Titles:

President, Electric Power Engineers, Inc.
Partner and shareholder, International I.G.M. s.a.r.l.

Education:

M.Sc. in Electrical Engineering (Power), Aug. 1991, Texas A&M University, College Station, Texas.
B.Sc. in Electrical Engineering, Dec. 1989, Texas A & M University, College Station, Texas. National Dean's List.

Experience:

Over 15 years of experience in Transmission System Analysis using state-of the-art analysis software (PSS/E and Powerworld), Renewable Energy Development, Distribution System Planning and Operations. See Key Qualifications.

Jan 06-Present **International Consultant**
Specialized in Power and Renewable Energy Transmission Integration and Design
- Soma 90 MW windfarm feasibility study, Turkey
- Ras El Khaimah long range plan for transmission grid expansion and supply/demand planning, UAE
- Ras El Khaimah wind integration, UAE

Jul 91-Present **Electric Power Engineers, Inc., Waco, TX.**
President and Owner (Nov 07 – Present)
Vice President & Shareholder (Dec 04- Oct 07)
Senior Electrical Engineer & Shareholder (Jan 99- Nov 04)
Vice President (Dec 92- Dec 98)
Graduate Engineer (Jul 91-Dec 92)

Feb 06-Jun 06 **American University of Science and Technology:**
Teaching CCE 444 "Power Transmission and Distribution". Also assemble the Syllabus and material for this new course.

Jun 92 **New York State Institute on Superconductivity- Buffalo, NY.**
SMES Utility Interest Group- Specialty Conference, 2nd Session
"Impact of SMES on Unit Availability and System Reliability", in collaboration with Dr. A.D. Patton / Texas A&M University.

Jan 90-Aug 91 **Texas A&M University, Electric Power Department, College Station, TX**
Research Assistant, on the large-scale applications of superconductors in power systems, with Dr. A.D. Patton.

Nov 89 **Texas A&M University – Electronics Material Laboratory, C.S., TX.**
Design and Construction of a High Temperature Superconductor Current Limiter.

Jul 88-Dec 88 **Bechtel Inc., Houston, TX.**
Assistant Engineer - internship. Experience included control engineering as well as plant power and electric design aspects (cable sizing, lighting, motor start etc.).

Professional Memberships and Registrations:

Professional Engineer, State of Texas (License #80999)
Professional Engineer State of Idaho (License *#12315*)
Professional Engineer State of Rhode Island (License *#8696*)
Texas Society of Professional Engineers
National Society of Professional Engineers.
Board of Engineers, Lebanon
American Wind Energy Association
Institute of Electrical and Electronics Engineers (IEEE).
Power Society of IEEE

Certifications:

Certificate for "Wind Energy and Wind Turbines" WTOnline course, with Dr. Vaughn Nelson, West Texas A&M University online, Fall 2003.
Certificate for "Substation Engineering and Design" Siemens Power Transmission & Distribution, Inc. Power Technologies International, Schenectady NY, December 2005.

Papers and Presentations:

- Nasr (Ballouz), Hala, and Patton, A.D., 1991. "**Impact of Energy Storage on Generating Unit Availability and System Reliability**", Paper and presentation, Conference *Proceedings of the Symposium on the Reliability of Electric Power Systems.*
- Ballouz, Hala, and Cousineau, Kevin, 2003. "**Evaluation of Power Factor Correction in Wind Parks and the Savings from Reduction in Power Loss**", Paper, *American Wind Energy Association Conference, Austin, Texas*.
- Ballouz, Hala, 2004. "**The cost benefits applied to a Wind/Storage System from the Impact of Energy Storage on Generator Availability and System Reliability**", Paper and presentation, *Global WINDPOWER 2004 Conference, Chicago, Illinois.*
- Ballouz, Hala, 2005, **"The Effect of Dynamic Rating of Transmission Lines on the Export Capacity Available to Wind Farms that are Applying for Interconnection.",** poster presentation, *WINDPOWER 2005 Conference, Denver, Colorado.*
- Ballouz, Hala, 2006, **"Wind Farm Grid Interconnection Milestones—Do(s) and Don't(s)",** poster presentation, *WINDPOWER 2006 Conference, Pittsburgh, Pennsylvania*
- Ballouz, Hala, 2007, **"Introduction to Engineering and Regulatory Requirements Including Interconnection, Transmission, and Access Issues",** presentation, *Texas Renewables '07, Texas Renewable Energy Association, Abilene, Texas*
- Ballouz, Hala, Carlos Matar, and Michael Edds, 2009, **"Distributed Wind Interconnection Challenges for Utility-Scale Wind Turbines",** *WindPower 2009. American Wind Energy Association conferenc, Chicago, Illinois.*

