IBM Institute for Business Value

Green and beyond

Getting smarter about the environment

IBM Institute for Business Value

IBM Global Business Services, through the IBM Institute for Business Value, develops fact-based strategic insights for senior executives around critical public and private sector issues. This executive brief is based on an in-depth study by the Institute's research team. It is part of an ongoing commitment by IBM Global Business Services to provide analysis and viewpoints that help companies realize business value. You may contact the authors or send an e-mail to iibv@us.ibm.com for more information.

By Karen Butner and Jacqueline Jasiota Gregory

Environmental sustainability is an imperative for 21st-century business – encompassing conservation, pollution prevention and more, but also enabling entirely new value propositions and benefits. Visionaries are seeking ways to lower costs while building more efficient and sustainable operations. They are strengthening their brands and reputations, while meeting government regulations and other compliance standards. But more important, they are creating greener products and services that give rise to new markets – profitably.

Today's world is smaller, flatter and hotter – the ecological result of living in a globally integrated society. Meanwhile, the demanding economic environment requires enterprises to do more while managing fewer resources – pressuring them to drive greater efficiencies, compete more effectively, and be proactive when it comes to energy conservation, environmental stewardship and operational sustainability. Empowered consumers – along with employees, stakeholders and business partners – are also demanding more responsible business practices. As companies develop enterprise environmental strategies and implement programs and initiatives to effect these goals, they can begin to overcome operational constraints, enrich their brands, improve regulatory compliance, strengthen customer ties and operate more effectively – now, and well into the future.

Environmental sustainability is now a mandate for today's global businesses.

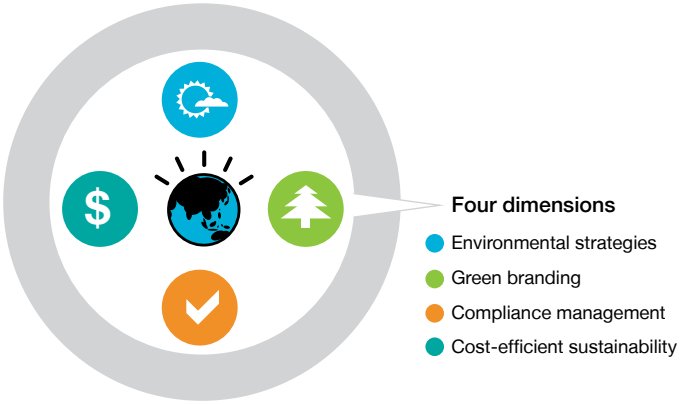
The four dimensions of environmental sustainability

More and more, CEOs understand how their business decisions impact the planet. According to the IBM CEO Study, environmental factors doubled in CEO importance over the past four years.[1] Expectations concerning energy and environmental policies, procedures and practices are rapidly changing: Eighty percent of CEOs view sustainability as impacting brand value.[2] A McKinsey global survey pointed out that 82 percent of executives expect some form of climate change regulation in their companies' home country within five years, and 60 percent of executives view climate change as important to their overall business strategy.[3] The new pressures are about being responsive to a range of stakeholders, and building a better, more sustainable business. Today's corporate leaders do not abandon operating principles or business acumen; rather, they embrace both within the context of sustainability.

We believe there are four dimensions of environmental sustainability. These factors incorporate the strategies that we create and the actions that we take to manage what we consume. They include:

- Environmental strategies
- Green branding
- Compliance management
- Cost-efficient sustainability.

These dimensions are not discrete; they must be dealt with as interlocking enterprise responsibilities.



Source: IBM Global Business Services and IBM Institute for Business Value analysis.

