P1409 CUSTOM POWER TASK FORCE

IEEE 15.06.05.01

Meeting Minutes

IEEE PES Winter 1998 Meeting, Tampa, Florida
Tuesday, February 3, 1998, 1:00 to 3:00 PM
Hyatt Regency Westshore Hotel, Sandhill Crane Room

The Custom Power Task Force met during the IEEE PES Winter 1998 Meeting in Tampa, Florida. Dan Sabin chaired the meeting.

Introductions

Attendees introduced themselves, identifying their names and company affiliations. A total of 49 people signed the attendance list, a summary of which is attached. Sabin asked the attendees to update their addresses, phone numbers, etc., on the membership list. The updated membership list is attached to these minutes. Fifteen members were downgraded from membership status to guest status at this time. These members had not attended a meeting since July 1996 and had not been touch with the task force since that time as well. Currently, the task force database lists 76 members, 16 correspondence members, and 95 guests.

Minutes from Berlin

The last meeting of the task force was at the 1997 IEEE PES Summer Meeting in Berlin, Germany. Sabin prepared the minutes for this last meeting and he reviewed them at the Tampa meeting. The discussion at the Berlin meeting focused on the group's PAR and on two presentations*: Update on Custom Power Technology Development and Application* by Dan Sabin, and *Economic Evaluation of Power Quality Conditioning Equipment for an Industrial Customer* by Marek Waclawiak. Those present at the Tampa meeting unanimously approved at the minutes.

The IEEE Standards System houses the homepage for the task force. It is located at http://stdsbbs.ieee.org/groups/1409/. Currently, the following information is available at the site:

- General information about P1409
- Archive of drafts of the P1409 Guide in Adobe Acrobat PDF format
- Announcements of meetings
- Latest version of the custom power technology development list
- Minutes and agendas from prior meetings in PDF format

Chair's Report

After the Berlin meeting, the P1409 chair submitted an updated Project Authorization Request (PAR) form to the chair of the Voltage Quality Working Group, Jim Burke. The PAR is the official document that authorizes work on your standards project in the IEEE. Burke submitted the form to Ben Spherling of the IEEE Transmission and Distribution Committee, who in turn submitted the form to Karl Mortensen. Mortensen acts as the Sponsor Chair of the Sponsor's Liaison Representative to the Standards Board. He ultimately submitted the form to the IEEE NesCom Secretary, who scheduled the PAR for discussion at the December 8, 1997 meeting of the IEEE New Standards Committee (NesCom).

At that December meeting, NesCom disapproved the P1409 PAR. There were six votes to approve the PAR and two to disapprove it. The reason that Jim Burke was given to explain why the PAR was disapproved what that NesCom wanted to know what was meant by "quality characteristics." NesCom specifically asked for one of two things: (1) replace the word "quality" with a quantifiable and IEEE defined notion, or (2) refer in the text to another standard which specifies the term quality and how it is measured. To resolve the negative votes, the chair of P1409 has revised the PAR, adding the following text to the text of the its scope:

> "The proposed document will address power assessment techniques as specified by IEEE Std. 1250-1995, which defines power quality terms and phenomena, and IEEE Std. 1159-1995, which provides a recommended practice for measuring power quality."

The P1409 PAR has been submitted and disapproved before. In December 1994, a PAR for P1409 was returned to sponsor for better focus and scope. IEEE NesCom wanted to know whether the standard was to address the distribution system of the electric supplier or the utilization of the electric source. In June 1995, a revised PAR was returned to sponsor for a clearer, more appropriate title. NesCom strongly also suggested international coordination.

Jim Burke was present at the P1409 meeting. He recommended that the task force resubmit the form again, making the requested additions about IEEE 1250 and 1159. The P1409 chair submitted the revised form at the IEEE Voltage Quality Working Group Meeting following the P1409 task force meeting.

