Seolhee Cho

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EDUCATION

Carnegie Mellon University *Aug 2020 – Present*
Ph.D. Candidate in Chemical Engineering | GPA:4.0/4.0
Advisor: Prof. Ignacio E. Grossmann (Ph.D.)

Incheon National University *Mar 2015 – Feb 2017*
M.S. in Energy and Chemical Engineering | GPA:4.0/4.0
Advisor: Prof. Jiyong Kim (Ph.D.)

Incheon National University *Mar 2011 – Feb 2015*
B.S. in Energy and Chemical Engineering | GPA:3.7/4.0

RESEARCH EXPERIENCE

Ph.D. Student | Carnegie Mellon University, Pittsburgh, PA *Aug 2020 – Present*
Supervised by Prof. Ignacio E. Grossmann (Ph.D.)

1) Optimization model and algorithm for expansion planning of reliable power systems

- Proposed *Generalized Disjunctive Programming* (GDP) model for a long-term expansion planning with hourly-operation decisions, which can optimize both the main generation systems and reserve systems.
- Considered the impact of operational strategies of generations (including dual role of generators) on power systems reliability.
- Used a point failure probability and capacity failures states to estimate power systems reliability.
- Developed a bilevel decomposition with tailored cuts to reduce computational expenses, and proved the effectiveness of the decomposition with case studies.
- Perform a collaborative work with California Energy Commission to provide guidelines for establishing carbon-neutral and reliable power systems in California (On-going).

2) Proactive capacity planning of transmission systems and redispatch of generation systems to prevent electricity supply disruptions (On-going)

- Formulate a two-stage stochastic *Generalized Disjunctive Programming* (GDP) model for expansion planning of transmission systems under disruption.
- Consider line hardening and new installation as solution to improving resilience.
- Propose a method to generate different disruption scenarios considering extreme weather depending on transmission systems network.

Master student | Incheon National University, Incheon, South Korea *Mar 2015 – Feb 2017*
Supervised by Prof. Jiyong Kim (Ph.D.)

1) Biomass-to-Hydrogen economy

- Developed an optimization-based decision making model for design and analysis of biomass based hydrogen energy supply network considering both waste biomass and dedicated energy crops.
- Evaluated the impact of biomass-based hydrogen energy systems in terms of economics and environmental impact.
- Proposed a multi-period and multi-sites mixed-integer linear programming (MILP) model for a long-term expansion planning of biomass-to-hydrogen supply chain networks.

2) Biofuel infrastructure development

- Proposed an MILP optimization model for the optimal selection of production technology and supply chain network
- Performed a case study of Jeju Island, South Korea, to evaluate the feasibility of different ethanol-gasoline blends scenarios.

Undergraduate Research Student | Incheon National University, Incheon, South Korea
Supervised by Prof. Jiyong Kim (Ph.D.) *Jan 2014 – Feb 2015*

- Evaluated the impact of renewable energy systems using different evaluation criteria: economics, energy security, and environmental protection

Work Experience

Researcher | Innovation Center for Chemical Engineering, South Korea *Mar 2017 – Jul 2020*
Supervised by Prof. Jiyong Kim (Ph.D.)

1) Life Cycle Analysis (LCA) of enhanced coalbed methane recovery (ECBM) systems

- Conducted Life Cycle Analysis (LCA) of CO_2 enhanced coalbed methane recovery (ECBM) systems, which includes raw material capture/transportation, CO_2 injection/CH_4 extraction, purification, and solved a case study of Tavan Tolgoi basin, Mongolia.

2) Knowledge-based platform development for early-state screening of catalysts

- Developed a new computer-aided platform (called METAL (Methanol process: Techno-economic Analysis Laboratory)) to assess technical and economic performances of CO_2 hydrogenation catalysts in the early R&D stage of new catalyst discovery.
- Evaluated 38 types of CO_2 hydrogenation catalysts reported in the literature using the proposed platform, and provided a guideline for new discovery of catalysts.

