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1. Executive Summary

Sapporo, located in Japan’s northernmost territory, has grown into a city of 1.9 million people over its brief, 150-year history. At the start of the Meiji Era, plans to develop Sapporo were launched as a national policy based on the model of Kyoto, the western capital. Compared to other Japanese cities with lengthier histories, Sapporo is unusual in that it has grown into a large metropolis over a short period of time.

Various foreign countries influenced the development of Sapporo through the introduction of technologies and the involvement of their people. Those who contributed to the development of city parks, university campuses and the like have been remembered with bronze statues. These include William S. Clark, president of the Massachusetts Agricultural College (now the University of Massachusetts, Amherst), who laid the foundation for what is now Hokkaido University. Although he only stayed in the area for eight months, his parting expression, “Boys, be ambitious,” has become a local and even national mantra.

Challenge: Reduction of Greenhouse Gas Emissions and Increased Sustainability

Like most cities around the world, Sapporo today is striving to meet strict new targets for greenhouse gas emissions and environmental sustainability. These targets require the city to achieve greater control over its energy consumption and other behavior that has a direct or indirect bearing on its consumption of resources.

These environmental challenges tie in closely with national policies and laws. Following revisions to the targets set out in the original Kyoto Protocol, and the enactment of the Act on Promotion of Global Warming Countermeasures, Sapporo City has made clear its desire to take a strong position on environmental issues, by issuing a public pledge to develop a specific plan of action as a matter of priority.

Under the strong leadership of Mayor Fumio Ueda, the “Sapporo, Environmental City” declaration was issued in June 2008, and established as a code of conduct for citizens. This declaration was translated in English, Chinese and Korean, communicating Sapporo’s undertaking to the world.

It was in this context that Sapporo approached the IBM Smarter Cities® Challenge (SCC) team in 2010. The city’s governors sought support as they developed a plan of action. This came together in March 2011 as the “Sapporo Vision for the Promotion of Global Warming Countermeasures.” The vision, which was consolidated ahead of the national government’s development of a related legislative bill, included a mid-term target to reduce the volume of greenhouse gases by 25% by the year 2020. To this end, it set out a scenario for progress toward this goal, including 10 action items.

Against this backdrop, IBM was asked to do the following:

- Determine issues to be faced in implementing the vision; and
- Offer recommendations on the resolution of issues and present a roadmap.

Sapporo entered the SCC program last year, originally with a view to progressing against these findings. However, following the devastating earthquake and tsunami that hit north-east Japan in March 2011, and the resulting Fukushima nuclear power plant disaster, the scope of the initiative was redrawn. In the wake of the disaster, Mayor Ueda issued a strong message focused not only on countermeasures to global warming, but also toward a “society that is not dependent on nuclear power”, emphasizing the need to consider and focus on renewable energy wherever possible. Following an interview with the mayor, IBM committed to conduct its activities within this newly expanded scope.
Approach
The IBM SCC team received considerable cooperation and support from the Sapporo client team, the Sapporo City Environmental Department, by way of numerous interviews and the provision of supplementary materials. This was despite the fact that a series of special events was taking place in Japan at the time – it was the Bon season in Japan, when people gather in their ancestral hometowns to remember and celebrate their forefathers.

The IBM SCC team took the following initial steps during the consultation phase:
• Expand on the issues
• Organize and order the facts, findings and conclusions
• Formulate practicable recommendations.

These steps were conducted comprehensively by way of interviews, surveys and other, related activities, following the so-called “spiral” approach where activities are carried out from day to day with the deliverable in view, leading to a report within a short period. The Smarter Cities Challenge Sapporo Team comprised team members who had selected with the guidance of the IBM HR department as having diverse roles and skills. This approach proved an effective tool from the perspective of carrying out day-to-day intellectual activities effectively.

Recommendations
The resulting recommendations were aligned with the framework of the “Sapporo Vision for the Promotion of Global Warming Countermeasures” which the client had put together, tying in directly with the roadmap which proposes activities toward 2020.

The following are examples of major recommendations:

1. Broad-based Cooperation
• List other local government organizations with annual CO₂ emissions similar to those of Sapporo, and present future benchmark projections;
• Take steps to enable citizens to easily understand the connection between the mayor’s manifesto and the policies of other departments.

2. Transparency
• Introduce IT-based data gathering, and highlight the importance of technology-based data gathering and analysis in future;
• Highlight the need for field surveys on the energy use of multi-family units (e.g. apartment blocks), in recognition that there is an accelerating trend toward this kind of accommodation.

3. Environment and Economy
• Progress with research to encourage environmental businesses that leverage biofuels;
• Present the direction that Sapporo should take with respect to the mega solar business, which is aimed at renewable energy and on which discussion is moving forward rapidly.

4 Environmental Education
• Education about the importance of environmental sustainability is already actively under way. To enhance this, the impact of measures taken should be monitored and reported, to highlight what is already being – or could be – achieved.
• Communicating the sustainability message to Sapporo’s 13 million annual visitors should be a priority, to boost the city’s brand and reputation as an environmental leader. Environmental education policies should also be reviewed in the light of this strategy.

In drawing up these recommendations, the IBM SCC team developed a roadmap that takes into consideration matters such as the timing of enactment of future, the development of new plans by the city authorities, and activities that require a budget.
Conclusion

One of the objectives for Sapporo is to protect and reestablish forests by encouraging use of alternative sources of energy based on bio-fuels. As the supply of starch grain and sugar cane becomes reduced, the inedible parts of plants (lignocelluloses) are emerging as alternative materials for bio-ethanol production. Whichever approach the city takes, it needs to build a workable economic model for associated energy production and consumption. This needs to include a way for electricity-based utilities and new players in the energy market to build viable businesses, which may demand a review of related law, regulation and customs.

Education is vital too, to maintain and build on public concern about and willingness to play a part in addressing environmental issues. The IBM SCC team hopes an approach will be established that focuses all of the various parties involved on Sapporo’s countermeasures to climate change.

By following these recommendations, it is the IBM SCC team’s belief that Sapporo’s governing body will have a good starting point from which to build the city’s brand as an “Eco-Capital”.

Thanks

According to the results of a national poll published in the media on August 22, 74% of Japanese people agree that nuclear power should be “gradually reduced”. The Sapporo City Council is already proactively supporting a national initiative to look at ways of reducing Japan’s dependence on nuclear power. To this end, the city is currently inviting opinions and suggestions from the public on both energy-saving measures and alternatives to nuclear power.

The IBM-Sapporo SCC project had to absorb and work with these big themes as the post-Fukushima situation evolved from day to day. The IBM team feels privileged to have had this unique experience to help formulate strategy at such a critical point in the city’s history, and is immensely grateful to have spent such an eventful three weeks working alongside the local authorities as they looked for future alternatives.
2. Introduction

2.1. What is the Smarter Cities Challenge (SCC)?
Today, there are more than 450 cities in the world that have a population of over a million, accounting for more than 50% of the world’s population – which will become 70% by the year 2050. These cities can be seen as complex networks made up of components that include people (citizens), businesses, transportation, communication, water, energy, city services and other systems. The better connected these elements are, and the more reliable and efficient the infrastructure, the better the environment for business and the better the service provided to the public, resulting in an improved quality of life.

With this in mind, IBM in 2008 set out its vision for a “Smarter Planet™” – an exploration of how the world could work and behave in future if the infrastructure connecting communities and the facilities within them were more dynamic and intelligent. This look into the future included a description of “Smarter Cities” – i.e. cities that are able to function more efficiently through a better connected, more intelligent infrastructure – and optimized services built upon that infrastructure.

To take this vision forward, IBM focused on seven core functions that would contribute most significantly to making cities better and smarter: government services; transport; public safety; medical services; education; energy and communications; electricity and gas systems; and water resources management. From this basis, IBM embarked on a proactive program to work with the governing bodies of cities around the world to move toward this vision.

The IBM Smarter Cities Challenge is a three-year program designed to provide a total of $50 million in services to 100 cities around the world. For each initiative, specially-selected cross-discipline teams from IBM analyze the selected city and provide a series of detailed recommendations to the mayor. The resulting blueprint is intended to enable the cities to be more prosperous, provide better services to residents, promote greater civic participation, and make city management more efficient.

The Smarter Cities Challenge harnesses not only on IBM's intrinsic technological capabilities, but also the knowledge gained from Corporate Service Corps (CSC) initiatives over the past three years. Through the Corporate Service Corps, IBM sends skilled personnel from across its global business to work together in cross-cultural teams on community-driven development projects at the intersection of business, technology and society. To date, through the CSC scheme, IBM has provided 1,000 employees from a broad range of disciplines as part of 100 teams which have been dispatched throughout the world. These teams then work in cooperation with local government organizations, non-profit groups and businesses to develop a blueprint for a smarter, more connected and more livable environment.

2.2. Introduction to Sapporo
Sapporo is the fourth-largest city in Japan by population, and the largest city on the island of Hokkaido. It is the capital of Hokkaidō Prefecture, located in Ishikari Subprefecture, and an ordinance-designated city of Japan.

Outside Japan, Sapporo is known for hosting the 1972 Winter Olympics (the first ever held in Asia), and for the annual Yuki Matsuri in the city, internationally referred to as the Sapporo Snow Festival. This draws more than 2 million tourists from around the world. The city is also home to Sapporo Brewery and the famous white chocolate biscuits, shiroi koibito, (“lovers in white”), which are sold exclusively in Hokkaido.

Sapporo derives its name from the Ainu language and is thought to reference the river, either from sari poro pet (“river with wide reed bed”) or sat poro pet (“dry, great river”). In 1869, Ezo, the land inhabited by the Ainu people was renamed Hokkaido; the Hokkaido Development Commission was installed and the construction of the Sapporo headquarters initiated. The initial colonial militia settled in 1875, railroads were set down, and work began to promote industry and construct the capital of Sapporo based on the Long-range Sapporo Development Plan.
Over the decades, Sapporo has grown through a series of mergers and the incorporation of neighboring towns. In 1970, the population of Sapporo passed one million; two years later it became a cabinet-order designated city (that is, one of Japan’s official major cities). Today, it has a population of over 1.9 million, accounting for 30% of the population of Hokkaido.

2.3. Issues Faced by Sapporo (Global Warming Countermeasures and Energy Consumption Behavior)

The city of Sapporo is keen to protect its natural environment, featuring abundant greenery which benefits from four distinct seasons. Sapporo has a typical “Japan-Sea” climate: summers are balmy, winters are cold and snowy.

The city’s governing body believes it must further improve the environment it was given and preserve it for the next generation. This also means taking a proactive stance against environmental issues such as global warming, which are already having a tangible impact on Japan and Sapporo, in the form of record heatwaves and increasingly significant typhoons.

In Sapporo, 90% of total carbon dioxide emissions derive from houses, offices, automobiles and the like. Because winter energy consumption of kerosene and gasoline by heaters and vehicles is substantial, it is essential that not all residents and businesses – i.e. not only the local government – face up to their responsibilities and undertake measures cooperatively. On June 25, 2008, the city made a formal pledge, known as the “Eco-Capital, Sapporo” declaration, and developed the “Sapporo Vision for the Promotion of Global Warming Countermeasures”, setting out measures the city’s residents, businesses and government should collectively working toward, starting immediately, to make Sapporo a world-class “Eco-Capital”.

The “Sapporo Vision for the Promotion of Global Warming Countermeasures” (the “Vision”) is the city’s own interpretation of the actions it must take to comply with Japan’s national Global Warming Countermeasures Act. The main theme of this SCC project, then, has been to resolve a series of issues related to the promotion of the Vision.

Highlights of the city’s Vision and the associated targets are described below.

More than 90% of the greenhouse gases emitted in Sapporo are derived from the activities of local residents, businesses and the transport sector. Any plan to reduce CO₂ emissions, then, must promote (1) energy conservation and (2) the use of renewable energy in place of fossil fuels in the various settings of home, transportation and work.

For each constituency (residents, businesses and the Sapporo city government) to achieve its mid-term target as part of the grander plan, the city is aiming to reduce its emissions by around 3,400,000t-CO₂ (around 70% of the broader target) from:

a) the deployment of energy-saving homes, high-efficiency hot-water supply and heating equipment, which are closely tied to the daily lives of the citizens;

b) the promotion of energy conservation and the deployment of renewable energy by businesses;

c) new initiatives in the transport sector, including encouraging the adoption of next-generation vehicles and environmentally-friendly driving.

Sapporo is aiming to address the remaining 1,670,000t-CO₂ reduction needed to meet its mid-term target through future promotion of technological innovations – with respect to the use of nuclear power and new energy sources, as well as products and approaches that work together with new national government systems.
Among these various undertakings, those relating to the residential sector (which is responsible for 36% of Sapporo’s CO₂ emissions) are especially important. It is not going too far to say that individual Sapporo residents hold the key to Sapporo’s achievement of its mid-term target, as well as its long-range goal. This is true particularly given the high energy consumption rates associated with heating and hot water during the winter months, due to the city’s location in a cold region. The hope here is for substantial emissions reductions by making homes, hot-water supply and heating equipment more efficient.

In drawing up its Smarter City recommendations for Sapporo, the IBM SCC team took into account these targets and ambitions, as well as the measures outlined in Japan’s “National Mid- and Long-Term Roadmap, Draft Proposal by Minister of the Environment”, published in March 2010 (hereafter referred to as “the National Roadmap”). It is possible that the blueprint will need to reflect the ongoing development of the national government’s plans, the deployment of new systems or designs, and technological innovation. In this event, global warming countermeasures will be considered in line with the actual situation, through the development of policies that are appropriate to the circumstances.

In order to achieve the mid-term target, the SCC’s scenario for progress calls for each constituency (residents, businesses and the Sapporo city government) to cooperate fully and proactively to reduce emissions by 3,400,000t-CO₂.

To succeed, the Vision requires that each party adheres to 10 specific actions. These are set out in detail, and also described within the context of the wider picture, so that the connection between the different actions and reductions in greenhouse gas emissions can be fully appreciated. The IBM SCC team believes that this will encourage all of the parties to unite in embracing global warming countermeasures.

