

CREATING A WATER-EFFICIENT FUTURE FOR NORTH CAROLINA:
Recommendations from Successful Water- and Energy-Efficiency Programs

by

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ABSTRACT

North Carolina has become increasingly vulnerable to drought events in recent years as a result of population growth and the effects of climate change. While many western states began managing for water scarcity decades ago, water conservation is a relatively new management goal in much of the southeast. The aim of this study was to develop a set of recommendations for an effective water efficiency program for the state of North Carolina by applying the lessons learned by a select group of successful water- and energy-efficiency programs. Specifically, this research set out to answer the following questions: 1) what are some of the accomplishments and challenges faced by successful water- and energy-efficiency programs, 2) what drivers are responsible for motivating conservation-oriented behaviors, and 3) what is the most effective organizational framework for advancing water efficiency efforts? Research questions were addressed using a comparative case study approach. Data for this study were collected using document analysis methods and phone interviews with program administrators from five programs. Interviews were recorded and transcribed verbatim. Data were analyzed using NVivo 8, a qualitative research software program. Results of this study suggest that the creation of partnerships between utilities and environmental groups is the most effective organizational framework for advancing water efficiency efforts.

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I. INTRODUCTION

As a result of climate change, populations around the world are being exposed to greater variations in temperature, a higher frequency of storms of increasing severity, and longer-lasting droughts (Midkiff, 2007). The world must simultaneously address the impacts associated with exponential population growth, which has rendered many countries unable to meet their unprecedented demands for limited freshwater resources (Vickers, 2001; Gleick, 1993). As a result, by 2015 over 3 billion people are expected to live in areas of extreme water scarcity (McDonald and Jehl, 2003). Some predict that we may run out of water completely in areas of the United States, which would leave bottled water as the sole water source left for human consumption (Midkiff, 2007). While many western states began to implement water conservation measures decades ago, managing for water scarcity is a relatively new concept in much of the southeast (Midkiff, 2007).

North Carolina is one such location where water conservation is a relatively new management goal. As a result of record high temperatures and rainfall deficits from August to October of 2007, the state of North Carolina experienced its worst drought on record (NCDMAC, 2008). Fairly recent, rapid population growth in the region has made North Carolina even more vulnerable to drought events as demands for freshwater resources have increased (Bass, 2008). North Carolina must implement effective water conservation programs to reduce its vulnerability to future droughts, and to encourage more efficient use of this limited resource.

Some states in the United States have benefited from innovative water-efficiency programs that have resulted in substantial water savings while encouraging customers to consciously think about their water consumption. In addition, some energy-efficiency programs in the U.S.

provide example and precedent that can be of use to managers wishing to design innovative and effective water-efficiency programs. The purpose of this research is to study existing water- and energy-efficiency programs in the U.S. to develop an understanding of the necessary components that need to be included in the creation of a successful water efficiency program in North Carolina.

II. BACKGROUND

A. WATER EFFICIENCY & CONSERVATION MEASURES

Water efficiency refers to the idea of using water in smarter and more innovative ways so less is used to achieve the same quality of life. Sustainable water savings can be achieved when efficiency measures are coupled with conservation-oriented behaviors that encourage people to use water wisely. As described below, many non-price- and price-based water efficiency measures exist that can produce substantial water savings including: conservation-oriented water rates, retrofit and rebate programs, irrigation restrictions and separate metering, xeriscapes and native gardens, water audits and leak detection and repair programs, water re-use and on-site storm-water capture, and public education and marketing campaigns.

Municipalities have achieved substantial water savings by using conservation-oriented water rates which, even when installed without other conservation measures, can result in a demand decrease of 5 to 8 percent or more (Stallworth, 2000). Managers may choose from multiple options when designing water rates for a particular service area. Historically, many utilities used declining block rate structures which charge consumers less as their water consumption increases. This rate structure was designed to provide an incentive for economic development as large, predominantly industrial water users could use substantial quantities of water while paying

only a small sum. In recent years, many water systems in North Carolina have been eliminating declining block rates and adopting more conservation-oriented rates such as: uniform rates which reduce the average demand, increasing block rates which charge more per block of increased water consumption, seasonal rates which charge more during peak season, and excessive use charges which are used during drought emergencies to discourage water use over a certain threshold (NCLM and UNC-EFC, 2008). Water conservation-oriented rate structures not only encourage drought preparedness through reduced consumption, they also increase awareness of current conditions through more accurate price signaling, and can help to delay the need for expensive infrastructure expansion projects (NC-DENR, 2004).

Introducing retrofit and rebate programs to improve and replace inefficient appliances and commodes can also result in substantial water savings. Low-flow showerheads use about half as much water as regular showerheads, and dual-flush toilets can reduce water usage by up to 25% without compromising their efficiency (H₂OUSE Newsletter 3). In 1990, New York City faced a water shortage as a result of drought emergencies and population growth. To remediate the situation, a low-flow toilet rebate program was introduced to replace over 1 million inefficient toilets from 1994 to 1997 (Ritchie, 2007). The savings associated with using a toilet rebate program compared to the avoided infrastructure expansion projects equaled \$250 million. The low-flow toilets saved between 70 million and 90 million gallons a day throughout the city, enough water to fill 6,700 Olympic-sized swimming pools (Martindale, 2001).

Water metering and/or restrictions provide another means of encouraging water conservation during drought events. Water use trends in North Carolina show that usage peaks during the summer months when people are irrigating their lawns, but this is also when the State is more

prone to scarcity. As a result of the disproportionate use of water for outdoor use compared to indoors, many municipalities enact water restrictions to limit irrigation to certain days or hours to reduce evaporation and waste. Some cities are also beginning to enforce the use of separate metering for irrigation which has two main benefits: 1) it tells consumers how much they are using on their lawns relative to indoors and how much they are saving during times of drought, and 2) it allows utilities to charge separate rates for irrigation use above a certain threshold and in extreme cases to be able to shut off the meters without impacting indoor use (Linstroth, 2008).

Alternatives to restricting irrigation include rethinking landscaping and vegetation choices to limit water use outdoors. The types of grasses, trees, and shrubs present in your garden can significantly impact the amount of watering required. In the western states there has been a movement encouraging xeriscaping of gardens, a form of landscaping using plants that require very little water to survive. Significant outdoor water savings can also result from switching to native species that have adapted to the climatic conditions of the region.

Water audits help to create an accurate record of how much water is being used and of how much water is “unaccounted for” – i.e. lost before it reaches customers. By actively doing water audits, municipalities can increase their water accountability through the detection and repair of leaks which result in high levels of unaccounted for water. A lot of potable water is lost through leaky pipes in dire need of repair. This not only wastes water, it also wastes energy and money for the treatment of water that is not being consumed.

Many states have been able to reduce the amount of potable water being used for irrigation by encouraging the use of gray water (wastewater from sinks, baths, showers, or washing machines). Additionally, on-site storm-water capture can result in significant water savings

through the use of rain barrels or cisterns. Gray water and water captured by rain barrels and cisterns provides an additional source of supply that can be used for outdoor watering.

Public education and marketing campaigns also play an important role in encouraging people to think more consciously about their water consumption. If done effectively, these campaigns can result in significant and long-term changes in behavior leading conservation practices to become a way of life and not just a drought mitigation tool.

B. BARRIERS TO WATER EFFICIENCY

Despite the innovations noted above, a number of significant barriers exist that are preventing the implementation of effective water efficiency programs. Some of the barriers that will be discussed in more detail below include: financial, market-based, infrastructural, regulatory and informational, historical, perceptual, and barriers regarding affordability concerns. While these barriers are all specific to North Carolina, they may also be responsible for preventing the implementation of efficiency programs elsewhere.

1. Financial Barriers

Historically, the EPA and the USDA were responsible for financing infrastructure and water system improvement programs. Since 1990, these federal funds have been greatly reduced and the state has become the most important source of grant funding. Today, the EPA distributes its funds to states to administer revolving loan programs such as the DWSRF (Drinking Water State Revolving Fund) and the CWSRF (Clean Water State Revolving Fund). Both of these funds can be important sources of financial assistance to states attempting to implement water efficiency measures and programs (US-EPA, 2003). Activities that can be funded by these two programs include: replacing aging infrastructure, installing water meters, funding retrofit and rebate

programs, installing dual pipe distribution systems for water re-use, and developing water efficiency plans (US-EPA, 2003).

Unfortunately, while these efficiency projects are eligible for funding there is currently insufficient funding to meet North Carolina's needs so only high priority projects are being funded by the DWSRF, these include projects involving the replacement of aging infrastructure or projects to comply with the Safe Drinking Water Act (Miles, 2008).

Additionally, many communities fear degraded bond ratings as a result of revenue instability from conservation-oriented water rates (Hughes, 2005). Lower bond ratings can impact a community's ability to qualify for private lending programs. But, given the decline in federal funds many communities have to rely on private lending sources to fund their infrastructure improvements. A fear of downgraded bond ratings acts as a barrier to water efficiency programs because bond ratings are generally highest for communities that are able to accommodate growth through supply expansion projects and increased revenues rather than through strict conservation measures and increased efficiency (NC 2030 Water Initiative).

The most significant financial barrier associated with water efficiency programs is the fear of reduced revenues. Many water utilities operate with an incentive to sell as much water as possible to increase revenues -- i.e. the more gallons sold; the more funding is available to be used for operation and maintenance costs. This "business model" creates a significant disincentive for many utilities to implement effective conservation programs because they would lose revenue as a result of reduced sales.

2. Market Barriers at the Home and Business Scale

The market for more efficient products is growing, but not everyone is taking advantage of these measures because of market-based barriers such as: high initial purchase costs, insufficient rebate programs, split incentives, transaction hassles, and varying durations of home occupancy (Cillo and Lachman, 1999).

High initial investment costs discourage buyers from investing in more efficient products. In general, more efficient products cost more (at least when they initially come on the market). For example, when compact fluorescent light bulbs first came out they were significantly more expensive than incandescent bulbs. This high initial cost not only discourages home-owners who may not have the money to pay for the initial investment, but it also discourages developers who may not be willing to pay extra for end use savings they will not personally receive. Rebate programs help to increase awareness of the existence of more efficient products. Unfortunately, many rebate programs are insufficient when it comes to encouraging participation because there are never enough for everyone.

Split incentives result when developers and residents do not share the same incentive when it comes to the installation of more efficient, cost-saving appliances (Cillo and Lachman, 1999). For example, most homes are built by builders and developers who provide the appliances and units for the home but are not responsible for paying the bills. Builders, landlords, and developers have no investment in the end-use savings and so there is very little incentive for them to choose the most efficient appliances, especially if they cost more.

Currently, no single source exists to gather the auditors, contractors, and inspectors to perform water audits and retrofit homes or businesses. This means that people must transact this business

with multiple entities. The complexity associated with dealing with so many different entities discourages many people from taking advantage of these services.

Additionally, many efficiency programs neglect to consider the duration of occupancy when they encourage people to invest in water efficiency measures. The average duration of occupancy in a home is approximately 7 years, so if you will not see savings from your investment for another 10 years, there is very little incentive to invest in these measures.

3. Infrastructural Barriers

There are two main barriers to water efficiency programs that concern infrastructural improvement and expansion projects. As populations continue to expand in cities across the country, many communities have used infrastructure funding to lay new pipes to expand water services, while existing infrastructure sits in disrepair (US-EPA, 2006). North Carolina is no exception. As a result of years of insufficient funding and maintenance, North Carolina is expected to need \$7.64 billion over the next 25 years in order to make capital improvements to aging distribution systems in dire need of replacement. Without these infrastructure improvements, the state of North Carolina will continue to lose an annual average of 11 percent of unaccounted for water, almost 35 billion gallons, through leaking distribution pipes (ASCE, 2006). While this is a big problem that needs to be addressed, it also means that available loans are often targeted away from other conservation and efficiency efforts.

Secondly, many municipalities tend to build big and impressive dams, reservoirs, and pipelines to increase water supplies rather than introducing more cost-effective water efficiency programs. These prestige- and investment-driven supply expansion projects can result in substantial environmental degradation while incurring significant construction costs that are often paid for

using taxpayer dollars. Because big engineering projects can result in increased bond ratings as a result of capital expansion and the prospect of increased revenues, these projects are becoming a serious impediment to demand-side conservation and efficiency programs throughout the country.

4. Regulatory and Informational Barriers

Many states throughout the U.S. struggle to implement effective water conservation programs due to insufficient information regarding water resources or because the state has not enabled legislation mandating such programs. After severe droughts affected much of the U.S. during the 1980s, many states began to create drought emergency response plans and pass legislation mandating water conservation. While most states now have these emergency response plans in place, very few have adequate legislation addressing water efficiency during times of plenty.

Until 2008, North Carolina had only minimal legislation regarding statewide water conservation efforts. As a result, during droughts many neighboring communities in North Carolina responded by adopting very different emergency water conservation approaches. Many communities did not have a clear understanding of how water use in one community could seriously impact water users downstream (NC-DENR, 2004). After North Carolina faced a serious drought in 2002, House Bill 1215 Conserve Water/Promote Green Energy was passed. The bill required the following actions to be taken: North Carolina's Department of Environment and Natural Resources (DENR) had to evaluate and report on water conservation measures being used in North Carolina, the Environmental Management Commission (EMC) had to adopt rules to govern water conservation and reuse during drought, and local governments had to create local water supply plans (LWSPs) (NC-DENR, 2004). However, a lack of coordination when these plans were created made their effectiveness difficult to evaluate.

After North Carolina experienced an exceptional drought in 2007-2008, the North Carolina legislature passed House Bill 2499, an act designed to improve drought preparedness and response throughout the state. While the bill asks for the mandatory registration of water withdrawals, and the implementation of strict water conservation measures during times of scarcity, North Carolina still has inadequate policy regarding the need for continued water efficiency even during times of plenty. A policy designed to encourage everyday efficiency and conservation would help to prepare communities across North Carolina from waiting too late to implement emergency conservation measures.

