

## **Socio-Technical Synthesis**

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

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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My technical and STS projects both address the broader socio-technical problem of climate change and the reduction of greenhouse gases. The technical work I have completed details carbon dioxide capture in concrete production utilizing the processes of oxy-fuel combustion and accelerated carbonation curing. My STS research focuses on deforestation in the Brazilian-Amazon, specifically the details around why government initiatives (rollbacks) have not effectively curbed deforestation rates, using Actor Network Theory. Deforestation, or the removal of trees, relates to my technical work in that trees are a natural source of carbon dioxide capture, while the focus of my technical work is a process design for carbon dioxide capture.

The technical project focuses on integrating the processes of oxy-fuel combustion and accelerated carbonation curing into concrete production to reduce emissions associated with the process. The process utilizes a Reduced Emission Oxygen (REO) kiln, which mixes a pure oxygen stream and sedimentary materials to form clinker (the precursor, small pellets, to cement), and converts oxygen into carbon dioxide (CO<sub>2</sub>) via oxy-fuel combustion. This CO<sub>2</sub> is then taken off as a waste stream, and purified (water vapor and other components are removed) into almost pure gaseous CO<sub>2</sub>. This gaseous CO<sub>2</sub> is then introduced to the concrete (dust made from the clinker, mixed with aggregate and water). The process of accelerated carbonation curing allows the concrete to capture the CO<sub>2</sub>.

For the STS project, deforestation in the Brazilian-Amazon is analyzed in the framework of Actor Network Theory. Actor Network Theory is the combination of social and technical actors within an environment to create a network (Law, 235). This network is formed by a network builder, whose function is to establish roles in the network and solve problems. Some actors in a network can be considered “rogue” actors, or those attempting to undermine the system in place: in this case, rollbacks to reduce Brazilian deforestation. Examples of rogue

actors brought forward in the STS project include the Brazilian President Bolsonaro, the United States, China, and the United Nations.

By doing both projects simultaneously, instead of independently, I was able to obtain an understanding of entities that would oppose the development of a new CCS technology, like the novel process designed in the technical project. In the context of the STS project, trees (a natural form of CCS) were torn down due to a number of rogue actors. Similar actors in the network of concrete production may work to undermine the technology detailed in the technical project. Therefore, by studying the STS project, I was able to uncover motives and other characteristics of actors that may wish to undermine the carbon-capturing concrete network; information which can be taken into account when developing and/or making recommendations with regard to this technology.

#### Reference

Law, J. (1987). On the social explanation of technical change: The case of the Portuguese maritime expansion. *Technology and Culture*, 28(2), 227-252. doi:10.2307/3105566