Automation and digitalization:
For greater efficiency in mobility
Siemens at a glance

€78.4 billion orders\(^1\)

343,000 employees\(^2\)

€71.9 billion revenue\(^1\)

Division Structure

<table>
<thead>
<tr>
<th>Power and Gas</th>
<th>Wind Power and Renewables</th>
<th>Power Generation Services</th>
<th>Energy Management</th>
<th>Building Technologies</th>
<th>Mobility</th>
<th>Digital Factory</th>
<th>Process Industries and Drives</th>
<th>Healthcare (separately managed)</th>
<th>Financial Services</th>
</tr>
</thead>
</table>

Portfolio examples

- Gas turbines, generators, compressors, instrumentation & control, electrical engineering
- On/offshore wind turbine plants
- Service for gas, steam and wind turbines
- Power transmission and distribution, energy automation, smart grids
- Fire protection, security, building automation, heating and air conditioning systems
- High-speed, regional and urban trains, rail infrastructure, traffic management systems
- Security, communication and software solutions for industry, service
- Process automation, drives and software solutions
- Technologies for imaging, lab diagnostics, IT solutions

1) FY 2014
2) At September 30, 2014
Mobility Division
Greater efficiency thanks to intelligent products and solutions

FY 2014: Orders €9.3 billion – Revenue €7.2 billion – Profit margin: 7.3% – Employees: ca. 26,000

Business Units

<table>
<thead>
<tr>
<th>Mobility Management</th>
<th>Mainline Transport</th>
<th>Urban Transport</th>
<th>Turnkey Projects &amp; Electrification</th>
<th>Customer Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Products, solutions and turnkey systems for rail and road automation and optimization</td>
<td>Short-distance, regional and long-distance rolling stock, and product and system solutions for passenger and freight transport</td>
<td>Rail-bound urban public transport vehicles, eBuses and passenger coaches</td>
<td>Complete rail and road solutions and rail electrification solutions</td>
<td>Services and tools for servicing road and rail infrastructure and rolling stock</td>
</tr>
</tbody>
</table>

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Mobility portfolio – an overview

- Integrated, intermodal mobility solutions
- Rail automation for passenger and freight transport
- Regional and high-speed trains
- Power supply solutions for rolling stock and road vehicles
- Rolling stock for short- and long-distance rail transport
- Railway turnkey projects
- Locomotives
- Automated fare collection
- Services for rail and road transport
- Road traffic management
- Integrated, intermodal mobility solutions
Mobility Division – A global footprint

Main locations

- Austin
- Louisville
- New York
- Novato
- Pittsburgh
- Sacramento
- Chippenham
- Poole
- Several Service Depots
- The Hague
- Wallisellen
- Madrid
- Châtillon
- Toulouse
- Augsburg
- Berlin
- Braunschweig
- Erlangen
- Krefeld
- Lühe-Wildenau
- Munich
- Wegberg-Wildenrath
- Moscow
- Sochi
- St. Petersburg
- Yekaterinburg
- Beijing
- Shanghai
- Xian
- Graz
- Vienna
- Melbourne
- Brisbane
- Bratislava
- Aurangabad
- Bangkok
- Madrid
- Moscow
- Sochi
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- St. Petersburg
- Yekaterinburg
- Beijing
- Shanghai
- Xian
- Graz
- Vienna
- Melbourne
- Brisbane
Order highlights in fiscal year 2014 and 2015 ...

**Rhine-Ruhr Express**
82 Desiro HC commuter trains incl. 32 years service for one of Europe’s biggest conurbations

**San Francisco Light Rail**
175 cars – one of the biggest orders for light rail cars ever placed in the USA

**Eurostar**
Orders seven additional Velaro e320 16-car trainsets – option exercised

**Amtrak**
Orders Sitrans SFC plus static frequency converters, two 30-megawatt units for the New Jersey High Speed Rail Improvement Program

