Report on
Training Course on Demand Forecasting

Introduction
At the request of WASCO, a half-day workshop on Demand Forecasting took place on the 21th of March 2019 in Castries. The purpose of bringing forward the workshop was to allow as many WASCO staff as possible to participate. The Workshop will again be conducted during the Training Event in July, in connection with the CAWASA Regional Conference.

Proceedings
The workshop was attended by 19 staff members of WASCO and a list of participants is attached. The program of the workshop was as follows:

- Introduction
- Factors which affect demand
- Some concepts regarding demand
- Data needed for demand forecasting
- Sources of data for demand forecasting
- The need for demand management
- Instruments for demand management
- Exercise

A PP presentation and the trainers’ notes for the course are attached as Annex 1 and 2 to this report. All trainees received a Handout, which is available within WASCO.

Evaluation
All participants filled in a short evaluation form. The results indicated that all participant were either satisfied or very satisfied with the agenda of the workshops, its results and the way the workshop was conducted. Also, majority of the participants were also very satisfied with the level of staff involvement during the workshop. Overall most participants were very satisfied with the arrangements for the workshop and many have made the suggestion for additional training in the area of water demand forecasting, surveys and data analysis.
Conclusion

The workshop will again be conducted in July 2019. Additional practical exercises will be added to the program and there will be training on conducting household surveys.
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<tr>
<td>1</td>
<td>Gregory Inglis</td>
<td>Water Services</td>
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<td>Antony Gosem</td>
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<td>Malcolm Kirton</td>
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<td>Nicholai Hyacinth</td>
<td>Strategic Department/GIS</td>
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<td>Matthew Francis</td>
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<td>Jim King</td>
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<td>Adrian Medard</td>
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<td>Water Services</td>
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<td>Ken Goodman</td>
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<td>Josetta McLaren</td>
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<td>Ignatius Jean</td>
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<td>18</td>
<td>Mandille Alcee</td>
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<td>20</td>
<td>Lester Arnold</td>
<td>Planning consultant</td>
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A. Domestic Demand
- Number and size of households
- Population growth
- Family income and income distribution
- Costs of water presently used
- Cost of future water used
- Connection charges
- Availability and quality of service
- Cost and availability of water using devices
- Availability of alternative water sources
- Present water consumption
- Legal requirements
- Population density
- Cultural influences
B. Commercial Demand
- Sales and turnover
- Costs and volume of water presently used
- Price of future water used
- Connection charges
- Costs of water using appliances
- Quality and reliability of service
- Working hours of various types of commercial establishments
- Legal requirements

C. Industrial Demand
- Present and future costs of water
- Type of industry and water use intensity
- Relative price of alternative sources
- Quality and reliability of supply
- Costs of treatment and disposal of waste water
- Legal requirements

D. Agricultural Demand (for [non] piped water supply)
- Present and future costs of water
- Availability of other sources
- Quality and reliability of supply
- Supply cost of alternative water systems
- Number of cattle
- Legal requirements

E. Public Services Demand
- Present and future costs of water
- Revenue of local governments
- Number and size of public schools, hospitals, ministries, etc.
- Legal requirements

F. Technical requirements
- Unaccounted for Water (leakage)
- Peak factors
- Seasonal fluctuations
The demand for water is the **quantity** of water demanded at a given **service level** and at a specified **price**.

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In this Handbook, a linear demand curve will often be used for illustrative purposes, as indicated by line $D_1$. However, the nonlinear relationship $D_2$ is also considered.
FUTURE COSTS OF WATER

DEMAND MANAGEMENT IN MELBOURNE

EXERCISE

You are to prepare a demand forecast for Castries for the next 25 years. Please answer the following questions:

1. What type of data do you need?
2. How are you going to collect the data?
3. What sources of information you intend to use?
4. What measures would you propose to manage demand?
A.3 Trainers Notes

Course name: Demand Analysis and Forecasting

Time: To coincide with CAWASA Seminar

Objective: At the end of the workshop participants will be able to
- Identify the various factors which determine the demand for water
- Explain the need to manage the demand for water
- Describe the various instruments to manage the demand for water
- List the types of data needed to forecast the demand for water
- Identify the main sources for data collection
- Explain the concepts Willingness and Ability to Pay
- Carry out a simple exercise in forecasting water demand

Duration: One day

Training methods: Short lectures, group discussions, group work, various exercises


Target Group: 1. Utility and government staff involved in the planning and design of new water supply systems or extensions of existing water supply systems
2. Staff working with regulatory authorities supervising water utilities

