Comments to:
Energy Policy Roundtable in the PJM Footprint
By: Richard S. Mroz
President, NJBPU
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INTRODUCTION

Good morning everyone. I want to thank the Kleinman Center for Energy Policy here at the University of Pennsylvania and also Dr. Jonathan Raab, of Raab Associates, who has led the New England Electric Restructuring Roundtable, for inviting me to this inaugural meeting of the Energy Policy Roundtable.

Jonathan has been very successful over the years with his other endeavors with the NE Restructuring Roundtable. I know that his expectations and those of the Kleinman Center are to seek to replicate that kind of success with a robust policy framework with this Roundtable in the PJM footprint.

So I am honored to be the speaker who helps to inaugurate these efforts. And I am further grateful to discuss the Christie Administration's efforts in New Jersey to integrate Distributed Energy Resources into the workings of the energy and utility industry and provide some context for the discussions this Roundtable will have today and in the future.

First though I want to provide some historical context for the issues we will be discussing. And I want to provide you some insight particularly into the history of the New Jersey fabric of public policy on energy and the environment. Then I can update you specifically on what New Jersey is doing now and planning for the future.

Introduction and Historical Perspective

In coming here today perhaps many of you saw reminders of the important role that the Philadelphia region has played in history. You may have past Independence Hall or caught a glimpse of the Liberty Bell – both iconic symbols of American independence and Philadelphia's historic role in the birth of our nation.

There is another reminder though of a looming figure in history at the foot of the Ben Franklin Bridge. It is a 101’5″ / 58 ton statute standing at the foot of the bridge. The “Bolt of Lightning” statute is a memorial to Benjamin Franklin - an American diplomat and natural philosopher, and founder of this University where we are today. This statute is significant for our discussions today and to the works of Franklin who proved that lightning and electricity were the same.
It also says something about the spirit of Philadelphia and the people of this region – and its sports fans - of which I am one. See, it would take someone with the competitive spirit of Philadelphia to walk outside in an electrical storm to fly a kite … all to prove a point.

Today as we consider issues that confront us - whether about future matters at PJM – or matters at the NJBPU - or generally regarding the demands, challenges and evolution of our electric grid - I find myself thinking of how the people of this region and especially of my fellow New Jerseyans manage and respond to challenges and how they have been centers of innovation – even from the beginnings of the electric industry – like Mr. Franklin.

Thomas Edison is recognized by many as THE most productive electrical explorer. It was in New Jersey at Edison's laboratory in Menlo Park that much of this began. There he unveiled his incandescent light bulb - promising he said to - “make electricity so cheap that only the rich will burn candles."

Over a hundred years later, his inventions have transformed our world - from the light bulb to the phonograph - to the motion picture - this NJ native made an indelible impact. I feel fortunate as a New Jerseyan that Edison was not the only major innovator from the Garden State.

In Newark, NJ in 1921, Willis Haviland Carrier invented the centrifugal chiller - the first system to efficiently cool large spaces. Depending on your perspective - you might blame NJ for the peak demand during the hottest summer days – or as a generator you may thank us.

About Two and a half decades later in 1947 at Bell Laboratories in Murray Hill, New Jersey, the transistor was invented allowing for the miniaturization of circuitry, ushering in the information age. David Sarnoff of the RCA Corp. developed technologies for radio and television in NJ – and Enrique Caruso performed and made recordings in the place I grew up, right across the Delaware River from here in Camden, NJ. Band-aids, chlorinators to sanitize drinking water, and the first solid body electric guitar made by Les Paul … all were developed in NJ.

We New Jerseyans are incredibly proud of our history of invention - and I am fortunate to be part of efforts to encourage innovation when addressing the many challenges in our state – and around the PJM grid. - Whether because of new technologies that are making an emerging "integrated grid" more likely – or which is making renewable energy easier assimilate into the grid - or through our initiatives to ensure energy resilience.

Innovation on Energy Issues and Nexus with Environmental Stewardship

New Jersey has a collective experience in energy issues and environmental issues that gives us a unique perspective. And some of these experiences are somewhat surprising – or refreshing – to realize that our confrontation of these challenges with the grid - maybe isn't so new. And that we can draw upon our history to meet and succeed against these challenges.