Published Reports:

"Statewide Load Flow Modeling Study of the Texas Electric Grid" *– with Electric Power Engineers, Inc. in collaboration with Virtus Energy Research Associates, Inc.* Analysis of the capacity and limitations of the electric transmission grid to distribute electric power generated by renewable resources within the state of Texas, including but not limited to a broad study in conjunction with Sustainable Energy Development Council (SEDC).

- *Numerous other professional reports while working with Electric Power Engineers, Inc..*

Software products:

Development of **"EPE Engineering/Mapping Software" in Visual C++**, which runs under the **AutoCAD** Platform (Object ARX) and combines circuit diagram mapping with engineering calculations. Engineering calculations include voltage drop, load flow, short circuit, outage management, and motor start calculations. A GIS application with all data stored in Databases.

Development of several of the "**EPE Accounting**" modules under **Visual Fox Pro**. Namely: Time Sheets program, Payroll Summary report, Voucher Report, Benefit Spread, and Work Orders management software.

Development of "**Looped Load flow**" module. Calculations and solution of power networks, using Gauss Seidel and Newton Raphson methods - FORTRAN and Visual C++ versions .

Key Qualifications:

Vast Experience in Transmission System Analysis, development/design/engineering/procurement of Renewable Projects, Distribution System Planning and Operations, as well as high end power system simulation software operation and programming:

Transmission System Analysis:

Transmission System Planning Studies – Significant experience (since 1994) in analyzing the feasibility of generation interconnection to the transmission grid, including power flow calculations, transmission and wheeling pricing and operational issues. Conducted all the calculations for analyzing the capacity and limitations of the electric transmission grid to distribute electric power generated by renewable resources within the state of Texas (for the Sustainable Energy Development Council of the State of Texas). Several years experience using the widely known power system analysis software **PSS/E of PTI, as well as PowerWorld**.

Design – Substation and transmission interconnection one-line diagrams. Design of wind generation plants collection system. Protective relaying. Also hold a certificate in substation design from Power Technologies, International.

Generation Interconnection - Processing interconnection of wind generators with the transmission grid from the initial filing of the application process all the way through the negotiations for the interconnection agreement and negotiations with the transmission providers.

Renewable Energy Development:

Assisting developers of renewable generation, in particular wind, in the evaluation and development of generation resources since 1994. Completed *load flow modeling, grid interconnection, and/or design of wind generation projects* for over 50 clients, including leading companies like GE, Airtricity, AES, BP, Gamesa, Babcock and Brown, etc. The following highlights some of the expertise in renewable energy development.

- Several years experience in *load flow* calculations and modeling of the electric transmission grid using the transmission program PSS/E of PTI/Siemens, as well as PowerWorld.
- Experience in evaluating *feasibility and system impact studies* that analyze the prospect of interconnecting wind to a transmission grid.
- Continuous research (since 1994) in the transmission industry operational standards and tariffs.
- Open Access Transmission Tariffs and Locational Marginal Pricing issues within several transmission grids.
- *Interface discussions* with transmission service providers as well the Electric Council of Texas (ERCOT) Independent System Operator (ISO) for the interconnection of renewable projects.
- *Responses to requests for proposals* for the purchase of renewable generation.
- *Evaluation transmission system construction upgrades and the associated costs* necessary to incorporate renewable generation projects into the transmission grid.
- Analysis expertise in the *evaluation of wheeling charges as well as losses* within a transmission grid or in export of power across one or more transmission grids.
- Proposing and utilizing *Special Protection Schemes* in order to accommodate or expand the scope of renewable generation projects under certain limiting grid conditions.
- *Mapping* of potential wind generation sites with the transmission grid.
- ***Design-engineering-procurement*** coordination for renewable generation projects, in particular wind and solar.

