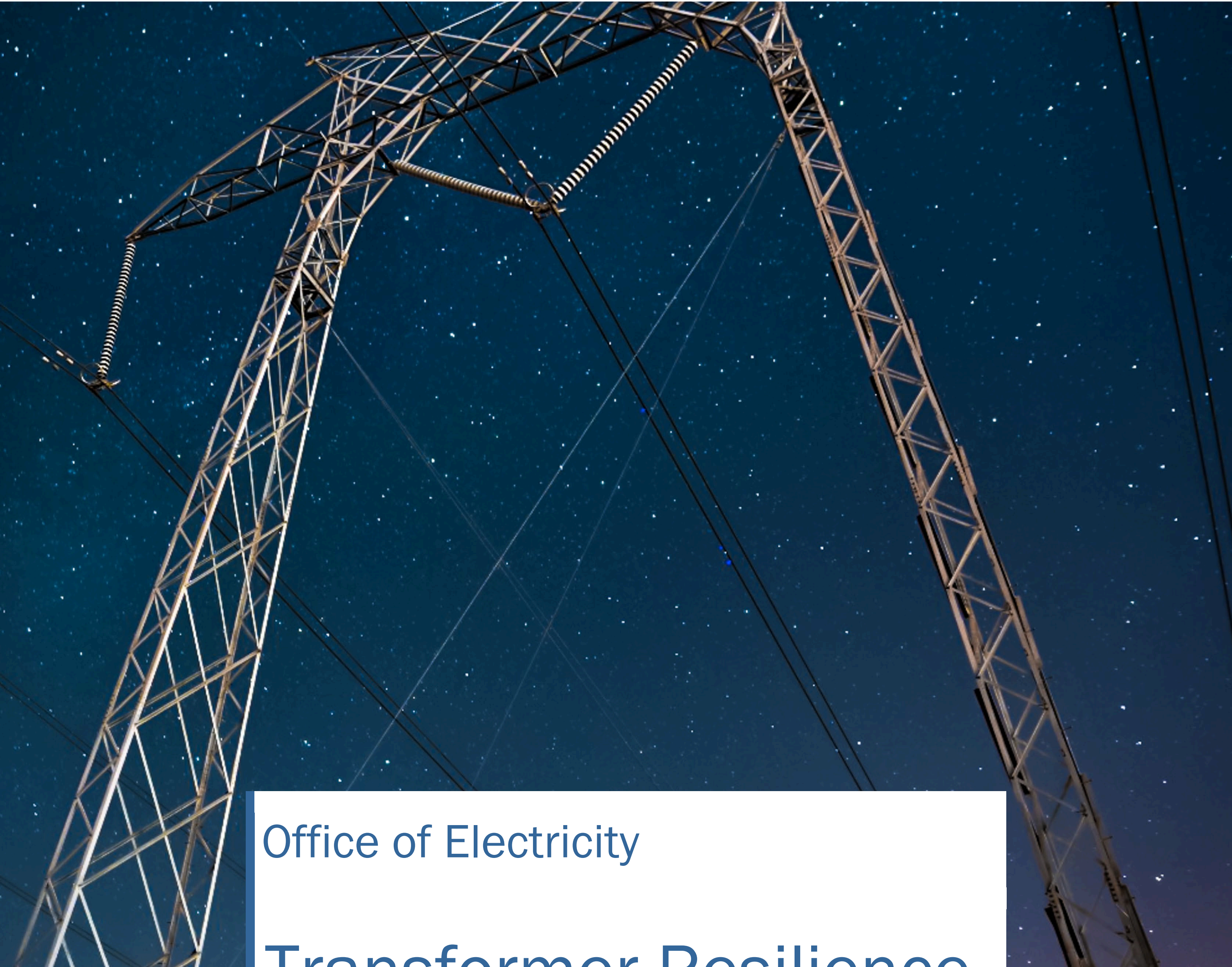

Office of Electricity

Transformer Resilience and Advanced Components (TRAC) 2023 Program Review Report

June 2023

Acknowledgements

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List of Abbreviated Terms

A	AC	Alternating Current
	AAR	Ambient Adjusted Rating
	AI/ML	Artificial Intelligence/Machine Learning
	ANN	Artificial Neural Network
	ANPA	Association of Nepali Physicists in America
B	BDV	Breakdown Voltage
	BESS	Battery Energy Storage System
C	CB	Circuit Breaker
	CGI	Controllable Grid Interface
	CITRC	Critical Infrastructure Test Range Complex
	CHIL	Controller Hardware in Loop
D	DAB	Dual Active Bridge
	DC	Direct Current
	DGA	Dissolved Gas Analysis
	DLR	Dynamic Line Rating
	DOE	U.S. Department of Energy
	DSP	Digital Signal Processor
	EMI	Electromagnetic interference
	EI	Eastern Interconnection
	EMT	Electro-Magnetic Transients
	EPRI	Electric Power Research Institute
	ES	Energy Storage
F	F_{upper}	Upper Limit of Frequency

	FET	Field-Effect Transistor
G	GA	Genetic Algorithm
	GETs	Grid Enhancing Technologies
	GFL	Grid Following
	GFM	Grid Forming
	GMLC	Grid Modernization Laboratory Consortium
	GO	Grain-Oriented
H	HF	High Frequency
	HFL	High Frequency Link
	HSST	Hybrid Solid State Transformer
	HVDC	High-Voltage Direct Current
I	INL	Idaho National Laboratory
	IPS	Intelligent Power Stage
	IR	Infra-red
	ISO-NE	Independent System Operator – New England
	ITO	Indium Tin Oxide
K	KVA	Kilovolt Ampere
L	LPT	Large Power Transformer
	LV	Low Voltage
M	MMC	Modular Multilevel Converter
	MMM	Magnetism and Magnetic Materials
	M_S	Saturation Magnetization
	MPC	Model Predictive Control
	MTdc	Multi-Terminal Direct Current
	MV	Medium Voltage

N	NETL	National Energy Technology Laboratory
	NREL	National Renewable Energy Laboratory
	NO	Non-Oriented
O	OLTC	On Load Tap Changers
	ORNL	Oak Ridge National Laboratory
	OE	Office of Electricity
	OSW	Offshore Wind
P	P	Active Power
	PCM	Production Cost Model
	PD	Partial Discharge
	PE	Power Electronics
	PFC	Power Flow Control
	PIM	Polymer of Intrinsic Microporosity
	PNNL	Pacific Northwest National Laboratory
