

**ENERGY AND ENVIRONMENTAL ECONOMICS, INC.**

San Francisco, CA

*Technical Manager*

Mr. Go's work at E3 spans the resource planning, transmission, market analysis, and distributed energy resources (DERs) practice areas. Currently, he manages the development of **RECAP**, E3's probabilistic resource adequacy assessment model, which provides utilities, market operators, and regulators with an understanding of how firm and energy-limited resources can meet load under a wide range of plausible system conditions. He is also a principal contributor to E3 models **RESOLVE** (long-term capacity expansion) and **RESTORE** and **IDSIM** (optimized DER dispatch and least-cost DER portfolio). In addition to developing E3's analytical tools, Mr. Go invests significant effort to train both E3 staff and clients on how to effectively use and leverage E3's tools.

Mr. Go joined E3 in 2016 upon receiving both his M.S.E. in Environmental Management and Economics and his B.S. in Environmental Engineering from the Johns Hopkins University. Prior to E3, Mr. Go's research experience focused on developing novel power systems optimization models and solution algorithms to investigate operational and planning questions for transmission-constrained systems under high renewables. Select projects at E3 include:

- **California Independent System Operator Demand Response ELCC Analysis, 2019-Present.** Managing project to examine the effective load carrying capability of demand response programs using E3's RECAP model, in collaboration with CAISO and stakeholders in its ESDER 4 initiative.
- **California Public Utilities Commission Integrated Resource Plan, 2019-Present.** Supporting the CPUC's integrated resource plan by developing E3's RESOLVE model and updating key assumptions that underpin California's statewide electricity plan.
- **Hawaiian Electric Companies Integrated Grid Planning, 2019-Present.** Managing project to support HECO's Integrated Grid Planning process to develop updated system needs assumptions and evaluate bids on each of HECO's operating islands in the context of Hawaii's long-term energy policies.
- **Transmission Benefits Analyses for Confidential Developer Clients, 2016-Present.** Analyzed the long-term energy, capacity, and renewable procurement benefits associated with various transmission projects across the U.S., which clients used to determine whether to continue project development.
- **Western Energy Imbalance Market Benefits Studies, 2016-2019.** Analyzed potential operational benefits of subhourly wholesale market transactions via Western EIM integration for NorthWestern Energy, Portland General Electric, and el Centro Nacional de Energía (Baja California). Managed studies for the Public Service Company of New Mexico and Bonneville Power Administration.
- **Orange & Rockland Utilities Non-Wires Analysis Toolkit & Bid Evaluation, 2017-Present.** Enhanced E3's spreadsheet-based integrated demand-side model to calculate the net benefits of portfolios of distributed energy resources to meet utility needs for transmission and distribution

project deferral. Linked ORU's toolkit with E3's New York Storage Tool (developed for the New York State Energy Research & Development Agency) to enable detailed storage bid evaluations.

- **California Energy Commission Solar + Storage Tool, 2017-2019.** Expanded E3's RESTORE model to evaluate the system-wide and locational net benefits of a customer-sited portfolio of solar, storage, and other distributed energy resources.
- **Puget Sound Energy Flexibility Study, 2017.** Assisted in development of PSE's PLEXOS production cost model and assessed intra-hour flexibility challenges at high wind penetrations to support 2017 Integration Resource Plan.
- **Sacramento Municipal Utilities District, 2017.** Updated PLEXOS simulation of SMUD's system to understand the impact of increasing renewable generation and broader regional changes on the utility's energy supply costs.
- **Hawaiian Electric Companies Power Supply Improvement Plan, 2016.** Updated E3's RESOLVE model for HECO's December 2016 PSIP update. E3 worked with HECO and its stakeholders to develop a set of least cost investment pathways to reach 100% renewables by 2045, helping guide policy and investment decision-making. Additionally, developed a training course for HECO staff to run RESOLVE, RECAP, and hosting capacity analyses in-house to aid in future decision-making.
- **CPUC Locational Net Benefits Analysis Demonstration, 2016.** Developed a spreadsheet-based demonstration tool to determine the location-specific avoided costs associated with the installation of distributed energy resources.

## **SANDIA NATIONAL LABORATORIES**

*Technical Intern—Discrete Math & Optimization*

Albuquerque, NM  
June 2015 – June 2016

- Created a two-stage, stochastic model in Python and Pyomo to co-optimize transmission, generation, and energy storage investments on a large-scale power network
- Studied the economic value of simultaneously considering bulk energy storage investments with transmission and generation expansion planning decisions for high renewables scenarios
- Implemented and investigated the use of Bender's decomposition and Lagrangian relaxation methods to accelerate solution of large-scale expansion planning models

## **JOHNS HOPKINS UNIVERSITY**

*Research Assistant*

Baltimore, MD  
October 2014 – June 2016

- Developed a model in GAMS to compare siting and sizing decisions of a merchant energy storage investor recovering costs via energy arbitrage to those of a welfare-maximizing centralized planner
- Investigated possible issues of market power from energy storage merchants in transmission-constrained networks

## **CITY OF BALTIMORE, OFFICE OF SUSTAINABLE ENERGY**

*Energy Analyst Intern*

Baltimore, MD  
February 2015 – May 2015

- Investigated energy storage applications and opportunities for co-locating with solar PV project in Baltimore City based on case studies of existing projects around the US

**COMILLAS PONTIFICAL UNIVERSITY**

*Visiting Researcher*

Madrid, Spain  
June 2014 – January 2015

- Developed and compared various unit commitment approximations in GAMS for generation expansion planning models for systems with significant renewables
- Implemented *k*-means clustering methods in Matlab to estimate system states for use in expansion planning models
- Organized one-day, workshop on linear and mixed-integer linear programming in power systems for participating students

**Education**

The Johns Hopkins University

*M.S.E., Environmental Management and Economics*

Baltimore, MD

2016

The Johns Hopkins University

*B.S., Environmental Engineering*

*Minor in Engineering for Sustainable Development – Urban Development*

Baltimore, MD

2015

## Citizenship

United States

## Presentations

1. "Optimal Portfolio Investment of an Energy Storage Merchant in the Energy Imbalance Market." INFORMS Annual Meeting, Philadelphia, PA. November 2015.
2. "Combining the L-Shaped Method and Lagrangian Relaxation for Expansion Planning with Storage Devices and RPS Constraints." INFORMS Annual Meeting, Houston, TX. November 2017.

## Refereed Publications

1. R. Go, F. D. Munoz, J-P. Watson, "Assessing the Economic Value of Co-Optimized Grid-Scale Energy Storage Investments in Supporting High Renewable Portfolio Standards", Applied Energy, 183, 2016, 902-913. <http://dx.doi.org/10.1016/j.apenergy.2016.08.134>.