Informational barriers also affect the successful implementation of water efficiency programs throughout the U.S. Many states, including North Carolina, have insufficient data regarding the amount of water being withdrawn from their ground water reserves. For example, currently no system exists to monitor more than 2 million already established private wells in North Carolina (Holman, Kleczek, and Polk, 2007). Due to the lack of property rights associated with groundwater resources in North Carolina, people are often unwilling to report their withdrawals for fear that they will end up with limited access. To project the future demand and supply conditions that North Carolina will face in coming years more information on the current available supply of the state's water resources must be obtained.

Furthermore, many municipalities throughout the U.S. lack independent technical expertise to make necessary water efficiency improvements. Technical expertise is needed to change current rate billing systems to tiered-water rates and to bill more frequently in such a way as to send out effective price signals. Even installation of new appliances and water efficient irrigation technologies can require some expertise. Technical assistance programs that are operated by

engineering firms or private utilities often push larger projects to make a profit while independent technical experts can properly install water efficient technologies in a cost-effective manner.

During the droughts of 2002 and 2007-2008 in North Carolina, many neighboring municipalities responded using widely different emergency responses, leading to a lot of confusion. Stage 2 Conservation levels that were in effect in one community were not equal to Stage 2 Conservation levels next door but they were all receiving the same news broadcasts. While a “one size fits all” program does not account for the fact that communities have different available supplies and demographics, a more comprehensive regional approach to the management of North Carolina’s water resources could significantly reduce the confusion and encourage faster adoption of drought-response measures.

Additional efforts also need to be made to send more accurate water-use information to water customers. For example, if water bills are going to be used to send price signals to customers, bills need to be sent more frequently and must contain accurate usage information in units that people will understand. For example, many counties in North Carolina still receive their water bills on a bimonthly timeframe which means that any rate increases associated with a drought will not be received until 2 months later resulting in many disgruntled customers.

5. Historical Barriers

The success of water efficiency programs in North Carolina has been limited by perceptions that are deeply rooted in the historical context of the state. In the 1930s, the population of North Carolina was around 3 million people (NC-REDC). During the 20th century, North Carolina experienced widespread poverty. In an effort to increase economic growth throughout the

region, North Carolina encouraged industry migration to the area through its large labor force, low wages and production costs, and cheap and abundant resources (Wood, 1986). All of these factors gave southern industry a competitive advantage over their northern counterparts and many industries began to migrate south. The Textile Industry is one such example of an industry that moved down from New England to take advantage of the cheaper production costs and the use of free untreated water from streams (Wood, 1986).

Today, many water-intensive industries continue to pay nothing for the use of water from North Carolina streams because water is still thought of as a cheap and abundant resource (Rogers, de Silva, and Bhatia, 2002). Between 1990 and 2000, the population of North Carolina grew by 21.4 percent from 6.6 million to 8 million people (NC-REDC). Such recent and fairly rapid population growth throughout the state has increased the demand for freshwater resources resulting in a serious strain on North Carolina's available water supply.

6. Perceptual Barriers

Multiple barriers exist to the implementation of effective water efficiency programs that are a result of peoples' perceptions. For example, people who grew up in North Carolina when it was considered to be a "water-rich" state may be less aware of how the stresses on the state's water resources have changed as a result of population growth and more variable precipitation.

Another example of a perceptual barrier is the American mentality that green lawns are an essential feature of our homes and should be watered and fertilized accordingly. Especially in North Carolina, people prefer to use fescue grass on their lawns which requires more water to stay green during hot summer months than other grass species.

Artificially low prices for water resources, especially in the southern U.S., have resulted in the perception that water is a plentiful and cheap resource that should be free. In North Carolina where we have historically charged very low prices for water resources, shifting to charging the “true cost” of water and implementing conservation-oriented water rates will result in price increases across the board and a lot of unhappy customers. While water in a stream is free, water that has been treated and pumped to your faucet is a service that has costs associated with it. In order for utilities to be able to cover costs associated with the operation and maintenance of their facilities and the distribution networks, it is necessary that people pay the full cost for the services associated with their water usage.

Most importantly, people need to continue to be conscious of their water usage even during times of plenty. More emphasis needs to be placed on demand-side programs that encourage people to more consciously think about reducing their consumption over time instead of accepting big engineering projects that encourage excessive use by giving consumers a false sense of a growing supply.

7. Affordability Concerns

A general fear faced by many municipalities is that by increasing water rates and charging the “true cost” of water an undue burden will be placed on low-income customers who can least afford it. This concern is especially pronounced in areas where a high percentage of the population live at or below the poverty threshold. Unfortunately, North Carolina state law does not allow municipal water enterprises to develop classes of customers based on income or to have separate rate structures based on the household income of customers. So, a system may not charge a low-income customer who uses 5,000 gallons less than it charges a wealthy customer

who consumes 5,000 gallons (Hughes, 2005). This law is stopping municipalities from increasing water rates for those that can afford it. Because rate structures must apply to all customers regardless of income, water rates are kept low and corporate and industrial users can take advantage of the artificially low prices while our reservoirs become depleted.

Low-income customers typically use less water than other single-family customers but often live in areas with older infrastructure with more leaks (Hasson, 2002). If water audits for leaks were required before raising prices, low-income customers could achieve substantial savings and be rewarded for conserving and using less water.

There is no reason to let affordability concerns hinder conservation efforts. With the help of assistance programs, low-income customers can create payment plans that enable them to pay their water rates over time and are also given the resources to cover the cost of water audits, retrofits and initial costs to qualify for new efficient appliance rebates. These programs ensure that water savings can be achieved by all customer classes regardless of income.

C. EFFICIENCY PROGRAM ACHIEVEMENTS & SOLUTIONS

While there are no programs that have been able to successfully address *all* of these impediments, there are several innovative water- and energy- efficiency programs that offer insights on how to achieve more efficient use of our water and energy resources.

1. Water Efficiency Programs & Partnership Formation

While the water efficiency movement is still very much in its infancy, several programs have been able to achieve substantial water savings through the formation of non-profit partnerships. As a result of globalization, it has become increasingly important for organizations from different sectors to work alongside each other. The water efficiency sector is no exception.

Partnerships are defined by Long and Arnold (1995) as: “voluntary collaborations between two or more organizations with a jointly-defined agenda focused on a discrete, attainable and potentially measurable goal” (Hartman, Hofman, and Stafford, 1999). While “most of us prefer to stay on paths we know, sharing goals and work practices with people who think and act like us: governments working with governments, businesses with businesses, non-profit groups with non-profit groups” (Gentry and Fernandez, 1998), we now live in a globalized world where it is becoming increasingly difficult for organizations to succeed as completely isolated entities. As a result of increased globalization, many organizations have begun to forge partnerships with other parties to achieve collective goals. The following section outlines five possible theories behind the formation of partnerships that can be applied to the water efficiency sector.

Gentry and Fernandez (1998) suggest that one of the primary reasons for the formation of partnerships to manage scarce resources, such as water, is the occurrence of a widespread crisis such as a drought that affects the interests of all the stakeholders involved.

It is not enough that governments, businesses or NGOs believe there is a crisis affecting their individual interests. Only when other groups recognize that the crisis also impairs their ability to achieve their individual goals does a basis for significant cooperation exist. Collective action to fulfill complementary individual needs which cannot be met alone is the foundation on which... partnerships are built (Gentry and Fernandez, 1998).

Large-scale droughts can therefore, foster the formation of partnerships between such stakeholders as utilities, environmental groups, and businesses to work collectively to encourage water conservation to deal with the crisis. For these partnerships to be successful, they must be able to foster collaboration between stakeholders in spite of their differences. As defined by Gray (1989), collaboration is “a process through which parties who see different aspects of a problem can constructively explore their differences and search for solutions that go beyond their own limited vision of what is possible.”

Additional evidence suggests that some partnerships are formed in an effort to minimize production and transaction costs for firms. Transaction costs include expenses associated with arranging, managing, and monitoring transactions in markets (Barringer and Harrison, 2000). By forming partnerships, organizations can reduce transaction costs. For example, if a partnership organization can buy efficiency measures in bulk, it can lower transaction costs for individual firms as a result of increased economies of scale. However, for most non-profit partnerships involving the management of scarce resources, such as water, transaction costs are not likely to be the primary driver responsible for the creation of an alliance because these organizations are mission-driven rather than profit-driven.

The formation of partnerships might be more likely to result from shared dependence on resources, such as water. According to Barringer and Harrison (2000), “firms partner with other firms to obtain access to critical resources and to increase their power relative to other organizations.” Trade organizations are an example of partnerships forged as a result of resource dependence. Water conservation partnerships function in the same way as trade organizations in that members are often provided with “access to special services at low costs, relevant industry information, legal and technical advice, and a platform for collective lobbying” (Barringer and Harrison, 2000).

An additional theory behind the formation of partnerships is the stakeholder theory which envisions organizations at the center of a network of stakeholders. Organizations often form partnerships with other stakeholders in an effort to achieve common objectives, such as water conservation. Barringer and Harrison (2000) suggest that “these cooperative relationships can be

a powerful mechanism for aligning stakeholder interests and can also help a firm reduce environmental uncertainty.”

The learning theory also offers insight into the formation of partnerships suggesting that these interorganizational relationships are formed in order to “capitalize on opportunities for organizational learning” (Barringer and Harrison, 2000). Partnerships can be very effective at transferring knowledge between organizations.

Knowledge creation occurs in the context of a community, one that is fluid and evolving rather than rigidly bound or static. The canonical formal organization with its bureaucratic rigidities is a poor vehicle for learning. Sources of innovation do not reside exclusively inside firms; instead they are commonly found in the interstices between firms, universities, research laboratories, suppliers and customers (Powell, Koput, and Smith-Doerr, 1996).

Learning is also a primary motivation for the formation of partnerships such as trade associations and water conservation partnerships because these interorganizational relationships foster the sharing of information between different sources of expertise. However, Barringer and Harrison (2000) emphasize that the degree of learning that results from partnerships “depends on the degree of connectivity and the degree of centrality” between and within such organizations.

In the past few decades, several partnerships have been created to more effectively and efficiently manage water resources. Members of these partnerships generally include utilities, non-profit environmental groups, businesses, and large-scale associations. While the scale and exact composition of these partnerships vary, they are all working to transcend organizational and geographic boundaries to foster the sharing of information between members.

Responsibilities of partnerships include the collection and distribution of information and educational materials on leading conservation and efficiency practices, facilitating training and informational workshops, and in some instances, the distribution of efficiency equipment to

utilities at lower prices due to increased economies of scale. In July of 2007, The Alliance for Water Efficiency, a new national non-profit organization, was created with the sole mission of encouraging water efficiency. This national organization was created by reviewing several leading state and regional partnerships such as the California Urban Water Council (CUWCC), the Colorado WaterWise Council, and the Partnership for Water Conservation, among others.

2. Energy Efficiency Programs

Energy efficiency programs may also serve as valuable models for water conservation programs because they face many of the same disincentives as water efficiency programs. The energy-efficiency movement began in the 1970s as a result of the energy crisis and efforts to decrease our energy dependence on the Middle East. Initially, efficiency programs were initiated by utilities who were simultaneously trying to sell as much energy as possible to increase their revenue stream (Nichols, Sommer, and Steinherst, 2007). Electric utilities face a similar disincentive when it comes to conservation because increased efficiency results in reduced sales (Nichols and Raskin, 1989). However, the advent of several independently administered (non-utility) energy efficiency programs during the past decade has resulted in substantial energy savings and greenhouse gas emission reductions. These programs help utilities to overcome the disincentive to conserve by focusing on the provision of energy efficiency services, leaving the utilities to concentrate on increasing their energy sales (Nichols et al., 2007). Independently administered energy efficiency programs in New York, New Jersey, Maine, Vermont, Wisconsin, and Oregon all provide promising examples for how we can effectively overcome barriers to water conservation and efficiency (Nichols et al., 2007).

III. RESEARCH QUESTIONS

The primary goal of my master's project was to create a set of recommendations for the design of an effective water efficiency program by applying the lessons learned by a select group of existing energy- and water-efficiency programs. To do this, I researched three main questions:

- 1) What are some of the accomplishments and challenges faced by successful energy- and water-efficiency programs?
- 2) What drivers are responsible for motivating conservation-oriented behaviors?
- 3) What is the most effective organizational framework for advancing water efficiency efforts?

IV. MATERIALS & METHODS

1. TRADITION OF INQUIRY

I used a comparative case study approach, comprised of interview and content analysis methods, to collect data for this project. As described by Schramm (1971),

the essence of a case study, the central tendency among all types of case study, is that it tries to illuminate a decision or set of decisions: why they were taken, how they were implemented, and with what result.

This comparative case study attempts to shed light on a select group of water- and energy-efficiency programs specifically focusing on: why they were founded, how they were implemented, and their challenges and accomplishments.

According to Yin, a case study is “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (Yin, 1994). In the case of this particular study, I had a hard time disentangling the phenomenon (i.e. the founding of efficiency programs) from the context (i.e. the particular place and time). The case study tradition of inquiry was chosen for this project, in particular, because: 1) it is able to deal with a situation in which there are many

variables of interest, 2) it relies on multiple sources of data, and 3) it allows for the “prior development of theoretical propositions to guide data collection and analysis” (Yin, 1994).

2. DATA COLLECTION & ANALYSIS

Data collection for this project involved the conduction of semi-structured phone interviews with water conservation and energy efficiency administrators from both utility-run and independently-run programs located in Washington, Oregon, California, and Colorado. See Appendix I for a compilation of the different questions that were asked. Phone interviews were recorded using a digital audio recorder after permission was granted by participants. Hand-written notes were also taken as a supplement to the recording. I began recruiting participants in November 2008 using an email requesting a phone interview with the program administrator to discuss their program in more detail. Interviews were conducted between December of 2008 and early February of 2009. Each interview lasted between 40 minutes to an hour. In accordance with the Institutional Review Board requirements, participants could end the interview at any time.

These interviews were used to develop an understanding of the potential accomplishments and challenges faced by conservation and efficiency programs. Initially, administrators were asked if there were any site-specific criteria that they needed to address when designing their programs. However, after conducting the first interview, I reframed the question to ask administrators whether they had been able to identify particular drivers that were responsible for motivating conservation in their respective service areas.

