Transforming Water:

Water Efficiency as Stimulus and Long-Term Investment

Alliance *for* Water Efficiency

Position Paper

December 4, 2008

About the Alliance for Water Efficiency

The Alliance for Water Efficiency is a broad-based non-profit organization located in Chicago and dedicated to the efficient and sustainable use of water in the United States and Canada. It brings together a diverse range of stakeholders to advocate for water-use efficiency and conservation. Providing safe drinking water, maintaining economic competitiveness, and protecting ecosystems are all enhanced by improvements in water use efficiency. Reducing water demand and network water loss are often the lowest cost options for developing new supplies and meeting environmental needs.

The Alliance web site contains a wealth of information on conservation programs and practices. We invite you to visit us for further information at **www.allianceforwaterefficiency.org**

Carole D. Baker
Chair, Board of Directors

Mary Ann Dickinson
President and CEO

Contributors to this Analysis

David Mitchell
General Partner
M.Cubed
mitchell@mcubed-econ.com

Thomas Chesnutt, Ph. D.
President
A & N Technical Services
tom@antechserv.com

Janice Beecher, Ph.D.
Director of the Institute for Public Utilities
Michigan State University
beecher@msu.edu

David Pekelney, Ph.D.
Director of Policy Research
A & N Technical Services
pekelney@antechserv.com

Alliance for Water Efficiency
300 W. Adams Street, Suite 601
Chicago, Illinois 60606

www.allianceforwaterefficiency.org

Transforming Water: Water Efficiency as Stimulus and Long-Term Investment

Summary

Water Efficiency programs have an established track record as cost-effective long-term public resource investments. Less well understood are the short-term economic impacts of these rapidly scalable and adaptable programs, and the ability of these programs to quickly deliver economic benefit as well as sustainable solutions. This paper quantitatively examines the short-term economic growth impacts of water/energy efficiency investments, specifically in terms of job creation, income, GDP, national output, water savings, and other benefits.

Our consultant team modeled a wide range of water/energy efficiency program possibilities, across all water-using sectors and involving indoor, outdoor, and water system efficiencies. This modeling clearly confirms that economic stimulus benefits could be broadly distributed throughout the national economy:

1. The economic output benefits range between $2.5 and $2.8 million per million dollars of direct investment.
2. GDP benefits range between $1.3 and $1.5 million per million dollars of direct investment.
3. Employment potential ranges between 15 and 22 jobs per million dollars of direct investment.

Thus, direct investment on the order of $10 billion in water/energy efficiency programs can boost U.S. GDP by $13 to $15 billion and employment by 150,000 to 220,000 jobs and could save between 6.5 and 10 trillion gallons of water, with resulting energy reductions as well.

This modeling clearly confirms that economic stimulus benefits could be broadly distributed throughout the national economy.

Stimulus benefits from these investments are comparable to other public infrastructure investment options, with the important added advantage that they can be deployed in short time frames and can be readily scaled according to need. The long-term strategic, economic, social, and environmental benefits of these programs also make them “no-regret” investments in the nation’s future.

Introduction

When considering water infrastructure-related stimulus investments, it is important to avoid thinking too narrowly in terms of reconstructing existing infrastructure. Indeed, some amount of investment in system reconfiguration can offer improved efficiencies. This position paper labels these investments as "water efficiency" programs, and includes:

- **Investments in improved indoor water use efficiency** that yield the same or improved customer benefits while using less water—such as high efficiency toilets (or HETs), clothes washers, dishwashers, showerheads, and faucet aerators.
- **Investments in improved outdoor water use efficiency**—such as smart irrigation controllers, improved irrigation equipment, and real-time irrigation efficiency monitoring.
- **Investments in commercial/industrial/institutional water use efficiencies**—such as cooling tower retrofits, plumbing fixture replacement, and process water improvements.
- **Water utility efficiency improvements**—including system leak detection and control, energy efficiency audits, and water rate reform.

