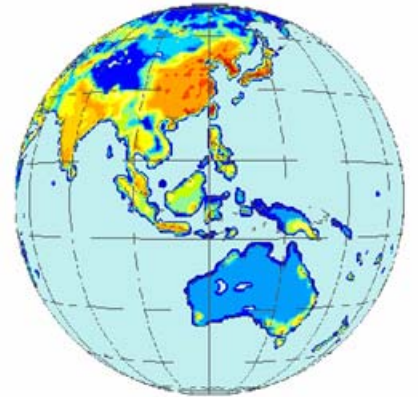


Introduction of Water Management Model



Yasuaki Hijioka

National Institute for Environmental Studies

APEIS Training Workshop, NIES, 19 October 2006

Presentation outline

- Background
 - Water Crisis
 - AIM's approach for model development
 - Current situation in access to safe water and sanitation
 - International goals (Millennium Development Goal and VISION 21)

- Development of water management model
 - Objectives
 - Model characteristics
 - Model flow diagram
 - Example of simulation results



Water crisis

■ Water resources are becoming scarce

- Agricultural crisis
 - ✓ Due to changes in lifestyle and population increase
- Environmental crisis
 - ✓ Not only reduce the amount of water available for industrial and agricultural development but has a profound effect on aquatic ecosystems and their dependent species
- An increase in tensions
 - ✓ Tensions among different users may intensify, both at the national and international level. Over 260 river basins are shared by two or more countries

■ People lack drinking water and sanitation

➤ Towards a way to improve the situation

- Saving water resources
- Improving drinking water supply
- Improving transboundary cooperation



AIM's approach for model development

- Water availability ([Dr. Takahashi](#) and [Dr. Hanasaki](#) have been developing the model coupling with GCM data)
 - Global warming will lead to change of the global hydrological cycle
 - Changes in the total amount of precipitation and its frequency and intensity
 - Changes in the magnitude and timing of run-off and the intensity of floods and droughts
- Water demand
 - Agricultural water demand ([Dr. Takahashi](#) and [Dr. Hanasaki](#))
 - Household water demand ([Hijioka](#))
 - Industrial water demand (Who?)



Access to safe water and sanitation

■ Household water demand

- ▶▶▶ Necessity to take into account **access to safe water/sanitation coverage**
 - As of 2002, approximately **1.1 billion** people worldwide had no access to **safe drinking water** and approximately **2.4 billion** could not access **safe sanitation** (approximately **18%** and **39%**).
 - Low rates of access to safe water and sanitation are conspicuous in the developing countries.
 - ✓ **Sub-Saharan Africa**: the water supply coverage was only **58%** and sanitation coverage only **36%** as of 2002
 - ▶▶▶ A further problem is that there is no sign of these coverage rates increasing



Benefits of access to safe water and sanitation

■ Health benefits

▶▶▶ Reducing the risks of [water-borne diseases](#)

- Unsafe water and sanitation conditions have become very large risk factors in the developing countries, with approximately 1.6 million deaths in 2000 attributable to diseases caused by these factors
- Damage from [diarrhea](#) is large, accounting for the death of 1.8 million people in 2004
 - ✓ 88% of these deaths were due to unsafe water supply and sanitation conditions
 - ✓ Majority of these deaths have been [children aged less than five years](#)

■ Financial benefits

- Avoiding [health sector treatment cost](#)
- [Time saving](#) in fetching water



Future targets (MDG and VISION 21)

■ Millennium Development Goals

- ◆ Target 10 of Goal 7 in the UN Millennium Development Goals sets forth the following objective for access to safe water and sanitation:
“Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation.”

■ VISION 21

- ◆ Prepared by the Water Supply and Sanitation Collaborative Council (WSSCC):
“By 2025 to provide water, sanitation and hygiene for all.”



Objectives of Water Management Model development

- Reinforcement of water demand part in the water resource model and link to CGE model
- Focus on **water demand** and **water supply/sanitation services**
 - **Water demand**
 - ✓ Sectoral assessment: **Domestic**, Industry, Agriculture
 - ✓ Water savings: Technology, System, Institution, Behavior
 - **Access to safe water supply** and **sanitation**
 - ✓ Millennium Development Goals 7, Target 10: Halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation
 - ✓ VISION 21: By 2025 to provide water, sanitation, and hygiene for all (Water Supply and Sanitation Collaborative Council)
- Assessment of optimal solution for sustainable water management



Overview of Water Management Model

- Target area: Global, Region, Country, County
- Unit area: Region, Country, County, City
- Basic concepts
 - Process and bottom-up type model based on the future diffusion of technologies for water supply and sanitation facilities
 - Separation of urban and rural area
 - Sector: Domestic, Industry, Agriculture

