ISSN 2301-6590

OPTIMIZATION UTILIZATION OF WATER RESOURCESDAM BATUTEGI USINGMETHOD OF LINEAR PROGRAM

Aprizal,HeryFitriyansyah
Master of Civil Engineering, Graduate School, University of Bandar Lampung, Jl. Zaenal Abidin Pagar Alam 26 Bandar Lampung, 35142, Indonesia

Abstract-*Water is the source of life and take on an important role in supporting human activities. Form of the problems faced in the utilization of water resources management in general is a problem right way so that at the optimum can result from existing resources. Efforts should be made to overcome these problems by taking into account the constraints faced, the negative impacts and completion is expected to be effective and efficient.Among the various alternatives, the research to optimize the utilization of the water dam Batutegi an option. Linear program is one form of optimization techniques. The objective function is to maximize the amount of water that can be supplied for irrigation. The problem is the availability of water in the dam Batutegi. Completion of this optimization problem using QM For Windows software.Efficiency optimization results are outflows of 2:05 m3/sec in the first growing season, 1:19 m3/sec in the second growing season and the addition of irrigated area of 1,100 ha in the first growing season, 512 ha in the second growing season.*

Keywords*: optimization, bendunganbatutegi, linear methods*

INTRODUCTION

Alternatives to address the problem of availability of water resources is to build a dam, weir and dam. One of the existing dam in Lampung province is Batutegi Dam. Water at the dam Batutegi function is as a supply for the development of rice cultivation in the area Irrigation Sekampung of the original 43 588 ha to 66 573 ha. Another benefit is for hydroelectric power (hydropower) for 2 x 14 MW, the supply of raw water for drinking water of 2,250 liters / second (Bandar Lampung 2000 liters / second, Metro 200 lt / dt and Branti 50 liters / second), control floods, tourism and fisheries.

Normal water surface elevation at the dam Batutegi + 274.00 m. At normal water surface elevation dam Batutegi purpose and benefits can be achieved. At this time the monthly average elevation Dam

Batutegi + 251 684 m. This elevation is below the critical limit at the elevation chart Batutegi Dam in accordance with the Operation and Maintenance manuals Batutegi Dam. Terbatasnyasumberdaya water can inhibit or restrict the use and management of water resources optimally. For optimized utilization of water resources located in Batu Dam Tegi with respect to decreasing quantity, one way is to optimize the functionality and benefits Tegi Batu Dam.

In these conditions there are two contradictory things are Parties Communities and Local Government issued requires water for many Social Aspects while the business of Party Rock Dam Tegi In this case of O & M of Water Resources Central River Region I Mesuji Sekampung want water capacity in advance to be able to maintain the condition of the water and keep the dam remained stable Technical Aspects.

Decision to resolve these cases should consider the interests of both parties, namely: social Social and dam security interests (Technical Aspects). In order to achieve the optimal solution or in other words, the best solution can be obtained through the use of optimization techniques. One of the optimization techniques that belong to the mathematics program are: linear programming method.

RESEARCH OBJECTIVES

The purpose of this study is:

a. To know with limited water resources in the dam Batutegi how optimal utilization of water resources for
b. irrigation to the planting season I and II the growing season by using linear programming method so that the plan can be achieved rice acreage.
c. b. To provide insight to the reader that in the sort of analysis can also be done with the system software QM For Windows. .

LITERATURE REVIEW

1.Linear Programming

Linear Programming is an optimization technique in which the relationship of mathematical functions declared in a linear (rank one) good relationship in the form of equations, inequalities and constraint functions, or linear program is a way to solve a problem based on the rules of mathematics in which all relationships

between variables - peubahnya (variable) is linear, both that of the provisions - provisions limit (Constraints) as well as that of the optimization function. Solving problems mathematically linear program must meet the following criteria:

a. Decision variables are not negative.

b. The existence of the objective function and the decision variables can be described in a set of linear functions.

c. Resource constraints can also be described as a set of linear functions.

Since its introduction in the late 1940's decade, the linear program has proved to be one of the most effective methods. Its success stems from the flexibility in defining a variety of fields such as: military, industrial, agricultural, transportation, economy, health, engineering and even social and behavioral sciences.

Linear Program is one of the methods to solve optimization problems. Problems combination products (Product Mix) is one of the most popular linear program solved.

