

Life Cycle Assessment (LCA) of overhead vs. underground primary power distribution in Southern California Santa Barbara Bren School of Environmental Science and Management Southern California Southern California

University of California, Santa Barbara

Southern California Edison

Sarah Bumby, Katya Druzhinina, Rebe Feraldi, Danae Werthmann; Faculty Advisor: Roland Geyer

Problem

Overhead Cable

Steel Castings

Plastic Insulators

Wooden

Production

Installation

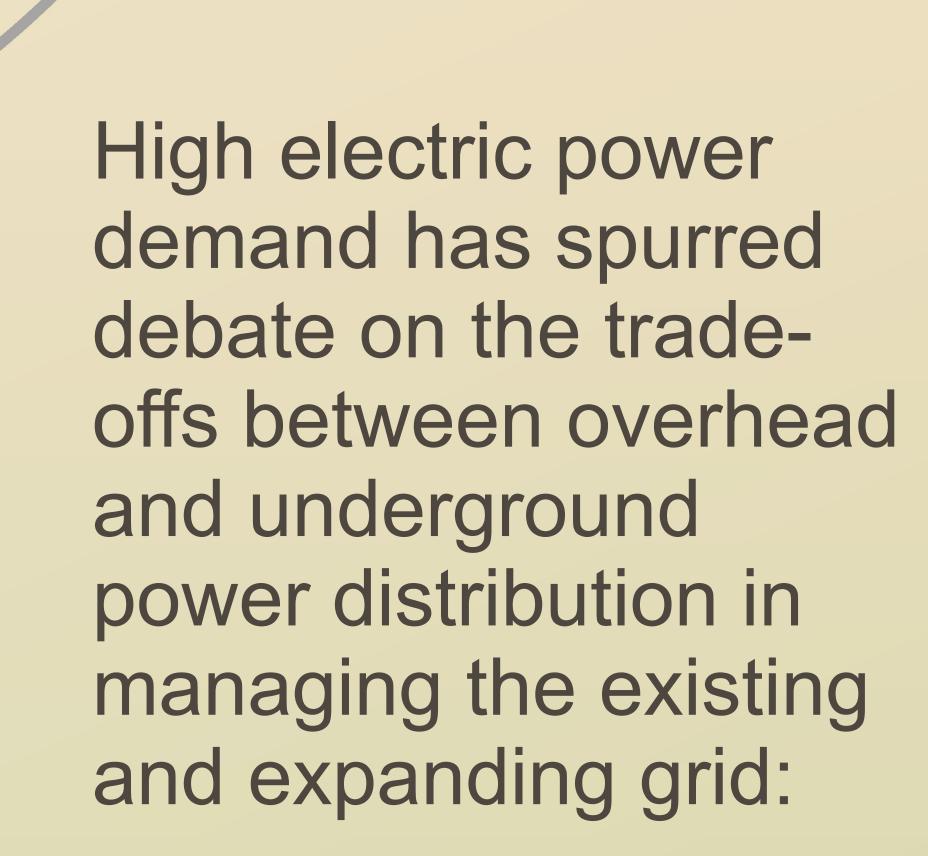
Maintenance

End-of-Life

Transportation

Decommissioning

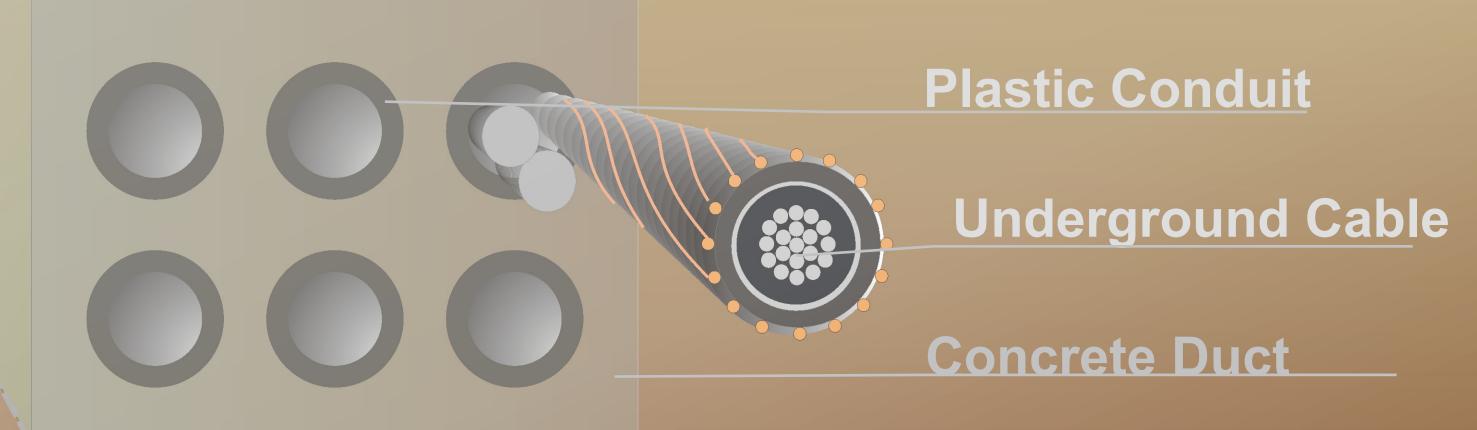
Utility Pole



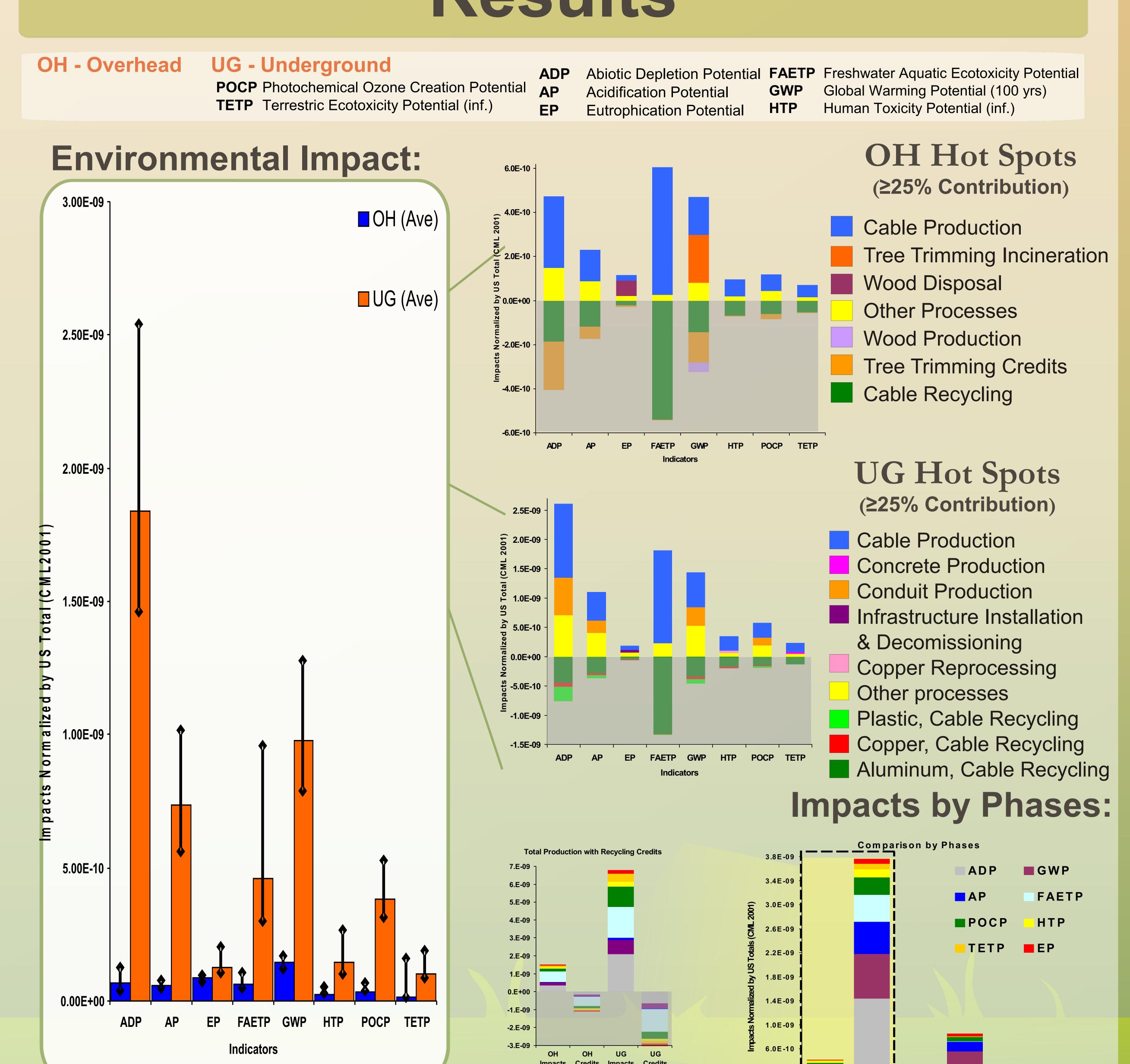
	Overhead (OH)	Underground (UG)
Aesthetics		
Safety		
Reliability		
Cost		
Lifetime		
Environmental Impact		

Project Goal:

Perform a comparative Life Cycle Assessment of overhead (OH) versus underground (UG) primary power distribution systems



Results



Most of the impact happen in the production and end-of-life phases. Thus, supply chain collaboration is critical in reducing environmental impacts

Overhead system has less impact across all indicators, in all scenarios

Recommendations:

- Encourage stakeholders nationwide to consider the larger environmental impacts of an underground system in the decision-making process regarding primary power distribution;
- Southern California Edison should engage in green supply chain management since most environmental impacts occur upstream & downstream of their corporate boundaries;
- Use the developed model and 'hot spot' analysis to investigate alternatives for materials, and component and process désigns

