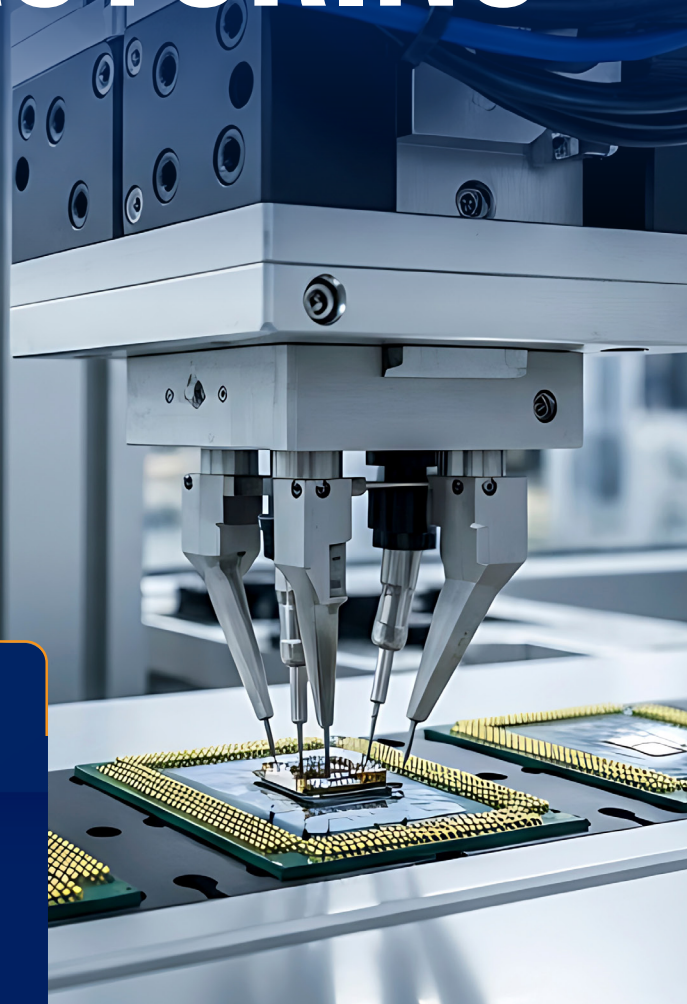




TATA CONSULTING ENGINEERS
ENGINEERING A BETTER TOMORROW™

ADVANCED MANUFACTURING

Engineering
High-Performance
Manufacturing
Facilities





Engineering the Complete Manufacturing Environment

The performance of an advanced manufacturing facility depends on more than its production equipment. Clean and controlled environments, stable utilities, reliable power, integrated automation and coordinated infrastructure directly influence production quality, yield, uptime and scalability. Tata Consulting Engineers brings these elements together through integrated engineering and project delivery, aligning manufacturing processes, production technologies, facility systems, utilities and infrastructure within one coordinated framework.

Integrated Capabilities Across the Silicon Value Chain



TCE integrates production processes, specialist equipment, controlled environments, high-purity utilities and supporting infrastructure across the silicon value chain.

Reliable

Production continuity and operational resilience



Scalable

Capacity expansion and evolving technologies



Sustainable

Optimised energy, water and lifecycle performance



Delivery-Ready

Coordinated technology, equipment and construction partners



Segments We Serve

Advanced manufacturing relies on precision processes, controlled environments and specialised infrastructure. TCE brings together production requirements, facility systems, utilities and project delivery to create reliable, scalable and manufacturing-ready facilities. Our capabilities span the silicon value chain, semiconductor FABs and OSATs/ATMP, solar manufacturing, battery-cell production and other high-performance manufacturing environments.

