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Theme 4

Water Use and Supply Management

WORKSHOP 2: ADDRESSING WATER CRISIS IN RAPIDLY GROWING CITIES

24 November 2009

Korea Environment Institute

Chair: **Choi Sang-Ki**
Vice President
Korea Environmental Institute (KEI)

Co-Chair: **Dr. Vicente Tuddao**
Executive Director
River Basin Control Office (RBCO)
Department of Environment and Natural Resources (DENR)
Philippines

The East Asian Seas Congress 2009

"Partnerships at Work: Local Implementation and Good Practices"

Manila, Philippines
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Department of Environment and Natural Resources (DENR) Philippines

THE WATER CHALLENGE

Theme Keynote: Coordinated Management of Freshwater and the Coastal Zone — The Added Challenge of Climate Change
Prof. Torkil Jønch Clausen, Senior Advisor, Global Water Partnership

Workshop Keynote: Water Security and Integrated Water Resource Management in Asia
Dr. Choi Sang-Ki, Vice President, Korea Environment Institute

As the most indispensable commodity of human life, water became the center theme of the world's environment and development instruments. This is because there is no way of achieving sustainable development without securing water. As water became scarce, water security became a serious concern for most of the countries. The causes of water scarcity are plenty: population growth, pollution, failure in management such as disparities between water supply and demand, weak water use regulation and enforcement, as well as inefficient water use stimulated by inadequate water pricing, and depletion of groundwater resources, among others. With anticipated increase in climatic uncertainties, the problem of water scarcity is expected to exacerbate in years to come.

What then is the water situation in Asia? Very serious. The water challenge in Asia stems mainly from the growth in population and economy. Asia and Pacific covers more than 60% of the world's population, two-thirds of global population growth but only 36% of the

world's water. It is expected that urban population will increase by 60% in 2025. In this setting, Asia and Pacific is facing serious water challenges to sustain population and economic growth as water is needed for basic needs, growing cities, food and energy (Jønch Clausen). Many Asia-Pacific countries are already using too much of their water resources and suffer from both the least available water and the worst water quality (UNESCAP, 2005 and 2006).

Figure 1. Status of water scarcity (NRC, 2009).

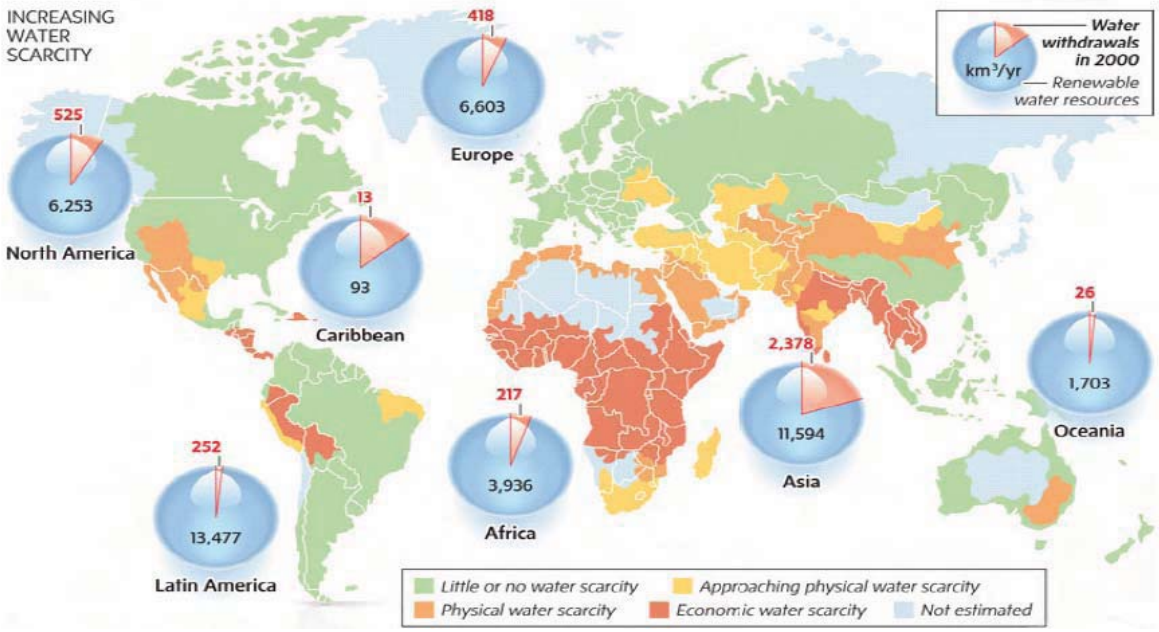
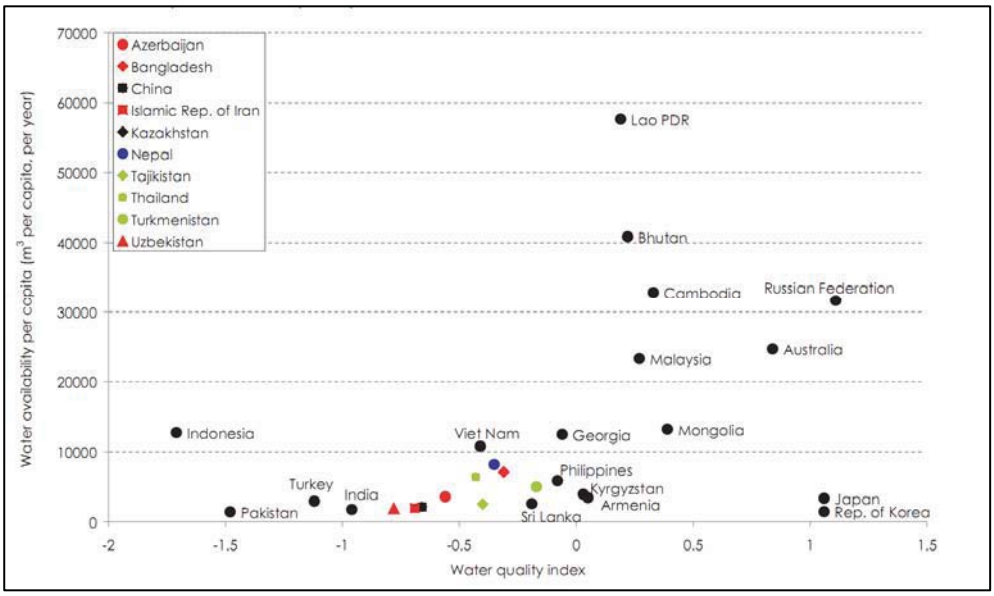


Figure 2. Water availability vs. water quality in Asia (UNESCAP, 2006).