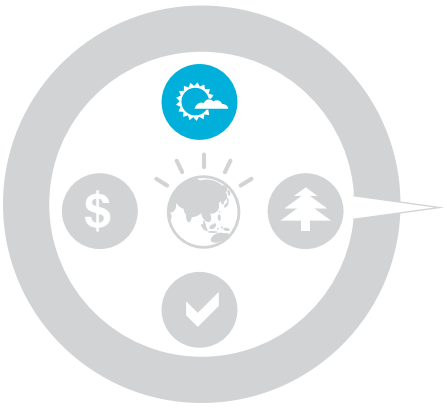
Figure 1. **Four dimensions of environmental sustainability.**

Environmental strategies

Aligning an organization's "green strategy" with its overall business strategy is paramount. This begins with a clear understanding of the overall corporate objectives and priorities, followed by carefully defined programs, goals and tasks that address environmental and stakeholder views. Stakeholders, of course, include shareholders who are typically focused on earnings and profits. Of growing concern is the ability to access new markets with product/service innovations that not only generate revenue, but also meet increasing customer demands for environmental efforts that help reduce or recycle packaging, and provide traceability of raw material and component sources. And then there are the employees, vendors and influencers. Finally, the corporate strategy must address changing leadership, as well as employees' attitudes toward sustainability – all while enacting policies and change programs that can support and drive environmental stewardship.

Development of a comprehensive sustainability strategy requires many different views of the business – taking into account the varied dimensions of resource consumption: energy, water, land, air quality and waste. The increasing costs of water and energy sources due to the rise in demand, cost to produce and reduction in supply are issues to contend with. Regulatory pressures are likely to intensify – coming from both global agreements and local legislation. From investors to market analysts, to employees, consumers and government and non-government organizations, the demand for consideration of environmental and economic consequences of our actions is growing.

To identify and effectively manage the potential environmental impact on stakeholders and operations, it is important to establish a strong worldwide environmental management system (EMS). The strategies and policies that govern an EMS typically address areas such as the conservation of energy and other natural resources, environmental protection, sourcing compliance and the manufacturing of environmentally conscious products.



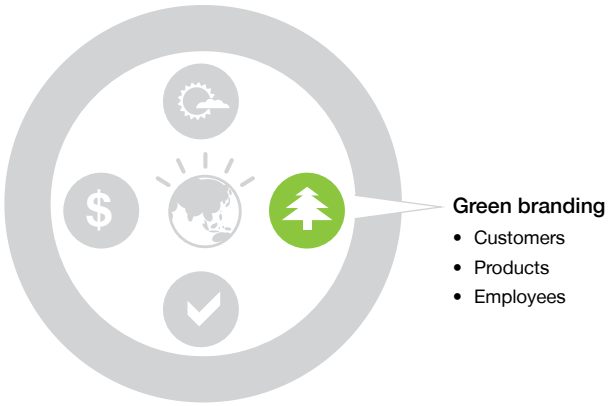
Green branding

The IBM study, *Attaining Sustainable Growth through Corporate Social Responsibility*, revealed that many executives are developing a green strategy to enhance their organization's competitive position. While 63 percent believe they have sufficient information behind their customers' requirements for products and services, 76 percent admit that they do not understand their customers' expectations concerning corporate social responsibility.[4]

The sustainable, customer-focused enterprise has a vision for understanding customer expectations as they relate to sustainability, and creating experiences to meet those expectations. Analytics can be applied to customer intelligence to tailor communications about product and service features. Across the product life cycle, there are opportunities to reduce the environmental impact, and develop new environmentally friendly products for key markets and customer segments. Customer-facing operations are designed to enhance the green experience. The end goal is to protect and enrich the brand, improve customer communications and create a "greener" customer experience – from sales and marketing communications, to product and service design, to call center and channel interaction.

The sustainable enterprise understands and meets customer expectations in the context of sustainability.

While it is important to effectively brand products and services to customers, the enterprise must also *brand itself* as an environmentally sustainable employer – an area of focus that continues to play a larger role in employee attraction and retention.



Compliance management

Government regulations and compliance standards for improving air quality through carbon reduction programs, water and waste management initiatives are now top-level business requirements. In the aforementioned IBM study, *Attaining Sustainable Growth through Corporate Social Responsibility*, 67 percent of respondents indicated that they have mature strategies and processes in place for regulatory reporting on green strategies and initiatives.[5] Compliance reporting is expected to increase in many countries as governments and non-governmental organizations seek standards in carbon footprint monitoring and carbon trade initiatives.

Compliance management and regulatory reporting are key requirements for operational sustainability.

