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**Report of the training workshop  
on the use of**

**M<sup>3</sup>WATER in Water Allocation and Investment Policies  
in the Volta Basin**

*– Focus on Burkina Faso –*



***ORGANISED BY***  
**Sustainable Development of Research Capacity based on the  
GLOWA Volta Project**  
***AT***  
**Hotel Residence Prestige 2000, Ouagadougou**  
***FROM***  
**13<sup>th</sup> to 15<sup>th</sup> July 2010**

## **Introduction**

The main purpose of the training workshop is to introduce participants to the use of the model M<sup>3</sup>WATER. The training workshop in Ouagadougou, Burkina Faso was from Tuesday, July 13-15, 2010, at Hotel Residence Prestige 2000. Dr. Barry, Coordinator of WASCAL project opened the workshop by welcoming participants. In his address, he iterated that this workshop is part of the last workshops of SDRC-GLOWA Volta project. Dr. Barry informed participants about the new project christened “**WASCAL**” and gave a brief background to the project. He said WASCAL would be building on the GLOWA Project and asked participants to get themselves in readiness to be involved when the time comes. The resource person for the workshop was Dr Nicos Perez, assisted by Dr Bruno Barbier.

The first day of the workshop was devoted to:

- The presentation of the training program and objectives of the workshop
- The installation of GAMS models and M<sup>3</sup>WATER
- The presentation of the model M<sup>3</sup>WATER and hydrology of the Volta Basin
- The presentation of GAMS interface model followed by the presentation of a simulation exercise with GAMS.



**A Section of participants during the workshop**

Dr Perez and Dr Barbier presented the training program for the three days to participants. After which, participants proceeded to copy the training materials, install GAMS and M<sup>3</sup>WATER model on their personal laptops. However, almost all participants were novices to both models.

A presentation on basic economics was made by Dr Perez to enable participant's get familiar with economic terms and enhance their knowledge of the role economics and business models in the allocation of water in a watershed. Economics was defined as a social science that examines how people choose to use limited or scarce resources in attempting to satisfy their unlimited wants. This definition led to the introduction

M<sup>3</sup>WATER Model to the participants as a model for simulations and equitable allocation of resources. Like any software, the use of the M<sup>3</sup>WATER model requires some prior knowledge in the field for its implementation. Though GAMS model was installed on the participants' computers, to facilitate its use, resources persons noted that the Model generated a series of errors, they took participants through the procedure in which GAMS react to errors and how to solve it.

The moderators raised some questions about the model:

- How many interfaces have GAMS and who is M<sup>3</sup>WATER designed for?
- How the model works?
- How to apply it in a simple policy analyze.

The resource person explained that M<sup>3</sup>WATER model has two interfaces with GAMS. The first interface is for decisions makers, technocrats and policy analysts to assist them simulate and have a pictorial view about climate change and irrigations, demographic etc. The second interface based on excel is for professionals/specialist namely researchers and technicians. This interface allow them to directly make simulations on irrigation, crops, producers and consumers profit, the management of water and the impact of climate change in watershed based on historical data.

### **Simulation of climate change**

As part of the practical and hands-on exercise, the resource person simulated the impact of climate change over year 2030 and 2039. The simulation revealed that the dry season will be (four months) longer, the rainy season will be shorter by three months, there quantity of the precipitation will not change and the quantity of water will still be the same as usual raises series of questions.

However, particular emphasis was placed on the presentation on the M<sup>3</sup>WATER model as a tool for decision support. This presentation was interactive which allowed participants contribute actively and also asked questions. The resource person made an attempt to clarify issues participants do not understand. Among the questions raised by participants on this presentation were (Appendix 1).

During the presentation resource person came out with some possible scenarios on how a country will react if situations in the simulation were true?

- In this case there will certainly be discrepancy in the seasons, which will lead to a shift of the planting seasons, and choice of crops.
- Burkina Faso will change its water policy and has to build more dams to prevent water from flowing into Ghana.
- The supply of water will decrease while demand increases and that will certainly have impact on hydro-electricity. Hence, what will happen is to find a compromise between hydro-electricity and agriculture.
- Burkina will have to make a choice, either to import products to face the situation or to grow rice upstream by building dams but the governments will not allow dams upstream in the Basin. The M<sup>3</sup>WATER model simulation will be according to the amount of water available to determine the type of crops to grow.

- Will a construction of Dams upstream Akossombo affect its capacity? The construction of dams upstream Akossombo will not affect its capacity and will even increase the quantity of water. Dams like Bui and Samandeni can't prevent water from flowing to Akossombo.

