



R.P. DELIO & CO.

Raymond Delio

DIRECTOR, PROJECT & PROGRAM MANAGEMENT CONSULTANT

EDUCATION

- > MBA, Strategy and Entrepreneurship, Rensselaer Polytechnic Institute (4 classes remaining)
- > BS, Chemical Engineering with concentrations in Material Science and Inorganic Chemistry, Rensselaer Polytechnic Institute & Siena College Dual BS program.

TRADE EXPERIENCE

- > Electrician, Palmer Entertainment Group

PROFESSIONAL REGISTRATIONS

- > Approved to sit for NY PE Exam (October 2013)

PROFESSIONAL CERTIFICATIONS

- > Approved to sit for PMI PgMP Certification (2013)
- > PMP Project Manager Professional #512510
- > LEED Green Associate #10315515
- > CEM Certified Energy Manager #017620
- > CDSM Certified Demand-side Manager
- > Lorman Construction Compliance
- > OSHA Confined Space

PROFESSIONAL MEMBERSHIPS

- > IEEE, PMI, USGBC, AIChE, ACS, NSPE, NFPA, BOMI, IFMA, EWB, ASQ, AEE, AgSTAR, USGBC, ASME, ASHRAE, EAA (Electric Auto Association), EDTA (Electric Drive Transportation Association), WEVA (World Electric Vehicle Association)

Mr. Raymond Delio is a CEM, CDSM, PMP, LEED GA utility-scale renewable energy integration expert with over 19 years of progressive experience in directing large and complex research & development, design and construction, and EPC projects. He currently manages, with P&L responsibility, programs as large as \$2.5 Billion, thanks to an enviable track record in delivering – to target – a number of critical and ground-breaking projects.

His breadth of engineering and management experience spans industrial, utility and commercial projects across the widest spectrum of markets:

- > Renewable & traditional energy (Solar, Cogen, Wind)
- > Transmission and distribution (< 115kV)
- > Semiconductor manufacturing (>45nm)
- > Data centers (Tier 4, 15MW, 100kV, with high renewable energy integration)
- > Medical, food and beverage manufacturing
- > Wastewater treatment and waste-to-energy
- > Specialty chemicals and gases

He has managed teams as large as 135 people, right across the US, and reaching around the globe – including in the South Pacific, Ireland, Taiwan, Malaysia, and Costa Rica.

CONTENTS

| | |
|----|---|
| 2 | Program & Project Management Experience |
| 5 | Operations Management Experience |
| 7 | Design & Engineering Management |
| 9 | Human Resources Management Experience |
| 10 | Media, Entertainment & Security Services Experience |
| 12 | Electrical Services Experience |
| 14 | Process Engineering Experience |
| 17 | Information Technology & Infrastructure Experience |
| 19 | Clean Energy Experience |
| 23 | Automotive Engineering Experience |
| 24 | Current Positions |
| 25 | Position Papers |
| 27 | Research Experience |
| 28 | Awards |

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- > 9 Reservoir Street
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Raymond Delio

Ray P. Delio has repeatedly demonstrated his ability to successfully manage advanced technology projects, whatever their complexity and difficulty, rapidly earning himself the responsibility for reproducing that success with the running of major programs, at the highest levels of challenge, and organizational significance.

SIGNIFICANT ROLES

Director, Project & Program Management Consultant: Inter-Island Renewable Energy Network – Hawaiian Electric Company, HI. 2012 (Active): Focusing on the strategy, legislative policy, **program budget** and organizational change necessary to deliver overall project execution for the Inter-Island Renewable Energy Network, a \$2.5bn program to help meet the state Renewable Energy Portfolio goal of 40% before 2030.

Director Of Engineering: Utility-Scale Solar PV Systems – SunDurance Energy, LLC Edison, NJ. 2011: **Directing engineering projects**, providing input on constructibility, validation of design and construction schedules, assurance of efficiency in the design process, and managing design costs.

Program Manager: Smart Grid and Distributed Generation Infrastructure – United Illuminating Company, Shelton, CT. 2009-2011: Responsible for **planning and delivery** of utility transmission and distribution electrical construction projects across the territory, as part of the corporation's Ten Year Plan.

Program Manager: Renewable Energy Systems – Energy and Power Solutions, Inc., New Haven, CT. 2008-2009: Responsible for **planning and oversight** of energy conservation and generation construction projects for Fortune 100 clients of this pioneering start-up business venture.

Program Manager: Facilities Services & Electronics and Advanced Technology – CH2M Hill, Pittsburgh, PA. 2006-2008: Responsible for **planning and oversight** of design for construction projects for the Fortune 100 clients of this global leader in full-service engineering, consulting, construction, and operations.

Project Manager: 200mm/300mm Factories Worldwide Process Engineering – Intel Corporation, Hillsboro, OR. 2001-2005: **Led the design and development** of semiconductor fabrication and packaging process technologies, as well facilitating the transfer of new processes from development to high-volume factories worldwide.

RELEVANT CERTIFICATIONS & SKILLS

Holder/ registered for following certificates:

- > PMP – PMI Certified Project Manager Professional #512510
- > PgMP – PMI Certified Program Manager Professional (Exam scheduled for July 2013)

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SIGNIFICANT PROJECTS

Director, Project & Program Management Consultant (Active position): Hawaiian Electric Company, HI: Program Manager for the Inter-Island Renewable Energy Network (IREN). Corporate point contact for a \$2.5 billion transformational 600+MW utility-scale renewable generation and transmission program, with the goal of integrating the separate systems that deliver power across the Hawaiian Islands. In this role:

- > Focus on the strategy, legislative policy, program budget and organizational change necessary to deliver overall project execution for the Inter-Island Renewable Energy Network (including generation, transmission, distribution and smart grid), with ultimate goal of meeting the state's Renewable Energy Portfolio Standard of 40% before 2030.
- > Direct the program team and provide input on policy, proposed legislation, constructibility, validation of design, construction scheduling, assurance of efficiency in the design process and the managing of scope, so as to meet corporate initiatives and State mandates.
- > Lead the strategic planning and project definition to align the implementation of Wind, Solar, Geothermal, Ocean Wave and Ocean Thermal, and Hydro renewable energy, as well as interisland cable and smart grid, into existing projects at Hawaiian Electric, Maui Electric and Hawaiian Electric and Light Companies.

Director of Engineering: SunDurance Energy, Edison, NJ: United Stationers, Cranbury, New Jersey (\$ Confidential) – Responsible for the Commissioning, Construction and Administration of 3.265MW rooftop solar energy system, with with 14,000 Trina solar panels on 570,000 square-foot warehouse roof

Director of Engineering: SunDurance Energy, Edison, NJ: Atalanta Corporation, Elizabeth, New Jersey (\$ Confidential) – Responsible for the Commissioning, Construction and Administration of 410kW rooftop solar energy system.

Director of Engineering: SunDurance Energy, Edison, NJ: Responsible for the Commissioning, Construction and Administration of the following projects:

| Project Name | Size MW(dc) | Application Type(s) | Finance Structure |
|------------------|-------------|------------------------|-------------------|
| NJMC 1A Landfill | 3.120 | Ballasted Ground & PLC | EPC/ARRA |

Director of Engineering: SunDurance Energy, Edison, NJ: Responsible for the Energy Auditing, Planning, Permitting, Design and Bidding for the following projects:

| Project Name | Size MW(dc) | Application Type(s) | Finance Structure |
|-------------------------|-------------|----------------------|-------------------|
| IPP 1 | 10.0 | Ground | |
| Rutgers University | 8.0 | Parking Canopies | Lease |
| Middlesex Apple Orchard | 6.8 | Ground | PPA |
| IPP 2 | 3.5 | Ballasted Roof | PPA |
| US Navy in California | 1.7 | Single-axis Trackers | PPA |
| Stockton College | .900 | Parking Canopies | PPA |

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Electric Utility Program Manager: United Illuminating Company, New Haven, CT: Smart Grid Network Transformer Sidewalk Vault Rebuild (\$70M over 2 years). Responsible for full-service Design and Construction Management Program to rebuild the underground transmission and distribution system, utilizing smart grid and energy storage technology, in Bridgeport, CT and New Haven CT. Responsible for the Program's strategic and tactical operational planning, system design and asset replacement strategy. Developed construction standards, and policy and implementation for safe rehabilitation. Authored DPUC testimony to justify the program costs and schedule of values. Ensured Program's OSHA compliance, under 29 CFR §1910.269. Coordinated closely with relevant authorities (CT EPA, the City of Bridgeport and New Haven Building Departments, and CT DOT). Directed Program's procurement and supplier contract negotiations, qualifications and quality control. Successfully developed a TARGET ZERO safety and security culture, with 90,000 program team work hours with ZERO injuries or security violations.

Electric Utility Design and Construction Program Manager: United Illuminating, New Haven, CT: Network Vista Switching and 13.8kV/240V Transformation (\$2,400,000). Responsible for design and construction management of Vista-based switching for heavy commercial customers in the city of New Haven, CT and Bridgeport, CT.

Process Engineering Department Manager: CH2M Hill [Intel Corporation], Rio Rancho, NM: P1268 Programming (\$25,000,000). Responsible managing team delivering facility demand and capacity analysis for Process Gas, Liquid and Waste system analysis. Directed scope of work development, to enable the conversion of F11 and F11X from 1266 to 1268 technology, following on from the demonstration and installation of over 600+ manufacturing tool-sets, facility main and lateral sizing, POC capacity, and cost estimates.