More and more companies are joining voluntary Cap-and-Trade consortiums, and mandatory Cap-and-Trade schemes are likely to grow significantly over the coming years within certain geographies. Combined, these initiatives will place heavier compliance burdens on organizations, and highlight the need to apply financial and reputation incentives to drive down emissions. These strategies, which exact an overall limit on emissions for a sector of the economy, and require organizations to purchase and retire allowances to match their emissions, can be a valuable tool in helping countries meet their overall emission-reduction targets.

Cap-and-Trade schemes are also likely to move beyond the current focus on energy-intensive organizations – creating compliance and reporting challenges for a much wider group of organizations. An example of this is the Carbon Reduction Commitment (CRC) scheme[6] in the United Kingdom, which is due to commence in April 2010. This mandate is targeted at the non energy-intensive sector – covering emissions that fall outside of the existing EU Emissions Trading Scheme and UK Climate Change Agreements. It will cover approximately 5,000 organizations, ranging from retailers and hotel chains, to local and central government departments. The CRC is also designed to use other financial incentives and reputation levers to drive down emissions, with published league tables ranking organizations based on their performance. Additionally, the CRC will be used as a basis for distributing financial bonuses and penalties.[7]

New reporting requirements are also becoming mandates for water and waste management standards. Seventy-five percent of executives in the IBM sustainability study cited that the number of advocacy groups collecting and reporting informa-

tion on their industry, enterprise and/or product in the past three years has grown. Seventy-five percent also reported a significant increase in the information they must provide on sourcing, composition and the impact of their products, services and operations in the past three years.[8] What must be juggled here is the increasing transparency with compliance-reporting authorities, and the need to anticipate the concerns customers have regarding sourcing, packaging and products.

When developing their enterprise strategies, executives must ask themselves what new processes and technologies they need to apply to meet new regulatory compliance standards. A review of product engineering, manufacturing and disposal processes can help identify the high-risk points and gaps regarding energy and environmental requirements. These can then be prioritized, and compliance activities put in place to exceed regulatory requirements and gain competitive advantage.

Cost-efficient sustainability

Developing a cost-efficient sustainability strategy is easier said than done; it is all about balancing the trade-offs to optimize efficiencies. Carbon management, energy consumption, water, waste management and other environmental concerns should be approached and analyzed from a holistic viewpoint, while evaluating overall performance goals of cost, service and quality in terms of their relationships to one another.

A comprehensive sustainability strategy and performance criteria are developed to manage and reduce carbon output, water inefficiencies and energy usage, along with the associated costs. Sophisticated performance monitoring, coupled with advanced modeling techniques, can help improve efficiency and performance while driving bottom-line cost reduction. Advanced analytical techniques can be applied to evaluate the impact and resultant efficiencies of product design; packaging; production; distribution; transportation; facilities; energy options; inventory policies, IT and real estate.

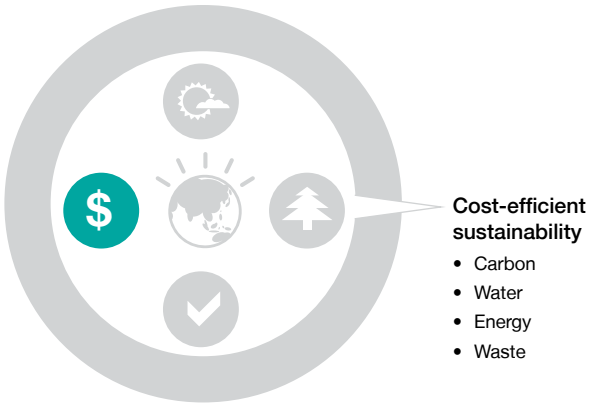
According to BusinessWeek magazine, "Water will be the oil of the 21st century."[9] Just as diminishing supplies of oil and natural gas are changing peoples' lifestyles, increasing competition for scarce water is presenting significant impediments and economic risk for both individuals and enterprises around the world.

Advanced water management involves using sensors to capture realtime data for analysis and simulation visualization of projected usage. Monitoring water requirements from a network perspective can better balance utilization, and support new policies and procedures for managing fluctuations in flow. Actuators can be applied to automatically control, or "turn-on and turn-off" system-wide water utilization, such as irrigation systems.

