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LOCAL GOVERNMENT ACTION ON WATER, SANITATION, AND HUMAN SETTLEMENTS CASE SUMMARIES

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Local Government Action on Water, Sanitation, and Human Settlements

Case Summaries

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Introduction

The global challenges of water, sanitation, and human settlements are inextricably linked. Local government plays an important role in providing these basic services and many have already implemented innovative programs to address water, sanitation, and human settlement challenges in their communities.

The following nine case summaries present a range of approaches used by local governments to improve water efficiency and water quality, increase access to proper sanitation, sustainably dispose of sewage waste, provide citizens with sustainable and affordable housing, integrate informal settlements in the city, and improve air quality. The experiences of these developed and developing countries from all regions of the world are examples of the key role local governments can play in achieving the internationally agreed upon goals within the Johannesburg Plan of Implementation.

Sewage Sludge Reduction Strategy – Aalborg, Denmark

Municipal Profile

Population: 162,264 (2002)

Land Area: 560 square kilometers

Municipal Budget: US$1.6 billion (2003)

Challenge

To decrease the amount of sewage sludge being produced by the municipality and to develop new and more sustainable methods for disposing of the sludge.

Action

The introduction of stricter requirements for the treatment of wastewater in Denmark and concerns about the environmental impacts of disposing of sewage sludge as fertilizer led the Municipality of Aalborg to investigate methods to reduce sewage sludge and develop new techniques for disposing of residuals.

The city wished to reduce the 30,000 tons of dewatered sludge remaining after treatment and to develop a higher degree of flexibility for end disposal. In 1994, the municipality decided to create a strategy to manage sewage sludge that would:

- be appropriate from both an environmental and economic standpoint,
- be able to withstand changes to national legislation,
- develop new customers for the end disposal (outside of agriculture),
- reduce the environmental impact.

Aalborg City Council adopted a new, five-stage sludge strategy in 1996 that met all of the above requirements. The first and second stages of the strategy included a change in operations at an existing biogas plant that made the treatment more effective, and the construction of a new biogas plant. Anaerobic digestion of sewage sludge at the biogas plants involves fermenting the sludge in tanks at a temperature of 55 degrees Celsius for about 15 days to both kill pathogens and reduce the quantity of sludge. The biogas generated during this process, consisting largely of methane, is captured and then transformed into energy.

The third stage was the establishment of a sludge drying plant that came into operation in 2000. Sludge usually contains a large amount of water that can encourage the growth of pathogens. By drying the sludge in a closed system in which evaporated water is condensed and returned to the wastewater treatment plant, negative environmental impacts are minimized. The total energy requirements for the drying plant are met by the energy created at the biogas plants. This stage is closely linked to the fourth stage of the strategy: sanitation of the sludge at the drying plant to kill any remaining pathogens. The final stage of the project involves the transfer of the excess heat from the treatment plants to the district heating network.

The municipality still needed to dispose of the sanitized sludge remaining after treatment had taken place. Throughout the 1990s, the sludge was disposed of as agricultural fertilizer at 30 to 40 farms. Although the demand for the sludge was quite high, the municipality wanted to develop new options for disposal so that they would have greater flexibility and less dependence on only one market. Because of concerns about the environmental risk associated with this form of disposal, Aalborg began to research alternatives in 1994. Tests conducted in cooperation with Aalborg Portland Cement showed that the granulate portion of sanitized sludge can replace the pyrite ash and silica sand normally used in cement production. Furthermore, the organic portion of the remaining sludge can be used as fuel at the cement plant (replacing coal). As of 2000, Aalborg Portland Cement has used the granulate in cement production.

Results

The anaerobic digestion of sludge at the biogas plants decreased the amount of dewatered sludge from 30,000 to 19,000 tons due to the increased decomposition of organic matter as well as improved dewatering. After the sludge is dried, the remaining granulate amounts to only 4,500 tons—a total reduction in sludge of 85%. In fact, this reduction is higher than Aalborg anticipated while developing the strategy.

