



**SIEMENS**

*Ingenuity for life*



Solutions for Industry Verticals

Unlock the  
potential with  
digitalization

v02/10-2018

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# Unlock the potential with digitalization

The World Economic Forum estimates that digital transformation could unlock USD 100 trillion in value for societies over the next decade. With government initiatives like “Digital India” and “Make in India” - India has positioned itself to capitalize on the opportunities of digitalization and to support continued strong GDP growth.

Digitalization provides the means to unlock the full potential of an organization’s assets and operations, to optimize performance and even create new business models. Many organizations recognize that digitalization is critical for future success but are unsure where to start their digital transformation, which technologies to apply and often lack the capital and skills required.

Digital transformation cannot be achieved by software and data alone. It requires a deep understanding of customer needs, of specific markets, and of hardware solutions. Combining our deep domain knowhow with our digital expertise and the experience of a large installed fleet, we are pleased to present this vertical markets report. With a particular focus on India, the report looks at key growth drivers in selected verticals, customer challenges and digital solutions to address them.

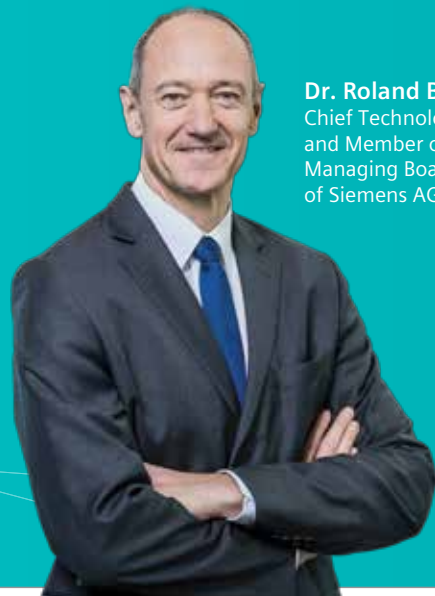
The pace of technological change in the digital age requires collaboration. At Siemens we collaborate with

a strong ecosystem of partners. To work more closely with customers, we opened 20 MindSphere Application Centers at 50 locations worldwide, with four centers in India. Each center, which specializes in a particular vertical market, co-creates digital applications with customers. These digital solutions are developed using MindSphere, Siemens’ open, cloud-based operating system for the Internet of Things.

With the arrival of the Internet of Things in industry and infrastructure, many organizations are seeking to incorporate digital strategies into their business models. By embracing digitalization, Siemens has reinvented itself into one of the world’s top 10 software companies. Digitalization is at the core of our strategy and innovation roadmap. In fiscal 2017, we invested around 41600 cr INR in R&D, while revenue from software and digital services grew by 20 percent. We continue to expand our digital capabilities, focusing on disruptive technologies like additive manufacturing, artificial intelligence and digital twin, to name a few, that could offer customers better outcomes.

We hope this report offers valuable insights for your digital transformation. In the meantime, our dedicated Vertical Market Managers are ready to assist you to chart out your customized digitalization roadmap.

*We at Siemens, are committed to partnering India’s digital transformation*



**Dr. Roland Busch**  
Chief Technology Officer  
and Member of the  
Managing Board  
of Siemens AG



**Sunil Mathur**  
Managing Director and  
Chief Executive Officer,  
Siemens Ltd.



Dear customers,

Rapid technology advancement is helping us improve speed, efficiency and flexibility of our operations at an unprecedented scale. With Digitalization, we are on the cusp of a new industrial era, a.k.a. Industry 4.0. This book takes a deep look at the value chain of specific industry verticals, and the areas where Siemens' technology can make a positive impact.

This book is timely, as we are also witnessing the changing nature of customer-vendor relationships. Vendors are increasingly encouraged and challenged to act as partners in their customers' businesses, which necessitates a better understanding of the domain, and an application of technology to achieve tangible outcomes therein. Few examples from our perspective:

- How can we help a Pharmaceutical company improve compliances and their records needed for drug approvals?
- How can we help a Distribution utility reduce ATC losses?
- How can we help a Power Generation utility reduce coal consumption?

These, and many more challenges that industries face can be resolved (and the resultant performance, improved) through Digitalization. We have described several real-life examples here in this book; where we started with a problem statement or pain point as expressed by our customer, and worked together with them to create the right solution. We are sure some of these will resonate with you as well. Details of the Siemens vertical market managers are also published on each page – do reach out to them or to me personally should you wish to start a conversation with us!

One last point – what sets Siemens apart from others is our understanding of your domain, which when coupled with our deep technical knowledge of electrical, automation and industrial software systems – gives us a unique advantage to create tangible outcomes for you. Our solutions go well beyond data and visualization, to derive meaningful insights from the data and to enable impactful actions in time.

We hope you will find this book useful – you may also download a soft copy from the below QR code.

We look forward to a meaningful conversation with you.

Warm regards,

**Krishnakumar Ramanathan**

Head – Key Accounts, Vertical Markets &  
Chief Customer Officer  
Siemens Limited  
[r.krishnakumar@siemens.com](mailto:r.krishnakumar@siemens.com)



# Digitalization is happening today

**50 billion**  
connected devices by 2020

**2.5 quintillion**  
bytes of data generated every day in 2017

Proliferation of **use cases**

**90%** of Indian C-suite executives  
view digitalization as a  
near-term strategic imperative

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Know more about  
Digitalization



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# How do I derive business value

## New business models



**Speed**



**Flexibility**



**Quality**



**Efficiency**



**Security**

The digital transformation is gaining momentum. Companies are already unlocking this potential - by using end-to-end digitalization. Siemens has the domain expertise in industry verticals as well as the engineering and digital know-how to generate performance improvements across the entire value chain.

Siemens solutions shorten time-to-market and increase flexibility, quality, and efficiency. They enable new business models while assuring highest levels of cybersecurity.

Two core elements of end-to-end digitalization solutions are:

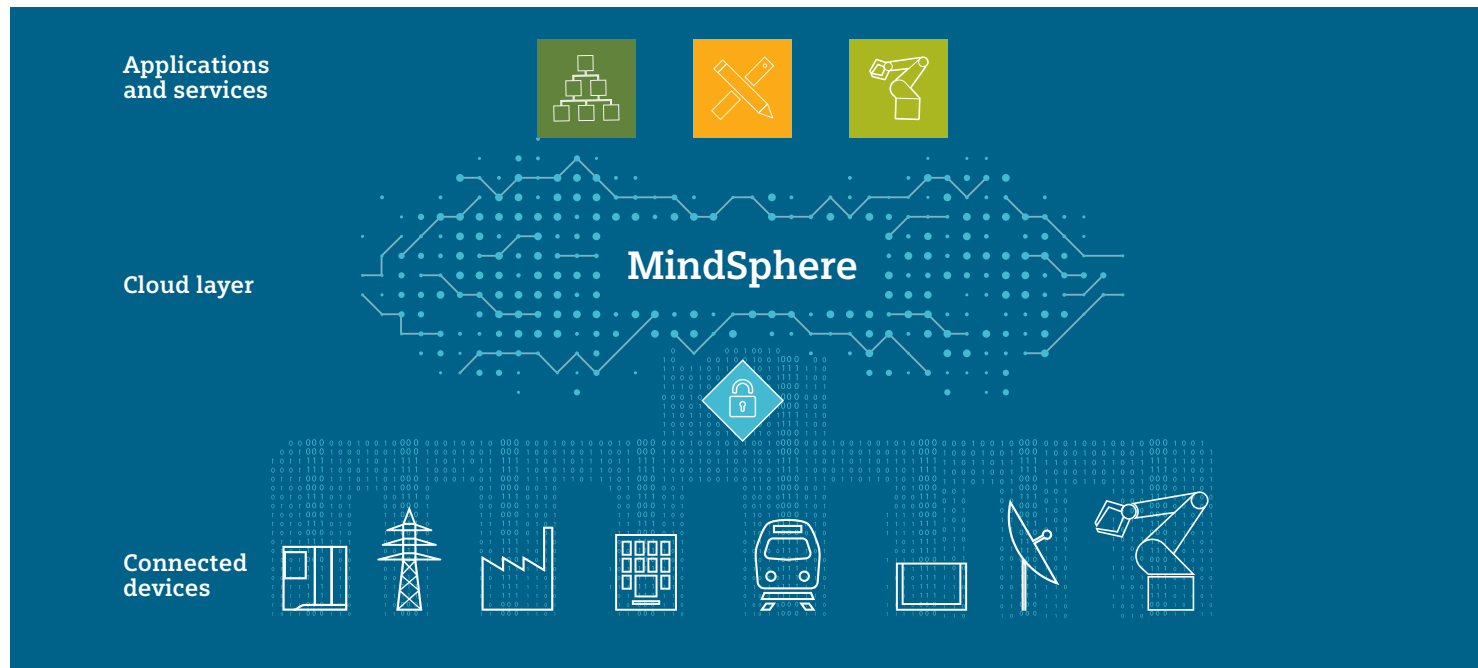
- MindSphere – Cloud-based, open Internet of Things operating system
- Digital Twin – Virtual representations of product and production

# MindSphere

## Connecting devices and applications via the cloud

MindSphere is Siemens' cloud-based, open Internet of Things operating system, connecting real objects to the digital world. By applying advanced analytics, MindSphere enables you to harness value from the wealth of data.

MindSphere enables the development of powerful industry applications (MindApps) and digital services to drive business innovation. Its open 'Platform as a Service' capabilities enable a rich partner ecosystem for applications and services. To protect your company's assets and intellectual property, MindSphere adheres to the strictest cybersecurity standards.



