GLOBAL GREEN CITIES
of the 21st Century

Shaping the Cities of Tomorrow

Key Findings from the Global Green Cities of the 21st Century International Symposium

A Bay Area Council Economic Institute Report
September 2012

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of the 21st Century

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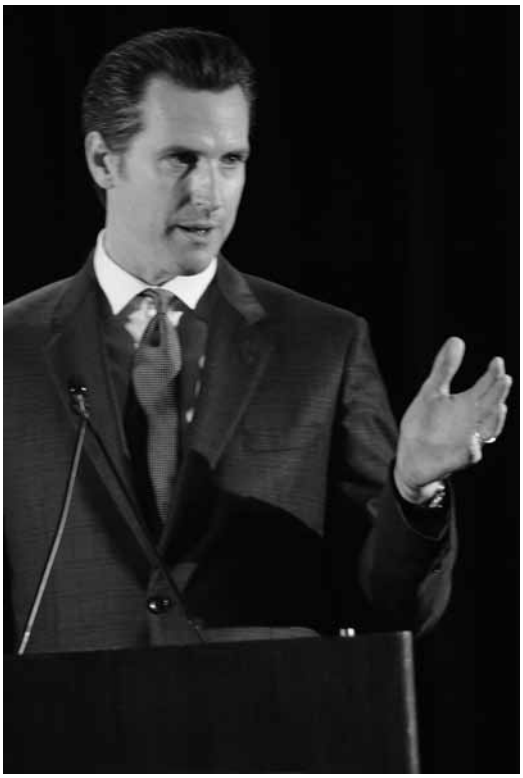
Foreword

From February 23–25, 2011, two hundred experts and global leaders met in San Francisco for the Global Green Cities of the 21st Century International Symposium, to discuss the state of the art in green city design and sustainable urbanization. Participants included mayors, international organizations and research institutes, scholars, architects and urban planners, developers, technologists and investors. Cities from North America, Europe and Asia were represented, including cities with developed infrastructure and slow growth, and rapidly-growing megacities. Through a series of plenary and breakout exchanges, some using Cisco's TelePresence technology to engage global leaders virtually, the assembly explored challenges, needs and opportunities that point to shared experience and best practice in developing vibrant, sustainable urban centers.

The symposium was developed by the Bay Area Council Economic Institute, with support from Deutsche Bank's Alfred Heerhausen Society, LSE Cities (the London School of Economics), Cisco Systems, and a wide range of corporate and institutional partners.

This report captures the spirit of the discussion and its conclusions. It is deliberately brief, focusing on the big ideas and points of agreement as well as, in some cases, divergence. For more information and key documents on the strategies and elements that together can produce more energy-efficient liveable cities, and for information on related events on green cities and sustainable urbanization organized by Bay Area Council Economic Institute partners, please visit the Global Green Cities website at www.globalgreencities.com.



Gavin Newsom

Ed Lee

Chuck Reed

Wim Elfrink

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Welcome Remarks Summary

Why Green Cities?

Sean Randolph, President & CEO, Bay Area Council Economic Institute

Sean Randolph set the stage for the symposium by noting that cities are where the world's business, financial and human capital are focused. Cities are the primary source of growth and innovation and are also where the world's population is increasingly concentrated. They are also the leading consumers of energy and the primary source of greenhouse gasses. With cities throughout the world continuing to grow, and as many as 300 million people migrating to cities in both China and India in the coming decades, how metropolitan areas manage growth has profound economic and social implications. The challenges in the expanding megacities of emerging economies and in the more mature urban centers of the United States and Europe may be different, but shared experience points to best practices and technologies that will define our future economy and quality of life. The participants in the exchange that follows include some of the best thinkers on this subject and represent cities that are leaders in the field. Together they are helping to shape the strategies that will create the global green cities of the 21st century.

Green Mall, South Axis, Guangzhou, China / Heller Manus Architects

Welcome Keynote Summary

San Francisco: Prioritizing Sustainability

Ed Lee, Mayor of San Francisco

San Francisco Mayor Ed Lee introduced the diverse initiatives that make San Francisco the greenest city in the United States, and stated his goal of making San Francisco a global leader in sustainability as well.

How does San Francisco do it? Lee stressed the importance of **changing the city's transportation fleet to electric vehicles**. It is important to ensure that consumers feel comfortable with transitioning to electric vehicles (EVs). A critical step, Lee explained, is to rapidly provide the necessary charging infrastructure in homes, businesses, and public facilities. By 2013, San Francisco plans to have a fleet of EV taxis that operate on battery switching technology developed by Better Place. Lee stated that "very shortly, you will be able to go from San Francisco to San Jose in a 100% battery-switched yellow taxi."

Another core San Francisco program focuses on **retrofitting existing buildings** for energy efficiency. The city aims to significantly improve its carbon emissions by transforming its existing building stock. This requires cooperation from the private sector. Working with building owners and property managers, the city created an ordinance encouraging commercial buildings to report and benchmark their energy use. Lee restated his ambition to place San Francisco at the international vanguard in sustainability by announcing the goal of making the entire city 100% renewable-energy-fueled for both the private and municipal sectors, concluding that "if the City and County of San Francisco can do it, every city in the world can learn from us."

"…all of the electric power that is used in the city, municipal and private, will come from 100% renewable energy by 2020."
– Mayor Ed Lee

"Sometimes we get it right…sometimes we get it gloriously wrong. But we are committed."
– Lt. Governor Gavin Newsom

Key Points

- With national governments around the world hesitant to take the necessary steps to combat climate change, it is up to cities and their leaders to take the initiative.
- San Francisco set a blueprint to deliver on its promises, using an objective third party climate registry to measure greenhouse gas emissions and ensure transparency, and collaborating with the private sector to ensure the city's full commitment.
- By focusing on building operations and design retrofits, mayors should view the green transition as an opportunity for job creation in a new economy.

Welcome Keynote Summary

How San Francisco Became a Sustainability Leader

Gavin Newsom, Former Mayor of San Francisco, Lieutenant Governor of California

California Lieutenant Governor and former Mayor of San Francisco Gavin Newsom outlined the city's experience and ambitious vision in the period when he led San Francisco to its current prominence in sustainable growth.

