Crisis in Power Engineering Education:
A National Security Concern
Minneapolis, MN October 21-22, 2022

Developing Storage Systems / Renewables

Combining personal passion with careers in Power engineering

Dr. Anushree Ramanath
Staff Modeling Engineer, Electrical Systems
Form Energy

INTRODUCTION

ANUSHREE RAMANATH

Feb 2022 – Present
Staff Modeling Engineer, Electrical Systems, Form Energy
- Techno-economic analysis and electrical performance modeling

Jun 2020 – Feb 2022
Senior Systems Engineer, Storage Engineering, Enphase Energy Inc.
- Microinverters and storage systems, third party component integration

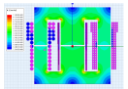
May 2019 – Aug 2019
Power Electronics and Firmware R&T Intern, Corporate R&T, Electrification Technologies
- High power traction inverter

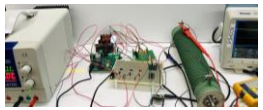
Jan 2019 – May 2019
Graduate Teaching Assistant, University of Minnesota
- Climate Crisis: Implementing Solutions

Jun 2018 – Dec 2018
Systems Control Engineer – Co-op, Integrated Energy Systems
- Implementation of Microgrid HIL simulator

May 2017 – Aug 2017
Research Aide - Energy Systems, Argonne National Laboratory (*Data Science Intern*, Corporate R&T, Eaton)
- Setup of EMCB on cloud for ARPA-e NODES

Aug 2016 – May 2020
Graduate Research Assistant, University of Minnesota Twin Cities
- Power electronics for renewable energy integration and sustainable environments