**Customer Service Thailand**
Successful extension of the full service contract for Bangkok's metro system

**Rheinbahn AG**
Modernization of light railway signaling and operating systems for Düsseldorf light rail

**UK – South West Trains**
Order for 30 five-car trainsets for the Desiro City concept

**Paris Line 14**
Signaling and operating systems for the 4-station extension of the driverless metro line

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… and examples of successful project milestones

<table>
<thead>
<tr>
<th>Velaro D</th>
<th>Velaro Turkey</th>
<th>Finland: broad gauge Vectron</th>
</tr>
</thead>
<tbody>
<tr>
<td>407 Series receives authorization in France in March 2015</td>
<td>First train finished authorization process, passenger service in spring 2015</td>
<td>VR Group, advance Vectron arrives in Helsinki for tests, begin of series production</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ÖBB cityjet</th>
<th>USA: Amtrak Cities Sprinter</th>
<th>Istanbul, Turkey</th>
</tr>
</thead>
<tbody>
<tr>
<td>First trip in ÖBB network in March 2015, first train presented in Krefeld in November 2014</td>
<td>Passenger service begins, and first long-term service contract won</td>
<td>Marmaray Tunnel inaugurated, Siemens signaling system connects Europe and Asia</td>
</tr>
</tbody>
</table>
Mobility market will remain very attractive over medium term

Mobility – accessible market\(^1\)

<table>
<thead>
<tr>
<th>Market by business</th>
<th>FY 2012-2014</th>
<th>FY 2018-2020e</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rolling stock</td>
<td>66</td>
<td>77</td>
</tr>
<tr>
<td>+1.2%</td>
<td>+2.6%</td>
<td></td>
</tr>
<tr>
<td>Rail and road infrastructure</td>
<td>77</td>
<td>66</td>
</tr>
<tr>
<td>+3.6%</td>
<td>+2.6%</td>
<td></td>
</tr>
<tr>
<td>Service</td>
<td>77</td>
<td>66</td>
</tr>
<tr>
<td>+3.3%</td>
<td>+2.6%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Market by region</th>
<th>FY 2012-2014</th>
<th>FY 2018-2020e</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe, CAME</td>
<td>66</td>
<td>77</td>
</tr>
<tr>
<td>+2.3%</td>
<td>+2.6%</td>
<td></td>
</tr>
<tr>
<td>Asia/Australia Americas</td>
<td>77</td>
<td>66</td>
</tr>
<tr>
<td>+3.5%</td>
<td>+2.7%</td>
<td></td>
</tr>
</tbody>
</table>

- Mobility accessible market remains very attractive
- CAGR still nearly 3% despite exceptionally high market volume in 2014 (South Africa, Middle East)

1) MO accessible market based on UNIFE World Rail Market Study 2014, adjusted to MO portfolio; CAME = CIS, Africa, Middle East
Social trends in the urban age

Population

2010
~50% of the world's population lives in cities

By 2030
Urban population will grow from 3.5 billion to ~4.7 billion, mainly in developing countries

Economy

2010
~50% of global GDP is produced in 600 cities; Top 100 cities generate 38% of the global total

By 2025
77% of global GDP growth will be generated by middleweight cities in emerging markets

Energy and CO₂

Cities account for two-thirds of the world's energy consumption and up to 70% of its CO₂ emissions

Energy consumption pattern is dependent on city and industry structure

Urban pop. growth by 2030, by type/region

- Developed: 6%
- Latin America: 8%
- Africa: 25%
- Asia Pacific: 60%
- RoW: 10%

Urban GDP growth by 2025, by type

- Developed: 23%
- Developing: 77%
- Large: 37%
- Medium: 51%
- Small: 12%

Urban energy consumption, by sector

<table>
<thead>
<tr>
<th>Sector</th>
<th>Energy Consumption (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport</td>
<td>35%</td>
</tr>
<tr>
<td>Buildings</td>
<td>55%</td>
</tr>
<tr>
<td>Industry</td>
<td>10%</td>
</tr>
<tr>
<td>Commerc. City</td>
<td>60%</td>
</tr>
<tr>
<td>Industrial City</td>
<td>30%</td>
</tr>
</tbody>
</table>

