



LEHIGH
UNIVERSITY

ENERGY SYSTEMS
ENGINEERING

Talent & Skill Sets for a New Utility Workforce!

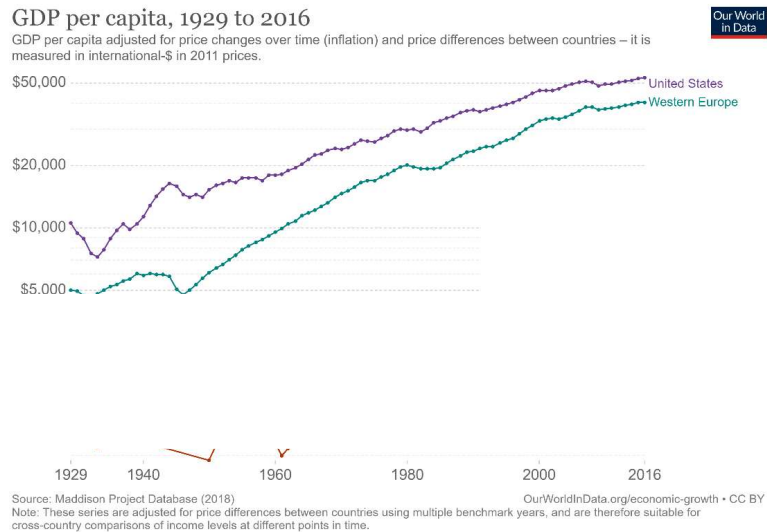
April 9, 2024

PROFESSIONAL MASTERS STUDIES

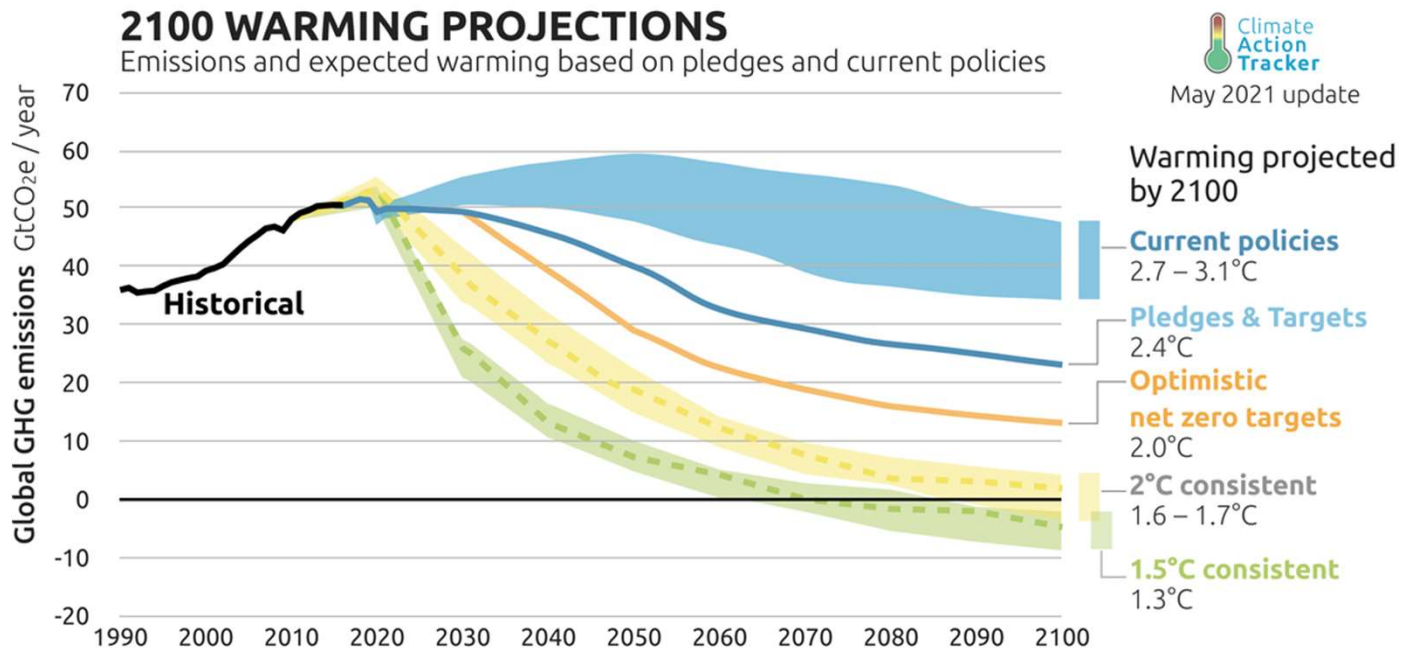
Rudy Shankar, MBA, Ph.D.