The recycling of the sludge for biogas and power production and the use of excess heat have had a positive impact on energy use at the wastewater treatment plants. Although the new treatments have increased energy use, the net energy use has decreased by two-thirds because energy production has increased significantly (from approximately 6 million kilowatt-hours to 28 million kilowatt-hours). Furthermore, energy use associated with the transportation of the sludge has decreased significantly due to the decreased quantities and the close proximity of the cement plant to the sewage treatment plants (unlike the farms to which the sludge was previously sent).

Forty percent of the sludge remaining after treatment is inorganic ash and can be used to directly replace raw materials normally used in cement production. The remaining organic portion of the sludge is used to replace coal as a fuel. Since the use of sludge as a fuel replacement is not yet recognized as an approved use by the Danish government, the municipality must pay a fee for the disposal of the organic portion of the sludge. However, it has led to a reduction in the emissions of carbon dioxide and nitrous oxides from the cement plant.

The total investment in the sludge strategy from 1996 to 2000 amounted to approximately DKK 90 million (approximately US$15 million). The operating costs for the wastewater treatment, sludge treatment, and sludge disposal are more or less the same as before the strategy was implemented. Households in Aalborg and three neighboring communities pay for wastewater treatment—it is this income that was used to cover the cost of the project.

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Reducing Water Demand in a Drought-Prone City —Bulawayo, Zimbabwe

Municipal Profile

Population: 1 million

Land Area: 639 square kilometers

Challenge

To implement water conservation and augmentation measures in a drought-prone city.

Action

An industrial metropolis, Bulawayo is the second largest city in Zimbabwe. The city is located in a dry, drought-prone region that receives an average annual rainfall of 460 millimeters. Water shortages were common in Bulawayo in the 1990s, especially during the 1990 to 1992 drought. Since the cost of importing water from other sources was prohibitive, the city council and various stakeholders supported the introduction of a number of water augmentation and conservation measures to reduce water losses and raise public awareness of the need to conserve water.

The city estimated that 23% of the total water entering Bulawayo's network could not be accounted for and was assumed to be lost primarily through leakage. As a result, a Leakage Control Unit was set up to control water losses in the city's water network by detecting leaks, controlling water pressure, and replacing old pipes and valves. The unit has reduced the number of burst pipes and minimized underground leaks, reducing unaccounted-for water to approximately 17% (as of 2002).

In an effort to replace the use of potable water where such high quality is not required, the final liquid effluent from four of the city's eight wastewater treatment plants is sold to schools, hospitals, parks, and a eucalyptus tree plantation for irrigation purposes. The final effluent from the city's largest treatment plant is discharged to a farm that grows wheat, sorghum, and maize and raises cattle. The liquid effluent is used to irrigate the crops and pasture while the semi-solid sludge and dry sludge are used as fertilizer.

In 1992, the city introduced a rising block tariff structure for its residential water consumers, where higher levels of consumption attract progressively higher rates for each succeeding unit of water. The move has reduced the average water consumption by approximately 23%.

Water rationing is applied when water in the city's dams is projected to last for less than 21 months. The last period of water rationing, which limited daily water consumption to 100 liters per capita, ceased in 2000. In addition, during times of extreme drought the city undertakes water augmentation measures such as the use of urban boreholes and a ban on the use of hosepipes.

Results

A decade after the implementation of a range of water conservation measures, water conservation has become part of the city's culture. Current per capita water consumption in Bulawayo is 140 liters per day.

The water situation in Bulawayo has improved significantly over the 1990s, largely because of the increased inflow of water into the city's dams after Cyclone Eline in 2000. As well, the city has learned that by managing its water pressure and monitoring water consumption in specific meter zones it can reduce water losses and cut the extremely high cost of reactive maintenance. The resulting financial savings can be used for water treatment and conveyance.

For many years the city has undertaken public campaigns for water conservation through the media. From this experience the city has learned that it is necessary to communicate continuously with all water users to explain how to use and conserve water effectively.

Through the implementation of its water conservation programs, the city has learned that through rationing, water consumption can be reduced to very low levels. While the impact on residential consumers is low, industrial consumers are more directly affected and may threaten to close down or relocate their operations.

