Testimony of

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Thank you for the opportunity to come before you this morning to discuss the economic opportunities presented by clean energy.

Those opportunities are abundant. It's important to review the current economics of clean energy to understand why.

Nationally we are seeing clean energy starting to compete head-to-head with fossil fuels — and win. In fact, a study released last September by the Lawrence Berkeley National Laboratory found that utility scale solar is now cost-competitive with natural gas.[1] The report found that the price of solar energy has fallen 70 percent since 2009 and the pace of new solar construction is "unprecedented."

We see similar trends across the clean energy economy. A 2014 study by the global consulting firm Lazard found that even when excluding subsidies, wind and solar are the cheapest forms of electricity generation for new installations. [2]

Other analysis indicates that residential and commercial solar prices fell by 10 to 20 percent last year, while advances in turbine technology also brought down the cost of wind energy.

Indeed, according to the US Energy Information Administration, electric generating facilities expect to add more than 26 gigawatts (GW) of utility-scale generating capacity to the power grid during 2016.[3] Most of these additions come from three resources: solar (9.5 GW - the most of any single energy source), natural gas (8.0 GW), and wind

[1] http://www.greentechmedia.com/articles/read/Utility-Scale-Solar-Reaches-Cost-Parity-With-Natural-Gas-Throughout-America
[2] https://www.lazard.com/media/1777/levelized_cost_of_energy_-_version_80.pdf
[3] http://www.eia.gov/todayinenergy/detail.cfm?id=25172

(6.8 GW), which together make up 93% of total additions. If actual additions ultimately reflect these plans, EIA noted that 2016 will be the first year in which utility-scale solar additions exceed additions from any other single energy source. This level of additions would be more than the total solar installations for the past three years combined.

The advances in the competitiveness of renewable energy is reflected by the number of jobs associated with the sector.

Three weeks ago, the US Department of Energy released the first U.S. Energy and Employment Report (USEER).[4] It provides a broad view of the national current energy employment landscape, and finds that:

- 3.64 million Americans work in traditional energy industries, including production, transmission, distribution, and storage.
- Of these, 600,000 employees contribute to the production of low-carbon electricity, including renewable energy, nuclear energy and low emission natural gas
- An additional 1.9 million Americans are employed, in whole or in part, in energy efficiency.
- Roughly 30 percent of the 6.8 million employees in the U.S. construction industry work on energy or building energy efficiency projects.

Let's take a closer look at Pennsylvania.

Solar

Solar job creation is booming across the country. The U.S. solar industry now employs slightly over 200,000 workers, representing a growth of 20 percent since November of 2014. Last year the industry added workers at a rate nearly 12 times faster than the overall economy.

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4 http://www.energy.gov/sites/prod/files/2016/03/f30/U.S.%20Energy%20and%20Employment%20Report.pdf

Pennsylvania's solar industry ranks in the top 20 in number of jobs and is projected to grow 20 percent in the next year, according to the 2015 Solar Jobs Census[5] published by The Solar Foundation.

There are 2,498 solar-related jobs in 493 companies in Pennsylvania. Allegheny County's 238 jobs is the third-most in Pennsylvania, behind only Montgomery and Bucks counties. Pennsylvania ranks No. 20 in the U.S. in number of jobs, but No. 40 among the 50 states in per capita measures.

By comparison, according to The Solar Foundation, California's 75,598 jobs ranks No. 1 in the solar industry, while New York's 8,250 puts it No. 4 on the ranking. Ohio has 4,811 solar-related jobs.

Energy storage

Two companies in Pittsburgh -- Aquion and Axiom – are making battery storage systems. That's one of the obvious big hurdles to achieving wider deployment of renewable energy, and we're hoping that Pennsylvania can become a home, if not the home, of the most advanced battery technology. Distributed storage for solar systems will be worth $8 billion in 2026, according to Lux Research, an independent research and advisory firm.[6] There is a huge opportunity here to create jobs to service that market.

Wind power

The U.S Department of Labor recently announced that wind turbine service technicians are the nation's fastest growing job category.[7] Growth in the field is expected to increase by 108 percent over the next ten years – more than twice as much as occupational therapy assistants, the second fastest growing occupation.

