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WATER AND ENERGY USE EFFICIENCY

HEARING

BEFORE THE

SUBCOMMITTEE ON WATER AND POWER

OF THE

COMMITTEE ON
ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

ONE HUNDRED TWELFTH CONGRESS

SECOND SESSION

TO

EXAMINE THE ROLE OF WATER USE EFFICIENCY AND ITS IMPACT ON ENERGY USE

JULY 25, 2012

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WATER AND ENERGY USE EFFICIENCY

WEDNESDAY, JULY 25, 2012

U.S. SENATE,
SUBCOMMITTEE ON WATER AND POWER,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The subcommittee met, pursuant to notice, at 2:30 p.m., in room SD–366, Dirksen Senate Office Building, Hon. Jeanne Shaheen presiding.

OPENING STATEMENT OF HON. JEANNE SHAHEEN, U.S. SENATOR FROM NEW HAMPSHIRE

Senator SHAHEEN. Good afternoon, everyone.

Welcome, to our panelists.

I am a little embarrassed that we are talking efficiency today, and it is freezing in this room. It is a challenge that I have throughout the capitol complex. So, hopefully, as the result of all of our efficiency discussions, we will be more efficient on the way we use air conditioning and heat in this building.

But, I want to welcome all of you. Thank you for those of you attending this afternoon's hearing. We are here to discuss water use efficiency, as it relates to energy consumption.

We live in a world of constrained water supplies, with over 60 percent of counties across the country facing drought as we speak today. The topic of water efficiency is a timely and urgent issue and one that really demands immediate attention.

Water and energy are interconnected in many ways. Electricity generation requires substantial amounts of water, and pumping and treating water requires electricity. Within the context of efficiency, this water and energy nexus is perhaps most easily understood by the principle that every drop of water saved in the U.S. conserves energy, and every unit of energy saved conserves water.

But, despite this clear link, efforts to improve efficient water and energy use have traditionally been handled separately. However, as we will hear today, there is substantial evidence to show that there is a need to unify these efforts into a more collaborative and comprehensive framework.

For example, in one of the only detailed analyses completed to date addressing the energy-water nexus, the California Energy Commission found that nearly 20 percent of the State's electricity and 30 percent of their natural gas consumption is used to move, treat, and heat water.

Further, inefficiencies in our Nation's infrastructure emphasize the need to update and improve water delivery systems. In fact, ac-

cording to the National Institute of Building Sciences, nearly 60 percent of electricity and 20 percent of water are lost before water is delivered.

Today's hearing will provide us with an opportunity to better understand water efficiency and how different techniques and strategies have been deployed across various sectors of our economy to save water. For example, typical water-efficient technologies are being incorporated in plumbing fixtures and fittings, residential appliances like washing machines and dishwashers, and wastewater treatment and water filtration systems. Codes and standards also play a significant role in the world of water efficiency. Building codes represent an important foundation for implementing programs and policies that encourage efficiency.

Together, these emerging technologies and codes and standards are helping to make great improvements in our efforts to conserve water and energy.

The private sector is really leading the way in this arena, finding that it is in their best interest to save water, not only because it helps their bottom line by saving costs, but also because consumers want more sustainable products.

Finally, I am looking forward to hearing from our panelists about what they see as the barriers that currently exist to more fully deploying water-efficient techniques and technologies.

I am very pleased to welcome today's witnesses. Our panel includes: Mr. Henry Green, the President of the National Institute of Building Sciences; Mr. Daniel Bena, who is the Senior Director at PepsiCo; Mr. Russ Chaney, CEO of IAPMO Group; and Mary Ann Dickinson, President and CEO of the Alliance for Water Efficiency.

I look forward to hearing all of your testimony, and we will recognize Ranking Member of the Water and Power Subcommittee, Senator Lee, for his opening comments, before we go to your testimony.

Senator Lee.

STATEMENT OF HON. MIKE LEE, U.S. SENATOR FROM UTAH

Senator LEE. Thank you, Senator Shaheen, and I also want to thank our witnesses who have joined us today. I look forward to hearing your different perspectives on how we can use our efforts to promote water use efficiency to also promote efficiency in energy use.

Senator Shaheen has outlined very well how water and energy are inextricably connected. I am encouraged that our committee continues to look at how these two things are connected.

Although the allocation of water is a State-driven process, through the years, the Federal Government has been involved in the development of various measures to reduce water and energy use. The Committee has considered ideas in the past that have helped reduce the amount of energy to produce water, as well as ways to reduce the amount of water needed to produce energy.

The reliable development of water and energy constitutes something of a backbone of our economy. Safe, reliable, and cost-effective supplies of water and the energy cost of producing, treating, and cleaning the water will continue to be a critical driver for all

sectors of our economy, including agriculture, industry, and the domestic sector.

In my State, in the State of Utah, energy production and water efficiency certainly go hand-in-hand. I believe this Committee can assist State and local governments with ideas as to how to more efficiently manage the connection between energy and water.

I encourage our witnesses today to think outside the box on different options, to help expand our understanding of how water and energy are connected.

In addition, I look forward to hearing their perspectives on the role that local, State, and Federal entities can play in helping consumers reduce both water and energy use.

I would also like our witnesses to discuss the role that industry has played in developing technologies that have already reduced our water use, which, as I understand it, has led to the greatest reduction of energy use within the commercial, industrial, and even the domestic sector.

Again, I look forward to hearing what our witnesses, Mr. Green, Mr. Bena, Mr. Chaney, and Ms. Dickinson, have to say about these issues here today, each of which is very important.

I am going to have to step out in a few minutes. I apologize for that, but with your permission, Senator Shaheen, I will submit those in writing.

Senator SHAHEEN. Thank you very much, Senator Lee.

Mr. Green, we will begin with you.

STATEMENT OF HENRY L. GREEN, AIA, PRESIDENT, NATIONAL INSTITUTE OF BUILDING SCIENCES

Mr. GREEN. Thank you very much, Chairman Shaheen, and Ranking Member Lee, and the members of this committee. Thank you for the opportunity to testify today.

I am Henry Green and I am President of the National Institute of Building Sciences. The Institute was established in 1974 to serve as an authoritative source to make findings and advise the public and private sector on the use on building sciences and technology.

The buildings are responsible today for about 40 percent of the Nation's primary energy use. Three-quarters of the electricity produced is consumed in the building sector, representing over $300 billion in expenditures. While these numbers alone are staggering, they do not reveal the associated impact on water resources. According to the U.S. GS, electrical energy is responsible for almost half of the Nation's water withdrawals. Reduction in water use can also result in decreased energy demand.

The California Energy Admission found that pumping and treating drinking water and wastewater represents 19 percent of the State's electricity load. Consumer water heating represents 32 percent of its gas load. Few other States have done this kind of analysis, and no such national research exists today.

More comprehensive building water use data is vital to the continued improvement of water management in buildings. EIA's Commercial Building Energy Consumption Survey and the Residential Energy Consumption Survey provide a long record of energy use, but no such resource exists for water use. While CBECS and RECS are not perfect and have recently suffered funding issues, they re-

main valuable resources in monitoring the progress of energy efficiency programs.

Further information is lacking on the end use of water in commercial buildings. To advance plumbing codes and information development of water resource programs and pipe-sizing methodologies, researchers, manufacturers, and utilities, with Government support, should research and implement advanced metering and sub-metering technologies. Policymakers should provide leadership and direction in the development and support of research programs. The establishment of science-based metrics will allow a better understanding of how to best achieve energy and water use efficiencies.

Benchmarking of energy use by commercial building owners has grown considerably. However, tools and recognition opportunities do not exist relative to water use. The lack of data for water use by building type and end use likely underlies the slow emergence of such programs.

Surprisingly, many water utilities still charge flat rates, even in water-scarce areas. Construction codes and standards, State and local governments must require increased use of water metering. Installing meters and billing according to usage has been shown to be the single most effective water conservation measure a water utility can initiate.

Currently, there are no Federal agency that has the mandate or ability to adequately consider all of the high-performance building attributes and support the numerous goals placed on the building community. Just for green buildings, which include elements of water and energy efficiency, GAO identified 94 initiatives in 11 agencies. A cross-agency working group on building-related issues to develop holistic strategies for achieving national goals would be an incredible value.

Water delivery infrastructure provides unique challenges that are not completely understood. Continued flow reductions may place the health and safety of occupants and the efficacy of plumbing systems at risk. Researchers need to better understand water use in buildings to balance the need for energy and water efficiency, while maintaining residual pressures for safety and performance concerns.

EPA's WaterSense program is an essential element of water-focused benchmarking initiatives, but it focuses solely on individual products. Such a focus does not assure water-efficient buildings. Increased funding for the WaterSense program can help facilitate the development of a comprehensive WaterSense program for buildings.

Many institutional building owners have relied on ESCOs for them to determine how, in fact, they can save energy in their buildings. No such program exists today with respect to water usage.

The obsession of using potable water for nearly all applications may not be suitable; however, no Federal regulation governs water quality or permissible utilization of non-potable water.

In conclusion, there may be a national research program focused on understanding the complex relationships between energy and water, including production, infrastructure, training, and funding. Consistency of approach, appreciation of value, and mandates are

essential to ensuring the water-energy nexus is better understood and future decisions are made with an appreciation for the balance between energy and water considerations.

Thank you for this opportunity to testify today.

[The prepared statement of Mr. Green follows:]

PREPARED STATEMENT OF HENRY L. GREEN, AIA, PRESIDENT, NATIONAL INSTITUTE OF BUILDING SCIENCES

Chairwoman Shaheen, Ranking Member Lee, and members of the Subcommittee, thank you for the opportunity to provide testimony on water efficiency, buildings, and the connection between water and energy.

The National Institute of Building Sciences (Institute) was established by Congress in 1974 upon recognition of a lack of an authoritative national source to make findings and to advise both the public and private sectors on the use of building sciences and technology to achieve recognized goals (12 USC 1701j-2).

To achieve its mission to support advances in building science and technology to improve the built environment, the Institute has established a diverse portfolio of councils and programs that engage building industry experts in examining and developing tools, technologies and practices to meet identified needs. This testimony reflects the diversity of water-related issues identified by many of our councils, from the Multihazard Mitigation Council and Sustainable Buildings Industry Council to the Consultative Council.

Water and Energy Use in Buildings

As defined by Congress in the Energy Independence and Security Act of 2007 (EISA), a high performance building "integrates and optimizes on a life cycle basis all major high performance attributes, including energy conservation, environment, safety, security, durability, accessibility, costbenefit, productivity, sustainability, functionality, and operational considerations." While water is not explicitly mentioned, it is an essential consideration in many of these attributes.

It is becoming increasingly obvious that water, like energy, will serve as a fundamental focus of building related policies. Recent drought conditions nationwide, including those in Texas and Georgia, water shortage declarations in Kentucky and fire prone landscapes across the country demonstrate the growing need to focus on how we use water. The Environmental Protection Agency reports that 36 states expect to experience local, regional or statewide water shortages by 2013.[1] Just last week, the National Climatic Data Center reported that the nation is experiencing the largest drought since the 1950s. In June, about 55 percent of the country was in at least a moderate short-term drought-the highest level since December 1956-and at least 70 percent of the nation is in some state of drought.

Americans use more water in the home than in any other country in the world, except Canada. Going forward, the U.S. Census Bureau expects the greatest percentage of regional population growth in areas of the country where water resources already are stressed. As will be demonstrated by my testimony and the testimony of others, a holistic focus on opportunities to use both water and energy efficiently will provide an economically efficient opportunity to use our resources wisely.

As you may know, buildings are responsible for approximately 40 percent of the primary energy use in the United States.[2] Almost three quarters of the electricity produced in the U.S. is consumed in the building sector and represents over $300 billion in expenditures.[3] While these numbers alone are staggering, they do not reveal the associated impact on water resources. According to the U.S. Geological Survey, the generation of electricity is responsible for almost half of the nation's water withdrawals.[4] This equates to about 23 gallons per kilowatt hour generated. Therefore, any energy use avoided results in less water use.

In addition, reductions in water use can result in decreased energy demand. Energy is consumed in the conveyance of water from the source to the point of treatment, the treatment process itself, the distribution of water to the point of use, the heating of water during use, and the wastewater treatment process. The California

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[1] U.S. Environmental Protection Agency (EPA), Water Supply and Use in the United States (2008).

[2] Building Energy Data Book, http://buildingsdatabook.eren.doe.gov/, Table 1.1.3

[3] Building Energy Data Book, http://buildingsdatabook.eren.doe.gov/, Table 1.1.9

[4] Kenny, J.F., Barber, N.L., Hutson, S.S., Linsey, K.S., Lovelace, J.K., and Maupin, M.A., 2009, Estimated use of water in the United States in 2005: U.S. Geological Survey Circular 1344, 52 p.

Energy Commission found that 19 percent of the state's electric energy load comes from the pumping and treatment of drinking water and wastewater, and 32 percent of its gas load is related to the heating of water by consumers. However, few other states have done this analysis, and there has been no national research into this important area. These values reveal the huge potential to achieve significant energy savings through improved water efficiency measures.

Data and research on water use in the building sector is lacking and requires a focus at several scales of magnitude. While we have a long history of energy use data for the building stock in general, from programs like the Energy Information Administration's Commercial Building Energy Consumption Survey (CBECS) and the Residential Energy Consumption Survey (RECS), no such resource exists for water use. While CBECS and RECS are not perfect and have recently suffered from funding issues, they remain a valuable resource in monitoring the progress of energy efficiency programs, facilitating changes in codes and standards, and establishing national goals. The need for more comprehensive building water use data is vital to the continued improvement of water management in buildings across the country. The next version of CBECS will include new data on water use, but more data and research is needed.

In addition to the need for water usage data for the building stock as a whole, water use benchmark data by distinct building types do not exist. Establishment of such a dataset could result in development of comprehensive benchmark data that supplies a general range of "water use intensity" values represented as gallons per square foot. Water use intensity values can be used within codes and standards to develop performance-based standards, by water utilities to identify large and inefficient users, by water auditors to develop water management strategies, and by federal and local governments to craft water use policies. This benchmark data also would provide a means to compare the water use of one building against another to determine a relative level of water efficiency.

Further, there is a lack of information on the end uses of water in commercial buildings and very little research has been conducted on the topic. Thus, while the aggregate usage data that can be obtained by traditional metering of various building types is important and will result in significant water savings, the proper sizing of plumbing systems and the implementation of other water efficiency strategies requires a greater understanding of the use patterns associated with discrete fixtures, appliances and equipment. Such research would monitor, in real-time, water consuming equipment and processes in commercial buildings, such as plumbing fixtures; commercial kitchen equipment; irrigation; laboratory/medical equipment; heating, ventilation and air conditioning (HVAC) systems; and ornamental fountains. This data could be examined to understand patterns in water end use and to support development of metrics that provide benchmarks on water end uses for distinct building types. To advance plumbing codes and inform development of water efficiency programs and proper pipe sizing methodologies, researchers, manufacturers, and utilities (with governmental support) should research and implement advanced metering and sub-metering technologies that can provide greater insight into how water is used in various building types. Building owners, designers, operations and maintenance staff, policymakers, and codes and standards developers could utilize such information to more accurately estimate water use by building type and the potential savings of efficiency opportunities.

As a first step to development of a water use benchmark and resulting opportunities to reduce water use, construction codes and standards must require increased use of water meters in all building types. This is especially true for multi-family residential buildings where residents currently lack financial incentive to repair or replace leaky pipes, plumbing fixtures and appliances. In addition, requiring water meters for specific use applications within a building will provide building facility managers with an effective water efficiency feedback mechanism. These include: makeup water to cooling towers, evaporative condensers, larger evaporative coolers, fluid coolers, large boilers, and makeup water supplies to swimming pools.

Given the value of water to the viability and resilience of communities, the construction community calls on this committee, Congress at large, and the Administration to provide leadership and direction towards the development and support of research programs that will advance the establishment of accepted science-based metrics and allow better understanding of how to best achieve energy and water use efficiencies in buildings.

Challenges in Reducing Water and Energy Use

Currently, no federal agency has the mandate or the ability to adequately consider all high-performance building attributes and support the numerous goals placed upon the building community. Considering just green building programs

(which include elements of water and energy efficiency), the Government Accountability Office identified 94 initiatives housed in 11 agencies.[5] Opportunities to increase collaboration across all building issues and within each individual issue area are necessary. A cross-agency working-group on building-related issues that could develop holistic strategies for achieving national goals would be incredibly valuable.

Unlike the somewhat straightforward nature of the energy delivery infrastructure, water delivery infrastructure provides unique challenges that are not completely understood. While net-zero energy use does not generally impact the safety inherent in existing delivery infrastructure, net-zero water efforts require careful consideration. Existing water infrastructure and plumbing is based on historic flow rates. Decisions to implement some water efficiency strategies that reduce water consumption levels without fully understanding the systemic implications of reducing flows in water supply pipes and sanitary systems can result in unintended consequences.

Continued flow reductions on both water supply and sanitary drain systems, without fully understanding the implications of these flow reductions, place the health and safety of occupants and the efficacy of plumbing systems at risk. Researchers need to better understand water use in buildings to properly size water pipes to balance the needs for energy and water efficiency with the need to maintain residual pressures for safety and other performance concerns.

While many water purveyors have fully metered systems, many water agencies surprisingly still charge customers flat rates, even in water-scarce regions of the United States. State and local governments must immediately begin to require that all buildings be metered for water use, at the gross building level at a minimum, but, ideally, sub-metered for all significant water uses within the building. Installing meters and billing according to usage has been shown to be the single most effective water conservation measure a water utility can initiate. As recently measured by utilities, unmetered water consumption is reduced 15 percent to 30 percent when utilities implement metering and commodity rates.[6]

Benchmarking of energy use by commercial building owners has grown considerably through the development of the Environmental Protection Agency's EnergyStar for Buildings Program and its Portfolio Manager Tool; the passage of rating and disclosure requirements in cities like Seattle, New York, Washington DC, and Philadelphia; and recognition programs such as ASHRAE's Building Energy Quotient, Building Owners and Managers Association 360 program, the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) and the Green Building Initiative's Green Globes Program. Similar tools and recognition opportunities do not exist relative to water use. The lack of benchmarking data for water use by building type and end use likely underlies the slow emergence of such programs.