Newsom emphasized the need for cooperation between government and business to achieve ambitious goals. Business in San Francisco supported the vision. Politically, Newsom also had to overcome the doubts of both Republicans and Democrats, who didn't believe it was possible to dramatically change the way that energy is produced and consumed, or to both reduce greenhouse gas emissions and grow the economy. A participant with 120 international mayors in signing the Urban Environmental Accords in 2005, the lieutenant governor expressed his vision that **cities should pave the way for sustainability ahead of national governments, through exemplary action and by setting audacious goals**. San Francisco is now on track to meet its commitment to sharply reduce its carbon emission levels.

Making San Francisco a leader in the nation was achieved through "**the sum total of lots of small ideas**," with a wide variety of initiatives such as: grease recycling, transforming the municipal fleet to alternative energy, providing accessible electric car infrastructure, limiting the use of plastic bags, and targeting all new commercial construction to achieve a LEED Gold certification. The former mayor pointed out that building retrofits not only greatly reduce carbon emissions but also were a strong source of job creation.

Lieutenant Governor Newsom noted that the acceptance of increased regulation was linked to a focus on the economic benefits from sustainable retrofits. With the green sector outperforming all others in California during the recession, he cited the example of investing in the green and clean-tech sectors: **For every billion dollars spent, the coal sector created 890 jobs while investments in retrofitting existing buildings created 7,000 jobs**.

View down Columbus Avenue, San Francisco

Conference Keynote Summary

Technology Enables Positive Change

Wim Elfrink, Executive Vice President & Chief Globalization Officer, Cisco Systems

While the extent of its influence remains debated, there is a consensus that technology serves as an important catalyst for change. This idea is exemplified by Cisco's focus on sustainability through connectivity.

Wim Elfrink, executive vice president of Cisco, began by explaining the demographic shifts the world is undergoing. With an increasing global population and migration towards urban centers, cities are becoming powerful engines for economic growth. Some cities and regions have a shrinking, aging population while others need to plan for a growing, young work force. Some cities have established infrastructure that will require revitalizing, while others are building completely new infrastructure and need progressive planning. With each unique context, Elfrink noted, "new business models and economic cycles will emerge."

Calling for innovative thinking, he illustrated how he believed the goal of sustainability can be achieved:

1. Urban planning and development must focus on sustainability. This requires visionary leaders, open global standards, smart regulation, public-private partnerships, and new ecosystems of business opportunities. Leaders must expand their views to embrace the new challenge.
2. Technology can link everything together to improve efficiency and reduce costs. The innovative implementation of new discoveries can enable all sectors, including transportation, construction, communication, and energy, to reduce carbon emissions.
3. Awareness of the efforts being made by government and industry can strengthen public opinion and behavior, while leaders can replicate successful tactics.

Technology can support these processes through connectivity. Linking technologies can enable shrinking populations to be more productive, connect rural areas for affordable virtual education and healthcare, shape the next economy through new services and jobs, and serve the environment by saving carbon emissions through reduced travels and improved energy efficiency.

> "Sustainability is economic, social, and environmental."
> – Wim Elfrink

Key Points

- As more people migrate to urban centers, the global role of cities will increase.
- Business models and economic cycles will be specific to their environments, and cities must develop their own unique paths.
- Connectivity can enable productivity, create new services, and help the environment.
- There is a need for visionary leadership, global standards, smart regulation, public-private partnerships, and new ecosystems.
- Visibility, of both the efforts being made and the results achieved, is important to the public's understanding of what works and the ability of communities to pursue shared goals.

Summary of Conversation with Global Leaders

Asian Perspectives on Urban Development

***Moderator*: Wim Elfrink,** Executive Vice President & Chief Globalization Officer, Cisco Systems
Khoo Teng Chye, Executive Director, Centre for Liveable Cities (Singapore)
Young-Gil Song, Mayor of Incheon, South Korea
Rajeev Chandrasekhar, Member of Parliament, Karnataka State and Bangalore Urban District, India
Amitabh Kant, CEO, Delhi-Mumbai Industrial Corridor Corp., India

As representatives of the most rapidly developing economies of the world discussed their challenges, their themes often related to infrastructure and institutional capability. Compared to western counterparts, the large-scale changes underway in Asia offer the opportunity for innovation with the potential to leapfrog past mistakes.

Despite their shared growth and prosperity, Asian cities also have many differences. New cities, such as Korea's Songdo (close to Incheon), look to build high-tech business hubs from the ground up, while India's Bangalore is challenged just to provide basic infrastructure and services as its population grows. Singapore, on the other hand, has already completed the successful build-out of much of its urban infrastructure.

Drawing lessons from experience across the globe, these booming economies are each looking to address urbanization and sustainability in their own, uniquely adapted ways.

Incheon, Korea

The mayor of Incheon, Young-Gil Song, explained Incheon's ambitious goal of creating one of the world's smartest cities and molding it into a new metropolitan hub for the rapidly growing north-eastern region of Asia. The new city of **Songdo, on the edge of Incheon, has a strategy focused on communication, with the goal of having all of its parts connected through information technology**. Through connected communities, the mayor believes the city can reduce emissions while improving residents' quality of life.

Bangalore, India

Rajeev Chandrasekhar focused on Bangalore's inadequate urban planning and infrastructure. As the city has rapidly grown, it has been unable to maintain proper services for its increasing population. Looking to resolve this problem, he explained the city's Urban Development Portfolio and his ambition to improve the city's institutions and infrastructure. A key to success, he underlined, is the significant role of public-private partnerships in creating public services: Sustainability must be part of these new strategies, but **the immediate challenge is to meet even basic infrastructure needs**.

Singapore

Singapore is home to more than five million people, while boasting 55% greenery and the distinction of being one of the most liveable cities in Asia. Khoo Teng Chye used clean water as an example of how to balance dynamic growth with a green environment and a high quality of life. He stressed the importance of diversifying water resources and investing early in good governance and technologies. Now **a hub for water knowledge and solutions**, Singapore has also established a policy-oriented knowledge center, the Center for Liveable Cities (CLC), to distill and share Singapore's expertise on sustainable urban development. CLC's third edition of its flagship global conference, the World Cities Summit in Singapore from July 1–4, 2012, was a gathering of government leaders and industry experts to address liveable and sustainable city challenges, share integrated urban solutions, and forge partnerships.

