

Panel: Recipes for Success in a Mineralization Program

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The Six Sins of Greenwashing

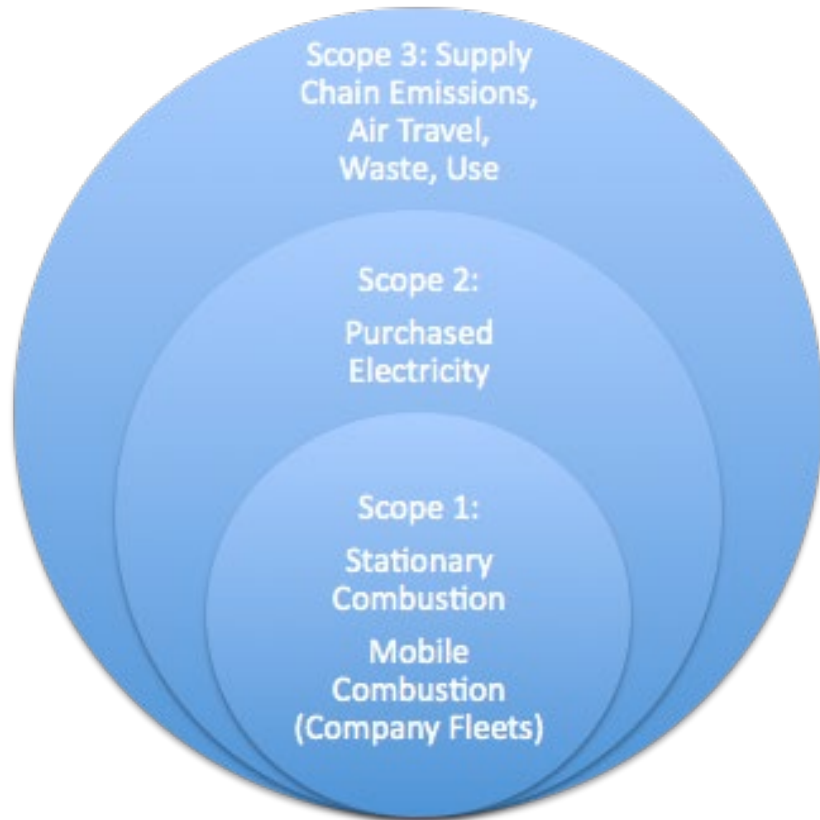
1. Sin of the Hidden Trade-Off (57% of the sins)
 - Is carbon sequestration always good for the environment?
2. Sin of No Proof (26%)
3. Sin of Vagueness (11%)
4. Sin of Irrelevance (4%)
5. Sin of Lesser of Two Evils (1%)
6. Sin of Fibbing (1%)



This mobius loop is intended to mean that the product is made from recycled material. But is it the whole product, or the package? And is it made of 100% recycled material, or less? And is it post-consumer waste, or post-industrial waste? Without a qualifying statement, the symbol is likely to mislead the buyer, committing the Sin of Vagueness.

Keys for Sustainable Process Development:

1. Life Cycle Thinking



For an average product, scopes 1 & 2 only account for 26% of total carbon emissions.

However, scope 3 is often neglected.

- Scope 3 = “Everything else”
- Upstream and downstream!

To sequester carbon, how much carbon emission was generated throughout the process life cycle?

Key 2: Process Optimization with Example

- Optimized a bioleaching process, using biolixiviant derived from corn stover, to extract Li, Co, Mn, and Ni from black mass.
- Economic analysis to increase net present value (NPV).



Finding Optimal Conditions

- To maximize NPV, design of experiments was conducted with additional help from thermodynamics modeling.



Global Warming Potential of Optimized Process

- Lower than other leaching methods due to lower acid consumption, mild chemical use, and efficient Co recovery.

Key Takeaways

1. Life cycle thinking
2. If we can't measure it, we can't manage it.
3. Identify cost drivers and environmental hotspots
 - What are the major bottlenecks?
4. Suggest improvement opportunities
 - Material/energy choice, process design/engineering, etc.