# Global Initiatives for Smart Urban Development

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*OVERVIEW: Hitachi is active in the fields of plant, information, and operation and maintenance services for essential services (including electricity, gas, and water), transport (including rail and road), and other social infrastructure. With the aim of participating in the construction of the next generation of environmentally conscious cities in Japan and around the world (smart urban development), Hitachi established a Smart City Business Management Division in April 2010 and a Water Environment Solutions Division in June 2010 to strengthen its activities aimed at meeting the current need for innovation in social infrastructure. There is a rising level of global activity in the area of demonstrations and other urban development projects such as eco-cities and Hitachi is participating in these in ways that include product development and increasing the added-value of its products by applying advanced technology in the field. In addition to facilitating innovation in social infrastructure, Hitachi is also working on feasibility studies in conjunction with government policy objectives in which it puts an emphasis on initiatives that take account of the individual circumstances of each city or community.*

## INTRODUCTION

THE provision of essential services, transport, and other aspects of urban infrastructure does not end with the construction of efficient and reliable infrastructure. Activities that are in harmony with urban plans and are aimed at objectives such as enhancing infrastructure operation and establishing systems that take account of city goals are growing in intensity around the world. There are growing expectations for smart urban development in which various different types of information are exchanged between service providers and users to provide feedback for improving services.

This article describes Hitachi's participation in feasibility studies and large-scale demonstrations projects relating to the provision of social infrastructure outside Japan and also its initiatives aimed at investigating new technologies for enhancing this infrastructure.

## TRENDS IN SOCIAL INFRASTRUCTURE INNOVATION

The way in which social infrastructure is provided varies widely and takes on different forms depending on the different systems and circumstances in each country.

A pressing issue for emerging economies is that they continue to experience a trend toward excessive concentration of economic activity and population in urban areas resulting in growing social and environmental costs and a deterioration in social efficiency. Accordingly, urban construction and the provision of infrastructure are proceeding in parallel to help achieve both economic progress and a low-carbon society.


*Fig. 1—DMIC Concept[1].*
*The DMIC (Delhi-Mumbai Industrial Corridor) extends approximately 1,500 km between Delhi and Mumbai and 300 km in the north-south direction.*

In developed economies, on the other hand, with low birth rates and aging populations, there is growing support for the “compact city” concept, a form of urban development that seeks to reduce social, environmental, and other costs while improving social efficiency and which focuses on things like supplying local energy demand with local production and locating residential areas close to employment. Currently, the redevelopment of social infrastructure in economically-developed cities is at the stage of running large-scale demonstrations of the core smart city technologies.

There is a need for social infrastructure innovation that is appropriate to each region and numerous countries are making political announcements regarding infrastructure investment in conjunction with economic policies.

## INITIATIVES FOR PROVISION OF ESSENTIAL SERVICES

The question of how to provide essential services such as water, electricity, and gas lies at the core of smart urban development. The following sections describe initiatives being taken by Hitachi in relation to the provision of essential services in various different places.

### Provision of Water Infrastructure in India

An urban development project is underway in India based on the DMIC (Delhi-Mumbai Industrial Corridor) concept[1]. The DMIC concept was agreed between the Minister of Commerce and Industry of India and the Japanese Minister of Economy, Trade and Industry in December 2006.

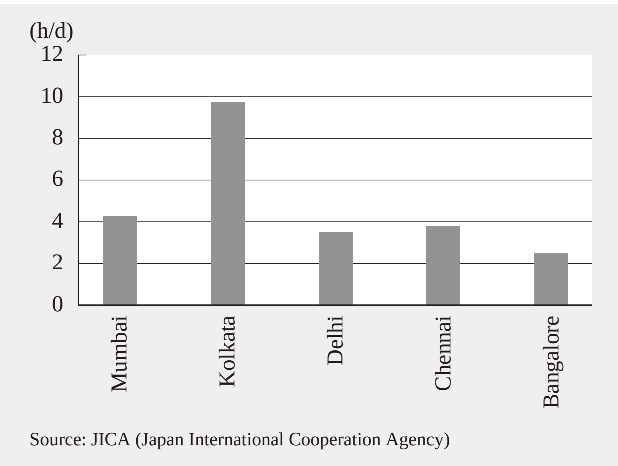


*Fig. 2—Average Length of Water Supply per Day in Major Indian Cities.*
*India’s major cities face water shortage problems.*

The DMIC concept is a broad-based infrastructure development that will link Delhi, India’s capital, and Mumbai, its largest city, via a high-speed and high-capacity freight railway link and involves the creation of industrial complexes, roads, ports, and other infrastructure along its length (see Fig. 1).