Delhi-Mumbai Industrial Corridor, India

Providing another example of issues specific to India, Amitabh Kant highlighted the nation's efforts to engage in very-large-scale urban planning. The urban corridor being developed between Dehli and Mumbai will be designed to provide cities with efficient and sustainable transportation. Highlighting the need for integrated planning, Kant explained that "India is at a point where it can absorb good technology from across the world as it drives to create new cities." Suggesting the immensity of this effort, **the Corridor is planning the development of 24 new industrial and residential cities, built on sustainable principles, along a 1,483-kilometer, high-speed, freight-rail backbone**. Kant's perspective aligned closely with Rajeev Chandrasekhar's statement that India needs strong master planning to guide its urban growth.

Bangalore shopping street, 2005

Morning Keynote Summary

San Jose: A Call for Collaboration

Chuck Reed, Mayor of San Jose

As nations recognize the need for global sustainability, technologies in green and clean industries have seen tremendous growth. As mayor of a world-renowned technology hub, Chuck Reed explained San Jose's "Green Vision" plan and its objective to spur job growth by supporting the cleantech sector. The strategy, he noted, requires a series of close relationships with the private sector.

To leverage the government's role in the market, cities must transform their procurement processes. San Jose thus began "demonstrative partnerships" to help new cleantech companies overcome the infamous "Valley of Death." More than simply recruiting young companies for city projects, these partnerships let the city and companies work together to design and deliver the project they want without the usual bureaucratic restrictions of the procurement process. Partnerships for San Jose's smart streetlights and electric car infrastructure proved that such cooperation can not only contribute to employment and sustainability, but can also support new companies with innovative technologies.

Mayor Reed went on to stress that these demonstrative partnerships must be combined with collaboration at the regional, state, and federal levels to help bring down bureaucratic barriers and harmonize differing administrative requirements. For companies, these bureaucratic procedures can increase the cost of implementation and installation, hindering the deployment of innovative technologies. Cities have the ability to control how long it takes for inspections, permits, and regulations, and they need to make their rules more uniform. Residential solar is a good example. Cities also need to "**work at the speed of business**." If they do, they can both create jobs and increase tax revenues.

An example of a project to green the city is San Jose's plan to install 62,000 **smart streetlights** that not only use energy-saving LEDs, but have motion and chemical sensors and are dimmable, programmable, networkable, and controllable from a central facility.

"We are helping cleantech companies help us to develop the specifications for a product that we hope to buy and they hope to sell."
– Mayor Chuck Reed

Key Points

- To help create jobs and revenues, a city should look for ways to help its cleantech industry grow.
- Bureaucracy has been a serious obstacle for companies, and if they want to help their cleantech companies grow, cities must "work at the speed of business."

Summary of Conversation with Global Leaders

Perspectives from Europe and North America

***Moderator*: Anil Menon**, President of Globalisation and Smart+Connected Cities, Cisco
Konrad Otto-Zimmermann, Secretary General, ICLEI–Local Governments for Sustainability, and Chair, World Economic Forum's Global Agenda Council on Urbanization
Naheed Nenshi, Mayor of Calgary
Jean-Louis Missika, Deputy Mayor of Paris
Isabel Dedring, Environment Adviser to the Mayor of London
Uli Hellweg, Managing Director, IBA Hamburg GmbH
Steve Lewis, CEO, Living PlanIT

In the conversation with mayors from Europe and North America, there was a consensus on the need to achieve sustainability in all of its forms: social, economic, and environmental. However, as each presenter spoke of unique challenges, it became clear that **every city needs to adapt technologies and ideas to its own social, geographic, and economic circumstances**. The speakers agreed that governments must work with the private sector to bring the bureaucratic process up to market speeds and provide favorable environments for innovation.

While cities have their distinct challenges, such as Calgary's paradoxical availability of space and London's divided boroughs, differing approaches can contribute to the resolution of common problems. This can be seen in Paris and London, with their respective approaches to electric vehicles and public cars.

London electric vehicle parking zone

ICLEI–Five Focus Points for All Cities

To achieve sustainable ecosystems in the world's cities, leaders will need to revolutionize existing governance and encourage a green economy. Explaining the impending challenges that leaders around the world must plan for, Konrad Otto-Zimmermann identified five points all cities should focus on:

1. Transforming urban systems toward maximum eco-efficiency.
2. Planning for resilient long-term infrastructure.
3. Transforming the economy to a green focus.
4. Striving for health and happiness.
5. Creating improved methods of governance.

Otto-Zimmermann acknowledged that different parts of the world will require different kinds of transformations. While some may need to transform their existing infrastructure to improve efficiency, others that are experiencing rapid urbanization and population growth should plan and build smart, intelligent systems to the highest possible standards in order to prepare for the future.

"In the next 40 years, we have to build the same urban capacity that we as humans have built over the last 4,000 years."
– Konrad Otto-Zimmermann

Calgary–Dealing with Too Much Space

As mayor of Calgary, Naheed Nenshi faces the paradox of having too much space. With an abundance of geographical space to grow, sprawl has historically been the city's main growth strategy. The need for sustainability now requires Calgary to change its perspective on how it uses space and governs for growth. The mayor laid out three solutions:

1. **Density can provide the most efficient way for citizens to share land, air, and water.**
2. Diversity must be encouraged to stimulate innovation.
3. A sense of discovery is needed for communities to experiment with new ideas and innovation.

Agreeing with Konrad Otto-Zimmermann on the need for improved governance, Nenshi explained that **municipalities needed to shift from their traditional role as "regulators" to a role of "facilitators."**

"Thoughtful planning requires making sure the right regulation and governance mechanisms are there in order for the market do its work."
– Mayor Naheed Nenshi

Paris–Collaborating for Innovation

Using the city's "Plan Climat" as an example, Deputy Mayor Jean-Louis Missika stressed the importance of communication and collaboration in spurring innovation. Dubbing these coordinated efforts "**Living Labs**," Paris is trying to help innovative companies prove their concepts by demonstrating them in the city. The installation of solar panels on new buildings is being encouraged, and a "sustainable cities institute" is stimulating dialogue between researchers, city planners and politicians.

Innovative efforts include building retrofits, **public bicycle stations** throughout the city, and the city's **electric car sharing program**, designed to reduce the necessity of car ownership; 2,000 electric cars will be available for pick-up and drop-off at rental stands throughout Paris and will be shared by 50 cities in the Île-de-France region. Mayor Missika noted that innovation must come from an inspired dialogue between researchers, city planners, and politicians.

"For us, the city of the future is a city where the people are using transportation services and not their own cars. The system we are designing will change the way transport is used."
– Deputy Mayor Jean-Louis Missika

London–Leveraging Public-Private Partnerships

In the symposium's spirit of amicable inter-city competitiveness, Isabel Dedring asserted London's determination to become the largest green city in the world. The city understands the importance of **public-private cooperation** and continuously searches for ways to engage its people, municipal boroughs, and businesses.

