CHAPTER 6

Cebu City, the Philippines

Cebu City is the second-biggest growth area in the Philippines after Manila. Cebu City is a midsize coastal city with a population of 799,763. Metro Cebu includes several other cities, Lapu-Lapu, Mandaue, and Talisay, which cumulatively have a population of about 2 million. Cebu City occupies mountainous terrain and has a land area of 291 square kilometers (km^2). The highest point in Cebu City reaches an elevation of 900 meters. Cebu City's plateau area occupies 23 km^2, about 8 percent of its total area, but is home to two-thirds of the city's population. Cebu Island occupies a strategic location, easily accessible by air and water, and is an important port. Cebu City is less than an hour away from Manila by plane and within a few hours of any city in Southeast Asia (map 6.1). It is served by an international airport and busy seaport.

The city has a tropical climate and an average temperature of 25.6 degrees C (centigrade) with an average relative humidity of 75 percent. Rainfall is at its lowest levels from February to April and gradually increases from May to July.

Cebu City has a thriving commercial seaport, and a majority of the city's labor force (73 percent) is employed in trade and other related services such as banking, real estate, insurance, and community and personal services. About 19 percent of the population is employed in industry, and 8 percent in agriculture and related services. The services sector is growing and is expected to maintain its economic dominance. Cebu City's strategic location and seaport help support trade and services. The majority of establishments in Cebu City are still considered micro or small enterprises with an average capitalization of 1.5 million Philippine pesos (Php) (US$34,445) or less. Some 67 percent of these business establishments are situated in the central part of the city and collectively account for about 77 percent of the city's economy.

The central Philippine government and Cebu City government are the focal points for policy action, but there is a strong base of grassroots action in Cebu City. Under a new local government code, which aims to devolve certain powers away from the central government, the city has the power and authority to establish an organization responsible for the efficient and effective implementation of its development plans, programs, and priorities. The main

Map 6.1 Cebu City, the Philippines

Source: World Bank.

departments, committees, and external agencies responsible for the planning, development, and operation of energy-consuming sectors in Cebu City are represented in the flow chart in figure 6.1.

The city government fully controls solid waste management and its government buildings. It has partial control over transportation through traffic planning and regulation. Other agencies exercising control over the transportation sector are the Land Transportation Office and the Land Transportation Franchising and Regulatory Board, which enforce vehicle emissions and registrations, respectively. Public lighting is largely within the jurisdiction of the city, although there is a mix of responsibilities, with the national government responsible for lighting of trunk roads and Visayan Electric Company (VECo, the electricity utility) owning all street lighting poles and responsible for installing luminaires. The city does not generate electricity, which is provided by VECo. The majority of water is supplied by Metropolitan Cebu Water District (MCWD), a public water utility, with a number of private water companies engaged in smaller-scale potable water supply. Cebu City has no formal sewerage system, although septic tank waste (septage) is currently disposed of at the city landfill.