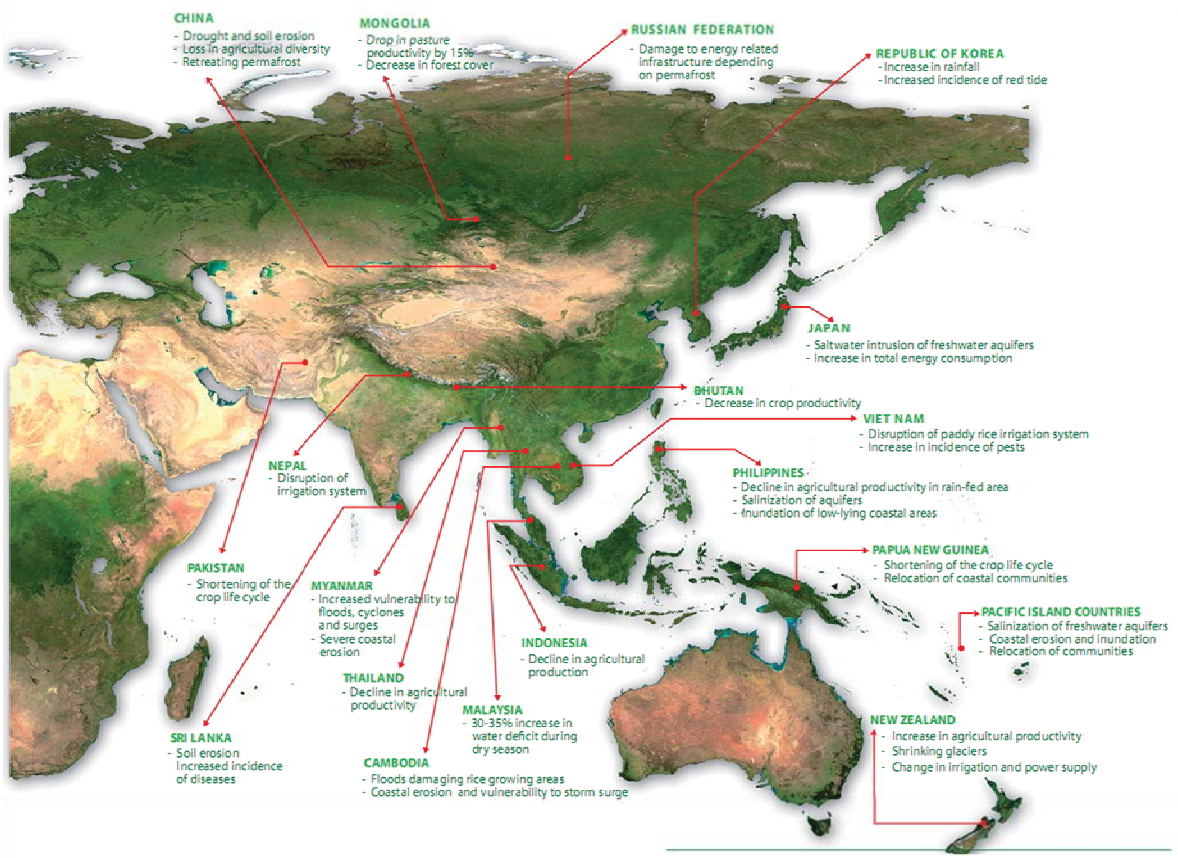


WATER AND CLIMATE CHANGE

As atmospheric concentration of carbon dioxide is increasing, global warming will also continue for some considerable time in the future. Global warming causes serious problems in food, water, ecosystems, extreme weather events, and irreversible changes (Stern review, 2007) and these negative consequences are already happening across the world. IPCC report suggests that five key impacts of global warming, i.e., water, ecosystems, food, coasts and health, are all linked to water. Global warming will hit through water, for example, changes in hydrological cycle (evaporation, runoff and water temperature), increased variability in extremes (floods, droughts, cyclones), and accelerated sea level rise. As a consequence, the mega-deltas of Asia, the small island states, and mega-coastal cities will be hotspots of the impacts of climate change.

When water is the conveyor of negative impacts of climate change, water should be the main subject of climate change adaptation. There are two approaches to adaptation to climate change: hard and soft solutions. Hard solutions include dams, dikes, levees, sewer networks, drainage canals, and desalination, whereas soft solutions include demand management through 3Rs (Recharge, Retention and Recycle), enhanced efficiency, reuse, watershed management, flood proofing, flood retention measures, insurance, and global trade/virtual water. As always, effective adaptation would be formulated through combining some relevant adaptation measures in the vulnerable areas.

Figure 3. Selected impacts by climate change in the Asia-Pacific region (UNESCAP, 2006).



WATER MANAGEMENT FRAMEWORKS: IWRM AND ICM

As an internationally promoted management framework, IWRM is usually adopted for water management. It is also widely accepted that IWRM is considered as the best approach to address the impacts of climate change in the water sector (5th World Water Forum, 2009). IWRM is founded on three pillars of principles, namely: economic efficiency; equity; and environmental sustainability (Figure 4). On the other hand, water in coastal areas is oftentimes managed within the framework of ICM, being one of the key components of sustainable development aspects (Figure 5). As ICM incorporates all components of sustainable development aspects, it is considered as a broader management framework compared to IWRM. Nonetheless, the two approaches, IWRM and ICM, share common characteristics including sectoral integration, decentralization, conflict resolution, adaptive management and systematic approach, and ecosystem-based management. The two approaches are also equally recommended by a number of international instruments such as WSSD, Agenda 21 and UNFCCC.

Figure 4. Principles and structure of IWRM (UNESCO, 2009).

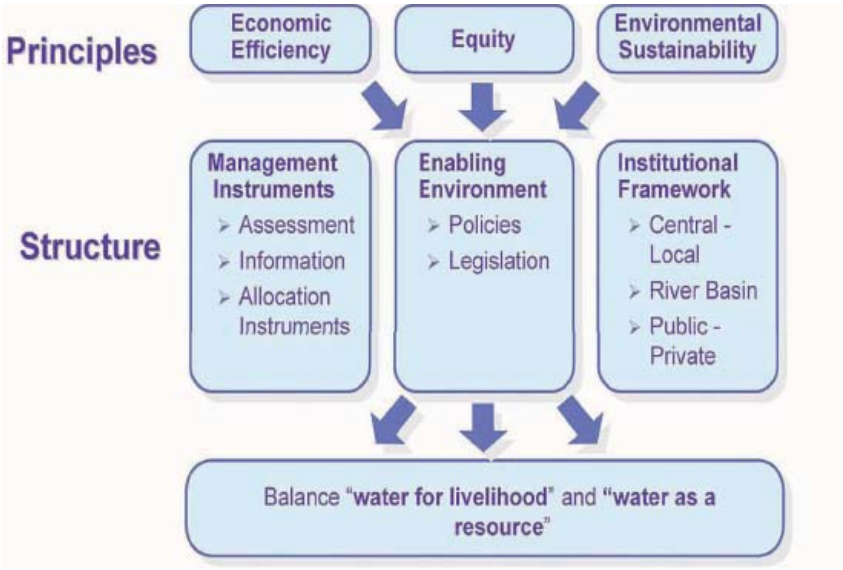
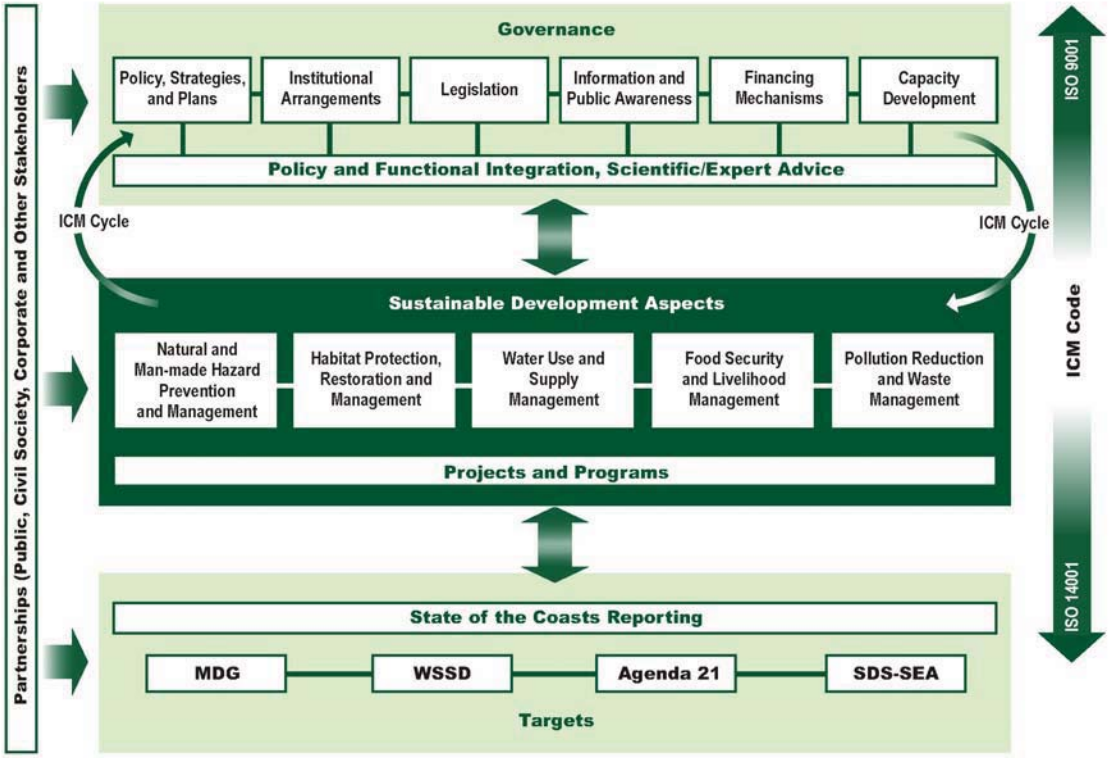