Each individual action targets a specific issue that needs to be addressed. The 10 Actions specified in the Vision, and their target impact on CO₂ emissions, are set out below:

1. Developments with a view to creating energy-efficient homes suitable for a northern-climate [reduction of about 290,000t-CO₂];
2. Developments to encourage adoption of high-efficiency hot-water supply and heating equipment [reduction of about 1,080,000t-CO₂];
3. Developments to encourage usage of next-generation automobiles, mass transit systems and the like [reduction of about 580,000t-CO₂];
4. Development toward the acceptance and expansion of environmentally-friendly living [reduction of about 580,000t-CO₂];
5. Development toward the reduction of CO₂ derived from business activities [reduction of about 450,000t-CO₂];
6. Development toward the deployment and expansion of solar energy generating facilities [reduction of about 90,000t-CO₂];
7. Development toward the deployment and expanded use of lignocellulosic (inedible plant-based) bio-fuels [reduction of about 130,000t-CO₂];
8. Development toward expanded use of renewable energy [reduction of about 50,000t-CO₂];
9. Development toward the acceptance and expansion of waste reduction and recycling [reduction of about 60,000t-CO₂]; and
10. Development toward the cultivation of the region’s greenery [reduction of about 90,000t-CO₂].
3. SCC Approach – Sapporo

3.1. Scope of the Program
Having consolidated the details of Sapporo’s global warming countermeasures in the Vision, and defined the 10 recommended actions, bringing Sapporo’s plans in line with the national government’s agenda for tackling global warming, the IBM SCC team now needed to set out specific measures that would be required of residents, businesses and the city government to deliver a low-carbon society.

To this end, the IBM team engaged in a three-week consulting exercise, supporting the development of a more detailed roadmap for change that (a) identified specific issues that needed to be overcome (by way of surveys and analysis), and (b) provided a series of defined, actionable recommendations.

To this end, the IBM SCC Sapporo team took the following basic steps:
• Identify, extrapolate and develop the key issues;
• Consolidate and prioritize findings and conclusions; and
• Formulate practicable recommendations.

In view of the current situation, the IBM SCC team also considered the extent to which it would be possible to advance global warming countermeasures while securing stable electrical power over the long term. It was recognized however that such measures will be greatly influenced by the future policies of the national government, so any actions will need to be implemented in line with the energy policies of the next administration.

3.2. Issue Development Method
To build a comprehensive and truly reflective picture of the main issues facing Sapporo, which could be summarized and acted upon within a realistic timeframe, the IBM SCC team employed a “spiral” approach to the research phase.

The Smarter Cities Challenge Sapporo team was made up of IBM personnel who had been specially selected with the guidance of IBM’s HR department to represent the optimum mix of skills and experience. Having the right combination of expertise, and employing a continuous feedback loop, ensured that the day-to-day intellectual activities were completed effectively.

In extrapolating the likely issues, the SCC team took as its starting point the “perspectives in scenario development” set out in the Vision, to see how this stood up against the feedback gained through interviews, as well as additional information gleaned from reference materials provided and responses to inquiries. This research was further broadened to include a series of fact-finding field trips, where the IBM SCC team had a chance to see the pellet boiler at the Maruyama Zoo; snow storage cooling facilities; existing and planned solar energy installation locations; and the Tomari nuclear generator facility.

In reviewing the findings, the team looked for common themes, and organized real and perceived issues into seven broad categories (Strategy, Structure, Staff, System, Skill and Area Characteristic and Information), before drilling down into details.

The projected issues were brought together as set out in Figure 1.
Figure 1
Development of Issues
4. Main Findings and Issues

The IBM SCC team mapped the most commonly cited issues on to four perspectives that had been identified in Sapporo’s Vision for climate warming countermeasures, while making provision for the additional consideration of Transparency. (See Figure 2).

- **Environment and Economy** – In promoting global warming countermeasures, it is important to reduce greenhouse gas emissions while aiming for the promotion of related industries and the development of Sapporo’s economy, and to take positive action while being aware of the economic benefits caused by the activities of each party (i.e. residents, businesses and the local government).
- **Environmental Education** – In order to progress with global warming countermeasures, it is important for individuals to act with consideration for the environment on a continuous basis. To that end, environmental education will play a large role both in increasing awareness of the environment and in raising individuals who can think, decide and act for themselves.
- **Broad-based Cooperation** – While on the one hand, cooperation within Sapporo must take the lead in promoting global warming countermeasures, especially as Sapporo is the largest city in Hokkaido, it is also important for such measures to be connected to the environmental protection and economic vitalization of other municipalities in Hokkaido. Moreover, it is important for Sapporo to drive both domestic and international cooperation as a major city of the developed world.
- **Transparency** – It will be important to continually verify how far Sapporo has come when measured against the scenario set out in the Sapporo Vision for the Promotion of Global Warming Countermeasures, and whether this is consistent with the state of society. Since issues were found with management methods that express management benchmarks numerically, the IBM SCC team considers that a more appropriate way of thinking about this issue is in terms of “Transparency”.

Specific findings and challenges relating to these four themes are described in the paragraphs below.

4.1. Environment and Economy

In order to advance sustainable global warming countermeasures in Sapporo, it is essential to reduce greenhouse gas emissions while encouraging related industries and developing Sapporo’s economy. Like other cities throughout Japan, Sapporo has substantial financial liabilities; its ranking as a city for “financial capability” is low and there is awareness that its financial base is weak as it is a consumption-based city. To enhance the financial base, the city needs to find new ways to secure increased tax revenues and create new industries.

Under Environment and Economy, the IBM SCC team pinpointed the following specific issues:

- The ESCO business, which started in the United States and which the Ministry of Economy, Trade and Industry took the lead in expanding in 1996, has been applied to three of the city’s facilities and has begun to show results.
- There are many small and medium-sized enterprises, and the economy has been impacted by the recent economic slump. Prospects are dim for improvement on the so-called “hard” or material/infrastructure side of the economy, such as capital investment.
- The scale of the timber industry in Sapporo itself is limited, but timber from forest-thinning activity is being leveraged for the development of nearby forests.
- Renewable energy has few reduction targets currently, but much is expected of this area in future.
- The target of 1,180,000t associated with energy conversion is based on a vision that presumes the operation of the Tomari nuclear generator.
- Several companies are already looking for possible sites that are expected to become available with the enactment of the legislative bill on renewable energy special measures.
- The Sapporo City Council unanimously approved the canvassing of “Opinions concerning the Conversion to Energy Policies Not Dependent on Nuclear Power” on June 30, 2011.
Development of expected issues relating to the achievement of the vision for promoting warming countermeasures

Scenario development: Necessary perspectives and approaches

1. Environment and Economy
2. Environmental Education
3. Broad-based Cooperation

New perspectives

1. Environment and Economy
2. Environmental Education
3. Broad-based Cooperation
4. Transparency

Figure 2
Development and organization of expected issues
IBM's Smarter Cities Challenge Report

Sapporo

Population: 1,891,494 Persons (as of 3/31/2010)
Area: 1,121.12 km²
Standard budget scale: 417,356,599 Thousand of yen
Total revenue: 826,617,450 Thousand of yen
Total governmental expenditures: 826,666,999 Thousand of yen
Actual balance: 480,006 Thousand of yen

Source: Sapporo City, FY2009 Comparative Financial Analysis of Municipalities

Figure 3
Sapporo city, financial comparison
4.2. Environmental Education

In order to progress with measures to counteract global warming, it is imperative that individual citizens become personally aware of the problem to the point that they assume responsibility for their impact on and behavior toward the environment. Raising awareness and achieving a lasting change in individuals’ behavior requires education.

The IBM SCC team organized its findings related to this theme under the umbrella of “Environmental Education”, and distilled the following issues as potentially having a bearing on progress:

• Policies on climate warming countermeasures geared toward Sapporo’s 13 million annual visitors are not currently included in the outline plan, the “Sapporo Tourism Promotion Plan” (provisional name).7
• The publication delivered to every household in the city, *Koho Sapporo* (which translates as *Sapporo Public Information*) is leveraged as a tool to gather feedback on city policies (for example electricity-saving campaigns).
• The city is applying to businesses certified under METI’s New National Energy Strategy and is planning to promote environmental education through the “Energy Park” that is scheduled to open in October 2011.

4.3. Broad-based Cooperation

Because Sapporo is the largest city in Hokkaido, it is also the largest municipal emitter of greenhouse gases in Hokkaido. Therefore it must take the lead in driving climate warming countermeasures. It is important that Sapporo, a city associated with large-scale consumption of a diverse range of goods and products, actively promotes measures aimed at its own consumption habits and acts with awareness of the need to maintain the environmental protection and economic revitalization of other municipalities in Hokkaido.

In extrapolating the issues related to this theme, the IBM SCC team included (a) cooperation among the various constituencies within Sapporo City itself; (b) cooperation with Hokkaido, as well as with other municipalities within Hokkaido; and (c) cooperation with the national government as well as other cities both within Japan and overseas.

The main considerations under the banner of Broad-based Cooperation are set out below:

• There are no major electrical generating facilities within Sapporo. All electricity is supplied from outside the city.
• Sapporo’s CO₂ emission profile is most similar to that of Fukuoka on an annual basis, so common resolution strategies can be expected.
• In terms of the cultivation of greenery, there is a greenhouse gas reduction effect from the national forests, managed by the Forestry Agency, so this target has already been met.
• With regard to wind-generated electricity, this cannot be promoted until the law on related assessment has been enacted.
• The legislative bill on global warming countermeasures was withdrawn, and the linked scheme developed by Sapporo was assembled not as an action plan but as a vision. Because the year 2012 marks the conclusion of the Kyoto Protocol, a legislative bill will probably be decided soon.
• No particular city was in mind when the vision was developed.
• Hokkaido has a budgeted policy for promoting biomass projects.
4.4. Transparency

Progress against environmental sustainability targets can only be fairly and practically assessed if it can be monitored in an independent way against defined measures. Since the requirements may well change along the way, compared to those set out originally in the Sapporo Vision for the Promotion of Global Warming Countermeasures, the situation must be assessed repeatedly to ensure the aims and measures are still relevant. Numerical benchmarks were felt to lack value for this reason, leading the IBM SCC team to re-categorize related issues under the heading of Transparency, shifting the emphasis to the need for continuous assessment.

The main issues likely to affect progress under this heading are outlined below:

- The method for calculating CO₂ emissions is defined in the Local Public Agency Plan of Action for Global Warming Countermeasures, and is based on the Mid- and Long-Term Roadmap, Draft Proposal by the Minister of the Environment.
- The best methods for visualizing the 10 actions set out in the original Vision have not yet been determined.
- The 10 distinct actions are based on the National Roadmap but some of the targets have been set independently by the city of Sapporo.
- In terms of encouraging behavior such as environmentally-friendly driving habits, the only means of measuring performance is via surveys.
- With regard to targets for environmentally-friendly living; renewable energy; small and medium-sized enterprise and so on, that the IBM SCC team believes that assigning numerical values will be difficult.
- The urban development of Sapporo has resulted in a traffic network – including the development of wide roads and parking lots – that makes it all too easy for citizens to use (and rely on) automobiles for getting about.
5. Recommendations

In order for all of the above to happen – for there to be greater environmental awareness, proactive involvement and co-operation among all parties concerned; economic regeneration through support for new businesses and enhanced tax collection; and visible progress in line with relevant local and national targets – the first step must be to strengthen the lines of communication across and beyond the city. This applies both internally across local government departments, and as they connect with other authorities further afield; and between the city and its residents, and the city and existing and new businesses. Much of this can be facilitated through strategic yet practicable use of technology.

When the issues and findings are prioritized, as depicted in Figure 4, it is possible to define critical goals such as: (a) a “depth of awareness” of the environment and (b) the “formation and growth of the economy” in a new environment.

One of Sapporo’s priorities is to reduce the city’s dependence on fossil fuels, in recognition that this is not sustainable or environmentally responsible. One of its goals is to increase investigation into and use of alternative sources of energy such as bio-fuels, including bio-chips made from lignocellulosic substances (the inedible part of plants). This also fits with the aims of the city to support reforestation, preserving Sapporo’s greenery.

Associated with this area is an opportunity to create a new environmental business; the drive to create and adopt new forms of energy will have a bearing on the formation of economic models – for electricity-based utilities, new businesses and national and local governments.

However, capitalizing on this opportunity will require changes to the existing law, regulation and customs, and Sapporo will need to positively address the issue of how the utilities and new businesses will secure business viability.

To maximize public awareness and “buy-in”, there needs to be a holistic approach to education which encompasses all of the parties whose behavior needs to change to achieve both city-specific and national targets. If Sapporo wants to achieve its desired status and brand recognition as an “Eco-Capital”, it cannot afford to skimp on this fundamental objective.

5.1. Broad-based Cooperation

5.1.1. Strengthening the Functions of Cross-Sectional Organizations

Recommendations

The IBM SCC team recommends that consideration should be given to enhancing the functioning of lateral cooperation, such as by the establishment of common indicators by all departments, the assessment of effectiveness based on common indicators, and so on.

In accordance with Mayor Ueda’s manifesto, the visions and plans of each department are developed and announced with the inclusion and participation of citizens. However, there are cases where matters are difficult to understand – for example where it is not clear (a) how the actions taken by each department relate to each other; or (b) whether differences may exist between content that is interpreted as being the same. For this reason it is recommended that cross-sectional teams are built, to promote cross-sectional cooperation and ensure that common indicators are established by all departments. This will help ensure that effectiveness is evaluated against common indicators, and that information is held in common. Secondly, particularly high-priority issues should be promoted even within the environmental administrative authorities.
Figure 4

The foundation of matters relating to the leveraging of lignocelluloses bio-chips aimed at reforestation, as well as other consideration, is particularly need to be as an environmental business and the conversion to new forms of energy is closely related to the formation of economic models.

Environmental education means calling for an increase in the level of awareness of all parties involved in Sapporo’s climate warming countermeasures with respect to the environment. The achievement of this will cause the further elevation of Sapporo’s brand power and its transmission of information as an Eco-Capital throughout Japan and overseas.

Connection between the tools used in the relevant survey and the goals

- Ultimate aim of formation of an economic model and formation of environmental education
- The strengthening of cooperation within departments, with residents, related local governments and the like is the first step of everything.
In Mayor Ueda’s manifesto, six items are set out, the fourth of which (Environmental Town of Concerted Action) relates specifically to the environment. In accordance with this manifesto, the Environmental Department, Economic Department, Tourism and Culture Department, and the Citizens Town Management Department, and others, now develop their visions and plans of action with citizen participation. These activities are linked to implementation plans and announced as highly polished municipal information. However, as is outlined below, there is room for improvement in relation to several points.

When the Economic Department prepared the “Sapporo Industrial Promotion Vision: FY2011 to FY2020,” it listed the environment – “which all society will unite to address” – as an important field that will drive the growth of the Sapporo economy.

Two fundamental policies relate to this subject. One, relating to an overarching policy to “create environment-related industry that takes advantage of the strengths of Hokkaido and Sapporo”, is the promotion of the development and manufacture of biomass energy, initially in the form of lignocellulosic biofuels such as lignocellulosic pellets.

Meanwhile, the 10 actions described in the Environmental Department’s Vision also include developments toward the deployment and expanded use of fuels whereby the deployment of pellet stoves, boilers and the like are to be promoted.