Questions pertaining to organizational structure and administration were asked to assess the advantages and disadvantages of developing partnerships between utility and non-utility entities. Ultimately, these data were used to make recommendations regarding the effectiveness of

different types of organizational frameworks for advancing water-conservation efforts in North Carolina and elsewhere.

Initially, I had intended to interview administrators from a group of at least 20 water conservation and energy-efficiency programs; however, after my first interview was conducted, I decided to reduce the scope of this project for time management purposes. I focused my efforts on five programs including: one example of an independently administered energy-efficiency program, two utility-run water conservation programs, and two independently administered water conservation organizations.

The specific programs that were researched in this study include: Oregon's Energy Trust, Seattle Public Utilities Saving Water Partnership, Denver Water's Tap+Smart Conservation Program, the Partnership for Water Conservation, and the California Urban Water Conservation Council (See Appendix II). I also used program websites and annual reports to collect background information on: administration type, program costs, reported water/energy savings, and cumulative benefit-cost ratios where available (Table 1).

Phone interviews were transcribed verbatim using the digital audio recording and hand-written notes. To organize and analyze my data, I used NVivo8, a qualitative research software program. I used a framework analysis approach to analyze my data as outlined by Lacey and Luff (2007) in Box 1.

Box 1. Key Stages in Framework Analysis:

- Familiarization
- Identifying a thematic framework
- Coding using NVivo 8
- Charting of themes into tree nodes
- Mapping and Interpretation

Firstly, I began the framework analysis by familiarizing myself with the data. The process of familiarization occurred throughout the course of transcribing the interviews, as well as through additional reading of the completed transcripts. While reading through hard copies of the transcripts, I began to identify a thematic framework and highlighted key themes and noted them in the margins. I then imported the written transcripts of the interviews into NVivo 8 and coded for the following themes: the drivers that resulted in the founding of the program, key program measures that were included and how they were determined, program achievements and challenges, the advantages and disadvantages of developing partnerships, as well as important site-specific criteria that needed to be addressed including motivators of conservation in the area. Themes were initially coded as free nodes (i.e. individual themes) which were then charted into tree nodes (overarching themes) comprised of more specific themes (nodes). Eventually, mind maps of tree nodes and their branching themes were created as a visual representation of the relationships present. Maps were then used as an additional source for data interpretation.

Initially, the scope of this project included talking with independently run (non-utility) energy-efficiency organizations with the aim of using these organizations as models for a similar independent, non-profit water conservation program for North Carolina. That is, I wished to assess the effectiveness of utility-run vs. independently-run water conservation programs.

However, after interviewing Janet Nazy of the Partnership for Water Conservation in Puget Sound, I began to research the theory and motivation behind the creation of partnerships between organizations such as utilities and non-profits. I was persuaded that my initial scope was too narrow because even though several independent (non-utility) water conservation programs exist, they do not exist in isolation. Additionally, my initial hypothesis that utility-run programs would be less effective as a result of the perverse incentives noted above (See Financial Barriers)

neglected to consider the potential effectiveness of utility-run programs that are addressing these barriers while partnering with other community organizations, such as Denver Water and Seattle Public Utilities. Therefore, in all subsequent interviews I attempted to take a more objective approach by asking program administrators (regardless of their administration type) about the advantages and disadvantages of developing interorganizational partnerships as a means of more effectively encouraging water conservation and efficiency.

V. INTRODUCTION TO PROGRAMS

The five programs that were included in this study were chosen because of their exemplary leadership in the field of water or energy conservation and efficiency. The reasoning behind the inclusion of these specific programs will be discussed in more detail below. While some of these programs have long histories working in the field of conservation, others are new to the field. Regardless of the breadth of their experience, they all offer unique insight into the inner workings of water- and energy-efficiency programs – their challenges, their accomplishments, and future directions for the field.

1. The Partnership for Water Conservation

In 2004, the Partnership for Water Conservation was created as a nonprofit 501(c)(3) organization in the Puget Sound region. It was designed to facilitate discussion between non-profits, environmental groups, businesses, and utilities. The Partnership has also worked to include organizations such as the Washington State Nursery and Landscape Association and the Master Builders Association in an effort to bring businesses that use or have a vested interest in water into their membership. Following the example of the California Urban Water Conservation Council, the formation of the Partnership was encouraged by utilities who felt there

was a need for greater coordination and communication across the region. While the Partnership currently serves 11-12 counties that surround the Puget Sound, they are considering expanding to reach counties in eastern Washington where there is a big need for conservation efforts (2008 12 16, Interview with Janet Nazy).

The Partnership for Water Conservation's mission is to actively engage:

the Puget Sound region in conservation efforts generating measurable water savings that support communities, provide long-term economic benefits and protect watersheds by helping sustain necessary flows in rivers and streams (PWC, 2005).

In order to fulfill this mission, the Partnership provides various programs and services for its customer base including: regional water conservation information programs; education programs; contract services including water audits, workshops, and rebates; and advocacy.

When members join the Partnership, they declare an affiliation with one of three groups called 'caucuses'. These caucuses are: the environmental caucus, the utility/local government caucus, and the business/consumer/ratepayer caucus (PWC, 2005).

I chose to interview Janet Nazy, the executive director, of the Partnership for Water Conservation because this partnership emerged as a unique example of the successes that can be achieved through cooperative efforts in the field of water conservation. While several regional non-profits in the field of energy efficiency exist, there are very few examples of this type of organizational framework for running effective conservation programs for water resources. The Partnership offered a unique opportunity to observe how a non-profit organization can overcome some of the disincentives faced by utility-run programs while still incorporating utilities within its membership structure.

2. Energy Trust of Oregon, Inc.

The state of Oregon has a longstanding history of working on energy efficiency and renewable energy development according to Energy Trust's executive director, Margie Harris. The first programs began in the state during the 1970s as a reaction to the energy crisis. In the past 20 years, the Pacific Northwest is estimated to have saved around 65.7 million megawatt hours (MWh) through energy efficiency efforts (2009 01 14, Interview with Margie Harris).

In 1996, four states in the Pacific Northwest got together and conducted a Regional Review. They were particularly concerned about the impact of energy costs on low-income customers and the impact of energy on the environment. As a result of this review, a systems benefit charge (SBC) was created to collect funds for investments in efficiency, which added a three percent charge to the utility bills of all customer classes for two of the largest electric utilities in the state: Pacific Power and Portland General Electric. The recommendation for this charge was passed as a part of Oregon's Electric Restructuring Law, Senate Bill 1149, in the 1999 session. The additional revenues were invested in projects such as the weatherization of low-income housing and energy-efficiency projects for schools. Energy Trust was referenced in the Electric Restructuring Law of 1999 as an independent non-profit entity (2009 01 14, Interview with Margie Harris). Since 2002, the Energy Trust has worked to address the concerns that were originally raised in the Regional Review, through its mission: "to change how Oregonians produce and use energy by investing in efficient technologies and renewable resources that save dollars and protect the environment" (Energy Trust, 2009). The funds to fulfill Energy Trust's mission come from the systems benefit charge and are used to invest in energy efficiency and renewable energy projects throughout the state.

I chose to include the Energy Trust in this study because it acts as an example of how independently run energy efficiency programs can act as valuable models for effective water conservation programs – in part, because of their longstanding history relative to water conservation programs, and also through their efforts to partner with other organizations. While there are several independently administered energy efficiency programs located throughout the country, Energy Trust is unique in that they choose to partner with local utilities. “It is a philosophical approach that we have used from the inception of our time here and it is my personal belief that we should not be in competition with the utilities; we should be leveraging the utilities,” says Margie Harris, executive director of Energy Trust (2009 01 14, Interview with Margie Harris). This is a very unique model in the country – even compared to other non-profit energy efficiency programs – that provides great insight into the benefits of forming partnerships with utilities.

3. Seattle Public Utilities: Saving Water Partnership

The Saving Water Partnership is a regional program that was adopted in 1999. Partnership members include Seattle Public Utilities and 17 other local utilities that fund water conservation programs in Seattle and King Counties. The current long-term goal of the Partnership is the “Regional 1% Conservation Program” which has aimed to make the region 10 percent more efficient over the 10 year period between 2000 and 2010. A 10 percent reduction in water use would result in savings of almost 14.5 million gallons of drinking water per day according to the most recent annual report (SWP Annual Report, 2008). These savings would mean that demand at the end of 2010 would be the same as it was in 2000 despite population growth in the region. To achieve this goal peak season per capita consumption must decrease by at least one percent each year between 2000 and 2010. In order to track the progress of this goal, a *Ten Year*

Conservation Program Plan was created (SWP Annual Report, 2008). Seattle Public Utilities and their wholesale customers are committed to achieving this goal in compliance with the Washington Water Use Efficiency Rule of 2003 which regulates municipal water suppliers in the state of Washington.

While some utilities that were originally a part of the Saving Water Partnership have chosen to break away and run their own programs independently, the majority of utilities in this region have realized the value of being part of a regional effort. Seattle Public Utilities are not only partnering with local utilities in the Saving Water Partnership, but are also a member of the Partnership for Water Conservation, and are partnering with energy utilities in the area to achieve both energy and water savings. The Saving Water Partnership was the EPA WaterSense Partner of the Year in 2008 and is considered to be a national leader in its efforts to conserve water. I interviewed Al Dietemann, Water Conservation Lead for Seattle Public Utilities to learn more about their achievements in the field of water conservation and to gain insight into some of the advantages and disadvantages of forming partnerships.

4. Denver Water: Tap+Smart Conservation Program

Denver, a city that is no stranger to drought, has been actively pursuing water conservation efforts since the 1930s when signs on street trolley cars in downtown Denver had “Save our water, our most precious resource” written on them (2009 01 26, Interview with Melissa Elliott). The most current incarnation of their conservation plan, Tap+Smart, was initiated after the drought in 2002-2003 when customers cut their water use by a third as a result of conservation messaging. After these savings were achieved, the board of Denver Water decided to make these reductions in water use permanent. Their long-term goal is to reduce overall water use by 22

percent by 2016 which would amount to a gradual savings of approximately 35.18 million gallons per day (2009 01 26, Interview with Melissa Elliott).

The Tap+Smart program uses a combination of “carrots”, such as rebates and incentive contracts, and “sticks”, or regulatory incentives, to get customers to change their behavior to eliminate waste, and also to incorporate efficiency measures to make any necessary water-use as efficient as possible. Denver Water has become internationally renowned for its creative marketing campaign entitled “Use Only What You Need” which promotes their Tap+Smart program. In addition to these program successes, Denver Water is also actively partnering with other organizations in the region as a member of the Colorado WaterWise Council which works to “promote and facilitate the efficient use of Colorado’s water”, as well as with Xcel Energy to market both energy- and water-efficient products and behaviors. Denver Water has also partnered with a local non-profit called the Mile High Youth Corps which trains young people as plumber’s apprentices to conduct low-income retrofits in about 2,000 homes a year (2009 01 26, Interview with Melissa Elliott).

Denver Water was chosen for this study because it provides a fine example for how to run a successful utility-run water conservation program, while offering additional insight into the benefits of partnering with neighboring organizations.

5. California Urban Water Conservation Council

The California Urban Water Council (CUWCC) was originally founded in response to the drought that California suffered during the late 1980s. There was a proposal at the time by the State Water Resources Control Board to regulate utilities to employ water conservation measures. Environmental organizations were suing various utilities for ‘unreasonable use’ of the

state's water resources (2009 02 06, Interview with Chris Brown). In response to this litigation and the pressure of pending regulation from the State Resources Control Board, major utilities in the state joined forces with leading environmental organizations to negotiate a Memorandum of Understanding (MOU) which was signed in 1991. The membership, which originally consisted of 100 members, has now grown to 398 members (2009 02 06, Interview with Chris Brown). Those signing the MOU agree to develop and implement, when it is cost-effective to do so, water conservation Best Management Practices (BMPs) into their programs in accordance with the Council's mission: to increase urban water use efficiency statewide. The Council works to create partnerships between urban water agencies, non-profits, and the private sector. The CUWCC also maintains a BMP reporting website for members to report their savings. This information is used to track statewide water conservation progress. Additional information on the BMPs for water conservation is provided on the CUWCC website which has become internationally renowned (www.cuwcc.org). I talked with Chris Brown, executive director of the CUWCC to find out why the CUWCC has been such a successful partnership and to consider the feasibility of applying lessons learned by the CUWCC to the creation of a similar partnership in the state of North Carolina.

Table 1: Background Information on Participating Organizations

Organization	Location	Date of Inception	Organizational Affiliation	Program Costs	Most Recent Reported Water/Energy Savings	Cumulative Savings	Cumulative Benefit:Cost Ratio
Partnership for Water Conservation¹	Puget Sound, Washington (Regional)	2004	Nonprofit 501 (c)(3)	-	-	-	-
Energy Trust of Oregon, Inc.²	Oregon (Statewide)	2002	Nonprofit	\$56 million	306,600 MWh 230,000 Dth	-	3.2
Seattle Public Utilities: Saving Water Partnership³	Seattle, Washington (Regional)	2000	Utility-run	\$3.12 million	1.28 million gallons per day	7.63 million gallons per day	-
Denver Water: Tap+Smart Conservation Program⁴	Denver, Colorado	2003	Utility-run	\$2 million	12.57 million gallons per day	-	-
California Urban Water Conservation Council⁵	Sacramento, California (Statewide)	1991	Nonprofit	\$2.59 million	-	1,512 million gallons per day	-

¹ Partnership for Water Conservation website (www.bewatersmart.net). Data unavailable.

² Energy Trust of Oregon 2007 Annual Report. (April 15, 2008). Savings converted into MWh from average megawatts. Reported savings and costs from 2007.

³ Saving Water Partnership 2007 Annual Report. (2008). Reported savings and costs from 2007.

⁴ Denver Water's Tap+Smart Solutions Magazine (2008). Reported savings and costs from 2007.

⁵ California Urban Water Conservation Council 2006 Annual Report. (2007). Reported savings and costs from 2006.

VI. RESULTS & ANALYSIS

What are some of the accomplishments and challenges faced by successful efficiency programs, and what is the most effective organizational framework for advancing water efficiency efforts?

