

Thesis Project Portfolio

Power Plant Design using Allam Cycle CCS

(Technical Report)

**Top-Down Approach to Influencing Carbon Capture and
Sequestration Policy: Why the Bottom-Up Approach Will Fail**

in Generating Effective Policy for CCS Technologies

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Table of Contents

Sociotechnical Synthesis

Power Plant Design using Allam Cycle CCS

Top-Down Approach to Influencing Carbon Capture and Sequestration Policy: Why the Bottom-Up Approach Will Fail in Generating Effective Policy for CCS Technologies

Prospectus

Sociotechnical Synthesis

There is substantial data indicating that the globe is undergoing a period of rapid and human caused warming. The international panel on climate change lists anthropogenic CO₂ emissions as the primary reason for this period of warming. Current statistics show that temperatures are already 1 °C warmer on average than preindustrial times and to prevent permanent damage to most ecosystems that number needs to be halted at 1.5 °C before the end of the century. With that in mind there is an urgency to find methods of energy generation that can eliminate carbon emissions. To meet this urgency, I have designed an environmentally friendly power plant. In addition, I have done some extensive research into flaws with the current environmental policy making system.

In the technical portion of my thesis, I designed a power plant that burns fossil fuels but still manages to capture and sequester all of the CO₂ generated via combustion. It has the benefit of being a bridging technology. Renewables simply are not capable of handling the load of modern-day energy demands, yet there is a very urgent need to make sure that CO₂ emissions are eliminated. With that in mind, this technology is the perfect solution to both of these issues; however, it's greatest strength, is also its greatest weakness. Because the power plant is a bridging technology, it suffers from having very little public awareness and support.

In my STS research, I focused on fundamental flaws in the environmental policymaking process. Using a framework put forth by Giels, I analyze the policymaking landscape in the USA and point out substantial flaws in continuing to use a "bottom-up" approach to making policy. Instead of waiting for local governments to start making policy that will be adopted later on by higher levels of government, there is already international policy in place that should be trickled down. Instead of a "bottom-up" approach, I propose using a "top-down" approach. The paper also discusses how using a top-down approach to policy making is in line with the urgency associated with this topic.

These projects were heavily influenced by each other. The technical portion was designed to provide a solution to an urgent climate change problem while the STS portion provided a means to effectively implement that design. By doing both of these in tandem with each other I gained a complete understanding of the sociotechnical systems at play in the climate change landscape. These projects exemplify actor network theory in action by showing how a particular actor, especially one as large as a power plant, needs a firm network surrounding it to reach its fullest potential.

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