Many institutional building owners, including governments, universities and hospitals, have been working with energy service companies (ESCOs) to implement and finance energy efficiency improvements where costs are paid through the resultant energy savings. Few programs of this type exist to finance water efficiency improvements. Many private companies may be unwilling to enter this market because of the lack of benchmark data and an ability to understand how potential upgrades will ultimately affect water savings and the associated cost savings. Further, the diversity of pricing structures for water and the relatively low cost may not make such efforts economically viable.

The lack of a national policy or plan for addressing water related issues has kept the need and opportunity in the background. Without a holistic view of our nation's water needs, policymakers at all levels of government will have difficulty making appropriate and responsive decisions. The Institute's Consultative Council has recommended that the federal government prioritize, coordinate, and support development of a national water strategy prior to the emergence of inevitable water shortages.

EPA's WaterSense program is an essential element of the development of a water focused benchmarking initiative, but focuses solely on individual pieces of equipment and not the use of water throughout a building. Increased funding for the WaterSense program can help to facilitate increased product coverage and potential development of a WaterSense for Buildings Program.

WaterSense designations only exist for a few product types. Existing rating systems like LEED and Green Globes only require efficient plumbing fixtures and do not consider all other indoor water consuming equipment in buildings, such as commercial kitchen equipment, cooling towers and water-consuming medical equipment,

[5] GAO-12-79, Green Building: Federal Initiatives for the Nonfederal Sector Could Benefit from More Interagency Collaboration, November 2011

[6] The Alliance for Water Efficiency—2011

as well as non-critical functions, such as ornamental fountains. These partial requirements on their own do not assure water-efficient buildings because no benchmark data exists upon which to generate accurate and defensible performance-based goals. Green building programs in general provide specification criteria without providing the "how-to" information on effective implementation and integration within buildings. Codes and standards developers and professional organizations work to fill this gap. Model code developers have already developed comprehensive "green" building or plumbing codes that, while prescriptive in nature, do address commercial and institutional applications. Ensuring cooperation across these organizations and their criteria can help realize the achievement of water efficient buildings.

Education and training on the connection between energy and water and the opportunities to reduce their use is essential to achieving national goals in these areas. Specific audiences include operations and maintenance personnel, architects and engineers, state and local building departments, policymakers and building occupants. Buildings have a complex life cycle, from concept, design and construction to commissioning, occupancy, modification/renovation and deconstruction. Education and training within the building professions must reflect this complexity, including the specific skill needs at each point in the building's life cycle. These lifecycle considerations include efficient use of energy and water through reduced waste and demand management, improved occupant comfort and health, and upgrading the human-building system interface. In each time period within the building's life cycle, particular segments of the building community must be engaged and have the requisite knowledge to adequately address the unique needs within that time period.

While the Institute focuses primarily on the built environment, we recognize that buildings do not exist in isolation; they rely on connections to other sectors of the economy. Such connections include utilities, finance and manufacturing. Understanding these connections is essential to the design, construction and operation of buildings, so I will focus some of my testimony on illuminating these connections.

Efficiency and conservation methods within buildings should continue to be employed in construction designs. However, the backbone of the nation's electrical and water delivery systems also needs significant repair and improvement. With nearly 60 percent of electricity and 20 percent of water being lost before it ever enters service, significant savings will not be realized until the delivery systems become more efficient and waste is reduced. Aging supply lines need to be replaced to ensure proper delivery of both potable water and water for fire protection. Ten percent of the nation's water distribution system is over 80 years old and 30 percent is between 40 and 80 years old. Nearly 2 trillion gallons of water is lost annually through leaks in water pipes. This annual loss equates to an estimated $1 to $2 billion. Aside from the cost implications, it is estimated that a five percent reduction in water distribution system leakage would save 313 million kWh of electricity and avoid approximately 225,000 metric tons of CO_2 emissions annually.[7] The American Society of Civil Engineers, in a 2009 report, gave the U.S. drinking water and wastewater system a D-. The electrical infrastructure faired only slightly better by earning a D+. Both systems require significant investments in technology and distribution systems simply to maintain their current service, let alone to keep up with growing demands.

According to Congressional Budget Office estimates from 2002, it will take $335 billion over the next 20 years to repair and update water distribution systems and an additional $300 billion to do the same for sewer systems. The process of repairing the nation's crumbling infrastructure can create tens of thousands of long-term American jobs. The United States Conference of Mayors estimates that every job created through rebuilding water systems creates more than 3.6 jobs elsewhere and every dollar invested in water infrastructure adds $6.35 to the national economy.

In an era of constrained water supplies, the very conservative approach in the United States of using potable water for nearly all applications may not be sustainable. Reusing lightly contaminated graywater collected onsite reduces the quantity of potable water consumed by the facility as non-potable supplies replace potable supplies. Additionally, sewer systems receive less water. The same occurs for reclaimed/recycled water, where a portion of the wastewater generated by entire communities is collected, treated and returned to facilities for non-potable reuse. This reduces the influent collected for treatment to potable water standards and also reduces the effluent discharged to the environment. Treatment of non-potable water also is less energy-intensive than treatment to potable water standards. Rainwater harvesting also offsets potable water consumption and has the added benefit of reducing the quantity of stormwater needing onsite management.

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[7] The Carbon Footprint of Water, Bevan Griffiths-Sattenspiel and Wendy Wilson (2009).

Interest in the use of non-potable water for various applications has surged in recent years, driven in part by the emergence of new stretch codes and standards, as well as the recognition that water is a finite resource. Numerous applications are available, including water closet and urinal flushing, cooling tower makeup, automatic fire suppression systems, landscape irrigation and fountains. Non-potable water may include rainwater, graywater, reclaimed water and non-potable water from various other alternative sources. Currently, however, there are no federal regulations governing water quality or permissible utilizations for non-potable water. In 2004, the Environmental Protection Agency released EPA/625/R-04/108, Guidelines for Water Reuse. While that document is instructive, it is not binding. The Guidelines for Water Reuse is currently undergoing an update intended to further streamline it and incorporate the latest findings. The update is slated for completion by October 2012. The regulations on how non-potable water can be used in applications inside and outside of buildings are highly variable throughout the nation. Many states do not even have such regulations. The lack of uniform regulations is currently the greatest impediment to more wide-spread use of non-potable water in buildings and on building sites.

Thermal insulation is routinely used to improve the thermal efficiency of hot water delivery systems. Although specific requirements vary, all major building energy codes currently require some pipe insulation on domestic hot water (DHW) piping. DHW piping insulation requirements have been based on the energy savings associated with reduced heat loss from piping systems. However, thermal insulation also helps conserve water by reducing the time it takes from the initial demand for water (turning on the tap) until the water is delivered to the demand point at the required temperature. A study is needed to quantify the potential energy and water savings associated with increasing the use of pipe insulation.

In conclusion, there must be a national research program directed to understand the complex relationship between energy and water, including production, infrastructure, training and funding. Consistency of approach, consistency of appreciation of value and consistency of mandates are essential elements to ensuring the water / energy nexus is better understood and future decisions are made with an appreciation for the balance between energy and water considerations.

As the entity charged by Congress to provide an authoritative source for findings and advice to the public and private sector on the use of building science and technology to achieve national goals, the Institute is pleased to offer its expertise to the Subcommittee, Congress at-large and federal agencies.

Senator SHAHEEN. Thank you very much.

Mr. Bena.

STATEMENT OF DANIEL W. BENA, SENIOR DIRECTOR, SUSTAINABLE DEVELOPMENT, PEPSICO, INC., PURCHASE, NY

Mr. BENA. Thank you Chairwoman Shaheen, Ranking Member Lee, and other distinguished members and guests. I appreciate the opportunity to speak to you on behalf of PepsiCo and our environmental sustainability efforts, particularly as they relate to strengthening water use efficiencies.

My name is Dan Bena and I am the Senior Director of Sustainable Development for PepsiCo, a global food and beverage leader with net revenues of more than $65 billion and nearly 300,000 associates worldwide, including more than 100,000 of whom are employed in the United States.

PepsiCo employees are united around a principle known as "performance with purpose", a shared commitment to sustainable growth through investments in a healthier future for both people and our planet.

We have made several public commitments around environmental sustainability based on the principle of performance with purpose. Particularly germane to this hearing is the progress we have made in water conservation. By the end of 2011, 4 years early, we exceeded our system-wide goal to improve water use efficiency by 20 percent per unit of production by 2015.

This success and the strategies driving it have been recognized across the globe. For example, earlier this year, PepsiCo received the U.S. Water Prize from the Clean Water America Alliance, and next month, are proud to be the recipient of Stockholm Industry Water Award.

We have also improved our energy use efficiency by 8.2 percent from a 2006 baseline. These efficiencies represent a savings of almost $32 million for 2011 and correspond to approximately 1.5 million megawatt hours of thermal of electric energy reductions, enough energy to supply nearly 100,000 U.S. homes for a year.

One of the ways we continue to achieve these results is through the broad-scale deployment of what we call ReCon, Resource Conservation, an innovative system used to improve energy and water use efficiency in our manufacturing facilities. The ReCon process involves auditing our energy and water use streams within the plant, assigning relative values to each, and then focusing in on what can be improved, using best practices employed throughout PepsiCo.

It is also important to mention that over the last 8 years, PepsiCo's partnership and relationship with the U.S. EPA ENERGY STAR program has been very strong. We have been recognized as partner of the year in energy management in 2007 and partner of the year in sustained excellence in 2008, 2009, 2010, 2011, and 2012.

Our energy management program has, in fact, been highlighted in the U.S. EPA's public service announcement, as saving $179 million, 20 trillion BTUs, and eliminating 3 billion pounds of carbon dioxide since 1999.

Recognition is wonderful, but collaboration is crucial to resolving the magnitude of the global crises we face today. In this context, I cite the progress of the Beverage Industry Environmental Roundtable, a voluntary technical coalition of leading global beverage companies.

Over the 3-year period, from 2008 to 2010, the industry aggregate water use ration improved by 9 percent, avoiding the use of approximately 39 billion liters of water in 2010. That is enough water to supply the entire population of New York City for 8 straight days.

However, water and energy use in our food and beverage facilities is only a small part of the water and energy picture. Agriculture, in fact, represents 70 percent of water use globally, 30 percent of the world's greenhouse gas emissions, and 40 percent of worldwide employment. To improve resource use in agriculture not only has a significant, positive impact on our environment, but is critical to PepsiCo's business.

One way PepsiCo is positively impacting resource use is through irrigation. Evolving our irrigation methods, from flood irrigation to pivot to drip can conserve in excess of 70 percent of on-farm water use. We are also piloting innovative technologies, such as those developed with Cambridge and Columbia Universities, which have the potential to conserve billions of gallons of water in agriculture. We have automated the direct seeding of rice process, growing a staple food crop, using 20 percent less water and 70 percent fewer greenhouse gas emissions.

With specific regard to the nexus of water and energy, I close by sharing the example of our journey to near net zero: running a facility primarily on renewable energy resources and recycled water, while producing nearly zero waste. Using innovative technologies, our Casa Grande, Arizona facility is generating two-thirds of all energy used from renewable sources and is working toward the goals of 75 percent of the water to be recycled, 50 percent reduction in greenhouse gas emissions, and an 80 percent reduction in the use of natural gas. These results are not the product of imposed regulation; they are the result of understanding the nexus between business value and social performance.

Again, I appreciate the opportunity to be here, and thank Chairwoman Shaheen and Ranking Member Lee for allowing us to share PepsiCo's perspectives on its environmental sustainability efforts.

[The prepared statement of Mr. Bena follows:]

STATEMENT OF DANIEL W. BENA, SENIOR DIRECTOR, SUSTAINABLE DEVELOPMENT, PEPSICO, INC., PURCHASE, NY

I would like to take this opportunity to thank Chairman Bingaman and Ranking Member Murkowski for their important work on this Committee. I would like to specifically thank Subcommittee Chairwoman Shaheen and Ranking Member Lee for holding this hearing and inviting PepsiCo to talk about its efforts to reduce energy usage and improve water efficiency.

My name is Dan Bena, and I am the Senior Director of Sustainable Development for PepsiCo, the largest food and beverage company in North America and second globally, with net revenues of more than $65 billion and a product portfolio that includes 22 brands that generate more than $1 billion each in annual retail sales. With nearly 300,000 associates worldwide—over 100,000 of which are employed in the United States— and serving consumers in more countries and territories than the United Nations has member States, PepsiCo's people are united by what we call Perfounance with Purpose. Performance with a Purpose is a principle through which PepsiCo is committed to sustainable growth by investing in a healthier future for people and our planet. We believe this means a more successful future for PepsiCo.

In this context, we have made several public commitments around environmental sustainability. Specifically, to:

- help conserve global water supplies, especially in water-stressed areas, and provide access to safe water;
- continue to make our packaging increasingly sustainable, minimizing our mpact on the environment;
- work to eliminate solid waste sent to landfills from our production facilities; work to achieve an absolute reduction in GHG emissions across our global businesses; and,
- continue to support sustainable agriculture by expanding best practices with our growers and suppliers.

Particularly germane to the focus of this subcommittee is the progress we have made in the area of water conservation. We established a system-wide goal in 2006 to improve our water use efficiency by 20 percent by 2015, and I am proud to advise that by the end of 2011, we exceeded that goal—four years earlier than our target. This progress is being recognized in a number of ways such as PepsiCo's receipt of the US Water Prize this year from the Clean Water America Alliance, and receipt of the Stockholm Industry Water Award.

We have also improved our energy use efficiency by 8.2 percent from a 2006 baseline. This represents an estimated $32 MM savings in 2011, which corresponds to approximately 1.5 million MWH of thermal and electric energy. This is equivalent to the average annual energy consumption for nearly 100,000 US homes.

PepsiCo's vehicle fleet has and will continue to play a critical role in the achievement of our energy reduction targets. For example, in 2008, our Frito-Lay business in the United States set a goal to reduce fossil fuel dependency 50 percent by 2020 and become the most fuel efficient fleet in North America. Over the last four years, with a portfolio of solutions tied to people, process, and technology, Frito-Lay has reduced fuel usage by 14 percent and has built a glide path to the 50 percent reduction. This 14 percent reduction in fuel usage from Frito-Lay North America elimi-

nated 6,600,000 gallons of gasoline, which is equivalent to taking more than 11,000 cars off the road.

One of the ways we continue to achieve these results is through the broad-scale deployment of ReCon (Resource Conservation)—an innovative system used to improve energy and water use efficiency in our manufacturing facilities. Through the ReCon process, we audit our energy and water management practices, compare all energy and water uses and costs, and assign relative values to each in order to zero in on what can be improved. Then we make adjustments based on best practices used throughout PepsiCo.

Since 2008, PepsiCo has executed a strategic engagement program with suppliers in North America, and by the end of 2011 the program involved 50 suppliers representing over 120 facilities. These suppliers leveraged the ReCon program to deliver a single-year 2.5 percent improvement in thermal energy efficiency, 7 percent improvement in electrical energy efficiency and an 18.7 percent reduction in waste-to-landfill. This corresponds to an estimated productivity improvement of nearly $2 million in 2011.

Throughout the last eight years, PepsiCo's partnership and relationship with the EPA Energy Star program has been very strong. PepsiCo has been an active participant with the Food Processing Focus Team and has spoken at a number of Energy Star events. Our Energy Management Program has been highlighted in the EPA's Public Service Announcements (see Addendum One*). The EPA's Guidelines for Energy Management have been used as the foundation of PepsiCo's successful internal and external Energy Management/Sustainability programs. And, as a direct result of PepsiCo's Supplier/Co-Packer Outreach Program, more than 150 additional companies have joined the Energy Star Program.

Since joining the EPA Energy Star program, PepsiCo has been recognized with awards for Partner of the Year in Energy Management in 2007 and Partner of the Year in Sustained Excellence in 2008, 2009, 2010, 2011 and 2012.

Recognition is great, but no single company can alone resolve the magnitude of the global crises we face today, which is why collaboration and partnership are so critical for lasting solutions and impact. In this context, I cite the progress of the Beverage Industry Environmental Roundtable (BIER). The Beverage Industry Environmental Roundtable is a technical coalition of leading global beverage companies working together to advance environmental sustainability within the beverage sector. Formed in 2006, BIER aims to accelerate sector change and create meaningful impact on environmental sustainability, including water efficiency, matters. Through development and sharing of industry-specific analytical methods, best practice sharing, and direct stakeholder engagement, BIER accelerates the process of analysis to sustainable solution development.

Each year, the industry water dataset continues to grow in size, with 2011 representing the most robust report to date, including over 1,600 facilities distributed across six continents. Analyses were conducted to determine industry water use, production, and water use ratio over a three year period from 2008-2010. Over this period, the industry aggregate water use ratio improved by 9 percent, avoiding the use of approximately 39 billion liters of water in 2010. To put this in context, this is enough water to supply the entire population of New York City for eight days (see Addendum Two).

However, water and energy use in our food and beverage facilities is only a small part of the picture. Agriculture represents approximately 70 percent of water use globally, and as high as 90 percent in developing economies; 30 percent of the world's greenhouse gas emissions; and 40 percent of the worldwide employment. To improve resource use in agriculture is to have significant positive impact on the environment.

Improved resource use also makes good business sense. For example, six out of 10 of PepsiCo's top-sourced raw materials are agricultural. We conduct agricultural operations in 30 countries. For PepsiCo, maintaining a sustainable supply chain is paramount to minimizing risks to our business operations.

One of the ways that we are maintaining a sustainable supply chain is by focusing on irrigation. The irrigation methods employed by PepsiCo are constantly evolving to better meet the needs of local communities. Irrigation methods such as flood, pivot, and drip can conserve in excess of 70 percent of farm water use. We are piloting technology such as i-crop, developed in partnership with Cambridge University, and low-cost tensiometers, developed in partnership with the PepsiCo Foundation and the Earth Institute, both of which have the potential to conserve billions of gallons of water in agriculture.

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*All addendums have been retained in subcommittee files.

We are also testing innovative approaches to reduce on-farm greenhouse gas emissions. One example is with our US Tropicana business, where the single biggest contributor to Tropicana's carbon footprint wasn't the transport of the juice to stores or the energy required to operate a modern citrus farm. Rather, it was the fertilizer used to grow the orange trees. A great deal of natural gas is used to make nitrogen fertilizer, and a great deal of fertilizer is used on citrus trees—so much that fertilizer accounted for 15 percent of the total carbon footprint for our orange juice. We have partnered with a company called Yara, to pilot an alternative fertilizer. If successful, the greener fertilizers could lower the carbon footprint of PepsiCo's citrus growers by as much as 50 percent and reduce the total carbon footprint of Tropicana orange juice by up to 12 percent. Given how much fertilizer is used throughout the U.S. farming system as a whole—more than 13 million tons of nitrogen in 2007 alone—a greener way to help plants grow could put a serious dent in U.S. carbon emissions (see Addendum Three).

