STATE OF ILLINOIS
ILLINOIS COMMERCE COMMISSION

DAKOTA ACCESS, LLC	)	
	)	
Application Pursuant to Section 15-401 of the	)	
Common Carrier by Pipeline Law and Sections 8-503	)	
And 8-509 of the Public Utilities Act and for a	)	Docket No. 14-0754
Certificate of Good Standing and Related Authority to	)	
Construct and Operate a Petroleum Pipeline as a	)	
Common Carrier Pipeline and When Necessary to	)	
Take Private Property as Provided by the Law of	)	
Eminent Domain	)	

<u>UNITED ASSOCIATION EXHIBIT 1.3</u>

"THE UNITED ASSOCIATION AND AMERICA'S ENERGY FUTURE"

MAY 20, 2015

The United Association and America's Energy Future

2014

William P. Hite
General President

FOREWARD

Dramatic changes have taken place in global and national economic conditions in the last decade, giving rise to an increased awareness of the need for reliable energy supplies and greater environmental responsibility in energy production and consumption. Recent events have also demonstrated the strained condition of our aging energy infrastructure systems, and geopolitical trends have further hastened the importance of moving towards energy independence.

At the UA, we believe that an economy built to last must make the most of North America's energy resources. It must be fueled by homegrown and alternative energy sources that strengthen our economy, promote steady job growth, and make us more secure and less dependent on foreign oil. That is why we support an "all of the above" approach to developing new sources of energy, promoting the responsible development of domestic oil and natural gas, boosting renewable power generation, supporting growth in nuclear power, and increasing energy efficiency in all sectors. The economic well-being and security of this nation depends on maintaining affordable and secure access to a diverse energy portfolio, which is why the UA supports the development of a sensible, progressive energy policy that balances our nation's current energy needs, as well as our economic viability, with environmental concerns.

We believe that American workers have been and will continue to be a crucial factor in driving U.S. competitiveness in the energy sector. There are billions of dollars of investment for both conventional and alternative energy sources that are ready to proceed in the coming years. These projects—including nuclear and natural-gas powered electricity generation, alternative energy projects, environmental upgrades at existing coal facilities, and efficiency retrofits across residential, commercial and industrial sectors—all require a highly-trained skilled workforce.

The UA Training Department spends over $250 million annually on cutting-edge training and skills updating because we know that a well-trained workforce is essential to delivering clean, reliable, and affordable energy to homes and businesses. We proudly invest millions of dollars in training our members and maintaining training centers across the country, focusing on areas such as pipeline construction and maintenance, nuclear construction and maintenance, solar and hydropower technologies, energy efficiency, and other skills critical to the energy industry.

We hope this paper inspires more conversations about opportunities for training and employing workers in these industries, as well as the importance of a diverse and balanced energy portfolio moving forward.

William P. Hite
General President

ABOUT THE UNITED ASSOCIATION

The United Association (UA) is a multi-craft union whose members are engaged in the fabrication, installation and servicing of piping systems. There are approximately 340,000 highly skilled UA members who belong to individual local unions across North America. For more information, visit: www.ua.org

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INTRODUCTION

The United States has long benefited from a diversity of energy resources, including traditional sources such as oil, natural gas and coal, as well as renewable energy from water, solar and geothermal sources. Equally important, the U.S. still enjoys a global competitive advantage when it comes to creating innovative technologies and methods to improve efficiency and reduce environmental impact.

Key to maximizing our energy productivity and meeting sustainability goals is managing our energy infrastructure. Our existing infrastructure is vast, complex, and vital to every facet of modern life and to the functioning of our entire economy. The total capital investment embodied in the nation's existing energy infrastructure is enormous, as are the financial and institutional resources that will be required to continue maintaining and expanding this infrastructure.

Right now, our energy infrastructure in the United States is aging, even crumbling in some areas. We cannot develop new resources and advanced technologies if we don't make the investments needed to upgrade and expand key components of our energy systems. Current vulnerabilities pose significant risks to public health and safety, our efforts to reduce greenhouse gas emissions, and our nation's overall position in the global marketplace. To demonstrate how strained our current systems have become, each year the American Society of Civil Engineers issues a Report Card rating our country's various infrastructure systems. In 2013, the ASCE gave our energy infrastructure a D+.

The infrastructure needs of the future will be substantial, judging by the most recent energy supply and demand forecasts released by energy experts. Overall, forecasts from EIA's *Annual Outlook 2014* show that continued growth in energy demand will require an expansion of U.S. capacity to generate and transmit electricity, refine petroleum, deliver natural gas, and improve end-use energy efficiency. It will not be possible to meet the nation's energy and economic needs or achieve desired reductions in greenhouse gas emissions without enhancing, expanding and diversifying America's energy infrastructure.

"You can't expect the United States to remain a first-rate world leader with a second-rate infrastructure."

- UA General President William P. Hite

United Association members are among those who know better than most just how important energy infrastructure is—after all, we build and maintain virtually all aspects of this infrastructure. We keep it running and we know what happens when it fails. We know what it takes to ensure we have electricity to light our homes, gasoline to power our cars, and fuel to get food and products to our citizens. That's why the UA has been such an ardent proponent of a sensible, realistic and sustainable energy policy, one that not only takes advantage of our own natural resources but also includes a real investment in the systems that process and transport those resources.

With increased demand comes abundant job opportunities in both traditional and emerging energy industries, and many of these jobs—such as building new power plants—cannot be exported and will remain in the United States. In the coming years, massive recruitment and training will be necessary to offset the retirement of the baby boomers—so continued training will be necessary in order to keep our workforce competitive. The UA stands ready to lead the way in preparing the next generation of workers to install and maintain new and traditional technologies across all sectors.