Solid growth perspectives in public transport

Demand growth in urban mobility, by mode of transport

<table>
<thead>
<tr>
<th>Year</th>
<th>Base</th>
<th>High Shift</th>
<th>OECD</th>
<th>Non-OECD</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>9.8</td>
<td>13.0</td>
<td>13.0</td>
<td>22.8</td>
</tr>
<tr>
<td>2050</td>
<td>11.6</td>
<td>19.4</td>
<td>36.2</td>
<td>38.8</td>
</tr>
</tbody>
</table>

Key trends

- **Significant overall demand growth** until 2050 (x2.2), mainly Non-OECD driven
- **Highest growth rates**: India (x3.7), Africa (x3.3), China (x2.8)
- **Base Scenario**: Trend extrapolation
  - Strong growth of individual traffic (x2.7) and only modest growth (x1.4) of public transport
  - High risk of gridlock: Congestion, energy/emissions
- **High Shift Scenario**: Penetration of best-practices and policy shift
  - Disproportional increase of public transport (x2.7), in both OECD and Non-OECD cities
  - Non-linear development, upsurge from 2020 onwards
Global trends are driving profitable growth

**Global trends**

**Digital transformation**
- Networked world of complex and heterogeneous systems

**Globalization**
- Global competition driving productivity & localization

**Urbanization**
- Infrastructure investment needs of urban agglomerations

**Demographic change**
- Decentralized demand of a growing and aging population

**Climate change**
- Higher resource efficiency in an all-electric world

**Market development (illustrative)**

- **Digitalization**
  - Turnkey projects
  - Distributed wayside infrastructure
  - Traffic management
  - Predictive maintenance

- **Automation**
  - Unattended train operation
  - Station and network control systems
  - Rolling stock
  - Active energy management

- **Electrification**
  - Power Generation
  - Power Transmission, Distribution and Smart Grid
  - Efficient Energy Application
  - Imaging and In-Vitro Diagnostics

**Market growth**
- ~2-3%
- ~4-6%
- ~7-9%

**Mid-term 2020**
Digitalization drives the Mobility business

**Availability …**
- Smart data analytics for infrastructure and vehicle service
- Combine high vehicle/infrastructure performance with best-in-class service and maintenance

**Throughput …**
- Integrated resource management
- Software for next-generation train control (ETCS Lx and CBTC)
- Next-generation digitally enhanced interlockings

**Passenger experience …**
- Passenger information and assistance systems
- Broadband and entertainment services
- Automated fare collection “be-in / be-out”

**Guaranteed availability**

**Best asset utilization**

**Enhanced passenger experience**
Digitalization
More intermodality, energy efficiency and passenger comfort

Availability ...

- Predictive maintenance
- Availability guarantee for equipment
- Optimized spares bundling

Throughput ...

- Extended OCS
- Train driver advisory system/autonomous driving
- Active energy management

Passenger experience ...

- Integrated resource mgmt. and intelligent asset mgmt.
- Automated fare collection (BiBo)/eTicketing
- Integrated Mobility Platform (IMP)

Rail & Road

- MLT+UT
- Cross
- MM

Intermodal

- SIEMENS

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New era in urban and regional transport
Desiro City for maximum throughput on the Thameslink line through London

- Delivery of 115 newly developed Desiro City regional trains (1,140 cars)
- Maximum throughput (trains per hour) increased 25% through automatic driving\(^2\)
- Improved energy efficiency – through lightweight construction and intelligent systems (25% weight reduction\(^1\))
- Trainguard Automatic Train Operation (ATO) for ERTMS Level 2
- Desiro City Thameslink rolling stock will be operated as 8- and 12-car trainsets in dual mode
- Long-term maintenance by Siemens in two new depots
- "Always connected" – innovative passenger information system

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\(^1\) Compared to predecessor models
\(^2\) ATO GoA2: Automated Train Operation – Grade of Automation 2 (driver in cab)
Trainguard MT train operation system for mass transit
High throughput thanks to short headways