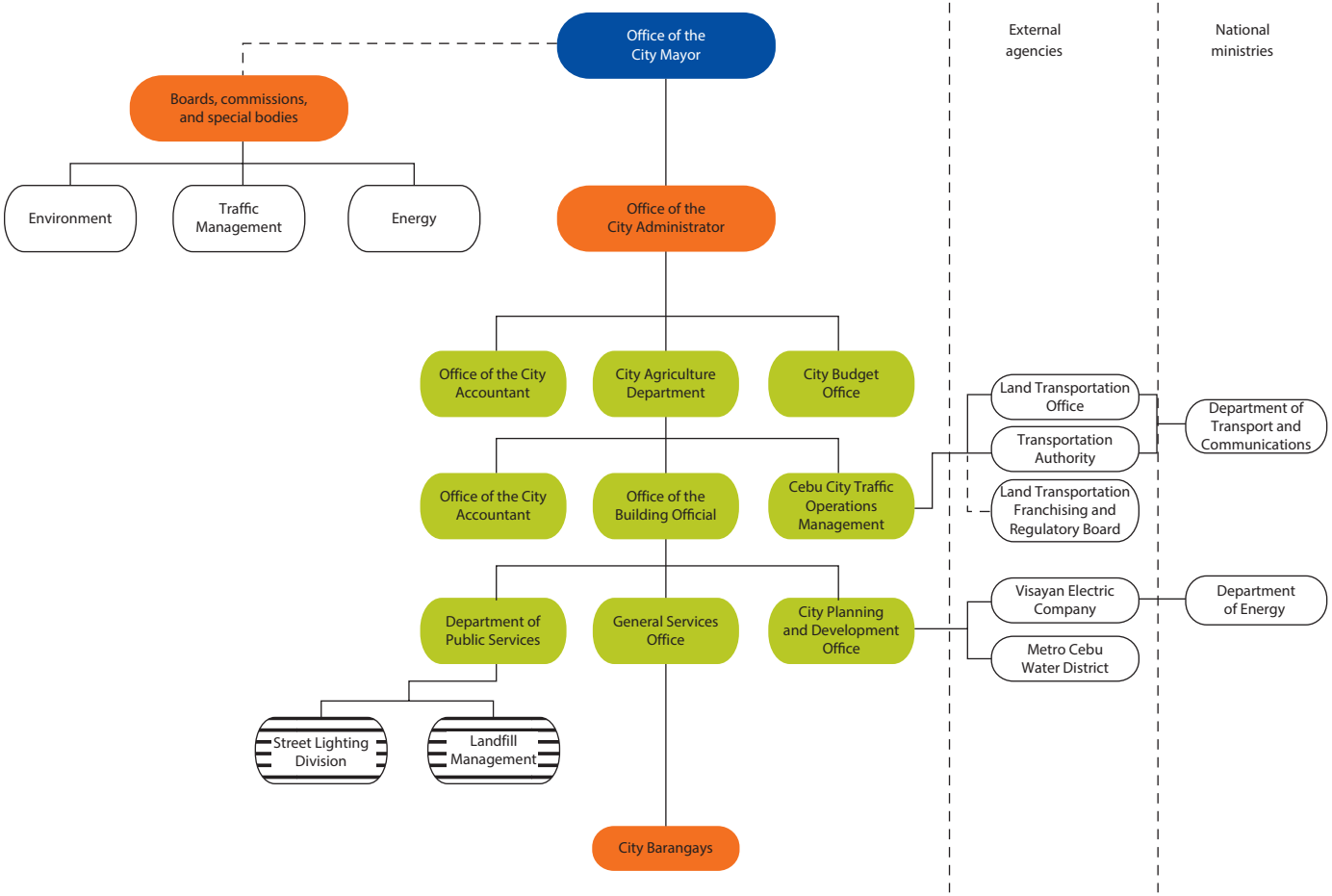
National Energy Efficiency Strategy

At the national level, President Benigno Aquino III announced his intention to encourage more public-private partnerships to improve Cebu City's economy. Cebu City officials and businessmen have identified seven areas of concern: the need for more infrastructure, improvement of the tourism industry, reduction of power costs, modernization of Mactan-Cebu International Airport, realization of Panglao International Airport, implementation of a mass transit system, and building of the Cebu-Bohol Bridge. The priority attached to these sectors illustrates the importance to the Philippines of energy efficiency and infrastructure projects, which are also relevant to Cebu City.

The Philippine government has initiated a number of energy efficiency programs to achieve the targeted annual savings of 23.4 million barrels of fuel oil equivalent in 10 years through the National Energy Efficiency and Conservation Program. Programs and initiatives include the following:

- The Road Transport Patrol program targets a 10 percent reduction in fuel consumption by providing consumers with information on the efficient use of fuel through proper vehicle maintenance and efficient driving through seminars and workshops and the use of all types of media.
- Voluntary agreements between government and the private sector encourage industrial economic zones in which businesses voluntarily monitor energy consumption and implement energy efficiency and conservation programs.
- An energy audit service is provided by the Philippine Department of Energy to manufacturing plants, commercial buildings, and other energy-intensive companies to help them understand their energy use patterns and identify initiatives to improve their energy performance.

Figure 6.1 Cebu City Government Structure for Energy-Consuming Agencies



Source: Phase I pilot study.

- Infomercials and publications encourage energy efficiency.
- The Partnership for Energy Responsive Companies encourages industrial and commercial establishments to voluntarily monitor their energy consumption and implement energy efficiency and conservation programs.
- The Partnership for Energy Responsive Ecozones is a partnership of private sector companies formed in conjunction with the Power Patrol Project (http://projects.wri.org/sd-pams-database/phillipines/power-patrol-program) to encourage energy efficiency and conservation in economic zones.
- Energy standards and labeling of appliances and equipment aim to improve the efficiency of appliances by requiring energy-rating labeling of products.
- The Enercon program is an initiative to incorporate energy efficiency into the procurement guidelines of government agencies, bureaus, and offices.
- Energy use standards for buildings have been developed, but are not yet mandated, to give guidance on energy efficient building design.
- Initiatives for heat rate improvement in power plants will bring power plant generating units to their optimum performance levels by improving their operational capability.
- The systems' loss-reduction program requires energy utilities to implement measures to cut nontechnical losses.

City-Level Energy Efficiency Strategy

The city government has enacted a number of energy efficiency initiatives:

- The Cities for Climate Protection Campaign in 1999 is administered by Local Governments for Sustainability.
- The International Resource Cities Program is a technical cooperation program between Cebu City, the Philippines; Larimer County, Colorado; and Fort Collins, Colorado. The program was funded by the US Agency for International Development (USAID) and implemented by the International City/County Management Association. In March 2001, an action plan was prepared that establishes the objectives of the partnership and serves as the framework for the relationship between the communities. It also identifies how Cebu City intends to target the financial assistance from USAID.
- A climate change forum was initiated and conducted by the Cebu City government in 2008.
- Cebu City formed action plans on energy.

The city government already has a focus on energy issues covering a wide range of departments and services. Considerable progress has been made in addressing energy consumption, and the city has proposed and engaged in a variety of energy efficiency activities, including the following:

- *Building initiatives*—policies for light fixture replacements and air conditioning operation hours

- *Waste sector initiatives*—barangay-level composting and the "No Segregation, No Collection" policy, which requires residents to sort their trash into three containers: recyclables, organic waste, and others
- *Efforts to encourage sustainable transportation*—for example, bicycle lane pilot areas and sidewalk repair schemes

Building on these initiatives to develop a strategic approach to demand management will be beneficial to Cebu City's future development, contributing to the city's energy security, improving its citizens' quality of life, and attracting businesses.

