Development and Investment Policies and the Efficient Allocation of Water Resources in the Volta Basin*

Applications of the M^3-WATER Decision Support System

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*Abstract in page 110

Three Major Sub-Topics

1. Estimates of Current Demand and Supply of Water and Projections to 2040

2. The development of a Decision Support System (DSS) – M^3 WATER – to efficiently allocate water to different uses, sectors, and riparian countries

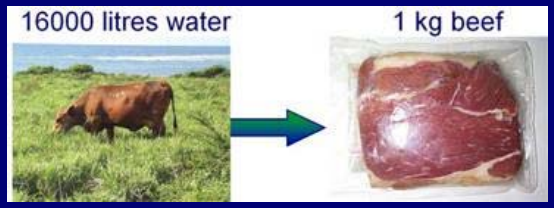
3. Rice Self-Sufficiency in Ghana: An application of M^3 WATER – DSS in Development and Investment Policy Analysis

Demand and Supply of Water – Current and Projected

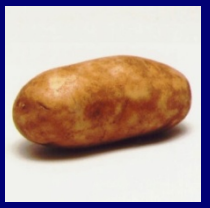
Demand for Water

- Hydropower ≈ 1,200 m^3/sec
- Domestic ≈ 0.045 m^3/capita/day
- Industry ≈ 101 million m^3/yr
- Agriculture ≈ 1,964 m^3/capita/yr

Virtual Water ‘embedded’ in food commodities



1,300 li => 1 kg



900 li => 1 kg

4,800 li => 1 kg

4,000 li => 1 kg

1,000 li => 1 li

3,400 li => 1 kg

2,800 li => 1 kg

1,300 li => 1 kg

3,900 li => 1 kg

6,100 li => 1 kg

40 li => 1 slice

5,000 li => 1 kg

5,000 li => 1 kg

Demand and Supply of Water – Current and Projected

Demand for Water - Surface Water

2005

	Population	35.63 million
• Hydropower	≈ 1,200 m^3/sec	37.84 billion m^3
• Domestic	≈ 0.045 m^3/capita/day	0.59 billion m^3
• Industry	≈ 101 million m^3/yr	0.10 billion m^3
• Agriculture	≈ 1,964 m^3/capita/yr	69.96 billion m^3
	Total Demand	108.53 billion m^3

Supply of Water - Surface Water

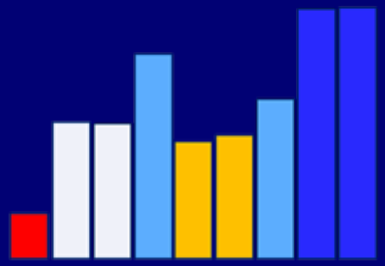
• Rainfall		
• Runoff /Rivers	Normal Year	32.20 billion m^3
• Lakes/Reservoirs		
• Ground water		

Demand and Supply of Water – Current and Projected

Demand for Water - Surface Water

		2005	2040
	Population	35.63 million	71.55 million
• Hydropower	≈ 1,200 m^3/sec	37.84 billion m^3	37.89 billion m^3
• Domestic	≈ 0.045 m^3/capita/day	0.41 billion m^3	0.83 billion m^3
• Industry	≈ 101 million m^3/yr	0.10 billion m^3	0.13 billion m^3
• Agriculture	≈ 1,964 m^3/capita/yr	2.58 billion m^3	6.42 billion m^3
	Total Demand	40.93 billion m^3	45.25 billion m^3

Supply of Water - Surface Water



Very Dry Year	10.79 billion m^3
Dry Year	28.73 billion m^3
Normal Year	32.20 billion m^3
Wet Year	43.22 billion m^3
Very Wet Year	59.41 billion m^3
Average of 9-year series	37.55 billion m^3

Climate Change

- Climate projections for 2030-2039 show no significant change in total annual rainfall levels, but April and May would become drier while September and October would become wetter

M³-WATER - A Decision Support System

Multi-country Multi-sector Multi-use

W ater
A llocation
T echnology for the
E fficient management of
R esources in the Volta Basin

The name alludes to cubic meter of water which is the common volumetric measure of water.

