# Attachment VII

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

New York Independent System Operator, Inc. Docket No. ER14-___-000

**AFFIDAVIT OF**
**ANTHONY LICATA**

Mr. Anthony Licata declares:

1. I have personal knowledge of the facts and opinions herein and if called to testify could and would testify competently hereto.

## I. Purpose of this Affidavit

2. The purpose of my affidavit is to present and describe the independent analyses that I prepared to assist The Brattle Group ("Brattle") in conducting additional due diligence regarding the proxy plant selection issue presented by the New York Independent System Operator, Inc.'s ("NYISO's") as part of the 2013 update to the NYISO's Installed Capacity ("ICAP") Demand Curves.[1]

3. I was responsible for evaluating technical and permitting compliance issues associated with the installation and operation of a gas-fired F class frame simple-cycle combustion turbine ("F class frame"), with limited (but rapidly-switched) backup operation using ultra low sulfur diesel ("ULSD") with a selective catalytic reduction emissions control system ("F class frame with SCR") to control NOx emissions.

[1] Capitalized terms that are not otherwise defined herein shall have the meaning specified in the filing letter to which this Affidavit is attached or the meaning set forth in the Services Tariff as revised by the Commission's acceptance of the NYISO's filing to establish a New Capacity Zone and subsequent related filings in Docket Nos. ER12-360 and ER13-1380.

## II. Qualifications

4. I am currently Vice President and Co-Owner of Licata Energy & Environmental Consultants, Inc. ("Licata Energy") Licata Energy has been in environmental and energy consulting business since 1990. Licata Energy advises clients on emissions compliance strategies, business development as related to Environmental Protection Agency ("EPA") regulations, and licensing of new technologies.
5. I have been actively engaged in the air pollution control systems and the power generation business since 1966 and have been working with SCR technologies since the mid-1980s. In my career I have provided testimony to legislative committees and in arbitration proceedings regarding the technical and economic viability of air pollution control systems. I was elected a Fellow of the American Society of Mechanical Engineers ("ASME") in 2002 and received the Life Time Achievement Award from the World Pollution Control Association in 2012. I am currently Chairmen of ASME's Research Committee on Environment, Energy and Waste. I was Co-Chair of the Power Division of the Institute of Clean Air Companies for six years and was responsible for the NOx and $SO_2$ committees. I have authored or co-authored over 100 technical papers, of which 22 relate to NOx emission controls and SCR controls.
6. Prior to forming Licata Energy I worked for a government regulatory agency, a utility (Potomac Electric Power Co. in Washington D.C.), and major contractors and engineering firms throughout the world. This included 12 years working at Babcock Power, Inc., a manufacturer of boilers and heat recovery steam generators as well as air pollution control systems that has installed over 45,000 MW of SCRs in the United States. During my career I was responsible for the development of several independent power plants as well as the operation and environmental compliance of two waste-to-energy plants, one of which was

located in California. I am familiar with air emissions reporting requirements under the federal Clean Air Act as well as the air permitting and compliance requirements in both California and New York.

7. While at Babcock Power, I was part of a team that provided the design and emissions control equipment for the Greenidge Multi-Pollutant Control Project (the Greenidge Station is a 115 MW coal-fired unit located in Dresden, New York, on the western shore of Seneca Lake), which was conducted as part of the U.S. Department of Energy's Power Plant Improvement Initiative. The Greenidge project established the commercial readiness of a multi-pollutant control system that offered large emission reductions for smaller high sulfur coal applications with small space requirements, mechanical simplicity, operational flexibility and low capital costs. After the completion of the Greenidge project we installed a similar system at AES Corporation's Westover Project near Binghamton, NY.

8. I was also responsible at Babcock Power for the licensing of its SCR and Flue Gas Desulfurization technologies. My activities included transfer of the technologies from Babcock Power's German licensor to the United States. This work included adjusting designs to meet operating conditions and applicable standards in this country. Also, while at Babcock Power, I led a team in developing the concepts for the application of SCRs for simple cycle applications with special interest on frame turbines.

9. While at Licata Energy, I worked as the technical representative in the United States for KWH GmbH, a German manufacturer of catalyst used in coal and gas fired applications in the power industry. Through this work, I gained significant knowledge related to the performance of catalysts, the fundamentals of catalyst designs and experience in the application of catalysts used in emissions control applications for the power industry.