Before explicitly answering these research questions, I will consider the circumstances that led to the implementation of these selected programs, their accomplishments and how they measure success, the challenges they faced, how they managed to motivate their customers to conserve, how they ensure the sustainability of their programs, and the advantages and disadvantages associated with their chosen organizational framework.

A. CIRCUMSTANCES LEADING TO PROGRAM IMPLEMENTATION

Before we consider whether a similar program could be implemented in the state of North Carolina, it is important to take into consideration the circumstances that led to the development of these programs. Upon asking program administrators about the circumstances surrounding the founding of their programs, I determined that there are many unique factors that contribute to the successful implementation of efficiency programs including: the occurrence of drought events, the presence of a pre-existing relationship of interdependence between communities, growth that spurred the need for conservation as a cost-effective means of meeting demands, the presence of enabling legislation, and the support of stakeholders.

States such as California and Colorado have been managing droughts for decades. This longstanding history of managing for water scarcity made the implementation of their water conservation programs almost second nature. Extraordinary drought events work to heighten awareness about the need to conserve water resources and can (and have) served as drivers for the development of water conservation programs in several states. Both California and

Colorado's current water conservation programs were developed after exceptional droughts affected their states.

The state of California also provides a unique example of how a pre-existing relationship of interdependence between water users can help foster the development of a statewide water conservation program. The formation of the State Water Project in the late 1950s by the California Department of Water Resources, which was originally designed to siphon water resources to water-scarce Southern California, may in fact have been a contributing factor, decades later, to the formation of their statewide water conservation program. While not generalizable across the entire state, the interdependence that grew from the State Water Project likely resulted in a regional conversation about water resources that could be re-initiated to address the issue of regional water conservation decades later. As Chris Brown of the CUWCC stated it, "ironically, a big project that provided water ends up being the reason everyone can sit at the same water conservation table decades later" (2009 02 06, Interview with Chris Brown).

Many states, such as Washington, had to implement water conservation programs as a cost-effective means of increasing available supply. Forecasted population growth throughout the region and concerns over environmental impacts associated with increasing demands for water resources led many utilities to begin considering alternative means of creating additional water supplies. For most utilities that have planned for growing demands, they should have some clear idea of the costs associated with creating a new supply.

That is a fundamental piece for them to understand what their incremental cost is for their next unit of supply. Once they've done that, then you can look and say ok, if we're going to pay this much for an increase in supply, how much could we purchase that supply back from our customers who are using our current water inefficiently? Once you have that information, then you go back to your rates and your forecasting and you see that if we do implement conservation we save this amount of water. Then look at the

financial impacts for the utility and look on the other side of the ledger and say ok, if we don't do conservation, what's the financial impact for the utility? For most utilities the cheapest water they'll ever get is water they conserve from their own customers. (2009 01 13, Interview with Al Dietemann)

Even in areas that are affected by drought, going out “onto the market [to] purchase additional water supplies and build additional storage for it and additional treatment capacity [is] much more costly than it is for a conservation program” according to Melissa Elliott of Denver Water (2009 01 26, Interview with Melissa Elliott).

The fact is, because of population increases and because of streams and water sources, we're always going to have to increase our water supplies or use it more efficiently and most times you have to do both. (2009 01 26, Interview with Melissa Elliott)

In addition to the factors noted above, programs are also implemented as a result of legislation. For example, the Washington Water-Use Efficiency Rule requires all municipal water suppliers to establish water savings goals, install service meters within 10 years, meet a distribution system leakage standard, develop a water use efficiency program, evaluate or implement water use efficiency measures to manage water use, and annually report progress towards meeting water savings goals (WDOH, 2003). Even in the case of energy efficiency in Oregon, Energy Trust was the product of state legislation, referenced in the Electric Restructuring Law of 1999. Sometimes legislation, or even litigation in the case of the California, can result in the necessary impetus to set up effective efficiency programs.

It is also important to have stakeholder support – both from customers, utilities, and from progressive leaders – in order to mandate the formation of a regional program. In the case of Denver Water, they had a very progressive board that pressed for the continuation of water conservation initiatives that ultimately resulted in the Tap+Smart Program. For California, it was concerned citizens from leading environmental groups that ended up pushing utilities to

reconsider their water-use. Even in the state of Washington, public support is what carries their water conservation programs forward. As Al Dietemann notes:

What we found more and more with our customer surveys, was that customers not only supported the utilities doing conservation, they wanted to see more and were willing to pay for it through their rates. So, I think that kind of public support will hopefully be transmitted to the elected officials. This was a public mandate that they wanted to step up to. It's like climate change and a variety of other issues that we are dealing with right now. It's a hot footed position and it's one that you don't want to be against conservation if you are an elected official here – it's not a place to be. That kind of strong political support is probably the foundation of our successful public effort and so it's probably what carries the momentum as we move forward.
(2009 01 13, Interview with Al Dietemann)

These factors are not all inclusive, nor are they essential, but they do offer insights into the potential circumstances that act as drivers for the formation of effective, long-term water- and energy- efficiency programs.

B. PROGRAM ACCOMPLISHMENTS

When thinking about what criteria characterize a successful water efficiency program, review of some of the accomplishments achieved by these programs that make them unique leaders in the field of water- and energy-efficiency and conservation is important. My data provided evidence of five types of accomplishments that will be discussed below using specific examples from each program. The five types of accomplishments include the: provision of effective communication and education tools, celebration of successes, delivering savings to underserved markets, achieving market transformation of emerging technologies, and achieving behavior and process changes to accrue resource savings.

The Partnership for Water Conservation

While the Partnership for Water Conservation is a relatively young organization, they have achieved some successes worth noting. Specifically, the Partnership has made significant strides

in its efforts to improve communication across the region and through its provision of education tools.

The Partnership has successfully “combined resources and expertise to deliver consistent, cost-effective programs and messages” (PWC, 2005). Prior to the formation of the Partnership, there was no standardized messaging across the region which confused customers. Additionally, the Partnership has worked to educate the public and foster communication through public forum events. Recently, they ran a public forum on global warming and its effects on conservation that was attended by 100 people (2008 12 16, Interview with Janet Nazy). They have also done six workshops for water users and providers focused on the benefits of water conservation and how to comply with the Water Use Efficiency Rule. Janet Nazy mentions another primary example of the Partnership’s successful ability to foster information sharing between utilities in the following statement:

*Something we didn’t do this year but we’re going to continue doing is what we call professional development meetings where utilities can come together , and the other members too, but basically aimed at utilities, to talk about what they are doing and share ideas ... a networking opportunity. That’s been very successful.
(2008 12 16, Interview with Janet Nazy)*

Furthermore, the Partnership has started an awards program to honor people who do conservation or who have advanced conservation throughout the region. The thought behind this celebration of success is that if successful conservation efforts are acknowledged, conservation will be thought of as a good idea and more people will want to participate. They have also bought efficiency devices and materials in bulk to leverage bulk buying resulting in lower prices. While this service is fairly new, there has been a lot of interest by utilities and the Partnership has:

seen people who have never bought anything before buy stuff and so I think that's a good thing. It is helping raise awareness and make it easier for them. Governments have to go through a whole bidding process usually and ... if they purchase from us they don't have to and so it helps them in the long run in a lot of different ways making it easier for them to get conservation items.
(2008 12 16, Interview with Janet Nazy)

While the Partnership was founded relatively recently, they are working hard to achieve their mission to encourage more effective water conservation throughout the Puget Sound region.

Energy Trust of Oregon, Inc.

The Energy Trust has a long and noteworthy history of implementing energy efficiency renewable energy projects throughout the state of Oregon. According to Margie Harris, the program's greatest accomplishments have been in the areas where other programs have not been as successful, mainly through their ability to deliver savings to previously underserved markets.

Some of them are in those underserved markets that I mentioned earlier, particularly industrial, that seems to get a lot of attention nationally because we have been able to penetrate those markets and deliver what we call mega-projects. They are very large-scale projects primarily in pulp/paper and lumber companies. And they've been big combined heat and power projects and they've been major process improvement programs that really benefit large industrial customers here and allow them to stay competitively in business and employ a lot of people.
(2009 01 14, Interview with Margie Harris)

In addition to these mega-projects, the Energy Trust has also been successful in encouraging the market transformation of emerging technologies. For example, the Pacific Northwest is highly saturated with compact fluorescent light bulbs (CFLs) because of the market transformation activities that Energy Trust and the Northwest Energy Efficiency Alliance funded. The Energy Trust has also been instrumental in encouraging the widespread use of more efficient front-loader washing machines and efficient dishwashers throughout the region.

Seattle Public Utilities: Saving Water Partnership

The Saving Water Partnership (SWP) has been particularly successful in its efforts to encourage changes in behavior, equipment, and industrial processes resulting in substantial water savings.

The SWP continued to be on target to meet its 2010 goal as part of the “Regional 1% Conservation Program”. In 2007, the program saved 1.28 million gallons per day (SWP Annual Report, 2008). They have achieved notable low cost savings by partnering with the Cascade Water Alliance to leverage programs with energy utilities, Puget Sound Energy and Seattle City Light, to distribute efficient showerheads and aerators throughout the region. They have also saved a lot of energy and water through their clothes washer incentive program for high efficiency clothes washers (SWP Annual Report, 2008).

On the commercial side, the Saving Water Partnership (SWP) has had a lot of success increasing the efficiency of pressure cooling processes by converting them over to a central cooling tower or to air cooling processes which eliminate water waste. Additionally, SWP has done a lot of work with commercial laundries.

Laundries in our area used to be really inefficient. We have probably increased the efficiency levels of commercial laundries by 75% in the last decade. They are using about 25% as much water as they did back then and they are probably actually doing more laundry than they did back then. (2009 01 13, Interview with Al Dietemann)

They have also worked to improve water efficiency in the food service sector, for bottling companies, and in hospitals.

Most people don't realize that a lot of x-ray machines and some of the vacuum pumps in hospitals only use water and there are technologies to convert them over to non-water use technologies. (2009 01 13, Interview with Al Dietemann)

The SWP has also worked hard to change behaviors of its customers to more consciously think about their water use. Evidence suggests that behavior measures are more cost-effective than equipment installation but:

you have to keep re-investing in the behavior messaging year after year after year or people will go back to their old wasteful ways. Whereas if you put a piece of equipment in, it is generally going to stay there and be utilized for the next 10, 15, or 20 years. (2009 01 13, Interview with Al Dietemann)

That being said, the SWP has also made substantial strides in this area through its long-term, continuous messaging efforts.

Denver Water: Tap+Smart Conservation Program

Denver Water's Tap+Smart Conservation Program stands out mostly because of its creative and cutting edge marketing campaign called "Use Only What You Need." This campaign has been particularly successful at encouraging people to actively partake in more conservation-oriented behaviors and activities. For three years, Denver Water has hired an advertising company to help with the campaign which costs around \$1 million a year - an expensive but highly effective investment.

The message "Use Only What You Need" came about because people don't like the word "conservation", they felt like it made them feel like they had to give up something. But, they did like the idea of reducing waste; they didn't like people wasting our natural resources. Using only what you needs says that if you really 'need' to take a ten minute shower, go ahead! Certainly, if you can get it accomplished in five minutes, we appreciate you doing that. (2009 01 26, Interview with Melissa Elliott)

The campaign is comprised of a lot of very creative elements. Last year they arranged orange, 55 gallon barrels into huge sculptures around the city to visually portray water wasted in various activities. One sculpture depicted the amount of water a leaky toilet wastes each month. Another one that stood 3 stories tall represented how much water an irrigation system can waste over the summer if it is not tuned properly (2009 01 26, Interview with Melissa Elliott).

Other marketing efforts were used to encourage people to save water by getting them to think about the impact of excessive water use on their rivers. In supermarkets conveyor belts that looked like rivers were installed at check-outs. The bar you put down to distinguish your order from the next person's had "Use Only What You Need" written on it and the belt said "keep our waters flowing, conserve" as it moves by. This program has been noted for its success as a water conservation awareness tool, and also as an example of a new marketing niche (2009 01 26, Interview with Melissa Elliott).

Denver Water also has a taxi cab that has been retrofitted so that it only contains the essentials needed to drive it. While the cab is still street legal, it draws attention because of its unconventional appearance – it is covered in clear panels and has only a driver's seat so passengers would have to sit on the floor. The cab also exhibits the "Use Only What You Need" message so that people can identify it with the Tap+Smart Program.

Denver Water also engages in a lot of event work to increase awareness about its Tap+Smart Program. They have someone dressed in a toilet costume emblazoned with "Stop running toilets!" participate in 5 km runs and other events. At a football game between Colorado State and the University of Colorado with 76,000 people present, the "running toilet" ran onto the field during halftime and was tackled by a security guard while the messages: "Stop running toilets!" and "Use Only What You Need" flashed on the screen (2009 01 26, Interview with Melissa Elliott).

Denver Water has also supplemented these marketing efforts with a television advertising campaign. The advertisement features a group of animated flowers that have had too much to drink. The tagline is "Don't let them drink too much!" Denver Water's "Use Only What You

Need” campaign has become nationally renowned because they have engaged in creative and cutting edge ways to get people to respond and interact with their messages rather than resorting to nagging their public to conserve. According to Melissa Elliott, 82% of Denver Water customers associate these messages with the Tap+Smart Program and are able to identify with the message suggesting that this technique really resonates with their customers (2009 01 26, Interview with Melissa Elliott).

Denver Water’s Tap+Smart Program also boasts a “High Bill Audit Program” which uses personal communication and education to encourage customers to reduce their water-use. Sometimes people call in questioning why their water bill is higher than expected. To answer these questions, Denver Water responds by providing water audits for individual residences. For example, for a single-family residence, the technician would do an indoor and outdoor inspection to check leaks from toilets, and underground sprinklers. The technician would also assess how long and how often the sprinkler system is set to run. Once the audit is complete, the technician then communicates with the property owner about what is happening, why their water use might be the way it is, and how they can solve the problem (2009 01 26, Interview with Melissa Elliott).