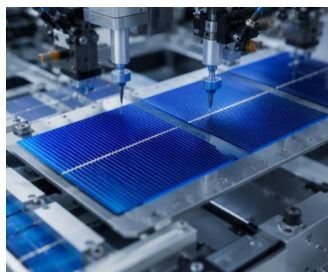
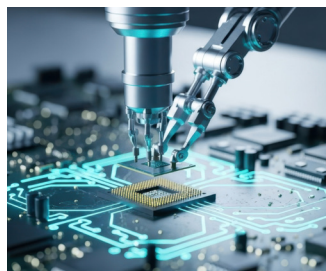


Silicon and Ingot-to-Wafer Manufacturing

The silicon value chain extends from quartzite and metallurgical-grade silicon to polysilicon, crystal growth, ingot production and wafer manufacturing. These upstream materials and processes support both semiconductor and solar photovoltaic applications. TCE provides integrated engineering for polysilicon, ingot and wafer manufacturing facilities, bringing together production equipment, high-temperature processes, process cooling, gas and chemical distribution, water systems, vibration control, material handling and supporting infrastructure.

Semiconductors and Electronics

TCE supports semiconductor FABs, outsourced semiconductor assembly and test facilities (OSAT), electronics manufacturing and component production. Our capabilities include ISO-classified cleanrooms, Tool Utility Matrices (TUM), Facility Utility Modules (FUM), process utilities and Tool hook-up systems. Expertise across high-purity utilities, HVAC, ultra-pure water, reliable power, vibrational sensitivity, and gas and chemical distribution systems helps connect sensitive production requirements with safe, scalable and manufacturing-ready infrastructure.

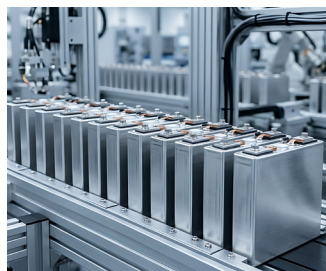


Solar and Photovoltaic Manufacturing

Integrated engineering across the solar manufacturing value chain, covering ingot and wafer production, photovoltaic cells, modules, solar glass and associated manufacturing infrastructure. TCE brings together production processes, specialist equipment, clean and controlled environments, process utilities, material flows, automation and phased capacity development to support efficient and scalable solar manufacturing facilities.

Battery Cells and Energy Storage

Integrated engineering for battery-cell manufacturing facilities and gigafactories, including dry rooms, controlled production environments, process utilities, equipment interfaces, material handling, automation and infrastructure planned for future expansion. TCE also supports facility planning, production support systems, safety infrastructure and scalable utility networks to enable reliable and efficient battery-cell production.



Engineering the Systems That Enable Production

Advanced manufacturing facilities require production, facility and infrastructure systems to operate as one coordinated environment. TCE integrates these systems around the manufacturing process and its performance requirements.



Buildings and Infrastructure

Architecture and facility planning, civil and structural engineering, site development, production-support buildings and supporting infrastructure. Capabilities include site characterisation, structural dynamics, vibration-sensitive foundation design and mitigation measures for precision manufacturing equipment and cleanroom facilities.



Production and Process Integration

Production-area planning, process interfaces, tool/equipment layouts, technology-provider coordination, production flows and equipment/tool integration.



Controlled Environments

Cleanrooms and dry rooms with required ISO classifications, supported by precise temperature, humidity, vibration, pressure and contamination control.



Safety, HVAC and Logistics

HVAC, exhaust and emissions control, fire and life safety, hazardous-material systems, dry-mist fire protection, automated storage, material handling and internal logistics.



Utilities and Power

High-purity gases, specialist process utilities, reliable electrical power and power-quality systems, ultra-pure, deionised and process-water systems, process cooling water and compressed dry air.



Water and Operational Resilience

Water treatment, wastewater management, recycling and reuse, zero-liquid-discharge systems, utility redundancy, maintainability and operational resilience.



Engineering the Ingot-to-Wafer Environment

Solar ingot and wafer manufacturing combines high-temperature crystal growth, precision material processing and utility-intensive production within a tightly controlled facility.