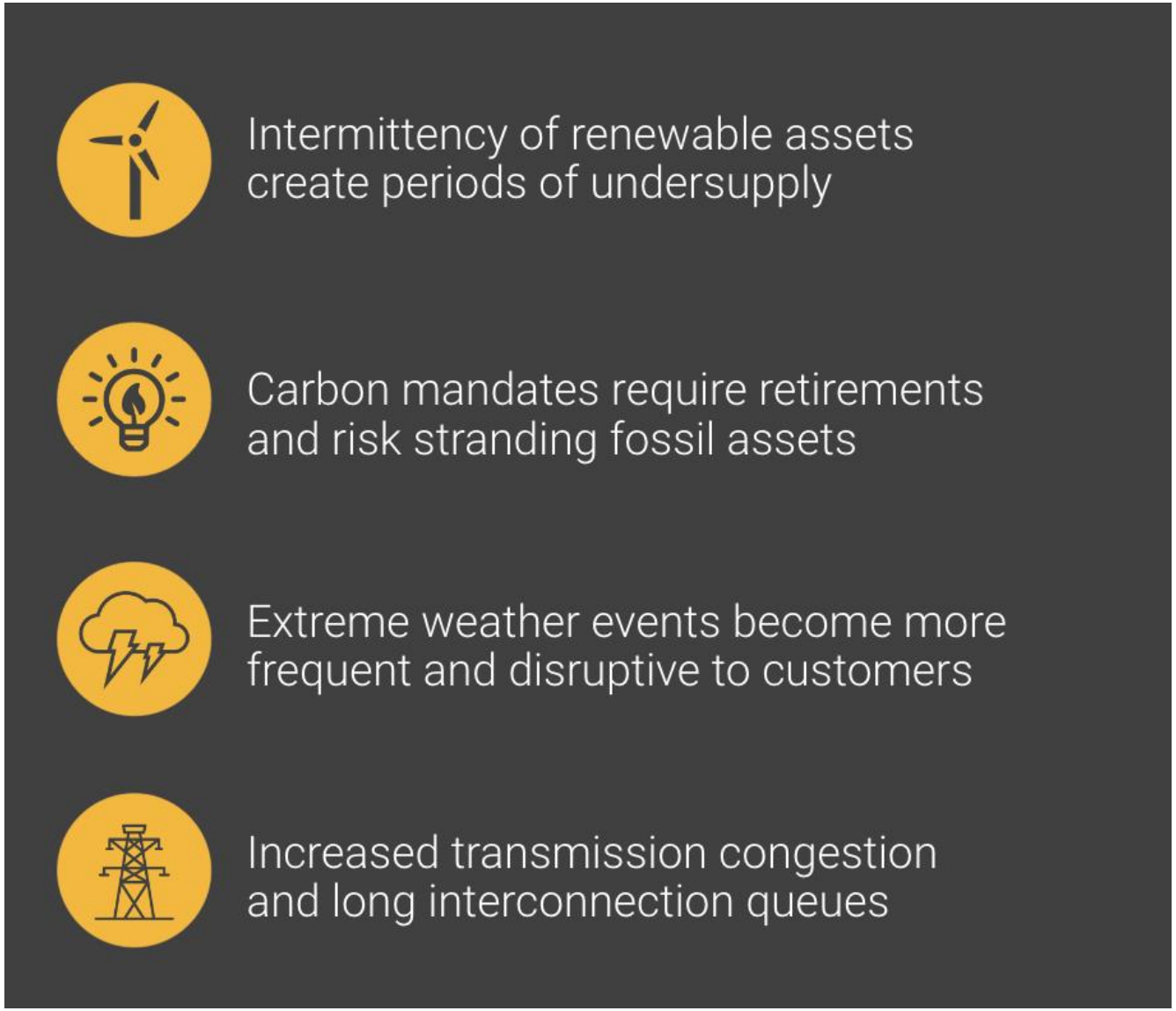


2011 – 2016 – Full-time roles and Internships in India
CodeFrontier Software Pvt. Ltd., Exeter Software India Pvt. Ltd., Bosch, Prok Devices, ERI, BHEL

EDUCATION
2020 MS and Ph.D. in Electrical and Computer Engineering, University of Minnesota Twin Cities, USA
2013 BE in EEE, BNMIT (was affiliated to Visvesvaraya Technological University, India)

THE CHALLENGE

The electrical grid needs to fundamentally transform to meet the challenges posed by climate change



INFLUENTIAL STUDIES AND EARLY PROCUREMENTS SIGNAL THE NEED/DESIRE FOR LONG-DURATION STORAGE SOLUTIONS

gtm: Solar Grid Edge Storage Wind Trending Podcasts White Papers Webinars

ENERGY STORAGE

California Could Need 55GW of Long-Duration Storage to Meet Its 2045 Carbon-Free Grid Goal

A new study calculates a drastically higher need for long-duration storage than state officials had recognized.

JULIAN SPECTOR | DECEMBER 09, 2020

As solar comes to dominate California's electricity supply, long duration storage will become increasingly valuable, a new study contends.

gtm: Solar Grid Edge Storage Wind Trending Podcasts White Papers Webinars

ENERGY STORAGE

The First Major Long-Duration Storage Procurement Has Arrived

California's community-choice aggregators are moving ahead of the traditional utilities.

JULIAN SPECTOR | OCTOBER 16, 2020

Pumped hydro will compete with newfangled technologies to supply 500 megawatts to California communities.

THE SOLUTION – MODULAR SCALABLE MULTI-DAY STORAGE

GWs of multi-day storage projects deployed by 2030 will enable a lower carbon, more resilient electricity grid

- ✓ Improved grid reliability
- ✓ Higher renewables penetration
- ✓ Accelerated fossil retirements
- ✓ Lower cost emissions reductions
- ✓ Less congestion and curtailment

SYSTEM BUILDING BLOCKS

Our rechargeable, static iron-air battery leverages globally abundant materials and off-the-shelf components

Iron Anode

- Highly abundant
- Very low-cost metal
- Non-toxic
- Highly recyclable

Air Electrodes

- Commercially proven air electrodes
- Readily scalable production

Water based electrolyte

- High pH (like AA batteries)
- Non-flammable
- No heavy metals

Balance of System

- Off-the-shelf water distribution, HVAC, & air handling system components
- Standard utility-grade inverter

KEY ADVANTAGES OF OUR TECHNOLOGY

LOW-COST

Less than 1/10th the cost of lithium-ion battery technology.

