, body in white, paint, general assembly, and battery pack
- Drive unit manufacturing

Services Provided by Jacobs

- Vehicle launch manufacturing engineering support
- Body shop quality control plan creation
- Process and product certification
- Dimensional control optimization
- Process and throughput optimization utilizing lean principles
- Creation of process documentation
- Training and qualification of inspection and repair personnel

Project Facts:

- Client: Confidential
- Client Product: Electric Vehicles and Battery Packs
- Size: 3,300,000 SF (with expansion goal of 3,900,000 SF)
- Capacity: 52,000 vehicles/year
- Project Duration: 2021 – Ongoing Engineering Support Services

Gigafactory for EVs and Batteries

Southern United States

Project Description

New gigafactory for EV car and cell manufacturing including:

- ✓ Stamping, Casting, Body in White, Paint, and General Assembly
- ✓ Cell production
- ✓ Battery pack and drive unit assembly
- ✓ Plastics Injection
- ✓ 100,000 SF of employee office, break room, conference room, rest room, and dining

- Complete EV manufacturing from raw material to stamping and casting, paint to final assembly
- Complete cell manufacturing from raw material delivery and mixing, coating and drying, electrode manufacturing, through assembly and formation

Services Provided by Jacobs

- Architectural, civil, land development, wastewater, industrial water, potable and process water, transportation, structural, mechanical, electrical, process and controls engineering
- Building Information Modelling
- Specialist systems design including electrolyte distribution, dust collection, VOC abatement, clean room and dry air systems
- Smoke and fire modeling for life safety
- Permitting support
- Field engineering and construction management support

Key Drivers

- Speed to market
- Flexibility
- Nimble response
- Specialized resources
- Ability to 'right size' team

Site in July 2020

Site in October 2021

Project Facts:

- Client: Confidential
- Client Products: Electric Vehicles and Lithium-Ion Battery Cells
- Size: 11,500,000 SF
  100 GWh with Phase 2
- Capacity: 250,000 vehicles/year and growing
- Project Duration: July 2020 – April 2022 with ongoing engineering support services

New Gigafactory for EVs and Batteries

Northern Europe

Project Description

Design of the complete cell manufacturing process from raw material delivery and mixing, coating and drying, electrode manufacturing, through assembly and formation.

The new gigafactory includes:

- ✓ Cell production
- ✓ Battery pack and drive unit manufacturing
- ✓ EV Assembly
- ✓ Production lines for casting, paint, structural battery, drive unit & cells
- ✓ Quality control laboratories

Services Provided by Jacobs

- Permitting support
- Building information modelling (BIM)
- Mechanical, electrical, process and controls engineering
- Field engineering and construction management support
- Design of specialist systems including industrial heating and cooling plant, electrolyte distribution, dust collection, clean room and dry air systems

Key Drivers

- Speed to Market
- Flexibility
- Nimble Response
- Specialized Resources
- Ability to Right Size Team

Project Facts:

- Client: Confidential
- Client Products: Lithium-Ion Battery Cells
- Size: 600,000 m^2 (6,500,000 SF)
- Capacity: 100 GWh after Phase 2
- Project Duration: 2020 - 2023 with ongoing engineering support services

EV and Battery Facility Expansion

Western United States

Project Description

We developed the design for miscellaneous retrofits and new equipment installation and continue to provide field support services for this existing EV and Battery Manufacturing Facility. The project scope includes:

- Lead Legacy Permit Closeout effort. 900+ open permits closed out in two years.
- Developed Assembly Building, South Paint, and Plastics buildings overall egress permit documents which helped eliminate gating factors for permit approval to allow construction to begin promptly . All have been approved by the City
- Completed 30+ sub-projects related to manufacturing related to manufacturing tools, workplace, restrooms, office, and cafeteria spaces
- Build working relationship with city building officials
- Performed fire hazard simulations in support of value engineering cost savings initiatives
- Parking Improvement

Services Provided by Jacobs

- Design and Field Support Services including Architectural, Civil, Fire, Structural, Electrical, Mechanical, Plumbing, Process Piping, Landscape, BIM and Design Manager services.
- Smoke, egress, and fire modeling for life safety.
- Provide recommendations for hazardous materials quantities.
- Permitting support.
- 3D REVIT modeling and laser scanning.
- Supplement client plant design architectural/engineering team with our staff.
- Project performance reports to client leadership.