The following technologies were considered “improved:”	
Water supply Household connection Public standpipe Borehole Protected dug well Protected spring Rainwater collection	Sanitation Connection to a public sewer Connection to septic system Pour-flush latrine Simple pit latrine Ventilated improved pit latrine

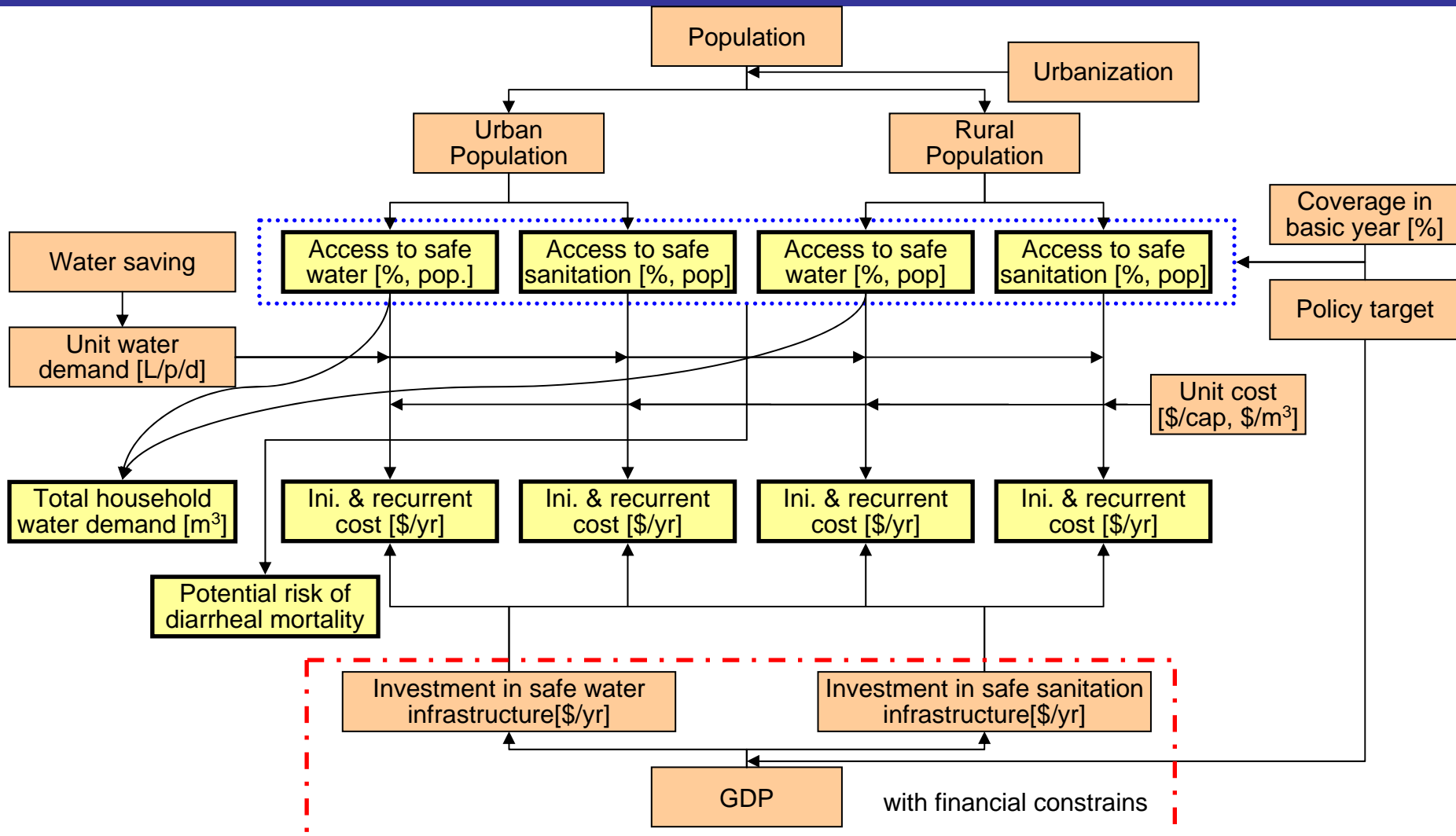


Model characteristics

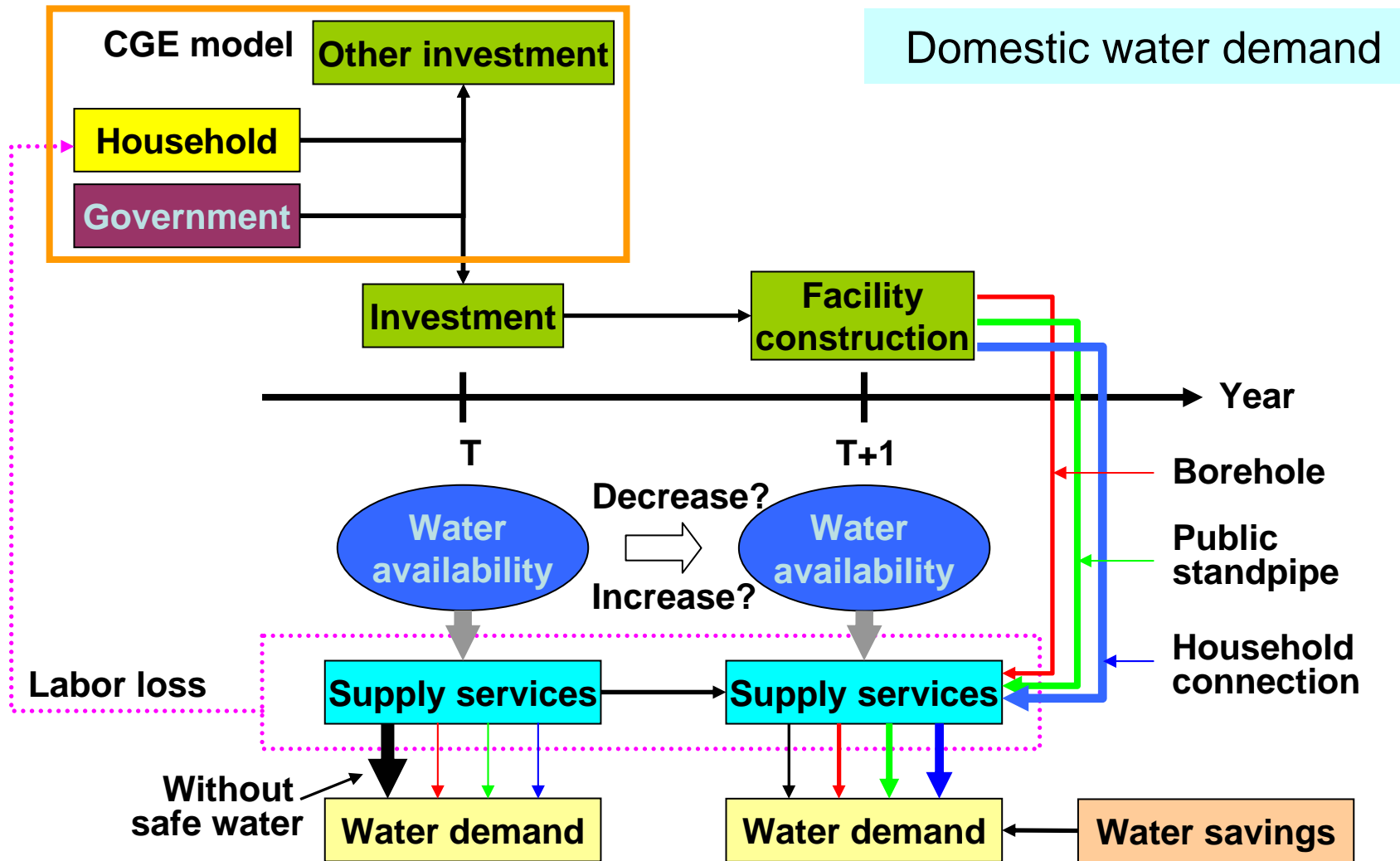
- The model:
 - can quantitatively assess the means of achieving the targets for access to safe water and sanitation
 - can estimate various combinations of technologies according to objectives and policies,
 - can estimate future household water demand taking the effects of water-saving measures into consideration and,
 - can estimate the relative risk of diarrheal mortality based on the safe water and sanitation