Likewise, energy management and monitoring can capture significant usage data from a network grid and flow perspective. Scenario planning and modeling can be employed to "test" the use of alternative energy sources and understand the differences in associated power and cost equations.

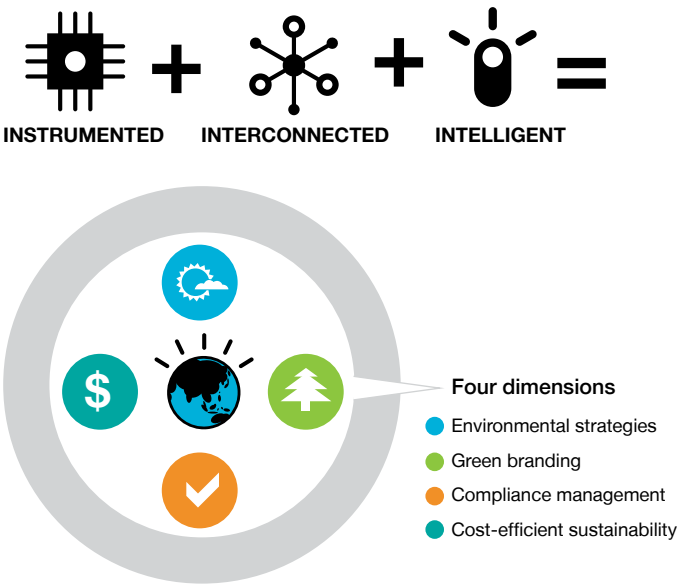
Manufacturing and transportation are the highest emitters of carbon. Carbon footprint modeling techniques can be used to evaluate the trade-offs of various transportation modes, production scenarios and traffic flow patterns to capture, calculate, and evaluate reduction policies and programs. Smart buildings, data centers and call centers can monitor energy usage to enable significant cost savings and higher efficiencies.

A holistic green business intelligence capability measures company performance in terms of energy consumption and Greenhouse Gas (GHG) emissions. It allows effective reporting, and provides management with key performance indicator (KPI) dashboards, which monitor and report on green KPIs, juxtaposed with the company's standard operational and financial reporting. The goal, of course, is to better manage carbon dioxide emissions, water and energy consumption, help ensure compliance and meet stakeholder demands for information.



Unlocking the value in green

There is an opportunity for smarter organizations to unlock the *value in green*. There is also the potential for lowering costs while overcoming operational barriers…strengthening reputations while meeting regulatory requirements…and creating products and services that can satisfy customer demands and give rise to new markets. We believe that these "mandates for change" can help build smart sustainability within the enterprise *and* with the network of partners in the value chain.



Source: IBM Global Business Services and IBM Institute for Business Value analysis.

Figure 2. **An opportunity for smarter organizations to find the value in green.**

Smart systems are emerging – with the potential to improve our lives and profoundly impact the environmental challenges facing society and the planet. *We are more instrumented*. We now have the ability to measure, sense and see the exact condition of practically everything – with the potential to act on information in realtime. *We are more interconnected than ever*. People, systems and objects can communicate and interact with each other in entirely new ways. *We are more intelligent*. We can respond to changes quickly and accurately, and get better results by predicting and better preparing for future events.

We believe that substantial societal and economic shifts will drive the emergence of new, more sustainable business opportunities – leading the new "green and beyond" economy.

The mandates for building smart sustainability – to find the value in green – require that we collectively achieve:

- **Sustainable operational efficiency**
  - *Supply chain management*: Increase efficient carbon, water and waste management – from the supplier, to the manufacturer, to the transporter, to distribution and beyond.
  - *Design for the environment*: Use fewer resources in the creation of products; improve environmental attributes for products; reduce waste creation and associated disposal costs.
  - *Workforce*: Decrease employees' environmental impact with remote work and collaboration strategies.
- **Green buildings and infrastructures**
  - Manage the environmental impact on buildings and physical assets.
  - Take out cost and improve the efficiency of information technology.
  - Enable readiness with regulatory compliance.
- **Intelligent ecosystems**
  - Use predictive analytics for water management.
  - Optimize power generation for utilities.
  - Optimize transportation systems.

