BEFORE
THE OHIO POWER SITING BOARD

In the Matter of the Application of Oak Run Solar Project, LLC for a Certificate of Environmental Compatibility and Public Need to Construct a Solar-Powered Electric Generation Facility in Madison County, Ohio	)))))	Case No. 22-549-EL-BGN

Direct Testimony of Dr. John Boeckl

On behalf of
Dr. John Boeckl

May 10, 2023

/s/ Matthew Eisenson
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Counsel for Dr. John Boeckl

Q-1. Please state your name, current title, business address, and home address.

A-1. My Name is John Boeckl, I am the Senior International Focal Point for the Materials and Manufacturing Directorate of the US Air Force Research Laboratory located at 2179 12th Street, WPAFB, OH 45433-7718, and my residence is at 4565 State Route 38 NE, London OH, 43140.

Q-2. How long have you lived in London, Ohio?

A-2. I have lived in London at the same address for the past 23 years and have been a resident of the State of Ohio for my entire life. My residence is approximately 1,000 feet from the site of the planned Oak Run Solar Project. My wife has taught elementary school in the London area for the past 20 years and my three children attend or attended school in the Jonathan Alder School District.

Q-3. What is your occupation?

A-3. For the past 33 years I have been a Civilian Employee for the US Air Force. The past 26 years I was employed at the Materials and Manufacturing Directorate of the Air Force Research Laboratory on Wright Patterson Air Force Base. The initial 5 years of my career associated with the Materials and Manufacturing Directorate was as a graduate student in a program called Palace Knight that the US Air Force sponsored to develop employees to obtain their Ph.D. My graduate studies and eventual Doctoral Thesis were conducted at the Ohio State University and related to advanced solar cell materials research. For the next 18 years of my career, I was a Research Scientist performing electronic materials research on a number of solid-state, two dimensional, and

nanomaterials again for the Materials and Manufacturing Directorate. In January of 2020 I took on a new role in the Directorate and became the Senior International Focal Point in which I engage with foreign countries to develop collaborative research projects with the Materials and Manufacturing Directorate. I am attaching my C.V. as Attachment JB-1.

Q-4. What has been your involvement in the community?

A-4. For the past 18 years I have been a volunteer coach with numerous sports teams connected with my children's school and local city teams. I attend the St. Patrick Catholic Church which was also connected to the school my wife taught at for 15 years and have been a volunteer at many of their social and fundraising events. I am also an avid beekeeper and have given demonstrations at local schools and mentor a number of local beekeepers.

Q-5. What is the purpose of your testimony?

A-5. I am testifying in support of the Oak Run Solar Project because I believe it will bring benefits to my family and the local community.

Q-6. In your opinion, what are those benefits?

A-6. First, as a signatory of a Good Neighbor Agreement and a corollary rooftop solar agreement, I will receive a direct benefit from the project. Upon completion of the project, I will receive a residential solar energy system to offset my usage and reduce my monthly bill.

Second, as a scientist who understands the cause and impacts of climate change, as well as conventional air and water pollution, I understand that projects such as the Oak Run Solar project will have significant environmental benefits. In particular, I understand that replacing conventional fossil fuel power plants, such as coal-fired power plants, with renewable energy sources, such as solar energy projects, will help to mitigate global climate change while improving local air quality and reducing the risk of water pollution.

Third, as someone who lives close to the project site, I also believe that the construction and operation of a solar farm at the site would be far less disruptive to my lifestyle than other possible uses of the land. For example, I would greatly prefer living next to a solar farm than a large-scale dairy farm (i.e., mega-dairy), housing development, manufacturing facility, or landfill. This is not just a hypothetical. In 2007, the previous owner of the site, Orleton Farms, LLC, submitted a permit application to the Ohio Department of Agriculture for a dairy facility that would have housed 5,428 dairy cows at the site. I live approximately 1,000 feet downwind of the site and was deeply concerned about the odors that would have wafted onto my property. I was also concerned about the vast quantities of manure that would have been generated at the site, which could leaked into the water and harmed the fragile ecosystems of the Little Darby Creek and Spring Fork. I would be thrilled to live near a relatively quiet, non-polluting, low-traffic solar farm instead.

Fourth, I believe the surrounding region has a serious opportunity to benefit from the boost of economic activity and tax revenue that the Project will deliver. In addition to creating jobs, the Project will deliver hundreds of millions of dollars in revenue to the local school districts and tens of millions of dollars to the fire department, ambulance,

and other services through a payment-in-lieu-of-taxes (PILOT) agreement. As a local resident and taxpayer, I believe this revenue will increase the quality of services in the town or help to offset my own tax burden or both.