## III. Overview of Technical Approach taken for The Brattle Report

10. The NYISO initially contacted Brattle in early October 2013 as it was seeking an experienced consultant to help further evaluate the commercial viability of F class frame with SCR. I was hired by Brattle to conduct research into, and evaluate the available information regarding, developments for high temperature and medium-high temperature catalyst operating in SCR applications on large simple cycle gas turbines.[2] I gathered information from SCR manufacturers, catalyst vendors, engineering trade press and conference materials, as well as publicly available data on the permit conditions and environmental performance of both simple-cycle and combined-cycle turbines.

11. In addition to reviewing the NYISO and NERA/S&L demand curve reports, I reviewed my personal files for market studies and prior work conducted on simple cycle gas turbines with SCR. I reviewed technical papers, brochures, reference lists published by turbine, catalyst and SCR manufacturers. I had discussions with several colleagues active in the field of permitting, designing, installing and operating gas turbines with SCR technology, including turbine, catalyst and SCR manufactures; and I reviewed the EPA's RACT/BACT/LAER Clearinghouse[3] and its Clean Air Markets program database.

12. I had several conversations with S&L regarding the assumptions it made in the NERA/S&L Report. In addition, I reviewed S&L's cost estimate for SCR applications with the F class

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[2] While the temperature ratings for catalyst vary by manufacturer, generally speaking normal catalyst operates optimally in temperatures of 600 -750 °F, medium-high temperature catalyst is designed to work at temperatures between 800 - 900 °F and high temperature catalysts are designed to work at temperatures between 900 and 1,100 °F and higher. With proper engineering and design these all can be used in hot temperature SCR applications (*i.e.*, SCR applications on combustion sources with exhaust gases that may require tempering air systems).

[3] The EPA's RACT/BACT/LAER Clearinghouse is a database of emissions limits and associated control technology that has met the requirements for Reasonable Available Control Technology ("RACT"), as well as state of the art Best Available Control Technology ("BACT") and Lowest Available Emission Rate technology ("LAER") for stationary sources that have been permitted and constructed throughout the United States.

frame and LMS100 simple cycle gas turbine. I spoke to several SCR and catalyst vendors regarding guarantees for emission levels and catalyst life. All of the vendors I had contact with indicated that they expected normal industry guarantees and warranties would be available to meet New York State's emission requirements.

13. Because it faced air pollution limitations similarly stringent to those applied in New York, the recently commissioned and currently operating Marsh Landing Generating Station in California ("Marsh Landing") was of particular interest. That facility employs four simple-cycle F-class frame-type combustion turbines with SCR. After I reviewed Marsh Landing's permit, along with other recently permitted simple cycle and combined cycle plants in California and New York, I concluded that the permitting requirements in New York would likely be very similar to those issued to Marsh Landing. Brattle and I reviewed the available six months[4] of emissions data from the EPA's Clean Air Markets database for Marsh Landing's operations and confirmed that Marsh Landing was both achieving its permitted emission limits and operating throughout its expected operating range.

14. Brattle and I also contacted the original SCR equipment manufacturer, *i.e.*, Mitsubishi Power Systems Americas ("MPSA"), to gain further insight into the facility and the broader commercial feasibility of applying SCR technology on high-temperature applications such as simple cycle F-class combustion turbines. I had several discussions with MPSA, in addition to meeting with the company's SCR team, to discuss its perspective on the engineering issues associated with Marsh Landing. MPSA hosted a full-day meeting on October 25, 2013 at the Savannah Machinery Works, attended by Brattle, Licata, S&L and NYISO staff, to discuss these matters.

[4] At the time of writing, Marsh Landing has operated successfully for seven months, and data through the first 6 months of operation is available from the EPA.

15. Based upon a review of Marsh Landing emission data using the Continuous Emission Monitor Systems ("CEMS") data downloaded from EPA's Clean Air Markets database, my discussions with MPSA and, based upon my experience in operating power plants and using EPA's data, I have concluded that to date the Marsh Landing facility has conformed to its permit terms and limits. In order to confirm compliance with all permit requirements with certainty I would need to review plant operating records, which are not publicly available.

16. To complete my work for the NYISO I collected engineering design and performance data for various large simple cycle gas turbines, various medium-high and high temperature catalyst vendors and catalyst types, and various SCR design types. I also collected air permitting and air emission data, paying particular attention to Marsh Landing, as well as the operating history of two failed applications of simple-cycle F-class frame-type combustion turbines with SCR cited by S&L: the Cambalache Facility in Puerto Rico and the Riverside Facility in Kentucky. I evaluated information from other large frame type simple cycle applications that are currently operating. I made additional requests of and received replies from sources, including MPSA and various catalyst and SCR vendors, such as ATCO Emission Management ("ATCO"), Hitachi Power Systems America Ltd. ("Hitachi"), Cormetech, Inc. ("Cormetech"), Haldor Topsoe, Inc., Ibiden Ceram Environmental, Inc., and BASF Corporation. I analyzed, evaluated and categorized all available information that we could obtain. As the data was summarized, I began to formulate opinions and additional questions to be addressed. These questions were formed as challenges to ensure that as much information could be obtained in the time available, and all available sources were investigated.