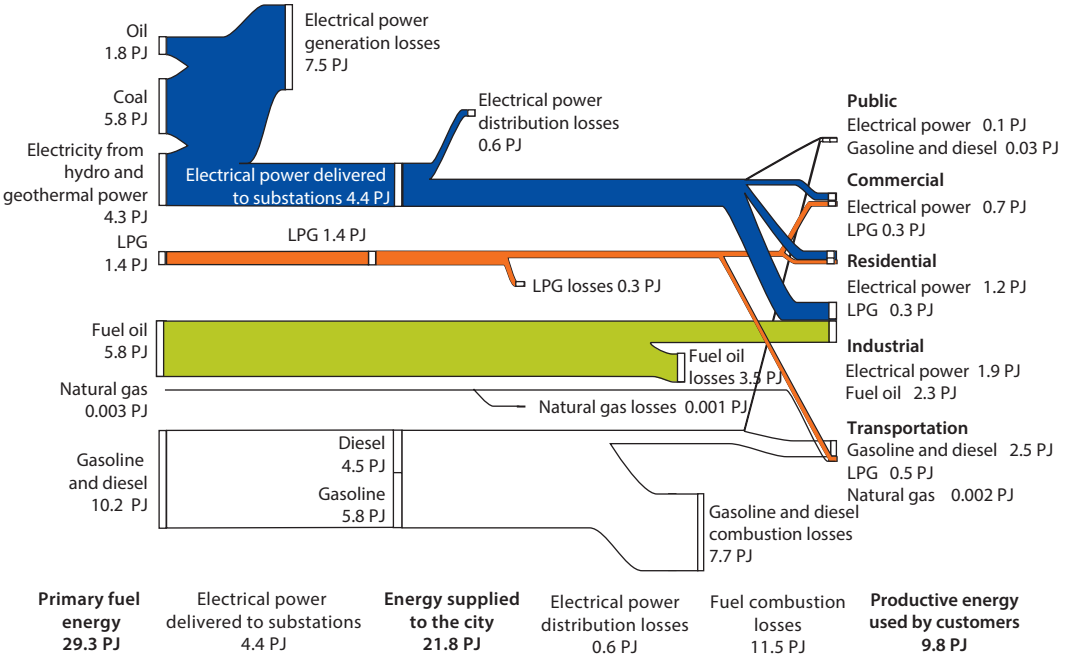
Energy Use and Carbon Emissions Profile

An overview of Cebu City's energy supply profile provides the city government with valuable insights for strategic planning with respect to energy security and economic growth. Cebu City imports almost all of its energy; other than the 11 percent of electricity consumed that is generated within city boundaries, all energy sources (electricity, oil products, and natural gas) are imported. Although Cebu City has significant potential to harness solar power, it does not do so because no renewable power technology is installed in the city. Cebu City's energy flows and profile are summarized in a Sankey diagram (figure 6.2) to illustrate citywide energy supply and demand characteristics of its different sectors.

The total primary energy supplied to Cebu City is 21.8 billion megajoules (MJ; or 6.5 gigajoules per capita), or 6 billion kilowatt-hours (kWh; or 6 megawatt-hours per capita). Some 20.4 percent of this is in the form of electricity and 79.6 percent is in the form of petroleum products. A very small amount of natural gas is also imported into the city. The reliability of energy supply is consequently an important consideration for future energy planning. Transportation is the biggest energy user in Cebu City, consuming 51 percent of the city's primary energy and accounting for a substantial share of fuel combustion losses (see figure 6.3). Industry is the second-biggest energy user in Cebu City, consuming 36 percent of energy. The residential sector accounts for 7 percent of consumption and the commercial sector 5 percent. Industrial, residential, and commercial users are the biggest consumers of electricity. The residential sector was the dominant electricity user in 2008 but saw a 26 percent decline in consumption in 2009 and only a moderate 4 percent increase in 2010. The commercial sector has held relatively steady. In contrast, industrial sector electricity use has grown explosively, with a 50 percent increase in 2009 and a more moderate 8.2 percent increase in 2010.

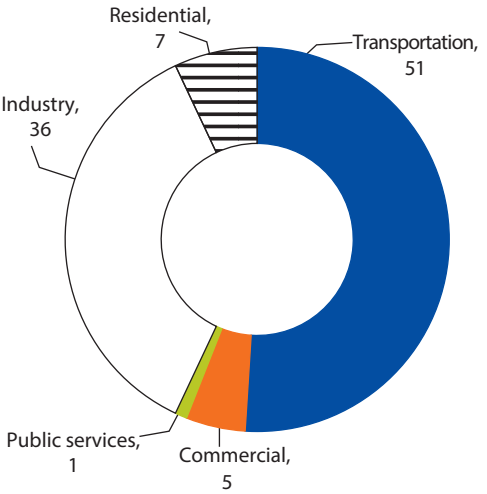
On the whole, citywide usage increases steadily year-on-year, with electricity demand growing 4.3 percent from 2008 to 2009 and 4.5 percent from 2009 to 2010. If Cebu City maintains this trend, electrical energy demand will double in 16 years. From a policy-making perspective, untempered electricity consumption will negatively affect energy security, economic growth, and quality of life and should be addressed by Cebu City officials.

Figure 6.2 Cebu City Energy Flows, 2010



Source: Phase I pilot study.
Note: LPG = liquefied petroleum gas; PJ = petajoule. "Public" includes the end-use energy of city buildings, street lighting, city vehicles, water, wastewater, and solid waste management.

