

## SECOND ANNUAL WORLD BANK CONFERENCE ON Environmentally Sustainable Development THE HUMAN FACE OF

# THE URBAN ENVIRONMENT



14. 14

# Water Resource Management in Mexico City

Ismael Herrera

The metropolitan area of Mexico City is approximately 3,773 square kilometers. According to the 1990 census, the metropolitan area contained 17 percent of the total population of the country—or approximately 15 million people—and 45 percent of its industrial activity, generating 38 percent of the country's GDP. Combined with its concentration of government offices, international business, cultural activities, and leading universities and research institutes in the country, the capital dominates the national economy as few other national capitals do. If Mexico City were a state, it would represent the fourth largest economy of the Western Hemisphere—behind the United States, Canada, and Brazil.

The metropolitan area has expanded rapidly in two ways—industrially and residentially. Residential growth has had two patterns planned movement by upper- and middle-class families, and disordered movement by poor, sometimes illegal settlers from inside the metropolitan area and out. The pockets of low-income residents have gradually become established in the area, and authorities have come to recognize their permanence, regularizing land possession and eventually providing urban services, including water, although the services are sometimes inadequate.

Supplying water for such a large city is a daunting challenge, made the more difficult by Mexico City's location in the Valley of Mexico, at an altitude of about 7,300 feet, with the lowest valley pass at 8,000 feet. The main source of water supply (72 percent) is the Mexico City aquiferbut dangers of land subsidence above the aquifer mean that this source cannot be exploited without restriction. Given the scarcity of water, the consumption and costs of water are extremely high in the metropolitan area.

To address these problems quantitatively as a basis for developing technical solutions, the National Academy of Sciences and the National Academy of Engineering in Mexico, in cooperation with the National Academy of Sciences of the United States, have undertaken a study of water resource management in Mexico city. The study has been coordinated by a bilateral committee consisting of 14 members, 7 from each country. This discussion addresses four issues raised in the first meeting of the bilateral committee-the supply and disposal of water, the quality of the water supply, including public health concerns, the feasibility of implementing a demand management system for controlling consumption, and the legal and institutional arrangements necessary for managing water supply.

#### The Issues

Two issues are paramount in the metropolitan area of Mexico City: how reliable the aquifer will continue to be as a source of water, and how successful the recently constructed deep drainage system has been at controlling the long recurring problem of flooding. Other issues include:

• Water quality. Whether the procedures used for treating water and ensuring its quality are safe for the environment and people.

- Demand management. Whether reducing the demand for water, rather than increasing its supply, is a satisfactory option for water management, without restricting development and progress.
- Legal and institutional framework. How the complex network of legislative agencies and regulatory bodies can be made more efficient.

#### Findings of the Study

The study reached several conclusions:

#### Water Supply Needs Are Being Met

The Valley of Mexico is a closed basin—although it has been opened artificially—and it is important to distinguish between internal and external sources of raw water. The most important source of water supply for Mexico City is an internal one—the aquifer that flows beneath it. Other internal sources come from surface water—from Rio Magdalena, Presa Madin, springs, and ice from Popocatepetl and Iztlacihuatl—but they represent only a small fraction (2.3 percent) of total supply.

Mexico City has two external sources of water supply. One is the Cutzamala system, which takes water from the Cutzamala-Lerma-Santiago basin, approximately 100 kilometers west of the Valley of Mexico, and about 1,000 meters below it. The other is the Lerma Valley, which yields groundwater.

Study estimates indicate that 97 percent of the population in the federal district has access to water through an urban distribution network, and that the remaining 3 percent are served by tank trucks or self-supplies. In the state of Mexico overall these proportions are 90.5 percent and 9.5 percent, respectively. Consumption in the federal district is 364 liters per person daily; in Mexico overall it is 230 liters per person per day. Consumption in the district varies by income and type of household. For comparison, the rates in the United States range from 250 to 1,120 liter person per day, with an average of 660. To address the rapid growth of the urban population, the government of the federal district has established 150 liters per person per day as its basic quota for supplying the new urban population.

#### The Aquifer Is Being Overexploited

The aquifer is very thick and has been explored recently to great depths—3,000 to 4,000 meters. The study contains a detailed description of it as it is known at present. An important feature of the aquifer is a thick cover of compressible clay, which creates ground subsidence when worked on, damaging construction and civil works in the country.

Water is being extracted at a rate of 43 cubic meters a second. The figure of 16 cubic meters a second is generally accepted as an adequate recharge rate for the aquifer, although more optimistic computations put the rate at 26 cubic meters a second. Although the aquifer is being overexploited, it could continue to supply water at the present rate for many years—a century or more—if not for the associated land subsidence, which is extremely expensive and inconvenient.

Another important factor is that only 20 percent of the area of the aquifer is covered by clay layers. Thus, there are some management opportunities for exploiting other areas of the aquifer, which some of the utilities have already pursued.

#### The Quality of Water Is Good

All of the water from the Cutzamala system is purified at the treatment plant in Los Berros. Its installed capacity is 10 cubic meters a second, although it currently treats 10.6 cubic meters a second; in the original project its capacity was 24 cubic meters a second. The treatment consists of percolation, coagulation and flocculation, gravity sedimentation, and rapid filtration through sand.

Several treatment plants were originally slated to treat groundwater from wells located in the Valley of Mexico. At present, however, these plants are performing only chlorine disinfection.