Though this paper focuses primarily on quantifying the stimulus effects of investments in water efficiency programs—in terms of increased economic activity and total jobs created—there are also important qualitative benefits of water efficiency as a stimulus investment:

1. Water efficiency programs connect directly to communities, necessitating citizen involvement.
2. Water efficiency programs empower water customers to control their water bills.
3. Water efficiency programs beneficially impact low income communities that have a disproportionate share of outmoded fixtures and infrastructure.
4. Water efficiency will be a 21st century growth industry, and these programs can firmly reinforce the position of U.S. manufacturers as leaders in water efficient technology innovation in product design.
5. Water efficiency programs directly address distressed communities, where water distribution infrastructure has not been adequately maintained or replaced and where household and commercial appliance stocks tend to be older and less efficient.
6. Water efficiency programs can reduce long-term political conflicts between regions and adjoining countries.
7. Water efficiency programs can vastly reduce the use of energy to pump, treat, and pressurize water systems.
8. Increasing water efficiency can forestall the need for energy-intensive new water supply development.
9. Reduced energy results in reduced greenhouse gases and an increase in national energy independence.

Methodology

An input-output (I-O) model of the U.S. economy was used to evaluate the near-term economic benefits of large-scale investments in water and energy efficiency programs. Near-term economic benefits were measured in terms of creation of jobs and labor income, and contribution to gross domestic product (GDP) and national output. Impacts were evaluated with IMPLAN I-O modeling software and the 2007 national data file.

Several types of water/energy efficiency program investments were evaluated. These included:

- rebate and direct install programs aimed at replacing older, less efficient appliance and plumbing fixture stock;
- outdoor water use programs involving landscape surveys and equipment upgrades;
- commercial/industrial cooling tower water/energy retrofits;
- industrial process water improvements; and
- municipal water utility leak detection and system water loss reduction programs. In all cases, program specifications and cost estimates were based on actual water/energy efficiency programs developed for U.S. municipal water utilities.

Program expenditures were subdivided into the following categories:

- expenditures for repair, maintenance and new construction;
- expenditures for new physical assets;
- expenditures for surveys, installation, and other services; and
- expenditures for program administration.

Category-specific unit expenditures were developed for each program (e.g. physical asset costs per toilet replaced or per cooling tower retrofitted).

The category-specific unit expenditures were then mapped to the appropriate economic sectors in the IMPLAN I-O model.[1] Unique mappings were done for each water/energy efficiency program to account for the different expenditure patterns across the programs. In cases where program expenditures involved purchases from retail or wholesale suppliers, IMPLAN's margining capability was used to account for the entire value chain from manufacturing to transportation and warehousing and then to wholesale and retail distribution. In situations where product manufacturing involved multiple stages or processes, expenditures were further divided to account for all manufacturing steps (e.g. high efficiency toilets involve ceramic, plate metal, plastic, and possibly wood manufacturing sectors).

In cases where programs involved cost-sharing with end-users (e.g. a rebate program that covers half the cost of a new appliance or water using device) it was assumed that end-users would offset program-induced expenditures by an equivalent reduction in expenditures on other goods and services. In other words, the analysis took the conservative stance that these programs would redirect business and household expenditure into efficiency investments, but not increase overall spending beyond already planned or anticipated levels. In this way, the methodology only counted the economic benefits associated with direct investment from national stimulus programs, and does not double count benefits from economic activity that would likely have occurred anyway.

The changes to sector final demands resulting from the program mappings were run through the IMPLAN I-O model to determine the impacts to employment, income, GDP, and national output. Total impacts estimated with the model consist of the direct and indirect impacts of program expenditures. The direct impacts include jobs, labor income, and output associated with the direct spending by the water/energy efficiency programs. The indirect impacts result from the ripple effect of this spending on backward linked industries and disposable household income.