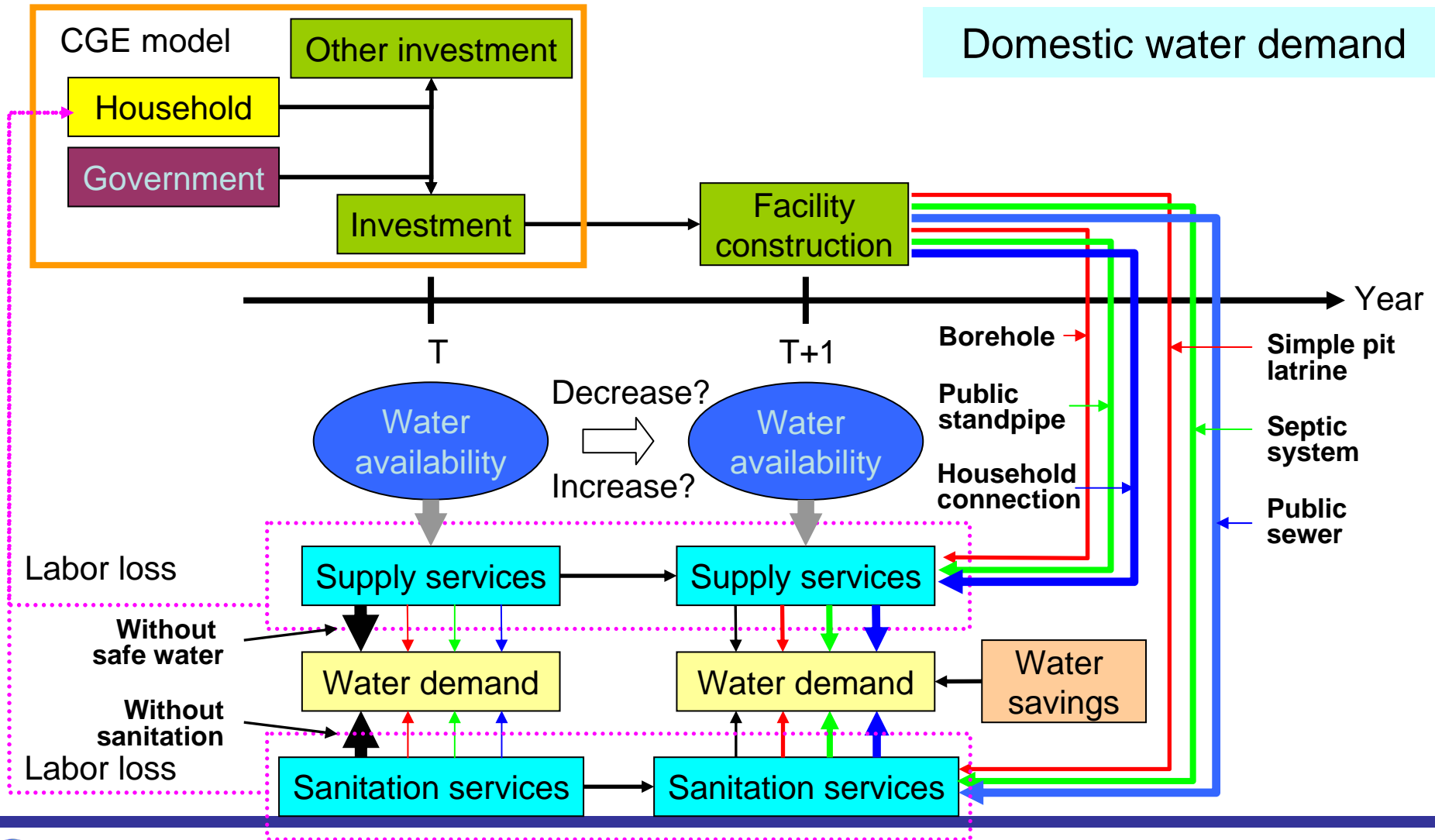
Model flow diagram



Structure of Water Management Model link to CGE model (1)



Structure of Water Management Model link to CGE model (2)



Example of water management assessment

- Target:
 - Halve by 2015 the proportion of people without sustainable access to safe water and sanitation
 - By 2025 to provide water, sanitation, and hygiene for all
- Country: Bangladesh, Indonesia, Philippines
- Scenarios and Output:
 - Coverage of water supply and sanitation technologies
 - Investment, operation and management cost
 - Health impacts: Relative risk of diarrheal mortality
- Base year: 2000, Target year: 2015, 2025
- Data: GDP, Population, Improved water supply and sanitation data, etc (Coverage, Cost, Unit water use (L/person/day), Potential risk of diarrhoeal mortality based on access to improved water and sanitation)



Relative risk of diarrheal mortality

- Health impacts: **Relative risk of diarrhoeal mortality**
 - Assessment of relative risk based on access to safe water supply and sanitation excluding present condition and other related factors (medical, dietary, climate condition)