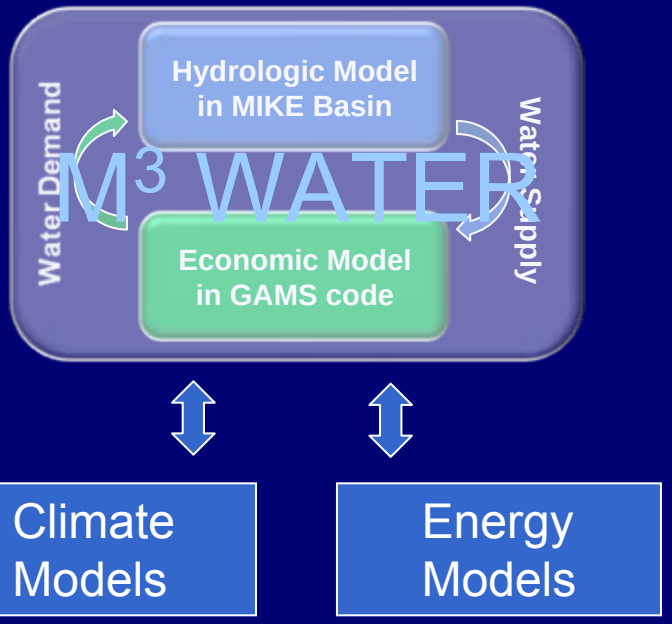
But also describes the nature and primary function of the DSS

Countries
- **Ghana**
- **Burkina Faso**

Sectors
- **Agriculture**
- **Domestic**
- **Industry**
- **Hydropower**

Uses
- **Consumptive and Non-consumptive**
- **Environmental use**
- ***In situ* and *ex-situ***

Integrated Hydrologic-Economic Model



M³-WATER - Decision Support System

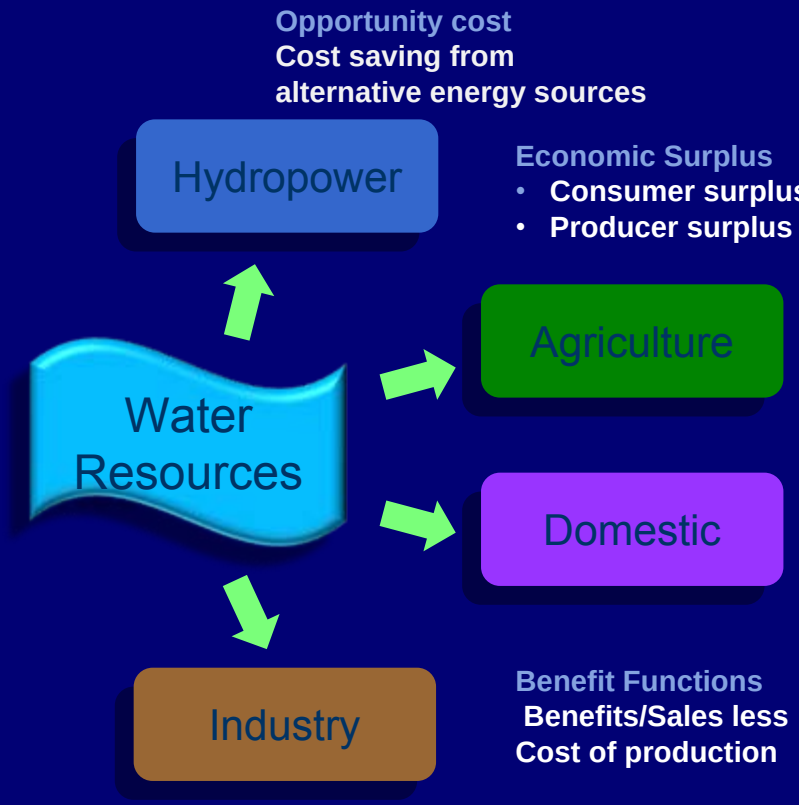
Parallel Criterion of water allocation

'The principle of the **greatest common good to society** in prioritizing conflicting uses of water'

- Guiding Principles
National Water Policy, Ghana 2007

Economic Efficiency :
Allocation of water resources that maximizes the **total net benefits to society**