	PV	Photovoltaic Plant
Q	Q	Reactive Power
R	RMS	Root Mean Square
S	SC	Synchronous condenser
	SCR	Short Circuit Ratio
	SiC	Silicon-Carbide
	SSPS	Solid State Power Substation
	SST	Solid State Transformer
T	TMS	The Minerals, Metals & Materials Society
	T_{upper}	Upper Limit of Temperature
V	VSC	Voltage Source Converter

W	WI	Western Interconnection
Z	ZVS	Zero Voltage Switching

Executive Summary

On June 27-28, 2023, the TRAC program within the U.S Department of Energy (DOE) Office of Electricity (OE) conducted its bi-annual program review. The meeting brought together 89 participants, including representatives from utilities, equipment vendors, engineering associations, consultancies, academia, national laboratories, and government. The review included presentations representing 19 projects within the TRAC portfolio; each presentation was provided by a member of that project's research team. A panel of 15 formal peer reviewers evaluated the projects and provided feedback.

The TRAC program supports research and development (R&D) activities that aim to advance technologies and approaches that maximize the value and lifetimes of existing grid components and enable the next generation of grid hardware to be more adaptive, more flexible, more reliable, and more cost-effective than technologies available today. Next-generation grid components can improve equipment performance and lifetimes over current designs, simplify integration of advanced technologies, and provide new capabilities required for the future grid.

The program review solicited feedback from formal peer reviewers and attendees to ensure that program activities remain centered in high-impact focus areas, thereby optimizing the use of Federal resources to fill critical R&D gaps. TRAC program management used the expert feedback to improve the program quality, and project principal investigators (PIs) reviewed the evaluations to improve project efforts. In addition, the review provided attendees with an opportunity to learn more about the TRAC program's vision, direction, and ongoing activities.