Once the changes have been made, the property is tracked and compared to a sample group that has not been talked to by a qualified technician. The results of this initiative are summarized below:

*We found that the sample group over the last two years has reduced their indoor water usage by 2%. The group that we went out and did the audits on reduced their water usage by 11%. So then that’s 9%. So just by having a gentleman go out and work one-on-one with his customers, we get 9% savings out of their water use.
(2009 01 26, Interview with Melissa Elliott)*

California Urban Water Conservation Council

One of the California Urban Water Conservation Council's greatest accomplishments is defined by the Council's efforts to encourage the market transformation of newer, more efficient toilet models. As a result of these efforts, California has surpassed other areas in the country in terms of the numbers of high-efficient toilet installations (2009 02 06, Interview with Chris Brown). Additionally, the Council has played a critical role in the research and development of new weather-based irrigation controllers. A new study showing the success of these controllers at reducing irrigation demand is expected to be published by the Council later this year (2009 02 06, Interview with Chris Brown).

One area that makes the Council unique, other than its experience, is that the education and training tools they provide are not only used by utilities in California, but are also used by utilities all over the world.

In fact, there are utilities all over the world that have links to the Council's website for their customers and for their own use on their own web pages. We have a web link that they can put on their website. I think we've lost count of how many utilities do that. I think we've had tens of thousands of hits on our website every month from around the world. (2009 02 06, Interview with Chris Brown)

C. MEASURES OF SUCCESS

How do you define the success of a water- or energy-efficiency program? While no definition clearly states what characterizes a successful program, inferences can be made through careful review of the above programs and how they have measured their success. Analysis of my data generated seven specific measures whereby the success of a water- or energy-efficiency program could be evaluated. These measures are summarized in Box 2.

Box 2. Measures of Success:

- Water and energy savings achieved
- Achievement of program goals
- Cost-effectiveness of program initiatives
- Environmental benefits
- Increased perceived value of conservation by customers
- Market penetration of efficiency products
- Increased participation in program efforts

All of these programs measure success by looking at the water or energy savings achieved over time as a result of their initiatives. For ‘hardware’ programs, meter readings can be monitored to measure savings over time. By comparing savings achieved by program participants to non-participants, programs can get an idea of how successful their programs have been at encouraging improved efficiency. It is much more difficult to measure the savings associated with behavior measures because in this case you are just encouraging customers to water their lawn less, or not to leave the water running while they brush their teeth. In order to measure these savings,

*you can do surveys with folks and take a look at changes in behaviors over time and develop a baseline. We’ve done that and kind of tracked whether the messaging and behavior changes are consistently changing over time and then trying to take some credit for those by asking people why they were changing their behaviors. If the response was they were doing so because they heard some type of utility-based messaging, then you can begin to start taking credit for some of those savings.
(2009 01 13, Interview with Al Dietemann)*

To get an estimated measurement of behavior savings, the Saving Water Partnership uses a subtraction process outlined below:

We have a pretty good idea of what demand would be in the absence of any conservation efforts through our demand forecasting and we have a pretty good idea, like I mentioned, of what our equipment and hardware savings are and we have a relative idea of how

influential our pricing is to customers. So, we make strong estimates on all of that and then the volume of water... that is left that we cannot fully account for, we assume has been saved through our behavior messaging. As long as our customer surveys are showing that people heard this messaging and a substantial number of them took some actions in that direction. We assume we must have been a part of that! I don't think it's a really bad assumption, because if you look at other parts of the state, even in Washington, where utilities don't have aggressive conservation programs and don't have aggressive messaging programs, they are not seeing those same conservation savings from their customers. So, we know that we must be having some kind of influence but honing that down to a decimal point is tough. (2009 01 13, Interview with Al Dietemann)

While it is difficult to measure these changes in behavior, this method does offer some insight into the success of the Saving Water Partnership's messaging campaign.

Some programs measure their effectiveness through the achievement of set program goals such as: increasing membership, or increasing awareness through growing workshop participation and wider newsletter distribution, or from positive evaluations from public forums. In some cases, these goals can refer to specific savings goals attached to programs within an overarching Conservation Plan as is the case for Denver Water's Tap+Smart Conservation Program. In other cases, programs may want to achieve savings goals while being able to maintain or improve production processes. For example, if you can reduce water use while maintaining or improving efficiency through the use of retrofits or process changes, such as in the case of Energy Trust's industrial mega-projects, you are also achieving water savings while allowing businesses to maintain their competitive edge.

Other programs measure their success by measuring the cost-effectiveness of their initiatives. In the case of Seattle Public Utilities, they use a Conservation Potential Assessment (CPA) which reviews 138 different water efficiency measures to determine which program measures are most cost-effective (2009 01 13, Interview with Al Dietemann). This assessment looks at the cost,

volume, and reliability for different conservation measures and determines the value of the measure for the utility, the individual customer, and to society in general (SWP Annual Report, 2008). Measures that result in significant cost savings and benefit utilities and customers alike will be considered the most successful. However, in some cases, the utility benefits and cost-savings must come first because the utility is the one bearing the cost (2009 01 13, Interview with Al Dietemann).

Additionally, some secondary benefits can also be used to measure the success of programs including those impacting the environment such as increased stream flow for wildlife habitat.

Customer surveys can also be used to determine whether the public's value of conservation has increased over time as a result of program efforts as was found by the Saving Water Partnership.

When we first started out 20 years ago, only about 20-25% of our customers thought water conservation was valuable in the Northwest and had any relevance and now about 80% of our customers respond to the same question saying that it definitely has value to them and we should keep doing it. So, you can see just in 20 years how strongly the opinion has swung in the public's mind. That happened not because we had serious droughts or whatever, but because we had this long-term, continuous messaging. (2009 01 13, Interview with Al Dietemann)

While market transformations can take up to five years to occur (2009 01 14, Interview with Margie Harris), as more water efficient products come on the market and people become more aware of the potential water and monetary savings, a greater number of people are beginning to invest in water efficient products. Just last year for instance, Denver Water increased the number of high-efficiency toilet rebates they distributed by 300 percent (2009 01 26, Interview with Melissa Elliott). While there may be other confounding factors responsible for the increased interest in more efficient products, this indicates that Denver Water has been instrumental in the market transformation for high-efficiency toilets in its service area.

It is also important to consider how program participation levels change over time. Initial participation levels for a program can give insights into what changes might need to be made based on the initial response. Additionally, some programs measure the success of their efforts by monitoring customer satisfaction levels over time using customer surveys. The success of water conservation initiatives is tied very closely with how identifiable programs and messages are by the public. Responses to customer surveys can give some indication as to whether these programs are being embraced by the public.

Many different strategies can be used to measure the success of programs over time. While ‘how’ these programs measure success is important, their ability to measure success over time is equally important and relies on these programs having clear, measurable goals and effective monitoring and evaluation protocols in place.

D. CHALLENGES FACED

When considering creating a water efficiency program for North Carolina, challenges to existing water- and energy-efficiency programs can be instructive. Analysis of my data provided evidence of at least twelve challenges faced by these programs (Grouped in Box 3). These challenges will be discussed in detail in this section.

Box 3. Challenges Faced by Programs:	
1. Droughts & Other Emergency Events	7. Offsetting behaviors
2. Jurisdiction & Autonomy	8. Difficulty expanding membership
3. Budgeting & Prioritization	9. Creating an ongoing program
4. The Economy	10. Lack of flexibility
5. Managing growth sustainably	11. Lack of understanding
6. Passive vs. Active Programs	12. Changes in strategy over time

Droughts & Other Emergency Events

While droughts and other crisis events can act as catalysts for program implementation and support, they also have the ability to act as a two-edged sword. Extraordinary drought events and severe storms, such as hurricanes, are hard to plan for but result in large fluctuations in water supply and demand, and utility revenues. For many utility-run programs, their ability to effectively encourage conservation without facing revenue deficits is dependent upon accurate forecasting and the implementation of relevant conservation rate structures.

All water conservation programs need to have plans in place to deal with droughts and floods before they occur. Rate changes must be properly explained to customers so they understand exactly why their rates are increasing and do not feel as though they are being punished for conserving (2009 01 26, Interview with Melissa Elliott). Unfortunately, rate changes are not always clearly explained to customers. The drought that affected Charlotte-Mecklenburg Counties in North Carolina during 2007-2008 meant that water rates had to go up by 15% because conservation during the drought resulted in a budget deficit for the utility. As Julia Oliver of the Charlotte Observer writes: “It’s official, Charlotte-Mecklenburg water and sewer customers: Your rates will go up because you conserved” (Oliver, 2008). While it is true that conservation measures such as irrigation restrictions resulted in reduced water sales for the utility, Charlotte’s rate increases were necessary, not only to cover the costs of lost sales, but also to encourage long-term conservation in a region where “the days of limitless, inexpensive water are over” (“Observer”, 2008). During times of drought it is much harder to plan for revenue fluctuations so current rate structures may not be enough to balance out lost revenues. As a result, rate increases will become a more frequent occurrence unless utilities create drought contingency plans in advance to cover unexpected revenue shortfalls.

Water conservation programs need to have long-term messaging strategies that are able to endure even as the public's attitude to water conservation may shift during emergency weather events. While droughts can act as a crisis, a wake-up call, to customers to use their water wisely, they are fast forgotten once a hurricane hits. In mid-Atlantic states like North Carolina, where we experience both droughts and hurricanes, we need to be aware of the challenge of encouraging people to use their water efficiently even during times of plenty.

Jurisdiction & Autonomy

Other challenge faced by regional water conservation programs are the issues of jurisdiction and autonomy. Regional water conservation programs are often faced with the challenge of trying to include utilities that would rather run their own programs. For example, when commenting on why several utilities left the Saving Water Partnership, Al Dietemann said, "Some jurisdictions just like the autonomy of being able to make all of their own decisions, and that's fine, as long as they know they are going to pay a premium price for doing that" (2009 01 13, Interview with Al Dietemann). While it can be much more cost-effective to run water conservation programs through regional partnerships,

a lot of utility managers don't want to give up their identity to their customers by turning over specific rebates or specific programs to a large entity. Because who is paying ultimately is the utility for those programs so utility managers generally want their customers to know that it was their utility who paid for it and not some group they don't know or even understand... (2009 01 13, Interview with Al Dietemann)

The only way to really address this challenge is to try to have a central program that has jurisdiction over a large number of users so you can have standardization and consistency while still achieving economies of scale (2009 01 14, Interview with Margie Harris). Jurisdictional challenges also come into play when some utilities not wishing to send their constituents conservation messages end up receiving the messages anyway as a result of regional messaging

campaigns and mass-media coverage.

Budgeting & Prioritization

Annual budgeting challenges are faced by many utilities who deal with fluctuating revenues and large variations in the costs associated with providing water services.

*Some years the utility might have to invest to upgrade a treatment plant or they need to raise salaries or hire more staff or something. Well, those all impact utility costs and conservation typically is one of those programs that is not strongly mandated, the results aren't anyway, even though the program might be mandated.
(2009 01 13, Interview with Al Dietemann)*

In years where the utility needs to invest in larger capital improvement programs, water conservation programs will not be a top priority.

*There can be a tendency to put them at the bottom of the list for resources when time gets tough. There's always going to be competing demand for funding of programs for conservation. I don't think that's unique to Seattle that's pretty much across the country, all the utility conservation managers I talk to say they pretty much lose on that one. It's a tough world out there, and conservation doesn't necessarily rank really high when it comes to dividing up the utility pie for resources.
(2009 01 13, Interview with Al Dietemann)*

Even water conservation programs run independently of utilities, while more mission-driven, have substantial costs associated with them and, unless they are self-funded, often heavily rely on utility dues to fund their programs – so these same challenges apply.

The Economy

Other challenges faced by water conservation programs have to do with the state of the economy. Especially given the current economic crisis, many programs are facing new challenges when it comes to encouraging investment in water- and energy-efficiency. Margie Harris of Oregon's Energy Trust talked about some of the challenges associated with trying to triple results given the current recession.

We are investigating every possible kind of way to do that at precisely the time that it is needed most and at the time when the capital in the economy is the least available because of credit ratings and the financial crisis and downturn and the loss of jobs, etc. One area that would make a huge difference that we believe is adding financing to our tool-kit and we are actively working on that. (2009 01 14, Interview with Margie Harris)

As many programs begin thinking about future initiatives, economic concerns are serving as a significant obstacle. Denver Water has been very successful at encouraging conservation in their region; their next step involves getting people to use their water more efficiently, but therein lies the problem:

Certainly, as we see people losing their jobs or being more concerned about their funds, they are probably less likely to go out and buy a high-efficiency washing machine. In other words, they are less willing to make those changes just to be a good environmental steward. (2009 01 26, Interview with Melissa Elliott)

The new administration's stimulus package includes some funding for water conservation efforts that should help rectify the situation.⁶ However, these funds will be distributed through State Revolving Funds to only a select list of projects. While this package may help in the short-run, the concerns faced by the public as a result of this recession will not fade quite so quickly and may impact their purchasing power for efficiency products for some time to come.

Managing Growth Sustainably

As these programs get underway, they need to work to ensure that their growth is sustainable.

As Margie Harris comments:

We've grown very rapidly. I think it's important to pay attention to how you grow and how you select opportunities for growth. The expectations upon us, I would venture to say, have never been greater than they are right now. (2009 01 14, Interview with Margie Harris)

Managing growth is always a challenge but it is important to be aware of your capabilities and

⁶ See the Alliance for Water Efficiency website for more detail on funds being allocated toward water-efficiency efforts here: http://www.allianceforwaterefficiency.org/Water_Efficiency_Watch_February_2009.aspx#signed

limitations when facing a new, relatively untouched, market for water conservation to ensure that you can meet the demands of a growing population with a limited supply of freshwater resources.

Passive vs. Active Programs

Many water conservation programs face the challenge of *actively* engaging their customers to conserve.

A lot of California utilities run what I call a “passive-feel good” program and then they look up at us and say, “How can you guys in Seattle be so successful and how come we’re not?” I said, well are you really seeking out and identifying the motivators and the barriers for your own customers for doing this or are you assuming they’ll just jump on board because you say it is a good idea? (2009 01 13, Interview with Al Dietemann)

Programs that wish to engage customers in their water conservation initiatives need to actively seek what factors will motivate them to become invested in conservation efforts. As will become evident in the following section, many different motivating factors can result in, or deter people from, participating in conservation programs. These factors are often unique to the service area and need to be determined and linked to conservation messages rather than assuming people will conserve simply because you said it was a good idea.