The deployment of new technologies, including the latest energy efficiency methods, renewable technologies, advanced coal with carbon capture and advanced nuclear processes will require new construction, operation and maintenance skills—skills which will need to be improved and refreshed on a consistent basis. This poses a great challenge for the industry, but also a great opportunity for labor organizations like the United Association. We train for the future—not just for today. Our training programs produce the premier workforce for the construction and maintenance of new and existing energy facilities and infrastructure.

This paper will focus mainly on the need for improving our nation's infrastructure, as well as the opportunities for American workers to be a part of the solution. Not only will improving our infrastructure employ men and women right away, it will lay the foundation for economic growth and energy security in the future.

OIL & NATURAL GAS

The majority of the energy that is required for us to maintain our way of life is supplied by oil and natural gas, which account for roughly 62 percent of our energy consumption. Even as renewable energy consumption is expected to grow over the next decades, projections estimate that 59 percent of U.S. energy demand will still be met by oil and natural gas in 2040.[i]

While there is much work to be done in terms of increasing domestic energy production, significant improvements have been made since President Obama took office. While approximately 60 percent of U.S. oil was imported in 2005, today the number is closer 40 percent and falling.[ii] In the last two years, American oil production has reached its highest levels in over two decades and natural gas production has reached an all-time high. For the sake of our nation's economy and security, we should strive to produce an even larger percentage of our energy needs domestically and obtain imports from geographic neighbors and allies like Canada.

The United States is now the number one natural gas producer in the world, and for the first time in decades, our nation is now producing more oil at home than we import from abroad. According to the White House, "These are important steps to reduce America's dependence on foreign oil and responsibly leverage our nation's homegrown energy resources."[iii]

In fact, the White House lauded the domestic expansion of oil production with the launch of the Quadrennial Energy Review in early 2014. According to a White House Press Release, "Since President Obama took office, domestic oil production has increased more than 50 percent and natural gas production is now the highest it has ever been."[iv]

The U.S. has an abundant supply of both oil and natural gas, and new technologies have been developed to extract resources once impossible to reach in a manner that is environmentally and economically feasible. These new sources have brought about rapid changes in the infrastructure needed to bring these supplies to market. Unconventional resources are poised to continue to contribute to steady job creation, economic growth, and reliable energy production in the United States for decades to come.

The American energy boom has proven to be an important driver for our economic recovery—creating jobs and stimulating the economy. The oil and natural gas industry currently supports 9.8 million men and women across the United States in a wide range of highly skilled, well-paying jobs (accounting for approximately 5.6 percent of total employment.[v] In 2011, the industry distributed $224 billion in wages paid to U.S. employees, promoting economic growth and bolstering the middle class. Continuing to expand access to America's oil and natural gas resources can create 1.4 million more jobs by 2030.[vi]

UA members across the country—whether moving oil, natural gas or natural gas liquids (NGL)—are building and repurposing pipelines to meet new infrastructure needs.

A key part of addressing future energy challenges will be developing and maintaining the systems by which we transport energy supplies. Pipelines—when properly designed, manufactured, installed and maintained by skilled workers—will be an important low-carbon emissions method of transporting materials.

The U.S. has the largest network of oil and natural gas pipelines of any country in the world. It spans nearly 2.6 million miles, safely carrying more than 14 billion barrels of crude oil each year[vii] and all natural gas produced in the U.S.—more than 25 trillion cubic feet in 2012.[viii]

As technology allows us to extract more of our own domestic sources of oil and natural gas, infrastructure projects like pipeline development will continue to employ thousands of UA members and strengthen the reliability of service and diversify the sources of energy supply. With better infrastructure, more Americans will have access to reliable energy at lower costs—to heat their homes and fuel their vehicles. Investing in our energy delivery infrastructure will mitigate risk for future degradation and help keep the power on when major storms or unforeseen circumstances arise.

OUR POLICY PRIORITIES:

SUPPORT FOR KEY LEGISLATION: We support legislative efforts to expedite the build-out and repair of our oil and natural gas pipeline network.

SWIFTER PERMITTING PROCESS BY THE DOE AND FEDERAL ENERGY REGULATORY COMMISSION: In the short-term, another corrective measure would be to improve the federal process for pipeline permit applications. Right now, the regulatory process can cause significant delays in the construction of critical infrastructure.

INNOVATIVE FINANCING: We are committed to actively working with policymakers, stakeholders and the public to brainstorm innovative ways to finance infrastructure projects. This involves education efforts, encouragement of public-private partnership and partnering with consumer groups and state officials to develop acceptable finance solutions. We've found that it is important to engage consumer groups, in particularly, because ratepayers often bear the front of postponed improvements. For example, consumers paid at least $20 billion for gas that was unaccounted for and never used between 2000 and 2011.

PIPELINE VS. RAIL

In the past, crude oil imports largely entered the U.S. near refining facilities on the coasts, where pipelines then moved products to customers across America. Today, with domestic production on the rise, the situation is increasingly the opposite. Oil and natural gas produced in America now needs to be transported to refineries and processing facilities before they can be moved to market. There is inadequate transportation infrastructure to meet this important need.[ix]

In the absence of sufficient pipeline location and capacity, transportation by rail has increased significantly. Since 2009, transportation of crude oil by pipeline has experienced an annual growth rate of 5 percent while rail movement has experienced an annual growth rate of 119 percent.[x] As oil production has risen in North America, energy companies have increased the number of U.S. rail shipments of crude oil and refined petroleum products to 408,000 carloads last year—up from only 11,000 in 2009.[xi]

Studies have shown that rail is considerably more environmentally hazardous than pipelines, resulting in higher overall energy use, increased carbon emissions, and an explosion rate significantly higher than pipelines. Use of rail to transport oil is also taking its toll on many of our country's key agricultural communities who are experiencing severe disruptions in the delivery of their products to market. For example, according to a University of Minnesota study, rail delays and disruptions caused in part by increased oil shipments cost Minnesota corn, soybean and wheat farmers $100 million in 2013.[xii]

In all, more than 1.15 million gallons of crude oil were spilled from rail cars in 2013, according to information released by the Pipeline and Hazardous Materials Safety Administration (PHMSA). Compare this to the period from 1975 to 2012, in which railroads spilled a total of 800,000 gallons, and it's clear that increasing transportation by rail is not the solution.