Distribution System Planning:

Involvement in all aspects of the operations & planning of electric utilities distribution system since 1991, largely in the State of Texas. Experience covers the daily operations and maintenance aspects, as well as short and long term planning analysis. Routinely produced many studies and reports on Distribution System Long Range and Short Range Work Plans, Sectionalizing Work Plans, Motor Start Analyses, and System Operations Summary Reports such as power factor & losses tune up as well as Voltage Regulation and others. Conducted power requirement studies which included Load forecasting.

Skilled in performing distribution system analysis using Electric Power Engineers' Engineering/Mapping software, which distinguishes itself in its advanced GIS-Mapping/Engineering features.

Distribution Power System Planning- Rural Electrification Administration work plans, system protection plans, rate studies, power requirement studies and load planning, as well as substation feasibility studies.

Power System Operation – System mapping, system operations summary, voltage regulator settings, power

factor correction (capacitor placement and sizing), motor starting, and system maintenance.

Design – Distribution lines, protective relaying and basic Substation specification recommendations.

Software development. –

Experience includes programming skills in Visual C++ and AutoCAD Object ARX, database (SQL) as well as Visual Fox Pro.

ENGINEERING PROJECTS

The following provides a list of engineering projects/clients that is representative of work completed by Electric Power Engineers, Inc. under the direction of Hala Ballouz, P.E.:

Renewable Energy Development

Electric Power Engineers, Inc. assists developers of wind generation in evaluation and development of wind generation resources in Texas. *Load flow modeling* of the electric transmission grid, *mapping* of the state-wide transmission grid, *mapping* of potential wind generation sites, special investigations of *transmission grid interconnection issues*, *cost estimates for wheeling and losses*, *interface discussions* with the Electric Council of Texas (ERCOT) Independent System Operator (ISO), interface discussions with various transmission service providers, *responses to requests for proposals* to provide wind generation, etc. are provided on a regular basis.

- Several years experience in loadflow calculations and modeling using the transmission program PSS/E of PTI.
- Experience in evaluating feasibility and system impact studies that analyze the prospect of interconnecting wind to a transmission grid.
- Continuous research (since 1994) in the transmission industry operational standards and tariffs. Electric Power Engineers Inc. is knowledgeable in Open Access Transmission Tariffs and Locational Marginal Pricing issues within several transmission grids.
- Capabilities in evaluating transmission system upgrades and the associated costs necessary to incorporate wind projects into the transmission grid.
- Analysis expertise in wheeling charges within a transmission grid or in export across one or more transmission grids.
- Electric Power Engineers, Inc. has special knowledge in proposing and utilizing Special Protection Schemes in order to accommodate or expand the scope of wind projects under certain conditions.
- Design/Engineering/Procurement of renewable generation projects, in particular Wind.

Electric Power Engineers, Inc. has completed *load flow modeling, grid interconnection, and/or design of wind generation projects* for numerous clients, some of which are listed below

AES SeaWest, Inc
AES Deepwater
Airtricity, Inc.
Allison Wind Inc.
American Shoreline
Arcadia Wind Power
Babcock and Brown Power Operating
Bilgin Elektrik
BP Alternative Energy North America, Inc.
Cielo Wind Power, LLC
Citizens Energy
Clipper Windpower
Deere Credit, Inc.
Distributed Wind Generation
Independent American Energy Company
J.D. Consulting, L.P.
Moore Wind Power
Murphy International Development Corporation
Navitas Energy
New Mexico Windpower
New Amsterdam Wind
North American Wind
Penn Real Estate Group
PYCO Industries, Inc.
Shell WindEnergy, Inc.
Signal Wind Energy, LLC
Superior Renewable Energy LLC
Tierra Energy