Director, Energy Systems Engineering Program

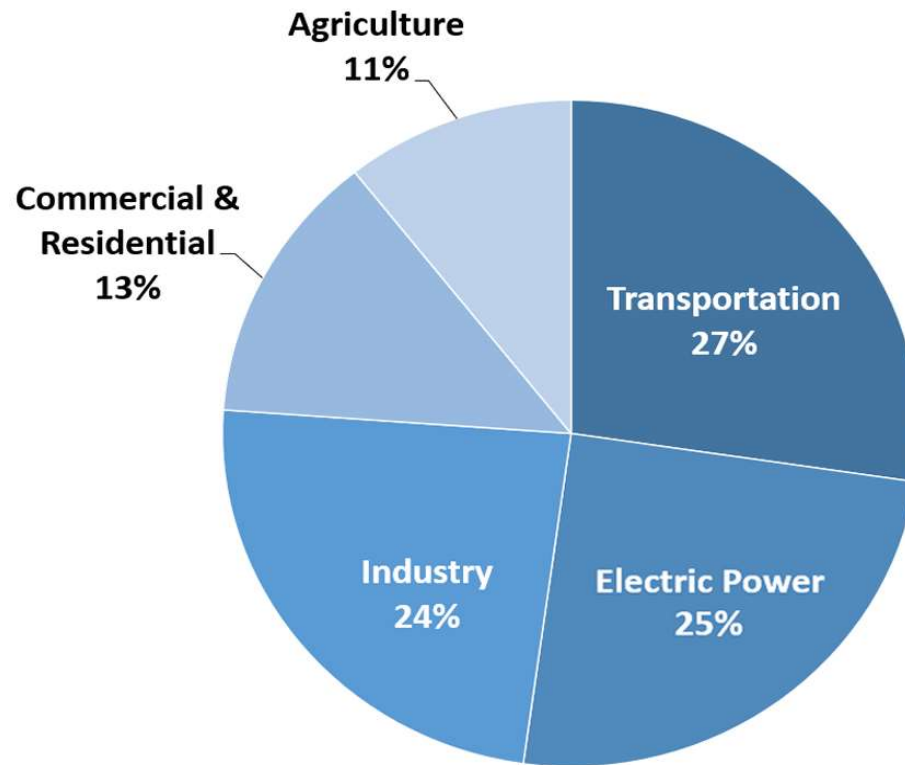
Electricity & GDP



- 20th Century- US & Western Europe Prosperity- Linear relationship
- 21st Century- China & India



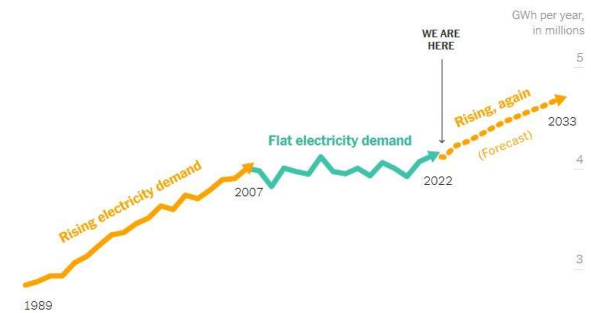
Sources of U.S. Greenhouse Gas Emissions in 2020



U.S. Environmental Protection Agency (2022). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020

ELECTRIFICATION!