Today, there are about 185,000 miles of pipelines in the U.S. carrying crude oil to refineries and petroleum products to market,[xiii] and they have an impressive track record of delivering these commodities to their destinations without incident more than 99 percent of the time.[xiv] From 1999 to 2011, the number of liquid spills from pipelines has been reduced by 59 percent, and the volume spilled has been cut by more than 43 percent.[xv] It's no wonder pipelines are widely considered the safest and most efficient way to transport energy products.

NATURAL GAS

Natural gas is the cleanest burning fossil fuel, enhancing its desirability as a fuel option. Due to a number of power plants switching from coal to natural gas, a milder winter and lower gasoline demand, carbon dioxide emissions hit a 20-year low in the beginning of 2012. With natural gas increasingly used to meet electricity generation, the EPA has found that compared to the average air emissions from coal-fired generation power plants, natural gas power plants produce half as much carbon dioxide, less than a third as much nitrogen oxides, and virtually no sulfur oxides.[xvi]

The natural gas boom in the United States offers a tremendous opportunity to strengthen American energy security by drastically reducing our dependence on imported oil, while at the same time creating new U.S. jobs and industries. Our domestic natural gas resources are also reducing energy costs across the economy – for manufacturers investing in new facilities and families benefiting from lower heating costs.

$1,200 average amount families' disposable incomes increased in 2012 due to lower natural gas costs from unconventional development.[xvii]

452,000 potential net U.S. job growth resulting from LNG exports by 2035.[xviii]

500,000 potential new jobs supported by new oil sands development within 25 years.[xix]

NATURAL GAS PIPELINES

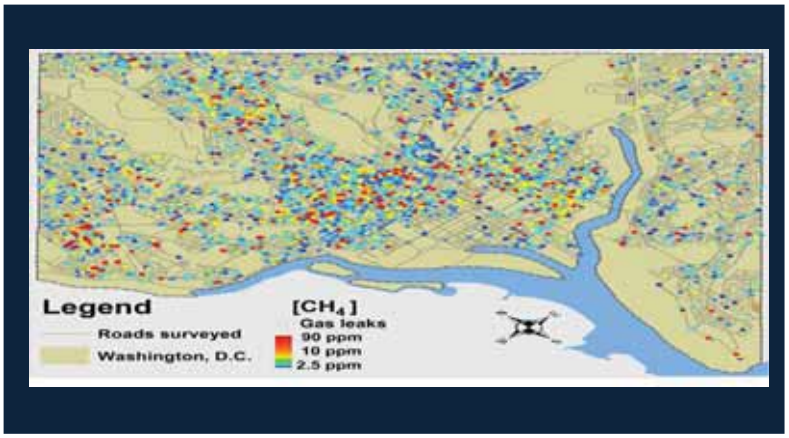
For most of us, the more than 1.25 million miles of natural gas distribution pipeline across the United States are out of sight - and out of mind - until something goes wrong.

That's what Harlem residents learned when a cast iron gas main from 1887 - over 127 years old - exploded and leveled two buildings. Nationally, the Department of Transportation estimates that more than 30,000 miles of decades-old cast iron pipe are still being used to deliver gas. Although these pipes have been identified by the PHMSA as particularly vulnerable to corrosion and compromise, they have been in use since the 1830's and are still used today.

Much of our pipeline system is 50 or 60 years old — or older. Actually, it's a testament to the skill of the people who originally constructed these pipelines that the system has functioned so well for so long. However, failures in this aging system are becoming more and more common. Leaking pipelines pose a risk to public health and cost consumers millions in terms of higher gas and electric bills. Methane leaks from natural gas pipelines contribute substantially to air pollution, and we know the harm that comes when a pipeline ruptures. All in all, the economic impact of our aging pipeline infrastructure can be measured not in the millions but in the billions of dollars.

Gas companies are already undertaking pipeline replacement, but the American Gas Foundation estimates that, at the current rate, it would take 30 years or longer for many pipeline operators to upgrade just the distribution part of the pipeline network. We can't wait that long. Each day we postpone this investment, we are placing the health, and even the lives, of our citizens at risk.

According to a recent study by Boston University and Duke University, there are currently thousands of leaks in the natural gas pipelines that service Boston and the District of Columbia.



In Washington, D.C. alone there are estimated to be more than 5,892 leaks from underground natural gas pipelines. Several manholes were discovered to have methane concentrations as high as 500,000 parts per million of natural gas — about 10 times greater than the threshold at which explosions can occur. Methane is the second-largest greenhouse gas emitted into the atmosphere, accounting for 18 percent of our emissions.

In an effort to jumpstart the process of replacing our pipeline system, the United Association has joined with other unions, industry leaders, and organizations like the BlueGreen Alliance (BGA) in calling for the replacement of our pipeline infrastructure. The UA was proud to be a part of the release of a new BGA report, *Interconnected: The Economic and Climate Change Benefits of Accelerating Repair and Replacement of America's Natural Gas Distribution Pipelines,* which shows we can create 313,000 jobs and reduce global warming pollution by accelerating the rate we are repairing and replacing America's natural gas distribution pipelines. According to the report, accelerated repair could save nearly $4.4 billion worth of gas and prevent 81 million metric tons of greenhouse gases from being emitted into the atmosphere.