Hitachi is working in a consortium with other associated companies to investigate the creation of social infrastructure system packages and the proposal of smart solutions in areas such as transport, water treatment, and electricity supply for the industrial complexes[2].

This section describes a feasibility study for supplying water infrastructure.

**Survey of current status and investigation of plans for providing water infrastructure**

Because India continues to experience high rates of population and economic growth, it is anticipated that work on establishing water and other social infrastructure will be ongoing.

As a member of the Global Water Recycling and Reuse System Association, Japan, which seeks to apply Japanese technology to solve problems with water on a global level, Hitachi participated in a survey of the current status of water infrastructure in India carried out during 2010.

At 69% (in 2007), availability of tap water in India is low and because water supplies are often inadequate with frequent supply failures, the length of time water supplies are available is 10 hours or less per day even in major cities (see Fig. 2). While work is underway on establishing sewage treatment facilities, its level of availability is still only 33% due to problems in areas such as households’ connections to the sewers and industrial waste water treatment. Industrial water is also in short supply, a factor that has caused some companies to hesitate to set up operations in India.

The Delhi-Mumbai Industrial Corridor Development Corporation Ltd. (established in January 2008 to manage the DMIC project) is currently studying splitting its overall plan for water infrastructure into the following two steps.

(1) Conduct business simulations based on the assumption that the project will proceed on the basis of a PPP (public private partnership).

(2) Conduct a feasibility study into waste water treatment. The project will achieve zero discharges and minimize initial investment and operating costs by allowing for up-scaling.

**Hitachi involvement in provision of water infrastructure**

Hitachi will carry out the business simulation as part of “The Preliminary Feasibility Study for Smart Community Project” work it was contracted to perform by the Ministry of Economy, Trade and Industry of Japan in the 2010 fiscal year to further improve the accuracy of the survey of business feasibility.

Based on the results of this study and drawing on experience from past projects involving water resource solutions such as promoting the rationalization of water supply and sewage services in the Republic of Maldives and domestic waste water recycling in the Emirate of Dubai in the United Arab Emirates (UAE)(3), Hitachi will contribute to the provision of water infrastructure in India.

### Initiatives Associated with Construction of Eco-city in China

A large number of environmentally conscious urban development projects called “eco-cities” are underway in China. These projects are designed for multiple purposes including residential, commercial, and industrial use. Many of these large developments are being led by investment companies and the approach to urban development whereby partner companies with specific technologies are brought together to develop the actual systems can be said to have become a trend for the provision of social infrastructure in overseas markets.

Hitachi is participating in eco-city construction projects in China and is working on the development of social infrastructure using frameworks such as CEMSs (community energy management systems)(4). For example, it is anticipated that collaborating with investment companies on the development and installation of energy management systems will help position Hitachi for a role in future eco-cities, an area in which major expansion is planned.

### Involvement in US Smart Grid Demonstration

Hitachi was contracted by Japan’s New Energy and Industrial Technology Development Organization (NEDO) in the 2009 fiscal year to participate in a joint US-Japan smart grid demonstration project in New Mexico in the USA(5) which is now underway. The demonstration project is being undertaken in collaboration with other participating companies and Hitachi is working on development and verification for a demonstration system in the existing Los Alamos County electricity grid. This involves operating an electric power storage system using lead-acid batteries alongside of other types of power storage and determining the efficiency and quality achieved through the high-level operation of a PCS (power conditioning system) that supplies power generated by solar power modules to the electricity grid. A preliminary survey of the existing electricity grid and aspects of the local environment was conducted in March 2010 and development of the demonstration system is to proceed in the future.