The quality of the water from the Mexico City aquifer is generally quite good. The thick layers of clay that cover the aquifer have very low permeability and constitute very effective protection against pollutants. However, as has been mentioned, only 20 percent of the area is overlaid by these strata, and the rest is exposed. The aquifer is particularly vulnerable in the recharge areas, where many of the irregular, illegal settlements have moved, and in which inadequate sanitation and disposal services increase the risks to the aquifer.

#### Demand Management and Water Conservation

Both water costs and water consumption are out of control. It is not clear whether increasing the supply of water is the correct measure to cope with demand from the growing population and burgeoning economic activity. Given the scarcity of water, as well as stricter water quality and environmental standards, water costs have escalated, leaving the water utilities with an annual deficit estimated to be US\$1 million. This shortfall drastically restricts the ability of the system to expand and provide essential services to areas that lack them.

Until recently, water authorities have focused their attention on increasing supply, constructing new and impressive waterworks, and networks to bring water from far away. However, little attention has been given to demand management—a realistic and equitable pricing and metering system that, rather than pursuing water conservation, seeks to increase the efficiency of water consumption and to recover water costs more effectively. Recently, these issues have begun to have a more pronounced position in the water strategy. The system requires that users play an active role, and public awareness campaigns have been introduced.

#### Water Management and Moves toward Privatization

Water supply in Mexico City is governed by a wide range of laws and regulations and managed by a complex network of institutions responsible for developing and administering water and sanitation services in the metropolitan area. These institutions start at the federal government level with the Water Commission, which in turn governs the Water Agency of the Valley of Mexico, the governments of the federal district, the state of Mexico, and local municipal governments. In addition, two secretariats are responsible for health and environmental management.

The institutional framework for water management in Mexico City is currently undergoing extensive change—particularly in the federal district. On July 14, 1992, a privatization decree was issued, which established a new semiautonomous Water Commission for the Federal District, whose primary goal is to increase the efficiency of the supply of water and of wastewater disposal. The Dirección General de Construcción y Operación Hidráulica—the entity that is largely responsible for these functions in the federal district—will continue to serve as an operational agency, but plans call for privatizing such functions as potabilization and water supply, and the drainage and treatment of residual waters.



#### SECOND ANNUAL WORLD BANK CONFERENCE

#### ON

#### ENVIRONMENTALLY SUSTAINABLE DEVELOPMENT

"THE HUMAN FACE OF THE URBAN ENVIRONMENT"

#### SECTION III-C

## SHARING AND CONSERVING COMMON RESOURCES: WATER SUPPLY AND WATER RESOURCES

#### Tuesday, September 20, 1994

2:35 p.m.

H Building Auditorium The World Bank 600 19th Street, N.W. Washington, D.C.

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## Chair, Sandra Postel, Professor, Tufts University, Global Development and Environment Institute, Boston, Massachusetts Overview, Guy Le Moigne, Senior Agriculture and Natural Resources Advisor, World Bank Lessons of Experience Sao Paulo, Brazil - Guarapiranga River Basin: Ivan Carlos Maglio, Guarapiranga Program Coordinator, Department of Water Resources and Sanitation for the State Government of Sao Paulo Water Resource Management in Eight Asian Megacities: Arthur McIntosh, Senior Project Engineer, Water Supply and Urban Development Division, Asian Development Bank Turkey-Clean-up of Izmir Bay: Nuran Talu, Advisor to the President, Environment Commission of the Turkish Grand National Assembly

AGENDA ITEM

Mexico-Management of Water Resources, Mexico City, Mexico: Ismael Herrera-Revilla, Professor, National University of Mexico xx

Rapporteur, Letitia Obeng, Senior Water and Sanitation Specialist, World Bank xx

3

7

xх

xx

XX

PAGE

guidance, to improve the central guidance. And the financial commitments should be expedited for implementation. And the last thing, the economic instruments should be used. And the planning side, utilization of a GIS data base should be encouraged. Of course, it has started.

In conclusion, I would like to underline two points. We recognize the value of technical and scientific studies in the area, in the Izmir Bay area; however, without cooperation and coordination of the efforts of all institutions, national or international, the expected results cannot be achieved. Finally, this problem is not specific to Izmir due to the fact that Turkey has not yet established rational institutional structures to solve these environmental problems. This causes extra problems in the implementation of particular projects such as Izmir.

Thank you.

[Applause.

CHAIRPERSON POSTEL: Thank you, Nuran.

Our last speaker for this afternoon before our break is Mr Ismael Herrera, who is currently working in the fields of civil engineering, geophysics, and groundwater. He is a mathematician working on applications of mathematics to these various areas.

He has been Director of the Institute of Geophysics at the National University of Mexico, and was organizer and founder of the National Council for Science and Technology. He is former President of both the National Academy of Sciences and the National Academy of Engineering of Mexico.

Today, Mr. Herrera will speak to us about the management of water resources in Mexico City, which in my view is certainly on of the most difficult urban water management challenges we face today.

MR. HERRERA: Thank you. I will be talking about the problems of water supply in Mexico City.

I want to first of all say that my talk is based on a study that is being carried out jointly by the National Academy of Sciences of the U.S.A. and the Academy of Science of Mexico, as well as the Academy of Engineering of Mexico. This study includes, has analyzed the sources of water that are being used or can be used in the future for supply of Mexico City, quality problems that are associated with the water in Mexico, water demand management, and the regulatory and institutional framework of the problems.

I must say, however, that, as Sandra mentioned, I am a mathematician. My connection with water problems has been through modeling, mathematical modeling. However, I have had some suggestions of the kind of presentation by Mr. Guy Le Moigne, which I appreciate very much, some suggestions about the kind of material that would be of greater interest for this audience.