TRAINING VETERANS

Infrastructure projects offer a prime opportunity to create jobs for the men and women who need them most, including our nation's returning military. The UA developed the Veterans in Piping (VIP) Program to help connect transitioning service members with careers in our industry, including the construction and maintenance of pipelines. It's the only program of its kind that prepares service members for a job prior to military discharge at no cost to participants or the government.

The UA VIP Program has been recognized as one of the leading programs in the country for assisting veterans, which is an honor we take great pride in. There are several key reasons for this recognition, including the fact that the VIP Program provides not only high skills training in key occupations, but also guaranteed job placement. We place 100 percent of our VIP graduates in quality jobs with good pay, along with healthcare and retirement benefits.

The program comprises of 16 to 18 weeks of specialized, intensive training in highly marketable skills such as welding and HVACR. We also provide participants with additional skill training opportunities after they complete this program by connecting them to our established apprenticeship training programs, which are recognized in the industry as the best in the business. On top of all this, these individuals can earn college credit along the way for their training—which can be applied to toward a college degree.

Military and government officials have lauded the VIP Program as a model in workforce development. The program has earned the praise of the U.S. Congress, the Department of Labor, the Department of Defense, and the Military Officers Association of America (MOAA). In 2011, General President Hite received the Distinguished Service Award from the MOAA on behalf of the UA for this program. This was the first time in the organization's 84-year history that a labor leader has been awarded with such recognition.

As America's most abundant fossil fuel resource, coal has played a major role in our country's energy portfolio for decades. The United States is home to the largest estimated recoverable reserves of coal in the world. In fact, we have enough coal to last more than 200 years, based on current production levels. Coal is produced in 25 states spread across three major coal-producing regions. In 2013, approximately 70 percent of production originated in five states: Wyoming, West Virginia, Kentucky, Pennsylvania, and Illinois.[xx]

The United States has around 1,300 coal-fired electricity generating units in operation at almost 560 plants across the country. Coal supplies roughly 39 percent of the electricity generated nationally and is expected to maintain a significant role in providing reliable and affordable power in the future.[xxi] While the industry as a whole faces challenges, including low natural gas prices and new environmental regulations, there is a lot of potential for cost-effective carbon capture, utilization and storage that can advance coal's economic and environmental viability.

According to the National Mining Association, the mining industry as a whole supports nearly two million American jobs and generates annual revenues in excess of $100 billion. Over the next 5-10 years, mining operations will need approximately 55,000 new employees to meet demand and to replace retiring employees.[xxii]

IN 2012, U.S. COAL MINING WAS RESPONSIBLE FOR 204,580 DIRECT JOBS.

National Mining Association / U.S. Bureau of Economic Analysis

Over the long term, electricity demand is projected to increase steadily, growing 28 percent by 2040. According to the EIA, from 2016 to 2030, coal production increases gradually as growing electricity demand and rising natural gas prices spur the use of coal for power generation. After 2030, when existing coal units reach maximum utilization rates and virtually no new capacity is built, coal production stabilizes.[xxiii] In 2040, natural gas is expected to account for 35 percent of total electricity generation, while coal will account for roughly 32 percent.[xxiv]

OPPORTUNITIES FOR CLEANER USE

Over time, coal has become a cleaner energy resource as its environmental performance has been improved dramatically. The rate of emissions per unit of output from coal-fired electric generation has dropped approximately 78 percent since 1990, and further reductions are possible.[xxv]

The development of carbon capture and storage (CCS) technology is critical for any successful climate strategy, both here and abroad. There are close to 1,200 coal boilers on order around the world, and nations like China and India are not in a position to reduce their use of coal anytime soon. If the United States can capture the first-move advantage in CCS technology, we will greatly reduce the carbon emissions from fossil fuel use and prosper by selling domestically-produced second generation CCS technologies around the world.[xxvi]

The Department of Energy has invested in research on more than a dozen experimental carbon-removal technologies, including the development of coal gasification plants. Coal gasification converts coal to pipeline-quality synthesis gas and uses ultra-clean technology that can remove harmful gases and capture and has the potential to store more than 90 percent of carbon emissions.

POLICY IN FOCUS:

In January 2014, the U.S. Environmental Protection Agency (EPA) issued a revised new source performance standard proposal for emissions of CO2 that requires new coal-fired power plants to limit their emissions to 1,100 pounds of CO2 per megawatt hour. The proposed emission limit would effectively require that new coal-fired electric generating units employ carbon capture and sequestration (CCS) technologies to reduce uncontrolled emissions of CO2 by approximately 50 percent. For existing power plants, in June 2014 the EPA released proposed rules designed to cut CO2 emissions at current coal-fired electric generating units 30 percent from 2005 levels by the year 2030.[xxvii]

The UA supports a sensible approach to lowering emissions that focuses on providing states and industry with flexibility, while limiting the impact on American workers. We continue to work closely with the EPA and other regulatory bodies, industry, and state and local authorities to develop suitable options for coal plants to continue operations.

Nuclear energy is a clean, reliable power source that addresses our growing concerns about clean air and climate change. It's also the only major form of energy that doesn't emit carbon pollution. To be sure, renewable sources such as wind and solar are growing rapidly—but, combined, they still supply only a small percentage of the nation's electricity. And renewables are intermittent. They produce power when the dune shines or the wind blows. Only nuclear generates cheap, reliable electricity all day and all night, no matter the weather.