Project Facts:

- Client: Confidential
- Client Product: Electric Vehicles and Lithium-Ion Battery Cells
- Size: 403 acres; 3,600,000 SF
- Capacity: 650,000 vehicles/year
- Project Duration: 2020 - 2023

Gigafactory Expansion – Multiple Projects

Western United States

CUB2 Project: Completed 2023

Project Description

- We supported the client's engineers and architects in schematic design for the Central Utility Building development project. This includes the Cooling Yard and Thermal Storage Tank.

Services Provided by Jacobs

- Architecture, Structural, Civil, Mechanical, Electrical, Fire Protection and I&C support

Challenges/Solutions

- We formed a new Jacobs team specifically for this project and to create a smooth transition we developed a robust project onboarding process such as creating and implementing a project execution plan.
- This project required and aggressive timeline. By utilizing our Jacobs Global Network of engineers, designers and SMEs we were able to increase manpower quickly.

Semi-Truck Manufacturing Building: 9/2023 - Present

Project Description

- Currently, we are supporting client engineers and architects in early design for a new 1.3 MM SF building which will house a semi-truck manufacturing line including Paint Shop, Drive & Battery assembly, and General Assembly.

Services Provided by Jacobs

- Architectural, Engineering and Design services

Value Add

- First Principle Thinking to Challenge the Status Quo
- Supporting Onboarding of New Staff through Mentorship
- Experienced Local Office & Staff with Established Relationships

Project Facts:

- Client: Confidential
- Client Products: Battery Cell, Module, Pack, Drive Unit and Vehicle Manufacturing
- Size: Total Building Area: 500,000-1,300,000 SF
- Capacity: Expansion of 350 GWh capacity
- Project Duration: 2023 - Present

EV Assembly Plant

Southeast US

Project Description

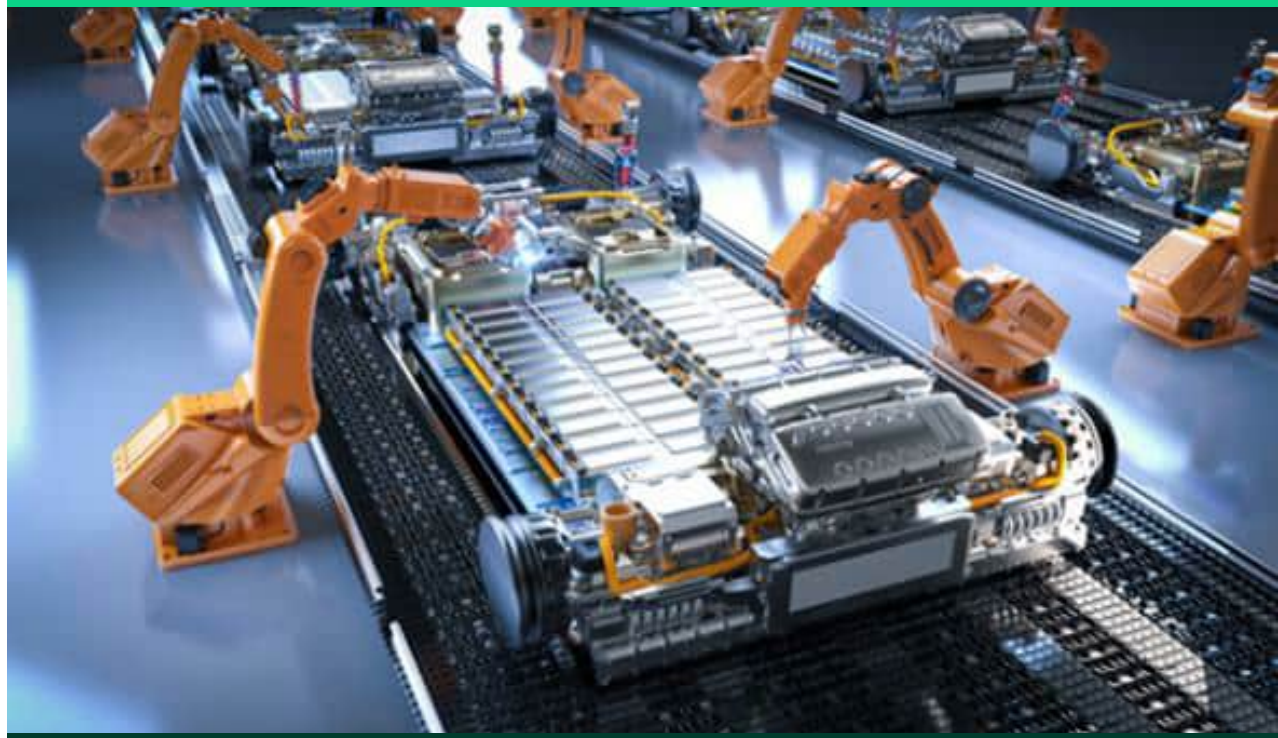
- Greenfield electric vehicle manufacturing facility
- The Phase 1 production facility size is approximately 3,500,000 SF under roof with an intended production capacity of 45 jobs per hour / 200,000 vehicles per year
- Schedule critical project requiring:
    - Fast-track execution phasing with overlapping (parallel) design, procurement, and construction activities
- Project delivery:
    - Multiple prime contractors for early work packages and general contractor packages by building
    - Requires design to be developed and issued for construction in packages by discipline/scope groupings that support construction sequencing
- This strategy will facilitate construction starting as early as possible and remove the constraint of design development and contracting for later trades from early work.

