Tina L. Toburen, P.E.
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T2E3, Inc
Energy Efficiency Enterprises

Experience 20 Years in the power generation and energy services industry

Education Master of Science in Mechanical Engineering,
University of Washington, 1994
Thesis Title: *Supersonic Diffusers in Dual-Mode Scramjet Engines*

Bachelor of Science in Mechanical Engineering
University of Washington, 1992

Registrations Registered Professional Engineer, Washington State

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Summary of Expertise

Mechanical Engineer with experience in power plant operations, commercial and thermal performance modeling, performance testing and performance monitoring software development and installation.

Serve as Owner's Engineer, Test Director and/or Test Engineer on gas turbine simple cycle, combined cycle, cogeneration, and coal-fired boiler plant testing projects. Review, Prepare and/or implement performance test procedures and models for testing. Implement performance test plans including installing test instrumentation, collecting and analyzing data, interfacing with the plant distributed control system (DCS) for downloading plant data during testing, and preparing and submitting final test reports.

Founder and President of T2E3, Inc. - a business providing software and consulting services for the power generation industry. Responsible for the design, development, marketing, sales, installation, training and support of performance monitoring packages and automated reporting systems for new and existing clients. Also develop material and serve as instructor for the T2E3 Performance Seminar Series for power generation equipment.

Related Experience

Complete Test Services for the WMMPA Exira Power Station
Exira consists of 2 LM6000 PC SPRINT GT's in simple cycle with a central Chiller Package for inlet cooling and dual fuel capability. Served as Test Director and Test Engineer during the performance tests in early spring and also ran a dedicated Chiller Package Test in mid summer. The chiller test was completed separately in order to find a day hot and humid enough to provide the chilling load needed to prove out the chillers.

Seminar Developer and Instructor: LM6000 Performance Characteristics, Testing and Long-Term Condition Monitoring
Developed and maintain the material for the seminar. Serve as Instructor to present the seminar annually. Seminar is focused on LM6000 performance including the application of Throttle Push Corrections. Material also covers PTC 22, test uncertainty and how to effectively test and monitor gas turbine performance.

Served as Owner's Engineer for the Griffith Energy Project
During the 2001 startup of the GE7FA 2x1 plant, supported all Owner's interests during startup, including test coordination meetings and reviews of procedures and performance analysis results. When test results showed gas turbines were short on performance, brought in additional instrumentation which proved the apparent

performance loss was due to imbalances in the chiller coil coolant flow. The test instrumentation was used to balance the chillers, resulting in improved overall plant performance. I continue support long-term performance monitoring at Griffith.

Compressor Water Wash Performance Tracking Software
Developed a compressor water wash tracking software program using Microsoft's .NET platform and the SQL Express database. Software allows users to input operating data for a gas turbine compressor, then analyzes the performance of the compressor over time to determine the economic impact of a water wash, and to make recommendations for adjustments to the water wash schedule based on actual data.

Trader's Dispatch Model
Used Visual Basic and Microsoft Excel to design, build and run models to determine the break-even price of generation for use in both day-ahead and real-time energy trading. Model included a method to determine the cost savings for running facilities in base load versus peaking operation.

Commercial Cost Model
Used Visual Basic and Microsoft Excel to design, build and run cost analysis models for 16 DuPont manufacturing sites in preparation of an AEP/Conoco/DuPont joint venture. Cost models were used to determine errors or omissions in plant operating data as well as to find potential savings in operating costs. Equipment modeled included boilers, steam turbines, air compressors, DP:DPO vaporizers, cooling towers, condensers, pumps and chillers.

Major Maintenance Schedule Program
Developed a program using Microsoft Excel and Visual Basic to schedule the major maintenance of industrial gas turbines. The program calculates total lifetime equipment costs using the manufacturers' data for maintenance intervals and pricing options as input by the user. The program is able to capture the savings of spare parts rotation schedules as well as pricing discounts and international fees.