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Increasing Access to Sanitation—Hyderabad & Vijayawada, India

Municipal Profile

Population: Hyderabad—3.44 million (2001); Vijayawada—1 million (2001)

Land Area: Hyderabad—168 square kilometers; Vijayawada—58 square kilometers

Challenge

To meet the sanitation requirements of rapidly growing populations in order to improve the lives and health of the poor.

Action

It is estimated that 69% of Indians (690 million people) lack access to adequate sanitation. Poor sanitation is linked to diarrheal diseases that lead to the deaths of 600,000 children under five every year. A lack of sanitation also impacts on the local environment and water supply. Municipal corporations in India are traditionally responsible for providing sanitation services, however rapid urban population growth and limited finances have made this a challenging task. In response to the urgent need for sanitation services, the Municipal Corporations of Hyderabad and Vijayawada entered into a partnership with the Sulabh International Social Service Organisation.

Founded in 1970, Sulabh International is a non-governmental organization working to improve sanitation facilities for the poor throughout India. In 1986, Hyderabad and Vijayawada entered into a public-private partnership with Sulabh International for the provision of pay toilets in their communities. Both corporations signed 30-year leases with Sulabh to construct, operate, and maintain the toilet facilities. The municipalities cover the cost of land, construction, electricity, and water. Sulabh charges 20% over and above the cost of construction for the establishment of the toilets. Construction of the facilities takes approximately 6 months.

Sulabh International pays for the maintenance and day-to-day operation costs of the toilets through a pay and use system. The use of toilets or baths costs 1 rupee (about US$0.02) and the use of urinals is free of charge. However, street children, those who cannot afford to pay, the elderly, and disabled people can use the facilities free of charge. In order to maintain the facility, Sulabh hires caretakers to care for the unit 24 hours a day and live on-site. They are responsible for ensuring a high level of cleanliness as well as the collection of user fees. Sulabh International monitors the complexes and officials from the corporations also inspect the locations regularly.

Sulabh International has adopted a number of unique building techniques and developed methods that reduce the long-term maintenance costs of the units. They use designs and materials that can help to ensure the good condition of the building and cleanliness. The toilets built are a special design developed by Sulabh International. The toilet is a two-pit, pour flush latrine style, which requires only 2 liters of water to flush and can be constructed easily of locally available materials.

Results

This public-private partnership has helped the corporations to fulfill their responsibilities as service providers by improving public access to sanitation. Since 1986, Sulabh has constructed and/or maintained approximately 58 community toilet complexes in Hyderabad and established 50 free of charge units in 29 slums (with a grant from the corporation). The corporations have also realized cost savings of 10 million rupees (US$221,240) per year, as they do not have to pay for the operation or maintenance of the complexes for 30 years.

Research has shown that it is those most in need who use the toilets—primarily those living below the poverty line and slum dwellers. Customer satisfaction with the facilities with regard to accessibility, cleanliness, and availability of soap and water is over 90% and 99% of users expressed a willingness to pay for sanitation services. The high quality of service and cleanliness has led to increased usage of the facilities by local populations (70% as compared to 30% to 40% of those not maintained by Sulabh International).

A positive spin-off of the initiative is increased employment—it is estimated that 4,000 to 5,000 jobs are created for six months while the facilities are under construction. Furthermore, about 250 to 300 people are employed to maintain and operate the units.

Key to the success of this initiative has been high-level political support within Hyderabad and Vijayawada as well as encouragement of the public-private partnership by the state government. The pay and use approach has also been important to the success of the toilet complexes as surplus revenue has allowed Sulabh International to expand its services in the communities.

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Improving Air Quality—Mexico City, Mexico

Municipal Profile

Population: 18.1 million

Land Area: 1,487 square kilometers

Challenge

To respond to the negative health impacts of poor air quality in Mexico City by implementing a range of initiatives.

Action

The municipalities located in the Metropolitan Zone of the Valley of Mexico face unique challenges when trying to address their air quality problems due to the area's physical characteristics. Because of its high altitude, the area's air contains 23% less oxygen than at sea level, resulting in less efficient fuel combustion and higher pollution emissions. The mountains surrounding the area create a barrier to proper air circulation, trapping gases and pollutants. With a population of approximately 18 million and 3.5 million vehicles, mobile sources are responsible for more than 80% of atmospheric contaminants.

