AREVA

July 17, 2009

Mr. Todd Arnold
Senior Vice President Smart Grid and Customer Systems
Duke Energy
139 East Fourth Street
Cincinnati, Ohio 45202

Subject: Letter of Commitment in support of Duke Energy Business Services LLC's application to U.S. Department of Energy Smart Grid Investment Grant Funding Opportunity Announcement DE-FOA-0000058

Dear Mr. Arnold:

AREVA T&D, Inc. is pleased to provide this letter of strong support for Duke Energy Business Services LLC, on behalf of Duke Energy Indiana, Inc., Duke Energy Kentucky, Inc. and Duke Energy Ohio, Inc. ("Duke Energy") in the above-cited Department of Energy funding opportunity. Duke Energy's planned Smart Grid Deployment is an end-to-end Energy Internet powered by two-way digital technology. Duke Energy will deploy "Smart Grid" functionality throughout its Midwest service areas that includes implementation of two-way communication networks on the distribution grid, automated metering infrastructure ("AMI") including installation of more than one million smart meters, advanced distribution automation, supporting IT infrastructure, Home Area Networks including technologies that enable new energy efficiency programs, new customer pricing options and support for plug-in hybrid electric vehicles/ electric vehicles.

AREVA T&D, Inc. has provided Duke Energy with proposals to provide distribution and energy management systems and enhancements to support this deployment and is pleased to be a key vendor supplying smart grid technology to Duke Energy on this funding proposal.

We strongly believe this project supports the job creation, economic stimulus, and energy infrastructure objectives of the Recovery Act and the Smart Grid Investment Grant Program, and we urge the Department of Energy to fund Duke Energy's Smart Grid Deployment project.

Sincerely,

Randy Berry
Managing Director
AREVA T&D

AREVA T&D
10865 Willows Road NE - Redmond, WA 98052 - USA
Tel.: 1 425.822.6800 - Fax: 1 425.250.1400

July 29, 2009

Donna Williams
Contract Specialist
MA-642.2/L'Enfant Plaza Building
U.S. Department of Energy
1000 Independence Ave., S.W.
Washington, DC 20585-1615

Re: Letter of Commitment for Duke Energy's Application to DE-FOA-0000058A

Dear Ms. Williams:

Cisco Systems, Inc. is pleased to provide a letter of support for Duke Energy's application for funding under the Integrated and/or Crosscutting Systems topic area of the above referenced FOA for the *Smart Grid Investment Grant Program.*

Cisco is committed to delivering successful Smart Grid solutions and believes that as the world builds out a smart, secure energy grid for the 21st century, networking technology will serve as the platform and public-private cooperation will be key to the success. Designed to meet the requirements of next-generation energy networks, Cisco Smart Grid solutions take advantage of a secure, standards-based IP-infrastructure for energy providers and consumers.

Cisco is committed to Duke Energy's long-term success in this effort.

Regards,

Marthin De Beer
Senior Vice President/General Manager
Emerging Technologies Group &
Cisco Smart Grid Board Chair

P.O Box 1640
Waukesha, WI 53187-1640

2300 Badger Drive
Waukesha, WI 53188-5951
Phone: (262) 896-2400
Fax: (262) 896-2313

COOPER Power Systems

July 17, 2009

Mr. Todd Arnold
Senior Vice President Smart Grid and Customer Systems
Duke Energy
139 East Fourth Street
Cincinnati, Ohio 45202

Subject: Letter of Commitment in support of Duke Energy Business Services LLC's application to U.S. Department of Energy Smart Grid Investment Grant Funding Opportunity Announcement DE-FOA-0000058

Dear Mr. Arnold:

Cooper Power Systems is pleased to provide this letter of strong support for Duke Energy Business Services LLC, on behalf of Duke Energy Indiana, Inc., Duke Energy Kentucky, Inc. and Duke Energy Ohio, Inc. ("Duke Energy") in the above-cited Department of Energy funding opportunity. Duke Energy's planned Smart Grid Deployment is an end-to-end Energy Internet powered by two-way digital technology. Duke Energy will deploy "Smart Grid" functionality throughout its Midwest service areas that includes implementation of two-way communication networks on the distribution grid, automated metering infrastructure ("AMI") including installation of more than one million smart meters, advanced distribution automation, supporting IT infrastructure, Home Area Networks including technologies that enable new energy efficiency programs, new customer pricing options and support for plug-in hybrid electric vehicles/ electric vehicles.

Cooper Power Systems provides Duke Energy with various types of electrical equipment, has provided additional proposals to support this deployment and is pleased to collaborate with Duke Energy on this funding proposal.

We strongly believe this project supports the job creation, economic stimulus, and energy infrastructure objectives of the Recovery Act and the Smart Grid Investment Grant Program, and we urge the Department of Energy to fund Duke Energy's Smart Grid Deployment project.

Sincerely,

Michael A. Stoessl
Group President
Cooper Power Systems

CONVERGYS
Outthinking Outdoing

201 East Fourth Street, 102-1800
Cincinnati, Ohio 45201-1638
513 723 3480
Fax 513 723 3477
bob.lento@convergys.com

Robert A. Lento
President
Information Management

July 24, 2009

Mr. Todd Arnold
Senior Vice President Smart Grid and Customer Systems
Duke Energy
139 East Fourth Street
Cincinnati, Ohio 45202

Subject: Letter of Commitment in support of Duke Energy Business Services LLC's application to U.S. Department of Energy Smart Grid Investment Grant Funding Opportunity Announcement DE-FOA-0000058

Dear Mr. Arnold:

Convergys Corporation is pleased to provide this letter of strong support for Duke Energy Business Services LLC, on behalf of Duke Energy Indiana, Inc., Duke Energy Kentucky, Inc. and Duke Energy Ohio, Inc. ("Duke Energy") in the above-cited Department of Energy funding opportunity. Duke Energy's planned Smart Grid Deployment is an end-to-end Energy Internet powered by two-way digital technology. Duke Energy will deploy "Smart Grid" functionality throughout its Midwest service areas that includes implementation of two-way communication networks on the distribution grid, automated metering infrastructure ("AMI") including installation of more than one million smart meters, advanced distribution automation, supporting IT infrastructure, Home Area Networks including technologies that enable new energy efficiency programs, new customer pricing options and support for plug-in hybrid electric vehicles/ electric vehicles.

Convergys Corporation has provided Duke Energy with a detailed proposal to provide a customer billing platform to support this deployment and is pleased to collaborate with Duke Energy on this funding proposal.

We strongly believe this project supports the job creation, economic stimulus, and energy infrastructure objectives of the Recovery Act and the Smart Grid Investment Grant Program, and we urge the Department of Energy to fund Duke Energy's Smart Grid Deployment project.

Sincerely,

ECHELON

August 6, 2009

Mr. Todd Arnold
Senior Vice President Smart Grid and Customer Systems
Duke Energy
139 East Fourth Street
Cincinnati, Ohio 45202

Subject: Letter of Commitment in support of Duke Energy Business Services LLC's application to U.S. Department of Energy Smart Grid Investment Grant Funding Opportunity Announcement DE-FOA-0000058

Dear Mr. Arnold:

Echelon Corporation is pleased to provide this letter of strong support for Duke Energy Business Services LLC, on behalf of Duke Energy Indiana, Inc., Duke Energy Kentucky, Inc. and Duke Energy Ohio, Inc. ("Duke Energy") in the above-cited Department of Energy funding opportunity. Duke Energy's planned Smart Grid Deployment is an end-to-end Energy Internet powered by two-way digital technology. Duke Energy will deploy "Smart Grid" functionality throughout its Midwest service areas that includes implementation of two-way communication networks on the distribution grid, automated metering infrastructure ("AMI") including installation of more than one million smart meters, advanced distribution automation, supporting IT infrastructure, Home Area Networks including technologies that enable new energy efficiency programs, new customer pricing options and support for plug-in hybrid electric vehicles/ electric vehicles.

Echelon Corporation has provided Duke Energy with proposals to provide smart metering, data concentrators and systems software to support this deployment and is pleased to collaborate with Duke Energy on this funding proposal.

We strongly believe this project supports the job creation, economic stimulus, and energy infrastructure objectives of the Recovery Act and the Smart Grid Investment Grant Program, and we urge the Department of Energy to fund Duke Energy's Smart Grid Deployment project.

Sincerely,

Oliver R. Stanfield
*Executive Vice President and Chief Financial Officer*

550 Meridian Ave,
San Jose, CA 95126
tel: 408 938 5200
fax: 408 790 3800
www.echelon.com

GRIDPOINT

GridPoint, Inc. / 2801 Clarendon Blvd. / Suite 100 / Arlington, VA 22201
p. 703.667.7000 / f. 703.667.7001 / www.gridpoint.com

July 29, 2009

Mr. Todd Arnold
Senior Vice President Smart Grid and Customer Systems
Duke Energy
139 East Fourth Street
Cincinnati, Ohio 45202

Subject: Letter of Commitment in support of Duke Energy Business Services LLC's application to U.S. Department of Energy Smart Grid Investment Grant Funding Opportunity Announcement DE-FOA-0000058

Dear Mr. Arnold:

GridPoint, Inc. ("GridPoint") is pleased to provide this letter of strong support for Duke Energy Business Services LLC, on behalf of Duke Energy Indiana, Inc., Duke Energy Kentucky, Inc. and Duke Energy Ohio, Inc. ("Duke Energy") in the above-cited Department of Energy funding opportunity. Duke Energy's planned Smart Grid Deployment is an end-to-end Energy Internet powered by two-way digital technology. Duke Energy will deploy "Smart Grid" functionality throughout its Midwest service areas that includes implementation of two-way communication networks on the distribution grid, automated metering infrastructure ("AMI") including installation of more than one million smart meters, advanced distribution automation, supporting IT infrastructure, Home Area Networks including technologies that enable new energy efficiency programs, new customer pricing options and support for plug-in hybrid electric vehicles/ electric vehicles.

GridPoint has provided Duke Energy with proposals to provide interactive customer toolsets for energy management and associated systems software and is pleased to collaborate with Duke Energy on this funding proposal.

We strongly believe this project supports the job creation, economic stimulus, and energy infrastructure objectives of the Recovery Act and the Smart Grid Investment Grant Program, and we urge the Department of Energy to fund Duke Energy's Smart Grid Deployment project.

Sincerely,

Michael R. Lach
Chief Operating Officer, GridPoint

SCHWEITZER ENGINEERING LABORATORIES, INC.
2350 NE Hopkins Court • Pullman, WA 99163-5603 USA
Phone: +1.509.332.1890 • Fax: +1.509.332.7990
www.selinc.com • info@selinc.com

July 22, 2009

Mr. Todd Arnold
Senior Vice President Smart Grid and Customer Systems
Duke Energy
139 East Fourth Street
Cincinnati, Ohio 45202

Subject: Letter of Commitment in support of Duke Energy Business Services LLC's application to U.S. Department of Energy Smart Grid Investment Grant Funding Opportunity Announcement DE-FOA-0000058

Dear Mr. Arnold:

Schweitzer Engineering Laboratories, Inc. (SEL) is pleased to provide this letter of strong support for Duke Energy Business Services LLC, on behalf of Duke Energy Indiana, Inc., Duke Energy Kentucky, Inc. and Duke Energy Ohio, Inc. ("Duke Energy") in the above-cited Department of Energy funding opportunity. Duke Energy's planned Smart Grid Deployment is an end-to-end Energy Internet powered by two-way digital technology. Duke Energy will deploy "Smart Grid" functionality throughout its Midwest service areas that includes implementation of two-way communication networks on the distribution grid, automated metering infrastructure ("AMI") including installation of more than one million smart meters, advanced distribution automation, supporting IT infrastructure, Home Area Networks including technologies that enable new energy efficiency programs, new customer pricing options and support for plug-in hybrid electric vehicles/ electric vehicles.

SEL has provided Duke Energy with a detailed proposal to provide protective relaying technologies to support this deployment and is pleased to collaborate with Duke Energy on this funding proposal.

We strongly believe this project supports the job creation, economic stimulus, and energy infrastructure objectives of the Recovery Act and the Smart Grid Investment Grant Program, and we urge the Department of Energy to fund Duke Energy's Smart Grid Deployment project.

Sincerely,

Erik C. Newman
Vice President, Sales and Customer Service

SQUARE D

by Schneider Electric

July 17, 2009

Mr. Todd Arnold
Senior Vice President Smart Grid and Customer Systems
Duke Energy
139 East Fourth Street
Cincinnati, Ohio 45202

Subject: Letter of Commitment in support of Duke Energy Business Services LLC's application to U.S. Department of Energy Smart Grid Investment Grant Funding Opportunity Announcement DE-FOA-0000058

Dear Mr. Arnold:

Schneider Electric is pleased to provide this letter of strong support for Duke Energy Business Services LLC, on behalf of Duke Energy Indiana, Inc., Duke Energy Kentucky, Inc. and Duke Energy Ohio, Inc. ("Duke Energy") in the above-cited Department of Energy funding opportunity. Duke Energy's planned Smart Grid Deployment is an end-to-end Energy Internet powered by two-way digital technology. Duke Energy will deploy "Smart Grid" functionality throughout its Midwest service areas that includes implementation of two-way communication networks on the distribution grid, automated metering infrastructure ("AMI") including installation of more than one million smart meters, advanced distribution automation, supporting IT infrastructure, Home Area Networks including technologies that enable new energy efficiency programs, new customer pricing options and support for plug-in hybrid electric vehicles/ electric vehicles.

Schneider Electric has provided Duke Energy with a detailed proposal to provide electrical equipment for this deployment and is pleased to collaborate with Duke Energy on this funding proposal.

We strongly believe this project supports the job creation, economic stimulus, and energy infrastructure objectives of the Recovery Act and the Smart Grid Investment Grant Program, and we urge the Department of Energy to fund Duke Energy's Smart Grid Deployment project.

Sincerely,

Michael Rice
Vice President, Field Services
Schneider Electric
North American Operating Division

**Schneider Electric**
9870 Crescent Park Drive
West Chester, OH 45069
Tel. (513) 777-4445 Fax (513) 755-5028
www.us.schneider-electric.com

Schneider Electric

verizon

Todd Arnold
Senior Vice President, Smart Grid and Customer Systems
Duke Energy
526 South Church Street
Charlotte, NC 28202-1802

Dear Mr. Arnold,

As you know, Verizon Communications supports Duke Energy's industry-leading Smart Grid efforts, including its application for funding under the American Recovery and Reinvestment Act of 2009 to further those efforts. Verizon looks forward to continuing its close working relationship with Duke Energy in support of its Smart Grid efforts by offering Verizon's extensive portfolio of high quality commercially available wireline and wireless communications services. Verizon stands ready to provide services as one of Duke Energy's reliable and trusted vendors and help Duke Energy deliver on the Department of Energy's Smart Grid goals for interoperability, enhanced energy efficiency and security.

Verizon Communications Inc. (NYSE:VZ), headquartered in New York, is a global leader in delivering broadband and other wireless and wireline communications services to mass market, business, government and wholesale customers. Verizon Wireless operates America's most reliable wireless network, serving more than 87 million customers nationwide. Verizon's Wireline operations provide converged communications, information and entertainment services over the nation's most advanced fiber-optic network. The Wireline business also includes Verizon Business, which delivers innovative and seamless business solutions to customers around the world. A Dow 30 company, Verizon employs a diverse workforce of more than 235,000 and last year generated consolidated operating revenues of more than $97 billion.

We look forward to working with Duke Energy on their Smart Grid initiative and supporting the achievement of our nation's energy efficiency goals. If there are any questions please contact Robert Heffron at Robert.heffron@verizonbusiness.com or 703-886-3442.

Sincerely,

Robert Heffron
Verizon
Manager, Utility Vertical Market

# Attachment I: Political Support Letters

STEVEN L. BESHEAR
GOVERNOR

LEONARD K. PETERS
SECRETARY

**ENERGY AND ENVIRONMENT CABINET**
OFFICE OF THE SECRETARY
500 MERO STREET
12TH FLOOR, CAPITAL PLAZA TOWER
FRANKFORT, KY 40601
TELEPHONE: (502) 564-3350
FACSIMILE: (502) 564-3354
www.eec.ky.gov

July 30, 2009

The Honorable Steven Chu
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Subject: Letter of support for Duke Energy Business Services LLC's application to U.S. Department of Energy Smart Grid Investment Grant Funding Opportunity Announcement DE-FOA-0000058

Dear Secretary Chu:

I am writing in support of the funding application of Duke Energy Business Services LLC, on behalf of Duke Energy Kentucky, Inc., Duke Energy Ohio, Inc. and Duke Energy Indiana, Inc. ("Duke Energy") for its Midwest Smart Grid Deployment.

If Duke Energy is successful in obtaining stimulus funding and continues to receive constructive regulatory support, Duke Energy will install distribution automation equipment in Kentucky. Duke Energy will ultimately develop a digital network to allow two-way communication between Duke Energy and customers. The distributed automation will provide a more reliable grid and communications infrastructure.

The project is "shovel-ready." Duke Energy has developed plans for accelerated deployment of distribution automation equipment in Kentucky if funding is granted. Federal funding would allow Duke Energy to accelerate deployment of the project.

This project supports the objectives of Kentucky's comprehensive energy plan to improve energy efficiency in the residential and commercial sectors. This project also supports the job creation, economic stimulus, and energy infrastructure objectives of the Recovery Act

and the Smart Grid Investment Grant Program. It is exactly the kind of project President Obama and the U.S. Congress had in mind when they promoted and passed the American Reinvestment and Recovery Act and I urge favorable consideration of the Duke Energy proposal.

Sincerely yours,

Leonard K. Peters
Secretary

LKP:wh

SHERROD BROWN
OHIO

COMMITTEES:
AGRICULTURE, NUTRITION, AND FORESTRY
BANKING, HOUSING, AND URBAN AFFAIRS
HEALTH, EDUCATION, LABOR, AND PENSIONS
VETERANS' AFFAIRS

# United States Senate

WASHINGTON, DC 20510
July 29, 2009

The Honorable Steven Chu
Secretary
U.S. Department of Energy
1000 Independence Ave. S.W.
Washington, D.C. 20585

Dear Secretary Chu:

As the Department of Energy considers applications for the Smart Grid Investment grant opportunity as funded through the American Recovery and Reinvestment Act of 2009 (DE-FOA-0000058), I would like to bring to your attention the proposal submitted by Duke Energy Business Services LLC for its Midwest Smart Grid Deployment program.

Duke Energy's plan would develop a digital network to allow two-way communication with its customers. The plan includes approximately 680,000 new smart meters, 420,000 gas communication modules, and distributed automation that would improve grid reliability. If Duke Energy is awarded funding, it is my hope that customers in Ohio, Kentucky, and Indiana will have better access to the tools needed to lower utility costs and reduce carbon emissions.

Ohio is well positioned to lead the country in creating and expanding the green manufacturing sector. We have made significant investments in alternative energy, and have proven that Ohio's workforce is second to none in developing and adapting the skill sets necessary for the green manufacturing industry. With the regional leadership of Duke Energy, it is my hope that the economic incentives afforded by the development of smart grid businesses will benefit Ohioans for many generations to come.

It is my understanding that the Public Utilities Commission of Ohio approved Duke Energy's smart grid deployment plan to serve Ohio customers, and that the company has already installed 43,000 electric smart meters and 24,000 gas modules. As the Department of Energy reviews the application, I am confident you will find that the objectives of Duke Energy's application are closely aligned with the goals of the Smart Grid Investment Grant program.

I respectfully request that the Department of Energy give serious consideration to Duke Energy's application for funding. I ask that you keep my office informed on the status of this application.

Thank you for your efforts.

Sincerely,

Sherrod Brown

Sherrod Brown
United States Senator

Cc: Patricia Hoffman, Principal Deputy Assistant Secretary, Office of Electricity Delivery and Energy Reliability

DAN BURTON
5TH DISTRICT, INDIANA

COMMITTEES:
FOREIGN AFFAIRS
SUBCOMMITTEES:
WESTERN HEMISPHERE
RANKING MEMBER
ASIA, THE PACIFIC AND THE GLOBAL ENVIRONMENT

OVERSIGHT AND GOVERNMENT REFORM
FORMER CHAIRMAN (1997–2002)
SUBCOMMITTEES:
NATIONAL SECURITY AND FOREIGN AFFAIRS
DOMESTIC POLICY

# Congress of the United States
## House of Representatives
Washington, DC 20515–1405

WASHINGTON OFFICE:
2308 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515–1405
TELEPHONE: (202) 225–2276

DISTRICT OFFICES:
8900 KEYSTONE AT THE CROSSING
INDIANAPOLIS, IN 46240
TELEPHONE: (317) 848–0201
TOLL-FREE: (800) 382–5020

209 SOUTH WASHINGTON STREET
MARION, IN 46952
TELEPHONE: (765) 662–6770
TOLL-FREE: (877) 846–2936

www.house.gov/burton

August 4, 2009

Lisa Epifani
Assistant Secretary for Congressional
and Intergovernmental Affairs
U.S. Department of Energy
Forrestal Building, Room 7B138
1000 Independence Avenue, SW
Washington, DC 20585-0800

RE: Smart Grid Investment Grant # DE-FOA-0000058

Dear Ms. Epifani:

I would like to express my support and interest in the grant application for the U.S. Department of Energy's Smart Grid Investment Grant Funding Opportunity # DE-FOA-0000058 submitted by Duke Energy Business Services L.L.C.

Funding will allow installation of more than 800,000 new digital "smart meters" in each of the 69 Indiana counties served by Duke Energy, the state's largest electric utility. The proposal includes the installation of technology that will improve the reliability of the grid and provide customers with the tools they need to make wiser energy choices. The smart grid also improves the environment by allowing for the integration of more renewable distributed energy resources onto the grid, resulting in decreased carbon emissions.

I trust Duke Energy will be a responsible steward in implementing the process needed to complete this project. I ask that you give thorough consideration to this request, consistent with applicable rules and regulations and relevant statutes. If there is any way my office can be of assistance to you, please do not hesitate to contact Kerry Byrne, who serves as my grant coordinator. She can be reached at 317-848-0201. Thank you for your efforts and attention on behalf of this request.

Sincerely,

COPY

Dan Burton
Member of Congress

DB/kb

STATE OF INDIANA
OFFICE OF THE GOVERNOR
State House, Second Floor
Indianapolis, Indiana 46204

Mitchell E. Daniels, Jr.
*Governor*

July 31, 2009

The Honorable Dr. Stephen Chu
Secretary of Energy
U.S. Department of Energy
1000 Independence Ave., SW
Washington, DC 20585

Dear Secretary Chu:

I am writing to urge your consideration of the funding application of Duke Energy Business Services LLC. This application is made on behalf of Duke Energy Indiana, Inc., Duke Energy Kentucky, Inc. and Duke Energy Ohio, Inc. ("Duke Energy") for its Midwest Smart Grid Deployment ***(U.S. Department of Energy Smart Grid Investment Grant Funding Opportunity Announcement DE-FOA-0000058).***

Smart meters and automated equipment, as proposed by Duke Energy, will provide the company and its customers with up-to-date energy-usage data. Customized usage data will be a central component in enabling utilities to develop new programs and new ways to help consumers conserve power and use power more efficiently. Smart Grid will improve the way our nation uses energy by allowing customers to remotely manage their lights, air conditioning, heat and other household appliances.

Duke Energy's planned Midwest Smart Grid Deployment includes an investment of approximately $800 million in the states of Indiana, Ohio and Kentucky, for smart metering, two-way communications, distributed automation, pricing pilots, and behind the meter technologies. Over half of that investment—just over $400 million over three years—will be in the state I represent, Indiana.

Duke Energy's investment in smart grid will transform energy delivery and energy efficiency operations in Indiana and the industrial Midwest and will improve development opportunities for Indiana and the region. I support the Duke Energy smart grid request.

Sincerely,

M E Daniels, Jr.

STEVE DRIEHAUS
1st District, Ohio

COMMITTEE ON FINANCIAL SERVICES
Subcommittee on
Housing and Community Opportunity

Subcommittee on
International Monetary Policy and Trade

Subcommittee on
Oversight and Investigations

COMMITTEE ON
OVERSIGHT AND GOVERNMENT REFORM
Subcommittee on
National Security and Foreign Affairs

# Congress of the United States
## House of Representatives
## Washington, DC 20515–3501

408 Cannon House Office Building
Washington, DC 20515
(202) 225-2216
Fax: (202) 225-3012

441 Vine Street, Suite 3003
Cincinnati, OH 45202
(513) 684-2723
Fax: (513) 421-8722

July 31, 2009

The Honorable Steven Chu
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Subject: Letter of support for Duke Energy Business Services LLC's application to U.S. Department of Energy Smart Grid Investment Grant Funding Opportunity Announcement DE-FOA-0000058

Dear Secretary Chu:

I am writing in support of the funding application of Duke Energy Business Services LLC, on behalf of Duke Energy Ohio, Inc., Duke Energy Kentucky, Inc. and Duke Energy Indiana, Inc. ("Duke Energy") for its Midwest Smart Grid Deployment. If Duke Energy is successful in obtaining stimulus funding and continues to receive constructive regulatory support, Duke Energy would also invest several hundred million dollars to deploy a smart grid system in Ohio, Kentucky and Indiana.

Duke Energy's plan includes approximately 680,000 new digital electric "smart meters" and 420,000 gas communication modules in Ohio. Duke Energy will develop a digital network to allow two-way communication between Duke Energy and customers. The project also involves distributed automation for a more reliable grid and communications infrastructure. This investment will make the electric grid more reliable and efficient. Smart grid is the enabling technology for time-of-use utility rates and advanced energy efficiency services. If Duke Energy receives stimulus funding, customers will get quicker access to these tools they need to lower their utility bills by making wiser energy choices. The smart grid will also allow for the integration of more renewable distributed energy resources onto the grid, thus reducing carbon emissions.

The project is "shovel-ready." Duke Energy has already installed some of the equipment – approximately 43,000 electric smart meters and 24,000 gas modules. The Public Utilities Commission of Ohio issued an order on December 17, 2008 approving Duke Energy's plan to deploy a smart grid system to serve Ohio customers. Federal funding would allow Duke Energy to accelerate deployment of the project; would provide quicker access to energy-savings tools for customers; and would greatly reduce the costs of this important investment for Duke Energy's electric and gas customers.

This project supports the job creation, economic stimulus, and energy infrastructure objectives of the Recovery Act and the Smart Grid Investment Grant Program. It is exactly the kind of project President Obama and the U.S. Congress had in mind when they promoted and passed the American Reinvestment and Recovery Act and I urge favorable consideration of the Duke Energy proposal.

Sincerely,

Steve Driehaus
Member of Congress

Commonwealth of Kentucky
Public Service Commission
211 Sower Blvd.
P.O. Box 615
Frankfort, Kentucky 40602-0615
Telephone: (502) 564-3940
Fax: (502) 564-3460
psc.ky.gov



July 27, 2009

The Honorable Steven Chu
Secretary of Energy
U.S. Department of Energy
1000 Independence Ave., SW
Washington, DC 40585

Re: Duke Energy Business Services, LLC – Smart Grid Application

Dear Secretary Chu:

The Kentucky Public Service Commission (KPSC) broadly supports efforts to cost effectively add efficiency and reliability to the electricity transmission and distribution system. The KPSC believes that Smart Grid deployments offer great promise in improving efficiencies and reliability in the delivery of electricity, to reduce electricity demand, to enable distributed generation and other benefits.

The projects included in the subject grant will likely be submitted to the KPSC for approval. The KPSC would consider the projects based on the evidence it receives concerning the need for and cost effectiveness of the project to deliver the benefits expected, the impact on rates, and other criteria under Kentucky law.

The KPSC understands that the grant requires the projects be completed within a definitive timeframe and will make every effort to process related applications expeditiously.

Sincerely Yours,

Jeff DeRouen
Executive Director

*The Public Utilities Commission of Ohio*

*Monitoring marketplaces and enforcing rules to assure safe, adequate, and reliable utility services.*

Ted Strickland, Governor
Alan R. Schriber, Chairman

Commissioners
Ronda Hartman Fergus
Valerie A. Lemmie
Paul A. Centolella
Cheryl Roberto

August 3, 2009

Secretary Steven Chu
United States Department of Energy
1000 Independence Ave., SW
Washington, DC 20585

Dear Secretary Chu:

As the state agency charged with regulatory oversight over Ohio's investor owned electric utilities, the Public Utilities Commission of Ohio (PUCO) would like to offer its strong support to the Duke Energy Ohio Smart Grid Investment Grant Program (DE-FOA-000058) application.

The acceleration and expansion of Duke Energy Ohio's Smart Grid program is aligned with the state's recently enacted electricity law, Senate Bill 221. Ohio's law encourages the deployment of advanced metering infrastructure in conjunction with the use of time differentiated pricing. It also includes aggressive energy efficiency and peak demand reduction standards.

Ohio's law also requires the development of distribution performance standards. Duke Energy Ohio has committed to improve the quality of its distribution service as smart grid technologies are deployed. This will provide a foundation for additional job creation by firms that rely on digital technology and require a high level of reliability and power quality.

On December 17, 2008, the PUCO issued an order approving Duke Energy Ohio's plan to deploy a complete smart grid system. To ensure that this project will optimize the way electricity is generated, delivered, and used, Duke Energy Ohio agreed to convene a stakeholder working group to explore opportunities to maximize the benefits of its smart grid investment. Additionally, there will be a mid-deployment program review to assess performance and ensure that improvements identified in the review are implemented. As part of the PUCO's Order, Duke Energy Ohio will be able to recover smart grid investments through a non-bypassable distribution rider on customers' bills.

Federal funding will allow Duke Energy Ohio to accelerate the deployment of the project, provide quicker access to energy-savings tools for customers, and reduce the cost to Ohio consumers of an important investment that will provide region-wide economic, reliability, and environmental benefits. This project supports the job creation, economic stimulus, and energy infrastructure objectives of the ARRA and the Smart Grid Investment Grant Program. My colleagues and I encourage the DOE to look favorably upon Duke Energy Ohio's application and recognize the PUCO's commitment to Duke Energy Ohio's smart grid initiatives.

Sincerely,

Alan R. Schriber
Chairman

GEORGE V. VOINOVICH
OHIO

524 HART SENATE OFFICE BUILDING
(202) 224-3353
TDD: (202) 224-6997
http://voinovich.senate.gov

# United States Senate

WASHINGTON, DC 20510-3504

APPROPRIATIONS
RANKING MEMBER, SUBCOMMITTEE ON HOMELAND SECURITY

ENVIRONMENT AND PUBLIC WORKS
RANKING MEMBER, SUBCOMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE

HOMELAND SECURITY AND GOVERNMENTAL AFFAIRS
RANKING MEMBER, SUBCOMMITTEE ON OVERSIGHT OF GOVERNMENT MANAGEMENT, THE FEDERAL WORKFORCE, AND THE DISTRICT OF COLUMBIA

July 28, 2009

The Honorable Steven Chu
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Secretary Chu:

I write in support of the grant application submitted by Duke Energy, for funding in the Smart Grid Investment Grant Program, FOA Number DE-FOA-0000058, which was created and funded in the American Recovery and Reinvestment Act of 2009.

I understand that Duke Energy's plan *'Midwest Smart Grid Deployment'* includes the installation of approximately 680,000 new digital electric "smart meters" and 420,000 gas communication modules in Ohio. These monitoring devices will be connected to a digital network to allow two-way communication between Duke Energy and customers. The region's electric grid will be made more reliable and efficient through these upgrades, and allow customers the option for time-of-use utility rates and advanced energy efficiency services. The smart grid will also allow for the integration of more renewable distributed energy resources onto the grid, thus reducing carbon emissions.

Duke Energy has already installed some of the equipment – approximately 43,000 electric smart meters and 24,000 gas modules. And Duke officials indicate that the Public Utilities Commission of Ohio issued an order on December 17, 2008 approving Duke Energy's plan to deploy a smart grid system to serve Ohio customers. Federal funding would allow Duke Energy to accelerate deployment of the project; would provide quicker access to energy-savings tools for customers; and would greatly reduce the costs of this important investment for Duke Energy's electric and gas customers.

Please give all due consideration to this request. If there are any questions, please contact my grants coordinator, Linda Greenwood at (419) 259-3895. Thank you.

Sincerely,

George V. Voinovich

George V. Voinovich
United States Senator

cc: Donna Williams, Grant Specialist
Office of Electricity Delivery and Energy Reliability
U.S. Department of Energy

STATE OFFICES:
36 EAST SEVENTH STREET
ROOM 2615
CINCINNATI, OHIO 45202
(513) 684-3265

1240 EAST NINTH STREET
ROOM 2955
CLEVELAND, OHIO 44199
(216) 522-7095

37 WEST BROAD STREET
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COLUMBUS, OHIO 43215
(614) 469-6697
(614) 469-6774 (CASEWORK)
(800) 205-6448 (CASEWORK)

78 WEST WASHINGTON STREET
P.O. BOX 67
NELSONVILLE, OHIO 45764
(740) 441-6410

420 MADISON AVENUE
ROOM 1210
TOLEDO, OHIO 43604
(419) 259-3895

BRAD ELLSWORTH
8TH DISTRICT, INDIANA

COMMITTEES:
ARMED SERVICES
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SMALL BUSINESS
CONTRACTING AND TECHNOLOGY
INVESTIGATIONS AND OVERSIGHT

# Congress of the United States
## House of Representatives
## Washington, DC 20515–1408

August 3, 2009

The Honorable Steven Chu
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Dear Secretary Chu:

I am writing in support of the funding application of Duke Energy Business Services LLC, on behalf of Duke Energy Indiana, Inc., Duke Energy Kentucky, Inc. and Duke Energy Ohio, Inc. ("Duke Energy") for its Midwest Smart Grid Deployment *[U.S. Department of Energy Smart Grid Investment Grant Funding Opportunity Announcement DE-FOA-0000058].*

Duke Energy's is planning a significant smart grid investment in the Midwest. The company is planning to invest about $800 million in the states of Indiana, Ohio and Kentucky. About $400 million of the investment is will be directed to Indiana.

This smart grid project is good for the Midwest and Indiana for a number of reasons:

- It will modernize the electric grid, allowing the company to improve the reliability and efficiency of its system. Among its benefits, it will allow the utility to detect and address outages earlier, minimizing the inconvenience and costs associated with power outages.
- It will improve the environment in two important ways: First, improving customer knowledge as to how they use electricity and ways they can conserve or use electric power more effectively and secondly, promoting the integration of renewable power onto the electric grid.

I should also note that Duke Energy Indiana has already done a lot of work to ensure that this will be shovel ready by the time the DOE makes its funding decisions. Duke Energy has filed a petition and settlement before the Indiana Utility Regulatory Commission requesting approval to invest in smart grid activities and a Commission ruling is expected soon.

101 NW MARTIN LUTHER KING, JR. BOULEVARD
ROOM 124
EVANSVILLE, IN 47708
(812) 465-6484

901 WABASH AVENUE
SUITE 140
TERRE HAUTE, IN 47807
(812) 232-0523

513 CANNON HOUSE OFFICE BUILDING
WASHINGTON, DC 20515
(202) 225-4636
TOLL FREE (866) 667-0227

This project aligns well with the goals of the American Recovery and Reinvestment Act. It creates jobs, stimulates local investment and federal funding under this program would help reduce the costs of this important project for Duke Energy's electric customers.

I support Duke Energy Indiana grant application and I personally feel they would be a very worthy recipient. Thank you very much for your time and attention to this matter. Please do not hesitate to contact me if I can be of assistance as you make your determinations.

Sincerely,

Brad Ellsworth
Member of Congress

BE/ab

STATE OF INDIANA

INDIANA UTILITY REGULATORY COMMISSION
101 W. WASHINGTON STREET, SUITE 1500 EAST
INDIANAPOLIS, INDIANA 46204-3407

http://www.in.gov/iurc
Office: (317) 232-2701
Facsimile: (317) 232-6758

July 29, 2009

The Honorable Steven Chu
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

**Re: Duke Energy Business Services LLC's application to U.S. Department of Energy Smart Grid Investment Grant Funding Opportunity Announcement DE-FOA-0000058**

Dear Mr. Chu:

This letter is being provided by the Indiana Utility Regulatory Commission ("Commission" or "IURC") in support of the U.S. Department of Energy ("DOE") funding application ("Funding Application") submitted by Duke Energy Business Services LLC, on behalf of Duke Energy Indiana, Inc., Duke Energy Kentucky, Inc. and Duke Energy Ohio, Inc. ("Duke Energy") regarding its planned Midwest Smart Grid Deployment.

The IURC is aware that Duke Energy's planned Midwest Smart Grid Deployment could include an investment of approximately $800 million in the states of Indiana, Ohio and Kentucky over a three year period for smart metering, two-way communications, distributed automation, pricing pilots, and behind the meter technologies. The Commission also understands that of Duke Energy's total request for $200 million in federal stimulus funds for its Midwest Smart Grid Deployment, approximately 55% of the funds received would be directed to Duke Energy Indiana's smart grid activities.

While the Commission is currently considering a request made by Duke Energy Indiana, in Cause No. 43501 to implement Smart Grid Technology in Indiana, and cannot comment specifically on the issues presented in that proceeding, the Commission recognizes that the receipt of federal DOE funds could provide needed economic stimulus in Indiana. In addition, if the proposal presented by Duke Energy Indiana is approved by the Commission, the receipt of DOE funds could act to offset a portion of the cost of the requested Smart Grid deployment resulting in an overall benefit to ratepayers. In this context the Commission supports Duke Energy's Funding Application.