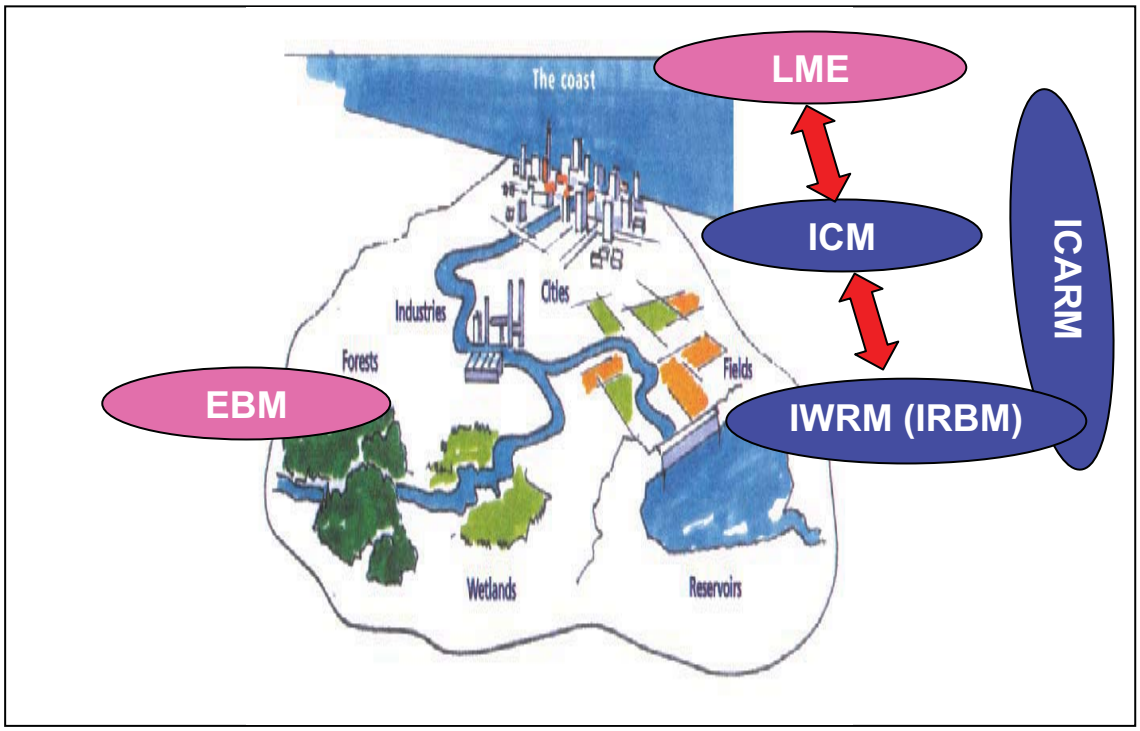
Figure 5. Process-oriented Common Framework for Sustainable Development of Coastal Areas through ICM Implementation (PEMSEA, 2007).



Being the major water resources in Asia, rivers affect coastal areas through sediment transport and quality and quantity of water. Hence, river basin and coastal area should be considered as one continuum and as one system. For example, building dams in the upper Mekong River will severely affect the ecosystems downstream, the river delta and eventually the coast. Also in Bangladesh, the changes in snowmelt caused by climate change will affect the flood pattern, which will. in turn. affect downstream development plans such as hydropower construction, irrigation plan and zoning scheme.

Given this situation, ICM is expanding its management boundaries to upstream areas, which is called functional expansion linking upstream and downstream. Scaling up of ICM has been attempted at sites like Xiamen, China and Nampho, DPR Korea. However, there is a need to link the two management frameworks for better coordination between upstream and downstream. One such linkage can be illustrated through the application of ICARM programme (Figure 6, Jønch Clausen).

Figure 6. Various management frameworks for upstream-downstream and coastal areas.



VARIOUS ISSUES AND CHALLENGES RELATING TO WATER RESOURCE MANAGEMENT

What are the actual water challenges in the countries in Asia? The following section examines four cases of selected challenges: two advanced countries (RO Korea and Japan) and two developing countries (Philippines and Lao PDR).

Economic Valuation of Groundwater in Metro Manila and Adjacent Areas

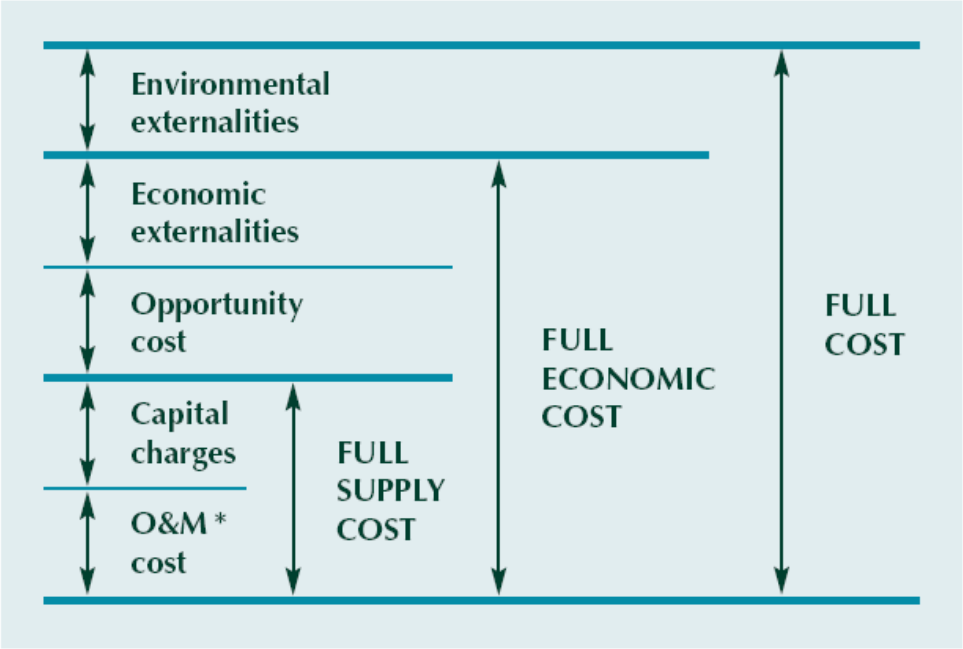
Ms. Maria Corazon M. Ebarvia, PEMSEA

Manila Bay area, Philippines, is experiencing various challenges relating to water management including: insufficient coordination among water-related agencies; ineffective regulations on water use and wastewater discharges; lack of regular and systematic monitoring; inconsistent enforcement of laws and policies; inadequate incentives for water conservation and waste management; and lack of facilities. These problems lead to over-extraction and depletion of groundwater, pollution of surface water bodies and contamination of groundwater, particularly in the Manila Bay area where more than 10% of the Philippine population resides. It is also observed that the water table is dwindling seriously and saltwater intrusion and land subsidence are occurring.