Trainer: J.W. Overbeek, Institutional Expert and Economist

Tentative Program:

1. Introduction
2. Group work to identify the various factors which determine the demand for water
3. Introduction on the various instruments to manage water demand
4. Group discussion on the effectiveness and feasibility of the identified instruments
5. Group work to identify potential sources of data needed for demand forecasting
6. Introduction on Willingness and Ability to Pay followed by discussion
7. Carry out a simple case study in estimating water demand
Session Guide

A. The Determinants of the Demand for Water
   1. Divide participants in groups of two (sitting next to one another). Ask all groups to take 10 minutes and list the factors that determine the future demand for water and make a distinction between domestic and industrial/commercial demand.

   2. After 10 minutes ask the first group to mention the first three factors. Ask group 2 to add another three factors. Continue the exercise until participants have listed most of the determinants of the demand for water mentioned below.

   3. Write down the definition of the demand for water, as follows:

       The demand for water is the quantity of water demanded of a given service level and at a specified price.

       Explain that the demand is always related to a specific product or service level and the price paid for the product or service level.

B. Some Concepts

   4. What is the difference between the “demand” for water and the “consumption” of water. Elicit the concept of “constrained” demand, i.e. that the actual demand is higher as consumption, but e.g. the water utility cannot provide enough water.

   5. Ask participants if all water that WASCO produces represents additional demand for water? Elicit by questioning and discussion the difference between non-incremental demand and incremental demand for water. The difference is relevant, because non-incremental demand does not generate benefits for a water supply project, as it just replaces water. Incremental demand represents a benefit for a water supply project.

   6. Ask participants what they can say about the relationship between the price and the volume of water demanded. Participants may suggest that the higher the price the lower demand. Suggest that in case supply of water is very limited, e.g. only a few liters per day, consumers may be willing to pay very high prices for water, for drinking. However, for the next few liters, e.g. for cooking, they will be prepared to pay less, and for the next 10 liters (for washing) they will be prepared to pay even less. Draw a demand curve on the board (nonlinear and linear) The downward slope of the demand curve indicates the decreasing marginal value of water. For practical purposes the linear demand curve is often used, whereas the non-linear version probably is a better representation of actual consumer behavior.

   7. Draw a demand curve for a consumer who uses water from a public tap. Ask participants where the demand curve for water from a consumer with water from a house connection would lay. Probably the HC demand curve would lay higher and to the right of the PT demand curve indicating that consumers are willing to pay a higher price for the same quantity of water with a quality that they perceive as higher.

   8. Introduce the concept of price elasticity. Price elasticity is the relative change in the quantity of water demanded divided by a relative change in the price of water. If the price elasticity is
<1, we call demand inelastic, and if price elasticity is >1, we call demand elastic. Studies of the World Bank show, that the average demand for water is rather inelastic and ranges between -0,2 and -0,8. This means that if the Price increases with 10% the demand for water will decrease with 2% - 8%.

9. Explain to participants that it would actually be very useful to know the actual shape of the demand curve. For that purpose, sometimes Willingness to Pay surveys are being carried out in the course of forecasting demands and planning for system development. In such WTP surveys, consumers are being asked how much they are willing to pay for a connection and/or for water. Such surveys often make use of the Contingency Valuation Method.

10. Another important determinant of the demand for water deals with income. Ask participants what will happen to the demand for water if income increases. Participants may guess that when income increases, customers are willing to pay more for the same quantity of water. This is called income elasticity, which represents the relative change in the quantity of water demanded divided by the relative change in income. Income elasticity for water is rather inelastic and estimated at between 0,4 and 0,5, which means that e.g. an increase in income with 10% will lead to an increase in water demand of 4%.

11. Ask participants what they know about Ability to Pay which is defined as the ratio of the monthly household water consumption expenditure to the monthly household income. World Bank and other organizations apply a standard whereby ability to pay for water should not exceed 5%, which means that households should not be asked to spend more than 5% of their income for water supply.

C. Data needed and sources of information for water demand forecasting

12. Ask participants what sources are available to collect the necessary data for forecasting demand:
   (i) collection of secondary data from existing studies, water enterprises, government agencies, etc.;
   (ii) conducting reconnaissance surveys in the area to observe the actual field situation; and
   (iii) collection of primary data through field observations and household surveys.

