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A woman with long dark hair, wearing a bright yellow tank top and dark shorts, is sitting in a meditative lotus position on a concrete ledge. She is looking out over a city skyline at dusk. The sky is a mix of blue and orange, and the city lights are beginning to glow. In the background, several tall skyscrapers are visible, with one particularly prominent one on the right side. The overall mood is peaceful and contemplative, contrasting the natural world with the urban environment.

SIEMENS

Ingenuity for life

Cities of the future

Creating Smart Cities in Canada

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Smart
Cities

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Cities of the future

With the rapid pace of city growth and increasing demands on infrastructure, the need for investment in smart city solutions has never been greater. Public budgets, changing demographics and aging city infrastructure add to the complexities of achieving prosperous, sustainable, resilient and inclusive cities. This complex environment drives the need for consolidated city performance data including smart analytics. In this age of **digitalization**, cities can use data to become more efficient, offer simplified city services and evolve.

Siemens offers the perfect combination of expertise and experience as an innovation leader to provide intelligent solutions for Canadian cities for both today and tomorrow.



Population

By 2030, 4.7 billion people will be living in cities across the globe.

Cities are growing by 1.5 million people each week



Economy

The world's 50 largest cities have a combined GDP of \$9.6 trillion

By 2025, 40% of global GDP growth will be generated by cities in emerging markets



Environment

Cities use ~80% of the world's energy

Cities use ~60% of the world's drinking water

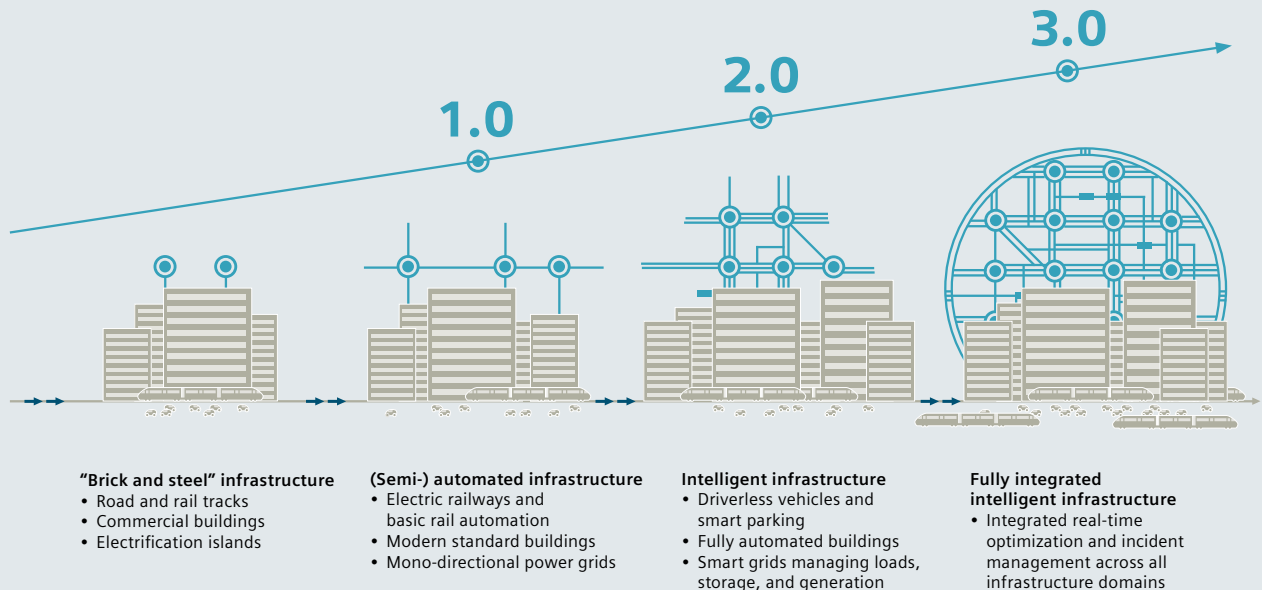
Cities generate more than 70% of the world's CO₂ emissions

What is a Smart City?

Smart cities of the future will be informed, connected and aimed to a more sustainable and resilient path to prosperity. The term “smart” embraces not just the technological, but also the social and human aspects of a city.

By adding new sensors and updating existing infrastructure for the digital age, cities will experience significant impacts on the efficiency, capacity and service delivery to citizens, their economic opportunity and overall quality of life.