FLEXIBLE

No geographic limitations: can be sited anywhere to meet utility-scale needs.

OPTIMIZABLE

Pairs well with lithium-ion batteries and renewable energy resources to enable optimal system configurations.

SCALABLE

Materials and designs with global scale needed for zero carbon economy.

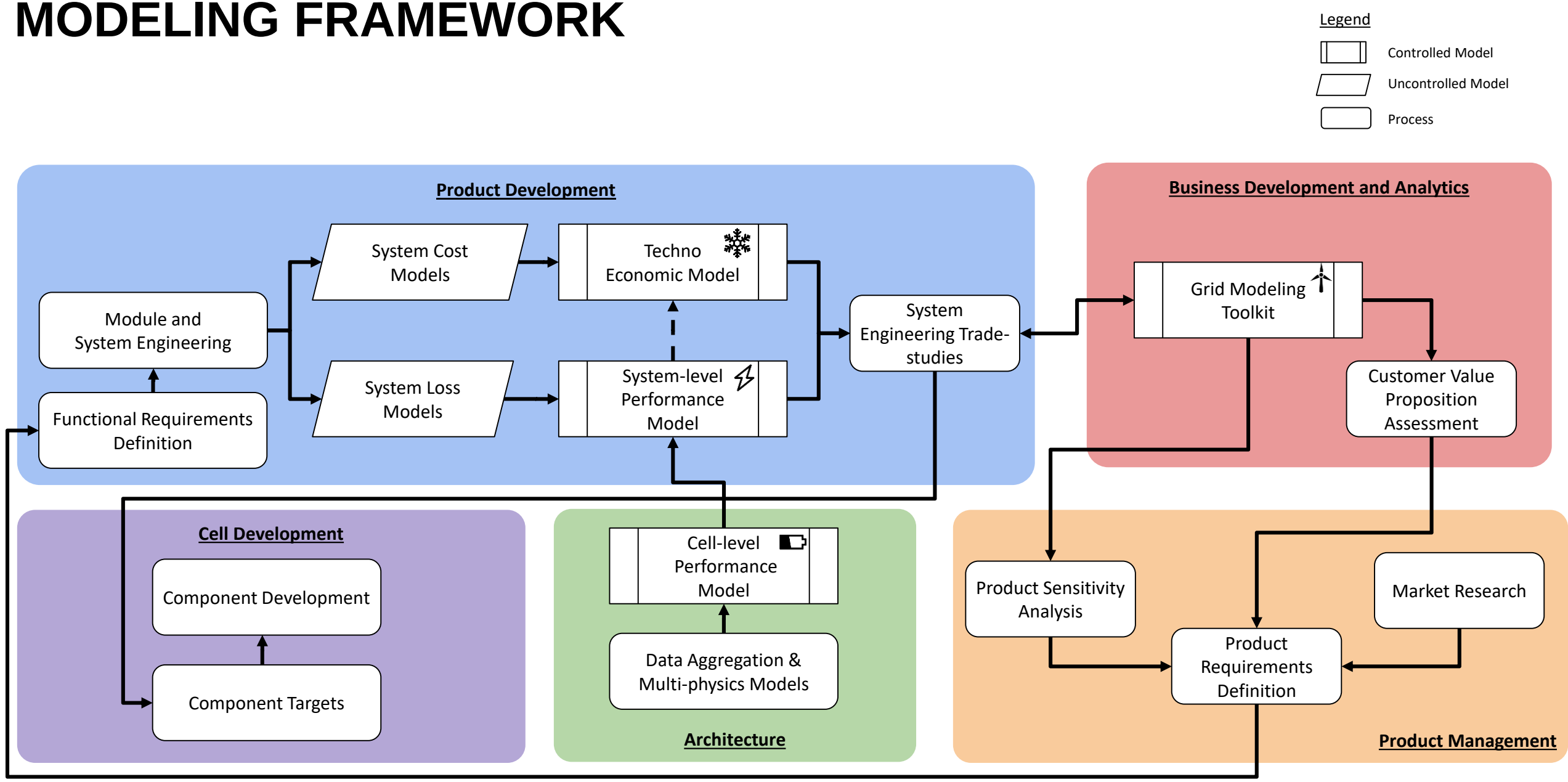
MULTI-DAY

No need to supplement number of modules to achieve 100+ hour duration required to make renewables reliable.