However, the information contained in these policies is difficult to understand in concrete terms. For example, it is unclear how these policies relate to one another, whether they have a parent/child relationship, or whether they call for the same response on the part of citizens.

In the “Sapporo Urban Development Vision Stage 3”, Section 4 (Environmental Town of United Action), Section 1 (Promotion of a Low-Carbon Society and Building of a Recycling-Oriented Society), which the Citizens Town Management Department is currently developing, 10 hypothetical businesses are listed. Of these, nine appear to be related to the 10 actions prescribed in the Sapporo Vision. However, as it currently stands, it is not clear whether these actions are working toward the same targets or whether they are at the same or different levels.

In another example, the Tourism and Culture Department is currently developing the outline plan of its Sapporo Tourism Promotion Plan (provisional name), however, as can be seen from the publicly available information in Table 1, policies on the environment are not yet included.

A study of the light rail infrastructure is also being conducted currently with citizen participation. It is indispensable to the promotion of global warming countermeasures that the Environmental Department implements cross-sectional management of important information – for example through a list of outstanding issues, with respect to matters that have not been coordinated among departments, matters currently under review and so on.

Further, if the “Deployment of Energy that is Environmentally Friendly and that Takes Advantage of Regional Characteristics” in the “Gaia NEXT Project 2011” policy is implemented cooperatively and regional characteristics are promoted, a multiplier effect can be expected.
5.1.2. Model Cases and Performance Indicators

Recommendations

The IBM SCC team recommends a review of the scenario set out in the Vision, as well as the establishment of model cases and the study of Sapporo’s own performance indicators, in order to develop a plan of action.

Such a review should be carried out every fiscal year, for performance against existing policies, and taking into consideration new or amended policies for responding to common environmental issues faced in Japan that require mutual cooperation. Model cases that can be referred to might include environmentally advanced countries such as Germany, where the improvement of comprehensiveness, innovation and independence of policies is verified each fiscal year, and changes managed in line with developing circumstances. Another useful point of reference is the system and framework of Fukuoka City, which, like Sapporo, has high greenhouse gas emissions from its civil sectors. Establishing a model case for each objective, and developing Sapporo City’s own indicators, would be highly worthwhile.

When the example of Germany is raised, it is not for the sake of simple comparison since the national Government is deeply involved in policy; rather it is to emphasize that benchmarks can be effective. For example, each fiscal year – or in any case where major legislation is enacted in Japan – the verification of major items such as the improvement of comprehensiveness, innovation and independence of policies, could be achieved through a checklist. As things currently stand, there is room to further deepen the review – with respect to CO₂ emission reduction, nuclear policies and environmental industries following the enactment of legislation, and with respect to “park and ride” systems and car-sharing initiatives from the Traffic Department.
Table 2 – Comparison of Environmental Policies with Germany Issues for further study

<table>
<thead>
<tr>
<th>Improvable item</th>
<th>Japan/Sapporo</th>
<th>Germany</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1: Enact legislation</td>
<td>2009: Sapporo City initiates garbage fees</td>
<td>2003: Mandatory deposit system</td>
</tr>
<tr>
<td>2 CO₂ emission reduction and nuclear policies</td>
<td>2008: Renewable energy 3.2%</td>
<td>2010: Renewable energy 17%</td>
</tr>
<tr>
<td>2-1: Sustainable energy</td>
<td>2003: Reactor Protection System Law</td>
<td>1990: Commencement of FIT fixed-price purchase system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2009: Extended 12 years; Changed to closure in 2035.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2011: Officially decided to close all 17 nuclear plants by 2022.</td>
</tr>
<tr>
<td>3 Park and Ride systems</td>
<td>1974: Introduced in Sapporo City</td>
<td>1970: Reassessment of municipal streetcars</td>
</tr>
<tr>
<td></td>
<td>1971: Sapporo City underground shopping arcade opens</td>
<td>Provision of bike paths</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pedestrian malls</td>
</tr>
<tr>
<td>4 Car sharing</td>
<td></td>
<td>1988: Car sharing company incorporated</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Car sharing used as public vehicles</td>
</tr>
<tr>
<td>5 Introduction of environmental tax</td>
<td></td>
<td>1999: Environmental tax</td>
</tr>
<tr>
<td>6 Environmental industry</td>
<td></td>
<td>2009: Renewable energy employment: approximately 340,000 people</td>
</tr>
</tbody>
</table>

Table 2 above, meanwhile, shows how Sapporo could draw on the system and framework employed by Fukuoka City, given that the two cities share similar issues and targets.
### Table 3 – Fukuoka City Regional Promotion Plan for Global Warming Countermeasures (Phase 3)

<table>
<thead>
<tr>
<th>Countermeasures of residential sector and actions by each core group</th>
<th>System/Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1: Countermeasures relating to lifestyle</td>
<td></td>
</tr>
<tr>
<td>1-1-1: Put energy-saving activities into practice</td>
<td></td>
</tr>
<tr>
<td>1-1-1-1: Countermeasures relating to lifestyle</td>
<td></td>
</tr>
<tr>
<td>1-1-1-2: Deployment of energy-saving appliances</td>
<td></td>
</tr>
<tr>
<td>1-1-1-3: Put resource-saving activities into practice</td>
<td></td>
</tr>
<tr>
<td>1-1-2: Countermeasures relating to the home</td>
<td></td>
</tr>
<tr>
<td>1-1-3: Countermeasures relating to private cars</td>
<td></td>
</tr>
<tr>
<td>1-1-3-1: Proper utilization of private cars</td>
<td></td>
</tr>
<tr>
<td>1-1-3-2: Utilization of fuel-efficient cars</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Countermeasures of residential sector and actions by each core group</th>
<th>System/Scheme</th>
</tr>
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<tbody>
<tr>
<td>1-1-1: Countermeasures relating to lifestyle</td>
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<tr>
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</tr>
<tr>
<td>1-1-1-2: Deployment of energy-saving appliances</td>
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</tr>
<tr>
<td>1-1-1-3: Put resource-saving activities into practice</td>
<td></td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>1-1-3: Countermeasures relating to private cars</td>
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</tr>
<tr>
<td>1-1-3-1: Proper utilization of private cars</td>
<td></td>
</tr>
<tr>
<td>1-1-3-2: Utilization of fuel-efficient cars</td>
<td></td>
</tr>
</tbody>
</table>

- Cooperation with each organization
- Spread of Eco-Watt program
- Advice system
- Energy-saving competition (paid household award system)
- Energy-saving labeling system
- Subsidization policy for installation of solar energy generation systems
- Home performance display systems
- System for submission of energy-saving plans
- Systems for bus priority
- Field surveys on commuting
- One-day transit passes for private-car-free day
- Preferential tax treatment
- Municipal parking lot reduction and exemption system
- Mandatory no-idling policies for parking lots
Table 3 – Fukuoka City Regional Promotion Plan for Global Warming Countermeasures (Phase 3) (continued)

<table>
<thead>
<tr>
<th>System/Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2</strong> Countermeasures of business sector and actions by each core group</td>
</tr>
<tr>
<td><strong>2-1</strong>: Countermeasures relating to services</td>
</tr>
<tr>
<td><strong>2-1-1</strong>: Put energy-saving activities into practice</td>
</tr>
<tr>
<td>Cooperation with each organization</td>
</tr>
<tr>
<td>Acquisition of ISO certification and preferential treatment for EA21 participants</td>
</tr>
<tr>
<td>Introduction of case studies</td>
</tr>
<tr>
<td><strong>2-1-2</strong>: Deployment of energy-saving appliances</td>
</tr>
<tr>
<td><strong>2-1-3</strong>: Put resource-saving activities into practice</td>
</tr>
<tr>
<td>Revision of solid waste disposal fees and review of reduction and exemption systems</td>
</tr>
<tr>
<td>On-site surveys</td>
</tr>
<tr>
<td>Countermeasures against inappropriate transporting of resources into city</td>
</tr>
<tr>
<td>Restrictions on transporting resources into city</td>
</tr>
<tr>
<td>Drafting and study of overall policies</td>
</tr>
<tr>
<td>Free distribution of water flow restrictors</td>
</tr>
<tr>
<td><strong>2-2</strong>: Countermeasures relating to business facilities</td>
</tr>
<tr>
<td><strong>2-2-1</strong>: Deployment of energy-saving equipment, etc.</td>
</tr>
<tr>
<td>Energy management designated places of business</td>
</tr>
<tr>
<td>Reports on the status of energy use</td>
</tr>
<tr>
<td>Simplified energy-saving checkup</td>
</tr>
<tr>
<td>Diffusion and support of ESCO</td>
</tr>
<tr>
<td><strong>2-2-2</strong>: Promotion of energy-saving for buildings</td>
</tr>
<tr>
<td>Scheme for assessment and guidance for plans</td>
</tr>
<tr>
<td><strong>2-3</strong>: Countermeasures relating to service vehicles</td>
</tr>
<tr>
<td><strong>2-3-1</strong>: Proper utilization of service vehicles</td>
</tr>
<tr>
<td>Systems for bus priority</td>
</tr>
<tr>
<td><strong>2-3-2</strong>: Increase the efficiency of distribution</td>
</tr>
<tr>
<td>Set up freight transport parking meters (support for cooperative shipping and delivery)</td>
</tr>
<tr>
<td>Modal shift (strengthen the functions of airports and railroads)</td>
</tr>
<tr>
<td><strong>2-3-3</strong>: Utilization of fuel-efficient cars</td>
</tr>
<tr>
<td>Preferential tax treatment</td>
</tr>
<tr>
<td>Municipal parking lot reduction and exemption system</td>
</tr>
<tr>
<td>Financing system</td>
</tr>
<tr>
<td>Mandatory no-idling policies for parking lots</td>
</tr>
</tbody>
</table>
When part of the Fukuoka City Regional Promotion Plan for Global Warming Countermeasures (Phase 3) is benchmarked from the perspective of systems and frameworks, some noteworthy points arise.

There is potential, for example, for Sapporo City to study the energy-saving competition that Fukuoka is planning, or for the two cities to hold a joint competition or similar, as an action in the category of “development toward the acceptance and expansion of environmentally-friendly living” set out in the Sapporo Vision for the Promotion of Global Warming Countermeasures.

As another example, in Sapporo the 5th and 20th day of each month are designated as days to refrain from using automobiles as far as possible – such days are called “Refreshing No-Car Days”. Meanwhile in Fukuoka, in order to promote widespread consciousness about the impact of driving on the environment, every Friday had been designated as a private-car-free day; in connection with this policy, the city has been running an initiative to sell one-day transit passes for the public transport network. (However, because the Fukuoka City Environmental Department will cease to exist as of FY 2011, the sale of such passes ended on March 25, 2011.)

In addition, Fukuoka has set up freight transport parking meters and is carrying out support for cooperative shipping and delivery. It is also possible to go outside of the framework of benchmarks to exchange information among related cities and carry out exchanges such as studying each others’ policies.

5.1.3. Progress Management of Mass Transit

Recommendations

With respect to municipal electric railways, currently no clear goals or progress management method are set out in the mayor’s manifesto or the national Government’s Mid- and Long-Term Roadmap. Early coordination among city departments is desirable to rectify this.

As is shown in Table 4, the Sapporo Vision does not include any goal-setting for mass transit. The improvement of mass transit is a Sapporo policy with overriding priority according to the mayor’s manifesto, which states “We will promote town management that increases Sapporo’s appeal and dynamism through the expansion of light rail systems and the redevelopment of the city core.” The IBM SCC team recommends that this point should in future be managed from the perspective of the environment as an important approach to contributing to CO₂ reduction – by first engaging in enhanced coordination with the Traffic Department, then deciding on the direction to take as a city and incorporating this into the Vision.

The development of mass transit is a factor that receives emphasis in national policies as an important contributor to CO₂ reduction. In fact, among the eight items set out in the National Roadmap, mass transit is described as amounting to “regional development – regional development for walk-able living.”

Table 4 – Vision Action No. 3: “expanded utilization of next-generation automobiles, mass transit systems and the like”

<table>
<thead>
<tr>
<th></th>
<th>Goal setting</th>
<th>Progress management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deployment of next-generation automobiles</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Environmentally friendly driving</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Mass transit systems</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
This being the case, the IBM SCC team recommends that, with the cooperation of the Traffic Department as the agency with responsibility for mass transit policy, Sapporo harnesses progress management from the standpoint of CO₂ emission reduction with the aim of improving and expanding mass transit and promoting its use – starting, for example, with the light rail network that is emblematic of Sapporo (Figure 5), followed by the subway and bus systems, and the town management associated with these. This will have a significant impact of CO₂ reduction.

The improvement of the light rail system is an important mass transit policy. Sapporo’s system is going through large-scale cutbacks to the point that it had at one point been designated for elimination; today, although it runs at a deficit, the network remains due to the ardent support of Sapporo’s residents. The expansion of the light rail system is an important policy within the mayor’s manifesto and, as the result of public discussion in 2010, a public document was issued, stating that the system would be expanded and turned around so that it operates in the black\(^7\). This policy, and associated reductions in CO₂ emissions, should be handled by applying progress management from the perspective of promotion of global warming countermeasures, leading to positive PR for the city.

Under “regional development for walkable living” in the National Roadmap, the goal is for “10% reduction in automobile use for each passenger”, and Sapporo can expect the same degree of reduction. Taken together with the reduction in the share of automobile shipments, an overall reduction of 30,000,000t-CO₂ is expected from transport; proportionally divided among the 2010 population of Sapporo City\(^8\), this is equivalent to a reduction of about 450,000t-CO₂. This equates to 13% of the reduction of 3,400,000t-CO₂ due to the development of the scenario in the Sapporo’s Vision.
5.2. Transparency

5.2.1. Introduction of Numerical Value Target Management Cycle

Recommendations
The IBM SCC team recommends that Sapporo continues to set increased numerical targets for each designated action, and increase the transparency of progress such that the three constituent parties – the city of Sapporo (the mayor and each department), and its businesses and residents – own this progress together and are assured of being able to implement the Vision.

As the result of interviewing those involved, the SCC team came across the following issues relating to the actions prescribed in the Vision:

- Targets cannot be established.
  No way of measuring actual results has been established.
- Information is not sufficiently accurate.
  Actual values achieved cannot be obtained. CO₂ emissions are calculated using proportional division-based values, computation, etc.
- Information is not sufficiently granular.
  It is not possible to obtain the information necessary to create policies suitable for the regional characteristics of Sapporo – including seasonal influence, family structures and the like.
- Information is not sufficiently current.
  Depending on statistical data means that it takes a year or more to obtain information, with the result that the more recent situation cannot be grasped.