TCE integrates the process, facility and infrastructure requirements across crystal growth, ingot cropping and grinding, wafer slicing, surface processing, cleaning and inspection. Engineering extends to power systems, process cooling, gas distribution and recovery, vacuum systems, process exhaust, silicon-dust management, deionised water and vibration isolation.

This coordinated approach translates complex production requirements into a safe, maintainable and construction-ready manufacturing facility.

From Concept to Commissioning

Delivering Manufacturing Facilities with Greater Certainty

Advanced manufacturing projects bring together production technologies, specialist equipment, global vendors, complex facilities and demanding implementation schedules. Fragmented delivery can create interface gaps, redesign, delays and cost escalation. TCE provides an integrated delivery framework across the project lifecycle, reducing interfaces and improving coordination, constructability and delivery confidence.



Plan

- Site evaluation, selection and due diligence
- Feasibility and technology assessment
- Capacity planning and project definition
- Master planning and facility programming
- Concept engineering and cost estimation
- Project implementation strategy and scheduling



Engineer

- Basic and detailed engineering
- Design review and validation against the approved design basis
- Process and production-area integration
- Mechanical, piping and electrical engineering
- Architecture and facility planning
- Civil, structural and infrastructure engineering
- Automation, instrumentation and control systems
- Safety, reliability and maintainability engineering
- Equipment and technology-provider interface management



Deliver

- Owner's Engineer and OEPC™ services
- EPCM and project management consultancy
- Procurement assistance and vendor coordination
- Review and coordination of GFC drawings
- Construction and quality management
- HAZOP leadership and vendor-drawing review
- Regulatory and statutory coordination
- Testing and commissioning support
- Operational-readiness and handover support



Integrated, Digital and Sustainable by Design

Central Integration Across the Technology Ecosystem

Advanced manufacturing programmes bring together technology providers, concept design & basic engineering consultants, original equipment manufacturers, design-and-build vendors, contractors and specialist agencies. TCE acts as the central engineering integrator, aligning technology inputs, equipment requirements, facility design, utilities and infrastructure within one coordinated delivery framework. This integrated approach helps identify interface risks early and supports consistent decision-making across the project.

Connected Digital Delivery

TCE establishes a connected digital environment across design, construction, commissioning and handover. This enables earlier clash detection, improved constructability, coordinated documentation and more reliable project information.



Modelling and Simulation

- BIM from concept to as-built stages
- Plant and multidisciplinary facility modelling
- Model federation and clash coordination
- Engineering analysis and simulation

Digital Construction and Twins

- 4D construction planning
- Digital-twin development
- Lifecycle information management
- Digital construction management through SmartSite™

Intelligence and Asset Data

- AI-enabled engineering and operational optimisation
- Controlled document workflows
- Structured asset information for commissioning and operations
- Data-led decision support across the asset lifecycle



Sustainability Built in from the Start

Energy, water, materials and lifecycle performance are considered from the earliest planning and engineering decisions. TCE's approach includes energy modelling, renewable-energy integration, water recycling and reuse, heat recovery, waste minimisation, embodied-carbon assessment and circularity planning.

Green-facility design can be aligned with LEED, IGBC, ISO 14001 and ISO 50001 principles, as applicable. Lifecycle-cost analysis and appropriately designed utility redundancy help support production uptime without unnecessary capacity or energy consumption.

Projects Across Advanced Manufacturing Value Chain

Semiconductor Assembly and Test Facility

Assam, India

TCE is providing Owner's Engineer and project-control services for an advanced outsourced semiconductor assembly and test facility. The engagement spans concept and detailed engineering, specialist utilities, clean-manufacturing requirements, procurement coordination and construction management.

Advanced Semiconductor Packaging Plant

Bhubaneswar, India

TCE is providing design engineering and procurement support for establishing India's first advanced chip packaging / embedded glass substrate ATMP facility. The scope includes integration of process requirements with utilities and infrastructure, development of Facility Utility and Tool Utility Matrices, technical bid evaluation, vendor drawing review and integrated 3D/BIM modelling.