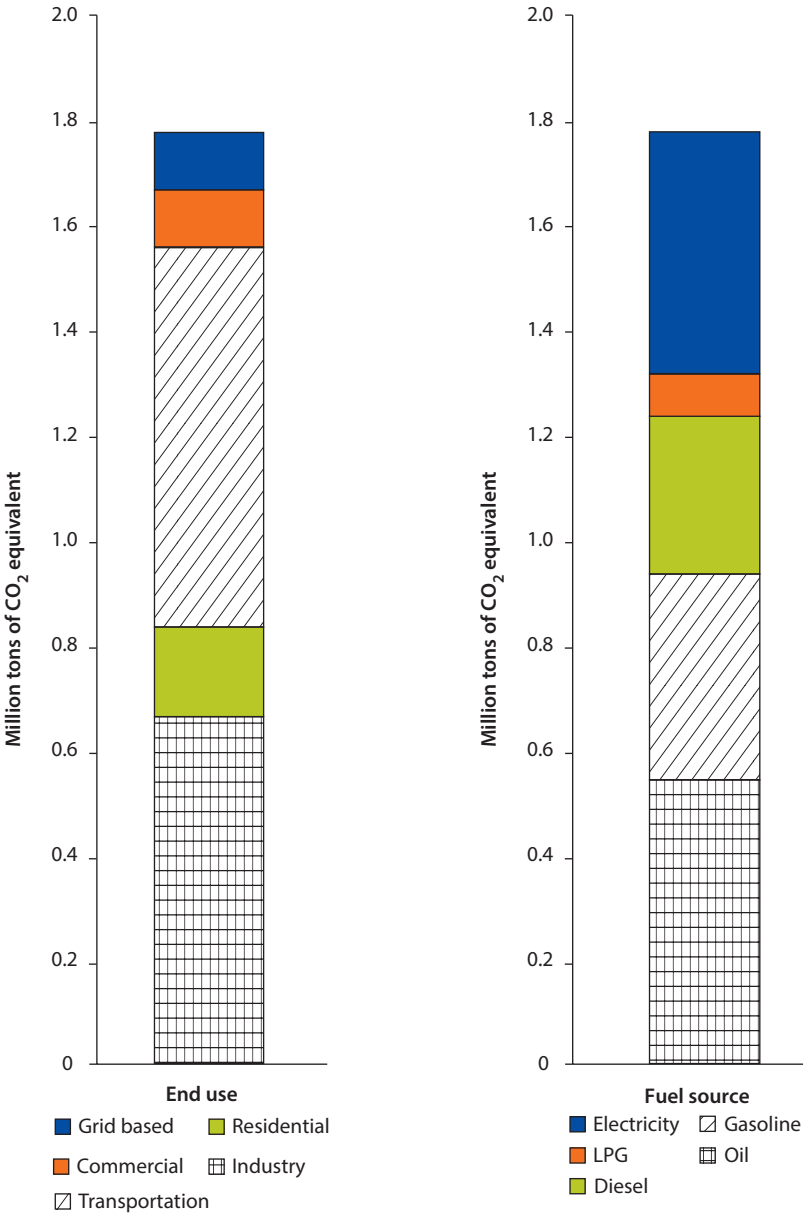
Figure 6.3 Cebu City Energy Consumption by End Use
Percent



Source: Phase I pilot study.

Greenhouse gas (GHG) emissions present a slightly different picture from the energy balance results (see figure 6.4). Close to 1.8 million tons of carbon dioxide equivalent ($MtCO_2e$) were emitted by all sectors in Cebu City in 2010. Residual fuel oil and electricity are the biggest contributors by source, at 31 percent and 26 percent, respectively. Both of these energy sources are used almost entirely by the industrial, commercial, and residential sectors. Gasoline and

Figure 6.4 Cebu City GHG Emissions by End Use and Fuel Source



Source: Phase I pilot study.

diesel, which make up 22 percent and 17 percent of emissions, respectively, are used exclusively by the transportation sector.

The transportation and industrial sectors are the largest contributors to Cebu City's emissions with 40 percent and 38 percent shares, respectively. The residential sector accounts for 9 percent of emissions and the commercial sector accounts for 6 percent.

Transportation and industry are the most significant sectors for both the energy balance and the GHG inventory results. It is worth noting, however, that transportation uses just over half of the city's energy, but its share of GHG emissions is 40 percent, whereas industry consumes 36 percent of Cebu City's energy but produces a disproportionate 38 percent of emissions. This points to the importance of fuel choice and systems efficiencies in linking energy and GHG emissions.

Sector Review and Prioritization

Cebu City's interest in pursuing the TRACE (Tool for Rapid Assessment of City Energy) diagnostic underscores its commitment to achieving optimal energy efficiency. The analysis was carried out across six city sectors: passenger transportation, city buildings, water and wastewater, public lighting, solid waste, and power and heat. These were, in turn, assessed against the performance of a range of peer cities through a benchmarking process. This review provided a number of significant findings that helped focus activity during the early part of the study and contributed to the definition of priority sectors for further study.

Key findings of the Cebu City diagnostics in comparison with the cities in the TRACE database follow:

- Low electricity use per capita and low energy use per unit of gross domestic product (GDP)
- High transportation energy use per capita, despite very high dependence on public transportation, arising from the dominance of inefficient jeepneys, as well as from congestion and low fuel efficiency (Many jeepneys are aging, with older, inefficient engines, and also typically carry fewer passengers than they are designed to carry. These factors, as well as the common practice of operating the vehicles for many years with occasional second-hand engine replacements, point to significant potential for improvement in the energy and operational efficiencies of this public transportation mode.)
- Low per capita water use but high energy density of potable water production
- Mid-range electricity consumption per kilometer of lit roads with room for improvement in public lighting
- Low but increasing electricity consumption in city buildings
- Low levels of recycling due to the absence of a formal solid waste recycling program
- Low levels of transmission and distribution losses in the electricity network

Table 6.1 Cebu City Sector Prioritization Results

Priority ranking	*Sector*	*2010 energy spending (US$)*	*Relative energy intensity (%)*	*Level of city authority control*[a]	*Savings potential (US$)*[b]
City authority sector ranking					
1	Street lighting	2,238,761	20.0	1.00	447,752
2	City buildings	1,363,920	19.9	1.00	271,420
3	City vehicles	2,187,659	10.0	1.00	218,766
4	Solid waste	622,922	15.0	1.00	93,438
Citywide sector ranking					
1	Public transportation	89,696,607	10.0	0.21	1,883,629
2	Potable water	1,410,895	30.0	0.15	63,490
3	Power	Unknown	15.0	0.11	Potentially large

Source: Phase I pilot study.
a. 0 = no influence; 1 = maximum influence.
b. Based on TRACE (Tool for Rapid Assessment of City Energy) benchmarking; these figures are indicative of the savings that may be possible, but not necessarily practicable.

