

Minutes – Fourth Meeting: WG PC57.133

"Guide for Evaluating Transformer Performance under Reverse Power Flow"

3:00 to 4:00 PM EDT | June 10, 2025

Virtual only – Google Meet

Chair:	Ryan Hogg	Bureau of Reclamation	rhogg@ieee.org
Vice Chair:	Bruce Webb	Knoxville Utilities Board	bruce.webb@kub.org
Secretary:	Drew Welton	Intellirent	dwelton@intellirentco.com

Minutes – items in green = discussion during meeting

1. [Behavior](#), [Copyright](#), and [Patent](#) – reviewed all slides
2. Quick review – PAR (expires 12/31/2028) – reviewed
3. Attendance form and quorum check (78 members; 40 required for quorum)
 - a. QR code to Google Form used for attendance – 63 total in attendance
 - b. 36 members in attendance
 - i. did NOT achieve quorum
 - ii. no official business able to be conducted
 - c. 27 guests in attendance
4. Agenda approval – not able to be approved, no quorum
5. Minutes approval – March 25, 2025 meeting (Denver) – not able to be approved, no quorum
6. Status update – TF Definition of Transformer Reverse Power (Chair = Ryan Hogg)
 - a. R. Hogg discussed all the following sub-bullets (b. through d.), including the TF submitted definition back to the working group
 - b. Held 3 virtual meetings, work complete
 - c. Definition and note approved unanimously by TF:
 - i. "transformer reverse power flow" - A transformer operating condition in which power flows from the designed power output (secondary) winding(s) to the designed power input (primary) winding(s).
 - ii. Note: Some transformers are designed for power flow in both directions.
 - d. TF work is complete, no further meetings planned
7. Request task force chairs/volunteers, literature review & draft proposed guide sections
Volunteers listed in green
 - a. Literature review – Joe White
 - b. Voltage regulation – Ed teNyenhuis
 - c. Core saturation – Ed teNyenhuis
 - d. Winding heating – Ed teNyenhuis
 - e. Voltage imbalance – Alan Zhang
 - f. Volts per turn increase – Luis Fernando de Oliveira

- g. Asymmetrical pennant cycle tap changer – Karsten Viereck
 - h. Inverters – Hemchandra Shertukde and Phil Hopkinson
 - i. GSUs – David Garcia, Ryan Hogg, Jose Izquierdo, and John John
 - j. OLTC high number of operations – James Gardener and John John
 - k. Paralleling transformers – Eric Elson and James Gardener
 - l. Over voltage – *no volunteer*
8. Presentation – “Impacts of reverse power flow on substation transformers”
- a. by Jouni Peppanen (EPRI) and Wei Ren (EPRI)
 - b. Working Group obtained copyright permission to show and use EPRI’s presentation (document dated May 21, 2025)
 - c. Slides included with minutes
 - d. Questions/comments following presentation
 - i. Chris Johnson: How many transformers to validate the thermal model?
 - 1. Wei Ren answer: 20
 - ii. Luiz Fernando de Oliveira: Recent paper written by Luiz on power flow from inner to outer winding or the other way
 - iii. David Garcia: Would like to see information related to the thermal impacts, designers consideration of thermal impacts of reverse power
9. Call for volunteers to present at future meetings: – *ran out of time to discuss*
- a. E.g., how have you/your organization been approaching reverse power and transformers, what impacts are you/your organization seeing...
 - b. Possible future/in the works
 - i. Fall 2025 – Joe White (Power Engineers)
 - ii. Fall 2025 – Dr Karsten Viereck (Reinhausen)
10. Old Business – none – *reviewed*
11. New Business – any? – *ran out of time to discuss*
12. Next meetings – *reviewed*
- a. In person: Fall 2025 in Bonita Spring, FL
13. Adjourn

Working Group Force Membership/Guests:

	First Name	Last Name	Affiliation	Membership	Attended June 10, 2025 Meeting?
1	Kayland	Adams	Prolec-GE Waukesha	Member	No
2	Gilles	Bargone	FISO	Member	No
3	Mats	Bernesjo	Hitachi Energy	Member	No
4	Daniel	Blaydon	Baltimore Gas and Electric	Member	No
5	William	Boettger	Boettger Transformer Consulting LLC	Member	No
6	Garrett	Bradshaw	Howard Industries	Member	No
7	Jeffrey	Brooks	Asplundh Engineering Services	Member	Yes
8	Alfredo	Carrizales	Prolec GE	Member	No
9	Thomas	Dauzat	AEP-SWEPCO	Member	Yes
10	Luiz	de Oliveira	Hitachi Energy	Member	Yes
11	Nikolaus	Dillon	Dominion Energy	Member	Yes
12	Fernando	Duarte	Hitachi Energy	Member	Yes
13	Roger	Dugan	(Retired) Self	Member	Yes
14	Eric	Elson	San Diego Gas & Electric	Member	Yes
15	Eduardo	Garcia	Siemens Energy	Member	Yes
16	James	Gardner	Prolec-GE Waukesha	Member	Yes
17	Ramsis	Girgis	Hitachi Energy	Member	No
18	Jose Antonio	Gonzalez Ceballos	Virginia/Georgia Transformers	Member	No
19	William	Griesacker	WGA	Member	Yes
20	Corey	Hanson	Flex-Core	Member	No
21	Giovanni	Hernandez Decanini	Virginia Transformers Corp	Member	Yes
22	Ryan	Hogg	Bureau of Reclamation	Member	Yes
23	Derek	Hollrah	Burns & McDonnell	Member	Yes
24	Saif	Hossain	Trench Group	Member	No
25	Jose	Izquierdo	Siemens energy	Member	Yes
26	Nick	Jensen	Delta Star	Member	Yes
27	John	John	Virginia Transformer Corp	Member	Yes
28	Christopher	Johnson	Oncor	Member	Yes
29	Akash	Joshi	Kimley-Horn	Member	No
30	Anton	Koshel	Delta Star Inc	Member	No
31	Mark	Lachman	Doble	Member	No
32	Xose	Lopez-Fernandez	Universidade de Vigo	Member	No
33	Kushal	Mahajan	Sungrow	Member	No
34	Swapnil	Marathe	Megger	Member	No
35	Brian	McCarrick	Virginia Transformer Corp	Member	Yes
36	Omar	Mendez	Prolec	Member	Yes
37	Emilio	Morales-Cruz	Qualitrol	Member	No

	First Name	Last Name	Affiliation	Membership	Attended June 10, 2025 Meeting?
38	Tyler	Morgan	Duke Energy	Member	Yes
39	Dan	Mulkey	Mulkey Engineering Inc	Member	No
40	Fredy	Murcia	Siemens Energy	Member	Yes
41	Hugo	Murillo	HJ	Member	No
42	Ali	Naderian	EnerPars	Member	No
43	Shankar	Nambi	Bechtel Energy, Inc.	Member	No
44	Sanjay	Patel	Royal Smit Transformers	Member	No
45	Vinay	Patel	Con Edison	Member	No
46	Gustavo	Prado	Siemens Energy	Member	No
47	Tim	Raymond	Inductive Reasoning	Member	No
48	Yuri	Rossini	Siemens Energy	Member	Yes
49	Marnie	Roussell	Entergy	Member	No
50	Amitabh	Sarkar	Virginia Transformer Corporation	Member	Yes
51	Markus	Schiessl	SGB	Member	Yes
52	Eric	Schleismann	Southern Company	Member	No
53	Hemchandra	Shertukde	University of Hartford	Member	No
54	Stephen	Shull	BBC Electrical Services Inv	Member	Yes
55	Andy	Speegle	Entergy	Member	No
56	Brad	Staley	Leeward Renewable Energy	Member	No
57	Sunny	Swarna	Virginia Transformer Corp	Member	No
58	Marc	Taylor	JFE Shoji Canada	Member	No
59	Joseph	Tedesco	Hitachi Energy	Member	Yes
60	Ed	teNyenhuis	Hitachi Energy	Member	Yes
61	Mark	Tostrud	Dynamic Ratings	Member	No
62	Kannan	Veeran	Virginia/Georgia Transformer Corp	Member	Yes
63	Karsten	Viereck	Consultant for Reinhausen	Member	Yes
64	Dharam	Vir	Prolec GE	Member	Yes
65	Pragnesh	Vyas	Cleveland cliffs	Member	No
66	David	Walker	MGM Transformers	Member	No
67	Joe	Watson	JD Watson and Associates	Member	No
68	Bruce	Webb	Knoxville Utilities Board	Member	No
69	Drew	Welton	Intellirent	Member	No
70	Joe	White	POWER Engineers	Member	Yes
71	Terry	Wong	Trench Limited	Member	Yes
72	Jeffrey	Wright	Duquesne Light	Member	Yes
73	Fei	Yang	Hitachi Energy	Member	No
74	Guang (Grace)	Yuan	Hitachi Energy	Member	Yes
75	Michael	Zarnowski	Carte International	Member	No
76	Hongzhi (Alan)	Zhang	Hitachi Energy	Member	Yes