So let me start with the general description of the metropolitan area of Mexico City. First of all, the population of the city is about 15 million, and it is the largest city of Mexico. Actually, Mexico is a very centralized country, and a lot of the activity is there, a lot of the economic activity. This population of 15 million represents a little less than 20 percent of the population of the whole country.

In the political divisions, first of all, it includes the federal district, which is similar to the District of Columbia in the States. It is the district where the capital is located, and it includes 17 municipalities of the State of Mexico. Mexico is a union of states, also, and the State of Mexico shares a large part of

59

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the metropolitan area of Mexico City.

Regarding the physical characteristics which seem relevant for our purposes is that Mexico City is a closed basin. The Valley of Mexico is closed hydrologically. It is very high It is 2,200 meters high, which also adds some complications to the water supply. The city rests on a very complex ? clays. This is relevant because when water is-well, one of the main sources for Mexico City's water supply is the aquifer which is below, which rests below the clays Of course, greater land subsidence ?) is produced when it is taken

There is a very big aquifer on these clays, and that's the source, one of the main sources, as I have mentioned. Everybody has referred to the economic activity, which about 40 percent of the country is located in Mexico City.

So I want to start with some of the quantity issues. Regarding the sources of water, let me mention the volume of water which is supplied, which is 60.3 cubic meters per second, the supply, is the total supply. Now, of this, the distribution between internal and external sources of this, 73.6 percent comes from internal sources, and 26.4 percent comes from -- is imported from other watersheds.

Regarding the aquifer importance, the aquifer, as I mentioned, is very important. 71.3 percent comes from the aquifer, and, of course, a big limitation is the line subsidence. If it not were because of the line subsidence, certainly it would be much easier because actually the aquifer is very big, very deep, more than 400 meters thick. And it could supply for a long period.

Regarding the imported water, it comes mainly from the Cutzamala System which supplies 17.6 percent. Regarding re-use, it has been increasing, but at present it's only 2.5 cubit meters per second.

The water distribution, regarding the distribution, first let me tell you the supply per person is 368 liters per person in the Federal District, in the part which is located in the Federal District, and in the State of Mexico it is 305 liters per person. It is a little less. In this respect, I must mention that, in general, the resources of the area which is located in the Federal District are better. They have more resources than in the State of Mexico, probably because the government is directly--you know, handled by the Federal Government of the country.

As a comparison, I should mention that in the states, the average--this is the figure I have--is that the average is 360 liters per person. This comparison shows that actually it is not bad, the supply in Mexico, if we take into account that the average income is much lower, is less than one-fifth of what it is in the states, the average economic income.

Regarding the distribution system, how many people are connected to the distribution system, in the Federal District it is 97 percent, so only 3 percent have to get supply otherwise, mainly by trucks, water trucks. In the State of Mexico, it's only 90.5 percent connected directly to the distribution system and 9.5 percent that have to get the supply in a different manner.

What about equity problems? Well, in general, the low-income people have more limited access to quantity and quality. This is connected with the fact that it is in the areas, the poorest areas, where the distribution system is less developed than, of course, people who are in better economic situations. They would be supplied with the distribution system. In general, we can say in this connection that a large percentage of the population is in unsatisfactory conditions.

Quality issues I have divided into two--well, I will start with public health problems associated with water. Regarding public health problems, we can talk about receiving pathologies, in particular diarrhetic diseases. I don't know if I am pronouncing correctly, diarrhetic diseases, and emerging pathologies, we can mention congenital and others that they are positively linked with the kinds of pollution associated with the industrial development.

What about potential quality problems. Well, something which is important, I think--I should mention--I would say that the greatest problem in Mexico City is associated with quantity more than with quality. In part, this is due to the fact that the aquifer, which is the main source, is well protected by these thick layers of clay that protect the aquifer from external pollution. In a large percentage--in a lesser part, it's about 30 percent of the area covered by this clay, and also that area is the one that is most settled. The potential for quality problems or for pollution are irregular settlements. Many of the new poor people that come to the city settle in the outskirts, which are precisely the areas of recharge for the aquifer, and they usually won't settle initially, and without adequate services eventually this is regularized, this is-even services improve because they have to supply services eventually. But, anyway, that's one of the problems for the quality of water. So that makes the aquifer vulnerable, and also the increasing industrial development poses different problems that I've described in the study, some of the problems.

What about comprehensive management of water resources? Well, let me talk about the past, before. In general, demand has been above (?) sustainable development. In the past, the management strategies focused on increasing quantity of water available rather than in demand management or controlling the demand. And this led on the one hand to the over-exploitation of the aquifer. The aquifer is being over-exploited. There is a deficit if we take into account how much is being withdrawn and how much is recharged of the aquifer. There is a difference of about 10 cubic meters per second.

Line subsidence, of course, is a great problem

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because of this, but it has been, to a large extent, controlled, on the one hand by the way it's been administered. But in the past, the problem of line subsidence was worse sometimes, particularly in the '50s it was very big. Then the aquifer started to be managed more rationally The distribution of damping (?) was changed, and because of that the problem was (?). But, anyway, the water withdrawing cannot be increased much more. Big water works were established also, with this and other systems which takes water from very far away, more than 100 kilometers, the deficit finances of the section ?), associated governmental subsidy to the sector and little attention to demand management. Now maintaining households, fixed price per household, water bills also frequently went unpaid.