Despite daunting challenges of governance in a city with 33 boroughs and unstable funding, successive London mayors have worked toward a greener future. Dedring described the political balancing in play through programs using innovative municipal funding that are aimed at engaging both residents and businesses. She emphasized that in looking for new and imaginative ways to partner with the private sector, it is important to create "not just the technologies, but also the financing and governance arrangements" that will enable collaborations among parties across the spectrum.

Like Paris, London is particularly focusing on **building retrofits and transportation infrastructure**. The city currently has 300 electric vehicle charge points, which will quadruple in the next 12–18 months, with a swipe-card system and a single back office. London's existing congestion charging offers a 100% discount for electric vehicles, which is helping to drive sales.

Hamburg–Making the Most of What Is Already Built

Speaking from Hamburg, Uli Hellweg noted that most of the city's housing and commercial infrastructure has already been built—unlike cities in rapidly developing parts of Asia. The city must therefore focus on tapping into the potential of its existing building stock through retrofits and by creating new sources of decentralized, locally-based energy. He explained that the government cannot concentrate the burden of retrofits on private owners, but must instead create sophisticated strategies to:

1. Subsidize tenants to increase the efficiency of houses.
2. Decentralize energy plants towards locally-based energy supplies.

Maximizing locally-generated, on-site power will let people see immediate benefits and profit in the long term. By forming an integrated bottom-up strategy which complements the top-down efforts of national governments, municipalities can effectively engage their own people. Ultimately, it is crucial to develop modern, locally-based solutions that allow everybody to help in the transition to green cities.

Vancouver and Portugal–The Opportunity for Green Construction

While productivity in the services sector has increased 200% in the past 20 years, productivity in construction has stagnated. This is in part due to a lack of effort in both the private and public sectors to think through the complex challenges of improving construction efficiency. New efficient buildings and construction methods require innovation in materials, electronics, and manufacturing. Speaking from London, Living PlanIT's CEO Steve Lewis saw the need for sustainable infrastructure as an opportunity to advance the field. Following work with the Vancouver Olympics, his latest project is in Portugal.

Technologies and processes must be integrated to make construction faster, cheaper and more sustainable; **state-of-the-art systems can help buildings run at lower costs both economically and environmentally**. To achieve this, innovation must be fully supported by local and national governments. Lewis stressed that governments must move at the speed of the markets, while also providing accountability through urban economic, social, environmental, and institutional indicators.

Electricity pylons and wind generators east of Hamburg

Three Pillars for Change

Breakout Exchange: Forum A

Design: Liveable, Compact, Transit-Oriented Cities

***Chair*: Philipp Rode, Executive Director**, LSE Cities, London School of Economics
Henk Ovink, Director of National Spatial Planning, Netherlands Ministry of Infrastructure and the Environment
Helle Lis Søholt, Partner & CEO, Gehl Architects (Copenhagen)
John Kriken, Consulting Partner, SOM (San Francisco)
Siegfried Zhiqiang Wu, Dean, College of Architecture and Planning, Tongji University (Shanghai)
Ranbir Saran Das, Managing Director, Fairwood Consultants Pvt. Ltd. (New Delhi)
***Commentator*: Michel St. Pierre**, Director of Planning and Urban Design, Gensler (San Francisco)
***Commentator*: David Nieh**, General Manager, Shui-On Land (Shanghai)

Design encompasses a wide array of sectors and industries. For cities, it can be defined as the "creation or manipulation of physical form across scales and sectors." The panelists reflected on their diverse experiences, focusing on the conditions that can trigger transformative new strategies.

Mobility provided the first example of a necessary paradigm change in design. Demanding a shift in the urban focus from cars towards people, Helle Søholt focused on **walkability**. Using Copenhagen as an example, she pointed out not only the health, social, and economic benefits of a city focused on pedestrians, but also the benefits of a cultural shift to pleasant and welcoming walking environments.

Good design should not only provide the sustainable and economic benefits of dense city building, but should also provide cities with appropriate open space, sunlight and social hearts. John Kriken and David Nieh demonstrated this idea through their many projects in China. **By conserving a city's natural features, together with careful attention to the public realm and the spaces between buildings, urban design can provide a unique sense of identity, diversity and vibrant livability.**

The challenges of China's dramatic urbanization remained a theme as Siegfried Wu described how **China used the 2010 Shanghai World Expo to demonstrate sustainable city design practices** which are now being carried forward in eight pilot projects in northern and southern China, as well as in Shanghai. "The Expo was an experiment in the future city."

Noticing a pattern in the factors behind paradigm shifts, the speakers agreed that crisis was often an important catalyst for change. Whether it was scarce land and water in China, rapidly growing population in India, or suffocating traffic density in Denmark, each region had growing concerns prior to a change of direction in design. Henk Ovink explained that Holland's geographical positioning as a low-lying country on a complex delta in northwest Europe confronts its strategies for development, growth and quality of life with the threat of floods and impending sea leve rise; this historic challenge has also been an opportunity, by serving as a stimulus for new design paradigms. Ranbir Das argued that as the world prepares for a variety of new crises, **developing nations can leapfrog to new design paradigms**. This is being being demonstrated in designs for GIFT, a new smart city in India's state of Gujarat.

"Space between buildings is more paramount to the success of cities than the buildings themselves."
– David Nieh

Key Points

- Urban design should focus on people and on the space in between buildings
- Improved walkability brings health, social, and quality-of-life benefits.
- Crisis and the sense of urgency are proven catalysts for design paradigm transformations.
- Events such as Expos can catalyze change; developing countries can leapfrog.
- Sustainability must be seen as a co-benefit of economic and social advances in design.

Historic buildings and open space create a unique sense of place in Xintiandi, Shanghai / SOM

Breakout Exchange: Forum B

Technology: Digital, Efficient and Low-Carbon Urban Systems

***Chair*: Matthew Le Merle**, Partner, Booz & Company
Kevin Surace, CEO, Serious Materials
David Helliwell, CEO, Pulse Energy
Kent Larson, Director, Smart Cities/Changing Places Research Group, MIT Media Lab
David Baum, Vice-President, Philips Roadway Lighting
Scott Barnette, Vice President for Corporate Business Development, North America, Hitachi
Chris Andrews, Lead product Manager, Infrastructure Conceptual Design, Autodesk
***Commentator*: Sven Beiker**, Director, Center for Automotive Research, Stanford

As the focus has grown on transforming cities into green and sustainable environments, technology is being asked to play an increasingly important role. Matthew Le Merle noted that we are entering a new phase in which previously unproven technologies have been tested in the field, so the question has shifted from "Are there technologies that can make a difference?" to "Which technologies are appropriate from the many that are being suggested?" The panelists discussed

developments in their respective fields and how technological innovation can help meet sustainability goals.