There are a few reasons I think that NJ has had the collective will to confront challenges – and embrace opportunities for change. New Jersey is the most densely populated state with 1,218 people per Sq. Mile. We have two cities listed in the top 10 of Most Densely Populated Cities – Jersey City and Newark. And with that came large industries, transportation hubs, the need to develop housing and commercial buildings, which also brings demands on the environment and equally compelling demands for what the utilities provide – water, wastewater, communications service and – electricity. But against those factors - NJ has great natural resources – from the foothills of the NE Mountain Ranges, waterfalls, large and small rivers, a long ocean front, vast forests, and rich farmland.

So NJ has had a great history advancing infrastructure to meet these demands of its residents and businesses - with its resources. Consider the Great Falls on the Passaic River in Paterson. One of the United States' largest waterfalls located on the Passaic River in the City of Paterson played a significant role in the early industrial development of New Jersey from the earliest days of the nation.

In 1791, Alexander Hamilton initiated America's first planned industrial center at the Passaic River's Great Falls. In doing so, he sought private investors who wished to achieve America's independence from British manufacturers established the Society for Establishing Useful Manufactures (S.U.M.) - with the goal of harnessing the power of the Great Falls.

Thomas Edison's Electric Company designed a 4849 kilowatt hydroelectric facility at the Great Falls that began operation in 1914 - these power systems were designated a Historic Civil Engineering Landmark in 1977. PSE&G purchased all electrical energy from the facility through a power purchase agreement until July 2014, when an Interconnection Service Agreement was entered into by PJM, Great Falls Hydroelectric Company and PSE&G.

Today, the City of Paterson is interested in developing the Great Falls into a 21st Century microgrid.

Consider also Yards Creek Generating Station - a 420 MW pumped-storage hydroelectric plant located in Warren County NJ – which began commercial operation in 1965. Yards Creek consists of two reservoirs created by earth-fill embankment dams. The upper and lower reservoirs are separated by an elevation of 700 ft. The storage facility, jointly owned by subsidiaries of PSEG and LS Power, provides energy regulation and spinning reserve during on-peak hours and an energy sink off-peak to allow base load plants to remain more fully loaded.

As I suggested our NJ experience also is such that we have a perspective on environmental stewardship – and even a history of seeking a nexus between environmental considerations and energy.

In the late ‘80s and early ‘90s, NJ developed and supported trash to steam technologies and planned for regional incinerators across the State that would have “unified” the waste stream in each county and direct that waste to regional facilities. Today, NJ has 5 Mass Burn Resource Recovery Facilities that process in excess of 6,400 tons of municipal solid waste per day and generate approximately 178 megawatts of electricity. So it is quite proper to suggest that NJ has long been for a long time – as well as currently - advancing “biomass” technologies.

As the needs for more electric base-load generation emerged over the decades NJ again sought to meet this demand. So it is worth reflecting on the role that this region – and particularly both New Jersey and Pennsylvania - has played in the development of nuclear power.

The World’s first full-scale atomic electric power plant was located in Pennsylvania. The Shippingport Atomic Power Station reactor’s first electrical power was produced in December 1957 as engineers synchronized the plant with the distribution grid of Duquesne Light Company - it remained in operation until October 1982.

Oyster Creek Nuclear Generating Station in Lacey Township is the oldest operating nuclear power plant in the United States - began operation in 1969.

PSE&G joined with Philadelphia Electric Company, Atlantic City Electric Company, and Delmarva Power & Light Company during the 1960s to plan and build nuclear generating facilities. The first plant, owned jointly with Philadelphia Electric Company, was put in service at Peach Bottom, Pennsylvania, in 1974. In NJ, the Salem I Nuclear Power Plant in Lower Alloways Creek was put in service in 1977, followed by the Salem II plant commissioned in 1981 and Hope Creek Nuclear Generating Station in Lower Alloways Creek in 1986.

Currently, nuclear makes up just under 50% of the generation fuel mix in NJ.

NJ has been a leader in using less coal and capitalizing on cleaner Natural Gas that is also now being produced especially in this state of PA at lower costs. According to EIA in 2015, NJ

electric generation from natural gas fueled sources outpaced generation from the state's four nuclear plants - 3,089 GWh to 3,051 GWh, respectively.