Know more about  
MindSphere



### Festo – Condition monitoring services

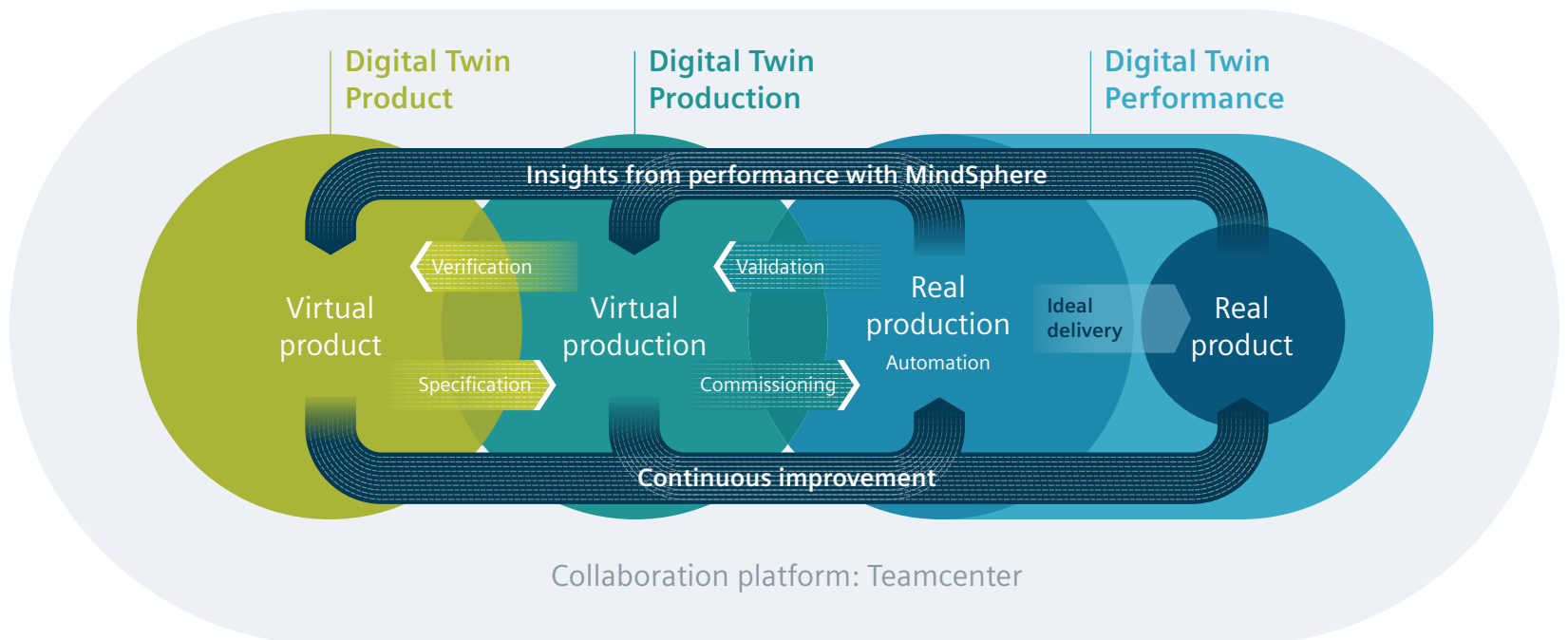
Consumption transparency is the starting point for predictive maintenance. For Festo, the German control and automation company, Siemens provides MindSphere solutions which gather real-time data right from the plant. Energy savings of up to 30% compared to existing plants of similar functionality can be realized.

# Digital Twin

## Simulating and optimizing product and production

Digital twins allow for a complete virtual representation of both the product and the production process. These virtual representations enable simulations, testing and optimization in the digital world, thus reducing costly and time consuming prototypes in the real world. The transition from integrated engineering to integrated operations is an important step. We provide integrated solutions across the entire plant lifecycle based on a common data model.

Using MindSphere, data from the actual performance are being fed back to the digital twins. Hence, these insights from the 'digital twin performance' support continuous and fast improvement of the next versions.



### Maserati – Boosting Product Design and Development

Digitalization starts with the design of a product. Maserati uses the CAD software NX for the Digital Twin to virtually create, simulate, and test their cars, significantly reducing the number of prototypes needed. In combination with the collaboration platform Teamcenter, the Maserati engineers manage their project collaboratively across various locations. The result: shortened time-to-market from 30 months to 16 months.

### Know more about Digital Twin

Discrete  
Manufacturing



Process  
Industries



**Siemens provides  
innovative solutions  
to meet your  
automation and  
digitalization needs**





## Siemens serves industry verticals in a dedicated manner



Aerospace & Defence\*



Battery Manufacturing



Cranes



Distributors



Food & Beverage\*



Machinery & Plant Construction



Minerals – Mining & Cement\*



Oil & Gas\*



Pharmaceuticals\*



Power Utilities\*



Solar\*



Tyre Industry



Wind



Automotive\*



Chemicals & Petrochemicals\*



Data Centers\*



Fiber Industry



Glass



Marine & Shipbuilding\*



Municipalities & DSOs



Panel Building



Ports\*



Smart Cities



Transportation & Logistics\*



Water

\*Covered in this edition

# Automotive

Reduce time-to-market and  
increase manufacturing flexibility



**4th**  
largest automotive  
market in the world



**5%**  
market growth p.a.  
until 2021



Vision of **100%**  
electric vehicles  
in new sales by 2030



**50,000 km**  
of new highways by 2022

Know more about  
Automotive



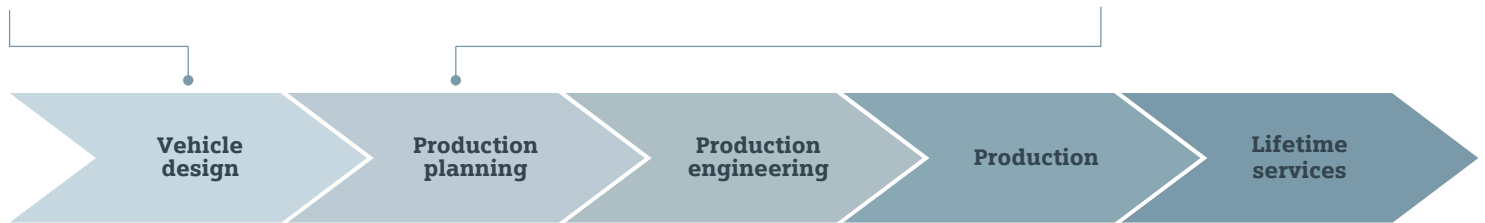


### Reduce development time

Siemens' NX design software creates the Digital Twin of an automobile. Together with Simcenter, the NX software simulates, tests and optimizes the design. Data generated in this process can also help to optimize the manufacturing process and reduce development time by up to 50%.

### Optimize production planning

Siemens' Tecnomatix Digital Twin software allows to create virtual production lines that simulate and optimize manufacturing thus shortening cycle time.



### Shorten time-to-manufacturing

Siemens' Teamcenter and Totally Integrated Automation (TIA) portal simulate and validate vehicle engineering along with virtually commissioning the line before the start of production. This reduces commissioning time on site by up to 70%. Additionally, the specialized automotive library SICAR facilitates automation for e-car and battery pack production.

### Improve operational efficiency

Siemens' manufacturing operations management solution enables flexible manufacturing by integrating business systems like ERP, control systems like SCADA and design platforms like NX. Production is automatically scheduled and executed while maintaining quality and efficiency. This solution enables higher flexibility, such that the vehicle's configuration can be changed even during production.

### Increase asset utilization

Siemens' MindSphere captures inputs from the shop floor and generates recommendations that can improve asset utilization by up to 5% and reduce energy consumption by up to 15%.

#### Virtual commissioning

A leading Indian automotive company plans to launch several models faster than competitors. Siemens' Teamcenter and TIA portal are enabling them to validate and simulate multi-model manufacturing on the Digital Twin of their production line.

#### Electric vehicle drivetrain and charging

For hybrid buses from a leading Indian automotive company which already operates on Indian roads, Siemens supplied the drivetrain solution. These buses consume 30% less fuel and accordingly reduce emissions. A conversion to a fully electric drivetrain can easily be done. Siemens also offers a comprehensive portfolio for electric vehicle charging.

#### End-to-end Digitalization – Ford

Ford leveraged Siemens' Digital Enterprise Suite across its value chain. It enabled Ford to increase their number of models, reduce factory energy cost by up to 30% and development time by up to 40%.

# Pharmaceuticals

Enhance drug quality and yield while ensuring compliance

Know more about  
Pharmaceuticals



**15%**  
market growth p.a.  
until 2020 from today's  
USD 30 billion



Government's  
**Pharma Vision 2020**  
and **DPCO** (Drug Pricing  
Control Order) drive affordability  
and aim at global sector leadership



**33%** cost productivity  
advantage compared to US



Over **500**  
US FDA-approved  
manufacturing sites



### Improve yield

Siemens' SIPAT software enables process analytics in the development and production stages. Consistent and reliable quality is ensured by analyzing process data based on mathematical models and by real-time feedback into the system. The solution can bring an immediate yield improvement of 1% per batch and can pay back within one year.