Sincerely,

David Lott Hardy, Chairman

RICHARD G. LUGAR
INDIANA
306 HART SENATE OFFICE BUILDING
WASHINGTON, DC 20510
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senator_lugar@lugar.senate.gov
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COMMITTEES:
FOREIGN RELATIONS, RANKING MEMBER
AGRICULTURE, NUTRITION, AND FORESTRY

# United States Senate

WASHINGTON, DC 20510–1401

July 29, 2009

The Honorable Steven Chu
Secretary of Energy
Forrestal Building, Room 7B138
1000 Independence Avenue, SW
Washington, DC 20585-0800

Dear Secretary Chu:

I am writing on behalf of Duke Energy's Smart Grid deployment project. My understanding is that Duke Energy proposes to implement a three year, $800,000,000.00 investment in this advanced electricity management technology across three states.

I am supportive of this company's efforts to secure financial assistance from the U.S. Department of Energy (DOE) for assistance in implementing this venture. Smart Grid holds promise for improved carbon management, enhanced energy efficiency, updated electricity delivery equipment for improved reliability, and support for new plug-in hybrid vehicles. I am encouraged by the leadership of Duke Energy in this effort to assist our nation's energy security, assist with reducing carbon dioxide emissions and advance the development of renewable energy and related job creation that our economic circumstances requires

I look forward to learning of the DOE's decisions on these smart grid applications. Thank you for your assistance with this matter.

Sincerely,

Richard G. Lugar
United States Senator

RGL/lar
cc: The Hon. Patricia A. Hoffman, Acting Assistant Secretary, Office of Electricity Delivery and Energy Reliability

# INDIANA OFFICE OF UTILITY CONSUMER COUNSELOR

July 29, 2009

The Honorable Steven Chu
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

**Subject: Letter of support for Duke Energy Business Services LLC's application to U.S. Department of Energy Smart Grid Investment Grant Funding Opportunity Announcement DE-FOA-0000058**

Dear Secretary Chu:

I am writing in support of the funding application of Duke Energy Business Services LLC, on behalf of Duke Energy Indiana, Inc. ("Duke Energy") for its Midwest Smart Grid Deployment.

Smart grid technology will transform the electric system through technological advances that provide energy companies and their customers the information they need to make better choices about how to provide and use energy.

The Indiana Office of Utility Consumer Counselor participates in all proceedings before the Indiana Utility Regulatory Commission on behalf of Indiana ratepayers. We have been extensively involved in Duke Energy's recent proposal to develop a smart grid in Indiana and believe all customers will benefit from a complete smart grid-enabled system. Smart meters and automated equipment, as proposed by Duke Energy, will provide the company and its customers with up-to-date energy-usage data. Customized usage data will be a central component in enabling utilities to develop new programs and new ways to help consumers conserve power and use power more efficiently. Smart Grid will improve the way our nation uses energy by allowing customers to remotely manage their lights, air conditioning, heat and other household appliances.

Duke Energy's planned Midwest Smart Grid Deployment includes an investment of approximately $800 million in the state of Indiana over three years, for smart metering, two-way communications, distributed automation, pricing pilots, and behind the meter technologies.

One of the key benefits of the Duke Energy proposal is its preparedness to utilize the funds requested. As previously mentioned, Duke Energy Indiana has already filed a petition with the Indiana Utility Regulatory Commission (IURC) to develop a smart grid and has reached a

INDIANA OFFICE OF UTILITY CONSUMER COUNSELOR



settlement with my agency and other interested parties, which was submitted to the IURC on July 15, 2009 for consideration and approval.

We reached a settlement agreement with Duke Energy Indiana in large part because we believe that Indiana ratepayers will benefit through empowering them to better manage their energy usage. We also recognize that the deployment of smart grid technology to approximately 780,000 Duke Energy customers could enable Indiana to foster economic growth in research and development, manufacturing, and distribution of smart grid-compatible technology.

My agency is statutorily mandated to represent the interests of the ratepayers and consumers of Indiana utilities. Given the precipitous costs associated with upgrading the distribution system and the distressed economic environment, the receipt of federal funds to offset the cost of this important technology for the benefit of Duke Energy's customers is of utmost importance to us and our constituents. Duke Energy's investment in smart grid will transform energy delivery and efficiency operations in Indiana and will improve development opportunities for the region. Therefore, I urge your approval of the Duke Energy smart grid funding application.

Sincerely,

A. David Stippler,
Indiana Utility Consumer Counselor

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MICHAEL R. PENCE
SIXTH DISTRICT, INDIANA

HOUSE REPUBLICAN CONFERENCE
CHAIRMAN

COMMITTEES:
FOREIGN AFFAIRS

# Congress of the United States
## House of Representatives
Washington, DC 20515–1406

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FAX: (765) 747-5586

50 NORTH 3RD STREET
RICHMOND, IN 47374
(765) 962-2881
FAX: (765) 962-3726

July 30, 2009

The Honorable Steven Chu
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Dear Secretary Chu:

I am writing in support of the funding application of Duke Energy Business Services LLC, on behalf of Duke Energy Indiana, Inc., Duke Energy Kentucky, Inc. and Duke Energy Ohio, Inc. ("Duke Energy") for its Midwest Smart Grid Deployment, under Funding Opportunity Announcement DE-FOA-0000058.

Duke Energy's planned Midwest investment is significant; approximately $800 million over three years in the states of Indiana, Ohio and Kentucky. About $400 million of the three year investment is planned for Indiana.

Duke Energy's effort will include the installation of more than 800,000 new digital "smart meters" in Indiana in each of the 69 Hoosier counties served by Duke Energy, the state's largest electric utility. It also includes the installation of technology that will improve the reliability of the grid and provide customers with the tools they need to make wiser energy choices. The smart grid also advances the development of renewables and improves the environment by allowing for the integration of more renewable distributed energy resources onto the grid, resulting in decreased carbon emissions.

Duke Energy Indiana has already made progress on its smart grid plans. By the time DOE makes its funding decisions, the Indiana portion of the project will be "shovel-ready." The Company has already filed a petition and settlement before the Indiana Utility Regulatory Commission ("IURC") seeking approval to invest in smart grid technologies and an IURC ruling is expected soon. Federal funding under this program would greatly reduce the costs of this important investment for Duke Energy's electric customers.

This project supports the job creation, economic stimulus, and energy infrastructure objectives of the Recovery Act and the Smart Grid Investment Grant Program and for this reason, I would respectfully request that you give this application for funding every appropriate consideration. You may direct any response or questions to my Deputy District Director, Kim Bennett, at 107 W. Charles St., Muncie, IN 47305 or via e-mail at kiml.bennett@mail.house.gov.

Thank you for your kind consideration of this most important matter.

Sincerely,

Mike Pence
Member of Congress
Sixth District, Indiana

klb

cc: The Honorable Patricia A. Hoffman, Acting Assistant Secretary, Office of Electricity Delivery & Energy Reliability, U.S. Department of Energy

Jean Schmidt
2nd District of Ohio

418 Cannon House Office Building
Washington, DC 20515
(202) 225-3164

# Congress of the United States
## House of Representatives

**Committee on Agriculture**
Subcommittees
*Ranking Member*, Horticulture and Organic Agriculture
Department Operations, Oversight, Nutrition, and Forestry
Conservation, Credit, Energy, and Research

**Committee on Transportation and Infrastructure**
Subcommittees
Aviation
Highways and Transit
Railroads, Pipelines and Hazardous Materials

July 31, 2009

The Honorable Steven Chu
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Dear Secretary Chu:

I am writing in support of Duke Energy Business Service LLC, on behalf of Duke Energy Ohio, Inc., Duke Energy Kentucky, Inc. and Duke Energy Indiana, Inc. ("Duke Energy") application under the U.S. Department of Energy grant program; for the purpose of its Midwest Smart Grid Deployment.

I have been informed that Duke Energy's plan includes approximately 680,000 new digital electric "smart meters" and 420,000 gas communication modules in Ohio. Similarly, the project also involves distributed automation for a more reliable grid and communications infrastructure to make the electric grid more reliable and efficient. Duke Energy indicates that this smart grid is the enabling technology for time-of-use utility rates and advanced energy efficiency services, to give their costumers quicker access to the tools needed to lower their utility bills by making wiser energy choices.

I have been told that the project is "shovel-ready". Duke Energy has already installed some of the equipment –approximately 43,000 electric smart meters and 24,000 gas modules. Furthermore, this grant would allow Duke Energy to accelerate deployment of the project; allowing for the integration of more renewable distributed energy resources onto the grid, thus reducing carbon emissions.

I support Duke Energy Business Services LLC's application request under the U.S. Department of Energy Smart Grid Investment Grant Funding Opportunity, and ask that this application be given every consideration in accordance with all applicable laws and regulations.

I would appreciate it if you would acknowledge receipt of this letter and keep me apprised of your action on their application.

Sincerely,

Jean Schmidt

Jean Schmidt
MEMBER OF CONGRESS

cc: Mr. John J. Finnigan, Jr.

*District Offices*

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Suite 170
Cincinnati, Ohio 45236
(513) 791-0381

601 Chillicothe Street
Portsmouth, Ohio

www.house.gov/schmidt

TED STRICKLAND
GOVERNOR
STATE OF OHIO

August 4, 2009

The Honorable Steven Chu
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Re: **Letter of support for Duke Energy Business Services LLC's application to U.S. Department of Energy Smart Grid Investment Grant Funding Opportunity Announcement; DE-FOA-0000058**

Dear Secretary Chu:

I support the funding application of Duke Energy Business Services LLC, on behalf of Duke Energy Ohio, Inc., Duke Energy Kentucky, Inc. and Duke Energy Indiana, Inc. ("Duke Energy") for its Midwest Smart Grid Deployment. If Duke Energy is successful in obtaining stimulus funding and continues to receive constructive regulatory support, Duke Energy will accelerate its deployment and will invest several hundred million dollars to deploy a smart grid system in Ohio, Kentucky and Indiana.

Duke Energy's plan includes approximately 680,000 new digital electric "smart meters" and 420,000 gas communication modules in Ohio. Duke Energy will develop a digital network to allow two-way communication between Duke Energy and customers. The project also involves distributed automation for a more reliable grid and communications infrastructure. This investment will make the electric grid more reliable and efficient. Smart grid is the enabling technology for time-of-use utility rates and advanced energy efficiency services. If Duke Energy receives stimulus funding, customers will get quicker access to the tools they need to lower their utility bills by making wiser energy choices. The smart grid will also allow for the integration of more renewable distributed energy resources onto the grid, thus reducing carbon emissions.

Furthermore, the project is "shovel-ready." Duke Energy has already installed some of the equipment – approximately 43,000 electric smart meters and 24,000 gas modules. The Public Utilities Commission of Ohio issued an order on December 17, 2008 approving Duke Energy's plan to deploy a smart grid system to serve Ohio customers. Federal funding would allow Duke Energy to accelerate deployment of the project; would provide quicker access to energy-savings tools for customers; and would greatly reduce the costs of this important investment for Duke Energy's electric and gas customers.

As one of the nation's largest producers and users of retail electricity, Ohio offers a valuable testing ground for smart grid technology. As you will see in their respective applications, each of our investor-owned utilities is applying for grant funds under this program. Each of them has a different customer base and a different approach to smart grid, based on market specific conditions. Together the requests represent the opportunity to help millions of consumers and to provide invaluable lessons for the nation's grid technology, and I support them all.

77 SOUTH HIGH STREET • 30TH FLOOR • COLUMBUS, OHIO 43215-6117 • 614.466.3555 • FAX: 614.466.9354

This project supports the job creation, economic stimulus, and energy infrastructure objectives of the Recovery Act and the Smart Grid Investment Grant Program. It is exactly the kind of project President Obama and the U.S. Congress had in mind when they promoted and passed the American Reinvestment and Recovery Act and I urge favorable consideration of the Duke Energy proposal.

Sincerely,

Ted Strickland

Ted Strickland
Governor, State of Ohio

Duke Energy®

# Attachment J: Executive Support Letters

526 South Church Street
Charlotte, NC 28202-1802

Mailing Address:
Mail Code EC3XC / P.O. Box 1006
Charlotte, NC 28201-1006

August 6, 2009

Ms. Donna Williams, Contract Manager
U.S. Department of Energy
Office of Headquarters Procurement
MA-64
1000 Independence Avenue, SW
Washington, DC 20585

SUBJECT: DE-FOA-0000058, Smart Grid Investment Grant, Office of Electricity Delivery and Energy Reliability

Dear Ms. Williams:

Duke Energy's regulated utility operations serve approximately four million customers located in five states — North Carolina, South Carolina, Indiana, Ohio and Kentucky — representing a population of approximately 11 million people. On behalf of our customers in Indiana, Kentucky and Ohio, the company is pleased to submit this application to the U.S. Department of Energy under the "Smart Grid Investment Grant" program. The application describes what we believe is the first regional initiative to fully deploy a Smart Grid network as an initial step toward the widespread modernization of the nation's electric transmission and distribution systems.

Smart Grid technology represents the most significant upgrade to our distribution system since electricity was first harnessed. It will lead to capabilities and functions that are unimaginable today. By replacing analog switches, meters and controls with new digital, two-way devices, we bring intelligence and interactivity to electricity transmission and distribution. Near term, that means our customers will have more information and control over their energy use, and we will have more precise, real-time data to help optimize our system on a multi-state or regional basis. Subject to regulatory approval, our proposed project will invest over $800 million in Smart Grid technologies in Duke Energy's Midwest service territories, creating approximately 1900 new primary and secondary jobs to stimulate the economy.

At Duke Energy, we are doing all we can to accelerate our nation's transition to a low-carbon future. To achieve our mission of delivering affordable, reliable and increasingly clean energy, we are investing across the low-carbon spectrum. This includes developing a diversified portfolio of energy efficiency, renewables, new advanced clean coal technology, and new nuclear capacity. Smart Grid is a critical component of this portfolio and supports our industry-leading efforts to expand energy efficiency. We believe that the "utility of the future" must integrate all of these elements if the industry is to offer reliable and cost-effective electric supply and meet the challenge of climate change.

Although there has been much discussion about Smart Grid's potential, moving from small-scale demonstrations to full-scale deployments has been slow. Given the critical importance of Smart Grid to our customers and our industry, we have taken a leadership role in obtaining state regulatory approvals and other steps for commercial deployment. By way of example:

- Late in 2008, the Public Utilities Commission of Ohio approved our save-a-watt energy efficiency and Smart Grid programs.
- To date, we have installed more than 70,000 smart electric meters in three states and about 40,000 digital gas meters in the Midwest.
- We are field-testing, at a pilot scale, a number of advanced Smart Grid technologies at a subdivision in Charlotte, N.C.
- This year we reached settlements with all major parties in Indiana, including the Indiana Office of Utility Consumer Counselor, on our Smart Grid initiative. A final order is expected from the Indiana Utility Regulatory Commission by the end of 2009.
- We recently opened Smart Grid Envision Centers in Kentucky and North Carolina to showcase advanced Smart Grid technology to familiarize our regulators, legislators and other stakeholders with the Smart Grid's potential.

These initiatives redefine the boundary between our utility equipment and our customers' home and business power networks. In the past, utility service stopped at the meter. We are striving to go beyond the meter so that our customers have the ability to use energy more efficiently and productively, while reducing their monthly bills. Our save-a-watt energy efficiency and Smart Grid programs are the enablers.

In our last annual report we explained how we are building an environmentally advanced generation and distribution system as a bridge to a low-carbon future. Unfortunately, current economic conditions have significantly affected our plans. We have delayed some capital spending and are reducing our operating costs every way we can. Prior to the downturn, we were planning to invest nearly $1 billion over the next five years in Smart Grid technology, subject to regulatory approvals. While we continue to move ahead with Smart Grid deployment, our progress has been slowed by the recession.

Obtaining federal financial support under the Recovery Act is critically important for keeping our Smart Grid commercial deployment program on track. We believe the progress we have made to date, including obtaining regulatory approvals, places our project in a unique position of being immediately "shovel-ready," thus fulfilling the goals of the stimulus plan and allowing our customers to be among the first in the nation to realize the benefits of Smart Grid technology.

Our commitment to Smart Grid is further evidenced by the industry-leading team of seasoned professionals we have assembled. The team is led by Senior Vice President, Todd Arnold, whose sole responsibility is to execute our Smart Grid program. He has overall corporate accountability for the project. Other key managers include Vice President, Smart Energy Systems, Mark Wyatt; and General Manager, Smart Grid Implementation Strategy and

Planning, Don Denton. This team has decision-making authority to commit the resources required to execute the project. The team has our support as well as the support of Duke Energy's other corporate officers.

As noted above, our Smart Grid initiative is critical to our mission of supplying our customers with energy that is affordable, reliable and clean. We are grateful for this opportunity, which will enable the advancement of Smart Grid technologies regionally and nationally.

Sincerely,

James E. Rogers, Jr.
Chairman, President and Chief Executive Officer

Lynn J. Good
Group Executive and Chief Financial Officer

James L. Turner
Group Executive; President and Chief Operating Officer, U.S. Franchised Electric and Gas

Todd W. Arnold
Senior Vice President, Smart Grid and Customer Systems

JULIE S. JANSON
President

Duke Energy Ohio, Inc.
Duke Energy Kentucky, Inc.
139 E. Fourth Street
EA503
Cincinnati, OH 45202

513-419-5757
513-419-5842 fax
julie.janson@duke-energy.com

July 31, 2009

Ms. Donna Williams, Contract Manager
U.S. Department of Energy
Office of Headquarters Procurement
MA-64
1000 Independence Avenue, SW
Washington, DC 20585

**Subject: Letter of support for Duke Energy Business Services LLC's application to U.S. Department of Energy Smart Grid Investment Grant Funding Opportunity Announcement DE-FOA-0000058**

Dear Ms. Williams:

We are writing to express our commitment to the funding application of Duke Energy Business Services LLC, on behalf of Duke Energy Indiana, Inc., Duke Energy Ohio, Inc. and Duke Energy Kentucky, Inc., ("Duke Energy") for its Midwest Smart Grid Deployment.

Throughout the 20th century, our nation's electric power delivery grids served our nation well, providing adequate, affordable energy to homes, businesses and manufacturers. This once state-of-the-art system helped create a level of prosperity unmatched by any other nation in the world. But a 21st century U.S. economy cannot be run on a 20th century electric grid. As end uses of electricity have become more and more sophisticated and digitized, electricity's role as an enabler of economic productivity has become even more important. However, the electricity distribution networks that deliver power to each customer are effectively the last bastion of an outmoded analog, electromechanically-controlled network in today's digital world.

Smart grid technology – such as our Midwest Smart Grid Deployment – can play a meaningful role in the creation of a cleaner, more efficient, more reliable and more robust energy system. We believe that a true smart grid must incorporate elements of traditional and cutting edge power engineering, sophisticated sensing and monitoring technology, information technology, and communications to provide better grid performance and to support a wide array of additional services to customers. The key attributes of such smart grid technology include improved reliability, increased end-use energy efficiency and customer options, increased system efficiency, the facilitation of renewable distributed generation, and increased grid security.

Our Midwest Smart Grid Deployment is designed to promote efficiency in the delivery and use of electric energy – both system efficiency and end-use customer energy efficiency. Additionally, it will improve the reliability of our distribution system and therefore, the reliability and quality of the service we provide to the public. Finally, our Midwest Smart Grid

Deployment will enable numerous customer choices and options, thus further increasing the quality, efficiency and value of the service we provide. By deploying this system across three states, we will have a regional system involving both competitive and traditional state regulatory paradigms. We have already secured the necessary state regulatory approvals or have settlements pending for deploying the smart grid system in these states. Our project is truly "shovel-ready."

Although customers will see benefits from this modernization of the electric grid, they will also feel the burden of the associated costs. Given that the Midwestern states our Midwest Smart Grid Deployment will cover have been hit especially hard by the recent economic recession, we feel that it is even more important that Duke Energy seek federal funding to alleviate the rate pressures on its customers. The requested federal funds would be used by Duke Energy to offset a portion of the cost of this important technology for its customers in Indiana, Ohio and Kentucky, and will allow Duke Energy to deploy the smart grid system more rapidly than without this funding. Therefore, on behalf of our customers, we strongly urge the approval of the Duke Energy smart grid deployment funding application.

Sincerely,

Julie Janson
President, Duke Energy Ohio, Inc. / Duke Energy Kentucky, Inc.

Jim Stanley
President, Duke Energy Indiana, Inc.

STATE OF INDIANA

INDIANA UTILITY REGULATORY COMMISSION

| | | |
|---|---|---|
| VERIFIED PETITION OF DUKE ENERGY INDIANA, INC. REQUESTING THE INDIANA UTILITY REGULATORY COMMISSION TO APPROVE AN ALTERNATIVE REGULATORY PLAN PURSUANT TO IND. CODE § 8-1-2.5-1, *ET SEQ.*, FOR THE IMPLEMENTATION OF AN ELECTRIC DISTRIBUTION SYSTEM "SMARTGRID" AND ADVANCED METERING INFRASTRUCTURE, DISTRIBUTION AUTOMATION INVESTMENTS, AND A DISTRIBUTED RENEWABLE GENERATION DEMONSTRATION PROJECT, FOR APPROVAL OF NEW DEPRECIATION RATES FOR ELECTRIC DISTRIBUTION PLANT, FOR A WAIVER OF THE PROVISIONS OF 170 I.A.C. § 4-1, *ET SEQ.*, AND FOR ASSOCIATED ACCOUNTING AND RATE RECOVERY MECHANISMS, INCLUDING A RATEMAKING PROPOSAL TO UPDATE DISTRIBUTION RATES ANNUALLY AND A "LOST REVENUE" RECOVERY MECHANISM, IN ACCORDANCE WITH IND. CODE § 8-1-2-42(a) AND IND. CODE § 8-1-2.5-1 *ET SEQ.*, AND PRELIMINARY APPROVAL OF THE ESTIMATED COSTS AND SCHEDULED DEPLOYMENT OF THE COMPANY'S SMARTGRID INITIATIVE | ) | CAUSE NO. 43501 |

## SUBMISSION OF SETTLEMENT AGREEMENT

Duke Energy Indiana, Inc. respectfully submits in the above-captioned proceeding an executed Settlement Agreement between Duke Energy Indiana, Inc., the Indiana Office of Utility Consumer Counselor, Duke Energy Indiana Industrial Group, the Citizens Action Coalition of Indiana, Inc., and Nucor Steel, a Division of Nucor Corporation.

Respectfully submitted,

By: Melanie D Price

Kelley A. Karn (Atty. No. 22417-29)
Melanie D. Price (Atty. No. 21786-49)
Elizabeth A. Herriman (Atty. No. 24942-49)
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Kay Pashos (Atty. No. 11644-49)
James R. Pope (Atty. No. 5786-32)
Baker & Daniels LLP
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kay.pashos@bakerd.com
jim.pope@bakerd.com

Counsel for Duke Energy Indiana, Inc.

**CERTIFICATE OF SERVICE**

The undersigned hereby certifies that copies of the foregoing Submission of Settlement Agreement were delivered or mailed, postage prepaid, in the United States Mail, this 4th day of June, 2009, to the following:

Indiana Office of Utility Consumer Counselor
National City Center
115 W. Washington Street
Suite 1500 South
Indianapolis, IN 46204

John P. Cook, Esq.
John P. Cook & Associates
900 W. Jefferson Street
Franklin, IN 46131

Holly Rachel Smith
Russell W. Ray, PLLC
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Alexandria, VA 22310

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Peter J. Mattheis
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Brickfield, Burchette, Ritts & Stone, P.C.
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Washington, DC 20007

Jerome E. Polk
Polk & Associates, LLC
101 West Ohio Street, Suite 2000
Indianapolis, IN 46204

Attorney for Petitioner
Duke Energy Indiana, Inc.

Kelley A. Karn, Atty. No. 22417-29
Melanie D. Price Atty. No. 21786-49
Elizabeth A. Herriman, Atty. No. 24942-49
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**Duke Energy Indiana SmartGrid Settlement**
**IURC Cause No. 43501**

This Settlement Agreement is entered into by and between Duke Energy Indiana, Inc., the Indiana Office of Utility Consumer Counselor, Duke Energy Indiana Industrial Group, The Citizens Action Coalition of Indiana, Inc., and Nucor Steel, a Division of Nucor Corporation (the "Settling Parties") as of this 4th day of June, 2009. It is the intent of the Settling Parties that this Agreement will facilitate the deployment of smart grid technology on the Duke Energy Indiana system, to the benefit of customers in the following ways: (1) increase efficiency, optimize operations, and improve reliability of the distribution system; (2) facilitate demand response and conservation programs that can defer the need for additional supply-side capacity and can give customers more control over their energy usage and energy bills; and (3) assist in the accommodation of additional renewable generation and additional customer-owned generation on the Duke Energy Indiana system.

**A. Deployment Issues – the Settling Parties agree as follows:**

1. **Alternative Regulatory Plan.** The Indiana Utility Regulatory Commission ("IURC" or "Commission") should approve an alternative regulatory plan for Duke Energy Indiana's deployment of smart grid technology and for the recovery of associated costs as outlined in this Settlement Agreement.

2. Smart Grid Meter Deployment Schedule. The Commission should authorize Duke Energy Indiana to deploy smart grid technology as outlined below in section 2.a. thru e. and section 3:

a. The Company will plan to begin deployment of smart meters approximately 90 - 180 days of receipt of an acceptable Commission Order in this proceeding. The initial deployment will be at a rate of approximately 500 meters/week through the first quarter of deployment. This rate of deployment is substantially lower than Duke Energy Indiana's original or rebuttal proposals, allowing time for the Company and interested parties to review the results prior to full-scale deployment.

b. In the second quarter of deployment, Duke Energy Indiana will increase the rate of its deployment to approximately 2,000 meters/week and will continue at that rate through the end of the fourth quarter of deployment.

c. Approximately 12 months after deployment begins, the Company will ramp up to its initially proposed deployment rate of approximately 6,800 meters/week.

d. The Commission should approve the deployment of Smart Grid technology such that no costs associated with a deployed smart meter will be recovered until two-way communications through the IT infrastructure are established.

e. Duke Energy Indiana will work with the OUCC, the Commission's Consumer Affairs Division, and other interested parties to propose an acceptable method of notifying customers of involuntary disconnection in order to begin to remotely disconnect customers without an on-site presence by a Company representative, and will request a waiver of applicable Commission rules.

f. As discussed below in section D.1, Duke Energy Indiana plans to request stimulus funds associated with its smart grid deployment. If such funds are received, Duke Energy Indiana reserves the right to use the stimulus funds received to further accelerate its proposed deployment in the event that an accelerated deployment is encouraged by or mandated by the Federal government in order to receive maximum stimulus funds, subject however to the Rider Caps discussed below. In addition, the Company agrees to abide by its commitment in section D.1 in the event it receives stimulus funding and must accelerate deployment.

3. **Distribution Automation, IT and Communications Network Deployment.**

a. The deployment schedule associated with the Company's distribution automation equipment and IT infrastructure will remain as proposed in the Company's case-in-chief, specifically: Duke Energy Indiana will install approximately 20% of the distribution automation equipment in each year of the five-year deployment schedule. The IT infrastructure costs will remain as proposed in the Company's case-in-chief. The communications network will occur in parallel to the distribution automation and meter deployment levels. The Commission should approve the deployment of SmartGrid technology such that no costs related to equipment associated with a specific network/circuit will be recovered until the equipment is energized, operational, and/or two-way communications are established where required. (See SmartGrid Deployment Collaborative section.)

b. The Settling Parties recognize that it is important for Duke Energy Indiana to be able to deploy all parts of its SmartGrid Initiative in parallel in order to produce the benefits proposed in this proceeding.

4. **SmartGrid Deployment Collaborative.** Deployment progress will be monitored by a Deployment Collaborative including Duke Energy Indiana, OUCC, and other interested Settling Parties. The Deployment Collaborative will meet quarterly and Duke Energy Indiana will provide updates on deployment progress. The Deployment Collaborative will review meter installation, distribution automation, communication network, and IT infrastructure plans and progress. Duke Energy Indiana will retain the ultimate decision-making with regard to deployment (subject to any Commission oversight and direction).

5. **Renewable Distributed Generation Initiative.** Duke Energy Indiana agrees with the Settling Parties to create a Renewable Distributed Generation Initiative/Pilot Program with details to be decided by the Deployment Collaborative (or a subgroup thereof), with discussions beginning not later than 30 days after an acceptable Order from the Commission in this proceeding. Goals of this initiative include testing the deployment of company-owned renewable installations on customer-owned premises, as well as increasing the amount of customer-owned renewable generation connected to the Duke Energy Indiana distribution system, both of which should ultimately reduce the need for base load and peaking generation additions (if the amounts of renewable generation produced are material). A pilot project plan will be developed by the Deployment Collaborative (or a subgroup thereof) and submitted to the IURC for final approval at a later date before initiation of the pilot will begin. The Deployment Collaborative will also discuss the possibility of changes to Duke Energy Indiana's net metering and tariff, and the possibility of piloting a "feed-in tariff." The Settling Parties agree that costs associated with the Renewable Distributed Generation

Initiative/Pilot Program will be deferred (with carrying costs at the Company's overall weighted cost of capital) for subsequent recovery via the SmartGrid Rider, as set forth in the Rate Recovery Mechanism section. Note that this is the only pilot program the costs of which are reflected in the SmartGrid Rider caps. The Settling Parties also agree that the Commission should decline to exercise its full CPCN jurisdiction over this Renewable Distribution Generation Initiative pilot project. Duke Energy Indiana will submit proposed leases, lease terms, etc. to the Commission for its review in conjunction with any filing.

Additionally, Duke Energy Indiana agrees not to use the declination of CPCN jurisdiction related to the renewable distributed generation initiative to avoid coming back to the Commission for a wider-scale deployment of Company-owned renewable resources in the future.

6. Reporting. Duke Energy Indiana will make quarterly operational and implementation filings with the Commission outlining the progress of pilot programs and full-scale deployments, including budgetary expenditures, milestones met and performance metric data analysis. These quarterly reports will continue for one year after full deployment of the SmartGrid Initiative, or the last pilot program has concluded, whichever occurs later. The quarterly reports will contain, at a minimum, the following information:

   a. Projected deployment and implementation plans for the upcoming quarter, and the current year, including applicable design requirements, performance goals, metrics, and milestones;

b. Review of the previous quarter's SmartGrid costs, benefits achieved, and system performance levels;

c. Review of deployment lessons learned;

d. A high level overview of the following year's plan and any associated costs and other details to the extent available.

e. Any other reasonable requests for information made by the Deployment Collaborative parties or the IURC.

In addition, Duke Energy Indiana will provide the following documentation to the Deployment Collaborative parties and the IURC, when such documentation becomes available:

f. When complete, the PMO Playbook for Indiana (along with any modifications or updates;

g. When complete, the Design Basis Document for Indiana (along with any modifications or updates);

**B. Pricing Pilots – the Settling Parties agree as follows:**

1. **Pilots Collaborative**

a. **Formation**. Upon issuance of a Final Order in this Cause, a Duke SmartGrid Initiative Pricing/Pilots Collaborative ("Pilots Collaborative"), consisting of representatives of Duke Energy Indiana, the OUCC, and other interested Settling Parties shall be formed (along with various subgroups of the Pilots Collaborative, as outlined below). The IURC shall also have an opportunity to participate in the Pilots Collaborative, should it choose to do so. Other agreed-upon non-voting members may be invited to participate in the Pilots Collaborative. The purpose of the Pilots

Collaborative will be to address those issues as outlined in this Settlement Agreement, those issues arising once SmartGrid deployment begins, or any other issues. The Pilots Collaborative shall be formed not later than 30 days after an Order from the Commission in this proceeding.

b. Decision-making. Decisions made by the Pilots Collaborative (or any subgroup of the Pilots Collaborative) must be unanimous in order to move forward with implementation of such decisions. Should the Pilots Collaborative (or any subgroup) fail to reach a unanimous consensus on any issue, any Pilot Collaborative member may bring the issue before the IURC for final determination.

c. Program Modifications. The Pilots Collaborative shall have the ability to unanimously approve program modifications as long as changes do not go outside the guidelines set out in this Settlement Agreement or result in spending above capped spending levels. Should the Pilots Collaborative unanimously approve modifications to the existing programs, and if the Commission agrees, no Commission approval would be needed to implement such modifications. It is anticipated the IURC will need to approve any proposal that results in an increase in rates. Notwithstanding any of these provisions, each party shall retain the right to pursue any legal remedies available to it.

2. Residential and Small Commercial Pricing Option Pilots. Duke Energy Indiana agrees to work with the OUCC and interested Settling Parties in the Pilots Collaborative to develop time differentiated pricing and bill information offers to residential and small commercial customers. Each member of the Pilots Collaborative may appoint members to a Residential and Small Commercial SmartGrid Pricing Subgroup

("Subgroup #1"). These collaborative discussions will begin not later than 30 days after an Order from the Commission in this proceeding approving this Settlement Agreement. Subgroup #1 will develop the detailed pricing offerings, including number of pilots, number of pilot participant customers, marketing of pilot offers, development of rates, length of pilots, etc. Subgroup #1 will also determine the appropriate cost recovery mechanism to propose to the Commission for such pilots. While the details of the offerings will be determined by Subgroup #1, the Settling Parties agree to the following pilot programs and guiding principles:

a) The pilots will have a reasonable number of participants to ensure a representative sample and include a control group and experimental groups.

b) The residential pilots may include a multi-family housing component in an effort to increase energy efficiency for this hard to reach segment of customers.

c) The experimental rates must be revenue neutral for the class, cost-effective and based on various costing periods and seasons.

d) Costing periods and seasonality will be determined by Midwest ISO day-ahead prices for the PSI node and current planning criteria for Duke Energy Indiana.

e) Residential and small commercial customers pricing pilots will include, but are not limited to, Flat Rate, Time of Use ("TOU"), Critical Peak Pricing ("CPP"), and enhanced usage information, both with and without enabling technologies such as residential energy management systems.

f) Pricing pilots will be offered where meters are installed and all supporting infrastructure is complete.

g) The Company will perform customer surveys and other means of measuring customer response prior to offering pricing pilots and after the pricing pilots have ended.

h) Duke Energy Indiana will actively market pricing pilots and design marketing materials with Subgroup #1.

i) The pricing pilots will last for approximately two years and customers in a pricing pilot will take part for a minimum term.

j) The Pilots Collaborative members will jointly file an analysis of the results of pricing pilots and include recommended time-based rate designs to be offered by Duke Energy Indiana following the pilot programs.

k) Implementation of the pricing pilots is contingent upon cost recovery approval acceptable to Duke Energy Indiana.

3. **Large Commercial and Industrial Pricing Option Pilots / SmartGrid C&I Pricing Collaborative.** The Company is committed to developing time-differentiated pricing options for customers over 500 kW. Each member of the Pilots Collaborative may appoint members to a SmartGrid C&I Pricing Subgroup ("Subgroup #2"). Subgroup #2 will develop the detailed pricing offerings, including number of pilots, number of pilot participant customers, marketing of pilot offers, development of rates, length of pilots, cost recovery issues, etc. The Settling Parties agree on the following guiding principles:

a) Pilot rate offers will include real time pricing (RTP), including a two-part RTP design, and other time differentiated pricing offerings with details to be developed by Subgroup #2.

b) The Company will market the pricing pilots to its customers and work with Subgroup #2 to design effective marketing materials.

c) In addition, given the unique needs of many large commercial and industrial customers, the Company agrees to consider time differentiated pricing options proposed by individual customers and to confer with such customers about their proposals. Once the customer and the Company have reached agreement, said proposal will be presented to the Pilots Collaborative for approval and implementation (subject to Commission approval).

d) Pricing pilot and offers must be cost-effective and must recover the costs of serving the participating customers.

e) Implementation of the pricing pilots is contingent upon cost recovery approval acceptable to Duke Energy Indiana.

4. **Home Area Network Pilot Program**. The Company is willing to collaborate with the OUCC and other interested Settling Parties on developing a Home Area Network (HAN) Initiative/Pilot Program ("Subgroup #3). Subgroup #3 shall begin discussions not later than 30 days after an Order from the Commission approving this Settlement Agreement. Subgroup #3 will explore the potential of the HAN pilot, including the testing of pricing options and a full range of appliances in association with residential energy management systems. A pilot project plan will be developed by Subgroup #3 and submitted to the IURC for final approval. Implementation of the HAN pilot is contingent upon cost recovery approval acceptable to Duke Energy Indiana.

5. **Plug-in Hybrid Electric Vehicle (PHEV) / Electric Vehicle (EV) Pilot Program**. Each member of the Pilots Collaborative may appoint members to a PHEV/EV

Initiative/Pilot Program Subgroup ("Subgroup #4"). Subgroup #4 discussions shall begin not later than 30 days after an Order from the Commission approving this Settlement Agreement. A PHEV pilot project plan will be developed by Subgroup #4 and submitted to the IURC for final approval. Implementation of the PHEV/EV pilot is contingent upon cost recovery approval acceptable to Duke Energy Indiana.