- Operationalized in M³ WATER



M³-WATER - Decision Support System

Global Settings

Population Growth

Ghana	Burkina Faso
High	High
Medium	Medium
Low	Low

GDP Growth Rate

Ghana	Burkina Faso
[ ] %	[ ] %

Climate Scenario

- With Climate Change
- Without Climate Change
- User Selectable

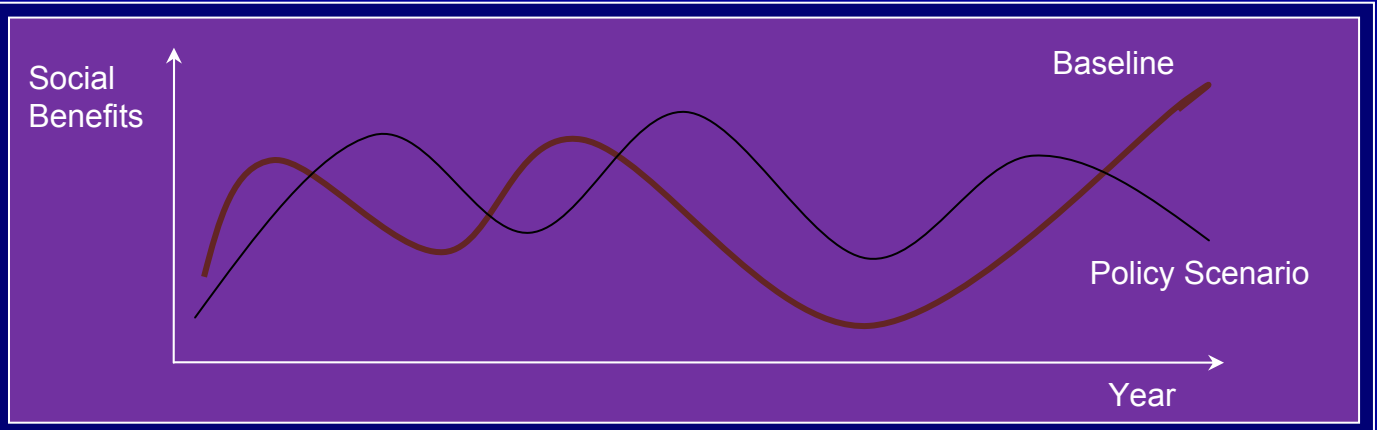
Policy Alternatives

	Ghana	Burkina Faso
Irrigation Investment	☐	☐ Irrigation Investment
Increasing Labor Productivity	☐	☐ Increasing Labor Productivity
Investment in Modern Technology	☐	☐ Investment in Modern Technology
Hydropower Management	☐	☐ Hydropower Management
Food Self-Sufficiency Targets	☐	☐ Food Self-Sufficiency Target

[ ] Run the Model

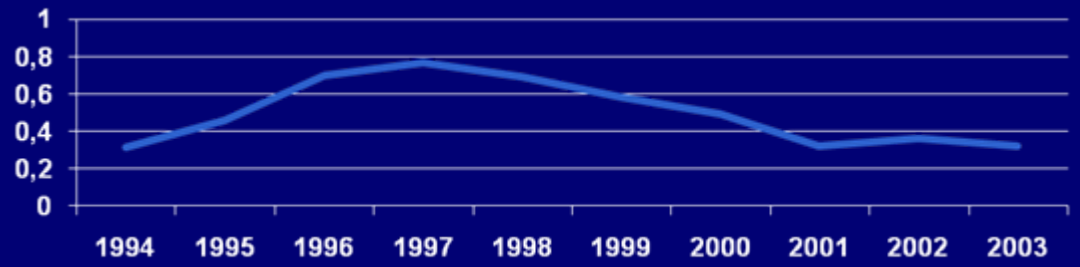
Results Selection

- ☐ Welfare indicators
- ☐ Crop Production Levels
- ☐ Agricultural Income
- ☐ Rural Employment
- ☐ Food Self-Sufficiency
- ☐ Impact on Akosombo Operation



Policy Analysis: Self-Sufficiency in Rice in Ghana

Historical levels of self-sufficiency in rice



10-year ave. – 44%

Current – 32%

Policy Analysis - Self-Sufficiency Target: 80% rice self-sufficiency in 10 years

Results – individual policy taken independently

	To achieve 80% rice self-sufficiency
• Irrigation expansion	50 % increase from current level
• Yield improvement	100 % increase from current level
• Population Policy (low growth rate)	- can only achieve 35% self-sufficiency

Notes on the policy alternatives

Irrigation expansion will divert more water to agriculture. Yield improvement of 100% in 10 years is not easy to achieve. More realistic approach to achieve the target is a mix or combination of the above policies, in which the policy analyst can experiment on

End of Presentation

Thank you very much!

For inquiries and further information about this presentation please visit

Our M3 WATER display booth on

or contact

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