Program Manager: CH2M Hill [IBM Corporation], NY: Responsible for a major renovation program (totaling \$155m/year) requiring full service Design and Construction Administration services for IBM and IBM Alliance Partners (DoD, AMD, Global Foundries, SONY, NXP, Chartered, Infineon, Toshiba and Samsung in NY, and VT). Responsible for strategic and tactical operational planning, resources and financial management, process improvement, cost reduction, and multi-disciplinary high performance team building. Managed the PMO for the office using PMI best practices. Demonstrated history of implementing highly successful HR initiatives including recruiting, hiring and retaining staff, salary negotiation and HR legal issues. Developed a TARGET ZERO safety and security culture with over 100,000 hours worked with no injuries or security violations. Developed and integrated custom RFI, submittal and document control systems to provide client with visibility deep into the Design and Construction Administration Program.

Operations Manager: Palmer Entertainment Group, Inc, US East Coast: Managed the creative development, design, production, and staging of corporate meetings, celebrity entertainment concerts & events, product launches, training & education programs, marketing communications consulting, and related multimedia. Developed clients from across the East coast, contracted construction, rental based designs, staging services, labor contracting, installation and dismantling services, and logistics.

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Ray P. Delio has broad experience of directing and managing operations for complex facilities and installations, across a wide range of services, including operations management, supply-line quality control, facilities commissioning, surveying and master planning.

SIGNIFICANT ROLES

Director Of Engineering: Utility-Scale Solar PV Systems – SunDurance Energy, LLC Edison, NJ. 2011: Responsible for the **operations, maintenance**, retro-commissioning, and performance guarantee for numerous Renewable Energy installations, as part of the company's driving forward of US solar PV generating capacity.

Program Manager: Renewable Energy Systems – Energy and Power Solutions, Inc., New Haven, CT. 2008-2009: Responsible for full P&L and project delivery for Fortune 100 clients of this pioneering start-up business venture, entailing the **maintenance, procurement and logistics** of goods and services across the US, Caribbean and Mexico. Also led major Build/Own/Operate PPA's for industrial and commercial solar and co-gen projects.

Program Manager: Facilities Services & Electronics and Advanced Technology – CH2M Hill, Pittsburgh, PA. 2006-2008: Responsible for **managing industrial and large commercial properties** with a focus on manufacturing facilities, commercial and office, data center, solar, fuel cell, semiconductor manufacturing and power generation space. Had full P&L and office responsibility, from sales to maintenance, for this global leader in full-service engineering, consulting, construction, and operations.

SIGNIFICANT PROJECTS

Director of Operation & Maintenance: SunDurance Energy, Edison, NJ: Responsible for the Operations, Maintenance, Retro-Commissioning, Performance Guarantee and any Electrical Repairs on the following systems:

| Project Name | Size MW(dc) | Application Type(s) | Finance Structure | Notes |
|----------------------------|-------------|----------------------------|-------------------|--|
| Morris County | 3.100 | Parking Lot Canopy & Roofs | PPA | 16 schools & municipal bldgs; Award-winning financing! |
| Atalanta Corporation | 1.210 | Flat & Metal Seam Roof | EPC | |
| NY Jets Training Center | 0.690 | Standing Seam Roof | PPA | Built in over 100 degree weather ahead of schedule |
| Atlantic City Utility Auth | 0.500 | Carport | EPC | Award-winning project; Customized structural design |
| University of Texas | 0.300 | Parking Lot Canopy | EPC/ARRA | Project funded by ARRA |
| NJ Army Base | 0.290 | Carport | EPC | Customized structural design |
| Global Pharma Co. | 0.135 | Ballast Rooftop | EPC | |
| Jersey Construction | 0.100 | Fixed Tilt Ground | EPC | 2008 Act Performance 106% |

Design and Construction Project Manager: CH2M Hill [IBM Corporation], East Fishkill, NY: Fire Alarm and Fiber Optic Communication Upgrade (\$7,550,000) - Responsible for project and construction management to upgrade alarm system for a 740-acre industrial site with 14 buildings including the construction of a NOC (network operation center), NISPOM secure data center, 4 miles of underground fiber-optic cable, new ADT fire alarm control panels, audible, visualization & initiation appliances for critical areas with fire alarm system zone monitor modules to tie-in existing initiating appliance with new fire alarm system as well as extensive point of use energy monitoring, life safety, SCADA, and SIP VOIP telephony.

Photolithography Process Engineer: Intel Corporation, Chandler, AZ: Principal engineer responsible for projects requiring facility operations investigations and ISO compliance.

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Photolithography Process Engineer: Intel Corporation, Chandler, AZ: Principal engineer responsible for projects involving training for operations and maintenance personnel, and the tracking and certification of operations and maintenance technicians, process engineers and managers.

Operations Manager: Palmer Entertainment Group, Inc, US East Coast: Managed the logistics, supply-line management and quality assurance for various aspects of the production and staging of corporate meetings, celebrity entertainment concerts & events, product launches, training & education programs, marketing communications consulting, and related multimedia.

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Ray P. Delio has exceptional experience in the management of design and engineering teams, delivering successfully on a swathe of projects, through Design-Build, Design-Bid-Build and EPC (Engineering Procurement Construction) arrangements.

SIGNIFICANT ROLES

Director Of Engineering: Utility-Scale Solar PV Systems – SunDurance Energy, LLC Edison, NJ. 2011: Directed the **engineering team**, providing input on the constructibility, validating the **design and construction** schedules, ensuring the design process is efficient, while managing design costs.

Program Manager: Smart Grid and Distributed Generation Infrastructure – The United Illuminating Company, Shelton, CT. 2009-2011: Responsible for the integration of **design and construction**, across multiple business units, of a \$120M eight year program to replace underground electrical transmission and distribution assets.

Program Manager: Renewable Energy Systems – Energy and Power Solutions, Inc., New Haven, CT. 2008-2009: Responsible for the **engineering, permitting & construction** of the State of Massachusetts first WWTP Biogas co-generation system.

Design & Construction Project Manager: Electronics and Advanced Technology – CH2M Hill, Pittsburgh, PA. 2006-2008: Responsible for supervising the **engineering and construction administration** of major semiconductor and data center projects, for the advanced-technology Fortune 100 clients of this global leader in full-service engineering. Developed and executed a **strategic staffing plan for an EPC office** of 24.

EPC Project Manager: Palmer Entertainment Group, Poughkeepsie, NY. 1989-2001: Managed the delivery of full-service architecture, **engineering, consulting, construction management (EPC)** for the entertainment, hospitality and conference center industries.

SIGNIFICANT PROJECTS

Design Build Project Manager: Energy and Power Solutions, Inc [Dean Foods / Garelick Farms], Lynn, MA: Ammonia / Glycol Refrigeration Central Plant Infrastructure Upgrade (\$3,300,000) – Responsible for development, design, and construction management to integrate new chillers, compressors, evaporative condensers, energy efficiency controls measures, floating head pressure controls, and process-integrated heat and cooling exchangers, into an existing milk and juice plant.

Design Build Project Manager: Energy and Power Solutions, Inc [Dean Foods / Garelick Farms], Rensselaer, NY: Solar PV Installation (\$3,100,000) – Responsible for development of 500kWe roof mounted solar power into this industrial client system. Responsibilities included performing site inspection, production modeling, rebates and incentives calculation, interconnection application review and system electrical integration planning.

Design Build Project Manager: Energy and Power Solutions, Inc [Dean Foods / Garelick Farms], Lynn, MA: Anaerobic Digester Biogas Co-generation (\$1,700,000) – Responsible for sales, design, permitting, interconnection and air permitting to integrate five C65 Capstone Microturbine systems into a grid parallel arrangement into a wastewater treatment plant. This system was the first Biogas Co-generation system in approved for construction by the state of Massachusetts DEP. The system was rated at 325kWe and produced 1,200,000 BTU/hr hot water, used in maintaining temperature for the anaerobic digestion process. Project included a proprietary gas conditioning skid and Microturbine control system.

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Developer & Design Build Project Manager: Energy and Power Solutions, Inc, [Dean Foods / Garelick Farms] Lynn, MA and Franklin, MA: Clean Heat and Power Thermal Efficiency Improvements / Food Plant CHP Platform development (\$700,000) – Responsible for the design, and construction management to integrate 2,700,000 BTU/hr potable commercial hot water generation into a custom storage and delivery system, including an 18,000 gallon insulated vertical hot water storage tank, with PLC-based controls and automation, and process piping directly into the Clean-In-Place Tanks, Balance Tanks, High-Temperature Short-time Heat (HTST) Exchangers and heat recovery systems. By observing and evaluating operations at the two facilities, and comparing and contrasting their performance, the project was able to implement a strategy to enable two facilities (Food Plant and CHP) to surpass their energy and cost-saving goals whilst increasing Food Plant throughput.

Construction Project Executive: CH2M Hill [IBM Corporation], East Fishkill, NY: Construction Manager for Silane Gas Storage Pad (\$1,200,000) – Responsible for the design project management and construction administration for the upgrade of a 3,840 cu. ft. Silane Gas Storage Pad. Provided daily construction oversight, reviewed site specifications for all items being installed, and requested submittals to assure needed level of oversight. Prepared coordination drawings to assure that sensitive work was properly planned and performed, so as to prevent system outage to gas customers.