### Enhance manufacturing flexibility

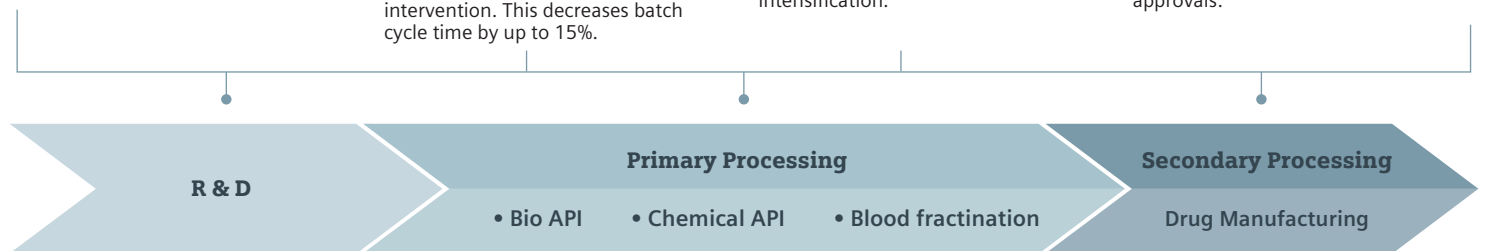
Siemens' process automation solution enables batch planning, scheduling and overall management of the production order. It consists of SIMATIC PCS 7, SIMATIC BATCH and Preactor - interfacing with Siemens' electronic batch record and also ERP systems. This setup enables a more flexible workflow, easier recipe management and reduced human intervention. This decreases batch cycle time by up to 15%.

### Process simplification

The XHQ operational intelligence software aggregates, relates and presents operational and business data in real-time – enabling data transparency and continuous improvement of the manufacturing process. Additionally, data can also be uploaded to MindSphere to perform process analytics and generate insights to drive process simplification and intensification.

### Regulatory compliance

Siemens' electronic batch record solution SIMATIC IT eBR enables paperless manufacturing within regulated processes. It supports operational and manufacturing efficiency in both manual and highly automated environments - designing, executing and approving the batch record. Additionally, the increased data integrity helps expedite regulatory approvals.



Our 'integrated engineering' and 'integrated operations' for process plants provides a foundation for digital twin, simulation and analytics on MindSphere

#### Process Analytical Technology

Siemens' SIPAT solution enabled a leading Indian pharmaceutical player to bring 'quality by design' into their formulation plant. The solution correlates process data with quality parameters, thus, predicting quality deviations ahead of completion. This enables process adjustments to ensure consistent batch quality.

#### Electronic batch recording

A leading Indian manufacturer simplified its processes by deploying Siemens' eBR solution. It was implemented in running plant without disrupting operations. The manufacturer was able to further improve its data integrity and expeditiously address all regulatory requirements.

#### Personalized vaccines – BioNTech

The German company develops personalized therapies for cancer and other diseases. For manufacturing of personalized vaccines at optimized cost, they implemented an automated factory powered by Siemens MES solutions. It allows for vaccine production of lot size of one by direct inputs from the ERP system and production with minimal human intervention.

# Food & Beverages

Enable flexible manufacturing and increase operational efficiency

Know more about  
Food & beverages



**6th**

largest food market globally



**60** agriculture  
export zones



**USD 33 billion**

investment expected over  
the next decade



Increasing need for

**customized  
variants**



### Reduce time-to-market for bakery

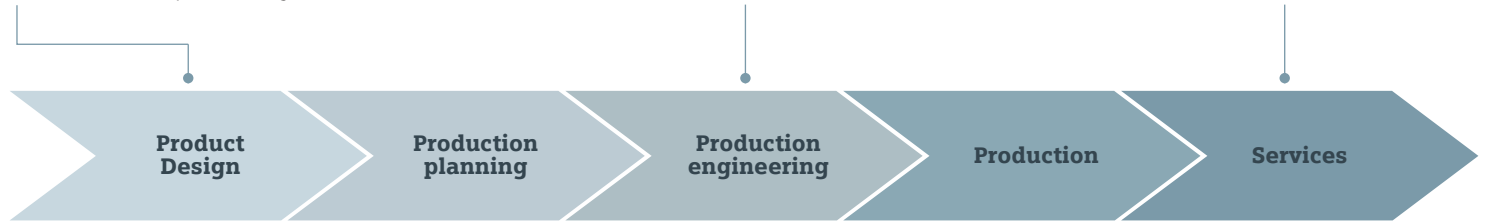
Siemens' SIMATIC IT R&D suite enables defining and optimizing new product compositions by taking supply chain constraints and consumer expectations into consideration. Specialized modules like regulatory management help to automatically generate nutrition profiles and allergen declarations. Additionally, Teamcenter NX creates the Digital Twin of the package for stress testing along with real-time collaboration to create an appealing product design. These solutions help in reducing the time-to-market.

### Reduce commissioning time for dairy

SIMATIC PCS 7 and the Totally Integrated Automation (TIA) portal flexibly and efficiently handle the electrical and automation design with integrated engineering. Engineering efficiency is increased for the production process as well as for bottling and packaging through integrated workflows. Virtual commissioning enables validation and simulation before start of production, thereby reducing commissioning time.

### Increase uptime and reduce cost for consumer packaged goods

The fleet management application of MindSphere provides transparency on machine performance metrics. Data captured translate into insights for preventive and predictive maintenance of critical assets. Siemens' Energy Analytics solution captures utility data like electricity, water, and gas of a factory correlated to production helping reduce energy consumption thereby optimizing cost.



### Optimize factory design for confectionery

Siemens' COMOS and Tecnomatix facilitate simulation and optimization of a confectionary factory through Digital Twin. Simulation of the production processes, material validation and bottleneck identification helps to optimize the factory design in the virtual world. This helps optimize capital investments.

### Improve operational efficiency for softdrinks

SIMATIC IT Preactor enables planning and scheduling of production orders based on cost, energy consumption as well as availability of material, equipment, employees and other process related constraints like cleaning in process. Additional solutions based on line balancing algorithms minimize downtime and increase operational efficiency.

#### Simulate packing lines – LoeschPack

The leading packing OEM leveraged Siemens' Tecnomatix portfolio to simulate and optimize their packing lines. LoeschPack can test their machines on the Digital Twin facilitating a faster feedback loop. This approach identifies bottlenecks and overcapacities, improves production parameters, and optimizes packing systems.

#### Fully automated dairy plant – Rajkot Dairy

Siemens' dairy automation solution based on SIMATIC PCS 7 and TIA integrated the Intelligent Motor Control Center, production machines, laboratory PCs and weighbridge with the control room. The solution enabled Rajkot Dairy, a member of AMUL, to set an ambitious target of producing 0.6 million liter of milk per day plus an option to expand output by another 30%.

# Aerospace & Defence

Increase throughput and enable flexible manufacturing



**5th** largest defence budget globally and pioneer in **space launches**



**30%** domestic value-add mandated under the FDI rules

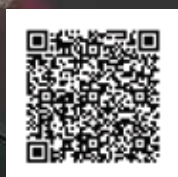


Indian companies to buy civil aeroplanes worth **USD 290 billion** over the next 20 years

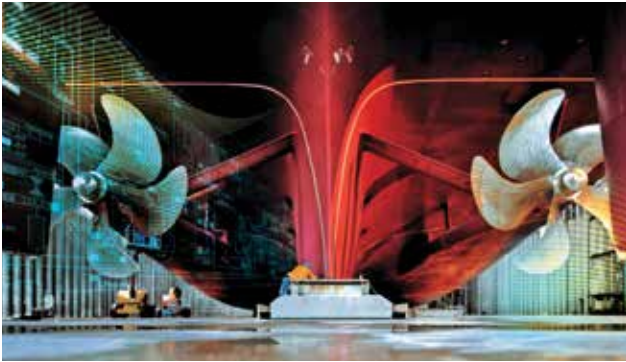


Government's **UDAN** program driving affordability and regional connectivity

Know more about  
Aerospace & Defence





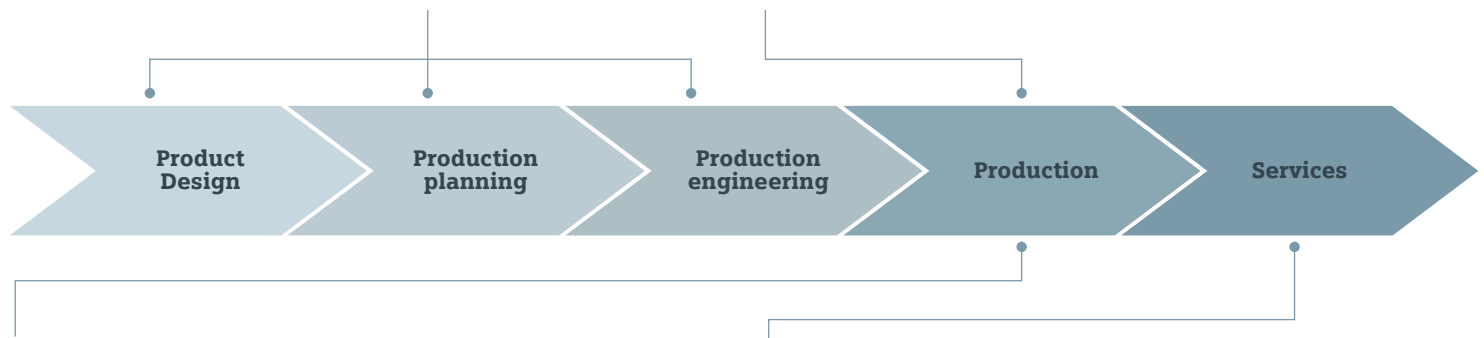


### Reduce time-to-market

Siemens' software solutions create the Digital Twin of the product and the production. Products can be modeled and optimized on NX CAD and CAM, and manufacturing processes can be virtually simulated and commissioned on Tecnomatix. Improvements in productivity of up to 40% can be realized using these digital solutions.

### Reduce lifecycle cost of marine vessels

Siemens' SINAVY solution provides electric and hybrid propulsion systems for surface vessels and submarines. The solution consists of an automation platform, generators, as well as propulsion motors and drives. The transition from diesel to electric or hybrid propulsion can save up to 30% in lifecycle costs while Siemens' global service network ensures maximum uptime of the vessel.