Speakers stressed that **energy efficiency is critical**. With large amounts of energy consumed by transportation and buildings, there is a large abatement potential embedded in much of today's outdated structures. **Building materials** can make an enormous difference. Kevin Surace cited the work that Serious Materials is doing on the Empire State Building: replacing the building's 26,000 windows with new windows designed to reduce heat loss will save 50,000 tons of CO_2 and $410,000 in annual costs over their lifetime. Good energy management will achieve a further 10–15% reduction in overall energy consumption.

David Helliwell agreed that **in-depth analytics of a building's energy consumption can bring energy intelligence to both new and existing structures**. Software now available can point to quick and easy energy-saving measures, as well as investments that can lead to long-term improvements. Kent Larson pointed to the potential gains from technologies such as **sensors,** which can monitor a building's environment and turn off systems that aren't in use, reducing energy consumption by as much as 40% without significantly impacting people's lives.

David Baum pointed to potential energy savings in **lighting**. Eighty percent of today's buildings use out-of-date lighting technologies and only 1% have lighting control systems. Installing LED lights and adding controls can increase energy efficiency by 60–70%.

Decision-making can be a complex challenge for policymakers and city planners, who are often unsure about which of the many investment options they're presented is the right one. **Because technology evolves and becomes outdated, it is important to have good master planning with open standards, backwards compatibility and upgradeability**.

Holistic, "**systems thinking**" is important to allow investments in different technologies to work together. Scott Barnette said this kind of thinking is central to Hitachi's work on the master plan for Tianjin EcoCity in China, and to work on the Delhi-Mumbai Industrial Corridor, which will require four new power plants, three seaports, and six new airports. Chris Andrews cited conceptual **urban design tools** being developed by Autodesk that provide information on the environmental impact of proposed infrastructure, city and structural designs.

The group recognized that while technologies provide potential solutions, human behavior ultimately decides whether people engage with an innovation. Accordingly, information and communication are crucial in demonstrating the economic benefits of sustainable investments. From this perspective, it may be better to focus on saving money than on climate change, which has become politicized. Sustainability and efficiency go hand in hand, and the economic benefits of investments in sustainability are often understated.

While the lower price of fossil energy can slow the progress of sustainable technology adoption, the panel agreed that public policy can influence and support the market through incentives, mandates, and help with up-front costs.

Key Points

- Building efficiency presents major near-term opportunities.
- Good master planning—with open standards, backwards compatibility and upgradeability—is important.

Redevelopment plan for Huangpu Riverfront in Shanghai, including public access, open space and protection from sea level rise / SOM

Breakout Exchange: Forum C

Behavior: Greener Living, Better Lifestyles

***Chair*: Dimitri Zenghelis**, Visiting Fellow, Grantham Institute for Climate Change and the Environment, London School of Economics, and Senior Adviser to Cisco
Yvon Le Roux, Vice President, Smart+Connected Communities, Global Public Sector, Cisco
James Sweeney, Director, Precourt Energy Efficiency Center, Stanford
Conrad Wagner, Senior Lecturer in Mobility Studies, Lucerne University
Steve Lewis, CEO, Living PlanIT
***Commentator*: Per Mielstrup**, Climate Director, Monday Morning (Copenhagen)
***Commentator*: Ezra Rapport**, Executive Director, Association of Bay Area Governments

Behavioral change stems from a cycle of processes that often begins with technological innovation. As Dimitri Zenghelis pointed out, one "cannot swap in an energy efficient light bulb if someone has not invented it yet." There is also a pattern linking technological innovation, policy intervention, and popular will. Recognizing these relationships, the session focused on how to catalyze behavioral change.

Technology can be a catalyst for behavioral change. Increased connectivity supports evolving attitudes towards more flexible workplaces. For

example, more people are engaging in collaborative work without having to physically be in the office. Similarly, the growing accessibility of car-sharing programs reflects technological advances that are inducing behavioral change in public transportation use.

However, without a crisis or a sense of urgency, innovations on their own may not fundamentally change people's lifestyles or perspectives. To do that, government regulation is often necessary. Consequently, the question arises, "To what extent can and should government intervene?"

Positive incentives such as economic opportunity, environmental health, improved lifestyles, and tax and regulatory policies such as carbon pricing and congestion charging, must all be on the table. Public-private partnerships were also underlined as invaluable methods for quickly scaling beneficial innovations.

In order to address the perceived threat of increased regulation on existing lifestyles, the speakers agreed on the importance of educating people about the positive benefits of a more sustainable lifestyle and a better environment. **Demonstration of successful initiatives can positively influence behavior**. As an example, James Sweeney described people's responsiveness to information about their neighbors' electricity use: when told that their neighbor is using less electricity than they are, they tend to reduce their own consumption.

The barriers to behavioral change are not just economic and technological, but cultural and infrastructural. Habits eventually embed themselves in the culture and create a self-sustaining equilibrium, which can be difficult to change. Using the example of programs to discourage smoking, Sweeney pointed to the enormous efforts by governments over several decades to change an established equilibrium.

Ultimately, the speakers agreed, **behavioral change requires a holistic approach**.

"Until you get a handle on why people are behaving as they do, it's tough to solve these problems."
– James Sweeney

"Cities, where global and national debates aren't barriers to action, are the perfect vehicle for innovation and will be the main platform for the green transformation."
– Per Meilstrup

"There is no sense of urgency, and there won't be until it is seen in prices."
– Ezra Rapport

Key Points

- Since changing an existing equilibrium is difficult, it is important for rapidly-developing parts of the world to lock into the right infrastructure as early as possible.
- Public information and education are essential to overcoming perceived threats to existing lifestyles.
- A holistic approach is necessary to guide markets towards sustainable outcomes.