## INITIATIVES FOR PROVISION OF ROAD TRANSPORT INFRASTRUCTURE

This section looks at the initiatives being taken by Hitachi that deal with alleviating traffic congestion in urban areas and the provision of infrastructure for the adoption of EVs (electric vehicles), two issues facing road transport in overseas countries.

### Involvement in Eliminating Traffic Congestion in Urban Areas

Chronic road traffic congestion is a social problem faced by the mega-cities of Asia which continue to experience explosive growth. Delays in the movement of people and goods due to traffic congestion cause economic losses. In terms of the environment, there are urgent calls for measures to deal with the increase in $CO_2$ (carbon dioxide) emissions that is another negative side effect of congestion. A comprehensive solution to this problem requires physical measures such as the construction of road networks made up of ring and spoke roads and the provision of other means of public transport. However, another timely and cost-effective way of confronting the problem is to provide information-based support such as the ability to determine the extent of traffic congestion accurately and then supply this information to traffic administrators and users.

(1) Traffic information generation system

One effective way of obtaining traffic information is to collect position and other information about driving conditions from a number of vehicles (called “probe cars”) that are using the road network and use this to generate information about traffic conditions across the entire urban region. Hitachi ran a demonstration in Beijing in 2006 that extended from the collection of traffic information from probe cars to its distribution(6) (see Fig. 3).

The demonstration successfully collected position information from 2,000 Beijing taxis and used it to generate information about congestion and other traffic

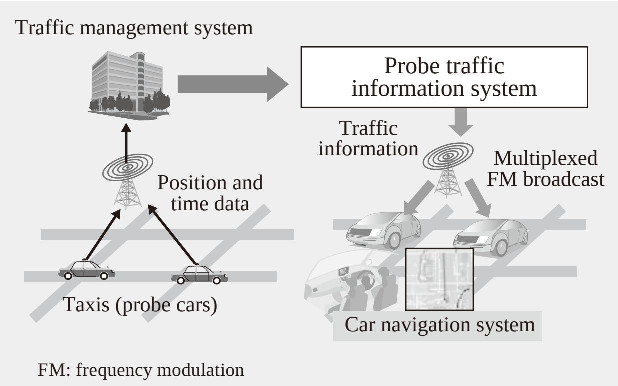


*Fig. 3—Overview of Probe Traffic Information System in Beijing.*
*Traffic information is generated from position data collected from 2,000 taxis and used to provide details of traffic congestion to the car navigation systems in the demonstration vehicles.*

conditions which was then transmitted by multiplexed FM (frequency modulation) broadcasting to navigation systems fitted in 10 demonstration vehicles where it was overlaid on the map display. The service was subsequently introduced in Beijing where it helps avoid or mitigate congestion. It is anticipated that the same approach could also be used elsewhere and the possibility of introducing traffic information systems based on this technology in other overseas cities is currently under investigation.

(2) Traffic inflow control systems

Although road pricing is one way of restricting the inflow of vehicles to congested areas, forcing vehicles to stop and pay a toll each time they enter an area is just as likely to increase congestion. Instead, methods that have proved successful in practice include the use of image recognition technology to read vehicle number plates for subsequent billing (as used in London) or communicating with a special-purpose vehicle-mounted terminal similar to Japan's ETC (electronic toll collection) system (as used in Singapore). However, these methods require a significant investment in infrastructure such as the installation of roadside sensors and communications devices. Accordingly, it is believed that the use of other methods such as GPS (global positioning system) to determine vehicle position so that billing can be invoked when the vehicle enters the restricted area will also prove effective. Hitachi has gained experience in image recognition, ETC, and satellite positioning in Japan and is conducting surveys and investigations into how to satisfy requirements in other parts of the world.

## Activities Aimed at Introduction of EVs

The potential to increase the use of EVs globally is a key to reducing $CO_2$ emissions in land transport. Automotive manufacturers continue to release new EVs and various governments are starting to establish the infrastructure for EV charging. Unfortunately, EVs still suffer in comparison with internal combustion engines in terms of their range and slow recharging time. Accordingly, alongside an expansion in the quantity of