Design and Construction Project Manager: CH2M Hill [Intel Corporation], Chandler, AZ: Bulk Chemical Distribution System install (\$8,000,000) – Responsible for engineering, procurement and construction management projects in Bulk chemical distribution, for Methanol, Ethanol, TMAH, NMP, DI-Water, and N₂, all requiring design compliance with SEMI standards, AZ building codes, OSHA 29 CFR 1910, ASME B31.1 piping standards, NFPA standards and EPA waste disposal regulations.

Design Project Manager: CH2M Hill [IBM Corporation], East Fishkill, NY: Cooling Tower 6 (\$2,400,000) – Responsible for project management to deliver replacement of a 6-cell cross-flow wooden cooling tower (installed in 1985) with a new 4-cell counter-current Marley SPX 18,000 gpm cooling tower. Design required a custom cantilever reinforced concrete hydraulic basin to hold 18,000 gpm, with a sump pit for free cooling operation, and the laying of 30' high concrete foundation piers.

Design Project Manager: IBM Corporation, East Fishkill, NY: Site-wide Air Handler Unit Replacement Project (\$18,000,000) – Responsible for the project management to design a site AHU upgrade project, with of 150 tons mechanical room, and roof-top HVAC equipment serving 1,500,000 sq. ft. of office, clean room & laboratory space.

Design Project Manager: CH2M Hill [IBM Corporation], East Fishkill, NY: Reliability Stress Lab (\$487,000) – Responsible for project management to deliver the design for a 22,000 sq. ft. chip testing and reliability lab, for the analysis of semiconductor chips using Blue M Integrated Thermal Inline Curing Ovens, and Blue M Environmental Test Chambers.

Design Project Manager: CH2M Hill [IBM Corporation], Yorktown, New York: High Purity Gas Supply to microelectronic factory (\$307,000) – Responsible for project management and piping design for ammonia gas delivery system to avoid inline condensation and filter fouling.

Design Project Manager: CH2M Hill [IBM Corporation], East Fishkill, NY: High Purity Hydrogen Distribution (\$547,000) – Responsible for project management to deliver the design routing and metal pipe supports for 316 stainless steel high-purity piping, with standard purity to ultra-high purity hydrogen. Project employed Aeronex Purifier, Mott Sintered Metal Filter and Carten high-purity valves.

Design Project Manager: CH2M Hill [IBM Corporation], East Fishkill, NY: HBS Tool Install (\$2,111,000) – Responsible for project management and design delivery to rearrange and construct a C4 mold clean area for the installation of a wet etch tool, using HEPES buffered saline and custom sump pump control panels. Special chemical containment considerations, and process liquid piping, required a challenging design. Assisted in design documents for P&ID's, PLC installation drawings, networking architecture, I&C scope of work. Provided technical assistance in selection of instrumentations & field devices, sump pump control panels.

Design Project Manager: CH2M Hill [IBM Corporation], East Fishkill, NY: Engineering Test Floor (\$1,260,000) – Responsible for project management and cooling water piping design, to install Teradyne J973 VLSI Test System and UltraFLEX™ test systems, and stand-alone Teradyne test probers.

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Raymond Delio

Ray P. Delio has acquired a great deal of experience in the essential endeavor of maximizing potential from staff, achieved through intelligent human resources management. He has excelled in assignments to deliver on technical staffing, staff retention and staff training policies, as well as for ensuring compliance with hazardous materials, safety and emergency management programs.

SIGNIFICANT ROLES

Program Manager: Smart Grid and Distributed Generation Infrastructure – United Illuminating Company, Shelton, CT. 2009-2011: Responsible for **safety compliance** for major program to deliver utility transmission and distribution upgrade, as part of the corporation's Ten Year Plan.

Program Manager: Facilities Services & Electronics and Advanced Technology – CH2M Hill, Pittsburgh, PA. 2006-2008: Responsible for developing and **executing strategic staffing plan** for an EPC (Engineering Procurement and Construction) office of twenty four staff, at this global leader in full-service engineering, consulting, construction, and operations.

RELEVANT CERTIFICATIONS & SKILLS

Holder of following certificates:

- > Lorman Construction Compliance
- > OSHA Confined Space

Implemented HR compliance programs for:

- > OSHA (Occupational Health and Safety Authority)
- > HAZOP (Hazard & Operability)/ PHA (Process Hazard Analysis)
- > FMEA (Failure Mode Effects Analysis)
- > TARGET ZERO (Safety Program)

SIGNIFICANT PROJECTS

Electric Utility Program Manager: United Illuminating Company: Responsible for design and construction management program to rebuild the underground transmission and distribution in Bridgeport and New Haven, CT. Responsible for OSHA compliant rules for engineering consultant and construction contractors, under 29 CFR §1910.269 to perform work. Close coordination with CT EPA, and City of Bridgeport and New Haven Building Departments and CT DOT. Developed a TARGET ZERO safety and security culture with 90,000 program team work hours with ZERO injuries or security violations.

Program Manager: CH2M Hill [IBM Corporation] New York: Responsible for a major renovation program (\$155,000,000/year) requiring design and construction administration services for IBM and IBM Alliance Partners (DoD, AMD, Global Foundries, SONY, NXP, Chartered, Infineon, Toshiba and Samsung) in Fishkill NY, Poughkeepsie Yorktown Heights NY and Burlington, VT. Experience shown with PHA, HAZOP, and FMEA analysis and implementation of corrective action plans. Demonstrated a history of implementing several highly successful HR initiatives, including the recruiting, hiring and retaining staff, salary negotiation and HR legal issues. Developed a TARGET ZERO safety and security culture with over 100,000 hours worked with no injuries or security violations.

Photolithography Process Engineer: Intel Corporation, Chandler, AZ: Principal engineer responsible for process development projects in the roll out of training for operations and maintenance personnel. Project required the complete redevelopment of existing training IT systems and content to properly inform, train, track and certify operations and maintenance technicians, process engineers and managers.

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Ray P. Delio has gained a considerable pool of media and entertainment expertise, from over a decade building up a major East Coast services company, dedicated to serving the entertainment industry. The diverse range of talents accrued from this included event production, lighting and sound control, stage design, viral marketing and artist management.

SIGNIFICANT ROLES

Principal – Operations Manager: Palmer Entertainment Group, Inc, US East Coast: 1989-2001. Managed all aspects of operations for this company that provided a wide range of **entertainment outsourcing** and **brand-immersive media services**.

SIGNIFICANT PROJECTS

Operations Manager: Palmer Entertainment Group, Inc: Managed the creative development, design, production, and staging of corporate meetings, celebrity entertainment concerts & events, product launches, training & education programs, marketing communications consulting, and related multimedia. These services were delivered in all forms of media including live events, broadcast television, film & video, print, exhibits, displays & installations, websites, DVD, and interactive technologies. Developed clients from across the East coast, contracting of custom scenic and prop construction, customized rental based designs, on-site supervision, staging services, rigging, lighting, labor contracting, installation and dismantling services, and logistics. The company also manufactured and installed custom 120, 208/240, 480V electrical power distribution components and control systems for the stage and lighting show control markets.

Electrician: Palmer Entertainment Group: Responsible for events listed below, requiring electrical services and the standard production systems which included: power distribution and DMX control system for tie in of 100,000 watt Crown and Cerwin Vega sound reinforcement; 17,000 watt light show consisting of (4) High End Systems Cyberlights, (2) Clay Paky Golden Scan (8) Dataflash strobe lights; F100 fog machine and Optisolar 250; Wildfire UV flood lights; LCD projectors and screens; high res. video capture station; Flying Pig Control board; ancillary control electronics. Additional services included stage structural design, rigging, event security, concessions, clean up, VIP Parking, graphic design. Following is a partial list of events served:

- > Newburg Skate Park, Newburg, NY: "Clover" March 3, 1995
- > Prospect Park, Brooklyn, NY: "Outlaw"
- > Newburg Skate Park, Newburg, NY: "Love" February 11, 1995
- > Neil Simon Theater, Manhattan, NY: "The Orb, Concert after-party"
- > St Luke's Episcopal Church, Beacon, NY: "Dream" January 1, 1995
- > Club Octagon Manhattan, NY: "Alan Sanctuary Event Weekly Club" '94 to '96
- > Newburg Skate Park, Newburg, NY: "Cyber-Link" November 26, 1994
- > SUNY New Paltz, New Paltz, NY: "BIGALA Event"
- > Newburg Skate Park, Newburg, NY: "Synthesis 2" September 24, 1994
- > Fusion Nightclub, New Paltz, NY: "Fusion Friday"
- > Newburg Skate Park, Newburg, NY: "The Fantasy Project" March 3, 1994
- > Rocky Point Amusement Park, Rocky Point, RI: "Casper 2"
- > Poughkeepsie Armory, Newburg, NY: "Polaris" September 24, 1994
- > Northern Lights Inc, Clifton Park, NY: "8 ball" Productions"
- > East Greenbush Park, Albany, NY: "Osmosis" November 20, 1993
- > Poughkeepsie Jewish Community Center, NY: "Polaris 2"
- > Newburg Skate Park Newburgh, NY: "Synthesis" July 9, 1993
- > Poughkeepsie Jewish Community Center, NY: "Nebula"
- > Newburg Skate Park, Albany, NY: "Liquid Vision" April 8, 1993
- > Poughkeepsie Jewish Community Center, Poughkeepsie, NY: "Nebula 2"
- > Studio One Dancesport, Brewster, NY: "Weekly Club" 1994

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Raymond Delio

Electrician: Palmer Entertainment Group, [Ithaca College IPAC] Ithaca, NY: Responsible for event “Daydream 2” Apr February 25 1995. Required custom 120/208v power distribution and DMX control system for tie-in of 50,000 watt Crown and Cerwin Vega sound reinforcement, plus 14,000 watt light show consisting of (8) High End Systems Intellebeam 700HX, (4) Dataflash strobe light, F100 fog machine and Optisolar 250, Wildfire UV flood lights, and ancillary control electronics.