Finally, understanding this subcommittee's interest in the nexus between water and energy, I share two initiatives at PepsiCo of which we are especially proud.

The first is our snacks manufacturing facility in Casa Grande, Arizona. A few years ago, Frito-Lay set out on an ambitious mission to transform an existing facility so that it would run primarily on renewable energy sources and recycled water while producing nearly zero waste. We called this effort "near net zero." We chose the Casa Grande, Arizona facility because of its location, where sunlight is plentiful and water conservation is important, and its size—big enough to be effective, yet small enough to be manageable. Frito-Lay invested in and implemented a combination of technologies to enable Casa Grande to significantly reduce the use of key natural resources and reduce the site's overall environmental footprint. Using innovative technologies, our Casa Grande facility is generating two-thirds of all energy used from renewable sources and is working towards significant reductions. Specifically, 75 percent of the water is recycled, 50 percent reduction in greenhouse gas emissions, and an 80 percent reduction in the use of natural gas (see Addendum Four).

Finally, we understand the importance of lasting change being within reach only when large-scale policies are enacted. In Gujarat, India, PepsiCo Foundation partnered with the Columbia University Water Center to test a new approach to positively impact food security, water security, and climate security—all in one model. The details are supplied in a white paper as Addendum Five, but, in short this paper presents the results of the Columbia Water Center's study of the severe groundwater crisis in the Mehsana region of Northern Gujarat, India. The study concludes that the current pattern of groundwater exploitation is both costly for the state and unsustainable for farmers, and could lead to the complete failure of agriculture in the area within a few years if left unchecked. The study was conducted as the first phase of a multi-phased project designed to help conserve water and energy while improving farmer incomes in North Gujarat. Future papers will outline the initial outcomes of the area pilot project along with resulting recommendations for policymakers in the area.

Again, I would like to thank Chairwoman Shaheen and Ranking Member Lee for giving PepsiCo this opportunity to share its perspectives.

Senator SHAHEEN. Thank you very much, Mr. Bena.

Mr. Chaney.

STATEMENT OF GP RUSS CHANEY, CEO, INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS, ONTARIO, CA

Mr. CHANEY. Chairwoman Shaheen, Ranking Member Lee, and members of the subcommittee, we appreciate the opportunity to sit before the Subcommittee on Water and Power to discuss the critically important issue of water use, water efficiency, and the important impact water efficiency has upon our country's overall energy use.

My name is Russ Chaney and I am the CEO of the IAPMO Group. The IAPMO Group led by the International Association of Plumbing and Mechanical Officials was founded in 1926. With membership of approximately 8,300 members, IAPMO publishes the Uniform Plumbing Code, the Uniform Mechanical Code, the

Uniform Solar Energy Code, and the Uniform Swimming Pool, Spa and Hot Tub Code, all designated by ANSI, as American National Standards.

In 2010, IAPMO published the first green construction code in the United States, the Green Plumbing and Mechanical Code Supplement. The Green Supplement is a separate document from the Uniform Plumbing and Mechanical Codes and it establishes requirements for a green building, water efficiency, and water reuse, applicable to plumbing, mechanical, and solar energy systems.

The Green Supplement serves as a resource for many progressive jurisdictions across the country that are implementing green building and water efficiency programs. By adhering to the water efficiency provisions found within the Green Supplement, 35 percent water savings over baseline code and EPAct level requirements can be obtained in both residential and commercial buildings.

Just last month, IAPMO was invited to join the United States Water Partnership. This partnership, which was unveiled by Secretary of State Hillary Clinton, includes nearly all Federal agencies and many other notable organizations.

IAMPO recognizes that, especially here in the United States, the energy embedded in water is both grossly under-recognized as an area of opportunity where energy savings can be cost-effectively realized, and is underutilized as a source of clean, renewable energy.

In January 2012, the U.S. EPA officially delegated the development of a heat metering standard to a partnership of ASTM International and IAPMO. This standard will greatly assist the country in realizing the benefits, and improving the acceptance, of solar thermal, radiant, and other hydronic technologies.

IAPMO also recognizes that the only way for an integrated water use strategy to be successful is to minimize consumption and maximize recovery. Fully developed codes and standards addressing the safe installation and use of water reuse technologies, such as rainwater catchment systems, gray water systems, and systems—municipally supplied reclaimed water will be critical to eliminate barriers, while maintaining health and safety.

However, much more needs to be done to address our water and energy needs. We ask that the Federal Government develop incentives for State and local governments to adopt and properly enforce comprehensive Green Plumbing codes.

We ask that the Federal Government support the research and development of less invasive water metering and sub-metering technologies, and then deploy these technologies to better understand the complex water use patterns associated with various building types. This will yield very significant water and energy efficiencies, through smarter-sizing of our buildings' plumbing systems.

We ask that the Federal Government consider incentives to building owners that voluntarily have their buildings audited, and then implement the results of those audits to reduce their energy and water use.

We ask the Federal Government to provide incentives for State and local governments to require water utilities to conduct independent leakage audits and to report the percentage of water leaking from their distribution systems, along with a plan for the re-

pair and update of those systems, that demonstrate excessive leakage.

According to the American Society of Civil Engineers, our leaking water infrastructure wastes over 7 billion gallons of potable water every day. Now, please keep in mind that this is water that has been treated to strict and expensive drinking water standards. Frankly, we find it is unacceptable that we ask our Nation's manufacturers to continually trim tenths of a gallon off the consumption levels of their products, at considerable cost to both them and the end consumer, when so much water is being lost between the point of treatment and the point of use. This is an area that must be improved upon.

The Federal Government should become more actively engaged in the development of necessary research programs and provide financial support for scientific study to ensure that increasingly precious water supplies are used as efficiently as possible in buildings, while maintaining health and safety.

Finally, we ask that the Federal Government support the integration of IT-based networks, into both our Nation's water distribution systems and within our build—our Nation's buildings, in order to help create smart water systems as part of a national water strategy.

As you know, there is no substitute for water. While we will always be able to use the incredible ingenuity of the American people to find alternate sources of energy as our needs and circumstances evolve, we must recognize that there simply is no substitute for water.

Thank you very much.

[The prepared statement of Mr. Chaney follows:]

PREPARED STATEMENT OF GP RUSS CHANEY, CEO, INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS, ONTARIO, CA

Chairwoman Shaheen, Ranking Member Lee and members of the subcommittee, we appreciate the opportunity to sit before the Subcommittee on Water and Power to discuss the critically important issue of water use, water efficiency and the important impact water efficiency has upon our country's overall energy use.

My name is Russ Chaney, Chief Executive Officer for the IAPMO Group. The IAPMO Group, led by the International Association of Plumbing and Mechanical Officials, was founded in 1926, and remains the pre-eminent code development, product certification and testing, and training/curriculum providing organization for plumbing, mechanical, swimming pool, solar and radiant heating industries in the United States and around the world. With approximately 8,300 members, IAPMO remains the only standards body where plumbing, mechanical and solar codes are developed employing a true and fully voluntary consensus process. We proudly publish our flagship model codes, the Uniform Plumbing Code, Uniform Mechanical Code, Uniform Solar Energy Code and Uniform Swimming Pool, Spa and Hot Tub Code, as designated as American National Standards, accredited by the American National Standards Institute (ANSI).

IAPMO's membership is comprised of plumbing and mechanical professionals, inspectors, engineers, code officials, manufacturers of plumbing, mechanical and building products, plumbing and mechanical contractors, water and energy efficiency experts—all areas and expertise required in the design, installation and maintenance of our country's plumbing, mechanical, solar and hydronic systems.

In addition to providing code development assistance, The IAPMO Group provides critically needed training and education programs, including the Green Plumbers USA program, an industry-leading plumbing and mechanical product testing and certification program, a building products evaluation service and a manufacturer-preferred quality assurance program.

In 2010, IAPMO published the first green construction code in the United States, the IAPMO Green Plumbing and Mechanical Code Supplement. The Green Supplement is a separate document from the Uniform Plumbing and Mechanical codes and establishes requirements for green building, water efficiency and water reuse applicable to plumbing, mechanical, and solar energy systems. The Green Supplement serves as a resource for many progressive jurisdictions across the country that are implementing green building and water-efficiency programs. By adhering to the water-efficiency provisions found within the Green Supplement, 35 percent water savings over baseline code and EPAct level requirements can be attained in both residential and commercial buildings.

Each component of The IAPMO Group works toward playing an integral part in protecting the health of people everywhere and toward making the most efficient use of our nation's most precious resource.

Just last month, IAPMO was invited to join a critically important initiative on international water efforts in the United States Water Partnership. This partnership, which was originally unveiled by Secretary of State Hillary Clinton in March, includes partners such Coca-Cola, Proctor and Gamble, the Water Institute at the University of North Carolina, nearly all federal agencies and many other notable organizations. The purpose of this partnership is:

"To ensure sustainable and equitable water management that benefits people and our environment through:

- Improving access and quality of service for water, sanitation and hygiene.
- Advancing integrated water resource management.
- Increasing efficiency and productivity of water use.
- Improving governance through stronger public and private institutions, policies and processes."

This is a very exciting initiative that will help address water problems on a global scale.

IAPMO is proud to be a contributor to the National Institute of Building Science's Consultative Council by chairing the council's Water and Energy Efficiency Topical Committee, and we fully support the recommendations put forth by the council as published in the institute's Annual Report to the President of the United States.

IAPMO recognizes that, especially here in the United States, the energy embedded in water is both grossly under-recognized as an area of opportunity where energy savings can be cost effectively realized and is underutilized as a source of clean, renewable energy.

On Jan. 20, 2012, the U.S. EPA officially delegated the development of a Heat Metering standard to a partnership of ASTM International and IAPMO. Since that time, IAPMO and ASTM International have worked to expand the scope of their combined efforts on solar thermal technologies in support of the Heat Metering standardization project. These efforts will greatly assist the country in realizing the benefits—and improving the acceptance—of solar thermal, radiant and other hydronic technologies.

IAPMO also recognizes that that the only way for an integrated water-use strategy to be successful is to minimize consumption and maximize recovery. Fully developed codes and standards addressing the safe installation and use of water-reuse technologies such as rainwater catchment systems, gray water systems and municipally supplied reclaimed water will be critical to eliminate barriers while maintaining health and safety. In 2012, we formally adopted all technical provisions on water reuse from our Green Supplement into our baseline model code, the Uniform Plumbing Code. As such, the Uniform Plumbing Code became the first baseline code to provide guidance on the safe use of these technologies, along with a path of compliance for the installation of these systems in a model construction code.

As significant as these accomplishments—and the combined accomplishments of all the dedicated and talented people who comprise our nation's standards and codes developing organizations—are, much more needs to be done to address our water and energy needs. Specifically, we respectfully ask that the federal government consider the following actions that will greatly assist the private sector in moving forward toward a more water and energy efficient future:

- We ask that the federal government develop incentives for state and local governments to adopt and properly enforce comprehensive green plumbing codes. As good as our nation's codes are, if they are not adopted and enforced at the local level, the country cannot realize the efficiencies these codes provide.
- We ask that the federal government support the research and development of less invasive water metering and sub-metering emerging technologies and then deploy these technologies to better understand complex water-use patterns asso-

ciated with various building types. This will yield very significant water and energy efficiencies through smarter sizing of our building's plumbing systems.

- Widespread energy and water auditing will provide data and information required to establish more accurate baseline metrics and will help prioritize the installation of energy- and water-efficient technologies that provide the best return on investment and real-time or near real-time feedback to building owners. We ask that the federal government consider incentives for building owners who voluntarily have their buildings audited and implement the results of those audits to reduce their energy and water use.
- We ask that the federal government provide incentives for state and local governments to require water utilities to conduct independent leakage audits and report the percentage of water leaking from their distribution systems, along with a plan for the repair and update of systems that demonstrate excessive leakage. Much is known about the needs of our aging water infrastructure and it is critically important that these issues be addressed. According to the American Society of Civil Engineers, our water infrastructure rates a grade of D-minus with over 7 billion gallons of potable water a day wasted due to leaking water infrastructure. Keep in mind, that this is water that has been treated to strict and expensive drinking water standards and contains all of the embedded energy embodied in such treatment and delivery. Frankly, we find it unacceptable that we ask our nation's manufacturers to continually trim tenths of a gallon off of the consumption levels of their products—at considerable cost to both them and to the end consumer—when so much water is being lost between the point of treatment and the point of use. This is an area where improvement is necessary.
- The federal government should become more actively engaged in the development of necessary research programs and provide financial support for scientific study to ensure that increasingly precious water supplies are used as efficiently as possible in buildings while maintaining health and safety. IAPMO, along with the Alliance for Water Efficiency, the American Society of Plumbing Engineers, the Plumbing Manufacturers International, the International Code Council and the Plumbing—Heating—Cooling Contractors Association is a founding member of the Plumbing Research Efficiency Coalition, PERC, which is conducting a research program on the impact of reduced flows on building drains. This research is needed to ensure that we do not experience unintended consequences related to our water-efficiency efforts. The entire plumbing industry is concerned that we may be reaching tipping points at which plumbing products and systems fail to operate as intended and risk the health and safety of our citizens. We may, in fact, be at the practical limits of efficiency and any further reductions in efficiency levels in some consumer products, specifically toilets and showerheads, need to be based on scientific study in order to ensure continued efficacy and safety in addition to increased levels of water and energy efficiency. Sadly, PERC struggled mightily to secure the meager funding needed to support their research effort and was turned away on numerous occasions when seeking support from the federal government. Fortunately, however, PERC was able to secure most of the funding needed to begin this research by securing funding from other NGOs and the private sector. The member organizations of PERC are self funding the remainder of the cost. I think we can all agree that it should not be so difficult to conduct this desperately needed research.
- The EPA should take the lead in the development of uniform national non-potable water-quality standards applicable to various permissible utilizations of non-potable water. Water-quality standards should reflect the minimum water-quality parameters required to protect public health and safety and protect the integrity and function of plumbing systems and devices.
- Finally, we encourage the Federal Government to earnestly begin work on the development of a comprehensive and coordinated water strategy to meet the needs of our growing nation. We applaud the efforts of the National Institute of Standards and Technology (NIST) in convening stakeholders for a White House summit to discuss the role of emerging technology in addressing our nation's water needs and concerns. Our water strategy should include requirements for the incorporation of IT based systems and components into all water distribution projects that receive Federal funding. These IT enhanced systems, characterized as "smart water systems" will be capable of monitoring for leaks thus ensuring efficiency and more consistent compliance to the requirements of our safe drinking water standards. Similar technologies can also be deployed in building plumbing systems providing real time feedback to building managers. As we go about the necessary work of repairing our water infrastructure and

plumbing systems, we must also modernize these systems as well in order to maximize the full potential of our investments.

Chairwoman Shaheen, Ranking Member Lee and members of the subcommittee, it is indeed an honor to be able to provide these comments to you today. As you know, there is no substitute for water. While we will always be able to use the incredible ingenuity of the American people to find alternate sources of energy as our needs and circumstances evolve, we must recognize that there simply is no substitute for water. We rely on access to safe, clean water every day.

Last summer the state of Texas was stricken with a severe drought that resulted in the closure of businesses in the impacted areas. Already this summer, according to the National Climate Data Center, well over 50 percent of the nation is experiencing drought conditions resulting in the worst drought crisis since the 1950's. Combined with certain population growth, especially in the most water-challenged regions of our country, these realities illustrate that the time to take action on our water-related needs is now.

The good news is that addressing these needs carries with it profound job-creation opportunities. The United States Conference of Mayors estimates that every job created through rebuilding water systems creates more than 3.6 jobs elsewhere and every dollar invested in water infrastructure adds $6.35 to the national economy. Retrofitting of buildings and homes that still have older water-guzzling plumbing fixtures and fittings with high-efficiency models can create thousands of additional jobs and yield substantial water and energy savings at the same time. Let's take advantage of these opportunities to address two urgent national needs: job creation and ensuring a secure water future for the United States of America.

Again, I appreciate your time today and look forward to answering any questions you may have.

Thank you.

Senator SHAHEEN. Thank you, Mr. Chaney.

Ms. Dickinson.

STATEMENT OF MARY ANN DICKINSON, PRESIDENT/CEO, ALLIANCE FOR WATER EFFICIENCY, CHICAGO, IL

Ms. DICKINSON. Thank you, Senator Shaheen, Senator Lee.

The Alliance for Water Efficiency is pleased to participate in this hearing on the important connection between water and energy, and we greatly appreciate the strong leadership of both of you on this critical issue.

My name is Mary Ann Dickinson, and I am the President and CEO of the Alliance, which is a nonprofit organization of 365 stakeholder organizations of very diverse affiliations that all have experience in water conservation programs and policies. We are dedicated to furthering the efficient and sustainable use of water in North America, and we are the only national organization devoted solely to this purpose.

We have been interested in the relationship between water and energy since we were founded 5 years ago. A project of which we are particularly proud is a joint effort we undertook with the American Council for an Energy Efficient Economy, ACEEE, in 2010, to coalesce the views of 75 different organizations in the United States that are involved in both water and energy. The resulting work product, A Blueprint for Action, contains numerous recommendations for national and State action, in the areas of policy, standards and codes, programs, and research.

Of particular interest is how much water is needed, or embedded, in the generation of electricity and how much energy is embedded in drinking water pumping and treatment, as well as wastewater treatment.

With a fuller understanding of this significant relationship nationally, Federal funding programs can be developed which will

cost-effectively and collectively save the most amount of energy and water and, therefore, greenhouse gas emissions for the United States. Copies of the Blueprint report are being provided to you, all the committee members and staff, and we urge you to consider its recommendations.

We wish in our testimony to make 3 basic points, as follows: No. 1: Water efficiency has already been very successful in saving the Nation's resources and in helping to deter—defer new capacity infrastructure and, thus, should be further promoted at the Federal level.

Plumbing product and appliance standards, as you have heard, have reduced indoor water consumption by a range of 43 to 86 percent per fixture or appliance, depending upon the product. EPA's WaterSense label, launched in 2006, has labeled over 4,500 products; the sales of which have resulted in 287 billion gallons saved and $4.7 billion saved in consumer water and energy bills.