Two or more products are made with limited resources, such as the limitations of people, machines, materials, hours, discharge water and so on.

The objectives are usually to maximize profit or minimize cost of products made. Linear Program is a tool determinastik namely: assume all model parameters are known with certainty. Whereas, in fact, quite rare these parameters with uncertain value. To compensate for this condition, the value of the linear program provides post-optimization analysis and systematic parametric analysis to enable decision making by testing sensitivity.

Standard equations (general) of the linear program is expressed as follows (Wurbs, 1996; Hiller & Lieberman, 1994;):

Objective function

Maximize:

(1) (Constraint function)

A11 A12 X1 + X2 + A1nXn ≥ or ≤ B 1 ..... (2)

A21 A22 X1 + X2 + A2nXn ≥ or ≤ B 2 ..... (3)

AM1 + AM2 X2 X1 + Amn Xn ≥ or ≤ B m (4)

Non-negative terms: xj ≥ 0for j = 1,2,3, ..., n. (5)

Where:

Objective function coefficient cj = j-th variable

Aij = coefficient of the i-th constraint function to the variable-j

Bm = Top right-hand side of the equation-m obstacle to the

shows the value of the constraint conditions.

Xj = j-th decision variable

The objective function Z =

I = 1,2, ... , M (the index for

variable number of constraints)

J = 1,2, ... , N (indeksuntuk

Jumlahvariabelkeputusan

Dipergunakanpada Beberapaasumsi the linear process that is (Pranoto, 1993):

a. The rise and fall of proportionality Z value and use of existing resources will change proportional (proportional) with changes in activity level.

b. Linierity the objective function of the constraint equations must be expressed as a linear function.

c. Divisibility the resulting output can be any activity fractions as well as the value of Z.

d. Deterministic ie all the parameters in the model and the linear program remains unknown.

e. Aditivity the value Daris emua decision variable has a value equal to the number of functions of individual variables.

In the linear programming software to solve the problems that digunakanadalah: QM for Windows Version 2.0. QM program for windows merupakanpaket computer program to solve the problems of quantitative methods, management science or operations research. QM for Windows is a combination of DS and POM program for windows. Completion of the linear program in mulaidengan:

Simplify the equation by entering a value - the value of which is unknown.

The initial data that must be entered into the program is the number of variables and constraints with the goal of maximum amount.

Furthermore, the coefficients of the objective function and constraint equations inserted one by one.

The next step executable programs (solve) to get results.

METHODOLOGY

Design research is a guide that contains step - steps to be followed in conducting the research. In order to obtain the maximum results in the optimizer Dam Batutegi using this linear program will require targeted research design, in this case done some stage work as follows:

a. Perform data collection and related effect on the optimizer dam including supporting data such as: water surface elevation data, the data pattern of water discharge operations, acreage planted 2007/2008.

b. Perform calculations using QM software For Window.

c. Formulate patterns based on the operation of the dam optimizing results.

RESULTS

1. Patterns Reservoir Optimization Operation

In the process of calculation and optimization stages using QM for Windows software obtained an important output of the pattern of reservoir operations on each - each planting period. Operation pattern is a guide for policy retrieval or perform a water problem and acreage.

Patterns operating policies, one example in the reading patterns of reservoir operation policies are as follows:

a. For policy pattern in the second period, then the reading patterns of operation / policy reservoir adapted to planting season.

b. Patterns of operation / policy can be read if the inflow to the reservoir has been known to every month. Inflow that there can not be excluded all but accommodated first to anticipate gadu season.

 ISSN 2301-6590

c. Pattern of this policy can be used to record when there is rain in the dam downstream and upstream weir Batutegi Argoguruh then the door closed and the operation for irrigation operation pattern will be adjusted.

d. Pattern of this policy is to read how much water released from the dam Batutegi, then output from this program is tailored to the needs of outflow of water to the plants (cropping pattern).

2. Pattern and Optimization of Existing Operations

Any dam or reservoir operations using patterns. The pattern for this Batutegi Dam operation in question is a graph showing the great water that must be removed for the water needs of the agricultural land in the planting season I (Rendeng) and second growing season (Gadu).

From the simulation results obtained expenditure efficiency water so the water crisis can be anticipated premises storing / accommodate existing inflow so as to raise the dam water level. This shows that the linear programming optimization can be used to anticipate the water crisis. Efficiency of reservoir outflow after optimization of each month at 2:05 m3/sec is the first growing season and planting season 1:19 m3/sec at II.