[5] http://www.thesolarfoundation.org/solar-jobs-census/states/
[6] http://www.luxresearchinc.com/news-and-events/press-releases/read/energy-storage-solar-systems-will-be-8-billion-market-2026
[7] http://www.bls.gov/news.release/pdf/ecopro.pdf

Turbine technicians are just one field among many supported wind energy. The US wind industry supports over 73,000 jobs nationally and is poised for strong growth. The Department of Energy says wind power could support up to 380,000 jobs by 2030.[8]

In the Commonwealth, the last wind power project built here went online in 2012.

Energy Efficiency

We have relatively old building stock in Pennsylvania. Indeed, Pennsylvania has about the third oldest building stock of any state in the nation. So there are immense energy efficiency gains to be made in the built environment, and immense opportunities to create family-supporting, sustainable jobs in communities across Pennsylvania.

Governor Wolf has led the way in expanding energy efficiency investment in the Commonwealth. Last year, the Governor worked with the State Treasurer's Office and Pennvest to expand the important and highly effective work of the Keystone Home Energy Loan Program (HELP), enabling them to issue a $50 million bond comprised of home energy efficiency projects in order to reinvest the proceeds in additional energy efficiency projects**.**

Lawrence Berkeley National Laboratory has estimated that an additional 17 billion square feet of building space nationally is available for retrofit projects. I've seen estimates that green construction will account for over 3.3 million jobs and a third of US construction labor earnings by 2018. The US Green Building Council has estimated that indeed in Pennsylvania, green construction is estimated to contribute $29 Billion to GDP by 2018, creating more than 340,000 jobs, with LEED certified construction accounting for $12 billion in GDP and 138,000 of those jobs.

[8] http://www.energy.gov/eere/wind/maps/wind-vision

The U.S. Energy and Employment Report (USEER) report mentioned earlier indicates that the energy efficiency sector predicts hiring rates of 14 percent in 2016, or almost 260,000 new hires.

There are clearly huge opportunities to create green jobs in Pennsylvania. And there is an urgent need to do so.

The Pennsylvania we know today is being fundamentally altered by the impacts of climate disruption, according to scientists and economists from Penn State University. Last summer, DEP released a Climate Impacts Assessment Update report that they prepared. What the scientists found is profoundly disturbing:

- Pennsylvania has warmed 1.8°F in the past 110 years, and the warming will increase at an accelerated rate.
- By 2050, Pennsylvania will be 5.4°F warmer than it was in the year 2000.
- By 2050, Philadelphia's climate will be similar to current-day Richmond, Virginia, and Pittsburgh will be similar to current-day Washington, DC

Science is showing us that not only are the changes and disruptions to our state's climate significant, but they are occurring alarmingly fast, in ways that will affect key sectors of the economy, our health, and our quality of life.

To stave off the worst of climate disruption, between now and 2030, $550 Billion will need to be invested annually in renewable energy globally, and more than $381 Billion annually in energy efficiency, according to International Energy Agency.

In the US, the National Renewable Energy Laboratory has estimated that reaching national targets of 30% renewable energy by 2025 and 80% by 2050 will require investment of $50-70 Billion annually over the next decade.

How do we push sustainable energy and energy efficiency to scale? How do we get to a low- and ultimately zero-carbon energy future?

We're going to see retirements of coal plants and continued strength and growth in the gas sector, continued cost declines and continued growth in the renewable energy sector. And the cheapest ton of carbon to keep out of the atmosphere will continue to be the one we don't create through efficiency. So continuing to plan for this new energy future just makes business sense. And ALL of those changes make business sense in another respect – they offer the promise of tens of thousands of jobs for Pennsylvanians.

The market efficacy and the economics of clean energy development and energy efficiency and show that they can not only be a part of the nation's energy grid but integral to the nation's economy.

There's an immense economic opportunity for all states, and Pennsylvania, I think, in particular, to embrace alternative energy, embrace energy efficiency, embrace storage technologies, create jobs, and accelerate the development of our economy.

Thank you for the opportunity to provide testimony today.