Battery-Cell Manufacturing Facility

Assam, India

TCE's multidisciplinary engagement spans concept development, master planning, architectural and engineering design, process utilities, equipment integration and construction-phase services for a high-capacity battery-cell manufacturing facility.

Solar Ingot-to-Wafer Manufacturing Facility

India

TCE is engineering a multi-gigawatt solar ingot and wafer manufacturing facility. The scope integrates facility and master planning, specialist process utilities, vibration-sensitive structures, process exhaust management and construction support.

Solar Photovoltaic Cell and Module Manufacturing Facility

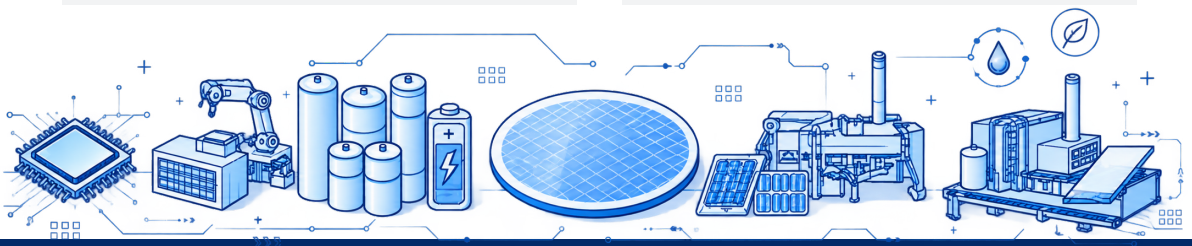
India

TCE is providing engineering and project management services for a large solar photovoltaic cell and module manufacturing facility. The engagement includes master planning, detailed engineering, procurement support and site supervision.

High-Capacity Solar-Glass Manufacturing Facility

India

TCE is delivering EPCM services for a highly automated solar-glass manufacturing facility developed through phased capacity expansion. The engagement includes coordination with international technology providers and specialist equipment partners.



Why TCE

One Integrated Engineering Team

Multidisciplinary capability across production processes, facilities, utilities, infrastructure and digital systems, with lifecycle support from feasibility through commissioning.

Semiconductor-Ready Teams

Customer-focused teams supported by continuous capability development, global design partners/ SMEs, including advanced semiconductor training through Arizona State University.*

Local Ecosystem Knowledge

Knowledge of local codes, standards and working practices, with connections across specialist contractors, vendors, suppliers and construction partners.

Lifecycle-Led Engineering

Safety, reliability, maintainability, sustainability and operational readiness incorporated from the earliest stages of facility planning and engineering.

Digitally Enabled Delivery

Integrated BIM, 3D modelling, engineering analysis and digital construction solutions that improve coordination, constructability and project visibility.

Global Partner and Expert Network

Collaboration with global technology partners, semiconductor experts and subject matter experts to address specialist requirements and support complex project delivery.

Owner-Side Perspective

Delivery through Owner's Engineer, OEPC™, EPCM, detailed engineering and project management models, with a clear focus on programme objectives and delivery outcomes.

Core Engineering Capability

Strong in-house expertise supported by advanced design, analysis, planning and project delivery tools.

About Tata Consulting Engineers

Established in 1962, Tata Consulting Engineers (TCE) is a wholly owned subsidiary of Tata Sons and a global engineering consultancy delivering infrastructure and industrial projects worldwide. TCE supports the development of mission-critical assets across Power, Infrastructure, Mining & Metallurgy, Hydrocarbons & Chemicals, and Advanced Manufacturing. Its services span the project lifecycle through Owner's Engineer, OEPC™, EPCM, Detailed Engineering Consultancy and Project Management Consultancy models.



64+

Years of Excellence



12,000+

Projects



8,500+

Engineers



60+

Countries



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Scan to **explore**

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