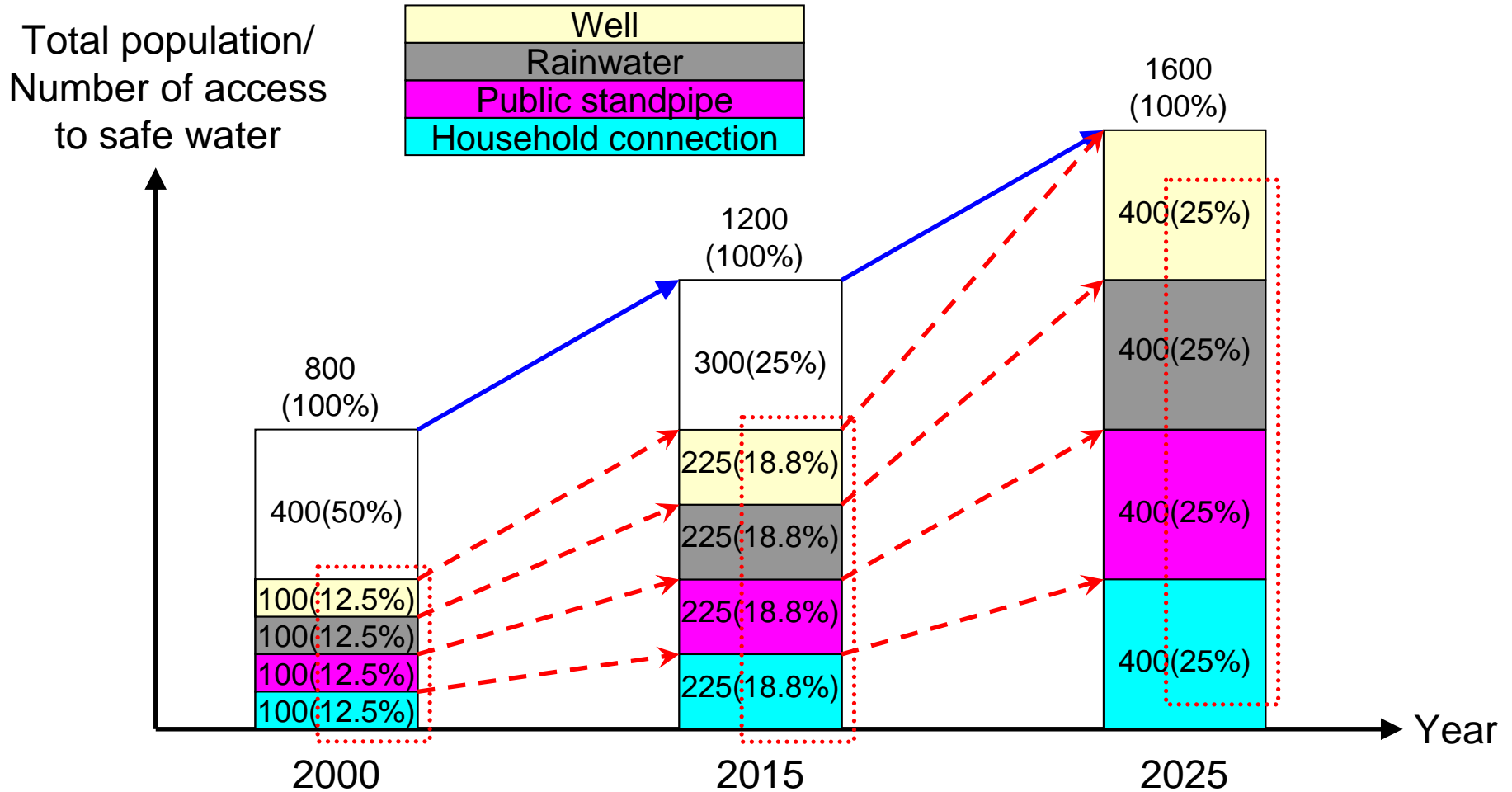
Category	Water supply	Sanitation	Diarrheal Risk
C1	HC	SC	1.0
C2	HC	IS with partial SC	2.5
C3	IWS with partial HC	IS	4.5
C4	IWS without HC	IS	6.9
C5a	NIWS	IS	6.9
C5b	IWS	NIS	8.7
C6	NIWS	NIS	11.0

HC: Household Connection, IWS: Improved Water Supply, NIWS: Not Improved Water Supply, IS: Improved Sanitation, SC: Sewer Connection, NIS: Not Improved Sanitation,