Fifth, as a professional who develops international research partnerships, I have observed that a major shift to renewable energy sources is underway across the globe. I see this project as an opportunity for Ohio to become a focal point as the U.S. leader in the global transition to renewables. I believe this project is at the cutting edge on at least three dimensions, including total generation capacity, total battery storage capacity, and commitment to agrivoltaics. The Applicant's witness Sarah Moser has testified in this proceeding that the largest agrivoltaic project in the United States is only 4 acres. I understand that Oak Run Solar is prepared to commit to employing agrivoltaics on at least 2,000 acres. I strongly support the concept of agrivoltaics, which allows farming and energy production to occur side-by-side, and I believe this project would truly distinguish Ohio as a leader. To help the Board visualize what these projects look like, I am including a diagram and two photographs from the National Renewable Energy Laboratory website as Attachment JB-2.

Q-7. Does this conclude your testimony?

A-7. Yes. However, I reserve the right to update this testimony to respond to any further testimony in this case.

CERTIFICATE OF SERVICE

I certify that The Ohio Power Siting Board's e-filing system will electronically serve notice of the filing of this document on the parties referenced on the service list of the docket card who have electronically subscribed to the case on this 10th day of May 2023.

/s/ *Matthew Eisenson*

Matthew Eisenson

Attachment JB-1

Curriculum Vitae of Dr. John Boeckl

John J. Boeckl
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Education
2003 Ph.D. Electrical and Computer Engineering, Ohio State University, Columbus, OH
1997 M.S. Electrical Engineering, Ohio State University, Columbus, OH
1989 B.S. Electrical Engineering, Cleveland State University, Cleveland, OH

Experience
2020-Present Senior International Focal Point, Air Force Research Lab, WPAFB, OH
2001-2020 Research Scientist, Air Force Research Lab, WPAFB, OH
1996-2001 Senior Palace Knight, Air Force Research Lab, WPAFB, OH
1989-1996 Electronics Engineer, Aerospace Guidance/Metrology Center, Newark Air Force Base, OH

Professional Service
Adjunct Professor: University of Dayton, Department of Materials Science
Air Force Institute of Technology, Physics Department
Wright State University, Department of Physics
Fisk University, Department of Physics

Merits
Materials and Manufacturing Directorate International Award (2016, 2011, 2009)
Affiliate Societies Council Outstanding Scientists & Engineers Award (2013)
Exemplary Civilian Service Award (1996)

Areas of Technical Expertise
General research interest has been in the characterization of graphene and carbon nanotubes formed on silicon carbide materials. His work in the Nanoelectronic Materials Branch is concentrated in two technical areas of interest to the Air Force: Agile RF Electronic Materials and Integrated Opto-electronics. In pursuit of material solutions in these areas, he is a lead researcher for low-dimensional carbon material growth on SiC. In addition to managing the synthesis efforts, he is also well versed in various characterization tools that are used to evaluate the resulting material both electronically and structurally.

Selected Recent Publications
1. "Towards high-mobility heteroepitaxial beta-Ga2O3 on sapphire - dependence of the substrate off-axis angle," by Subrina Rafique, Lu Han, Adam T. Neal, Shin Mou, John Boeckl, Hongping Zhao, Phys. Status Solidi A 2018, 215, 1700467.
2. "Graphene quantum dots direct electrochemistry and development of sensitive electrocatalytical glucose biosensor," S. Gupta, T. Smith, A. Banaszak, and J. Boeckl, 2017 Sep 29;7(10). pii: E301. doi: 10.3390/nano7100301.
3. "Highly-Conductive Homoepitaxial Si-doped Ga2O3 Films on (010) β-Ga2O3 by Pulsed Laser Deposition," Kevin D. Leedy, Kelson D. Chabak, Vladimir Vasilyev, David C. Look,

John J. Boeckl, Jeff L. Brown, Stephen E. Tetlak, Andrew J. Green, Neil A. Moser, Antonio Crespo, Darren B. Thomson, Robert C. Fitch, Jonathan P. McCandless, and Gregg H. Jessen, Appl. Phys. Lett. 111, 012103, 2017.

