BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

Pennsylvania Public Utility Commission	**:**	**Docket Number**
v.	**:**	**R-2018-3000164**
PECO Energy Company—Electric Division	**:**	

REBUTTAL TESTIMONY

MICHAEL K. WATERS

ON BEHALF OF

CHARGEPOINT, INC.

ChargePoint Statement No. 1

July 24, 2018

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I. INTRODUCTION AND SUMMARY OF RECOMMENDATIONS

Q: Please state your name.

A: My name is Michael (Mike) K. Waters.

Q: By whom are you employed and in what position?

A: I am a Director of Utility Solutions at ChargePoint, Inc.

Q: Please describe your qualifications, including your background, experience, and expertise.

A: In my current role, I work with electric utilities and other key stakeholders in Europe and North America on electric vehicle ("EV") market infrastructure engagement and investment and I support the development of policies and programs to accelerate the adoption of EVs and EV charging equipment and services across all sectors. I strategize with utilities to develop programs that utilize smart charging to provide benefits to EV drivers, charging station owners, and the distribution grid.

Prior to joining ChargePoint, I worked for Duke Energy for seven years in a variety of roles including Business Development Manager within the Distributed Energy Resources department, Technology Evaluation and Strategy Manager, Advanced Transportation Manager and Senior Product Development Specialist. For several years at Duke Energy, and at Progress Energy prior to the merger, my role included responsibility for developing the corporate strategy to enable large-scale adoption of electric transportation and oversight of related programs and services. Focus areas included grid impact assessments, education and outreach, customer support, and alignment of company research and development to support grid and customer friendly EV charging solutions. Example projects of relevance include managing the deployment of over 600 charging stations across four states, evaluating several prototype electric vehicles, and

deploying hundreds of charging stations to support company fleet EVs. During this time, I also served as a Board Member on the Electric Drive Transportation Association, member of the EEI Executive Electrification Task Force, and co-chair of the NC Electric Vehicle Task Force infrastructure committee. I earned a bachelor degree in Chemical Engineering from Georgia Tech and an MBA from Kenan-Flagler Business School at UNC. I'm a two-time recipient of the EPRI Technology Transfer Award and a licensed professional engineer in the state of North Carolina.

My resume is attached as Attachment A.

Q: Have you previously provided testimony in any formal hearings before regulatory commissions?

A: Yes. I recently submitted testimony in NSTAR Electric Company and Western Massachusetts Electric Company, each d/b/a Eversource Energy, D.P.U. 17-05; Massachusetts Electric Company and Nantucket Electric Company, each d/b/a National Grid, D.P.U. 17-13; and Duquesne Light Company, Pennsylvania PUC Docket No. R-2018-3000124. My testimony in each of these dockets was provided with respect to those companies' electric vehicle market development programs.

Q: Please describe ChargePoint.

A: ChargePoint is the largest and most open EV charging network in the world, with charging solutions for every charging need and all the places EV drivers go: at home, work, around town, and on the road. With more than 51,500 independently owned charging spots, ChargePoint drivers have completed more than 40 million charging sessions, saving upwards of 40 million gallons of gasoline and driving more than 975

million gas-free miles. More than 480 of these charging spots are deployed in Pennsylvania.

ChargePoint is unique in that we both design, engineer, and deploy residential and commercial alternating current Level 2 ("AC L2") and direct current fast charging ("DCFC") electric vehicle charging stations and design, engineer, and deploy a robust and advanced software network that provides value to drivers, site-hosts, and utilities. In addition, this software network enables sophisticated data analytics and grid management capabilities. ChargePoint also has the most advanced customer support operation in North America located in Scottsdale Arizona, that provides support to both site-hosts and drivers and is aimed at enabling a robust, scalable, and grid-friendly EV charging ecosystem.

Q: Please describe ChargePoint's previous involvement in transportation electrification efforts in Pennsylvania.

A: ChargePoint has also been involved in Docket No. M-2017-2604382, which concerns the Commission's policy on EV charging services provided by non-utility third parties, and Docket No. R-2018-3000124, specifically regarding the EV ChargeUP Pilot proposed by Duquesne Light Company.

Q: What is the purpose of your Rebuttal Testimony?

A: The purpose of my testimony is to respond to the Direct Testimony filed by Mr. Clarence Johnson on behalf of the Office of Consumer Advocate ("OCA"), Mr. Brian Kalcic on behalf of the Pennsylvania Office of Small Business Advocate ("OSBA"), and Mr. Patrick Bean and Ms. Katie Bell of behalf of Tesla, Inc. regarding PECO Energy

Company's ("PECO" or "the Company") proposed Electric Vehicle DCFC Pilot Rider ("EV-FC Rider," or "Rider").