The discussion during the chair's report resulted in two action items:

1. Resubmit the P1409 PAR with references to IEEE Std. 1250-1995 and IEEE Std. 1159-1995

2. Begin work on IEEE Special Publication with same scope and goals as P1409 document

Special Publication

The P1409 task force formed at the IEEE PES Winter 1994 meeting in New York. Since that meeting, it has been busied with getting a PAR form approved by IEEE NesCom, and has failed to do so three times. However, the group has not been idle in that time. The group has organized three panel sessions on custom power. One was held at the 1996 Transmission and Distribution Conference and Exposition held in Los Angeles; two were held at the IEEE PES Winter 1998 meeting in Tampa. Numerous people have contributed documents to the P1409 Guide; a first draft of that guide was written in time for the IEEE PES Winter 1997 meeting in New York.

The P1409 chair feels that there is sufficient material available to develop an IEEE Special Publication that will introduce and define the emerging technology of custom power. It will address devices and circuit configurations of power electronic equipment used in utility power distribution systems rated 1 kV through 38 kV. Topics for the special publication include definitions, general needs, configurations and their objectives, input and output requirements, laboratory and field performance measurements, case studies, engineering issues, and bibliographical information.

Dan Sabin is coordinating the development of the document. Any task force members who have material that they wish to submit for the document should contact Sabin. A letter of intent needs to be filed with the IEEE on the task force's intent on publishing the document.

It was agreed during the Tampa meeting that a target date of July 1998 would be good for a draft of the document. A tentative final publication date of February 1998 was identified as well.

Narain Hingorani of Hingorani Power Electronics, who is the chair of the CIGRE Custom Power Working Group, offered to supply the P1409 task force with definitions on custom power upon which his group has already settled. The CIGRE Custom Power Working Group is currently engaged in writing a paper entitled "Custom Power: State of the Art," which is focused on providing up to date information on the technology. It was suggested at the task force meeting that a liaison relationship be established between the P1409 task force and the CIGRE group.

Update on the Custom Power Technology Development List

Dan Sabin gave a presentation discussing the latest version of the Custom Power Technology Development List. The latest version is attached to these minutes. It now lists the activities of fifteen different utility systems. He discussed the utility applications of five custom power devices, including the static circuit breaker, static transfer switch, static series device, static shunt device, and static var compensator.

This presentation raised a lengthy discussion on the issue of task force scope. Jim Burke of ABB raised the question on what is custom power. Is the definition of custom power simply the application of devices controlled by power electronics that enhance power quality? If so, then why should the task force exclude series capacitors from its treatment on custom power devices? Others in the room disagreed, in particular, Neil Woodley of Westinghouse and Narain Hingorani. Hingorani explained that his definition of custom power is a concept based on the use of static controllers in the distribution system for electric utilities to supply value-added power with the reliability and power quality requested by the customer.

Another point raised during the presentation was the question of application voltage. Reigh Walling of General Electric asked why there was no mention in the presentation of static series device installations at the 480 volt level. He said that that there has been such a device installed at Public Service Electric and Gas for a number of years. What makes this device different than the devices at Duke Power and ScottishPower that were listed in the presentation? His point was that he felt that both devices internally condition power at 480 volts; they differ in that the Duke Power and ScottishPower devices use step-up transformers to apply the conditioned voltage at 12 kV. (Note: Steve Middlekauff of Duke Power made a point to the chair after the meeting that this statement was not true; the Duke Power device uses an internal 4000 volt DC link.) The chair answered Walling's question by stating that it is the voltage level at which the device is *applied* that is key to including a device in the scope of the task force. Einar Larsen of General Electric suggested that all task force documents should make a note to the reader that the concept of custom power includes certain devices but does not necessarily cover all aspects of power conditioning.

Special Technical Sessions

Application of Static Transfer Switches for Enhanced Power Quality

The custom power task force organized two special technical sessions for IEEE PES Winter Meeting. The first was entitled, "Application of Static Transfer Switches for Enhanced Power Quality," and was chaired by Greg Rauch of Dranetz-BMI Company. It took place on Monday, February 2, 1998, from 2:00 to 5:00 PM, in the Marriott Westshore Hotel, Regency Room. Over seventy people attended this session. A good discussion was held at the end of the session that focused on the responsibility of cost for static transfer switches.