In terms of total energy, natural gas provided 713.1 trillion Btu's of energy in NJ, while motor gasoline provided 446.1 trillion Btu's and nuclear 348.8 trillion Btu's.

Our NJ history on DER and Microgrids has been equally as interesting and innovative. New Jersey's first cogeneration facility was developed in 1936 in Parlin, NJ (Old Bridge Township). The state experienced a rapid expansion of combined heat and power (CHP) sites in the late 1980s as a result of PURPA (The Public Utility Regulatory Policies Act) - with the number of facilities increased by more than 4,000 percent from 1986 to 1996. Currently, the state has about 210 sites generating approximately 3,000 megawatts (MW) from CHP. In the Capital City of Trenton - the Statehouse and many of the public buildings making up the Capitol Complex are served by a district energy project that provides steam and chilled water.

New Jersey has approximately 380 MW of CHP/FC projects, both fossil fuel and renewably fueled, in over 100 locations throughout the state that could be defined as DER. If other Class I renewable facilities were to be included – which is nearly all solar - there are over 42,290 DER facilities totaling nearly approximately 1.75GW of capacity. We have catalogued 45 separate "microgrid" facilities that are either in a campus setting provide for on- site generation that can be "islanded".

Princeton University is regularly profiled for as a microgrid system which was initially developed solely for economic reasons; resiliency was come to be seen now as an added bonus. Princeton University normally operates its system to generate energy and cost savings 24/7 under blue-sky conditions.

Princeton University relies on a CHP unit, and when the cost for electricity is high, the campus uses more of their CHP generated electricity. When the price for electricity is low, the campus purchases more electricity from the grid. Through the active management of the CHP, thermal storage, solar and other infrastructure this is an advanced microgrid that has served to manage costs and provide for resiliency. With dedicated substations and switches – the

campus functions as a self-contained microgrid and did so as an island during Superstorm Sandy.

Current Status and The New Jersey's Energy Future

As I stated at the beginning of my comments – NJ has had a long experience with innovation, environmental considerations, and delivering on the energy needs of its residents – but all while considering the need to ensure reasonable costs. We have a diversified generation portfolio, in a restructured market, vast energy infrastructure especially for distribution, and distributed energy resources including being a leader with solar deployment.

So I was honored when Gov. Chris Christie appointed me to this post two years ago. He provided me the opportunity to continue advancing an energy policy that meets the energy needs of our 8.9 million residents and our business community. In my role as President of the BPU I am also the chairman of the State's Energy Master Plan (EMP) Committee.

Since 1977, New Jersey is statutorily required to produce an EMP every 10 years and to issue an update every three years. The Christie Administration published the most recent EMP in 2011 and I as Chairman of the Committee issued an Update in December 2015.

The 2011 EMP and the 2015 Update provides five overarching goals and 31 specific recommendations. Among other things, the EMP Update measures the State's progress toward achieving the five overarching goals contained in the 2011 EMP. They are:

- **Drive Down the Cost of Energy For All Customers**
- **Promote a Diverse Portfolio of New, Clean, In-State Generation**
- **Maintain Support for the Renewable Energy Portfolio Standard**
- **Reward Energy Efficiency and Energy Conservation and Reduce Peak Demand**
- **Capitalize on Emerging Technologies for Transportation and Power Production**

Since 2011 we all have come to realize that these needs for resilience notably because of natural threats from weather - especially Superstorm Sandy. Therefore, the 2015 EMP also included a section on Resiliency and addressed the issues of:

- **Protecting critical energy infrastructure;**
- **Improving the EDCs emergency preparedness and response;**
- **Creation of long-term financing for resiliency measures; and**
- **Increasing the use of microgrid technologies and DER.**

I believe that the 2015 Update tells a good story about energy in our State. New Jersey has made good progress towards the five overarching goals and many of the 31 policy recommendations contained in the 2011 EMP. Overall New Jersey has lower energy costs, while at the same time advancing energy efficiency, demand response and renewable energy. The State has fallen from a high energy cost state to a range that falls within the national average for total energy costs (electricity, natural gas, fuel oil and gasoline).