Today, nuclear power accounts for approximately 20 percent of U.S. energy consumption, at the lowest fuel cost of any source of electricity, and it emits no greenhouse gases or air pollutants. In fact, nuclear power generates more GHG-free power than the rest of the non-GHG emitting technologies combined. Nuclear power generation itself does not contribute to airborne emissions of carbon dioxide (CO2), a major greenhouse gas. Currently, nuclear power's nearest competitor among non-greenhouse-gas-emitting electricity generating technologies is conventional hydropower, which supplied about 7 percent of U.S. electricity generation in 2013.[xxviii]

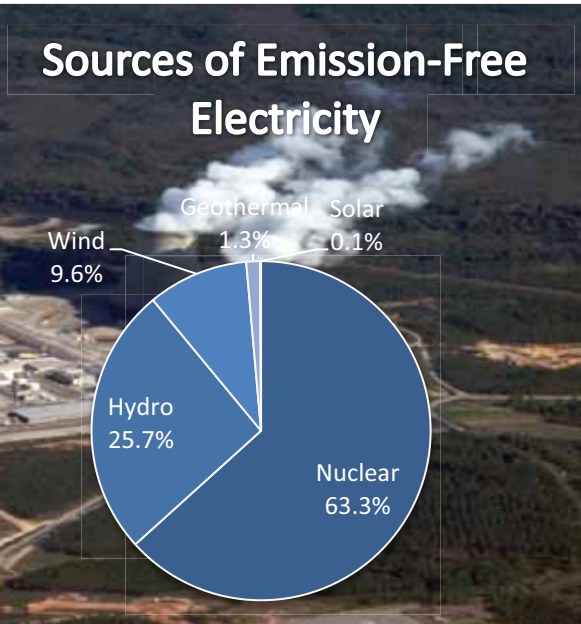
Nuclear energy, which is unique in its ability to provide 24/7 electricity without emitting greenhouse gases, is expanding, albeit at a limited pace. The upfront cost of building nuclear energy facilities is high, but low fuel costs over 40 to 60 years of power production and the absence of greenhouse gases during generation of electricity are overriding market factors.[xxix]

There are currently 100 operating commercial nuclear reactors at 62 nuclear power plants in the United States. The oldest operating reactors, Nine Mile Point Unit 1 and Oyster Creek, began commercial operation in December 1969. Thirty-four reactors began commercial operation between 1985 and 1996. The last reactor to enter service was the Watts Bar Unit 1 in Tennessee in 1996. Four reactors were permanently shut down in 2013.[xxx]

Five new nuclear reactors are actively under construction:

- Watts Bar Unit 2, Tennessee
- Vogtle Units 3 and 4, Georgia
- Virgil C. Summer Units 2 and 3, South Carolina

The Vogtle project is the largest construction project in the history of Georgia, and will provide a clean source of electricity for over 500,000 Georgia homes and businesses. It is also responsible for providing jobs to over 3,000 skilled craft construction professionals, as well as providing a much-needed boost to the local economy.



Nuclear power provides high-skilled, well-paying jobs for U.A. members who are among the country's most specialized workers in the construction and maintenance of nuclear power plants.

- A new nuclear facility requires up to 3,500 workers at peak construction, while the operation of the facility requires 400-700 permanent employees.

- On average, each nuclear energy facility generates $470 million in sales of goods and services in the local community and nearly $40 million in total labor income each year. The wages paid to nuclear power plant workers average 36 percent higher than other local jobs.[xxxi]

- Due in part to a wave of expected retirements, the industry expects to hire about 20,000 workers over the next five years.[xxxii]

"The U.S. nuclear industry must remain a vital and essential part of America's overall energy program . . . [It] has proven to be a safe, efficient and totally clean source of power to meet our nation's growing energy needs. And given its exemplary safety record in the U.S., there is no question that nuclear power should continue to be a key component for building a clean energy economy in the 21st century."

- UA General President Hite

The United States has the most nuclear capacity and generation among the 30 countries in the world that have commercial nuclear power plants. France, the country with the second highest nuclear capacity, relies on nuclear power for nearly 75 percent of its electricity. Fourteen other countries generate over 20 percent of their electricity from nuclear power.

Electricity demand is projected to increase steadily, growing 28 percent by 2040. For nuclear power to keep supplying 20 percent of our electricity, the industry will need to build about 25 reactors by 2040, according to the Nuclear Energy Institute.

SMALL MODULAR REACTORS (SMR'S)

One of the areas of greatest promise lies in the development of small, modular nuclear reactors that can be factory-built using safe, standardized designs and efficiently installed at the site of existing US nuclear power plants.

SMRs are about one-third the size of the reactors currently under construction. SMRs have simple compact designs that could be assembled in a factory and transported by train or truck directly to the plant site, potentially reducing the time it takes to construct a new nuclear power plant. The U.S. Department of Energy has awarded $452 million to support the design, certification and commercialization of SMRs in the United States. SMRs may help meet some of the nation's future electricity demand and could be deployed within the next 10 to 15 years.[xxxiii]

Thanks to innovations in the industry, the next generation of nuclear plants will use highly sophisticated technology with more enhanced safety features, and UA members will be an active part of their construction.

NUCLEAR WASTE

The President's recent Blue Ribbon Commission on America's Nuclear Future highlighted the importance of dealing with America's spent nuclear fuel and nuclear waste. A variety of new

technologies are emerging that will allow the United States to deal with spent nuclear fuel in a safe and responsible manner. Some of these technologies offer the opportunity to recycle spent fuel from nuclear reactors without contributing to global risks of nuclear proliferation. The United Association supports efforts to ensure safe, environmentally-sound approaches to the secure storage and disposal of spent nuclear fuel as well as the clean-up of the US legacy of nuclear waste from weapons production.