Project scope of work

- Design, procurement and construction of the process buildings, ancillary buildings, site development, and infrastructure
- Installation and routing of building and process utilities (up to process equipment tie points) are also included
- Conceptual design services, detail design services, and design support of Procurement and Construction for a complete project

Services Provided by Jacobs

- Architectural and Engineering Services



Project Facts:

- Client: Confidential
- Client Product: Electric Vehicles
- Size: 3,500,000 SF (approx.)
- Capacity: 200,000 vehicles per year
- Services: Conceptual & Detailed Design, Procurement, Construction Management
- Project Duration: May 2023 - Present

Multiple EV Battery Recycling Facilities

United States – 3 Facilities

Project Description

Cirba Solutions collects, transports and processes manufacturing scrap and end-of-life batteries, producing black mass from recycled lithium-ion batteries. It plans to invest more than $1 billion over the next five years to expand the infrastructure for battery recycling. Cirba and Jacobs have formed a strategic alliance to execute this investment program for three planned projects across the US.

- **Project 1 in Lancaster, OH**: We are designing and delivering a $200 million expansion for end-of-life battery processing facilities on Cirba's Lancaster, OH campus. Our subject matter experts are assisting their engineers and third-party consultants with developing first-of-its-kind equipment and process. We provide staffing to accommodate any client need, including standards development, equipment code expertise, process code expertise, laboratory expertise, and construction management. We are overlapping building development and process/equipment design to maintain the client's number one priority – speed-to-market. Additionally, we assisted Cirba in generating and maintaining procurement procedures that tied to federal grant funding. This heavily phased project overlapped multiple design, bid, construction, and permit packages to drive schedule and maintain completion milestones. TIC: $200 million brownfield expansion
- **Project 2 in Eloy, AZ**: We have started the design of a lithium-ion battery recycling facility in Eloy, AZ. Cirba will move into an already-existing building in Eloy, following a construction project that will expand it by 75,000 square feet. The company expects the facility will be in operation by 2023, bringing 110 permanent jobs to the area. TIC: $80 million brownfield retrofit

Services Provided by Jacobs

- EPCM

Project Facts:

- Client: Cirba Solutions
- Client Product: Black mass from recycled batteries
- Size: Varies
- Services: EPCM
- Project Duration: 2022-Ongoing (2025)