Electrician: Palmer Entertainment Group, [Roseland Ball Room], NY: Responsible for “Kindness” July 1, 1995. Required custom 277/480v power distribution and DMX control system for tie-in of 50,000 watt Crown and Cerwin Vega sound reinforcement plus 167,000 watt light show consisting of (16) High End Systems Cyberlights, (4) Clay Paky Golden Scan (16) Dataflash strobe lights, F100 fog machine and Optisolar 250, Wildfire UV flood lights, LCD projectors and screens, high res. video capture station, Flying Pig Control board and ancillary control electronics.

Electrician: Palmer Entertainment Group, [Orange County Fair Grounds], Middletown, NY: Responsible for event “Egg” April 29, 1995. Required custom 120/208v power distribution and DMX control system for tie in of 20,000 watt Crown and Cerwin Vega sound reinforcement plus 200,000 watt light show consisting of (6) High End Systems Cyberlights, (2) Clay Paky Golden Scan (8) Dataflash strobe lights, F100 fog machine and Optisolar 250, Wildfire UV flood lights, LCD projectors and screens, high res. video capture station, Flying Pig Control board and ancillary control electronics. Additional services included stage structural design, rigging, event security, concessions, clean up, VIP Parking, graphic design.



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Raymond Delio

Ray P. Delio has grasped an extensive practical experience in a number of electrical techniques and skills, resulting from over a decade building up a major East Coast electrical services company, dedicated to serving the entertainment industry. These include event electrical installation, electrical construction, and manufacture of power distribution systems and robotic control systems.

SIGNIFICANT ROLES

Principal – EPC Project Manager and Power Distribution Electrician: Palmer Entertainment Group, Inc, US East Coast:1989-2001. Involved all aspects of **electrical operations and installation** for this company, which that provided electrical services for the entertainment and media industries.

SIGNIFICANT PROJECTS

Operations Manager: Palmer Entertainment Group, Inc: Managed the rigging, lighting, labor contracting, installation and dismantling services, and logistics of entertainment and corporate events. Also involved in the manufacture and installation custom 120, 208/240, 480V electrical power distribution components and control systems for the stage and lighting show control markets. Constructed power distribution systems for robotics and programmed PLC automation control systems

Electrician: Palmer Entertainment Group: Responsible for events listed below, requiring electrical services and the standard production systems which included: 120/208v power distribution and DMX control system for tie in of 10,000 watt Crown and Cerwin Vega sound reinforcement;17,000 watt light show consisting of (4) High End Systems Cyberlights, (2) Clay Paky Golden Scan (8) Dataflash strobe lights; F100 fog machine and Optisolar 250;Wildfire UV flood lights; LCD projectors and screens; high res. video capture station; Flying Pig Control board; ancillary control electronics.

- > Newburg Skate Park, Newburg, NY: "Clover" March 3, 1995
- > Newburg Skate Park, Newburg, NY: "Love" February 11, 1995
- > St Luke's Episcopal Church, Beacon, NY: "Dream" January 1, 1995
- > Newburg Skate Park, Newburg, NY: "Cyber-Link" November 26, 1994
- > Newburg Skate Park, Newburg, NY: "Synthesis 2" September 24, 1994
- > Newburg Skate Park, Newburg, NY: "The Fantasy Project" March 3, 1994
- > Poughkeepsie Armory, Newburg, NY: "Polaris" September 24, 1994
- > East Greenbush Park , Albany, NY: "Osmosis" November 20, 1993
- > Newburg Skate Park Newburgh, NY: "Synthesis" July 9, 1993
- > Newburg Skate Park, Albany, NY: "Liquid Vision" April 8, 1993
- > Prospect Park, Brooklyn, NY: "Outlaw"
- > Neil Simon Theater, Manhattan, NY: "The Orb, Concert after-party"
- > Club Octagon Manhattan, NY: "Alan Sanctuary Event Weekly Club" '94 to '96
- > SUNY New Paltz, New Paltz, NY: "BIGALA Event"
- > Fusion Nightclub, New Paltz, NY: "Fusion Friday"
- > Rocky Point Amusement Park, Rocky Point, RI: "Casper 2"
- > Northern Lights Inc, Clifton Park, NY: "8 ball" Productions"
- > Poughkeepsie Jewish Community Center, NY: "Polaris 2"
- > Poughkeepsie Jewish Community Center, NY: "Nebula"
- > Poughkeepsie Jewish Community Center, Poughkeepsie, NY: "Nebula 2"
- > Studio One Dancesport, Brewster, NY: "Weekly Club" 1994

Electrician: Palmer Entertainment Group, [Ithaca College IPAC] Ithaca, NY: Responsible for event "Daydream 2" Apr February 25 1995. Required custom 120/208v power distribution and DMX control system for tie-in of 5,000 watt Crown and Cerwin Vega sound reinforcement plus14,000 watt light show consisting of (8) High End Systems Intellebeam 700HX, (4) Dataflash strobe light, F100 fog machine and Optisolar 250, Wildfire UV flood lights, and ancillary control electronics.

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Raymond Delio

Electrician: Palmer Entertainment Group, [Roseland Ball Room], NY: Responsible for "Kindness" July 1, 1995. Required custom 277/480v power distribution and DMX control system for tie-in of 50,000 watt Crown and Cerwin Vega sound reinforcement plus 67,000 watt light show consisting of (16) High End Systems Cyberlights, (4) Clay Paky Golden Scan (16) Dataflash strobe lights, F100 fog machine and Optisolar 250, Wildfire UV flood lights, LCD projectors and screens, high res. video capture station, Flying Pig Control board and ancillary control electronics.

Electrician: Palmer Entertainment Group, [Orange County Fair Grounds], Middletown, NY: Responsible for event "Egg" April 29, 1995. Required custom 120/208v power distribution and DMX control system for tie in of 20,000 watt Crown and Cerwin Vega sound reinforcement plus 20,000 watt light show consisting of (6) High End Systems Cyberlights, (2) Clay Paky Golden Scan (8) Dataflash strobe lights, F100 fog machine and Optisolar 250, Wildfire UV flood lights, LCD projectors and screens, high res. video capture station, Flying Pig Control board and ancillary control electronics.

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Raymond Delio

Ray P. Delio's career has been characterized by a broadening and deepening set of technical skills and expert knowledge, encompassing especially the fields of process engineering, instrumentation, plant automation, and chemical engineering:

SIGNIFICANT ROLES

Process Engineering Department Manager: Facilities Services & Electronics and Advanced Technology – CH2M Hill, Pittsburgh, PA. 2006-2008: Responsible for planning of process design projects for the Fortune 100 clients of this global leader in full-service engineering, consulting, construction, and operations.

Photolithography Development Engineer: Process Engineering – NXP Semiconductors, Fishkill, NY: 2005-2006: Responsible for advanced process engineering role with this semiconductor firm founded by Philips Electronics, helping to facilitate process discovery, development, materials and equipment selection, and managing the installation, startup and commissioning of 200µm semi-conductor tooling.

Project Manager – 200µm Factories Worldwide Process Engineering: Intel Corporation, Hillsboro, OR. 2001-2005: Led the design and development of semiconductor fabrication and packaging process technologies, as well facilitating the transfer of new processes from development to high-volume factories worldwide.

RELEVANT CERTIFICATIONS & SKILLS

Ray is familiar with the following process standards:

- > SEMI
- > ASME B31.1 piping standards
- > NFPA

Ray is also familiar with the following tools in 200µm and 300µm manufacturing:

- > ASML
- > DNS
- > STEAG
- > SVG
- > SEZ
- > LAM
- > TEL
- > BioRAD
- > Nikon
- > FSI

Ray is also familiar with the following quality control systems:

- > Total Productive Maintenance
- > ISO 9001:2000
- > ISO 14000

SIGNIFICANT PROJECTS

Program Manager: CH2M Hill [IBM Corporation], NY: Responsible for a major renovation program (totaling \$155,000,000/year) requiring full-service Design and Construction administration services for IBM and IBM Alliance Partners – DoD, AMD, Global Foundries, SONY, NXP, Chartered, Infineon, Toshiba and Samsung – in Fishkill NY, Poughkeepsie Yorktown Heights NY, as well as Burlington, VT. Responsible for strategic and tactical operational planning, experience gained with PHA, HAZOP, or FMEA analysis, and implementation of corrective action plans.

Design Project Manager: CH2M Hill [IBM Corporation], East Fishkill, NY: Cooling Tower 6 (\$2,400,000) – Responsible for project management to deliver replacement of a 6-cell cross flow wooden cooling tower (installed in 1985) with a new 4-cell counter-current Marley SPX 18,000 gpm cooling tower. Design required a custom cantilever reinforced concrete hydraulic basin to hold 18,000 gpm, with a sump pit for free cooling operation. The basin supporting the new tower sat on 30' high concrete foundation piers.