In 1996, the five-year Program to Improve Air Quality in the Valley of Mexico (known as PROAIRE) was introduced with the goal of expanding, strengthening, and continuing the air quality initiatives that had been implemented in the city in the early 1990s. The main objective of PROAIRE was to reduce peak and average concentrations of ground-level ozone in order to reduce the health risks associated with short- and long-term exposure to this pollutant. Since ozone is created by chemical reactions between nitrogen oxides and hydrocarbons in the presence of sunlight, the measures also focused on the reduction of these contaminants.

A partnership between the Government of the Federal District (Mexico City), the Government of the State of Mexico, the Ministry of Environment, Natural Resources, and Fisheries, and the Ministry of Health, PROAIRE focused on four areas:

- reducing industrial air emissions
- reducing emissions per kilometer in vehicles
- reducing the rate of increase in vehicle kilometers traveled
- reducing soil erosion

Efforts were made to reduce vehicle emissions from gasoline along with industrial and domestic fuels. Tetraethyl lead, a gasoline fuel additive, was eliminated and replaced with methyl tertiary-butyl ether (MTBE), an oxygenate that helps gasoline burn more completely, reducing vehicle emissions. Alternative fuels, such as liquefied petroleum gas and natural gas, have been promoted. Currently 35,000 vehicles are fueled by liquefied petroleum gas. A program to prohibit the use of industrial fuels that contain more than 2% sulfur has been implemented, which led to industry's adoption of

alternatives such as diesel, fuel oil, or natural gas. The use of catalytic converters was promoted, and they are now found in almost 50% of the city's cars.

Initiatives to improve and expand the city's public transport system have also been implemented in order to discourage the use of private vehicles. Subway lines have been extended, two light train routes were created, and electric trolley buses and 1,100 natural gas-powered buses are now in operation.

Results

At the end of the 1990s, progress had been made in reducing and containing air pollution emissions in the Metropolitan Area, despite an increase in the population, number of vehicles, and level of activity during the decade. Concentrations of lead in the air decreased by 99% compared to 1988 levels and sulfur dioxide levels dropped in comparison with acceptable standards. Carbon monoxide levels decreased significantly although the substance continues to pose a health risk in heavy traffic areas.

While ozone levels have also stopped increasing, they are still high and are usually twice the acceptable levels. The level of particulates remains high, especially in heavily industrialized and commercialized areas, as well as in areas with erosion problems.

In 2002, a new phase of PROAIRE was launched to continue efforts to improve Mexico City's air quality over the next eight years.

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Improving Wastewater Quality—Murcia, Spain

Municipal Profile

Population: 375,000

Land Area: 890 square kilometers

Municipal Budget: US$357 million

Challenge

To improve the quality of the Segura River by raising the quality of the wastewater it receives.

Action

Murcia, a city in southeastern Spain, has recently experienced a large increase in population along with growth in agricultural, industrial, and tourism activities. In the 1990s, due to its semi-arid climate and limited water resources, the city began to implement a series of measures to reduce water consumption and improve water quality.

The Segura River, which runs through the city, is a low-flow river. Over many years, the discharge of untreated industrial and municipal wastewater directly into the river has significantly lowered its water quality. While the Segura River is not currently used as a drinking water source, it was used for irrigation until it became too polluted. River water quality became a pressing issue as the city's economy depends on agriculture. Starting in the early 1990s, the city decided to improve the river's quality because of public complaints about the river's odor and the need to use some of the river water for irrigation purposes and other non-potable purposes in the future.

As a first step, the city connected all industries to the municipal sewer system, so that no industrial effluent would be discharged directly into the Segura River. The city then began to upgrade its 15 wastewater treatment plants to incorporate tertiary treatment. This improvement will mean that the final effluent from the wastewater treatment plants will be of excellent quality, free of residual contamination from microorganisms, and can be used for any irrigation application. Municipalities upstream from Murcia also made efforts to properly treat their wastewater before discharging it into the river.