The following list furnishes the names and affiliations of the panelists.

- Colin Bowler, ABB Power T&D Company, Inc.
- Eduardo Alegria, PG&E Energy Services
- Mark McVey, Virginia Power
- Wes Spencer, PowerDigm Systems
- Bill Carter, Detroit Edison
- Greg Welch, Commonwealth Edison

Application of Static Voltage Conditioning Devices for Enhanced Power Quality

The second technical panel session was entitled, "Application of Static Voltage Conditioning Devices for Enhanced Power Quality," and was chaired by Dan Sabin. It took place on Wednesday, February 4, 1998, 2:00 to 5:00 PM. It was also scheduled to take place in the Marriott Westshore Hotel, Regency Room. The following list furnishes the names and affiliations of the panelists and the title of their presentations.

- *Topologies of Custom Power Technologies for Voltage Support*, Neil Woodley, Westinghouse Electric Corporation
- *Field Experience with a Static Series Compensation Device*, Stephen Middlekauff, Duke Power
- *Power Electronic Tap Changer*, Le Tang, ABB Power T&D Company, Inc.
- *Factory Test of Static Voltage Regulators*, Eduardo Alegria, PG&E Energy Services
- *Static Series Voltage Compensator Applications*, Einar Larsen, General Electric
- *Distribution System Static Var Compensators: Field Experience*, Ray Kemerer, Power Quality Services, Inc.

Fearing that the room would be too small for expected audience of one hundred people, the chair attempted on Wednesday morning to have the second session rescheduled for a larger room in the Marriott, but was informed by the local IEEE organizing personnel that rescheduling was impossible. Over one hundred people did indeed attend the session. The room was so full that it became necessary to interrupt the panel session during the

presentation of the second speaker in order to move the session to a larger room in the Marriott. The IEEE organizing personnel had found a larger room once it became apparent that approximately thirty people could not fit into the smaller room. A positive note can be made on the two crowded panel sessions: there are many people who are very interested in hearing what is to be said about custom power technologies.

Some good presentations were made at this panel session delivered by both utility users and vendors of custom power devices. Some new device configurations were also announced as part of a presentation. The discussion at the end of the session focused on responsibility of cost. Some attendees see custom power as a potential means for power providers to offer enhanced power services to the customers who need it. One attendee felt that many of the vendors of custom power equipment are passing on R&D costs to utilities and therefore these vendors are slowing the growth of the market.

Liaison Relationships

No liaison reports were made at this meeting.

Appointment of Secretary

Stephen Middlekauff of Duke Power has been appointed as the secretary of the P1409 task force. Steve has attended many of the prior meetings, has been an active contributor the P1409 document, and has participated in two prior panel sessions sponsored by the task force. Dan Sabin and Steve shared the tasks of P1409 secretary for the Tampa meeting, but Steve will assume full responsibility for the position at the San Diego meeting.

Panel Session at Summer Power Meeting

Based on the success of the two custom power panel sessions held at the Tampa meeting, the IEEE Transmission and Distribution Committee asked Dan Sabin to organize a similar panel session for the next meeting of the Power Engineering Society in San Diego. Sabin is currently organizing this session.

Next Meeting

The next meeting of the Custom Power Task Force will be at the IEEE PES Summer Meeting in San Diego, California. The task force should meet on Tuesday, July 14, 1998.

Action Items

Action Item Number	Task	Coordinator	Status
1	Resubmit the P1409 PAR with references to IEEE Std. 1250-1995 and IEEE Std. 1159-1995	Dan Sabin	Complete
2	Begin work on IEEE Special Publication with same scope and goals as P1409 document	Dan Sabin	In progress
3	File letter of intent with IEEE on intent to publish special document	Dan Sabin	Not begun; will be complete by July 1998
4	Organize a panel session for the San Diego meeting of the IEEE PES	Dan Sabin	In progress