17. Given the evidence gathered and evaluated, I concluded that the F class frame with SCR is technically feasible at a modest engineering design and installation cost using proven modeling techniques. These costs, as estimated by S&L, are conservative and are not significantly greater than what S&L estimated for SCR installations on the LMS100 applications. I also concluded that it could be practically constructed in southeastern New York, meeting the most stringent air emissions requirements found in New York City.

18. In order to determine whether these two proven technologies could be practically constructed in New York State, I investigated the viability of the various components of the system – the combustion turbine, the fuel burned and the SCR construction . I also investigated how these components can be engineered into a single plant that can continue to produce the capacity expected of a F class frame turbine while reliably meeting the stringent environmental standards found in New York City. The major components I evaluated include the turbine, the SCR structure, the catalyst, the ammonia system, and the air cooling and mixing systems. Both the F class frame and aeroderivative machines (*i.e.*, LMS100) are proven technology and are in common use worldwide. I was able to verify, through conversations with the manufacturer, that the Siemens F5000(F5) is capable of meeting the 45 second fuel switching requirement in New York City. The ammonia storage and delivery systems required have also been proven on the over 115 simple cycle applications reviewed, (aeroderivative and frame) with no significant problems. Many of these applications included firing turbines on both natural gas and oil. In addition, there are many combined-cycle turbines with SCRs in operation that use similar ammonia systems.

19. With Brattle, I concluded that the question presented on technical feasibility and reliable operation required that we concentrate our evaluation on the SCR engineering, design and

construction that could be integrated into a system that "could be practically constructed" and is "economically viable." This conclusion was reinforced when we were informed in more detail of the issues that caused the failures of the SCR system on the simple cycle frame turbines at the Cambalache Facility[5] in Puerto Rico and even more importantly, at the Riverside Facility[6] in Kentucky, where faulty design and construction issues were identified as primary causes of the SCR failure. An undersized tempering air system, the use of the wrong catalyst type and improper installation of catalyst were major problems identified at the Riverside facility. Good engineering practices, such as physical flow modeling and computational flow dynamic modeling, both of which should be conducted in all SCR applications for simple-cycle combustion turbines, readily address the challenges faced with hot temperature SCR applications.

20. In addition, there are a number of SCRs that have operated at greater than 900 °F in the United States and Japan for many years that have not experienced structural issues. My conclusion is that competent SCR vendors have provided and continue to provide appropriate SCR reactors for application on F class frame turbines, as evidenced by successes at other frame installations (*e.g.*, the McClellan and McClure facilities[7] described in the Brattle Report). In particular, there have been various developments in the design of medium-high temperature and high temperature catalyst for use in such hot temperature SCR applications

[5] Three simple-cycle, diesel-fired frame turbines were retrofitted with SCRS at Cambalache in the late 1990s to lower NOx emissions. The SCRs failed to perform as anticipated from 1999 through 2001 as a result of catalyst poisoning. The SCRs were removed after 2001.

[6] In 2001 the Riverside Generating Company voluntarily installed SCR systems on simple cycle Siemens 501F turbines firing exclusively natural gas.

[7] Although the McClellan and McClure facilities are not F class frame turbines, they are frame turbines with exhaust temperatures and characteristics that are similar to an F class turbine. They are therefore relevant to the discussion at hand and their track record of reliable operation should not be discounted.

that provide SCR manufactures many more engineering options. Primary to this question is whether to utilize a tempering air system that both cools and diffuses the temperature of the gases exposed to the catalyst. In addition to Frame units many aeroderivative machines use air cooling to improve catalyst life and performance. SCR vendors that use air cooling include MPSA, Nooter/Erikson, ATCO, and Peerless Mfg. Co..