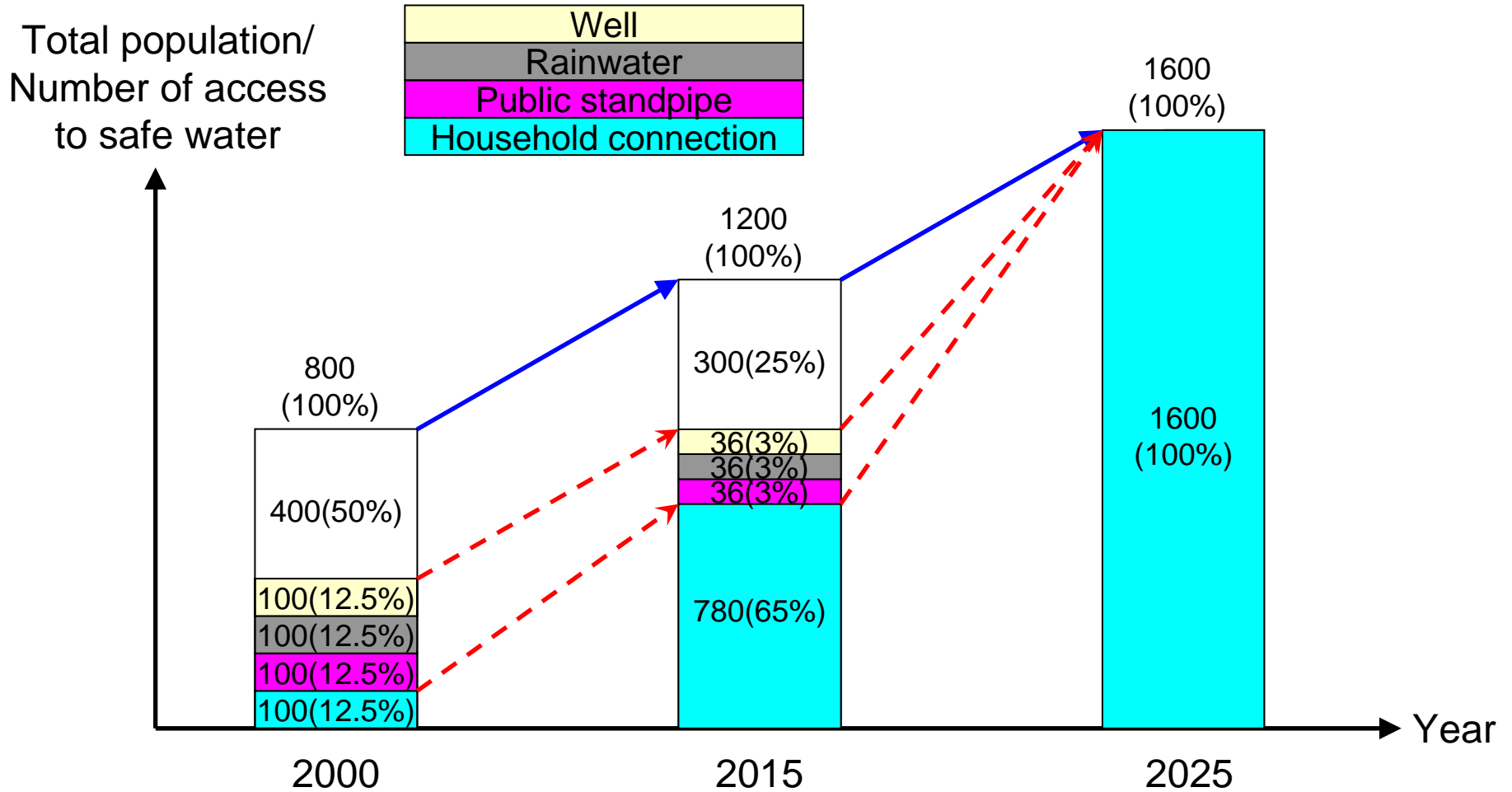
Case 1

- Constant ratios between coverage of water supply and sanitation



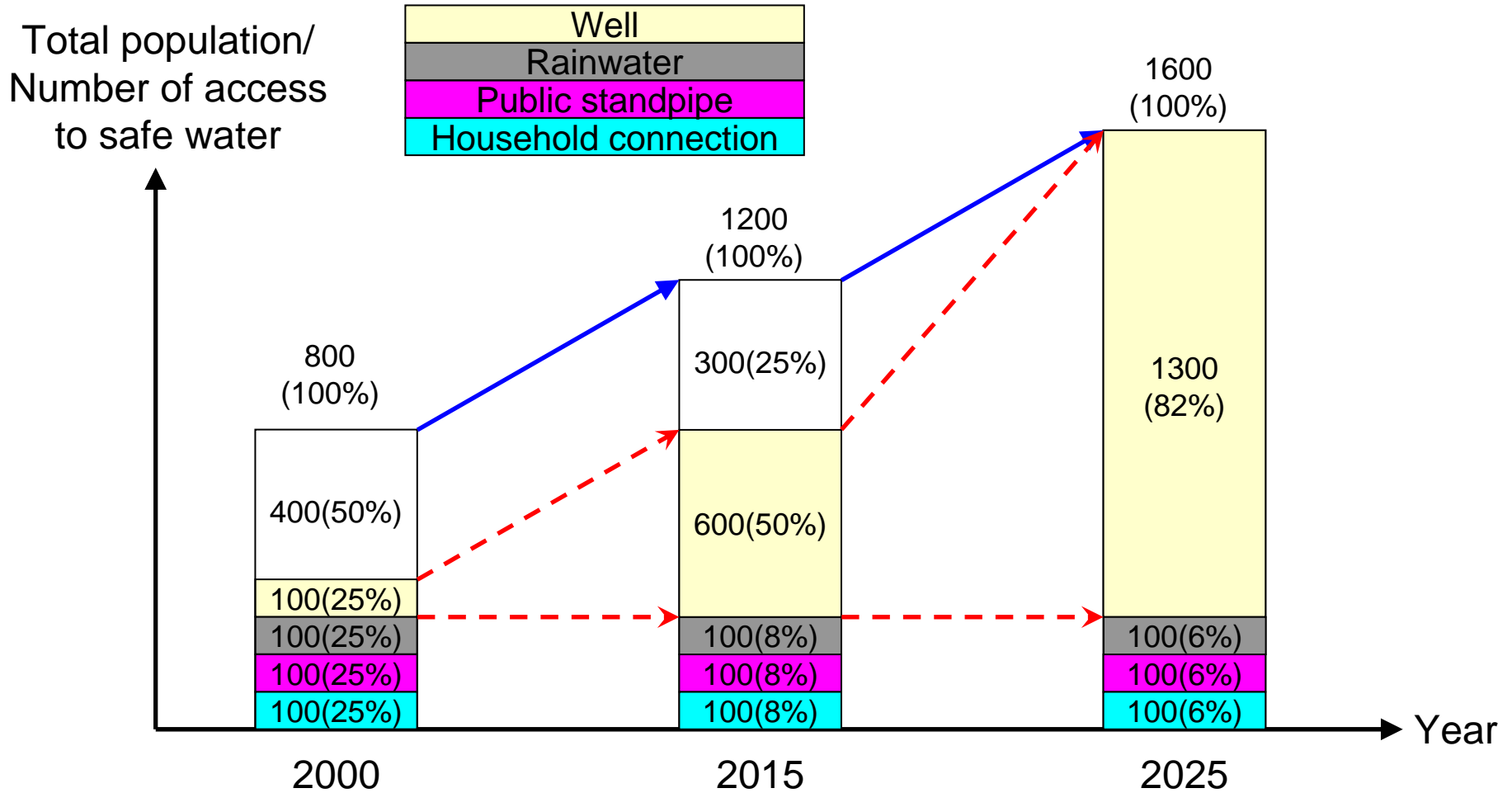
Case 2