Attachments

1. Meeting Agenda, Custom Power Task Force Winter 1998 Meeting
2. Meeting Attendance, Custom Power Task Force Winter 1998 Meeting
3. Most recent membership list for the Custom Power Task Force
4. Most recent copy of the Custom Power Technology Development List

Minutes submitted on March 9, 1998 by

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P1409 DISTRIBUTION CUSTOM POWER TASK FORCE

IEEE 15.06.05.01

Meeting Agenda

IEEE PES Winter 1998 Meeting, Tampa, Florida
Tuesday, February 3, 1998, 1:00 to 3:00 PM
Hyatt Regency Westshore Hotel, Sandhill Crane Room

The Custom Power Task Force will meet next during the IEEE Power Engineering Society 1998 Winter Meeting in Tampa, Florida. We will meet on Tuesday, 3 February 1998 from 1:00 PM to 3:00 PM in the Hyatt Regency Westshore Hotel.

1. Welcome
2. Introductions
3. Review minutes from previous Berlin meeting and agenda for present meeting
4. Update on PAR
5. Change in Focus: Special Publication
6. Update on the Custom Power Technology Development List
7. Technical Sessions
8. New Business
9. Internet Resources
10. Action Items
11. Next Meeting: Summer IEEE PES Summer Meeting in San Diego on July 14, 1998
12. Adjourn

P1409 CUSTOM POWER TASK FORCE

IEEE 15.06.05.01

Meeting Attendance

IEEE PES Winter 1998 Meeting, Tampa, Florida
Tuesday, February 3, 1998, 1:00 to 3:00 PM
Hyatt Regency Westshore Hotel, Sandhill Crane Room

Name	Representing
Gilles Allard	Hydro-Québec
George Bowden	Transalta Utilities Corp.
Richard L. Brown	Tempo Instrument Inc.
James L. Burke	ABB Power T&D Company, Inc.
Kevin Chan	ABB High Voltage Technologies, Ltd.
Randy Collins	Clemson University
Andy Dettloff	Detroit Edison
Shashi Dewan	Inverpower Controls
Russ Ehrlich	Conectiv / Delmarva Power
Dave Gilmer	Yampa Valley Electric Assn., Inc.
Pierre Giroux	IREQ (Hydro-Quebec)
Narain Hingorani	Hingorani Power Electronics
Reza Iravani	University of Toronto
Brian K. Johnson	Department of Electrical Engineering
John Kennedy	Georgia Power Company
W. O. Kramer	Silicon Power Corporation
Tom Kulas	Northern States Power Co.
Frank Lambert	Georgia Tech - NEETRAC
Tom LaRose	Salt River Project
Einer Larsen	General Electric
Peter Lehn	University of Toronto
Jim Lemke	Cinergy
Blane Leuschner	Square D Company
W. H. Liu	Bechtel
Edwin Liu	Bechtel Consulting
Mark F. McGranaghan	Electrotek Concepts, Inc.
Mark McVey	Virginia Power
Stephen Middlekauff	Duke Power Company
Ram Mukherji	Enron Energy Services
Ray O'Leary	S&C Electric
Thomas Ortmeyer	Clarkson University
Brian Prokuda	Keweenaw Power Systems
Alvaro J. P. Ramos	University of Pernambuco - Escola Politecnica
Greg Rauch	Dranetz-BMI
Paulo F. Ribeiro	Babcock & Wilcox - Accelerator & Magnet Systems
Tom Rollman	Excel Engineering
Francisco de la Rosa	Consultant
D. Daniel Sabin	Electrotek Concepts, Inc.