In this situation, groundwater became one of the hot management issues, as there is no proper pricing policy for it. In an attempt to devise an efficient price of groundwater, a study was conducted. The study recommended that the adoption of full cost pricing in a gradual approach is necessary. The full cost pricing would include costs for economic and environmental externalities in the groundwater price (Figure 7). The study suggested that revenue generated from full cost pricing would be used for land use plan and zoning,

groundwater monitoring and assessment. Also, supporting policies including improvement of water service delivery, development of alternative sources and development of sewerage system and wastewater treatment facilities are recommended as important components of water pricing.

Figure 7. Components of costs for water production and distribution.



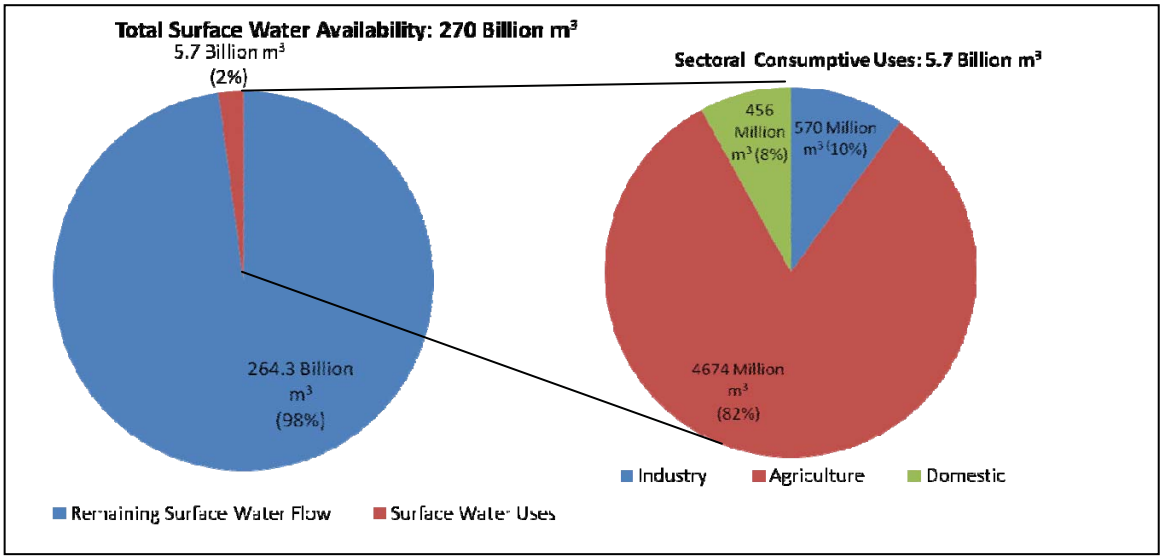
Domestic Water Supply Development and Need in Lao PDR
Mr. Souphasay Komany, Lao PDR

Lao PDR has the highest available water per capita in Asia amounting to 55,000 m^3 annually. Although rich in water resources, availability of water is more dependent on socioeconomic factors, rather than natural environment. Currently, little of the available water resources have been developed to meet the needs of safe water and sanitation in the country. In this situation, the country set a medium- and long-term policy and strategy for developing water and sanitation in 2005, in line with the Millennium Development Goal for 2015 which set the target at "ensure that 80% of the total population and 70% of the urban population have sustainable access to an improved water source."

The government reported some progress towards the implementation of the policy and strategy as well as the MDG goal. The government completed 51 projects in urban areas which account for 31% of the total goals in 2006. However, the country is facing challenges of low cost-recovery and inefficient service of the state-owned enterprises in implementing the projects. In the case of Pakse Water Supply Development Project, Champasack Province which lies along the bank of the Mekong River and Xedone River, water service is only covering 13% of the entire provincial population, leaving other residents suffering from water shortage. However, as Pakse province has gathered a high level of water tariff, increase in investment seems unreasonable.

As demonstrated in Lao PDR, water is not only an environmental issue but also a socioeconomic issue which needs to be considered in a holistic management framework of the government.

Figure 8. Water usage in Lao PDR.



Integrated River Management Strategies in RO Korea

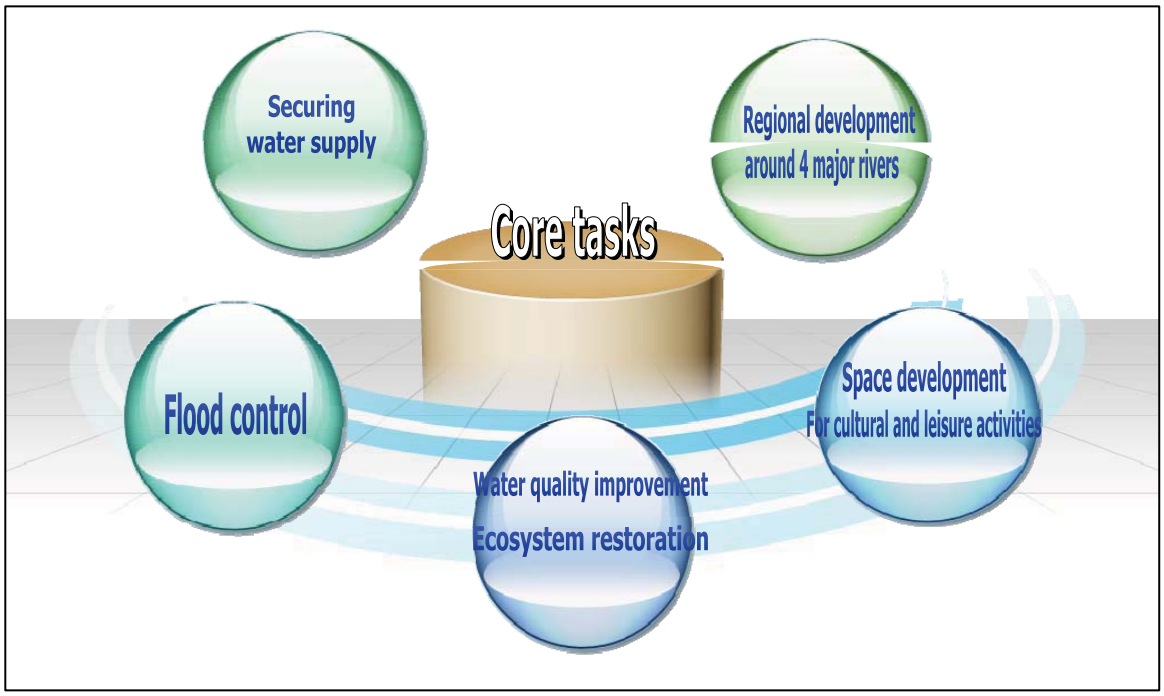
Dr. Lee Jin-Hee and Dr. Kim Ik-Jae, Korea Environment Institute, RO Korea

Having one-eighth of global average for available water per capita per year, RO Korea is considered as a water scarce country. Confronted with unequal seasonal distribution of precipitation, increasing water demand and deteriorating surface water quality, RO Korea is facing challenges of securing water for economic growth and meeting a high standard of living. Adding to these challenges is climatic variability which causes frequent draught and floods. Lack of overarching authority and fragmented responsibilities in water management within the government is also a problem.