- 100 % Clean Grid by 2035
- Net Zero GHG Emissions by 2050
- Distributed Energy Resources
- Decarbonization of Select Industries
- Electric Vehicles
- Hydrogen to Replace Traditional Fuels
- Nuclear Power & Advanced Nuclear



Energy Systems Engineering

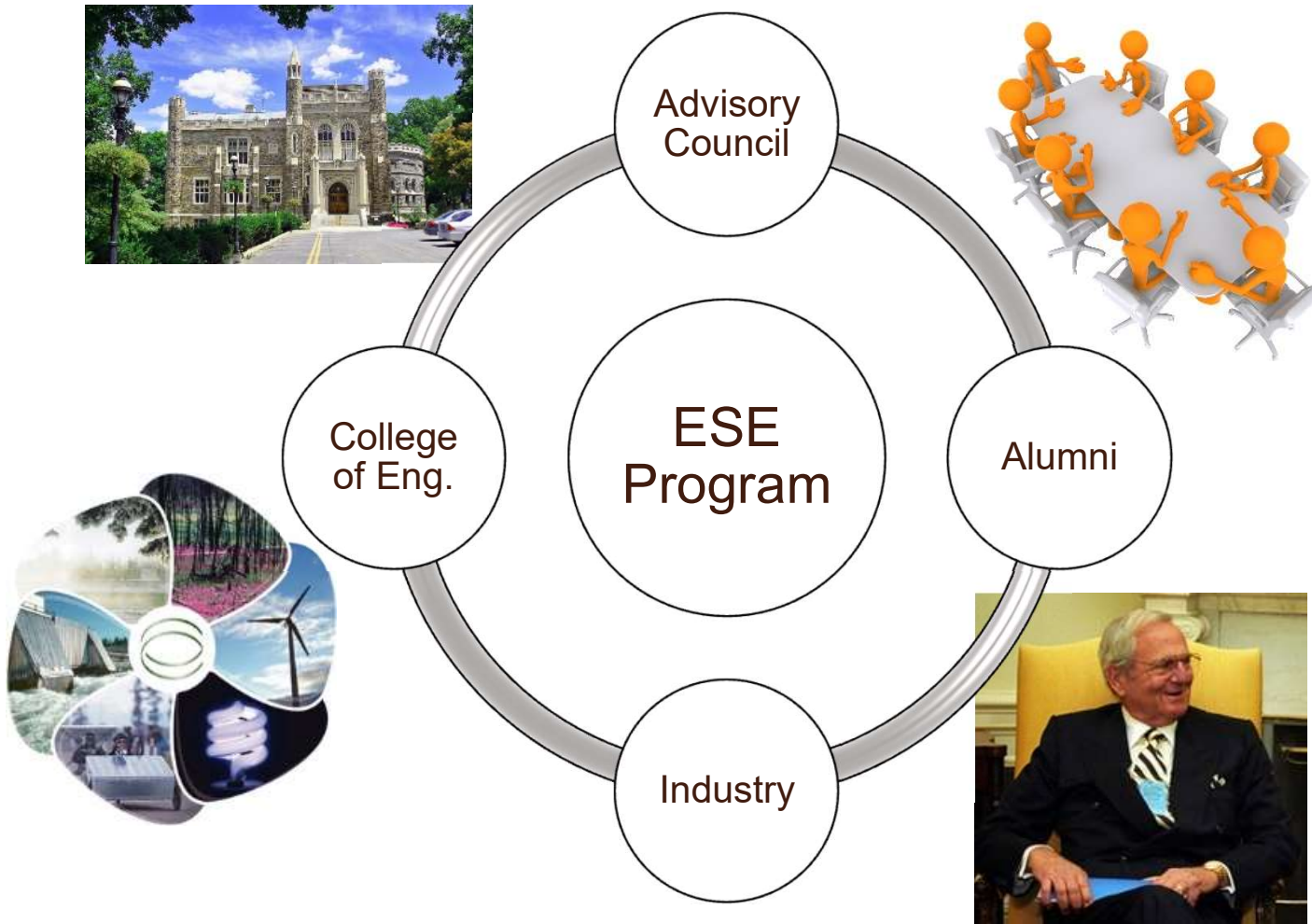
<https://ese.lehigh.edu>



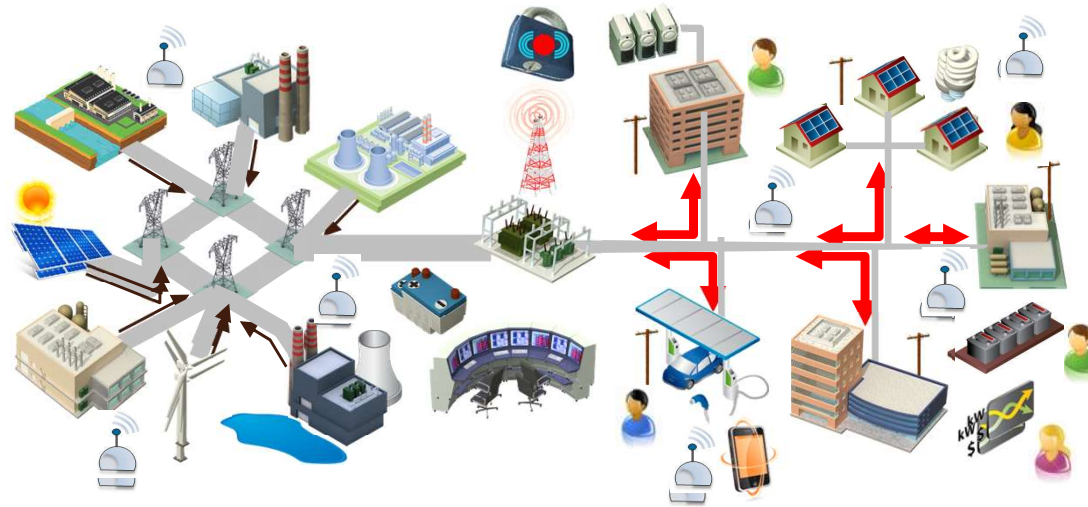
MISSION

Produce a new generation of world-class leaders for the energy industry

The ESE Learning Process



The Evolving 21st Century Grid



What is the pace of change?

The Evolving Electric Grid

- Digitization,
Decarbonization &
Decentralization
- Customer-centric
- Social equity

Power Generation Trends in “3D”

energycentral.