The TRAC program review also served as a mechanism to further solidify the advanced grid component research community. The program review included a keynote presentation from Michael Pesin, Deputy Assistant Secretary of Grid Systems and Components with DOE OE, which highlighted what the Grid Systems and Components Division does within OE. Having a forum for these interactions is critical to the advancement and adoption of innovative technology solutions, especially grid hardware. Lasting and effective change requires a diverse and engaged community; the TRAC program aims to catalyze and nurture this community, which spans diverse stakeholders from material scientists and system designers to equipment manufacturers and utility engineers.

The table below provides the current status, scores, and DOE comments for each of the 19 projects presented at the review.

Introduction

Overview

To date, much of the "smart grid" transformation has focused on applying advanced digital information and communication technologies to the power grid to improve the system's reliability, resilience, efficiency, flexibility, and security. To realize the full potential of a modernized grid, advances in the grid's physical hardware are also needed. Next-generation grid components can improve equipment performance and lifetimes over current designs, simplify integration of advanced technologies, and provide new capabilities required for the future grid. The TRAC program supports R&D activities that aim to advance technologies and approaches that maximize the value and lifetimes of existing grid components and enable the next generation of grid hardware to be more adaptive, more flexible, more reliable, and more cost-effective than technologies available today.

On June 27-28, 2023, the TRAC program within the U.S. DOE OE conducted its third program review. The program was initiated in fiscal year (FY) 2016 to fill a critical gap in DOE's R&D portfolio, drawing on opportunities identified during the 2015 Quadrennial Technology Review. Over several years, research projects across several focus areas were supported to build out a robust and diverse portfolio necessary to address program objectives. This program review was planned and executed under the direction of Andre Pereira (DOE), the current program manager for the TRAC research program.

The meeting brought together 89 participants, including representatives from utilities, equipment vendors, engineering associations, consultancies, academia, national laboratories, and government. The review included presentations of 19 projects within the TRAC portfolio; each presentation was provided by a member of that project's research team. For each presentation, a panel of 15 formal peer reviewers evaluated the project and provided feedback. Each reviewer reviewed 1-4 projects. Additionally, all attendees were given the opportunity to provide feedback on the research program through live questions and chats during the event. This report presents the feedback received from attendees, including summaries of the research project peer evaluations. The report also details the process used for the TRAC program review.

A complete list of participants and the agenda can be found in Appendices A and B, respectively.

Purpose

The TRAC program aims to coordinate its portfolio to maximize benefits from interrelated activities. While each technology and project can provide value to the industry individually, a coordinated portfolio approach amplifies results by leveraging synergies. Program reviews are useful in assessing and evaluating a research portfolio and informing program improvements to ensure projects continue to provide value. In general, reviews are conducted routinely (e.g., every two years) to evaluate activities based on a range of criteria including scientific merit, likelihood of technical success, actual or anticipated results, and effectiveness of research management. Results from each project evaluation and program assessment feedback into program planning and portfolio management. This important process helps guide research directions, assess progress, and direct (or redirect, if necessary) resources toward the most promising technology pathways.

Program reviews also serve as a mechanism for interested parties to learn about the status and future directions of a research program. Lasting and effective change requires a diverse and engaged community; the TRAC program aims to catalyze and nurture this community, which spans stakeholders from material scientists and system designers to equipment manufacturers and utility engineers.

Program Review Process

Prior to the program review, a panel of peer reviewers was selected and trained to perform project and program evaluations. The project evaluations were based on presentations delivered by the project principal investigators (PIs) or their designated representatives. Peer reviewers attended the review to observe each project presentation and established a preliminary assessment in a customized spreadsheet with notes in real time. Based on the information captured, reviewers submitted a final evaluation against pre-established criteria, along with supporting comments, within two weeks of the program review. The evaluation and feedback collected from peer reviewers and other attendees will be used to improve the quality of the program and individual projects.

This section provides more details about the process.

Project Presentations

Before the review, PIs of projects were given presentation templates to ensure consistency and were informed of the established evaluation criteria via a training webinar. The PIs used the templates and criteria when developing their project presentations. During the review, the PI or a designated representative delivered the presentation to the review panel and other attendees who were present. After the conclusion of the review, DOE compiled the project evaluations for review and dissemination, and PIs used the feedback to improve their efforts.