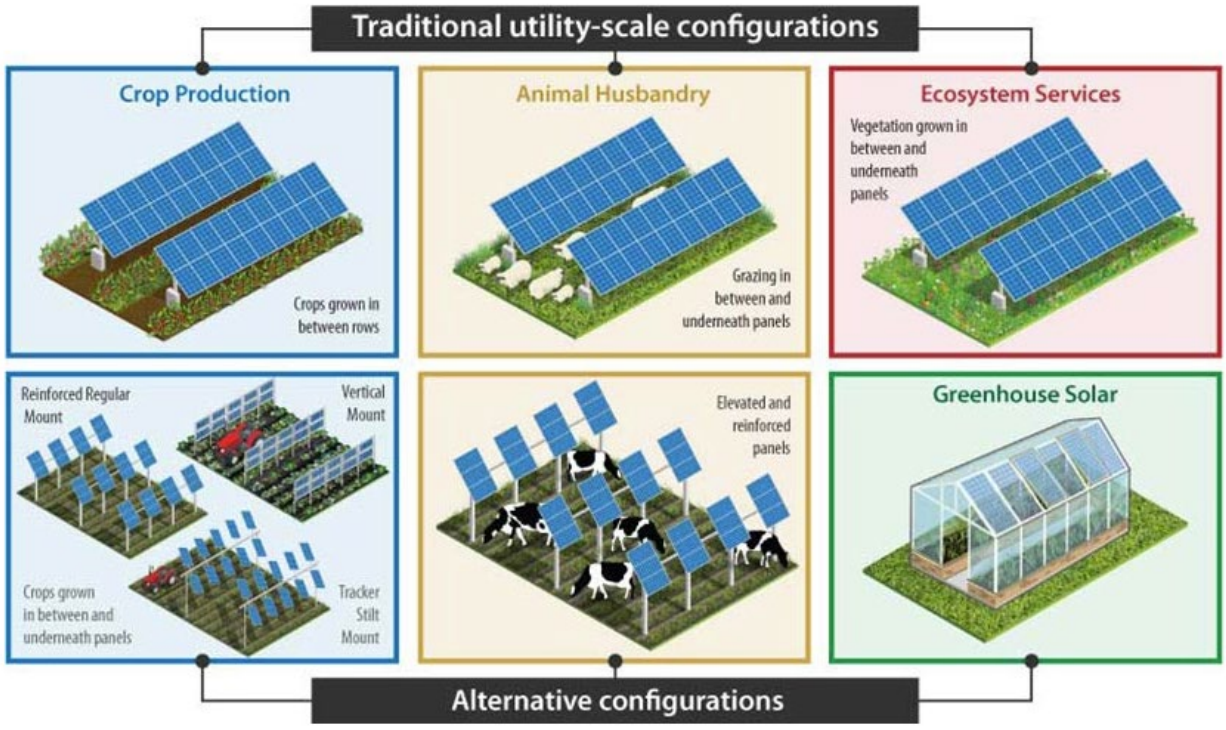
4. "Work Function Characterization of the Directionally Solidified LaB6–VB2 Eutectic," T. Back, S. Fairchild, J. Boeckl, M. Cahay, F. Derkink, G. Chen, A. Schmid, A. Sayir, Submitted to Ultramicroscopy.
5. "Al2O3−BaTiO3 nanolaminates fabricated by multistationary target pulsed laser deposition with in situ ellipsometry," John G. Jones ; John J. Boeckl ; Steven R. Smith ; Gerald R. Landis ; Neil R. Murphy ; Zhongqiang Hu ; Cynthia T. Bowers ; Charles E. Stutz, J. Nanophotonics, 11(4), 043506, 2017.
6. "Filament Formation in Lithium Niobate Memristors Supports Neuromorphic Programming Capability," C. Yakopcic, S. Wang, W. Wang, E. Shin, J. Boeckl, G. Subramanyam,T. Taha, Neural Computing and Applications 2017. Doi 10.1007/s00521-017-2958-z.
7. "Solid source growth of graphene with Ni–Cu catalysts: towards high quality in situ graphene on silicon," N. Mishra, J.J. Boeckl, A. Tadich, R.T. Jones, P.J. Pigram, M. Edmonds, M.S. Fuhrer, B.M. Nichols, F. Iacopi, Journal of Physics D: Applied Physics, 50, 9, 2017.
8. "On-Silicon Supercapacitors with Enhanced Storage Performance," M. Ahmed, B. Wang, B. Gupta, J.J. Boeckl, N. Motta, F. Iacopi, Journal of the Electrochemical Society, 164, 4, 2017.
9. "Direct graphene growth on transitional metal with solid carbon source and its converting into graphene/transitional metal oxide heterostructure," J. Park, T. Back, S.B. Fairchild, W.C. Mitchel, S. Elhamri, J. Boeckl, D. Martinotti, L. Douilliard, P. Soukiassian, Carbon, 116, 303-09, 2017.
10. "Local investigation of the emissive properties of LaB6–ZrB2 eutectics," M.-H. Berger, T. C. Back, P. Soukiassian, D. Martinotti, L. Douillard, S. B. Fairchild, J. J. Boeckl, V. Filipov, and A. Sayir, J Mater Sci, DOI 10.1007/s10853-017-0816-0, 2017
11. "Modeling Graphene with Nanoholes: Structure and Characterization by Raman Spectroscopy with Consideration for Electron Transport," Jie Jiang, Ruth Pachter, Teresa Demeritte, Paresh Chandra Ray, Ahmad E. Islam, Benji Maruyama, and John J Boeckl, J. Phys. Chem. C, Just Accepted Manuscript, DOI: 10.1021/acs.jpcc.5b10225, Publication Date (Web): 21 Jan 2016.
12. "A Raman spectroscopy signature for characterizing defective single-layer graphene: Defect-induced I(D)/I(D0) intensity ratio by theoretical analysis," Jie Jiang, Ruth Pachter *, Faisal Mehmood, Ahmad E. Islam, Benji Maruyama, John J. Boeckl, Carbon 90, 53-62, 2015.
13. "A thin film approach for SiC–derived graphene as an on-chip electrode for supercapacitors", M.Ahmed, M.Khawaja, M.Notarianni, B.Wang, D.Goding, B.Gupta, J.J. Boeckl, A.Takshi, N.Motta, S.E.Saddow, and F.Iacopi, Nanotechnology 26 (43), 434005, 2015.
14. "Morphology dependent field emission of acid-spun carbon nanotube fibers," S B Fairchild, J Boeckl, T C Back, J B Ferguson, H Koerner, P T Murray, B Maruyama, M A Lange, M M Cahay, N Behabtu, C C Young, M Pasquali, N P Lockwood, K L Averett, G Gruen and D E Tsentalovich, Nanotechnology 26, 2015.
15. "A catalytic alloy approach for graphene on epitaxial SiC on silicon wafers," F. Iacopi,N. Mishra, B.V. Cunning, D. Goding, S. Dimitrijev, R. Brock, R.H. Dauskardt, B. Wood, J.J. Boeckl, JMR, 30, 05, 2015.
16. "Morphology dependent field emission of acid-spun carbon nanotube fibers," S B Fairchild, J Boeckl, T C Back, J B Ferguson, H Koerner, P T Murray, B Maruyama, M A Lange, M M