To resolve the water challenges, the government set out a holistic project entitled “the Four Major Rivers Restoration Project,” aiming at securing water supply, flood control, water quality improvement and ecosystem restoration. The project also aims at the development of land along the four major rivers, which is relatively underdeveloped compared to the large cities in the country. It is expected that the project will provide comprehensive solutions to draught and floods, improve water quality and boost local economy. As a leading research institute in water management and policies in RO Korea, the Korea Environment Institute is providing research solutions for the project.

The project, costing more than US$ 22 billion over four years, is a good example of demonstrating how important water security is in RO Korea.

Figure 9. Five major components of the four major river restoration project.



Status and Perspective on "Water for the Sea" in Japan
Prof. Satoquo Seino, University of Tokyo, Japan

As a water-scarce country, Japan has a long history of managing water as a valuable resource by enforcing sophisticated laws and regulations. Almost all rivers in the country have several dams constructed along its path to the sea for water storage and multi-purpose use. As a consequence, annual river discharges into the seas were reduced — significantly causing malnutrition of the seas, which in turn causes declining coastal fisheries. Also, dams are blamed to be the main cause of diminishing stock of migratory fish species. Hence, the concept of "water for the sea" was introduced and a law, i.e., the Ariake and Yatsushiro Seas Restoration Act in 2002, has been enacted to resolve the conflict between fisheries and other sectors related to water use. The aims of the law are to address water for: transboundary use; fisheries; and river and coastal environment.

In Okayama prefecture in western Japan, the fisheries sector was not receiving sufficient water, which contains nutrients for seaweed and coastal fish species, due to strictly regulated operation of dams. With several consultations between concerned sectors to resolve this conflict, discharges from the dams of Takahashi River and Yoshii River were realized to support seaweed culture during the winter season in 2006. As shown in the case of Okayama prefecture, citizen's participation in consultation is considered as an essential component of conflict resolution in water use between sectors.

Figure 10. A river dam for water storage and flood control, which also become a barrier to migratory fish species.

APPLICATION OF ICM FOR WATER RESOURCE MANAGEMENT

ICM is a management framework for sustainable development of coastal areas. As water is a center theme of sustainable development, ICM can be effectively applied to manage water resources. The following is case studies of countries which apply ICM for water management.

Securing Water Source of Nampho and Pyongyang through ICM Scaling up to Taedong River Basin

Mr. Ri Ki Ho, MLEP, Democratic People's Republic of Korea

DPR Korea has been implementing ICM programmes and projects since 2000. The designation of Nampho as one of PEMSEA ICM demonstration sites in 2001 has been the fuel for the development of ICM policy within DPR Korea. In 2009, DPR Korea is focused on the development of a long-term plan for Taedong River management as a government priority. For this, various preliminary studies including river profiling and framework plan development have been conducted.

Taedong River flows through Pyongyang, the Capitol of the country, and reaches the west sea at Nampho City. Providing valuable water resources to the country's populous cities, the river is facing various threats including variability of water resources induced by climate change; overexploitation of forest; deterioration of water quality due to residential and industrial activities. To reverse the deteriorating trend of Taedong River, the government set

up a long-term plan for Taedong River management which covers five strategic areas: (1) constructing reservoirs for maximizing the water storing capacity; (2) developing a programme for water re-use; (3) developing regular environmental monitoring system and control; (4) developing a programme for modernization of sewage purification facility; and (5) developing a plan for arrangement of ports.

Realizing that the successful implementation of the long-term plan is highly dependent on the solidity of the management platform and the capacity of human resources, the government decided to include the Taedong River Management as a part of the ICM scaling up programme. Using the ICM framework, the government is drafting an action plan and capacity building for the management of the Taedong River. The government is expecting that the implementation of the Taedong River management plan would contribute to the attainment of goals of the SDS-SEA.

Empirical Appraisal of Watershed Management: A Case Study
Dr. Benrong Peng, Xiamen, PR China

Integrated watershed or ICARM approach is gaining currency due to its holistic view on environment, economic and social aspects of a society in consideration. For this reason, many integrated watershed programmes are now in place, particularly in China. In Fujian Province, Jiulong River provides water to 5 million residents of Xiamen, Zhangzhou, and Lonyan City and accounts for 25% of provincial GDP. However, with the rapid economic growth of the province, the river is facing numerous environmental problems including discharge of polluted water causing eutrophication and red tides, reduction of fish species, and degradation of ecosystems. Hence, Fujian Province initiated the Jiulong River Water Management Plan (JLRWMP), an integrated watershed management plan, in 1999.

After ten years of implementation, the evaluation of the JLRWMP and the gap analysis on the plan revealed that it is partially successful and showed various implementation gaps. Although the plan succeeded in COD discharge reduction, established a coordinating mechanism at the watershed scale and applied the watershed approach to solve transboundary pollution issues, the lack of pubic participation, ambitious goal setting which are not science-based, improper institutional arrangements and low rank of responsible authority and limited resources are identified as causes of partial success.

The conclusion of the study is that the most important consideration for a successful implementation of a watershed programme is the political and institutional will of the local government which is very dependent on the economic situation of the local setting. Hence, the study recommended that designing a watershed programme considering the local-specific social, economic and political background should be pursued in the development of future watershed programmes.

Water for Life Programme of the Municipality of Bani, Pangasinan Province
Mr. Marcelo Navarro, former Mayor, Bani, Pangasinan Province, Philippines

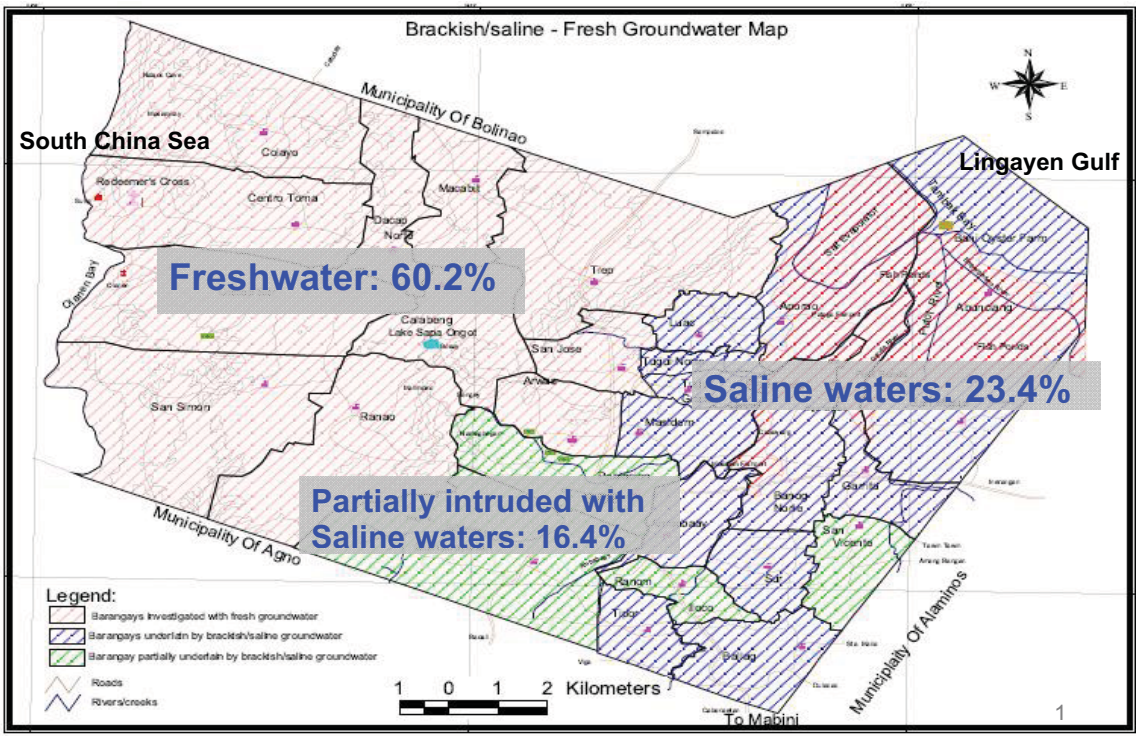
As a Level 1 Coastal Resource Management-certified municipality, the municipality of Bani, Pangasinan Province, Philippines, is implementing the “Water for Life” programme for securing its water resources from various threats the municipality has been facing, including crowded fish traps in the river which impede ingress and egress of water, planned operation of quarry plant from adjacent municipalities, and natural disasters such as floods. Also,