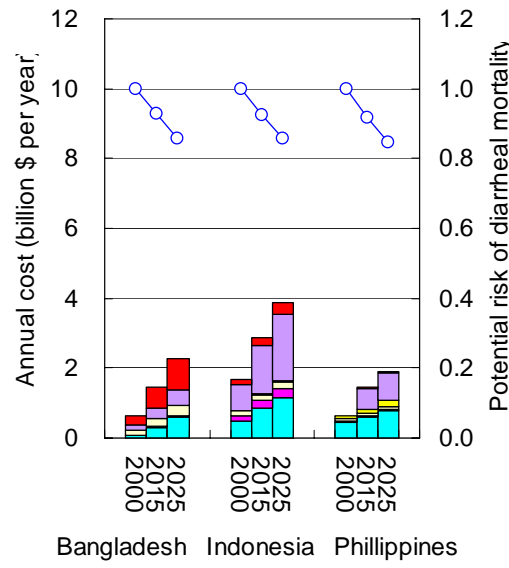
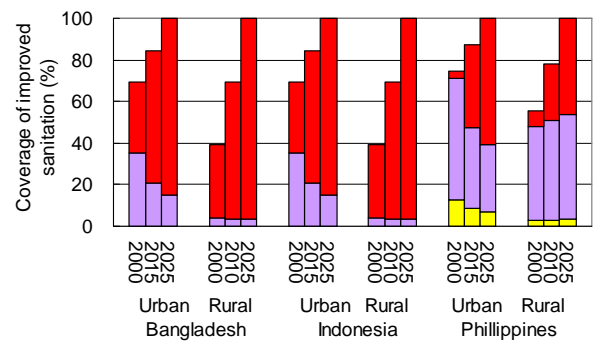
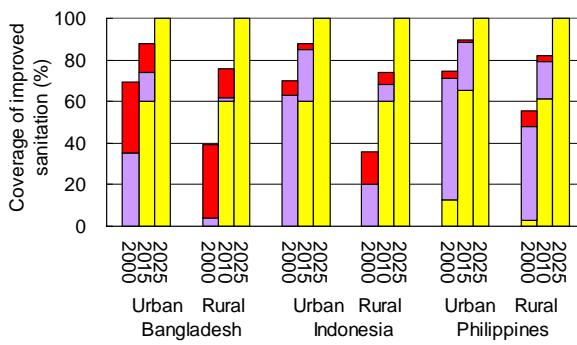
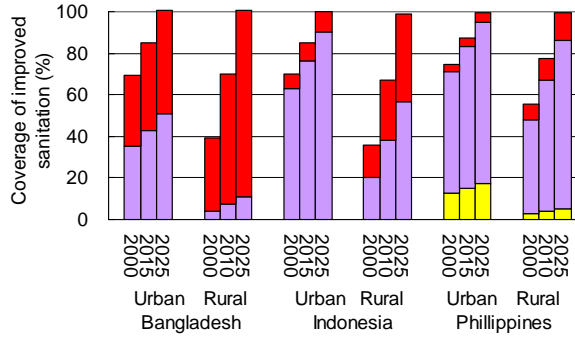
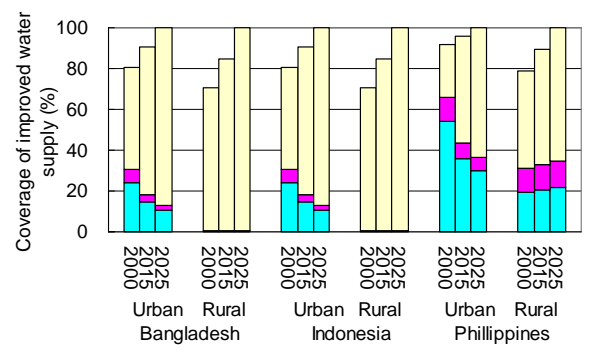