Lunch Keynote Summary

The Metropolitan Agenda

Bruce Katz, Vice President and Director, Metropolitan Policy Program, Brookings Institution

Joining by TelePresence screen from Washington D.C., Bruce Katz focused on the steps the United States must take to keep its competitive edge in a rapidly changing world economy. Challenging the widely held view that the United States is run by "small town America," he stressed that **metropolitan areas will shape the next economy—an economy that will be powered by low carbon, fueled by innovation and driven by exports and opportunity.**

The United States must lead the world's low carbon revolution. As China, India, Brazil, and other nations urbanize at a frenetic pace, new cities and developing economies have an advantage in installing and integrating technologies. Over the next decade, **there is a potential $1.2 trillion market in smart city design, production, and integration.** Katz stresses that to compete with intelligent cities such as Tianjin, Songdo, Freiburg, and Hamburg, the U.S. must embrace innovation. How can the U.S. seize the future, be an innovative nation and make its cities smart? One answer lies in a new generation of investments to seamlessly connect firms and places within the nation to markets abroad. To avoid outsourcing the production of every idea produced at home, advanced manufacturing must also

W57 housing complex, West 57th Street, New York / BIG

be supported. To provide opportunity, people must be armed with the education and skills necessary to compete globally.

The problem remains not what to do, but how to do it. Katz outlined a "pragmatic playbook" for the next economy that could be followed even during a period of partisan polarization and fiscal stress. This strategy involves three essential steps:

1. Each American metropolis must exploit its distinct competitive edge in the global economy. Katz elaborated that "the next economy must accentuate what is unique about different metros and reward those that intentionally build from their special assets and strengthen their strengths." This step can be achieved through metro-wide business plans.
2. State resources must be aligned with metropolitan priorities. Existing government structures can be an impediment due to small, redundant, inward-looking jurisdictions: "fragmentation duplicates spending, and balkanization undermines global competitiveness." To grow the next economy, state government has to revisit how local government is organized and invest in new ways.
3. Finally, the federal government must squarely support a low carbon economy and metropolitan growth. Citing Los Angeles' 30/10 infrastructure initiative as an example of bottom-up federalism, Katz urged that this process be repeated across the country.

Despite fiscal and political turmoil, the next economy is attainable. Each metropolis requires a vision for federal, state, and philanthropic actions that focus transformative investments. In the urban age, cities and metros must be a distinctive voice in the global debate over jobs and trade, environment, energy, and poverty.

"Cities and metropolitan areas will use technology to manage urban congestion, maximize energy efficiency, enhance public security, allocate scarce resources based on real-time information, educate their citizenry and heal their sick."
– Bruce Katz

Key Points

- The world economy is moving towards low carbon and the United States must not fall behind.
- In order to compete, the nation must stimulate domestic invention and innovation.
- With most economic activity taking place in the country's metropolitan areas, policy change is needed at the local, state, and federal levels in order to advance the development of efficient, specialized metropolitan economies.

Songdo International Business District, South Korea / KPF

Summary of Joint Discussion of Perspectives from the Forums

Design, Technology and Behavior: Visioning the Future

***Chair*: Rohit Aggarwala**, Senior Policy Adviser, C40 Cities
***Chair, Forum A*: Philipp Rode**, Executive Director LSE Cities, London School of Economics
***Rapporteur, Forum A* : Jeffrey Heller**, President, Heller Manus Architects (San Francisco)
***Chair, Forum B*: Matthew Le Merle**, Partner, Booz & Company (San Francisco)
***Rapporteur, Forum B*: Anupam Yog**, Board Director, Mirabilis Advisory (New Delhi)
***Chair, Forum C*: Dimitri Zenghelis**, Visiting Fellow, Grantham Center for Climate Change and the Environment, London School of Economics, and Senior Adviser to Cisco
***Rapporteur, Forum C*: Per Meilstrup**, Climate Director, Monday Morning (Copenhagen)

Summarizing the discussions in their respective breakout exchange panels, the speakers tackled a variety of issues, finding common ground on key points.

They agreed that there is a new global understanding of the need for sustainability, but diverging views on how to attain it. Jeffrey Heller illustrated the imperative through an equation combining the main recurring issues: "**sustainability + livability + mobility = viability.**" As an example of divergent means, Matthew Le Merle noted the challenge technology poses for cities that must carefully choose from a vast array of competing options. However, the panelists also perceived a roadmap.

First, it was clear that different solutions have emerged not just because of different interests, but also because of disparate contexts. Each region has its own cultural context, and every city should therefore adopt the technologies most appropriate to its needs. Philipp Rode pointed to the drastically different needs in Hamburg, which

has already built 99% of its infrastructure, compared to cities in India, where only 10% of the demand for infrastructure has been met. This point recurred in discussions throughout the day: **every city must adapt according to its own social, economic, and environmental situation**.

The panel also emphasized early planning. Dimitri Zenghelis noted that **sustainability will be influenced by cities' ability to lock in the right infrastructure from the start**. Other speakers reinforced the point that the most efficient solution to the difficulty of retrofitting infrastructure is to "fix it in the beginning."

Cultural histories and politics often stand as obstacles to urban transformation. Zenghelis pointed out that "the barriers to efficiency investment tend not to be technological or economic, but are more institutional, political, or cultural." Cities that choose a certain development strategy can become locked into that infrastructure and a paralyzing self-sustaining equilibrium resistant to change. It is particularly important for cities in fast-growing parts of the world like China or India to lock in the right infrastructure early. Where infrastructure is more established, cities need to jump from one equilibrium to another.

Philipp Rode spoke to the influences which can shift an existing paradigm. There was a consensus that crisis and the sense of urgency can spur transformation in the prevailing equilibrium. The speakers also agreed that **there needs to be a stronger focus on the economic benefits of sustainable strategies**. Per Mielstrup pointed to the underestimated social and economic value of a city going green, stressing the "need to look at what jobs are being created, whether property values going up, and how quality of life is being impacted." Once identified, these benefits can be used to counterbalance the factors causing resistance to paradigm change.

The panelists concluded that technology cannot change the entire paradigm on its own. **It is a combination of technology with urban systems, adaptive planning, and economic motivation that will provide leaders with the ability to engage their communities to move closer to sustainability goals**.