3) Techno-economic assessment of CO_2 to methanol synthesis processes

- Proposed two new methanol synthesis processes that use waste CO_2 and renewable H_2 as feedstock: advanced syngas-to-methanol (AS2M) and direct CO_2-to-methanol (DC2M) processes.
- Examined technical and economic capabilities of the two novel processes using four evaluation criteria: carbon efficiency, energy efficiency, CO_2 reduction, and unit production cost.

Publications

Full-length Papers

[1] **S. Cho**†, T. N. Do†, J. Kim, "Advanced design and comparative analysis of green methanol production routes from CO_2 and renewable hydrogen: *via* syngas vs. direct hydrogenation processes", *International Journal of Energy Research*, Under review. † Contributed equally

[2] **S. Cho**, J. Tovar-Facio, I. E. Grossmann, "Disjunctive optimization model and algorithm for long-term capacity expansion planning of reliable power generation systems", *Computers & Chemical Engineering*, 174, 108243 (2023). doi: 10.1016/j.compchemeng.2023.108243

[3] **S. Cho**, C. Li, I. E. Grossmann, "Recent advances and challenges in optimization models for expansion planning of power systems and reliability optimization", *Computers & Chemical Engineering*, 165, 107924 (2022). doi: 10.1016/j.compchemeng.2022.107924

[4] **S. Cho**†, C. Kim†, J. Kim, "Techno-economic assessment and early-stage screening of CO_2 direct hydrogenation catalysts for methanol production using knowledge-based surrogate modeling", *Energy Conversion and Management*, 244, 114477 (2021). doi: 10.1016/j.enconman.2021.114477. † Contributed equally

[5] C. Jeong†, **S. Cho**†, J. Kim, "RFID-based integrated decision making framework for resource planning and process scheduling for a pharmaceutical intermediates manufacturing plant", *Korean Chemical Engineering Research*, 58(3), 346-355 (2020). doi: 10.9713/kcer.2020.58.3.346. † Contributed equally

[6] **S. Cho**, J. Kim, "Multi-site and multi-period optimization model for strategic planning of a renewable hydrogen energy network from biomass waste and energy crops", *Energy*, 185, 527-540 (2019). doi: 10.1016/j.energy.2019.07.053

[7] **S. Cho**, S. Kim, J. Kim, "Life-cycle energy, cost, and CO_2 emission of CO_2-enhanced coalbed methane (ECBM) recovery framework", *Journal of Natural Gas Science of Engineering*, 70, 102953 (2019). doi:10.1016/j.jngse.2019.102953

[8] M. Lee, **S. Cho**, J. Kim, "A comprehensive model for design and analysis of bioethanol production and supply strategies from lignocellulosic biomass", *Renewable Energy*, 112, 247-259 (2017). doi:10.1016/j.renene.2017.05.040

[9] **S. Cho**, J. Kim, "An optimization-based planning of investment strategies for a renewable energy supply system from biomass utilization", *Korean Journal of Chemical Engineering*, 33, 2808-2819 (2016). doi:10.1007/s11814-016-0209-0

[10] **S. Cho**, Y. Woo, B. S. Kim, J. Kim, "Optimization-based planning of a biomass to hydrogen (B2H2) system using dedicated energy crops and waste biomass", *Biomass and Bioenergy*, 87, 144-155 (2016). doi:10.1016/j.biombioe.2016.02.025

[11] Y. Woo, **S. Cho**, J. Kim, B. S. Kim, "Optimization-based approach for strategic design and operation of a biomass-to-hydrogen supply chain", *International Journal of Hydrogen Energy*, 41(12), 5405-5418 (2016). doi:10.1016/j.ijhydene.2016.01.153

[12] **S. Cho**, J. Kim, "Feasibility and impact analysis of a renewable energy source (RES)-based energy systen in Korea", *Energy*, 85, 317-328 (2015). doi: /10.1016/j.energy.2015.03.081

Conference Proceedings

[1] **S. Cho**, I. E. Grossmann, "An optimization model for expansion planning of reliable power generation systems", 32nd European symposium on Computer Aided Process Engineering (ESCAPE32), *Computer-Aided Chemical Engineering*, 51, 841-846 (2022).