Flying Cloud, LLC
Gamesa Energia Southwest
Gamesa USA
GE Energy Power Generation
GE Wind Energy, LLC
Generation Energy Inc.
Georgia Pacific Corporation, Gypsum Division
Greenlight Energy
Higher Power Energy LLC
Hilliard Energy, Inc.
Virtus Energy Research Associates
Whatley Ranch
Wind Brokers, LLC
Wind Plus Holdings, Inc.
WindRose Power LLC
Wind Tex Energy, LLC
Windkraft Nord USA, Inc.
Your Resources, LLC
Zilkha Renewable Energy
Zugibe Energy Corporation

System Planning

Construction Work Plans

Construction Work Plan preparation includes system modeling to recommend system improvements, writing and coordinating the *Borrower's Environmental Report*, furnishing *Financial Forecast* data, and securing RUS approval (when applicable). Several of the electric distribution systems listed below have had Work Plans Prepared on a regular basis by Hala N. Ballouz.

Bartlett Electric Cooperative, Inc.
McLennan County Electric Cooperative, Inc.
Navarro County Electric Cooperative, Inc.
Wise Electric Cooperative, Inc.

Long Range Studies

Long Range Studies, including system modeling to recommend system improvements, financial modeling to optimize investment, and securing RUS approval (when applicable), have been completed for the following electric distribution systems:

Bartlett Electric Cooperative, Inc.
McLennan County Electric Cooperative, Inc.
Navarro County Electric Cooperative, Inc.
Wise Electric Cooperative, Inc.

System Protection Plans

System Protection Plans have been completed on a regular basis for the following electric distribution systems. System Protection Plans include calculating short circuit currents, sizing and locating fuses and reclosers, preparing three-phase recloser settings, securing RUS approval (when applicable), etc.

City of Brady, Texas
City of Hearne, Texas
McLennan County Electric Cooperative, Inc.
Navarro County Electric Cooperative, Inc.
Wise Electric Cooperative, Inc.

Retail Rate Studies

Retail Rate Studies including preparation of a Cost of Service Study, Rate Schedules, and presentation to the Public Utility Commission of Texas or City Council (as applicable) have been completed for the following electric distribution systems:

Belfalls Electric Cooperative, Inc.
City of Hearne, Texas
McLennan County Electric Cooperative, Inc.
Wise Electric Cooperative, Inc.

Power Requirement Studies

Power Requirement Studies or long term forecasts of electric capacity and energy requirements have been completed for the following electric distribution systems:

Bartlett Electric Cooperative, Inc.
McLennan County Electric Cooperative, Inc.
Navarro County Electric Cooperative, Inc.
Wise Electric Cooperative, Inc.

Substation Feasibility Studies

Substation Feasibility Studies have been completed for the following electric distribution systems:

Bartlett Electric Cooperative, Inc.
McLennan County Electric Cooperative, Inc.
Navarro County Electric Cooperative, Inc.
Wise Electric Cooperative, Inc.

Large Power Load Planning

Large Power Load Planning has been completed for numerous large commercial loads added to the following electric distribution Systems. Planning work for these large power loads includes *modeling system capacity* to serve the load, performing *motor start calculations*, preparing *rate comparisons*, conducting *contract negotiations* between the system owner and the large power customer, and preparation of the contract between the system owner and the large commercial customer.

Bartlett Electric Cooperative, Inc.
McLennan County Electric Cooperative, Inc.
Navarro County Electric Cooperative, Inc.
Wise Electric Cooperative, Inc.