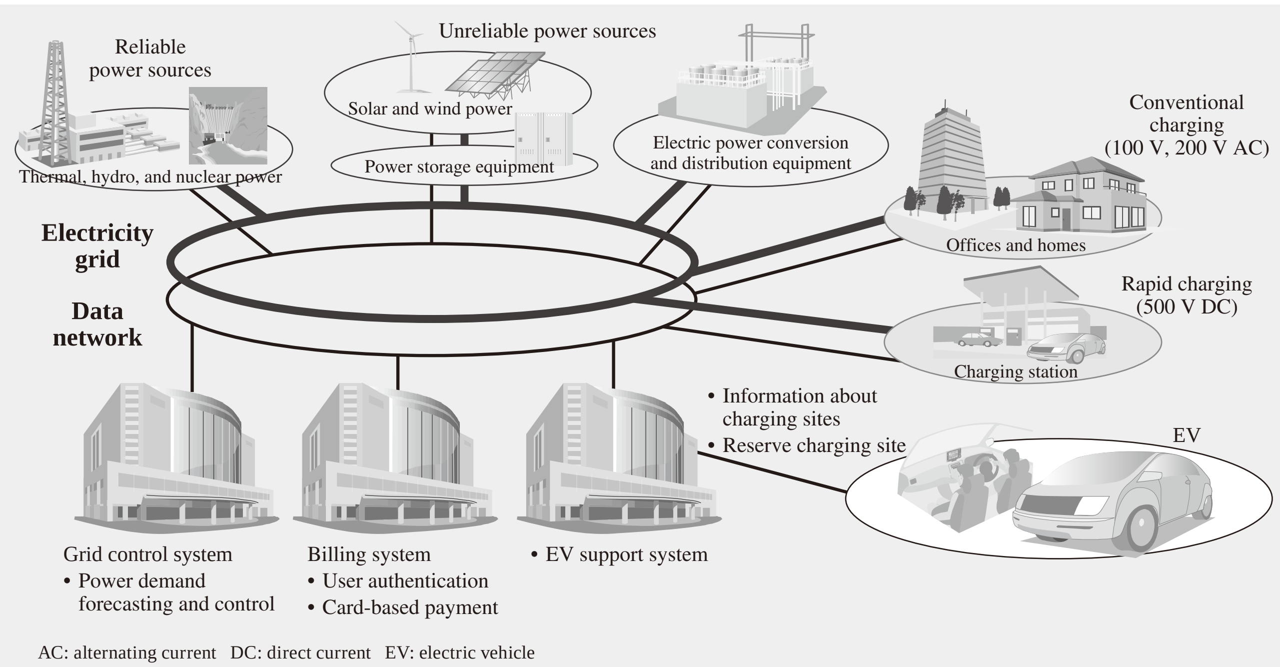


*Fig. 4—Concept of Driving Support and Charging Systems for EVs.*
*The EVs, charging systems, and driving support work together to form a smart grid.*

charging infrastructure, it is anticipated that assistance in the form of information systems, which provide efficient charging and prevent vehicles from running out of battery power on the road will prove effective. Also, because EVs carry about a large quantity of electric energy and are charged in arbitrary locations, changes to the electricity distribution network will also be needed to cope with the variation in electricity demand that will result from the widespread use of EVs.

Hitachi is investigating a system that monitors the status of EVs as they are driven and provides support at appropriate timings, and it is expected that the use of always-on connections to implement systems like this will allow the delivery of broad-based solutions for urban road transport. In addition to the commercialization of rapid charging units that can recharge EVs quickly, Hitachi is also looking at how these will interact with the electricity grid and is considering the development of solutions that will minimize the effect on the grid through measures such as the use of renewable energy and the coordination of electric power storage and charging schedules. Hitachi is working on global solutions for EVs based on its experience with ITSs (intelligent transport systems) that use data communications to link people, roads, and vehicles (see Fig. 4).

## CONCLUSIONS

This article has described Hitachi's participation in feasibility studies and large-scale demonstrations projects relating to the provision of social infrastructure outside Japan and also its initiatives aimed at investigating new technologies for enhancing this infrastructure.

Work on the provision of social infrastructure for smart urban development is underway in many countries and regions with the aim of achieving both economic development and a sustainable society that takes account of the environment.

Hitachi intends to continue contributing to the international community by building a framework for collaboration with relevant agencies and companies and promoting innovation in social infrastructure by getting involved in various initiatives.

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