The Pathway to Smart Cities






Power Grid Resiliency 

Smart Mobility 

 Intelligent Buildings

Smart Data Management 

Benefits of Smart Cities

Smart cities, enabled by digital connectivity, are about driving efficiencies in services and optimizing critical infrastructure through the use of data collection. Interoperability and analytics help to identify opportunities that will result in better service provision and reduce pressure on city budgets in the following ways:

- Identifying shared benefits between different sectors
- Consolidating infrastructure investments
- Coordinating resources between multiple departments
- Synchronizing systems, actions and operations
- Saving time and resources

Data provides insights into a city but those insights are often missed when data sets are considered independently. By combining active data sets from different sectors new patterns can be identified. By relating health data to housing data, air quality with transport, mobility with employment, the city will begin to illustrate where services may be prioritized. To gather that data infrastructure has to be digital. Digitally enabled infrastructure can then drive efficiencies in services through optimization of operations and equipment, changing operational patterns based on demand, and managing and maintaining the systems remotely.

How we put a technology lens on our cities to support decision making in the short and long term will define the economic success of today's cities as they journey to the future.

10 reasons to make your city smart:

1. To drive efficiency through reduced cost of service delivery
2. To cope with increased demand on city infrastructures
3. To reduce demand on scarce resources by identifying actual need and eliminating excess demand and resource duplication
4. To add capacity with minimal investment
5. To reduce cost to citizens, businesses and visitors
6. To deliver better services to citizens
7. To empower people with information and choice
8. To provide healthier environments and eliminate pollution
9. Drive innovation and provide business opportunity
10. To provide quality of life, attracting human capital, business investment and economic growth

Source: *The Siemens Crystal "The Age of Smart Cities"*



Top 10 Smart Cities in North America¹

1. Seattle
2. Boston
3. San Francisco
4. Washington D.C.
5. New York
6. Toronto
7. Vancouver
8. Portland
9. Chicago
10. Montreal

¹ Boyd Cohen "The 10 Smartest Cities In North America" www.fastcoexist.com/3021592/the-10-smartest-cities-in-north-america



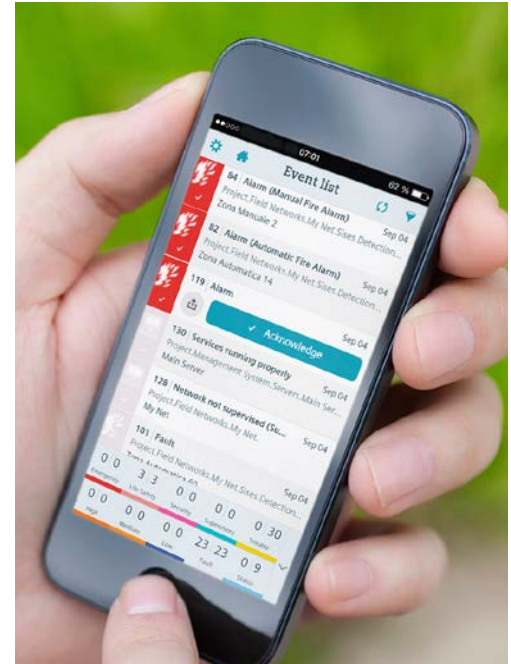
Intelligent Buildings

Today buildings account for 40 percent of the energy consumed worldwide. Modernizing existing buildings – making them more efficient, more integrated and more “smart” – therefore offers enormous savings potential.

Solutions like Siemens’ Desigo CC offer savings potentials for both new and existing structures. Desigo CC integrates a number of building functions in a management station platform that provides centralized monitoring and control. Fire protection, safety and security and building automation systems can all be integrated into a single system, increasing efficiency and ease of operation for building managers and improving safety conditions and comfort for users.

Smart building technology is designed to the highest standards of environmental efficiency, designed to not only reduce energy demands but give full control to the building users. The added sophistication of smart buildings is the installation of advanced energy management systems giving the building occupiers the ability to monitor usage and manage consumption to reduce unnecessary waste and limit their energy costs.

The system automatically monitors and controls all energy consumers from water treatment to air conditioning to lighting, ensuring that consumption is limited to actual energy required. All of this information can be conveyed through sensors located throughout the facility. Sensors also provide the ability for occupants to create their own comfort levels. Lighting automation is also integrated into the building management systems supported by motion detectors, ensuring that no light is left on longer than actually needed. This total building solution approach saves a further 20% energy compared with buildings without such solutions.