Q: Please summarize your positions and recommendations for the Commission.

A: My recommendations are as follows:

- Based on the testimony of Mr. Johnson and Mr. Bean and Ms. Bell that the EV-FC Rider will help overcome barriers to DCFC deployment and help PECO potentially develop a DCFC-specific rate, the Commission should approve the rider with a modification to allow customers to take service under the Rider until the pilot concludes, instead of only for 30 months or less.
- Based on the testimony of Mr. Kalcic and Mr. Johnson, the Commission should open a statewide proceeding to consider the appropriate role or roles for regulated utilities associated with a broader engagement in the competitive EV charging station market, or, alternatively, expand the scope of Docket No. M-2017-2604382 to consider this important issue.

II. THE EV-FC RIDER IS A POSITIVE STEP TO SUPPORT TRANSPORTATION ELECTRIFICATION

Q: What will you address in this section of your testimony?

A: In this section of my testimony, I will briefly state ChargePoint's overall position on PECO's proposed EV-FC Rider.

Q: What is ChargePoint's position on the proposed EV-FC Rider?

A: First, I wish to acknowledge that ChargePoint recognizes that the purpose of rebuttal testimony is to respond to the direct testimony of other parties, and not to respond directly to PECO's proposal. However, I wish to state briefly that ChargePoint appreciates that PECO proactively proposed the EV-FC Rider in its rate case.

ChargePoint agrees with direct testimony by Ms. Bell and Mr. Bean that utilities can and should play a critical role in the development of EV charging infrastructure[1] and in supporting their customers and the grid as transportation electrification continues to accelerate. Utilities, automakers, and charging infrastructure providers all play important roles and bring unique value in serving the end customer, the EV driver.

III. THE COMMISSION SHOULD APPROVE THE EV-FC RIDER WITH MODIFICATION TO ALLOW ELIGIBLE CUSTOMERS TO PARTICIPATE UNTIL THE PILOT CONCLUDES

Q: What will you address in this section of your testimony?

A: In this section of my testimony, I will discuss some of the observations made by Mr. Johnson and Mr. Bean and Ms. Bell regarding the benefits that the EV-FC Rider will have for customers, for the Company itself, and for transportation electrification efforts generally. I will also discuss Mr. Bean and Ms. Bell's observations about the Company's ability to potentially develop a rate or rates specifically for EV charging. ChargePoint concurs with many of these observations and these observations lead me to the conclusion that customers should be allowed to take service under the EV-FC Rider until the pilot concludes. In addition to the benefits that this change will provide to customers, it will also allow PECO to collect more robust data about DC fast charging and to design a more effective EV charging rate in the long term.

Q: What do Mr. Bean and Ms. Bell say about the benefits of the EV-FC Rider?

A: Mr. Bean and Ms. Bell provides a very helpful analysis of the impact that demand charges can have on the operation of DCFCs, especially at low utilization levels.[2] Mr. Bean and Ms. Bell's analysis suggests that DCFC site-hosts on PECO's General Service

[1] Tesla-1, p. 12 ll. 15-16
[2] *Id*. at p. 18, l. 7 – p. 20, l. 3.

commercial rate may not be able to economically offer public charging at a rate that is competitive with home charging until utilization of the DCFC exceeds at least a 15 percent load factor.[3] Practically speaking, this analysis indicates that, in order to be competitive, DCFC site-hosts who charge a fee for EV charging may need to operate their DCFCs at a loss in the early years when EV adoption is still growing and utilization rates are still low. Mr. Bean and Ms. Bell's analysis of the impact of PECO's demand charges is generally consistent with my experience regarding the impact of demand charges on the economic viability of operating DCFCs in other states. It should be noted that the economic challenges associated with demand charges would serve as an even higher barrier for smaller, independent site-hosts considering installing DCFCs but whose sole business is not EV charging.

Q: Do Mr. Bean and Ms. Bell recommend that PECO develop future tariffs designed specifically for EV charging?

A: Yes, Mr. Bean and Ms. Bell suggest that "PECO utilize this EV-FC Rider as a pathway for future DCFC rates where this Pilot should be leveraged to collect necessary load and billing data to design prospective EV charging specific delivery rates"[4] and "[o]vertime, we also suggest that PECO consider a more permanent type of rate that would be applicable to DCFC sites… ."[5]

Q: What is your position on this recommendation?