Peer Reviewers

Preparing for the review involved identifying technical professionals with relevant experience and expertise to serve as reviewers for the selected projects. These reviewers were chosen based on their technical expertise in topics of relevance to the TRAC portfolio, their professional experience related to the management of technology projects, and the diversity in organizational perspectives. The final panel composition represented a broad spectrum of expertise and perspectives.

Each of the projects were evaluated by multiple peer reviewers, with assignments made to ensure diverse and balanced perspectives. Additionally, all assignments were investigated to ensure that no conflicts of interest existed between assigned peer reviewers and the projects that they evaluated.

Reviewers received training before the formal event to ensure complete understanding of the review objectives, consistent interpretation of the criteria, and consistent application of scoring.

Below are the 15 individuals who were selected as peer reviewers, along with their professional affiliations.

- Alberto Del Rosso, EPRI
- Aminul Huque, EPRI
- Arvind Tiwari, GE Research
- Ayman EL-Refaie, Marquette University
- Fran Li, University of Tennessee, Knoxville
- GQ Lu, Virginia Tech
- Jason Autrey, Southern Company Services, Inc.
- Michael McAmis, Tennessee Valley Authority
- Mike Marshall, DRG Technical Solutions
- Patrick Hanley, Viridi
- Stephen M. Kelley, Southern Company Services, Inc.
- Steven Coley, Tennessee Valley Authority
- Sudipta Chakraborty, Eaton Corporate Research & Technology
- Swetha Srinivasan, Mitsubishi Electric Power Products, Inc.
- Zhiyu Shen, Microchip

Project Evaluation Criteria

The reviewers evaluated each project against pre-established criteria, developed to capture the information needed for the review's purpose. These criteria included the project's relevance to DOE and OE missions, impacts on industry, accomplishments, and management. In each area of evaluation, reviewers were asked to provide a numerical score for each project, according to the following scale:

1-2	3-4	5-6	7-8	9-10
Poor/Not adequate	Fair/Significant weaknesses	Good/Modest/ Some areas to improve	Very good/Few areas to improve	Outstanding/Excellent

In addition, reviewers were asked to provide comments/findings, recommended actions, and any considerations the PI should evaluate. Descriptions for each criterion and associated weights are listed below.

Significance and Impact (40%)

- The degree to which the project, as presented, effectively delivers, or has the potential to deliver significant value beyond its research findings. Key points to consider included:
- The degree of impact or potential impact the project has on the electricity delivery system, energy markets, or society
- The likelihood that the technology or project outcomes will become a valuable, widely accepted solution for the electric power industry
- The extent to which research findings spur or enable further innovations
- The effectiveness of technology transfer or the dissemination of results
- The degree to which collaboration with the energy industry, universities, government laboratories, states, and/or end users is being, or has been, pursued

Approach and Execution (20%)

- The degree to which the project, as presented, includes a clear, technically sound, and effective approach for achieving the goals and outcomes presented. Key points to consider included:
- Quality of project approach, including research plan, project execution, and relevance of research team areas of expertise
- The degree to which the project approach is free of major flaws that would limit the project's effectiveness or efficiency
- The degree to which technical or market barriers are, or have been, addressed; the quality of the project design; and technical feasibility
- The degree to which technical accomplishments are being achieved and progress is being made toward overall project goals and milestones
- If this project is continuing, the degree to which the project has effectively planned its future, defined milestones, identified risks, considered contingencies to mitigate/manage risks, built in optional paths, etc.

Technical Productivity and Quality (20%)

The degree to which the project, as presented, represents a valuable and appropriate use of government financial support. Key points to consider included:

- The degree of innovation and risk associated with the project and the extent to which federal investments are justified

- The relative quality and quantity of technical accomplishments and research outcomes, realized or expected, given the amount of federal funding allocated to the project
- The extent to which project accomplishments and outcomes to date are appropriate given the resources utilized

Relevance and Alignment (20%)

The degree to which the project, as presented, aligns with the mission, goals, and objectives of the Office of Electricity, and the TRAC research program. Key points to consider included:

- Relevance to the OE mission and the TRAC program goals to modernize the electric grid; enhance the reliability, resilience, and security of the energy infrastructure; and improve the lifetime and performance of grid components
- The degree to which the project addresses an existing, impending, or critical problem, interest, or need in the electric power industry
- The degree of alignment to the TRAC program technology objectives

Project Evaluations

Project Information

Research projects within the TRAC portfolio are organized into three activity areas: *Advanced Grid Integration Technologies, Advanced Power Control Equipment, and Advanced Materials Based Components*. In accompaniment to this report, the TRAC "Program Overview and Project Fact Sheets" document contains detailed information pertaining to the TRAC program, program activity areas, and an overview of each of the 19 projects evaluated. This section summarizes the results from the peer evaluations of the 19 presentations made.