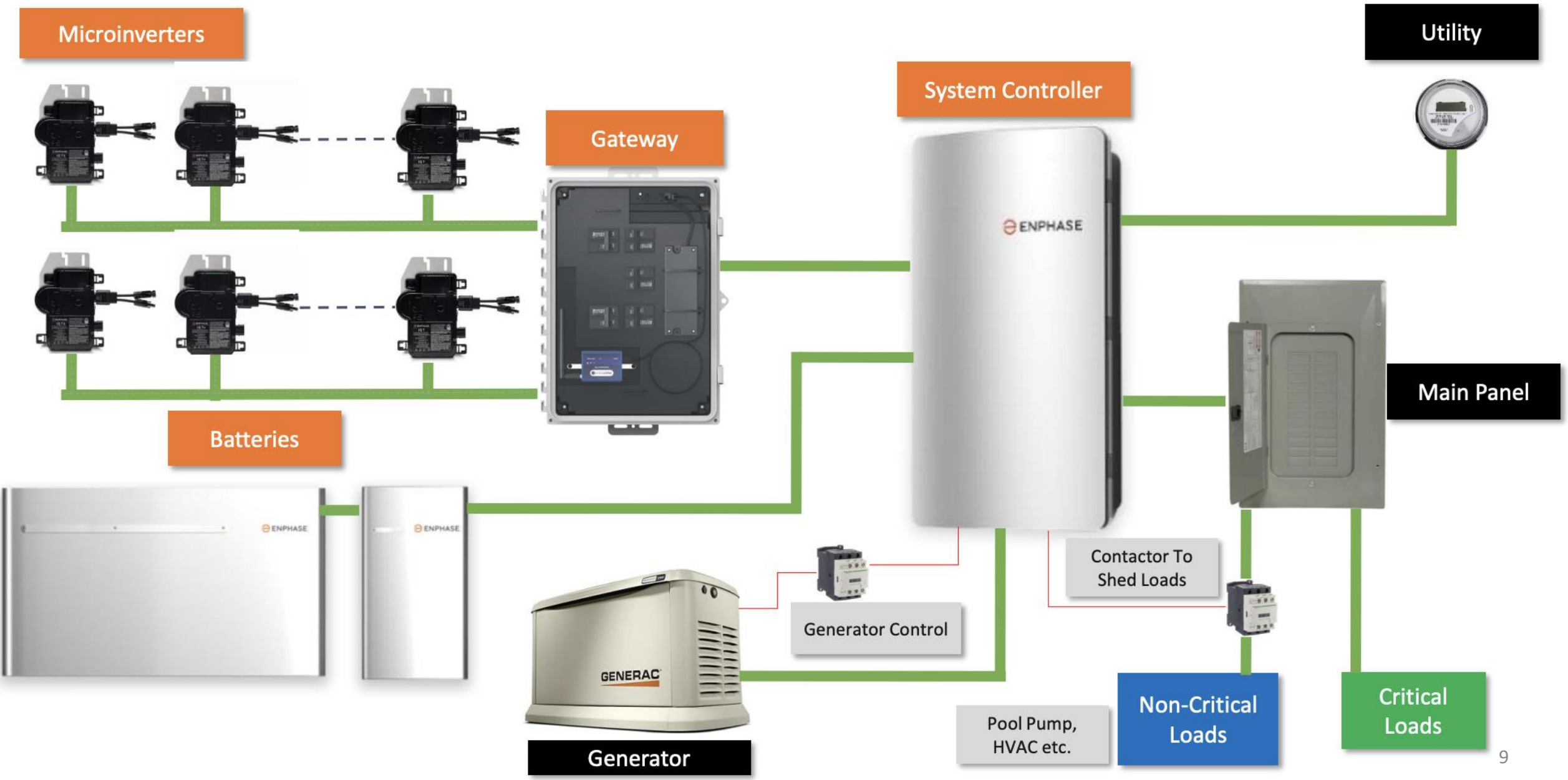
SAFE

No risk of thermal runaway. Made from non-flammable active materials. High recyclability.