Joseph M. Santuk	Virginia Power Co.
Tom Short	Power Technologies, Inc
Tony St. John	San Diego Gas & Electric
David Vannoy	Delmarva Power and Light
Randy Wachal	Manitoba HVDC Research Center
Marek Waclawiak	United Illuminating Company
Van Wagner	Square D
Reigh Walling	General Electric
Cheri Warren	Power Technologies, Inc.
Neil H. Woodley	Westinghouse Electric Corporation

Total in Attendance: 48

P1409 CUSTOM POWER TASK FORCE

IEEE 15.06.05.01

Membership List - March 9, 1998

Allard, G., Montreal, Québec, Canada
Antonopulos, C., Putnam Valley, NY
Baker, G., Maitland, FL
Balda, J., Fayetteville, AR
Barker, P., Schenectady, NY
Basch, V., Baltimore, MD
Bergeron, R., Varennes, Québec, Canada
Bollen, M., Gothenburg, Sweden
Bowden, G., Calgary, Alberta, Canada
Burke, L.J., Raleigh, NC
Carter, B., Detroit, MI
Caverly, D., Scarborough, Ontario, Canada
Chan, K., Zurich, Switzerland
Collins, R., Clemson, SC
Conrad, L., Plainsfield, IN
Crane, J., Maywood, IL
Dagher, F., Westboro, MA
Dettloff, A., Detroit, MI
Dewan, S., Burlington, Ontario, Canada
Ehrlich, R., Newark, DE
Eichin, P., Spokane, WA
Evans, R., Richmond, VA
Farraj, I.S., Los Angeles, CA
Forsten, K., Knoxville, TN
Gannon, W., Maywood, IL
Gentile, T., West Bridgewater, MA
Gilmer, D., Steamboat Springs, CO
Gunther, W.E., Knoxville, TN
Hanson, E., Ft. Edward, NY
Hensley, G., San Francisco, CA
Hingorani, N., Los Altos, CA
Jalali, S., Alpharetta, GA
Jefferson, T., Scarborough, Ontario, Canada
Jipping, J., Detroit, MI
Johnson, K.B., Moscow, ID
Keane, G., Orlando, FL
Kennedy, J., Atlanta, GA
Key, S.T., Knoxville, TN
Kreiss, D., Del Mar, CA
Krisciunas, M.P., Maywood, IL
Kulas, T., Minneapolis, MN
Lambert, F., Atlanta, GA
LaRose, T., Phoenix, AZ
LaRose, W.T., Phoenix, AZ
Larsen, E., Schenectady, NY
Lemak, T., Pittsburgh, PA
Lemke, J., Kokomo, IN
Leuschner, B., La Vergne, TN
Liu, H.W., San Francisco, CA
M., A.S., Richmond, VA
Mansoor, A., Knoxville, TN
Marz, B.M., Franksville, WI
McCluer, S., Costa Mesa, CA
McGranaghan, F.M., Knoxville, TN
McVey, M., Richmond, VA
Mehta, H., Malvern, PA
Middlekauff, S., Charlotte, NC
Moncrief, A.W., Norcross, GA
Morgan, L., Charlotte, NC
Mukherji, R., Covina, CA
Mullins, C., Harrisburg, PA
Narang, A., Toronto, Ontario, Canada
Nelson, B., Orlando, FL
O'Leary, R., Chicago, IL
Olson, L.G., Newark, NJ
Ortmeyer, T., Potsdam, NY
Otterstetter, A.T., Detroit, MI
Pearson, D., San Francisco, CA
Peele, S., Raleigh, NC
Prokuda, B., Howell, MI
Ramos, J.A., Recife, Brazil
Rauch, G., Santa Clara, CA
Reynolds, A.M., Vancouver, WA
Richardson, D., Palo Alto, CA
Roiz, J., Montréal, Québec, Canada
Ruest, D., Varennes, Québec, Canada
Sabin, D.D., Knoxville, TN
Sanborn, J., San Ramon, CA
Sarikas, P., Chandler, AZ
Sim, J.H., Ithaca, NY
St. John, T., San Diego, CA
Steeves, T., Burlinton, Ontario, Canada
Sundaram, A., Palo Alto, CA
Tu, L., San Ramon, CA
Waclawiak, M., Shelton, CT
Wagner, V., Troy, MI
Ward, D., Richmond, VA
Warren, C., Schenectady, NY
Weinold, M., Erlangen, Germany
Williams, C., Maitland, FL
Woodley, H.N., Pittsburgh, PA
Zaninelli, D., Milano, Italy

Total: 92 members and correspondence members

Custom Power Technology Development

A continuing goal of the Custom Power Task Force (IEEE 15.06.05.01) will be to centralize information concerning the development of custom power technology and the installation of devices that utilize this technology. This list presents the most current information available regarding custom power technology as of March 12, 1998.