For these reasons, it may not be possible to quantitatively determine the progress and effectiveness of policies, the appropriateness of targets and so on. Table 5 sets out the state of quantification for each action.
<table>
<thead>
<tr>
<th>Action in the Vision</th>
<th>Target Value</th>
<th>Accuracy</th>
<th>Granularity</th>
<th>Currency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Suitable for northern climate</td>
<td>Percentage of correspondence to the national and Sapporo housing standards.</td>
<td>Data on new, single-family homes can be obtained through statistical information. However, reductions are calculated by means of an emissions coefficient.</td>
<td>Classification based on dwellings. Does not assume granular measurement such as by household structure.</td>
<td>Data is assumed to be obtained from statistical information.</td>
</tr>
<tr>
<td>2. High-efficiency hot-water supply and heating</td>
<td>Percentage of replacement of existing types of hot water equipment and heating equipment.</td>
<td>Data on the deployment of equipment can be obtained based on statistical information. However, reductions are calculated based on statistical information.</td>
<td>Does not contemplate granular measurement such as by household structure.</td>
<td>Data is assumed to be obtained from statistical information.</td>
</tr>
<tr>
<td>3. Next-generation automobiles and mass transit</td>
<td>Purchase percentage of next-generation automobiles.</td>
<td>Data on the purchase of new autos can be obtained from statistical information. However, reductions are calculated based on statistical information.</td>
<td>Classification based on type of automobile. Does not contemplate granular measurement such as by season, traffic tie-ups or driver.</td>
<td>Data is assumed to be obtained from statistical information.</td>
</tr>
<tr>
<td></td>
<td>Percentage of environmentally-friendly driving practice and fuel efficiency improvement percentage.</td>
<td>It is not possible to actually measure the percentage of environmentally-friendly driving or the results thereof.</td>
<td>Granularity is undefined because actual measurement is impossible.</td>
<td>Currency of information is undefined because actual measurement is impossible.</td>
</tr>
<tr>
<td></td>
<td>Expanded utilization of mass transit systems.</td>
<td>Targets have not been established and accuracy is undefined.</td>
<td>Targets have not been established and granularity is undefined.</td>
<td>Targets have not been established and currency of information is undefined.</td>
</tr>
<tr>
<td>4. Acceptance and expansion of environmentally-friendly living</td>
<td>Electrical power consumption by energy-saving consumer electronics.</td>
<td>Consumption data can be obtained from electrical utilities. However, it is not possible to distinguish the percentage of effect due to energy-saving consumer electronics. Reductions are calculated by means of an emissions coefficient.</td>
<td>Classification by lighting and other consumer electronics. Does not contemplate granular measurement such as by household structure.</td>
<td>Data is assumed to be obtained from statistical information.</td>
</tr>
<tr>
<td></td>
<td>Percentage of actions taken with consideration for the environment.</td>
<td>It is not possible to actually measure the percentage of actions taken with consideration for the environment or the results thereof.</td>
<td>Reductions are assumed based on the number of households. Does not contemplate granular measurement such as by household structure.</td>
<td>Timeliness of information is undefined because actual measurement is impossible.</td>
</tr>
</tbody>
</table>
Table 5 (continued) – State of Quantification for each action

<table>
<thead>
<tr>
<th>Action in the Vision</th>
<th>Target Value</th>
<th>Accuracy</th>
<th>Granularity</th>
<th>Currency</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Reduction of CO₂ due to business activities</td>
<td>Percentage of businesses implementing energy-saving and implementation effect.</td>
<td>Data on CO₂ emissions can be obtained from statistical information.</td>
<td>Classification by subject business.</td>
<td>Data is assumed to be obtained from statistical information.</td>
</tr>
<tr>
<td>6. Solar energy generation</td>
<td>Deployment percentage.</td>
<td>Installation data can be obtained from statistical information. However, reductions are calculated based on emissions coefficient.</td>
<td>Classification by business, residential, etc.</td>
<td>Data is assumed to be obtained from statistical information.</td>
</tr>
<tr>
<td>7. Deployment of lignocellulosic biofuels</td>
<td>Fuel consumption of businesses.</td>
<td>Fuel consumption is calculated based on assumptions.</td>
<td>Classification by business, type of biofuel, etc.</td>
<td>Data is assumed to be obtained from statistical information.</td>
</tr>
<tr>
<td></td>
<td>Deployment percentage of single-family homes.</td>
<td>Data on deployment percentage can be obtained from statistical information.</td>
<td>Reductions are assumed based on the number of single-family homes deployed.</td>
<td>Data is assumed to be obtained from statistical information.</td>
</tr>
<tr>
<td>8. Utilization of renewable energy</td>
<td>Number of houses deployed.</td>
<td>Data on the deployment of equipment can be obtained from statistical information. However, reductions are calculated by means of an assumption of reduction.</td>
<td>Classification based on solar heat and geothermal heat.</td>
<td>Data is assumed to be obtained from statistical information.</td>
</tr>
<tr>
<td>9. Waste reduction and recycling</td>
<td>Waste reduction.</td>
<td>Waste reduction data can be obtained from statistical information. However, reductions are calculated based on emissions coefficient.</td>
<td>Classification based on the city’s burnable garbage volume. Does not contemplate granular measurement such as by household.</td>
<td>Data is assumed to be obtained from statistical information.</td>
</tr>
<tr>
<td>10. Cultivation of greenery</td>
<td>Percentage of Sapporo's forest reserve.</td>
<td>Reductions are calculated under the assumptions and proportional division based on the numerical values in the Kyoto Protocol.</td>
<td>Assumes reductions based on forests within Sapporo.</td>
<td>Information currency is undefined because actual measurement is impossible.</td>
</tr>
</tbody>
</table>
As a specific strategy to resolve these issues, the IBM SCC team recommends that a management cycle of numerical target-setting is defined, such as that set out below, and that all policies are integrated into this cycle. It is hoped that such cycle will be realized while taking into consideration the PDCA\(^{19}\) and BPM\(^{20}\) management methods. An illustration of this approach is set out in Figure 6.

1. **Ability to interpret actual results**: Conduct data collection with consistency through chronological order. There are numerous steps to the method of interpreting actual results. Starting with items that can already be obtained as fixed values (e.g. the number of automobiles deployed, based on statistical information), those doing the measuring should define and obtain data items that will serve as substitutes in cases where it is technically difficult to obtain fixed values. Surveys of residents on the effect of environmentally-friendly living come under this category. In future, it may be possible to leverage information technology to obtain difficult-to-achieve data such as the effect of environmentally-friendly driving. Sapporo must be able to appreciate the range of collection methods available and which will best serve its needs.

2. **Comprehension of achievement level**: A framework should be prepared to enable the city to understand the progress that has been made, based on the collection of data, at each of the following levels: the city as a whole; each department; businesses; and residents. The information desired will differ according to the reader – the mayor will look at the progress of the city as a whole and adjust policy to be optimal overall, for example, while residents will understand specific examples to see whether they can contribute proactively toward CO\(_2\) emission reduction through their own daily behavior. Choice of appropriate key performance indicators (KPIs) should be determined according to the likely readers, and information announced through appropriate means. Examples might include the publication on the city’s homepage of the progress of individual policies, and the deployment of a “dashboard”\(^{21}\) to verify the level of achievement toward the target, whether it is within the target range, etc.

---

**Figure 6**
Numerical Value Target Management Cycle

<table>
<thead>
<tr>
<th>Item</th>
<th>Specific example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar energy</td>
<td>Amount of electricity generated at schools</td>
</tr>
<tr>
<td>Environmentally friendly living</td>
<td>Effect of actions taken with consideration for the environment</td>
</tr>
<tr>
<td>Environmentally friendly driving</td>
<td>Fuel-efficiency improvement rate</td>
</tr>
</tbody>
</table>

**Effects due to introduction of numerical value target management cycle**
- Speed policies suitable for regional characteristics
- Sure and steady promotion of CO\(_2\) reduction

---

**Centralized management of in-city information**

**Sapporo Public Information**

**Feedback to citizens**

---

**Comprehension of actual results**

1. **Assessment and improvement**

2. **Incorporate all policies into the management cycle of numerical target setting**

3. **Comprehension of achievement level**

4. **Promotion of further reductions**

5. **Reflection in policies**

Data collection leveraging IT (improvement of freshness and granularity)
3. Promotion of further reductions: By being able to understand real achievement levels in numerical terms, it will become possible to quantitatively prioritize areas and policies that require intensified approaches. Increased information currency and granularity will enable the speedy study of very detailed policies that take into consideration not annual, country-wide data provided by the national Government, but factors such as the regional characteristics and seasonal fluctuations of Sapporo. Policies that provide accurate feedback to each constituency based on such information are advised. Possible specific methods for feedback might include the improvement of environmental awareness through the Kobo Sapporo.

4. Assessment and improvement: The IBM SCC team recommends building a framework in which it is possible to review regularly whether the initial targets and policies have proved to be appropriate. In this phase, it is advised that the review is conducted (and redefinition achieved) of the methods originally set for interpreting actual results; the indicators for understanding achievement levels (KPIs); and, by extension, whether the policies that were promoted were appropriate. The results of these steps will then be reflected in policies. Repetition of the actual-result interpretation cycle based on improved policies will enable the sure and steady promotion of CO₂ reduction based on real and current values.

5.2.2. Examples of Data Collection Leveraging IT Recommendations

There are examples of collection of traffic volume and driving data which involve leveraging IT and these are contributing to CO₂ reduction, including secondary effects in line with the analysis and application of the data that has been gathered. Advanced IT-based collection and study methods of this nature are recommended.

In Sapporo, residents tend to opt for automobiles over mass transit, which impedes CO₂ emission reduction. Support for this can be found in the significant traffic jams that occur during the winter time, when it is difficult to move on foot or by bicycle, and the fact that the utilization of mass transit has decreased substantially compared to automobile use. Indeed, dependence on automobiles is expected to increase (Sapporo Metropolitan Area Transit Master Plan22, 2.1.1).

Furthermore, it is not possible to understand the status of progress of CO₂ reduction relating to automobiles based on actual findings, which has direct implications for the city’s Vision. Of the 10 actions set out in the Vision for counteracting climate warming, the third indicates “next-generation automobiles and mass transit”, with targets for CO₂ reductions and fuel-efficiency improvement in line with the deployment of next-generation automobiles. These are to be calculated based on statistical information provided by the national Government (the Ministry of the Environment); the collection of actual values for emissions that take into consideration the regional characteristics of Sapporo is not assumed. As for environmentally-friendly driving, there is an assumption of the percentage of implementation and fuel efficiency improvement but, again, the collection of actual values is not assumed.

On the other hand, there are examples of collection of traffic volume and driving data that leverage IT throughout the world, including cases where such practices are contributing to CO₂ reduction, even if this is at a secondary level, though the analysis that is enabled. Sapporo should refer to such approaches when studying policies for eliminating dependence on automobiles.

Examples of such approaches are set out below, with accompanying objectives and effects:
Norwich Union (collection of driving data)
Norwich Union, the United Kingdom’s largest insurance company, built a pilot system to collect driving data obtained through a device installed inside automobiles, with the goal of building a framework that would allow the company to price insurance premiums on a “pay as you drive” basis (i.e. according to the time drivers spent at the wheel). The effects anticipated from this program included changes to driving habits, due to driver awareness of insurance premiums (including the avoidance of driving in downtown areas or during peak traffic times to avoid traffic jams). This, in turn, would be based on the accurate calculation and transparency of insurance premiums made possible by vehicle use data for each driver. This inspirational example demonstrates how the collection and publication of real data can be used to influence driver behavior.

A newspaper article covering the use of driver data collection, which includes a diagram of how the process works, is shown in Figure 7.

Sweden Road Ministry and Stockholm City (traffic data collection)
The city of Stockholm installed an intelligent fee-collection system in its downtown area. Fee-collection points were established at entrances to this zone, and fees were collected by reading vehicle registration numbers. Vehicles were identified by sensors (in the case of those with onboard units installed), and by license plates (in the case of vehicles lacking onboard units). All starting points and end points in the system are connected, including the information sources such as sensors and cameras, and the business processes such as the traffic fee invoicing system. Using this system, Stockholm was able to achieve a 20% reduction in traffic volume and a 40% reduction in CO₂ emissions – as well as a 40,000 person increase in public transportation use. The approach is illustrated in Figure 8.

Figure 7
Norwich Union’s driver data collection process (created by IBM based on Connectivity for a Smarter Planet)

Figure 8
Stockholm, Sweden’s approach (excerpt from Stockholm Road Traffic Innovation)
Kyoto University (traffic and driver behavior simulation)

In a drive to tackle problems in Kyoto’s metropolitan area, such as the elimination of traffic jams, the reduction of CO$_2$ emissions from automobiles and the realization of a more compact city, Kyoto University developed a traffic simulator. It based this not on analysis of actual traffic phenomena using statistical data, but rather on a dynamic action model that reflects people’s situational judgments. Using this approach, it was possible to conduct micro-simulations of changes to traffic based on the deployment of fee collection systems and speed limits to control CO$_2$ emissions – particularly relating to large volumes of traffic, such as 810,000 vehicles moving simultaneously.

The use of traffic simulation enables the estimation of the values of indicators that are difficult to measure with typical traffic volume surveys – including vehicle density, travel time and CO$_2$ emissions. The simulation is illustrated in Figure 9.

Such examples should offer inspiration to Sapporo. The city also has a further opportunity to leverage data that takes into consideration the regional characteristics of the city – including information on snow accumulation in winter (weather reports, snow-removal status, road heating, etc). Although it may be difficult to pull such data together dynamically at the current time, it should be possible in future to further improve traffic planning by studying plans to collect and leverage this kind of data in real time.
5.2.3. Promotion of Policies toward Small and Medium-sized Enterprises

Recommendations

In order to promote response from the offices of small and medium-sized enterprises, which are estimated to account for a majority of greenhouse gas emissions in the business sector, Sapporo should consider promoting an understanding of the actual situation (transparency); presenting the results of analysis of the collected data to each industry classification; and facilitating autonomous improvement by businesses.

The proportion of industry in Sapporo made up of small and medium-sized enterprises and tertiary industry is high compared to many other cities. Companies with 50 employees or fewer represent 90% of the places of business, as well as accounting for the majority of employees in Sapporo (companies with 100 employees or fewer comprise 70% of the city’s businesses). (See Figures 10, 11).
At the same time, the percentage of secondary industries such as manufacturing is low compared to the rest of the country, in terms of the number of business places and the number of employees. Rather, there is a high concentration of tertiary industry including service businesses, eating and drinking establishments and the hotel/lodging industry.