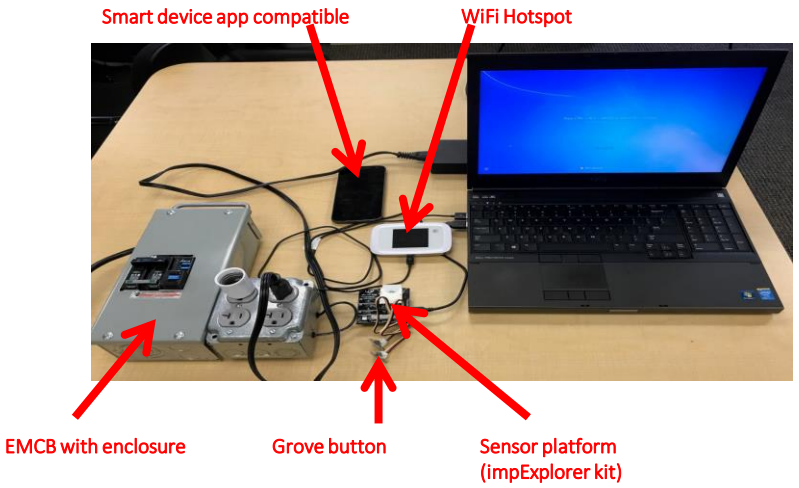
MODELING FRAMEWORK



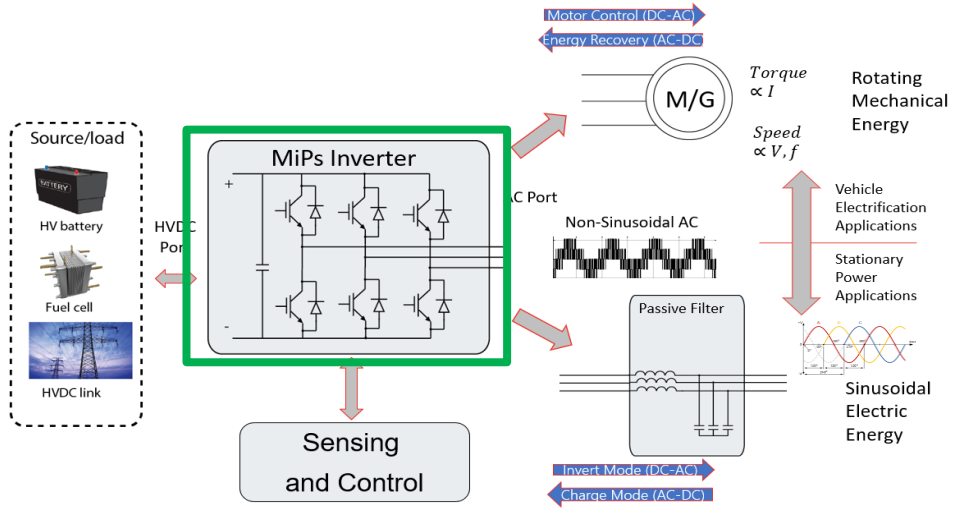
SOLAR AND STORAGE SYSTEM – WHOLE HOME BACK-UP



