

**UNITED STATES OF AMERICA  
BEFORE THE  
FEDERAL ENERGY REGULATORY COMMISSION**

**PJM Interconnection, L.L.C.**            )            **Docket No. ER15-68-000**

**AFFIDAVIT OF DR. SAMUEL A. NEWELL  
ON BEHALF OF PJM INTERCONNECTION, L.L.C.**

My name is Dr. Samuel A. Newell, and I am a Principal with *The Brattle Group* (“Brattle”). I am submitting this affidavit in support of the proposal by PJM Interconnection, L.L.C. (“PJM”) to update the administrative estimates of the costs to construct a new combustion turbine (“CT”) power plant and a new combined cycle (“CC”) power plant, used to determine minimum offer screening parameters in the Minimum Offer Price Rule under PJM’s capacity market (known as the Reliability Pricing Model or “RPM”).

I have extensive experience estimating new entry costs in capacity markets administered by Regional Transmission Organizations (“RTOs”) and have submitted expert testimony on that subject in several Commission proceedings. I submitted testimony (jointly with Mr. Christopher Ungate of Sargent & Lundy, LLC (“S&L”)) for ISO-New England, Inc. (“ISO-NE”) in April 2014 regarding the cost of new entry (“CONE”) for the ISO-NE Forward Capacity Market demand curve.<sup>1</sup> In December 2013, I also sponsored testimony (again with Mr. Ungate) to establish the ISO-NE Offer Review Trigger Prices based on estimates of Net CONE values for various technologies.<sup>2</sup> I co-authored the 2011 PJM CONE study<sup>3</sup> and provided affidavits in ensuing litigation,<sup>4</sup>

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<sup>1</sup> Before the Federal Energy Regulatory Commission, Docket No. ER14-1639-000, Testimony of *Dr. Samuel A. Newell and Mr. Christopher D. Ungate on Behalf of ISO New England Inc. regarding the Net Cost of New Entry for the Forward Capacity Market Demand Curve*, April 1, 2014.

<sup>2</sup> Before the Federal Energy Regulatory Commission Docket No. ER14-616-000, *Affidavit of Dr. Samuel A. Newell on Behalf of ISO New England* and the accompanying “2013 Offer Review Trigger Prices Study,” December 11, 2013.

Before the Federal Energy Regulatory Commission, Docket No. ER14-616-000, *Affidavit of Christopher D. Ungate on Behalf of ISO New England*, December 11, 2013.

<sup>3</sup> Kathleen Spees, Samuel Newell, Robert Carlton, Bin Zhou, and Johannes Pfeifenberger, *Cost of New Entry Estimates for Combustion-Turbine and Combined-Cycle Plants in PJM*, August 24, 2011 (“2011 PJM CONE Study”), Available at <http://www.pjm.com/documents/reports.aspx>.

which informed the Net CONE values PJM used in its capacity auctions for the 2016/2017 and 2017/2018 delivery years. In addition, my extensive related experience in market design for resource adequacy for ISO-NE, PJM, the New York Independent System Operator, Inc., the Midcontinent Independent System Operator, Inc., and the Electric Reliability Council of Texas has provided broad perspective on the capacity market context in which CONE is used.

My experience working for RTOs is also informed by my work for market participants building, buying, and contracting with generation plants. In that connection, I have led numerous generation asset valuation studies and resource planning studies.

I am an economist and engineer with more than 16 years of experience analyzing and modeling electricity wholesale markets, the transmission system, and RTO market rules. Prior to joining The Brattle Group, I was the Director of the Transmission Service at Cambridge Energy Research Associates and, before that, a Manager in the Utilities Practice at A.T.Kearney. I earned a Ph.D. in Technology Management and Policy from the Massachusetts Institute of Technology, an M.S. in Materials Science and Engineering from Stanford University, and a B.A. in Chemistry and Physics from Harvard College.

Complete details of my qualifications, publications, reports, and prior experience are set forth in my resume which is attached to my affidavit.

In October of 2013, PJM retained Brattle to review the Cost of New Entry (“CONE”) parameters of the RPM, as required periodically under PJM’s tariff. I led the Brattle review of CONE parameters, together with Mr. Ungate and his team at S&L as a sub-contractor. The Brattle team’s role was to estimate CONE, starting by determining the configurations and locations of the reference plants, overseeing S&L estimates of the capital cost and fixed operation and maintenance (“O&M”) costs, estimating certain components of capital costs (*e.g.*, gas and electric interconnection and land costs), estimating certain components of fixed O&M costs (*e.g.*, property taxes and firm gas contracts), analyzing the key financial assumptions (*e.g.*, cost of capital), and calculating the levelized costs. S&L’s role was to contribute expertise in determining the configurations and locations of the reference plants and to provide detailed capital and fixed O&M cost estimates of the reference plants specified for each PJM CONE Area.

The results of the analysis completed by Brattle and S&L are set forth in a report entitled “Cost of New Entry Estimates for Combustion Turbine and Combined Cycle Plants in PJM with June 1, 2018 Online Date” (“2014 CONE Study”). A copy of the 2014 CONE Study, which was prepared under my direction and supervision, is attached to my affidavit.

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<sup>4</sup> Before the Federal Energy Regulatory Commission, Docket No. ER12-513-000, *Affidavit of Dr. Samuel A. Newell on Behalf of PJM Interconnection, LLC, supporting PJM’s Settlement Agreement regarding the Cost of New Entry for use in PJM’s Reliability Pricing Model*, November 21, 2012.