Note that this is an application-oriented listing of projects. With these new technologies, companies are very reluctant to apply them until there is some field experience. Sharing of information about applications helps to generate acceptance for the technologies in the marketplace, identifies benefits and potential problems with the technologies in specific applications, and helps identify areas for future technology improvements. All of these are important overall benefits that can be achieved without the sharing of proprietary information about particular products and technologies.

A similar approach has been used for years in the HVDC Subcommittee and its associated working groups (more recently expanded to include FACTS technologies). The HVDC groups published a number of papers and bibliographies that documented HVDC installations around the world, helped develop guidelines for equipment specifications, and significantly enhanced the visibility of these new technologies in the marketplace. These are the kind of objectives that we would like to accomplish with the activities of the Custom Power Task Force.

Custom Power Technology Development - March 12, 1998

American Electric Power

AEP is in the process of installing an indoor 15kV, 600A static transfer switch at an industrial park in Columbus, Ohio. The switch is expected to be placed in service during the first half of 1998.

AEP has also installed a distribution static shunt voltage compensator at a rock crushing facility. This facility has two existing rock crushing operations with a third going into service. The operation produces minerals that are used in construction and agriculture. Simulations and site power quality monitoring demonstrated that unacceptable voltage flicker of approximately 8 to 12 percent would occur if the third operation were connected. This level of flicker would exceed the acceptable utility criteria of approximately 4 percent and adversely effect other customers on the feeder. The rating of the device installed at the facility to control the voltage flicker is ±2 MVA at 12.47 kV. It was placed online in January 1998. *(Last Update: March 1998)*

Baltimore Gas and Electric

BGE has demonstrated an indoor 15kV, 600A static transfer switch at an office building in downtown Baltimore. The switch was placed in service in September 1995 and has operated successfully since that time.

BGE has also placed an outdoor 15kV, 600A static transfer switch in service at a customer's chemical manufacturing plant in the Baltimore metropolitan area. The switch was placed in service in September 1996 and has successfully prevented over 12 service interruptions due to power quality events since that time.

Additionally, BGE has demonstrated a mobile 15kV, 600A static transfer switch at a customer's chemical manufacturing plant in the Baltimore metropolitan area. The mobile switch was placed in service in May 1997 and provided short term power quality protection until December 1998 when a permanent switch was installed in its place. The permanent installation is a 15kV, 1200A split-bus static transfer switch. *(Last Update: January 1998)*

British Columbia Hydro and Power Authority

BC Hydro is currently participating in a demonstration of a prototype shunt-connected distribution static compensator to reduce voltage flicker at a remote lumber mill on a rural 25kV feeder. BC Hydro is participating in prototype testing of a pole-mounted static series voltage compensation device, for which they are presently choosing a location. *(Last Update: January 1998)*

Cinergy

Cinergy has installed a 15kV, 600A solid state fast transfer switch. The switch is self-contained on a pad with an outdoor enclosure, removing the need for special rooms or trailers. After a successful serious of transfers involving both single- and three-phase source interruptions, the switch was put into service at a corporate office building. *(Last Update: March 1997)*

Clemson University

Clemson has been involved in specifying characteristics of voltage sags that are critical in evaluating the sizing of static series voltage compensation devices. *(Last Update: January 1998)*

Commonwealth Edison Company

ComEd is testing a static transfer switch. *(Last Update: October 1996)*

Detroit Edison Company

Detroit Edison installed a static transfer switch at the Ford Motor Company Sheldon Road Plant. Sheldon Road is a components plant that provides parts to all of Ford's North American assembly plants on a just in time basis. The switch was placed in service on November 10, 1996. This plant is fed from a 40kV subtransmission system and has a load has a load of 9MVA. The switch is installed on the 13.8kV side of the transformers.