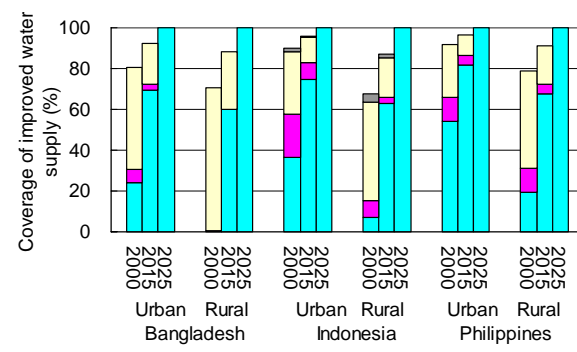
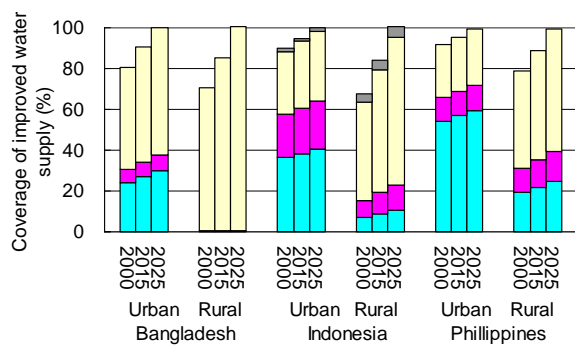
- Linear increase of Household Connection coverage
- Provide household connection for all by 2025