Present and future. Well, on the one hand, since 1988--in fact, even before, but especially after 1988, big changes have been introduced. Resource conversation, on the one hand, public consciousness of the need to save water, to make efficient use of water, conservation practices. Metering has also been introduced. It is going on, water bill involvement. Tariff policy, particularly restructuring of tariff policy, including marginal cost, privatization is, in general, now the administration of water has been privatized, water supply, water drainage, and water reclaiming and re-use have been privatized.

What is being done? Changes in law. Before, waters could not be commercialized by individuals because they belong to the nation. Now different measures have been introduced to make of water an economic resource. Organizational changes, private participation in water utilities is one of the main changes.

What about institutional arrangements? In the past, well, first let me talk about the nation of Chile As I mentioned, Mexico is a very centralized country, so even if the States are, according to the Constitution, independent, really they--in practice that's very little. It's very little effective, and the Federal Government overcharge the State Governments. There has been, however, the centralization tendency for more than 10 years. The Federal District water utility (?) in the State of Mexico, the state program responsibility was--that state Government is enlarging its share in these responsibilities on policies, playing an emerging responsibility. The National Government (?) some other system.

I am almost finished. I am on the last.

The institutional arrangements, in the Federal District there was a privatization decree on July 14, 1992. The Water Commission of the Federal District was created, which is partly non-governmental water treatment. The director of civil water reclamation is in charge of this, and private entities have competed for operation of infrastructure of potable water, secondary treatment of residual water, and the essential tasks that are foreseen are the installation of meters to avoid water losses in the distribution system, enforce water bills, and improve the distribution infrastructure.

So this is more or less the situation about water supply in Mexico City, and I think in general what is foreseen is to take productive measures and make a comprehensive management of the resource.

Thank you very much.

[Applause.

CHAIRPERSON POSTEL: Correct me if I'm wrong, Ismael, but wasn't Mexico the first country to pass national water efficiency standards for home water appliances and fixtures? I believe so, a couple years ago.

MR. HERRERA: Well, yes. Yes, that recommendation--again, what--

CHAIRPERSON POSTEL: I think it was the first.

MR. HERRERA: It was first, yes.

CHAIRPERSON POSTEL: May I suggest we take about a 10-minute break and then come back and pick up with questions and discussion. I think all the panel members will be up here. I think we all need a short break, and let's re-gather about 4:30 if we can.

Thank you.

[Recess.]

CHAIRPERSON POSTEL: Can I suggest we get started? We've got maybe a half-hour for questions and discussion. We'd like to break shortly after 5:00, if possible.

A couple quick announcements before we start the discussion period. One is that there is a special evening lecture this evening at 8 o'clock p.m. by Dr. Charles Correa of Bombay We're all welcome to attend that lecture. It is, I assume, here at the Academy.

VOICE: At the Academy, not here.

CHAIRPERSON POSTEL: Oh, right. We're not at the

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Academy. It is at the Academy tonight at 8 o'clock. Thank you

Secondly, during the discussion, if we could use the microphones, either this one which I'm holding or the one at the back, because there is a stenographer who is recording comments. So if you'd like your comments recorded, use the microphone. If you wouldn't like your comments recorded, you don't have to. But we prefer that you do Also, please identify yourself so that can also go into the recording.

I think we've got a lot of useful information out of the case studies, good examples and illustration of some of the principles that Guy laid out in the overview presentation. I was particularly interested myself in a lot of the demand management aspects of Arthur's presentation. I have some questions. But I would like first to give you all an opportunity to either comment or ask questions that may have arisen in any of the previous presentations.

Would anyone like to start us off? Would you like to either come to this mike or use the back one?

MR. ALOMON: My name is ? Alomon, a hydrologist working in water resources development in Ethiopia. I have a question, particularly to Mr. Le Moigne. While talking here about sharing and conserving resources, particularly water resources, many things have been mentioned here. What about the so-called international rivers? Has the World Bank developed a policy or is a policy being developed on international rivers? Because international rivers are, broadly speaking, [inaudible] approach on international rivers?

MR. LE MOIGNE: Yes, the Bank has a policy for financing projects on international rivers. We have no formal policy yet for financing projects on internationally shared groundwater aquifers. On internationally shared aquifers, it's treated on a case-by-case basis so far, but for international rivers we do have a policy that rests on the two principles of equity and appreciable harm, with a lot more emphasis on the appreciable harm concept than on the equity concept.

This policy is translated with a few ideas. If a country requests the Bank to finance project that is located on an international river basis, either this country has an agreement with the other riparian or riparians, and then the only objective is to make sure that the project proposed is in accordance with this agreement. When there is no

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agreement, our policy consists of requesting the country who asks World Bank financing for such a project to inform the other riparian of the main characteristic of that project so that they have a chance to voice their comments.

If the country refuses to contact directly the other riparians, then the country must authorize us to notify the other riparians. And if they refuse to let us notify the other riparian, then there is no lending. Once the other riparians are notified, they must be provided with the date in order to make an assessment to see to what extent, in their view, this project would affect, would create appreciable harms for their development, past, present, or future. And if within six months they have not replied, then we consider that they have no objection. If they have objection, then they are considered by both the ; country that requested lending and by the World Bank staff.

Now, then the Bank makes--in the end, after discussing the project, of course, tries to encourage countries to reach agreements. This is our first objective. But if this cannot be done for various political reasons or otherwise, we make our own assessment as to merits of the harm that can be caused to the other riparians. And if in our opinion the country that requested a loan for a project it will not cause harm to the other riparians, the management of the Bank may decide to overrule the objection of other states, if any, and still finance that project.