**C. Ratemaking/Accounting/Depreciation Issues – the Settling Parties agree as follows:**

1. <u>Rate Recovery Mechanism</u>.

   a. Duke Energy Indiana will withdraw its proposal for a distribution formula rate.

   b. Subject to any non-settling parties agreeing not to oppose this provision of the Settlement Agreement, Duke Energy Indiana and the Settling Parties agree to request that the Commission approve new depreciation rates for production, transmission, and general plant, in addition to the distribution depreciation rates as proposed by the Company, all as reflected in Attachment 4 hereto (including negative net salvage amounts included therein). Until the effective date of an order in Duke Energy Indiana's next retail base rate case, the differential between such new depreciation rates and Duke Energy Indiana's current depreciation rates (retail jurisdictional portion of $13.9 million annually) shall be reflected as a credit to retail customers via the SmartGrid Rider.

   c. Duke Energy Indiana will be authorized to implement a SmartGrid Rider, effective January 1, 2010, as shown on Attachments 1 and 2 hereto. The SmartGrid Rider uses estimated O&M costs[1] and actual historical capital investment costs, so Duke Energy Indiana's actual SmartGrid O&M deployment

[1] Including depreciation and taxes.

costs will be trued up and reconciled to the estimated O&M costs, with resulting credits or debits to customers in subsequent Rider proceedings, subject to the Rider Caps discussed below.

d. In addition, Duke Energy Indiana will be authorized to defer its SmartGrid Initiative deployment costs[2], net of associated savings/increased revenues as discussed in h. below, on an interim basis, until such net costs are reflected in the SmartGrid Rider, subject to the Rider Caps discussed below.

e. The SmartGrid Rider shall be frozen as of 6/30/2016 (meaning that the Rider amounts in effect as of that date will stay in effect, and no new costs will be added to the Rider after that date).

f. The Settling Parties agree that the SmartGrid Rider should not remain in effect indefinitely. In order to accommodate full deployment and the need for future rate case(s) to fully reflect the SmartGrid costs in retail rates, the SmartGrid Rider will terminate no later than thirty (30) months after full deployment is completed). The date of full deployment completion shall be determined by the Deployment Collaborative, and the Company shall notify the Commission and the parties to this proceeding of such deployment completion date. No party other than the Company shall propose termination of the SmartGrid Rider prior to that termination date; and the Company shall not propose extension of the SmartGrid Rider after that termination date.

g. The allowed net operating income under the return test, included in the Company's fuel clause filings, shall be increased for the net operating income

[2] SmartGrid Initiative deployment costs include: post-in-service financing costs, calculated at the Company's overall weighted cost of capital, depreciation costs, and operation and maintenance costs (including taxes).

(*i.e.*, an authorized return level resulting from SmartGrid capital investments from the SmartGrid Rider will be added to the authorized NOI for return test purposes).

h. In order to avoid sharp rate increases under the Rider and give customers more certainty and predictability with regard to SmartGrid Rider costs, the Company agrees to cap the revenue requirements allowed to be recovered via the SmartGrid Rider, as follows:

| Rider Period | SmartGrid Revenue Requirements (Retail Jurisdiction)[3] |
|---|---|
| 1/1/2010 thru 6/30/2010 | ($5,966,000) |
| 7/1/2010 thru 6/30/2011 | ($1,668,000) |
| 7/1/2011 thru 6/30/2012 | $21,509,000 |
| 7/1/2012 thru 6/30/2013 | $49,019,000 |
| 7/1/2013 thru 6/30/2014 | $65,621,000 |
| 7/1/2014 thru 6/30/2015 | $67,444,000 |
| 7/1/2015 thru 6/30/2016 | $67,444,000 |

These Rider caps include credits to customers for 100% of estimated meter readings savings and 100% of estimated savings for other direct operational savings and estimated increased revenues (excluding meter salvage value), all expected to result from the SmartGrid Initiative. (See Attachment 3, which outlines the categories and levels of credits included in the Rider Caps.) By

[3] These amounts reflect the annual depreciation credit amounts of (retail jurisdictional portion of) $13,900,000, which will continue only until the effective date of the Company's next retail base rate case order. The revenue requirement caps shall be increased by the retail jurisdictional portion of $13,900,000 annually upon the effective date of the Company's next retail base rate case order.

including these levels of estimated savings and estimated increased revenues in the Rider caps, the Company is effectively guaranteeing customers will realize at least these levels of these categories of savings and increased revenues in the short-term (and ultimately all such savings and increased revenues will benefit customers through general rate cases). If the Company receives a new base rate case order(s) during the deployment period which includes some or all of these savings and increased revenues in rates, the Rider Caps will be adjusted (increased) on a prospective basis following the effective date(s) of such rate order(s) to remove an amount of annual credit equal to the amount of credit that ties to the time period of the applicable rate case test period.

In order to at least partially accommodate possible differences in the timing of deployment, the Company will be allowed to defer (with carrying costs at the Company's overall weighted cost of capital) and subsequently recover any SmartGrid costs or return on SmartGrid investments which, if included in the Rider for the particular Rider period, would result in Revenue Requirements amounts for a particular Rider Period that are in excess of the applicable Rider caps, **but only if and to the extent that** such deferral and subsequent recovery does not cause Duke Energy Indiana to exceed the applicable Rider caps in such subsequent Rider Period(s).

i. The Company retains the right to argue for inclusion in rate base of capital above the levels currently projected in future general retail electric base rate cases. The Company retains the right to argue for a representative ongoing level of SmartGrid-related O&M in future general retail electric base rate cases.

2. **Regulatory Asset.** The Commission should approve the creation and subsequent recovery of a regulatory asset as proposed by Duke Energy Indiana for existing meters. This results in no increase in retail rates for the existing meters as they will be amortized over the remaining life of the meters (approximately 20 years).

3. **Allocation Methodology.** Duke Energy Indiana will directly assign new direct meter investment and costs between Rate RS and all other customers based on new meter investment. For all other customers, the allocation between rate schedules will be based on meter cost allocations from the most recent rate case. See Attachment 2.

4. **Larger commercial and industrial meters.** Duke Energy Indiana has a program in place to replace existing larger commercial and industrial meters (greater than 500 kW) with smarter meters. If the Company determines that such meters are not capable of performing all functionality associated with the SmartGrid Initiative, the Company will propose to replace such meters and seek to include the costs of such meter replacement in the SmartGrid Rider at that time (subject to the SmartGrid Rider revenue requirements caps described previously).

5. **Voltage Reduction.** The Settling Parties recognize that Duke Energy Indiana will not implement its voltage reduction strategy except at peak demand times, unless and until the Commission approves "lost revenue" recovery. The Settling Parties also agree to defer discussion on lost revenue recovery mechanisms until such time as the EPRI Green Circuit Study has been completed and reviewed by interested Settling Parties. The Settling Parties also agree any such lost revenue recovery mechanism must be approved by the Commission in a separate proceeding.

6. **Depreciation Rates.** The Commission should approve the implementation of Duke Energy Indiana's proposed new distribution depreciation factors as discussed in Petitioner's Exhibit J. This implementation of updated distribution depreciation rates is required for the implementation of the regulatory asset discussed above. In addition, the Commission should approve the implementation of Duke Energy Indiana's proposed new production, transmission and general depreciation factors as included in Attachment 4 to this settlement agreement (provided all parties join in this settlement or agree not to oppose the updated depreciation rate/ regulatory asset provisions of this Settlement Agreement.) The credit to customers for these depreciation rate changes via the SmartGrid Rider will terminate as of the effective date of new retail rates resulting from the first retail rate case order following initiation of the SmartGrid Rider. Duke Energy Indiana commits to file a full depreciation study in its next retail electric rate case. If such retail rate case is filed prior to December 31, 2011, the Company agrees that it will file the full depreciation study used to develop the depreciation factors reflected in this Settlement Agreement, and will seek continued Commission approval of such factors; provided, however, that the Company shall have the right to propose updates to these depreciation factors and its depreciation study for any material changes in law, regulation, or accounting rules, or material changes to the Duke Energy Indiana system. All Settling Parties may present evidence regarding appropriate depreciation rates in such Duke Energy Indiana rate case, and may challenge any updates proposed by the Company.

**D. Other Issues:**

1. Duke Energy Indiana agrees to use reasonable and good faith efforts to seek federal stimulus funds under the American Recovery and Reinvestment Act ("ARRA") for its SmartGrid Initiative proposal and its renewable demonstration initiative to reduce the costs of this Initiative to customers. The Company may also request ARRA stimulus funds associated with some of the proposed pilots. The Company agrees that the retail jurisdictional portion of all such stimulus funds received (net of costs to comply with the stimulus rules and regulations) will be applied for the benefit of customers through the ratemaking process. The Company agrees to discuss with the Deployment Collaborative precisely how any such stimulus funds received should be applied and treated.
2. Duke Energy Indiana commits that, during the time period the SmartGrid Rider is in effect, it will not work to eliminate or weaken the winter disconnect moratorium.
3. Duke Energy Indiana commits that, during the time period that the SmartGrid Rider is in effect, Duke Energy Indiana will not require (although it may offer) time-differentiated pricing for low-income customers.
4. Duke Energy Indiana commits to actively participate in support of development of interoperability standards.

**E. Procedural Terms:**

1. The Settling Parties will request Commission acceptance and approval of this Settlement Agreement in its entirety, without any change or condition that is unacceptable to any Party to this Settlement Agreement.

2. If the Commission issues an order accepting the Settlement Agreement in part, but modifying it materially in other respect(s), the Settlement Agreement shall be voidable at any Settling Party's option.
3. The Settling Parties shall offer all of their prefiled testimony and exhibits into evidence in the evidentiary hearing. The Settling Parties agree to the submission of Duke Energy Indiana's and all Settling Parties prefiled testimony into evidence at the evidentiary hearing.
4. The Settling Parties will provide each other settling party a draft of their testimony in support of the Settlement Agreement for review prior to filing. The Settling Parties will work together to prefile, sponsor and offer into evidence testimony supporting the Settlement Agreement.
5. The Settling Parties agree to waive cross examination of each other's witnesses at the evidentiary hearing.
6. The Settling Parties will work together to finalize and file an agreed upon proposed order in this Cause with the Commission as soon as possible. The Settling Parties will support or not oppose the proposed order in the settlement proceeding and will request that the Commission issue an order promptly accepting and approving this Settlement Agreement in accordance with its terms.
7. The Settling Parties will either support or not oppose on rehearing, reconsideration and/or appeal, any Commission Order accepting and approving this Settlement Agreement in accordance with its terms, including the submission of any applicable briefs and pleadings.

8. Any non-settling parties to this proceeding must agree not to oppose approval of new depreciation rates (including negative net salvage amounts).

Agreed To and Accepted this 4th day of June, 2009:

[Signature Pages to Follow]

Duke Energy Indiana, Inc.

By Todd W. Arnold
Todd W. Arnold
Senior Vice President, SmartGrid and
Customer Systems

Indiana Office of Utility Consumer Counselor

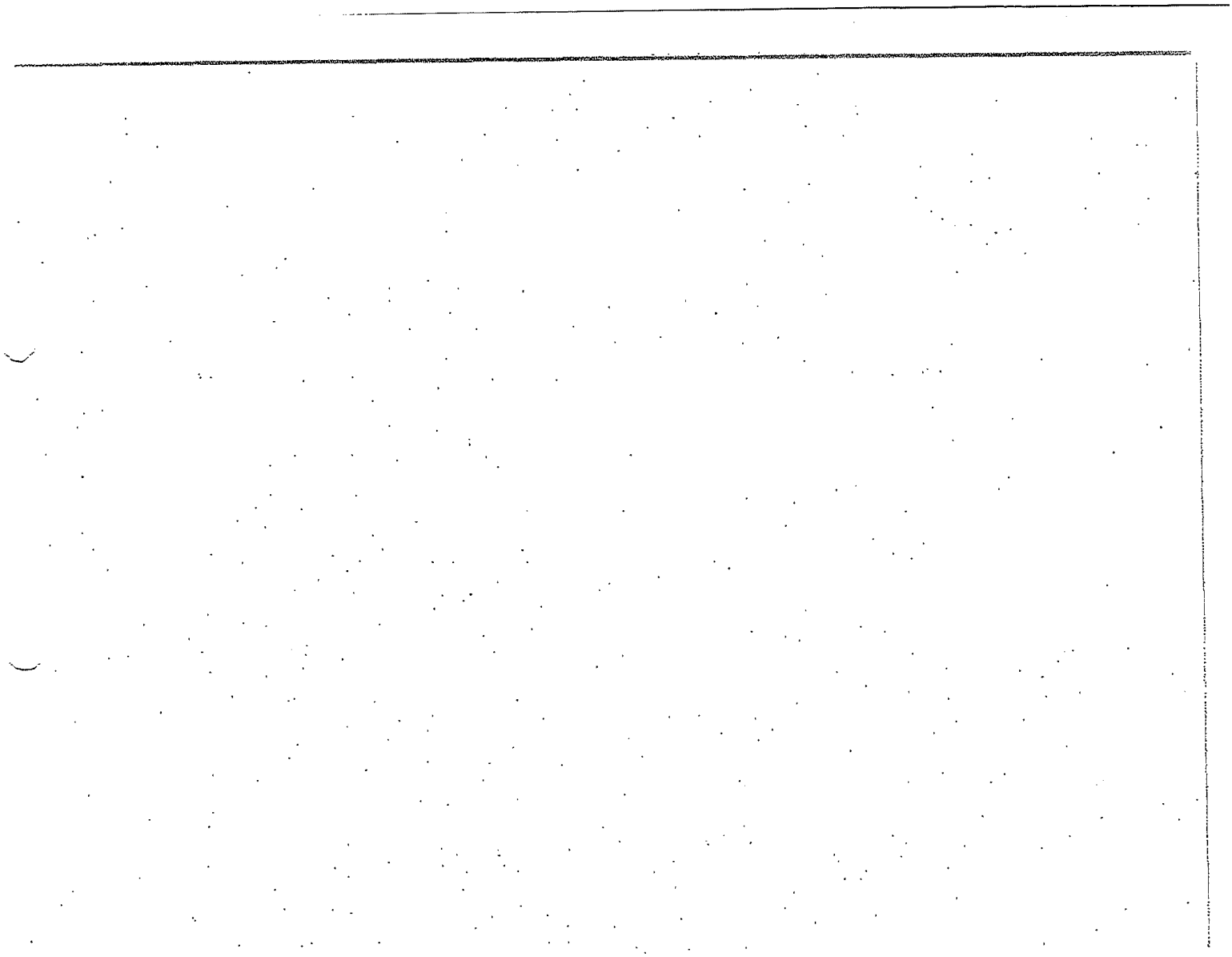
By Randall C. Helmen By: Karol H. Krohn
Asst. Consumer Counselor
Randall C. Helmen
Deputy Consumer Counselor

Duke Energy Indiana Industrial Group

By _____
Jennifer W. Terry
Attorney for Duke Energy Indiana Industrial Group

Nucor Steel-Indiana, a Division of Nucor Corporation

By _____
Peter J. Mattheis
Attorney for Nucor Steel-Indiana, a Division of Nucor Corporation



**Duke Energy Ohio**
**Case No. 14-2209-EL-ATA**
**Direct Energy First Set of Interrogatories**
**Date Received: February 12, 2015**

**DE-INT-01-019**

**REQUEST:**

In Case No. 13-1141-GE-RDR, both in discovery (Duke response to DE-INT-02-005) and on cross examination (Tr. at 22-39), Witness Schneider Jr. described the first generation (MDMS 1) and second generation (MDMS 2) meter data management systems Duke employs. The remaining questions relate to the MDMS.

Regarding MDMS 1:

a. Please provide the number of meters in MDMS 1. Please provide a breakdown of residential versus non-residential meters in MDMS 1.

b. Are all meters that are not in MDMS 2 in MDMS 1?

c. Does MDMS 1 lack scalable validation, estimate, and edit ("VEE") functionality for interval usage data?

    i. If not, please provide the date when scalable VEE functionality became available for MDMS 1.

d. Is the interval usage data coming from the meters in MDMS 1 VEE?

e. Please provide a definition of what Duke considers a "certified" meter for MDMS 1.

f. Are all the meters in MDMS 1 "certified"?

    i. If not all meters are "certified", please provide the percentage of meters that are currently "certified."

g. If a meter is "certified" for MDMS 1 does that mean the interval usage data from the meters (once through the VEE process and other quality testing) is billing quality data?

h. Is the monthly total usage data for meters in MDMS 1 billing quality?

i. Is the interval usage data for meters in MDMS 1 billing quality?

**RESPONSE:** Objection. This Interrogatory is overly broad and unduly burdensome, given that it seeks information that is unlimited as to time and that is neither relevant to this proceeding nor likely to lead to the discovery of admissible evidence in this proceeding. Duke Energy Ohio has not sought approval for any process for providing residential customer energy usage data to third parties. Without waiving said objection, to the extent discoverable, and in the spirit of discovery:

There are approximately 712,000 certified Ohio AMI meters in MDMS 1. There are 650,000 residential meters and 90,000 small commercial .

a. All of Duke Energy Ohio's AMI meters that are not managed by MDMS 2 are managed by MDMS 1.

b. Yes.

    i. N/A

c. Interval usage data coming from AMI meters in MDMS 1 has not gone through the VEE process.

d. Duke Energy Ohio considers an AMI meter as certified when it is determined to be capable of providing billing determinants from Over-The-Air (OTA) readings.

e. No.

    i. . Approximately 98.5% of all AMI meters deployed are certified.

f. Interval data for certified AMI meters in MDMS 1 have not gone through the VEE process necessary to be considered billable quality.

g. Duke Energy Ohio does not receive monthly total usage data from AMI meters in MDMS 1.

h. Interval data for certified AMI meters in MDMS 1 have not gone through the VEE process necessary to be considered billable quality.

**PERSON RESPONSIBLE:** As to Objection – Legal
As to response - Joe Thomas

**Duke Energy Ohio**
**Case No. 14-2209-EL-ATA**
**Direct Energy First Set of Interrogatories**
**Date Received: February 12, 2015**

**DE-INT-01-020**

**REQUEST:**

In Case No. 13-1141-GE-RDR, both in discovery (Duke response to DE-INT-02-005) and on cross examination (Tr. at 22-39), Witness Schneider Jr. described the first generation (MDMS 1) and second generation (MDMS 2) meter data management systems Duke employs. The remaining questions relate to the MDMS.

Regarding MDMS 2:

a. Please provide the number of meters in MDMS 2. Please provide a breakdown of residential versus non-residential meters in MDMS 2.

b. How many meters in total can MDMS 2 accommodate?

c. Are all meters that are not in MDMS 1 in MDMS 2?

d. Is MDMS 2 only able to accept "gap" meters for large residential and medium size commercial and industrial customers?

    i. What is the usage threshold to qualify as a large enough residential customer to have a gap meter installed? How was this determination made?

e. Please describe the difference between the types of meters in MDMS 2 and MDMS 1.

f. What is the difference between a "gap" meter and the meters installed for smaller residential customers?

g. Is there currently any room in MDMS 2 to migrate customers from MDMS 1 to MDMS 2?

h. Is MDMS 2 full and unable to accept any additional meters?

i. Can a meter be removed from MDMS 2 and placed into MDMS 1?

    i. If yes, how much time (in days) does it take to migrate a meter from MDMS 2 to MDMS 1?

j. Are there any plans to migrate meters in MDMS 1 to MDMS 2? If so, please provide:

   i. Number of meters expected to migrate from MDMS 1 to MDMS 2.

   ii. When those meters are expected to migrate.

   iii. How much time (in days) does it take to migrate a meter from MDMS 1 to MDMS 2?

   iv. Amounts already spent on planning or actual migration of meters.

   v. Projected amounts to be spent to finish the migration.

   vi. Total budget for the migration.

   vii. Expected capabilities, including the quickest turnaround time in which Duke could communicate AMI meter data to CRES providers (e.g. daily for previous day's usage) and the granularity of data (one hour, fifteen minute, one minute) that could be communicated to CRES providers after the migration to MDMS 2.

   viii. Description of major implementation tasks/benchmarks and expected timeframes for each major task/benchmark.

   ix. Timeframes for completion and implementation ("go live" date)

   x. Whether Duke is performing (or will perform) the migration with internal resources or Duke is outsourcing any of the work associated with a migration.

   xi. Whether interval usage data for the migrated meters (after migration) will be available to CRES providers before the customer bills for the billing cycle.

   xii. Whether interval usage data for the migrated meters (after migration) will be billing quality.

k. Is it possible to expand MDMS 2 to include more meters?

l. Are there any plans (currently underway or in the future) to expand MDMS 2 to accommodate more meters? If so, please provide:

   i. Number of meters the expanded MDMS 2 would accommodate.

   ii. Amounts already spent on the expansion.

iii. Projected amounts to be spent for the expansion.

iv. Total budget for the expansion.

v. Expected capabilities, including the quickest turnaround time in which Duke could communicate AMI meter data to CRES providers (e.g. daily for previous day's usage) and the granularity of data (one hour, fifteen minute, one minute) that could be communicated to CRES providers after the expansion for meters in MDMS 2.

vi. Description of major implementation tasks/benchmarks and expected timeframes for each major task/benchmark.

vii. Timeframes for completion and implementation ("go live" date)

viii. Whether Duke is performing (or will perform) the expansion with internal resources or Duke is outsourcing any of the work associated with the expansion.

m. Does MDMS 2 have scalable validation, estimate, and edit ("VEE") functionality for interval usage data for all meters in MDMS 2?

i. If not, please provide the date when scalable VEE functionality will be available for MDMS 2.

n. Is the interval usage data from the meters in MDMS 2 VEE?

o. Please provide a definition of what Duke considers a "certified" meter for MDMS 2.

p. Are all the meters in MDMS 2 "certified"?

i. If not all meters are "certified", please provide the percentage of meters that are currently "certified."

q. If a meter is "certified" for MDMS 2 does that mean the interval usage data from the meters (once through the VEE process and other quality testing) is billing quality data?

r. Is the monthly total usage data for meters in MDMS 2 billing quality?

s. Is the interval usage data for meters in MDMS 2 billing quality?

t. Does Duke have the ability to manually move meters in MDMS 1 to MDMS 2?

u. Is Duke manually moving customers to MDMS 2?

i. Is Duke moving customers in time of use pilot programs to MDMS 2? If yes, please provide the number of customers moved in 2013, 2014, and 2015 year to date.

ii. Is Duke manually moving customers in any other Duke tariff or on any non-time of use pilot program to MDMS 2?

iii. Is Duke manually moving customers for any CRES provider to MDMS 2?

v. Please describe the process required to move a meter from MDMS 1 to MDMS 2.

w. Is it possible to manually move a meter from MDMS 2 to MDMS 1?

x. Is there a flag or any other indicator to let a CRES provider know if the meter is in MDMS 1 or in MDMS 2?

i. If not, please provide the cost to add that information to (a) the eligible customer list and (b) historical usage information.

**RESPONSE: Objection.** This Interrogatory is overly broad and unduly burdensome, given that it seeks information that is unlimited as to time and that is neither relevant to this proceeding nor likely to lead to the discovery of admissible evidence in this proceeding. Duke Energy Ohio has not sought approval for any process for providing residential customer energy usage data to third parties. Without waiving said objection, to the extent discoverable, and in the spirit of discovery, Duke Energy Ohio will describe current status of its systems as follows:

a. Duke Energy Ohio currently has approximately 94,000 certified AMI meters in MDMS 2. That includes 51,000 residential and 43,000 non-residential meters.

b. MDMS 2 can accommodate a total of 125,000 certified AMI meters for Duke Energy Ohio, to allow for normal growth.

c. All of Duke Energy Ohio's AMI meters that are not managed by MDMS 1 are managed by MDMS 2.

d. No.

i. There is no usage threshold to qualify for having a gap meter installed. Gap meters are installed when a customer cannot be served with a 200A Form 2S meter.

e. MDMS 1 only contains 200A Form 2S AMI meters. MDMS 2 contains all other AMI meter types and a limited number of 200A Form 2S AMI meters for customers on pilot TOU rates.

f. Gap meters are any AMI meters other than the 200A Form 2S AMI meters.

g. MDMS 2 must be upgraded to support migration of the 200A Form 2S AMI meters from MDMS 1.

h. Duke Energy Ohio currently has approximately 94,000 certified AMI meters in MDMS 2. MDMS 2 can accommodate a total of 125,000 certified, non-200A Form 2S AMI meters for Duke Energy Ohio, to allow for normal growth.

i. Yes, for specific 200A Form 2S meters, but this is avoided as it is a very manually intensive effort. This is not a scalable process. Non 200A Form 2S AMI meters cannot be migrated from MDMS 2 to MDMS1.

   i. It takes one day to migrate a single meter from MDMS 2 to MDMS 1.

j. There are currently no approved projects to migrate meters in MDMS 1 to MDMS 2.

   i. See response to DE-INT-01-020(j).

   ii. See response to DE-INT-01-020(j).

   iii. It takes one day to migrate a single meter from MDMS 1 to MDMS 2.

   iv. See response to DE-INT-01-020(j).

   v. See response to DE-INT-01-020(j).

   vi. See response to DE-INT-01-020(j).

   vii. See response to DE-INT-01-020(j).

   viii. See response to DE-INT-01-020(j).

   ix. See response to DE-INT-01-020(j).

   x. See response to DE-INT-01-020(j).

   xi. See response to DE-INT-01-020(j).

   xii. See response to DE-INT-01-020(j).

k. Yes.

l. There are no approved projects to expand MDMS 2 capacity for Duke Energy Ohio at this time.

   i. See response to DE-INT-01-020(l).

ii. See response to DE-INT-01-020(l).

iii. See response to DE-INT-01-020(l).

iv. See response to DE-INT-01-020(l).

v. See response to DE-INT-01-020(l).

vi. See response to DE-INT-01-020(l).

vii. See response to DE-INT-01-020(l).

viii. See response to DE-INT-01-020(l).

m. Yes.

i. See response to DE-INT-01-020(m).

n. Yes.

o. Duke Energy Ohio considers an AMI meter as certified when it is determined to be capable of providing billing determinants from Over-The-Air (OTA) interval meter data.

p. No.

i. Approximately 98.5% of all AMI meters deployed are certified.

q. Yes.

r. Duke Energy Ohio does not receive monthly total usage data from AMI meters in MDMS 2.

s. Yes, following the VEE process.

t. Yes, for specific 200A Form 2S meters, but this is avoided as it is a very manually intensive effort. This is not a scalable process.

u. No.

i. Customers can move into the pilot programs until May 2015. 2013: 1117 customers. 2014: 58 customers. 2015: Zero customers.

ii. No.

iii. No.

v. This process can be performed for specific 200A Form 2S meters, but this is avoided as it is a very manually intensive effort. This is not a scalable process. This process includes a

large number of steps with include, but are not limited to: stopping the account, service point, meter configurations, etc. in MDMS-1; Updating the Customer Information System to indicate the MDM system responsible for the usage data; configuring MDMS-2 to accept the usage data; configuring the Head End System to send the data to the right MDMS; etc.

w. Yes, for specific 200A Form 2S meters, but this is avoided as it is a very manually intensive effort. This is not a scalable process.

x. No.

i. Unknown at this time.

**PERSON RESPONSIBLE:**

Joe Thomas

**Duke Energy Ohio**
**Case No. 14-2209-EL-ATA**
**OCC Fourth Set of Interrogatories**
**Date Received: June 13, 2016**

**OCC-INT-04-074**

**REQUEST:**

Please separately explain whether all the residential Echelon meters and the commercial Itron meters are currently providing or capable of providing the following functionalities as listed below and indicate whether any response is related to the AMI meter model and its inherent hardware and software capability or the presence of the "first generation" or "second generation" MDMS:

A. Ability to connect to a customer's Home Area Network or customer's "smart" appliance;

B. Ability to remotely connect and disconnect the meter without a premise visit;

C. Ability to access 15-minute and hourly interval usage information on a daily basis;

D. Ability to detect meter tampering with an automated alarm;

E. Ability to provide "green button" data as set forth in the Department of Energy (DOE) standard;

F. Ability to "ping" the meter to determine its "on" and "off" status; and

G. Ability to connect with and the status of whether the metering information and status are connected to the Company's Outage Management System.

**RESPONSE:**

A. Niether meter or system can connect directly to a customer's Home Area Network or customer's "smart" applicance.

B. Both meter and systems are capable.

C. Both metering solutions can meter and provide 15 min or hourly interval usage data and communicate on a daily basis.

D. Both meters have this capability.

E. Objection. This interrogatory is vague, ambiguous, and unduly burdensome. The question is susceptible to different interpretations and Duke Energy Ohio would have to engage in speculation and conjecture to ascertain the intended meaning of this request.

F. Yes, both meters can be "pinged" to test their communication and Load Side Voltage.

G. Itron OpenWay meters have the ability to communicate outage events. Echelon meters do not have this "last gasp" capability.

**PERSON RESPONSIBLE:** A. through E. and G. - Joseph Thomas
F. - Legal

**Duke Energy Ohio**
**Case No. 17-0032-EL-AIR**
**OCC Ninth Set of Interrogatories**
**Date Received: August 15, 2017**

**OCC-INT-09-199**

**REQUEST:**

Referring to the Direct Testimony of Sasha Weintraub at page 12, please identify all options that are available to Duke Energy Ohio residential customers now for obtaining usage alerts.

**RESPONSE:**

Currently, Duke Energy Ohio residential customers are only able to see their usage data online through the Online Services portal. This doesn't provide any alerting capabilities, no dollar amounts are provided (only kWh usage), and the customer's rate is not considered in the calculation.

**PERSON RESPONSIBLE: Sasha Weintraub**

**Duke Energy Ohio**
**Case No. 17-0032-EL-AIR**
**OCC Eleventh Set of Interrogatories**
**Date Received: September 15, 2017**

**OCC-INT-11-213**

**REQUEST:**

Referring to Company Witness Weintraub testimony, page 11, which states "The Company has been identifying and developing a suite of EBSs that the AMI Transition enables and could be provided to Duke Energy Ohio residential electric customers." One of the EBSs the Company describes is a "smart meter usage app". In its recently-filed rate case in North Carolina, the Company describes a "bridge" which communicates with AMI meters equipped with the ZigBee-compliant home area networking chip.

a) Are the Echelon meters equipped with a ZigBee-compliant home area networking chip? If not, please explain why the Company chose to install meters without a ZigBee-compliant home area networking chip. If the Echelon meters do have such a chip, please explain why Echelon meters couldn't be used in conjunction with a ZigBee-compliant "bridge" to offer a smart meter usage app.
b) Can the data provided by Echelon meters in daily scalar reads, when made available to third parties via the Green Button Alliances' Connect My Data standard, be used to offer a smart meter usage app? If not, please explain why not.
c) Please describe the differences in capabilities between a smart meter usage app enabled by the proposed AMI transition and a smart meter usage app designed to work with the existing Echelon meters/daily scalar reads/Connect My Data standard. Please provide any customer research which indicates customers have expressed an interest in accessing differences in capabilities the proposed AMI transition would make available that are not available with the existing Echelon meters/daily scalar reads/Connect My Data standard.

**RESPONSE:**

a) The Echelon meters are not equipped with a ZigBee-compliant home area networking chip. At the time when Duke Energy Ohio chose the node environment AMI solution, it was not yet evident which communications protocol would become an industry standard for communications among in-home devices, energy management systems, etc. In the years since the node environment AMI solution was chosen by the Company, Zigbee has become one of the industry's leading communications protocol standards.

b) Objection. This Interrogatory is vague, ambiguous, and unduly burdensome. The question is susceptible to different interpretations and Duke Energy Ohio would have to engage in speculation or conjecture to ascertain the intended meaning of this request.

c) Objection. This Interrogatory is vague, ambiguous, and unduly burdensome. The question is susceptible to different interpretations and Duke Energy Ohio would have to engage in speculation or conjecture to ascertain the intended meaning of this request.

**PERSON RESPONSIBLE:**

a. Donald L. Schneider, Jr.
b. - c. Legal

**Duke Energy Ohio**
**Case No. 17-0032-EL-AIR**
**OCC Eleventh Set of Interrogatories**
**Date Received: September 15, 2017**

**OCC-INT-11-211**

**REQUEST:**

Referring to Company Witness Weintraub testimony, page 11, which states "The Company has been identifying and developing a suite of EBSs that the AMI Transition enables and could be provided to Duke Energy Ohio residential electric customers." One of the EBSs the Company describes is "Usage Alerts". Can the daily scalar reads provided by the existing Echelon meters and communications network be used to provide "Usage Alerts"? If not, please explain why not.

**RESPONSE:**

Usage alerts requires interval data, not scalar data. The Echelon meter can provide interval data, but the Company does not plan to integrate Usage Alerts with EDMS.

**PERSON RESPONSIBLE:** Joseph R. Thomas

**Duke Energy Ohio**
**Case No. 17-0032-EL-AIR**
**OCC Eleventh Set of Interrogatories**
**Date Received: September 15, 2017**

**OCC-INT-11-208**

**REQUEST:**

Referring to the Company's response to OCC-INT-09-200 regarding the proposed new outage alert capabilities associated with the AMI transition.

a) Please describe the current business process associated with outage alerts, starting with an outage report from a single meter and customer messaging through the premises visit and repair by Company personnel.
b) Are the Echelon meters integrated into the Company's Outage Management System? If so, is this integration different in kind or degree with the Itron meters?
c) Please describe the interconnection and functionalities associated with the Echelon and Itron meters with the Company's Outage Management System in terms of recording outages, locating outages, and estimating time to repair, identifying differences where they exist.
d) Please provide calculations which ensure the proposed meter communications network has bandwidth sufficient to accommodate tens or hundreds of thousands of smart meter outage reports occurring simultaneously, such as might occur during a major storm event.
e) Please estimate the number of false outage reports the Company expects to receive from meters annually, and describe the steps the Company will take to reduce the frequency and cost of false outage reports.
f) Please provide the number of single-premise outages reported in 2016, the average duration of these outages in 2016, the impact on system-wide SAIDI of these outages in 2016, and the reduction in average duration of such outages from the proposed outage alert capability. Please provide all estimates, assumptions, calculations, and workpapers used in your answer.
g) Please indicate whether or not the current installed base of Echelon meters has an outage reporting feature, defined as the ability to generate an automatic signal that power is out and a "last gasp" transmittal of usage data.
h) Please indicate whether or not the current installed base of Itron meters has an outage reporting feature, defined as the ability to generate an automatic signal that power is out and a "last gasp" transmittal of usage data.

**RESPONSE:**

a) No current business process exists for the proposed new outage alert capabilities. This is a future offering.
b) Yes, Echelon meters are integrated into Duke Energy Ohio's Outage Management System (OMS) in the same way as Itron meters. However, Echelon meters do not

provide a "last gasp" functionality, thus making their implementation into the Outage process much more limited in functionality.

c) These functionalities do not exist today for either meter type. The meters can be pinged through OMS to verify whether power is on. Itron meters can provide a "last gasp", but Echelon meters do not have this functionality.
d) These calculations have not been performed to date, as existing network bandwidth has not been challenged.
e) System design will allow for more detailed analysis and understanding of faulty outage alerts and minimization of such impacts in the future.
f) Duke Energy Ohio had 8,920 single-premise outages in 2016. The average duration of those single-premise outages was 196 minutes. The Company did not track the impact on system-wide SAIDI of these outages in 2016 and has not calculated the reduction in average duration of such outages from the proposed outage alert capability.
g) Duke Energy Ohio's Echelon meters do not have an outage reporting feature.
h) Duke Energy Ohio's Itron meters have an outage reporting feature, but it has not been implemented into OMS as of yet.

**PERSON RESPONSIBLE:** Joe Thomas as to a-e and g-h, Lee Taylor as to f

**Duke Energy Ohio**
**Case No. 17-0032-EL-AIR**
**OCC Eleventh Set of Interrogatories**
**Date Received: September 15, 2017**

**OCC-INT-11-209**

**REQUEST:**

Referring to Company Witness Weintraub testimony, page 11, which states "The Company has been identifying and developing a suite of EBSs that the AMI Transition enables and could be provided to Duke Energy Ohio residential electric customers." One of the EBSs the Company describes is "pick your own due date". Can the daily scalar reads provided by the existing Echelon meters and communications network be used to offer a "pick your own due date" service? If not, please explain why not.

**RESPONSE:**

Yes, except that this program will not interface with EDMS.

**PERSON RESPONSIBLE:** Joseph R. Thomas

**Duke Energy Ohio**
**Case No. 17-0032-EL-AIR**
**OCC Eleventh Set of Interrogatories**
**Date Received: September 15, 2017**

**OCC-INT-11-210**

**REQUEST:**

Referring to Company Witness Weintraub testimony, page 11, which states "The Company has been identifying and developing a suite of EBSs that the AMI Transition enables and could be provided to Duke Energy Ohio residential electric customers." One of the EBSs the Company describes is "prepaid advantage". Can the capabilities of the existing Echelon meters and communications network be used to offer "prepaid advantage"? If not, please explain why not.

**RESPONSE:**

See response to OCC-INT-11-209.

**PERSON RESPONSIBLE:** Joseph R. Thomas

**Duke Energy Ohio**
**Case No. 17-1263-EL-SSO**
**OCC Fourth Set Interrogatories**
**Date Received: August 31, 2017**

**OCC-INT-04-202**

**REQUEST:**

Referring to Mr. Schneider's testimony, page 9, which describes a "business continuity effort" that Duke has begun to deal with Ambient Communications node failures.

a. Please quantify capital and operating costs associated with this effort included in the rate case test year.
b. Please quantify the projected capital and operating costs associated with this effort in 2017 and 2018.
c. If capital and operating costs associated with this effort are included in the rate case test year, please identify with specificity the testimony, exhibits, attachments, work-papers, or other rate case filing documents in which this test year spending can be located.
d. Please describe the basis for Duke's decision to deploy Itron meters and associated meter data management system for residential customers. In your response please disclose when and why Itron meters and associated meter data management system and communication system were first installed for residential customers.
e. Please quantify the costs of the business continuity effort to transition from a node AMI environment to a mesh environment for residential customers to date.
f. Please explain how the costs of the business continuity effort in transitioning from a node AMI environment to a mesh communications environment for residential customers have been recovered to date.