Next, the city focused its efforts on working with local industries to reduce the amount of water they consumed (during processing) and to reduce the pollutants present in their effluent. Murcia's industrial sector includes agriculture and food, chemical, metal, and textile operations. The city offers a free consulting service to help local industries reduce their consumption of water and the level of pollution in the water. For example, city staff advised industries on the use of new technologies that reduce or eliminate the need for water in industrial cooling and cleaning processes. The city also encouraged industries to pre-treat their wastewater on-site to reduce the risk of toxic pollutants being discharged into the river.

City staff inspect local companies periodically to ensure that the wastewater from their production processes complies with the municipal sewer use bylaw in order to prevent

the illegal discharge of effluent into the sewer system. Companies that do not comply with the bylaw are either fined or asked to shut down their operations.

Results

After six years, the city had succeeded in reducing the pollutant load (including levels of organic matter, conductivity, chemical oxygen demand, and heavy metals) in the Segura River by 80%. Inspections of local industries have resulted in the closure of several companies for non-compliance with the city's wastewater bylaw, and required others to take steps to improve the quality of their effluent.

After investing approximately US$67.8 million (55 million Euro) since the early 1990s in water efficiency and water quality improvements (including major improvements to the city's water and wastewater infrastructure), Murcia has reduced its water consumption by 12% during the last six years. Daily per capita water consumption is 194 liters. With a continually growing population, water shortages will remain a concern for the city. In the future, the city may consider using water from the Segura River for non-potable uses, since its quality has greatly improved as a result of local efforts.

As a result of implementing its water efficiency and water quality initiatives, the city has learned that excellent management, leadership, and communication over the long term are the keys to success. A concerted effort by a team of highly-motivated people under a highly-educated technical leader, along with strong political support, will lead to a positive result.

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Sustainable Community Housing—Port Phillip, Australia

Municipal Profile

Population: 81,000

Land Area: 20 square kilometers

Municipal Budget: US$64 million

Challenge

To address social, economic, and environmental issues within a densely-populated area by providing innovative, sustainable, community housing for low-income residents.

Action

In 1994, the former Cities of Port Melbourne, South Melbourne, and St. Kilda amalgamated to form the City of Port Phillip, a densely-populated industrial city. As a result of the amalgamation, Port Phillip inherited three surplus municipal depot sites that the council chose to redevelop instead of sell. Having an active community housing program since 1985, the council wanted to maintain the city's social diversity and, at the same time, increase the number of neighborhood villages by using one of the sites for a housing project.

In 1996, the council selected the St. Kilda municipal depot, a 12,230-square meter site located in a densely populated, mixed use area, as an ideal setting for a mixed private and community housing project. It was determined that a public-private partnership would be the most economically viable way to move forward. The City of Port Phillip Housing Program worked with a team of architects, corporations, and housing consultants to create a masterplan. The masterplan included developing a 237-unit, three-to-five storey residential project in six buildings (five new, one reused) that incorporated environmentally sustainable design features and high-quality urban design and architecture.

Through a tendering process, the council selected Inkerman Developments Propriety Limited as the project developer. Construction of the Inkerman Oasis Residential Development project commenced in 2000 and is anticipated for completion in June or July 2005.

Some of the project's ecologically sustainable design features include:

- orientation of most buildings to achieve optimum solar access;
- solar hot water heating for 16 of the community housing units in one building and solar-powered lighting along public access walkways;
- rooftop gardens above a sub-basement parking lot;
- increased natural ventilation and minimal use of mechanical ventilation or air conditioning;
- use of low energy/resource efficient appliances and fixtures and the achievement of high energy efficiency ratings for unit design and materials selection.

The design also features wastewater recycling and reuse, including special low-impact treatment of greywater (water released from dishwashers, washing machines, bathroom sinks, showers, etc.) and stormwater. The combined greywater and stormwater are treated and reused for garden irrigation and toilet flushing. Black water (sewage and kitchen sink waste) is treated by the conventional sewage system.

The wastewater reuse system will be the first project in Australia to combine stormwater and greywater recycling in this type of housing project. The system has a variety of benefits including the reduction of potable water requirements in the project by 20% in summer and 40% in winter.

Results

The first phase of the development, the construction of 15 community housing units, has been completed and the city has assumed ownership of the homes. Council will take possession of an additional 13 community housing units upon the completion of phase two, completion date for which has been delayed until June–July 2005 while the private units are sold.