### Enable flexible manufacturing

Siemens' SINUMERIK TRAORI feature in CNC increases manufacturing flexibility and throughput. This feature can be installed on any 5-axis simultaneous milling machine to optimize the tool path and reduce switchover time between specifications.

### Reduce operational cost

Siemens' Analyze MyCondition solution, powered by MindSphere, captures machine data and processes them in the cloud to prevent machine failures and support disturbance-free machine operations, thus, improving machine productivity.

#### Throughput increase – MTU Aero Engines

The German aircraft engine manufacturer aimed at precision manufacturing of blisks of lot size one. The SINUMERIK TRAORI solution across all CNC control boxes in their production line enabled optimized tool motion, shorter switchover time and automatic compensation of errors during machining. This digital solution enhanced the production from 500 to 3500 blisks per year without additional hardware.

#### Electric propulsion lab – Indian Navy

Siemens has set up the medium voltage and electric propulsion lab at INS Valsura, Jamnagar. This one-of-its-kind setup facilitates the Indian Navy's modernization plans of adopting energy-efficient electric propulsion systems. The lab offers hands-on training and simulation of electric propulsion and MV systems for the Naval officers and sailors.

#### Electric aircraft – Siemens and Airbus

Siemens has developed extremely efficient motors to power electric aircraft in collaboration with Airbus and further partners. Currently, the 50kg motor delivers an output of 260 kW – five times more than a conventional drive system and propels the aircraft to top speeds of 340 km/h. The aim is to produce new regional aircraft powered by hybrid-electric propulsion systems in the near future.

# Data Centers

Improve power utilization effectiveness  
and optimize lifecycle cost

 **23%**  
market growth p.a. until 2020

 Co-location revenue of  
**USD 2 billion**  
by 2019

 **Telecom, e-commerce  
& financial inclusion**  
programs driving investments

 Push towards higher  
**data localization**

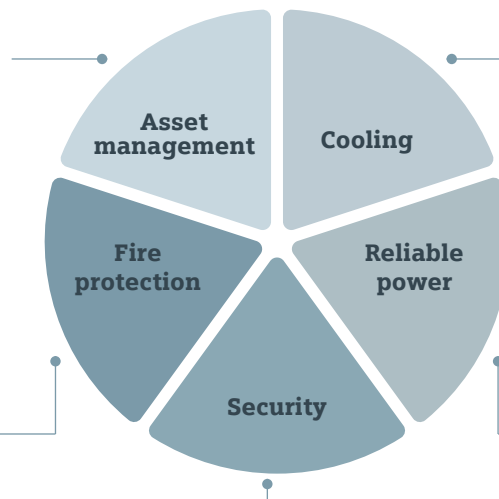
Know more about  
Data Centers





### Increase data transparency

Siemens' data center infrastructure management solution Clarity LC offers a comprehensive view of the data center. Seamless integration with the building management system Desigo Control Center enables increased transparency and facilitates smarter decision making. This leads to reduced power consumption and optimized lifecycle cost.



### Reduce energy costs

The computational fluid dynamics module in the Clarity LC solution reduces energy cost by analyzing heat patterns and dynamically adjusting the air flow. The solution can also simulate and optimize layout design for new data centers, thus, maximizing energy efficiency.

### Minimize operational disruptions

Siemens' end-to-end fire management solution offers accurate early smoke detection, automatic alarm release by Fire Finder and timely extinguishing by Sinorix. The silent discharge nozzle technology ensures quiet and effective extinguishing, minimizing the risk of data loss due to hard disk failures.

### Ensure building security

Siemens' data center security solution includes perimeter protection, intrusion detection, access control and intelligent video surveillance solutions. The integrated control room enables increased visibility and prompt response facilitating business continuity.

### Increase system availability

Siemens Total Integrated Power solution ensures efficient and reliable power supply to maximize system availability and safeguard critical data. The integrated portfolio includes products and services across voltages and throughout the project life cycle.

#### Building management system

A leading Indian data center provider implemented Siemens' Desigo Control Center to increase transparency on energy consumption per rack and temperature footprint. The solution enabled operators to improve the power utilization effectiveness by 10% from 1.67 to 1.5.

#### Data center infrastructure management – Atos

Siemens' Clarity LC solution enabled Atos with an intelligent dashboard of its IT and facility infrastructure. The solution at its data center facility with 490 racks and 960kW facilitates increased power consumption visibility, simulate 'what if' scenarios and accurately generates invoices from over 7 million power readings per month.

#### Integrated power solution – Digital Realty

The world's largest full-scale data center provider commissioned Siemens to address its power requirements. The solution consists of fully pre-assembled electrical rooms with the complete power distribution equipment as well as fire safety and lifecycle services. The integrated approach helped reduce implementation time by more than 30%.

# Minerals

Reduce cost in cement and mining production processes



**2nd** largest cement and **4th** largest iron producer globally



**99 cities** selected under the smart city mission



**USD 15 billion** investment in roads until 2020



**Housing for all** by 2022

Know more about Minerals



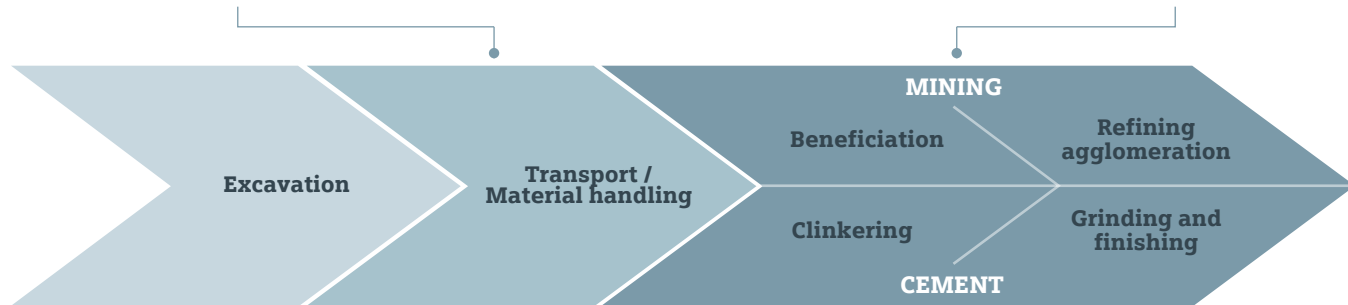


### Improve stockyard operations

Siemens' MAQ solution for stockyards supports safe and reliable management of bulk materials. It enables material tracking, quality monitoring, real-time inventory management, as well as autonomous machine operations. The 3D visualization of the stockpile facilitates precise blend control.

### Increase operational efficiency

Siemens' scalable Manufacturing Execution System connects business systems like ERP with shop floor systems, across geographies and factories. Data-driven insights from the solution enable enhanced manufacturing responsiveness, improved supply chain efficiency and production optimization.



Our 'integrated engineering' and 'integrated operations' based on COMOS provide a foundation for digital twin, simulation and analytics on MindSphere

### Enhance energy efficiency

Siemens' kiln and mill control systems, KCS and MCS, enable optimization of closed loop controls with CEMAT and advanced process control. Input parameters like heat and vibrations are analyzed in real-time to dynamically adjust the set points and optimize the process. This stabilizes operations, improves product quality and reduces energy consumption by up to 8%.

### Optimize manufacturing performance

SIMULEX enables visualization and simulation of the dynamic process behavior of cement plants. Comprehensive training to plant operators is provided in a running plant environment, without posing risk to product quality, equipment, personnel or production. Thereby, performance is optimized under varying input conditions.

#### Kiln and mill optimization – Wonder Cement

Siemens' kiln and mill optimization solution improved productivity for Wonder Cement's greenfield project. The CEMAT automation with KCS and MCS enabled automatic and hands-free operation of many loops. Optimized set points provided to the automation system regulated kiln temperature, reduced mill vibration, and stabilized input feed.

#### Manufacturing Execution System – Vale

Following several acquisitions, the Brazilian mining company had 23 different legacy IT systems across its supply chain. Siemens deployed an MES solution across 38 locations and created a unified dashboard to handle real-time data. Increased labour productivity, higher system uptime, and lower IT cost are expected to deliver USD 70 million of savings until 2020.

#### Automated stockyard – Boxberg Lignite

At the Boxberg power plant in the German state of Saxony, a fully-automated stockpile management system ensures uniform lignite quality. The system also allows for unmanned operation of the stock-yard machines based on the 3D model of the stockpile. Increased data transparency has led to higher performance, full utilization of the stockpile area and optimized energy consumption.