**RESPONSE:**

a. Capital costs associated with the business continuity effort were not incurred until after June 2016; consequently, capital costs are not included in the rate case test year. There were no O&M costs associated with the business continuity effort during the rate case test year either.

b. See table below:

c.

| | Total | 2017 | 2018 |
|---|---|---|---|
| Capital | 24,136,045 | 10,081,979 | 14,054,066 |
| O&M | 60,506 | 60,506 | 0 |
| **Total** | **24,196,551** | **10,142,485** | **14,054,066** |

response to OCC-INT-04-202(a).

d. Objection. The interrogatory is susceptible to differing interpretations and thus Duke Energy Ohio would have to engage in speculation and guesswork to ascertain the intended meaning of this Interrogatory. Without waiving said objection, to the extent discoverable, and in the spirit of discovery, referring to the business continuity effort, the basis for Duke Energy Ohio's decision to deploy Itron meters and associated meter data management system for residential customers as part of its business continuity effort was already explained in testimony.

e. See table below for actual costs through July 31, 2017:

| | 2017 |
|---|---|
| Capital | 3,102,258 |
| O&M | 2,404 |
| **Total** | **3,104,662** |

f. To the best of my knowledge, the costs of the business continuity effort have not been recovered to date. These projects are not in-service on the books as of today.

**PERSON RESPONSIBLE:** Donald L. Schneider, Jr.

**Duke Energy Ohio**
**Case No. 17-1263-EL-SSO**
**OCC Fourth Set Interrogatories**
**Date Received: August 31, 2017**

**OCC-INT-04-204**

**REQUEST:**

Referring to Mr. Schneider's testimony generally, and to Attachment DLS-1 specifically.

a. Does the proposed transition to the mesh environment involve the replacement of Echelon meters with Itron meters? If not, please explain how the Echelon meters will communicate with the Cisco Connected Grid Routers (CGRs).
b. If the proposed transition to the mesh environment does involve the replacement of Echelon meters with Itron meters, please quantify the portion of the AMI transition capital ($143.4 million) which relates to i) new meters; ii) new meter installation; iii) new gas meter modules; iv) new gas meter module installation; v) Cisco CGRs; vi) CGR installation; vii) all other devices/software (please list).
c. Please provide the results of any cost analyses the Company completed to evaluate options which avoid replacing the Echelon meters, including, but not limited to:
    i. Replacing the communications cards in the Echelon meters with communications cards which could be read directly by the public 4G cellular network;
    ii. Replacing the communications cards in the Echelon meters with communications cards which could be read by the Cisco Connected Grid routers;
    iii. Replacing the communications network, including the communications cards in the Echelon meters, with the L&G communications network solution Ericsson is now using;
    iv. Replacing the communications nodes with Ericsson's SGN 3200 product; and
    v. Other scenarios to avoiding Echelon meter replacement the Company may have considered.
d. If any of the options which avoid replacing the Echelon meters is infeasible, please explain the nature of such infeasibility.
e. Please quantify the current (December 31, 2016) book value of:
    i. Existing Echelon meters;
    ii. Existing Ambient Communications nodes; and
    iii. EDMS.
f. Please explain whether or not the $143.4 million capital required for the proposed transition to a Mesh environment includes Company return on equity or interest on debt.

g. Assuming the Company's current authorized rate of return, debt-equity ratio, cost of capital, weighted average debt interest rate, 7.73% discount rate, and 20-year asset life, please estimate the net present value of the $143.4 million capital required for the proposed transition to a mesh environment. Please provide details of this calculation in Excel native format with formulas intact.
h. Using the same assumptions listed in (g) above, please estimate the NPV to customers of the $143.4 million capital required for the proposed transition to a mesh environment using a 15-year asset life. Please provide details of this calculation in Excel native format with formulas intact.
i. Using the same assumptions listed in (g) above, please estimate the net present value of the $143.4 million capital required for the proposed transition to a mesh environment using a 10-year asset life. Please provide details of this calculation in Excel native format with formulas intact.
j. Provide any cost benefit analysis prepared by the Company's proposed AMI transition investment using the same categories and methodologies required to justify the Company's original AMI investment in 2009.

**RESPONSE:**

a. Yes.

b. See response to OCC-INT-02-009.

c. Objection. This Interrogatory is overly broad and unduly burdensome, given that it seeks information that is unlimited as to time and that is neither relevant to this proceeding nor likely to lead to the discovery of admissible evidence in this proceeding. Without waiving said objection, to the extent discoverable, and in the spirit of discovery, Duke Energy Ohio cannot confirm the OCC's claim that certain "options" it contemplates would actually allow Duke Energy Ohio to "avoid replacing the Echelon meters". These "options" appear to require development of a new and unique AMI solution which would not be in service elsewhere in North America, presenting similar issues we have today with the Ambient/Echelon AMI solution. Duke Energy Ohio's proposed solution is a marketable proven AMI solution that Duke has chosen to standardize across all jurisdictions, keeping AMI systems and inventory costs down.
    i. Duke Energy Ohio did not perform a formal cost analysis for this exact "option".
    ii. Duke Energy Ohio did not perform a formal cost analysis for this exact "option".
    iii. Duke Energy Ohio did not perform a formal cost analysis for this exact "option".
    iv. Duke Energy Ohio did not perform a formal cost analysis for this exact "option".
    v. Attachment DLS-1 represents Duke Energy Ohio's cost analysis of avoiding Echelon meter replacement.

d. Objection. This Interrogatory is overly broad and unduly burdensome, given that it seeks information that is unlimited as to time and that is neither relevant to this proceeding nor likely to lead to the discovery of admissible evidence in this proceeding. Without waiving said objection, to the extent discoverable, and in the spirit of discovery, Duke Energy Ohio cannot confirm the OCC's claim that certain "options" it contemplates would actually allow Duke Energy Ohio to "avoid replacing the Echelon meters." Duke Energy Ohio neither confirms nor denies whether any of the "options contemplated by the OCC are infeasible.

e. i. The Net Book Value of Echelon meters as of December 31, 2016, was $49,053,660.
ii. The Net Book Value of communication nodes as of December 31, 2016, was $89,843,793 (includes electric and gas).
iii. The Net Book Value of EDMS as of December 31, 2016, was $0

f. The figure is the cash expenditure projected for the capitalized portion of the project; consequently, it excludes any carrying costs (debt or equity).

g. The question assumes that the currently authorized weighted-average cost of capital equals the discount rate. Therefore, the NPV equals $143.4 million.

h. See response to OCC-INT-02-007(g).

i. See response to OCC-INT-02-007(g).

j. Duke Energy Ohio did not perform such a cost analysis.

**PERSON RESPONSIBLE:**

a. Donald Schneider, Jr.
b. Donald Schneider, Jr.
c. As to Objection - Legal
As to response - Donald Schneider, Jr.
d. Legal
e. Cindy Lee
f. Donald Schneider, Jr.
g. Donald Schneider, Jr.
h. Donald Schneider, Jr.
i. Donald Schneider, Jr.
j. Donald Schneider, Jr.

**Duke Energy Ohio**
**Case No. 17-0032-EL-AIR, *et al.***
**OCC Third Set of Interrogatories - Stipulation**
**Date Received: May 11, 2018**

**OCC-INT-03-073**

**REQUEST:**

Regarding the infrastructure modernization plan under "component three" of the PowerForward Rider:

a) Does Duke intend to replace residential Echelon meters with Itron meters (or other meters compatible with the mesh system) before any such infrastructure modernization plan is approved?
b) If your answer to (a) is yes, please state, using the best available information, how many residential Echelon meters will be replaced and over what period of time, the projected cost of replacing such meters, how Duke will determine which meters to replace, and how the Stipulation proposes for Duke to charge customers for the cost of such meters.
c) Does Duke expect that the infrastructure modernization plan will include a proposal to replace all residential Echelon meters with Itron meters (or other meters compatible with the mesh system)?

**RESPONSE:**

a) The Ohio AMI Transition, which will replace Echelon AMI meters with Itron AMI meters, is a separate, independent effort from component three of the PowerForward Rider. The Ohio AMI Transition will proceed as proposed in the Testimony of Don Schneider, while component three of the PowerForward Rider will require a separate proceeding and subject to hearing, the timelines of which cannot be assumed at this time.
b) See response to OCC-INT-03-073(a).
c) See response to OCC-INT-03-073(a).

**PERSON RESPONSIBLE:** Donald L. Schneider, Jr.

**Duke Energy Ohio**
**Case No. 17-0032-EL-AIR, *et al.***
**OCC Fifth Set of Interrogatories - Stipulation**
**Date Received: May 23, 2018**

**OCC-INT-05-110**

**REQUEST:**

If Duke it *(sic)* not able to request recovery of the costs of replacing its Echelon meters with Itron meters (and associated capital costs) through Rider DCI, how does Duke propose to recover those costs from ratepayers? In your response, identify the "next base electric rate case" in light of the Stipulation pending in this proceeding as that term is used in Duke's response to OCC-INT-09-184 in Case No. 17-32 as referenced in Duke's response to OCC-STIP-INT-03-074.

**RESPONSE:**

(a) Objection. This Interrogatory is vague, ambiguous, and unduly burdensome. The question is susceptible to different interpretations and Duke Energy Ohio would have to engage in speculation or conjecture to ascertain the intended meaning of this requestThe question necessarily assumes that the Stipulation is either modified or rejected by the Commission. In any event, the Company reserves the right to seek recovery as part of its next rate case or in some other forum, e.g., PowerForward.

(b) Objection. This Interrogatory is vague, ambiguous, and unduly burdensome. The question is susceptible to different interpretations and Duke Energy Ohio would have to engage in speculation or conjecture to ascertain the intended meaning of this request The question necessarily assumes that there would be a modification of the Stipulation that may void all other components of the Stipulation. Duke Energy Ohio cannot predict the timing of the next rate case if the Stipulation is voided.

**PERSON RESPONSIBLE:** As to the objection - Legal
As to the response - William Don Wathen Jr.

**Duke Energy Ohio**
**Case No. 17-0032-EL-AIR, *et al.***
**OCC Third Set of Interrogatories - Stipulation**
**Date Received: May 11, 2018**

**OCC-INT-03-091**

**REQUEST:**

Does Duke intend to design and implement the battery storage project as a stand-alone system owned and operated by Duke? If not, please describe how Duke will integrate the project with its distribution and transmission system and who will own and/or operate the battery storage facility.

**RESPONSE:**

The proposed battery storage system will be integrated with the Company's distribution system, and will be owned and operated by Duke Energy Ohio.

**PERSON RESPONSIBLE:** Zachary Kuznar

**Duke Energy Ohio**
**Case No. 17-0032-EL-AIR, *et al.***
**OCC Third Set of Interrogatories - Stipulation**
**Date Received: May 11, 2018**

**OCC-INT-03-054**

**REQUEST:**

Referring to the Reliability Standards section on page 13 of the Stipulation and Recommendation, what is the total number of battery storage project(s) that are being proposed during the term of the ESP?

**RESPONSE:**

The total number of projects has not been determined at this time.

**PERSON RESPONSIBLE:**

Zachary Kuznar

**Duke Energy Ohio**
**Case No. 17-0032-EL-AIR, *et al.***
**OCC Third Set of Interrogatories - Stipulation**
**Date Received: May 11, 2018**

**OCC-INT-03-055**

**REQUEST:**

Referring to the Reliability Standards section on page 13 of the Stipulation and Recommendation, what is the total size and capacity of each battery storage project that is being proposed during the term of the ESP?

**RESPONSE:**

The final size and capacity of each storage project has not been determined at this time. The Company expects to deploy a total of about 10 megawatts.

**PERSON RESPONSIBLE:**

Zacharay Kuznar

**Duke Energy Ohio**
**Case No. 17-0032-EL-AIR, *et al.***
**OCC Fifth Set of Production of Documents - Stipulation**
**Date Received: May 23, 2018**

**OCC-POD-05-043**

**REQUEST:**

In Duke's response to OCC-STIP-INT-03-062, the Company states that the estimated cost of 10 MW of energy storage projects is $2.00/watt based on "industry knowledge" and "prior experience."

a) Provide the documents relied upon by Duke in this response with respect to the "industry knowledge" relating to the costs of the proposed 10 MW of energy storage projects.
b) Provide the documents relied upon by Duke in this response with respect to Duke's "prior experience" relating to the costs of the proposed 10 MW of energy storage projects.

**RESPONSE:**

a) See for example, OCC-POD-05-043 Attachment A, specifically slide 28. Additionally, the Company is engaged in projects in other jurisdictions that provide insight into current market conditions.

b) See response to a. above.

**PERSON RESPONSIBLE:** Zachary Kuznar

# U.S. Energy Storage Monitor:

## 2017 Year In Review and Q1 2018 Full Report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# Contents

## About This Report

**U.S. Energy Storage Monitor** is a quarterly publication of GTM Research and the Energy Storage Association (ESA). Each quarter, we gather data on U.S. energy storage deployments, prices, policies, regulations and business models. We compile this information into this report, which is intended to provide the most comprehensive, timely analysis of energy storage in the U.S.

**Notes:**

- All forecasts are from GTM Research; ESA does not predict future pricing, costs or deployments
- References, data, charts and analysis from this report should be attributed to "GTM Research/ESA U.S. Energy Storage Monitor"
- Media inquiries should be directed to Mike Munsell from GTM Research (munsell@gtmresearch.com) or Ellen Backus with the Energy Storage Association (202.765.2800)

For more information or to purchase the full report, visit www.energystoragemonitor.com.

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## Scope of This Report

**Capacity Metrics:** In general, the electric utility sector uses the term "capacity" to refer to power capacity (i.e., megawatts). We report energy storage capacity and deployments in power capacity (measured in watts) and energy capacity (measured in watt-hours). All of our data sources (details on data sources provided in Appendix), including program administrators, utility companies, utility commissions and system operators, currently track and report energy storage queue, deployments and interconnections in terms of power capacity: watts, kilowatts or megawatts. GTM Research converts data in energy capacity (watt-hours, kilowatt-hours or megawatt-hours) using a mix of publicly available and survey data, and multiplying by discharge duration (hours). In keeping with industry convention, GTM Research defines capacity in terms of the interconnected power capacity, and not in terms of the flexible resource capability a given storage asset can provide (charging and discharging).

Please note that some projects are publicly announced based on flexible resource capacity. For these projects, the announced capacity may differ from our capacity totals.

**Historical Deployment Data:** The report is titled "Q1 2018" to reflect the release quarter, but it covers historical deployment data ending Q4 2017. More details on deployment reporting methodology are available in the Appendix.

**Segments:** We report energy storage capacity data in three segments: residential, non-residential and front-of-the-meter. Projects that are deployed on the end-customer side of the meter (i.e., behind the meter) are reported as falling in either the residential or non-residential segment. The non-residential segment includes commercial, industrial, education, military and nonprofit deployments, but excludes uninterruptible power supply. Regardless of their size, projects that are deployed on the utility side of the meter (i.e., in front of the meter) are reported in the front-of-the-meter segment. In some cases, we differentiate these as "distribution domain" and "transmission domain" to clarify the point of interconnection.

**Technologies:** Electrochemical (batteries) and electromechanical technologies, excluding pumped hydro, are included in the historical deployment and forecast data.

**Market Size:** Market size is reported in megawatts (or kilowatts) and megawatt-hours (or kilowatt-hours) of deployments (i.e., interconnected and operational) by year and segment, as well as in U.S. dollars based on system price estimates and annual deployments.

# 1. Introduction and Key Findings

## Q4 2017 U.S. Energy Storage Scorecard

| | Q4 2017 | Q4 2016 | Change |
|---|---|---|---|
| Total Deployments (MWh) | 100.0 | 230.0 | Down 57% |
| Front-of-the-Meter Deployments (MWh) | 23.0 | 213.3 | Down 89% |
| Behind-the-Meter Deployments (MWh) | 77.0 | 16.7 | Up 362% |
| Total Deployments (MW) | 62.0 | 140.9 | Down 56% |
| Front-of-the-Meter System Price – 2 Hr. ($/kW) | $1,200-$1,700, median $1,450 | $1,350-$1,800, median $1,550 | Down 6% |
| Front-of-the-Meter Pipeline (MW) | 15,832 | 10,497 | Up 51% |

## 2017 U.S. Energy Storage Scorecard

| | 2017 | 2016 | Change |
|---|---|---|---|
| Total Deployments (MWh) | 431 | 340 | Up 27% |
| Front-of-the-Meter Deployments (MWh) | 281 | 257 | Up 10% |
| Behind-the-Meter Deployments (MWh) | 150 | 84 | Up 79% |
| Total Deployments (MW) | 215 | 231 | Down 7% |
| Front-of-the-Meter System Price – 2 Hr. ($/kW) | $1,313-$1,800, median $1,538 | $1,400-$2,125, median $1,700 | Down 10% |
| Cumulative Five-Year Forecast (MW) | 10,242 (2019-2023) | 7,549 (2018-2022) | Up 36% |

## 2017: A Transition Year for Energy Storage Market as Stage Set for Massive Growth

**Total U.S. energy storage deployments reached 431 MWh in 2017**, a 27% increase from the 340 MWh in 2016.

- **In megawatt terms, total capacity dropped 7% to 215 MW in 2017** from 231 MW in 2016
- Trend signifies the increased focus on longer-duration systems as the front-of-the-meter (FTM) market shifts from short-duration applications (e.g., PJM's RegD market) to longer-duration applications like resource adequacy and renewable integration

**Front-of-the-meter markets saw modest 10% growth**, up to 281 MWh in 2017.

- The final Aliso Canyon projects came online in early 2017 but interconnection of several large projects slipped into 2018
- FTM storage capacity in megawatt terms fell by 22% in 2017, again signifying the shift from short-duration to long-duration applications

**In contrast, behind-the-meter (BTM) deployments reached a record-setting 70 MW in 2017**, nearly the same as 2015 and 2016 combined.

- The residential market led the charge with 248% year-over-year growth, while non-residential grew 33% over the same period
- BTM deployment growth was driven primarily by California's Self-Generation Incentive Program and other markets including Hawaii, Massachusetts and New York

**The Section 201 tariffs on imported solar products cast a shadow over the energy storage market**

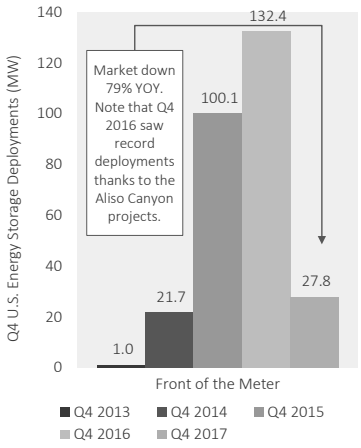
- The solar trade case will have negative effects on storage growth, though the declines will be modest: For 2018-2022, forecasts decreased by 3% for residential, 4% for non-residential and 4% for FTM (note these declines are affected by additional factors including softening of the Arizona and New Jersey markets)

Click here to be taken to Section 4, an in-depth analysis of Section 201's effect on the energy storage sector.

# 2. Energy Storage Market Overview

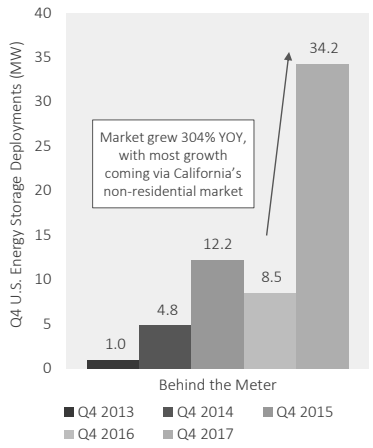
## The U.S. Deployed 62 MW of Energy Storage in Q4 2017

Front of the Meter



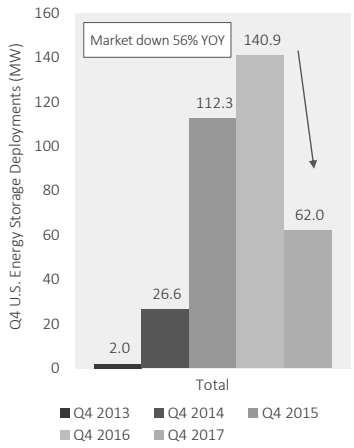

Source: GTM Research

Behind the Meter




Source: GTM Research

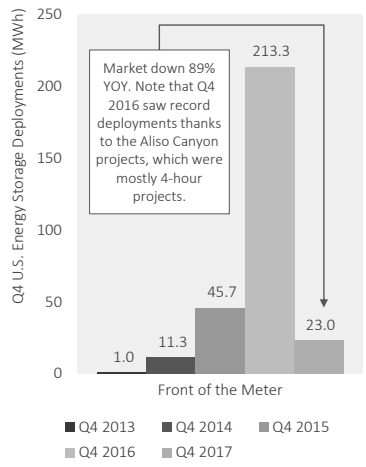
Total




Source: GTM Research

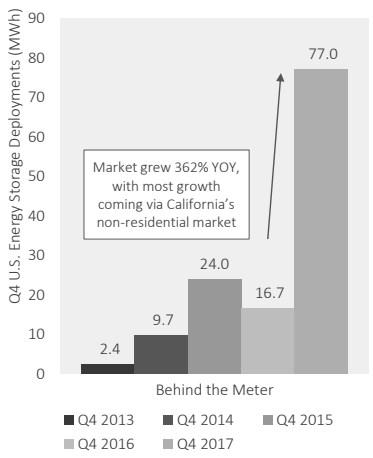
# The U.S. Deployed 100 MWh of Energy Storage in Q4 2017

Front of the Meter



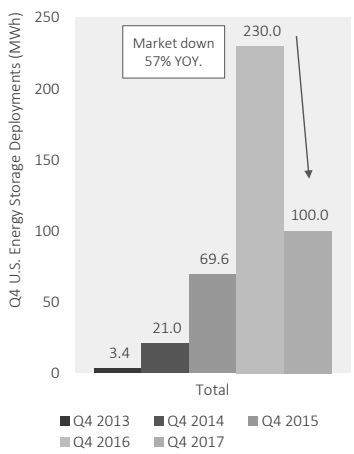

Source: GTM Research

Behind the Meter




Source: GTM Research

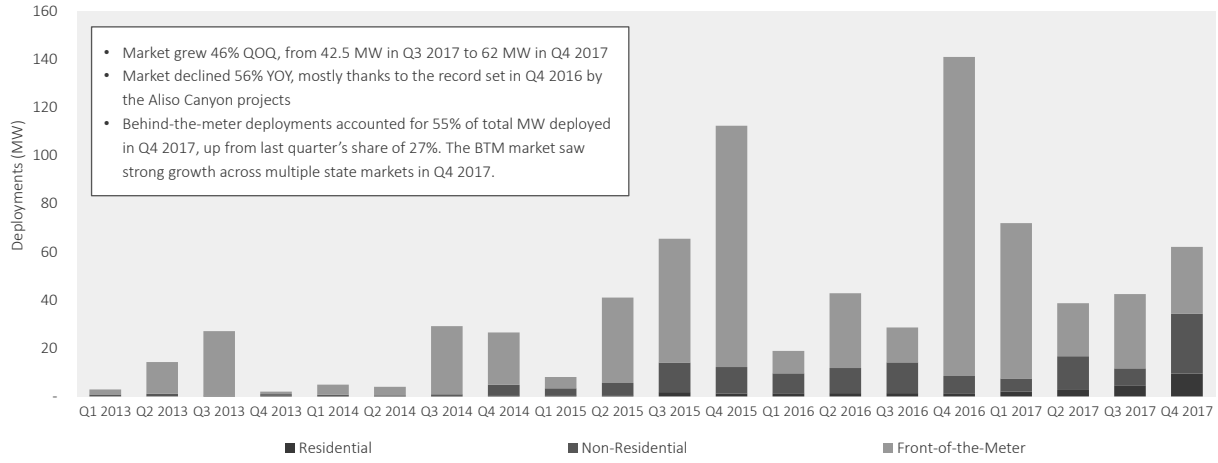
Total




Source: GTM Research

## U.S. Q4 2017 Deployments in Megawatts Down 56% From Previous Year

U.S. Quarterly Energy Storage Deployments by Segment (MW)



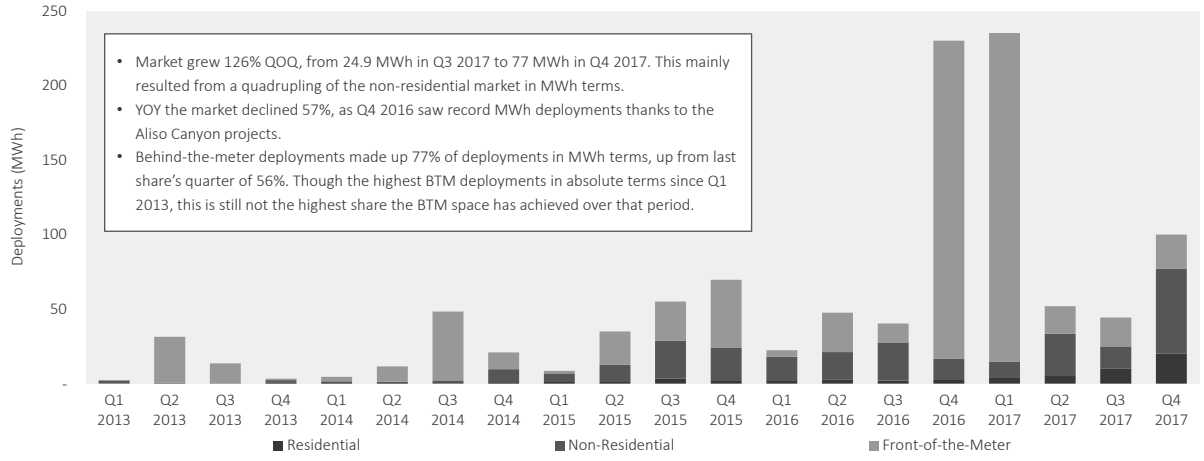

- Market grew 46% QOQ, from 42.5 MW in Q3 2017 to 62 MW in Q4 2017
- Market declined 56% YOY, mostly thanks to the record set in Q4 2016 by the Aliso Canyon projects
- Behind-the-meter deployments accounted for 55% of total MW deployed in Q4 2017, up from last quarter's share of 27%. The BTM market saw strong growth across multiple state markets in Q4 2017.

Source: GTM Research

PUCO Case No. 17-0032-EL-AIR et al.
OCC-POD-05-043 ATTACH A
Page 14 of 105

# U.S. Q4 2017 Deployments in Megawatt-Hours Down 57% From Previous Year

U.S. Quarterly Energy Storage Deployments by Segment (MWh)

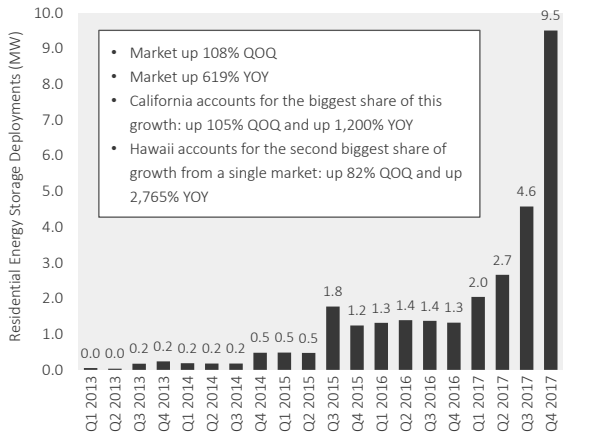



- Market grew 126% QOQ, from 24.9 MWh in Q3 2017 to 77 MWh in Q4 2017. This mainly resulted from a quadrupling of the non-residential market in MWh terms.
- YOY the market declined 57%, as Q4 2016 saw record MWh deployments thanks to the Aliso Canyon projects.
- Behind-the-meter deployments made up 77% of deployments in MWh terms, up from last share's quarter of 56%. Though the highest BTM deployments in absolute terms since Q1 2013, this is still not the highest share the BTM space has achieved over that period.

Source: GTM Research

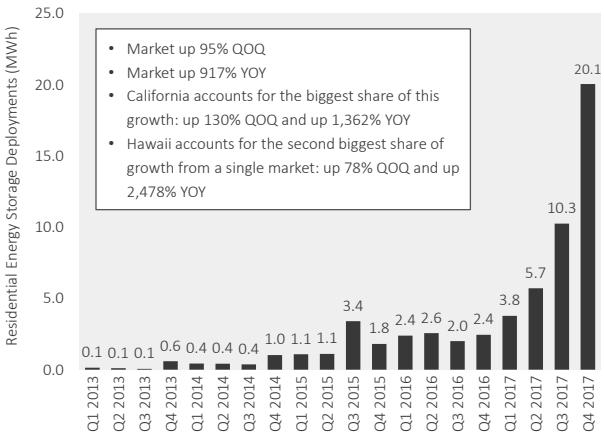
## Residential Market Grows More Than 95% QOQ, Led by California and Hawaii

Residential Market (MW)




Source: GTM Research

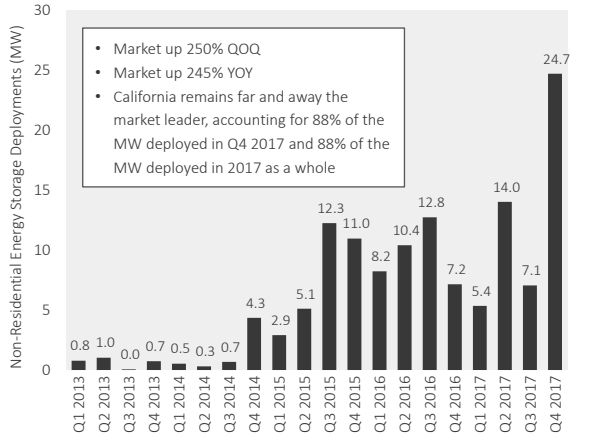
Residential Market (MWh)




Source: GTM Research

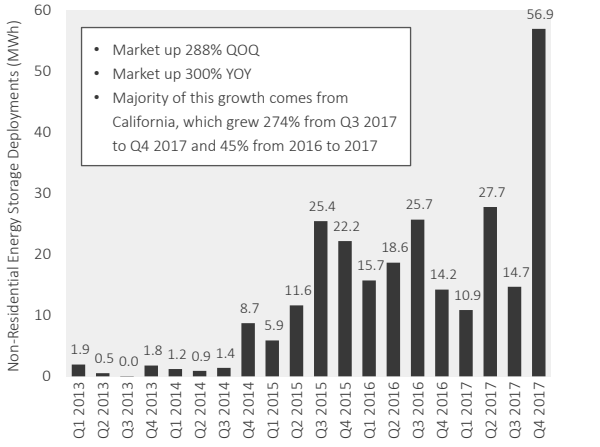
## Non-Residential Market Triples QOQ as California Market Experiences New Installation Wave

Non-Residential Market (MW)




Source: GTM Research

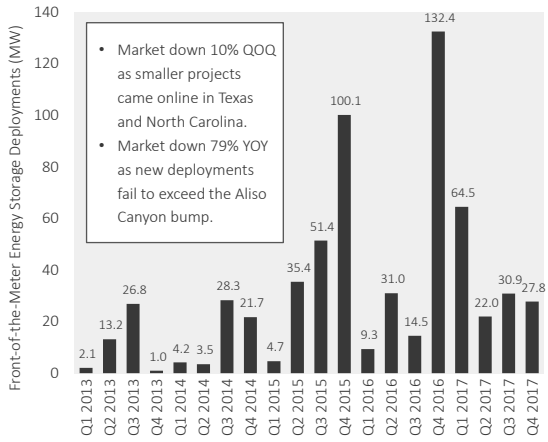
Non-Residential Market (MWh)




Source: GTM Research

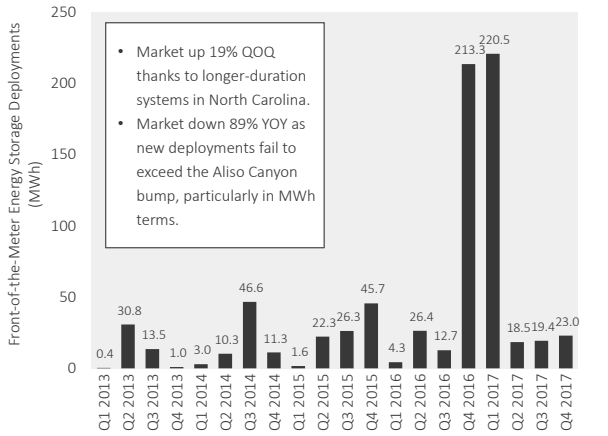
# Front-of-the-Meter Market Looks back At Aliso One Year Later, Deployments Can't Compete

Front-of-the-Meter Market (MW)




Source: GTM Research

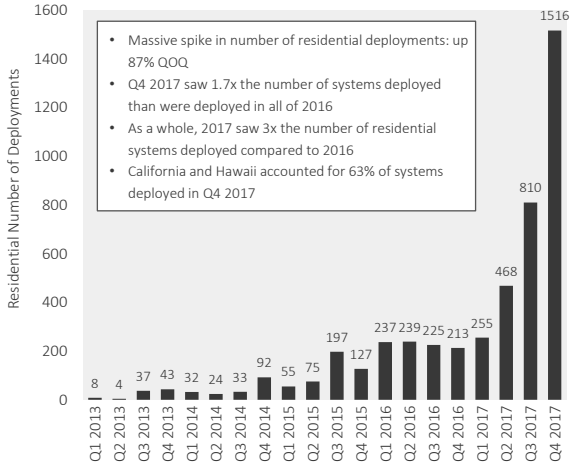
Front-of-the-Meter Market (MWh)




Source: GTM Research

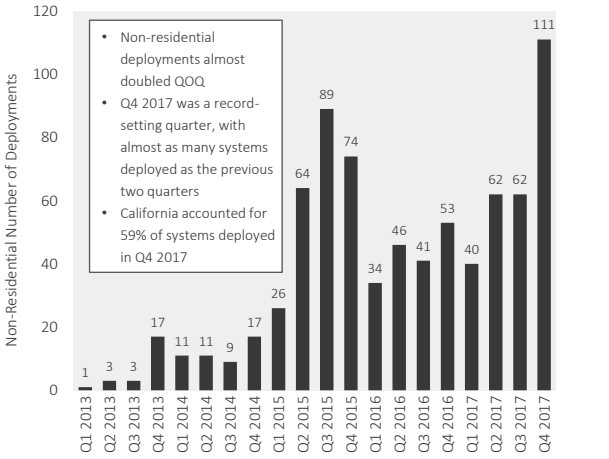
# Behind-the-Meter Segment Saw a Record 1,627 Deployments

Residential Market (Number of Deployments)




Source: GTM Research

Non-Residential Market (Number of Deployments)

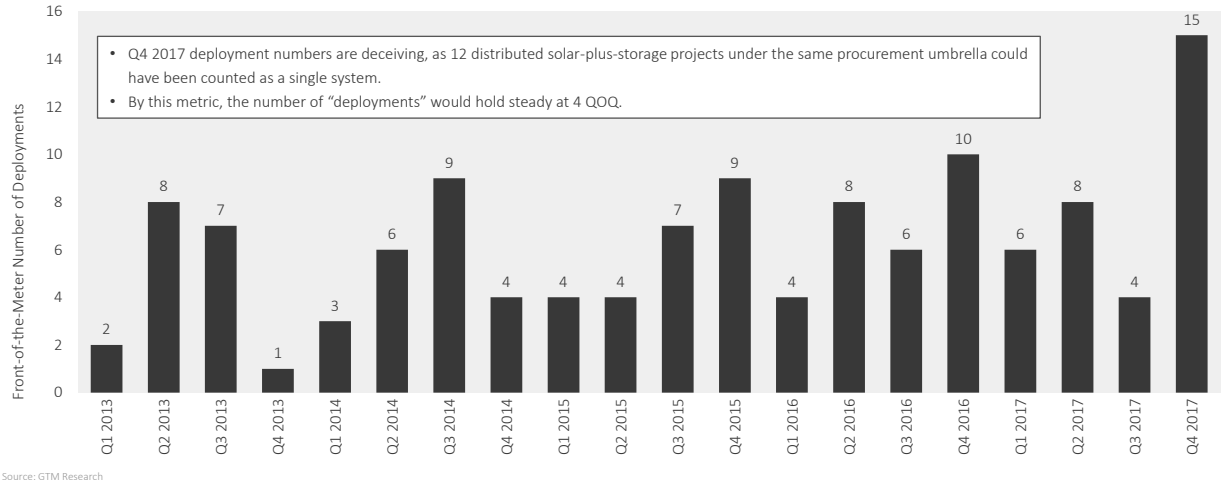



Source: GTM Research

PUCO Case No. 17-0032-EL-AIR et al.
OCC-POD-05-043 ATTACH A
Page 19 of 105

# Front-of-the-Meter Deployments Spike, Depending on the Method Used to Aggregate DERs

Front-of-the-Meter Market (Number of Deployments)




Source: GTM Research

## Top Energy Storage Markets, Q4 2017: Texas Leads FTM, California Dominates BTM

Top 3 Markets by Segment in Q4 2017 (Power Capacity)

| Rank | Residential | Deployments (kW) |
|---|---|---|
| 1 | California | 3,829 |
| 2 | All Others* | 2,530 |
| 3 | Hawaii | 2,221 |

| Rank | Non-Residential | Deployments (kW) |
|---|---|---|
| 1 | California | 21,782 |
| 2 | All Others* | 1,493 |
| 3 | New York | 500 |

| Rank | Front-of-the-Meter | Deployments (MW) |
|---|---|---|
| 1 | Texas | 21.8 |
| 2 | All Others* | 6.0 |
| 3 | - | - |

*GTM Research is currently monitoring eight individual markets: Arizona, California, Hawaii, Massachusetts, New Jersey, New York, PJM and Texas.