Today, New Jersey's natural gas prices are among the lowest in the country. Prices in our state were the 17th highest in the nation in 2011; today we rank among the four least expensive states in the country.

The 2015 EMP Update also reports that New Jersey continues to meet its progress toward our renewable energy portfolio standard as nearly 15% of the retail electricity supply comes from renewable sources; with solar accounting for almost 3% of the in-state generation mix this energy year.

New Jersey is 4th in deployed solar in the country and recently surpassed 1.6GW of installed capacity - and 92% of the total solar capacity was installed during the Christie Administration.

Of significance, New Jersey has invested $ 2.4 Billion in all renewable energy in the last 15 years. This includes the former solar rebates of $363M and since the implementation of SRECs, New Jersey has invested $1.6B to pay for them to incentivize solar development. So to be clear - this State has invested $2 Billion just in solar since 2001.

Our commitment to Energy Efficiency is equally as compelling. In the last 15 years, New Jersey has invested $2.4 Billion in energy efficiency. Almost $1.7B through the BPU Clean Energy Program of which $900M - more than 50% of all Clean Energy funding - has been during this Administration. And over those 15 years the BPU has authorized the EDCs and GDCs to invest $727M in energy efficiency programs.

NJ is now – like many states – relying on low cost NG for new Clean In-State Generation. Over 2,000 megawatts (MW) of new CCNG base-load generation has been built already in the last 5 years and we have expressions of interest of more being built. But NJ is moving forward and expanding on this balanced energy portfolio consistent with our history I have discussed today. With the EMP Update the Christie Administration affirms the policies:

- We will expand Distributed Generation (DG) including CHP
- We support emerging technologies such as biomass, storage and fuel cells.
- We reinforce our use of landfill gas and solar.
- We will continue to support nuclear and any emerging industry interest for expansion.
- We maintain this State's commitment to future offshore wind.
- We will rationalize the energy efficiency programs that the NJBPU administers with the programs run by the Electric Distribution Companies (EDCs) and Gas Distribution Companies (GDCs).
- We will continue to promote energy efficiency and demand response and will work within the PJM Demand Response Programs.
- We are seeking from the EDCs specific plans for Distribution Automation upgrades and eliciting their future plans for Smart Grid and AMI deployment. These two approaches will ensure the infrastructure is available as end use technology develops for use in a building or home to better manage energy or utility systems.

Currently, New Jersey has several programs that support DER microgrids including:

1. NJCEP for CHP and Fuel cells program is a Commercial and Industrial EE program that provides between 30 to 60% of the project costs at between $0.35

to $4.00 per watt up to a cap between $2 to $3 million depending on the DER technology and size.

2. NJCEP Biopower program is a renewable energy program that is currently a competitive solicitation.
3. Energy Storage program is a renewable energy program that is currently a competitive solicitation.
4. Energy Resilience Bank is an EDA program that provides grants and low interest loans for DER technologies including CHP, fuel cells and battery storage.
5. Energy Saving Improvement Program is a BPU program that provides a mechanism for local government to finance energy conservation measures
6. PSE&G Energy Efficiency Economic (E3) program provides zero interest financing for hospital CHP projects

An illustration of our efforts on DR resources includes our efforts to support energy storage technologies. As part of the Christie Administration's commitment to grow the State's innovation economy, a few weeks ago the BPU and EDA announced the approval of Eos Energy Storage LLC (Eos) for assistance through the Edison Innovation Green Growth Fund (EIGGF). Eos will use a $2 million loan to advance its energy storage technology in the Garden State.

I mentioned Princeton University as an example of an advanced microgrid. Currently there are 8 campus-wide CHP facilities that can operate as a microgrid. Several medical facilities are also able to maintain power through CHP microgrids, becoming larger shelters as well as accepting patients from other facilities.

All of these facilities also have solar to varying degrees; however none of solar arrays operated during major outages. In fact, none of the solar in New Jersey operated during the major storm outages, as they contain safety devices that shut them down. As part of our efforts to develop "islands of power" we are evaluating ways to safely island solar generation during major outages.