Advanced Grid Integration Technologies Projects

Advanced grid integration technologies enable grid hardware to be adaptive, flexible, self-healing, resilient, reliable, and cost effective. During the peer review, the following advanced grid integration technologies projects were evaluated:

- Modular Solid-State Switch (MS3)
  - Ghanshyamsinh Gohil, Hitachi Energy
- High Voltage, High Power WBG Module Development
  - Jack Flicker, Sandia National Laboratories
- SSPS Field Demonstration
  - Jason Autrey, Southern Company

- Solid State Power Substation (SSPS) 1.0 Controller
  - Joao Pereira Pinto, Oak Ridge National Laboratory
- SSPS 1.0 Hardware Prototype Development
  - Madhu Chinthavali, Oak Ridge National Laboratory
- GMLC 2.4.2 – Multiport HUB: SSPS Architecture Framework
  - Michael Starke, Oak Ridge National Laboratory
- Medium voltage DC/DC Intelligent Power Stage (IPS)
  - Prasad Kandula, Oak Ridge National Laboratory
- MVDC Use Case
  - Prasad Kandula, Oak Ridge National Laboratory
- SSPS Hardware in the loop (HIL) validation
  - Radha Krishna Moorthy, Oak Ridge National Laboratory
- SSPS 1.0 node Use case Validation with Smart Universal Power Electronics Regulators (SUPERs)
  - Radha Krishna Moorthy, Oak Ridge National Laboratory
- Scalable Hybrid Large-Scale dc-ac Grid Analysis Methods
  - Suman Debnath, Oak Ridge National Laboratory

Below are summarized results from the reviews of these projects.

	Average Score	8.6
	Score Range	6.4 - 9.9

Advanced Power Control Equipment Projects

Advanced power control equipment will help meet the needs of the future grid with electronic/electrical power conversion and control products. The following advanced power control equipment projects were evaluated:

- SuperFACTS: Super-Flexible & Robust AC Transmission System
  - Vahan Gevorgian, NREL
- Transmission Optimization with Grid Enhancing Technologies (TOGETs)

- Bjorn Vaggensmith, Idaho National Laboratory
- LPT FOA GA Tech
    - Deepakraj Divan, Georgia Tech
- LPT FOA University of Texas Austin
    - Sanjay Rajendran, University of Texas at Austin
- LPT FOA Nextwatt
    - Sudip Mazumder, Nextwatt

Below are summarized results from the reviews of these projects.

	Average Score	8.5
	Score Range	6.9 - 9.9

Advanced Materials Based Components Projects

To support a modern resilient, reliable, and secure electric grid, advanced materials-based components are needed to meet the many demands and expectations of the electric grid of the future. The following advanced materials-based components projects were evaluated:

- Optical Fiber Sensors for Acetylene Detection
    - Jeffrey Wuenschell, NETL
- Al/Ca Composite Conductor
    - Iver Anderson, AMES
- Soft Magnetics for Power Conversion Applications
    - Jagan Devkota, NTEL

Below are summarized results from the reviews of these projects.