RENEWABLES

There is tremendous job growth potential now for developing alternative and traditional forms of

energy generation, and the United Association has been at the forefront of anticipating changing technologies. From building low-carbon power plants to retrofitting HVAC equipment, and from developing the most innovative geothermal solutions in industrial or residential settings to plumbing systems that use grey water or waterless technology, the UA strongly supports sustainable energy construction and is training workers today for the jobs of tomorrow.

The UA Training Department spends $250 million annually on apprenticeship training, skill upgrading and other skill development activities, including training in the implementation of sustainable technologies through our environmental training programs. A strong supporter of LEED® certification for building, we align our training with the U.S. Green Building Council's education mission and the standards of leading environmental construction groups. Since 2009, the UA has been using Green Training Trailers, which tour the country to introduce UA apprentices, journeyman-level workers, and green building expo participants to renewable energy technologies and sustainable building concepts. The 54-foot-long mobile classroom provides an overview of a number of power generating technologies, including geothermal technology, solar thermal systems, and rainwater catchment and gray water systems.

In addition, the UA's recent historic affiliation with the Australian Plumbers Trades Employees Union strengthens our ability to deal with the challenges of emerging technologies and innovations for water conservation, energy efficiency and carbon reduction, and allows our membership to gain even greater access to advanced knowledge and best practices in water conservation, irrigation systems, rainwater harvesting, and geothermal energy production.

Geothermal

Geothermal power is an emerging factor in the diversification of U.S. energy supply. Geothermal provides electricity, heating, and cooling for millions of Americans—and its use is expanding. Geothermal net electricity generation totaled 10.9 giga-watt hours during the first eight months of 2011, up ten percent from the same period in 2008.[xxxiv] New enhanced geothermal systems (EGS) technology promises to expand power generation beyond natural geothermal locations. Now in early development, EGS allows water to be pumped underground to be heated by the earth and then used to generate steam-generated turbine electricity upon recovery. The UA is keeping pace with developments in geothermal technology, and our members are already at work updating current systems across the country.

According to the Geothermal Energy Association, the U.S. geothermal industry employs approximately 20,000 men and women, including welders, pipefitters, plumbers and HVAC technicians. A majority of the jobs (86 percent) are full-time, permanent positions. According to a report by the Western Governors Association (WGA), continued developments in geothermal energy can result in the creation of almost 100,000 jobs.

Hydropower

Hydropower is one of the largest sources of clean, renewable electricity in the United States. Today, we have over 100 giga-watts of hydroelectric capacity[xxxv] providing about 8 percent of the nation's electricity needs.[xxxvi] In fact, the United States avoids emitting more than 235 million tons of carbon dioxide pollution into the atmosphere each year by using hydropower.[xxxvii]

The Department of Energy estimates that there could be an additional 300 giga-watts of hydropower through efficiency and capacity upgrades at existing facilities, powering non-powered dams, new small hydro development and pumped storage hydropower.[xxxviii]

The U.S. hydropower industry currently provides about 7 percent of the nation's electricity and over 70 percent of renewable electricity output annually.[xxxix] The industry employs up to 300,000 workers, including UA members. Job growth in the coming decades will largely be in updating and modernizing existing hydro sites, installing new applications at non-powered dams, and pumped storage - without large new dams.[xl]

Increased revenues from the sale of hydropower can result in a new source of funding for operating, maintaining, and rehabilitating our aging water delivery infrastructure, including pipeline development projects. Further development of this cost-effective, clean energy option will support economic growth and local job creation.

The importance of hydropower as a source of electricity generation varies by geographic region. While hydropower accounted for 8 percent of total U.S. electricity generation in 2013, it provided 64 percent of the electricity in Oregon and Washington. Because hydroelectric generation relies on rainfall and melting snow, it varies widely from month to month and year to year.[xli]

Solar

Solar energy production meets the highest environmental standards while producing negligible emissions, and can be used for electricity, light or heat in residential, commercial, and industrial sectors. Many different technologies are used to convert solar energy into other usable forms of energy—including solar heating and cooling.

Solar thermal energy for electricity generation requires a location where there is sunlight much of the time and sufficient available space for mirrors. Trough-shaped parabolic mirrors automatically follow the sun and focus the sun's rays at thirty to sixty times their normal intensity on a receiver pipe filled with synthetic oil. The oil is heated to and passes through a heat exchanger to produce steam for a conventional steam turbine electricity generator. Natural gas serves as a supplemental fuel for cloudy weather and nighttime operation.[xlii]

Solar heating and cooling systems collect the thermal energy of the sun through solar collectors and use it to heat or cool water for use by a home or business, rather than using electricity or natural gas.

In 2011, the U.S. solar industry employed an estimated 100,237 solar workers—defined as those workers who spend at least 50 percent of their time supporting solar-related activities—up 6.8 percent from 2010.[xliii] UA members are currently working on solar thermal systems and other solar energy projects across the country, including the construction of the largest commercial solar plant in the world, the Ivanpah Solar Field. The project is estimated to generate approximately $650 million in wages and employee earnings in its first 30 years of operation.

ENERGY EFFICIENCY

Energy efficiency is the easiest way to extend today's energy supply into the future. The greatest "new" source of energy comes from reduced demand and greater efficiency and conservation. In

fact, America uses about half as much energy today for every dollar of GDP as it did back in 1970.[xliv] Increased energy efficiency creates a more cost-effective and competitive economy with improved energy security and reduced emissions. Closing this gap between our own energy supply capability and demand creates a big first step towards greater energy productivity—what we get from the energy we produce.