Since going in service, the switch has avoided costly downtime. Without the STS, the Sheldon Road Plant would have experienced nine disturbances in the past year; five due to outages of the preferred feeder and four due to voltage sags. These disturbances would have had substantial impact on this plant which has large injection molding processes, as well as welding processes for heat exchangers and radiators. *(Last Update: January 1998)*

Duke Power Company

A series compensation device was placed on-line carrying critical customer plant load in late August 1996 on the Duke Power Company system in Anderson, South Carolina. The device is now in service at Orian Rug Company where the unit is protecting the automated yarn manufacturing and weaving plant from voltage sags and disturbances coming from the Duke Power distribution system that serves the plant. The unit is rated at 2MVA, can store 660kJ, and operates at 12.47kV. Normal load current is approximately 120A. As of January 1998, the series compensation device is continuing to perform as designed, and is still being closely monitored. *(Last Update: January 1998)*

Florida Power Corporation

A series voltage compensation device is installed at the FPC 230/12.5 kV, 100MVA Econ substation in Orlando where it protects one of the six 12.5kV feeders. The project is designed to demonstrate the ability of the series device to provide improved feeder power quality in a high isokeraunic environment. Power quality measurements of the Econ feeder data will be compared with the unprotected feeders. *(Last Update: January 1997)*

Hydro-Québec

During the last two years, Hydro-Québec has performed electromagnetic transient simulation of technologies related to static transfer switches, static series compensators and static shunt compensators. The next step of their program is to test the actual control system of those systems in our real-time simulator at IREQ. They hope to be able to test the control system of some commercial transfer switch in November 1997. Their main goal is to verify the dynamic response of the system to realistic disturbances on a typical Hydro-Québec distribution network. During 1998, Hydro-Québec will probably make a field test of a 25kV transfer switch at a customer site depending on the real time simulator results. *(Last Update: September 1997)*

Oglethorpe Power

Oglethorpe Power Corporation and Oconee Electric Membership Corporation, a member system of Oglethorpe Power, are host utilities to an installation of an distribution static var compensator installed on a 12.47kV feeder serving a building products plant in Dudley, Georgia. The plant uses many large induction motors that cause flicker when starting and operating. In addition to flicker, a low power factor is present when the motors are idling, which is often the case. *(Last Update: April 1997)*

Pacific Gas and Electric Company

PG&E installed two static transfer switches in September 1996. Both are rated at 25kV, 300A and are in commercial operation. PG&E is progressing with development of a fast voltage regulator rated at the same voltage and current. This will protect the customer from sags even on radial taps. Circuit simulation and scaled-down prototype testing has been completed for many line-load conditions. *(Last Update, January 1998)*

Powercor Australia, Ltd.

A 50 Hz series compensation device is being commissioned at the Bonlac Foods plant at Stanhope, Victoria in Australia where it will protect the sensitive dairy food process plant load from disturbances originating on the Powercor Australia overhead rural distribution system. The Bonlac plant produces powdered milk and other related dairy products from milk supplied by nearly 800 dairy farms in the area. The unit is rated at 2MVA, can store 660kJ, and operates at 22kV. *(Last Update: January 1997)*

Public Service Electric and Gas

PSE&G has been involved in a number of custom power projects:

- 150kVA advanced power line conditioner
- solid state breaker (13.8kV)
- series compensation device
- pole-mounted advanced static var compensator

PSE&G also has each of the devices, except the last, in place and operational. *(Last Update: August 1996)*

ScottishPower

A 4MVA 50Hz series compensation device is being installed at the Caledonian Paper Mill at Irvine, Scotland to protect the paper machine from voltage sags originating on the 132kV system feeding the mill. Installation involved segregating the critical load 11kV bus protected by the series device from the rest of the plant load. *(Last Update: July 1997)*

Texas Utilities

TU has demonstrated an outdoor 15kV, 600A static transfer switch at an electric operations building in Fort Worth, Texas. The switch was placed in service in October 1996 and has operated successfully since that time. *(Last Update: January 1998)*