People need to be able to relate it personally to their life. You can’t be so abstract to say “Just do it because it’s a good thing to do”. You have to relate it to future generations, you have to relate it to their pocket book, you have to relate it their community and community values. (2009 01 13, Interview with Al Dietemann)

Offsetting Behavior

Some evidence suggests that the installation of efficiency-equipment can result in an offsetting behavior whereby people don’t have to consciously think about their water use because they believe that the equipment is taking care of it for them. An experiment by Geller, Erickson, and Buttram (1983) found evidence of this behavior when they worked to encourage residential

water conservation through educational, behavioral, and engineering strategies (hardware programs).

They found that, even though their engineering devices treatment did save water, it was significantly less than it should have been according to the capacities of the devices themselves and laboratory data. This suggests offsetting behavior. Even more significant, they report evidence that in situations where people don't know that the engineering retrofits are in place, such engineering devices do succeed in conserving significant amounts of water (Campbell, 2004).

This evidence suggests that when people know they are using high-efficiency hardware they engage in offsetting behaviors. For example, some people might say, "I have a low-flow showerhead, so I can take longer showers and don't have to worry."

While this phenomenon might be widespread, Al Dietemann suggests that efficiency devices, when successful, might actually encourage people to invest in additional efficiency measures.

For a business, for example, we often go in and convince them to change out a piece of equipment, they do so, they see the results on their sewer bill (they're fairly dramatic). Suddenly they say, "Well, that was easy, what else could we do to keep our bill lower?" A lot of them say, "Let's ask our employees or let's educate our employees about water waste". In some ways having a successful piece of equipment can actually motivate people. I call them stepping stones. A lot of people will try an efficient clothes washer or an efficient showerhead or an efficient toilet, and they'll say "Hey, that wasn't such a sacrifice, that wasn't such a hardship, maybe I'll try something else or maybe I'll change the way I wash the car or water my lawn." I think it does have a building relationship to it also.....I think success builds on success too, and they are probably more likely to do another conservation measure if they have had a good successful experience with another. (2009 01 13, Interview with Al Dietemann)

The challenge lies in being able to encourage efficiency through engineering devices while being aware of the potential for people to engage in offsetting behavior. Campbell suggests that this behavior can be ameliorated through one-on-one communication and education efforts (2004).

Difficulties Expanding Membership

After water conservation programs spend a few years getting themselves established, they then work to increase their memberships and to reach out to groups that might have been

underrepresented in the initial membership structure. During this current economic crisis, programs such as the Partnership for Water Conservation have struggled to grow their memberships as people are less willing to invest in non-profits. Even without the current recession, it can be hard to get environmentalists and businesses on board.

It's hard to get environmentalists, even though they have an interest, to become part of boards because they are almost always volunteers themselves for their own non-profit organizations so it's hard to get them to be on another board or to put in more time for another organization but we feel it's important to have their feedback. It's also hard to get businesses to see the value.... because they don't realize where their water comes from and that it could possibly be in danger especially during the summer and so it's a lot of education of businesses too. (2008 12 16, Interview with Janet Nazy)

In these cases it is important to consider what motivates members to come to the table while reworking incentives and opportunities to engage members during times of hardship.

Creating an Ongoing Program

Another challenge involves trying to create a long-term conservation ethic that is sustainable over time.

Like I said, it's not something you can start and stop, it's not going to be effective if you turn it on, turn it off every other year. It's an ongoing message that's reinforced by elected officials and folks at the utility who are reminding their customers of the importance of it all the time....Unfortunately, in some areas you get into these cyclic things with a couple of years with dry conditions and then a couple years with flooding and wet conditions and everyone forgets about the dry conditions and then when you get back to trying to save again people don't remember. Sometimes it's hard to keep momentum when you have large swings in different climate from year to year. (2009 01 13, Interview with Al Dietemann)

It is not easy to keep a program going, rain or shine, but in order to be successful the message to conserve has to be ongoing. This involves reaching out to community leaders and investing in continuous advertising campaigns in order to remind customers of the importance of conservation *every day*.

Lack of Flexibility

A challenge faced by the California Urban Water Conservation Council (CUWCC) was that some of their Best Management Practices (BMPs) regarding landscape water budgets were very difficult, and time consuming for utilities to implement (2009 02 06, Interview with Chris Brown). Over time it appeared that there were better alternatives such as landscape conversions that could achieve similar water savings. To meet this challenge in 2008, the CUWCC introduced:

*a flex track menu to the BMPs so that utilities that felt like they could save at least as much or more water than the traditional BMP approach could implement those alternatives in order to meet the BMP goals. We're anticipating that we're going to see some shifting in BMP implementation and emphasis over time. We're already aware that utilities have found in the case of landscaping that assigning a water budget doesn't always lead to significant water savings and perhaps just changing the landscape material in the long-run might be a more effective way to reduce landscape water use.
(2009 02 06, Interview with Chris Brown)*

As this example shows, a lack of flexibility can result in less efficient practices if the program is unable to adapt to the capabilities of member organizations and customers. We live in a dynamic world that is fraught with uncertainty. Having a flexible and adaptable program is an effective way of dealing with uncertainties regarding the potential needs of members, customers, and the environment over time.

Lack of understanding

Many programs must educate customers about the source of their drinking water. Denver Water has a challenge in that,

...customers don't really know where their water comes from. Our water comes from snowmelt and much of our water originates in the Colorado River Basin which isn't the basin that we live in. In Colorado we have some very unusual water use laws. The folks that live in the Colorado River Basin aren't very excited in giving – I shouldn't say giving because we actually own the water that we use – but they aren't interested in us using it

unwisely and they watch us very carefully and there are a lot of negotiations that go with that. (2009 01 26, Interview with Melissa Elliott)

In the case of Denver Water, customers need to develop a greater understanding of how dependent they are on water that comes from a neighboring basin. This is a challenge faced by many programs – people in general do not have a clear understanding of the source of their water resources or of the natural hydrological cycle. “We drink the tears of Leonardo da Vinci and wash in the saliva of dinosaurs” among other things – people just are not aware of it (Snitow, 2007). In an effort to overcome this challenge, many water conservation programs engage in public education efforts to educate our youth so they might develop an understanding of where their water resources come from and actively work to encourage conservation in their households and schools. The Town of Cary in North Carolina has been very successful at addressing this challenge through its water conservation education programs which involve conducting workshops with the town’s youth to educate them about where their water comes from and of the impacts of their water use on downstream neighbors. Youth build models of water distribution systems using straws, and other materials to develop a better understanding of how their water is cycled from river, lakes and streams to their faucet and back again (Cefalo, 2008).

Changes in Strategy over Time

An additional challenge occurs when program strategies need to change over time to encourage more aggressive conservation to achieve savings that extend beyond current long-term goals.

I think we are going to have to become a lot more aggressive and invasive in our water conservation practices. So, if we have to continue in the future of reducing water use beyond our 10 year goal, we’ll have to put some rules in place. It might mean that when you sell your home, you might have to change out all your fixtures and put in efficient ones before people can move in. That might be seen as kind of invasive to some people and an expense. (2009 01 26, Interview with Melissa Elliott)

Successful implementation of these more aggressive changes is good, but an additional challenge lies in getting the public to accept more invasive water conservation practices. Given the predicted increases in water scarcity in some areas as a result of climate change and population growth, more aggressive and invasive water conservation practices will become a reality that water conservation programs, and their customers, will ultimately have to face.

E. MOTIVATING PEOPLE TO CONSERVE

What are the drivers responsible for motivating people to adopt conservation-oriented behaviors? In this section, examples from the literature and from interview data are used to unravel some of the theories behind the drivers responsible for motivating people to conserve. Identification of these drivers can aid programs in their efforts to create conservation messages that resonate with the public.

Despite decades of research on conservation and environmental behavior, there is still a substantial amount of uncertainty regarding the drivers that are responsible for motivating pro-environmental behavior changes. McMakin, Malone, and Lundgren (2002) studied the motivations behind people's energy use and found that:

People were more likely to make permanent changes in their energy behaviors if the new behaviors were easy and convenient to perform, when they had the skills and resources needed to change behaviors, when their neighbors and friends were changing in similar ways, and when they made commitments to change in public settings.

Additionally, research by Lam (2006) suggests that perceived moral obligations, such as citizen's duty, may also be responsible for driving environmentally responsible behaviors such as water conservation. For example,

...since water conservation can be viewed as a social dilemma – using water liberally brings personal comfort and convenience, but is against public interests – it seems quite

likely that perceived moral obligations will affect people's willingness to conserve (Lam 2006).

In other cases, people appear to be motivated to adopt pro-environmental behaviors because they feel "the need (or pressure) to uphold and/or coincide with the moral code or social expectation" in their community (Illanit, Figueredo, Frias-Armenta, and Corral-Verdugo, 2006). Other evidence suggests that a high level of social cohesion and the presence of collective ideologies within a community can act as strong motivators for conservation-oriented behaviors.

When a group has high social cohesion, the group's attitudes may act as social anchors to facilitate attitude shifts in individuals with ideas divergent from the group's, bringing such individual's views in alignment with the group (Illanit et al., 2006).

The Cooperative Research Centre for Water Quality and Treatment conducted surveys throughout Australia to determine factors responsible for motivating water conservation behaviors. The four factors that the Centre identified included: a utilitarian driver for people that wanted to make sure that water would be available in the future, an environmental driver for people who were concerned about the environment, a money driver for people who cared about saving money by conserving, and a social driver for people who wanted to be seen as doing the right thing by their community (Roseth, 2006).

Moreover, McKenzie-Mohr and Smith (1999) suggest that in order to change people's behaviors, we have to first understand what they perceive to be the benefits and barriers associated with that change. Their research indicates that (McKenzie-Mohr and Smith, 1999):

- People will naturally gravitate to actions that have high benefits and for which there are few barriers.
- Perceived barriers and benefits vary dramatically among individuals. A benefit to one person may be a barrier to another.
- Behavior competes with behavior. That is, people make choices between behaviors. Adopting one behavior frequently means rejecting another.

They suggest that if we can remove the barriers and increase the benefits for adopting these behaviors, environmental programs could significantly improve their effectiveness.

Analysis of my data suggests that at least 13 drivers may be responsible for motivating customers to conserve. Table 2 exhibits these drivers, the rationale behind them, as well as a recommended course of action for employing these drivers to encourage conservation.

Table 2: Drivers for Conservation

<i>Conservation Driver</i>	<i>Rationale</i>	<i>Course of Action</i>
Drought	Motivation to conserve arises from fear or regulatory measures associated with extreme water-scarcity	In times of drought programs need to emphasize scarcity by advertising the limited supply available. In the case of NC, when reservoirs got down to days of water left, people were motivated to conserve in order to avoid a crisis situation.
Altruistic Appeal	Motivation to conserve arises because people want to “do the right thing”	Emphasizing that water conservation is the ‘right thing to do’ vs. water waste can encourage those who are motivated to “do the right thing” to participate in conservation efforts.
Media	Motivation to conserve arises as a result of media campaigns and mass messaging encouraging conservation	Mass messaging by the media saying, “we are all in this together, we need to conserve as a community,” can reach entire communities while also encouraging peer pressure to get members who are not conserving to participate in the community effort.
Being “Green”	Motivation to conserve arises as a result of the “green” revolution and people wanting to live a more sustainable existence; using less to do more	Messaging conservation as a “green” and sustainable activity to engage in will resonate well with individuals trying to live a greener lifestyle.
Community Values	Motivation to conserve arises as a result of community leaders encouraging citizens to conserve because it is of value to the community	Programs need to engage environmental organizations, elected officials, and valued members of the community to talk with citizens about the value of implementing water conservation practices in their community.

<i>Conservation Driver</i>	<i>Rationale</i>	<i>Course of Action</i>
Future Generations	Motivation to conserve arises because people are concerned about leaving an ample supply to meet the needs of future generations	Programs need to emphasize saving water to meet the needs of future generations to get people, who would otherwise not be motivated to conserve, to start thinking about the water needs of their children and grandchildren.
Environment	Motivation to conserve arises because people care about nature and the environment and want to ensure environmental water needs are met	In areas where people are concerned about environmental issues or are outdoor enthusiasts, programs need to emphasize the importance of having water to meet ecosystem services including recreational and wildlife habitat uses.
Regulatory Incentives	Motivation to conserve arises because people want to comply with rules to avoid getting fined	Programs need to lobby for more stringent water-use regulations and need the capacity to enforce ordinances to make sure these incentives are not a “paper tiger” and will actually work to motivate conservation behaviors.
Saving Money	Motivation to conserve arises because some people are concerned about achieving monetary savings and lowering their water bills, particularly low-income and commercial customers	Programs need to emphasize long-term monetary savings that can result from more efficient use of water resources. Programs need to be customized to engage both low-income and commercial customers through specified loan financing opportunities.
Rebates	Motivation to conserve arises as a result of programs offering incentives such as rebates for high-efficiency appliances like toilets, washing machines, and dishwashers.	Programs need to couple messaging with a sufficient number of competitive rebates for high-efficiency appliances to encourage large-scale participation.
Being Efficient	Motivation to conserve arises because some people want to increase the efficiency of their behaviors or processes in their home or business.	Programs need to emphasize efficiency savings that can arise from participation in conservation efforts including avoided opportunity costs such as time savings that can result from industry process changes.
Education/Awareness	Motivation to conserve arises as people become more educated and aware of the importance of conservation and begin to support successful efforts	Programs need to have long-term, ongoing education campaigns to encourage sustainable conservation behaviors. Youth education programs designed to reach the ‘next generation’ of water users are an effective way of encouraging residential conservation.

<i>Conservation Driver</i>	<i>Rationale</i>	<i>Course of Action</i>
Interdependence	Motivation to conserve arises because of pre-existing interdependence on neighbors for water resources – especially if you are located at the end of the pipeline	Emphasizing our interdependence and our reliance on limited shared surface and groundwater resources can aid in promoting regional conservation efforts.