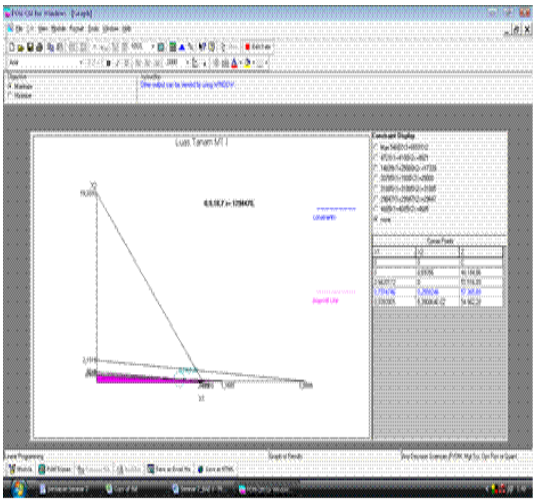

Figure 1. Optimization results

CONCLUSION

Based on the results of research conducted for Batutegi Dam optimization using linear programming it can be concluded as follows:

1. For the optimization analysis on the implementation of Water Resources analysis techniques can help pengoptimalkan pemafaatan system resources so that the efficiency of water use can overcome the crisis of Water Resources.

2. In the linear programming optimization techniques can be used as a reference or guideline in the operation of the reservoir.

3. Based on the results of the optimization are spending efficiency of water every month at 2:05 m3/sec in the first growing season and planting season 1:19 m3/sec II as well as the additional acreage of 1,100 ha in the first season and 512 ha in the second growing season

4. At the moment there is rain in the area downstream of the dam and upstream dams Batutegi Argoguruh, drain pipe for irigáis closed.

5. On the use of software programs to help solve the problem of linear constraint functions and variables should be made as simple as possible so that it can facilitate in running the software. Developed equipment such as: theory, just a computer program to assist in decision making. Thing that is worth noting is the terrain, social and others.

REFERENCES

1. Aprizal., 2003, *Optimasi Waduk Menggunakan Program Dinamik Stolastik (Kasus Waduk Saguling Jawa Barat*, Program Pasca Sarjana Universitas Diponegoro, Semarang.

2. Rachmad Jayadi., 1994, *Teknik Optimasi untuk Pengelolaan Sumber Daya Air*, Modul Teknik Sumber Daya Air, Jurusan Teknik Sipil, Fakultas Teknik Universitas Gadjah Mada, Jogjakarta

3. Riduwan, Drs, M.B.A., 2004, *Metode Dan Teknik Menyusun Thesis*, Alfabeta, Bandung

4. Riani A. Santosa.,2001, *Optimasi dan Penentuan Skala Prioritas Pengembangan Sumber Daya Air (Studi Kasus SWS Seputih – Sekampung Lampung)*, Tesis Pengutamaan Rekayasa Sumber Daya Air, Jurusan Teknik Sipil, Program Pascasarjana Institut Teknologi Bandung, Bandung

5. Petrus Wijayayanto, SE., Mei 2007., *PanduanProgram Aplikasi QM For Windows Versi 2.0*., Fakultas Ekonomi Universitas Kristen Satya Wacana., Salatiga .

6. Soedibyo., 1993, *Teknik Bendungan*, PT. Pradnya Paramita, Jakarta.

7. Suharyanto, Hari nugroho, Gusta gunawan., 2001, *Optimasi Multi Waduk Serial dengan Program Linier dan Simulasi*, Makalah Ilmiah. Semarang.

8. Hall,W.AdanDracup, J.A., 1970, *Water Resousces System Engineering*, Mc. Graw Hill Book Co, New York, U.S.A.

9. HamzahHilal., 2005, *Metode Programming Linier UntukMenyelesaikan Problem PembangkitEkonomisPadaSistemTenaga Listrik*,

10. Prossidingsemilokadankomputasisertaaplikasi 2005, Jakarta.
11. Sudjana, Prof, DR, M.A, M.Sc., 1992, *MetodeStatis*tika, Tarsito, Bandung.

12. SitiQomariyah., 1993, *KajiUlangPengelolaanWadukWonogiri*, JurnalPenelitian Dan PengembanganPengairan, Jakarta