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Process Engineering Department Manager: CH2M Hill [Intel Corporation], Rio Rancho, NM: P1268 Programming (\$25,000,000) – Responsible for the team for completing facility demand and capacity analysis for Process Gas, Liquid and Waste system analysis, and scope of work development, to enable the conversion of F11 and F11X from 1266 to 1268 technology. Scope of work developed from the demonstration and installation of over 600+ manufacturing tool-sets, facility main and lateral sizing, POC capacity, and cost estimates.

Design and Construction Project Manager: CH2M Hill [Intel Corporation], Chandler, AZ: Bulk Chemical Distribution System installation (\$8,000,000) – Responsible for the engineering, procurement and process development projects for Bulk chemical distribution of Methanol, Ethanol, TMAH, NMP, DI-Water, and N2. Design compliance as required with SEMI standards, AZ building codes, OSHA 29 CFR 1910, ASME B31.1 piping standards, NFPA standards and EPA waste disposal regulations.

Design Project Manager: CH2M Hill [IBM Corporation], East Fishkill, NY: Site-wide Air Handler Unit Replacement Project (\$18,000,000) – Responsible for project management to design for site AHU upgrade project of 150 tons mechanical room, and roof top HVAC equipment serving 1,500,000 sq. ft. of office, clean room & laboratory space.

Design Project Manager: CH2M Hill [IBM Corporation], East Fishkill, NY: Reliability Stress Lab (\$487,000) – Responsible for project management to deliver the design for a 22,000 sq. ft. chip testing and reliability lab for analysis of semiconductor chips using Blue M Integrated Thermal Inline Curing Ovens and Blue M Environmental Test Chambers.

Design Project Manager: CH2M Hill [IBM Corporation], Yorktown, New York: High Purity Gas Supply to microelectronic factory (\$307,000) – Responsible for project management and piping design for ammonia gas delivery system to avoid inline condensation and filter fouling.

Design Project Manager: CH2M Hill [IBM Corporation], East Fishkill, NY: High Purity Hydrogen Distribution (\$547,000) – Responsible for project management to deliver the design routing and metal pipe supports for 316 stainless steel high-purity piping, and standard to ultra-high purity hydrogen. Project employed Aeronex Purifier, Mott Sintered Metal Filter and Carten high-purity valves.

Design Project Manager: CH2M Hill [IBM Corporation], East Fishkill, NY: HBS Tool Install (\$2,111,000) – Responsible for project management to rearrange and construct a C4 mold clean area for the installation of a wet etch tool, using HEPES buffered saline and custom sump pump control panels. Special chemical containment considerations, and process liquid piping, made for a challenging design. Assisted in the design documents for P&ID's, PLC installation drawings, networking architecture, and I&C scope of work. Provided technical assistance in selection of instrumentations & field devices, sump pump control panels.

Design Project Manager: CH2M Hill [IBM Corporation], East Fishkill, NY: Engineering Test Floor (\$1,260,000) – Responsible for project management and cooling water piping design to install Teradyne J973 VLSI Test System and UltraFLEX™ test systems and stand-alone Teradyne test probers.

Process Design Engineer: CH2M Hill [IBM Corporation], East Fishkill, New York: Cooling Tower Condenser Water Treatment System (\$2,600,000) – Responsible for project management and process engineering to design improvements in redundancy and operator access for a system that feeds sodium hypochlorite, sulfuric acid, inhibitors, and biocides to three 18,000 gpm cooling tower systems. Design used bundled PTFE tubing inside PVC containment pipes to transfer fluids to water header for each system. Project required upgrades to PLC and I/O to Quantum PLC with custom interfacing with GE Pacemaker pump controls. Employed radar tank levels, leak detection, local sump control panel and added 400 analog and digital I/O points and SCADA update.

Process Design Engineer: CH2M Hill [IBM Corporation], East Fishkill, NY: Site Final Effluent Toxicity Engineering Study (\$75,000) – Responsible for project management and process engineering to deliver conceptual design and cost estimating for. Study considered desalination for 105,000 gpd final-effluent discharge TDS reduction, alternate discharge point selection and upgrade of associated wastewater treatment plants, for 6 MGD site discharge and changes to manufacturing operations.

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Raymond Delio

Wet Etch & Photolithography Project Manager: Koninklijke Philips Electronics N.V, East Fishkill, NY: Principal engineer and project manager responsible for developing advanced wet and photo fabrication processes technologies for BiCMOS and CMOS products. Performed process discovery, definition and development, materials and equipment selection, as well as process optimization for front- and back-end lithography, and wet etch processes. Selected and installed wet etch and photolithography tool-sets. Developed Total Productive Maintenance and ISO 9001:2000 and ISO 14000 control systems. Responsible for supplier selection and incoming chemicals and material quality.

Wet Etch Development Engineer: Koninklijke Philips Electronics N.V, East Fishkill, NY: Wet Etch Tool Install (\$4,600,000) – Installed, commissioned and completed process development for BiCMOS and CMOS products on SEZ 304, 203 and DaVinci wet etch tools.

Photolithography Development Engineer: Koninklijke Philips Electronics N.V, East Fishkill, NY: Installed, commissioned and completed process development for BiCMOS and CMOS products on TEL ACT 8, SVG 90S and ASML TWINSCAN and PAS 5500 tools, using positive and negative resists for front-end and back-end photolithography.

Photolithography & Packaging Development Project Manager: Intel Corporation, Chandler, AZ: Principal engineer and project manager responsible for process development projects in the transfer of photolithographic, wet/dry etch, and metrology technology (developed in Chandler, AZ) to high-volume manufacturing, assembly & test sites across the corporation. Led cross-functional, continuous improvement teams to reduce the cost of unit processes (and defect density), and to improve the yield and throughput. Managed a large global multi-disciplined group of engineers and technicians, in the development of semiconductor fabrication and packaging process technology that achieved savings of \$23M/yr worldwide. Project involved development using ASML, SVG, TEL, Nikon, DNS, SEZ, BioRAD, FSI, STEAG, LAM tools in 200µm and 300µm manufacturing.

Ion Implant Process Engineer: Intel Corporation, Chandler, AZ: Principal engineer responsible for process development projects in path-finding for implant layer resist technology. Project required extensive DOE, using SAP and JMP data analysis to reduce development time, and increase chances of first time success and DFM.

Photolithography Process Engineer: Intel Corporation, Chandler, AZ: Developed copper and non-copper back-end packaging technology for advanced Intel microprocessor and flash products. Project included developing new copper / non-copper segregation and de-contamination protocols.

Photolithography Process Engineer: Intel Corporation, Chandler, AZ: Principal engineer responsible for process development projects, in path-finding, for various polyamide and silicone based resist systems. Project required vendor analysis and selection based on balance sheet, extensive site visits, facility operations investigations and ISO compliance.

Spin-On-Glass Process Engineer: Intel Corporation, Chandler, AZ: Principal engineer responsible for process development project in Spin-on-glass coating and removal modules. Project required extensive TEL ACT8 equipment modifications.

Photolithography Process Engineer: Intel Corporation, Chandler, AZ: Principal engineer responsible for process development projects in risk and process tolerance analysis (FMEA & HAZOPs studies) on photolithography, reactive ion etch, wet etch, plating, annealing and diffusion, electrical test and final assembly process areas.

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Raymond Delio

Ray P. Delio has in-depth expertise of deploying IT infrastructure, associated with significant installation projects, such as data centers and semiconductor fabrication plants, as well as specific IT skills acquired throughout his technology-focused career:

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SIGNIFICANT ROLES

Program Manager: Smart Grid and Distributed Generation Infrastructure – United Illuminating Company, Shelton, CT. 2009-2011: Responsible for **communication design** aspects of utility transmission and distribution electrical construction projects across the territory, as part of the corporation’s Ten Year Plan.

Program Manager: Facilities Services & Electronics and Advanced Technology – CH2M Hill, Pittsburgh, PA. 2006-2008: Responsible for modeling and design aspects of **major data center infrastructure projects** for the Fortune 100 clients of this global leader in full-service engineering, consulting, construction, and operations.

Project Manager: 200µm Factories Worldwide Process Engineering – Intel Corporation, Hillsboro, OR. 2001-2005: **Led the design and development** of semiconductor fabrication and packaging process technologies, as well facilitating the transfer of new processes from development to high-volume factories worldwide.

RELEVANT CERTIFICATIONS & SKILLS

Experience with following standards/ systems:

- > NERC CIP compliance
- > SIP VOIP
- > MIDI
- > NISPOM regulations
- > SAP
- > AutoCAD
- > SCADA control
- > JMP

SIGNIFICANT PROJECTS

Design and Construction Program Manager: United Illuminating, New Haven & Bridgeport, CT: Smart Grid Network Protector Communication for 480V sidewalk vault transformation (\$3,400,000) – Responsible for design and construction management to install and commission a fiber optic and wireless NERC CIP compliant communication system providing SCADA control of 13.8kv to 480V transformation network transformers across multiple locations in the city of New Haven, CT and Bridgeport, CT.

Design and Construction Program Manager: United Illuminating, New Haven, CT: Network Vista Switching and 13.8KV/240V Transformation (\$2,400,000) – Responsible for design and construction management Vista based switching of 240V heavy commercial customers in the city of New Haven, CT and Bridgeport, CT.

Design and Construction Project Manager: CH2M Hill [IBM Corporation], East Fishkill, NY: Engineering Data Center (\$22,100,000)– Responsible for project management to design a 2.2 Megawatt Engineering Computer Data Center that supports 200µm and 300µm manufacturing applications. Design included fiber optic communications, UPS, airflow modeling, spot cooling and life safety service.