# Oil & Gas

Generate data-driven insights  
to reduce lifecycle cost



**3rd**

largest consumer of oil  
and gas products globally



Government's vision  
to reduce India's oil  
and gas imports

by **10%** by 2022



**620 million**

tonnes of crude oil reserves



**70 bcm gas**

to be consumed by 2022  
up from today's 50 bcm

Know more about  
Oil & Gas





### Reduce offshore platform lifecycle cost

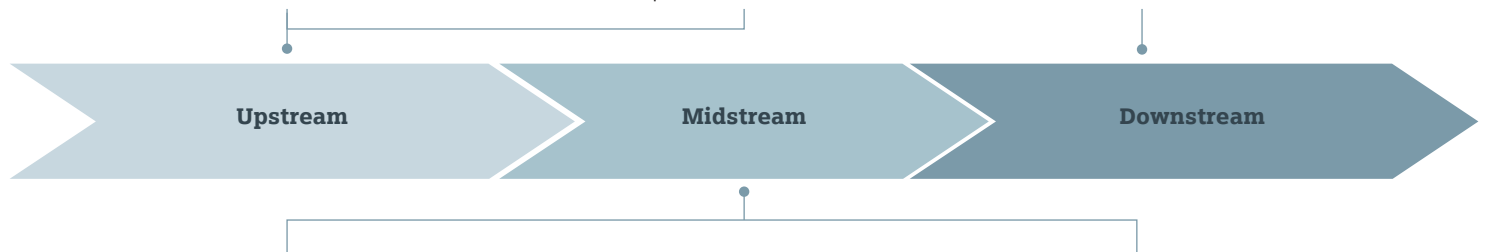
Siemens' Topside 4.0 solution enables the creation of the Digital twin of a topside facility. Optimized design, integrated simulation with 3rd party control systems and virtual commissioning can save engineering cost by up to 30%. Real-time facility data can be processed on MindSphere for predictive analytics. For a mid-sized Floating Production Storage and Offloading unit cycle time can be reduced by 3-9 months as well USD 10-15 million of CAPEX and more than USD 100 million over 10 years in OPEX can be saved.

### Maximize pump uptime

Critical Electric Submersible Pumps (ESP) in oil fields can be monitored and analyzed via a MindSphere application. The predictive maintenance AI solution uses past failure patterns of ESPs and data such as pressure and temperature. Thus, upcoming incidents can be detected early to implement timely countermeasures and to increase production uptime.

### Improve plant efficiency

Siemens' XHQ platform enables fact based decision by capturing operational and business data from a refinery and presenting them in an intuitive dashboard. The XHQ portfolio offers applications like performance analytics or performance management to improve productivity by up to 30%.



### Improve power efficiency of the pipeline

Siemens' smart pumping technology enables real-time performance monitoring on MindSphere to reduce power consumption. The solution actively manages production to reduce stress loads that can occur during batch changes, thus, increasing asset life and decreasing forced outages. For a typical 1300 km pipeline with 18 pumps, powered by smart pumping technology, the payback period is estimated to be under a year and savings up to USD 60 million during the 40-year lifecycle of the pipeline can be realized.

### Reduce construction lead time

Siemens' E-House is a prefabricated power supply solution - consisting of components such as switchgears and transformers. This plug-and-play approach reduces construction lead time and can save up to 20% of the total cost of ownership.

#### Real-time operations management

Siemens' XHQ solution enabled one of the largest refineries in India with end-to-end data transparency of their operations and business processes. Real-time operation tracking and seamless integration with the ERP system has facilitated faster decision making, minimized downtime and reduced operational cost.

#### Digital offshore solutions – Aker BP

At a new North Sea facility, the Norwegian oil exploration company implemented a suite of Siemens' digital solutions - including Topside 4.0. The suite provides process simulations for virtual testing and training and an onshore operation center for remote condition monitoring. Aker BP was able to save about 30% of cost, reduce the workforce on the platform and stabilized operations within one week.

# Power Utilities

Enable efficient generation and smart grids

Know more about  
Power Utilities



**3rd**

largest power generation capacity globally



**6%**

growth p.a. of electricity demand until 2021 with increasing share of renewables



**INR 1.1 trillion**

investments in power generations until 2022



Government's **UDAY** and **Electricity for All** programs drive investments





### Reduce lifecycle cost

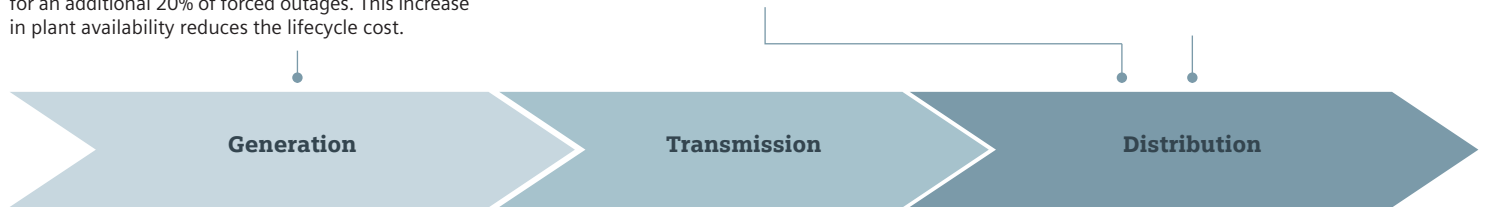
Siemens offers a comprehensive power generation portfolio of gas and steam turbines based on latest technology with best in class efficiency and environmentally friendly solutions. Additionally, our digital fleet center solution connects power units with the highest security standards to a remote control center for continuous monitoring and diagnostics. Electricity producers can avoid up to 40% of forced outages and take corrective measures for an additional 20% of forced outages. This increase in plant availability reduces the lifecycle cost.

### Increase grid availability

Siemens' digital substation portfolio captures substation data from digitally enhanced assets to facilitate grid automation, maintain power quality and prevent asset failures. Data can be securely transferred to MindSphere for generating insights for better grid availability, reliability and improved efficiency.

### Reduced operational cost

Siemens' Energy IP Meter Data Management software facilitates reduction in OPEX and service improvement by capturing, processing and analyzing load data from smart meters. The solution, used by over 75 utilities and 75 million devices globally, communicates with the meter and receives notifications when outages, tampering or other events occur. It also integrates with other IT systems like ERP and billing systems.



### Reduce spare part lead time

Siemens' additive manufacturing technology facilitates rapid prototyping, manufacturing and advanced repairs. The solution builds components from CAD models up to 40% faster than conventional manufacturing along with complete flexibility in design.

### Improve operational efficiency

Siemens' closed loop automatic generation control regulates the power output from multiple plants by remotely monitoring grid parameter like frequency and interchanges. With more and more renewables feeding into the grid, the solution enables smooth ramp up and ramp down of conventional sources without any manual intervention, thereby, reducing losses.

#### Remote monitoring and diagnostics – Vedanta

Siemens' digital fleet center solution connects three power plants of Vedanta across India to a monitoring station enabling predictive maintenance. The solutions reduce unplanned outages, increase availability of power assets and optimize costs.

#### Additive manufacturing – JSW Steel

Siemens produced its first 3D-printed industrial steam turbine replacement part globally for JSW Steel. The solution consists of two oil rings printed from metal and enables us to meet our customer's requirements much faster.

#### Closed loop automatic generation control

Siemens' closed loop AGC was the first of its kind to be implemented in India. The solution enables automated increase and decrease in generation with a quick response time. It's success has influenced the Central Electricity Regulator Commission to mandate closed loop AGC across all load dispatch centers in the country.

# Power Utilities - Services

Digitalization and innovative solutions improves flexibility, efficiency, and productivity in power plant applications



Electricity Generation in India:  
**1200 Billion**

Units in FY17-18

*Conventional Power - As on year ended March 31, 2018*



Estimated Growth of **7%**  
CAGR in energy generation till FY23



Investment potential of  
**~USD 1 Trillion**  
across value chain



Renewable Integration and  
per capita consumption increase  
to drive investments

Know more about  
Power Plant Services



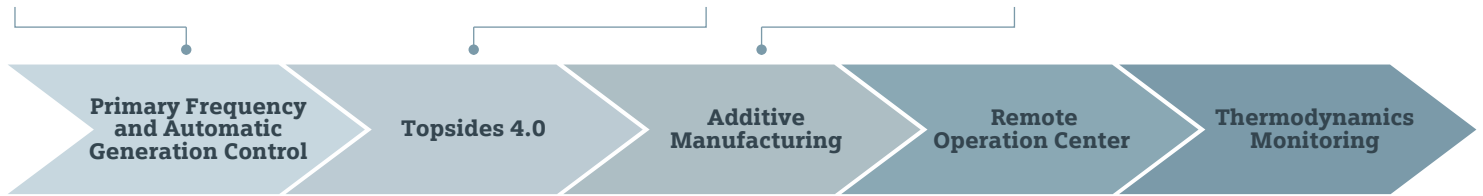


Power Plant Services focus on supporting efficient, reliable and sustainable power generation through parts, repair, servicing, retrofits, modernization, engineering solutions, digitalization and asset management across the power island, electrical & control systems and balance of plant such as coal and ash handling systems.

Condensate throttling, based on Siemens' Frequency Control Solution, is used for immediate generation of additional power for frequency control. In the current regime of renewable energy integration into the power grid, this technology provides flexibility to the thermal power plant unit. Plants with AGC technology can regulate the generation variation automatically according to the grid parameter conditions, thus leading to reliable power, stable power grid and boosting integration of renewable energy into the grid.

Siemens Topsides 4.0 is a digital lifecycle approach to rotating equipment and electrical and automation systems, underpinned by secure communications. It is designed to enable digital project management and manufacturing, virtual testing and commissioning, and delivery of an intelligent "digital twin" of a topsides facility, which can be used by operators for decision-making support and asset optimization.

Siemens is utilizing state-of-the-art AM technology to pave the way for greater agility in steam turbine component manufacturing and maintenance and to set new benchmarks for industrial power plant services. The additive manufacturing technology significantly reduces the lead time to produce spare parts and will help meet high-end customized requirements of the Industry more quickly.



Siemens is developing the Remote Operation Center (ROC) to help customers meet strategic and operational goals with the focus on performance calculation and operation optimization to improve efficiency. The services include advanced big-data analysis, diagnostic capabilities, optimal economic dispatch, reliability centered maintenance and a role-based working center to match digital instructions to each users' specific role.

Siemens has developed a unique online performance monitoring solution for a combined cycle power plant, which includes the boiler feed pumps, condensate pumps and circulating water system. These performance monitoring calculations, which are part of the SPPA-T3000 platform, are designed to provide unit performance information and assist in the immediate detection of the reduced efficiency of any monitored plant component or overall plant performance degradation.