Most Desired Skills to Advance

- Problem Solving
- Oral/Written Communication
- Teamwork
- Digital Technology & Energy Analytics (AI)
- Professionalism/Work Ethic
- Career Management

ARTIFICIAL INTELLIGENCE APPLICATIONS*



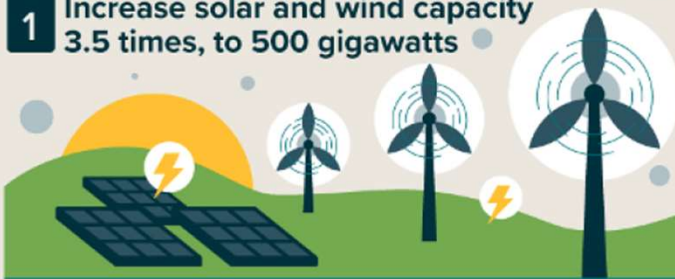
- Address Complexity of Planning & Operating Electric Grids
 - Diversified & Distributed Resources
 - Intermittency
- Increasing use of Sensors & Internet of Things
 - Improve efficiency
 - Reduce O&M costs
- Revamping Electricity Markets
 - Load Flexibility
 - Dynamic Pricing



Getting to Net-Zero Carbon Emissions by 2050

8 actions needed by 2030

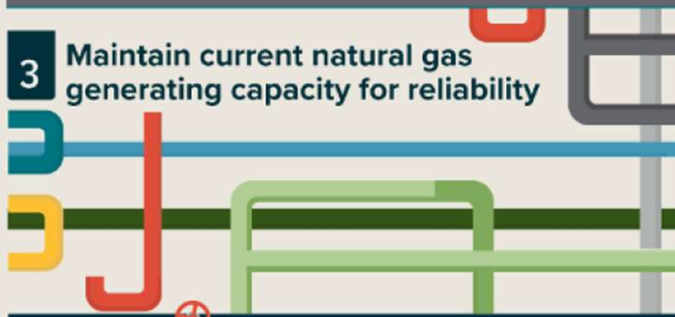
1 Increase solar and wind capacity 3.5 times, to 500 gigawatts