### **Simulation on crops**

The resource person also mentioned that the M<sup>3</sup>WATER model is an excellent tool for crops simulations. He explained that M<sup>3</sup>WATER helps to determine the acreage of land needed for cultivation, the quantity of water needed and also to determine which crops can be beneficial to producers. In a hypothetical situation where two different crops can be cultivated in the same season, which one should be cultivated first. Simulations exercises based on profit was made on the choice of crops such as maize, rice and tomato using different irrigation scheme. The simulation allowed participants to have an insight into how to make choices between crops according to their benefit and productions methods. From the simulation, Tomato appears to be the most beneficial crops in both irrigation types.

### **An excellent tool of equitability.**

It was later explained that the M<sup>3</sup>WATER model takes not only the profit of the producer into account but also considers the consumer. But governments will prioritize, taking into account the interest of both consumers and producers.

Dr Perez went ahead to explain that M<sup>3</sup>WATER will be a useful model at the national level and also for the Volta basin Authority (V.B.A.) since the Niger Basin and the Senegal River have their own model. To make the model efficient and interesting there is a need to add hydrological data. Hence, the model can play a key role as far as the management of water within the basin is concerned.

### **Recommendations.**

In the concluding discussion, the participants accepted the fact that the M<sup>3</sup>WATER model as a tool of prediction and simulation of the impact of climate change, it will play a key role in the resolutions of demographic, irrigation and the impact of the climate change issues. Participants went ahead to make some suggestions for the improvement of the M<sup>3</sup>WATER:

- The extension of the model to sub-basins.
- The extension of the model to all state members of the Volta Basin Authority.
- The integration of hydrological map in the model to allow users to directly have access to hydrological data.
- To include the eco-system, livestock in the model

## APPENDIX 1

A participant asked the moderators to explain the results of this simulation since other models predict severe dry seasons, the increase of heat, famine, water scarcity?

The resource person responded by saying that there are many models of simulations on the impact of the climate change and Some of this models will predict the increase of heat, dryer season, famine but the M<sup>3</sup>WATER model predict more precipitations in a short period of time but the quantity of water will not change.

**Question:** Can you explain the advantage of the climate scenario in 2040 in relation to water supply?

**Ans:** The annual quantity of rain will probably remain the same but the intra-annual will experience a shift. The season will be drier at the beginning (April, May) and wet at the end of the season (September, October). The period of semi will probably shifted to minimize the long pockets of drought.

**Question:** There is a close link between industry and energy sector. We note however that between 2005 and 2040, has increased demand for hydropower is not significant compared to that of the industry. How can you explain this difference?

**Ans:** The presenter explained by the use of alternative energy source hydroelectric power by industries.

**Question:** Can you give us the confidence that you place on M<sup>3</sup>WATER?

**Ans:** It is  $\pm$  10% compared to reality for 2005. We must however understand the objectives of the model rather than model validation. It's more a tool for decision support and scenarios, its inputs can deviate from the future reality.

**Question:** In your optimization models, you were limited to three scenarios: in the Basin of Burkina Faso and Ghana. Given that half of Togo is located in the basin why don't you account it or all countries that share the basin of the Volta?

**Ans:** This choice is mainly due to the availability of data, which limits the integration of other countries. It is however noted that the hydrological simulation takes into account the entire basin (hence the whole country). The limitation lies mainly in other sectors such as agriculture or demography.

The presentation of the hydrology of the basin generated some questions for clarification. The following questions were then posed to the resource persons:

**Question:** Since the simulation model covers the entire basin, is it possible to identify a small pool to better see the details?

**Ans:** It is possible and these studies may be assigned to students in the future to improve

the model. It must also be said that certain sectors such as hydropower (input or national Basin) will not be integrated in small unit basin contrary to the agricultural sector.

**Question:** The policy for managing our resources in our country is for the most part bare figure. In this case, how come you to leave the figures of these texts to feed the model?

**Ans:** It is possible to transform certain development policies in numbers despite being stripped of numbers.

**Question:** The GAMS model takes into account perennial crops?

**Ans:** there are very marrow of forest management in gams. They can be used to account for perennial crops?

**Question:** Since perennial crops not the same consumption patterns of water and even life, how can this be taken into account by the model?

**Ans:** Multi-periodic models can be used in this kind of situation.

**Question:** Several climate scenarios are taken into account in the practical simulation, how the crop yield is it calculated in the simulation?

**Ans:** the end result is an average of different climate scenarios. The model can also be used in a study of the economic value of seasonal forecasting.

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