Before doing this, when there are objections, we very often will appoint a group of experts, international experts to review the World Bank assessment. Now, this does not happen very often. It happened once. It happened once in the case of a project in Somalia some five or six years ago. They wanted to build a dam on a river called the Daua River, which is shared by Ethiopia and by Kenya. We informed the other countries, Ethiopia and Kenya, and concluded that the objection raised would not affect the economy of the project in Somalia and, as far as water use, would not create appreciable harm to the other two countries.

This Bank staff assessment was confirmed by this international panel of experts, so based on that ground, the Bank was prepared on that item to finance, to participate in the financing of the project, dam construction on the Daua River in Somalia. There were other conditions, however, such as the macroeconomic conditions, that were not met and which are not likely to be met in the very near future. So this project was never financed.

This policy of having an international panel of experts was developed just about the time when we created that panel. Since then, I don't think we have used that panel

Of course, the Bank, as you know, is always willing to assist countries who make requests. Our most famous case is, of course, the India-Pakistan treaty to which we were--had a participating role.

Thank you.

CHAIRPERSON POSTEL: Thank you. Other questions, comments? Yes, sir?

MR. VIROW: My name is Givi Virow (?). I'm a professor of environmental sciences and public policy at George Washington University. I have two completely disconnected questions. One is, I'm quite interested in the caretaker approach How exactly does it work in a very large city? And what is the advantage of having a regional caretaker when you can have infrastructure for the whole city?

A completely disconnected question is: Some of

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the speakers have mentioned about reduction of losses. Considering many of the older cities in developing countries have old infrastructure, what type of ?) are being used for reduction of losses? I'm not talking about (?) now but just reduction of losses. The crux of the question is we are experimenting in this country with using ? technologies for other infrastructure. Is anything being done in the developing countries that you talked about?

MR. McINTOSH: As regards the caretaker approach, I must admit that it's my idea, and I'm going to try to see it into fruition in Colombo in Sri Lanka on a pilot of 5,000 connections, starting within the next six months and going over a duration of about 18 months. I don't see why it shouldn't work in a large city. Basically it comes down to a question of responsibility for what's happening in that area, and also the ability of that caretaker to interact with the community and to be a part of that community, not to be something seen from outside.

In regard to the reduction of losses in technology, I have felt that when you have reduction of unaccounted-for water, many times we get consultants, often from the U.K., where there are no water meters in their system, and the emphasis is on leakage control and leak detection equipment. When you've got unaccounted-for water losses on the order of 50 percent and more and you can walk around and see visible leaks and water meters that don't work and illegal connections, there's a great deal that can be done before you should come to using leakage detection equipment.

So on the technology, I don't think we have to get too sophisticated When we've got the simple things out of the way and working, then we can look at those other losses that could be reduced by using more modern technology.

Thank you.

MS. BREWSTER: I'm Ms. Brewster from United Nations, New York. I just wanted to elaborate a little on the Bangkok case, and I think it may respond to what he asked, also.

From around 1970 to 1990, the Metropolitan Water Works of Bangkok had this huge campaign to reduce losses. There were three main efforts. One was leak detection, and one was replacement of old pipes--they dug up the streets-and the third one was metering. And those three things combined, it was a huge effort to reduce losses considerably

75 ••• over the 20-year period, and I think it was very successful.

But I just wanted to say that a lot of the effort behind that or the spirit behind it came from the donors. There was a lot of Japanese investment, and they set up an excellent training center at the Metropolitan Water Works for leak detection, repair, pipe replacement and so on And they've been training people from all over the region. They've had the Vietnamese there and the Filipinos and Indians, Sri Lankans, and everybody has been training there. So that was a really--it's an excellent center. And that effort, I think, a lot of it came from the Japanese side and maybe even from ADB or World Bank.

Now, so there's problems with replication of that sort of thing. First of all, a lot of the effort came from outside donors, and Thailand is a very attractive, creditworthy recipient of funds and loans. And not all countries have that sort of attractiveness. The Thais have still not considered conservation. They're still not talking about conservation. The block rates are, you know, very low, and they're still talking about interbasin transfers and they're talking about importing water from Burma. I find that so bizarre because they still haven't

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76

even thought about conservation or demand management.

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The other thing, you still can't drink the water in Bangkok, so they really haven't dealt with the water quality issues. They can't cover the cost of water through the tariff structure, although the NWWA is much more autonomous than it used to be. And they say they can't reduce the unaccounted-for water any more than they have. It's 30 percent, and they don't think they can get below that.

The only reason I'm bringing up all these issues is because the leak detection was so successful in reducing unaccounted-for losses from 70 percent down to 30, could it be the donors in some of the multilaterals who have such an influence on that campaign, go the next step and go into demand management and give them some very sort of defined criteria for reducing water (?) through demand management before they think about interbasin transfers?

MR. McINTOSH: Bangkok is a very interesting case. The Asian Development Bank put a lot of money into Bangkok. We could take some of the credit for that, for the reduction of unaccounted-for water, but when a water utility is making close to US\$100 million profit--and I mean real profit--a

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77

year, as that authority is doing, it will not listen to the Asian Development Bank for leverage to--there is no leverage there for us to ask for demand management.

I agree 100 percent. Demand management is needed in Bangkok. It is the largest, it is the highest per capita consumer of water in Asia as a city, and when they--last year they had a drought and they were screaming that they were in a crisis. But the answer was very easy, and they didn't want to use demand management.

Now, I think that this demand management problem should be tackled as a question of tariff structure and not as a question of putting the price up, because the tariff structure for Bangkok is almost flat. There's no disincentive at 30 cubic meters per household to put the price up. It's the structure that needs to be looked at, not the price per se.

CHAIRPERSON POSTEL: Bob?