21. While MPSA's accomplishments and performance at Marsh Landing are largely documented in the Brattle Report, I also had several in-depth discussions with ATCO, a Canadian firm that provided additional useful information that was not available in time to be included in the Brattle Report. ATCO, which has eleven SCR applications completed for simple cycle turbines on its reference list, normally installs cooling air as part of its SCRs for aeroderivative machines, and has supplied SCRs for a number of GE projects. ATCO indicated to me that for cooling air systems in SCR installations, it uses the same engineering design and modeling approach for both simple-cycle aeroderivative and simple-cycle frame applications. The choice to use cooling air systems on aeroderivative machines is an economic question, where ATCO can use less catalyst in a SCR system operating at the lower temperatures associated with tempering air systems, while also providing better protection from extreme temperatures for the catalyst. It typically designs the catalyst to be exposed to a bulk temperature of 900 °F, which it believes is an appropriate economic balance of engineering design technology, fan horsepower (~ 1,500 hp) and reliable catalyst performance. ATCO, like MPSA, advises the use of redundant fans to ensure that the catalyst is well protected; however, in the Marsh Landing application, MPSA designed the tempering air system to a bulk temperature of less than 850 °F, which required larger fans but a less expensive type of catalyst.

22. Air cooling also can reduce the amount of catalyst required. For example, Haldor Topsoe reported that employing cooling air on LMS100 simple cycle machines can reduce the catalyst volume from 35 to 25 cubic meters. It is important to note that the use of cooling air is often required by the design specifications. The catalyst vendors provide the air flow and temperature design criteria to which the SCR vendor designs, but these criteria will vary based upon the catalyst selection. It is clear from the failures at the Riverside and Cambalache Facilities that proper catalyst selection is critical to reliable SCR operations. While the primary reasons for these failures have been identified above, it is important to note that catalyst vendors no longer offer the coated catalyst that was used in those applications. That being said, there are many proven medium high and high temperature catalyst types on the market today. Cormetech has sold catalyst for simple cycle applications above 900 °F since 2003. Haldor Topsoe has catalyst in SCR systems on Solar turbines that produce exhaust gas greater than 1000 °F. In a paper presented at the Power Gen conference in 2002, Hitachi provided the data that clearly showed its success with high temperature SCR applications dating back to the early 1990s. Below is a summary table compiled from catalyst vendor information indicating the various catalyst applications currently in operation.

| Vendor | > 750 °F | 800-899 °F | 900-999 °F | >1,000 °F |
|---|---|---|---|---|
| Cormetech | 5 | 133* | 20 | 2 |
| Ceram | 31 | 5 | 1 | 8 |
| BASF | | | | 24 |
| Haldor | | 101 | 27 | 3 |
| Hitachi | | | | 9 |
| % of applications by temperature | 10% | 65% | 13% | 12% |

* MPSA used 850 °F as the catalyst design specification for Marsh Landing

23. In addition I researched the Cambalache Facility's experience with burning oil, as it related to concerns of fouling or poisoning the NOx catalysts, and the impact it would have on SCR performance, if any. It was reported to me that the oil burned at the Cambalache Facility in Puerto Rico, was not the type specified in the SCR and catalyst design.

24. It is also important to note, in this analysis of burning oil in turbines with SCR controls, that New York State mandates the use of Ultra Low Sulfur Diesel ("ULSD"). ULSD is a significant departure from heavier distillate fuels, like that used at Cambalache more than a decade ago. These heavier fuels contain multiple orders of magnitude more particulate, sulfur and metals that can foul or poison catalyst. For example, sulfur content in No. 2 fuel oil ranges from 500ppm to 10,000ppm. In comparison, the New York State Department of Environmental Conservation regulations[8] restricts the sulfur content in distillate fuels to a maximum of 15ppm.

25. Second, it must be noted that any potential impacts of burning ULSD in an F class Frame turbine with SCR controls are no different from those that could occur when burning ULSD in an LMS100 with SCR controls. There are many aeroderivative machines operating on all grades of diesel fuels, and while the Marsh Landing Facility does not use a back up fuel, we were able to obtain some test data from the McClure plant firing oil. In any case, I cannot see how requiring that an F class frame with SCR be able to burn ULSD would exclude it from being a proven technology. In fact, in the October meeting in Savannah, MPSA stated that the SCR/catalyst design for Marsh Landing would not have to change if it were to burn

[8] *See* 6 NYCRR Subpart 225-1.2 Sulfur-in-fuel limitations

ULSD, and that MPSA would expect equivalent performance of the SCR on ULSD, or better, than it is achieving burning natural gas.

26. I also believe that due to the higher temperatures at which frame units operate, they may have less of a chance to foul catalyst than aeroderivative units.

27. Finally, provided the catalyst vendor is in informed of the fuel composition, it can make the required adjustments to the volume of catalyst needed. All the major catalyst vendors I spoke with stated that they would provide performance guarantees to facilities burning ULSD. If an SCR can be engineered to work reliably for an aeroderivative simple cycle turbine burning ULSD, which is unquestionably proven, then there is no reason the application cannot also be engineered to work on the larger frame turbine burning the same fuel.