Employment History

T2E3, Inc. - Kirkland, WA
President and Principal Engineer; October 2010 to Present

T2E3 - Kirkland, WA
Sole-Proprietor and Principal Engineer; January 2007 to October 2010

McHale & Associates, Inc. - Sammamish, WA
Manager, Performance Monitoring, 2005 to 2006; Principal Engineer, 2002 to 2005;
Sr. Engineer, 2000 to 2002; Associate Engineer, 1995 to 1997

Puget Sound Energy - Bellevue, WA
Project Manager, 1999 to 2000

Operational Energy Corporation (an Enron Company) - Redmond, WA
Operations Engineer, 1998 to 1999

E.I. DuPont de Nemours and Company - Waynesboro, VA
Power Engineer, 1997 to 1998

Raytheon Constructors Inc./Plant Services - Bellevue, WA
Associate Engineer, 1994 to 1995

Computer Programs / Languages

GE Enter's GateCycle, Visual Studio .NET, C#, Visual Basic, HTML, Microsoft Office Applications (Excel, Word, Power Point, Access) and VBA, Fortran and Adobe Acrobat

Professional Affiliations

American Society of Mechanical Engineers, Member
ASME PTC Standards Committee; Member
ASME PTC 51: Combustion Turbine Inlet Air Conditioning Equipment; Member
ASME PTC 70: Ramp Rates; Member
ASME PTC 102: Operating Walkdowns Guideline; Member
ASME PTC-PM: Performance Monitoring Guideline; Chair
Tau Beta Pi: Lifetime Member

Publications

"How the Use of Limited Plant Data can Support Improvement in Combined-Cycle Operations"; J.M. Perez (City of Riverside, CA), T.L. Toburen (T2E3, Inc.), ASME Power Conference Proceedings, 2012

"Applications of PTC-51 Gas Turbine Inlet Air Conditioning Equipment"; T.L. Toburen (T2E3, Inc.), ASME Power Conference Proceedings, 2011

"An Experience with ASME PTC-70 Ramp Rates"; T.L. Toburen (T2E3, Inc.), ASME Power Conference Proceedings, 2010

"Energy Efficiency by Optimizing Annual Testing Schedules – Coordinating RATA Testing with other Annual Test Requirements"; T.L. Toburen (T2E3), Allen Kephart (Clean Air Engr), Rhonda Walker (GSE Systems), ASME Power Conference Proceedings, 2009

"Incremental Heat Rate and Optimization – New Applications for ASME PTC-PM Performance Monitoring Guideline"; T.L. Toburen (T2E3), Sam Korellis (EPRI), Joe Milton (Reliant), ASME Power Conference Proceedings, 2008

"Monitoring Compressor Efficiency for Maximum Performance"; T.L. Toburen (T2E3), PowerGen Conference Papers, 2007

"How to Conduct a Plant Performance Test"; T.L. Toburen and L.B. Jones (McHale & Associates, Inc.), Power Magazine, September 2006

"Managing Power Generation Assets to Maximize Profits"; T.L. Toburen (McHale & Associates, Inc.), www.EnergyPulse.net, 2004

"A Long Term Assessment of Plant Performance,"; M.P. McHale, T.L. Toburen (Raytheon Engineers & Constructors), T. Miller, T. Grigg (Lone Star Energy), ASME, 1995

Project List

The following is a partial list of projects where involvement has included (1) performance test director or owner's engineer, (2) modeling and analyzing performance, (3) providing on-site testing instrumentation and support and/or (4) modeling and software for real-time monitoring and reporting functions (shown alphabetically by project name).

Item	Project	Location	Client	Size-MW	Description
2	AMEA	Sylacauga, AL	AMEA	100	2 x LM6000 Gas Turbine Peakers
1,2,3, 4	Arlington Valley	Maricopa County, AZ	D-FD and Dynegy	980	2x1 GE7FA Gas Turbine Combined Cycle
2,3	Bastrop	Austin, TX	Duke Fluor Daniel (D-FD)	536	2x1 GE7FA Gas Turbine Combined Cycle
2	Cheswick	Cheswick, PA	MPR Associates, Inc.	600	GE Steam Turbine
2,4	Cottonwood	Deweyville, TX	McHale Performance and Kelson Energy	1279	4, 1x1 GE 7FA combined cycle facility