• Trainguard MT is the most widely used radio-based CBTC train operation system in the world
• Optimum use of track infrastructure by moving block operation with short headways (< 80 seconds)
• Scalable for all degrees of automation (semi-automatic and fully automatic driverless operation)
• Energy-saving operation through intelligent ATO control (coasting & cruising principle) and optimized timetable management
• Prepared for mixed-mode operation with ERTMS/ETCS
• Very low maintenance costs as a result of reduction or elimination of outdoor equipment (track vacancy detection, signals)
• Project references: Beijing Line 10, Copenhagen, Istanbul, Hong Kong, São Paulo, New York, Barcelona, Paris
Controlguide OCS integrates operations and dispatching
Efficient decision-making through seamless data integration

The maintainer performs necessary maintenance and repair work of rail installations and equipment.

The dispatcher coordinates train operations on a look-ahead basis and in case of unexpected incidents.

The security manager is responsible for ensuring security in rail operations.

The supervisor is responsible for dispatching in the case of incidents with a cross-regional impact.

The signaler is responsible for safe and punctual train operation.

The maintenance manager coordinates and monitors all necessary maintenance and repair work.

The information manager ensures that passengers are immediately notified in the event of irregularities.

The supervisor is responsible for dispatching in the case of incidents with a cross-regional impact.
Controlguide OCS: Increased throughput thanks to digitalized workflow and optimized infrastructure performance

OCS

Operations optimization

Best asset utilization
Intelligent dispatching

- Contingency timetable
- Dynamic traffic optimization
- Rule-based conflict resolution
- Forecast and conflict detection

Best work organization
Mobile devices and HMI

- Integration layer
- Restriction management
- Mobile access management

Traffic interoperability
ETCS train control

- Restriction handling
- ETCS control and display
- Restriction management

Operations automation

- Automatic route setting
- Timetable management (basic)
- Driverless train operation
- Archive

- IXL control and display
- Automatic train regulation
- Timetable construction
- Vital control and display
- Simulation

- Record and playback
- Training

Major challenges in rail traffic

- Increased network throughput without additional infrastructure
- Automation and digitization of knowledge processing
- Minimized energy consumption
- Traffic interoperability
- Centralized and integrated traffic management
- Optimized lifecycle costs and investment security

Data integration from device control to traffic management level for optimized infrastructure throughput

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# Rail Electrification:
Energy efficiency and stable grids for the smart grid age

## Smart Sitras portfolio
for the smart grid age

- Integration of regenerative energy sources
- Recuperation of braking energy
- Recovery: bi-directional transfer of active power
- Power quality for both grids together

<table>
<thead>
<tr>
<th>Task</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency conversion</td>
<td>Sitras SFC plus</td>
</tr>
<tr>
<td>Static Var Compensator</td>
<td>Sitras SFC plus</td>
</tr>
<tr>
<td></td>
<td>Sitras RVC plus</td>
</tr>
<tr>
<td>Active balancing</td>
<td>Sitras RAB plus</td>
</tr>
<tr>
<td>Energy exchange</td>
<td>Sitras SFC plus</td>
</tr>
<tr>
<td>Energy storage</td>
<td>Sitras SES</td>
</tr>
<tr>
<td></td>
<td>Sitras MES</td>
</tr>
<tr>
<td>Energy recovery</td>
<td>Sitras TCI</td>
</tr>
</tbody>
</table>

## Features

- Both grids stabilized
- Increased power quality
- Less energy consumption for reduced lifecycle costs
- Reduced CO₂ emissions
- Operation without overhead contact line in mass transit systems

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Service: ensure reliability rates of over 99 percent is our aim
Further increase through digitalization of maintenance

Vehicle and infrastructure diagnostics
- Data collection (sensors, monitoring devices, cameras)
- Selecting/ prioritizing data
- Remote data access by means of Siemens’ own common Remote Service Platform (cRSP)

Centralized diagnostics system
- Basis for analysis and fault prognosis
- Diagnostics server houses databases with collected data