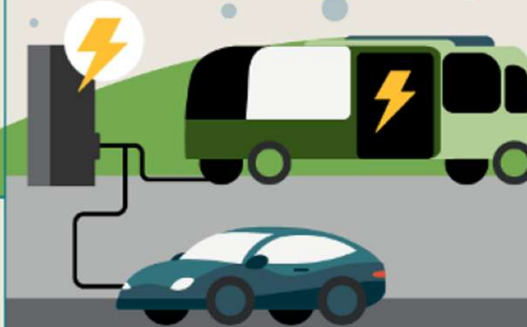
2 Eliminate most electricity generation from coal



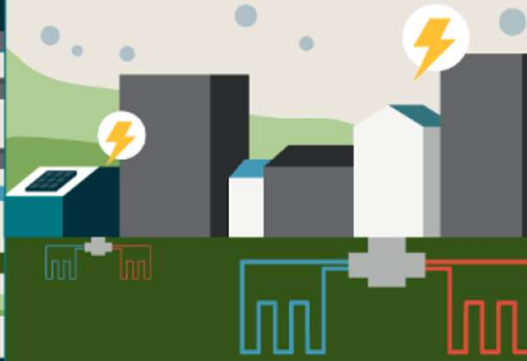
3 Maintain current natural gas generating capacity for reliability



4 Increase zero-emission vehicle sales share to 50%



5 Increase sales share of building heat pumps to 50%



6 All new buildings and appliances meet strict energy efficiency goals



7 R&D for carbon capture, sequestration, and carbon-neutral fuels



8 Build electricity transmission and pipelines for carbon dioxide and hydrogen gas.

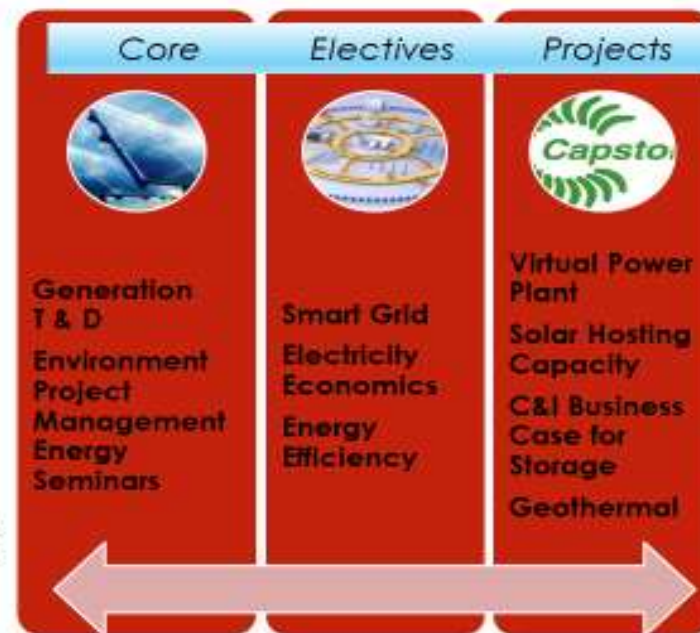


M. ENG IN ENERGY

- 10-month 30-credits
 - 18 core + 12 electives
- Core subjects taught by industry professionals
- Energy Seminar Series + Field Trips (3 credit elective)
- 6-credit Industry-sponsored Capstone Projects

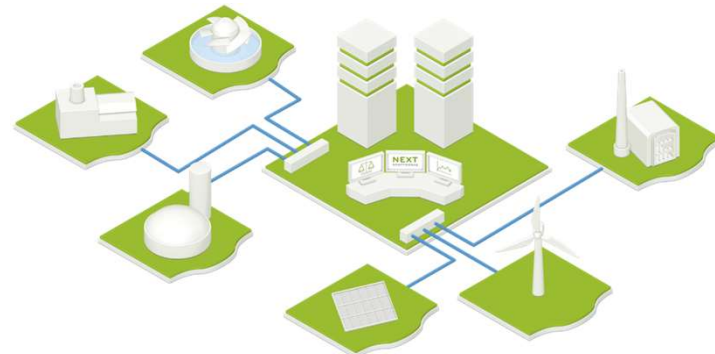
OUTCOMES

- "4+1" students well positioned to enter the energy workforce
- Professional workers positioned for leadership in energy