Building management starts with Desigo

The integrated building management platform Desigo CC that increases performance and enhances your image, offers you more safety, security, and comfort, and drastically reduces your costs. The new Desigo CC app offers mobile remote access to building automation and alarm management.

Milton Velodrome



The town of Milton needed a flagship building that can be reused as a community building after the TORONTO 2015 Pan Am Games finished. Siemens' Total Building Solution integrated security, automation and fire alarm systems together to increase the efficiency of the building. An integrated Power Monitoring system was installed to monitor the Siemens Low Voltage Distribution products. All this resulted in reduced energy costs and a Class A automation system that can save up to 30% thermal and 13% electrical energy.

TORONTO 2015 Pan Am Games Athletes' Village

10,000 participants required housing for a short period of time where athlete and spectator safety was a top priority. Siemens provided an easy-to-use ultra-high resolution video security system that collects real-time wireless data that is stored on a 36 TB storage system. Siemens also provided 24/7 technical support throughout the games. The housing has been repurposed and has left a legacy for the Toronto Waterfront.

Building management starts with Desigo.

Desigo™ is the answer to these challenges – and the innovative Desigo CC™ building management platform is a milestone in the history of building technology. With Desigo CC, you can control and optimize all the systems in the building.



Security

Integrated security systems allow for minimized response times.



Power

The average costs of downtime for mid-size companies are around

US\$ 70,000

per hour.

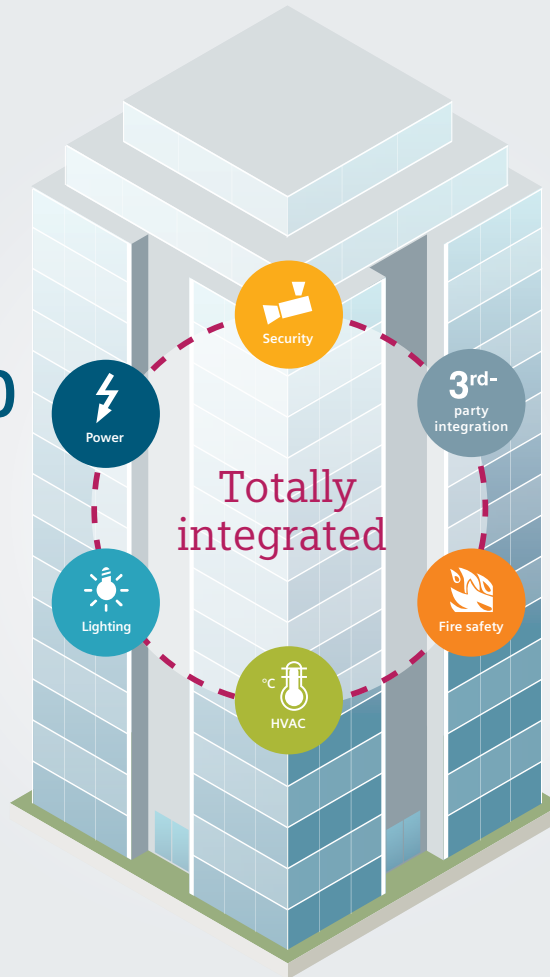


Lighting

Efficient lighting management can save up to

80%

of costs.



Advantage™ Services

We protect your investment and increase efficiency, while managing your risks and costs.



Fire safety

70%

of companies involved in a major fire never recover. We offer unique detection reliability and protection against false alarms.



HVAC

Energy monitoring combined with lighting, shading and power on demand can reduce up to

20%

of energy costs.





Power Grid Resiliency

A resilient energy supply is central for economic growth and stability, as well as social well-being. However today's grids were not designed to handle the growing power requirements or the increasing proportion of fluctuating power generated from renewable sources.

These trends – in addition to power outages caused by storms, excessive demand and aging infrastructure – have a significant impact on businesses and households alike. If the power supply fails, there are repercussions across all infrastructure domains.

Siemens offers a range of systems to improve energy efficiency, delivering comprehensive power transmission and distribution solutions for power grids. These range from products, solutions, services and systems for a decentralized, proactive and demand controlled smart grid, to the integration of low-voltage and medium-voltage products into smart, reliable, efficient and stable power grids as well as energy storage solutions. These Siemens services enhance sustainable power generation.