[1] The IMPLAN model includes 440 separate economic sectors. IMPLAN sectoring is based on the North American Industry Classification System and the Bureau of Economic Analysis 2002 U.S. Benchmark Tables.

Results

The economic benefits per million dollars of direct investment for the range of programs evaluated are shown in Table 1. Output benefits range between $2.5 and $2.8 million per million dollars of direct investment. GDP benefits ranges between $1.3 and $1.5 million per million dollars of direct investment. Employment potential ranges between 15 and 22 jobs per million dollars of direct investment.

The programs in Table 1 were selected for illustrative purposes only. Other programs of similar design focusing on other aspects of water/energy efficiency would be expected to provide similar stimulus benefits.

Thus, direct investment on the order of $10 billion in water/energy efficiency programs similar in scope to those shown in Table 1 has the potential to boost U.S. GDP by $13 to $15 billion and employment by 150,000 to 220,000 jobs.

Table 1

Economic Stimulus Benefits, Per Million Dollars of Investment

Total impact per million dollars of direct investment	*Million $ (except employment)*			
Program Option	*Output*	*GDP*	*Labor Income*	*Employment*
Water System Loss Control	$2.82	$1.44	$1.05	21.6
ET Irrigation Controller Rebate/ Direct Install Programs	$2.55	$1.31	$0.85	20.4
HE Toilet Rebate Program	$2.54	$1.47	$0.96	18.0
HE Toilet Direct Install Program	$2.46	$1.38	$0.87	17.2
Industrial Water/Energy Survey and Retrofit Program	$2.78	$1.31	$0.89	15.6
Retrofit Cooling Towers with Conductivity and Ph Controllers	$2.47	$1.29	$0.78	15.4
Restaurant Surveys and Direct Install Equipment Retrofits	$2.79	$1.26	$0.82	14.6

Impacts calculated using IMPLAN Pro Version 2.0.1021 and 2007 national economy data file.

The model results indicate that economic stimulus benefits would be broadly distributed through the national economy. Table 2 shows the distribution of GDP and employment benefits at the 2-digit NAICS level of sector aggregation, assuming $10 billion of direct investment in water/energy efficiency programs.[2]

Table 2

Distribution of Benefits from $10 Billion of Direct Investment in Water/Energy Efficiency Programs

Economic sector *2-digit NAICS*	**GDP** *Million $*	**Employment** *Jobs*
Ag, Forestry, Fish and Hunting	$89	1,706
Mining	$181	591
Utilities	$232	438
Construction	$1,112	16,917
Manufacturing	$2,313	24,315
Wholesale Trade	$1,016	8,353
Retail Trade	$1,398	24,768
Transportation and Warehousing	$357	5,235
Information	$431	2,459
Finance and Insurance	$753	5,594
Real Estate and Rental	$1,054	5,500
Professional— Scientific and Tech Services	$818	9,123
Management of Companies	$305	2,242
Administrative and Waste Services	$682	18,191
Educational Services	$57	1,651
Health and Social Services	$437	8,328
Arts— Entertainment and Recreation	$78	2,059
Accommodation and Food Services	$220	7,077
Other Services	$1,113	17,548
Government and Non NAICs	$857	13,409
Total	**$13,501**	**175,504**

[2] Table 2 assumes direct investment is divided evenly across the programs shown in Table 1.

Water Savings

The estimated costs for the diverse range of water efficiency programs yield water savings at unit costs ranging between $170/million gallons (rate reform/water budgets) and $1,600/million gallons (industrial process), with an average around $575/million gallons. An accurate accounting of water savings depends on the exact mix of programs implemented, so savings estimates must be general until it is known what the programs are that will be selected. Plumbing fixtures cannot be replaced twice for double the water savings, for example. It is conservatively estimated that a well-implemented set of programs could yield water savings in the range of $1,000-$1,500/million gallons.