	Average Score	7.2
	Score Range	6.1 - 8.0

Appendix A. List of Participants

A	Alan Sbravati, Hitachi Energy
	Alberto Del Rosso, EPRI
	Aminul Huque, EPRI
	Andre Pereira, U.S. DOE
	Andrew Foote, Volkswagen Group of America
	Arvind Tiwari, GE Research
	Austin Walker, Electric Power Board of Chattanooga
B	Babak Parkhideh, UNC Charlotte
	Barry Mather, National Renewable Energy Laboratory
	Bjorn C. Vaagensmith, INL
	Bo Zhang, INL
	Bogdan Borowy, Eaton Research Labs
	Brian Berland, Stryten Energy
	Brian Rowden, Oak Ridge National Laboratory
C	Caty Schwengels, Oak Ridge National Laboratory
	Christopher Fiorentino, Stryten Energy
D	Daniel Ciarlette, Boston Government Services
	Daniel Evans, UNC Charlotte
	Dave Howard, U.S. DOE
	Deepakraj Divan, Georgia Tech
	Didier Rouaud, General Electric
E	Edward Chambers, NETL
F	Fernando Palma, U.S. DOE
G	Gab-su Seo, NREL
	Ghanshyamsinh Gohil, Hitachi Energy
H	Hannah Taylor, U.S. DOE
	Heron Plaza Rico, Stryten Energy
	Hui Li, Florida State University
I	Iver Anderson, AMES National Laboratory

J	Jack Flicker, Sandia National Laboratories
	Jagan Devkota, NETL
	James Wade, Stryten Energy
	Jason Autrey, Southern Company
	Jeffrey Wuenschell, NETL
	Jin Wang, OSU
	Joao Onofre Pereria Pinto, ORNL
	Joseph Barron, Mitsubishi Electric Power Products
K	Kate Faris, ICF Next
	Keith Dodrill, U.S. DOE
	Kevin Vallecorsa, Siemens Energy
	Kristie Armstrong, Ergon, Inc.
L	Laura Touton, ORNL
	Leon Tolbert, University of Tennessee
	Lillie Ghobrial, General Electric
	Luiz Cheim, Hitachi Energy
M	Madhu Sudhan Chinthavali, ORNL
	Mark Nations, North Carolina State University
	Mark Wilton, Sunbelt Rentals
	Matthew Messenger, NETL
	Meredith Braselman, ICF Next
	Michael Pesin, U.S. DOE
	Michael McAmis, TVA
	Michael Starke, ORNL
	Mike Marshall, DRG Technical Solutions
	Murali Baggu, NREL
O	Omar Mendez Zamora, Prolec Ge
	Owen Goldstrom, ICF
P	Patrick Hanley, Viridi
	Penny Humphreys, DRG Technical Solutions
	Philip Irminger, DRG Technical Solutions
	Philip Bingham, ORNL

Q	Quan Nguyen, PNNL
R	Radha Sree Krishna Moorthy, Oak Ridge National Laboratory
	Rafal Wojda, ORNL
	Rajendra Prasad Kandula, ORNL
	Rambabu Adapa, EPRI
	Rick Raines, ORNL
	Rob Havsapian, NREL
	Robert Wagner, ORNL
	Rolando Burgos, VT
S	Sanjay Rajendran, The University of Texas at Austin
	Sarolta Petersen, ICF Next
	Scott Gray, Siemens Energy Inc.
	Scott Childers, Stryten Energy
	Shahil Shah, NREL
	Stephen Kelley, Southern Company
	Steven Coley, TVA
	Sudip Mazumder, Nextwatt LLC
	Sudipta Chakraborty, Eaton
	Suman Debnath, ORNL
	Swetha Srinivasan, Mitsubishi Electric Power Products, Inc.
T	Teja Kuruganti, ORNL
	Travis Smith, DRG Technical Solutions
V	Vahan Gevorgian, NREL
	Valerio De Angelis, PNNL
W	Wei Du, PNNL
	William Armstrong
Y	Yue Zhao, University of Arkansas
Z	Zhiyu Shen, Microchip Technology

Appendix B. Program Review Agenda

DAY 1 – TUESDAY, JUNE 27, 2023

Time	Agenda
8:30 – 9:00 am	**Opening Remarks and Keynote** • Susan Hubbard, Deputy for Science and Technology, Oak Ridge National Laboratory • Michael Pesin, Deputy Assistance Secretary, Grid Systems and Components, Office of Electricity, U.S. Department of Energy
9:00 – 9:30 am	**TRAC Program & PACE Overview** • Andre Pereira, TRAC Program Manager, Office of Electricity, U.S. Department of Energy
9:30 – 10:30 am	**U.S. Department of Energy Panel** • David Howard, Senior Program Manager, Office of Cybersecurity, Energy Security, and Emergency Response, U.S. Department of Energy • Fernando Palma, Program Manager, Office of Electricity, U.S. Department of Energy • Hannah Taylor, Technology Manager, Wind Energy Technology Office, U.S. Department of Energy
10:30 – 10:40 am	**BREAK**
10:40 am – 12:00 pm	**TRAC Program Presentations** • Prasad Kandula, Research Staff Scientist, Oak Ridge National Laboratory *Medium voltage DC/DC Intelligent Power Stage (IPS)* • Ghanshyamsinh Gohil, Lead Scientist, Hitachi Energy *Modular Solid-State Switch (MS3)* • Jack Flicker, Principal Member of Technical Staff, Sandia National Laboratories *High Voltage, High Power WBG Module Development* • Madhu Chinthavali, Group Leader, Power Electronics Systems Integration, Oak Ridge National Laboratory *SSPS 1.0 Hardware Prototype Development*