On September 25, 2014, I submitted with Mr. Ungate an affidavit on behalf of PJM in Docket No. ER14-2940-000 to support the CT CONE values (based primarily on the 2014 CONE Study) that PJM filed in that proceeding for use in the RPM Variable Resource Requirement (“VRR”) Curve. In this proceeding, PJM is filing changes to the CT and CC new entry cost estimates used in the MOPR, again based largely on the 2014 CONE Study. The CT values presented here are the same CT values PJM filed in Docket No. ER14-2940-000 for the VRR Curve, and the CC values, like the CT values, also were calculated from the 2014 CONE Study and reflect certain changes requested by PJM. This affidavit summarizes the methodology and results of the 2014 CONE Study, and notes the elements of the estimates changed at PJM’s request.

Our starting point was to determine representative technical specifications and locations for the reference natural gas-fired CT and CC plants. To do so, we relied primarily on the “revealed preference” of developers in the PJM region and around the U.S., as reflected by recent and proposed CC and CT plants. For CONE Areas where revealed preference data is weak or scattered, we identified promising locations from a developer perspective based on proximity to gas and electric interconnections and key economic factors such as labor rates and energy prices.

For CTs, we defined a representative reference plant based on two General Electric Frame 7FA.05 gas turbines with selective catalytic reduction (“SCR”) technology and carbon monoxide (“CO”) catalyst environmental controls to reduce air pollutant emissions, evaporative cooling for power augmentation, and dual-fuel capability. We found in our analysis that dual fuel has not been dominant in the CONE Area 3: Rest of RTO area for CT plants, but PJM requested that we calculate CONE in all areas assuming dual-fuel capability. The net summer installed capacity of such a plant is 383 to 396 MW depending on the ambient atmospheric conditions assumed in each location, with a net heat rate of approximately 10,300 Btu/kWh.

For CCs, we defined a representative reference plant based on a 2x1 plant configuration with two General Electric Frame 7FA.05 gas turbines, SCR technology and CO catalyst environmental controls to reduce air pollutant emissions, evaporative cooling for power augmentation, and dual fuel capability in each CONE Area except CONE Area 3: Rest of RTO and CONE Area 2: SWMAAC. In place of dual-fuel capability in SWMAAC, we assumed the reference CC plant will contract for firm transportation service on the Dominion Cove Pipeline (“DCP”). The net summer installed capacity of such a plant is 649 to 668 MW when operating the supplemental duct firing capacity depending on the ambient atmospheric conditions assumed in each location, with a net heat rate of approximately 7,000 Btu/kWh in duct firing mode.

Based on these configurations, we estimated the capital and fixed O&M costs of the reference CC and CT plants for each CONE Area. More specifically, for each plant specified, we conducted a comprehensive, bottom-up analysis of the capital costs to build the plant: the engineering, procurement, and construction (“EPC”) costs, including equipment, materials, labor, and EPC contracting; and non-EPC owner’s costs, including project development, financing fees, gas and electric interconnection costs, and inventories. We separately estimated annual fixed operating and maintenance (O&M)

costs, including labor, materials, property taxes, and insurance. The 2014 CONE Study describes the bases for each of these estimates.

We then calculated the levelized CONE value for the reference CT and CC plants using an after-tax weighted average cost of capital (“ATWACC”) of 8.0% based on our review of various market reference points, as documented in the 2014 CONE study. We calculated levelized costs assuming 20 years of cash flows that are constant in real terms (*i.e.*, growing with inflation) and, alternatively, cash flows that are constant in nominal terms. Because PJM is filing CONE values based on the level-nominal assumption, I present only those results in this affidavit.

Following the release of the 2014 CONE Study, PJM conducted a stakeholder process to review the report and solicit input on the assumptions. As a result of those discussions, PJM chose to adopt, in lieu of the labor cost estimates provided in the 2014 CONE Study, an alternative labor cost estimate provided by the Independent Market Monitor for the PJM Region.<sup>5</sup> At PJM’s request, we included these alternative labor costs in a recalculation of the CONE values from the 2014 CONE Study, and show those results in this affidavit.

The estimated CONE for the reference CT plant in each CONE Area with an online date of June 1, 2018 based on the 2014 CONE Study, including the level-nominal assumption and dual-fuel capability for all areas, as calculated as an alternative option in the 2014 CONE Study, plus the alternative labor cost estimate provided by PJM are as shown in Table 1.

**Table 1**  
**Reference CT Plant CONE Estimates**

CONE Area	CT CONE ( <i>\$/MW-year</i> )
CONE Area 1	\$132,200
CONE Area 2	\$130,300
CONE Area 3	\$128,900
CONE Area 4	\$130,300
CONE Area 5	\$126,400

The estimated CONE for the reference CC plant in each CONE Area with an online date of June 1, 2018 based on the 2014 CONE Study, including the level-nominal assumption, as calculated as an alternative in that study, plus the alternative labor cost estimate provided by PJM, are as shown in Table 2.

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<sup>5</sup> See Affidavit of Dr. Paul Sotkiewicz of PJM, which is being submitted concurrently with this affidavit

**Table 2**  
**Reference CC Plant CONE Estimates**

<b>CONE Area</b>	<b>CC CONE</b> <i>(\$/MW-year)</i>
CONE Area 1	\$185,700
CONE Area 2	\$176,000
CONE Area 3	\$172,600
CONE Area 4	\$179,400
CONE Area 5	\$164,200

This concludes my affidavit.