Thus, the water savings from a $10 billion water efficiency investment could be as follows: For a range of water efficiency programs costing on average $1,000/million gallons, 10 trillion gallons of water total, or 2.7 billion gallons per day. For a range of water efficiency programs costing up to $1,500/million gallons, that same investment of $10 billion would yield 6.5 trillion gallons of water total, or 1.8 billion gallons per day.

The scale of this volume of water is best thought of as a comparison. It could supply the urban water requirements of 5 percent of the U.S. population over a 10 year time period, or 50 percent of the U.S. population for a year.

Rapid Deployment Potential

Water/energy efficiency programs can be rapidly deployed and scaled to need. These are key advantages with respect to the current economic crisis. The nation's economy is currently in a race against time. Water/energy efficiency programs require much less time to plan and deploy than do large infrastructure works. By directing stimulus investment into water/energy efficiency program deployment, the new administration can hit the ground running while it mobilizes resources for larger public works projects. The feasibility of rapid efficiency program deployment has been proven over many years by western U.S. water managers responding to periodic droughts and shortages. There now exists a range of demonstrated approaches for quickly deploying efficiency programs in the field, initiated in time periods of 90 days or less.

Aid for Distressed Communities

Some of the best opportunities for conservation investment are in lower-income areas where water distribution infrastructure has not been adequately maintained or replaced and where household and commercial appliance stocks tend to be older and less efficient. The City of Los Angeles pioneered the use of community-based-organization (CBO) deployment models for ultra-low flush toilet installation in the early 1990s. Working with local CBOs not only helped the city to replace over 2 million toilets, but also created employment opportunities where unemployment rates were highest. Many water/energy efficiency programs do not require highly skilled labor to implement. These types of programs are well suited for assisting communities suffering from endemic underemployment.

"No Regret" Investments in the Nation's Future

The long-term strategic, economic, social, and environmental benefits of water/energy efficiency programs make them "no-regret" investments in the nation's future. Investing in these programs now will, over the longer term, help advance national energy policy, promote sustainable resource use, contribute towards GHG emissions reduction, and lessen mounting regional conflicts over water resources.

Diffusing Regional Water Conflicts

Pressures on the nation's overstretched fresh water resources are spawning regional conflicts over water resources. Wrangling among Colorado Basin states, in the grips of a decade-long drought, is intensifying. States in the southeast are now locked in legal battle for control of fresh water supply, and the Chicago Tribune reports that potentially huge battles over water are looming in the Great Lakes region as cities, towns and states fight for access to the world's largest body of fresh surface water.

In every case, the source of conflict is the same: demands for fresh water are outpacing available supplies. California has reached a point where there is simply not enough water to meet the demands of industry, agriculture, and households in an environmentally sustainable way unless new ways to do more with less are found. It is seeking to reduce per capita water use by 20 percent by 2020. Similarly, Texas has been warned that it will need to reduce per capita water consumption by 25 percent in the next two decades in order meet growing demands. Las Vegas is now paying homeowners to rip out their lawns and taking other drastic actions to save water. These imbalances have prompted the Interior Department to warn that "explosive population growth and the emergence of the demand for water for environmental restoration and attainment of the goals of the Endangered Species Act will typically define the extent and severity of water supply-related conflicts." Water use efficiency investments will be a key component of policies intended to address these imbalances.

Contribution to National Energy Policy

The water and energy sectors are highly interdependent. Water utilities and water customers use enormous amounts of energy to withdraw, treat, and distribute water. Thus, saving energy becomes one of the most compelling reasons to save water: it is good for the economy and good for the environment in terms of reduced oil dependence as well as greenhouse gas reduction. Both water and energy efficiency reduce other negative externalities as well. Saving water also saves chemicals produced in energy-intensive processes. Thus, advanced water efficiency must be part of the "low-hanging fruit" that can be captured as part of a comprehensive energy policy.

