Research Interests:
The Energy/Environmental Biotechnology & Biochemical Engineering Laboratory (E/EBBE lab) was established in the Fall of 2011. The core technologies of this lab are biochemical engineering, biomass energy, biorefinery, microalgae biotechnology/engineering, enzyme engineering, and environmental biotechnology. The main purpose of our research is to develop highly efficient and commercially-viable technologies for the production of biofuels and bio-based chemicals from flue gas CO₂, renewable resources, and organic wastes/wastewaters. Recent research topics include microalgal biorefineries (e.g., biodiesel, aquaculture feed, pigments, protein, cosmetics, etc.), lignocellulosic biorefineries (e.g., bioH₂, bioalcohols, diols, etc.), biosurfactants, membrane applications, and biological recovery of valuable metals from geothermal or industrial wastewaters.

Major research achievements
- Producing biofuels (bioH₂, ethanol, butanol, biodiesel) from cellulosic and microalgal feedstocks
- Developing integrated processes for CO₂ re-utilization via microalgae platform
- Developing microalgae-based biorefinery system to produce high-value products and fine chemicals
- Establishing a demonstration plant (300 ton) for large-scale outdoor cultivation of microalgae

Representative Publications:
- WY Cheah, PL Show, JC Juan, TC Ling, J-S Chang, D-J Lee (2016) Converting wastewaters to energies: A microalgae platform. Applied Energy (published online) [IF= 5.746]
Major research activities

- Microalgal species isolated from nature environment
- Heterotrophic production of DHA and astaxanthin

Microalgae-based carbon capture & utilization

- Flue gas
- Wastewater
- CO₂, NOx, SOx
- Microalgae cultivation
- Microalgal species isolated from nature environment
- Heterotrophic production of DHA and astaxanthin

Microalgae cultivation demonstration plant

- 300 ton open pond (DHA-rich)
- 20 ton raceway pond

Microalgae-based biorefinery processes

- CO₂ capture & microalgae cultivation
- Strain improvement
- Photo-bioreactor
- CO₂ fixation from flue gas
- Genetic engineering
- Chemical or physical treatment
- Harvest & Separation

Process for biodiesel synthesis using microalgae oil

- Lipid/oil
- Fatty acid
- Biodiesel
- Bioethanol
- Animal feed
- Health food
- Pigment
- Protein
- Reducing sugar
- Biomass residue
- Adding co-solvent and catalysts
- Wet microalgae