"Environmental gains are co-benefits of an economic strategy."
– Philipp Rode

"Even though the issue is national and global, you can positively affect the quality of life and the quality of the environment on a city by city basis."
– Jeffrey Heller

"The goal is to reach a paradigm where green cities are not only a social and environmental imperative but are also a rigorous and profitable economic opportunity."
– Dimitri Zenghelis

Key Points

- Every city has its own context and must adopt its own strategies to achieve the common goal of a sustainable future.
- The key factor that often leads to a paradigm shift is crisis, or the sense of urgency caused by an impending crisis.
- It is important to focus on the economy, where environmental gains are co-benefits of broader economic strategies.
- Early planning is essential. Particularly in fast-growing parts of the world like China and India, cities must lock into the right infrastructure, while areas that are already developed will need to jump from one equilibrium to another.
- A simple template to assist cities to understand both the process by which to determine what technology to consider for local implementation, and the options that are available, would be a useful resource.

Afternoon Keynote Summary

Sustainable Hedonism—How Quality and Sustainability Can Work Together

Bjarke Ingels, Founding Partner, BIG – Bjarke Ingels Group

After the disappointing results of the COP15 conference in Copenhagen, Bjarke Ingels concluded that the discussion on sustainability needed to evolve from the mistaken belief that our quality of life must be sacrificed in order to achieve the goal of sustainability. Described as a "rock star" of international architectural design, he captured the attention of participants through an energetic presentation about his projects across the world and the philosophies that support them.

Quality of life and sustainability are not mutually exclusive. They can, in fact, be linked, and increasing sustainability can actually make life more enjoyable. This concept of "**hedonistic sustainability**" provides the basis for many of BIG's innovative designs. The Danish Pavilion BIG designed for the 2010 World Expo in Shanghai combined culture, sustainability, and pleasure. The pavilion presented the city of Copenhagen through its globally-recognized statue of the Little Mermaid and the city's clean harbor water. The structure's inclusion of an interactive, ramped bicycle course presented the Danish cycling culture. Its design enabled natural ventilation and cooling, demonstrating sustainable design adapted to Shanghai's humid summer climate. By creating a sustainable building that was at once cultural, engaging, interactive and green, BIG endeavored to show that sustainable architecture and design can produce a higher quality of life.

A second philosophy that Ingels termed "**architectural alchemy**" presented the idea of "creating added value by mixing traditional ingredients together in a way that optimizes possibilities." Participants were shown an apartment complex with "all the benefits of a suburban lifestyle like a house with a garden, but in a dense urban context, and with a penthouse view," together with a parking garage, green roof, rainwater irrigation and incorporated artwork. "There is a symbiotic effect as the facades of the offices become the handrails of the path, and the handrail of the path becomes the lighting, so that everything is integrated."

Other projects that were presented added dimension to the Ingels design concepts:

1. 8 House is a high-rise residential complex with "the diversity and liveliness of an historical city." Built on the idea of architectural alchemy, and fusing commercial with residential space, the project expands public space vertically, enhancing the opportunity for spontaneous social encounters that are normally restricted to the street level.
2. W57 is a high-rise housing complex on Manhattan's west side waterfront that combines urban density, views, and the social potential of a courtyard.
3. The proposed Loop City is defined by public transit, a smart grid and strategic

8 House residential complex, forming a figure eight around two courtyards including an outdoor bike path to the 10th floor, Southern Ørestad, Denmark / BIG

densification, connecting Eastern Denmark with southern Sweden to create a cross-border metropolitan region.

4. A waste-to-energy plant, incorporating esthetic design with natural ventilation, lighting, and irrigation, also provides a ski slope in winter and a visitor's center to educate people about pollution.

Calling on architects to evolve from designing "two-dimensional facades or 3D architectural objects," Ingels challenged them to become "designers of ecosystems" that address not just flows of people through cities and buildings, but also flows of energy. Returning to the theme of sustainable hedonism, he stressed the importance of moving past the antiquated views of sacrifice and abnegation for sustainability and turning the vision of the economically, environmentally and socially sustainable city into a pragmatic master plan for the future.

Key Points

- Architectural alchemy shows that value—if not gold—can be added by mixing traditional ingredients in new ways.
- Designers and planners should be creators of economically, environmentally, and socially-inclusive ecosystems.
- Sustainability does not have to come at the expense of quality of life.

Discussion Summary

Transportation as a Catalyst for New Urban Forms

***Moderator*: Greg Lindsay**, Contributing Editor, Fast Company
Tom Wright, Executive Director, Regional Plan Association (New York)
Tom Murcott, Executive Vice President and Chief Marketing Officer, Gale International, and Global Foreign Investment Officer, Songdo International Business District
Bjarke Ingels, Founder & Partner, BIG – Bjarke Ingels Group (Copenhagen)

As cities continue to grow and merge into large metropolises and megaregions, transportation plays an increasingly significant role in connecting people, places, and activities. The panelists agreed that in addition to improving quality of life by reducing commutes, **transportation can serve as a catalyst for new urban forms**.

Using high-speed rail in America's northeast corridor as an example, Tom Wright stressed that governments must move past sprawled investments to concentrate on strategic infrastructure that can maximize returns. The same methodology is being implemented by Incheon's government in planning the new business district of Songdo. Tom Murcott explained how the project's developer is creating a network with around-the-clock public transportation and a 15-minute commute to the international airport, or less than an hour to downtown Seoul. The system also consistently encourages human power with high quality pedestrian or bicycle paths.

Urban forms are affected by transportation nodes that converge people from a multitude of places. Greg Lindsay's book *Aerotropolis* focuses on the ability of airports to shape entire regions. The city of Songdo is an example of a project strategically designed around its airport, which is located 3.5 hours from a third of the world's population. Tom Wright cited another example of the "transit effect"—in New York every minute saved on the commute increases home values by almost $3,000—and pointed to the limitations of strategies that segment infrastructure investments with political boundaries.

All the panelists agreed that transportation's powerful influence as a social tool goes further than its infrastructural use. As shown by BIG's Loop City project for a transportation-linked zone straddling the strait between Denmark and Sweden, transportation can permit people, places, and cultures to connect, communicate, and achieve a higher potential: "The Loop City has made people in Denmark more aware that there is a highly educated population right across the water in Sweden that speaks practically the same language, and instead of going 8 hours to Stockholm, residents in Sweden realize they have another capital city on the other side of the water."

Key Points

- To be transformative, transportation must be built with a holistic view, layering in a variety of options, activities, and infrastructures.
- Because connectivity transforms urban localities, investments should also consider indirect and unplanned impacts.