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77	Shibao	Zhang	PCORE Electric	Member	No
78	Waldemar	Ziomek	PTI Transformers LP	Member	Yes
79	Stefan	Abelen	Maschinenfabrik Reinhausen Germany	Guest	Yes
80	Mihirkumar	Amin	Eaton Corporation	Guest	Yes
81	Kyungchan	An	HYOSUNG	Guest	No
82	Alex	Ayala	ERMCO power partners	Guest	No
83	Duvier	Bedoya	Hitachi	Guest	No
84	Edwin	Betancourt	Siemens Energy	Guest	No
85	Enrique	Betancourt	Prolec GE	Guest	No
86	Naveen	Bhardwaj	Trench Group	Guest	No
87	Kevin	Biggie	Weidmann	Guest	No
88	Jeremiah	Bradshaw	Bureau of Reclamation	Guest	No
89	Josipa	Brekalo	Koncar D&ST	Guest	No
90	Christopher	Brown	San Diego Gas and Electric	Guest	No
91	David	Calitz	Siemens Energy	Guest	No
92	Fidel	Castro	Sdge	Guest	No
93	Bhaumik	Choksi	Hitachi Energy	Guest	No
94	Rhett	Chrysler	ERMCO	Guest	No
95	Adriana	Cisco Sullberg	Salt River Project	Guest	Yes, requested membership - granted after meeting
96	Brian	Conneighton	Cleveland Cliffs	Guest	No
97	Janet	Crockett	Fayetteville PWC	Guest	Yes
98	Rich	Cryer	Digitaldrid inc	Guest	No
99	Marcos	Czernorucki	Hitachi Energy	Guest	No
100	Sami	Debass	EPRI	Guest	No
101	Scott	Digby	Duke Energy	Guest	No
102	Paul	Dolloff	EKPC and University of Kentucky	Guest	No
103	Samraghi	Dutta Roy	Siemens Energy Inc	Guest	No
104	Janko	Dzodan	Koncar D&ST	Guest	No
105	Egui	Espitia	Reinhausen Manufacturing Inc	Guest	No
106	Sanford	Fong	Georgia Power	Guest	Yes, requested membership - granted after meeting

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107	Patrick	Foster	NextEra Energy	Guest	No
108	Raymond	Frazier	Ameren	Guest	No
109	Alan	Fujimori	Romagnole	Guest	Yes
110	Jose	Gamboa	The H-J Family of Companies	Guest	No
111	Miguel	Garcia	Hitachi Energy	Guest	No
112	David	Garcia-Paredes	Virginia Transformers Corp	Guest	Yes
113	Dragana	Gasic	Koncar D&ST	Guest	No
114	Orlando	Giraldo	The H-J Family of Companies	Guest	No
115	Alireza	Gorzin	Black & Veatch	Guest	No
116	Shawn	Gossett	Ameren	Guest	No
117	Christine	Grunbaum	Ameren	Guest	Yes
118	Jesse	Hall	Virginia Transformer Corp.	Guest	Yes
119	Didier	Hamoir	Transformer Protector Corporation	Guest	No
120	Kevin	Hampton	Siemens Energy	Guest	No
121	Kyle	Heiden	Eaton	Guest	Yes
122	Peter	Heinzig	Weidmann	Guest	No
123	Jean Carlos (JC)	Hernandez-Mejia	Georgia Tech NEETRAC	Guest	No
124	Saramma	Hoffman	PPL	Guest	No
125	Phil	Hopkinson	Hvolt	Guest	No
126	Miljenko	Hrkac	Hitachi Energy	Guest	No
127	Balaji	Janakiraman	Virginia Transformer	Guest	Yes
128	Kurt	Kaineder	TRENCH	Guest	No
129	Thrinadha	Katapalli	Virginia Transformer Corp	Guest	No
130	Gary	King	Consultant/self	Guest	Yes
131	Kenneth	Klein	Johnson	Guest	Yes
132	Dmitriy	Klempner	Southern California Edison	Guest	Yes
133	Nicholas	Koinis	CenterPoint energy	Guest	No
134	Matija	Koprivnjak	Končar D&ST	Guest	No
135	Nihat	Kosedagi	Hitachi Energy	Guest	No
136	Krzysztof	Kulasek	Delta Star Inc.	Guest	No
137	Jihun	Lee	HD HYUNDAI ELECTRIC	Guest	No
138	Junho	Lee	HD Hyundai Electric	Guest	No
139	Angela	Leigl	Eaton	Guest	No
140	Tim-Felix	Mai	Siemens Energy	Guest	No
141	Kumar	Mani	Duke Energy	Guest	Yes
142	Daniel	Martinez	Jfe guest	Guest	No
143	Katherine	Marulanda	Magnetron	Guest	No
144	Filip	Mikulecky	Koncar Power Transformers Ltd.	Guest	No
145	Curtis	Moore	DIGITALGRID, INC.	Guest	No

