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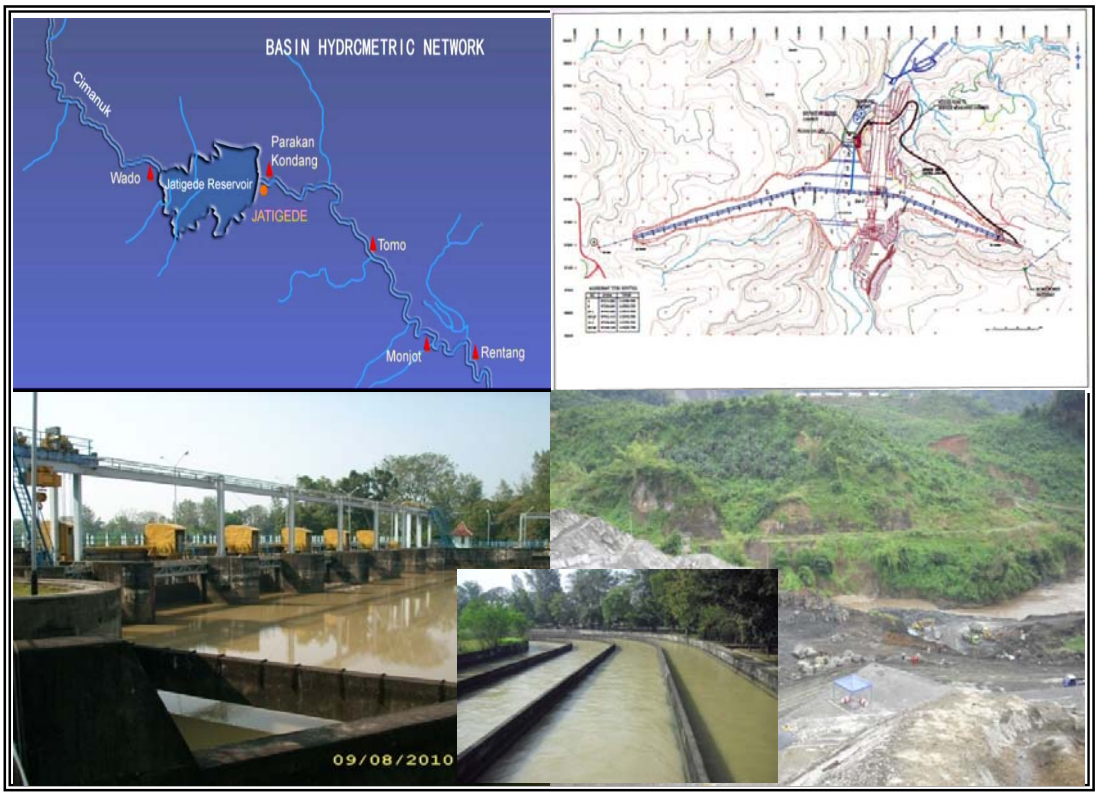

Optimizing Reservoir Operation, Water Distribution and Cost-sharing System of a Multipurpose Reservoir; Case of Jatigede Reservoir Scheme, Indonesia

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Master of Science Thesis
by

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SUMMARY

This study is applied to analyze reservoir operation, water distribution, and possible cost-sharing in Jatigede Reservoir Scheme, which is under construction now until around 2013. Jatigede Reservoir function emphasizes as storage reservoir or conservation reservoir to fulfil water demand for irrigation 90,000 ha in Rentang, water supply for Domestic, Municipal, and Industrial (DMI) 3500 l/s, and electricity/hydropower with installed capacity 110 MW. To reach the objectives of the study, this research has applied a generalized reservoir-system simulation model using HEC models and mass balance simulation as its basic concept, CROPWAT 8.0 and also a statistic approach. The optimization is applied using trial and error approaches to reach the objectives, maximize the yield and minimize the shortages of no water distribution.

Hydrological analysis from historical discharge and rainfall-runoff analysis with HEC HMS found that the available water inflow to Jatigede Reservoir in the last 20 years shows significant changes, higher runoff in the wet season and lower runoff in the dry season due to the increasing impervious surface area in the catchment of Cimanuk River Basin. Simulation of reservoir operation using HEC ResSim 3.0 found that the elevation of the water level of the reservoir in the period January 1969-December 2007 varies between 230-261 m with the average 238-244 m. Daily operation with applying highest rule priority between DMI and irrigation gives the result failure (no water distribution) for irrigation and drinking water 35% for DMI and Irrigation and 46% for failure when applying highest rule priority between Hydropower and Irrigation. Maximum power generation varies between 590 GWh and 670 GWh per year.

Trial and error has been applied on simulation with HEC ResSim to find prioritized stack of goals/objectives based on flow target, pool elevation target, power target, and environmental target. The result shows with applying more specific the range of flow target to each demand, the failure of water distribution to DMI and irrigation decreases from 33% to 8% and range of daily water distribution to DMI varies between 2.3-3.2 m^3/s, irrigation 14-23 m^3/s, and power 31.4-38.4 m^3/s. The balance method in release allocation strategy of reservoir simulation gave a not optimal result in average of water distribution and power generation for all scenarios. Optimization in water distribution can be reached when a sequential method in release allocation strategy is applied for two outlets: irrrigation and hydropower. The result shows that with average flow to power outlet 61.2 m^3/s annual power generation on average can reach 217 GWh and maximum 667 GWh.

To increase the yield for all demand, it is suggested to control the water such that only one outlet goes to the power plant first or sequential method, to obtain higher flow for power generated then flowing out to the downstream for consumption by irrigation and DMI. In this case the water yield for power demand will reach on average 56.8 m^3/s or 92.5% of reliable water needed to reach the peak power generation. The water also can

overcome water demand in the downstream for irrigation, DMI, and environmental flow.

Calculation of possible cost sharing for irrigation is found for full supply cost (capital and Operation and Maintenance) Rp. 1,900 per m^3 in the wet season and Rp. 2,600 per m^3 in the dry season, which is equivalent with Rp 186,000 per ha in the wet and dry season, whereas for drinking water it was found Rp 3,200 per m^3 of water. Considering the flood damage downstream due to reservoir operation, the operation in Full Supply Level at EL 260 m will give 77% reduction of damage, whereas at EL 247 m will give 98% reduction of damage. However, each scenario of operation to minimize the damage cost of flood downstream will give loss of storage and reduce water yield of water supply.

Key Words:

Reservoir Operation, Simulation and optimization, Water Distribution, Cost Sharing