The percentage of total industry represented by the manufacturing industry, meanwhile, is about one-third that seen across the country as a whole, in terms of the number of business places and number of employees. (Figures 12, 13).

**Figure 12**
Percentage of Sapporo business places by industrial classification

**Figure 13**
Percentage of Sapporo employees by industrial classification

*Source: IBM, based on Sapporo City Statistics Book, 2010 Version*
As things stand currently, there is no accurate information on the CO₂ emissions of small and medium-sized enterprises in Sapporo, but some assumptions can be made based on the statistics about the industrial make-up of the city. It can be assumed, for example, that the number of employees parallels the size of the office. Distribution of CO₂ emissions by size of enterprise in the civil (business) sector can be estimated to closely relate to the distribution of percentage of employees by size of staff. Since companies of 100 employees or fewer comprise 70% of businesses, it is fair to assume that this section of the business sector accounts for the biggest proportion of CO₂ emissions in the city. For this reason, the promotion of global warming countermeasures to small and medium-sized enterprises is particularly critical.

“Development toward the reduction of CO₂ due to business activities” is the fifth action listed in Sapporo’s Vision of the Vision, which sets out a target that “all businesses in the city achieve about 1% of the energy-saving.” To ensure that small and medium-sized enterprises carry out global warming countermeasures, it is recommended that there are measures to study and address the following issues, which are likely to present challenges in the attempt to achieve this target:

- "It’s My Business" Consciousness: Small and medium-sized enterprises are not subject to all of the regulations that are imposed on large business, for example the “Act on the Rational Use of Energy” ("Energy-Saving Act") and the “Act on Promotion of Global Warming Countermeasures” ("Global Warming Countermeasures Act"). Partially as a result of this, their consciousness and understanding of the actual situation is insufficient. Business people themselves do not have a view of the performance or impact of their own companies, and in any case are likely to feel distanced from any sense of personal responsibility for their environmental impact when in the workplace. This lack of consciousness is not limited to Sapporo, but exists nationwide; however, due to the predominance of small and medium-sized enterprises in Sapporo, consideration of countermeasures is even more crucial.

- Insufficient know-how on how to revise business activities: Because they do not appreciate the actual situation, and moreover have no means of comparison with enterprises of similar size in the same industrial classification, it is possible that SMEs lack sufficient knowhow about how to reform and revise their business activities under their own steam (i.e. they lack the “soft” resources to make progress).

- Investment capacity: Against the backdrop of the recent social and economic situation, it is possible that such enterprises do not have the capital investment capacity (i.e. “hard” or material resources) for climate warming countermeasures that do not directly connect to their core business. In addition, there may be problems in obtaining credit from financial institutions, because of the difficult financial environment currently. This may restrict their response to the global warming issue.

In order to bring about a Plan-Do-Check-Act (PDCA) cycle in which small and medium-sized enterprises themselves autonomously promote improvement, it is important that they first come to terms with the current situation with regard to global warming. Unlike with large businesses, it is necessary to make available convenient, low-cost means of improvement to small and medium-sized enterprises. Currently in Sapporo, so-called “watt checkers” are being deployed as part of a campaign to cut household electricity use. The expansion of this sort of awareness program to small and medium-sized enterprises, through data gathering on a per-device basis, holds promise as an effective first step.

Bird’s-eye view of the entire place of business: As the next step as part of the short-term response, it is recommended that electrical utilities gather information on the current situation across an entire place of business in drawing up a company’s monthly utility statement. Measurement by each device or piece of equipment by means of “watt checkers” is limited in that this practice only allows an organization to understand the improvements relating to a portion of devices. Building a picture of the energy consumption across the entire place of business requires that integrated information can be fed into the various policies undertaken by business owners – enabling them to identify and influence patterns of behavior and consumption as they vary by season, day of the week, outside temperature, and so on.
Provision of know-how through information analysis: Enabling greater transparency of energy consumption patterns can be expected to stimulate reduced usage among SMEs through self-help. However, in order to stimulate faster, more effective response by more businesses, it is necessary to stimulate the accumulation of know-how by government agencies and advice through demands for information disclosure. An effective approach might be to analyze collected data, as is being done in the “Home Environmental Checkups” promoted by the Ministry of the Environment.

Upgrading of countermeasures: Given Japan’s situation in the wake of the recent earthquake and tsunami disaster, it is expected that in future, nationwide limits on energy consumption will come into play. While on one hand, the use of sensor technology can be expected to enable comprehension of energy consumption, studies on schemes for IT-based data gathering will rapidly develop too and it is likely that the cost of deploying IT devices will come down in the near future.

In the light of these developments, it is hoped that there will be a wider deployment of digital data gathering processes that leverage IT, enabling more accurate analysis that can inform the way small and mid-sized companies behave. The benefit of using IT to automate this process and integrate the data is that this can be done not only very reliably and accurately, but also at higher frequency (e.g. hourly consumption data) and with greater granularity (e.g. consumption data by individual office floor) (See Figure 14).

<table>
<thead>
<tr>
<th>Short term: Can be done right away</th>
<th>In future: Develop an information foundation and upgrade</th>
</tr>
</thead>
<tbody>
<tr>
<td>First of all: Transparency</td>
<td></td>
</tr>
<tr>
<td>By Device</td>
<td>Sum total</td>
</tr>
<tr>
<td>Development of “watt checkers” etc.</td>
<td>Monthly total in utility statement, etc.</td>
</tr>
<tr>
<td>Limited effect</td>
<td>Bird’s eye view of the entirety</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum total</td>
<td>By floor, etc.</td>
</tr>
<tr>
<td>Per hour</td>
<td>Per hour</td>
</tr>
<tr>
<td>Real time, etc.</td>
<td>Real time, etc.</td>
</tr>
<tr>
<td>Improvement of frequency</td>
<td>Improvement granularity</td>
</tr>
</tbody>
</table>

**Figure 14**
Diagram of the promotion of transparency in the short and long term
5.2.4. Promotion of Policies for Multi-family Units

Recommendations

The percentage of inner-city households that are in apartment blocks or some other form of multi-family unit is 63% and rising, so promoting the transparency of the actual results and effectiveness of deployment is becoming more important.

In Sapporo, the percentage of apartment (multi-family) units has been increasing year on year, and as of FY 2008, they had grown to represent 63% of all housing units (see Figure 15). The reasons for this include, in particular, convenience during the winter season (e.g. alleviating the burden of snow removal for senior citizens), and the convenience of proximity to transport links. On the other hand, this concentration can also be seen as evidence of the inducement to reside in the downtown area, along subway lines and so on, as indicated in the “Fourth Sapporo Long-term General Plan”30; as well as steady progress toward the “lifestyle of citizens who live in a compact town” as set out in the city’s Vision.

In order to improve the effectiveness of the “diffusion of energy-efficient homes of suitable for a northern-climate” and “acceptance of environmentally-friendly living” described in the Vision, as well as the “eco project”31 currently being implemented, it is necessary for Sapporo, with its high percentage of emissions from the residential sector, to actively study policies that facilitate energy-saving steps in multi-family units. This should bring about sure and steady reductions in the residential sector, which unlike the industrial sector is not governed by energy-saving regulations.

The “Sapporo Housing Master Plan 2011”32 aims to promote the building of homes that take the environment into consideration, while improving the quality of existing stock with a view toward improving their earthquake resistance as well as eco-friendliness. The plan also sets out the need for quality improvement and environmental consideration in city-provided housing, which includes the utilization of surplus land due to the rebuilding in collaboration with welfare and town-management policies33. It is hoped that the deployment of environment-friendly devices will be promoted to coincide with any such rebuilding.

Source: IBM, based on Sapporo City Statistics Book, 2010 Version

Figure 15
State of Sapporo Housing by Structure Type
The deployment of energy-saving gas heat appliances that Sapporo promotes as part of its “eco project” and other related initiatives is gaining recognition due to increased energy-saving consciousness and the associated economic benefits. Such deployment is increasing rapidly in newly-constructed multi-family units. That said, the deployment of energy-saving appliances in existing multi-family units is currently considered to be technically difficult so is not progressing here.

The ESCO project provides an example of an effective means of facilitating the deployment of energy-saving appliances while reducing the burden on local governments. Since 2003, Sapporo city has been developing various approaches to implementing the “Survey of the Possibility of Deploying ESCO,” and steadily promoting the project. Various approaches are already being developed, such as employing the means to integrate multiple facilities in the interests of economic rationalization – through the expansion of the project and the promotion of the ESCO project at Sapporo’s ward office facilities. This is targeted at city hospitals and multi-facilities.

In terms of the application of the ESCO project to existing housing, in addition to technical problems there is also the issue of the project being considered inferior in terms of its scope and scale. In addition, since the benefits of the project are not clear to residents (in comparison to improvements in crime prevention, earthquake resistance, help for the elderly and so on), the incentives for improvement have been found not to work. The promotion of the project is also hampered by the need to work toward agreements with management associations.

To resolve these issues, the IBM SCC team feels it would be effective to:

- provide management associations, residents, etc. with specific menus of effective energy-saving devices; and
- develop and disseminate a business that leverages a scheme for the ESCO project, which guarantees the benefits of deploying such devices (i.e. reduced energy costs), a leasing system that enables reduced initial investment outlays, and so on.

Further, to bring about improvement on the material/infrastructure (capital) front and realize the goal of “individual residents taking action” and the “need to reform the ways of everyday life” (as set out in the “Eco-Capital” declaration), the provision of information will be effective in improving the softer skills and resources side of the equation. Increased transparency on energy consumption will be effective in improving the ordinary citizen’s awareness – of the benefits of adopting a more environmentally-friendly lifestyle – while facilitating the development of information collection platforms and analyzing and reducing collected data will enable Sapporo to guide ordinary citizens toward self-reform through their understanding of the results of improvement.

5.3. Environment and Economy

5.3.1. Development of a Bio-fuels Ecosystem

Recommendations

The IBM SCC team recommends that, through cooperation with nearby municipalities, the city of Sapporo, which has a limited timber industry, studies the potential for developing a “local production for local consumption” ecosystem in which more economical bio-fuels and equipment purchases are possible. This research should be conducted with reference to actual results achieved both in Japan and overseas.

To support the economic potential of pellet fuel, it is desirable to think in terms of the parallel development of the local timber industry; however, the scale would be limited if based only on the timber industry of Sapporo. Compared to the widely-used conventional kerosene stoves, pellet stoves and boilers face substantial impediments to deployment – due to both the inconvenience of having to frequently supply fuel by hand, and the high price of equipment. At the same time, the promotion of deployment by means of government subsidies is problematic from the standpoint of sustainability in an environment where there is no prospect of increased tax revenues based on any expansion within Sapporo of industries relating to pellets.
This being the case, it is recommended that, through cooperation with nearby municipalities with active timber industry and related industries, Sapporo looks into the potential benefits of harnessing bio-fuels, by exploring the impact seen elsewhere in Japan as well as overseas. The aim of this research would be to develop an ecosystem in which more economical bio-fuels and equipment purchases become possible, and whereby the economy involving bio-fuels functions on a “local production for local consumption” basis. For example, it is probably possible to accelerate the deployment of pellet stoves and boilers by devising (in cooperation with nearby municipalities involved in pellet production) a policy of temporary subsidies to promote the major expansion of both the timber industry and pellet consumption.

For example, in the country of Sweden, in northern Europe, which has a locally active timber industry, a large-scale shift to bio-fuel-based electricity generation began in 1990, which by 2010 had succeeded in surpassing electrical generation based on fossil fuels in terms of electricity generated (see Figure 16). The case of Freiberg, Germany, where impressive progress has also been seen, provides a further reference.

**Figure 16**
Sweden's usage of bio-fuels (data from SVEBIO)
In these examples, a benevolent cycle was created. Making it possible to profit from costly forest-thinning activity enables a timber industry comprised of forest development and timber production to flourish, and the drop in prices of bio-fuels (such as pellets obtained from forest thinning activity) continues. In the case of Sapporo, it is desirable that the city, with its limited timber industry, works not on its own but together with nearby municipalities that have flourishing timber industries.

If nearby forests can be made into tourism resources, meanwhile, an increase in visitors to the city can be expected. Currently, there do not appear to be any policies aimed at deriving economic benefit for the city from the development of the surrounding forests. It is suggested therefore that Sapporo considers establishing an agriculture and forestry promotion office within its tourism board, using as a reference Kyoto City which promotes nearby forests as tourist attractions.

5.3.2. Possibility of Credit Business, Leveraging Surplus Reductions

Recommendations

It will be possible for Sapporo, as the municipality with the greatest energy demand in Hokkaido, to develop a new business aimed at supporting nearby municipalities in achieving their targets, by realizing its own 25% reduction through increased efforts and turning the surplus portion into credits.

Sapporo, a major city accounting for 30% of the population of Hokkaido, claims the greatest energy demand in Hokkaido while generating the largest proportion of CO₂ emissions, despite having a relatively small percentage of manufacturing industries (see Figure 17). However, there are no large electricity-generating facilities within Sapporo; rather, electricity is supplied from facilities outside the city. Given the localized characteristics of Sapporo, in terms of the concentration of energy consumption among residents and businesses, to the city should consider contributing to the reduction efforts of other, nearby regions and of Hokkaido.

Specifically, it is recommended that Sapporo is open to considering the development of a new business which would see the city sell the surplus reductions created through its efforts to other regions and municipalities, by steadily implementing the scenario based on the city’s declared 10 actions, and realizing additional reduction efforts in the run-up to the year 2020.

The following study forms the basis of a possible proposal to contribute to regional energy demand countermeasures through reduction of “energy consumption that generates CO₂”.

- **Contribution through positive electrical generation:**
  By promoting the leveraging of (a) solar energy generation within the city, including the deployment of mega solar; and (b) distributed generation of renewable energy by means of wind power, biomass, etc, and advancing the study of smart grids (next-generation transmission networks) discussed in a separate section of this report, it is possible to bring about the management and transparency of information concerning energy. A study should be made of the possible deployment of “virtual power plants” through the unified management of electrical power resulting from such distributed generation.