Design and Construction Project Manager: CH2M Hill [IBM Corporation], Poughkeepsie, NY: Production Data Center (\$76,000,000) – Responsible for project management to design a Tier IV 8 Megawatt High Density Computer Data Center. System utilized a state-of-the-art 800 watt/sq. ft. machine, with advanced thermal energy recovery implementing a mix of IBM cooling technologies and co-generation systems, including efficiency breakthroughs and revolutionary design for cloud computing.

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Design and Construction Project Manager: CH2M Hill [IBM Corporation], East Fishkill, NY: Fire Alarm and Fiber Optic Communication Upgrade (\$7,550,000) – Responsible for project of construction management to upgrade alarm system for a 740-acre industrial site with 14 buildings including the construction of a NOC (network operation center), NISPOM secure data center, 4 miles of underground fiber optic cable, audible, visualization & initiation appliances for critical areas, with fire alarm system zone monitor modules to tie-in existing initiating appliance with new fire alarm system, as well as extensive point of use energy monitoring, life safety, SCADA, and SIP VOIP telephony.

Design Project Manager: CH2M Hill [IBM Corporation], East Fishkill, NY: HBS Tool Install (\$2,111,000) - Assisted in design documents for P&ID's, PLC installation drawings, networking architecture, I&C scope of work.

Ion Implant Process Engineer: Intel Corporation, Chandler, AZ: Principal engineer responsible for process development projects, which required extensive DOE using SAP and JMP data analysis to reduce development time and increase chances of first time success and DFM.

Electrician: Palmer Entertainment Group, Inc, US East Coast: Experienced in programming robotic show control lights and MIDI synchronization, and the complex machine controls systems (relay & solid state logic) used in automated lighting, generator control, and integration into house lighting control systems.

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Raymond Delio

Ray P. Delio has built up an exceptional clean energy skills base, taking in a wide range of new technologies – encompassing environmental energy generation (solar, natural gas, co-generation, biogas, wastewater), smart grid deployment, energy efficiency and demand management methodologies, and energy auditing/master-planning:

SIGNIFICANT ROLES

Director, Project & Program Management Consultant: Inter-Island Renewable Energy Network – Hawaiian Electric Company, HI. 2012 (Active): Focusing on the strategy, legislative policy, program budget and organizational change necessary to deliver the Inter-Island Renewable Energy Network, a \$2bn program covering the generation, transmission, distribution and smart grid technologies needed meet the state Renewable Energy Portfolio goal, of 40% before 2030.

Director Of Engineering: Utility-Scale Solar PV Systems: SunDurance Energy, LLC Edison, NJ. 2011: Directing **renewable energy engineering** projects, with a focus on solar PV, providing input on constructibility, validation of design and construction schedules, assurance of efficiency in the design process, and managing design costs. Also undertook role as **forward technology scout**, identifying promising **frontier clean energy** technologies.

Program Manager: Smart Grid and Distributed Generation Infrastructure – United Illuminating Company, Shelton, CT. 2009-2011: Responsible for planning and delivery of smart grid technology into the utility transmission and distribution network, as part of the corporation's Ten Year Plan.

Program Manager: Renewable Energy Systems: Energy and Power Solutions, Inc., New Haven, CT. 2008-2009: Responsible for planning and oversight of **ground-breaking energy conservation and co-generation** construction projects for the Fortune 100 clients of this pioneering start-up business venture.

RELEVANT SKILLS & CERTIFICATIONS

Ray P. Delio has received the following certifications:

LEED Green Associate #10315515

- > CEM Certified Energy Manager #017620

Ray P. Delio is a member of the following organizations:

- > USGBC (U.S. Green Building Council)
- > IEEE (Institute of Electrical and Electronics Engineers)
- > AEE (Association of Energy Engineers)
- > ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers)

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Raymond Delio

RELEVANT PROJECTS

Director, Project & Program Management Consultant (Active position): Hawaiian Electric Company, HI: Program Manager for the Inter-Island Renewable Energy Network (IREN). Corporate point contact for a \$2 billion dollar transformational 600+MW utility-scale renewable generation and transmission program, with the goal of integrating the separate systems that deliver power across the Hawaiian Islands. In this role:

- > Focus on the strategy, legislative policy, program budget and organizational change necessary to deliver overall project execution for the Inter-Island Renewable Energy Network (including generation, transmission, distribution and smart grid), with the ultimate goal of meeting the state's Renewable Energy Portfolio Standard of 40% before 2030.
- > Direct the program team and provide input on policy, proposed legislation, constructibility, validation of design, construction scheduling, ensuring efficiency in the design process and the managing of scope, so as to meet corporate initiatives and State mandates.
- > Lead the strategic planning and project definition to align the implementation of Wind, Solar, Geothermal, Ocean Wave and Ocean Thermal, and Hydro renewable energy, as well as interisland cable and smart grid, into the existing Hawaiian Electric, Maui Electric and Hawaiian Electric and Light Companies.

Director of Engineering: SunDurance Energy, Edison, NJ: United Stationers, Cranbury, New Jersey (\$ Confidential) – Responsible for the Construction, Administration, Commissioning of 3.265MW ballasted rooftop solar PV energy system, 570,000 square-foot warehouse roof (about the size of 10 football fields), with 14,000 Trina solar panels. The system will provide nearly 100% of United Stationers' electricity needs, and produce 3,900,000 kWh/year (equivalent to taking the carbon output of over 525 cars off the road or eliminating the amount of carbon sequestered annually by 570 acres of pine forests).

Director of Engineering: SunDurance Energy, Edison, NJ: Atalanta Corporation, Elizabeth, New Jersey (\$ Confidential) – Responsible for the Construction, Administration, Commissioning of 410kW non-penetrating rooftop solar energy system. The system will reduce carbon dioxide emissions by approximately 330 metric tons annually and is the equivalent to taking over 60 passenger vehicles off the road each year.

Director of Operation & Maintenance: SunDurance Energy, Edison, NJ: Responsible for the Operations, Maintenance, Retro-Commissioning, Performance Guarantee and any Electrical Repairs on the following solar PV systems (including the **ground-breaking Morris County** schools project):

| Project Name | Size MW(dc) | Application Type(s) | Finance Structure | Notes |
|----------------------------|-------------|----------------------------|-------------------|--|
| Morris County | 3.100 | Parking Lot Canopy & Roofs | PPA | 16 schools & municipal bldgs; Award-winning financing! |
| Atalanta Corporation | 1.210 | Flat & Metal Seam Roof | CPA | |
| NY Jets Training Center | 0.690 | Standing Seam Roof | PPA | Built in over 100 degree weather ahead of schedule |
| Atlantic City Utility Auth | 0.500 | Carport | CPA | Award-winning project; Customized structural design |
| University of Texas | 0.300 | Parking Lot Canopy | CPA/ARRA | Project funded by ARRA |
| NJ Army Base | 0.290 | Carport | CPA | Customized structural design |
| Global Pharma Co. | 0.135 | Ballast Rooftop | CPA | |
| Jersey Construction | 0.100 | Fixed Tilt Ground | CPA | 2008 Act Performance 106% |

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Raymond Delio

Director of Engineering: SunDurance Energy, Edison, NJ: Responsible for the Construction, Administration, Commissioning of the following solar PV systems :

| Project Name | Size MW(dc) | Application Type(s) | Finance Structure |
|------------------|-------------|------------------------|-------------------|
| NJMC 1A Landfill | 3.120 | Ballasted Ground & PLC | EPC/ARRA |

Director of Engineering: SunDurance Energy, Edison, NJ: Responsible for the Energy Auditing, Planning, Permitting, Design and Bidding for the following solar PV systems:

| Project Name | Size MW(dc) | Application Type(s) | Finance Structure |
|-------------------------|-------------|----------------------|-------------------|
| IPP 1 | 10.0 | Ground | |
| Rutgers University | 8.0 | Parking Canopies | Lease |
| Middlesex Apple Orchard | 6.8 | Ground | PPA |
| IPP 2 | 3.5 | Ballasted Roof | PPA |
| US Navy in California | 1.7 | Single-axis Trackers | PPA |
| Stockton College | .900 | Parking Canopies | PPA |

Electric Utility Program Manager: United Illuminating Company, New Haven, CT: Smart Grid Network Transformer Sidewalk Vault Rebuild (\$70M over 2 years) – Responsible for over \$140M cost-of-work full-service Design and Construction Management Program to rebuild the underground transmission (13.8kv) and distribution (480V and 208V) system, using grid and energy storage technology in Bridgeport, CT and New Haven CT. Responsible for strategic and tactical operational planning, substation design, smart grid communication, NERC CIP compliance, SCADA and proprietary control system design, and civil and electrical system asset replacement strategy. Development of construction standards, and the means and methods for the safe rehabilitation, of sidewalk and street-placed structural transformation vaults, duct bank and man holes. Author of provision of DPUC testimony to justify the program costs and schedule of values. Developed OSHA compliant rules for engineering consultant and construction contractors under 29 CFR §1910.269 to perform work. Closely coordinated with CT EPA, the City of Bridgeport and New Haven Building Departments, and CT DOT. Procurement and supplier contract negotiation, qualification and quality control. Successfully developed a TARGET ZERO safety and security culture, with 90,000 program team work hours with ZERO injuries or security violations.