Water utilities can save energy with efficient pumps and efficient pumping practices, including off-peak pumping to adequate storage. Water and wastewater utilities may also find ways to cogenerate energy onsite in order to reduce electricity demands. Infrastructure improvements that reduce leakage and losses also save both water and energy. Efficient water use by all customers (industrial, commercial, and residential) provides across-the-board savings by avoiding energy costs throughout the entire production cycle. Reductions in hot water use directly save both energy and water, with appreciable benefits to households. Smart meters may play a role in promoting both water and energy efficiency.

Bold leadership and policies are needed to help realize the opportunities presented by the energy-water nexus. The time has come for more explicit integrated approaches to water-energy management. Water efficiency cannot displace water infrastructure, but it can become an integral part of the infrastructure. Water systems and water usage in the U.S. are far from optimal. The costs are paid by the environment and the economy in terms of both water and energy.

Consider these energy consumption facts:

The California Energy Commission has documented that 19% of the state's electric energy load is related to the pumping, treatment and distribution of drinking water and the collection and treatment of wastewater.

A full 32% of the state's natural gas load is related to the heating of consumer end use hot water.

The Commission documented that 95% of its energy efficiency goals could be met with water efficiency programs at 58% of the cost, thereby demonstrating the clear cost effective value of water efficiency programs.

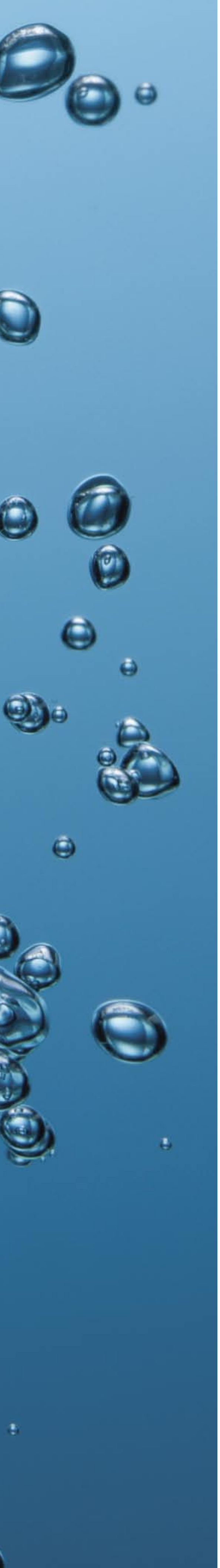
The California State Water Project is the largest single user of energy in the state, consuming an average of than 25% of the total electricity consumption for the entire state of New Mexico. In the process of delivering Bay-Delta water to Southern California, the project uses 2-3% of all electricity consumed in the state.

A study done nearly a decade ago documented that 4% of the nation's electricity use goes towards moving and treating water and wastewater, although that figure is deemed by most experts to be much lower than the actual national average.

Approximately 80% of municipal water processing and distribution costs are for electricity.

Groundwater supply from public sources requires 1,824 kilowatt-hours per million gallons—about 30% more than supply from surface water, primarily due to a higher requirement of raw water pumping from groundwater.

To reach universal coverage by 2025, nearly 3 billion people need to be linked with a water supply and more sanitation, thereby increasing the electricity consumption of the water and wastewater sectors by 33%.



For more information:

California Energy Commission

Integrated Policy Report:
www.energy.ca.gov/2005publications/CEC-100-2005-007/CEC-100-2005-007-CMF.PDF

Center for Sustainable Systems

U.S. Water Supply and Distribution Factsheet:
http://css.snre.umich.edu/css_doc/CSS05-17.pdf

United States Department of Energy

Energy Demands on Water Resources Report to Congress
on the Interdependency of Energy and Water:
http://www.sandia.gov/energy-water/docs/121-RptToCongress-EWwEIAcomments-FINAL.pdf

Alliance for Water Efficiency
300 W. Adams Street, Suite 601
Chicago, Illinois 60606

www.allianceforwaterefficiency.org

Printed on recycled paper using soy-based inks. FSC and Rainforest Alliance Certified, Processed Chlorine Free Certified.