The TRACE analysis identifies priority areas in which significant energy savings are possible. Table 6.1 indicates the amount of energy spending in each of these sectors, the relative energy intensity (the percentage of energy that can be saved in each sector, based on TRACE benchmarking), and the level of influence the city government has over these sectors. The savings potential is calculated by multiplying these three factors. The TRACE contains a playbook of 58 energy efficiency recommendations applicable across all sectors.[1] The recommendations themselves are not meant to be either exhaustive or normative. They simply outline a number of policies and investments that could help local authorities in Cebu City achieve higher energy efficiency standards.

The table shows priorities with respect both to sectors over which the city authority has maximum influence, and to citywide issues for which the authority has limited influence. The ranking suggests that the city government should prioritize street lighting, followed by city buildings and city vehicles. On a citywide basis, public transportation is clearly a focal area, followed by potable water supply.

Following the sector-by-sector analysis, each recommendation was reviewed to establish its applicability to the Cebu City context. This filtering helped focus the process on those recommendations that are both viable and practical.

Recommendations

Transportation

Transportation in Cebu City is dominated by jeepneys, with private automobiles, taxis, and motorcycles also playing increasingly important roles. A high proportion of Cebu City's taxis run on liquefied petroleum gas as a response to the incentives in place for drivers to upgrade their engines to combat urban air pollution. With regard to fuel use minimization, the city's General Services Office (GSO) implemented a biofuel project in which ethanol was used as an additive in city

government automobiles. This activity is expected to result in a 15 percent reduction in fuel use in the transportation sector.

Cebu City experiences significant congestion during rush hour. Parking restrictions are in place and are regulated by zoning ordinances. However, these restrictions have not been rationalized by any strategic plan for the city. The last transportation plan was produced in 1972 and a new plan is currently being prepared. The high-profile proposal to introduce a bus rapid transit (BRT) system in combination with the city's efforts to reduce traffic congestion indicate that a comprehensive transportation plan that is aligned with overall city planning will be essential.

Nonmotorized modes of transportation such as bicycles are not common, which may be due to safety concerns associated with using crowded and often chaotic streets. In an effort to encourage sustainable transportation, a local nongovernmental organization has spearheaded the Road Revolution initiative. The Road Revolution involves closing Osmena Boulevard to vehicular traffic for a day to enable the public to enjoy entertainment activities and to experience the street's improved environment when it is occupied by pedestrians rather than automobiles, all the while reducing GHG emissions. This program has been implemented twice and received mixed reactions. Some members of the public enjoyed the initiative while some, especially businesses located on Osmena Boulevard, were negatively affected by the lack of access.

Public Transportation Development

The public transportation sector in Cebu is privately run and is dominated by jeepneys. The public transportation mode share is 80 percent, which is particularly high, but jeepneys tend to work inefficiently, with regard to both fuel consumption and route optimization. One of the most notable observations made by the Sustainable Urban Energy and Emissions Planning (SUEEP) team is the need for an integrated planning approach to ensure that plans for BRT, land use, street signals, parking policies, vehicle registration pricing, and sidewalk policies are all adequately integrated and that there is an effective means for turning plan into practice. Integrated planning is especially important for transportation planning. Currently, traffic flow in Cebu City is congested during peak hours and growing private car use will exacerbate this problem. Encouraging nonmotorized transportation alongside the development of robust public transportation will be critical to mitigating congestion and improving the quality of transportation. The Cebu City Planning and Development Office and the City Traffic Operations Management are responsible for ensuring that nonmotorized modes are encouraged through city planning.

Coupled with nonmotorized transportation, the promotion of public transportation should be part of an energy efficient strategy for Cebu City. A formal public transportation system has been in the works for a number of years. A BRT pre-feasibility study has been completed and further studies are under way. The city plans to improve public transportation, and authorities have

placed an emphasis on the need for capacity building to institutionalize transportation data gathering and management. The city could take advantage of a few carbon financing resources, such as the Clean Development Mechanism (CDM), for its BRT program.

Vehicle Emissions Standards Testing

Vehicle emissions standards testing infrastructure could be more effectively applied to encourage and enforce better vehicle emissions. Lower emissions will lead to better air quality and reduced energy consumption. The current testing and enforcement system is fragmented because different city and national government departments regulate (license) test centers, and enforcement is either weak or ineffective because cars can be back on the road after a few simple measures are applied to get the vehicle to pass inspection. New testing equipment that meets standards for measuring an engine's efficiency would be required. Enforcement activities and resulting sanctions should also be revised to ensure that poorly performing vehicles would be identified and removed from service. The implementation of such a measure is potentially administratively difficult because of the fragmented nature of Cebu City's existing testing system and the magnitude of enforcement required. One way to address this issue would be to establish a government-run emissions testing center as a model for private testing centers.

Inefficient two-stroke motorcycle engines are widespread in Cebu City. Fifteen two-stroke to four-stroke engine replacement programs have been successful in a number of other cities, and this is an area in which Cebu City could make significant gains with minimal investment.

Cebu City's fleet vehicles do not follow a formal maintenance regime beyond the first few years following purchase. Initially, cars are well maintained to keep up their warranties. After the warranties expire, a city-operated vehicle maintenance center repairs faulty vehicles as necessary. The replacement parts are usually the cheapest available, leading to early failure of replacements in many cases. Life-cycle costing is not factored into parts procurement.

It is highly recommended that the GSO spearhead a city vehicle fleet efficiency program. Procurement and maintenance policies should be implemented to maximize the efficiency of the city's fleet. This includes incorporating life-cycle costing in replacement parts procurement for vehicles.

Solid Waste

Residential and commercial waste is collected at the barangay level and by city garbage trucks through the Department of Public Services. Barangay-collected waste is brought to the landfill in barangay-owned vehicles using fuel provided by the city government. Waste collection and processing in Cebu City is currently characterized by grassroots initiatives at the barangay level. Barangay Luz, in particular, has spearheaded a number of actions, including the Kwarta sa Basura (Money from Trash) program, which organizes a women's group to create marketable products from waste.