28. Based on the data gathered, Brattle and I were able to draw a conclusion that SCRs on F class frame units "could be practically constructed" and "are economically viable." In my judgment F class frame units can comply with all applicable environmental limitations utilizing existing SCR engineering technology – a commercially available and proven technology in the power industry. All the key components are available and proven. The use of cooling air systems on aeroderivative machines is a proven technology, and with Marsh Landing among other applications on frame units this technology should be considered to be proven. The use of catalyst in the design range of frame units is also proven. A qualified technology vendor should and will be able to readily combine these two proven technologies into a commercially and technically viable facility. With the physical and CFD modeling currently being used for both frame and aeroderivative units, all of these systems can be integrated into a compliant unit. MPSA and ATCO are known to be actively selling SCRs

for simple cycle F class frame units and it is my understanding from my review and discussions conducted for the NYISO that Siemens and Vogt Power (Babcock Power) have plans to enter the SCR market. Therefore, competition in this field is not restricted.

29. The determinations and conclusions I have reached in conducting this work discussed above are based solely on the information and data Brattle and I acquired during the course of our assessment along with my experience, and my understanding of the general criteria for economic viability and practicality of constructing such power generating facilities with post combustion emissions controls.

This concludes my Affidavit.

ATTESTATION

I am the witness identified in the foregoing affidavit. I have read the affidavit and am familiar with its contents. The facts set forth therein are true to the best of my knowledge, information, and belief.

Anthony Licata

Subscribed and sworn to before me this 26th day of November, 2013.

Notary Public

My commission expires: 7/2/16

YOVAN S COLLADO
Notary Public - State of New York
NO. 01CO6264842
Qualified in Westchester County
My Commission Expires 7/2/16

# Biographical Information

Anthony Licata, Partner
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Tony has over 40 years of experience in the power generation field. He started his career as a startup and performance engineer involved in the startup of fossil-fired boilers and air pollution control systems.

His air pollution control systems experience includes wet and dry FGD systems, low-NOx burners/combustion controls, SCRs, SNCRs, ESPs, and baghouses. He has provided testimony to various legislative committees on the impact of air pollution control legislation.

He has an in-depth knowledge of combustion processes and the control of dioxins through combustion technologies and mercury control in power plants and waste-to-energy facilities. Beginning in 1972, Tony developed four pilot plant FGD systems and converted the designs to full-scale implantation projects.

In 1978, he went to work for Gibbs & Hill (Part of Dravo) as a Project Manager and then Vice President of Dravo where he was responsible for the design, construction, startup, and operations of both waste-to-energy and fossil-fired power plants. He went to work for Potomac Electric in 1988 as Vice President of Business Development to develop IPP projects.

From 1990 to 2000, Tony was co-owner of Licata Energy & Environmental Consulting, Inc. and was responsible for providing consulting services to the power industry related to air pollution systems, combustion, and plant operations. During this period he was the technical and marketing representative for:

- L. & C. Steinmüller in the US for their boiler and air pollution control systems
- KWH a SCR catalyst manufacture.
- Dravo Lime Company, now Carmeuse, where he researched and purchased new technologies to expand their lime-based product line.

Tony joined Babcock Power Inc. (DB Riley, Inc.) in 2000. He was responsible for implementing their environmental service business, their mercury control product line, and development of new technologies. He was promoted to Vice President and became responsible for the transfer of wet and dry FGD and SCR technologies from their European licensees and converting them to US based-technologies. Tony was also responsible for strategic planning and business analysis related to emission regulations

He retired from Babcock Power in 2012 and reentered Licata Energy providing technical and business consulting to the power industry

He has received numerous certifications and awards based on his work in the waste-to energy and fossil-fuel industries including:

- ASME's QRO certification for operating waste-to-energy plant.
- Member of the QRO certification board
- ASME's 2002 Dedicated Service Award.
- ASME's Solid Waste Processing Division's Dedicated Service Award 2002
- Elected a Life Fellow of ASME in 2003.
- AWMA's Waste Management Award in 2003.
- ASME's Pioneer Award in 2012.
- World Pollution Control Association's Life Time Achievement Award in 2012
- Alternate member ASME's PTC 40 on FGD testing
- Chairmen ASME's Research Committee on Energy, Environment and Waste

Tony has published over 100 technical papers on environmental issues.

Tony's current work is based on integrated multi-pollutant control strategies including NOx, $SO_2$, $SO_3$, mercury and fine particulates and is consulting on emission compliance strategies, business development as related to EPA regulations and licensing of new technologies.

Rev. 4 Bio Information Tony Licata