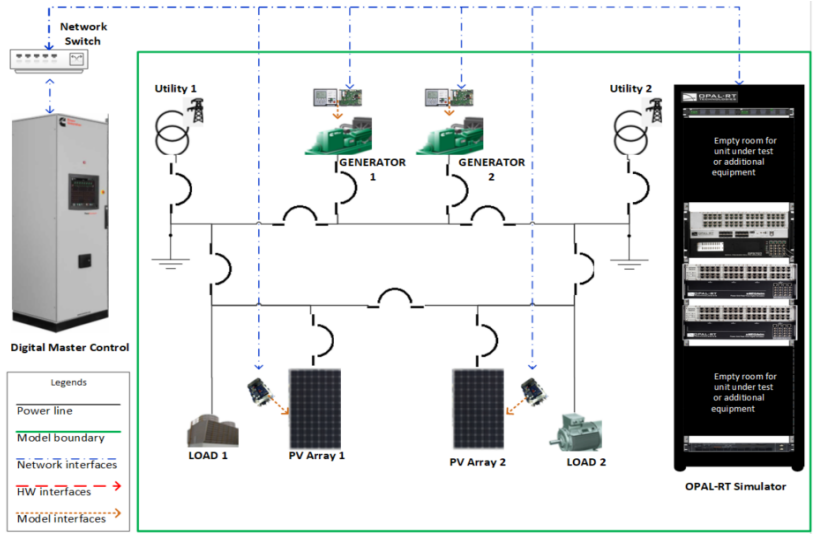
EXPERIENCES AS A GRADUATE STUDENT - INDUSTRY



Eaton's Energy Management Circuit Breaker connected to cloud



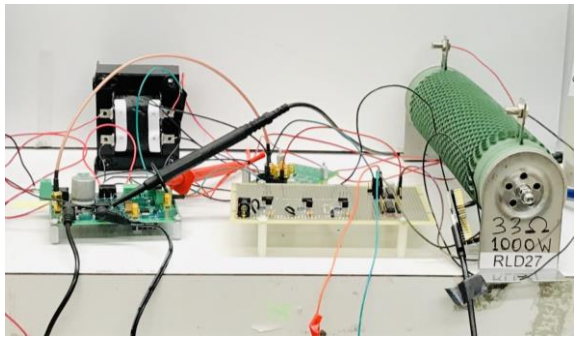
High-power traction inverter platform for Cummins



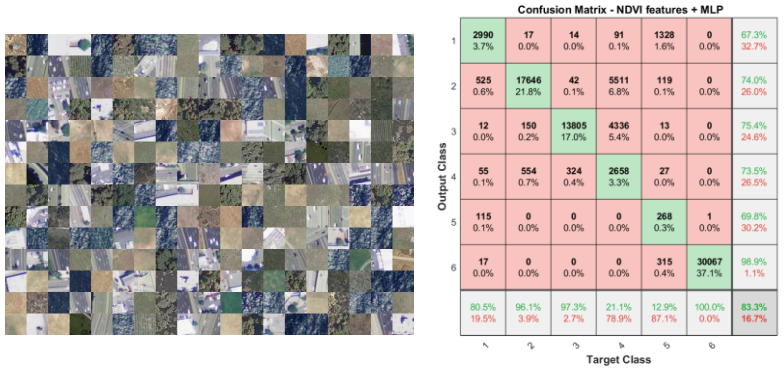
Microgrid hardware-in-the-loop simulator for Cummins

EXPERIENCES AS A GRADUATE STUDENT - RESEARCH

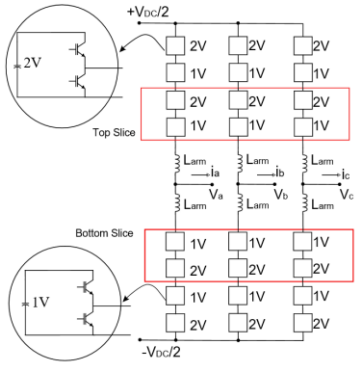
Wind emulator



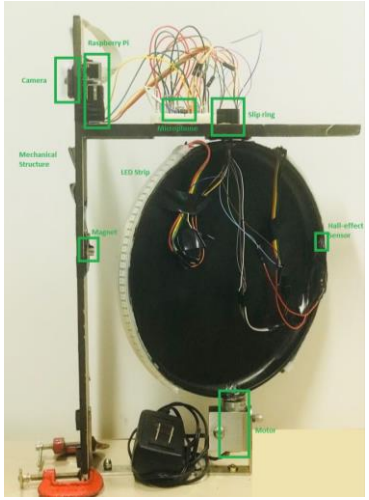
Converter with integrated magnetics



Land cover classification of aerial images



A-MMCs for utility-scale renewable integration



User-interactive persistence-of-vision

Q & A