   Household surveys normally provide:
   (i) data about family size, occupation, income etc.;
   (ii) data about the quantity, quality and costs related to the current water supply (and sanitation) situation; and
   (iii) data about the future use of water supply and sanitation: the preferences of respondents about the future level of service, type of facility and what they are willing to pay for the preferred level of service.

D. The need to manage water demand
13. Is there a need to manage the demand for water? Elicit various reasons from participants why it is useful to consider demand management:
   a. Limited availability of water
   b. The need to share water among various sectors (agriculture, hydropower, tourism, nature, etc)
   c. The future costs of water

14. What can we say about the future costs of water supply? Will it be more expensive or less expensive as compared to our current supply. Elicit by questioning that the future costs of water, in the long run, will tend to be more expensive as compared to the current water source, because water will need to be transported, treated, etc. The following figure demonstrates this effect:

   - Explain the concepts Willingness and Ability to Pay

E. Various instruments to manage the demand for water

15. Draw a demand curve on the whiteboard, and ask participants how they would go about reducing demand: Elicit the following answers:

   a. reduce the quantity demanded by increasing the price of (excessive) water use. This will result in a reduction of demand through a movement along the same demand curve. At a higher price, a smaller quantity of water is demanded. By introducing financial incentives, consumers (domestic and nondomestic) can be expected to reduce their water consumption. Often, the objectives and reasons for such a policy will have to be thoroughly explained to the users through public education programs. Examples of introducing financial measures include:
      i. increasing the average water tariff;
      ii. introducing progressive water tariff structures, aiming at reduction of excessive water use;
      iii. increasing tariffs for wastewater discharge: (industries will be particularly sensitive to this measure);
      iv. introducing ground water abstraction fees;
v. fiscal incentives (e.g. for investments in water saving devices or treatment plants);
vi. utilization of water markets: experience from water markets in the United States and Gujarat, India indicates that water markets create a framework which contributes to the efficient use of water.

b. Move the demand curve to the left, resulting in a reduction in the quantity demanded and moving the demand curve to the left. This means that at the same price level, the quantity of water demanded will be reduced. This can be achieved through:
   i. introduction of water saving devices;
   ii. changing consumer behavior through educational programs;
   iii. legal measures (e.g. regulating the use of groundwater);
   iv. industrial “water-audit” programs. This entails a review of the use of water and waste water in industrial plants, with the purpose of reducing the use of water.
   v. save the use of water or avoid waste of water resources on the supply side.
      Such measures could include:
      • increase in efficiency at the utility level (reduction of production losses, UFW); and
      • institutional changes (merger of utilities may create economies of scale).

16. In most cases, water demand management and conservation policies will consist of a comprehensive set of measures to be carried out over a longer period to achieve the desired results. However, in the long run, it may save millions of dollars in deferred investment, like the case study Melbourne (hand out the example).

F. Carry out a simple exercise in forecasting water demand

17. Tell trainees that now they will apply what they have learned in the sessions today. Divide participants in groups of 3-4 persons. Each group has that task to prepare a Demand Forecast for Babonneau (Hill 20 System) for the next 25 years. Each group has about 30 minutes to answer the following questions:

   a. What type of data do you need?
   b. How are you going to obtain the data?
   c. Which measures do you think could be considered to manage demand?

Reconvene the groups and ask each group to give a short presentation the answers to the three questions. Compare the three presentations and conclude the session.
Handout 1: The Determinants of the Demand for Water

A. Domestic Demand
- Number and size of households
- Population growth
- Family income and income distribution
- Costs of water presently used
- Cost of future water used
- Connection charges
- Availability and quality of service
- Cost and availability of water using devices
- Availability of alternative water sources
- Present water consumption
- Legal requirements
- Population density
- Cultural influences

B. Commercial Demand
- Sales or value added of non-subsistence commercial sector
- Costs and volume of water presently used
- Price of future water used
- Connection charges
- Costs of water using appliances
- Quality and reliability of service
- Working hours of various types of commercial establishments
- Legal requirements

C. Industrial Demand
- Present and future costs of water
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D. Agricultural Demand (for [non] piped water supply)
- Present and future costs of water
- Availability of other sources
- Quality and reliability of supply
- Supply cost of alternative water systems
- Number of cattle
- Legal requirements

E. Public Services Demand
- Present and future costs of water
• Per capita revenue of local governments
• Number and size of public schools, hospitals etc.
• Legal requirements

F. Technical requirements

• Unaccounted for Water (leakage)
• Peak factors
• Seasonal fluctuations