By the end of 2011, EPA estimates that there have been reductions of 34—38.4 billion kilowatt hours of electricity, along with reductions of 13 million metric tons of greenhouse gas emissions. That is equivalent to planting about 50 million trees. EPA's work in this area is a significant achievement in a short time.

But the Nation's water utilities have been active as well, reducing consumer demand across the country through cost-effective investments in end-use conservation programs. With the country's infrastructure needs now estimated by EPA to be in neighborhood of $334 billion by 2027, reduced demands due to water efficiency can help reduce the need for infrastructure capacity expansion, which is a significant part of the infrastructure estimate.

In fact, EPA's Community Water System survey in 2006 estimated that in the Nation's 53,000 community systems, over 50 percent of the capital expenditures were for the expansion of infrastructure, not rehabilitation or replacement. Thus, water efficiency can be a cost-effective solution in these expanding systems, where population growth may require new supplies, storage, or enlarged treatment systems.

Point No. 2: Saving water saves energy, and the benefits are documentable. As you have also heard from the other witnesses, California has done seminal research in this area, beginning in 2005 and with its integrated energy policy report, which our Blueprint for Action recommends be duplicated nationwide. This work by the Energy Commission showed that the amount of embedded energy in water and wastewater was in a wide range, from anywhere from 2,000 to 20,000 kilowatt hours per million gallons of water produced.

A national study conducted by River Network in 2009, which is called the Carbon Footprint of Water, estimated that as much as 13 percent of the Nation's electric energy load is related to water and wastewater deliveries, equivalent to approximately 15 percent of the U.S. carbon load.

Further studies completed by the California Public Utilities Commission clarified, in more detail, the extent of embedded energy in a variety of different water supply sources. The detailed copy of our testimony gives a lot of those figures in a table that is on page 8.

Point No. 3: Water efficiency research, as well as consumer retrofit programs, should be funded and incentivized on a par with energy efficiency programs, because they yield documentable energy savings.

With the Nation's drought now gripping 62 percent of the counties in the U.S., and with water supplies likely to reach shortage conditions if it continues, the time is right for the Federal Government to carefully assess water efficiency as a beneficial strategy. Although many water-efficient products, technologies, and programs already exist, more research and development is needed. To date, funding has been extremely limited and insufficient, given the chronic need.

With respect to consumer incentives, billions of dollars have been spent over the past decade on energy efficiency consumer rebates and tax incentives, but in the area of water efficiency, these programs have been largely undertaken by the water system ratepayers, with very little State or Federal funding.

Thus, we strongly recommend that national incentives be enacted for water efficiency programs, and further, that a national policy be instituted to allow energy efficiency funding to be used for cold water conservation programs, as well as hot water conservation programs. By cold water programs, I mean programs that reduce plumbing, volumes, or irrigation—increase irrigation efficiency.

The reason we are asking for this is because of the clear embedded energy benefits that this investment would provide nationally, as well as additional jobs in this area.

So, thank you for the opportunity to comment.

[The prepared statement of Ms. Dickinson follows:]

STATEMENT OF MARY ANN DICKINSON, PRESIDENT/CEO, ALLIANCE FOR WATER EFFICIENCY, CHICAGO, IL

The Alliance for Water Efficiency is pleased to participate in this hearing on the important connection between water and energy, and we greatly appreciate the strong leadership of Senator Shaheen and the Senate Committee on Energy and Natural Resources on this issue. The Alliance is a non-profit organization of diverse stakeholders with experience in water conservation programs and policies, and dedicated to furthering the efficient and sustainable use of water in North America. It is the only national organization devoted solely to this purpose.

We have been interested in the relationship between water and energy since we were founded five years ago. A project of which we are particularly proud is a joint effort we undertook with the American Council for an Energy Efficient Economy (ACEEE) in 2010, to coalesce the views of 75 organizations involved in the water-energy arena. The resulting work product, A Blueprint for Action, contains numerous recommendations for national and state action in the areas of policy, standards and codes, programs, and research. Of particular interest is how much water is needed (or "embedded") in the generation of electricity, and how much energy is "embedded" in drinking water pumping and treatment as well as waste water treatment. With a fuller understanding of this significant relationship, federal policies and funding programs can be developed which will cost-effectively and collectively save the most amount of energy, water and greenhouse gas emissions for the United States. Hardcopies of the report are being provided to committee members and staff, and we urge you to consider its recommendations. Electronic copies of A Blueprint for Action can be downloaded at the following link: http://www.allianceforwaterefficiency.org/blueprint.aspx

We wish to make three basic points in our testimony, as follows:

1. Water efficiency has already been very successful in saving the nation's resources and in helping to defer new capacity infrastructure, and should be further promoted at the federal level.—Plumbing product and appliance standards,

in effect since the Energy Policy Act of 1992 and refined in subsequent legislation, have reduced indoor water consumption by a range of 43-86 percent per fixture, depending upon the product (see Table 1*). EPA's WaterSense label, launched in 2006, has labeled over 4500 products, the sales of which have resulted in 287 billion gallons saved and $4.7 billion saved in consumer water and energy bills. By the end of 2011, reductions of 38.4 billion kWh of electricity were achieved along with reductions of 13 million metric tons of green house gas emissions—equivalent to the planting of over 50 million trees. EPA's work in this area is a significant achievement in a very short time. But the nation's water utilities have been active as well, reducing consumer demand across the country through cost-effective investments in end use conservation programs. With the country's infrastructure needs now estimated by EPA to be in the neighborhood of $334.8 billion by 2027, reduced demands due to water efficiency programs can help reduce the need for infrastructure capacity expansion, a significant part 3 of the infrastructure estimate. In fact, EPA's Community Water System Survey in 2006 estimated that in the nation's 53,000 community systems, 52.6 percent of the capital expenditures were for expansion of infrastructure, not rehabilitation or replacement. Thus, water efficiency can be a cost-effective solution in these expanding systems where population growth may require new supplies, storage or enlarged treatment systems.

2. Saving Water Saves Energy—and the benefits are documentable.—California has been a leader in this area, having done the seminal research in 2005 which the Blueprint for Action recommends be duplicated nationwide. This work by the California Energy Commission showed that the amount of embedded energy in water and wastewater was in the range of 2,000 kWh to 20,000 kWh per million gallons of water produced (see Figure 1**). A national study conducted by River Network in 2009 called The Carbon Footprint of Water estimated that as much as 13 percent of the nation's electric energy load is related to water and wastewater deliveries, equivalent to 5 percent of the US carbon load (see Figure 2). Further studies completed by the California Public Utilities Commission clarified in more detail the extent of embedded energy in a variety of different water supply sources (see Table 2). Energy intensities for drinking water and wastewater treatment technologies were documented. Now these values, as evidenced by the pilot projects which measured them, can be productively used in models to estimate energy savings from future water efficiency programs which include a wide variety of measures. The Alliance for Water Efficiency has built just such a model, called the Water Conservation Tracking Tool, which estimates not only the energy savings to the utility from both cold and hot water conservation programs, but also the savings to the customer and the overall reduction of green house gas emissions for a suite of chosen water efficiency programs (See Figure 3 for a sample output).

3. Water efficiency research, as well as consumer retrofit programs, should be incentivized on a par with energy efficiency programs, because they yield documentable energy savings.—With drought now gripping 62 percent of the counties in the US, and with water supplies likely to reach shortage conditions if it continues, the time is right for the federal government to carefully assess water efficiency as a beneficial strategy. Although many water-efficient products, technologies, and programs already exist, more research and development is needed. To date, funding has been limited and insufficient given the chronic need. For example, in the past 10 years only $3.5 million has been spent by EPA in water efficiency research, a fraction of what has been spent by the Department of Energy on energy efficiency research. With respect to consumer incentives, billions of dollars have been spent over the past decade on energy efficiency consumer rebates and tax incentives (see Figure 7). In the area of water efficiency, these programs have largely been undertaken by the water system ratepayers, with very little state funding. Virtually no federal money has been allocated for dedicated water efficiency programs. Even the American Recovery and Reinvestment Act (ARRA) allocated out of its $780 billion package $30 billion for energy efficiency programs but only $6 billion for overall water programs—20 percent of which had to be spent on "green infrastructure" which could include water efficiency. But an examination of the actual expenditures shows that only 29 percent of the 20 percent was actually spent on water efficiency; most of the money in the 20 percent set-aside was spent in energy efficiency, storm water, and environmental innovation projects (See Table 3). In FY12 Congress appropriated $811 million for energy efficiency programs in

*All tables have been retained in subcommittee files.
**All figures have been retained in subcommittee files.

DOE's Office of Energy Efficiency and Renewable Energy (EERE), and $50 million for Energy Star. Contrast that with zero funding for water efficiency programs and $2 million for WaterSense.

Thus, we strongly recommend that national incentives be enacted for water efficiency programs, and further that a national policy be instituted to allow energy efficiency funding to be used for cold water conservation programs as well as hot water conservation programs because of the clear embedded energy benefits that this investment would provide.

Thank you for the opportunity to comment.

Senator SHAHEEN. Thank you very much, Ms. Dickinson, and thank you all for your testimony.

I am going to start where you ended, and that is the lack of investment in looking at water use efficiencies. I was interested in your testimony because you talk—you do the comparison between how much has been spent on energy efficiency, and I am particularly interested in this because Senator Portman and I have a bill that is a fairly comprehensive approach to energy efficiency, that does not address water, as you point out.

But I wonder if you could talk about why you think that is; why has the focus been so much on energy and overlook the water side?

Ms. DICKINSON. There are probably a couple of reasons for that; one is historical. You know, we are structured to deal with water at the State level and not at the Federal. It is largely very fragmented within Federal agencies, whereas we have one central Department of Energy. So some of us have envy for a department of water that would have those same responsibilities and focus.

But I think also, we have been in such separate silos for so long that we have, until recently, until really the California work took place in 2005, we didn't really cross over and look at each other's impacts. Now we are seeing, as we look at products that the—for example, the Department of Energy is issuing product standards for.

Let's take ice makers as an example. An energy efficient ice maker uses water. A water-efficient ice maker uses energy. We need to find a sweet spot in between. We need to figure out how we optimize both the water and the energy savings, particularly because we have now discovered there is so much embedded energy in that water.

So, what we did in the Blueprint for Action was document that there are many places in energy efficiency programs and in energy policy and research programs where just adding the concept of water will make a lot of policy sense. Directing the Department of Energy to include water in its deliberations would be a very significant development. So we would be urging you to do that.

Senator SHAHEEN. Thank you. Mr. Chaney, did you want to add to that?

Mr. CHANEY. Just one very small point onto what Mary Ann provided, and that is, when one looks at the cost of certain types of energies compared with the cost of water, there is a dramatic difference. I think that is one of the reasons that water has not been focused on in a big way because it is, simply put, very cheap, comparatively speaking.

Senator SHAHEEN. Especially depending on where you live, right?

Mr. CHANEY. That is right.

Senator SHAHEEN. So, what are some of the barriers to deploying the use of water-efficient technologies, the kinds of codes and standards you talked about, Mr. Green? What are effective ways to overcome these barriers?

Do you want to go first on responding to that?

Mr. GREEN. I will try. First of all, I think that throughout our country, there is a problem today with regard to the application of codes and standards locally. There is not a universal application of codes and standards throughout the United States. There are some places in this country that don't even have codes in place.

So, water being lowest on the totem pole, if you will, in terms of safety issues, really hasn't been—hasn't drawn that much attention. We focus on things like structural safety in buildings; we focus on things about prevention of natural disasters in buildings. So, codes and standards get that kind of press, if you will, but not when it comes to water.

Aas the other panelists have talked about, water is relatively cheap. When you get your water bill at the end of the month, you really do not take too much look at it. But when you get the gas bill, that is a whole different thing. So, we focused, in terms of energy efficiency, in terms of codes and standards, to achieve better efficiencies with regard to energy use for heating and cooling.

Even your comments earlier today about how cool it was in this building, really are the point. Water, we don't even think about because it is there. You know, if we look at the kind of codes and standards that we have in this country, which are fairly applicable in terms of a lot of the areas, we need to get better at the production of more efficiencies in our buildings.

There is a lot of work going on today with respect to pipe-sizing and how to minimum water loss, but not that great. Then when we move over to the utility side, there really is no codes or standards that are applied by local units of government as a regulatory process; it is only by the utility. They regulate themselves in terms of water loss in their piping systems. So, that is where a lot of the inefficiencies are today.

If we had a comprehensive plan, in terms of looking at point of generation for water to point of distribution and use, we would have the whole gamut to be covered, but we don't have that continuity through the process.

Senator SHAHEEN. You talked about the abundance of water, and I think Ms. Dickinson and Mr. Chaney alluded to that, too. But, Mr. Chaney, I was impressed with the map you have in your testimony that shows the seasonal drought outlook and the projections for future drought, and the whole center of the country is projected to have a drought persist or intensify.

So when you look at the map and look at the potential for water scarcity, it adds a whole new dimension to the importance of efficiency; wouldn't you agree?

Mr. CHANEY. Absolutely, Senator Shaheen. We have very serious potential problems in our country. In many respects, we are behind many other developed countries. Australia is the most accepted model throughout the world with respect to drought conditions and how they have responded. The United States, simply put, is a decade or two behind many other developed countries.

As some of the other panelists have pointed out, you know, the EPA—some of our Federal agencies have begun to implement requirements with respect to ensuring that individual plumbing fixtures are of very high efficiency. But the building infrastructure and the water supply systems that bring the water from the utility to the individual buildings are wasting more—much, much more water than we could ever possibly think of saving.

So the infrastructure needs to be addressed. Then we need, frankly, resources to conduct research to understand what the implications are to public health and safety, because it is a continuing balancing point between water and energy conservation and taking that to a limit to ensure that we don't risk public health and safety.

Senator SHAHEEN. You talk about educating the public. What kinds of programs are out there that you all have been party to, that you think help with that public education piece?

Ms. Dickinson.

Ms. DICKINSON. Public education programs are largely handled at the local level by the water system that is serving the community, which is unfortunate because we don't have a national message. It is one of the issues that we are hoping to work on, on a national basis, at the Alliance for Water Efficiency because we don't have a national prerogative, a policy, a consumer education program that is recognized as being of national interest.

It really is focused on the local water shed and the local situation. That is partly because people have a very emotional attachment to their local water supplies and they don't think of it as a national issue. It is part of, I think, what we need to change.

Senator SHAHEEN. If each of you were going to recommend one thing that we could do to make water efficiency a higher priority, what would you recommend?

I do not know who wants—Mr. Bena.

Mr. BENA. From the perspective of a water and energy user in the food and beverage industry, one of the challenges that we have seen over the years is being able to calculate favorable return on investment for some of the technology projects that we've liked to employ. I think any Government intervention that could help via incentive or other mechanism, that would help make those ROI calculations more favorable, it would spur remarkable innovation and new technologies, and allow us, as the private sector, to incubate really novel approaches to both water and energy conservation.

Senator SHAHEEN. So give me some examples of what you think would be helpful.

Mr. BENA. One of the things that we are—and, again, this is somewhat nascent, but we are doing this in Gujarat, India, and it is an example outside the United States. It is done in partnership with the Columbia University Earth Institute. In this particular part of India, they see that water levels in aquifers are dropping up to 3 feet per year, so it is a really—it is an abysmal situation there.

At the same time, farmers, many of them are small-holder famers, are digging deeper wells. So when you dig deeper wells, obviously it requires more electricity to dig, to withdraw the water. The incentives scheme in Gujarat was essentially non-existent.

There was nothing—there was no policy that was incentivizing those farmers, either, A, to use less water or, B, to use less electricity.

So the Columbia Water Center, through funding from the PepsiCo Foundation, partnered with the government of Gujarat to actually try, and it is still very new, but it is trying a new scheme to incentivize those farmers, by giving them relief on electrical rates to use less water to pump—less water to grow the crops. So there we are seeing not only a twofold nexus of water and energy, but actually water, energy, and food, as well.

Senator SHAHEEN. So that the less water they use, the lower their bills are——

Mr. BENA. Correct.

Senator SHAHEEN. As opposed to what we often have in our electric system, which is the more energy you use, the less cost.

Mr. BENA. That is right. Traditionally, it has been unbridled use. It has been really——

Senator SHAHEEN. Right.

Mr. BENA. Unbridled water use.

Senator SHAHEEN. Do the rest of you have recommendations for one significant change that we can make?

Mr. Green.

Mr. GREEN. Yes. First of all, I think what you are doing today is really a start of what can be part of a national dialog on water efficiency and the nexus that we have today.

Last year, the National Institute of Building Sciences Consultative Council issued a report about the water nexus, part of that dialog. You have a copy of our annual report, which we provided to you today, that talks about that and the continuing work of the Consultative Council.

If we have a continued national dialog about the water nexus, one of the things that has to be done at this point is, for us to move forward, is to develop benchmark standards, by which we can measure use. Then, we can achieve better efficiencies, because now we would have something to compare our savings against.

Because there is no national program now, there is no way that we could say that the savings that we achieve are universal. They could be greater in one area versus another. So, that is the kind of discussion that needs to occur.

Senator SHAHEEN. So the importance of data that you talked about in your testimony?

Mr. GREEN. Yes, ma'am.

Senator SHAHEEN. Mr. Chaney.

Mr. CHANEY. I think, in some respects, Chairwoman Shaheen, we have got tools already available to us. The Uniform Plumbing Code, which is the American National Standard for plumbing system installations, and the Green Plumbing and Mechanical Code Supplement already provide for these high-energy-type systems that will help us address these water efficiency and energy efficiency needs, long term. Usually, that is not the case.

Usually, you know, we have got to work for many years to develop the underpinning research that provides us with the ability to develop the technology. The technology is already there. We have

got standards that address rainwater catchment systems, gray water recycling systems.

In some respects, they are not widely adopted by States throughout the country, because some perceive green technologies as being too expensive. It was the same experience 30 years ago with the solar energy, and the Federal Government had to provide incentives to kick-start the implementation of the systems. In many respects, that is what we are experiencing today.

The Uniform Plumbing Code is the most widely recognized code in the world. More than 50 percent of the world's population is covered by the provisions in that document. But here in the United States, we can't get many States to understand that the technology is already there, from an energy and water conservation perspective.

Senator SHAHEEN. Before I ask Ms. Dickinson to respond, I want to get Mr. Bena to comment on what you said about the perception that green technologies are more expensive. Because, clearly, PepsiCo has adopted those green technologies as a way to save money on your bottom line.