Rugged Communications for Electric Power Systems

Cities with modern electric power generation, transmission, and distribution systems require intelligent devices that can communicate quickly and reliably, around the clock and under the harshest conditions. Siemens offers the world's most reliable networking solutions that can handle the communication needs everywhere that electricity flows. Our industry-leading RUGGEDCOM communication network products are tailor-made for electric power applications, proven to last and with an uncompromising commitment to reliability.



With Siemens **Totally Integrated Power** approach, cities can benefit from integrated automation solutions. Our power distribution products and systems can be interfaced to building automation systems via communication capable circuit breakers and components. The portfolio is rounded out by service, offering maximum resiliency for cities.

Gas-Insulated Lines

In places where construction or environmental constraints prevent the installation of overhead power transmission lines, gas-insulated lines (GILs) are an economical and ecological alternative. GILs are laid in tunnels buried in the ground. Thanks to their encapsulated design, GILs are a highly reliable technological solution. Their transmission losses are up to 70 per cent lower than those of overhead lines and they cost much less to operate. Their simple, maintenance-free design ensures a long service life with no visible impact on natural landscape and frees up valuable land for development.





NB Power

“Siemens’ ingenuity is the secret sauce that’s going to allow our utility to be successful in the future.

– Brad Wasson, Program Director,
Reduce and Shift Demand, NB Power

NB Power understood that their customers will be more engaged in the electricity industry of tomorrow and that the practical solution to their future challenges was in helping manage customer demand. As a result, the utility is focusing on a “reduce and shift demand” program, turning to Siemens for a transformative smart grid solution.

Siemens is demonstrating its long-term commitment to NB Power’s undertaking by making major investments in New Brunswick, including opening a Global Centre of Competence and a Research and

Development office for Smart Grid in Fredericton, as well as investing in related research at New Brunswick universities. Making it all possible is a remarkable partnership between Siemens and NB Power built on a foundation of strong trust.

For consumers, this means that they will have more choice about how and when they use their electricity in the future as NB Power is able to expand its services. Siemens Smart Grid technology will enable the utility to introduce innovations such as household energy dashboards and smart thermostats.

Algonquin College



“Siemens is helping us create a living lab – a place where students can learn not just by seeing, but also by doing.

– Todd Schonewille, Director, Physical Resources at Algonquin College

Siemens' Energy Service Performance Contract (ESPC) with Algonquin College of Applied Arts in Technology is a 20-year, multi-million collaboration that has resulted in numerous efficiency and sustainability retrofits to the Ottawa campus. Installing the co-generation plant results in a number of benefits for Algonquin College:

- Reduces the College's energy expenses
- Opportunities for students and programs to conduct applied research projects
- Allows the College to continue to operate in an electricity outage

The energy management system balances the load between renewable sources, the microgrid and a co-generation plant that will provide 4 MW of power by 2017. In addition, the college would serve as a showcase and living laboratory of Siemens' leading-edge green technologies, and Siemens would help educate students and faculty on sustainability and be a catalyst for environmentally-conscious behaviour.



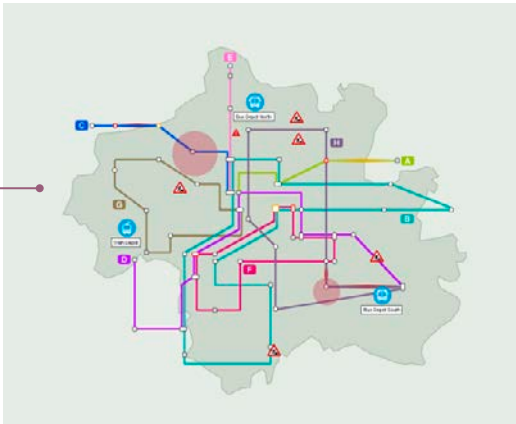
Smart Data Management

City wide ICT networks with unlimited bandwidth will become the foundation for smart cities. Networked communication systems, cloud computing, infinite storage, connected devices and more will provide data that cities can use to address their challenges and drive economic growth. Standards are evolving to help cities identify opportunities and the best approach to delivering smart city projects. Siemens has been working with cities globally and locally to help them develop data management systems across different infrastructures.