Wholesale Power Supply Contracts

Preparation of *Wholesale Power Supply Contracts* including *negotiation of contract provisions*, contract drafting, etc. have been completed for the following systems:

City of Brady, Texas
City of Hearne, Texas

System Design and Operation

System Operations Summary

Reports summarizing inputs from information metering installed on substations and distribution feeders are prepared on a quarterly basis for the following clients. These recommendations include *capacitor switching, phase balancing, load shifting, etc.*

City of Brady, Texas
City of Hearne, Texas
McLennan County Electric Cooperative, Inc.
Navarro County Electric Cooperative, Inc.
Wise Electric Cooperative, Inc.

System Mapping

System mapping using computer aided drafting (CAD) has been completed for the following clients. This mapping includes preparation of *dispatching maps, circuit diagrams, truck maps, detail maps, director's district maps, certification boundary maps, key maps, etc.*

McLennan County Electric Cooperative, Inc., McGregor, Texas
Navarro County Electric Cooperative, Inc., Corsicana, Texas
Clearwater Power Company, Lewiston, Idaho
Public Utility District No. 1 of Asotin County, Clarkston, Washington
Pennyrile Rural Electric Cooperative, Inc., Hopkinsville, Kentucky

Voltage Regulator Settings

Load drop compensation settings are prepared for system voltage regulators after revisions of system Work Plans for the following clients:

Bartlett Electric Cooperative, Inc.
McLennan County Electric Cooperative, Inc.
Navarro County Electric Cooperative, Inc.
Wise Electric Cooperative, Inc.

Motor Starting Analyses

Motor starting analyses are completed on a regular basis. Significant motor starting analyses include the following:

Chevron Pipeline, Navarro County Electric Cooperative, Inc. 2000 horsepower motor on 69 kV line
Tarrant County Water District, Navarro County Electric Cooperative, Inc. 8000 horsepower motor on 138 kV line.
Dynegy Midstream LLP, Wise Electric Cooperative, Inc. 300 horsepower motor on 24.9 kV line.
Energy Transfer Company

Software Development

EPE Software, LTD, a subsidiary of Electric Power Engineers, Inc. has developed state-of-the art PC-based software to meet the needs for *customer billing/records, mapping, and engineering requirements* of electric, water, gas, distribution utilities. Electric Power Engineers uses this software to perform services for the following clients:

Bartlett Electric Cooperative, Inc.
McLennan County Electric Cooperative, Inc.
Navarro County Electric Cooperative, Inc.
Wise Electric Cooperative, Inc.
City of Brady, Texas
City of Hearne, Texas

The following utilities have used or are currently using EPE Software "in house":

McLennan County Electric Cooperative, Inc., McGregor, Texas
Glades Electric Cooperative, Inc., Moore Haven, Florida
Clearwater Power Company, Lewiston, Idaho
Public Utility District No. 1 of Asotin County, Clarkston, Washington
Naknek Electric Cooperative, Naknek, Alaska
Public Utility District No. 1 of Wahkiakum County, Cathlamet, Washington
Public Utility District No. 1 of Kittitas County, Ellensburg, Washington
Pennyrile Rural Electric Cooperative, Inc., Hopkinsville, Kentucky
South Central Public Utility District, Nelson, Nebraska

International Projects

Soma Wind Farm, Manissa, Turkey – Bilgin Elektrik – Full blown feasibility analysis, including wind farm design using different turbine models and layout, and based on analysis of wind measurements. Provide complete financial analysis of all alternatives including but not limited to, equipment and construction costs, energy costs, wheeling and wholesale power costs and other economic indices Provide financing recommendations and assistance. The wind farm design recommended in the feasibility study provides the base for the next phase of the wind farm development.

Ras El Kaimah, UAE: Research and map existing transmission grid, and overlay Supply/Demand projections. Develop a long range plan to provide the Emirate delivery of power to exponential growth in industrial and large recreational developments. Propose alternative for power generation such as wind and nuclear including identifying grid interconnection strategy for new generation. Study the integration of a small 30 MW wind farm with the existing grid and private power plant in the Emirate.