Mr. BENA. I think in many ways, it still is a perception. What we have shown through many of the projects that we have implemented, like membrane bioreactors at our Casa Grande facility, like remote wind turbines in India that feed a significant portion of renewable energy to our plants, is that they are doable and you can make the ROIs work.

But, once again, a very important part of that calculation, I think, is some relief from governments.

The other thing I would say is——

Senator SHAHEEN. Can you define that a little bit better. When you say some relief from governments, what are you talking about?

Mr. BENA. So, some sort of incentive, either at the State or national level. Policy frameworks, for example, one of the things. Many countries where a PepsiCo operates actually don't have our national water adaptation plans. That is a really important first step, I would say, in terms of recognizing the water-energy nexus.

One of the things that we are involved with through the Water Resources Group 2030, which is now housed in the International Finance Corporation, is looking at policy models specifically to help close a 40 percent gap, which has been estimated between water supply and demand globally over the next 20 years. So, in some respects——

Senator SHAHEEN. So—I'm just going to stop you there.

Mr. BENA. Sure.

Senator SHAHEEN. Say that again, because I want to make sure——

Mr. BENA. Sure.

Senator SHAHEEN [continuing]. We all got that——

Mr. BENA. Sure.

Senator SHAHEEN [continuing]. Discrepancy that you are talking about.

Mr. BENA. So through an organization called the Water Resources Group 2030, which is an entity that started in the World Economic Forum and is now formally housed in the International Finance Corporation—the sole mission of the Water Resources

Group is to, at the invitation of governments around the world, help close the estimated 40 percent gap between water supply and water demand over the next 20 years.

What is really interesting about having a group motivated by that single goal is that there is a variety of opportunities within that. It can be agricultural interventions, right, like, tensiometers, which are some of the things that we are developing to save water use on farm. It could be things like the membrane bioreactors in facilities to help reuse water and make sure that the water reuse doesn't pose any sort of threat to product quality. You have this barrage of opportunities, all dedicated to this single goal, which is closing that 40 percent gap.

If we don't collaborate with governments, with the private sector, with NGO's, with academia, there is no way we are going to be able to hit that goal.

Senator SHAHEEN. Ms. Dickinson.

Ms. DICKINSON. This is hard because you have asked for only one recommendation, and, you know, my head is full of——

Senator SHAHEEN. You can give three.

Ms. DICKINSON [continuing]. Lots of them.

Senator SHAHEEN. You know, what——

Ms. DICKINSON. So, I gave you two in the testimony, so I am going to give you——

Senator SHAHEEN. Right.

Ms. DICKINSON [continuing]. A different one, because I think this is the underpinning activity that has to start first.

The work they did in California shows that we don't have a good understanding, certainly in the rest of the country, of the extent of embedded energy in water supplies and treatment and wastewater treatment. The numbers are highly local, highly specific. That is the lesson we learned from the California data.

So we have great numbers in California, but we don't have great numbers anywhere else in the country. Without having a good sense of what those national numbers and aggregated data base would produce, we don't have a good sense for how to emphasize it in policy or in incentives, or in continued regulatory work.

So, I think that is the first step and that is probably the first thing I would ask for.

Senator SHAHEEN. So you agree with Mr. Green, that we need to collect the data? Do you have a——

Ms. DICKINSON. The data Mr. Green, I believe, was talking about was at the building level, which I agree from an——

Senator SHAHEEN. Right.

Ms. DICKINSON [continuing]. Perspective is very important. But I am talking about the water utility and wastewater utility data. They need to inventory for each of their supply sources what their energy intensity is, and it is different for every system. But the collective value of it to the Nation is the number we really don't know.

EPRI did a study back, I think it was now almost 10 years ago, and those numbers are outdated. It is time to take a real look, based on the California methodology, of what our national numbers really are.

From there, we can build the connections. Energy efficiency incentives can be then paying for water efficiency programs that ac-

tually yield the energy benefit it is paying for because you will know exactly what that will do.

So at the Alliance for Water Efficiency, we have actually built a model that estimates the energy savings from water efficiency programs, both hot water and cold water, and estimates the greenhouse gas emission reductions, is largely based on the California-specific data that was generated, and it would be much better informed to have a better national picture if we had it.

Senator SHAHEEN. Do you have a proposal for who should keep—start collecting that data? Are—should it be the water systems, and then, who should they report that to in order to give us a national picture?

Ms. DICKINSON. I understand you have S. 1343, the Energy and Water Integration Act, and that stipulates the number of research projects that would be undertaken by a variety of agencies. That would be a place where that data could be collected. It needs to be a study. I think requiring the utilities to report it would just create a 10-year process. I think we can actually, in the space of a couple of years, create a good national data base with some confidence.

Senator SHAHEEN. That would allow us to model——

Ms. DICKINSON. Right.

Senator SHAHEEN [continuing]. What we are using.

Thank you.

Ms. DICKINSON. Then you can key the actual benefits of the incentives right to the defined energy savings that you are achieving.

The reason I mention that is there—in FY12, Congress appropriated $811 million for energy efficiency programs in DOE's Office of Energy Efficiency and Renewable Energy. We don't have anything like that in water efficiency, zero.

So, to me, that is a huge contrast, and you could, perhaps, address that in equity by having a better understanding of the benefits that water efficiency provides.

Senator SHAHEEN. One area where Government, I think, is beginning to recognize the importance of this nexus and address it is within the military. The Navy has a major program underway to conserve both energy and water. I am familiar with it because the Portsmouth Naval Shipyard, which is on the border between New Hampshire and Maine—so it is an installation important to both of us—was the winner in their category because of the savings that they have made with both energy and water.

But I was interested because I visited a hospital in New Hampshire last week, and I was looking at the efficiency measures that they had taken in the hospital, so very significant in terms of energy savings.

But they were really struggling with how to do the water savings piece because of the challenges of the technology that was available. How to do that, particularly in a situation where being able to use gray water is probably not as available as in some manufacturing installations, for example, where that is a better opportunity than in a hospital setting where they really have to have clean water in most of their practices.

But, can you all talk about the whole issue of gray water. Several of you mentioned that one of the requirements we have in this country is that the water has to be to a drinking water standard

in almost all of the water that we are treating, and, yet, we don't really need that standard in much of those water uses. So, how could we begin to address that?

Maybe, Mr. Bena, I'll start with you. Then, Mr. Green, I know you have some thoughts about that. But, how can we look at that and encourage companies to look at where they don't need the drinking water standard and——

Mr. BENA. I think, Senator, we frankly, along with many of our peer companies and our competitors, have been looking at that question for years. It was really through the lens of efficiency and eco-efficiency savings before it had anything to do with sustainability.

Frankly, we are in a somewhat unique position because we have a very intimate relationship with our consumers, right. You eat and drink. You ingest the things that we sell. As a result of that, it opens us up to something called a perception, and Lord knows—I mean, the consumers perception of what, you know, a treated process wastewater stream is may not always be based in the science that supports that.

So, for years, on the beverage side of the business, we have not allowed the reuse of water, even if it meets primary drinking water standards, for use back in—as ingredient water into our beverages. It is largely based on perception, not on science.

On the food side of the business, the Casa Grande plant that I mentioned in Arizona; the Tingalpa, Australia plant; soon to be a third plant in Chile is actually doing that. So they are now recycling process wastewater back to a level where they can use it with direct product contact to wash potatoes. Again, the perception is very different on the food side of the business versus beverage.

I will say that one of the barriers to, I think, this exploding, in terms of seeing potential reuse opportunities, is the lack of very clear standards with regard to the different tiers of what is useable for what applications. So, as a result of that, companies, by and large, are developing them themselves.

We learned very early on that that kind of a risk assessment can be so laborious and so costly that, in many ways, it is easier just to default to primary and secondary drinking water standards for water reuse, which, frankly, is what we have been doing.

Senator SHAHEEN. Mr. Green, did you want to add to that?

Mr. GREEN. I think he is very correct in that, because we have relied upon primary water—drinking water standards for use of water as a primary source.

Gray water, we just have not accepted the use of gray water universally in some applications. For example, gray water, couldn't be used—and it is being used for reclaimed water in terms of watering our lawns and so forth. But we really haven't used it in processing, in building systems. The contaminants that might be in those waters that we use in, for example, cooling towers, because we have to treat cooling towers so we don't develop bacteria. So we use primary water instead of recycled water in those conditions.

So we need to make sure that if we are going to use this recycled water, that they do meet the standard that we are using. So we are going to have various tiers of conditioning that we have to have. I think that gets back to the science of it, from the stand-

point of how are we going to use the water, where is it generated from, and how can a building reprocess, internally, to use water.

Those are the things that I think, when I talked about the dialog about how we use this water, I think that has all got to be contained in that discussion.

Senator SHAHEEN. Thank you.

Did either of you want to comment on that?

Mr. CHANEY. If I can add to it, Senator. The—you know, the water quality standards for recycled or reclaimed water are available. The design, installation, and maintenance standards for how to install the systems within buildings, they are available in the Green Plumbing and Mechanical Code Supplement.

I think one of the impediments has been the infrastructure costs that go along with redesigning the system, because, with the gray water recycling system, you now have dual piping that has to be introduced and there is an associated cost.

You know, in a home, you know, you may only be talking about $3,000 or $4,000. In a PepsiCo plant, you are talking literally, potentially millions of dollars. So there is a huge infrastructure cost that gets tied together. The standards are already there. That is what I was speaking to earlier.

So, in that respect, we have the tools from a design and installation perspective to install and maintain these systems. It is a matter now of understanding what the financial implications are.

Senator SHAHEEN. Anything to add, Ms. Dickinson?

Ms. DICKINSON. The gray water topic is an interesting one because gray water is largely permitted at the local health department level. Local public health officers have been permitting these systems only as pilots because there is no national epidemiological standard that they feel comfortable with, and that is an issue we need to address.

But, again, because of the lack of funding for this issue, there has been a group of stakeholders, and Russ's organization is part of it—there's 6 organizations that have come together to form a plumbing efficiency research coalition, and they are self-funding a number of studies on plumbing and efficiency issues to make sure that we proceed with as best an understanding as possible. For example, are we getting blockages in drain lines.

Gray water is on the list for study. But this coalition has access to zero Federal resources. We are self-funding these studies because we can't get access to, you know, Federal institutions to take a look at this issue.

So gray water probably needs the active participation of a number of Federal agencies, like the Center for Disease Control. You know, people who need to weigh in an help make sure that as we roll out the standards that Russ is talking about, that the local public health officers develop a level of comfort with it. Because, right now, they don't have it.

Senator SHAHEEN. Given those challenges, is—are the savings, they are significant enough to make it worthwhile? I mean, is this an area that we should be pursuing or should we——

Ms. DICKINSON. It depends.

Senator SHAHEEN [continuing]. Be pursuing the——

Ms. DICKINSON. For indoor fixtures, because we are ratcheting down so much of the actual volume, the flow volume of all those fixtures, we're generating less and less potential for gray water. But, you know, I think in the commercial and industrial installations, it's a different—if it's—it's a different matter. So I, you know, leave it to the others to address that point.

But we are seeing such enormous reductions in indoor water use domestically that the feasibility, economically, of retrofitting a house with a gray water system, you know, it's not cost effective; that feasibility isn't there.

Now new construction will be different, especially if you can use a lot of that gray water outdoors. But, again, standards don't uniformly exist for gray water application and irrigation. So these are all issues we need to address.

Senator SHAHEEN. Mr. Chaney.

Mr. CHANEY. Thank you, Chairwoman.

I just wanted to make one, I think, important point with respect to your question. That is, when we look at water conservation and whether or not the infrastructure cost justifies the expenditure, we not only—unlike with energy, in water, you look at not only the water savings, but the energy savings that go along with it.

So there is a dual benefit in respect to water savings. You always got to remember that that nexus exists, unlike in the reverse. That's an important distinction that we have to keep in mind when we consider these infrastructure costs.

Senator SHAHEEN. So as we're thinking about policies—national policies to help deal with water efficiency, the—a better approach might be to continue to encourage reduction in water use, as opposed to looking at how we can encourage more use of non-potable water. Is that what it sounds like you are all saying?

Mr. Bena.

Mr. BENA. I think, frankly, it's a little bit of both, and I think that that answer of both is going to become even more true as time goes on. When you think about population growth and population shift and the drought that you mentioned, and one of my co-panelists, the drought projections, I think we're going to have to use any and all tools at our disposal to be able to address the magnitude of the crises.

Furthermore, and again, the unique perspective of a consumer products company like PepsiCo—I can't believe I'm about to say this, but it doesn't always come down to financial cost. In fact, we have plants operating that do not have attractive returns on investment because of preserving our social license to operate in those geographies, which, frankly, can be absolutely crippling to a business. Unfortunately, there's no easy ways, as of yet, to kind of quantitate that social license.

Senator SHAHEEN. So, how can we support leadership in the private sector to address these issues? Obviously, PepsiCo has done an excellent job of looking at the challenges you face and why it is in your company's interest, both from a cost perspective, but also, as you point out, because of the social capital that you get as the result of doing the right thing in different places. How can you promote that kind of ethic and—among the private sector?

Mr. BENA. I think, Madame Chair, there have been—I have been at PepsiCo for 28 years. In the last, I would say, 5 years, I have seen an unprecedented and positive increase in collaboration.

It sometimes sounds pat, but it is so powerful when you can actually get the local government, or the National or the international government to collaborate legitimately with the private sector, and you bring NGO's to the party, and you bring academia to the party, the result is—you know, people use the word synergy, right; one plus one equals three. A lot of times that's overused. But with those kinds of collaborations, I think it's absolutely true.

You know, we've witnessed it. We continue to witness it. WRG was one example; United Nations CEO Water Mandate is another. I mean, it's essentially under the IGES of the U.N. Secretary General. But it is a private sector-led consortium. It has opened up such collaborative opportunities with the private sector, with governments, with NGO's. It is—I think anything that we can do to kind of spur that air of collective action would certainly benefit all involved.

Senator SHAHEEN. So, you mentioned the legislation, Ms. Dickinson. But how can the Federal Government be a partner in these kinds of initiatives?

Ms. DICKINSON. You have a Department of Energy that could be directed to take a look at the water side, the water impacts from its energy regulatory activities, and I think that would be an important step. You know, making sure we have good information would be another important step.

But I am hearing, you know, from other panelists, too, the issue of incentive. You know, the incentive is important because, as we know, water is not priced the same way as energy and is largely considered almost a free resource in some parts of the country. So since we price the water based on the cost of delivery and not on its resource value itself, it—you don't often get that return on investment.

So, the ability to provide an additional Federal incentive would be very significant, and I think there is a national benefit even beyond the resource issues there. Jobs are created by these efficiency programs. You know, we did an analysis that showed that if we invested $10 billion in the U.S. in water efficiency programs, we could create up to 220,000 new jobs in the implementation of these programs.

So these are all issues that I think we need to think about rolling in. I know this is not the economy to be talking about additional Federal funding for anything. But, to date, water efficiency has gotten zero in terms of Federal incentives, and it—I think it is time to readdress that.

Senator SHAHEEN. Included in that $10 billion figure, did you include any of the upgrades that need to be made to our current water and wastewater treatment systems, which obviously are, in many places, very out-of-date and in need of replacement?

Ms. DICKINSON. The $10 billion figure that I just mentioned was a study that we did that was solely dedicated to water efficiency, which is mostly end use programs, but also leak detection and repair that Russ mentioned in his comments. It was addressing the infrastructure leakage, not replacement of new infrastructure. That

was not part of our analysis. But repair of leaks and rehabilitation of those leaks was part of that analysis.

Mr. GREEN. Chairwoman Shaheen, at the risk of really getting the ire of my board of directors, I'd like to offer something to you in this discussion.

The National Institute of Building Sciences was, in fact, impaneled to be this link between private sector and public agencies to talk about issues such as this.

What I would propose is that there would be a program that would be developed to identify a national water plan that would bring both private and public sector organizations to the table, much like PepsiCo, IAPMO, other code organizations, and other resources, such that a report could be generated that could be delivered to you that might show all of the varying issues relative to the water nexus.

I know that's a daunting challenge, but that's something that I think that the Institute was, in fact, impaneled to do. As I said, I will talk to my board of directors about doing that kind of work.

This would not be a Government or a private sector program, but a collaboration between the two that would have both of the parties. Because if we start this discussion, the folks in the private sector are going to come to the table and we can bring some of the Federal agencies there that have various concerns: water quality, medical issues. We could invite all of them to the same kind of discussions so that it all could be compiled in a report.

I would hope I would get the support of the other panel members to look at something like that.

Senator SHAHEEN. I was just going to ask them if they support that idea.

Good. Are there any final comments that any of you would like to make before we close the hearing?

Ms. DICKINSON. I want to thank you very much for hosting a hearing on this topic. This is something that is very important to us as an organization, and we are very, very thrilled to see your attention to this issue.

Mr. CHANEY. Chairwoman Shaheen, I couldn't agree more. It's through these types of hearings that this important information gets into public policy debates.

As my co-panelists have indicated, this is something that really needs a lot of attention, given the major drought conditions that we're likely to experience as a country.

Senator SHAHEEN. Mr. Bena.

Mr. BENA. I think, Madame Chair, by addressing this genuinely as a nexus of water and energy, and potentially even adding the third component of food, it is a real opportunity for U.S. leadership to once again be shown.

Thank you very much for hosting.

Senator SHAHEEN. Thank you.

Mr. Green, final point?

Mr. GREEN. I would just like to say thank you very much for this opportunity. I think it is shown that there is, in fact, a great concern. That we at least share that concern, and we share it with you. we're hopeful, very hopeful, that as a result of our discussions, going forward, that we can make a difference.

Thank you, again.

Senator SHAHEEN. Thank you, all, very much for your testimony. I think you have given us a lot to think about and some real concrete recommendations for what might be helpful from the public sector, going forward.

I think if we remember nothing from the hearing, those of us who have listened, certainly the 40 percent difference between supply and demand ought to get everybody's attention.

So thank you, all, very much.

[Whereupon, at 3:39 p.m. the hearing was adjourned.]

APPENDIXES

APPENDIX I

Responses to Additional Questions

NATIONAL INSTITUTES OF BUILDING SCIENCES,
Washington, DC, August 15, 2012.

Hon. JEANNE SHAHEEN,
Chairwoman, Water and Power Subcommittee, Energy and Natural Resources Committee.

Hon. MIKE LEE,
Ranking Member, Water and Power Subcommittee, Energy and Natural Resources Committee.