Source: GTM Research

- California and Hawaii remain residential market leaders for single state markets, with the former deploying 3.8 MW and the latter deploying 2.2 MW in Q4 2017, records for both markets. Many of California's residential deployments were boosted by the Self-Generation Incentive Program, while Hawaii saw a surge in applications as a result of the Customer Self-Supply program. Puerto Rico also experienced a fair amount of market activity, as market players responded to calls for resilience projects in the wake of hurricane damage.
- California remains the king of the hill for the non-residential storage market with 21.8 MW deployed in Q4 2017, which constitutes 86% market share. The "other markets" category came in second with systems deployed in regions across the country, from the Northeast (New Hampshire), the Southeast (Alabama and Florida) and the Plains (Iowa). Like the residential market, Puerto Rico also saw a fair amount of market activity for non-residential resilience-focused projects.
- Texas led the front-of-the-meter market for the second straight quarter, thanks to three projects totaling 21.8 MW. "Other markets" came in second, with deployments in states such as Florida and Tennessee.

## Top Energy Storage Markets, 2017: California Rules BTM Market, Texas Leads FTM

Top 3 Markets by Segment in 2017 (Power Capacity)

| Rank | Residential | Deployments (kW) |
|---|---|---|
| 1 | California | 6,544 |
| 2 | All Others* | 5,859 |
| 3 | Hawaii | 4,332 |

| Rank | Non-Residential | Deployments (MW) |
|---|---|---|
| 1 | California | 45.1 |
| 2 | All Others* | 2.4 |
| 3 | New York | 1.8 |

| Rank | Front-of-the-Meter | Deployments (MW) |
|---|---|---|
| 1 | Texas | 51.8 |
| 2 | California | 43.5 |
| 3 | Arizona | 25.0 |

*GTM Research is currently monitoring eight individual markets: Arizona, California, Hawaii, Massachusetts, New Jersey, New York, PJM and Texas.

Source: GTM Research

- California was the undisputed BTM market leader for both the residential and non-residential segments, retaining its title from previous years. A combination of SGIP and procurement programs continue to drive the market.
- Texas came in first for the front-of-the-meter market, primarily driven by ERCOT's frequency regulation market. California came in second, thanks in large part to the final Aliso Canyon projects, which were deployed in Q1 2017.
- The strength of the "other markets" category reveals the diversity of regions that are seeing storage activity, including the Northeast, Southeast and West. Individually, these markets are quite small but they are rapidly becoming interesting in their own right. GTM Research plans to expand our state market coverage in the next iteration of this report.

# Top Energy Storage Markets' Cumulative Deployments Since Q1 2013

Top 3 Markets by Segment, Q1 2013-Q4 2017 (Power Capacity)

| Rank | Residential | Deployments (kW) |
|---|---|---|
| 1 | All Others* | 10,013 |
| 2 | California | 9,645 |
| 3 | Hawaii | 6,273 |

| Rank | Non-Residential | Deployments (MW) |
|---|---|---|
| 1 | California | 111.7 |
| 2 | All Others* | 6.2 |
| 3 | New York | 4.1 |

| Rank | Front-of-the-Meter | Deployments (MW) |
|---|---|---|
| 1 | PJM (excl. NJ) | 260.3 |
| 2 | California | 158.6 |
| 3 | All Others* | 95.3 |

| Rank | Total | Deployments (MW) |
|---|---|---|
| 1 | California | 279.9 |
| 2 | PJM (excl. NJ) | 262.9 |
| 3 | All Others* | 111.5 |

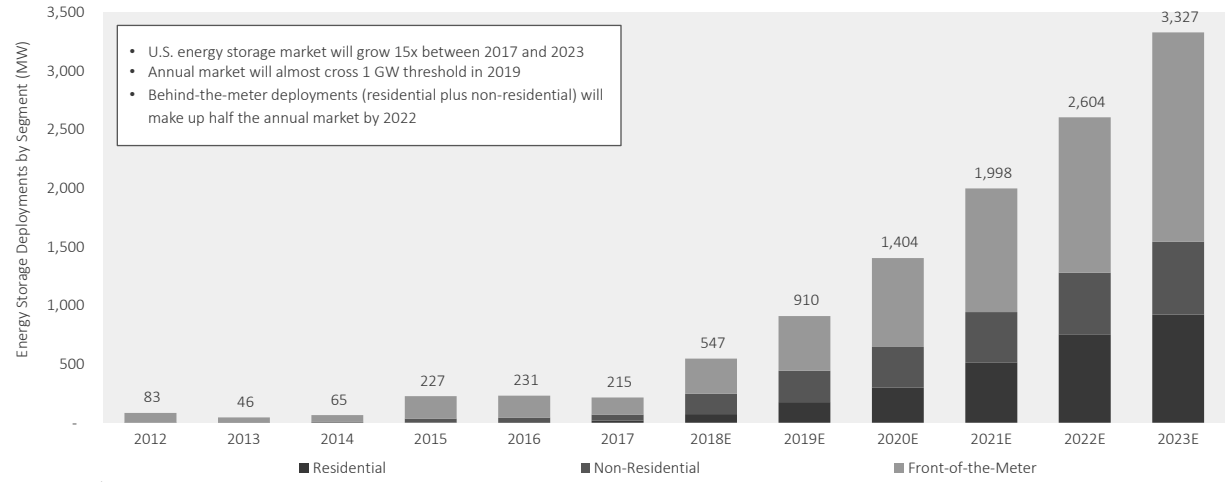
* GTM Research is currently monitoring eight individual markets: Arizona, California, Hawaii, Massachusetts, New Jersey, New York, PJM and Texas.

Source: GTM Research

- California holds the non-residential market in a vise grip with no signs of letting up. As more funding from SGIP is distributed and more systems come online via grid service programs, this is likely to continue. As other states initiate grid service programs and policies supporting energy storage, competition for second place will intensify with states like New York and Massachusetts as likely contenders.
- California is also the largest single state market for residential storage, with 32% of cumulative deployments between Q1 2013 and Q4 2017. Hawaii has a strong showing at second place where it is likely to remain, thanks to encouraging economics for solar-plus-storage under the Customer Self-Supply program.
- PJM (excl. NJ) remains the FTM market leader, though the majority of these megawatts are from legacy projects for the RegD market deployed between 2013 and 2016. California is inching closer to PJM, and will likely overtake it as systems procured under AB 2514 continue to come online.

# U.S. Energy Storage Annual Deployments Will Reach 3.3 GW by 2023

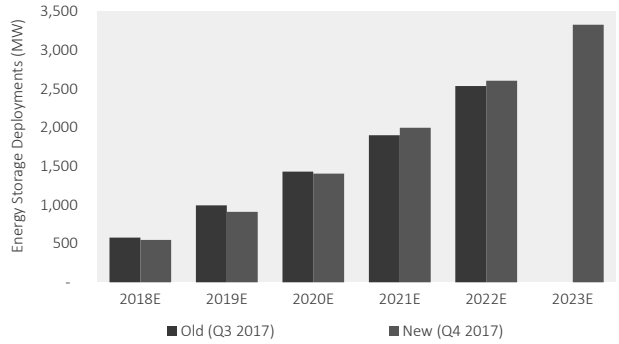
U.S. Annual Energy Storage Deployment Forecast, 2012-2023E (MW)




Source: GTM Research

# 2018-2022 Cumulative Energy Storage Outlook Lowered by 0.3 Percent

Changes to U.S. Annual Energy Storage Deployment Forecast, 2018E-2023E (MW)




Our 2018-2022 outlook shrank by 24 MW, dropping 0.3% versus our previous forecast. The biggest change is in 2019, which is down 9% versus the previous outlook; some of that change results from the Section 201 trade case, which will have the most affect on the 2019 market.

The biggest changes to the outlook were from the front-of-the-meter market for 2018-2022, where GTM Research raised the cumulative outlook by 140 MW given utility resource planning in states like Arizona, Hawaii and Massachusetts. Section 201 did have the effect of lowering forecasts across all 3 segments, but the cumulative percentage effect is lower than for the solar market as solar developers seek to use storage as a value-add offering for behind-the-meter customers, improving BTM economics and standalone storage demand for both non-residential and FTM markets.

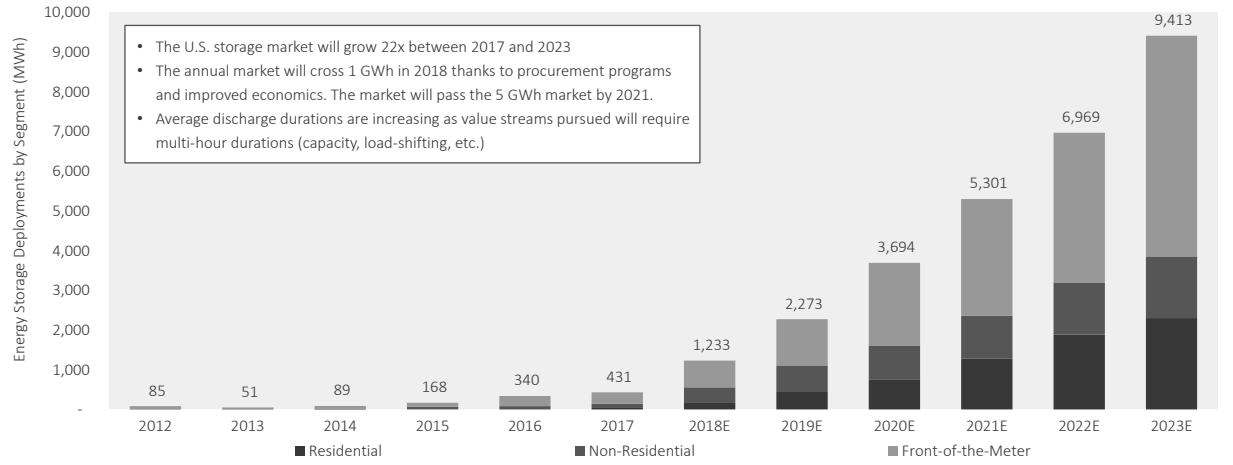
Source: GTM Research

| | 2018E | 2019E | 2020E | 2021E | 2022E | 2023E |
|---|---|---|---|---|---|---|
| Old (Q4 2017) | 578 | 995 | 1,430 | 1,900 | 2,535 | - |
| New (Q1 2018) | 547 | 910 | 1,404 | 1,998 | 2,604 | 3,327 |

PUCO Case No. 17-0032-EL-AIR et al.
OCC-POD-05-043 ATTACH A
Page 25 of 105

## The U.S. Market Will Grow to 9.5 GWh by 2023

U.S. Annual Energy Storage Deployment Forecast, 2012-2023E (MWh)




Source: GTM Research

PUCO Case No. 17-0032-EL-AIR et al.
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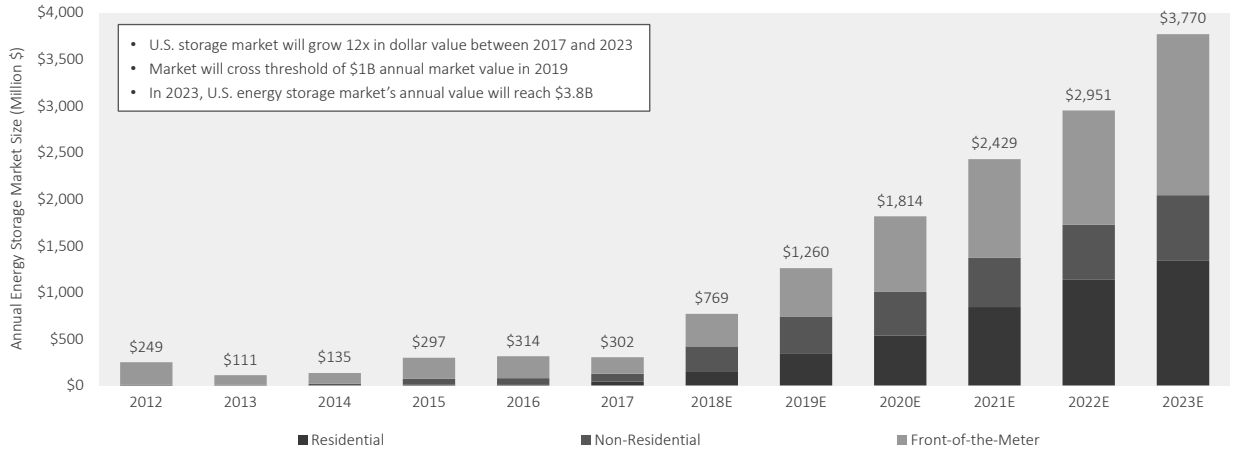
Page 26 of 105

## Energy Storage Will Be a $3.8 Billion Market by 2023

U.S. Annual Energy Storage Market Size, 2012-2023E (Million $)



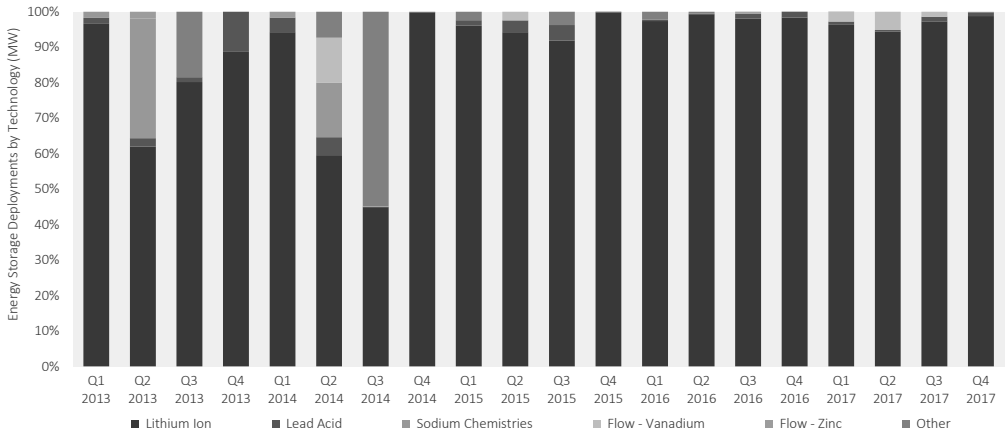

Source: GTM Research

# 3. Technology, System Price and Vendor Trends

PUCO Case No. 17-0032-EL-AIR et al.
OCC-POD-05-043 ATTACH A
Page 28 of 105

# Lithium-Ion Technology Continues the Trend of More Than 94% Share

Quarterly Energy Storage Deployment Share by Technology (MW %)




Li-ion held 98.8% market share in Q4 2017, leading the market for the 13th straight quarter

Lead-acid came in second, with 1.1% market share, followed by vanadium redox flow with 0.2%

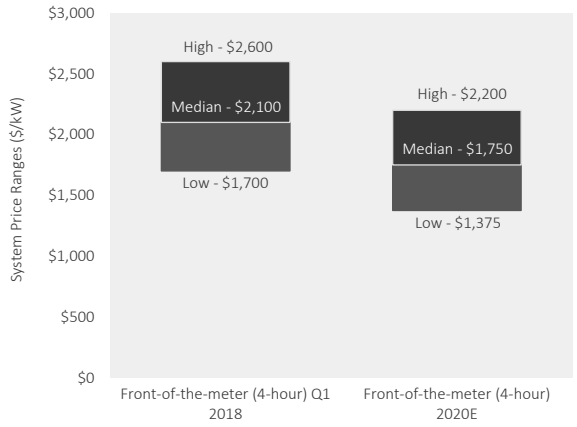
* "Other" includes flywheel and unidentified energy storage technologies.

Source: GTM Research

PUCO Case No. 17-0032-EL-AIR et al.
OCC-POD-05-043 ATTACH A
Page 29 of 105

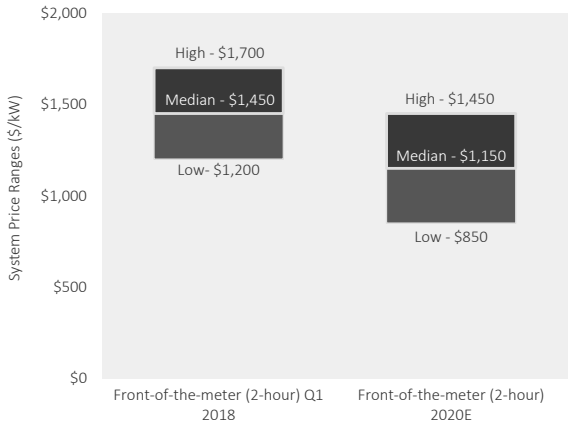
# Front-of-the-Meter System Price Trends in Q1 2018

Front-of-the-Meter Price Trends Q1 2018 and 2020E, 4-Hour ($/kW)




Source: GTM Research

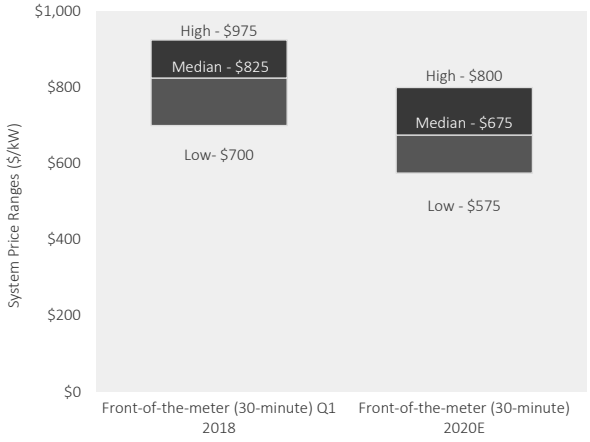
Front-of-the-Meter Price Trends Q1 2018 and 2020E, 2-Hour ($/kW)




Source: GTM Research

# Front-of-the-Meter System Price Trends in Q1 2018 (Cont.)

Front-of-the-Meter Price Trends Q1 2018 and 2020E, 30-Minute ($/kW)

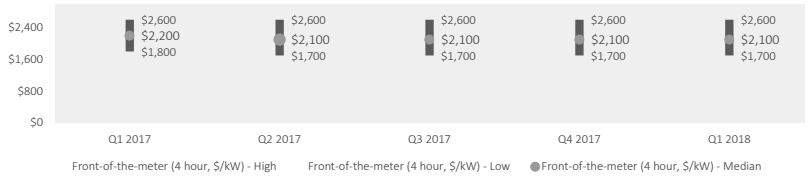



Source: GTM Research

- For front-of-the-meter applications, we track three types of systems:
  - Long-duration applications: Used for 4-hour applications such as capacity
  - Medium-duration applications: Used for 2-hour applications such as time-shifting
  - Short-duration applications: Used for 30-minute power applications such as frequency regulation
- Note that GTM Research has updated its system price reporting methodology for front-of-the-meter 4-hour and 2-hour duration systems. Going forward, all system prices will be reported in $/kW. These prices are for a front-of-the-meter lithium-ion battery system, without any special interconnection requirements and not associated with specific projects being deployed in Q4 2017. Pricing data is considered sensitive by vendors and developers, given the number of projects that are being deployed and the varying project cycles. This system-price data is instead estimated for projects deployed today based on the results of the bottom-up cost survey from interviews with vendors across the value chain, including battery vendors, system integrators and developers.
- It should be emphasized that system prices do not change linearly with discharge duration, as the cost of some balance-of-system components scale with power while others scale with the energy capacity of the system.

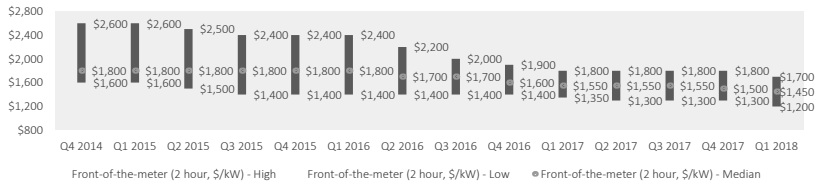
# Historical System Price Trends: Front-of-the-Meter Long- and Medium- Duration Prices Held Flat Across 2017

Historical System Price Trends: Front-of-the-Meter (4-Hour, $/kW)




Source: GTM Research

Historical System Price Trends: Front-of-the-Meter (2-Hour, $/kW)

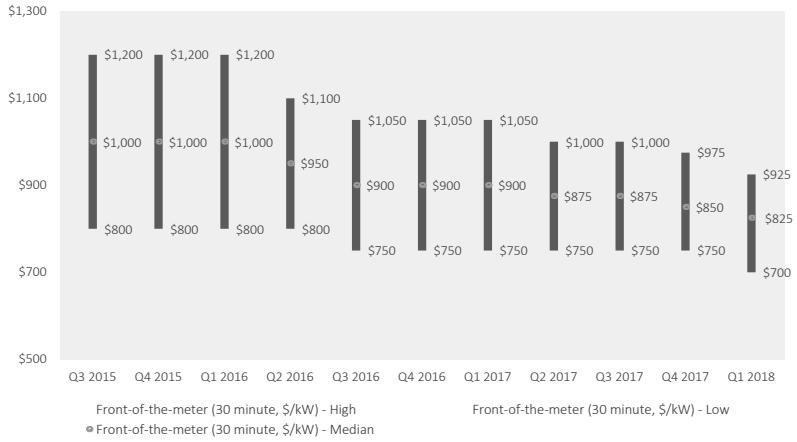



Source: GTM Research

- With few new front-of-the-meter projects deployed in the past several months, prices have held relatively steady for long (4-hour) and medium (2-hour) duration systems across 2017.
- Front-of-the-meter pricing for 4-hour duration systems remained flat in Q1 2018 but the pricing for 2-hour duration systems dropped by 6% on high and median and by about 8% on the low end from Q4 2017 to Q1 2018.
- Further system-price declines are anticipated in future quarters, enabled by higher contracted deployment volumes and driven by factors such as:
  - Reduction in battery-rack pricing, including batteries, wiring, racking and battery management systems.
  - Decline in balance-of-system (BOS) costs, driven by innovation, improvements in system design and engineering and emergence of alternate system architectures as the result of greater renewable integration.

# Historical System Price Trends: Front-of-the-Meter Short-Duration System Prices Declined Through 2017

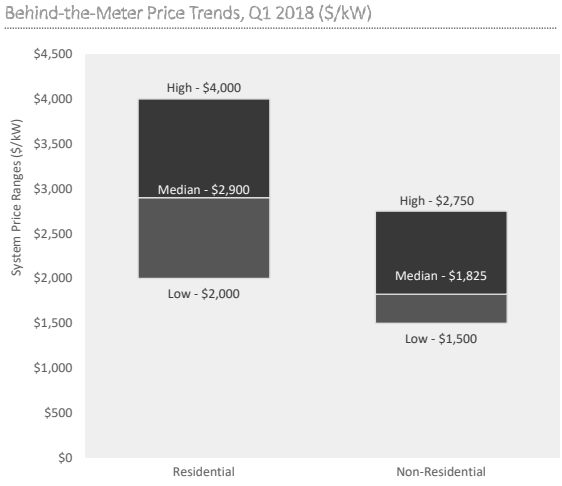
Historical System Price Trends: Front-of-the-Meter (30-minute, $/kW)




Source: GTM Research

- As more front-of-the-meter systems were deployed for power applications (short duration), prices for these systems came down across 2017 as more detailed information on several projects getting installed became available. High-end prices declined by more than 10% from Q1 2017 to Q1 2018.
- Deployments surged further in Q4 2017 and hence prices for these 30-minute duration systems continued to fall in Q1 2018. High, median and low prices came down by more than 5% from Q4 2017 to Q1 2018.
- Looking ahead, the decline in short-duration system prices will be largely driven by reductions in balance-of-system costs. BOS costs currently make up more than 50% of the short-duration system price stack and thus they represent a tremendous opportunity to bring down system-level prices.

# Behind-the-Meter System Price Trends in Q1 2018

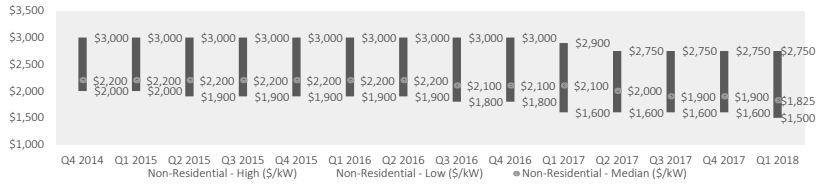



Source: GTM Research

- Note that GTM Research has updated its system-price reporting methodology for behind-the-meter residential and non-residential systems. Going forward, all system prices will be reported in $/kW. All quoted prices are for systems using lithium-ion batteries with 2-hour discharge durations and without any special interconnection requirements. Residential prices are higher than system prices quoted publicly by several markets players; this disconnect stems from the fact that GTM Research's reported prices reflect fully installed systems including the cost of installation, interconnection applications and metering, while in contrast, system vendors often quote prices for systems sold to installers.
- Both residential and non-residential system prices dropped in Q1 2018. Several companies have been heavily focused on bringing down the prices for behind-the-meter systems. Median prices for non-residential systems declined by 4% from Q4 2017, while the low end of the price range also fell by 6%. Non-residential deployments saw a tremendous growth, more than 3x from Q3 2017 to Q4 2017. This huge growth in system deployments led to increased competitiveness in the market, thus driving down non-residential system prices even further in Q1 2018.
- Residential system prices remained flat on the high end, but median prices dropped by 3% and low prices fell by 5%. On a quarter-over-quarter basis, the residential market more than doubled in Q4 2017 vs. Q3 2017. Continued growth in market competition, greater availability of products, and the launch of several storage pilot projects all led to system-price reductions in the residential market in Q1 2018.

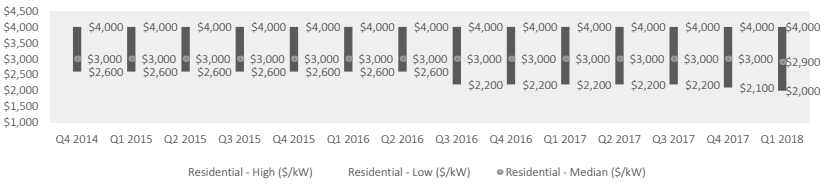
# Historical System Price Trends: Behind-the-Meter Held Flat Across 2017

## Historical System Price Trends: Non-Residential ($/kW)




Source: GTM Research

## Historical System Price Trends: Residential ($/kW)



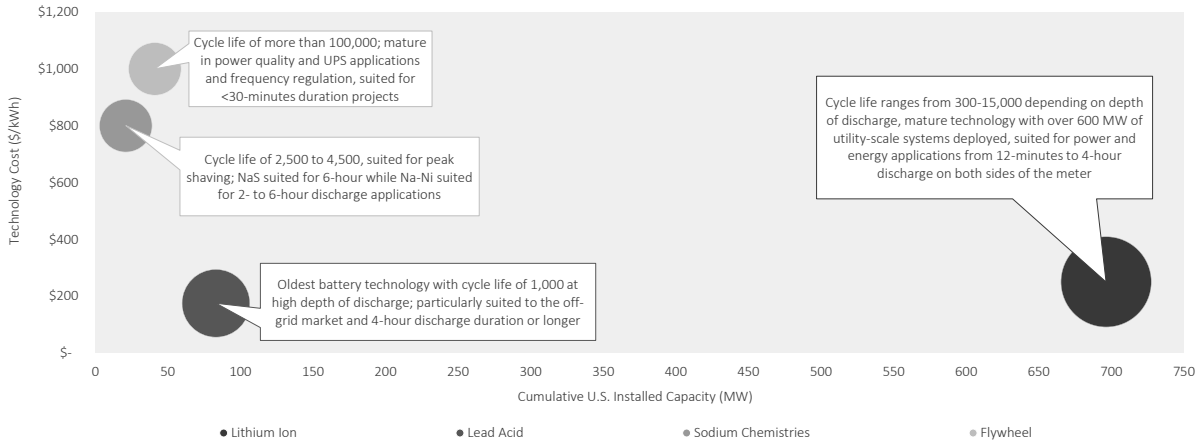

Source: GTM Research

- Non-residential system prices held flat across the low and high end through 2017. Median prices declined by around 10% through the year. An increasing number of system deployments, largely driven by California's SGIP, led to more than 2x growth in the non-residential market. This significant increase in deployments, combined with manufacturing ramp-up, led to system-price declines in the non-residential market.
- The residential market held largely flat across 2017. Q4 2017 was the only quarter across 2017 that saw largest number of deployments by both MW and MWh, and as a result, residential system prices only began declining toward the end of the year, trickling into Q1 2018.
- The behind-the-meter market was a big focus in Q4 2017 and the trend will continue across 2018. As storage deployments continue to grow, GTM Research expects soft-cost reductions in the behind-the-meter market that will bring down storage prices for both residential and non-residential systems.

PUCO Case No. 17-0032-EL-AIR et al.
OCC-POD-05-043 ATTACH A
Page 35 of 105

## Storage Technology Comparison

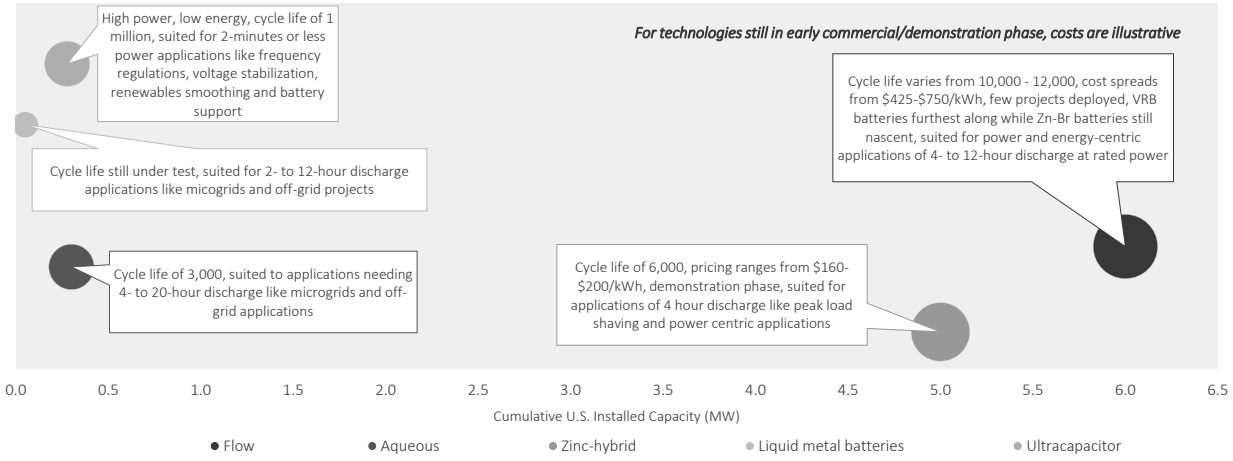
Commercialized Energy Storage Technologies: Cost ($/kWh) Versus Cumulative U.S. Installed Capacity (MW)




Source: GTM Research

## Storage Technology Comparison (Cont.)

Demonstration/Pilot Phase Energy Storage Technologies: Cumulative U.S. Installed Capacity (MW)




Source: GTM Research

## Vendor Ecosystem: New Product/Service Announcements

| Storage Tech Vendor | Power Electronics Vendor | Software Vendor | System Integrator | Developer | EPC/Installer | Description |
|---|---|---|---|---|---|---|
| | SMA | | | | | In November 2017, SMA announced the release of two front-of-the-meter storage products, the Sunny Central Storage 2750-EV-US for 1,500-volt projects and Sunny Central Storage 2475-US for 1,000-volt projects. |
| | | | NEXTracker | | | In December 2017, NEXTracker launched a balance-of-system solution, NX Drive, pre-engineered for lithium-ion batteries. These containers can be deployed for standalone storage or paired with generation. |
| | | | Trinabess | | | TrinaBESS introduced the addition of off-grid capability in its TrinaHome S Series, a residential energy storage solution in January 2018. |
| | | ADARA POWER | ADARA POWER | | | In January 2018, Adara Power unveiled its new commercial and industrial energy storage solution that ranges in size from 30 kW/65 kWh to 1 MW/2 MWh. |

## Vendor Ecosystem: New Product/Service Announcements (Cont.)

| Storage Tech Vendor | Power Electronics Vendor | Software Vendor | System Integrator | Developer | EPC/Installer | Description |
|---|---|---|---|---|---|---|
| | | | FLUENCE | | | Fluence, a joint venture between Siemens and AES Energy Storage, kicked off its operations in January 2018 and rolled out its SunFlex Energy Storage Platform for the solar-plus-storage market. Fluence also announced a dedicated project financing program from Siemens Financial Services. |

# Vendor Ecosystem: Partnerships and M&A Activity

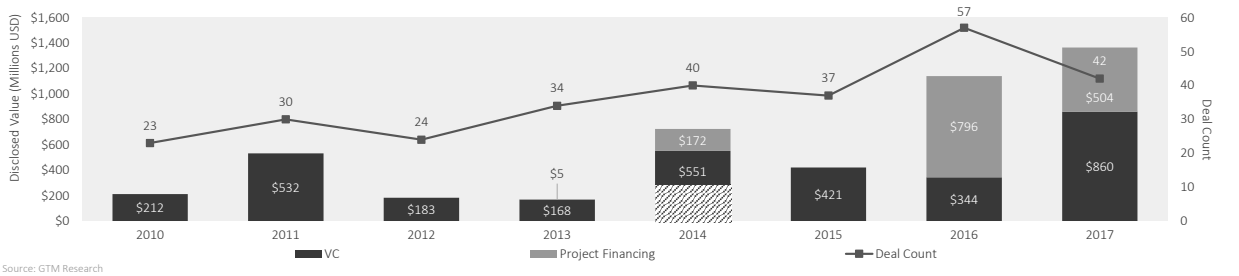
| Upstream/Storage Tech Vendor | Power Electronics Vendor | Software Vendor | System Integrator | Financier | Developer | EPC/Installer | Description |
|---|---|---|---|---|---|---|---|
| | | PEAK POWER | BGIS | | | | In November 2017, Peak Power announced a partnership with BGIS, a Canadian real estate management service provider. Under the partnership, Peak Power will offer the Synergy software platform to BGIS' clients. |
| ALBEMARLE | | | | | Exelon. | | Exelon and Albemarle, a major lithium supplier, partnered up in December 2017 to launch a new company, Volta Energy Technologies, which provides a model for financing energy storage technologies. |
| | | | | | EDF | | In December 2017, French utility EDF expanded its business by moving into the behind-the-meter distributed storage market in the U.S. |
| | IDEAL POWER | | JLM ENERGY | | | | As of January 2018, Ideal Power will supply JLM's commercial battery and microgrid projects in California with its 30kW dual-port Stabiliti series products. |

# Vendor Ecosystem: Partnerships and M&A Activity (Cont.)

| Upstream/Storage Tech Vendor | Power Electronics Vendor | Software Vendor | System Integrator | Financier | Developer | EPC/Installer | Description |
|---|---|---|---|---|---|---|---|
| | | | GreenCharge | | GreenCharge ENGIE | | Following the acquisition of Green Charge in 2016, Engie announced in January 2018 that Green Charge will now be rebranded as Engie Storage Services NA. |
| | SMA | | | | | sunrun | In January 2018, SMA and Sunrun entered into a partnership; the the inverter maker will supply its Sunny Boy US and Sunny Boy Storage US inverters for Sunrun's residential market. |
| | S&C | | S&C | | | | S&C Electric announced in January 2018 that it will be winding down its storage business and refocusing on its core competency around medium-voltage switching and protection, with a special focus on microgrids. |
| ionic MATERIALS | | | | +VOLTA | | | In February 2018, Volta Energy Technologies announced its first investment in Ionic Materials, a materials technology company aiming to commercialize polymer electrolyte for solid-state batteries. |

# Corporate Investments in Energy Storage Reached $1.4B in 2017

Disclosed Corporate Investments in Energy Storage, 2010-Q4 2017 (Million $, Number of Deals)




Source: GTM Research

Note: The total disclosed investment in 2014 was boosted by a rumored $250 million investment in Boston-Power (shaded in the figure above); Data excludes battery materials and upstream companies. 2014 data differs from *U.S. Energy Storage Monitor 2014 Year in Review* due to exclusion of EV startup Atieva and inclusion of stealth startup Fluidic Energy.

- Total corporate investments, including venture funding and project finance, reached $1.4B in 2017, with 63% of this total coming from VC investments. This amounts to a growth of 20% from 2016 when $1.1B was invested. Notably, 2017 saw a 37% drop in project financing though VC investment more than doubled year-over-year, from $344M in 2016 to $860M in 2017.
- The largest VC deal in 2017 consisted of $400M invested in Microvast by Citic Securities. The largest project financing deal was the establishment of a $250M financing facility to support solar-plus-storage. The largest deal in Q4 2017 was a $94.4M financing facility for NRStor led by SUSI Energy Storage Fund, followed by a $66M VC investment in Battery Energy Storage Systems by Tiger Infrastructure Partners.
- 2017 was marked by a fair amount of M&A activity. Highlights from year include: Enel acquiring Demand Energy (Q1), Wartsila acquiring Greensmith (Q2), Aggreko acquiring Younicos (Q3), Trane acquiring Calmac (Q4). Furthermore, AES Energy Storage and Siemens announced their energy storage joint venture, Fluence, in July 2017 and officially launched activity in January 2018.