AY 2024 Capstone Projects

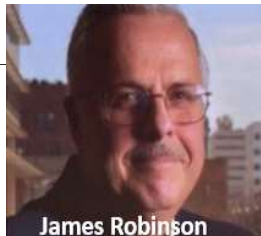
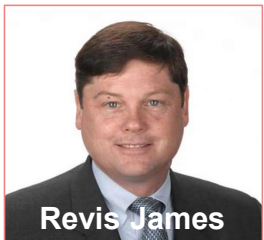
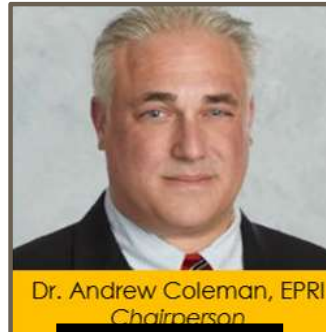
ID	Title
ESE 2024-01	A VIRTUAL POWER PLANT ON CAMPUS: TECHNICAL & ECONOMIC FEASIBILITY
ESE 2024-02	NUCLEAR POWER & THE ENERGY TRANSITION: DOMESTIC & INTERNATIONAL VIEW
ESE 2024-03	HYDROGEN HUB IN BETHLEHEM, PA: TECHNICAL AND ECONOMIC FEASIBILITY
ESE 2024-04	IDENTIFICATION & MAPPING OF FOSSIL-BASED ENERGY COMMUNITIES
ESE 2024-05	RENEWABLE FUEL OIL (RFO): TECHNICAL & ECONOMIC FEASIBILITY
ESE 2024-06	DEVELOPMENT OF NETZERO MULTIFAMILY HOMES IN THE NORTHEAST
ESE 2024-07	POWER THE BLUE ECONOMY: OPTIMIZING ENERGY STORAGE SOLUTIONS IN MARINE MICROGRIDS





Con Ed East River Facility

Energy Systems INDUSTRY ADVISORY COUNCIL





*I am project manager at **PPL's Transmission and Substations Department**. Through class lectures, business case studies, guest speakers, project-based learning, and company visits, I'm gaining technical skills and a **deeper understanding of many segments of the energy sector** that I can apply to my job daily.*

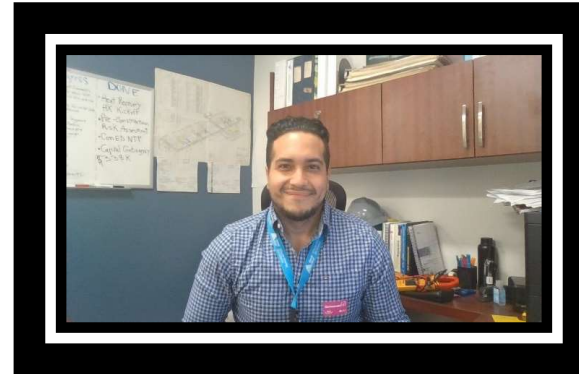


*I was recently hired as an Associate Analyst, NY Strategic Planning & Change Management at **National Grid**. My coursework provided me with insight into the evolution of generation technology, the challenges of integrating intermittent renewable sources, the history and operation of the grid, and potential paths towards net-zero. I am excited to **use the knowledge to drive what I hope will be an impactful career.***



*I believe that Lehigh's M.Eng. Energy System Engineering program has **provided several thought-provoking topics and courses** that will facilitate my path to achieving my aspirations.*

*I am a licensed professional engineer currently employed as a **Senior Engineer with PECO***



*As a recently hired engineer at **Kairos Power**, my job is to design and manage the build of the ventilation system for the company's first iteration of a salt-cooled modular nuclear reactor. The ESE Program has allowed me an in-depth look into **the integrated resource planning of the US grid system**.*

Understanding how future electric demand is forecasted and how this influences grid infrastructure investment offered me a different perspective and newly-found admiration for our electric grid.