Loop City plan for transportation and infrastructure connecting the cross-border region around Øresund Strait between Denmark and Sweden / BIG

"Transportation is a catalyst for new urban forms"
– Tom Wright

"Developers are always looking for catalysts which, by enabling change, can provide a competitive advantage."
– Tom Murcott

Discussion Summary

Enabling the Green City of the Future: Governance, Tools and Resources

***Chair*: Chris Luebkeman**, Principal, Foresight+Innovation Initiative, Arup
Nicky Gavron, Londonwide Assemblymember, Chair – Planning and Housing Committee, Greater London Authority, and Deputy Mayor of London, 2000–2008
Warren Karlenzig, President, Common Current
Stefan Denig, Head, Sustainable Cities Program, Siemens
Murat Armbruster, Senior Adviser, Carbon War Room
Ravi Viswanathan, General Partner, New Enterprise Associates

In the day's final discussion, speakers focused on how to implement the many ideas raised during the symposium. All agreed that cities and their partnerships with the private sector will play a crucial role in achieving global sustainability. Cities must also integrate sustainability planning and financial planning in their organizational structures and budgets. To do this, **cities have a growing array of tools**. In partnership with the United Nations, Common Current is helping to inform and guide mayors of future megacities on how to reach sustainability objectives. As an example, the recently published *Shanghai Manual: A Guide for Sustainable Development in the 21st Century* explains the need for planners to think in terms of life-cycle energy, including indicators such as land use, carbon, water, waste, and capital and operating costs.

City administrations by themselves have a relatively small impact on carbon emission reduction. Stefan Denig pointed out, using London as an example, that the city's direct actions have only a 3% impact on overall abatement potential, while citizens and companies account for approximately 75%. In addition to addressing public infrastructure, **cities need to guide their citizens and businesses in how to reduce their carbon footprints**.

Nicky Gavron stressed the need for collaboration between politicians and businesses. There needs to be a regulatory and statutory level playing field for engaging private industry, she said, citing The London Plan, where the government partnered with the private sector to provide an "integrated, economic, environmental, transport, and social infrastructure plan." The city's congestion charging policy, which has reduced center-city congestion by 70,000 vehicles per day, could not have been implemented without support from the business sector, which was losing $2 billion every year due to gridlock. Gavron also emphasized the potential value of national and global city networks in helping mayors move forward without having to wait for national governments.

Providing a private investor's perspective, Ravi Viswanathan explained how investors find and fund innovation, including cleantech. **Scaling innovative clean technologies is a challenge, and investors often need help from governments.** Describing a transportation investment involving electric vehicles, Viswanathan emphasized the importance of public-private partnerships, noting that "we wouldn't have been able to make that investment had it not been for massive support from the government."

Agreeing on the importance of collaboration between government and the private sector, Murat Armbruster focused on using businesses and markets to address climate change. For example, Carbon War Room had wondered why private

Bike-sharing station in Paris, 2008

capital isn't entering en masse into energy efficiency retrofit programs (despite the obvious abatement cost curve), and it looked for mechanisms to encourage those investments. One conclusion was that cities should provide some catalytic capital so that building owners can become comfortable with new, sustainable models. Doing this can shift risk in a way that helps the market to open and capital to come in.

Key Points

- Cities must network with each other and partner with businesses.
- Considering the overall abatement need, the impact of government action by itself is relatively limited compared to the potential impact of actions by citizens and businesses.

"National and global city partnerships, working with business partners, can help cities move forward with or without national governments."
– Nicky Gavron

"We're going to see a markedly different world, where cities bolster their role as the global hubs of economic, cultural and technological innovation."
– Warren Karlenzig

Closing Summary

Confronting the Demographics of Urban Growth

Stuart Brand, Co-founder, Global Business Network

In a closing discussion, Stuart Brand, creator of the *Whole Earth Catalog* and co-founder of Global Business Network, emphasized the need for sustainable cities, particularly in rapidly-developing economies. For most of the world's people, cities spell opportunity. Today one half of the world's population is urban, a number expected to grow to 61% by 2030 and 80% by mid-century. Of the world's 10 largest cities in 2015, only one (New York) will be in a developed country, and cities in emerging economies are growing three times faster than cities in more developed economies. With more cars and rising demand for electricity, they are moving quickly toward the energy consumption patterns similar to those in developed countries. If not addressed, this will drive emissions and climate change in the wrong direction. Society's future requires new energy options and better management of both built and natural infrastructure.

Traffic in Times Square, New York

Closing Summary

The Next American Dream

Peter Calthorpe, Principal, Calthorpe Associates

Consistent with Bjarke Ingels' positive vision for the potential of sustainable architectural design, Peter Calthorpe framed a positive vision for the benefits of sustainable urban design—a vision that reduces the carbon footprint while enabling more affordable and sustainable prosperity. If progress translates into a suburban lifestyle for all, or if India and China adopt our recent auto-oriented, low-density (or even high-density) development patterns, we're all in trouble. Climate change, energy and the economy should be addressed through the lens of lifestyles, communities and smart growth. Future environmental and economic costs will be a product of how we define what it means to be middle class.

Smart growth means community design that reduces auto dependence, increases housing choice, and creates walkable, mixed-use places. This concept subsumes three strategies: lifestyle, conservation and clean energy. All three approaches are essential, but lifestyle and conservation must come first, because they are the most cost effective and easily available tools. They also target the greatest source of greenhouse gas emissions: 53% of greenhouse gas emissions in the U.S. come from buildings and personal transportation; of the balance, 29% come from industry, 9% from freight and aircraft, and 9% from agriculture and other non-energy related activities.

A study prepared by Calthorpe Associates for the Vision California project (funded by the California High-Speed Rail Authority in partnership with California's Strategic Growth Council) compared a "Trend" future dominated by low-density suburban growth and very moderate conservation policies to a smart growth "Green Future" alternative that assumes 35% of growth coming from urban infill, 55% from more compact, walkable, mixed-use suburban expansion, and only 10% from standard low-density development. In that scenario, the land consumption required to accommodate new population growth through 2050 is reduced 67% from the Trend projection, and the number of vehicle miles traveled is reduced 38%.

The Green Future scenario also pushes vehicle fuel economy to a 54 mpg average. We still have cars, but they're more efficient and we use them less. Total annual greenhouse gas emissions from transportation and buildings drop from more than 274 million metric tons to 83. And more efficient and compact buildings use less energy and cost less to operate. The combined reduction in vehicle and residential energy and water costs saves the average California household $10,450 a year (measured in 2008 dollars).

What's not to like about such an urban future?

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