<table>
<thead>
<tr>
<th>Local government name</th>
<th>CO₂ total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sapporo City</td>
<td>10,286,627</td>
</tr>
<tr>
<td>Muroran City</td>
<td>3,977,507</td>
</tr>
<tr>
<td>Asahikawa City</td>
<td>2,244,489</td>
</tr>
<tr>
<td>Tomakomai City</td>
<td>1,915,123</td>
</tr>
<tr>
<td>Hakodate City</td>
<td>1,851,290</td>
</tr>
<tr>
<td>Kushiro City</td>
<td>1,499,883</td>
</tr>
<tr>
<td>Obihiro City</td>
<td>1,201,073</td>
</tr>
<tr>
<td>Otaru City</td>
<td>1,123,455</td>
</tr>
<tr>
<td>Kitami City</td>
<td>1,037,499</td>
</tr>
<tr>
<td>Ebetsu City</td>
<td>745,832</td>
</tr>
</tbody>
</table>

**Figure 17**
Comparison of CO₂ emissions of Hokkaido’s municipalities (2003 estimates)
• **Contribution through negative electrical generation:**  
The possibility of contributing to the reduction policies of municipalities unable to achieve their targets should be considered in the following way: (1) CO₂ reductions, achieved through the steady implementation of various policies developed in the Vision, should be treated as “negative electrical generation”; (2) the effects of reduction policies should be understood and measured in such a way that they can be reflected in the domestic credit system implemented by the national Government⁴²; and [3] reductions should be turned into credits, made possible through an understanding of the difference between the estimated usage (had the policies not been implemented) and the actual usage.⁴³

Using Sapporo's reduction efforts toward regional contributions will require the development of various systems that include cooperation with the national Government's system. It is hoped that this will come within the scope of future discussion, as a business development based on the extension of the technical study of smart grids.

**5.3.3. Study of the Deployment of Smart Grids**  
**Recommendations**

It is recommended that the city of Sapporo, which aims to expand the use of renewable energy, begins to consider the deployment of technology such as smart grids to aid the way it manages energy consumption and carbon reduction initiatives. An investigation of the approaches of other cities will be of great value here, to determine what is possible and how this is best achieved.

In the wake of the serious nuclear accident caused by the recent earthquake and tsunami in Japan, movements are accelerating throughout the country to reduce dependence on nuclear power – for example, via the Renewable Energy Special Measures Act⁴⁴, which seeks to force electrical power suppliers to purchase electricity generated by renewable energy for certain periods at certain prices. Sapporo is also aiming to create a more sustainable society through steps such as soliciting the views of its citizens⁴⁵ on a post-nuclear society, and publicly inviting proposals⁴⁶ to conduct a survey on the use and leveraging of sustainable energy.

It is noteworthy that three of the 10 points in the “Sapporo Vision for the Promotion of Global Warming Countermeasures” (specifically numbers 6, 7 and 8) address this issue, demonstrating Sapporo's acceptance that the expanded utilization of renewable energy – such as solar and wind power – is an issue that absolutely must be addressed.

However, any strategy to deploy renewable energy must take into account the following issues:

- **Instability of electrical supply:** Sunlight and wind power, by their nature, offer fluctuating supply capability depending on the season and time of day. For this reason, it is difficult to rely on these sources for regions that continuously consume large amounts of electrical power.

- **Distribution of electrical power sources:** These sources do not generate bulk volumes at large-scale power plants; rather, multiple electrical power sources exist on a power grid. Distributed supply and demand control is required.

- **Installation costs:** Devices need to be newly installed, creating issues of labor and cost.

- **Electricity generation cost:** Compared to existing electricity-generating facilities, there is a high cost per unit of energy.

The characteristics of each type of renewable energy differ with respect to the above issues (e.g. solar power provides an unstable supply, but installation is easy). In addition to the characteristics of each form of energy, Table 6 displays a list that includes volume efficiency and potential scale.

In order to resolve this sort of energy supply problem, it is necessary to respond by combining (a) devices, based on laws and regulations including incentives to business (such as fixed purchase systems and deregulation), with (b) methods that use IT to coordinate supply and demand, storage technologies and so on.
It is recommended, therefore, that Sapporo begins to study the deployment of technology such as smart grids, with a view to harvesting unstable energy supplies and drawing these into the power grid, and optimizing energy usage from both supply and demand sides. This approach is illustrated in Figure 18. An analysis will be required (taking into consideration various case studies), of what Sapporo can achieve as a city; what the issues relating to deployment will be; and which institutions will facilitate deployment.

Ultimately, the IBM SCC team believes smart grids should be promoted by the city of Sapporo – i.e. the local government that bears responsibility for regional development – as a leader that can show what proactive city management should look like, and spearheading an initiative that includes application for special zone status and incentives to business.

### Table 6 – Renewable energy and its characteristics

<table>
<thead>
<tr>
<th>Renewable energy</th>
<th>Stability of electrical power supply</th>
<th>Concentration of electrical power sources</th>
<th>Easy of installation</th>
<th>Electrical generation cost</th>
<th>Volume efficiency</th>
<th>Potential scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar energy (residential)</td>
<td>★</td>
<td>★</td>
<td>★</td>
<td>★</td>
<td>★</td>
<td>★</td>
</tr>
<tr>
<td>Mega solar</td>
<td>△</td>
<td>★</td>
<td>△</td>
<td>★</td>
<td>★</td>
<td>★</td>
</tr>
<tr>
<td>Wind power (Land-based)</td>
<td>★</td>
<td>★</td>
<td>△</td>
<td>★</td>
<td>★</td>
<td>★</td>
</tr>
<tr>
<td>Biomass</td>
<td>★</td>
<td>★</td>
<td>★</td>
<td>★</td>
<td>★</td>
<td>★</td>
</tr>
<tr>
<td>Small and medium water power</td>
<td>★</td>
<td>★</td>
<td>△</td>
<td>★</td>
<td>★</td>
<td>★</td>
</tr>
<tr>
<td>Geothermal</td>
<td>★</td>
<td>★</td>
<td>★</td>
<td>★</td>
<td>★</td>
<td>★</td>
</tr>
</tbody>
</table>

- ★ Have advantage
- △ Moderate
- ▲ Subordinated

Source: IBM based on energy and environment meeting materials.
Research into smart grids and related opportunities as an approach to optimizing energy usage is advancing around the world, with perceived benefits seen as improved control over demand for services, and the deployment of renewable energy. Specific examples of demand control include (a) residents proactively saving energy because they are able to monitor their consumption levels or electricity charges via the Web; (b) the ability to control electricity consumption through the ability to view information in near real-time; and (c) the ability to make informed choices – for example in shifting the time when household electrical appliances are used.

In terms of the deployment of renewable energy, there are advances in area-based energy management schemes and the like which leverage multiple energy sources including solar and wind power. These enable efficient, optimal utilization of energy and approaches based on the proactive cooperation of citizens, whereby residents select and implement flexible, energy-saving activities in line with their desired lifestyles. One example of such an approach is set out below.
Dubuque, Iowa (USA)

The city of Dubuque in Iowa has established a project to roll out a number of measures that are designed to reduce the impact on the environment, with a view to creating a more hospitable and sustainable city. These include:

- The deployment of systems to promote efficient energy consumption and water resources management;
- Enabling greater understanding of energy use through near-real-time monitoring, monitor and analysis of accurate information from the electrical grid and the water system;
- Increasing consciousness among residents of their consumption habits, as a drive toward cost and CO₂ reductions.
- Promoting CO₂ reduction through the integration of smart parking systems and public transit networks, with a view to reducing private sector emissions.

It is recommended that this kind of approach to project management, including the pilot format, offers a useful reference point for similar initiatives in Japan. The outline of the format is shown in Figure 19.

The pilot roll-out is described in more detail below.

**Phase 1: Consulting (6 months)**

To begin with, Dubuque and IBM collaborated in a consulting/analysis phase, designed to better understand the issues and identify the city's specific needs – from the standpoint of measurement standards to be monitored, systems to be improved and the test environments to be used. In this phase, the partners that would be needed (i.e. private sector companies, etc) were selected and began participating; Dubuque's fundamental data-creating questions were devised; and the scenario to be used in the testing and measurement of progress was created.

**Phase 2: Corroborative Experimentation (18 months)**

In the second phase of the project, a system of corroborative experiments was established to verify several ideas relating to potential innovative reforms. In order to be able to maximize use of all of the resulting data for the purpose of experiments and analysis, this was provided to the broader educational research community (including Iowa State University), for more in-depth interpretation. The point of these corroborative experiments was to (a) change the behavior of the residents on various levels; and (b) identify incentives that would be effective in stimulating the residents to adopt sustainable habits.

**Phase 3: Large-scale development (18 months)**

- Expansion of application to the entire year
- Expansion of subject buildings
- Expansion of applicable communities
- Transition from games to real transactions

*Source: IBM, from example introduction website*
Phase 3: Large-scale development (18 months)
In the next planned phase, the successful pilot programs will be selected for broader deployment across the greater part of Dubuque. This also includes implementing the resulting systems on a shared IT infrastructure.

Kitakyushu Smart Community Creation Project
In a second example, Japan’s national Government (Ministry of Economy, Trade and Industry) recruited a number of regions to carry out a “Next-Generation Energy Society System Demonstration”. The purpose of the initiative was to create and deploy a Japanese smart grid, which the Government had identified as a strategy for long-term growth). Kitakyushu City was selected for the “Kitakyushu Smart Community Creation Project”. The initiative is illustrated in Figure 20.

Specific examples of renewable energy undertakings and those concerning supply and demand control are set out below:

- **Development of the “10% New Energy” City Block**
  One aim is to draw 10% of the city’s energy from “new” sources, in a zone where 21,000kw of electrical power supply is currently being provided. The target is to use composite binary generation, leveraging 1,000kw (compared with 400kw currently) of solar energy generation, 400kw of fuel cells, small wind power generators and industrial waste heat. In addition, research will be progressed to development around mega solar projects, and collaborative policies on the supply of electrical power, throughout the town.

- **Deployment of energy-saving systems to buildings**
  In addition to targeting various buildings including general households, offices, commercial facilities, museums, factories and hospitals, the project encompasses energy-saving deployments including high-efficiency air conditioning and lighting systems, to city infrastructure including streetlamps, with a view to building a system that connects into and partners with the energy management of the area as a whole.

- **Building of an area energy management system with “energy-saving spots” at its core**
  The project will merge the development of the “10% new energy” zone and the deployment of energy-saving systems to buildings with the mission-critical electrical power system; take advantage of leading-edge energy controls, electric vehicles, rechargeable batteries and so on; and build control systems that enable energy management for the area as a whole. Under this area energy management system, management and operational controls that integrate the solar, hydrogen, wind power, waste heat in the area will be implemented.

In addition, an area community system will be built as a scheme to stimulate control on the part of customers. Measures include the use of application of dynamic pricing, the transparency of area and individual energy usage, and environmental reward programs. In short, energy-saving activities will be integrated into daily life and business activities.

As outlined above, experiments are now under way to integrate various forms of energy such as solar, wind power, fuel cells, electric vehicles and rechargeable batteries into power grids. Further, the demonstration and verification of carbon-offset environmental reward programs and energy management systems are being advanced as concrete actions.
Role fulfilled and form

- Introduce new energy into city plans in a planned way
- Civilian use of factory energy

**Deployment of Energy-saving Systems to Entire City Block**

Deployment of BEMS and HEMS that Correspond to Demand Response
- Smart House (20 households)
- Smart Stores (four locations)
- Smart Schools (four schools)
- Next-generation Service Stations (one location)
- Smart Hospitals (one location), etc.

- Reconcile the efficient energy utilization of individual facilities with optimization of the energy utilization of the town as a whole
- Standardization of smart metering by the town as a whole, overcoming differences between factories, buildings and the like.

**Building Local Communities Through Next-generation Transportation Systems, etc.**

General Mobility Management System

In addition to the large-scale deployment of electric vehicles, etc., promotion of the use of bicycles, and the practical application of small mobile devices, build a general mobility management system through steps such as cooperation with mass transit systems, community buses and the like.

- Provision of next-generation mobility stations
- Transit system that takes into consideration senior citizens, including an on-demand community bus operated in conjunction with hospitals.

**The “10% New Energy” City Block**

**Town Mega Solar**

Develop solar energy generation of 1,000kW in the region

**Kitakyushu Hydrogen Town**

Supply hydrogen through secondary hydrogen pipeline (use in fuel cells, etc.)

**Binary electrical generation**

Binary electrical generation demonstration projects, etc. using low-temperature waste heat from factories

**Deployment of Energy-saving Systems to Entire City Block**

**Role fulfilled and form**

- Reconcile the efficient energy utilization of individual facilities with optimization of the energy utilization of the town as a whole
- Standardization of smart metering by the town as a whole, overcoming differences between factories, buildings and the like.

**Building Local Communities Through Next-generation Transportation Systems, etc.**

**General Mobility Management System**

In addition to the large-scale deployment of electric vehicles, etc., promotion of the use of bicycles, and the practical application of small mobile devices, build a general mobility management system through steps such as cooperation with mass transit systems, community buses and the like.

- Provision of next-generation mobility stations
- Transit system that takes into consideration senior citizens, including an on-demand community bus operated in conjunction with hospitals.

**Role fulfilled and form**

- Reconcile the efficient energy utilization of individual facilities with optimization of the energy utilization of the town as a whole
- Standardization of smart metering by the town as a whole, overcoming differences between factories, buildings and the like.
Creation of Regional Energy Management

Regional Energy-Saving Spots
The region energy will become a foundation of management.

- Optimized distribution of energy in response to electricity generation status
- Reformation of control by consumers with the aim of optimizing the entire region
- Transparency of energy and CO$_2$
- Provision of Regional Energy-Saving Spots that include the function of providing incentives that will motivate consumers.

Large-scale Deployment of Smart Meters
Deployment of Smart Meters to approximately 70 companies and 200 houses

Carbon Offset and Environmental Reward Systems
Provision of incentives to promote citizen action.

Role fulfilled and form
- Maximum application in response to regional demand for new energy
- Minimization of energy use of the entire region
- Minimization of the impact of unstable energy generation on mission-critical electrical power.

Figure 20
The Kitakyushu Undertaking (Excerpt from the Regional Energy Management Demonstration Project in Kitakyushu)
5.4. Environmental Education

5.4.1. Establishment of indicators for environmental education and understanding its effect

Recommendations

It is recommended that, in order to understand the effect of environmental education and improve such activities, Sapporo should look to develop performance indicators, and be able to interpret and act on the resulting data.

The city of Sapporo has a history of engaging very affirmatively in environmental education. Examples include the enactment of the “Sapporo City Environmental Basic Ordinance” in 1995, the development of the “Sapporo City Environmental Education and Study Basic Policy” in 1996, and the revision of the “Sapporo City Environmental Education Basic Policy” completed in 2007 through the joint efforts of the Environmental Department and the Board of Education. Given that the situation is changing and developing all the time, the city needs to be in a position where it has an appropriate grasp of the situation at any one time, so that it is able to respond accordingly.

A look at Table 8, the “Sapporo City Environmental Education Program”⁵¹, shows that the program is largely classified into (a) elementary school focus, (b) junior and senior high school focus, and (c) household, area and workplace focus, and includes substantial content. This program was developed as a set of guidelines for effective environmental education, and efforts are being made to inform schools in order to promote its practical application. However, at the current time, no measure of performance has been established.