# 4. Section 201 Trade Case Impacts on U.S. Storage

## Section 201 Solar Trade Case Possesses Implications For Storage Market

The Section 201 solar trade case dominated energy market discussions in late 2017 and early 2018. Brought forward by manufacturer Suniva in April 2017 and supported by manufacturer SolarWorld, the trade case argued that cheap solar panels manufactured in foreign nations had caused injury to U.S. solar manufacturing. Ultimately, the U.S. International Trade Commission (U.S. ITC) voted unanimously that injury had occurred and made recommendations to the White House in November 2017. President Trump issued a decision in January 2018 which imposes tariffs on imported cells and modules, as well as a quota that exempts 2.5 GW of solar cells each year from the tariff. The results of the decision begin in 2018 and will last through 2022.

Given the intertwined nature of the solar and storage markets, the Section 201 decision affects the U.S. energy storage market as well. GTM Research previously found that the results of the trade case decision will lead to a cumulative decline of 11% in U.S. solar demand during the tariff period (2018-2022), with 65% of this reduction coming from front-of-the-meter solar. However, the question remains: How much of an effect will the trade case have on the U.S. energy storage market during that time?

## Section 201 Context and Results: Year 1 Module Prices to Increase by $0.10/W

**April 26, 2017**

- Suniva, a U.S.-based manufacturer, declares bankruptcy, files Section 201 trade petition. Proposes $0.40/W cell tariff and $0.78/W minimum module import price.

**May 25, 2017**

- SolarWorld, parent company of the largest U.S. crystalline-silicon solar manufacturer, files for insolvency citing "ongoing price erosion," signs on as co-petitioner.

**September 22, 2017**

- U.S. ITC votes unanimously that serious injury occurred due to imports.
- Excludes Singapore, Canada and free trade agreement countries (except Mexico and Korea) from remedy scope.

**November 13, 2017**

- U.S. ITC recommendation report submitted to the White House.
- Suggested remedies are less severe than those initially requested, but still significant.

**January, 2018**

- White House issues decision implementing an ad valorem tariff dropping over four years per one of the suggested remedies and pairing it with a more generous 2.5 GW cell quota.

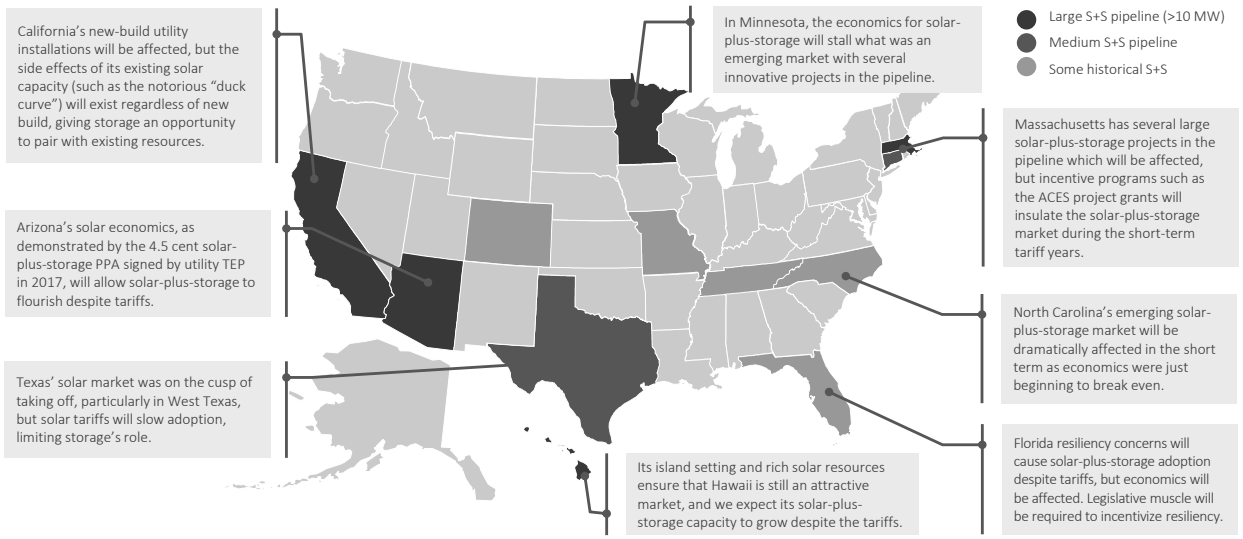
Final Decision on Section 201 Will Result in an Average $0.10/W Increase in Year 1 Prices to Modules, Stepping Down to a $0.04/W Premium by Year 4

| Final Decision on Section 201 | Year 1 | Year 2 | Year 3 | Year 4 |
|---|---|---|---|---|
| Time Period | Feb. 7, 2018-Feb. 6, 2019 | Feb. 7, 2019-Feb. 6, 2020 | Feb. 7, 2020-Feb. 6, 2021 | Feb. 7, 2021-Feb. 6, 2022 |
| Safeguard Tariff on Cells and Modules | 30% | 25% | 20% | 15% |
| Cells Exempted from Tariff (Quota) | 2.5 GW | 2.5 GW | 2.5 GW | 2.5 GW |

Source: GTM Research, *U.S. Solar Outlook – Initial Reactions to Section 201 Decision*

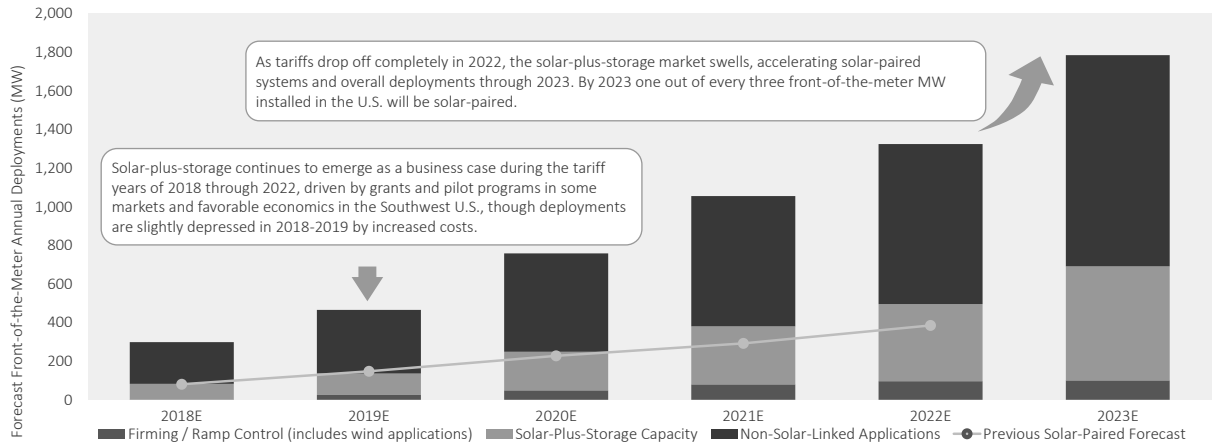
PUCO Case No. 17-0032-EL-AIR et al.
OCC-POD-05-043 ATTACH A
Page 45 of 105

## Section 201: FTM Solar-Plus-Storage Pipeline – Which Markets Will Be Affected? Which Are insulated?



# Front-of-the-Meter Energy Storage Forecasts Dip Due to 201 but Recover for 2023

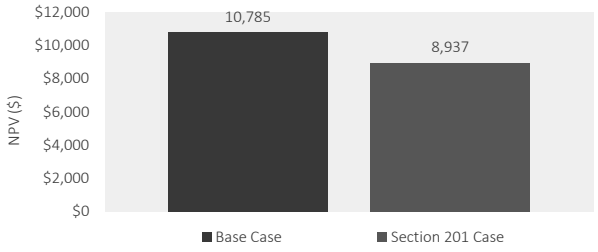
Updated Front-of-the-Meter Forecast Comparison: Solar-Plus-Storage Breakout




Source: GTM Research

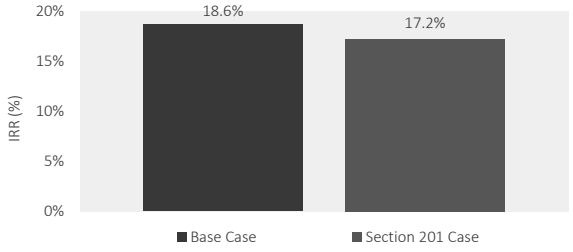
# Section 201 Causes 17% Reduction in Net Present Value for Residential Solar-Plus-Storage

SDG&E Residential Solar-Plus-Storage NPV, 2018




Source: GTM Research. Based on 5 kW/13.5 kWh Li-ion storage system paired with a 10 kWdc solar PV system under DR-SES tariff.

SDG&E Residential Solar-Plus-Storage IRR, 2018




Source: GTM Research. Based on 5 kW/13.5 kWh Li-ion storage system paired with a 10 kWdc solar PV system under DR-SES tariff.

- GTM Research analyzed two cases for residential solar-plus-storage deployed in SDG&E territory in 2018: one based on solar system prices in the absence of Section 201 effects, and one affected by the results of Section 201. In this case, Section 201 adds a roughly 9% price increase to residential solar in California.
- Our analysis found that the increased solar system prices led to a 17% reduction in NPV and a 140-basis-point reduction in IRR. Even in the Section 201 case, solar-plus-storage holds onto a positive NPV and healthy IRR in SDG&E territory.
- Though the reduction is not massive, any change in IRR and NPV can have nontrivial effects on the storage market, which remains in the early-adopter phase and thus is sensitive to changing economics. Nevertheless, today's residential storage adopters are relatively inelastic to smaller shifts in PV prices, and thus storage demand will fall at a smaller rate than solar demand as a result of Section 201.

## Section 201 – Key Takeaway for Energy Storage: Don't Panic

The fates of solar and energy storage are becoming rapidly intertwined, but **near-term energy storage deployments will not be heavily affected by the Section 201 trade case as energy storage continues to stand on its own**. While lower solar installations will affect energy storage in the long term, the industry benefits from established standalone business cases, from resource adequacy, to demand charge management, to ancillary services.

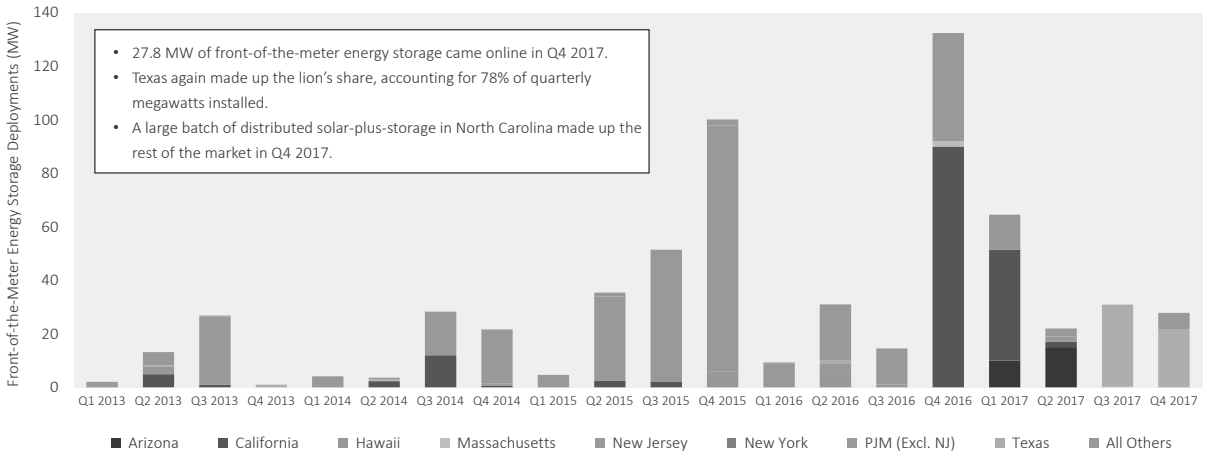
The next five years were seen to be solar-plus-storage's party, with a solar tariff the uninvited guest, but **the overall effects could be muted as existing capacity drives the need for storage even as new-build front-of-the-meter deployments slow**. Energy storage is increasingly looking at longer horizons through utility integrated resource plans, wholesale market reforms, and grid modernization efforts, so a slight downturn in one particular use case will not be enough to significantly slow the market's growth. Furthermore, a significant number of solar installers and developers on both sides of the meter are focusing on storage as a value-add for their business, and in some cases this will increase the overall proportion of solar-plus-storage installations over the next few years.

Beyond "don't panic," the effects of the trade case could even have a silver lining. **Even as non-residential and residential solar deployments slow, developers will begin integrating more storage into their offerings, resulting in fewer solar systems on roofs but storage being attached to more of them.** The same could be true for front-of-the-meter, where a developer could more easily absorb a $0.10/W increase when it is spread across a broader system including storage.

# 5. Front-of-the-Meter Market Trends

## Texas Continues to Drive Front-of-the-Meter Deployments in Late 2017

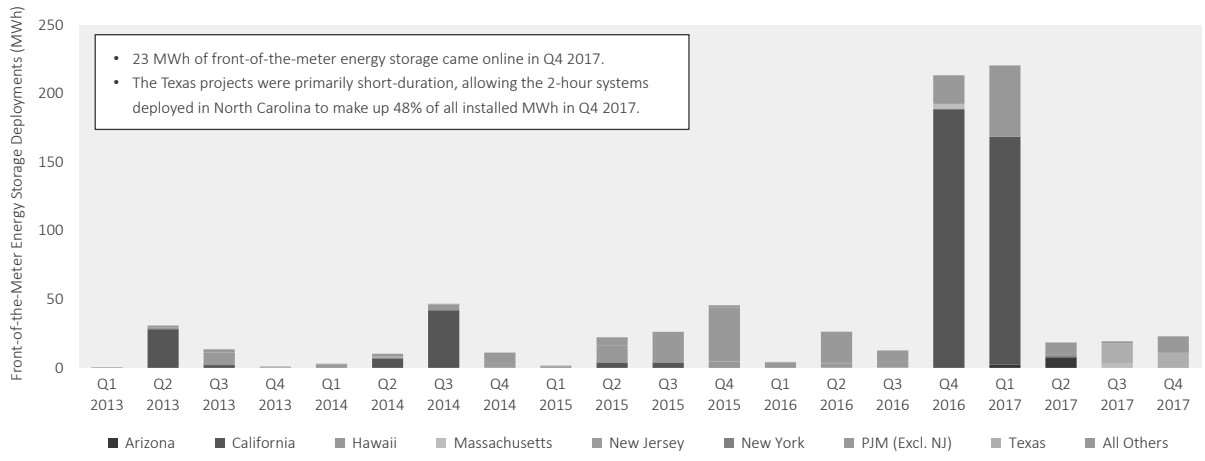
U.S. Quarterly Front-of-the-Meter Energy Storage Deployments (MW)




Source: GTM Research

## North Carolina Emerges With 48% of Installed FTM MWh in Q4 2017

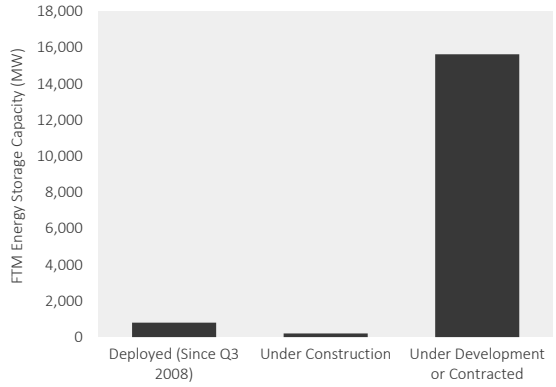
U.S. Quarterly Front-of-the-Meter Energy Storage Deployments (MWh)




Source: GTM Research

# U.S. Utility Energy Storage Pipeline Grows as Bets Are Placed in Massachusetts

U.S. Front-of-the-Meter Energy Storage Deployment and Pipeline (MW)




Source: GTM Research

Note that as of Q4 2016, GTM Research no longer includes the wholesale distribution access tariff queues for California's investor-owned utilities, as there is a significant overlap with the California ISO interconnection queue.

- The total front-of-the-meter pipeline through Q4 2017 is 15,832, up from 15,011 in Q3 2017, a 4 percent increase.
- California continues to represent the largest tracked pipeline with over 10.7 GW of projects under construction, contracted or planned, accounting for over 67% of the total pipeline.
- Reductions in PJM's interconnection queue have been significantly offset by several major projects added to the ISO-NE interconnection queue in Massachusetts.
- Several of the projects listed as battery systems in CAISO's interconnection queue are enormous, well beyond the scope of any project installed to date, and even potentially beyond the capability of the supply chain to support, indicating that they are speculative and not representative of long-term planning.

# U.S. Utility Energy Storage Pipeline Still Concentrated in a Few Markets

U.S. Front-of-the-Meter Energy Storage Deployment and Pipeline Through Q4 2017 (MW)

| Market | Operational (Since Q3 2008) | Under Construction | Under Development or Contracted |
|---|---|---|---|
| Arizona | 25.5 | 0.025 | 2666 |
| California | 166 | 103 | 10650 |
| Hawaii | 53 | 2 | 160 |
| Massachusetts | 3 | 0.5 | 508 |
| New Jersey | 2.8 | 0.5 | 20 |
| New York | 20 | 0.19 | 259 |
| PJM (Excl. NJ) | 306 | 92 | 143 |
| Texas | 97 | 0 | 696 |
| All Others | 132 | 3 | 529 |
| **Total** | **806** | **202** | **15,630** |

Source: GTM Research

- The total front-of-the-meter pipeline through Q4 2017 is 15,832, up from 15,011 in Q3 2017, a 4 percent increase, with many new projects added to the ISO-NE interconnection queue.
- Massachusetts' pipeline grew dramatically to 508 MW, up from only a handful of MW the quarter before, following announcements of a major deferral project on Nantucket, multiple FTM ACES award winners, and the addition of several large storage projects to the interconnection queue.
- Discounting Texas' planned compressed air projects positions Massachusetts as the No. 3 market in terms of active pipeline, surpassing New York, PJM and Hawaii.
- GTM Research includes Hawaiian Electric's 60 to 200 MW RFP at 90 MW, as reported in the utility's Power Supply Improvement Plan submitted to the Hawaii PUC.

# U.S. Utility Energy Storage Pipeline by Requested Commissioning Date (MW)

Projected U.S. Front-of-the-Meter Energy Storage Pipeline by Requested Commissioning Date (MW)

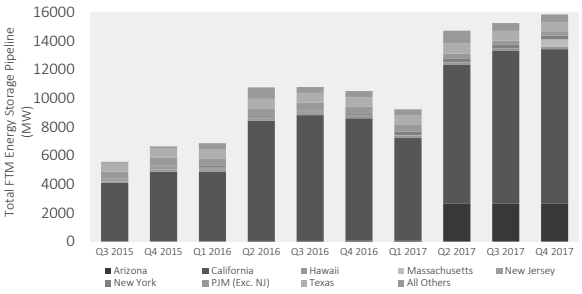
| Market | 2018 | 2019 | 2020 | 2021 | 2022+ | Unspecified/Delayed |
|---|---|---|---|---|---|---|
| Arizona | 22 | 30 | 2,083 | 0 | 530 | 2 |
| California | 546 | 2,478 | 4,195 | 2,720 | 804 | 10 |
| Hawaii | 20 | 104 | 0 | 0 | 0 | 38 |
| Massachusetts | 4 | 0 | 20 | 400 | 75 | 9 |
| New Jersey | 0 | 1 | 0 | 0 | 0 | 20 |
| New York | 74 | 175 | 0 | 0 | 0 | 10 |
| PJM (Excl. NJ) | 124 | 0 | 0 | 0 | 0 | 111 |
| Texas | 270 | 0 | 404 | 0 | 0 | 22 |
| All Others | 45 | 184 | 50 | 0 | 0 | 252 |
| **Total** | **1,106** | **2,972** | **6,751** | **3,120** | **1,409** | **474** |

Source: GTM Research

- 1,106 MW of projects submitted 2018 as their requested interconnection date, but GTM Research expects that only a portion of these megawatts will actually get interconnected in 2018. Developers with projects in the PJM queue, especially in the early stages of development, will likely adopt a conservative approach to the evolving PJM market rules, and it is unclear if Texas' large compressed air project will move forward.
- California ISO Cluster applications submitted in April 2017 included large blocks with 2019 and 2020 as the requested interconnection period. It is unlikely that all projects will get interconnected, given the timeline of AB 2514 and the fact that several of those projects did not win any RFPs. Of particular note is the size of several projects listed as solar-plus-storage projects with incredibly large (GW-scale in the case of one project listed for Arizona) storage portions, which are unlikely to move forward at that scale.
- The latest ISO-NE interconnection queue update included numerous large projects with submitted interconnection dates of 2020 and 2021, indicating that this market is receiving particular interest following the implementation of a storage mandate and numerous grants and regulatory advantages.
- The Texas pipeline consists primarily of two compressed-air projects with interconnection targets of 2018 and 2020, totaling 594 MW.
- It should be noted that the project pipelines in all other markets are potentially under-reported, as projects on the distribution grid or in regulated markets do not apply to ISOs/RTOs for interconnection queue requests.

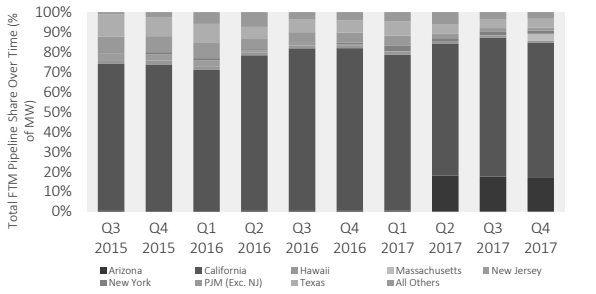
## Massachusetts Makes a Big Splash, Other Pipelines Remain Steady

U.S. Front-of-the-Meter Energy Storage Pipeline by Market, Q3 2015-Q4 2017 (MW)




Source: GTM Research

U.S. Front-of-the-Meter Energy Storage Pipeline Market Share, Q3 2015-Q4 2017 (%)




Source: GTM Research

- California continues to represent the majority of the front-of-the-meter energy storage pipeline, holding 67% of the pipeline, down slightly from 70% of the total pipeline in Q3 2017.
- Massachusetts marked the biggest change with 500 MW of pipeline projects tracked, bumping the state to over 3% of the total pipeline. The majority of these projects were tracked from the ISO-NE interconnection queue, but several other projects have been contracted publicly as well.
- A full list of tracked projects and interconnection queue applications is available in GTM Research's Energy Storage Data Hub.

## Front-of-the-Meter Policy and Market Developments, Q1 2018

**Colorado**

**Xcel** announced median bid prices for storage and renewable-paired storage for projects targeting 2023 completion dates, indicating the industry's optimism on continuing price declines.

**California**

Natural-gas peaking assets were dealt a serious blow, as both existing (**PG&E**) and planned (**SCE**) units are being re-examined with an eye toward replacing them with energy storage. The **CPUC** released a decision on multiple use cases. **PG&E**'s latest energy storage procurement awarded 165 MW of energy storage projects, primarily at the transmission level.

**Arizona**

A massive energy modernization effort was proposed by the Arizona Corporate Commission, including a 3 GW energy storage target, while **Salt River Project** released a new RFP.

**Texas**

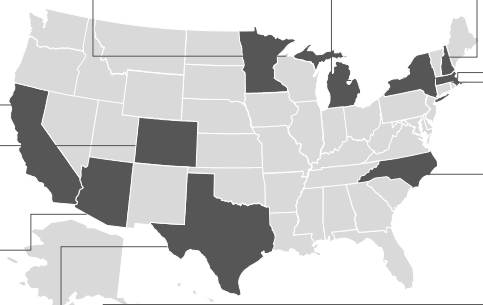
The **Public Utility Commission of Texas** moved to deny AEP's proposed energy storage deferral project, but opened a docket to study the issue that will consider storage ownership by distribution utilities in Texas.

**Minnesota**

**Great River Energy** launched a 10 MW solar-paired storage RFP.

**Michigan**

**Michigan's PSC** moved to require examination of energy storage in new integrated resource planning guidelines.



**Federal**

**FERC** ruled in favor of energy storage participation and eligibility in wholesale markets. A new energy storage tax credit was introduced in the **U.S. House of Representatives**, though its future is unclear. The budget resolution from February 2018 notably excluded energy storage while extending tax credits to many other technologies.

**New Hampshire**

HB 1647, which permits distribution utilities to own storage and monetize it in wholesale markets, was introduced in the **New Hampshire General Court,** the state legislature**.**

**New York**

**Governor Cuomo** proposed a bold 1.5 GW energy storage target alongside announcements of $260 million in funding from the state's green bank and NYSERDA. **NYISO** refined storage participation and eligibility. **Orange & Rockland** announced an NY REV demonstration project to explore storage value streams via a 4 MW/8 MWh storage portfolio.

**Massachusetts**

Winners for the **Advancing Commonwealth Energy Storage** (ACES) program were announced – 26 projects across a variety of use cases.

**North Carolina**

**Duke** released its updated 2017 integrated resource plan, including the potential for 75 MW of energy storage.

**ISO / RTO Markets**

Activity continues in proceedings in **PJM** and **MISO –** the latest MISO working group meeting discussed a potential new resource type for storage.

# FERC Rules Energy Storage Must Be Eligible to Participate in Wholesale Markets

**On February 15, FERC released draft final rules adopting participation and eligibility requirements for energy storage in ISOs and RTOs, implementing the notice of proposed rulemaking introduced in November 2016.**

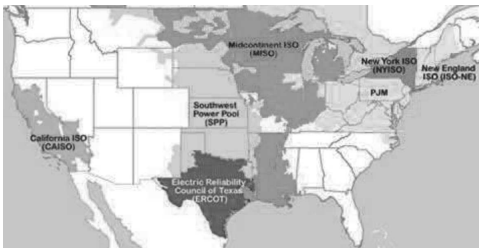
The ruling requires each RTO and ISO to revise its tariffs to ensure energy storage can participate fully in all markets for which it is "technically capable of providing" services, and that such participation will account for the unique operating characteristics of energy storage as a resource.

The long-anticipated announcement by FERC makes law the rules proposed more than a year ago, and it is hard to overstate just how much of the front-of-the-meter energy storage market this affects. About half of all electricity in the U.S. passes through a wholesale electricity market under FERC's authority (ERCOT notably is not under this umbrella), and while that very large playing field has just been leveled in storage's favor this process was already underway in four of the six affected ISOs and it is still up to the industry to get out and compete.

They will have to wait before they can – proposed tariff changes are not due from the ISOs for 270 days, with a further 365 to implement them, meaning the industry won't be reaping the benefits of the changes until almost 2020. Plenty of time to start planning.

Keep your eyes on two little words in the ruling – energy storage must be eligible for any services they are "technically capable" of providing. Could this term be used to, for instance, disqualify storage from providing capacity in markets with open-ended performance requirements?

Significantly affected: **ISO-NE** and **SPP**, which have both moved slowly to implement market rules for energy storage implementation, and **MISO**, where the process has just gotten started. The opportunity in all three markets is substantial, representing all or part of 15 states where we have seen limited or no FTM storage deployments or announced projects.




ISO Map Source: FERC

Less affected: **CAISO, PJM** and **NYISO**, where energy storage participation rules are already comparatively robust or being actively designed. **ERCOT** will not be immediately affected as it is the only ISO that does not fall under FERC's jurisdiction, but it will be affected in the long term if storage participation in other markets demonstrates positive results.

## California Activity Is a Shot Across the Bow for Natural Gas Peakers – Storage Is Coming

**In December 2017, SCE released its local capacity requirements procurement plan for the Moorpark sub-area,** identifying transmission solutions that reduce the required amount of capacity needed. The overall LCR deficiency in the region totals 318 MW. The transmission upgrade will address 232 MW needed, leaving 76 MW to procure after accounting for one existing 10 MW system. A localized grid resilience issue in Goleta could make storage unfeasible (the planning document suggests that there may not be enough backup transmission to charge an asset during off-peak hours), so a natural-gas facility under 55 MW is considered in this area. The initial plan to ensure capacity for this region, NRG's Puente natural gas plan, has been scrapped entirely, and SCE expects "that cost-competitive energy storage will be a critical component of the LCR Moorpark resource portfolio."

**In PG&E, a different but parallel story unfolded after Calpine submitted must-run offerings for several of its natural gas plants**, then informed CAISO if it didn't receive the RMR contracts it would not make the facilities available. CAISO determined two of the peaking assets (Yuba City and Feather River Energy) were required to provide local capacity, and deemed the entire Metcalf generation facility a must-run resource. The CPUC then interjected, telling PG&E in December 2017 to run a competitive solicitation that would include preferred resources and energy storage, following up with a formal notice in January 2018.

**These dramatic shifts from natural gas to transmission and storage/preferred resources demonstrates the unique conditions at play in California**, where an active legislature, engaged independent system operator, and forward-looking investor-owned utilities meet to create a regulatory perfect storm in favor of storage. This trend is not limited to California, though that market, with its unique intersection of legislative muscle, aggressive renewable goals and active ISO, make it a leader in the space. Notably, the University of Minnesota's Energy Transition Lab published a study in July 2017 indicating that solar-plus-storage was cost-effective for providing peak summer demand on a hot day. New York seems to be the market most likely to pick up the proverbial torch, as the NY-ISO ramps up its storage investigations while the state government aggressively promotes storage and renewables. New England could follow, although ISO-NE is not as actively engaged as other operators, and this could act as a bottleneck for widespread storage adoption.

## Arizona Steps Into the Leadership Role

**In January 2018, Arizona Corporation Commissioner Andy Tobin proposed the Arizona Energy Modernization Plan.**

- The proposal would, among a wide range of goals, set a 3 GW energy storage target by 2030, leapfrogging established or proposed targets in California, Oregon, Massachusetts and New York and establishing Arizona as a leader in the field.
- Aside from the energy storage target, other portions of the bill would greatly spur storage deployments, including a clean peak standard, which would incrementally increase the percentage of peak load utilities would need to procure year by year through 2030. Such a requirement would likely significantly benefit storage with its unique ability to time-shift clean resources to periods of peak demand.
- Arizona made numerous headlines throughout 2017, with aggressive integrated resource plans and significant project announcements and installations, but this plan sets a new even more aspirational tone by wrapping storage, EV infrastructure, clean peak, efficiency, and even biomass into one centralized vision with the end goal of an 80% clean energy (including nuclear) standard by 2050.
- This marks one of the first portfolio updates proposed, since most were announced prior to the renewable energy boom of the past decade, and it sets a benchmark for other states. Arizona, with its abundant solar resources, was an obvious candidate for an overhaul as its utilities had already met the initial 15% renewable standard.
- Initial replies to the proposal from utilities were noncommittal, and prospects for the plan are unclear. Tobin will ask the ACC to consider the issue in February.

# New York's Eye Test: Is the "Energy Vision" Finally Coming Into Focus?


**Governor Cuomo Eyes 1.5 GW Energy Storage Target**

The biggest news to come out of New York this quarter was legislation signed in November 2017 directing the Public Service Commission to adopt an energy storage target. Governor Cuomo set out his own 1.5 GW target for the state by 2025, a benchmark that will inform the PSC's deliberations. From the legislative and executive side, energy storage, along with offshore wind, has clearly emerged as an area of wide-ranging consensus amid the Reforming the Energy Vision proceeding. If similar mandates in California and Massachusetts are any indication, it will likely be well into 2018, if not 2019, before the PSC implements the storage target.

**Massive Funding: $200 Million From the Green Bank and $60 Million From NYSERDA Put the Spotlight on Pilots**

The governor's target comes with some serious teeth in the form of $200 million from the New York Green Bank and $60 million from NYSERDA toward energy storage pilots and deployments. This kind of large-scale investment will be just the momentum needed to drive storage deployments in a state where regulatory hurdles have, to date, stifled what would otherwise be a promising front-of-the-meter market for storage.

**NYISO Provides Visibility on Storage Integration and Eligibility**

The NYISO has also been hard at work under REV, creating a storage integration proposal that mirrors many of the proposals from 2016's FERC NOPR, and refining eligibility requirements for storage to ensure participate in wholesale markets. Such changes will be critical as New York truly revs up its investment in storage for truly sustainable business models to emerge.

## Storage Increasingly on Utilities' Radar, Included in Many Renewables RFPs

| Utility | Procurement Amount | Resources Included | Bid Date Due | Commissioning Date | Notable Details |
|---|---|---|---|---|---|
| Great River Energy | 10 MW storage, 10 MW solar | Solar and storage | February 23, 2018 | End of 2019 | Energy storage systems will be co-located with the solar systems and operate under what GRE describes as a Long Term Energy Storage Services Agreement with terms of at least 10 years. |
| Nevada Energy | 330 MW of renewables, storage sized 25 MW or greater | Renewable energy and storage | February 2, 2018 | 2020 and 2021 | The fact that energy storage is considered in a supplement to the primary RFP indicates that Nevada Energy does not want storage to displace other assets in the bidding process, or that the utility sees storage as a significantly different technology distinct from renewables. |
| Salt River Project | 100 MW of renewables | Solar, wind, geothermal and biomass | March 9, 2018 | End of 2020 | Bidders are encouraged to include energy storage (for the purposes of meeting SRP peak needs) in their proposals, though complementary proposals without energy storage are required. |
| Orange and Rockland | Seven projects ranging from 1-15 MW | Multiple | Varies by project – through 2019 | Varies by project – through 2022 | Load relief and reliability were the drivers for all seven projects |
| Xcel Energy | 454 MW to meet forecasted demand, and up to 1,114 MW | Multiple | November 2017 | End of 2023 | Median bid prices released show some of the lowest storage and renewable-paired storage prices to date |

In three of the cases shown above, energy storage has been directly included or encouraged in RFPs otherwise focused on renewable energy, highlighting use cases from peak capacity, to solar integration, to capturing curtailed wind energy. Additionally, Xcel's all-source solicitation in Colorado, though closed, shows the remarkable potential for renewable-paired storage. The commission's phase II decision is due in July, but before then the median prices revealed showed that storage is increasingly competitive even when competing with traditional generation. While standalone renewables will continue to be the norm over the next two procurements happening now, representing installations two to five years out, they increasingly highlight storage. We are seeing an inflection point in utility planning where storage becomes the norm, rather than the exception, when considering procuring renewable energy.

## PG&E's 165 MW Procurement Shows Continued Focus on Solar Integration and Deferral

| Counterparty Name | Parent Company | Online Date | Connection Point | Term (years) | Size (MW) |
|---|---|---|---|---|---|
| Calstor | EDF Renewable Energy | 11/1/2020 | Customer (Behind the Retail Meter) | 10 | 10 |
| Cascade Energy Storage | Enel Green Power | 12/1/2022 | Transmission | 20 | 25 |
| Diablo Energy Storage | LS Power | 12/1/2021 | Transmission | 10 | 50 |
| Kingston Energy Storage | Enel Green Power | 12/1/2023 | Transmission | 10 | 50 |
| Sierra Energy Storage | IHI Power Services/ Enel Green Power | 12/1/2023 | Transmission | 10 | 10 |
| Tesla, Inc. | Tesla, Inc. | 11/1/2021 | Distribution | 20 | 20 |

PG&E's 2016 energy storage RFO's winning bids were announced in December 2017. Six projects were awarded totaling 165 MW, with front-of-the-meter projects winning the lion's share, 155 MW. Commissioning dates vary from 2020 to 2023, as do project sizes and PPA terms, though there are two points of consistency – all projects will have 4-hour durations and, unsurprisingly, use lithium-ion technology. The awarded projects mark another set of signposts for the storage market, as PG&E identified three existing solar facilities it owns and operates that would benefit from the addition of storage and a distribution station where storage could defer significant investment. Solar integration and deferral were key trends for storage in 2017, and with this announcement the market shows continued optimism in these two verticals.

## FTM Energy Storage Policy Roundup

- The **California PUC** released a decision on multiple use cases for energy storage that was generally in line with outlines and proposals set and discussed by ISOs and stakeholders in the past. The **primary clarification divides use cases into domains** (customer, distribution and transmission), **and establishes that systems operating in a more distributed domain can provide services up, but systems cannot provide services down** (e.g., a system operating in the customer domain can provide services in all domains, but a system operating in the transmission domain cannot provide services in the distribution or customer domain).
- The **U.S. House of Representatives** introduced HR 4649 in December 2017 which **would extend a tax credit to energy storage systems.** Similar bills have been introduced in the past, and in the current legislative climate, particularly in an election year, progress on new minor legislation is likely to be slow. Some industry stakeholders are optimistic a compromise could be included into a larger budget in the future, as has happened with extensions of the PTC and ITC in the past. The latest budget deal in February omitted any energy storage tax credit.
- **MISO's** energy storage task force continues to progress, with the latest meeting on January 23, 2018 discussing the new resource type (stored resource type II), and issues related to asset dispatch, commitment, state of charge, and priority. The next meeting is set for March 1.
- The **Massachusetts Clean Energy Center** announced the winners of its Advancing Commonwealth Energy Storage (ACES) program in December 2017, awarding $20 million (double the initial amount) to 26 projects ranging from customer-sited systems at state universities to large front-of-the-meter projects for utilities. The projects represent 32 MW and 85 MWh of energy storage projects across multiple value streams and technologies, and are set to provide a true sandbox for storage, demonstrating storage's potential across the entire value chain.
- In January 2018, HB 1647 was introduced in the **New Hampshire state legislature**. The bill permits distribution service companies to own energy storage and mandates that storage not be precluded from earning revenue in the ISO New England wholesale market. If passed, **the bill will increase the opportunity for FTM storage in New Hampshire** as new opportunities will exist for utilities to deploy and monetize such assets. As of late February 2018, the bill remains in committee.

