

Seolhee Cho

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EDUCATION	Carnegie Mellon University Ph.D. Candidate in Chemical Engineering GPA:4.0/4.0 Advisor: Prof. Ignacio E. Grossmann (Ph.D.) <i>Pittsburgh, PA, USA</i> <i>Aug 2020 – Present</i>
	Incheon National University M.S. in Energy and Chemical Engineering GPA:4.0/4.0 Advisor: Prof. Jiyong Kim (Ph.D.) <i>Incheon, South Korea</i> <i>Mar 2015 – Feb 2017</i>
	Incheon National University B.S. in Energy and Chemical Engineering GPA:3.7/4.0 <i>Incheon, South Korea</i> <i>Mar 2011 – Feb 2015</i>
RESEARCH EXPERIENCE	Ph.D. Student Carnegie Mellon University Supervised by Prof. Ignacio E. Grossmann (Ph.D.) <i>Pittsburgh, PA</i> <i>Aug 2020 – Present</i> 1) Optimization model and algorithm for expansion planning of reliable power systems <ul style="list-style-type: none">Proposed <i>Generalized Disjunctive Programming</i> (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) <ul style="list-style-type: none">Formulate a two-stage stochastic <i>Generalized Disjunctive Programming</i> (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 Supervised by Prof. Jiyong Kim (Ph.D.) <i>Incheon, South Korea</i> <i>Mar 2015 – Feb 2017</i> 1) Biomass-to-Hydrogen economy <ul style="list-style-type: none">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 <ul style="list-style-type: none">Proposed an MILP optimization model for the optimal selection of production technology and supply chain networkPerformed 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**

Research Scholar | KeyLogic

Pittsburgh, PA

Supervised by Miguel Zamarripa-Perez (Ph.D.)

Jun 2023 – Aug 2023

- Collaborated with National Energy Technology Laboratory (NETL) to develop an IDAES expansion planning toolset.
- Restructure the existing expansion planning code, and add new modeling and solution capabilities.
- Verify the modeling assumptions and validity of input parameters by working with other research teams in KeyLogic and perform analysis for the California case study

Researcher | Innovation Center for Chemical Engineering

Incheon, South Korea

Supervised by Prof. Jiyong Kim (Ph.D.)

Mar 2017 – Jul 2020

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 Journal Papers

- [1] M. Park, **S. Cho**, J. Kim, "Process design and global sensitivity analysis of hydrogen fuel station with dual-operating modes for a sustainable H_2 city: Iterative optimization-based simulation using Generalized Disjunctive Programming", *Sustainable Cities and Society*, Under review
- [2] **S. Cho**[†], T. N. Do[†], J. Kim, "Advanced design and comparative analysis of methanol production routes from CO_2 and renewable H_2 : via syngas vs. direct hydrogenation processes", *International Journal of Energy Research*, 2023, 6270858 (2023). <https://doi.org/10.1155/2023/6270858> [†] Contributed equally
- [3] **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). <https://doi.org/10.1016/j.compchemeng.2023.108243>
- [4] **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). <https://doi.org/10.1016/j.compchemeng.2022.107924>
- [5] **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). <https://doi.org/10.1016/j>

enconman.2021.114477. † Contributed equally

- [6] 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). <https://doi.org/10.9713/kcer.2020.58.3.346>. † Contributed equally
- [7] **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). <https://doi.org/10.1016/j.energy.2019.07.053>
- [8] **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). <https://doi.org/10.1016/j.jngse.2019.102953>
- [9] 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). <https://doi.org/10.1016/j.renene.2017.05.040>
- [10] **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). <https://doi.org/10.1007/s11814-016-0209-0>
- [11] **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). <https://doi.org/10.1016/j.biombioe.2016.02.025>
- [12] 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). <https://doi.org/10.1016/j.ijhydene.2016.01.153>
- [13] **S. Cho**, J. Kim, "Feasibility and impact analysis of a renewable energy source (RES)-based energy system in Korea", *Energy*, 85, 317-328 (2015). <https://doi.org/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 et al., "Optimization for Infrastructure Planning of Reliable and Carbon-neutral Power Systems: Application to San Diego County", 2023 AIChE Annual Meeting, Orlando, Florida, USA, November 5-10 (2023).
- [2] **S. Cho**, I. E. Grossmann, "A two-stage stochastic *Generalized Disjunctive Programming* (GDP) model for proactive capacity planning of resilient power systems and redispatch under disruptions", 45th Annual ChEGSA Symposium, Pittsburgh, USA, October 26-27 (2023).
- [3] **S. Cho**, I. E. Grossmann, "A two-stage stochastic *Generalized Disjunctive Programming* (GDP) model for proactive capacity planning of transmission systems and redispatch of generation systems to prevent electricity supply disruptions", 2023 YinzOR Student Conference, Pittsburgh, USA, August 25-26 (2023).

- [4] **S. Cho**, J. Tovar-Facio, I. E. Grossmann[†], “Optimization model for expansion planning of reliable and resilient power systems”, The 23rd Conference of the International Federation of Operational Research Societies (IFORS2023), Santiago, Chile, July 10-14 (2023). [†] [Presenter](#)
- [5] **S. Cho**, I. E. Grossmann, “Optimization model for expansion planning of reliable and resilient power systems under extreme scenarios”, 11th World Congress of Chemical Engineering (WCCE11), Buenos Aires, Argentina, June 4-8 (2023).
- [6] **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, Arizona, USA, November 13-18 (2022).
- [7] **S. Cho**, J. Tovar-Facio, I. E. Grossmann, “Disjunctive optimization model for capacity planning of reliable power systems”, 2022 INFORMS Annual Meeting, Indianapolis, USA, October 15-18 (2022).
- [8] **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, June 19-23 (2022).
- [9] **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, June 12-15 (2022).
- [10] **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, July 20-21 (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 KICChE 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 KICChE 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 KICChE 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 KICChE 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 KICChE autumn meeting, Daejeon, South Korea (2014).

REVIEW	Energy Conversion and Management	2022 – present
SERVICE	INFORMS Journal on Optimization	2023 – present
HONORS AND AWARDS	Honorable Mention Award , 45th Annual ChEGSA Symposium, Carnegie Mellon University	2023
	Chevron Fellowship , Department of Chemical Engineering, Carnegie Mellon University	2023
	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)	

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