Sustainable operational efficiency

Sustainable operations are all about optimizing business processes with analytics to help reduce the cost of operations *and* the environmental impact. This means finding the value in green in supply chain and distribution, manufacturing/production, customer relationships and workforce productivity.

Supply chain management is one of the areas with the greatest opportunity to leverage the value in green through the reduction of energy, carbon, water inefficiencies and waste. Yet in IBM's recent Chief Supply Chain Officer study, *The Smarter Supply Chain of the Future*,[10] executives view the development and implementation of green strategies as a significant challenge.

Supply chain management is a prime area for leveraging the value in green.

Over 50 percent indicated that they have implemented these measures in product/packaging design, included carbon management in manufacturing/distribution targets, and have strategic plans and initiatives in place for carbon, water, waste management and energy usage.[11] In manufacturing operations, Lean and Six Sigma – or "Green Sigma" principles – can be applied using advanced analytical techniques to establish ongoing carbon-footprint and water management practices, with the goal of reducing resources consumed in manufacturing. Green Sigma methods encompass:

- *Performance*: Establishing key green performance measurements and targets.
- *Metering and monitoring*: Setting in place energy usage, carbon, transportation and compliance standards.
- *Process optimization*: Utilizing statistical tools and techniques to analyze, improve and optimize processes.

The value proposition for such *smart* industrial automation is significant: US$107 billion a year, according to a recent report by The Climate Group.[12]

Optimization models can be used to manage and reduce carbon output and water inefficiencies, reduce energy and water usage, and manage the associated costs. Typically, optimization models are applied to evaluate the trade-offs between customer service levels, quality, cost and CO_2 emissions. Areas of analysis include packaging options; product design; alternative production/operational processes; alternative distribution practices; various transportation modes and flows; energy sources; inventory policies; supplier compliance programs, and sourcing policies.

Such a comprehensive diagnosis and analysis of integrated supply chain activities for carbon management, reduction of

SMART IS
Consolidating distribution centers to reduce emissions by 15 percent and fuel costs by 25 percent.

COSCO: Performed an analysis of its operations across product development, sourcing, production, warehousing and distribution. The company ultimately consolidated its distribution centers from 100 to 40 to prevent 100,000 tons of emissions each year.

SMART IS
Reinventing manufacturing processes to use less water, energy and other chemicals.

IBM Burlington FAB: Retooled its chip-making process to cut annual water use by 20 million gallons, chemical use by 15,000 gallons and electricity use by more than 1.5 million kWh.

SMART IS
Reducing travel, real-estate and office costs while appealing to top talent.

A smart organization: Can reduce paper consumption by 80 percent, cut annual real-estate costs by tens of millions of dollars and eliminate 20 percent of programming (or software) code—and associated energy costs—by re-engineering its workforce operations.

carbon footprint, energy consumption, and water and waste management can lead to significant cost savings, while "greening" the environment. Sustainable procurement activities include sustainable sourcing (especially in emerging economies), supplier management compliance and risk management to encompass government regulatory compliance reporting.

The true economies of environmental and cost benefits magnify in product design and lifecycle management. *Designing for the environment* includes green product design/packaging design, designing for optimum operational efficiency, and designing for product end of life (disposal, refurbishment, recycle). Leading practices for designing and delivering energy-efficient, low-impact products and services consider the full spectrum of environmental product lifecycle management.

Some companies are using virtual product analysis and process simulation to augment their current design toolsets and optimize processes across the product life cycle of design, use and disposal. An example of improved packaging design is the use of recycled plastic to protect disc drives and compact disks. Instead of wood, which is a finite resource, pallets made from recycled materials (which would have gone into a landfill) save in weight and associated costs.

Workforce management is a growing area of concern for many executives as they seek to reduce energy, carbon, waste and costs associated with travel and office supplies, and instead enable virtual working environments. Many organizations, including IBM, embrace a virtual workforce. With employees physically located around the world – linked by the latest connectivity and collaboration tools – such policies support cost reduction in energy usage and unused real estate. Travel reduction policies, "foot-printing" for carbon effects, paper-reduction strategies and virtual training programs are other initiatives that many are undertaking.