It is estimated that energy savings of over one trillion dollars can be achieved in the next two decades with the appropriate investments. This could reduce end use energy consumption by roughly 23 percent from projected demand.[xlv]

Investments in energy efficiency can:

- Support an orderly energy transition period over the next half-century;
- Relieve pressure on U.S. energy production capacity;
- Lower or stabilize energy expenses, freeing up investment capital for other uses;
- Increase resiliency of buildings and systems during storms;
- Provide very attractive returns over the life of those investments; and
- Support numerous American jobs

The people in our industry have traditionally viewed themselves as stewards of public health. Sustainability is a natural extension of that responsibility.

improve the distribution of supplies, such as natural gas. We believe states should adopt the latest energy codes and continually upgrade state building standards for new buildings and major renovations. Public utilities should promote demand-side efficiency with improved customer

information, and contractors and state agencies can partner with utilities to enhance efforts.

Residential and Commercial Efficiency

Residential and commercial buildings account for more than 40 percent of total U.S. energy consumption.[xlvi] Just like other aspects of our infrastructure, homes and buildings require modernization to continue to operate effectively. Improving efficiency in residential and commercial buildings offers a tremendous opportunity save energy, lower emissions and create good jobs.

Significant gains have been achieved over the past four decades. For example, residential energy consumption is lower today than it was in 1980 on a per-household basis, even though the average house size has increased and most households have many more electronic devises than they did a generation ago. A variety of policies have been instrumental in boosting productivity throughout the residential and commercial sectors; they include appliance standards, product labeling and other information-based programs, building codes, tax credits and other subsidies, and performance contractors for government buildings.[xlvii]

Commercial buildings, in particular, consume a significant amount of resources. These buildings—hospitals, data centers, skyscrapers, and even grocery stores—represent 36 percent of our total energy consumption, 13 percent of drinking water use, and waste on average 30 percent of that energy—contributing 18 percent of U.S. carbon emissions.[xlviii] Retrofitting these buildings with modern materials and implementing new HVACR technologies reduces energy and water waste, save money, and lowers carbon pollution emissions. Proper operation and maintenance are vital and cost-effective ways to improve commercial building efficiency, and will ensure a building is running at its peak performance over decades, not just a few years. Investing in commercial retrofits could provide $1 trillion dollars in energy savings over the next decade.[xlix]

Efficiency improvements demand considerable labor, and these investments create good jobs across multiple sectors. The Department of Energy's Better Buildings Initiative—a federal effort to reduce commercial building energy use by 20 percent by 2020—is projected to create over 114,000 jobs alone. The bulk of those jobs will be in retrofits, including lighting manufacturing and installation, replacing heating and air conditioning units, water heating manufacturing and installation and much more.[l]

Members of the United Association are critical to achieving high-performance in residences and commercial buildings. Our members are responsible for reducing water use, from installing efficient fixtures and appliances to introducing whole-building wastewater reuse systems. Using less water also means using less energy to pump, heat, dispose, and treat water—resulting in substantial amounts of energy savings. Our members are also responsible for installing efficient HVACR systems that use as little energy as possible while keeping buildings comfortable and refrigeration systems running.

Industrial Efficiency

As the industrial sector grows in the coming years, there will be an important window for promoting investments that offer long-term energy savings. It's critical that we continue to research and explore the feasibility of new technologies, including Combined Heat and Power (CHP), as well as create incentives for facilities to increase efficiency through grants, loans, training, funding for audits/retrofits, and other programs.

Industrial energy consumption currently accounts for a little less than one-third of total U.S. energy demand.[li] In an effort to increase the efficiency of the industrial sector, the UA stands ready to support the installation of more efficient systems for energy and emissions control, as well as build new plants that will control and recycle wastes using the latest technologies.

Investments in industrial energy efficiency cost as much as 50 percent less than traditional forms of delivered new base load power.[lii] Accelerated investment in industrial energy efficiency will benefit manufacturers, utilities and consumers by improving American manufacturing competitiveness, creating jobs, and reducing harmful emissions.[liii]

Combined Heat and Power

The cogeneration process (CHP) is one of the primary methods being used to increase efficiency. CHP uses steam and electricity produced at facilities to create additional power, and it can simultaneously yield efficiency rates far greater than the separate generation of electricity and steam.[liv] The energy industry has invested billions of dollars in cogeneration technology over the past decade in order to reduce emissions. Meeting the President's established goal for new CHP could mean $40 to $80 billion of new capital investment in American manufacturing facilities.

In 2006, CHP produced 506 billion kilowatt-Hour (kWh) of electricity—more than 12 percent of total US power generation for that year. If the United States adopted policies designed to deliver 20 percent of generation capacity from CHP by 2030, the nation could save an estimated 5.3 quadrillion Btu (Quads) of fuel annually. Cumulatively through 2030, such policies would also generate $234 billion in new investments and create nearly 1 million new highly skilled, good-paying, technical jobs throughout the United States. And emissions of CO2 from the power sector would be reduced by more than 800 million metric tons (MMT) per year. Indeed, implementing this 20 percent scenario would avoid over 60 percent of the projected increase in US CO2 emissions between now and 2030.[lv]

In August 2014, the UA was proud to partner with Washtenaw Community College (WCC) to commission the college's first combined cooling, heat and power system for our Great Lakes Regional Training Center. The system will help save $60,000 in utility costs each year, generating 130 kW of electricity, 800,000 BTU/h (British Thermal Units per hour) of hot water, and 50 tons of chilled water for the Great Lakes Regional Training Center. The system will produce enough energy on site for 50-60 homes. Ultimately, the system will reduce the training center's carbon footprint by 889 metric tons of greenhouse gases, equal to that produced by 146 automobiles.

WATER INFRASTRUCTURE

Together, energy and water resources are the foundation of our nation's economy and essential to our nation's security. Emerging technologies and building standards promise to have a significant impact on the efficient delivery of energy and water, especially the use of pipelines in the delivery of water and liquids for other energy sectors. The UA stands ready to support immediate repair and build-out of our water supply and sanitation systems.