Of significance to signature projects we are now developing - the BPU has entered into two Memorandums of Understanding (MOUs) for the development of advanced microgrids.

- USDOE & NJ Transit – “Transit Grid”
- USDOE, City of Hoboken and PSE&G.

These MOUs were established to evaluate the potential to develop a microgrid; one within the northeast portion of the NJ Transit system and the other as part of a town center. NJ Transit along with support of the BPU is actively underway as they have selected a vendor for the design and build of this “Transit Grid”. And within the PSE&G service area in the City of Hoboken, the NJBPU is providing technical assistance along with DOE and Sandia Labs and facilitating discussions on operational and regulatory issues with Hoboken and the incumbent EDC.

In addition to these efforts with USDOE, the NJBPU engaged the New Jersey Institute of Technology (NJIT) and the Regional Planning Association (RPA) to map town centers that could be potential microgrids. The mapping was limited to the nine FEMA designated Superstorm Sandy impacted counties. The mapping is a first cut screening tool to identify municipalities that have a number of critical facilities in close proximity, making them good candidates for DER microgrid technologies. This effort mapped 27 potential town centers in 19 municipalities in the nine FEMA Sandy designated counties. This internal report will now become part of a larger staff report that is underway.

The NJBPU staff has been reviewing the status of the landscape of NJ microgrids and will soon be releasing a report that will provide information for the Board’s consideration in regards to establishing New Jersey’s initial microgrid policies.

The Report will be based upon the review, analysis and assessment of:

- Current publicly available microgrid reports and Distributed Automation/Smart Grid reports.
- Microgrid statutes, regulations, orders, proceedings filings and meetings in other states, as well as interviews and discussions with officials from those programs.

- Stakeholder discussions with electric distribution companies (EDC), gas distribution companies (GDC), the United States Department of Energy (USDOE) and their federal labs, and microgrid organizations.

The report will detail:

- Background & Superstorm Sandy Impacts.
    - The general impact of Superstorm Sandy including a summary of the overall economic impact, an update of the State's Hazard Mitigation Plan in regard to alternate energy and the state/local government FEMA recovery requests for back-up generators, and the history of electric system outages and the probability of future storm related outages.

- Microgrid classifications, the types of distributed energy resource (DER) technologies that can operate within a microgrid and the general benefits including resiliency and the cost ranges of DER microgrid technologies.

- New Jersey's relevant Public Utility Statutes and their relation to the general microgrid definitions and classifications.

- The Microgrid Energy Manager and management functions within the distribution and transmission grid systems.

- Microgrid actions in other States, including the current and projected DER cost trends that are impacting microgrid development national and internationally.

- New Jersey DER and Microgrid resources and current microgrid development in New Jersey, along with a summary of the New Jersey Town Center microgrid market potential report.

- A section on EDC Smart Grid and Distribution Automation Plans that summarizes national and New Jersey distribution automation and smart grids; the cost and benefits

of smart grids; and the status of distribution automation and smart grid development in New Jersey and other states.

- Summary of informal BPU Microgrid meetings and policy discussions with microgrid developers, electric and gas distribution companies, Rate Counsel, and microgrid market sector customer associations.

The Microgrid Report will then provide the BPU and the Christie Administration the foundation to explore with local officials, EDCs, technology companies, related industry, and public advocacy organizations the technological, operational, financial and regulatory issues that we must confront to advance microgrids.

Conclusion

All of you and I know that these issues that we must confront are many – and complex. The regulatory issues alone are daunting – especially considering that it is "sea change" for an industry that has worked within the same paradigm for a century. My approach – that I have articulated in around these policy issues – is to be deliberate and understand the issues we confront – whether technological or operational – before determining the specific path forward.

For me as a state regulator, I believe this approach allows us to confront these issues while continuing to keep a watchful eye on the current financial integrity of the companies we might otherwise disrupt - the companies that we regulate. And we must also at the same time ensure that these measures can be deployed to rate-payers at rates that are reasonable.

Nevertheless, we will continue to engage and confront these issues and challenges. And I am hopeful that we can and will confront these challenges with the same spirit of the innovators that preceded us – like those I mentioned from New Jersey or like Mr. Franklin.

Thank you for having me here today.