MR. WILKINSON: My name is Bob Wilkinson. I want to follow up on that question. I want to go just one step further. I agree with the data that you showed and the conclusions you're drawing in terms of price and the costeffectiveness of increasing efficiency instead of increasing supply. Is there some mechanism that the Bank or regional banks could employ that would require, at least on a par in terms of funding, least-cost demand-side measures, toilet replacement programs, et cetera, in conjunction with funding for any kind of supply project? It's the same problem we certainly have in this country. The California experience is really not that different from any country around the world. And the answers seem to be the same. It's cheaper to save water than it is to develop new supplies of water.

So if there's some mechanism that could be employed that would, short of forcing the issue, at least strongly encourage funding of those measures along with the supply side, maybe for both of you on the Bank side.

CHAIRPERSON POSTEL: John?

MR. BRISCOE: I am John Briscoe from the Water and Sanitation Division in the Bank. I think the sentiment that you expressed and others have expressed we all very much share If you look at Bank-funded water supply and sanitation projects, the costs in which--the major issue, I would argue, in virtually all of our discussions with all of the countries with whom we work is on tariffs. That is the biggest issue of all. With the tremendous pressure that we

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79

put on that, we managed to reach the very elevated level of about 30 percent of the costs of supplying water are covered in tariffs in Bank projects.

If we look by comparison at things like telecom or energy sectors, we are much closer to the break-even point, and that raises a very important question as to why is it so difficult in water and what's different about water. The answer is both very complex and very simple. The answer is water is perceived as somehow a resource that's different from a telephone, it's different from energy, because it's a basic need. It has always come; it has always been there at some level.

So I think that the issue of being able to work with governments in getting realistic tariffs is a very fundamental issue that has to be dealt with as a political problem as much as it is an economic problem. The leverage that the World Bank or the Asian Development Bank or anyone else has on this is not new, but it's far from 100 percent. There has to be a consensus developed in the country, in the city, that charging for water at something close to its marginal cost is, in fact, in the interest of all people. And I think some of what Mr. McIntosh spoke about today is a first very important piece of the puzzle.

When we have these discussions, the first point of that always is, no, we can't possibly do that because our poor people can't pay this. Now, this is not necessarily an entirely erroneous concern; however, when you look at what happens when you have inadequately financed systems, the answer is you will most always have rationing of one sort-you don't almost always, you always have rationing. Either water doesn't get to certain areas, or when it's an intermittent supply, you can always be sure that the people at the end of the pipeline are the poor. And as Mr. Le Moigne said earlier, there is no such thing as a person without a water supply

So everybody gets a water supply. And how do they get it? They get it through the sorts of mechanisms which Mr. McIntosh put up there, through vendors, through using of polluted supplies, et cetera. And when you look and there's a virtual consistency of this throughout the world, we find huge amounts of resources going into buying water; the poor people, far from benefiting from these subsidies, in fact just the opposite is true. The people who benefit from the subsidies are the people who get access, the people who get

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81

water, and that is never the poor. It is always the poor who are the ones who are the last end of that.

Now, that's a very important issue because it's one that we run across constantly, and I think that's an issue which has to be dealt with in a partnership form. It has to be one that comes about as a dialogue in the societies. If it comes about through the wicked World Bank coming in and imposing another tariff which will put the poor even poorer than they are now, there is not a chance of it happening. So there it has to be a part of the sort of participatory process that we've discussed here.

I think once we get--tariff supports are not the only issues. In many instances--and, again, the presentations today have touched on that--the costs of providing that water are inordinately high. They're inordinately high because the enterprises are stacked with the relatives of the latest political appointee.

In Latin America, for instance, if you look, we did a review a couple of years ago of water utilities, and there were more than 10 times--there were about 30 employees in those utilities per 1,000 connections, where an efficient utility in Latin America, like in Santiago, functions on three. So the costs of that provision is much, much higher, and that is just as important and it is the same route of accountability of social control that comes in it.

Now, I think this is a somewhat circuitous answer to your question because I think the issue we have found through the very significant failures we've had over the years, simple looking at the issue of unaccounted-for water and saying--I'll give you an example, an example we're not particularly proud of, and we can probably share the credit with some others at this table on this: Manila water The World Bank started its first project in Manila. supply I think there have now been five World Bank-funded projects on water supply in Manila. In the first of these, the unaccounted-for water is around 60 percent, and the primary objective of that was to reduce it. No, it wasn't 60, it was about 50 percent. After six projects, it's about 60 And the answer is -- I mean, you know, what the hell percent. Didn't anybody understand that very simple went wrong? logic?

The answer is we did understand the logic, but what we did not understand, I think, sufficiently, was that without a much more comprehensive approach which took account of incentives which face utilities, making utilities autonomous to a certain degree, making them accountable for being efficient and for providing services, no amount of codes passed on low-cost latrines, et cetera, will ever make a difference.

On the other hand, I think we have some very good cases in which, if you do change the incentive structure, that if there are incentives, if water is priced at something like its marginal cost, it becomes complete sense to a utility manager to do those things which are costefficient. And so the problem of unaccounted-for water--and I agree very much with what Arthur said. It's not a matter of sophisticated leak detection equipment. It's a matter of getting incentives right whereby the managers of utilities will be rewarded if they manage that efficiently. Those incentives should take account not just of the financial costs but the opportunity costs of water. And if you can get that in place, then you can have technical transfer of particular means for doing that, but can have the desired effect in a sustainable manner.