All forms of energy production, energy distribution, fuel extraction and fuel refinement require water or affect water resources in some way. Every aspect of extraction, treatment, conveyance, and use of water, as well as the treatment of wastewater, is dependent on sufficient and reliable energy. The availability of adequate water supplies has an impact on the availability of energy, and energy production and generation activities affect the availability and quality of water.[lvi]

- In the coming years, population growth will create an increased demand for water, and both scarcity and volatility of supply will drive the need for change in managing this critical resource. As freshwater supplies become more limited, critical infrastructure projects will be essential to meet both future water and energy demand.

- A breakdown of water systems can result in water disruptions, impediments to emergency response, and damage to other types of infrastructure. The EPA estimates that 700 water mains break every day, or nearly on every two minutes.

- According to the American Society of Civil Engineers, leaking pipes account for an estimated loss of seven billion gallons of clean drinking water a day.[lvii] Broken water mains can damage roadways and structures and hinder fire-control efforts, and unscheduled repair work to address emergency pipe failures may cause additional disruptions to transportation and commerce.

- The ASCE has given America's wastewater infrastructure a "D" in its 2013 report card. Without urgent action, over half of the nation's pipes will fall into "poor, very poor or elapsed" categories by 2020. According to a congressional study, corroded pipes cost U.S. drinking water and wastewater systems over $50.7 billion annually. This cost often translates into higher bills for consumers.

- The ASCE gave our nation's inland waterways the grade of D- in their 2013 Report Card for America's infrastructure. Investing in America's water transportation networks, including our ports and waterways, increases our nation's competitiveness in the global economy and creates much-needed jobs for Americans skilled workers.

- The Water Resources Reform & Development Act (WRRDA) authorizes the U.S. Army Corps of Engineers to continue to develop and maintain our country's vital port and waterways infrastructure needs, including flood risk management, hurricane and storm damage risk reduction, and environmental resolution will enable our water transportation networks to support more jobs.

Water infrastructure has a tremendous bearing on our economic competitiveness, our health and safety, and even national security. The full passage of WRRDA and other state and federal initiatives are important investments in our nation's future.

There is tremendous job growth potential now for water infrastructure improvements and UA members have the training and skills to build the next generation of projects that improve water-use efficiency for thermoelectric power generation (coal, oil, natural gas, and nuclear) and mitigate the impact of production on water supplies. The American Water Works Association has previously advised Congress that an investment of $10 billion in drinking water projects would create 400,000 jobs: 90,000 of those jobs in piping, fittings, cement, aggregates and other building professions. The U.S. Conference of Mayors estimates that every job created in water infrastructure adds 3.7 jobs elsewhere, and each dollar invested in water infrastructure adds $6.35 to the national economy. By incorporating Buy American provisions, we can ensure that these projects have an even larger impact

on our economy.

Quality construction and maintenance required skilled workers who are familiar with sustainable technologies and water quality standards. At the UA, we know that a well-trained workforce is essential to building infrastructure that delivers clean, reliable water to homes and business. UA members across the country install and maintain gray water systems, geothermal and hot water circulating systems, and rain water catchment and recycling systems—as well as fit non-corrosion prone pipes with leak-detecting sensors.

Across our training curriculum, from renewable energy to conservation to efficient use of water runoff, the UA is working to implement and expand safe, sustainable building practices. Our skilled craftsmen and women have installed numerous rainwater harvesting systems across the country to channel water in an effort to reduce overall water use. Members of UA coal 290 (Portland, Oregon), for example, have installed several different rainwater reclamation systems that use the water to flush toils and run washing machines where regular treated water is not necessary. This practice reduces the dependence on water treatment facilities, saving energy and city resources. There are many cities throughout the country that are mandating rainwater harvesting on new residential and commercial construction, including Albuquerque and Santa Fe.

The UA and PTEU. In 2012 historic affiliation agreement to incorporate joint skills training. Both of our organizations have been fighting for clean water for well over one hundred years and can help in worldwide initiatives to improve the delivery of water. Australia is a global leader in water conservation and other green technologies that we can learn to better implement in the United States, including innovative irrigation systems, rainwater harvesting programs, and advanced processes for water treatment and recycling. We can also learn from Australia's progressive regulations concerning water management.

Photo (left to right): UA General President William P. Hite, PTEU Secretary Earl Setches, UA General Secretary-Treasurer Mark McManus

CONCLUSION

In the coming years, America will need to develop a diverse energy portfolio that includes both renewable and traditional energy sources if we intend to fully address environmental concerns and meet growing energy demand. To effectively reduce our reliance on energy imports, we need to accelerate the development of North American resources in the safest, most efficient, and most

environmentally sound way possible. This includes the responsible development of traditional energy sources such as oil, natural gas and coal, as well as alternative sources like nuclear and renewable energy.

If the U.S. is to fully realize an era of energy abundance and the jobs and economic growth that come with it, we must ensure we have the energy transportation infrastructure that is required to bring these products to market. Investment in American infrastructure, some of which is more than 100 years old, can strengthen public health, safety and quality of life. It can save energy, restore local environments, and increase resilience to climate variability including flooding, draughts, and major storms.

Because of the complexity of the U.S. energy system—including its regional nature, substantial private-sector ownership, and the multi-layered network of regulations that govern it—we know that moving forward will require the active participation of federal, state and local governments, the private sector, labor organizations, industry leaders, and citizens across the country. The UA is already leading our industry in training a skilled workforce with world-class expertise to build the next generation of energy projects, and we stand ready to help move America towards a more secure, efficient and clean energy future.

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