Pilot Line Facility for Lithium-Ion Battery Cells

Western US

Project Description

We coordinated with the client's team of designers and engineers to provide detailed design services for Phase 1 tenant improvement of the Pilot Line Facility for Lithium-Ion Battery Cells. The project included:

- Pilot Lines for lithium-ion battery cell manufacturing
- Improving existing facility to be manufacturing-ready
- Development of targeted improvements and next generation tool development
- Designing cost-effective solutions to meet unique site challenges and requirements

Services Provided by Jacobs

- Architectural and engineering services to support tenant fit-out and associated exterior and site improvements
- Designed on-site combined heat & power distributed generation plant to meet energy demand with substantial cost savings

Key Drivers

- Cost
- Speed to Market

Value Add

- Staff Ramping & Support
- Specialized Knowledge & Subject Matter Experts
- Experienced Local Office & Staff with Established Relationships

Project Facts:

- Client: Confidential
- Client Product: EV Lithium-Ion Battery Cells
- Size: Building 1 (232,000 ft^2) and Building 2 (121,000 ft^2)
- Services: Detailed Design
- Project Duration: August 2022 – July 2023

Cathode Active Material (CAM) Process Equipment Design

Southern United States

Project Description

- Cathode Active Material (CAM) Process Equipment Design including:
  - ✓ Precursor production areas
  - ✓ Bulk powder handling, including continuous mixing, calcination, brick crushing, washing/filtration and QC
  - ✓ Material handling including loading and unloading
- Complete cell manufacturing process from raw material delivery and mixing, coating and drying, electrode manufacturing, through assembly and formation

Services Provided by Jacobs

- Engineering services including mechanical, process, piping and controls
- Subject Matter Expertise (SME) services
- Process & Instrumentation (P&ID) Diagrams, Process Flow Diagram (PFD)
- 3D modeling using Revit, Plant 3D, SolidWorks and BIM360 collaboration
- Equipment specifications and datasheets development
- Controls functional description development

Key Drivers

- Scaling up a protype plant to full production deploying a new technology

Value Add

- Specialized Knowledge & Subject Matter Experts
- Scaling up a protype plant to full production deploying a new technology

Project Facts:

- Client: Confidential
- Client Product: Cathode Active Material (CAM)
- Size: 120,000 sq ft
- Services: Process Equipment Design
- Project Duration: 2022 - 2023

New Solid State Battery Material Expansion

United States, Multiple Locations

Project Description

Feasibility study, detailed design, procurement, and construction management for solid state battery materials in North America. This confidential client produces next-generation solid state battery materials that promise improved safety and performance over current lithium-ion batteries. We're supporting their growth at the original pilot facility as well as the greenfield production facility including master planning.

Examples of processes included in the feasibility study:

- Wet slurry processing including particle size reduction
- Pilot and Production scale high temperature kilns
- Pneumatic conveying of hazardous fine powders and final packaging

Services Provided by Jacobs

- Concept Design for pilot to production scale
- Feasibility Study including go/no-go phase gate
- Detailed Design
- Construction Management and Procurement
- Architectural, Civil, HVAC & Dry Room Design, Fire Protection, Electrical, Structural, Mechanical, Plumbing, Process and Controls Engineering

Value Add

- Speed to Market
- Specialized Knowledge & Subject Matter Experts
- Scaling up a prototype plant to full production deploying a new technology

Project Facts:

- Client: Confidential
- Client Product: Solid State Battery Materials
- Size: 150,000 SF
- Services: FEL2/FEL3/Detailed Design/Procurement/Construction Management
- Project Duration: 2023 – 2027 (anticipated)

EV Battery Process - Lithium Hydroxide

Southeast US

Project Description

- Develop 20,000 tons/year lithium hydroxide production facility conceptual engineering with capital cost and operating cost estimates and construction schedule
- Produce high-quality lithium hydroxide monohydrate ($LiOH \cdot H_2O$) powder, converted from varying impurity grade lithium carbonate material
- Project processes include the following:
  - Material Handling / Unloading
  - Mixing/reaction
  - Evaporation
  - Crystallization
  - Centrifugation
  - Drying
  - Packaging
  - Wastewater Treatment
- Greenfield option including production system & facilities, administration, laboratory, maintenance, utilities, raw & finish product warehousing and security
- Brownfield option at an existing mine processing site
- Use of our Global Integrated Design (GID) Team for an estimated client savings of $20,000