dismantling fish traps and nullifying the plan for a quarry plant operation took several years to resolve as these were brought to the court for hearing and decision.

Being a programme component, scientific survey of groundwater resources of Bani has been conducted within about four years of mapping out saline-intruded areas and freshwater areas. Also, small water impounding projects, establishment of protected areas and laying of water pipelines have been carried out. Important components of the programme include public participation and consultation and enactment of ordinances by the municipal council.

The programme is successful in solving water issues in the municipality of Bani through the leadership of the mayor. As in the Jiulong River case, Bani is a good example demonstrating that a strong political will is the key to the success of local water programme implementation.

Figure 11. Groundwater salinity map of municipality of Bani, Philippines.



GOOD PRACTICES AND INNOVATIVE TECHNOLOGIES IN WATER MANAGEMENT

In implementing water policy and programmes, there are several measures and incentives that can assist and promote water policy. The following section demonstrates good practices and innovative technologies in water management.

Water Pricing and Cost Sharing for Water Resource Protection in RO Korea

Dr. Moon Hyun-Joo, Korea Environment Institute, RO Korea

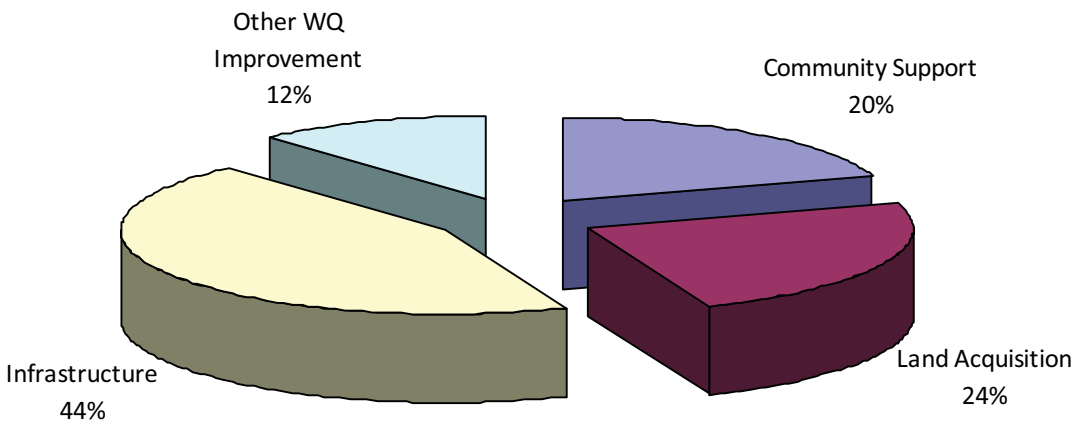
Water pricing is one of the efficient and effective measures to manage water demand as well as water resources. In RO Korea, full cost pricing is encouraged, thus, water prices

have been continuously increasing to cover production costs. One consideration is that even with a low price level, there could be some people who cannot afford enough water for life. Hence, supporting schemes for the lower income users through tariff reduction and exemption provisions are currently being implemented in Korea. For example, Seoul provides support on the basic rate of the water bill to the lowest income group and the city of Daejeon supports 10 m^3/month of fundamental use water to the lowest income group.

To protect water resources, keeping it as pristine as possible, it is necessary to regulate upstream watershed area through designation of water resource protection zones. In this situation, conflicts between upstream and downstream on land use often arises. To resolve this issue, the Korean government introduced the Water Use Charge, which allowed surcharge for piped water to support upstream residents for economic compensation, in 1999. Revenues collected from downstream residents are used to compensate upstream residents for losses due to strict land use regulation.

The case of water use charges in RO Korea indicates the possibility of a cooperative solution to the conflict between upstream and downstream residents under a cost-sharing principle. The government played a key role in resolving the conflict, aiming to both strengthen environmental regulations and provide a cross-subsidy for affected residents.

Figure 12. Utilization of revenue collected from Water Use Charge for upstream/downstream cost-sharing.



Singapore's Marina Barrage and Reservoir

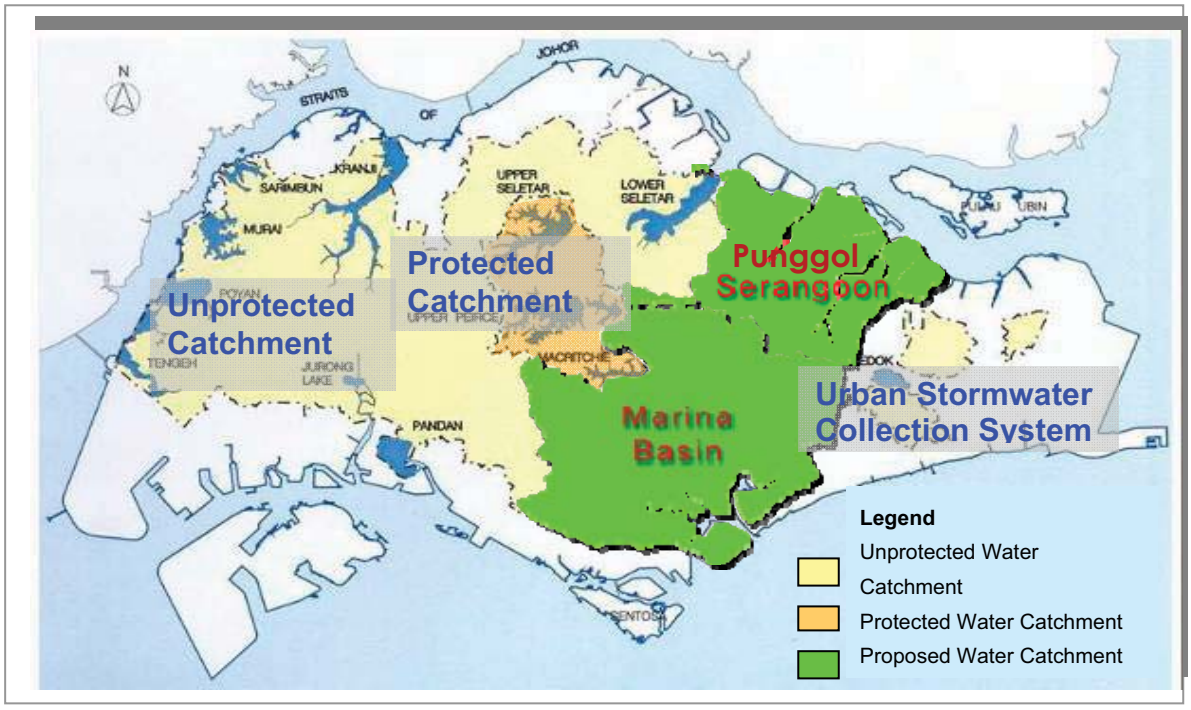
Mr. William Yeo, General Manager, Catchment and Waterways Department, PUB, Singapore

As a small island country, securing water is treated equally as securing its independence. In this situation, Singapore uses half of its territory as water catchment and it will increase to two thirds in 2011. Through the building of the Marina Barrage, the country is able to secure more than 90% of water needs within the country, importing only 10%. The Barrage provides three benefits, namely: water supply; flood control; and lifestyle attraction in downtown Singapore.