Smart Guard Traffic Management

Siemens' smartGuard traffic computer is a traffic control system that operates in a secure cloud. The service enables smaller cities and municipalities to build virtual, web-based traffic control systems without having to invest in costly hardware. Instead, they connect to a central traffic computer through a special controller that can be housed in a control cabinet next to each installation. Operators can then connect from any internet-capable device via a private cloud to smartGuard and monitor and manage their systems. Operators have an overview of traffic in their municipality at all times. They can monitor current traffic flow or get information regarding occupancy of parking garages. If needed, they can manage traffic by setting the light signals or dynamic street signs accordingly.



Siemens City Intelligence Platform

The Siemens City Intelligence Platform is an adaptable platform that has the ability to add applications across all sectors to provide a comprehensive overview of infrastructure operations and the interdependences between them. For Siemens, smart cities is not just about providing the city with clean, reformatted data from infrastructure that they can then use to plan more effectively. It is also about the intelligence of the infrastructure that operates within the city and providing the capability of improving its performance in real time so that the data being delivered to the city is coming from already optimized assets.

Analytics Roadmap²

Siemens leads the way in data analytics by moving from descriptive to prescriptive analytics

Four categories of data analytics

Descriptive:
What happened?

Diagnostic:
Why did it happen?

Predictive:
What will happen?

Prescriptive:
What shall we do?

Examples

- | | | | |
|--|---|---|--|
| <ul style="list-style-type: none"> • Plant operation report • Equipment fault report • City revenue reports • Service statistics | <ul style="list-style-type: none"> • Alarm management • Root cause identification • Fault analysis | <ul style="list-style-type: none"> • Power consumption prediction • Fault prediction • Passengers per hour | <ul style="list-style-type: none"> • Operation point optimization • Load balancing • Passenger optimization |
|--|---|---|--|

Current penetration across all Industries (*Gartner, 2013*)

99%
Adopted by vast majority but not all data

33%
Adopted by minorities

13%
Still few adopters

3%
Very few early adopters

Siemens approach to data analytics relies upon our domain know how, device know-how and analytics capability.

² The Siemens Crystal "The Age of Smart Cities"



Smart Mobility

Transportation of people and goods is a top priority for metropolitan areas. Population growth, congestion and the growing demand for mobility all place increasing burdens on Canadian transport systems with negative impacts for businesses, residents and overall quality of life.

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.

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.

The result is greater control throughout the entire transportation network, increased business potential, lower greenhouse gas emissions and reliable service for Canadians.

There is a new opportunity for cities to run railways that are interactive and self managing and provide a passenger experience that allows for a new level of sophistication and connectivity, essential for 21st century Canadians. Sensors on trains monitor the railway along which they travel and identify empty carriages for waiting passengers. Along with on-board communications networks and train control systems manage the speed and frequency of trains resulting in end-to-end efficiency that will make rail travel the preferred mode of transport. One out of every three light rail vehicles in North America is a Siemens vehicle.



Intelligent Transportation Systems

Reliable network communications are a critical necessity for monitoring and managing increasingly complex transportation infrastructures. Knowing what is happening and where, from tracking buses and trains on their routes, to locating and addressing stalled vehicles, to connecting drivers with important information about road and traffic conditions – effective traffic management demands intelligent transportation systems. Siemens RUGGEDCOM solutions can deliver accurate and timely information to transportation managers so they can prevent bottlenecks before they happen.



Siemens Integrated Smart Parking Solution

The Siemens Integrated Smart Parking Solution keeps commuters informed effortlessly, from their point of origin to their final destination, using statistical data on current and time-of-day-based parking availability. Routing apps and on-board or infrastructure-based navigation systems reduce commuter search time and ease the traffic. The overhead lamp-based detection solution enables details such as vehicle size requirements. Parking vacancy figures can be coupled with valuable data such as the time it will take to secure a parking space and the walking distance to the desired location.

Chargers for e-buses

A low-emission and energy efficient public transport network demands an appropriate charging infrastructure. Our solutions for e-buses make charging more efficient and affordable, and the use of renewables ensures no local emissions such as CO₂ or noise are produced. The top-down pantograph is a fast-charging system that can be mounted on a mast or roof of a bus stop. This flexible off-board charging solution can be used with multiple bus types and differing grid requirements. Currently a 450 kw charging solution is in operation in Montreal.