## FTM Energy Storage Policy Roundup (Cont.)

- The **Public Utility Commission of Texas** moved to deny AEP's proposed energy storage deferral project, but it opened a docket to study the issue to consider storage ownership by distribution utilities in Texas, which under current law are not permitted to own generation resources.
- In February 2018, **Orange & Rockland** announced a demonstration project under NY REV to explore non-residential energy storage value-stacking using a 4 MW/8 MWh portfolio developed, designed, installed, operated and maintained by Tesla; half the portfolio will consist of non-residential BTM projects and half will be from remote solar-plus-storage projects. O&R will retain dispatch benefits and operational priority of the aggregated fleet to supply grid services.

## Front-of-the-Meter Market Outlook: Applications

GTM Research analysis suggests that there will be four broad application areas for front-of-the-meter energy storage.

**Ancillary services**: Historically, PJM had been the only market with sufficiently high regulation prices to provide a clear entry opportunity for new merchant energy storage. Recently, however, systems have gone online in other regions, and two systems providing regulation in ERCOT drop deployments this quarter. Even regions without frequency regulation wholesale market products are considering whether to procure energy storage for ancillary services, particularly as they deal with greater penetration of renewables. ISO-NE and MISO have recently tweaked their fast-regulation market rules, and the Southwest Power Pool is actively working to develop them. Ancillary services are seeing deployments outside of ISO footprints, in applications as varied as providing black-start services in the Imperial Irrigation District in California to managing the Arizona grid.

**Capacity and demand management**: SCE has led energy-storage procurement for local capacity requirements, and SDG&E has followed suit, even expediting its projects in response to the Aliso Canyon gas leak. Utilities in New York state have issued RFPs for front-of-the-meter energy storage to meet their capacity needs. Utilities in the Northeast U.S. are increasingly looking to energy storage as a means to reduce capacity payments. New York's storage mandate is expected to result in increased storage procurement by state utilities for capacity needs, and multiple utilities across the country have included energy storage as a capacity resource in their integrated resource plans.

**Generation and T&D deferral**: Utilities are beginning to value electricity infrastructure-investment deferral use cases for energy storage, as evidenced by PG&E's distribution deferral RFO and the recent activity in Arizona and Massachusetts, as discussed previously in this report. However, in the restructured markets, storage used for deferral cannot be bid into wholesale markets until initiatives such as ESDER Phase 2 and others become operational. This will result in storage procurements for deferral continuing to occur through bilateral agreements, such as the ones in place in Arizona, Ohio and Washington. In a policy statement, FERC supported simultaneous use of storage for market and cost-recovery applications. A newly announced 8-hour project in Nantucket, Massachusetts indicates that this could be a strong market for long-duration systems.

**Renewable integration**: Hawaii and Puerto Rico were some of the first markets to deploy energy storage for renewable integration. A similar trend is now being seen in California and Arizona, among other markets, where the concept of firm solar PPAs is gaining traction. Salt River Project in Arizona is deploying a 40 MWh system, while Tucson Electric Power recently announced a 120 MWh solar-paired system scheduled to come online in 2019. Municipal cooperatives have made moves on solar-plus-storage projects as well; examples include Austin Energy, Connecticut Municipal Electric Energy Cooperative, Kauai Island Utility Cooperative, and most recently the Brunswick Electric Membership Corporation in North Carolina.

## Front-of-the-Meter Market Outlook: Markets

GTM Research's outlook on key front-of-the-meter markets is presented below.

**California**: California will lead front-of-the-meter energy storage deployments through 2023, mainly driven by AB 2514 procurement targets.

**Hawaii**: HECO in its most recent Power Supply Improvement Plan reported a 70 MW project in Oahu with a 2019 completion date and an additional 100 MW for regulation. GTM Research expects deployments toward this PSIP will be responsible for most of the market growth in Hawaiian Electric Utilities' footprint, with an upside if additional ancillary services and load-shifting needs are identified, as well as with additional storage procurement by Kauai Island Utility Cooperative.

**Arizona**: With APS' recent integrated resource plan calling for more than 500 MW of energy storage by 2032, Tucson Electric Power announcing a 120 MWh solar-paired system, and Salt River Project even getting in on the action with a 40 MWh solar-paired system, Arizona emerged in 2017 as a key market to watch for grid-side energy storage over the next several years. The trend continues in 2018 with a large solar-plus-storage system announced and significant legislative activity.

**Massachusetts**: Massachusetts is the third state to pass an energy storage mandate, announced to be a 200 MWh "aspirational" target by January 1, 2020. Based on the economics of these projects, the Department of Energy Resources may increase or enhance the storage target over the following years, resulting in an upside market through 2025.

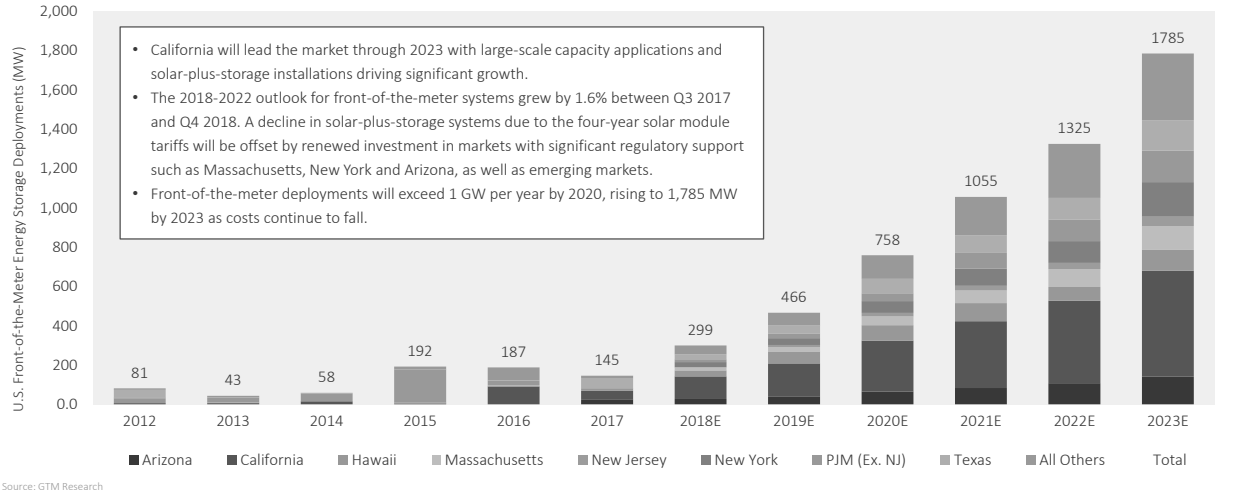
**PJM**: PJM will continue to grow at a slower pace (compared to the boom years of 2013 through 2015) in the short term, as changes to the dynamic regulation signal have significantly altered project economics in the ISO's territory. There will be a resurgence as PJM revamps and storage finds its footing in capacity performance products and other applications across the large market. The market's upside is significantly reliant on FERC, which may require the ISO to review its energy storage participation requirements through the complaint filed over the regulation market changes or through the notice of proposed rulemaking released in November 2016.

**Texas**: Despite passing on reforming its ancillary services market last year, some small projects have been installed or planned in the region. Further upside for the market relies on planned compressed-air energy storage projects, though their future and financing remains up in the air. Bethel Energy Center, the first of the two CAES projects to receive interconnection approval, could come online in 2020.

**All Others**: The Midwest, New England, Pacific Northwest states and Puerto Rico have taken the early charge on front-of-the-meter energy storage adoption in the "All Others" market category, although Florida, Colorado and other markets continue to emerge.

# Front-of-the-Meter Market Outlook (MW)

U.S. Annual Front-of-the-meter Energy Storage Deployment Forecast, 2012-2023E (MW)




Source: GTM Research

# Front-of-the-Meter Market Outlook (MWh)

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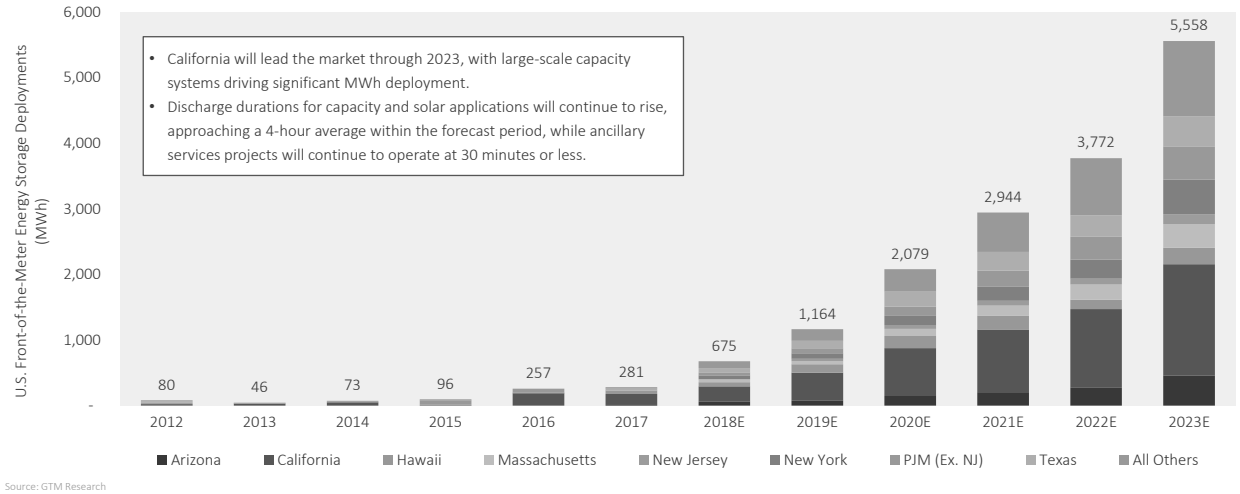



Source: GTM Research

# 6. Behind-the-Meter Market Trends

## Behind-the-Meter Policy and Market Developments, Q1 2018

**Colorado**

Members of the **Colorado State Senate Agriculture, Natural Resources and Energy Committee** voted to send Senate Bill 18-009, which would ensure customers have the right to install and use electricity storage, to the state Senate; such bills are key for reducing customer barriers to installing storage.

**California**

**CPUC** issued an order on storage for virtual net metering customers; it also established a working group to develop a greenhouse gas signal for SGIP-funded energy storage projects. The **CPUC** also issued guidance for multiple use applications.

**Arizona**

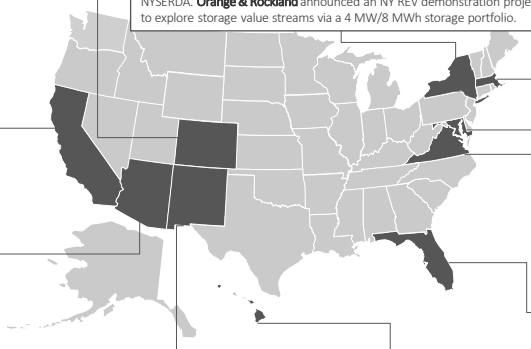
A massive energy modernization effort was proposed by the **Arizona Corporate Commission**, including a 3 GW energy storage target.

**New Mexico**

A BTM storage tax credit bill was introduced in the **New Mexico state legislature.**

**New York**

**Con Edison** initiated the next stage of its Demand Management Program, which includes incentives for battery and thermal storage. **Governor Cuomo** proposed a bold 1.5 GW energy storage target alongside announcements of $260 million in funding from the state's green bank and NYSERDA. **Orange & Rockland** announced an NY REV demonstration project to explore storage value streams via a 4 MW/8 MWh storage portfolio.



**Massachusetts**

**MA DOER** announced the results of the SMART auction. **MA DPU** approved new rates for **Eversource** DER customers that include a residential demand charge. **ACES** award winners were announced.

**Maryland**

**Maryland's storage tax credit** officially launched in January 2018.

**Virginia**

A BTM storage tax credit bill was introduced in the **Virginia state legislature.**

**Florida**

**The state legislature** introduced bills that, if passed, would establish a pilot program to explore resilience benefits from DERs including storage.

**Hawaii**

A bill to establish a storage tax credit was introduced in the **Hawaii State Senate.**

## Arizona Steps Into the Leadership Role

**In January 2018, Arizona Corporation Commissioner Andy Tobin proposed the Arizona Energy Modernization Plan.**

- The proposal would, among a wide range of goals, set a 3 GW energy storage target by 2030, leapfrogging established or proposed targets in California, Oregon, Massachusetts and New York and establishing Arizona as a leader in the field.
- Aside from the energy storage target, other portions of the bill would greatly spur storage deployments, including a clean peak standard, which would incrementally increase the percentage of peak load utilities would need to procure year by year through 2030. Such a requirement would likely significantly benefit storage with its unique ability to time-shift clean resources to periods of peak demand.
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**Governor Cuomo Eyes 1.5 GW Energy Storage Target**

The biggest news to come out of New York this quarter was legislation signed in November 2017 directing the Public Service Commission to adopt an energy storage target. Governor Cuomo set out his own 1.5 GW target for the state by 2025, a benchmark that will inform the PSC's deliberations. From the legislative and executive side, energy storage, along with offshore wind, has clearly emerged as an area of wide-ranging consensus amid the Reforming the Energy Vision proceeding. If similar mandates in California and Massachusetts are any indication, it will likely be well into 2018, if not 2019, before the PSC implements the storage target.

**Massive Funding: $200 Million From the Green Bank and $60 Million From NYSERDA Put the Spotlight on Pilots**

The governor's target comes with some serious teeth in the form of $200 million from the New York Green Bank and $60 million from NYSERDA toward energy storage pilots and deployments. This kind of large-scale investment will be just the momentum needed to drive storage deployments in a state where regulatory hurdles have, to date, stifled what would otherwise be a promising front-of-the-meter market for storage.

**NYISO Provides Visibility on Storage Integration and Eligibility**

The NYISO has also been hard at work under REV, creating a storage integration proposal that mirrors many of the proposals from 2016's FERC NOPR, and refining eligibility requirements for storage to ensure participate in wholesale markets. Such changes will be critical as New York truly revs up its investment in storage for truly sustainable business models to emerge.

PUCO Case No. 17-0032-EL-AIR et al.
OCC-POD-05-043 ATTACH A
Page 73 of 105

# CPUC Furthers Rulemaking on Virtual Net Metering and Greenhouse Gas Emissions

**CPUC Issued Decision on Virtual Net Metering for Solar-Plus-Storage**

- In January 2018, the California Public Utilities Commission (CPUC) issued the Decision to Facilitate Virtual Net Energy Metering Generation Paired With a Storage System (Decision 17-12-005). "Virtual net metering" refers to the process of allocating net energy metering (NEM) benefits from a solar system to tenants across multiple units in a building, such as an apartment complex.
- Previously, Decision 14-05-033 created a no-export rule that prohibits NEM compensation for exported energy that exceeds that produced by a NEM-eligible generator, such as a solar PV system. Decision 08-10-036 established the virtual net metering tariff and mandated that this tariff allow NEM benefits to be allocated to all meters on an individually metered multifamily affordable housing property, while Decisions 11-07-031 and 16-01-044 allowed any multi-tenant or multi-metered complex to take service under virtual net metering. Together, these policies created a situation where virtual NEM customers were discouraged from installing energy storage, as no economic benefit would be derived.
- CPUC decided to implement a policy whereby virtual net metering tariffs would be adjusted so that both the generator and storage device are located behind the same output meter, which would be required to include a physical non-import relay to prevent grid power from flowing toward the battery to ensure any electricity exports to the grid come from the generator only.
- **Clarity on the role of storage in virtual net metering is welcome, as it increases certainty when virtual net metering customers consider energy storage. The decision is likely to create upside for the behind-the-meter storage market, but not a significant one as a result of the limited proliferation of virtual net metering in California.**

**CPUC Established Energy Storage Greenhouse Gas Signal Working Group**

- In January 2018, CPUC issued a ruling to establish a working group to develop changes to the Self-Generation Incentive Program (SGIP) to improve greenhouse gas (GHG) emission reductions from storage systems.
- Previously, Decisions 16-06-055 and 15-11-027 together imposed operational requirements on energy storage systems to ensure GHG emission reduction, with the latter decision specifically updating roundtrip efficiency metrics to determine if energy storage systems resulted in reduced GHG emissions. In October 2017, the 2016 SGIP Storage Impact Evaluation Report prepared by Itron was released, which showed that, on average, energy storage systems increased net GHG emissions in 2016.
- The ruling directs the formation of a working group tasked with developing a GHG signal that will tell SGIP-funded energy storage systems when to charge or discharge to encourage GHG reductions. The working group must recommend a methodology by April 2, 2018.
- **Reducing GHG emissions is one goal of SGIP.** Therefore, **it is imperative that proper protocols be established to ensure energy storage systems are reducing, rather than creating, GHG emissions on balance.** It's unclear what the signal will be at this time, and how it may affect adoption (for example: economic outcomes may be negatively impacted by the signal, causing fewer customers to turn to storage). **The GHG signal proceeding must be watched carefully by industry players, and it is particularly important for stakeholders outside of California when thinking about how to ensure energy storage can play a role in fulfilling long-term climate goals.**

# Incentives Support the Future of Behind-the-Meter Storage in New York, Mass. and Maryland

**Next Phase of Con Edison's Demand Management Program Offers New Storage Pathways in New York**

- In January 2018, Con Edison announced incentive levels for the next stage of its Demand Management Program, which seeks to reduce electricity demand among non-residential customers.
- The 2019 program offers a battery storage incentive of $1,350/kW and a thermal storage incentive of $1,700/kW. The 2019 program has a funding level of $32 million. Auction B awards will be announced on April 19, 2018 while Auction C, if held, will open July 13, 2018. Projects must be completed by September 16, 2019.
- Given the 2019 program's funding and incentive levels, it **could create an upside of 23 MW of battery storage or 19 MW of thermal storage** if all funding is committed to either technology. **Though such an outcome is unlikely, the program nevertheless will increase storage deployment in New York.** Given the state's recent commitments to growing its storage market such as the upcoming energy storage target, such programs will be key to achieving these goals.

**SMART Compensation Levels Set in Massachusetts**

- In January 2018, Mass. DOER announced compensation levels for solar electricity were set under the Solar Massachusetts Renewable Target (SMART) program. SMART supplants Massachusetts' Solar Renewable Energy Credit II program, and transitions the behind-the-meter solar market to a new form of compensation for exported solar electricity. SMART's compensation is based on a competitive auction and system size; residential customers receive double the level of commercial customers.
- SMART also includes adders for projects that meet certain parameters, including solar systems paired with storage, which can yield an additional incentive of between roughly 2.5 cents/kWh and 7.6 cents/kWh, leading to a greater opportunity to deploy solar-plus-storage in Massachusetts. The SMART tariffs are expected to go into effect in the second half of 2018.
- **SMART invariably improves the economics of solar-plus-storage in Massachusetts and will lead to a significant upside as non-residential developers increasing pair solar and storage, while a greater number of residential customer pursue solar-plus-storage.** GTM Research conducted economic modeling of residential solar-plus-storage for both Eversource and National Grid customers under SMART and found a positive NPV and sub-6-year payback periods in both cases, though both were still weaker than solar-only.

**Maryland's BTM storage incentive**, which was passed as HB 490/SB 758 and covered in-depth in the Q2 2017 edition of this report, **officially launched in January 2018**. The program offers incentives of $5,000 per residential system and $75,000 per non-residential system for up to 30% of system cost, with an annual budget of $750,000.

# Incentives Support the Future of Behind-the-Meter Storage in Hawaii, New Mexico and Virginia

**Third Time's the Charm? Storage Tax Credit Proposal Returns to Hawaii**

- In January 2018, SB 2016 was introduced in the Hawaii state senate. SB 2016 seeks to establish an energy storage tax credit in Hawaii; similar bills were introduced two times before but both failed.
- If passed, SB 2016 would establish the following tax credits:
  - 30% for systems deployed between June 30, 2018 and December 31, 2018
  - 26% for systems deployed between January 1, 2019 and December 31, 2020
  - 22% for systems deployed between January 1, 2021 and December 31, 2021
  - 10% for systems deployed January 1, 2022 or later
- Currently, there is no funding limit for individual customers or on the whole for the program.
- **If passed, a large upside in Hawaii's BTM market would result, as storage economics would improve.** Already, residential solar-plus-storage has a clear economic case, and non-residential storage is beginning to take off. It remains unclear if the bill will pass, but given the greater maturity of the storage market the likelihood is higher today than for previous bills.

**New Mexico Enters the Ring: Proposed Storage Incentives in the Land of Enchantment**

- In January 2018, HB 77 was introduced in the New Mexico state House of Representatives. The bill sets out to establish energy storage tax credits for residential and non-residential storage.
- If passed, HB 77 would establish tax credits at the following levels:
  - Residential storage: Up to $5,000 but not exceeding 30% of the total cost of installation
  - Non-residential storage: Up to $75,000 but not exceeding 30% of the total cost of installation
- The program has a proposed annual budget of $750,000 and applies to storage installed after January 1, 2018 and before January 1, 2024. As such, if passed in its current form, the program could lead to **an upside of up to 900 residential storage systems or up to 60 non-residential storage over the program's six-year lifetime** assuming the funding was fully committed to one segment or the other. Given that New Mexico's storage market has seem minimal BTM storage market activity to date, this sort of growth would **cause a massive increase in New Mexico's BTM storage market, though the market will still remain modest compared to market leaders such as California, Hawaii and New York.**

**Virginia Explores Storage Incentives: Hope for Old Dominion?**

- In January 2018, HB 1018 was introduced in the Virginia state house of representatives.
- Bill sets out to establish energy storage tax credits for residential and non-residential storage.
- If passed, HB 1018 would establish tax credits at the following levels:
  - Residential storage: Up to $5,000 but not exceeding 30% of the total cost of installation
  - Non-residential storage: Up to $75,000 but not exceeding 30% of the total cost of installation
- The program has a proposed annual budget of $750,000 and applies to storage installed after January 1, 2018 and before January 1, 2023. As such, if passed in its current form, the program could lead to **an upside of up to 750 residential storage systems or up to 50 non-residential storage over the program's five-year lifetime** assuming the funding was fully committed to one segment or the other. Given that Virginia's storage market has seem minimal BTM storage market activity to date, this sort of growth would **cause a massive increase in Virginia's BTM storage market, though the market will still remain modest compared to market leaders such as California, Hawaii and New York.**

## Behind-the-Meter Storage Policy Roundup, Q1 2018

- In January 2018, HB 1133 and SB 1888 were introduced in the **Florida state legislature** with **the goal of establishing a security and disaster relief pilot program** that would include a provision for energy resources to improve resilience, such as energy storage. If established, the **program will explore the viability of energy storage and other DERs to enhance non-residential critical facility resilience and recovery from natural disasters.** Given the spate of weather damage to the U.S. in 2017, similar programs are expected to be explored by other states in 2018. If passed, the 2018-2019 fiscal year budget for the program will be set at $10M and the program results will be reported by October 1, 2019.
- The **Massachusetts Clean Energy Center** announced the winners of its Advancing Commonwealth Energy Storage (ACES) program in December 2017, awarding $20 million (double the initial amount) to 26 projects ranging from customer-sited systems at state universities to large front-of-the-meter projects for utilities. The projects represent 32 MW and 85 MWh of energy storage projects across multiple value streams and technologies, and they are set to provide a true sandbox for storage, demonstrating storage's potential across the entire value chain. These **demonstration projects will allow for exploration of multiple storage business models to inform future developer activities, while simultaneously offering learnings for the crafting of future policy concerning the services storage can provide.**
- In January 2018, the **Massachusetts Department of Public Utilities** issued Order 17-05-B, which approved a minimum monthly reliability contribution for new Eversource net-metered DER residential and non-residential customers. This decision marks Mass. DPU as the first state commission to approve mandatory demand charges for residential customers with behind-the-meter DERs, with a demand charge of $2.21/kW-month for residential customers under the new rate. The decision also eliminates optional time-of-use rates for residential DER owners. New rates will go into effect on January 1, 2019 for new net metered residential and non-residential customers; existing customers with DERs will not be subject to demand charges. Net metered residential customers currently include those with energy storage, solar and solar-plus-storage. A recent GTM Research analysis found that **the new rate structure slightly reduces the economic case for solar-plus-storage**, as there was greater value from storage for time-of-use shifting, but there was a large decrease in distribution charges which helps offset the increase in customer bills from demand charges. **More utilities will implement residential demand charges as DER penetration increases, but the opportunity for attractive solar-plus-storage economics is highly tied to the level of the demand charge and customer load profiles.** Note that GTM Research found in a previous report that non-residential standalone storage is generally economic when demand charges are $15/kW-month or greater. However, residential customers have flatter load profiles compared to non-residential customers, and thus would require even higher demand charges to make a clear economic case.

## Behind-the-Meter Storage Policy Roundup, Q1 2018 (Cont.)

- In February 2018, the **Colorado State Senate's Agriculture, Natural Resources and Energy Committee** voted to send Senate Bill 18-009 to the State Senate. The bill aims to **guarantee electricity consumers have the right to install and utilize electricity storage systems** on their property. **Ensuring there are as few barriers as possible to energy storage deployment is important to ensuring a healthy BTM storage market.** Though Colorado's BTM storage market is small today, it has seen some interest among market players and is the site of at least one BTM pilot project spearheaded by an electric utility (Xcel Energy).
- The **CPUC** released a decision on multiple use cases for energy storage that was generally in line with outlines and proposals set and discussed by ISOs and stakeholders in the past. The **primary clarification divides use cases into domains** (customer, distribution, and transmission) **and establishes that systems operating in a more distributed domain can provide services up, but systems cannot provide services down** (e.g., a system operating in the customer domain can provide services in all domains, but a system operating in the transmission domain cannot provide services in the distribution or customer domain).
- In February 2018, **Orange & Rockland** announced a proposed demonstration project under NY REV to explore non-residential energy storage value-stacking using a 4 MW/8 MWh portfolio developed, designed, installed, operated and maintained by Tesla; half the portfolio will consist of non-residential BTM projects and half will be from remote solar-plus-storage projects. O&R will retain dispatch benefits and operational priority of the aggregated fleet to supply grid services, while the systems will also provide benefits to host customers through reduced demand charges**. These types of projects are integral for proving the value aggregated BTM storage can provide, particularly for a market like New York, which has massive storage potential but has yet to see deployments that come close to matching the opportunity.**

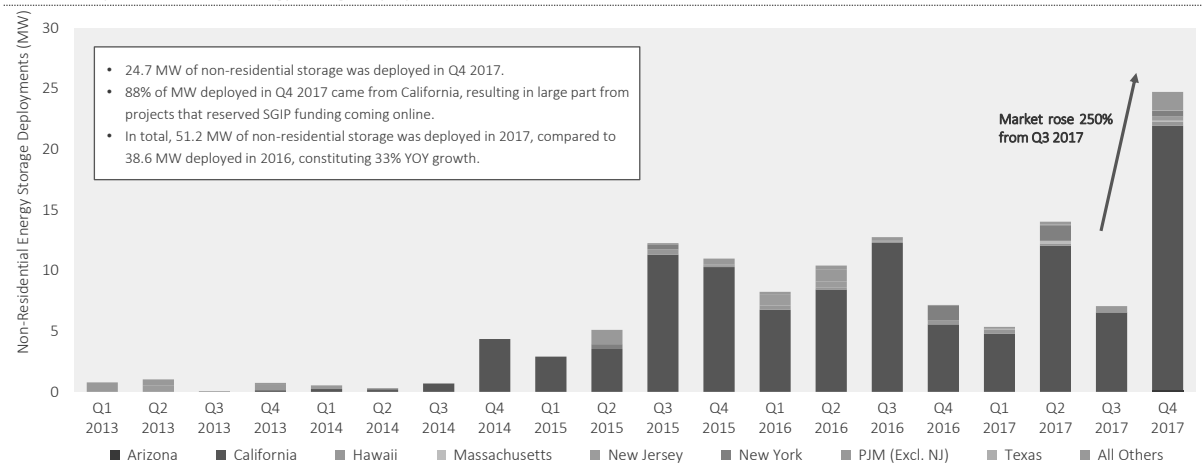
# 7. Non-Residential Market Trends

## Behind-the-Meter Non-Residential Market

PUCO Case No. 17-0032-EL-AIR et al.
OCC-POD-05-043 ATTACH A
Page 79 of 105

## Non-Residential Market Climbs to a Record 24.7 MW, Led by California

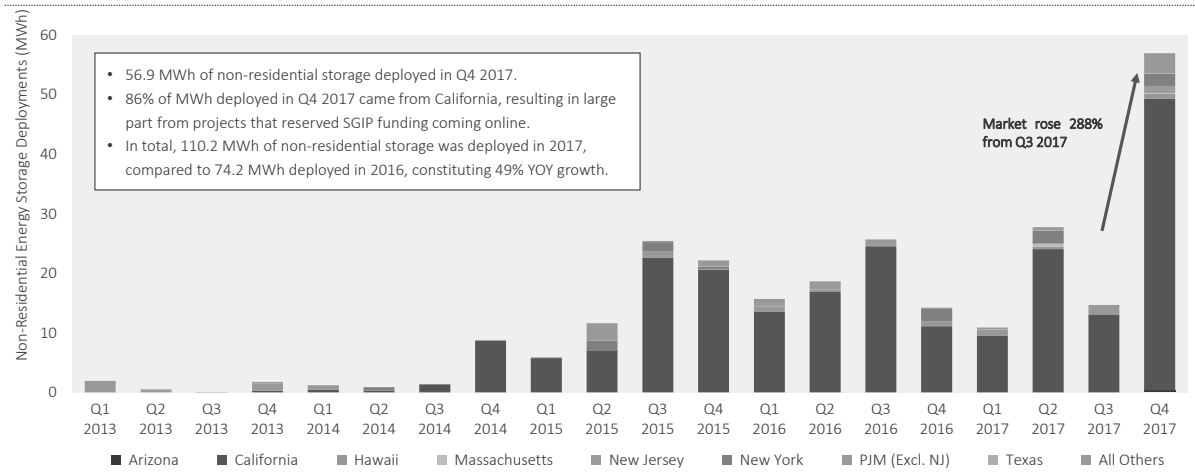
U.S. Quarterly Non-Residential Energy Storage Deployments (MW)




Source: GTM Research

## Non-Residential Market Climbs to a Record 56.9 MWh, Led by California

U.S. Quarterly Non-Residential Energy Storage Deployments (MWh)

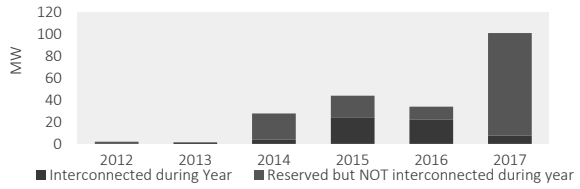



Source: GTM Research

## Non-Residential SGIP Reservations Surged in Q4 2017 as New Program Queue Resolves

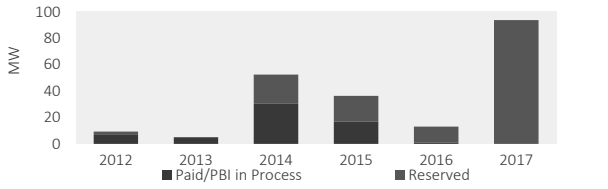
- The new iteration of the Self-Generation Incentive Program opened May 1, 2017. Step 1 was quickly subscribed across all four program administrators (CSE, PG&E, SCE and SCG), and as such the submitted projects entered into a lottery. Step 2 opened in early June 2017, and as of early February 2018 only SCE and SCG have reached the Step 2 allotment for large scale storage; SCE entered Step 3 in early January 2018 and SCG is expected to open Step 3 in the near future. For the year 2017: 450 projects totaling 93.7 MW reserved funding, a massive surge from several months ago when 36.2 MW had reserved funding. Step 2 of the program offers $0.4/Wh for standalone non-residential storage projects and $0.29/Wh for energy storage projects claiming the ITC, while Step 3 offers $0.35/Wh for standalone projects and $0.25/Wh for projects claiming the ITC. The incentive applies for up to 60% of eligible project costs.
- As of early February 2018, a total of 432 projects totaling 64.6 MW had received at least the 50% upfront incentive, while an additional 149 MW across 620 projects had reserved funding. A total capacity of 60.5 MW has been interconnected.
- Activity spiked in late 2017, as systems that applied for funds when Step 2 opened reserved funding. Confirmed reservation of SGIP funds took several months longer than expected given the large number of applications for the new program. Learnings from the early phases of the new program are expected to shorten the timeline for subsequent program steps.

Interconnected vs. Reserved Capacity by Year (MW)




Source: CPUC (SGIP), GTM Research

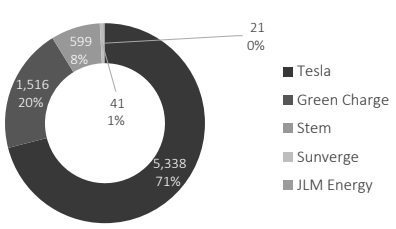
Paid vs. Reserved Capacity by Year of SGIP Application (MW)




Source: CPUC (SGIP), GTM Research

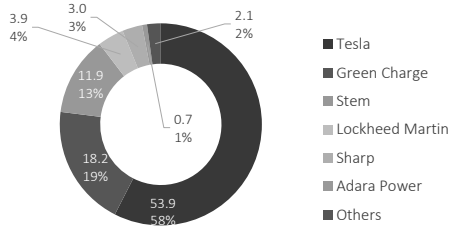
## Non-Residential SGIP Reservations Surged in Q4 2017 as New Program Queue Resolves (Cont.)

Projects Interconnected in 2017, Non-Residential (kW, % Vendor Market Share)




Source: CPUC (SGIP), GTM Research

Applications Received in 2017 With Reserved Funding, Non-Residential (MW, % Vendor Market Share)




Source: CPUC (SGIP), GTM Research

- As of early February 2018, a total of 432 projects totaling 64.6 MW had received at least the 50% upfront incentive, while an additional 149 MW across 620 projects had reserved funding. A total capacity of 60.5 MW has been interconnected.
- 7.52 MW of non-residential storage was interconnected in 2017 via SGIP. Tesla leads the market with 5.3 MW (71% market share), followed by Green Charge with 1.5 MW (20%).
- Tesla accounts for the largest share of reserved project capacity with 58%, followed by Green Charge with 19%. A more diverse array of players have reserved funding in recent months, including companies like Stem, Adara Power, Johnson Controls, PowerSecure, Sharp, Ice Energy, Viking Cold Solutions, Lockheed Martin and more.
- Though the new SGIP has seen rule changes, including changes to the incentive structure and a developer cap, the market is nevertheless dominated by the same vendors that held much of the market in 2016. Note that Tesla supplies batteries to a number of players while also developing projects, and thus influences the market at both ends of the value chain.

## Non-Residential Market Outlook: Applications

GTM Research analysis suggests that there will be three broad application areas for non-residential energy storage: demand-charge management, resiliency and backup, and grid and wholesale market services.

**Demand-charge management**: A majority of commercial and industrial customers pay as much as 50% of their electricity bills in demand charges. Energy storage offers peak demand-reduction opportunities, leading to 20% to 30% electricity bill savings in many cases. Markets with high demand-charge tariffs (upward of $15/kW to $30/kW) represent a particularly attractive opportunity already, and by 2021, we anticipate that even markets with tariffs of $11/kW and above will start to look attractive.

**Resiliency and backup**: Commercial and industrial customers can be sensitive to outages due to expensive equipment and critical facilities. States in the Northeast have established programs to increase grid resiliency, and states in the Northwest are pursuing resiliency policies, relying on energy storage along with other upgrades. However, customers with existing backup power needs may already possess this type of infrastructure in the form of diesel generators, in which case the value proposition for storage requires an additional benefit such as electricity bill reduction or reducing carbon emissions. In the wake of recent hurricanes affecting Puerto Rico, Texas and the Southeastern U.S., the resilience conversation is expected to intensify and storage will increasingly be a part of these conversations.

**Grid and wholesale market services**: California utilities have been at the forefront of exploring the use of energy storage for grid services, including demand response, ancillary services and local capacity. In September 2016, SCE awarded 50 megawatts' worth of contracts for demand response from non-residential energy storage and energy conservation under the utility's Preferred Resources Pilot program, while the Demand Response Auction Mechanism program recently saw at least 3.7 MW of behind-the-meter storage committed for the 2018 and 2019 delivery periods. The New York Reforming the Energy Vision initiative has entered into its demonstration phase, in which several pilot projects involve energy storage; additionally, the Brooklyn-Queens Demand Management program in New York City seeks to employ energy storage for demand response, with an expansion announced in July 2017. Hawaii recently introduced a demand response plan that proposes four grid services for which it could procure energy storage and other distributed resources. In Hawaii, HECO rolled out storage 1 MW of systems under the Energy Excelerator program to improve grid efficiency. In Massachusetts, several storage companies received funding for BTM storage projects under the MA DOER's Peak Demand Grant Reduction program, with up to 2 MWh of storage resulting in the next few years, while the ACES program will explore a variety of use cases for non-residential storage.