Green buildings and infrastructures

A green infrastructure is instrumented, interconnected and made intelligent to mitigate the environmental impact and lower costs by taking a comprehensive view of energy consumption that:

- Optimizes the efficiency and compliance of buildings and physical assets.
- Improves the operational efficiency of data centers.
- Intelligently manages business information to lower the energy cost of applications while meeting compliance standards.

Green buildings can include utilities, offices, laboratories, manufacturing facilities and warehouses. Sustainable facilities management uses realtime data analytics to evaluate the environmental aspect of factors such as energy consumption in buildings, maintenance diagnostics and asset utilization. Predictions pertaining to supply and demand for utilities (energy and water, for example) help managers plan and monitor usage.

Sustainable activities focus on optimizing the efficiencies of buildings and infrastructures.

A network of sensors, supported by asset management software and interfaces with inventory and other enterprise systems, supports continuous monitoring of carbon production (electricity use, heating energy, CO_2), water usage and waste generation. A dashboard enables integrated monitoring of energy consumption, asset condition, carbon emissions and physical security management. Open integration of building and resource data (energy, carbon emissions, water, waste and equipment) helps improve property and asset management – supporting cost reduction and operational efficiency.

Green data centers are characterized by active energy management and design, which includes energy-efficient hardware and tiered storage capabilities. Accurate thermal and energy-usage assessments are also used to support design flexibility in new and existing facilities. Adding to the bottom line is overall energy reduction, of course, as well as the extension of the life of the data center and IT equipment. The virtualization and consolidation of servers can have a significant impact on energy efficiency in terms of power and cooling costs, as well as carbon emission reduction. According to insights from the new IBM Chief Information Officer study, *The New Voice of the CIO*, CIOs agree on the top priorities for improving sustainable competitive advantage. Virtualization ranked very high at 77 percent.[13]

Information management plays an important role here as well. Increasing voluntary and mandatory regulatory compliance reporting will place additional pressures on information requirements. Data is collected by a host of business partners, in both structured and unstructured forms. Equipping the people in our organizations with the tools to anticipate, predict and act on this vast data will require precision at a new level of enterprise content management: providing information how, when and where it is needed the most.

SMART IS
Building green data centers to support corporate brand objectives.

kika/Leiner: Designed and built a new energy-efficient, scalable modular data center – reducing electrical consumption by up to 40 percent. The new data center extended the company's environmental strategy to include its data center.

SMART IS
Proactively addressing information growth and environmental regulation.

A smart organization: Can build a green infrastructure to anticipate and respond to information growth, measure and verify performance and achieve data compression rates of up to 80 percent.

SMART IS
An intelligent green building that optimizes energy and property management.

Shanghai, China: A Five Star hotel implemented diagnostics and monitoring of energy usage in consideration of guest traffic flow. The results: 40 percent reduced energy cost/revenue versus other Five Star hotels.

Intelligent ecosystems

Intelligent ecosystems gather, synthesize and apply information to change the way entire industries and populations operate. *Smart water* is achieved by applying monitoring and management technologies – using predictive analytics for water management. *Smart traffic* uses realtime traffic prediction and dynamic tolling to reduce congestion and its by-products while positively influencing related systems. *Smart energy* monitors usage from the source through the grid to the end user – analyzing customer usage and optimizing the network.

Smart water

Water flows through everything – air, land, our bodies *and* the global economy. We use water to process raw materials, manufacture products, generate electricity, and transport people and goods. Every time we interact with water, we change its direction, chemistry, usefulness or availability, and contribute to rampant waste.

As an increasingly scarce resource with no substitutes in a complex regulatory environment, water is a growing source of brand, operational and geopolitical risk. Water management has traditionally been hampered by information that is hard to access, fragmented and inconsistent. At the same time, understanding, measuring and managing the total cost of water is essential to understanding the relationship of water, energy and carbon management.

Today's technologies can monitor, measure and analyze entire water ecosystems – from rivers and reservoirs to the pumps and pipes in our homes. This level of intelligence can provide governments, businesses, communities and nations that are dependent on a continuing supply of fresh water with a realtime, reliable flow of information as they work to manage water conservation, water efficiency, new water technologies, new legislation and workforce challenges.