Drought

Many people are motivated to adopt conservation-oriented behaviors during times of drought. These crisis events – where municipalities find themselves with only a minimal number of days of available supply left in their reservoirs – can scare people into conserving because they fear that their water supply will run out. By December of 2007, most of North Carolina was characterized as being in a state of exceptional drought. Many communities were counting down the number of days left of water in their reservoirs. North Carolina was facing a major water crisis and North Carolinians rose to the challenge and responded by conserving. The problem is that once a crisis has been averted, and the reservoirs appear full again, people often begin to return to more wasteful water-use behaviors.

Altruistic Appeal

In some cases, people are motivated to conserve because they feel “it is the right thing to do” for their society and the environment. As mentioned above, altruistic appeal can act as a social driver responsible for changing people’s behaviors due to their perceived moral obligation, their sense of duty to society and the environment.

Media

Others are motivated by mass media and marketing campaigns encouraging conservation.

Denver Water found that:

people are motivated by what the media says, so during the drought there were a lot of messages about “we’re all in this together, we need to conserve as a community.” That tended to resonate well with customers. (2009 01 26, Interview with Melissa Elliott)

Mass media campaigns are able to reach entire communities and can also aid in creating a sense of social cohesion in the community which can encourage those who were not conserving before to adopt conservation behaviors as a result of peer pressure.

Being “Green”

The current trend spreading across the country is to focus on reducing our carbon footprints in an effort to be more “green”. Being “green” involves living a more sustainable existence, using less to do more. Denver Water’s message to conserve and “Use Only What You Need” is one example of a message that resonates well with customers who are attempting to live a greener existence.

Community Values

Many people are motivated by their communities to adopt conservation-oriented behaviors. As Al Dietemann describes below, water conservation programs would do well to *actively* engage with environmental organizations, elected officials and valued members of the community to talk about the issue of water conservation and how members of their community could be more involved.

Working with a Spanish community for example here, you get no-where unless you work with community groups. Their whole structure is oriented towards the community. If their community mayors are saying conservation is valuable and something they should be thinking about then we get tremendous cooperation. If I print out a little stuffer in Spanish and send it out to a large portion of my Spanish speaking population, then it goes in the recycling bin because they don’t feel that there’s strong community support for it. (2009 01 13, Interview with Al Dietemann)

Future Generations

Additionally, many people are motivated to conserve because they want to ensure that there will be water available for future generations – for their children and grandchildren. As Al

Dietemann explains:

We use future generations which resonated really well, preserving water for future generations, a lot of people didn't care so much about themselves but they wanted to make sure that their kids had a good supply and a good environment. Of course, some people don't have kids, but they can still get the same message to preserve for future generations. (2009 01 13, Interview with Al Dietemann)

The message to conserve for future generations or to “do it for the kids” has been used regularly by social-marketing campaigns trying to encourage people to change their behaviors or to encourage support for causes such as climate change and breast cancer.

Environment

In some cases, it can be beneficial to center messaging on environmental values to get people to conserve. This message resonates particularly well in areas where people feel strongly connected to nature and the environment.

However, as Janet Nazy of the Partnership for Water Conservation suggests, tying environmental water uses to municipal uses is not always easy.

Just because it is a plentiful resource doesn't mean you should waste it no matter what. And sometimes it's hard to get people to realize it. ...[A] big part of our mission is to keep water in streams for wildlife and to keep our watersheds healthy and it always seems like the environment loses if there is a drought. Usually they are manmade droughts - meaning that there isn't enough water for people to use to water their lawns or something– but it's not really a natural drought, it might be a low time, but it's not really considered a drought except in terms of the people using the water. It's really hard to get people to see that they are not the only ones needing the water....But, you have to tie those two together and make people aware that the water that comes out of the tap is being taken from a stream or from an aquifer somewhere. A lot of people have no clue where their water comes from. (2008 12 16, Interview with Janet Nazy)

Regulatory Incentives

Others might be motivated by regulatory incentives because they are worried about getting a ticket or a fine for not complying with rules (2009 01 26, Interview with Melissa Elliott).

Saving Money

Low-income customers are usually much more conscious about saving money and so “they might be motivated by increased water rates and lowering their water bill might be important to them” (2009 01 26, Interview with Melissa Elliott). Additionally, commercial customers are also very motivated by monetary savings that could increase their competitive advantage. As Melissa Elliott from Denver Water comments, “if we’ll pay for the improvements, they’ll go ahead and do it” (2009 01 26, Interview with Melissa Elliott). By paying rebates to lower up-front costs, many customers that would not otherwise be motivated to conserve, can be encouraged to save water.

Rebates

Rebates are also a very important motivational driver for conservation. Many customers benefit from rebates which can lower high up-front costs as mentioned above. Rebates also help to increase awareness of high-efficiency appliances which is an important step in transforming the market for more efficient products. As noted by Melissa Elliott, “...we see huge numbers of people buying high efficiency washing machines; just last year the number of rebates we did on high-efficiency toilets was up over 300 percent” (2009 01 26, Interview with Melissa Elliott).

These rebates are working to provide people with incentives to go out and purchase these products and benefit from substantial water and monetary savings.

Being Efficient

Some customers are motivated by the need to increase the efficiency of their behaviors or processes within their home or business. Ultimately, we can all use our water and energy resources in more efficient ways to achieve resource savings, monetary savings, as well as opportunity cost savings such as less time being wasted through inefficient behaviors and processes. Al Dietemann points out that:

*most people in America, regardless of where they are in the country, are very inefficient in how they apply irrigation water. The absolute volume of irrigation water will differ depending on where you are in the country but the inefficiencies of how water is applied for irrigation are pretty universal around the country. So, you hammer in on the ways that people can be more efficient rather than dwelling on the actual volume of water that you see and yet again, the message would be rather consistent.
(2009 01 13, Interview with Al Dietemann)*

While water-use practices might differ across the country, Al Dietemann points out that there is always room for improvement; we can always use our resources more efficiently.

Education/Awareness

Education and increased awareness can also act to motivate people to adopt more environmentally responsible behaviors such as water conservation. Janet Nazy emphasizes the need for an ongoing education process to reach people who may not have been reached otherwise:

It's a matter of education [and] rate structures and trying to identify those people [who aren't conserving] and trying to work with them. But there are some people that you will never [be able to]change their minds but education is an ongoing process and maybe you won't change their minds but maybe you'll change their kids' minds if you're teaching conservation in the schools and that kind of thing. It just has to be an ongoing education process. (2008 12 16, Interview with Janet Nazy)

Long-term education campaigns can be used to reach otherwise unreceptive populations, but can also be used to increase support for conservation efforts as Al Dietemann explains:

It is somewhat self-feeding in some ways and we use the opportunities to keep iterating our success to our customers on a routine basis like I say, “keeping customers informed helps keep them educated”, and if they’re educated, their understanding grows and is transmitted to the decision-makers who then continue to support the efforts.
(2009 01 13, Interview with Al Dietemann)

In general, the more educated and aware people are regarding the state of an area’s water resources, the more likely they are to engage in water-conservation initiatives because they have a heightened understanding of the potential consequences that could result if no action is taken.

Interdependence

As mentioned earlier (See section: Circumstances Leading to Program Implementation), having a pre-existing relationship of interdependence between municipalities, as occurred in California as a result of their State Water Project, can result in motivating people to adopt conservation-oriented behaviors. For example, if you live at the end of the pipeline and water has to travel a long way to get to you, you are likely to be more conscious of the water savings that could be achieved by partnering with neighbors to conserve.

F. SUSTAINABILITY

What makes a program sustainable and why is it important that programs be able to encourage long-term conservation even during times of plenty? I was able to identify nine initiatives that have been adopted by these programs to encourage the sustainability of their efforts over time (Box 4).

Box 4. Sustainability Initiatives:

- Long-term focus and goals
- Strong membership
- Reliable source of funding
- Being self-funded
- Legislation
- Employee education
- Research
- Networking and information sharing
- An attitude of ‘success builds success’

The projected effects of climate change suggest that many communities will face greater variation in the availability of their water resources as a result of changes in precipitation. In order to ensure that a sustainable supply of water is available for future generations, it is important that water conservation programs are able to encourage long-term conservation even when a sufficient supply of available water exists. The problem is illustrated here by Al Dietemann of Seattle Public Utilities:

We just went through a series of bad floods out here last week. I had customers out here saying, “how can you talk about water conservation when my basement is flooded and I’ve got water up to my kazoo?” and I think it gets back to let’s look at our highest quality sources of drinking water and even though you have a lot of floodwater around you, that’s not drinking water, and that’s not water that has any value to most people – refocusing them back on what’s really important, that we still don’t have abundant water quantities of drinking water. That refocuses most people.
(2009 01 13, Interview with Al Dietemann)

In the end, encouraging people to conserve when it’s raining or when their basement is flooded will always be difficult, but certain initiatives adopted by these programs help to ensure the sustainability of their programs over time.

Firstly, a long-term focus and long-term goals for the program is incredibly important, whether it be by reducing water consumption by one percent each year for ten years to achieve a 10 percent

savings, as has been the goal of the Saving Water Partnership, or by 22 percent by 2016 which is the goal of Denver Water's Tap+Smart Conservation Program. Long-term goals provide a vision for the program and act to ensure that program initiatives will continue over time in an effort to achieve the envisioned savings. That being said, short-term goals are equally important to be able to monitor incremental savings and evaluate progress toward reaching long-term targets.

Additionally, the sustainability of a program can hinge on its ability to maintain a strong membership as is the case for the Partnership for Water Conservation and the California Urban Water Conservation Council (CUWCC). As Chris Brown from the CUWCC explains:

*...we have a membership structure now with dues and so that's been important. The Council has benefited from the fact that the State has passed bonds which included water conservation provisions and the Council has done quite a bit of work to implement those bond-funded projects. That's all on hold right now because of the financial situation in the state of California. [Given]... the Governor's and legislature's failure to pass the budget, all the bond funding has been put on hold. So, really the fact that we have a strong membership structure has turned out to be really critical for the long-term health of the Council. I think that [it] is probably a pretty critical element...
(2009 02 06, Interview with Chris Brown)*

In the above example, Chris Brown emphasizes the importance of having membership dues to be able to fund projects even when the state, California for example, is under financial stress.

However, being a self-funded organization (as opposed to relying on external funding sources) is also an important contributor to the sustainability of a program. This is particularly important for not-for-profit organizations such as the Energy Trust, the CUWCC, and the Partnership for Water Conservation, who are reliant on funding from donors, grants, and membership dues. The Partnership for Water Conservation is still in the process of trying to become a self-funded organization as is illustrated below:

*That's something that we're working on. We are heavily funded by the utilities. They pay a lot more. If you look at our dues structure, Seattle pays \$10,000 where a non-profit environmental group pays \$100, and businesses... pay [a maximum of] \$200. So we're trying to make sure that we're not utility-centric and we're looking at getting grant money and we're looking at doing fee-for-service and those kinds of things so that we have diversified funding so that we feel that we can be independent of the utility emphasis. Because most of our members are utilities too - two thirds of our membership at least are utilities. They have the most to gain because of the work that they do but we want to make sure that we provide services for all of our constituents.
(2008 12 16, Interview with Janet Nazy)*

As Janet Nazy indicates, being self-funded is important for non-profits to be able to identify themselves as independent, less “utility-centric” entities. However, becoming self-funded is a gradual process that will develop as the membership grows over time. More importantly, organizations must have a reliable source of funding available to ensure program sustainability over time – whether funding comes from membership dues or grants from the government is less important, as long as there is ongoing funding available for efficiency and conservation efforts.

In contrast, the sustainability of Oregon's Energy Trust program is embedded in the state's legislation which dictates that the Energy Trust remain responsible for encouraging energy efficiency savings over time. As Margie Harris points out, “the best thing that we can do to prove our worth is to deliver the results that are expected of us. So, that's what we've done” (2009 01 14, Interview with Margie Harris). By fulfilling their role as is written in the Electric Restructuring Law, the Energy Trust is able to ensure that it receives the necessary ongoing political support to remain sustainable over time.

While the sustainability of Denver Water's conservation program is heavily reliant on their ability to retain a good funding stream, the program has also made efforts to ensure its sustainability through such initiatives as: employee education, research, and networking and information sharing opportunities. Melissa Elliott elaborates on the importance of employee

education in the following remark: "... we do a lot of employee education on conservation and efficiency to make sure that our employees understand the need for it and ... can be on the lookout for new and upcoming programs" (2009 01 26, Interview with Melissa Elliott).

Additionally, encouraging ongoing research by employees can ensure that the program is offering the most up-to-date solutions while constantly seeking ways to improve initiatives to achieve even greater savings.

While research and education are important factors contributing to the sustainability of Denver Water's efforts, their emphasis on networking and information sharing is also a sustainability strategy worth noting. As Melissa Elliott explains:

We are very keyed-in to the fact that you can't let your elected officials and your key leaders not understand what you're doing. We do a lot of work to present to groups that we would not normally present to – it might be a group of folks that run/manage office buildings ..., [or] it might be our state legislature, [or] it might be the governor. We want to make sure that we are out in front of people who make decisions long-term and that they know this is important. We do have a board that is very keyed-in to this and very supportive so that is very helpful as well. And, I have a good number of staff members here but I make sure they are trained and that they are able to do research and they are able to see what others are doing throughout the nation. I have three people right now at a conference in Portland who are soaking in what other people are doing and they also are presenting what we are doing here at Denver Water. They are sharing information and networking. I think that having them be keyed in helps make sure that these programs continue for the long-term. (2009 01 26, Interview with Melissa Elliott)

Networking and information sharing opportunities provide programs with the ability to leverage off of each others' knowledge bases to improve conservation and efficiency efforts over time.

The sustainability of programs can also be based on the concept that 'success builds on success.'

For example, on a small scale, customers will be more likely to invest in more conservation measures if their previous investments have been successful (2009 01 13, Interview with Al Dietemann). The same idea applies on larger scales too. Demonstration of overall program

success can lead to greater investment in future conservation efforts – ensuring the sustainability of the organization in the long-term (2009 01 26, Interview with Melissa Elliott).