A: I concur with this recommendation. Generally, one of the purposes behind a utility pilot program is for the utility to collect data and study a potential new offering. It would therefore be reasonable for PECO to collect data from the EV-FC Rider. These data

[3] *Id*. at p. 19, ll. 6-7.
[4] *Id*. at p. 4, ll. 9-11.
[5] *Id.* at p. 15, ll. 6-7

should be used, as Mr. Bean and Ms. Bell suggest, to develop future, more permanent rates designed specifically for commercial customers to deploy and operate DCFCs.

Unlike traditional commercial customers on demand-based rates, site-hosts offering public DC fast charging have very limited ability to manage or mitigate the impact of demand charges without negatively impacting the EV driver experience. Furthermore, as stated by Mr. Bean and Ms. Bell, the utilization and load factor for DC fast chargers will initially be rather low[6] but will increase over time as EV adoption increases. High demand charges coupled with low utilization in the early EV adoption periods can be an impediment towards market development. Although specific site impacts vary considerably, I agree with the Rocky Mountain Institute's assessment referenced by Mr. Bean and Ms. Bell, which found that "demand charges can be responsible for over 90% of a charging station's electricity costs."[7] Accordingly, I support Mr. Bean and Ms. Bell's recommendation that PECO use the data it collects from the EV-FC Rider to develop a longer-term rate solution to support commercial customers seeking to deploy DCFCs.

Q: Do you believe that the Rider, as designed, will fully support Mr. Bean and Ms. Bell's stated recommendation for PECO to develop a future, more permanent rate associated with DCFC?

A: Partially. I agree with Mr. Bean and Ms. Bell that "...a beneficial purpose served by this Rider is the collection and study of data on these sites for the purpose of developing prospective DCFC rates."[8] However, I am concerned that a maximum of 30 months of eligibility per DCFC site-host will not be sufficient to achieve Mr. Bean and Ms. Bell's

[6] Id. at p. 17, l. 16
[7] Id. at p. 17, ll. 6-8
[8] Id. at p. 11, l0-12

recommendation and the full potential of the Rider's objectives. EV adoption is still in its nascent stages in Pennsylvania and utilization rates of DCFCs during the first 30 months of the EV-FC Rider pilot are likely to be very different from what they will be during the remaining 30 months of the 5-year pilot. Designing an effective and sustainable DCFC-specific rate design will require the broadest data set possible that reflects utilization in later years when EV adoption is greater.

Mr. Bean and Ms. Bell also point to several examples of DCFC-specific rates that reduce or eliminate demand charges, each of which lasts for significantly longer than 30 months – if the rate is time-limited at all.[9]

Q: What does the OCA say regarding the ability of the EV-FC Rider to encourage EV adoption?

A: Given the current low penetration of EVs in the market, Mr. Johnson correctly observes, "Whether electric vehicles can significantly increase market share in the future may depend on overcoming barriers to customer acceptance. The [EV-FC Rider] tariff extends a reasonable policy of assessing utility charges for fast charging stations in order to encourage businesses which provide charging service to electric vehicles."[10]

Q: What is ChargePoint's position on the Mr. Johnson's observation?

A: Mr. Johnson's testimony indicates that he recognizes that traditional demand charge rate structures in the context of nascent EV adoption are a major barrier to site-hosts investing in DCFCs and that a lack of sufficient DCFCs will pose a barrier to widespread EV adoption. I concur that using alternative rate designs, such as Mr. Bean and Ms. Bell have

[9] *Id*. at p. 16, l. 4 – p. 17, l. 2.
[10] OCA Statement No. 3, Direct Testimony of Clarence L. Johnson, p. 34, ll. 1-5.

proposed, to encourage site-hosts to provide EV charging services, particularly DCFCs, is one important element in a larger effort to support the adoption of electric vehicles.

Q: Do you believe the EV-FC Rider will be sufficient to encourage businesses to provide DCFC services?

A: Partially. I am concerned that, for many site-hosts, only 30 months of partial relief from demand charges will not be enough to encourage them to invest in DCFCs. Because site-hosts cannot effectively mitigate or manage demand charges, site-hosts could be subject to unpredictable operating cost burdens if they were required to go on a new rate halfway through the pilot period. Furthermore, the associated capital costs to acquire and deploy DCFCs are also significant and a major factor in site hosts determining whether or not to deploy such charging solutions. Prospective site-hosts will be more likely to make the upfront capital investment in DCFCs if they know that they will have more than 30 months of partial demand charge relief.