SMART IS
Lowering congestion and carbon emissions by influencing traffic patterns on a city scale.

Stockholm, Sweden: Implemented an intelligent toll system that uses cameras, sensors and central servers to identify vehicles and charge drivers based on when and where they drive—cutting traffic by 20 percent and emissions by 12 percent.

SMART IS
Knowing exactly where a power outage occurs and instantly dispatching a crew to fix the problem.

DONG Energy: Installed remote monitoring and control devices to gain an unprecedented level of information about the current state of the grid, lessening outage times by a potential 25-50 percent.

SMART IS
Using first-of-a-kind electric and gas metering to reduce "meter-to-cash" costs by 50 percent.

Oxxio Metering: Utilizes a unique wireless data communication module that gathers data from "smart" meters and sends it directly to a central control facility. Oxxio also implemented a first-of-a-kind solution that integrates electric and gas metering data, and allows customers to monitor their electricity and gas consumption.

Smart traffic
Cities everywhere are facing more demands for sufficient infrastructures – and finding it harder to cope. In the United States alone, as the population grew nearly 20 percent between 1982 and 2001, traffic jumped 236 percent.[14] Quite simply, our transportation infrastructure and management approaches can't handle the world's traffic.

While building new roads and new lanes often isn't possible, building intelligence into the roads and the cars – with the instrumentation of roadside sensors, radio frequency tags and global positioning systems – certainly is. By infusing intelligence into its transportation system, a city's streets, bridges, intersections, signs, signals and tolls can be interconnected and made smarter. Smart toll systems, predictive flow congestion management and traffic speed monitoring can help reduce congestion, shrink fuel use and cut carbon emissions by impressive percentages.

Smart energy
The structure of today's electric grids reflects a time when energy was cheap, environmental impact wasn't a priority, and consumers weren't even part of the equation. Yet more than half the energy generated today never reaches a single light bulb, and with little or no intelligence to balance or monitor power flows, enough electricity is lost annually to power India, Germany and Canada for an entire year.[15]

Smart organizations can achieve true sustainability and tangible business benefits.

Many utilities are now adding a layer of digital intelligence to their grids – creating intelligent utility systems that actually look a lot more like the Internet than a traditional grid. These smart grids use sensors, meters, digital controls and analytic tools to automate, monitor and control the two-way flow of energy across operations – from power plant to plug. A power company can optimize grid performance, prevent outages, restore outages faster and allow consumers to manage energy usage right down to the individual networked appliance. Based upon consumer usage patterns, peaks and valleys can be smoothed by offering consumers alternative pricing schemes – hence altering consumer behavior. "Smart" grids can also incorporate new sustainable energies such as wind and solar generation, and interact locally with distributed power sources or plug-in electric vehicles. All of this instrumentation generates new data that advanced analytics can turn into insight so that better decisions can be made in realtime

Conclusion

The world will continue to become smaller, flatter and soon … smarter. We are moving into the age of a globally integrated and intelligent economy, society and planet. We have only just begun to uncover what is possible on a smarter planet. But by systematically managing water and energy use, as well as greenhouse gas emissions, smart organizations can realize true sustainability while achieving real business benefits – driving growth at the individual, organizational and population levels. We must all work together to drive real progress in our world – to become green and beyond.

About the authors

Karen Butner serves as the global supply chain management leader for the IBM Institute for Business Value. In this role, she is responsible for research and thought leadership surrounding global strategies and market insights, including issues such as sustainability. Karen is the architect and author of the *IBM Global Chief Supply Chain Officer Study: The Smarter Supply Chain of the Future*, and also served as an author and editor-in-chief for *Reshaping Supply Chain Management: Vision and Realty*, a book published in 2006. In addition, she is frequently invited to speak at national and international venues, and is widely quoted in leading business and industry publications. With over 25 years of experience, her concentration has been to assist clients in the high technology, retail, consumer products, electronics, travel and transportation industries develop strategies and improvement agendas. Karen can be reached at *kbutner@us.ibm.com*.

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