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146	Charles	Morgan	Eversource Energy	Guest	No
147	Aniruddha	Narawane	Eaton	Guest	No
148	Eduardo	Orozco	GE Grid Solutions	Guest	Yes
149	Ashwin	Padmanaban Iyer	STP	Guest	No
150	Dipeshkumar	Patel	Hyper solutions	Guest	No
151	Monil	Patel	PG&E	Guest	No
152	Nitesh	Patel	Hyundai Power Transformers	Guest	No
153	Jouni	Peppanen	EPRI	Guest	Yes
154	Marcelino	Perez	Prolec	Guest	No
155	Luka	Peuc	Končar D&ST	Guest	No
156	Thien	Pham	Siemens Energy	Guest	No
157	Chris	Powell	Intermountain Electronics	Guest	No
158	João	Pranke	Federal University of Santa Maria	Guest	No
159	Adnan	Rashid	Measurement Canada	Guest	No
160	Robert	Reepe	Georgia Power Co	Guest	No
161	Wei	Ren	EPRI	Guest	Yes
162	Juan	Rodriguez	Magnetron	Guest	No
163	Rodrigo	Ronchi	WEG Transformers México	Guest	Yes
164	Michael	Rossignol	Central Maine Power Company	Guest	Yes
165	Paul	Salvato	Intellirent	Guest	No
166	Daniel	Sauer	Eaton	Guest	No
167	Kabir	Sethi	Hitachi Energy Germany Ag	Guest	No
168	Salahuddin	Shaikh	NRG Energy Inc	Guest	No
169	Masoud	Sharifi	Siemens Gamesa Renewable Energy	Guest	No
170	Leena	Shimpi	Mgm transformer	Guest	No
171	Igor	Simonov	Toronto Hydro	Guest	No
172	Jason	Snyder	First Energy Corp	Guest	Yes, requested membership - granted after meeting
173	James	Spaulding	City of Fort Collins Utilities	Guest	No
174	Markus	Stank	MR	Guest	Yes
175	Andy	Steineman	Delta Star, Inc.	Guest	No
176	Janusz	Szczechowski	Reinhausen	Guest	No
177	Michael	Thompson	SEL Engineering Services	Guest	No
178	Timothy	Tillery	Howard Industries	Guest	No
179	Eduardo	Tolcachir	TTE Transformers	Guest	Yes
180	Leonard	Torchia	PSE&G	Guest	No

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181	Reinaldo	Valentin	Duke Energy	Guest	Yes
182	Valentina	Valori	Hitachi Energy	Guest	No
183	Juan	Velasquez	Magnetron SAS	Guest	No
184	Krishnamurthy	Vijayan	Pennsylvania transformers	Guest	No
185	Matt	Weisensee	PacifiCorp	Guest	No
186	Bill	Wise	Wunderlich-Malec Engineering	Guest	Yes
187	Stephen	Wolbach	Alabama Power	Guest	No
188	Jiahao	Xie	S&C electric	Guest	Yes
189	Koray	Yavuz	Noark Electric US	Guest	No
190	Tim	Young	Hitachi Energy	Guest	No
191	Patrycja	Jarosz	IEEE SA	IEEE SA	Yes

Note: Membership was only granted to those requesting who had attended two of the last three meetings.