DEAR CHAIRWOMAN SHAHEEN AND RANKING MEMBER LEE:

Thank you for the opportunity to testify before the Water and Power Subcommittee about water efficiency and its connection with energy. I commend your leadership and see this hearing as an opportunity to start an ongoing national dialogue to address how we efficiently utilize this limited resource.

As I indicated at the close of the hearing, the Institute would be honored to spearhead the conversation on establishing a National Water Plan and hope you will support such an effort.

I am pleased to provide the following responses to your follow-up questions.

Question 1. What are the economic and job-related benefits of addressing aging water infrastructure and building plumbing systems?

Answer. Numerous organizations, from the American Society of Civil Engineers (ASCE) to the U.S. Conference of Mayors, have identified the state of our water-related infrastructure as a significant issue facing the nation. ASCE, in a 2009 report, gave the U.S. drinking water and wastewater system a D- grade. Investing in improvements to both the water distribution system and sewer system would result in economic and job-related benefits. The Congressional Budget Office found in 2002 that repairing and updating water distribution systems would require $335 billion over the next 20 years and an additional $300 billion to do the same for sewer systems.

In addition to the jobs necessary (including everything from manufacturing and engineering to construction) to complete such repairs and updates, further benefits would accrue. The United States Conference of Mayors estimates that every job created through rebuilding water systems creates more than 3.6 jobs elsewhere and every dollar invested in water infrastructure adds $6.35 to the national economy.

Nearly 2 trillion gallons of water are lost annually through leaks in water pipes. This annual loss equates to an estimated $1 to $2 billion. These costs are incorporated into a water utility's rate structure and are ultimately born by their ratepayers. Eliminating such wasteful expenditures would result in additional funds being available for ratepayers to invest elsewhere in the economy.

Incentives to conduct water audits for building plumbing systems can have the tri-fold benefit of creating jobs, reducing water use and saving building owners money. Such audits identify opportunities for the retrofit of existing fixtures and appliances (many of which are made in the United States).

Question 2. Please describe the work that you have done with Federal agencies to highlight the impact that water efficiency has on energy efficiency. What role has the Department of Energy played in incorporating this data into their energy efficiency modeling for buildings?

Answer. Though the Institute works with federal agencies extensively, it has had a very limited engagement on projects that address the connection between water

efficiency and energy efficiency. The majority of our work with federal agencies has been focused on resolving specific needs already identified by the agency. However, the following activities provide examples of our work in this area:

- Whole Building Design Guide: The Whole Building Design Guide (www.wbdg.org) is the world's largest repository of buildings-related information. Eleven agencies support the guide and reference its content for their building programs. The private sector also makes significant use of this resource. Pages on "Water Conservation" and "Protect and Conserve Water" identify the necessity to include energy issues when examining water issues.
- Mechanical Insulation Design Guide: The Mechanical Insulation Design Guide (www.wbdg.org/design/midg.php) serves as a comprehensive source of information on the benefits of mechanical insulation, criteria for selection, design and installation of mechanical insulation systems and case studies. Currently, the guide focuses primarily on the energy efficiency-related benefits of mechanical insulation, but as mentioned in my testimony, there are potential water efficiency-related benefits as well. Future versions of the guide will explore these issues in greater depth.
- Department of Energy (DOE) National Training and Education Resource (NTER) Weatherization Training Program: The Institute led development of a module for NTER that focused on training weatherization personnel in a virtual environment. While the module is primarily focused on improving energy efficiency, it does address some water-related activities, including insulating pipes and water heaters. Future NTER modules could be developed with a greater focus on tying water and energy efficiency together.

While the Institute is not privy to all considerations that go into DOE decision making and model development, the role of water efficiency in such activities appears limited. Generally, the codes and standards that address energy use for both commercial and residential buildings do not include a focus on water efficiency or the resultant energy savings. There are several specific areas in the context of codes and standards where a future focus on water efficiency is possible, including the use of mechanical insulation, the efficiency of water pumping and heating equipment, and the use of water for cooling of HVAC equipment. Putting a greater focus on the connection between water and energy at DOE and within other agencies (Environmental Protection Agency, Housing and Urban Development and National Institute of Standards and Technology) could provide a more holistic and comprehensive approach to the efficient use of limited resources. We would be pleased to work with this Subcommittee and the relevant agencies to embed water efficiency considerations in all energy-related discussions and vice-versa.

Question 3. Please describe the different job opportunities that could be related to a concerted focus on water efficiency within the building sector. In addition, where is most of the equipment made that is used to reduce water use, or improve overall water efficiency within the residential, commercial and industrial sectors?

Answer. There would be a variety of associated job opportunities created if a concerted effort was made to improve water efficiency within the building sector. Such efforts should start with identifying how water is currently used and opportunities to use water more efficiently. Water audits and commissioning efforts would require a cadre of skilled contractors. Once water saving opportunities were identified, they could be implemented by various different workers within the construction trades, including plumbers and landscapers. Both new buildings and complex retrofits aiming for improved water efficiency would be more likely to employ engineers and/or landscape architects. In addition, if a National Water Plan was advanced as a national priority with a concerted widespread focus, manufacturers would be more likely to invest in research and development to meet these priorities-thus increasing demand for various types of scientists and engineers.

On-site treatment of wastewater or use of graywater systems also could become more widespread, with an expanded focus on water efficiency. Employment of such systems would require plumbing engineers, plumbers, microbiologists, sampling and laboratory technicians, operations and maintenance providers, and others.

While there is limited definitive information available on how many plumbing products are made domestically, Plumbing Manufacturers International (which represents companies responsible for 80 percent of the plumbing products distributed and/or produced in the United States) reports that its membership has manufacturing facilities in 20 states. In addition to product manufacturing, the distribution and retail sales of products impact state and local economies across the country. While not an exhaustive list, prominent companies such as Kohler, Moen, American Standard and Delta manufacture most if not all of their plumbing products in the

United States. These companies and other U.S.-based manufacturers produce the majority of plumbing products used in the United States.

Thank you again for the opportunity to testify before the Subcommittee. As I indicated at the end of the hearing, the Institute would be pleased to begin the discussion on establishment of a National Water Policy that could begin to address many of the issues raised by me and other witnesses. We will be reaching out to your offices in the near future to assure that you are aware of the progress of this effort and to get your input as it develops.

Please consider the Institute as a resource as you address additional buildings-related issues.

Respectfully submitted,

HENRY L. GREEN, HON. AIA,
President.

RESPONSES OF DANIEL W. BENA TO QUESTIONS FROM SENATOR SHAHEEN

Question 1. You highlight the real environmental benefits that PepsiCo's sustainable initiatives can deliver, but could you elaborate on what these initiatives mean to PepsiCo from a business perspective? What are the reasons PepsiCo invests in these types of initiatives?

Answer. First, and foremost, sustainability initiatives help grow our business and strengthen our social license to operate. They allow us the opportunity to help ensure PepsiCo will continue to flourish 10, 20, or 100 years from now.

Many companies mistakenly identify sustainability initiatives as something that sit apart from the business, when, in fact, these efforts must be considered as a part of the business, in every sense. This is the core principle in our operating model at PepsiCo called Performance with Purpose. We are guided by Performance with Purpose, because doing what's right for people and our planet leads to a more successful future for PepsiCo. It's our commitment to sustained growth with a focus on Performance, Human, Environmental and Talent Sustainability.

PepsiCo has a diverse set of stakeholders that demand we aggressively pursue environmentally sustainable initiatives. These audiences range from the socially responsible investment consortia, like Ceres, collectively representing trillions of dollars in assets under management; to members of local, national, and international governments, who are interested in innovative partnerships with the private sector; to non-governmental organizations, like non-profits and academics, who understand the value that the private sector can bring to global crises, such as water and climate insecurity but who at the same time hold businesses accountable. In addition, our PepsiCo shareholders expect healthy financial returns on their investment in our stock, and the productivity gains afforded by successful environmental sustainability programs are an important part of this performance. Also, our customers are increasing their expectations of the environmental stewardship of their supply chain partners, of which PepsiCo is a part. Finally, our consumers across the world are consistently redefining and raising their expectations of environmental stewardship and the private sector's responsibility within this sphere.

Within PepsiCo's Global Operations, we have created an internal approach called the "Five S Framework," which summarizes the business reasons for aggressively pursuing an environmental sustainability agenda. Specifically:

(1) Synchronize the needs of business and society
(2) Secure our supply chain and make it more resilient
(3) Sustain the right to operate and grow from our stakeholders
(4) Satisfy consumer demand
(5) Synthesize new productivity opportunities

Question 2. How does the implementation of water conservation programs affect PepsiCo's bottom line? How much has the company saved by using water efficient technologies and practices?

Answer. If we look at resource reduction more generally, over the last five years, our reduction of energy, water, and packaging materials has resulted in over $415 Million in productivity savings. Approximately $200 million of this is due to water and energy conservation, and approximately $215 million due to package lightweighting that removed approximately 336 million pounds of material, with commensurate savings in water and fossil fuel.

In 2011 alone, PepsiCo saved an estimated $50 million as a direct result of water and energy conservation practices.

Our year-end 2011 performance of a 21 percent increase in water use efficiency vs. a 2006 baseline not only surpasses our 2015 goal four years early, but represents

water conservation of 16 billion liters, enough to provide the entire planet with their daily drinking water allotment, or fill 16 Empire State Buildings. These kinds of savings are critical to secure our right to operate, particularly in water-stressed areas.

On the agricultural side of our business, our water conservation practices not only conserve significant volumes of water, but also help in improving yield-providing "more crop per drop."

We should note that water conservation initiatives like those contained in S. 3552, the Expanding Industrial Energy and Water Efficiency Incentives Act of 2012, that extend tax credits to manufacturers who invest in water conservation and reuse are critical. It is these types of incentives that encourage businesses to develop and implement water conservation strategies.

Question 3. Both your written and oral testimony reference ReCon. Would you elaborate in greater detail how this system works and how PepsiCo works with suppliers?

Answer. At PepsiCo, ReCon is the name given to our four-stage program of global best practice tools for resource conservation, and is based on the old adage, "if you treasure it, you'll measure it." Stage One focuses on granular measurement of resource use with our manufacturing facilities. For example, on the energy side, we estimate how much energy each individual motor, boiler, or heat exchanger uses and identify areas of opportunities and develop action plans to improve performance. By sharing information through our Operations network, we can strive to apply best practices globally. Stage Two focuses on the major users of resources within the plant, based on the data obtained from Stage One. We know that compressed air and process heating represent significant use of energy within our plants. The systems we use to treat and purify water are often themselves major consumers of water. Stage Three then focuses outside of our direct operations and extends to our supply chain. Stage Four encompasses our entire PepsiCo enterprise.

We constructed the first tool several years ago for energy management within our plants, based heavily on tools and information from the US Department of Energy. ReCon Energy was followed by ReCon GHG, ReCon Water, and most recently ReCon Solid Waste. The power of these tools comes from leveraging a common approach globally. Each has a Profiler, a tool which quantifies a plant's resource usage streams and substreams, and calculates the relative values/costs of those streams. In the case of water, for example, our ReCon Water Profiler allows the plant to dissect its water use and then provides a mapping of the relative volumes of each stream, along with the relative values of each stream. The values are assigned based on local cost of incoming water, treatment or conditioning chemicals, energy used to heat or cool, and finally costs associated with discharge.

Comparing these data allows a quantitative assessment of which streams offer the greatest opportunity for saving water by avoiding water use altogether, reducing the volume of water used, or reusing spent water. The Diagnostic, a series of customized audit-type questions, then assesses whether the plant is following best practices, and which opportunities exist for improvement.

In addition, since 2008, PepsiCo has executed a strategic engagement program with suppliers in North America. By the end of 2011, the program included 50 suppliers representing over 120 facilities. These suppliers leveraged the ReCon program to deliver a single-year 2.5 percent improvement in thermal energy efficiency, 7 percent improvement in electrical energy efficiency and an 18.7 percent reduction in waste-to-landfill. This corresponds to an estimated productivity improvement of nearly $2 million in 2011. Moreover, from 2007-2010, during the inaugural launch of our supplier outreach program, suppliers demonstrated an average 22 percent improvement in water use efficiency, on average.

Based on the success of the program in North America, we expanded the strategic engagement initiative to suppliers in South America and Europe in 2011. We anticipate similar results and would be happy to share them with the committee once they are available.

Question 4. I'm interested to learn more about PepsiCo's sustainable agriculture program and the irrigation strategies employed to conserve water. How are these strategies assisting in water scarce areas and how effective would they be in drought ridden areas of the United States?

Answer. PepsiCo's vision for sustainable agriculture is about increasing productivity and reducing risk for the benefit of our farmers and supply chain. Solutions to agricultural efficiency and productivity issues resulting from our environment demand that we ask and answer tough questions such as the impact of climate change.

We know we can effect change with our growers, because we have direct touchpoints with them. For example, in 2010, we began the Sustainable Farming Initia-

tive, a program that defines standardized metrics for sustainable agriculture and can be applied to any country, any crop, any size land base and for any farmer, large or small. It consists of establishing best practices within three pillars: environmental, social and economic. We started identifying sustainability indicators within the environmental pillar in 2011. Since then, nine indicators have been identified, including: soil, water, air, energy, agrochemicals, nutrients, GHGs, waste and biodiversity. Detailed criteria and best practices are being developed to address each one of the nine indicators. We are in the process of developing the social and economic pillars, which include identifying indicators covering health and safety, employment practices and working conditions, among others. We expect to launch the complete program globally in 2013 and are striving for our growers and agricultural suppliers to be compliant with the program by 2020.

Even more basic, and a core part of our Sustainable Agriculture Policy, the Sustainable Farming Initiative, and our day-to-day agricultural practices in the field with our growers, is resource conservation.

We continue to invest in a portfolio of water-conserving technologies and techniques here in the United States and around the world, both through our business and through our philanthropic arm, the PepsiCo Foundation. For example, in addition to evolving our irrigation practices from traditional flood irrigation, to central pivot, and ultimately to drip, we developed "i-crop" technology in partnership with the University of Cambridge in the UK. I-crop uses a variety of climatic sensors, GPS mapping, and root-zone water measurements, coupled with "cool farm software," to deliver precisely the amount of water needed to the root zone, precisely when it is needed.

The PepsiCo Foundation, in partnership with the Columbia University Earth Institute in New York City, developed a low-cost device called a tensiometer, which is a soil moisture probe currently being tested by thousands of farmers in India, and which is showing water savings in excess of 20 percent over traditional methods.

In China, PepsiCo is one of the largest agriculture-related enterprises, investing more than RMB 200 million (equivalent to more than USD 31 million) in local agricultural development. These investments, supported by PepsiCo's proven expertise in crop plantation and irrigation, have benefited more than 10,000 rural Chinese households and created a win-win solution for local farmers and the company. Examples include:

- A PepsiCo pilot farm in Inner Mongolia has used advanced irrigation technologies to transform desert into fertile potato farmland.
- The average yield of PepsiCo's potato farms in China has increased to 45 tons per hectare, meeting the global standard.
- PepsiCo has achieved up to 50 percent reduction in water consumption in potato cultivation by implementing advanced irrigation techniques.

The use of drip irrigation techniques in the cultivation of potatoes in India has the potential to reduce on farm water usage by as much as 50 percent. In addition to the considerable water savings, drip irrigation helps to increase yields without additional labor requirements, which results in overall cost savings. From 2008 to 2011, PepsiCo developed and expanded the drip irrigation technique to include 2,787 acres in four states (Haryana, Maharashtra, Gujarat and Karnataka), with plans to reach 4,000 acres in 2012. Farmers are provided with low-cost loans to cover costs, and PepsiCo has commitments to buy back potatoes as part of its supply chain.

We continue to leverage these approaches here in the United States across our supply chain. Over a ten-year period, our Frito-Lay business in the US reduced on-farm water usage by 715 Million gallons/year, reduced on-farm fuel usage by 250 thousand gallons/year, and reduced on-farm fertilizer use by 3.3 Million pounds/year.

Question 5. With different PepsiCo facilities across the country, how do the various water utility practices influence your efforts to conserve water? What have been the most effective programs?

Answer. As local businesses, we know the unique aspects of our communities, particularly as it relates to local water resources. In the United States, close to 100 percent of our facilities support local/municipal infrastructure systems as an industrial supply customer. In virtually every case, our plant production teams establish relationships with the municipality early in the process, so that we can be alerted of any issue that may impact supply. Similarly, we alert them of any unusual conditions which might impact their operations on the raw water side, or with regard to wastewater treatment.

This collaborative relationship between utilities and water users, like PepsiCo, should be considered among the most effective best practices.

The current drought experienced throughout the United States provides an excellent example. Like any customer, drought impacts us, and we generally cease any non-critical water use consistent with drought management. In addition, we work with other companies in the beverage sector, through the Beverage Industry Environmental Roundtable (BIER), to develop drought preparedness guidelines for our sector. It is during these times that a solid relationship and frequent dialog between utilities and its users is advantageous.

It is worth noting that one of the trends that we have witnessed, particularly with smaller utilities, is that when our manufacturing facilities reduce water usage in any given year, it is not uncommon for the water rates to increase the next year commensurate with the water reductions we have effected. This is understandable from the perspective of sustaining the utility operations budget, but, at the same time, can be counter-incentivizing to further incremental resource reduction by the user.

Alternatively, higher water prices could actually help justify acceptable returns on investments (ROI) for water conserving technology, like various forms of membrane treatment. So, accurate valuation of water across the board and across all industries needs further assessment.

Further exploration into solutions to these scenarios would be of benefit to both the utilities and the end users in the long term.

RESPONSE OF DANIEL W. BENA TO QUESTION FROM SENATOR LEE

Question 1. Please describe the areas that should be further researched to better understand interconnectedness between water and energy.

Answer. The hearing explicitly made the case that it takes energy to treat and move water, and it takes water to produce energy. Yet, too often, water use efficiency and energy efficiency are addressed separately. Admittedly, significant and positive impact can be achieved by pursuing efficiency improvements in water or energy individually. However, there is a growing trend in the environmental arena to better understand the true synergy of addressing water and energy use together-the so-called "water:energy nexus."

We suggest that a third leg should be added to this discussion-food security. If interested parties can begin to address the water: energy: food nexus holistically, using a "systems approach," we believe that significant impacts can be realized.