Considering the high population around the Barrage, maintaining water quality is also a challenge. Therefore, the government set out the integrated catchment management programme which comprises four main strategies: source control; applying mitigation measure; water quality monitoring and prediction using modeling; and public, private and people participation. Also, Singapore is utilizing advanced membrane technologies for desalinating seawater to increase water security.

Completed in 2009 employing state-of-the-art technologies, the Marina Barrage became a center of lifestyle destination and tourist attraction in Singapore. To provide water solutions based on Singapore's experience, Singapore is organizing the Singapore International Water Week (28 June–2 July 2010). A project of then Prime Minister Lee Kuan Yew in 1987, the Marina Barrage is also a demonstration of how important the political will of a leader for securing water resource.

Figure 13. Singapore – A city built on water catchment.



Climatic Changes and Wastewater Reuse Challenges in the Mediterranean Region

Dr. Nicholas Kathijotes, Cyprus University of Technology, Cyprus

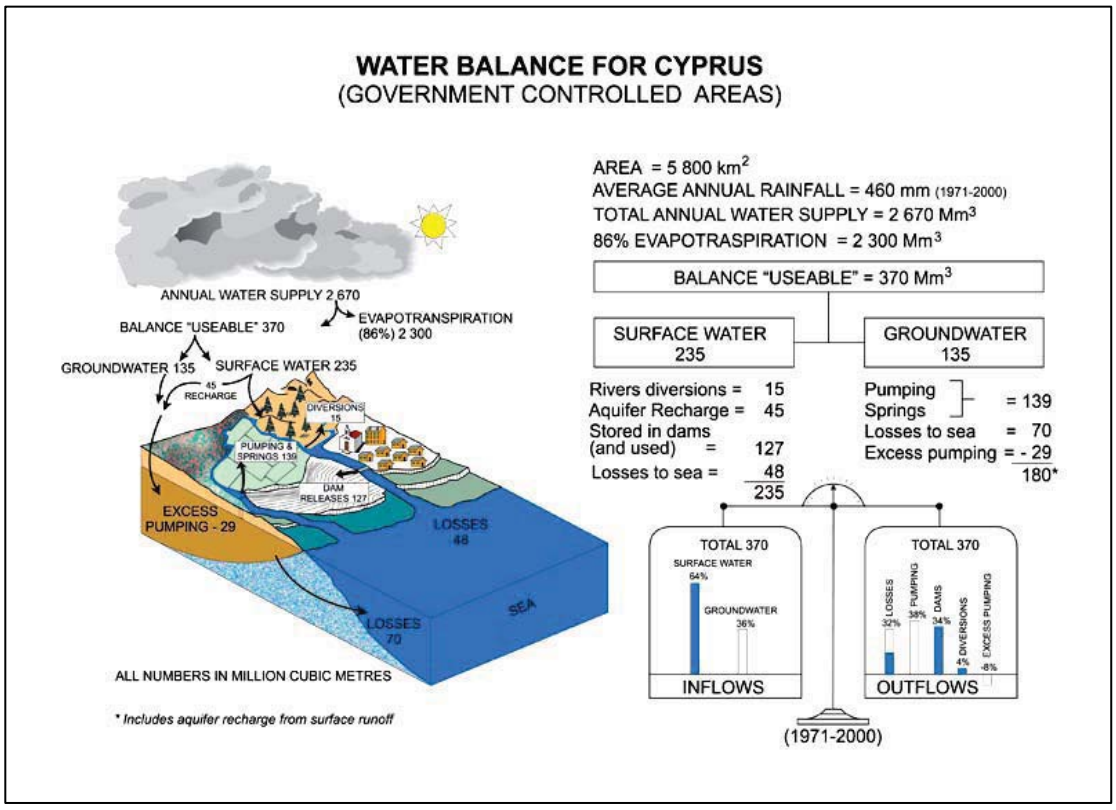
Compared to the tropical region of East Asia where water is relatively rich, water in the Mediterranean region, in arid and semi-arid regions, is considered as a limited resource. Cyprus is particularly one of water-poor countries of Europe and depending on almost entirely on rainfall for water resources. Agriculture is the major sector of water user, accounting for 70% of total use but its economic contribution is low. In this setting, as future demands will not

be met by traditional water resources like surface and groundwater, innovative solutions for water are required.

With the construction of wastewater treatment plants on the rise, reusing water from treatment plants are considered as beneficial for agricultural and other uses. The results of the use of recycled water in industrial and agricultural crops in Cyprus was very encouraging since, in most cases, both the production and the quality of the product outweigh those watered with freshwater. The use of recycled water has already been accepted by farmers and demand is rising rapidly. In addition, recycled water contains many nutrients which are directly up-taken by plants, such as nitrogen, phosphorus and potassium and trace elements that help significantly to the development of different crops. Although ingredients contained in treated wastewater may create undesirable effects on soils and groundwater, however, careful management including applying standards and regulations may overcome these negative effects.

The study also showed that recycled water has no negative effect on soil salinity and infiltration rates. On the contrary, it improves and conditions organic poor soils. Drop irrigation minimizes problems caused by salinity.

Figure 14. Water balance for Cyprus.



Recent Development of Desalination Technology and its Application to Address Water Problems in Small Communities

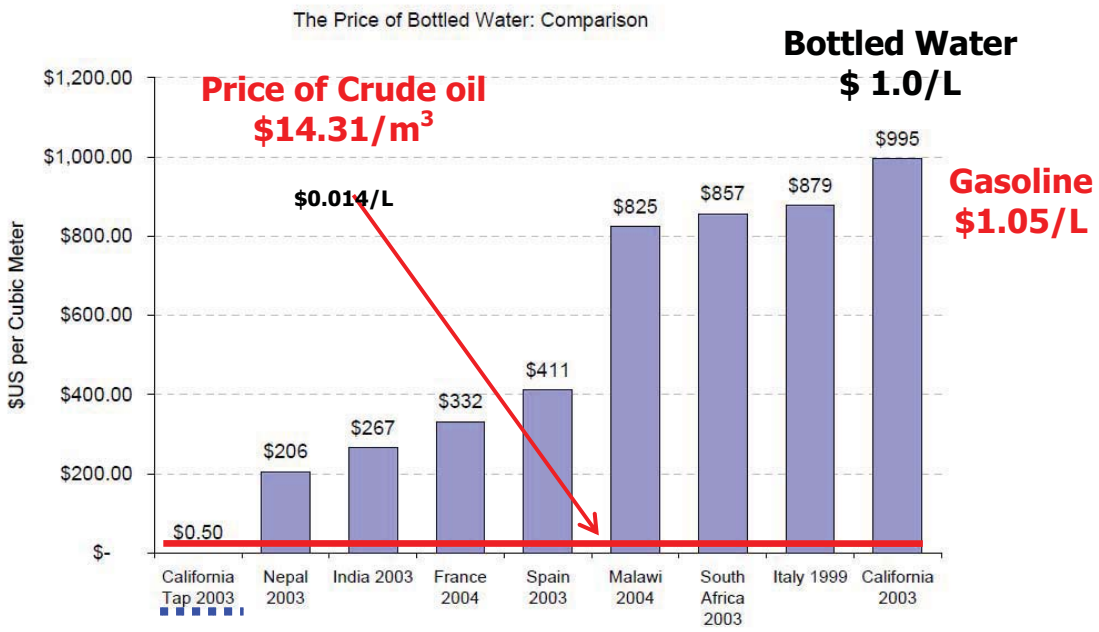
Prof. Kim Joon Ha, Gwangju Institute of Science and Technology, RO Korea

More than 97% of water in the earth is saltwater. As the population grows and freshwater resources are limited, the world is turning its eyes to seawater. Singapore is an exemplary case for using technology for securing water. Today, water from desalination and wastewater reuse through membrane technology is one of the main sources of drinking water in Singapore.