Project List (Continued)

1,2,3	Coyote Springs II	Boardman, OR	Portland General Electric	217	1x1 GE7FA Gas Turbine Combined Cycle
1,2,3	DEMEC	Smyrna, DE	Spectrum Energy	50	1 x LM6000 Gas Turbine Peaker
2,4	Dogwood	Pleasant Hill, MO	McHale Performance and Kelson Energy	625	2x1 W501FD2 combined cycle facility
2,3,4	Eastex	Longview, TX	AEP-Proserv	500	2x1 GE7FA Gas Turbine Combined Cycle
1,2,3	Exira	Exira, IA	R.W. Beck / WMMPA	96	2 x GE LM6000 Gas Turbine Peakers with inlet chillers & duel fuel
2,3,4	Griffith	Kingman, AZ	DENA and Dynegy	590	2x1 GE7FA Gas Turbine Combined Cycle.
2,4	GTAA	Toronto, Canada	SNC Lavalin Profac	117	2x1 GE LM6000PD combined cycle, cogeneration with central CHP plant
2,4	Hermiston	Hermiston, OR	Hermiston Generating Company	500	2x1 GE7FA Gas Turbine Cogeneration
1,2,3	Kendall	Kendall County, IL	NEPCO and Dynegy	1160	4, 1x1 GE7FA Gas Turbine Combined Cycle Plants
2,4	La Paloma	Bakersfield, CA	Complete Energy, LLC	800	4, 1x1 Alstom GT24 Gas Turbine Combined Cycle plants
2	Laredo	Laredo, TX	Topaz Power Group	190	2 x GE LMS100 Gas Turbine Peakers
1, 2	Winchester	Winchester, TX	LCRA/NAES	180	4 x GE LM6000 PD Gas Turbine Peakers with inlet chillers
2,4	Magnolia	Benton County, MS	McHale Performance and Kelson Energy	968	3, 1x1 GE 7FA combined cycle facility
2,3	Murray	Dalton, GA	Duke Fluor Daniel (D-FD)	1150	2, 2x1 GE7FA Gas Turbine Combined Cycle
2	Nueces Bay	Corpus Christi, TX	Topaz Power Group	677	2x1 GE 7FA combined cycle
2,4	Orange	Bartow, FL	Orange Cogeneration Associates	120	2x1 GE LM6000 Gas Turbine Combined Cycle
1,2,3	Orange Grove	Pala, CA	Industrial Construction Company	100	2 x GE LM6000 Gas Turbine Peakers w/ inlet chillers and gas compressors
2,3	Ouachita	Sterlington, LA	National Energy Production Co. (NEPCO)	726	3, 1x1 GE7FA Gas Turbine Combined Cycle
2,4	Panoche	Firebaugh, CA	PPMS / Wood Group	400	4 x GE LMS100 Gas Turbine Peakers
2	Penuelas	Puerto Rico	National Energy Production Co. (NEPCO)	510	2x1 W501F Gas Turbine Cogeneration
2,3,4	Perryville	Monroe, LA	Central Louisiana Electric Company (CLECO)	562	2x1 GE7FA Gas Turbine Combined Cycle
4	Plus Petrol	Argentina	Stewart & Stevenson Operations	150	Gas Turbine Simple Cycle; Reporting System
2,3	Red Oak	Sayreville, NJ	Washington Group International, Inc.	760	3x1 W501FD Gas Turbine Combined Cycle Plant
2,3,4	Reid Gardner	Moapa, NV	Nevada Power Corp.	655	Coal Fired Plant
1,2	Sentinel	Palm Desert, CA	CPV/Spectrum	800	8 x GE LMS100 Gas Turbines in Simple Cycle
2,3	Sugarcreek	Sugarcreek, IN	Mirant	320	2x1 GE7FA Gas Turbine Simple Cycle
2,4	Sundance	Casa Grande, AZ	Arizona Public Service	500	10 x LM6000 Gas Turbine Peakers
4	Wind Power	San Gorgonio, CA	FPL	30	Wind Power; Reporting system