### NTPC Dadri

Siemens Limited commissioned India's first condensate throttling-based Primary Frequency Control Solution at National Capital Power Station (NCPS), NTPC Dadri (Stage 2, Unit 6). Condensate throttling is one of the most advanced and efficient methods which can be used to rapidly activate stored energy enough for unit load support for a few minutes.

### OOEM Services

Siemens has a full-fledged and well-trained team to provide quality service, repair and modernizations solutions for other OEM machines. Successful service overhauls and on-site repair activities were completed in record time for 4 OEM machines (300 MW) at JSW Ratnagiri. Similarly, the HP module of a 500 MW BHEL make turbine was refurbished indigenously at our Vadodara facility resulting in increased efficiency and performance.

### SGT-700

Siemens developed the world's first 3D printed burner for SGT-700 gas turbine which has successfully completed one year of operations in a running power plant. In 2017, Siemens began printing gas turbine burners using selective laser melting technology and they were the first burners produced by Siemens' intelligent burner manufacturing (IBUMA) program in Finspång, Sweden. Each burner head is manufactured in one piece compared to traditional methods that required 13 individual parts and 18 welds.

# Chemicals and Petrochemicals

Reduced costs, agile production flexibility  
and increased plant availability

Know more about  
Chemicals and  
Petrochemicals



**3rd** largest producer  
of chemicals by volume in **Asia**  
and **6th** by output in the world



Chemical as an Industry is  
a key contributor to Indian economy,  
accounting to **2.11%** of GDP



By 2025, the Indian chemical industry  
is projected to reach **US\$403**  
billion



**3rd** largest consumer of polymers  
and agrochemicals



### Control Performance Analytics

Siemens Control Performance Analytics is a cloud-based service that collects control loop data in an anonymized form with enabled secure data connection and provides detailed reports and suggestions for implementation. It results in increased product quality, minimized equipment utilization, increased throughput and reduced operator work load.

### Valve Monitoring

The Valve Monitoring Solution is a central platform devised for critical assets such as valves, pumps etc. It uses existing diagnostics and process data for anomaly detection and predictive maintenance. The monitoring systems are fully integrated with MindSphere ready cloud-based application resulting in reduced downtime and optimizing asset maintenance.



### Reduced time to market

Shorter innovation cycles, reduced time to market and, above all, plant and project data terabytes all pose major challenges for plant designers and operators, even as early as the planning stage. The COMOS software solution for plant lifecycle management consistently implements the complete integration of all processes – during both the engineering stage and the operation/ maintenance stage. In addition the powerful COMOS Walkinside 3D visualization software realistically presents highly complex plant models based on 3D engineering data.

### Asset Performance Management

Solutions such as SIMATIC PCS 7 and COMOS MRO (Maintenance, Repair & Overhaul) support in with efficient planning, implementation, and analysis of maintenance activities – including the connection of portable devices for remote services. With COMOS MRO, all aspects of the management, planning, operation and maintenance, including plant documentation, are carried out in a single system. This means that any changes to the plant due to service and maintenance processes are also immediately available in the engineering system.

#### Advance Process Control at Ineos, Phenol

Time-dependent dynamic model as basis for calculating the future process behavior in order to ensure consistent phenol concentration and product quality. Use of new Model Predictive Control module integrated into SIMATIC PCS 7 process control system without additional hard- and software. Load switch of process plant in automatic mode. Benefits - Increased throughput, improved process reliability, optimized energy and raw material use.

#### Mass customization and reduced costs

New Dulux plant in Merrifield has focused on the end-to-end digitalization of all processes for production of approximately 75 million liters of paint each year. Simulation platform SIMIT enabled early comprehensive tests and virtual commissioning of automation applications even before the real startup. Paperless production, achieved through SIMATIC IT eBR software.

#### Virtualization enables global cooperation

A multi-national who has R&D and Engineering team based out in India installed a virtual setup for Engineering, Simulation & testing of global projects. Siemens virtual platform of SIVAAS based on PCS 7 comprising of Emulated controllers, SIMIT for simulation and the Flow-net library to build process models was used as part of the set-up. This platform enables global collaboration & deployment between the teams for standardization of engineering & testing, thus providing shorter development & commissioning time.

# Solar

Innovative PV eBoP (electrical balance of plant) solutions for efficient, smart & reliable evacuation of clean energy to the grid



Target of **100 GW** installed solar capacity by 2022



India is endowed with a rich solar radiation of **5.5 kWh** per square meter per day



**India 3rd** largest solar market in the world



Cumulative solar capacity is **25GW**



World's largest solar park named '**Shakti Sthala**' was launched in Karnataka in March 2018

Know more about  
Solar



## Universal Solution

The Solar Tracking Control System from Siemens is the universal solution for dual- and single-axis solar tracking systems. Our SIMATIC S7-1200 control unit and special software jointly control the dual axis tracking of a solar unit. It controls movement in azimuthal and zenithal directions, independent of whether the requirements are for a photovoltaic (PV) or a concentrated solar power (CSP) facility.

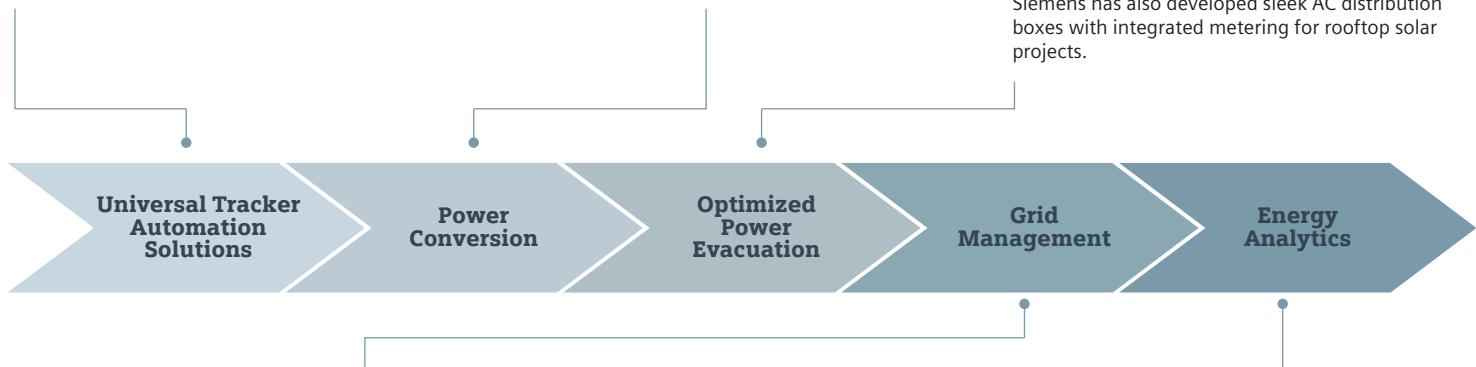
## Reduced Engineering Hours

The SINACON PV inverter is used in medium and large utility scale photovoltaic power plants to achieve high efficiency. It is equipped with 3-level IGBT modules for input voltages of up to DC 1500 V to maximize energy efficiency. The integrated DC and AC distribution makes the SINACON PV inverter cost efficient. Standardized interfaces for easy plug and play reduce engineering hours.

## Centerpiece of the Medium-Voltage Station

The MV-inverter station is a comprehensive plug-and-play solution with highest power density for extra-large PV plants. Three high-performance components from the Siemens portfolio work together perfectly: central inverter, transformer, and RMU (Ring Main Unit). It enables maximized cost reduction coupled with Open outdoor elements for efficient cooling.

Siemens has also developed sleek AC distribution boxes with integrated metering for rooftop solar projects.



## Integrated Energy & Storage Systems

With its EMS/ SCADA systems, Siemens offers an innovative, scalable process-visualization system with numerous high-performance functions for monitoring automated processes.

Siemens energy storage system is based on lithium-ion batteries. This system enhances grid stability while also enabling integration of higher volumes of power from renewable energy sources and exchange of active power between the battery storage system and the grid.

Energy storage is the most responsive and flexible solution available for Renewable Integration that can neutralize the volatility caused by renewables in the grid and enable better availability & utilization of renewable energy.

M/s Fluence (A Siemens and AES company) is our storage partner company which has technology platforms of Siestorage, Advancion & SunFlex depending on the project requirements.

## Intelligent Use of Data

Siemens EnergyIP DEOP provides a powerful IoT-platform for management of data from millions of distributed assets in near-real time. It has scalability for monitoring multiple asset types (Eg: multiple PV plants, storage, building data) and the unique gateway can collect data from multiple protocols (Eg: IEC-61850). The data can be accessed by a web-based app available on desktop, tablet, smartphone etc.

### AC Power evacuation for ReNew Power

Siemens provided a turnkey solution for AC electrical balance of plant for a 48 MW solar PV plant for ReNew Power at a remote site in Telangana. Siemens' Reliable & robust substation solution enables efficient solar power evacuation to the grid.

### New generation of Photovoltaic (PV) Central Inverters

Siemens India launched with Sinacon PV a new generation of photovoltaic (PV) central inverters with an output up to 5,000 kVA. Solar PV inverter converts the variable direct current (DC) output of a photovoltaic solar panel into a utility frequency alternating current (AC) that can be fed into a commercial electrical grid or used by a local, off-grid electrical network. The Sinacon PV is equipped with 3 level IGBT modules, has an outdoor design for harsh environments with fluid cooling and can operate up to 60°C ambient temperature.