Design Build Project Manager: Energy and Power Solutions, Inc [Dean Foods / Garelick Farms], Lynn, MA: PV Power Plant (\$3,100,000) – Responsible for development, design, and construction management to integrate 500kW roof mounted solar power system into this industrial client system. Responsibilities included performing site inspection, production modeling, rebates and incentives calculation, interconnection application review and system electrical integration planning.

Design Build Project Manager: Energy and Power Solutions, Inc [Dean Foods / Garelick Farms], Lynn, MA: Anaerobic Digester Biogas Co-generation (\$1,700,000) – Responsible for sales, design, permitting, interconnection and air permitting to integrate five C65 Capstone Microturbine systems, in a grid parallel arrangement, into a wastewater treatment plant. This system was the **first Biogas Co-generation system** in approved for construction by the state of Massachusetts DEP. The system has a rating of 325kWe, and produces 1,200,000 BTU/hr hot water used in maintaining temperature for the anaerobic digestion process. Project included a proprietary gas conditioning skid and Microturbine control system.

Design Build Project Manager: Energy and Power Solutions, Inc [Dean Foods / Garelick Farms], Lynn, MA: Ammonia / Glycol Refrigeration Central Plant Infrastructure Upgrade (\$3,300,000) – Responsible for development, design, and construction management to integrate new chillers, compressors, evaporative condensers, energy efficiency controls measures, floating head pressure controls and process integrated heat and cooling exchangers, into an existing milk and juice plant.

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Developer & Design Build Project Manager: Energy and Power Solutions, Inc. [Dean Foods / Garelick Farms] Lynn, MA and Franklin, MA: Clean Heat and Power Thermal Efficiency Improvements / Food Plant CHP Platform development (\$700,000) – Responsible for the design, and construction management for the integration of 2,700,000 BTU/hr potable commercial hot water generation into a custom storage and delivery system. Included an 18,000 gallon insulated vertical hot water storage tank, PLC-based controls and automation, and process piping directly into the Clean-In-Place Tanks, Balance Tanks, High Temperature Short Time Heat (HTST) Exchangers and heat recovery systems. By observing and evaluating operations at the two facilities, and comparing and contrasting their performance, the project was able to implement a strategy to enable two facilities (Food Plant and CHP) to surpass their energy and cost-saving goals and, at the same time, increase Food Plant throughput.

Design and Construction Project Manager: CH2M Hill [IBM Corporation], East Fishkill, NY: Co-generation plant (\$6,100,000 – Responsible for construction management to install and commission a grid parallel turbine 4.2MWe plus 4,000 lb/hr Steam (8bar) Co-generator plant for 650,000 sq. ft. office/laboratory building.

Design and Construction Project Manager: CH2M Hill [IBM Corporation], East Fishkill, NY: Emergency Stand-by Generator Replacement and Upgrade (\$1,160,000) – Responsible for project management to design an upgrade and replacement of a 600KW stand-by emergency generator system for 650,000 sq. ft. office/laboratory building.

Design and Construction Project Manager: CH2M Hill [IBM Corporation], Poughkeepsie, NY: Co-generation plant (\$5,000,000) – Responsible for construction management to install and commission a proprietary grid parallel reciprocating co-generator plant to stabilize utility power for critical high performance data center power systems including absorption chillers and heat recovery steam generation.

Design and Construction Project Manager: CH2M Hill [IBM Corporation], Poughkeepsie, NY: Production Data Center (\$76,000,000) – Responsible for project management to design a Tier IV 8 MW0 High Density Computer Data Center. System deployed was a state-of-the-art 800 watt/sq. ft. machine with the advanced thermal energy recovery by implementing a mix of advanced IBM cooling technologies and co-generation systems, including energy efficiency breakthroughs and revolutionary design for cloud computing. Project achieved energy savings greater than 40% and Data Center energy efficiency measures showed average pay back less than 2 years.

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Raymond Delio

Chief Technology Officer & Start-up Program Consultant: Automotive and Electric Drive Systems Integration – Clever EV, HI, 2012-13 (Active): Driving forward this startup company's technical vision, by undertaking active intellectual property (IP) management (including opportunity identification, research and evaluation, and the development and protection of IP), and the development of a continual improvement process (CIP) for accelerating procedure/component innovation. Have been responsible for:

- > EV component selection and systems integration
- > EV conversion process development
- > EV data systems integration for real time performance evaluation

By undertaking a programmatic approach towards this startup's breakout strategy, have been able to channel its talents and resources for success, progressing the company towards becoming a local center of EV knowledge, and an integral part of its developing EV infrastructure.

Race Prep and Performance Car Tuning Specialist: Vanzo Racing, Lime Rock Park, Poughkeepsie NY, 1987-1989: Responsible for developing tuning plan, sourcing and fabrication of tuning components (actively sourcing exotic components from overseas), engine repairs for damaged vehicles, preparing and adapting drive-trains (and other automotive components) for racing performance, including:

- > enlarging head ports
- > increasing throttle throats
- > upgrading intake, fuel, controls and exhaust systems
- > installing nitrous systems
- > installing lower back-flow pressure exhausts
- > installing higher amperage alternators for added electrical loads

Role required the managing of engineering specifications, the balancing of workloads and component selection, to fit tightly-prescribed budgetary constraints, and the submission of repairs documentation for customer information, as well as to meet district, state, and federal requirements.

Paint and Body Technician: Vanzo Racing, Lime Rock Park, Poughkeepsie NY, 1986-1987: Responsible for performing repair work on vehicle bodies, the preparation of vehicle body surfaces for priming and painting, managing all workloads and component selection to fit tightly-prescribed budgetary constraints, and the submission of documentation of repairs for customer information, as well as to meet district, state, and federal requirements.

RELEVANT SKILLS & CERTIFICATIONS

Ray P. Delio is a member of the following organizations:

- > IEEE (Institute of Electrical and Electronics Engineers)
- > AEE (Association of Energy Engineers)
- > Electric Auto Association (EAA)
- > Electric Drive Transportation Association (EDTA)
- > World Electric Vehicle Association (WEVA)

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Raymond Delio

R.P. Delio is currently active in the following roles:

- > **Chief Executive Officer** – R. P. Delio & Company: A family-owned boutique consultancy business, offering a range of clean energy, program management and technical services. The company has been in operation since 1989, trading under various different names.
- > **Director, Program Manager, In-House Project Management Consultant** – Interisland Renewable Energy Network – Hawaiian Electric Company (*since 2012*): A transformational program covering the generation, transmission, distribution and smart grid technologies needed to help meet Hawaii's Renewable Portfolio Standard goals of 40% renewable energy by 2030.
- > **Volunteer, 2012 President** – Hawaiian Chapter, Association of Energy Engineers (AEE) : A 501(C) 6 international energy efficiency and sustainability association, dedicated to improving the world's energy future through professional training, certifications, and community involvement.
- > **Partner** – Reservoir Street Property Management (RSPM): A privately held real estate management business overseeing multifamily properties in several states in the US, including Connecticut.
- > **Volunteer, Founder & Executive Director** – The Center For Sustainable Energy (CFSE): A Hawaii based 501(c)3 charitable non profit who's mission is to empower individuals in need by providing energy alternatives, using the power of non profit, the sacrifice of donors, the passion of volunteers and the creativity that comes from community involvement.

CFSE believes that low-cost energy options for those most in need is good for the community, the economy and the environment. Nowhere is this more important than for those living in low-income communities, and none are more in need than those living with the high utility rates that are associated with island energy markets. The CFSE works collaboratively with communities and local organizations to identify specific needs and to develop renewable energy solutions that are environmentally, socially and economically sustainable.

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Raymond Delio

R. P. Delio has authored a number of Position Papers, which are being considered for publication by the Association of Energy Engineers, through its professional journals.

MOVING FORWARD ON HAWAII'S RENEWABLE POTENTIAL

This position paper provides an overview of the renewable energy resources available to the State of Hawaii, as it implements a set of policies to realize a clean energy transformation - the Hawaii Clean Energy Initiative. It provides a summary of policy achievements thus far, and looks to the central role of the utility in achieving the state's ambitious goals.

Abstract: The people of Hawaii have set out a bold scheme, the Hawaiian Clean Energy Initiative (HCEI), for moving toward significant clean energy goals, and reducing their economic exposure to volatile oil prices. This paper provides an overview of the policy and regulatory response for realizing Hawaii's renewable energy potential. The focus is on the state policies, incentives and regulations that are applicable to renewable-sourced electricity generation, within the broad framework of the HCEI. Particular attention is called to the role of the utility, the Hawaiian Electric companies, and to whether a lack of progress, in certain parts of the initiative, can be remedied by a more sharply defined leadership structure – and a stronger role for the electric utility.

BRINGING SOLAR INTO THE FOLD – ASSESSING MERITS OF UTILITY-OWNED GENERATION FOR SOLAR PV

This position paper describes those policies that have a bearing on the financing of solar PV generation, and assesses the relative merits of UOG versus IPP approaches for IOUs, with respect to both the maximizing cost-effectiveness, and minimizing risk to their critical (and regulated) role as public service provider. Examples from, and applicability to, Hawaii are noted. Utility ownership of solar PV is found to be a favorable model, reducing both cost and risk.