The overall budget for the project was estimated at $50 million. City planning and research for the project amounted to $652,000, which was reimbursed by the developer in the form of two community housing units. The project involved four to five years of intensive work by a council staff member for planning and investigation, followed by an additional two years for contract of sale and planning permits.

One main obstacle was finding a way to incorporate useable structures left over from the depot. The reused building was historically significant and council encouraged the developer to make use of it. During the site's development, its flood-prone nature was discovered, which necessitated an adjustment to the final design with more modest roof gardens and additional methods of water recycling.

The project's mixed community and private housing is the first of its kind in Australia and supports the trend towards private-public partnerships. Its wide variety of environmental design features will also act as a model for developers and raise the level of sustainable development achievement in Australia.

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Integrating Informal Settlements as New Neighborhoods —Rio de Janeiro, Brazil

Municipal Profile

Population: 5.97 million

Land Area: 1,225 square kilometers

Challenge

To integrate Rio de Janeiro's informal settlements into the city as neighborhoods and improve living conditions in these areas.

Action

Rio de Janeiro, like many cities in the developing world, is facing rapid population growth that cannot be managed through traditional planning processes. Due to a lack of formal housing, migrants built homes on vacant land where there was no infrastructure or urban services. Informal housing has expanded significantly in the city—40% of households are located either on irregularly divided land or in slums. The settlements have inadequate, densely built housing and often lack access to proper sewage, water, and drainage systems as well as municipal services. These settlements can have negative environmental impacts such as soil erosion, landslides in steep areas, and water and soil contamination, which eventually affect human health and living conditions.

The Municipality of Rio de Janeiro, as part of its larger strategy to respond to slum issues, has recently developed the POUSO (Posto de Orientação Urbanística e Social) Project—the Center for Social and Urban Guidance. The overall objective of the project is to integrate informal settlements into the city as new neighborhoods. The goals of the project are to improve living conditions in low-income housing areas in the short term, to upgrade the social and economic outlook of the areas in the midterm, and to enable social and territorial justice in the city in the long term.

The project sets out to:

- create specific construction and environmental regulations in shantytown areas;
- enforce these regulations in part through the creation of a local construction permit system;
- legalize the informal areas by naming streets;
- develop environmental education activities specifically linked to the day-to-day problems these communities face (such as teaching residents the benefits of preserving Rio's forests).

The POUSO Project, an initiative of the Rio de Janeiro Secretariat of Urbanism, began in July 2003 in 30 areas of the city. Informal communities are eligible to take part in the program if they have been established on safe and secure land, have an organized residents' association, and a high level of interest in participating.

The city sends a team of four or five people—a planner, a social worker, and two or three local residents—to the community. These local residents are hired and paid by the city, and are usually women who live in the community and know it well. An initial community residents' meeting is coordinated by this team, who explains the nature of the project, and facilitates the election of up to 25 volunteer representatives of different areas of the community. The project team then trains and works with the elected representatives, who act as a bridge between the city government and the community. These volunteers talk to their neighbors and hold informal meetings to discuss the benefits of creating land use and construction laws, such as improved quality of life and access to municipal services (such as postal service and garbage collection). They also explain the rights residents will have once their neighborhoods are integrated into the city, and their resulting obligations. With much input from local residents, the volunteers and the POUSO team work together to develop laws for land use and occupation that take into account the local culture and the unique qualities of the community (height of buildings, slope of streets, etc.). Towards the end of the consultation process, a final community meeting is held where residents approve their new land use and occupation laws.

Results

To date, 30 POUSO project units have been established throughout the city, involving 70 communities (representing 58,000 households and 260,000 inhabitants). Surveys have been completed for each community on the type and height of buildings in the community, the width of its streets, and its social and economic situation. Land use and occupation laws have been approved in ten settlements and the process is underway in the remaining ones. The laws passed limit the height of buildings so that all homes have solar access; ensure a minimum road width so that municipal service vehicles can access all sections of the community; and clearly delineate the community's public and private spaces. Furthermore, 17 communities have had street names officially approved.