Examples of the use of performance indicator data can be found by (a) conducting a “Mini-Sapporo” exercise (based on a “Mini-Munich”⁵² initiative that the city of Munich in Germany implemented, where surveys of elementary school children and parents indicate a desire to further expand the program); and (b) cooperating with the Economic Department in developing a program to promote the Education for Sustainable Development program (ESD)⁵³, with emphasis on generations that have not been able to take part in the post-1996 program. Because awareness-promoting activities oriented will also need to be geared toward Sapporo’s 13 million annual visitors⁵⁴, it may also be necessary to gain agreement commitment from the Tourism and Culture Department to the Vision.

<table>
<thead>
<tr>
<th>Table 7</th>
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</thead>
<tbody>
<tr>
<td><strong>Development of enlightenment and education curriculum</strong></td>
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<tr>
<td><strong>Development of indicators for undertakings</strong></td>
</tr>
<tr>
<td><strong>Understanding of indicator data</strong></td>
</tr>
<tr>
<td><strong>Study of measures</strong></td>
</tr>
</tbody>
</table>

Examples of the use of performance indicator data can be found by (a) conducting a “Mini-Sapporo” exercise (based on a “Mini-Munich”⁵² initiative that the city of Munich in Germany implemented, where surveys of elementary school children and parents indicate a desire to further expand the program); and (b) cooperating with the Economic Department in developing a program to promote the Education for Sustainable Development program (ESD)⁵³, with emphasis on generations that have not been able to take part in the post-1996 program. Because awareness-promoting activities oriented will also need to be geared toward Sapporo’s 13 million annual visitors⁵⁴, it may also be necessary to gain agreement commitment from the Tourism and Culture Department to the Vision.

It is likely that the curriculum will need to be revised and augmented in line with further developments and changes in future, yet for the moment there is insufficient information to provide for this. In future, environmental awareness and education can be expected to advance further, as shown in Table 7, through the addition of approaches such as the development of activity-related performance indicators that can be readily understood and acted upon.
### Table 8 – Sapporo City Environmental Education Program

<table>
<thead>
<tr>
<th>Category</th>
<th>Program Name</th>
<th>Energy-saving</th>
<th>Waste reduction and recycling</th>
<th>Water and Greenery</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Elementary school</strong></td>
<td></td>
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<tr>
<td>Within curriculum</td>
<td>Social studies: How We Reduce Garbage (4th grade)</td>
<td></td>
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<tr>
<td></td>
<td>Where Does Water Come From? (4th grade)</td>
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<td></td>
<td>Let's Use Wood Carefully to Protect Forests! (5th grade)</td>
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<td></td>
<td>Science: How Electricity Works and Batteries (4th grade)</td>
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<td></td>
<td>Sapporo’s Raising Temperature (5th Grade)</td>
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<td></td>
<td>Carbon dioxide and Oxygen (6th grade)</td>
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<td></td>
<td>Living Things and the Environment (6th grade)</td>
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<td></td>
<td>Environmental Studies: Master Helpers Who are Gentle to the Earth (1st and 2nd grade)</td>
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<tr>
<td></td>
<td>Home Economics: Environmentally Friendly Cooking Practice (5th and 6th Grade)</td>
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<tr>
<td><strong>Outside Curriculum</strong></td>
<td>Multidisciplinary: Challenge! “Warm Biz” (5th and 6th grade)</td>
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<tr>
<td></td>
<td>Class activities: Let’s Think About Recycling Milk Cartons!</td>
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<td></td>
<td>Children’s Committee activities: Dispatch! From the Children’s Committee to All Schoolchildren!</td>
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<tr>
<td><strong>Entire School</strong></td>
<td>Goal: A School for Environmentally Friendly Living</td>
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<tr>
<td></td>
<td>Energy-saving That Can Be Done With One Finger!</td>
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<tr>
<td><strong>Middle School – High School</strong></td>
<td>Within curriculum: Social studies: Environmental Issues to Learn About in the Last Five Minutes (middle school)</td>
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<td></td>
<td>CO₂ Reduction That You Can Do</td>
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<td></td>
<td>Think About Global Warming and Energy</td>
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<td></td>
<td>Science: Science Study Communing with Greenery (middle school)</td>
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<td></td>
<td>Let’s Calculate How Much CO₂ Trees Absorb</td>
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<td></td>
<td>Science and Technical Home Economics: Technical Home Economics: Think About Energy-saving through Electricity Experiments (middle school)</td>
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</tbody>
</table>
### Table 8 (continued) – Sapporo City Environmental Education Program

<table>
<thead>
<tr>
<th>Category</th>
<th>Program Name</th>
<th>Energy-saving</th>
<th>Waste reduction and recycling</th>
<th>Water and Greenery</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Middle School</strong></td>
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<tr>
<td>High School (Continued)</td>
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<tr>
<td></td>
<td>Science and Multidisciplinary</td>
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<td></td>
<td>Living Things in the River</td>
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<td></td>
<td>Let’s Think About Sapporo’s Water Quality (middle school)</td>
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<td></td>
<td>Let’s Think About the Garbage Problem (middle school)</td>
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<td></td>
<td>Let’s Think About Sapporo’s Electricity</td>
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<td></td>
<td>Let’s Recycle the Milk Cartons From School Lunch</td>
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<tr>
<td><strong>Entire School</strong></td>
<td>Creation of curriculum for environmental education</td>
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<td></td>
<td>Approach to school that puts environmentally friendly living into practice</td>
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<td></td>
<td>Let’s Reduce Garbage from the School Festival (high school)</td>
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<tr>
<td><strong>Events</strong></td>
<td>Eco Summit in Sapporo!</td>
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<td><strong>Home</strong></td>
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<tr>
<td>Community</td>
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<tr>
<td>Workplace</td>
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<tr>
<td></td>
<td>Home</td>
<td></td>
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<tr>
<td></td>
<td>Energy-saving strategy</td>
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<tr>
<td><strong>Home and Community</strong></td>
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<tr>
<td></td>
<td>Let’s Think About the Environment Through Food</td>
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<tr>
<td></td>
<td>Rediscovery of “Garbage” and “Resources”</td>
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<tr>
<td></td>
<td>Let’s Get Familiar with Greenery</td>
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<tr>
<td><strong>Community</strong></td>
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<td></td>
<td>Let’s Start Environmental Behavior While Having Fun</td>
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<tr>
<td><strong>Workplace</strong></td>
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<td></td>
<td>Let’s Take Action in the Workplace to Reduce the Burden on the Environment</td>
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</tbody>
</table>
5.4.2. Education of Visitors

Recommendations

With regard to communicating Sapporo’s environmental mission to tourists and other visitors, it is recommended that the city develops an image strategy geared toward promoting Sapporo’s dreams and achievements in creating an “Eco-Capital”. This strategy should be broken down into a series of specific plans, measured using performance indicators.

Because Sapporo already has strong brand power as a tourist destination, having been ranked No1 for “attractiveness” in a national Japanese survey, it is recommended that through the “Sapporo Tourism Promotion Plan” (*provisional name*) that is currently in development, Sapporo develops a cohesive image strategy appropriate to its “Eco-Capital, Sapporo” goals.

Sapporo’s No1 brand status was awarded following a major “area brand survey” conducted by the Brand Research Institute, Inc, which looked across 1,000 local governments and the 47 prefectures in Japan, and ranked regions according to 63 criteria – including level of awareness, attractiveness, image and so on.

In the 2010 survey, as illustrated in Table 9, Sapporo was ranked No1 in Japan for attractiveness. For five continuous years since the launch of the survey, Sapporo has ranked No1 for the level of desire people had to visit. The city also ranked No1 in terms of the desire to purchase products for the third year in a row; and moved from the No2 spot in 2009 to No1 in 2010 for criteria assessing an area’s resources – for example, “the food is delicious” and “they have souvenirs and local products that I want to buy”. In addition, the city’s ranking for the “level of information provision” increased from No5 in the previous year to No1.

Because the survey describes area brands numerically in terms of the “attraction” that consumers feel for each area, this enables analysis of the various factors constituting “attraction” from the results of survey items – such as tourism, residence, products and other items. This paves the way for the city to collect and monitor objective data relating to Sapporo environmental credentials, harnessing the multiplier effect of tourism and the environment in the city system.

Table 9 – Rankings of level of attractiveness (municipalities ranked from 1 to 10)

<table>
<thead>
<tr>
<th>Rank 2010</th>
<th>Rank 2009</th>
<th>Local government name</th>
<th>Name of prefecture, etc.</th>
<th>Number of points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>Sapporo City</td>
<td>Hokkaido</td>
<td>57.0</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Hakodate City</td>
<td>Hokkaido</td>
<td>55.5</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Kyoto City</td>
<td>Kyoto</td>
<td>52.2</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Yokohama City</td>
<td>Kanagawa</td>
<td>49.6</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>Otaru City</td>
<td>Hokkaido</td>
<td>47.3</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>Kobe City</td>
<td>Hyogo</td>
<td>46.4</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>Kamakura City</td>
<td>Kanagawa</td>
<td>44.5</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>Furano City</td>
<td>Hokkaido</td>
<td>44.0</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>Kanazawa City</td>
<td>Ishikawa</td>
<td>38.6</td>
</tr>
<tr>
<td>10</td>
<td>13</td>
<td>Nagasaki City</td>
<td>Nagasaki</td>
<td>38.3</td>
</tr>
</tbody>
</table>
An example of this can be seen in Kyoto’s “Future Kyoto Tourism Promotion Plan 2010+5”\textsuperscript{56}. This lists seven projects as basic policies, of which numbers 1-4 are emphasized particularly. Environment-related policy is designated as one such emphasis policy. As shown in Table 10, the methods of promotion are planned into two main categories: the promotion of environmental credentials to visitors; and the development of environmentally-themed tourism attractions.

Because eco-tourism\textsuperscript{57} is being extensively and proactively promoted in Hokkaido, it is possible for Sapporo’s appeal as an Eco-Capital to grow even further – from a new perspective as a base for environmental excursions.

### Table 10 – Kyoto City “Future Kyoto Tourism Promotion Plan 2010+5”: Seven Projects

<table>
<thead>
<tr>
<th>1</th>
<th>“Travel as if Living There” Project (Main Points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1: Promotion of morning and evening tourism</td>
<td></td>
</tr>
<tr>
<td>1-2: Development of lodging facilities that support diverse needs</td>
<td></td>
</tr>
<tr>
<td>1-3: Activities to encourage multi-night stays</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>“Kyoto is Lovelier on Foot” Project (Main Points)</td>
</tr>
<tr>
<td>2-1: Development of an environment for enjoyable walking</td>
<td></td>
</tr>
<tr>
<td>2-2: Improved convenience of public transportation</td>
<td></td>
</tr>
<tr>
<td>2-3: Promotion of tourism involving walks through nature that is famous for its scenic beauty</td>
<td></td>
</tr>
<tr>
<td>2-4: Promotion of tourism appropriate for Kyoto, an environmental model</td>
<td></td>
</tr>
<tr>
<td>2-4-1: The promotion of environmental aspect to visitors</td>
<td></td>
</tr>
<tr>
<td>2-4-2: The development of environmentally themed tourism attractions</td>
<td></td>
</tr>
<tr>
<td>2-4-2-1: Expansion of eating and drinking establishments taking part in “Do You Kyoto? Day”</td>
<td></td>
</tr>
<tr>
<td>2-4-2-2: Promote the city-wide achievement of KES approval, including the tourism industry</td>
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<tr>
<td>2-4-2-3: The spread of “Mister Sun Power Generation” that puts to practical use natural energy through local production for local consumption</td>
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</tr>
<tr>
<td>3</td>
<td>“Residents Rediscover Kyoto” Project (Main Points)</td>
</tr>
<tr>
<td>4</td>
<td>“See Kyoto with Heart” Project (Main Points)</td>
</tr>
<tr>
<td>5</td>
<td>“Reduce Tourist Complaints to Zero” Project</td>
</tr>
<tr>
<td>6</td>
<td>“Securing New Fans of Kyoto” Project</td>
</tr>
<tr>
<td>7</td>
<td>“Skillfully Conveying the Charms of Kyoto” Project</td>
</tr>
</tbody>
</table>
5.5. Prioritization

Sapporo City has already developed its “Sapporo Plan for the Promotion of Global Warming Countermeasures” (initially drawn up in 2001 and revised in 2007). It is expected that when the “Basic Plan” is developed in future, based on the national Government’s proposed “Basic Act for Global Warming Countermeasures”, a more detailed plan of action will be developed setting out specific measures that will be undertaken in Sapporo. As noted above, this will need to allow for ongoing changes to requirements over time, and new developments enabled by the latest technological innovations.

To ensure positive forward action, the IBM SCC team advises prioritization when it comes to designing and introducing benchmarks.

Table 11 shows a proposed prioritization scheme for benchmarking which pays special attention to:

- Relative difficulty of implementation, e.g.
  - elements with high regulatory constraints;
  - elements whose purchasing cycles are difficult to work within;
  - elements that require cooperation between all departments; and
  - elements that will incur costs.
- Items whose target values are not established
- Items for which actions have not been broken into segments
- Items for which it is not possible to measure actual values
- Items that will have a large-scale effect.

It is desirable that any system employs allows for Sapporo itself to (a) add to and revise benchmarks; (b) concentrate resources on the more critical items without delay.

For example, it is possible to make target value references for appropriateness by comparing the CO₂ emission reduction percentage targeted for each item of the national Government’s roadmap. Table 12 compares the target reduction percentage from 2007 to 2020 for each of the sectors set out in the Vision – civil residential, civil business and transport.

When these are compared to the national Government’s Mid-Term Roadmap, it can be seen that Sapporo’s CO₂ emissions reduction target values are aggressive in the case of civil residential, and moderate in the case of civil business and transport. Of course, if the latter is a response to the specific regional characteristics of Sapporo (including the snowy climate, for example), there is no problem. However, if this is not the case, these values should be revised, because Sapporo could be missing an opportunity for increased CO₂ emissions reductions in line with the national Government’s policy.