With the advancement of the technology, desalination of seawater is becoming more and more affordable. For example, California tap water costs about US$ 0.5/m^3 which is similar to the price of desalinated water from large-scale desalination plants. Considering that the current price of bottled water is about US$ 1/L and gasoline for US$ 1.05/L and crude oil for US$ 0.014/L, future demand for desalinated water will be high.

There are still barriers in the use of desalination: high capital cost, high energy consumption, and environmental issue with the rejects. Many research institutions including GIST, RO Korea, are devoted to developing technologies to make the desalination with low energy consumption, low fouling rate, and efficient scaling up to a large-scale plant. It is expected that desalination will become an affordable option for meeting water needs in some areas.

Figure 15. Comparison of bottled water and oil in various countries.



CONCLUSIONS

The following are conclusions drawn from the paper presentations and panel discussions:

- Asia and Pacific is especially vulnerable to water shortage due to rapidly growing population and economy, and changing climate;

- Climate change is an added challenge to achieving water security. Frequent extreme weather events are causing numerous water-related disasters and the frequency is worsening;

- The most significant constraint is poor and fragmented water governance. In most countries, water is managed by a number of different government agencies and jurisdictions. Proliferation of different laws related to water and inadequate capacity to enforce them; and low-cost recovery in the water sector are also problems;

- Poor water management in the river basins results in pollution of coastal waters (from point and non-point sources), as well as changes in coastal morphology. Thus, upstream and downstream coordination is important to better management of water;

- There are innovative ways of securing water, for example, full cost pricing, desalination and drip irrigation. These innovative solutions will play key roles in some critically vulnerable areas.

- Capacity building for local governments and stakeholder participation are key to improving water resources management in many developing countries;

- Charging full cost water pricing which includes both direct costs and externalities is the ultimate goal of water pricing. However, it is complex and difficult to achieve in a short period of time.

The panel discussants are Prof. Torkil Jonch Clausen, Global Water Partnership; Prof. Zou Quilin, Third Institute of Oceanography, China; and Dr. Chu Jang Min, KEI, RO Korea.

RECOMMENDATIONS

The workshop participants recommended the following:

- Coordinate and implement IWRM at the basin level with ICM at the coastal areas through ICARM to ensure proper management of the interconnected water resources;

- Move forward to full cost water pricing but in a step-by-step gradual process;

- Promote upstream and downstream collaboration among stakeholders through cost sharing, partnership and participation and monitoring in the management of water resources;

- Institute a lead oversight and central coordinating government agency to rationalize fragmented and uncoordinated water plans and programs;

- Need to recognize IWRM, ICM, IRBCAM as the basic approach to climate change adaptation;

- International cooperation and sharing of experiences and technologies through partnerships is the way forward;

- Need for mechanisms to encourage and compensate upstream stakeholders to protect water and land resources for the benefit of downstream stakeholders;

- Recognize "what you do not measure, you cannot manage" and ensure proper monitoring in all river segments;

- Recognize water demand management as the first step to reduce pressure on water resources, including the 3Rs: Recharge, Retention and Recycling."

- Consider all options for better water management, including improved agricultural water management such as drop irrigation and advanced reuse and desalination technologies in water scarce and densely populated areas.

ACKNOWLEDGEMENTS

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UNESCAP. 2005. Good Practices on Strategic Planning and Management of Water Resources in Asia and the Pacific.

Annex 1

WORKSHOP ON ADDRESSING WATER CRISIS IN RAPIDLY GROWING CITIES

24 November 2009

Workshop Programme

Workshop Chairs:
- Dr. Choi Sang-Ki, Vice President, Korea Environment Institute
- Dr. Vicente Tuddao Jr., Executive Director, RBCO, DENR, Philippines

TIME	ACTIVITY
10:00 – 10:30	**Theme 4 Joint Session Keynote Speech** • Dr. Torkil Jonch Clausen - Global Water Partnership Senior Adviser Theme keynote will be attended by participants of workshops on Alternative Energy (T4 W1), Addressing Water Crisis (T4 W2) and other interested audience.
Workshop Opening	
10:30 – 11:00	**Keynote Presentation: Water Security and Integrated Water Resources Management in Asia** • Dr. Choi Sang-Ki, Vice President, KEI, RO Korea
Session 1. Case Studies on Issues and Challenges to Water Management	
11:00 – 12:30	**Economic Valuation of Groundwater in Metro Manila and Adjacent Areas** • Ms. Maria Corazon M. Ebarvia, PEMSEA **Integrated River Management Strategies in RO Korea** • Dr. Lee Jin-Hee, KEI, RO Korea **Status and Perspective on "Water for the Sea" in Japan** • Prof. Satoquo Seino, The University of Tokyo **Domestic Water Supply Development and Need in Lao PDR** • Mr. Souphasay Komany, Lao PDR **Discussion** • Facilitators: Dr. Vicente Tuddao and Dr. Torkil Jonch Clausen
12:30 – 14:00	Lunch
Session 2: Water Resource Management through an Integrated Management Approach (ICM)	
14:00 – 15:00	**Securing Water Source of Nampho and Pyongyang through ICM Scaling Up to Taedong River Basin** • Mr. Ri Ki Ho, MLEP, DPR Korea **Empirical Appraisal of Watershed Management Program: A Case Study** • Dr. Benrong Peng, Xiamen, China

	Water for Life Programme of Municipality of Bani, Pangasinan • Mr. Marcelo Navarro, former Mayor, Bani, Pangasinan Province, Philippines **Discussion** • Facilitators: Dr. Vincente Tuddao and Dr. Torkil Jonch Clausen
Session 3: Good practices and innovative tools for water management	
15:00 – 17:00	**Water Pricing and Cost Sharing for Water Resource Protection in Korea** • Dr. Moon Hyun-Joo, KEI, RO Korea **Singapore's Marina Barrage and Reservoir in the City** • Mr William Yeo, General Manager, Catchment & Waterways Department, PUB, Singapore **Coffee Break** **Climatic Changes and Wastewater Reuse Challenges in the Mediterranean Region** • Dr. Nicholas Kathijotes, Cyprus University of Technology, Cyprus **Recent development of Desalination Technology and its application to address water problems in small communities** • Prof. Kim Joon Ha, GIST, RO Korea **Discussion** • Facilitators: Dr. Vicente Tuddao and Dr. Torkil Jonch Clausen
Part 4: Open Forum	

17:00 – 18:30	**Panel Discussion**
	• Panelists:
	  ○ Dr. Torkil Jonch Clausen, GWP
	  ○ Prof. Zhou Quilin, TIO, China
	  ○ Dr. Chu Jang-Min, KEI, RO Korea
	
	Recommendation and Wrap up