Method

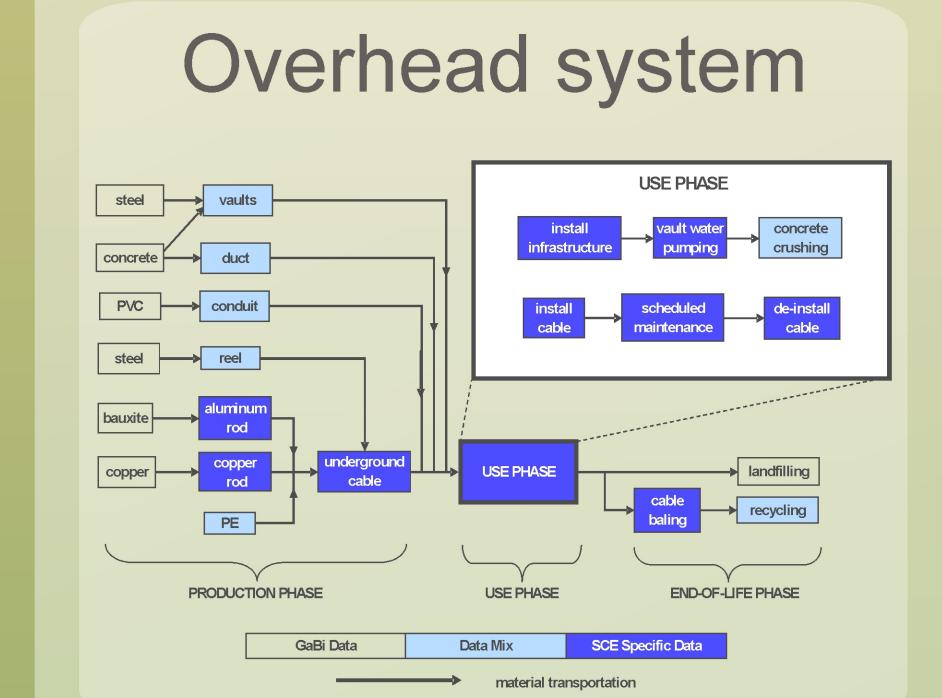
Data & Tools:

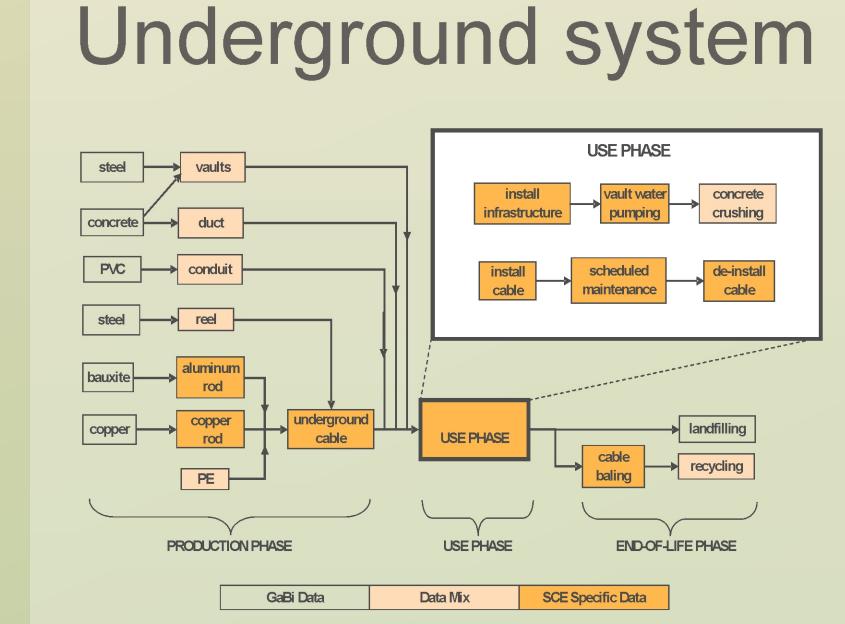
- Data from Client & their Supply Chain
- GaBi 4.3 Life Cycle Assessment Software - Proprietary Inventories Balancing Tool
- **Ecoinvent Inventory Database**

Functional Unit:

1 circuit mile of power line for the delivery of medium voltage power over 1 year, including infrastructural components

Flow Diagrams:





Parameterization & Sensitivity Analysis

Parameter	Range
OH Cable Lifetime	30-50 years
OH Infrastructure Capacity	1-4 circuits per pole
UG Cable Lifetime	20-40 years
UG Infrastructure Capacity	1-6 circuits per duct
UG Infrastructure Lifetime	100-150 years
OH Cable Recycling Rate	0.911 - 0.950
UG Cable Recycling Rate	0.727 - 0.950
PCP Leaching to Soil	0% (no leaching)
	to 100% (all PCP leaches)

Assumptions & Limitations

- Simplest topography assumed
- Did not account for transformers
- Did not account for impacts from land use and electromagnetic fields, due to the controversy and complexity of the issues