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**Syllabus: Independent Study - Industrial Decarbonization (ENVS-490)**

**Course Information**

Industrial Decarbonization Independent Study

ENVS-490-003

Credits: 3

Summer 2021

Asynchronous

**Instructor Information**

Instructor: Dr. Sauleh Siddiqui

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Office Hours: By appointment

**Course Overview**

The industrial sector is a primary driver of growing GHG emissions, they are some of the most difficult emissions to address, and mitigating them is critical to achieving a global zero-carbon energy system. This independent study will focus on deep decarbonization pathways for the emissions-intensive industrial processes of concrete, steel, and industrial-chemicals (plastics, fertilizers, etc.). The objective of the project will be to outline a specific research question, in the context of industrial decarbonization, that has yet to be addressed by the scientific community and to create a project report or deliverable that summarizes the research.

**Student Learning Outcomes**

* Identify the life-cycle GHG emission sources of the most energy and emissions intensive industrial process.
* Evaluate strategies and technologies that can accelerate industrial decarbonization.
* Understand the impact technological, economic, social, and political factors have on industrial decarbonization.
* Identify potential decarbonization pathways for the industrial sector.
* Explore a specific issue or topic relevant to industrial decarbonization.

**Grading and Assessment**

*Grading Scale*

Final Percent Grade

93%-100% A

90%-92% A-

87%-89% B+

83%-86% B

80%-82% B-

77%-79% C+

73%-76% C

70%-72% C-

60%-69% D

Under 60% F

*Final Grade Calculation*

 Project Proposal 10%

 Project First Draft 15%

 Preliminary Project 20%

 Final Project 25%

 Weekly Research Journals (5% each) 30%

 100% Total

**Course Outline**

| **Days** | **Deliverable/Topic** |
| --- | --- |
| 6/30 | Project Proposal/Deliverables |
| 7/02 (12:00 pm) | Weekly Research Journal #1 |
| 7/09 (12:00 pm) | Weekly Research Journal #2 |
| 7/16 (12:00 pm) | Weekly Research Journal #3 |
| 7/23 (12:00 pm) | Weekly Research Journal #4 |
| 7/28 | Project First Draft |
| 7/30 (12:00 pm)  | Weekly Research Journal #5 |
| 8/04 | Preliminary Project Deliverable |
| 8/06 | Weekly Research Journal #6 |
| 8/11 | Final Project Deliverable |
| 8/14 | End of Term Grades Due |

**Final Project Deliverable**

**Working Bibliography**

Cao, Z., Masanet, E., Tiwari, A., Akolawala, S. (2021) Decarbonizing Concrete: Deep

decarbonization pathways for the cement and concrete cycle in the United States, India,and China. *Industrial Sustainability Analysis Laboratory, Northwestern University*. Evanston, IL. <https://www.climateworks.org/report/decarbonizing-concrete/>

Dell, R. (2020). Build Clean: Industrial Policy for Climate and Justice. *ClimateWorks Foundation*. [https://www.climateworks.org/report/build-clean-industrial-policy-for-climate-and-justice](https://www.climateworks.org/report/build-clean-industrial-policy-for-climate-and-justice/)

Friedmann, S. J., Fan, Z., & Tang, K. (2019). Low-Carbon heat solutions for heavy industry: sources, options, and costs today. *Columbia Center on Global Energy Policy*, (October), 44–49. <https://www.energypolicy.columbia.edu/sites/default/files/file-uploads/LowCarbonHeat-CGEP_Report_100219-2_0.pdf>

Hasanbeigi, A., Kirshbaum, L., Collison, B., Gardiner, D. (2021) Electrifying U.S. Industry: A Technology- and Process-Based Approach to Decarbonization. *Renewable Thermal Collaborative.* <https://www.renewablethermal.org/wp-content/uploads/2018/06/Electrifying-U.S.-Industry-2.1.21-1.pdf>

Nelson, L., Lin, J. et al. (2020) Green Hydrogen Guidebook*.* *Green Hydrogen Coalition*.

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Rissman, J., Bataille, C., Masanet, E., Aden, N., Morrow, W. R., Zhou, N., … Helseth, J. (2020). Technologies and policies to decarbonize global industry: Review and assessment of mitigation drivers through 2070. *Applied Energy*, 114848. <https://doi.org/10.1016/j.apenergy.2020.114848>

Roelofsen, O., Somers, K., Speelman, E., & Witteveen, M. (2020). Plugging in: What electrification can do for industry. *McKinsey & Company*. <https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/plugging-in-what-electrification-can-do-for-industry>