12:00 – 1:30 pm	**Working Lunch**
1:30 – 3.00 pm	**TRAC Program Presentations** • Michael Starke, Power Systems Researcher, Oak Ridge National Laboratory *GMLC 2.4.2 – Multiport HUB: SSPS Architecture Framework* • Radha Krishna Moorthy, R&D Associate Staff, Oak Ridge National Laboratory *SSPS Hardware in the loop (HIL) validation* *SSPS 1.0 node Use case Validation with Smart Universal Power Electronics Regulators (SUPERs)* • Joao Pereira Pinto, PhD, Oak Ridge National Laboratory *Solid State Power Substation (SSPS) 1.0 Controller* • Jason Autrey, Manager, Power Delivery R&D, Southern Company *SSPS Field Demonstration*
3:00 – 3:10 pm	**BREAK**
3:10 – 4:50 pm	**TRAC Program Presentations** • Vahan Gevorgian, Chief Engineer, National Renewable Energy Laboratory *SuperFACTS* • Deepakraj Divan, Profesor, Georgia Tech *LPT FOA GA Tech* • Sanjay Rajendran, Graduate Research Assistant, University of Texas at Austin *LPT FOA University of Texas Austin* • Sudip Mazumder, President, Nextwatt *LPT FOA Nextwatt* • Bjorn Vaagensmith, Power Systems Researcher, Idaho National Laboratory *Transmission Optimization with Grid Enhancing Technologies (TOGETs)*
4:50 – 5:00 pm	**Closing Remarks**

DAY 2 – WEDNESDAY, JUNE 28, 2022

Time	Agenda
8:30 – 8:40 am	**Welcome Remarks** • Andre Pereira, TRAC Program Manager, Office of Electricity, U.S. Department of Energy
8:40 – 10:20 am	**TRAC Program Presentations** • Suman Debnath, Energy Science and Technology Directorate, Oak Ridge National Laboratory *Scalable Hybrid Large-Scale dc-ac Grid Analysis Methods* • Prasad Kandula, Research Staff Scientist, Oak Ridge National Laboratory *MVDC Use Case* • Jeffrey Wuenschell, Research Scientist, National Energy Technology Laboratory *Optical Fiber Sensors for Acetylene Detection* • Iver Anderson, Senior Metallurgist, Ames National Laboratory *Al/Ca Composite Conductor* • Jagan Devkota, Research Scientist, National Energy Technology Laboratory *Soft Magnetics for Power Conversion Applications*
10:20 – 10:30 am	**BREAK**
10:30 – 10:50 am	**New Project Portfolio** • Bjorn Vaagensmith, Power Systems Researcher, Idaho National Laboratory
10:50 – 11:50 am	**National Lab Grid Integration Capabilities** • Murali Baggu, Laboratory Program Manager - Grid Integration, National Renewable Energy Laboratory • Valerio DeAngelis, Manager, Power Electronics and Energy Conversion Group, Sandia National Laboratories • Wei Du, Electrical Engineer, Pacific Northwest National Laboratory • Bo Zhang, Staff Scientist, Energy Storage & Electric Transportation Department, Idaho National Laboratory

	• Brian Rowden, Grid Systems Hardware Group Leader, Oak Ridge National Laboratory
11:50 am – 12:00 pm	**Closing Remarks** • Andre Pereira, TRAC Program Manager, Office of Electricity, U.S. Department of Energy
12:00 – 1:00 pm	**Working Lunch (optional)**
1:00 – 3:00 pm	**GRID-C Tour and Demos (optional)**