Services Provided by Jacobs

- Conceptual Design
- Construction Cost Estimate for both Greenfield and Brownfield options
  - Aspen Plus Modeling
  - Process Flow Diagrams
  - Equipment Lists
  - Conceptual Layouts
  - Budgetary Equipment Pricing
  - Preliminary Electrical Load Requirements

Project Facts:

- Client: Lithium Americas
- Client Product: Lithium Hydroxide Monohydrate (Bulk Chemical)
- TIC: $200M
- Services: FEL2
- Project duration: February 2021 – June 2021

Battery Material Precursor Facility

West Deptford, New Jersey

Design of a new battery materials facility from the ground up to provide new demonstration plant production of a new proprietary lithium battery material. Project overall total installed cost was $50 million.

Produce 10,000 MTA of the Lithium-ion cathode precursor (pCAM) utilizing new continuous hydroxylation reactors, contained belt filters and spin flash dryers

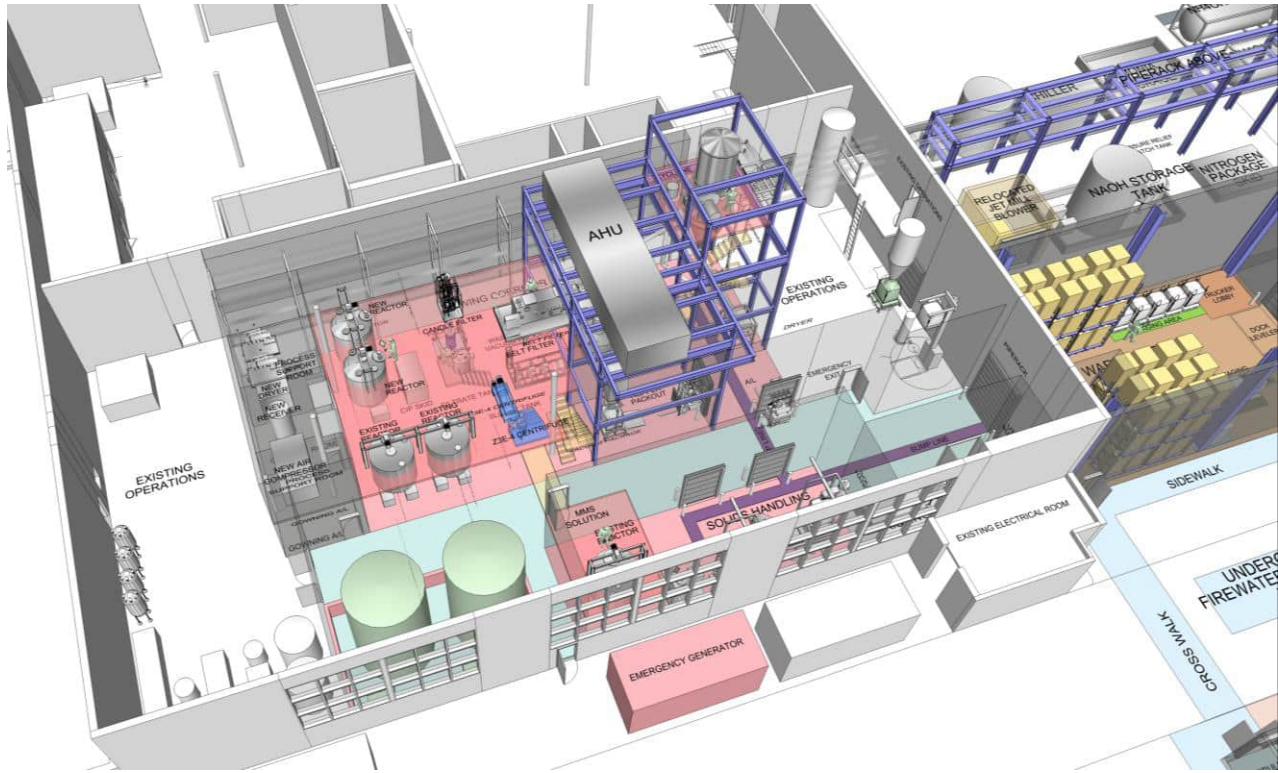
New candle filtration equipment used to remove solid waste and effluent stream control and environmental processing processes are streamlined.

