

Optimizing CIP and O&M Costs for Economic Sustainability

Consuming up to 35 percent of the energy used by municipalities, water supply and wastewater treatment systems are among the most energy-intensive facilities owned and operated by local governments. The social and political pressures to efficiently manage these facilities are compounded by rapidly changing regulatory demands, aging infrastructure needs, and uncertain population growth. Typically, these uncertainties are addressed by incorporating redundancy and conservatism in the planning and design of new facilities, which increases cost. Instead, a better solution is to reduce costs and risk through increased knowledge and forecasting capabilities.

What is OPTIMO®?

Developed by Carollo to help utilities manage complex, interconnected treatment and conveyance systems, OPTIMO® uses optimization algorithms to maximize treatment capacity while minimizing risks, operation and maintenance costs, and demands on natural resources. This innovative planning tool is a mass and energy balance model that simulates water and wastewater flow routing, treatment, distribution, and energy supply and demand. The model accounts for multiple physical and water quality constraints, while minimizing total system O&M costs.

OPTIMO® is especially applicable to utilities that operate multiple and/or interconnected facilities, but can also be used effectively by single-plant utilities.

OPTIMO® may be operated in two different modes.

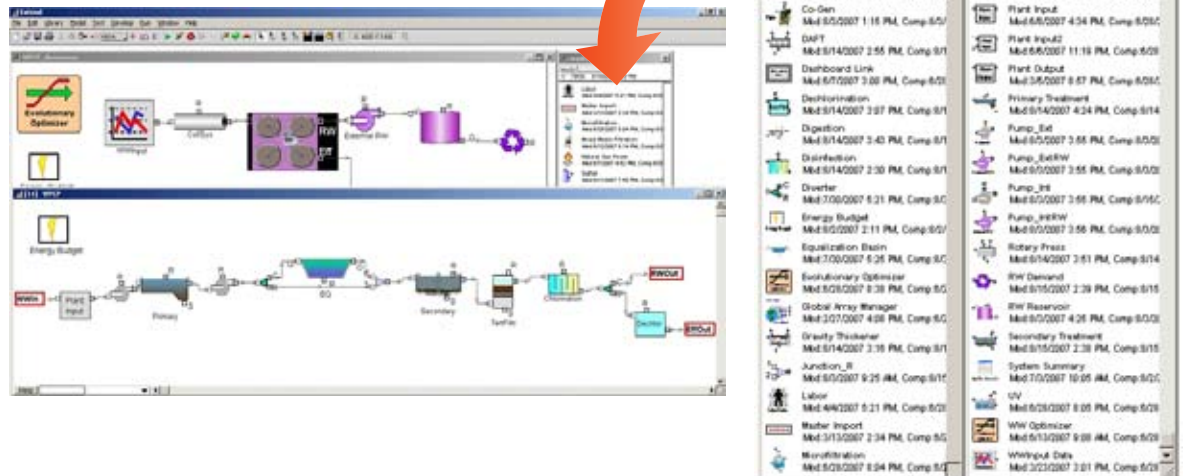
- **Scenario run mode** can be used to determine the need and timing of new facilities. For example, if the existing system cannot convey projected flows, the model will identify the bottlenecks and additional required capacities for each scenario, raising a red flag to the user that capital improvements are required.
- **Optimization mode.** OPTIMO® will determine the lowest cost scenario, utilizing “hidden capacity,” minimizing energy and chemical consumption, reducing greenhouse gas emissions, and satisfying recycled water demands.

Model Features

A powerful and flexible planning tool, OPTIMO® is:

- **User friendly.** The “drag ‘n drop” user interface allows for rapid generation of “what if” scenarios in minutes.
- **Simulation based.** Flow balance and cost calculations are based on time series data inputs: influent flow, power rates, and recycled water demands.
- **Customizable.** The model is not “hard coded” and may be easily modified to fit individual utility needs.
- **Comprehensive.** OPTIMO® incorporates engineering, financial, and regulatory models into one model.