Fault recognition
- Processing of diagnostic data in the Rail Support Center
- Once analyzed, data is included in work instructions for maintenance

Rail Support Center
- Draws up work instructions for maintenance
- Deploys mobile technicians if required
- Manages logistics for the required spare parts
- Ensures feedback of field experience into the service process
- Transfers pattern analyses to other projects
eTicketing – Intermodality all the way to the end customer
For attractive public transport with seamless mobility access

Basic technical set-up:
- Based on RFID, Bluetooth LE or Wi-Fi technology in smartphone or smartcard
- eTicket automatically detected when passenger is inside a vehicle
- Charging based on the route traveled
- Prepaid and postpaid payment methods possible
- Potential for intermodal use beyond public transport

- Modular eTicketing system for seamless mobility access in cities – attractive and efficient for user and operator
- Development of innovative be-in/be-out solutions (based on cards and mobile phones) supplements established check-in/check-out solutions
- Together with Integrated Mobility Platform (IMP) complete offering for door-to-door trips: "IMP" integrated into public transport systems with, for example, barcodes also suitable for check-in/check-out
The heart of future-oriented individual mobility
Intermodal traffic information centers

- Berlin: Europe’s most modern traffic control and information center
- Controls more than 2,000 traffic lights, 1,150 detectors, 250 cameras and eight traffic management systems
- Total length of the network of roads, tunnels and motorways covered: 1,600 kilometers
- Current traffic data available with FCD via TomTom
- Traffic information is provided to the public, media and authorities via the Internet, e-mail and SMS services
Saves time and CO$_2$
Holistic parking management system simplifies search for parking spots

![Diagram showing a parking management system with various components and benefits]

- **Basic solution:**
  - Modular design, infrastructure-based detection
  - Authorization and identification solutions (RFID)
  - Control center
  - Communication with residents, travelers and monitoring personnel

- **Integrated systems:**
  - Traffic management
  - Parking garage management
  - Energy management
  - Payment systems
  - Multimodal travel offerings
  - Lighting management

- **Benefits:**
  - Reduces traffic and emissions
  - Optimizes use of infrastructure
  - Increases traffic safety
  - Efficient management
**Digitalization driving customer benefit**

**Metro Riyadh – Exemplifies opportunities for integration of all performance levers**

<table>
<thead>
<tr>
<th>Metro Riyadh</th>
<th>Digital enhancements of electrification and automation components</th>
<th>Optimized throughput</th>
</tr>
</thead>
<tbody>
<tr>
<td>- World's largest urban transport project with 7 metro lines, total length of 175 km</td>
<td>- Driverless metro trains</td>
<td></td>
</tr>
<tr>
<td>- Siemens' contribution:</td>
<td>- Sensors, IP comms, advanced automation</td>
<td></td>
</tr>
<tr>
<td>- Turnkey systems for Lines 1 &amp; 2: metro trains, electrification, signaling/communication, interlockings</td>
<td>- 50% more capacity, 15% energy savings</td>
<td></td>
</tr>
<tr>
<td>- 63 km, &gt;15,000 passengers/hour, shortest headway of 90 sec.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Digital services</th>
<th>Guaranteed availability</th>
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<tr>
<td>- Smart data analytics for infrastructure and vehicle service</td>
<td></td>
</tr>
<tr>
<td>- Predictive maintenance</td>
<td></td>
</tr>
<tr>
<td>- Performance-based contracts</td>
<td></td>
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</tbody>
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<table>
<thead>
<tr>
<th>Vertical software/IT solutions</th>
<th>Enhanced passenger experience</th>
</tr>
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<tr>
<td>- Passenger information and assistance systems</td>
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<td>- Broadband and entertainment services</td>
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</tr>
<tr>
<td>- Automated fare collection &quot;Be-in/Be-out&quot;</td>
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</table>

Within ~1.6 bln. order

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Welcome to the Siemens booth
at the 61st UITP World Congress and Exhibition in Milan

Fiera Milano Congressi
Hall 4 – Booth 4F 150
June 8-10, 2015