### Medium Voltage Inverter Stations - Brazil

The engineering firm Quebec Engenharia is building a solar farm with a total capacity of 38 MW in northeastern Brazil. Siemens has supplied seven inverter stations for connection to the local distribution grid. These stations consist of a 4.36 MWac central inverter, the transformer and the medium-voltage switchgear.

# Marine and Ship-Building

Electrical propulsion & Digitalization solutions -  
Enabling greener and efficient global fleets



Know more about  
Marine and Ship-Building



Indian Coast line of  
**7500+Kms**, guarded by  
250+ Naval/Coast Guard Vessels



Indian Shipping fleet has  
**500+ Vessels**,  
making it one of the largest fleet  
among developing nations  
(Ranked 14th Globally)



**20+ shipyard** - Naval  
and Commercial Ship construction



**14%** annual growth from  
2014-18 in Coastal shipping in India

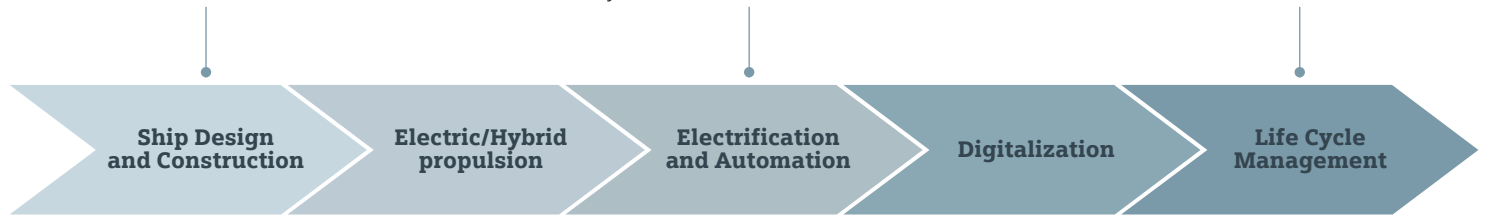




Digitalization of the marine business is creating new possibilities to increase efficiency and reduce costs while meeting environmental regulations. Siemens PLM solutions ranging from integrated design, digital construction to ship service and support enables shipyard to design, engineer, build better and more affordable ships.

SISHIP/SINAVY IMAC Automation system provides a comprehensive solution for seagoing ships integrating all the products and services operator needs for sustained maximization of performance. Horizontally it improves ship's operations, Vertically it integrates the ship's information and end-to-end security management, facilitating better decision making. At the same time, it is designed for optimal ship specific maintenance over the whole life cycle ensuring exhaustive and sustained plant productivity in their very core.

In today's marine industry, ship owners and operators face a wide range of daily challenges. Invariably, they all share the same goal – to keep their vessels operations safe and reliable. High-level operability is always uppermost on their minds. After all, only a working vessel generates revenues. That's what SISHIP and SINAVY life-cycle management (LCM) modules and services are all about – optimizing the operability of vessels over the long term.



Integrated Solution from Siemens SISHIP/BlueDrive PlusC, Electric/Hybrid propulsion family provides a reliable, sustainable and environmental friendly propulsion solution for ships in Naval, Commercial and Offshore sector. They are clearly superior, both technically and in operation to normal diesel drive systems in almost all areas. Thanks to their flexibility and versatility, these propulsion systems are customized to meet the widest range of demands. Extremely quiet and low in vibration, they are excellently suited for use on board a wide range of ship types.

Siemens' web based data application SISHIP EcoMAIN solution provides real-time monitoring and analyzing of the entire energy flow on board. A tailored app helps to optimize energy consumption and emissions by making the right decisions, addressing power generation, propulsion, trim, waste heat and HVAC (Heating, ventilation, and air conditioning). It provides on board and shore-based system with a user-friendly, easy-to-operate graphical user interface (GUI). The graphical user interface shows all applications in a unique layout providing the customized information required for decision making by a fleet owner/operator.

### Siemens PLM for Naval shipbuilding in India

Marching towards establishing industry 4.0 standards, Mazagon Dock Shipbuilders Limited kicked off implementation of Product Lifecycle Management (PLM) system, first time in the history of shipbuilding in the country. MDL, along with the many firsts being introduced in Project 17A, has added another new feature in the project by adopting the PLM solutions from Siemens.

### Zero Emission All-electric ferry, Norway

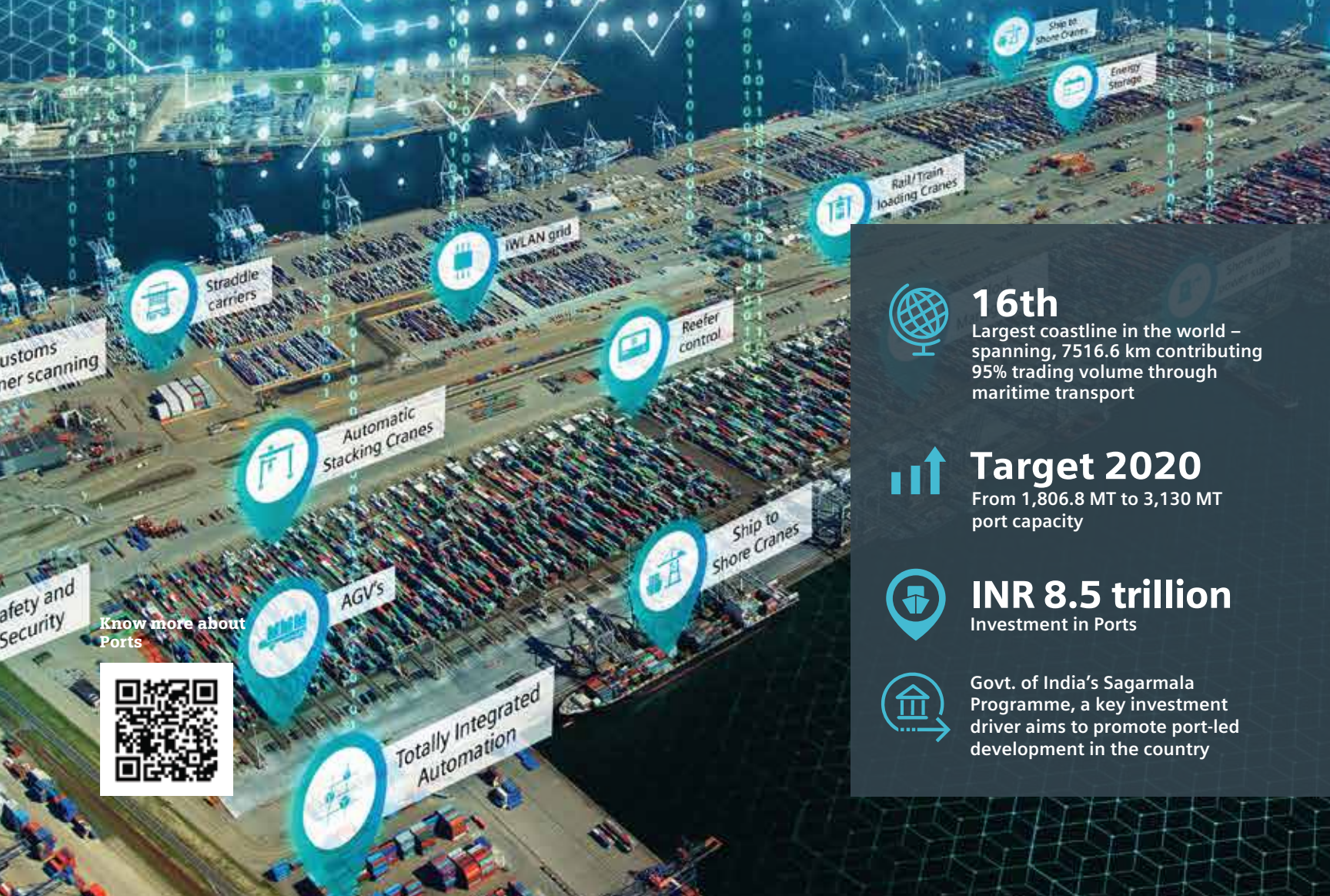
The world's first all-electric drive carry ferry AMPERE powered with Siemens SISHIP BlueDrive PlusC electric propulsion solution, makes 34 runs of 20 minutes each day, and recharging its batteries from the local power grid. Powered by a pair of 450 kW motors and 10 tons of lithium batteries built by Siemens Norway, the lightweight all-aluminum ferry can carry up to 360 passengers and 120 vehicles across Sognefjord.

### Digitalization – Fleet Management

With 60+ installed references SISHIP EcoMAIN is providing an exhaustive Marine 4.0 solution for a wide range of customers - from leading global cruise line operators to largest container fleet owners. The established references shows fuel saving combined with evidence for compliance to emission regulations. The App-principle allows an open and customized system – this is a Marine 4.0 answer for every vessel type.