MS. MAIKU: My name is Michelle Maiku ?), and I'm a Ph.D. student I'm currently doing my Ph.D. on financing and managing water provision. I'm looking at Trinidad and Tobago in the Caribbean, and the question is directed to Arthur McIntosh.

The Trinidad utility is a classic case of excessive government intervention, the use of water provision as a form of subsidizing the people. And the backlash of that is that there is a major problem with reliability in that the state has invested excessively in the production side, and water still does not get--it doesn't flow through the taps.

The question is the private sector's now interested in taking on the risk in the water sector. Should, therefore, the state maintain some presence in terms of production and encourage the sector to be involved on the distribution side? The reason I raise this question is because you had said that perhaps the state or government should remain involved in terms of settled policy but allow the implementation to be done by other organizations Is it possible to have the state involved in production and have some kind of privatization in terms of distribution?

MR. McINTOSH: What we've found is that private sector participation normally comes first from the

production end and last from the distribution end, and we don't have--I don't think we have any examples of successful ones at the distribution end in Asia that I can quite--John Briscoe might have some examples in other parts of the world.

But the point about government setting the policy and the agencies implementing that policy is that the agencies don't have to be private agencies. They can be government departments or government enterprises. But there must be a clear delineation between the policy, the written, stated policy, and the implementation of it, which means that government does not set tariffs. Government says what tariffs are supposed to do, what they're supposed to meet. And the utility then has a responsibility to administer that policy

Thank you.

CHAIRPERSON POSTEL: John, did you want to add anything?

MR. BRISCOE: I could add just a bit which is relevant to that. I think there actually are quite a lot of examples of distribution being--the word "privatized" is one that one has to tread around with caution. But as you no doubt know, the most "privatized" water industry in the world is in France, in which it, in fact, is not privatized, but it's publicly owned, but there are franchises given out And it's interesting to note that in the city of Paris, in France, the bulk water supply system is, in fact, run by an autonomous entity that's mostly owned by the city of Paris itself. So it's held in a public company. And the distribution in the city of Paris is given out in 30-year concession contracts, the Left Bank to the NSSO and the Right Bank to ?). So there are, in fact--the distribution side is quite often done.

I think the case of Mexico City is an interesting one in that case because you have there, if you will, a very gradual and graduated approach to involving the private sector. The water rates in Mexico City at the moment--and Mr. Herrera could correct me on that, but it is around one cent a cubic meter. So if you ask a private sector company, would you like to come in and run the water for a cent a cubic meter when your production cost is a dollar, it's very unlikely that anybody will be a willing buyer for that

By the same token, there are obviously very great benefits from getting a much more efficient management into that. The approach they've taken in Mexico City is to divide the city into four zones, and they have entered into essentially management contracts with two of the big British companies and two of the big French companies to manage those zones. Now, that's without very many of the incentives that normal private sector involvement would entail, but it's considered that perhaps in five years or ten years there will be enough experience with working with each other, you will have managed to work on the tariff side, it will become an investment which is attractive.

Just as a last word, you know, there's one very striking case in Latin America, which is Buenos Aires, in which there was a 30-year concession contract given by the government of Buenos Aires to a consortium led by Lioness Diso ? which has the contract for both water and sewage provision in Buenos Aires.

MR. LE MOIGNE: I would only add that I understand that Macau has a private water supply, and yet it's still in Asia

CHAIRPERSON POSTEL: Other questions, comments? Any panel members like to make additional comments, too. Just let me know if you'd like to add anything. I had one follow-up question, I think similar to one that was asked earlier about some of the efficiency measures going into the large Asian cities. That has to do with the efficiency of the water appliance infrastructure that's going into new construction in some of the larger Asian cities. Is that of the most efficient variety, the kinds that are now being used, say, in the United States based on new efficiency legislation we have here, or is it still the generation earlier, say, you know, three-and-ahalf--rather, using the 1.6 gallon or 6 liter toilets or the higher quantity uses that we were using five years ago?

MR. McINTOSH: The only example that I know of the megacities we looked at was Seoul where the government itself, in its own housing schemes, insisted on these watersaving devices. I think there were three different types that had to be installed. Whether they're up to date with-they probably would be up to date with what's going on in the U.S. But in the other megacities, I don't know that any of those--and that's why I said that in demand management, the water utility responsibility should be to go, to extend inside those homes, to actually look at how people use water and help them to use it better.

, 89

CHAIRPERSON POSTEL: The reason I was asking is that, as most of you may know, the United States passed water efficiency legislation in late 1992, which requires that manufacturers of plumbing fixtures meet certain standards of efficiency. This is for toilets, showerheads, faucets. And when you look at what the savings collectively are from those measures, it, over the long term, would reduce water use indoors, inside homes, by about 30 percent. So if you're looking at a fast-growing metropolitan area that is rapidly expanding water infrastructure, making sure that the most efficient appliances are going in, it makes a big difference to the long-term water capacity needs, waste water treatment needs and so forth. So that was the basis for my question.

MR. HERRERA: The only comment I wish to make in that respect is that's precisely taking place in Mexico City. Right now they are changing the equipment precisely to make efficient use of water.

MR. McINTOSH: By regulation?

MR. HERRERA: By regulation. That's very recent. Right now they are changing it. In my university, all the toilets were changed. CHAIRPERSON POSTEL: We can take one or two more. So if you have an additional question, speak up.

PARTICIPANT: My name is [unintelligible from ' Swedish (? I came in from the other room next to this where we were talking about sanitation. As we are touching upon it now, I'd like to pose a question here.