For example, in certain regions of the United States, water tables are declining. A farmer's response-or that of the utility that provides water to the farmer-is understandably to dig a deeper well. At just over eight pounds per gallon, the deeper the well, the more energy it takes to abstract that water used to grow the crop. At some point, additional pumps and pipelines will be needed to keep agricultural fields and cities hydrated almost certainly increasing costs to both water and energy use and thus increasing the cost of the food grown. Similarly, just as more energy is needed to abstract water, more water is often used to produce that energy. This in turn makes less water available for cultivation and places an even greater burden on our farms.

More research is needed to better understand the innovative methods needed to encourage mutually beneficial conservation efforts, i.e., growing a food crop, using less water, and conserving energy (or increasing the use of renewables). Too often, attention is directed toward rewarding a single aspect of the nexus, such as energy efficiency, despite the fact that water conservation plays an equally important role.

ALLIANCE FOR WATER EFFICIENCY,
Chicago, IL, August 15, 2012.

Hon. JEANNE SHAHEEN,
Chairman, Water and Power Subcommittee, Committee on Energy and Natural Resources, U.S. Senate, Washington, DC.

Hon. MIKE LEE,
Ranking Member, Water and Power Subcommittee, Committee on Energy and Natural Resources, U.S. Senate, Washington, DC.

DEAR CHAIRMAN SHAHEEN AND RANKING MEMBER LEE:

The Alliance for Water Efficiency is a broad-based stakeholder non-profit organization composed of 365 water supply utilities, business and industry stakeholders, environmental groups, and government agencies committed to promoting the efficient and sustainable use of water throughout North America. We believe that conserving water and using it efficiently is critical to ensuring that water resources are

available now and in the future to support healthy economies, ecosystems, communities, and individuals.

The Alliance was pleased to appear before the Subcommittee on Water and Power on July 25, 2012 to testify on our work on water and energy nexus issues. We have received follow-up questions from you, and we are pleased to provide answers as indicated below.

If we can provide any further information, please do not hesitate to contact us.

Sincerely yours,

MARY ANN DICKINSON,
President and CEO.

RESPONSES OF MARY ANN DICKINSON TO QUESTION FROM SENATOR SHAHEEN

Question 1. You mention the relationship between energy and water and the amount of energy embedded in water and wastewater treatment. Why is there such a wide range in the amount of embedded energy and what causes the disparity?

Answer. The amount of energy consumed by drinking water pumping and treatment, as well as wastewater pumping and treatment, varies significantly from water system to water system. The amount of energy needed varies because of physical constraints such as topography; technical constraints such as type of pumps and type of treatment processes; and the length of distances over which water needs to be pumped. It further varies by type of water supply source: surface water withdrawal; imported or transferred water; pumped groundwater; recycled water; or desalinated water. Each supply source will have a "signature" of how much energy is used between system input and eventual discharge, and it is essential to know the total energy signature in order to understand which supply sources use the most energy.

Beginning in 2005, the California Energy Commission conducted detailed work that showed the range of embedded energy in water and wastewater in California is between 2,000 kWh to 20,000 kWh per million gallons (MG) of water produced. The figure* below shows where energy is used in each phase of the pumping and treatment cycle. The most energy-intensive range is in water treatment, sometimes going up to 16,000 kWh/MG. The type of treatment is also a factor, with microfiltration being typically the most energy intensive treatment process.

Conveyance of water over long distances is similarly a high energy user, and thus the supply source is important too, with its own embedded energy signature. In my home community of Lake Arrowhead, California, the amount of energy needed for three different water supply sources varies greatly. When water is withdrawn and consumed from Lake Arrowhead itself, the embedded energy value of the pumping and treatment, including wastewater collection and treatment, is around 8,984 kWh/MG, based on an examination of the electric bills. When the water comes from groundwater wells, the embedded energy number is not too dissimilar: 8,873 kWh/MG. But when the Lake Arrowhead Community Services District has to buy additional water from California's State Water Project, the embedded energy number skyrockets to 24,991 kWh/MG. Clearly the imported water—which has to be pumped great distances over high elevations—is a very serious energy consumer as well as extremely expensive water.

Thus, it is critical that each water system compute its embedded energy numbers for all its pumping and treatment types, as well as for each one of its water supply sources, to see if there is high variation. Once this information is known, efficiency programs can be designed to optimize utility operations and to minimize the amount of energy needed for the highest energy-using supply source. Table 2 in my testimony gives a summary of all the various energy inputs that came out of the California research. This information is what needs to be aggregated and computed for each water system.

The high variability in embedded energy in drinking water and wastewater systems is a significant national issue because very little data exists on the regional variations across the country. It is imperative that we gather better information on the amount of energy being consumed by water and wastewater utilities, as well as their customers, so that appropriate efficiency programs are designed and implemented.

Question 2. I am interested in the work of the 75 organizations involved in the water-energy arena to identify recommendations for national and state officials in the areas of policy and research. What are some of the recommendations from the Blueprint for Action that might be relevant for this committee?

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*All figures have been retained in subcommittee files.

Answer. The Blueprint for Action[1] included policy as well as programmatic recommendations for moving the water-energy nexus issue forward. There were nine specific policy recommendations that we believe would be relevant for this committee's consideration and that we are hoping will be the subject of future legislation:

1. Encourage the implementation of regulatory structures and incentives that reward water and energy efficiency, including by establishing mechanisms to recognize the benefits of water and energy savings by programs, and consider setting water-saving targets for utilities, just as many states have energy-saving targets for utilities.
2. Encourage the Department of Energy to implement appliance and equipment standards on water-using appliances and equipment, and provide appropriate credit for direct and indirect water impacts in setting performance standards.
3. Develop, enact, and implement building codes that recognize water and energy efficiency.
4. Develop and propose specific energy-water elements to add to existing federal legislation, such as the Water Resources Development Act, the Federal Water Pollution Control Act, the Safe Drinking Water Act, the Energy Policy and Conservation Act, and the National Energy Conservation Policy Act.
5. Develop and propose tax incentives for water and energy efficiency, preferably performance-based.
6. Direct and provide resources to such federal bodies as the Energy Information Administration, national laboratories, the Federal Energy Regulatory Commission, the Census Bureau, the Department of Interior, and the Environmental Protection Agency to collect water and energy end-use data from across sectors and to extend existing and future energy policy analyses to include water impacts where possible.
7. Identify a platform enabling energy and water regulatory and governance bodies to communicate with each other readily.
8. Encourage increased collaboration among federal, state, and local agencies in such areas as the integrating of water and energy efficiency through the use of grant funding, research, regulation, and technical assistance from the Department of Energy, the Environmental Protection Agency, the Department of Agriculture, and the National Oceanic and Atmospheric Administration.
9. Require coordination between energy and water regulatory authorities when considering siting of new power plants or significantly expanding existing power plants.

RESPONSES OF MARY ANN DICKINSON TO QUESTIONS FROM SENATOR LEE

Question 1. Please describe the energy and water savings directly tied to repairing aging water infrastructure.

Answer. With water supply having so much embedded energy in it because of pumping and treatment, a utility that leaks a large amount of treated water out of its distribution system is not only losing money but losing valuable energy. This issue was studied by the California Public Utilities Commission in 2007-2009, when they appropriated $10 million to fund various water-efficiency pilot programs across the state. Nine pilot programs were jointly conducted between electric and water utilities, and a third-party contractor was hired to evaluate the results. The purpose of the pilots was to determine how much energy credit could be given for energy saved in "cold" water conservation programs, and what the potential for long-term energy savings would be if these water efficiency programs were adopted on a more widespread basis.

After three years of study, the results showed that of the nine pilot programs, the pilots with the highest energy savings were distribution system leak detection and low-income high efficiency toilets. The distribution system leak detection pilot was run by Southern California Edison in three demonstration communities, and the results showed that this particular program appeared to offer the greatest energy savings potential (at relatively low cost) out of the other nine pilot programs. In particular, the energy savings documented in this report are based on leaks that were actually repaired during the program period. The potential achievable water (and energy) savings were estimated to be much higher by the program implementation contractor.[2] The numbers from the study are as follows:

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[1] Addressing the Water-Energy Nexus: A Blueprint for Action and Policy Agenda, May, 2011. Alliance for Water Efficiency and the American Council for an Energy Efficient Economy. http://www.allianceforwaterefficiency.org/blueprint.aspx

[2] http://www.energydataweb.com/cpucFiles/33/FinalEmbeddedEnergyPilotEMVReport—1.pdf

1. The total amount of economically recoverable leakage for the three demonstration communities ranges from 60 to 116 million gallons per year.
2. The total amount of embedded energy saved in the three systems— from repaired leaks—was 178,143 kWh.
3. The total amount of potential energy that could be saved with proactive leak detection and management in the three communities is as high as 583,277 kWh.

Although this is only one study in one state, it shows the incredible promise presented by repairing aging leaking infrastructure. To date there is no federal program incentivizing this important activity.

Question 2. Please describe the relationships that are needed between water and electric utilities to better understand the water energy nexus.

Answer. The Alliance for Water Efficiency and the American Council for an Energy Efficient Economy decided to partner on the Blueprint for Action because there was no existing relationship of any kind between water and electric utilities to explore the water-energy issues. We wanted to begin a dialogue and start implementing joint projects that would get both sets of utility mangers out of their respective silos. A clear beginning is conducting joint research, but a longer term relationship on actually implementing joint efficiency programs is also needed.

The specific steps that we believe need to be taken to forge a good relationship are as follows:

1. Increase the level of collaboration between the water and energy communities in planning and implementing programs.
2. Achieve a deeper understanding of the energy embedded in water and the water embedded in energy.
3. Learn from and replicate best practice integrated energy-water efficiency programs.
4. Integrate water into energy research efforts and vice versa.
5. Separate water utility revenues from unit sales, and consider regulatory structures that provide an incentive for investing in end-use water and energy efficiency.
6. Leverage existing and upcoming voluntary standards that address the energy-water nexus.
7. Implement codes and mandatory standards that address the energy-water nexus.
8. Pursue education and awareness opportunities for various audiences and stakeholders.

The Blueprint for Action[3] report goes into more detail on each of these areas.

RESPONSES OF GP RUSS CHANEY TO QUESTIONS FROM SENATOR SHAHEEN

Question 1. You mention that the Federal government should provide incentives to help local communities adopt and enforce green codes. How do you envision such incentives working to improve water and energy efficiencies?

Answer. Here in the United States, we develop our codes and standards from the bottom up, meaning that the best subject matter experts, along with the stakeholders that are most affected by the contents of our codes and standards, get together, and in a transparent and consensus based process we develop incredibly comprehensive provisions that make up our construction codes and our green codes.

However, regardless of how well codes are developed and provisions that pertain to energy and water efficiency are deliberated in the process, they will have no impact at all unless updated codes are adopted and rigorously enforced at the applicable State or municipal level.

Currently, many jurisdictions are delaying the adoption of codes because we lack the agreed upon metrics to articulate a return on investment (ROI) for implementing updated codes. Hence, delaying the adoption of updated codes is often erroneously viewed as a cost avoidance measure.

The Federal government can assist by having the Department of Energy review updated codes and provide credible guidance in terms of ROI and also articulate the peripheral ecological benefits of the energy saving provisions contained in the updated code or voluntary green code. Such information will provide all stakeholders

[3] Addressing the Water-Energy Nexus: A Blueprint for Action and Policy Agenda, May, 2011. Alliance for Water Efficiency and the American Council for an Energy Efficient Economy. http://www.allianceforwaterefficiency.org/blueprint.aspx

at the municipal level with the factual information they need to fully understand the financial tradeoffs and benefits of adopting codes that contain water and energy efficiency provisions.

This would be particularly effective for green codes that address water efficiency as the incorporation of water efficient technologies, such as high efficiency plumbing fixtures and fittings and solar thermal technologies can be installed with minimal capital outlay, especially in new construction, yet provide water and energy efficiencies for the life of the building.

In addition, due to the economic squeeze that many municipal governments are being challenged with, they are often cutting back on the thorough inspection and enforcement of energy efficiency provisions, and focusing enforcement inspections on the life safety elements of the code only (fire safety, egress provisions, etc.).

Here, the Federal government can assist by providing financial incentives to municipalities for hiring properly trained code enforcement inspectors to staff levels where water and energy code provisions can be properly inspected and enforced.

Question 2. In your comments, you alluded to the need to support research for less invasive sub-metering technologies. Can you please elaborate on this and say why this is important in terms of yielding energy savings through water efficiency?

Answer. IAPMO currently has a Memorandum of Understanding with the American Society of Plumbing Engineers (ASPE) to arrive at updated pipe sizing requirements for buildings that take into account the new, lower consumption levels of today's plumbing fixtures and appliances, which are much lower than the consumption levels of those devices that were made as recently as 20 years ago.

This gives us a huge opportunity to reduce the diameter of the pipes in our buildings, which would provide essentially free water and energy savings by reducing the volume of water between the water heaters or boilers in a building and the point of use. While this sounds easy to do on the surface, what we have learned in our efforts with ASPE is that in order to accomplish this goal, we need to understand how water is being used in various building types. Armed with this knowledge, we can then arrive at the correct statistical formulas to determine the most efficient pipe sizing requirements for buildings in our codes.

The statistical formula currently used in our codes were developed by Dr. Roy Hunter who worked at the National Bureau of Standards, now the National Institute of Standards and Technology (NIST) back in the 1920's through the 1940's. We again need the leadership and brain power of the Federal Government in assisting with this complex issue. Every building that is constructed employing smart-pipe-sizing plumbing systems will yield a lifetime of water and energy savings with zero added cost.

IAPMO stands ready to work with the Federal government and other stakeholders to gain a better understanding about how water is being used in different building types so that we can make our plumbing systems efficient as possible while maintaining health and safety and ensuring system efficacy.

Question 3. You referred to "smart" water in your testimony. What sort of similarities do you see between a smart water infrastructure and smart grid and how can IAPMO assist in a smart water initiative?

Answer. As plumbing code developers, we are certainly not experts regarding the technical merits or capabilities of a smart electrical grid. However, in our view, there are conceptual similarities in functionality that can be shared. Specifically, a smart water distribution system would contain sensors to alert the owners of the system to a catastrophic leak or failure and allow for the isolation of such a failure in order to minimize the disruption of service to users, minimize water waste and also mitigate the potential for contaminates to infiltrate the whole distribution system.

It is also important to note, that as code developers, our area of jurisdiction and expertise is contained to plumbing systems in buildings, and not to water distribution systems. Leak detection technologies can also be used in building plumbing systems to provide real time feedback to building managers, enabling the repair of otherwise insidious leaks that not only waste water and energy but can also damage other building elements if left unrepaired.

IAPMO can assist by working within our compliance based code development process to help codify such smart technologies and, assuming such provisions are adopted by our members, require their installation in new construction.

Question 4. How can IAPMO collaborate with major water utilities to provide a unified water efficiency and conservation message to the American public?

Answer. When we consider our looming water crisis, it becomes apparent that much is needed in the way of public education and awareness. As mentioned during the hearing, we need to initiate a candid discussion about water with the American consumer.

IAPMO stands ready to work with water utilities across the country, both large and small, and with Federal government entities such as the EPA WaterSense division, towards the development of consumer awareness and education materials that can be included in utility bill and made available on the internet.

Our role in such an effort would be to advise home owners and commercial building owners regarding water efficiency technologies that can reduce consumption and save them money, while also making sure that these technologies are installed in a manner that ensures safety and meets plumbing code provisions.

RESPONSES OF GP RUSS CHANEY TO QUESTIONS FROM SENATOR LEE

Question 1. Please describe the similarities and differences between the water "grid" and the electric grid. How are these two connected?

Answer. As we mentioned in our response to one of Senator Shaheen's questions, as plumbing code developers, we are certainly not experts regarding the technical merits or capabilities of a smart electrical grid. Having said that, as we gain better understanding of the nexus between water and energy it becomes increasingly clear that efforts to foster water efficiency also yield surprising energy efficiencies and vice versa.

Question 2. What are the unknowns between the interconnectedness of the two that could be important for policy makers at the local, state and federal levels?

Answer. Currently, we lack data regarding exactly how much water is being used to generate electrical power, and conversely, how much energy is utilized in the treatment, distribution, heating and waste treatment of water. Only the State of California has calculated how much energy is embedded in these water based processes. Simply communicating and illustrating what we do know about this interconnectedness to decision makers at all levels of government, and keeping them appraised of findings as additional studies are conducted, such that they can better appreciate the "low hanging fruit" of energy savings through water efficiency will yield very significant water and energy savings.

Question 3. Could you please elaborate on the process you undertake to get accreditation for your codes?

Answer. IAPMO is accredited by the American National Standards Institute (ANSI) to develop the Uniform Plumbing Code (UPC), Uniform Mechanical Code (UMC), Uniform Swimming Pool, Spa and Hot Tub Code (USPC), and the Uniform Solar Energy Code (USEC) as American National Standards. Accreditation by ANSI means that IAPMO utilizes consensus code development processes which have been determined by ANSI to contain all of the essential requirements for due process which ANSI mandates be present in order to designate the document as an American National Standard. These essential requirements include, but are not limited to, the right that any person (organization, company, government agency, individual, etc.) with a direct and material interest in the subject matter be permitted to participate in the development of the document by:

(a) expressing a position and its basis;
(b) having that position considered; and
(c) having the right to appeal.

ANSI also requires that the development process provide for:

- Openness—participation shall be open to all persons who are directly and materially affected by the activity;
- Lack of dominance—the standards development process shall not be dominated by any single interest category, individual or organization; and
- Balance—the standards development process shall have a balance of interests.

The aforementioned IAPMO codes are developed utilizing committees of technical subject matter experts and others who debate and discuss the subject matter until the committee reaches consensus (not less than two-thirds of voting members). The committees are balanced, open and the development process is not dominated by any single interest category. All members of the public are welcome to participate in the process. The committee considers and provides a substantive response to all comments submitted by the public.

In 2011, after conducting an extensive audit, ANSI determined that IAPMO had achieved a consistent record of successful voluntary code development of the aforementioned codes and ANSI conferred "audited designator" status upon IAPMO thereby empowering IAPMO to designate the aforementioned codes as American National Standards without the need for additional review by the ANSI Board of Standards Review.

Question 4. Are you aware if the Department of Energy has made water a consideration in any energy related regulations?

Answer. Largely, the Department of Energy (DOE) has long ignored water and/or the imbedded energy within water as a component of its regulations. In working with many DOE staff, we have heard them state on many occasions that they are directed to look at direct energy, not indirect energy. Many forward-thinking staff at DOE have stated their desire to look at other energy savings potential, such as water, but there has not been much movement in that direction. We do know that agency staff have claimed they do not have the authority needed from congress to look at the imbedded energy within water.