Abstract: Evolving regulations, governmental support, and increasing public demand have driven investor-owned electric utilities (IOUs) towards the increased integration of environmentally-sourced distributed generation (DG) into their portfolios. The question addressed here is what is the most appropriate business model for the deployment of one such resource, solar photovoltaic (PV). Potential approaches include the direct utility ownership of generation (UOG) capacity; ownership by independent power producers (IPPs) who supply the utility; and innovative hybrid production ownership models.

BRIDGING THE CHASM: THE NEED FOR RESIDENTIAL SOLAR INCENTIVES TO BE FULLY INCLUSIVE

This position paper looks into the degree to which existing incentives for encouraging the adoption of solar PV generation, by residential electricity consumers, is biased. It is found that policy measures do appear to favor those who are in higher income brackets or social groups, over those in poorer sections of society. The objective of maximizing solar PV deployment would be best served by encouraging a fully inclusive access to clean energy such as solar PV. The paper puts forward changes to policy that may lead to wider and more inclusive uptake of solar PV.

Abstract: The question being addressed here is whether the current set of renewables policies, as applicable to residential solar photovoltaic (PV) deployment, is too narrowly focused. It is contended that the majority of existing incentives are applicable to only subsets of the population – specifically those with either high incomes, or good credit ratings or who are home-owners. The paper describes the broad social groups that make up contemporary US society, details the current policy set, and looks at research into potential bias in solar PV adoption.

The paper finds that there does appear to be material bias in the current policy set, and investigates potential avenues for rectifying that bias. Doing so would enable policy goals for residential PV deployment to play its part in the significant renewables component to energy supply over the coming decades. Both federal, state and local policy will be assessed, but the focus is on the local specifics of the situation in the state of Hawaii.

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Raymond Delio

LEGISLATIVE APPROACHES TAKEN BY HAWAII FOR ENCOURAGING SOLAR PV – COMPARISONS WITH THE MAINLAND

Solar photovoltaic (PV) power generation has the potential to be a major factor in Hawaii's clean energy transformation. The resource has been assessed as approaching 1 gigawatt (GW) nameplate capacity on the most populous island, Oahu. In order to facilitate the initial phase of PV deployment, the state government has introduced a number of innovative measures. It has also led to a number of regulatory and legislative challenges as the penetration levels of PV has increased dramatically. This paper provides an overview of the legislative and regulatory measures introduced in the state of Hawaii, and makes a comparison to two of the most developed solar PV markets on the mainland US – New Jersey and California.

Abstract: This paper sets out to address the legislative and policy lessons that can be applied to Hawaii's environmental energy transformation, from those states on the US mainland who share similar environmental energy integration goals. The two states with the highest ranking cumulative solar photo-voltaic (PV) electricity capacity (California and New Jersey) are assessed, with reference to their legislation and policy (as it affects the incentivizing of PV deployment); their progress in developing this capacity is also detailed. The state of Hawaii is similarly analyzed, with potential areas for improvements to legislation and policy identified, so as to produce a more effective (productive and low-cost) program for PV generation.

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Raymond Delio

DARPA Research Associate: Department of Chemical Engineering; Troy, NY: Conducted research into the development of Protease-Containing Silicates, incorporating photo-definable UV polymerizing vinyl monomers for use as Active Antifouling Materials. These polymeric materials are the building blocks for biocatalytic coating, used in lab-on-a-chip manufacturing.

Abstract: Biocatalytic silicates, composite materials composed of alpha-chymotrypsin and a silicate prepolymer, were prepared via a two-step polymerization process, following solubilization of the enzyme in the polymerization media. This new approach resulted in active and stable composites, and a calculated half-life of over 350 days in aqueous buffer at 30°C. The high stability and activity of this biocatalytic silicate was likely due to the covalent attachment between alpha-chymotrypsin and the silicate matrix. The protease-containing silicate was resistant to fouling by nonselective protein binding, as demonstrated by the dramatically reduced binding of human serum albumin to the silicate material when compared to that of a silicate containing pre-inactivated alpha-chymotrypsin.

NSF Scholar Research Associate: Albany Medical College, Albany, NY: Conducted research in the Department of Molecular Medicine, which revealed two major classes of fadD mutants with depressed enzyme activity.

Abstract: Fatty acyl-CoA synthetase (FACS, fatty acid:CoA ligase, AMP forming; EC 6.2.1.3) plays a central role in intermediary metabolism by catalyzing the formation of fatty acyl-CoA. In *Escherichia coli* this enzyme, encoded by the fadD gene, is required for the coupled import and activation of exogenous long-chain fatty acids. The *E. coli* FACS (FadD) contains two sequence elements, which comprise the ATP/AMP signature motif (213YTGGTTGVAKGA224 and 356GYGLTE361) placing it in the superfamily of adenylate-forming enzymes. A series of site-directed mutations were generated in the fadD gene, within the ATP/AMP signature motif site, to evaluate the role of this conserved region to enzyme function and to fatty acid transport. My research revealed two major classes of fadD mutants with depressed enzyme activity.

NSF Scholar Research Associate: Albany Medical College, Albany, NY: Conducted research in the Department of Molecular Medicine, identifying the gene responsible for enabling *Salmonella enterica* serovar Typhimurium to survive carbon-starvation.

Abstract: *S. typhimurium* is an enteric pathogen that causes significant morbidity in humans and other mammals. During their life cycle, salmonellae must survive frequent exposures to a variety of environmental stresses, e.g. carbon-source (C) starvation. The starvation-stress response (SSR) of *S. typhimurium* encompasses the genetic and physiological realignments that occur when an essential nutrient becomes limiting for bacterial growth. The function of the SSR is to produce a cell capable of surviving long-term starvation. My research reported that three C-starvation-inducible lac fusions from an *S. typhimurium* C-starvation-inducible lac fusion library are all within a gene identified as fadF, which encodes an acyl-CoA dehydrogenase (ACDH) specific for medium-/long-chain fatty acids.

PUBLISHED RESEARCH

- > **Rensselaer Polytechnic Institute, Dr. Jon Dordick**

Dordick Research Group, Troy, NY

Dr. J.B. Kim, R.P. Delio and Dr. J. Dordick "Protease-Containing Silicates as Active Antifouling Materials" *Biotechnol. Prog.*, Vol. 18, Issue 3, 551-555, 2002

- > **Albany Medical College, Dr. DiRusso and Dr. Black**

FATT Lab, Albany, NY

J. D. Weimar, C. C. DiRusso, R. Delio, P.N. Black "Functional Role of Fatty Acyl-Coenzyme A Synthetase in the Transmembrane Movement and Activation of Exogenous Long-chain Fatty Acids." *J. Biol. Chem.* Vol. 277, Issue 33, 29369-29376, August 16, 2002

- > **Albany Medical College, Dr. DiRusso and Dr. Black**

FATT Lab, Albany, NY

M. P. Spector, C. C. DiRusso, et al. "The medium-/long-chain Fatty Acyl-CoA Dehydrogenase (fadF) gene of *Salmonella typhimurium* is a phase 1 starvation-stress response (SSR) locus." *Microbiology*, Vol. 145, 15-31, 1999

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- > **Certified Demand-Side Manager** (CDSM): Demonstrates high level of competence, professionalism, and knowledge of the principles and practices of demand-side management, for the reduction of energy consumption. *Awarded in 2011.*
- > **LEED Green Associate** #10315515: Demonstrates green building expertise in non-technical fields of practice, including green building design, construction and operation. *Awarded 2010.*
- > **Certified Energy Manager** (CEM) #17620: Demonstrates high levels of experience, competency, proficiency, and ethical fitness in the energy management profession. *Awarded in 2008.*
- > **PMI Certified Project Manager Professional** #512510 (PMP): Demonstrates the experience, education and competency to lead and direct projects. *Awarded in 2006.*
- > **National Science Foundation Award** ATE Project #98-50310/01-01311 Cross-training Technicians & Engineers for Semiconductor Manufacturing. *Awarded 2004.*
- > **Intel Materials Division Recognition Award**: Photo-definable polyimide development and implementation across all 200mm copper and non copper interconnect factories. *Awarded 2004.*
- > **Intel Environmental Bronze Achievement Award**: Reducing resist usage that cuts waste and air emissions worldwide. *Awarded 2004.*
- > **Intel TMG Divisional Recognition Award**: Outstanding contributions to 86x Logic and 8x5 Flash process development. *Awarded 2003.*
- > **Intel TMG Lab Recognition Award**: Development of a quick, highly reproducible Atomic Force Microscopy sidewall and step height measurement procedure. *Awarded 2003.*
- > **Intel AZTech**: Major improvements in a mature photo-definable polyimide process. *Awarded 2003.*
- > **Intel Factory Award**: Test Wafer usage reduction. *Awarded 2003.*
- > **National Science Foundation Scholar Engineering Scholarship**. *Awarded 2000 & 2001.*
- > **National Science Foundation Scholar Molecular Medicine Grant Recipient**. *Awarded 1998, 1999, 2000.*
- > **National Institute of Health, Research Award for the Undergraduate**: Biochemistry of E. coli fatty acid transport. *Awarded 1999.*
- > **Science Engineering and Industrial Sponsors Award**, A.C.S. Division of Polymer Chemistry, Division of Polymeric Materials: Outstanding Performance in Organic Chemistry. *Awarded 1998.*
- > **A.C.S. Organic Chemistry Award**: Best Overall Performance by a Chemistry Major. *Awarded 1998.*
- > **Harvey Mudd Summer Scholar's Award**: Organometallic hypervalency of Tin (Ns IV) tri-halides. *Awarded 1998.*

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