To what extent is the Bank promoting dry solutions to urban sanitation today in the view of conserving water resources? And in connection with that, I can tell you that Sweden is a country with abundant water resources, but still there are some places in Sweden where there are difficulties. In one Swedish municipality on the west coast, the municipality has banned the use of water-borne sanitation. This happened one year ago.

CHAIRPERSON POSTEL: Any comments from panel members or anyone else on that comment? John, do you want to take that one?

MR. BRISCOE: As is often the case from the World Bank, a convoluted answer. In this particular case, I think we have tried very much to avoid a situation in which we take a position on a particular technology, just as it the case in Sweden I don't think you would be advocating that CHAIRPERSON POSTEL: We can take one or two more. So if you have an additional question, speak up.

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CHAIRPERSON POSTEL: Any comments from panel members or anyone else on that comment? John, do you want to take that one?

MR. BRISCOE: As is often the case from the World Bank, a convoluted answer. In this particular case, I think we have tried very much to avoid a situation in which we take a position on a particular technology, just as it the case in Sweden I don't think you would be advocating that all of Stockholm has dry toilets. Similarly, when we deal with developing countries, what we try to do is to try to encourage the consideration of a range of technologies, wet and dry, on-site and off-site, which are appropriate to particular areas. So that we see, for instance, in the downtown areas of big cities, in downtown Sao Paulo, with buildings 40 stories high, to talk about on-site dry solutions is nonsensical.

On the other hand, maybe in the favellos ?) in the periphery of Sao Paulo, this becomes very interesting where land size is appropriate, et cetera. So I think that the issue is not so much for the Bank or any other agency to try to be prescriptive about that, but to try to, once again, get the incentives in place whereby there is a cost on water and where there's a menu of options well developed, not--I think one of the things that we have had a problem with is we have often pushed technologies which are actually rather experimental and have not been proven into areas of developing countries where they have failed. And that is even worse than having not tried, in a sense.

So what we're trying to do is to develop a full range and make those available and get the criteria for judging those appropriately in place.

CHAIRPERSON POSTEL: Any additional comments, question MR. ALOMON: Speaking of tariffs, water supply tariffs, marginal costs for water supply tariffs are okay, as far as tariffs go. But I have one question on tariffs regarding sewage services. In most cases, these tariffs for sewage services are connected, some are related on the amount of consumption of water. This connection in most cases doesn't attract people to connect their system into the sewage network.

How do you look at this problem? I know a project, sewage treatment with a sewage network project, about \$30 million worth, but for ten years there are only about 2,000 connections. How do you look at this problem?

CHAIRPERSON POSTEL: John, do you want to take a stab at that one, or Arthur or anyone else on the panel?

MR. McINTOSH: I don't know that there's any easy answer to that one. In Manila, as we heard, there's a water charge and then a sewage charge and an environmental charge. But we haven't--in Asia, I don't see it as a constraint that people don't want to connect because the charges have not been so great. In general, the policies have been that just cover operation and maintenance costs for sewage schemes; whereas, in the water supply sector with a large city, they have to cover a lot more than that. And there are smaller and smaller elements of grant financing for development.

But we haven't noticed that people don't want to connect to sewers. They will connect, and the charges at the moment are minimal.

MR. BRISCOE: I think the question is an excellent question and does pose--we have actually quite a few cases of that sort where systems are put in where there are connection charges or there are monthly charges for sewage and people don't connect because of those.

I think that the issue actually has to start before the system goes in. Once the system's in, then you have some cost when you have a particular problem. But it relates to the earlier question; namely, what sorts of services are appropriate in particular areas? And I think what we see increasingly, what we're trying to do is to try and take an ex ante look at that and to try to look along the lines of the work that was described by the lady from Trinidad, look at the willingness to pay for different levels of service before you go in with the project. We have just right now a very interesting case in the Bank of where we've done this in a series of cities in the Philippines. Now, this is not in Manila, but they're in areas in which people have invested very heavily in on-site systems. In fact, the whole basement of the house is a septic tank, with enormous costs. They have permeable groundwater, or soil conditions. There's absolutely no problem of sewage disposal.

When we came in and asked them what would you be willing to pay for a house connection, the answer was zero because they had no problem. They absolutely--if you put them in there and you then require a connection fee, they're not going to pay for that. And that, I think, instead of putting them in and then saying how do we get the people to pay, before you put them in you'd better look and say what actually is the appropriate level.

We have found very interesting results from these. If you look in--we did some quite extensive work in West Africa, in Ouagadougou and Kumasi, and when you look at the relative costs of sewage solutions versus on-site solutions as a much lower cost, you found that the willingness to pay was actually very little different in that particular setting, in part because there was very little trust that the authority could actually manage the sewers. So you'd have a sewer, but the sewer would be a source of problem rather than solution.

I think that the issue is really to go back and look ex ante at what is willingness to pay, what are different costs of service, and try to match the demand and supply side, rather than putting it in and then saying, now, how do we get them to pay for it. That's the approach we're attempting to take more.

MR. MAGLIO: I wanted to add something in the case of Sao Paulo. It connects the sewage and water rates, they are connected. But we never counted for subsidies for different levels of consumption. So for the poor that use it ?) meters, there is a low level of subsidies. For ?) rate, it's big subsidies.

CHAIRPERSON POSTEL: If we have no other questions or comments, I think I'll just take the opportunity to thank our rapporteurs again. They've been furiously writing for most of the last couple of hours. I'll thank our panel members for sharing their experiences and thoughts and ideas with us, and I'll thank you all for coming and participating

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this afternoon.

Thank you very much.

[Applause.

[Whereupon, at 5:20 p.m., the session was

concluded.]

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