Q: Based on Mr. Bean and Ms. Bell's recommendation that PECO develop a more permanent rate for DCFCs based on data from the EV-FC Rider, and based on the Mr. Johnson's observation that reducing demand charges through the EV-FC Rider will help overcome barriers to EV adoption, what do you recommend?

A: Based on Mr. Bean and Ms. Bell's recommendation and Mr. Johnson's observation, I recommend that the Commission approve the EV-FC Rider with a modification to allow customers to participate until the pilot ends. I am concerned that limiting site-hosts to being served for only 30 months under the pilot rate would limit PECO's ability to collect useful data to design a new rate specifically for DCFCs. I am also concerned that limiting

site-hosts to 30 months would limit the pilot rate's ability to encourage prospective site-hosts to install DCFCs.

Q: Please provide the specific modification to the EV-FC Rider that you recommend to further advance the recommendations of Mr. Bean, Ms. Bell and Mr. Johnson.

A: I propose amending the section titled "TERM OF CONTRACT" in the EV-FC Rider as follows (deletions indicated by ~~strikeout~~): "The Company shall provide this credit ~~for no more than 30 months from the date of enrollment or~~ until the conclusion date of the pilot~~, whichever comes first. There is no right to automatic renewal~~. Extended participation may be possible and could be predicated on future regulatory directives as yet to be determined."

IV. CHARGEPOINT CONCURS WITH MSSRS. JOHNSON'S AND KALCIC'S STATEMENTS REGARDING THE APPROPRIATENESS OF THE EV-FC RIDER

Q: What will you discuss in this section of your testimony?

A: In this section of my testimony, I address Mr. Johnson's and Mr. Kalcic's statements on whether or not the proposed Rider is subsidized by ratepayers and how that impacts their conclusions. I will also address Mr. Kalcic's assessment and conclusion of whether the proposed Rider is appropriate in the context of supporting the competitive EV charging marketplace.

Q: Do Mssrs. Kalcic and Johnson agree on whether the EV-FC Rider should be approved?

A: Yes. Mr. Kalcic and Mr. Johnson both recommend the EV-FC Rider be approved.

Q: Do OSBA and OCA take a position on whether the Company's proposed EV-FC Rider is financially prudent and is in ratepayers' interest?

A: Yes. On behalf of OCA, Mr. Johnson states that the Rider is not unreasonably subsidized and further states, "Since the Company has no plans for recovering current revenue losses from other customers, the credit does not harm other customers."[11] On behalf of OSBA, Mr. Kalcic indicated that it is "significant" that PECO was not proposing to recover costs or foregone revenues from customers.[12]

Q: Please comment on the conclusions of Mssrs. Kalcic and Johnson regarding ratepayer impacts of the proposed Rider.

A: Given the Company's confirmation that it is not seeking to recover costs or foregone revenues from ratepayers,[13] and the benefits of such a program to the Company and customers, there is little disagreement on the positive net benefits for all ratepayers. While I also concur with Mr. Kalcic and Mr. Johnson on this specific assessment, I caution against solely using the metric of whether a program includes any cost recovery from ratepayers to determine whether a utility activity is prudent and reasonable. It is worth noting that there are many other examples of utility activities involving EV-specific rates and charging infrastructure incentives that are initially or partially subsidized by ratepayers, but which are justified by the benefits that transportation electrification provides to all ratepayers. Examples of such benefits include but are not limited to capital deferment of grid asset upgrades and more efficient grid utilization and throughput.

[11] Direct Testimony of Clarence L. Johnson on behalf of Office of Consumer Advocate, p. 34 ll. 18-21.
[12] OSBA Statement No. 1, p. 8, ll. 20-23.
[13] *Id*. at ll. 16-18.

Q: Do the parties take a position on whether PECO's proposed EV-FC Rider supports the competitive market?

A: Yes. Mr. Kalcic asserts that "it is important that any public utility involvement in the deployment of EV charging infrastructure not disadvantage private developers, and thereby impede the development of a competitive EV charging station marketplace."[14] Given that the Rider is not proposed to be ratepayer-funded, Mr. Kalcic concludes that it would therefore "not tilt the EV charging station playing field against private developers."[15]

Q: Please comment on the conclusions of Mr. Kalcic regarding impacts to the competitive market.