5.6. Mid-Term Roadmap

The Mid- and Long-Term Roadmap is set out below. This makes the following the main related policies:

a) pass the “Basic Act for Global Warming Countermeasures” (provisional name);
b) develop the “Sapporo Warming Plan of Action” (provisional name);
c) develop the “Sapporo General Transportation Plan”;
d) develop the “Sapporo Tourism Promotion Plan” (provisional name); and
e) develop the “Sapporo Town Management Strategy Vision”.
Table 11 – Degrees of Importance: Examples

<table>
<thead>
<tr>
<th>Action items and points of importance</th>
<th>Relative difficulty of effectuation</th>
<th>Goal setting</th>
<th>Actions broken into segments</th>
<th>Possible to measure actual values</th>
<th>Scale of effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Regulations</td>
<td>Purchasing cycle</td>
<td>Cooperation with other departments</td>
<td>Cost</td>
<td>Completed</td>
</tr>
<tr>
<td>Development toward the diffusion of energy-efficient homes of suitable for a northern-climate</td>
<td>14</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Development toward the diffusion of high-efficiency hot-water supply and heating equipment</td>
<td>14</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Development toward expanded utilization of next-generation automobiles, mass transit systems and the like</td>
<td>13</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Development toward the acceptance and expansion of environmentally friendly living</td>
<td>15</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Development toward the reduction of CO₂ due to business activities</td>
<td>21</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Development toward the deployment and expansion of solar energy generating facilities</td>
<td>13</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Development toward the deployment and expanded utilization of lignocellulosic biofuels</td>
<td>16</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>1</td>
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<tr>
<td>Development toward expanded utilization of renewable energy</td>
<td>21</td>
<td>3</td>
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<td>Development toward the acceptance and expansion of waste reduction and recycling</td>
<td>7</td>
<td>1</td>
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<td>Development toward the cultivation of the region's greenery</td>
<td>4</td>
<td>1</td>
<td>1</td>
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<td>0</td>
</tr>
</tbody>
</table>

Candidate for particular action

- **Red**: Degree of importance: High
- **Orange**: Degree of importance: Medium
- **Yellow**: Degree of importance: Low

**1 Point = Low, Good, Small**
**2 Points = Medium, So-so**
**3 Points = High, Unacceptable, Large**
Table 12 – Percentage of each sector’s CO₂ emissions reduction target

<table>
<thead>
<tr>
<th></th>
<th>Civil residential</th>
<th>Civil business</th>
<th>Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction target in the national government’s Roadmap (including reductions other than the scenario in the Vision)</td>
<td>180 million t-CO₂</td>
<td>240 million t-CO₂</td>
<td>240 million t-CO₂</td>
</tr>
<tr>
<td></td>
<td>50%</td>
<td>45%</td>
<td>38%</td>
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<tr>
<td>Reduction target in Sapporo City’s Vision (not including 1.67 million t-CO₂ of reductions other than the scenario in the Vision)</td>
<td>2.1 million t-CO₂</td>
<td>570,000 t-CO₂</td>
<td>580,000 t-CO₂</td>
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<tr>
<td></td>
<td>48%</td>
<td>16%</td>
<td>19%</td>
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<tr>
<td>Reduction target in Sapporo City’s Vision (one that rebates reductions other than the scenario in the Vision)</td>
<td>3.13 million t-CO₂</td>
<td>850,000 t-CO₂</td>
<td>860,000 t-CO₂</td>
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<td></td>
<td>72% (+22%)</td>
<td>24% (-21%)</td>
<td>29% (-9%)</td>
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</tbody>
</table>
Table 13

<table>
<thead>
<tr>
<th>Goal setting Completed</th>
<th>FY2011</th>
<th>FY2012</th>
<th>FY2020</th>
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<tbody>
<tr>
<td>Major Policy</td>
<td></td>
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<tr>
<td>Enactment of Basic Act for Global Warming Countermeasures</td>
<td></td>
<td></td>
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<tr>
<td>Sapporo Warming Plan of Action (provisional name)</td>
<td></td>
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<tr>
<td>Development of the Sapporo General Transportation Plan</td>
<td></td>
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<tr>
<td>Development of Sapporo Tourism Promotion Plan</td>
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</tbody>
</table>

1. Broad-based Cooperation

1-1 Implementation of benchmarks
1-1-1 Fukuoka City
1-1-2 Kyoto City
1-1-3 Germany
1-2 Progress Management of Mass Transit
1-3 Strengthening the Functions of Cross-Sectional Organizations

2. Transparency

2-1 Introduction of Numerical Value Target Management Cycle
2-2 Understanding the actual situation of small and medium-sized enterprises
2-3 Case studies of data collection leveraging it
2-4 Energy-saving steps in apartment (multi-family) units

3. Environment and Economy

3-1 Creation of a biofuels ecosystem
3-2 Conversion of surplus reductions into credits
3-3 Expanded study of renewable energy
3-4 Survey case studies of approaches to smart grids

4. Environmental Education

4-1 Study in connection with indicator data
4-2 Technical study of collected indicator data
4-3 Study image strategy regarding tourists

<table>
<thead>
<tr>
<th>Stage 1: Transparency</th>
<th>Stage 2: Transparency</th>
<th>Stage 3: Transparency</th>
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<tbody>
<tr>
<td>Plans</td>
<td>Corroborative experiment (draft)</td>
<td>Stage 1 practical use (draft)</td>
</tr>
<tr>
<td>Study of indicator data</td>
<td>Assessment 1</td>
<td>New Approach 1 and Assessment 2</td>
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6. Closing Remarks

Local government organizations face numerous challenges nowadays. These include:

- The need to implement crisis management measures, starting with disaster prevention and regional disaster plans;
- The need to support residents’ activities and facilitate citizen autonomy;
- Gender equality;
- City and transport planning;
- Maintaining welfare services and health services and addressing the falling birth-rate;
- Promotion of industry and facilitation of employment;
- Tourism and cultural promotion;
- Redevelopment projects; and more.

Because the subjects of these challenges are many and wide-ranging, operational administration must be performed based on plans that are rooted in firm policies, yet while still being sufficiently flexible and adaptable to allow future changes in requirements to be incorporated.

The everyday operational activities of the Sapporo City Environmental Department are no exception. Among projects concerning environmental protection, the reduction and appropriate processing of garbage, the planning and construction of parks and green spaces, etc, nature conservation and tree planting, and the running of Maruyama Zoo, global warming countermeasures are becoming increasingly important. It is necessary, then, to take these issues seriously and take action in accordance with plans.

Even during the term of this project, the government put out a policy on environmental cities of the future⁵⁹ – on the presumption of deregulation in order to promote new energy sources in the area most affected by the recent earthquake and tsunami. There have also been reports of a draft proposal for a mandatory 24% improvement in vehicle fuel mileage⁶⁰, and the development of a recommendation for a 30-year plan on new energy⁶¹. Reports relating to Sapporo and Hokkaido include the restarting of operation of the Tomari Nuclear Reactor No 3 for the first time since the earthquake disaster⁶².

At the same time, however, the city of Sapporo has been soliciting the views of its citizens toward a post-nuclear society⁶³. In addition, environmental projects are gaining speed, with companies building a 50,000kW mega solar facility – the largest in Japan⁶⁴ – and CO₂ emissions becoming more transparent⁶⁵. All of these new considerations now need to be factored in to existing and future plans as they are developed and refined. This demands regular reviews of the plans and their associated targets and performance measures – as well as the most suitable technologies that should be applied based on what is currently available (again, new developments are emerging all the time).

In addition, continued efforts will be required to unravel large issues by promoting wide-scale collaboration and sharing necessary information with all stakeholders. By periodically improving these activities, the foundations for effectuating the Mid- and Long-Term Plan will become increasingly solid and the performance of policies appropriate for an Eco-Capital will become possible.
7. Appendices

7.1. Acknowledgments

The IBM SCC Sapporo team received the cooperation of many people in the preparation of this report, and is deeply grateful to those who shared their valuable time, granting interviews and providing information on existing approaches.

<table>
<thead>
<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Fumio Ueda</td>
<td>Mayor of Sapporo</td>
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<td>Noriaki Ikushima</td>
<td>Deputy Mayor of Sapporo</td>
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We also received a multitude of rich ideas and data from subject matter experts across IBM. For all of their input, we would like to extend our heartfelt gratitude to:

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<td>Global Business Services London</td>
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<td>Djeevan Schiferli</td>
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<td>Colin Harrison</td>
<td>IBM CHQ, Executive Offices, Distinguished Engineer – Smarter Cities technical strategy, Strategy Consultant</td>
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<tr>
<td>Lyell E. Sakaue</td>
<td>Program Manager – Corporate Citizenship, IBM CHQ, Marketing, United States</td>
</tr>
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</table>
7.2. “Eco-Capital, Sapporo” Declaration

The entire text of the “Eco-Capital, Sapporo” Declaration issued by the city of Sapporo is included below:

宣言文

今、私たちがすでに取り組むべき課題、持続可能な課題、それを解決するための提案を中心に、

の未来を守るために、なにをすべきか、その方法について考えました。

私たち目指す課題は、地球の環境に与える影響を大きく、

きょうは、環境に与える影響を大きく、

到着に繋がるための提案を中心に、

持続可能な社会を実現するために、なにをすべきか、その方法について考えました。

私たちが目指す課題は、地球の環境に与える影響を大きく、

到着に繋がるための提案を中心に、

持続可能な社会を実現するために、なにをすべきか、その方法について考えました。

持続可能な社会を実現するために、なにをすべきか、その方法について考えました。

持続可能な社会を実現ために、なにをすべきか、その方法について考えました。
The Sapporo "Eco-Capital" Declaration

English

Declarations

Global environmental problems are an urgent issue. These problems have resulted from our mistaken practices. By using the resources of this earth to profit ourselves, we have made global problems that threaten the entire world. We must change our ways of life. We need to raise the consciousness of our actions, based on our desire to make this world better.

We are citizens of Sapporo. We demand to see Sapporo as a true eco-capital and to make efforts to that end.

The Sapporo Global Environment Charter

Preface (City of vegetables)

We, the citizens of Sapporo, believe that the future generations will inherit a city with a sound natural environment, beauty, comfort, and commensurate work and living environments.

We will be a city that enjoys water and greenery.

We will be a city that maximizes the resources of nature, water, and greenery.

We will be a city that promotes the use of renewable energy.

We will be a city that promotes the use of renewable energy.

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The Sapporo "Eco-Capital" Declaration

Declaration 1: (The Natural Environment)

We will be a city that enjoys water and greenery.

We will be a city that maximizes the resources of nature, water, and greenery.

Declaration 2: (Renewable Energy)

We will be a city that promotes the use of renewable energy.

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Declaration 3: (Sustainable Society)

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Declaration 52: (Sustainable Environment)

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## 7.3. SCC Sapporo IBM Team

<table>
<thead>
<tr>
<th>Name</th>
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<tbody>
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<td>Michiaki Tatsubori, Ph.D.</td>
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</tr>
</tbody>
</table>
8. References

5. According to the outline of the Sapporo City Budget for FY2011, the amount of the general accounting budget for Sapporo City in FY2011 is JPY846.400B, and the amount of the total accounting budget (general accounting, special accounting and corporate accounting) is JPY1.3898T. Total accounting has liabilities of 1.8119T (expected amount of municipal bond issuance).
6. The business of ESCO (Energy Service Company) is energy-saving services. The firm started in the United States. In 1996, the Ministry of Economy, Trade and Industry took the lead in its expansion.
15. “50 Chapters for Learning the Latest Information from Germany” [saishin doitsu jouhou wo shiru tame no 50 shou], Takashi Hamamoto, Hatsuki Yanagihara; Akashi Shouten, pp. 135-168. 168.
19. A management method in which quality maintenance and improvement as well as continuous service improvement activities are promoted by repetition of a spiral process (from the “@IT Information Management Terms Dictionary” [＠IT jouhou manejimento yougo jiten].
20. A management and service improvement concept whereby a management cycle comprised of “analysis,” “design,” “execution,” “monitoring” and “improvement/reconstruction” is applied to “business processes” and continuous process improvement is performed (from the “＠IT Information Management Terms Dictionary”).
21. An information system that summarizes various information from various information sources, derives management benchmarks in order to provide information needed to make judgments and decisions and displays the information in numerical values and graphs, etc. on a unified screen (from the “＠IT Information Management Terms Dictionary” [＠IT jouhou manejimento yougo jiten]
Sapporo Metropolitan Area Transit Master Plan (Main Volume), March 2010.
23. From Norwich Union’s “Pay As You Drive” insurance initiative using IBM Black Box (IBM case study).
27. “Watt Checker”: a gauge that makes transparent the amount of electrical power consumed by electric appliances, which Sapporo City is lending to households as an electricity-saving promotional campaign.

28. “Watt Checker”: a gauge that makes “transparent” the amount of electrical power consumed by electric appliances, which Sapporo City is lending to households as an electricity-saving promotional campaign.

29. A project carried out by the Ministry of the Environment that comprehends household energy consumption and reduces the information upon analysis. (http://www.env.go.jp/press/press.php?serial=13971). For example, it is conceivable to put together information on case studies of the activities and results achieved by industrial classification and type of operation (eating and drinking establishments, the lodging industry, etc.) and provide this information to city businesses.


31. A project promoted by Sapporo City that supports the deployment of high-efficiency heaters, etc. http://www.city.sapporo.jp/kankyo/energy/ecopro/


33. Sapporo City Housing Smarter Plan, 2011

34. Deployment status of high-efficiency heater “eko jouzu” (FACT): 9,494 pieces (2008); dissemination ratio (2008): approximately 14.0%. Reference: the 2010 number of FACT devices disseminated was 12,037.

35. Abbreviation for Energy Service Company. A business that operates a comprehensive service concerning energy-saving measures for buildings, etc.


40. An example of converting small scale renewable energy into credits is the “Re-energy Credit” in the Tokyo-to Environmental Assurance Ordinance. http://www.kankyometro.tokyo.jp/climate/attachement/shiryou4_100517.pdf

41. Virtual power plants: the idea of linking multiple dispersed small power plants into a network and treating them as one large power plant. There are several definitions, but for the original idea, see Shimon Awerbuch: The Virtual Utility: Accounting, Technology & Competitive Aspects of the Emerging Industry 1997.

42. A system promoted by the national government that certifies the CO₂ reductions of small and medium-sized businesses as credits for the purpose of achieving the targets of the Kyoto Protocol. http://jcdm.jp/

43. The “nega-watt” idea is an example of deeming emissions reductions as “negative” electrical generation. Colorado Public Utilities Commission report in 1989.


45. Let’s consider future energy policy so we can escape dependence on nuclear power. We are soliciting the views of all residents. https://www.city.sapporo.jp/kankyo/energy/iken.html


52. http://mi-mue.com/about/about_mm.html
58. This compares the percentage of the CO₂ emissions target reduced in each sector from 2007 to 2020. While the national government’s Roadmap included target values that take into account a projected increased amount of nuclear power-generated electricity, Sapporo City’s Vision segregates that portion. Given this, we carried out comparison by simply dividing the projected portion proportionally by the reduction in each sector and adding it to each sector's reduction.