Composting is widespread in Cebu City and operational at the city, barangay, and household levels. At the city level, the Inayawan landfill includes composting facilities for collected compost while barangays engage in small-scale composting, which benefits the city in two ways. First, it minimizes waste sent to the landfill, and second, it responds to the high demand for compost in Cebu City, which produces 25 percent of its own food. Households use the Takakura home method of composting, which was introduced to Cebu City in 2008 by Koji Takakura of Japan. Takakura's research team monitors the progress of composting in Cebu City as part of an ongoing project to establish a pilot area for successful home composting. All these initiatives have collectively contributed to Cebu City's recent reduction in the percentage of domestic solid waste that is disposed of at the landfill.

Disposal of hazardous and medical wastes is an ongoing challenge because no appropriate treatment facilities are available for these waste streams. Currently, they are disposed of at the landfill, exacerbating the risks posed by its current operation and ultimately, its restoration. To address this problem, the city government, through the office of Councilor Nida Cabrera, chairperson of the Committee on Environment, and in conjunction with a local nongovernmental organization and educational institutions, has initiated a household survey in the urban barangays to determine the types of household hazardous wastes that are generated and how they are disposed of.

Until the end of 2011, Cebu City had one landfill in Barangay Inayawan that accepted hazardous, septic, and noncompostable domestic solid waste. The landfill was constructed in 1998, with a design life of seven years. Dumping activities are no longer allowed in the area. Barangays located in the North District have started delivering their waste to a privately owned sanitary landfill facility in Consolacion, about 27 kilometers (km) from the Cebu City Hall Building. Barangays in the South District will use a transfer station that is currently being developed by the city in a private lot of nearly 8,000 square meters about 1 km from the old Inayawan landfill.

Landfill leachate at Inayawan currently remains untreated, posing further land and water contamination issues. The city has earmarked Php 11 million (US$250,000) for funding of a facility to treat the landfill's leachate, but no action has been taken to date.

As of 2011, recycling activities were largely carried out by the approximately 300 waste pickers operating as part of a collective at Inayawan landfill. It is believed that a recycling rate of 16 percent was achieved through the activities of the waste pickers. There are plans to implement waste segregation at source and potentially to install a centralized materials recovery facility, but no conclusive actions have been taken to date.

Efforts to minimize the amount of solid waste disposed of at landfill have been highly effective. Some 60 percent of domestic solid waste is biological or compostable waste. Some of this is composted at the barangay level, and some is brought to the landfill where there are larger-scale composting and wormery facilities. This policy has been in operation since April 2011.

Although the Department of Public Works is responsible for waste infrastructure, the barangays do much of their own waste haulage and management. A separate nonprofit organization at the landfill manages waste treatment. Because of the slightly fragmented institutional arrangements for waste management in Cebu City, the SUEEP team recommends that the Department of City Planning, with the support of the mayor, identify the appropriate party to undertake waste studies or to review previous recommendations made in such studies for their relevance.

Landfill Gas Capture

The city is developing plans to close the Inayawan landfill, creating an opportunity to capture landfill gas and produce energy. It is recommended that a study be undertaken to investigate the feasibility of a landfill gas capture project. A successful landfill gas capture project would potentially remove up to 4,900 tCO_2e annually from Cebu City's GHG emissions profile, and if used to generate electricity, could contribute to satisfying the city's electricity requirements.

Energy from Waste

The city has approved an allocation for waste from energy projects to be established at four sites for implementation in 2012: three at barangay material recovery facility (MRF) cluster sites in Luz, Quiot, and Talamban, and one upland site. The three MRF sites will use organic waste as feed and the upland site will use animal waste. The energy generated will be accessible to barangay residents for electrification and cooking purposes.

Collection Route Optimization

Following the cessation order issued by the mayor, no more dumping will occur at the Inayawan landfill. As a consequence, garbage trucks operated by the barangays and the city will deliver their waste to a private landfill located 27 km north of the city. Barangays in the north deliver their waste directly to the landfill and barangays in the south deliver waste to a transfer station 1 km away from the Inayawan landfill to reduce the distance waste must be transported by trucks originating in the south.

The SUEEP team notes that the city has already established a new route scheme for the diversion of waste from the old landfill site at Inayawan to the new Consolacion site and recommends that Cebu City continue to assess ways to optimize waste collection to minimize traffic and enhance fuel efficiency.

Septage Treatment

There is potential for the development of a septage waste treatment facility in Cebu City. The Spanish government funded an initiative to treat septage waste using a biodigester, but this project failed because the septage waste was often contaminated by industrial wastes before treatment, compromising the biological treatment process. Although technical knowledge in Cebu City for managing

septage waste is limited, it is understood that the landfill will be closed to septage by early 2012. Thus, the need to address treatment of landfill leachate and septage is pressing. It is suggested that the city government consider the possibility of a combined septage and leachate treatment facility located at the Inayawan landfill site. A feasibility study should first be undertaken to assess the technical viability of such a proposal and how the issues with contamination of septage can be overcome.

Solid Waste Treatment

With the closure of the Inayawan landfill and the pressing need to identify alternative means for the disposal of domestic solid waste, it is suggested that the city government undertake a feasibility study for development of a centralized MRF and, possibly, a new composting facility. The MRF can be staffed by former waste pickers (who are skilled in identifying waste types). Recovered materials could be bulked and shipped to local markets. Alternatively the city government may wish to consider providing incentives for the establishment of materials reprocessing businesses colocated with the MRF, thereby creating a positive economic impact.

Because the city pays for garbage truck fuel and many of the vehicles are old and inefficient, the city would benefit from vehicle upgrades and improved procurement processes. Maintenance regimes and driver education to encourage energy efficient driving practices are also recommended to improve vehicle performance.