Question 5. In 2010, Battelle Memorial Institute released a study on the energy efficiency impacts of hard water. The study concluded that scale formed by hard water can lead to as much as a 24 percent loss of energy efficiency in water heaters and that treatment with water softeners preserved the original factory efficiency ratings of water heaters over a 15-year lifetime. Are you familiar with this study and its conclusions?

Answer. The WQA / Battelle study was provided to our Green Technical Committee and was considered in the development of certain provisions contained in the IAPMO Green Plumbing and Mechanical Code Supplement. As such, yes, we are familiar with this study and its conclusions.

Question 6. Based on these types of results and the potential impact of hard water on energy efficiency, do you believe that reducing or eliminating scale is an important factor in allowing appliances such as water heaters to maintain their Energy Star ratings?

Answer. Clearly, reducing the buildup of scale in water heaters impacts the efficiency of water heaters whether it is an Energy Star labeled product or not. Scale also robs energy and water efficiency by clogging plumbing fixture fittings such as faucets and showerheads. However, the Green Technical Committee did find cause for concern with the WQA / Battelle study in terms of the water quality of the test water selected to conduct this study and with the recommendations that water softeners should be installed even in areas of very low water hardness levels.

We know that water softeners can reduce scale and thereby help maintain efficiency levels in water heaters. However, there is a downside to water softeners that needs to be taken into account as well. Most require the addition of salts. Backwashing these systems consumes water and produces a brine that increases salinity levels in wastewater and increase the utility costs to treat the water. As a result, some wastewater utilities are currently not allowing the installation of salt consuming water softeners in their jurisdictions.

It is interesting that you bring up this topic, Senator, as this is a prime example of the type of water efficiency research that is needed. We currently lack the metrics to arrive at an accurate accounting of these types of tradeoffs and determine where it makes sense to install water softeners (and similar technologies) and where they may cause more harm than good.

Question 7. It is understood that IAPMO is currently working with industry to develop a standard test procedure for ant-scale technologies. Such a test procedure would greatly enhance the opportunities for these technologies within federal energy efficiency programs. Can you tell us what the status is of this effort and when you anticipate the test procedure being finalized?

Answer. Yes, Senator, we are happy to report that there has been a high level of interest in this IAPMO initiative. We are currently developing IAPMO Standard Z601, Scale Reduction Devices. This standard is currently being vetted by the IAPMO Plumbing Standards Committee. It is expected that the test protocol validation and subsequent formal approval of the standard will take about one year; therefore, the Z601 standard should be published in the early fall of 2013.

APPENDIX II

Additional Material Submitted for the Record

INTERNATIONAL CODE COUNCIL,
Washington, DC, August, 8, 2012.

Hon. JEAN SHAHEEN,
Chairman, Senate Energy and Natural Resources Committee, Subcommittee on Water and Power, 304 Dirksen Senate Office Building, Washington, DC.

Hon. MIKE LEE,
Ranking Member, Senate Energy and Natural Resources Committee, Subcommittee on Water and Power, 304 Dirksen Senate Office Building, Washington, DC.

The International Code Council is pleased to address the critical issue of the energy and water efficiency relationship. We wish to extend our appreciation to the Senate Energy and Natural Resources, Water and Power Subcommittee, and to Chairman Shaheen and Ranking Member Lee for providing the opportunity to comment.

The International Code Council (ICC) is a member-focused association dedicated to helping the building safety community and construction industry provide safe and sustainable construction. We do so through the development of model building codes and standards used in the design, build and compliance process nationwide. Most U.S. communities and many global markets adopt ICC's International Codes (I-Codes). Presently, all fifty states and the District of Columbia have adopted the I-Codes at the state or jurisdictional level. Federal agencies including the Architect of the Capitol, General Services Administration, National Park Service, Department of State, U.S. Forest Service and the Veterans Administration also enforce the I-Codes for the facilities that they own or manage.

The relationship between water and energy use has long been recognized in many sectors, yet in the United States, we have traditionally addressed each topic individually. There are three primary categories for this energy/water relationship, each with different stakeholders and drivers.

- Centralized Water Supply and Treatment
- Water Point of Use Applications
- Energy Recovery from Wastewater

Centralized Treatment

Since the 1950's an increasing percentage of Americans and businesses receive water supplies and wastewater treatment from centralized, permitted facilities. Energy is consumed in the transport of water to the treatment facility, in the treatment of the water itself, and in the delivery of potable water to the customer. The amount of energy consumed in transport will depend significantly on the terrain and distance between the source and the water treatment facility. This accounts for the fact that the California State Water Project, which pumps water over the Tehachapi Mountains to users in the southern part of the state, is California's largest power consumer. Notably, future energy consumption for transporting water is likely to be even higher as population centers are forced to reach farther afield for sources of water. Treatment too draws significant amounts of energy, and future energy consumption is also likely to rise as water purveyors are forced to use lower quality sources. One extreme in this regard is desalination, which consumes significant quantities of energy using current technology.

Reduced demand for water resulting from water efficiency measures can provide immediate energy savings from both transport and treatment. Even modest water efficiency measures implemented on a community scale through green codes like ICC's International Green Construction Code (IgCC) can produce measureable energy savings for water purveyors. They can also delay or eliminate the need for the construction of expensive new treatment and pumping infrastructure.

Opportunities exist for similar savings by utilizing more decentralized water sources and treatment. This involves the use of alternate onsite water sources such as collected rainwater, graywater, and HVAC condensate to offset or eliminate the need for conventional centralized supplies with their embedded energy. While these systems are promising, care must be taken to protect the health and safety of the consumer through the use of codes like the IgCC and science-based standards. Research and development is also needed to ensure that the implementation of alternate onsite systems community wide does not consume more energy than a comparable centralized system.

Point of Use Applications

It is the end use of water that determines the overall demand within a region, and therefore sets the total energy consumed by a centralized treatment system. Therefore, the less water consumed by homes, office buildings, industry, and agriculture, the less energy that will be consumed by water purveyors treating and pumping water.

There are many applications where reductions in water consumption directly reduce energy demand at the point of use. The majority of public supply water is delivered to commercial and residential buildings, and ICC's model codes provide the basis for the construction of almost all of these buildings in the United States.

As a result, ICC's model codes and standards are uniquely positioned to provide immediate and measurable savings when implemented in jurisdictions. For example, reductions in hot water consumption carries with it proportional energy savings, all other things being equal. If a traditional showerhead is replaced with a WaterSense certified showerhead consuming 20 percent less water, as required in the IgCC, 20 percent less energy is required to heat the water (assuming the duration and temperature of the water stay the same). Within ICC's family of model building codes, such provisions aimed jointly at water and energy appear first in the base codes, like the International Building Code (IBC), International Residential Code(IRC), International Plumbing Code(IPC), and International Mechanical Code(IMC). High-performance model codes, such as the International Energy Efficiency Code (IECC) and the International Green Construction Code (IgCC), can provide even more savings.

Within ICC's family of codes, provisions that save water and energy can be found for:

- Bathing water (showers/baths)
- Pre-rinse spray valves
- Evaporative cooling towers
- Hot water distribution plumbing systems
- Dishwashers
- Clotheswashers
- Humidification systems
- Carwash systems

Notably, the development of codes and standards for many of these technologies are evolving rapidly. ICC's code process is designed to reliably and predictably update all of our model codes every three years, to incorporate new technology, recognize cost saving techniques and systems, and to adopt alternative methods of achieving safe and sustainable buildings. But the codes have no impact on buildings, or on water and energy use, unless they are adopted and enforced by the state and local jurisdictions with authority to regulate building construction.

Therefore the importance of communities adopting updated and current building codes cannot be overstated. Even relatively recent editions of the codes do not contain provisions for many new water and energy innovations. Failure to update codes may leave communities ill-prepared to safely implement new technologies and systems and the benefits they can bring when properly implemented. Both for financial reasons, and sometimes due to the opposition of groups who want to avoid the first cost of some code requirements, some jurisdictions have delayed adopting current codes. In many jurisdictions, the codes are 10 or more years old, and do not reflect current energy and water realities.

To promote the adoption of current building, sustainability, electrical and life safety codes, ICC and the National Fire Protection Association (NFPA) founded the Coalition for Current Safety Codes (CCSC). Dozens of safety, environmental, and business organizations, as well as hundreds of individuals, have joined this coalition to remind states and local governments of the importance of regular code review.

Federal support for the adoption of updated model codes, through both example and incentives, is essential for the safe implementation of water and energy conservation measures of various types, and the federal government should continue ef-

forts to support the adoption of current codes. Federal agencies have long been leaders in adopting the latest codes and standards to assure long term sustainability and safety of Federal buildings, and that leadership should be supported and encouraged.

Coordination between the codes is also of critical importance. When building, plumbing, mechanical, energy and green codes are designed to work together seamlessly; the greatest opportunity to support water and energy savings in the built environment is realized. For this reason, ICC promulgates a coordinated family of codes that ensure that provisions impacting energy or water are coordinated. This is the best way to avoid unintended negative consequences to water or energy-related codes, and to take advantage of positive interactions between disciplines.

The IgCC, a new model code first issued as a 2012 edition, takes the water/energy relationship one step farther than traditional model codes, and seeks to balance the interactions between all elements of sustainability in a building. Developed in partnership with the American Institute of Architects and ASTM International, it features the ASHRAE/USGBC/IESNA 189.1 standard as an alternate compliance path. This model code takes a balanced approach to sustainability, and ICC recommends it as a framework for sustainability in federal facilities and future legislation.

Energy Recovery from Wastewater

The final category in the energy/water relationship involves the recovery of energy from wastewater streams. Here, thermal and nutrient energy contained within wastewater is treated as a resource to be utilized, rather than waste alone. At the point of use, drainwater heat recovery can be used to recover thermal energy in wastewater to preheat incoming water. Nutrients and chemicals in wastewater streams can be mined using various technologies to extract energy in various forms. This practice has already become common at wastewater treatment plants where the energy is used to power plant operations. New research and technologies aim to move that energy recovery closer to the waste source.

Unique among green building rating systems and model codes, the IgCC addresses the emerging technologies associated with energy from wastewater, and provides for tools to measure such energy

In summary

- Promoting water efficiency for all users of public service water reduces pumping and treatment energy use and directly reduces energy use at the point of use.
- Modern, coordinated building codes are a vital means of reducing both energy and water consumption that is immediately available. These codes are essential to ensure that new technologies and systems are implemented in a safe and balanced manner. Federal efforts to encourage states to update codes can produce measurable savings.

STATEMENT OF PLUMBING MANUFACTURERS INTERNATIONAL, MEADOWS, IL

On behalf of Plumbing Manufacturers International (PMI), we appreciate the opportunity to submit our written statement for the record to the Senate Energy and Natural Resources Subcommittee on Water and Power's recent hearing on July 25, 2012 regarding the critically important issue of water use, water efficiency and the impact water efficiency has upon our country's overall energy use from the perspective of plumbing products manufacturers.

PMI is the leading national and technical trade association of plumbing products manufacturers in the United States. Our 31 manufacturers and allied members are responsible for at least 80 percent of all the plumbing fixtures and fittings sold in the U.S. The majority of PMI member companies operates manufacturing facilities in the U.S. and produces a wide range of from sinks, toilets, and urinals to bathroom and kitchen faucets, showerheads, drinking fountains, garbage dispos≥als, as well as a variety of fixtures.

Water-Efficient Plumbing Fixtures Reduce Water Consumption Levels & Wastewater Flows

It takes a considerable amount of energy to deliver and treat the water we use every day. Heating water for bathing, shaving, cooking, and cleaning also requires a lot of energy. With over half of all indoor residen≥tial water use taking place in bathrooms and kitchens, improved water efficiency in plumbing products is central to our nation's water conservation efforts. Studies continue to show that the use of water-efficient plumbing products is effective in saving water.

PMI and its member companies are committed to protecting the future of our national and local water supplies through water-efficient plumbing products and prac-

tices. Efficient plumbing products help consumers and communities hold down the rising costs of additional water supply and wastewater treatment infrastructure. Saving water also reduces the energy required to pump, heat, and treat water throughout the nation. Furthermore, using water more efficiently helps maintain water supplies at safe levels, and protects human health and the environment. Plumbing manufacturers are doing their part to improve water efficiency not only in their own manufacturing operations, but by producing an extensive number of water efficient plumbing products which are easily found in retail locations across the country.

Growth of Water Efficient Plumbing Products & U.S. EPA's WaterSense Program

Our commitment to water efficiency is evident in our industry's partnership with the U.S. Environmental Protection Agency's (EPA) WaterSense Program. This voluntary program, launched in 2006, promotes water efficient plumbing products and today brings to market over 4,000 water-efficient plumbing products from high efficiency toilets, bathroom sink faucets to showerheads and urinals. These prod≥ucts have been consumer tested and reduce water consumption by up to 30 percent.[1]

PMI and its members have worked diligently with the EPA WaterSense Program over the past several years to develop voluntary product specifications for water efficient products. An open public process has brought together the EPA, water efficiency experts, standards developers, plumbers, and PMI member manufacturers to consider and balance the range of technical and performance issues unique to each product. When a manufacturer makes a product that meets those specifications, the product is eligible for third-party testing to ensure the stated efficiency and performance criteria have been met. If the product passes the test, the manufacturer is rewarded with the right to put the WaterSense label on that product.

For companies to use the label, they must sign a WaterSense partnership agreement. Among other things, the partnership agreement defines the roles and responsibilities of EPA and the partnering organization, as well as proper use of the label on products, on packaging, and in marketing and other promotional materials.

WaterSense now makes it easy for consumers, as well as builders and plumbers, to find and select water efficient products with a label backed by third party, independent, testing and certification. In fact, the majority of our member companies produce products that display the WaterSense® label.

Rebates for Water-Efficient Plumbing Products

Some communities have water conservation plans in place that often include residential rebates for products that reduce water use to encourage the installation of low-flow fixtures which typically include toilets, showerheads and bathroom faucets. How you obtain that rebate varies from jurisdiction to jurisdiction. Some areas give away free products, others give the money up front and, in a majority of cases, others require proof of purchase. There are also eligibility requirements and limits on the types of products. In addition to products, some utilities offer free services. For instance, several communities offer a free water-saving audit.

Consumer Outreach

PMI has developed and maintains a consumer-focused website, www.safeplumbing.org, featuring important facts and guidance on clean water, water efficiency, and health and safety in plumbing fixtures and systems. In addition, our member companies have collaborated with EPA through national "Fix- A-Leak" Week and "We're For Water" events to drive awareness of repairing leaks and new water-efficient products on the market. Specifically, PMI and its member companies have been actively involved in a variety of public education campaigns including—WaterSense Fix-a- Leak Week—typically held in March. Dripping faucets can waste up to two thousand gallons of water each year in the average home. Leaky toilets can waste as much as two hundred gallons per day.

America's Water Infrastructure Challenge

High-quality drinking water and wastewater systems are essential to public health, manufacturers, business, and quality of life in the U.S. Much of our drinking water infrastructure, the more than one million miles of pipes beneath our streets, is nearing the end of its useful life and approaching the age at which it needs to be replaced. Water pipes are leaking and bursting with alarming frequency as the nation's plumbing infrastructure ages. Moreover, our shifting population brings sig-

[1] Products that seek the WaterSense label must: be water-efficient, using at least 20 percent less water than EPA's fixture-specific water use baseline-U.S. EPA Office of Wastewater Management- http://www.epa.gov/watersense/about___us/watersense___label.html

nificant growth to some areas of the country, requiring larger pipe networks to provide water service.

The American Water Works Association (AWWA) and other organizations have documented that our water and wastewater infrastructure is aging and that many communities must significantly increase their levels of investment in its repair and rehabilitation to protect public health and safety and to maintain environmental standards.

According to a recent study by the AWWA[2] , the cost of repairing and expanding the drinking water infrastructure will top $1 trillion in the next 25 years and $1.7 trillion over 40 years. As a nation, we need to have serious conversations at the federal, state and local levels about the funding required to repair our aging water infrastructure. Deferring needed investments today will only result in greater expenses tomorrow. As manufacturers of critical plumbing products that rely on clean water coming from the tap, this is a critical issue facing our industry and consumers. The longer we wait to make needed repairs and upgrades, the more acute these problems become and the higher the costs to American families and businesses.

Critical Plumbing Products Research

PMI supports research currently underway to discern future efficiency levels, balanced against the "tipping point" at which plumbing products no longer protect the health and safety of consumers. In fact, PMI is currently part of the Plumbing Research Efficiency Coalition (PERC) which is undertaking a building drainline research study that will analyze the potential for blockages resulting from the use of reduced flow water closets in commercial buildings and evaluate the use of higher volume flush valve discharges at intermittent intervals as a way to effectively clear drainlines.

The PERC research is intended to answer important questions about product performance and design considerations at lower flow rates. Once the research is complete, product/water efficiency questions will be able to be answered with facts and research data. We may, in fact, be at the practical limits of efficiency and any further reductions in efficiency levels in some consumer plumbing products, specifically toilets and showerheads, need to be based on scientific study in order to ensure continued efficacy and safety in addition to increased levels of water and energy efficiency.

The funding for this study took years to secure and came from code organizations, a variety of trade associations, including PMI, individual plumbing manufacturing companies and NGOs. Unfortunately, the federal agencies declined to support this critical PERC research. In the future, the federal government should be involved in the development of key research programs and provide some financial support for scientific study to ensure that increasingly precious water supplies are used as efficiently as possible in buildings and homes, while maintaining health and safety.

EPA's WaterSense program is an essential element in the development of a water focused benchmarking initiative, but focuses on individual plumbing products and not the use of water throughout commercial buildings.

Conclusion

PMI member companies are committed to designing and producing water-efficient products, without sacrificing performance. We understand the importance of both water conservation and energy reduction. Our association and its members continue to raise the bar in developing the most advanced water efficient plumbing products and further our commitment to preserving our environment. Our efforts will help ensure reliable water supplies today and for future generations.

We look forward to working with the committee in the 113th Congress to further discuss the important nexus of water efficient plumbing products and its impact on energy use. In the meantime, if you have any questions regarding our statement, contact Barbara Higgens, Executive Director, Plumbing Manufacturers International.

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[2] Buried No Longer: Confronting America's Water Infrastructure Challenge, American Water Works Association, Feb. 27, 2012-www.awwa.org/files/GovtPublicAffairs/GADocuments/BuriedNoLongerCompleteFinal.pdf.