## Non-Residential Market Outlook: Key Markets

GTM Research's outlook on key non-residential markets is presented below.

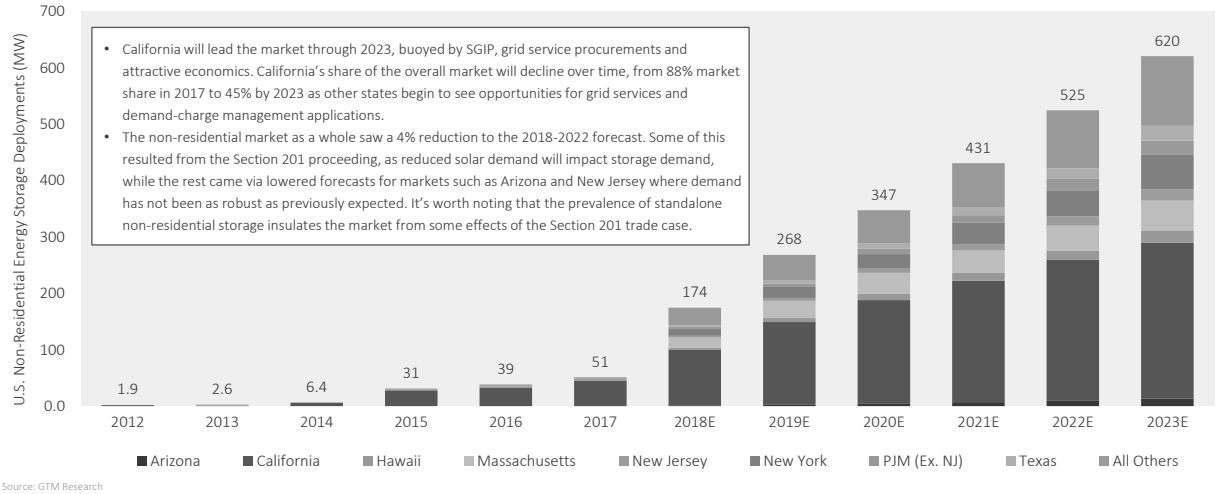
**California:** California will remain the strongest market for non-residential storage through 2022, though it will lose a slight amount of market share as other state markets blossom. The infusion of additional funding under the new SGIP regime will buoy the market, particularly as the new program's budget was recently doubled. Furthermore, non-residential procurements under programs like DRAM, LCR and PRP will come online over the next few years, adding more growth in California's non-residential storage market. California's market will see strong growth, increasing 6x from 45 MW in 2017 to 277 MW in 2023.

**New York:** New York's BQDM program influenced significant procurement of non-residential storage in New York City, and these deployments will come online within the next few years, while further deployments are expected under the program's next stage. Furthermore, the Fire Department of New York and Department of Buildings' battery safety study is expected to help ease challenges around deploying energy storage within NYC, reducing permitting and deployment timelines. The city also has a storage target of 100 MWh by 2020, indicating greater interest in deploying the technology, particularly to deal with peak load during the summer months. Additionally, a storage mandate has been approved, with the ultimate level to be set by the end of 2018. New York's annual market will soar to 61 MW in 2023.

**Massachusetts:** Massachusetts will see a notable upside in non-residential storage over the next few years, boosted by programs such as Advancing Commonwealth Energy Storage. Furthermore, the next iteration of the state's NEM policy, known as SMART, includes an incentive for solar-plus-storage deployments, which will buoy the non-residential market. Non-residential market players indicate that Massachusetts will be a key market in 2018 and beyond, with as much as 30%-40% of the state's new solar projects to be paired with storage in 2019. The state's 200 MWh storage target will also likely provide some upside in the non-residential market. These factors will contribute to a 54 MW annual market by 2023.

## Non-Residential Market Outlook (MW)

U.S. Annual Non-Residential Energy Storage Deployment Forecast, 2012-2023E (MW)

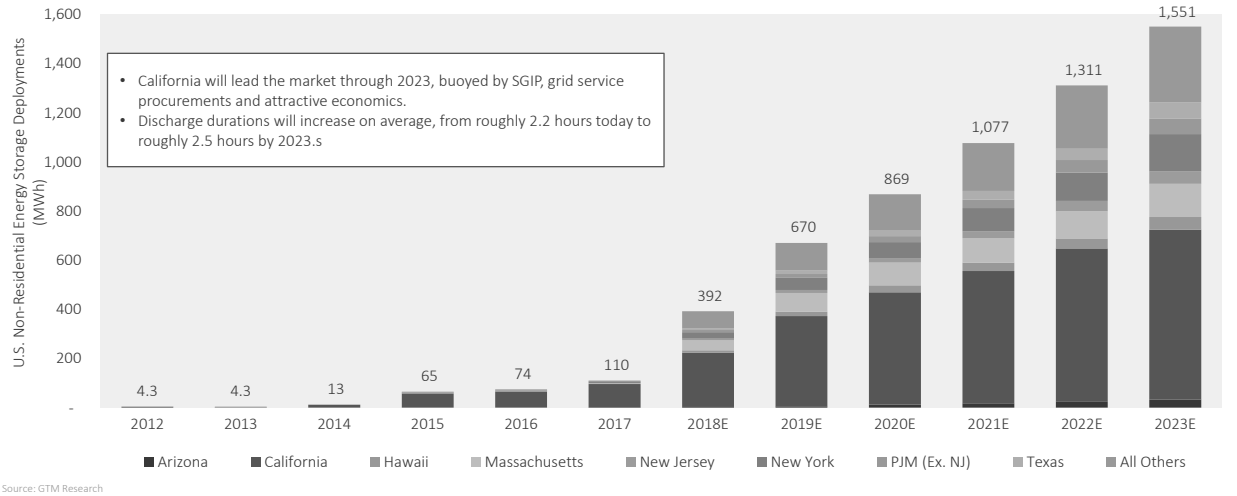



Source: GTM Research

PUCO Case No. 17-0032-EL-AIR et al.
OCC-POD-05-043 ATTACH A
Page 86 of 105

## Non-Residential Market Outlook (MWh)

U.S. Annual Non-Residential Energy Storage Deployment Forecast, 2012-2023E (MWh)




Source: GTM Research

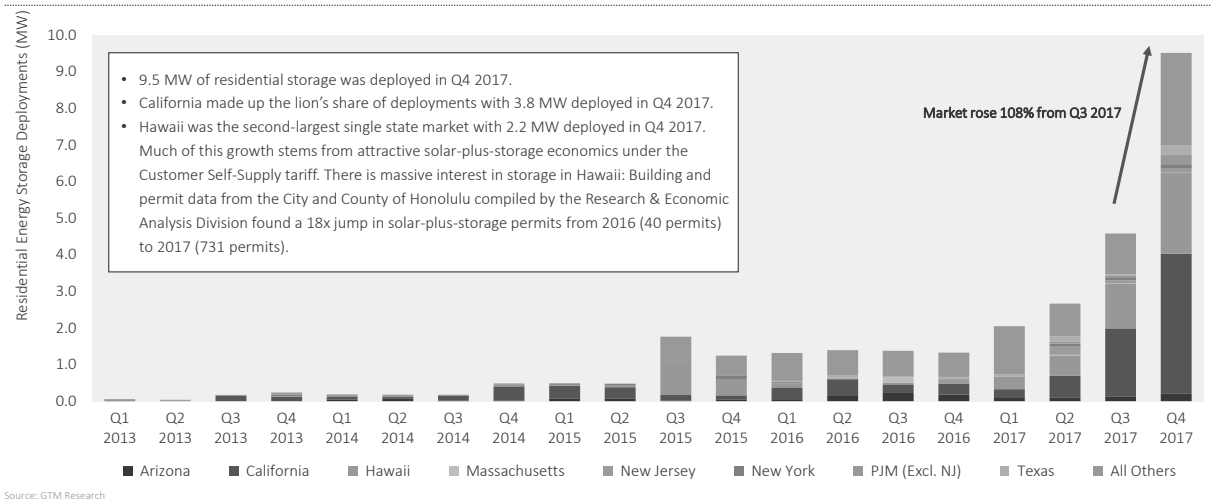
# 8. Residential Market Trends

## Behind-the-Meter Residential Market

PUCO Case No. 17-0032-EL-AIR et al.
OCC-POD-05-043 ATTACH A
Page 88 of 105

## Residential Market Rose to a Record 9.5 MW, Bolstered by Gains in California and Hawaii

U.S. Quarterly Residential Energy Storage Deployments (MW)

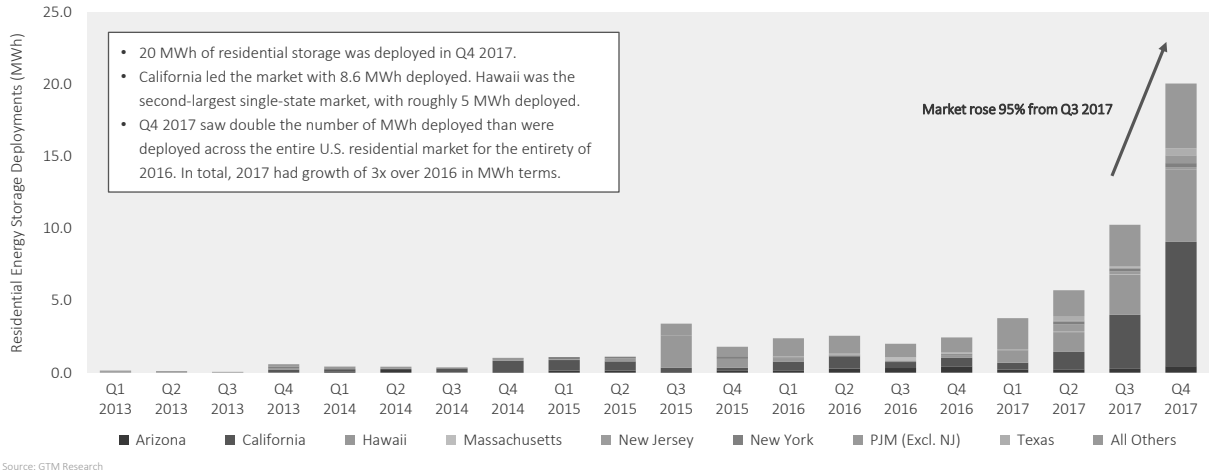



Source: GTM Research

PUCO Case No. 17-0032-EL-AIR et al.
OCC-POD-05-043 ATTACH A
Page 89 of 105

## Residential Market Rose to a Record 20 MWh, Bolstered by Gains in California and Hawaii

U.S. Quarterly Residential Energy Storage Deployments (MWh)

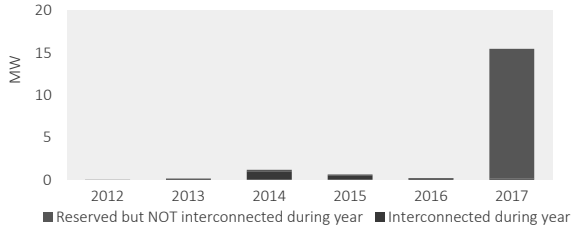



Source: GTM Research

# Massive Influx of Residential SGIP Reservations as Program Pushes Forward in Q4 2017

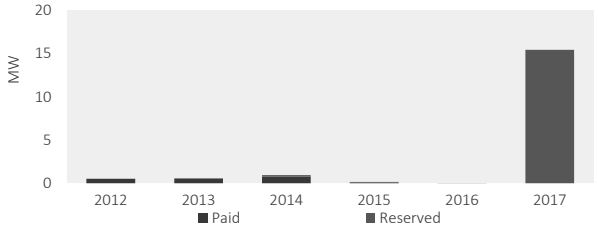
- The new iteration of the Self-Generation Incentive Program opened May 1, 2017. Step 1 was quickly subscribed across all four program administrators (CSE, PG&E, SCE and SCG), and as such the submitted projects entered into a lottery. CSE is the only program administrator that has filled Step 3, while the other three are still in Step 2 (with the exception of Step 3 of the Equity budget, which is open for SCE). Step 2 of the program offers $0.4/Wh and Step 3 offers $0.35/Wh for residential storage projects for up to 60% of eligible project costs.
- As of early February 2018, a total of 394 projects totaling 1.96 MW have received an SGIP incentive, while 15.7 MW across 2,355 projects have reserved funding, and 1.98 MW have been interconnected. 15.4 MW of projects received in 2017 have reserved funding, the majority of which was allocated in the last few months of 2017.
- The residential carve-out in the new iteration of the SGIP has proved instrumental in increasing the amount of funds reserved under the program, evidenced by the fact that within seven months of the new program opening, the reserved residential capacity was over nine times the entire reserved and paid capacity for the years 2013 through 2016. The residential carve-out has ensured greater certainty for residential storage market players in California, given that funds are allocated specifically to their segment. Residential market players have indicated a more bullish outlook for the next few years given these changes. As a result, the share of residential projects in the overall SGIP ecosystem will increase substantially compared to previous years.

Interconnected vs. Reserved Capacity by Year (MW)




Source: CPUC (SGIP), GTM Research

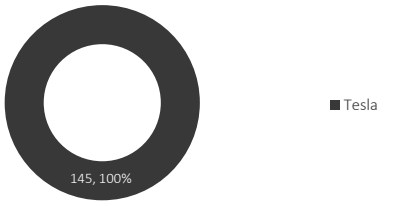
Paid vs. Reserved Capacity by Year of SGIP Application (MW)




Source: CPUC (SGIP), GTM Research

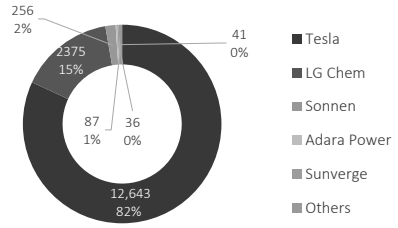
## Massive Influx of Residential SGIP Reservations as Program Pushes Forward in Q4 2017 (Cont.)

Projects Interconnected in 2017, Residential (kW, % Vendor Market Share)




Source: CPUC (SGIP), GTM Research

Applications Received in 2017 With Reserved Funding, Residential (kW, % Vendor Market Share)




Source: CPUC (SGIP), GTM Research

- As of early February 2018, a total of 394 projects totaling 1.96 MW have received an SGIP incentive, while 15.7 MW across 2,355 projects have reserved funding, and 1.98 MW have been interconnected. 15.4 MW of projects received in 2017 have reserved funding, the majority of which was allocated in the last few months of 2017.
- In 2017, only 145 kW of residential storage was interconnected, all of which was from Tesla. Now that a plethora of residential projects have reserved SGIP funds, more projects are expected to be deployed in the coming months from a wider variety of market players.
- Tesla accounts for the largest share of reserved funding with 82%, followed by LG Chem with 15%. Both companies offer storage solutions to a variety of players.
- The new SGIP has seen a massive spike in residential storage reservations compared to previous years, much of which is likely attributable to the residential carve-out. Such a funding allocation provides greater market certainty for residential players, and provides a massive boon to a segment which currently lacks clear economic drivers for deployment.

## Residential Market Outlook: Applications

GTM Research analysis suggests there will be three broad application areas for residential energy storage: time-of-use shifting, resiliency and backup; self-consumption; and grid and wholesale market services.

**Time-of-use shifting**: Most residential tariff regimes have flat tariffs, but a growing number of utilities are introducing time-of-use (TOU) tariff structures, some accelerated by the rise in solar NEM customers. As markets move to time-of-use tariffs or reduce the value of NEM, the economic case for adding storage to solar will become stronger. In California, the recent NEM 2.0 plan added non-bypassable charges of 2 to 3 cents/kWh on solar customers, as well as a mandatory TOU tariff. Both of these changes can increase the value of time-of-use shifting; recent economic analysis by GTM Research found NPV positive outcomes for solar-plus-storage under TOU rates for PG&E, SCE and SDG&E, though solar-plus-storage still has weaker economics compared to solar-only. Furthermore, utilities in other states including Arizona, Colorado and New York have proposed or are in the process of implementing optional residential TOU rates, which may present additional opportunities for residential energy storage, depending on the delta between electricity cost at off-peak and peak periods; modeling for Arizona found a positive NPV in one TOU rate, but with a 15+ year payback.

**Self-consumption:** "Self-consumption" refers to a customer consuming electricity she has stored in her storage system. Self-consumption requires some form of customer-sited generation, usually solar PV, in order to charge the storage system and offset grid consumption. This value stream becomes more attractive in response to some types of NEM reform, as lower compensation for exported solar electricity increases the value of storing and consuming electricity the customer generates. This value stream encourages positive economic outcomes today in markets such as Hawaii under HECO's Customer Self-Supply tariff or in California under NEM 2.0.

**Resiliency and backup**: Residential customers do not necessarily have expensive equipment or critical facilities that require backup. However, customers have shown a willingness to pay for protection from outages, as evidenced by residential backup generation sales. States in the Northeast have established programs to increase grid resiliency, relying on energy storage, along with other upgrades. System vendors and installers consistently mention backup as a value stream of interest desired by end customers, particularly those in the Northeast U.S. In the wake of recent hurricanes affecting Puerto Rico, Texas and the Southeast U.S. the resilience conversation is expected to intensify, and storage will increasingly be a part of these conversations.

**Grid and wholesale market services**: California utilities have been at the forefront of exploring the use of energy storage for grid services, including demand response, ancillary services and local capacity. SCE awarded 5 MW/20 MWh of residential energy storage under its Preferred Resources Pilot program in September 2016. The New York REV initiative has entered into its demonstration phase, in which several pilot projects involve energy storage. Hawaii recently introduced a demand response plan that proposes four grid services for which it could procure energy storage and other distributed resources. Utilities in the states of Kentucky and Vermont have also initiated grid services programs. Arizona has initiated multiple utility-sponsored residential solar-plus-storage programs to enable better utility load management and tariffs. Xcel Energy in Colorado is in the process of deploying an energy storage pilot that includes six residential systems to explore value that can be provided to both customers and the electric grid. Other utilities are entertaining opportunities to deploy residential storage, with more pilot programs expected to be announced in the coming year.

## Residential Market Outlook: Markets

GTM Research's outlook on key residential markets is presented below.

**California:** California will remain a leader in residential storage growth, particularly as the new iteration of the SGIP includes a carve-out for residential storage; as a result, a greater share of residential projects is expected to be deployed under SGIP, which is already bearing out by deployment numbers from Q4 2017. With the coming of NEM 2.0, opportunities for storage are increasing as TOU rates and non-bypassable charges come into force alongside reduced compensation for exported solar energy. Furthermore, 5 MW/20 MWh of residential storage was procured under the Preferred Resources Pilot, with these systems set to come online by mid-2019. These factors will culminate in a 513 MW annual market by 2023, 78 times the size of the 2017 market.

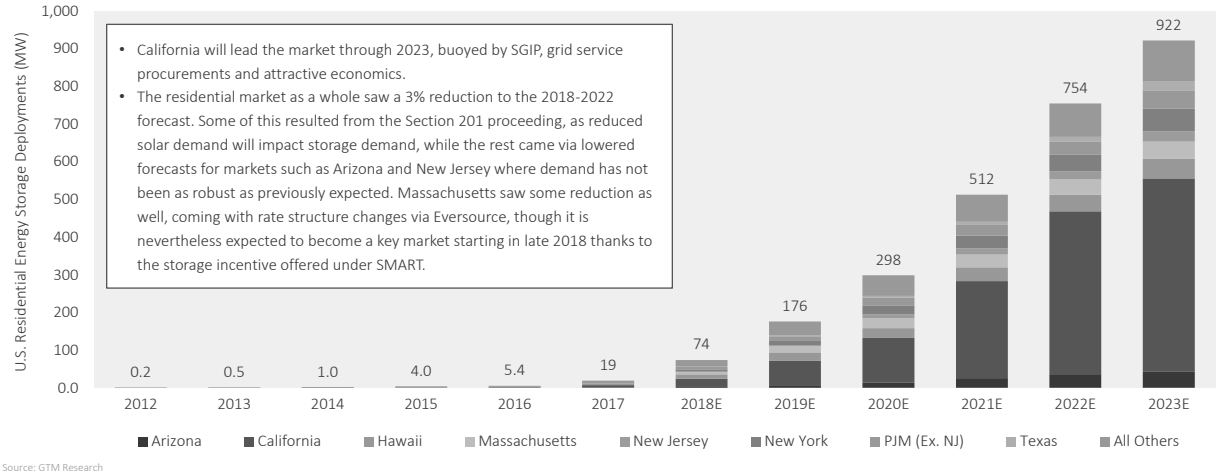
**Hawaii:** Hawaii reopened its Customer Grid Supply (CGS) program in early 2017 with a 20 MW cap, putting a damper on the storage market, as the alternative tariff, Customer Self-Supply (CSS), encourages solar-plus-storage. As the new CGS cap was reached, all new solar customers must enroll in CSS. Q4 2017 saw a further rise of CSS, as a substantial number of storage systems were interconnected under this program. The new solar program will lead to a further upside for storage, because although CGS is reopening as CGS+, there is both a cap and a rule that credits can only be gained at specific hours, meaning customers on this tariff may also pursue storage, while the Smart Export tariff is configured for solar-plus-storage. Anecdotal discussions with system integrators, developers and installers active in Hawaii's residential energy storage market indicate a bullish outlook for the next few years. Hawaii's annual residential storage market is expected to reach 52 MW by 2023, 12 times the size of the 2017 market.

**The Northeast:** The Northeast will continue to prove an interesting region for residential storage and constitute a non-trivial share of installations for resilience applications. However, given the lack of a clear economic case for backup power today, these deployments will remain concentrated among customers purchasing storage primarily for emotional reasons. This will change if residential storage systems are able to be leveraged for grid services such as peak load reduction, as is currently ongoing in Green Mountain Power territory in Vermont, although as a total addressable market, Vermont remains small. Con Edison's NY REV virtual power plant demonstration project, which would add ~300 new residential systems, is currently stalled, and thus it is unclear when or even if these systems will be added. Massachusetts is a market to watch, as the new solar program, SMART, begins in H2 2018 and includes an adder for solar systems paired with storage; anecdotal discussions with system vendors and installers indicate that Massachusetts will be a priority market in 2018 and 2019, while GTM Research found a positive economic outcome for residential solar-plus-storage in Massachusetts for customers on a TOU rate.

**The Southeast:** Though not a key market today, a fair number of market players indicated increasing demand from states like Florida and Georgia for resilience applications. Though not an economic use case, these markets are nevertheless seeing non-trivial demand despite being relatively small markets today.

# Residential Market Outlook (MW)

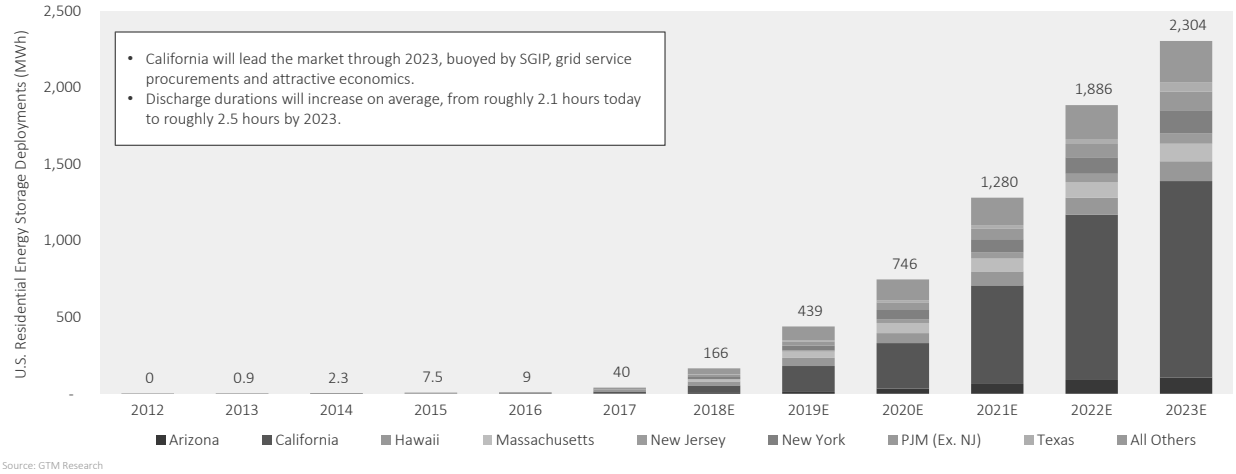
U.S. Annual Residential Energy Storage Deployment Forecast, 2012-2023E (MW)




Source: GTM Research

## Residential Market Outlook (MWh)

U.S. Annual Residential Energy Storage Deployment Forecast, 2012-2023E (MWh)




Source: GTM Research

# 9. Appendices

## Appendix A: Metrics, Methodology and Data Sources

- **Metrics:** GTM Research reports energy-storage capacity data in terms of power capacity (watts) and energy capacity (watt-hours). All of our data sources (details on data sources below), including program administrators, utility companies, utility commissions and system operators, currently track and report energy storage queue, deployments and interconnections in terms of power capacity: watts, kilowatts or megawatts. GTM Research reports storage capacity data in power capacity terms (watts, kilowatts or megawatts) based on the reported data, and in energy capacity terms (watt-hours, kilowatt-hours or megawatt-hours) using a mix of publicly available and survey data, and converting power capacity to energy capacity by multiplying by discharge duration (hours). This distinction is particularly important, as energy storage technology can be deployed for a wide range of discharge durations, from a few minutes (for applications such as power quality and frequency regulation) to a few hours (for applications such as bulk energy arbitrage).
- **Segments:** GTM Research reports the energy-storage capacity data in three segments: residential, non-residential and front-of-the-meter. Projects that are deployed on the end-customer side of the meter (i.e., behind-the-meter) are reported as falling in either the residential or nonresidential segment. Projects that are deployed on the utility side of the meter (front-of-the-meter), irrespective of their size, are reported in the front-of-the-meter segment.

## Appendix A: Metrics, Methodology and Data Sources (Cont.)

- **Historical Deployment Data:** Quarterly capacity deployment data is collected from program administrators, system operators, utility companies and utility commissions. In some cases, the program administrators report incentive application and award payment dates instead of deployed dates. In such cases, GTM Research consults with the utility companies or estimates the most likely installation date, based on our knowledge of typical project installation cycles in various markets. For front-of-the-meter projects, GTM Research maintains a database that tracks the status of planned and deployed front-of-the-meter projects. GTM Research reports deployment dates based on their "interconnection" or "online date" from interconnection queue data maintained by ISOs and utility companies. In certain cases, GTM Research consults with project developers and installers to provide the project commissioning (deployment) date. GTM Research also utilizes the U.S. DOE Global Energy Storage Database for information on technology in instances in which the information is not received from our primary data sources.
- **System Price Data:** Reported system price data is not associated with specific projects deployed, since pricing data is considered to be sensitive by vendors and developers, given the number of projects that are being deployed and the varying project cycles. System price data is the outcome of GTM Research's bottom-up cost survey based on interviews with vendors across the value chain.

# Appendix B: Acronyms

- **AB 2514:** California state law requiring the California Public Utilities Commission to adopt an energy storage procurement target. In October 2013, CPUC established an aggregate target of 1,325 MW by 2020 for PG&E, SCE and SDG&E.
- **APS:** Arizona Public Service, an Arizona investor-owned utility
- **BQDM:** Brooklyn-Queens Demand Management, a program in New York City to implement non-traditional technology to defer the need for a $1B substation
- **C&I:** Commercial and industrial
- **CHP (combined heat and power)*:** Generation of useful electric and heat energy using the same conversion system
- **CPUC:** California Public Utilities Commission
- **DER:** Distributed energy resource
- **DOD:** Depth of discharge
- **DOE:** United States Department of Energy
- **DOER:** Department of Energy Resources (Massachusetts)
- **DR (demand response)*:** Reduction of retail electricity end users' electric load in response to control or price signals
- **DRAM:** Demand Response Auction Mechanism, program to procure demand response in California
- **EE:** Energy efficiency
- **EPC:** Engineering, procurement and construction
- **ERCOT (Electric Reliability Council of Texas):** Independent system operator for most of Texas
- **ESDER (Energy Storage and Distributed Energy Resources):** California stakeholder initiative to develop rules for storage and other DER market participation

## Appendix B: Acronyms

- **FERC:** Federal Energy Regulatory Commission
- **FTM:** Front-of-the-Meter, refers to storage sited on the utility-side of the meter
- **GW (Gigawatt):** Unit of energy storage capacity in power; 1,000 MW
- **GWh (Gigawatt-hour):** Unit of energy storage capacity in energy; 1,000 MWh
- **HECO:** Hawaiian Electric Company, a Hawaii IOU and subsidiary of Hawaiian Electric Industries
- **HELCO:** Hawaii Electric Light, one of the Hawaiian Electric Companies family that has jurisdiction over Hawaii Island
- **IRP:** Integrated resource plan
- **ISO (independent system operator):** Operates a region's transmission grid and wholesale electric markets, similar to a regional transmission organization (RTO)
- **IOU:** Investor-owned utility
- **JEA:** Jacksonville Electric Authority, a community owned electric utility located in Jacksonville, Florida
- **kW (kilowatt):** Unit of energy storage capacity in power; 1,000 W
- **kWh (kilowatt-hour):** Unit of energy storage capacity in energy; 1,000 Wh
- **LCR (local capacity requirements):** Minimum local resource capacity needed for reliability in an area
- **MUA:** Multiple-use applications
- **MECO:** Maui Electric, one of the Hawaiian Electric Companies family that has jurisdiction over the island of Maui, Molokai and Lanai
- **MW (Megawatt):** Unit of energy storage capacity in power; 1,000 kW
- **MWh (Megawatt-hour):** Unit of energy storage capacity in energy; 1,000 kWh
- **NOPR:** Notice of proposed rulemaking

# Appendix B: Acronyms

- **NWA:** Non-wires alternative, a technology that can fulfill an electric grid upgrade in place of traditional technology
- **NY REV (Reforming the Energy Vision):** State policy aimed at increasing deployment of renewable generating resources and modernizing the grid
- **NYSERDA:** New York State Energy Research and Development Authority
- **PCS:** Power conversion system or power conditioning system – typically referencing power electronics converting DC to AC at a point of interconnection
- **PG&E:** Pacific Gas & Electric, a California IOU
- **PJM:** RTO for all or parts of 13 states (from Illinois to New Jersey) and the District of Columbia
- **PRP (Preferred Resource Pilot):** SCE's study to determine if clean energy sources can offset increasing customer demand
- **PSC:** Public Service Commission
- **PSCO:** Public Service Company of Colorado, Xcel Energy subsidiary
- **PUC:** Public Utilities Commission
- **RegD:** PJM's classification for fast-responding ("dynamic") resources
- **RFI/RFO/RFP:** Request for information/request for offer/request for proposal
- **RPS (renewable portfolio standard):** Regulatory requirement mandating a particular amount of renewables in the jurisdiction's electricity mix
- **RTO (regional transmission organization):** Operates a region's transmission grid and wholesale electric markets, similar to an ISO
- **SCE:** Southern California Edison, a California IOU
- **SDG&E:** San Diego Gas & Electric, a California IOU
- **T&D:** Transmission and distribution
- **TEP:** Tucson Electric Power, an Arizona IOU

# Appendix C: Key Documents

**Arizona**
- Arizona Energy Plan

**California**
- Decision 17-12-005
- Rulemaking 12-11-005: Assigned Commissioner's Ruling Establishing and Energy Storage Greenhouse Gas Signal Working Group
- CPUC Decision on Multiple Use Applications
- Vote on Storage in place of Peakers
- SCE Updated Moorpark Resource Plan

**Colorado**
- Senate Bill 18-009
- Xcel All Source Solicitation

**Federal**
- U.S. House of Representatives Storage Tax Credit Bill
- FERC Ruling on Wholesale Market Participation

**Florida**
- HB 1133
- SB 1888

**Hawaii**
- SB 2016

**Maryland**
- HB 490
- SB 750

**Massachusetts**
- MA DOER Order 17-05-B
- SMART Portal
- ACES Award Winners

Michigan
- PSC Guidelines on IRPs Including Energy Storage

**Minnesota**
- Great River Energy Solar-plus-Storage RFP

# Appendix C: Key Documents (Cont.)

**Nevada**

- Nevada Energy All Source RFP

**New Hampshire**

- HB 1647

**New Mexico**

- HB 77

**New York**

- New York Storage Mandate
- New York Clean Energy Plan
- NYISO State of Storage Report
- Orange & Rockland NWA RFP
- Orange & Rockland NY REV Demonstration Project
- Con Edison Demand Management Program Portal
- NYISO Spinning Reserves Eligibility

**North Carolina**

- Duke Updated IRP

**Texas**

- Texas PUC Decision on AEP's Proposed Deferral System

**Virginia**

- HB 1018

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March 2018

gtmresearch
is now Wood Mackenzie

**Duke Energy Ohio**
**Case No. 17-0032-EL-AIR, *et al.***
**OCC Third Set of Interrogatories - Stipulation**
**Date Received: May 11, 2018**

**OCC-INT-03-058**

**REQUEST:**

Referring to the Reliability Standards section on page 13 of the Stipulation and Recommendation, has Duke performed any cost benefit analysis related to the battery storage project(s) that are proposed to be funded by customers through the Rider DCI?

**RESPONSE:**

No.

**PERSON RESPONSIBLE:**

Zachary Kuznar

**Duke Energy Ohio**
**Case No. 17-0032-EL-AIR, *et al.***
**OCC Third Set of Interrogatories - Stipulation**
**Date Received: May 11, 2018**

**OCC-INT-03-059**

**REQUEST:**

Referring to the Reliability Standards section on page 13 of the Stipulation and Recommendation, will a cost benefit analysis be completed before any battery storage project(s) are funded through the Rider DCI? What criteria will be used to evaluate the cost effectiveness of the proposed battery storage project(s)?

**RESPONSE:**

It is unknown if a cost benefit analysis will be completed before any projects are funded through Rider DCI and final criteria have not been determined to evaluate the cost effectiveness of the proposed storage projects.

**PERSON RESPONSIBLE:**

Zachary Kuznar

**Duke Energy Ohio**
**Case No. 17-0032-EL-AIR, *et al.***
**OCC Fifth Set of Interrogatories - Stipulation**
**Date Received: May 23, 2018**

**OCC-INT-05-133**

**REQUEST:**

Regarding the response to OCC STIP- INT-03-0057, is the incremental amount of reliability improvement such as the number of outages that will be avoided and/or customer minutes interrupted that are avoided considered to determine if a battery storage project is cost effective?

**RESPONSE:**

Improving the reliability for customers is one metric that will be evaluated in determining the value of the storage asset.

**PERSON RESPONSIBLE:** Zachary Kuznar

**Duke Energy Ohio**
**Case No. 17-0032-EL-AIR, *et al.***
**OCC Second Set of Interrogatories - Stipulation**
**Date Received: April 26, 2018**

**OCC-INT-02-007**

**REQUEST:**

Page 13 of the Stipulation states that Duke may invest up to $20 million for a battery storage project, with those costs charged to customers through Rider DCI.

a. Explain the basis for the $20 million amount.

b. Will Duke be required to show that any such battery storage project is cost-effective (i.e., that the benefits to customers are greater than the cost of the project)?

**RESPONSE:**

a. Duke Energy Ohio is proposing a pilot of 10 MW to deploy in its service territory so it can show at scale the value that distributed battery storage can provide to the grid. It anticipates that this amount of storage fully installed will cost ~$20 MM.

b. Distributed battery storage can provide tremendous stacked benefit streams across the Transmission and distribution systems including T&D deferral, improvements in power quality and reliability, along with bulk system benefits such as frequency regulation. This pilot proposed by Duke Energy Ohio will be extremely important in proving these business cases so energy storage can be seamlessly integrated into the Company's electric system for the benefit of all retail customers as the Company continues to modernize its system.

**PERSON RESPONSIBLE: Zach Kuznar**

**Duke Energy Ohio**
**Case No. 17-0032-EL-AIR, *et al.***
**OCC Fifth Set of Interrogatories - Stipulation**
**Date Received: May 23, 2018**

**OCC-INT-05-131**

**REQUEST:**

Referring to the Stipulation and Recommendation at Attachment G, pages 5-6, is the Battery Pilot Program referred to in this section of the Stipulation part of the $20 million that is addressed in the reliability standards section of the Stipulation on page 13?

**RESPONSE:**

Not necessarily.

**PERSON RESPONSIBLE:** William Don Wathen Jr.

**Duke Energy Ohio**
**Case No. 17-0032-EL-AIR, *et al.***
**OCC Third Set of Interrogatories - Stipulation**
**Date Received: May 11, 2018**

**OCC-INT-03-056**

**REQUEST:**

Referring to the Reliability Standards section on page 13 of the Stipulation and Recommendation, please explain the evaluation criteria that will be used to determine if a battery storage project is appropriately deployed for the purpose of deferring circuit investment. To the extent that evaluation criteria was not developed, when will the evaluation criteria be developed and made available for public review and comment?

**RESPONSE:**

If a battery storage project defers or eliminates the need for a circuit investment than it has been appropriately deployed for the purpose of deferring circuit investments.

**PERSON RESPONSIBLE:**

Zachary Kuznar

Summary: Testimony Barbara R. Alexander Exhibit 2 of 2 electronically filed by Ms. Jamie Williams on behalf of Michael, William Mr.