A: I agree with Mr. Kalcic that assessing the potential impact of any regulated utility offering on existing private developers and the competitive market is appropriate and important. I concur with Mr. Kalcic that the proposed Rider does not interfere with the competitive market or private development. In fact, the Rider actively supports such development by encouraging site-hosts to actively participate in DCFC deployment, manage the driver experience, and maintain site-host choice of qualifying EV charging station and networking vendor. It is worth noting that there are many other examples of additional utility activities involving EV charging infrastructure that also can align with these objectives.

[14] *Id*. at ll. 30-33
[15] *Id*. at p. 9, ll. 9-10.

Q: Given the assertions and conclusions of Mssrs. Kalcic and Johnson, what do you recommend?

A: Both Mr. Kalcic and Mr. Johnson raise important considerations as the Commission examines the benefits and costs to participating customers and all ratepayers, as well as the potential impacts to the competitive marketplace, in its evaluation of the EV-FC Rider. I agree with both witnesses that the EV-FC Rider poses no concerns on these grounds as proposed. The EV-FC Rider is a positive step forward as the Company seeks to support the adoption of transportation electrification.

There are many other potential activities that could be pursued by the Company, and other regulated utilities in Pennsylvania, to support transportation electrification and encourage sustainable growth in the EV and EV charging markets. Some of these activities, such as incentivizing the deployment of EV charging infrastructure, could expand the role for regulated utilities in the competitive EV charging market and be accomplished in a way that preserves customer choice and ongoing competition. Recognizing that clarity on this broader subject is important for all parties but will not be fully addressed in this rate case, I recommend that the Commission open a generic proceeding to examine this issue and provide general guidance on potential roles for regulated utilities in Pennsylvania's competitive EV charging market. As an alternative to opening a new docket, the Commission could also expand the scope of Docket No. M-2017-2604382. This consideration should not delay or interfere with timely adjudication of the currently proposed EV-FC Rider.

V. CONCLUSION AND RECOMMENDATIONS

Q: Please summarize your recommendations for the Commission.

A: My recommendations are as follows:

- Based on the testimony of Mr. Johnson and Mr. Bean and Ms. Bell that the EV-FC Rider will help overcome barriers to DCFC deployment and help PECO potentially develop a DCFC-specific rate, the Commission should approve the rider with a modification to allow customers to take service under the Rider until the pilot concludes, instead of only for 30 months or less.
- Based on the testimony of Mr. Kalcic and Mr. Johnson, the Commission should open a statewide proceeding to consider the appropriate role or roles for regulated utilities associated with a broader engagement in the competitive EV charging station market, or, alternatively, expand the scope of Docket No. M-2017-2604382 to consider this important issue.

Q: Does this conclude your testimony at this time?

A: Yes.

Michael K Waters

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Summary

Clean Energy and Electric Transportation Specialist with extensive leadership experience in the clean tech field. Advanced knowledge of electric transportation, distributed energy technologies, as well as the electric utility business and regulatory models. Highly effective strategic thinker with a demonstrated ability to build diverse stakeholder coalitions to support a common cause. Dedicated to a sustainable energy future.

Highlights

Knowledge of electric utility business and regulations	Stakeholder engagement and relationship management
Electric transportation and alternative energy expert	Policy and strategy development
Excellent communication and interpersonal skills	Emerging technologies

Experience

CHARGEPOINT, INC. – Campbell, CA
February 2016 to Current
Director, Utility Solutions

- Responsible for establishing and managing relationships with investor owned, municipal, and cooperative utilities throughout North America.
- Support utilities to assess, develop, and implement customer facing programs that support the deployment of smart electric vehicle charging infrastructure and solutions.
- Developed Salesforce reporting tools to monitor utility related sales and compiled bi-weekly utility program status report to provide to executive management.
- Educate utilities on the technology and solutions to support utility needs related to data and load management while ensuring the efficient integration of EV load onto the grid.
- Coordinate major sales activity of ChargePoint solutions to utilities to meet their fleet and employee workplace charging needs.
- Solicit utility feedback on desired electric vehicle charging solutions to guide smart charging behavior and develop new business opportunities to meet those needs.
- Participate with local advocacy and stakeholder groups promoting utility involvement in the deployment of electric vehicle infrastructure.
- Assist utilities in evaluating potential grid impacts of electric vehicle adoption today and in the future.
- Guide public policy positions with respect to market development and regulatory oversight of utility engagement in electric vehicle charging infrastructure.