The project has increased community participation and political consciousness among residents. As the local population participates in all phases of the project, they gain a good understanding of the process and are able to play a major role. That the local population has some responsibility for the design and implementation of the process helps to ensure the long-term sustainability of the project.

People living in informal settlements are often second- or third-generation migrants. As a result, the city was challenged to change the habits and culture of the settlements with regard to building practices. Educating residents as to why changes are needed and linking environmental education to their day-to-day problems were crucial to the success of the project.

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Toilet Replacement Program—Toronto, Canada

Municipal Profile

Population: 2.59 million

Land Area: 632 square kilometers

Municipal Budget: US$4.7 billion (operating) and $1.7 billion (capital) in 2001

Challenge

To support the city's comprehensive Water Efficiency Plan and meet the city's target of a 15% reduction in water demand by 2011.

Action

The City of Toronto is responsible for supplying and treating water and wastewater for all city residents and businesses. By 2011, the city's population is expected to grow to 2.86 million and employment is expected to increase from 1.45 million jobs in 2001 to 1.62 million in 2011. Toronto's daily average residential water consumption is approximately 253 liters per capita. In 2003, the Toronto City Council approved the Water Efficiency Plan and adopted a target of a 15% reduction in water demand by 2011.

The Water Efficiency Plan contains a series of water saving initiatives to reduce water demand on average annual days and peak days and cut wastewater flows in order to postpone the need for costly expansions of the city's water and wastewater infrastructure. The measures outlined in the plan include toilet replacement, clothes washer replacement, and system leak detection programs. Of all the Plan's initiatives, the Toilet Replacement Program was found to be applicable in all sectors: single family residential, multi-unit (public and private housing) residential, and industrial, commercial, and institutional buildings.

While the provincial government mandated that water-efficient toilets (6 liters per flush) be installed in all new buildings in 1996, the new legislation did not apply to existing toilets. The Toilet Replacement Program for single family and multi-unit residents encourages city residents to replace existing inefficient toilets with an efficient model. Residents are offered a US$45 or $57 cash incentive to replace any high water use toilet (13-liter flush or higher) with a water efficient model. The city has selected several water-efficient models on their website. A $45 cash incentive is given upon installing a single flush, 6-liter, city-selected toilet while a $57 cash incentive is given for installing a dual-flush (choice of 3- or 6-liter flush) city-selected toilet. The city calculated the cash incentive through a cost-benefit ratio based on associated water savings.

In selecting the proper water efficient toilets, the city pre-tested each type of toilet for performance and water efficiency. They found that approximately 50% of the toilets on the market do not meet proper performance criteria. Some 6-liter toilets do not flush well, which may result in double flushing. Not all toilets are created equal; of the 44 different models tested by the city, 24 toilets met or exceeded the city's expectations.

The city maintains a monitoring and testing program and conducts field inspections of up to 5% of each selected toilet model every year to ensure that the models continue to meet the city's performance criteria as well as residents' expectations.

To participate in the program, residents are asked to complete an application form, submit a receipt showing their purchase of a toilet from a list of city-selected toilets, and install the toilet. The city also has a hotline service and a website that offers information about the program, step-by-step toilet replacement instructions, and information on where to dispose of the old toilet.

Results

The Toilet Replacement Program for multi-unit residents began in 1999, while the program for single family residents began in 2002. Both programs will continue as part of the Water Efficiency Plan until 2011 or until the city's water demand reduction target has been met. Now in the implementation phase, response to the programs has been enthusiastic. A total of 12,700 water-efficient toilets have been installed through the Toilet Replacement Program for single family residents and 100,000 installed for multi-unit residents (public and private sector). A Toilet Replacement Program for industrial, commercial, and institutional buildings is also being implemented in 2004.

The city has budgeted $227,000 to form an eight-member, full-time Water Efficiency Office.

The actual cost of implementing the Water Efficiency Plan through to 2011 is expected to be $56.6 million, of which $6.4 million is dedicated to incentives and program support costs. The city budgeted $14.2 million for the Toilet Replacement Program for single family residents (from 2002 to 2011) and $10.2 million for the Toilet Replacement Program for multi-unit residents.