[2] **S. Cho**, I. E. Grossmann, "An optimization model for the design and operation of reliable power generation systems", 14th international symposium on process systems engineering (PSE2021+), *Computer-Aided Chemical Engineering*, 49, 709-714 (2022).

[3] **S. Cho**, W. Won, S. Han, S. Kim, C. You, J. Kim, "An optimization-based design and analysis of a biomass derived hydrogen energy system", 13th international symposium on process systems engineering (PSE 2018), *Computer-Aided Chemical Engineering*, 44, 1573-1578 (2018).

PRESENTATIONS **Oral Presentations**

[1] **S. Cho**, J. Tovar-Facio, I. E. Grossmann, "Generalized Disjunctive Programming (GDP) model for the optimal capacity planning of reliable power generation systems", 2022 AIChE Annual Meeting, Phoenix, USA (2022).

[2] **S. Cho**, J. Tovar-Facio, I. E. Grossmann, "Disjunctive optimization model for capacity planning of reliable power systems", 2022 INFORMS Annual Meeting, Indianapolis, USA (2022).

[3] **S. Cho**, I. E. Grossmann, "An optimization model for design and operation of reliable power generation systems", International Symposium on Process Systems Engineering (PSE 2021+), Kyoto, Japan (2022).

[4] **S. Cho**, I. E. Grossmann, "Optimization model for multi-period and multi-site capacity planning of reliable power generation systems", European Symposium on Computer Aided Process Engineering (ESCAPE32), Toulouse, France (2022).

[5] **S. Cho**, J. Kim, "An optimization-based design and analysis of spatial B2H2 (Biomass-To-Hydrogen) system", International Conference on Chemical and Polymer Engineering (ICCPE'15), Barcelona, Spain (2015).

Poster Presentations

[1] **S. Cho**, J. Kim, "Techno-economic assessment of CO_2-enhanced coalbed methane (CO_2-ECBM) based on life cycle analysis", 2016 KIChE autumn meeting, Daejeon, South Korea (2016).

[2] **S. Cho**, M. Lee, J. Kim, "Optimization-based analysis for a design of biomass to hydrogen (B2H2) supply system", 2016 KIChE Spring meeting, Busan, South Korea (2016).

[3] **S. Cho**, J. Kim, "Strategic planning of renewable energy systems: Investment analysis for biomass to hydrogen (B2H2) supply system in Korea", 2015 autumn KIChE meeting, Ilsan,

South Korea (2015).

[4] **S. Cho**, Y. Woo, B. S. Kim, J. Kim, "An optimization-based design and analysis of spatial B2H2 (Biomass-To-Hydrogen) system", 2015 KIChE spring meeting, Jeju, South Korea (2015).

[5] **S. Cho**, J. Kim, "Feasibility and sustainability assessment of renewable energy source (RES)-based energy system in Korea", 2014 KIChE autumn meeting, Daejeon, South Korea (2014).

REVIEW SERVICE

Energy Conversion and Management	2022 – present
INFORMS Journal on Optimization	2023 – present

AWARDS

Best Paper Award, International Conference on Chemical and Polymer Engineering	2015
Idea Prize, 7th National College and Graduate Energy Competition, South Korea	2015
Best Student Award, Incheon National University, South Korea	2015

SKILLS

Programming Languages | Python/Pyomo, GAMS, R

Computer-aided Process Simulation | Aspen PLUS, Aspen HYSYS

Energy Systems Analyzer | EnergyPLAN, iHOGA, TIMES/MARKAL, HOMER, SAM

Life Cycle Assessment Tools | GaBi, GEMIS

Languages | Korean (native), English (Proficient)

Last update: May 9, 2023