OPTIMO® tracks flow, pollutants, energy, chemical, and labor costs in each unit process and throughout a treatment plant. The “drag ‘n drop” feature allows for rapid model configuration from customized libraries.



"Dedicated to creative, responsive, quality solutions for those we serve."

Typical Scenarios

OPTIMO® helps to answer fundamental questions under a variety of planning, operations, and engineering scenarios. Some examples include:

Fundamental Question	Model Application	Model Results and Implications
Planning: What new capital facilities are required and when are they needed?	Input projected flow and loads based upon projected population growth rates. Run model in scenario mode.	Processes with capacity limitations are identified and required additional capacity for new capital project is reported.
Operations: How can capacity be optimized and operations costs minimized?	Input the range of flow diversion and storage operational settings. Run model in optimization mode to minimize energy use.	Model determines bypass, diversion, and storage operational settings to optimize existing capacity and minimize energy use.
Engineering: What new facilities are required, and where in the system are they needed?	Drag and drop new facilities into the model from the customizable library and connect into treatment train. Run model in scenario mode.	Model reports cost, energy usage, and pollutant reductions based on new unit process. Also reports overall treatment train pollutant removals for comparison to regulatory standards.

How it Works

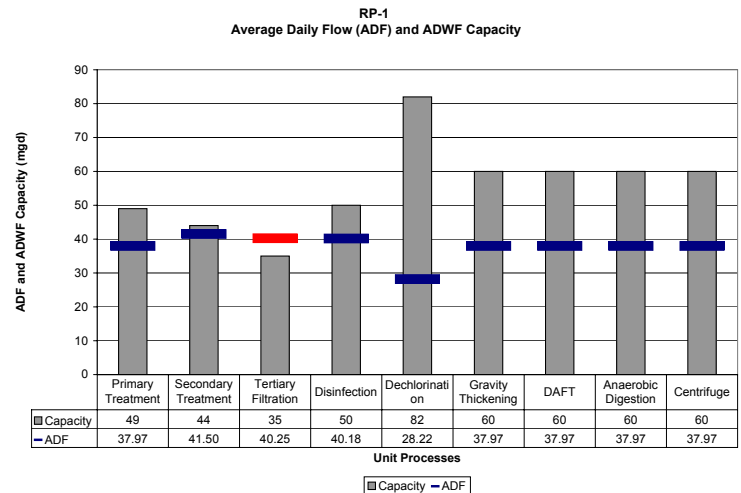
OPTIMO® allows configuration of complex water and wastewater systems that may include conveyance systems, treatment processes, flow equalization/storage, and/or water distribution systems from a library of “blocks.” The user connects these blocks (much as one would configure a flow chart or schematic) and inputs the desired operational parameters. The user may configure a “base case” and numerous scenarios for model test runs.

A summary block displays key output data including total O&M and capital costs, processes with insufficient peak and average capacity, and whether or not water demands are satisfied.

Case Study: Inland Empire Utilities Agency

Inland Empire Utilities Agency (IEUA) owns and operates multiple wastewater treatment plants with different treatment capacities, process capabilities, and discharge/reuse alternatives. The IEUA system consists of liquid treatment at four reclamation plants and solids treatment at two facilities. Several of the plants are interconnected with the ability to divert wastewater and/or solids to other plants. Given the complexity and interdependent nature of IEUA's facilities, determining the optimum set of operating conditions was challenging.

IEUA utilized OPTIMO® in both the scenario and optimization run modes. The scenario mode helped identify capacity bottlenecks in the existing system for future influent flows. This identified which of the plants should be expanded first, and the optimum timing for the expansions. The optimization mode determined the settings for bypasses and diversions for the lowest O&M cost, while satisfying recycled water demands and regulatory requirements.



Working with Inland Empire Utilities Agency, Carollo ran OPTIMO® in both the scenario and optimization modes to determine system bottlenecks and identify bypass and diversion settings for the lowest cost operation of multiple interconnected treatment facilities.