Raw solid material and final precursor have dedicated processing spaces designed for processing high potent compounds that require a containment level equivalent to an Operator Exposure Limit of 15 µg/m^3.

The plant upgrades include segregation with other processing spaces in the building and the addition of a new tank farm, truck unloading and warehousing spaces.

Our services include:

- Construction Cost Estimate
- Conceptual Design (FEL2) and BOD (FEL3):
  - Process Flow Diagrams
  - Piping and Instrumentation Diagrams
  - Long Lead Equipment Packages
  - Equipment Lists
  - Conceptual and Detailed Building Layout Layouts
  - Preliminary Electrical Load Requirements
  - Building and Environmental Permit Packages
  - 3D Model Design of processing areas



Project Facts:

- Client: Johnson Matthey
- Client Product: Lithium battery material
- TIC: $50M
- Services: Construction Cost Estimate, Conceptual Design & Basis of Design
- Project Duration: Jan 2019 –Mar 2020

$LiPF_6$ Sample Plant

Buffalo, NY

Project Description

We provided design for an installation of a new Lithium Salt product for the Lithium-Ion Battery Market, in an existing pilot plant. Project overall total installed cost was $15 million.

Our scope included renovating, modifying, and reusing four floors of a multi-story building for processing phosphorous, hydrogen fluoride, fluorine, lithium and intermediate products.

The pyrophoric nature of phosphorous required jacketed piping and the PF_5 transport required a specialized compressor.

The process included:

- One gas phase reactor step
- One counter current column reactor step
- One distillation step with final product isolated and dried on a nutsche filter dryer that produces a 70 kg/batch of lithium-ion battery electrolyte salts

Special metallurgy was required due to both corrosivity and high and low temperatures in portions of the plant. Temperatures less than -40°C are employed for crystallization using a specialized refrigeration system

Detailed design packages for all disciplines were provided to solicit lump sum pricing from contractors for the installation. 3D design was utilized to produce construction packages. Construction management was provided for all installation contracts.

Services Provided by Jacobs

- Basic design (FEL3)
- Procurement
- Construction management

Project Facts:

- Client: Honeywell
- Client Product: $LiPF_6$ salt for Lithium-Ion battery electrolytes
- Size: Equivalent to 30 GWh/year
- Services: Basic Design, Procurement, and Construction Management
- Project Duration: [to do]

Lithium Carbonate Plant Expansion

La Negra, Antofagasta, Chile

Project Description

We worked with Rockwood Lithium on a Lithium Carbonate Plant Expansion. The plant produced lithium carbonate via a precipitation reaction involving purified lithium chloride brine and a sodium carbonate (soda ash) solution. Subsequently, a production operation to produce lithium chloride anhydrous crystals and an additional operation to produce high-purity lithium carbonate via re-crystallization process were added. We provided conceptual, preliminary, and detailed engineering, procurement, and construction management services.

- The project required multiple unit operations with different types of product processing to form the final product. The project also required multi-continent project execution, which led us to work with our office in Santiago to help bridge the gap with local engineering and construction management resources.
- Our team achieved zero recordables and zero first aids during the project, winning the Santiago office a BeyondZero safety award.
- Through the design and construction of the project, we were able to deliver $13.4 million in cost saving to Rockwood.

Total Installed Cost (TIC): $200 million

Project Facts:

- Client: Rockwood Lithium
- Client Product: Lithium Carbonate (bulk chemical)
- Size: $200 million
- Services: Conceptual & Detailed Design, Procurement, Construction Management
- Project Duration: [to do]

Thank you!

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