

# Seolhee Cho

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EDUCATION	<b>Carnegie Mellon University</b> 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>
	<b>Incheon National University</b> 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>
	<b>Incheon National University</b> 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	<b>Ph.D. Student</b>   Carnegie Mellon University Supervised by Prof. Ignacio E. Grossmann (Ph.D.)	<i>Pittsburgh, PA</i> <i>Aug 2020 – Present</i>
	<b>1) Optimization model and algorithm for expansion planning of reliable power systems</b> <ul style="list-style-type: none"><li>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.</li><li>Considered the impact of operational strategies of generations (including dual role of generators) on power systems reliability.</li><li>Used a point failure probability and capacity failures states to estimate power systems reliability.</li><li>Developed a bilevel decomposition with tailored cuts to reduce computational expenses, and proved the effectiveness of the decomposition with case studies.</li><li>Perform a collaborative work with California Energy Commission to provide guidelines for establishing carbon-neutral and reliable power systems in California. (On-going)</li></ul>	
	<b>2) Proactive capacity planning of transmission systems and redispatch of generation systems to prevent electricity supply disruptions (On-going)</b> <ul style="list-style-type: none"><li>Formulate a two-stage stochastic <i>Generalized Disjunctive Programming</i> (GDP) model for expansion planning of transmission systems under disruption.</li><li>Consider line hardening and new installation as solution to improving resilience.</li><li>Propose a method to generate different disruption scenarios considering extreme weather depending on transmission systems network.</li></ul>	
	<b>Master student</b>   Incheon National University Supervised by Prof. Jiyong Kim (Ph.D.)	<i>Incheon, South Korea</i> <i>Mar 2015 – Feb 2017</i>
	<b>1) Biomass-to-Hydrogen economy</b> <ul style="list-style-type: none"><li>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.</li><li>Evaluated the impact of biomass-based hydrogen energy systems in terms of economics and environmental impact.</li><li>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.</li></ul>	
	<b>2) Biofuel infrastructure development</b> <ul style="list-style-type: none"><li>Proposed an MILP optimization model for the optimal selection of production technology and supply chain network</li><li>Performed a case study of Jeju Island, South Korea, to evaluate the feasibility of different ethanol-gasoline blends scenarios.</li></ul>	

**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 Papers**

- [1] **S. Cho**<sup>†</sup>, T. N. Do<sup>†</sup>, 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**
- [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). <https://doi.org/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). <https://doi.org/10.1016/j.compchemeng.2022.107924>
- [4] **S. Cho**<sup>†</sup>, C. Kim<sup>†</sup>, 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**
- [5] C. Jeong<sup>†</sup>, **S. Cho**<sup>†</sup>, J. Kim, "RFID-based integrated decision making framework for resource planning and process scheduling for a pharmaceutical intermediates manufacturing plant", *Ko-*

rean *Chemical Engineering Research*, 58(3), 346-355 (2020). <https://doi.org/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). <https://doi.org/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). <https://doi.org/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). <https://doi.org/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). <https://doi.org/10.1007/s11814-016-0209-0>
- [10] **S. Cho**, Y. Woo, B. S. Kim, J. Kim, "Optimization-based planning of a biomass to hydrogen (B2H<sub>2</sub>) 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>
- [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). <https://doi.org/10.1016/j.ijhydene.2016.01.153>
- [12] **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**, 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 (2023).
- [2] **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 (2023). † [Presenter](#)
- [3] **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 (2023).
- [4] **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).

- [5] **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).
- [6] **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).
- [7] **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).
- [8] **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 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 SERVICE	Energy Conversion and Management INFORMS Journal on Optimization	2022 – present 2023 – present
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AWARDS	Chevron Fellowship, Department of Chemical Engineering, Carnegie Mellon University Best Paper Award, International Conference on Chemical and Polymer Engineering Idea Prize, 7th National College and Graduate Energy Competition, South Korea Best Student Award, Incheon National University, South Korea	2023 2015 2015 2015
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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: September 23, 2023*