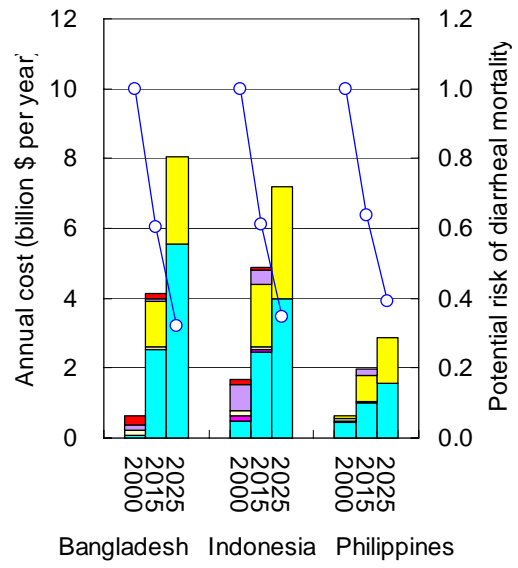
Case 3

- Additional people with safe water are served by Well
- Numbers of access to Household Connection, Public Standpipe and Rainwater are constant

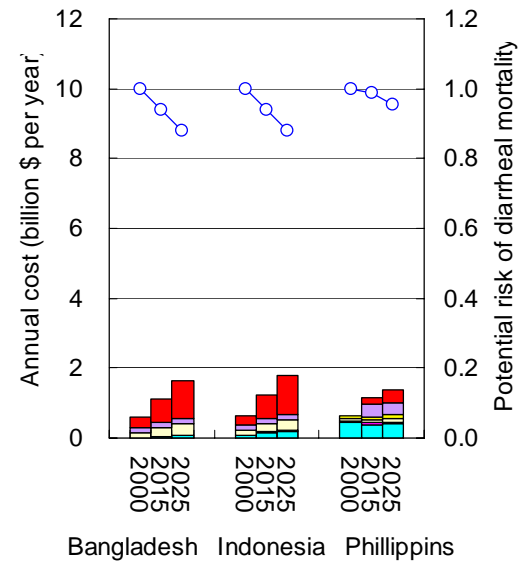




Case 1



Case 2



Case 3



Conclusion

- Development of water management model to analyze future domestic water demand, investment costs and health impacts (diarrhea mortality) considering condition of access to safe water and sanitation
 - ✓ Achievement of Millennium Development Goals 7, Target 10 and VISION 21
- Nest step
 - ✓ Cost-benefit analysis of meeting the MDGs on safe water and sanitation
 - ✓ Link to CGE model and water resource model



Thank you for your attention!!