Through the program the city has learned that educating stakeholders and the public about the benefits of water-efficient toilets is crucial. With the exception of new construction, it is not yet mandatory to install 6-liter toilets in Canada. Consumers have the choice between 6-liter and 13-liter toilets. Raising public awareness and educating consumers is key to ensuring that a water-efficient toilet is the toilet of choice. Encouraging manufacturers and retailers of city-selected toilets to maintain sufficient stock and work with consumers will result in greater customer satisfaction and extensive program implementation going forward.

Key Contacts

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Build Together Housing Scheme—Windhoek, Namibia

Municipal Profile

Population: 250,000
Land Area: 65 square kilometers
Municipal Budget: US$75.7 million

Challenge

To provide all low-income residents with adequate and affordable access to land, housing, and services, as a means to reduce poverty and increase quality of life within the city.

Action

One of the major challenges for the City of Windhoek has been the influx of people into the urban area. The average annual growth rate for the city is 5.44%, while the national growth rate is significantly lower at 3.75%. Windhoek is the largest city in Namibia and is five times larger than Oshakati, the next-largest urban center. Roughly 16% of the population live below a development level of 0 (earning US$0 to $14 per month) while the majority of households earn between $15 to $101 monthly. Eighty-two percent of residents cannot afford to purchase a plot of land (either communally or individually) and so must be accommodated on a lease basis.

In 1998, the Namibian national government adopted a policy of decentralization and the implementation of the national Build Together Housing Program was decentralized to local authorities. With this change, the City of Windhoek faced several housing-related challenges, including an outdated housing policy, no implementation strategy, and inadequate human resources. The city used decentralization as an opportunity to aggressively address the housing situation of the city's poor. It adopted a vision of housing as a basic universal need. The Build Together Housing Scheme makes financial resources available to low-income residents to construct houses. The scheme is based on the idea that adequate shelter is more than just a roof over one's head. Housing is viewed as the building block for citizens to have the associated rights of privacy, space, security, water supply, sanitation, and waste management.

The program is geared to low-income residents residing in squatter areas or shacks, and those without access to middle-income housing. Of these residents, only those earning less that US$460 per month qualify for housing assistance. The qualification amounts are based on the financial means of the person seeking the loan; repayments are set on a sliding scale where up to 25% of monthly household income may be used for monthly repayments. To maintain the affordability of housing, all loans between $460 to $4,900 are repayable over a 20-year period at a sliding scale interest rate of between 5% and 9% per annum based on monthly household income.

Other qualification criteria include land ownership; applicants must own land in Windhoek and submit proof of such ownership[1]. In addition, applicants must be

[1] As many residents of Windhoek cannot afford to purchase an *erf* (a measured plot of land with a registered title certificate), the city also offers an *erf* loan program to provide access to such tenured land.

Namibian citizens and not own any other housing properties in Windhoek. The city only plays a facilitating role in the housing delivery process, and thus the construction of the actual structure is left to the beneficiary. Technical assistance is provided in the form of standard housing designs, however beneficiaries are at liberty to choose any other professional to design the structure provided the design is in line with the accepted standards and within the affordability level of the beneficiary.

Under the building program guidelines a Build Together Committee was established to handle all housing matters. The committee consists of ten people that coordinate the implementation of the program and reflect, accommodate, and balance the interest of all those concerned.

Results

Over a period of three years, from 2000 to 2003, the Build Together Scheme has made housing loans available amounting to $1.4 million or 507 homes. Furthermore, $1.1 million has been earmarked for the 2003/2004 fiscal year to enable the construction of approximately 360 additional homes.

One reason for the success of the Build Together Scheme has been the involvement of stakeholders at all levels: national government, local authority, non-governmental organizations (NGOs), private sector, neighborhood committees, and residents. The program not only identified the various stakeholders but also clearly defined and assigned roles to all groups involved.

Furthermore, by choosing to assume a facilitative role in the housing delivery process, the city created a service that promoted empowerment. The city's intention in providing housing was based on assisting people to house themselves and not to provide housing itself. By leaving the majority of responsibilities with each household, the program helps to show that the government is creating systems that can be used to address residents' problems.

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