# Ports

Integration of real and virtual worlds for increased port productivity



**16th**

Largest coastline in the world – spanning, 7516.6 km contributing 95% trading volume through maritime transport



**Target 2020**

From 1,806.8 MT to 3,130 MT port capacity



**INR 8.5 trillion**

Investment in Ports



Govt. of India's Sagarmala Programme, a key investment driver aims to promote port-led development in the country

Know more about Ports





### Digitalization & Big Data

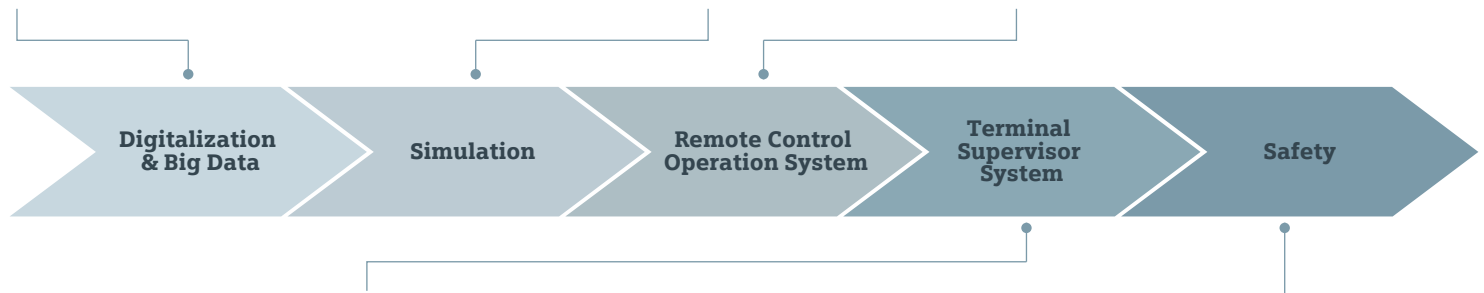
Siemens offers a complete Digitalized infrastructure for Ports to improve productivity, safety and efficiency. The integration of real and virtual worlds helps in maintenance, optimization of crane and block performance, timely delivery, logistic planning, commissioning etc.

### Simulation

A digital twin enables to evaluating scenario's and a reduced development time. Corresponding solutions can be pre tested leading to an accelerated commissioning time on site. The main advantage include assessment and performance analytics even before the system is delivered. Also during the operation customers can make best use of data and predictive maintenance.

### Remote Control Operation System

RCOS allows for automatic crane operation. Crane operators supervise the process from a remote location. To ensure safe, trouble-free unloading processes, the interplay between control and monitoring components is vital. Remotely monitored unmanned cranes automatically handle 90% of the containers.



### Terminal Supervisor System

Terminal Supervisor System, which monitors all operations in the port area, is used to centrally supervise all operations in the terminal, report disruptions, and ensure high productivity in the terminal area through optimal control of the processes. The Terminal Supervisor System assists to efficiently handle the high volume of moves, the ship-to-shore and horizontal transport. The system controls a large amount of information enabling quick action when there is a deflection of activities.

### Safety

Sensors like camera or laser systems help with target control, positioning and collision prevention. The gathering of operational data via Crane Management Systems enables the customer to optimize operations, service and maintenance and thus driving down the cost.

#### Africa's first automated container terminal

Siemens is supplying electrical systems used in 12 remote-controlled double trolley ship-to-shore cranes (STS). This order was placed by the Chinese Zhenhua Port Machinery Company (ZPMC), one of the world's biggest crane builders for APM Terminals MedPort Tangier. The terminal, to be opened in 2019, will be the world's first transshipment hub featuring an end loading yard concept.

#### The Jawaharlal Nehru Port Trust (JNPT)

Siemens has installed state-of-the-art Remote Control Stations (RCS) and port equipments at DP World-operated Nhava Sheva (India) Gateway Terminal (NSIGT) at JNPT, Navi Mumbai. The Remote Control Stations comprises of ergonomically designed desks and operator chairs with necessary controls to control the movements of the crane, monitors for visuals, remote I/O interface with communication to the server PC.

#### PSA Singapore

Siemens Cranes implemented electrical and automation systems for 56 Automated Rail Mounted Gantry Cranes to PSA Singapore Terminals, for the Pasir Panjang terminal Phases 3 and 4 developments. These SIMOCRANE cranes - as tall as a 5 story building - can stack containers about 20m high. 56 cranes are controlled by only 6 Operators from a centralized control room.



# Transport and Logistics

Shaping connected Mobility



Know more about  
Transport and Logistics



Indian Railways has the **4th**  
Largest Rail Network in the world



By **2030** Rail Passenger km  
in India is likely to grow from  
current 1098 billion km to  
**5765 billion** km /day



**8.11 Billion**  
passengers carried per annum



**~1400 kms**  
1400 kms of Metro are under  
various stages of construction  
(500 kms) & planning (900 kms)

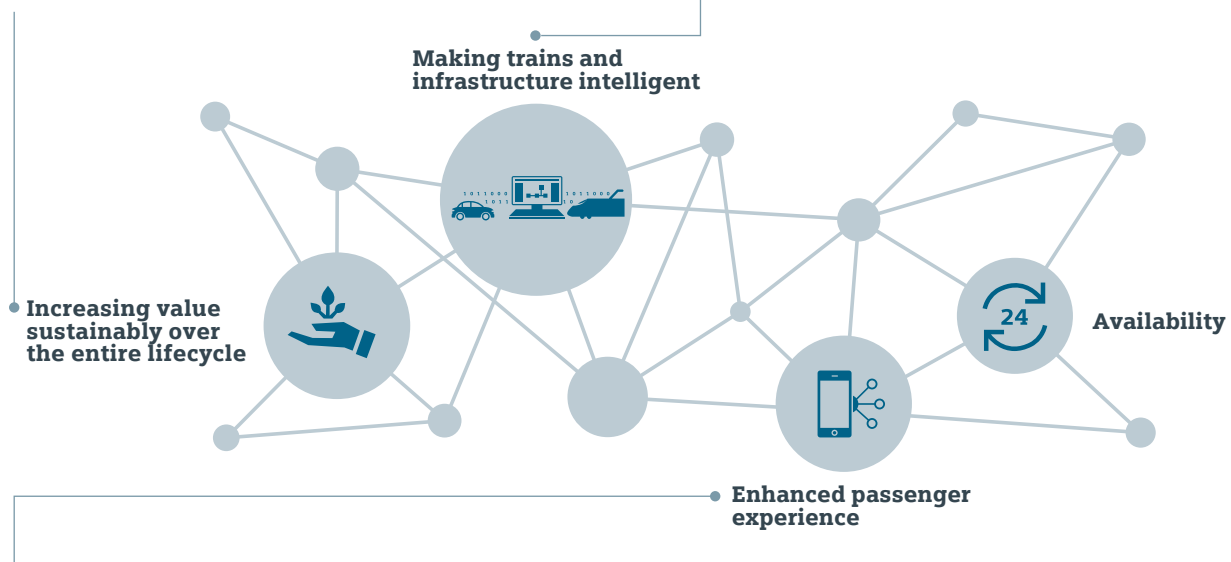
Mobility Division of Siemens offers innovative solutions to ensure that people and goods reach their destinations quickly and safely. Our expertise includes comprehensive domain and turnkey expertise that enables us to service the entire mobility spectrum – from operation controls for rail and road traffic, rail electrification systems, rolling stock, and electric buses to parking management and tolling solutions. Digitalization has fundamentally transformed the mobility industry: It has improved the availability of vehicles and infrastructures, optimized operations, improved safety, reduced costs and effort and has created novel business models.

### Hotel Load

Siemens' Head On Generation technology uses electrical energy from overhead catenaries there by reducing energy bill for Railways, Helps save costs through lesser maintenance requirements, better efficiency. Use of sustainable technologies and utilizing massive railways infrastructure for unconventional energy sources is imperative and can reduce the burden on the carbon footprint.

### Railigent

Rail transport is made more efficient, reliable and safe thanks to condition- based monitoring, data analysis and predictive maintenance concepts. Co- creation using Siemens' domain knowledge and our clients' expertise allows for comprehensive asset management and customer proximity.



### Integrated Mobility Solutions

Our intelligent solutions optimize the overall performance of transportation networks to better manage load and volume, while our integrated mobility platforms combine diverse transport providers to offer an end-to-end travel experience across metro, bus, car, bike-sharing, parking, and taxi services in real time. And as a single-source provider and system integrator, Mobility Division provides high-quality rail products and solutions for urban and interurban transportation and logistics.

### Mumbai Mainline

More than 150 service engineers from Siemens work 24x7 providing critical maintenance support on Mumbai EMUs with a clear value proposition: stringent time slots of four hours for maintenance and train availability of 99%.

### Gurgaon Mero

Rapid Metro Rail Gurgaon, India's first fully privately financed metro system, connects the Cyber City business district in Gurgaon to the Delhi Metro rail network. Metro passengers enjoy a comfortable ride with 99.8 percent punctuality.

#### Siemens Locomotive Tracking System

Indigenously designed, developed and implemented a System for Remote Monitoring of Locomotives (SILTS) in India. SILTS offers real-time monitoring of locomotive condition, GPS location, Smart Data Analysis, Smart Fault diagnostics, root cause analysis and smart prediction to aid maintenance of locomotives.

#### Metro Rail Infrastructure

Siemens has a footprint of more than 200 kms of signaling and 223 kms of electrification across eight cities in India of which Delhi, Gurgaon, Chennai, Kolkata and Nagpur include both signaling and electrification. Additionally, electrification in Noida & Ahmedabad; Signaling in Mumbai; Also Turnkey Depot Workshop equipments at Gurgaon and Nagpur.

#### Velaro, Spain

Velaro – developed entirely by Siemens itself – is one of the fastest multiple unit train series in the world with a top speed of up to 350 kilometers per hour. Thanks to its standardized platform concept, it can be adapted to suit the needs of different rail networks and customers. Predictive maintenance of 26 Velaro E - AVE S103 highspeed trains guarantees 100% availability from 2007 to 2022.





## New business models



**Speed**



**Flexibility**



**Quality**



**Efficiency**



**Security**

*Siemens' digitalization solutions  
help unlock your potential*

**Contact:**  
**Krishnakumar Ramanathan**  
Chief Customer Officer  
[r.krishnakumar@siemens.com](mailto:r.krishnakumar@siemens.com)

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Birla Aurora, Level 21,  
Plot No. 1080,  
Dr. Annie Besant Road,  
Worli, Mumbai – 400030

[www.siemens.co.in](http://www.siemens.co.in)

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