Water

Cebu City's potable water supply is sourced from groundwater. MCWD is the principal water utility, serving 50 percent of Cebu City's population. The rest of Cebu City's water is provided by independent suppliers that sell piped potable water from private wells. There is strong competition between these private suppliers and MCWD. Although MCWD's competitors are technically subject to the same regulations as MCWD, there is reportedly minimal enforcement of regulations relating to the siting, abstraction rates, and water quality from private wells.

Groundwater resources are a relatively energy-intense source of water supply because of the requirement for pumping, in comparison with surface water gravity-fed systems. Despite this, MCWD's water system is generally well maintained and uses energy efficient equipment, resulting in energy costs constituting about 30 percent of MCWD's operating costs.

MCWD has been the beneficiary of a number of energy efficiency projects funded by USAID. In 2006, the Alliance to Save Energy assessed MCWD's system and helped the agency to make a 0.5 kWh per cubic meter (m^3) reduction in overall energy use. MCWD is currently working with the Las Vegas Water District to improve energy efficiency by an additional 5 percent. MCWD has also taken strong action to improve leakage rates, but has run into some difficulties distinguishing its pipes from those of private suppliers, and has limited abilities

to fix leaks even when they are known to exist. It is of interest that MCWD has undertaken a thorough audit of the system to identify and remedy leaks, but losses have not been reduced significantly. The company does not have a complete understanding of the reasons behind this and is conducting further research into the issue.

MCWD has started an awareness-raising campaign to educate consumers about the importance of water conservation. However, this initiative is not yet widespread and could be more widely promoted.

Energy Efficient Water Resources

Prioritizing energy efficient water sources by deploying rainwater harvesting in city buildings and providing incentives for its uptake in private developments would reduce reliance on energy-intensive groundwater and reduce the currently unsustainable water withdrawal rate.

Water Efficient Fixtures and Fittings

Water efficient fixtures and fittings should be installed in government buildings and encouraged in private developments through educational measures. Types of energy and water efficient fittings applicable to both retrofit and new-build developments include the following:

- Low-flow taps and showers
- Water efficient household appliances
- Dual, very low, or siphon flush toilets
- Low-flush or waterless urinals
- Rainwater harvesting tanks

Water efficient fixtures and fittings help to reduce water consumption by reducing the volume of water used in each application, which also reduces the associated energy needed to treat and convey the required flows.

Efficient fittings can help to raise consumer awareness of the link between water use and energy consumption and generally leads to the consumer installing additional energy efficient products.

Wastewater

Cebu City has no citywide wastewater treatment facility. Wastewater is currently managed through household, or clusters of household, septic tanks. The septage is removed by tankers and disposed of, untreated, at the landfill. For this reason, Cebu City's energy use for wastewater is technically minimal (fuel use in haulage), but in the interests of public health, it is expected that a more comprehensive system will be developed. Wastewater management in the city will encounter significant challenges, including contamination of the groundwater supply from septic tank seepage and landfill leachate, and illegal dumping of septage waste.

Cebu City government can do little to influence the activities of the private septage haulers. Technical interventions may only be leveraged by the city

government's use of the planning system, which requires citywide technological measures the city can undertake.

It is recommended that the potential for sludge reuse be investigated. Cebu City does not currently have a sustainable sludge management strategy, but CDM funding could increase the feasibility of developing a sludge reuse project. Such a project would include treating the sludge under aerobic conditions (for example, dewatering and land application), or installing a new anaerobic digester that treats wastewater or sludge (or both), from which the biogas extracted is flared or used to generate electricity, and the residual after treatment is directed to open lagoons or is treated under clearly aerobic conditions.

City Buildings

The Department of Engineering and Public Works (DEPW) and Office of the Building Official (OBO) have complete control over the design of all city buildings with the exception of schools. There is no formalized refurbishment cycle for government buildings, which poses a significant challenge to achieving energy efficient performance in the existing building stock. In addition, energy efficiency is not currently a consideration in capital investment planning or life-cycle costing. This omission poses a barrier to the uptake of energy efficiency initiatives that require higher upfront investment but result in long-term savings.

As an initial step, the city government is using the landmark city hall building as a pilot project for achieving energy savings in buildings. The building is being retrofitted for a central air conditioning system as one of the project's major efficiency measures.

VECo has provided energy-saving tips to city departments and an ad hoc energy conservation committee was established to address energy use in the city.

Additionally, the GSO has been intensifying efforts to save energy. The GSO has begun collating data on energy use, issuing advice on energy efficiency tips, and collecting information on energy saving commitments from all departments across the city. Although this is a positive start, there is still a considerable range of opportunities to improve energy efficiency throughout the life cycle of city buildings.

Little focus has been given to energy efficiency across the city estate, although recent initiatives are starting to gain momentum. Audits of public buildings and energy efficiency calculations show that energy efficiency retrofits have good payback potential (less than three years), with continued savings thereafter over the lifetime of the project.

City Building Energy Efficiency Task Force

Currently, some measures are being implemented at the barangay level to improve energy efficiency in buildings. For example, Barangay Luz has collaborated with a paint company to provide homeowners with materials to create "cool roofs" for their homes. However, these initiatives are not coordinated at a city level and are therefore difficult to track.

In light of the above, as well as the need to coordinate energy efficiency measures in the building sector, it is recommended that a city building energy efficiency task force, comprising representatives from GSO, OBO, DEPW, VECo, and the national government's Department of Energy, be set up. The task force would design, implement, and manage energy efficiency initiatives in city buildings. The establishment of a task force will put in place a formal structure for these agencies to share ideas and approaches and streamline the city's efforts to enhance energy efficiency in buildings.