Cahay, N Behabtu, C C Young, M Pasquali, N P Lockwood, K L Averett, G Gruen and D E Tsentalovich, Nanotechnology 26 (2015).
17. “Vertical Graphene Growth from Amorphous Carbon Films using Oxidizing Gases,” The Journal of Physical Chemistry, Bachmatiuk, Alicja; Boeckl, John; Smith, Howard; Ibrahim, Imad; Gemming, Thomas; Oswald, S.; Kazmierczak, Wojciech; Makarov, Denys; Schmidt, Oliver; Eckert, J.; Fu, Lei; Rümmeli, Mark, Manuscript ID: jp-2015-05167v.R1

Attachment JB-2

National Renewable Energy Laboratory
Images of Agrivoltaics Projects[1]

Image #1



Agrivoltaics includes many different uses. Agrivoltaics systems can be installed in the same basic row layout as a traditional large-scale solar plant—or they can be modified to provide extra space for light, animals, or farm equipment to move under and between them.

[1] All images in Attachment JB-2, including captions, are screenshots from Harrison Dreves, *Growing Plants, Power, and Partnerships Through Agrivoltaics: Solar and Agriculture Pair Well Together, Thanks to Planning and Cooperation*, NREL, Aug. 18, 2022, https://www.nrel.gov/news/program/2022/growing-plants-power-and-partnerships.html.

Image #2


Jack's Solar Garden is a partner organization on the InSPIRE project and the largest commercially active agrivoltaics system in the United States. The 1.2-megawatt array generates enough power for more than 300 homes. Local nonprofits also use the space as pollinator habitat and to train young farmers, such as Brittany Staie, pictured here. Brittany was the farm manager at Jack's Solar Garden before joining NREL as a research intern. *Photo by Werner Slocum, NREL*

Image #3

Solar arrays can make a great home for grazing livestock, with the panels offering shade and shelter to the animals, who in turn keep the vegetation under the panels trimmed. *Photo from Lexie Hain, Lightsource bp*