No matter what initiatives are used, the sustainability of these programs is intimately tied to the success of their long-term messaging efforts as Al Dietemann demonstrates here:

*Like I said, it's not something you can start and stop, it's not going to be effective if you turn it on [and] turn it off every other year. It's an ongoing message that's reinforced by elected officials and folks at the utility who are reminding their customers of the importance of it all the time. So, that's kind of an important fundamental component no matter where you are in the country – it's kind of universal.
(2009 01 13, Interview with Al Dietemann)*

G. PARTNERSHIPS

The five programs researched in this study, including the utility-run programs, are all members of partnerships with organizations such as: utilities, community organizations, environmental groups, and non-profits. To gain greater insight into the reasoning behind the formation of water conservation program partnerships, I decided to ask program administrators whether they could describe some of the disadvantages and advantages associated with the formation of interorganizational relationships. Specifically, I wanted to know whether there were particular activities that were more successful when undertaken by partnerships rather than by utility-run programs, and vice versa. See Box 5 for a list of the advantages and disadvantages that were discussed by program administrators.

Box 5. Advantages and Disadvantages of Forming Partnerships:

<u>Advantages</u>	<u>Disadvantages</u>
<ul style="list-style-type: none">• Greater economies of scale• Leverage• Transcends boundaries• Standardized messaging• Information sharing capacity• Collective power• Mission-driven	<ul style="list-style-type: none">• Autonomy• Jurisdiction• Lost customer recognition• Conflicting interests• One size doesn't fit all

One of the main advantages of forming partnerships with other organizations is the creation of greater economies of scale, or cost savings as a result of larger scale efforts, as Al Dietemann describes below:

There are economies of scale associated with those larger organizations. There are certain things that those larger organizations can do more effectively, the youth education, some of the broad-reaching messaging programs that transcend utility boundaries are good examples, pooling resources to do research, and in some cases lobbying for legislation. That's going to be more effective than a utility trying to do that by themselves. (2009 01 13, Interview with Al Dietemann)

Additionally, partnerships can foster the leveraging of resources and information between membership organizations which not only results in cost sharing between organizations, but also reduces the occurrence of duplicative efforts. Unfortunately, some utilities are afraid of losing their autonomy and choose to forgo partnership membership as was seen in Washington.

... if each utility tried to run a conservation program in their little local jurisdiction, the cost would be considerably higher than if everyone banded together and all worked together to offer activities jointly. So we run a lot of our programs not only with the water utilities but with the energy utilities also in our area and those programs are basically leveraged... Most of the program partners realize the value of leveraging, some of them have broken away and tried to do their own thing and then they have come back and joined the flock again after they realized that it is a lot more expensive to try and do their own thing. Some jurisdictions just like the autonomy of being able to make all of

their own decisions, and that's fine, as long as they know they are going to pay a premium price for doing that. (2009 01 13, Interview with Al Dietemann)

Another advantage of the creation of partnerships is their ability to transcend both political and geographic boundaries. Partnerships are rarely tied to a single jurisdiction and so are able to sponsor large-scale water conservation efforts that could not be achieved by utilities on their own. As Al Dietemann explains:

A lot of stuff transcends utility boundaries, most of the media work, and most of the educational programs cut across utility boundaries. It is hard to run an effective media campaign using mass media and still stay within your boundaries because your messages ends up blaring all throughout your geographic region whether you want it to or not.(2009 01 13, Interview with Al Dietemann)

The ability of partnerships to transcend jurisdictional boundaries is what makes them so effective at sharing their messages across entire regions. However, many utilities argue that partnerships are overstepping their jurisdiction by sending messages across entire regions when some municipalities might not want their citizens to adopt conservation behaviors. Some utilities also fear that they will lose their identities and customer recognition by transferring their programs to a partnership organization as is illustrated in the following excerpt:

a lot of utility managers don't want to give up their identity to their customers by turning over specific rebates or specific programs to a large entity. Because who is paying ultimately is the utility for those programs so utility managers' generally want their customers to know that it was their utility who paid for it and not some group they don't know ...(2009 01 13, Interview with Al Dietemann)

Additional disadvantages of partnerships include having to deal with the conflicting interests that result from bringing groups together that would not ordinarily be working together. Especially in the case of utilities and non-profit environmental groups, there are often going to be conflicting objectives and motivations that will have to be discussed and resolved in order to achieve the collective goal of water conservation and efficiency. Also, regional partnerships do

not equate to “one size fits all” programs. Operating a statewide regional partnership means that program administrators need to take into account many more variables when designing programs and may need to customize programs to address the demographics and water supply and demand of specific locations within the region.

Despite the perceived disadvantages by utilities, partnerships offer several other advantages that need to be noted. For example, partnerships are able to standardize messaging to deliver a single, cohesive message across an entire region which can reduce confusion among members of the public who would normally be exposed to varying messages from neighboring jurisdictions (2008 12 16, Interview with Janet Nazy). Additionally, partnerships aid in the sharing of information between members which allows organizations to “learn from the mistakes or the successes of others and try those things and... be educated” (2008 12 16, Interview with Janet Nazy). There are some organizations, like Denver Water for example, that have been working on water conservation efforts for decades while other organizations are newcomers to the field.

As Melissa Elliott notes, information sharing is important because:

*We are the largest water utility in Colorado so I think we have a responsibility to help others that maybe don't have the staff or the resources that we have. So, if we find a program that is really successful and low cost and we have a good provider, we will provide that information to other utilities so that they can use it as well.
(2009 01 26, Interview with Melissa Elliott)*

Another advantage of partnerships is that they embody the collective power of their members. Collective power makes partnership representatives more effective lobbyists because they are able to present the views of many individuals in a clear and coherent manner. It also allows partnerships to aim for more impressive goals because they have the support and resources of all of their membership organizations.

While there are some utilities that would refrain from joining a water conservation program partnership because of the disadvantages noted above, discussion with these program administrators indicates that there are far more advantages associated with forging partnerships with other organizations than there are reasons to go it alone. Utilities and non-profits alike can learn a lot from partnering with one another – “there’s no reason to re-invent the wheel if somebody else has already figured it out” (2009 01 26, Interview with Melissa Elliott).

VII. CONCLUSIONS & RECOMMENDATIONS

In an age when man has forgotten his origins and is blind even to his most essential needs for survival, water along with other resources has become the victim of his indifference (Carlson, Darling, and Darling, 1962).

The time to begin sustainably managing the earth’s water resources is long overdue. Many states, like North Carolina, that were once water rich are now facing water stress as a result of the effects of climate change and population growth. North Carolina can no longer afford to sit idly and wait for the rains to come and solve all of its water woes. The time has come for North Carolina to adopt more effective water conservation initiatives to reduce its vulnerability to future drought events.

This study offers recommendations for how to transform North Carolina into a more water-efficient state by applying the lessons learned by a select group of energy- and water-efficiency programs. Specifically, it addresses: the importance of studying the accomplishments and challenges faced by existing water- and energy-efficiency programs throughout the U.S., the potential drivers that are responsible for motivating conservation-oriented behaviors, and the importance of selecting an effective organizational framework for advancing water efficiency efforts.

I believe that the design of an effective water conservation program for the state of North Carolina could benefit considerably from the study of the accomplishments and challenges faced by other existing energy- and water-efficiency programs in the U.S. In-depth analysis of these five programs indicates that effective efficiency programs are able to achieve substantial water and/or energy savings goals, while motivating people to more consciously think about their resource consumption, despite having to overcome significant challenges.

Additionally, the identification of motivational drivers for conservation-oriented behaviors, such as drought events and the desire to be “green”, can aid programs in their efforts to create conservation messages that better resonate with the public. Many theories exist that offer reasoning behind peoples’ adoption of environmentally responsible behaviors, and yet relatively little research has been done focusing on what triggers people to adopt water conservation behaviors. This study suggests that possible drivers responsible for encouraging effective water conservation behavior change include: drought events, being “green”, community values, the potential for monetary savings, and future generations, to name a few. Evidence from these programs suggests that North Carolina could achieve more effective water conservation if more research were conducted using customer surveys to determine key motivational drivers for conservation. Once these triggers are identified, conservation messaging can be specifically targeted toward a potentially receptive audience with the hopes of encouraging more widespread adoption of conservation behaviors.

Lastly, evidence from this study suggests that the most effective organizational framework for advancing conservation efforts is the formation of partnerships between non-profits, utilities, environmental groups, and businesses/associations that have a vested interest in water resources.

Partnerships can result in increased economies of scale, the leveraging of resources, information sharing and networking opportunities, and consistent, standardized messaging to encourage conservation behaviors across entire regions. I envision these kinds of partnerships being set up all across the U.S. in the next decade or so to foster more sustainable management of the country's water resources. Having a country-wide network of partnerships in addition to the national Alliance for Water Efficiency would foster the communication of challenges and solutions between organizations and across states, the sharing of resources needed to support new initiatives and research, and would facilitate the release of countrywide conservation messaging encouraging more efficient use of our water resources.

Ultimately, if North Carolina is going to improve its water-efficiency efforts in the near future, conservation managers need to shy away from investment-driven capital expansion projects and need to focus wholeheartedly on water conservation and efficiency. "It's like a lot of things, you have to have your heart in it, you've got to have your soul in it, you've got to be convinced that you think it's worthwhile and valuable and you have to search out for those techniques which are going to be successful" (2009 01 13, Interview with Al Dietemann).

In conclusion, I would recommend the following steps be taken in order to improve water-efficiency efforts in the state of North Carolina:

- ❖ More effective conservation-oriented rate structures need to be put in place to send accurate price signals of water use. Billing also needs to be more frequent and water-use needs to be displayed in units that people can understand.
- ❖ Water conservation programs need to be flexible in order to create a menu of programs that can cater for a diverse array of customer types including low-income, residential, commercial, industrial, and agricultural customers.
- ❖ Having progressive and supportive leadership is incredibly important in order to initiate innovative water conservation efforts.

- ❖ A well-established conservation ethic combined with the political will of the public and elected officials is necessary for the implementation of an effective water conservation program.
- ❖ An ongoing education program and marketing/messaging campaigns are essential to encourage people to adopt long-term conservation initiatives.
- ❖ Effective hardware programs for equipment, retrofits, and process changes will be instrumental in achieving necessary water savings while aiding in the market transformation for more efficient products.
- ❖ Programs aimed at motivating conservation-oriented behaviors are essential to encourage people to take shorter showers and to not leave the water running while they brush their teeth. Conservation Programs need to actively seek out motivational drivers by conducting customer surveys and speaking with community leaders.
- ❖ Training opportunities and informational tools such as workshops and online libraries and databases should be offered to educate people about the importance of water conservation and ways to use water resources more efficiently.
- ❖ Programs need to have clear, measurable, and attainable short- and long-term goals as well as a long-term vision for expected water savings over time.
- ❖ Programs should also offer a balance between “carrots”, positive incentives, and “sticks”, deterrents, to encourage water efficiency.
- ❖ Programs must have an evaluation method in place to measure goals and make adjustments over time.

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IX. APPENDICES

A. APPENDIX I -- Interview Questions

Independently Administered Energy Efficiency Programs:

- Why was your program founded?
- Why did you choose independent administration over administration by a utility?
- What were the key design criteria that were included in your program and how were they determined?
- What site-specific criteria did you need to address when designing your program?
- How do you measure the success of your program?
- What are the greatest accomplishments since the inception of this program?
- What challenges have you faced since the founding of your program?
- What measures have you taken to ensure the sustainability of this program?
- Do you perceive a change in the market for efficient products taking place? If so, what factors are responsible for driving this change?
- Have you ever considered expanding your program to include water efficiency initiatives?
- Do you think that the lessons learned from your program could be applied to the design of a similar program for water efficiency in North Carolina?

Utility-Run Water Efficiency Programs:

- What were the challenges associated with implementing this program given the perverse incentive to conserve? How were these challenges addressed?
- What were the key program measures that were included in your program and how were they determined?
- What are some of the drivers you have identified that you use to motivate people to conserve in your service area?
- How do you measure the success of your program?
- What are the greatest accomplishments since the inception of this program?
- What challenges have you faced since the founding of your program?
- What measures have you taken to ensure the sustainability of this program?
- Do you perceive a change in the market for efficient products taking place? If so, what factors are responsible for driving this change?
- What are some of the advantages/disadvantages of partnering with other organizations to achieve water savings? What are some of the things that partnerships can achieve that are more difficult for utilities to accomplish?

Independently Administered Water Efficiency Programs:

- Why was your program founded?
- Why did you choose independent administration over administration by a utility?
- What were the key design criteria that were included in your program and how were they determined?
- What are some of the drivers you have identified that you use to motivate people to conserve in your service area?
- How do you measure the success of your program?
- What are the greatest accomplishments since the inception of this program?
- What challenges have you faced since the founding of your program?
- What measures have you taken to ensure the sustainability of this program?
- Do you perceive a change in the market for efficient products taking place? If so, what factors are responsible for driving this change?
- Can you identify some areas for improvement?
- Do you think that the lessons learned from your program could be applied to the design of a similar program for water efficiency in North Carolina?

B. APPENDIX II - Participating Programs

❖ Partnership for Water Conservation

Location: Puget Sound Region, Washington

Website: <http://www.bewatersmart.net/>

Contact: Janet Nazy, Executive Director

❖ Energy Trust of Oregon, Inc.

Location: Portland, Oregon

Website: <http://www.energytrust.org>

Contact: Margie Harris, Executive Director

❖ Seattle Public Utilities: Saving Water Partnership

Location: Seattle, Washington

Website: <http://www.savingwater.org>

Contact: Al Dietemann, Water Conservation Lead for Seattle Public Utilities

❖ Denver Water's Tap+Smart Conservation Program

Location: Denver, Colorado

Website: <http://www.denverwater.org>

Contact: Melissa Elliott, Executive Director of Water Conservation Program

❖ California Urban Water Conservation Council

Location: Sacramento, California

Website: <http://www.cuwcc.org>

Contact: Chris Brown, Executive Director