A number of efforts have been made in the city buildings sector to improve energy performance, such as lighting replacement programs and the implementation of air conditioning schedules. Although the SUEEP team endorses these efforts, opportunity remains for improvement by replacing old air conditioning units and other inefficient appliances and by improving the design and construction of building envelopes. It is recommended that the existing efforts be continued and a city building audit and retrofit program be implemented through a city building energy efficiency task force.

It is noted that the Philippine Department of Energy supports energy efficiency through its Advisory Services for Major Industries and Commercial Buildings program. An energy audit is provided for a fee by the Department of Energy to manufacturing plants, commercial buildings, and other energy-intensive companies. A team of engineers from the department evaluates the energy utilization efficiencies of equipment, processes, and operations of these companies and recommends energy efficiency and conservation measures to attain energy savings. These advisory services may be a further avenue for the city government to pursue.

Green Building Guidelines

A consistent, citywide approach to procurement and green building guidelines is needed. Formalizing sustainability standards in the local design and construction industries is a huge challenge. The city should carefully consider adopting the Building for Ecologically Responsive Design Excellence (BERDE) code, which was recently introduced by the Philippine Green Building Council, in city building ordinances and future new build or renovation work. Both the DEPW and OBO have expressed interest in formalizing the design and construction process to encourage energy efficient green building design. The city has the power to enact ordinances for building codes, which will be advantageous should authorities wish to mandate compliance with green building codes.

If a green building code is adopted, rigorous implementation and monitoring will be big challenges for the construction industry. Typically, construction materials procurement and contractor tenders are the biggest impediments to the implementation of green building codes in industries that have not evolved to incorporate sustainability requirements. Thus, these areas will require particular attention and focus from the parties responsible for overseeing the implementation of a Cebu City green building code. Before deployment of the BERDE system, city government personnel with knowledge of Cebu City

building practices and contractor tenders will need to review the system's requirements. Identification from the outset of the aspects of the BERDE system that may not be practical for Cebu City, or components that are better applied to select developments, is imperative. It may also be appropriate to initially target high-end developments or develop a phased rollout that prioritizes some elements of BERDE above others.

The city can support its building industry by drawing on the experiences of Quezon City, including the identification of key challenges and opportunities associated with complying with such codes, and providing the resources needed to address them. It is strongly recommended that Cebu City establish contacts with the relevant agencies to capture the knowledge that Quezon City will have gained from its experience.

Public Lighting

Cebu City has good street lighting coverage, with the majority of areas being lit by low pressure sodium fixtures (mainly used in smaller streets), as well as significant numbers of fluorescent bulbs, mercury halides, and compact fluorescents. Along the coastline, high pressure sodium fixtures are used.

The city's previous efforts to upgrade street lighting encountered problems with fixture quality, which has resulted in undesirable or unacceptable lighting in some cases. General Electric, Phillips, Sylvania, and American Electric fixtures have been used in Cebu City, but it was unclear to the SUEEP team which fixtures had delivered the best performance. The city currently operates a program to upgrade low pressure sodium fixtures to metal halides along main thoroughfares, which does not take advantage of the more energy efficient technologies available.

However, the city government has put aside a budget of Php 5 million (US$114,800) for the installation of light-emitting diode (LED) fixtures along Osmena Boulevard in 2012, a pilot area for this project. The purpose of the project is to test the benefits of LEDs for power consumption and GHG emissions to inform decision making about a future rollout of LEDs. The city has concerns about potential theft of the expensive LED fixtures, indicating the importance of site selection to avoid this problem.

Public lighting in Cebu City is in the remit of the Department of Public Services: Street Lighting Division. Responsibility for street lights on national roads lies with the national government, and individual barangays maintain the lights on smaller streets. The imprecise ownership and accountability for proper operation of the system has resulted in several maintenance problems. Given this, definitive responsibilities of each agency should be provided to ensure clear ownership and accountability.

Street Light Audit and Retrofit Program

Despite the high cost of LED luminaires when compared with other types of fixture, the low energy and maintenance costs of efficient LED lamps makes them financially and technically viable. A simple cost-benefit analysis undertaken

by the SUEEP team suggests that an investment of Php 312 million (US$7.1 million) would have a payback period of 4.95 years, and would save an additional Php 540 million (US$12.4 million) over the 10-year lifespan of the project. This would also lead to an annual reduction in GHG emissions of 4,043 tons of carbon dioxide.

The SUEEP team notes that Cebu City had piloted the use of LED luminaires in parts of the city previously and is aware that the beam pattern of the luminaires did not meet current national street lighting standards. Although this issue could be addressed by altering the height or spacing of light poles, all of which adds cost to the program, using LED luminaires from alternative manufacturers that meet national street lighting standards could also be considered.

The team recommends that the city tries a range of LED luminaires in pilot areas to test their efficacy as a precursor to rolling out a more comprehensive street lighting replacement program. The city can apply CDM methodology AMS-II.C, which comprises activities that encourage the adoption of energy-efficient equipment and appliances (for example, lamps, ballasts, refrigerators, motors, fans, air conditioners, pumping systems).

Lighting Timing Program

The current use of photosensors to determine lighting on and off times may not be optimal. Because safety is the primary purpose of public lighting, the team has avoided drawing specific conclusions about the deployment of a lighting timing program but recommends that the Department of Public Services work in conjunction with other city authorities to determine if a lighting timing program would be effective for the city.

Conclusion

Cebu City government has recognized the need for a sound energy strategy as evidenced by its numerous excellent existing energy initiatives. The steps Cebu City has taken to improve energy use provide a sound starting point and clearly show the city's commitment to improving energy efficiency. In particular, better energy governance in government operations; on a citywide scale, better coordination between city planning and agencies; and enhanced procurement and green building codes are all key steps Cebu City officials must initiate to work toward a genuinely coherent energy strategy and policy for the city.

Note

1. For further details on TRACE, see chapter 3.