DUKE ENERGY CORPORATION - Raleigh, NC
June 2008 to January 2016
Business Development Manager, Distributed Energy Resources

- Responsible for developing the corporate strategy to enable large-scale adoption of electric transportation as well as identify offerings to support evolving customer needs related to renewable energy.
- Led the company's initiative to identify the value and positioning of electric vehicles as an integral part of a future distributed energy resource ecosystem on the grid.
- Provided national and state policy analysis to support the electric transportation strategy.
- Served as company representative and key member of collaborative efforts to advance electric transportation including with the Department of Energy, EPA, Clean Cities, and Center for Climate and Energy Solutions.
- Led the assessment of specific investment opportunities, product offerings, and services to support the company's 20 million customers with electric vehicle charging solutions.
- Conducted grid impact assessments to understand potential operational impacts from electric vehicle charging and proposed mitigation strategies to maintain system reliability and cost effectiveness.
- Managed relationships and exchanged technical knowledge with major automakers and infrastructure providers including Ford, General Motors, Nissan, GE, Eaton, Siemens, and ChargePoint.
- Provided corporate communications and external relations support for electric transportation matters.
- Worked collaboratively to ensure strategic alignment with key internal business unit stakeholders including Rates, Legal, Regulatory, Legislative Affairs, and Customer Service.

Technology Evaluation and Strategy Manager

- Managed corporate strategy, technology assessment, and operational readiness related to emerging "behind the meter" technologies affecting the utility grid and customers.
- Led the effort for Raleigh, NC, to host the international Plug-In 2011 conference and provided organizer support for the most successful Plug-In conference outside of California.
- Served as project manager for multiple charging station customer pilots that successfully deployed over 600 charging stations across four states while managing a budget of several million dollars.
- Chaired the NC Electric Vehicle Task Force infrastructure committee that was responsible for developing best practices and a charging station deployment plan for the entire state. Served as a board member on the
- Electric Drive Transportation Association.
- Led the development of several grant applications to advance electric vehicle projects that resulted in successful grant awards of over $10 million.
- Organized and launched community plug-in vehicle readiness planning committees with key community stakeholders in Raleigh, NC, as well as Orlando and Tampa Bay, FL.

Senior Product Development Specialist

- Provided technical expertise and product development leadership for the newly created Efficiency and Innovative Technologies Department.
- Supervised contract organization in the development of strategy white papers for three key emerging technologies including solar, energy storage, and electric transportation.
- Coordinated internal workshop to generate and prioritize alternative energy business opportunities for the newly created Emerging Technologies department.

CENTER FOR SUSTAINABLE ENTERPRISE, KENAN INSTITUTE, UNC - Chapel Hill, NC
May 2007 to August 2007
Sustainability Consultant

- Performed alternative energy and sustainability consulting services for a Fortune 250 energy company and a non-profit energy efficiency services firm.
- Developed market share model to provide future scenario analysis of consumer acceptance and market penetration for plug-in hybrid electric vehicles.
- Assessed the potential load impact, incremental costs, and net emissions of plug-in electric vehicles and presented strategic recommendations to senior management for developing a related program.
- Assisted with business plan development and created pro forma financial statements to expand a successful housing energy efficiency program nationwide.

CORNING, INC. - Wilmington, NC
May 1997 to August 2006
Manufacturing Specialist

- Served as subject matter expert in multiple process areas and as leader for several high-level cost reduction projects.
- Led plant-wide team that achieved $1 million in cost reduction through a 40% increase in blank size and improved equipment utilization.
- Developed and scaled into production process changes that reduced labor requirements by 25% and enabled potential continuous process operation.
- Reduced production costs for specialty product by $150K annually as leader of a process team that identified and implemented solutions to reduce optical trend.

Education

Master of Business Administration, 2008
THE UNIVERSITY OF NORTH CAROLINA – Chapel Hill, NC
Class Rank: Top 5%, Dean Scholar, Beta Gamma Sigma, Energy Club (VP), Consulting Club, Net Impact.

Bachelor of Science: **Chemical Engineering**, 1997
GEORGIA INSTITUTE OF TECHNOLOGY – Atlanta, GA
GPA: High Honors, Order of Omega Honor Society, Dean's List
Chemical Engineering High Honors, Order of Omega Honor Society, Dean's List, London Study Abroad Program

Additional Information

Certified Professional Engineer (North Carolina); Two-time Technology Transfer Award Winner (EPRI); Six-Sigma Green Belt (Corning); Co-author of two invention disclosures; PORCH-Hillsborough Volunteer