



Techno-economic, Decarbonization, and Decision Making

Samantha Reese

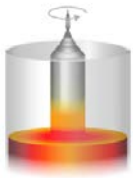
Industrial Summer Study 2023

Detroit, MI

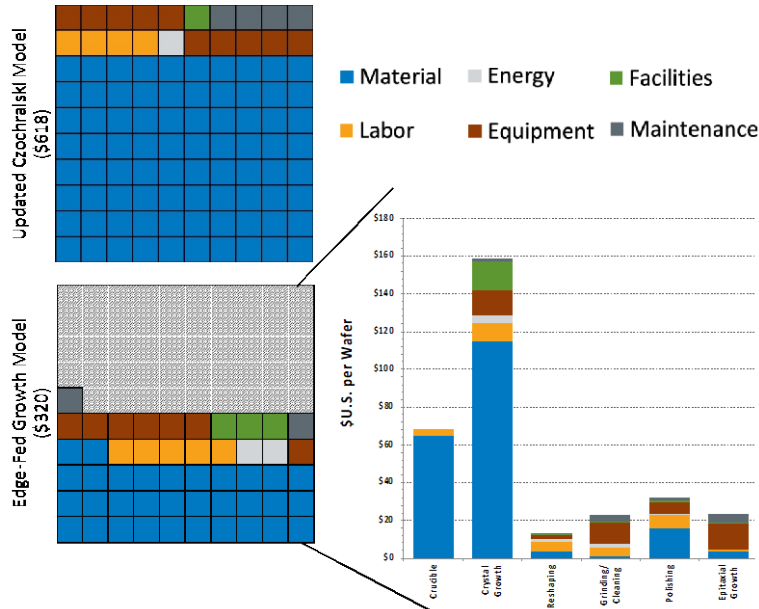
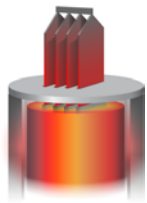
Bottoms-up Cost Analysis

- Evaluate early TRL work
 - Example: Ga₂O₃ Potential

Czochralski Method



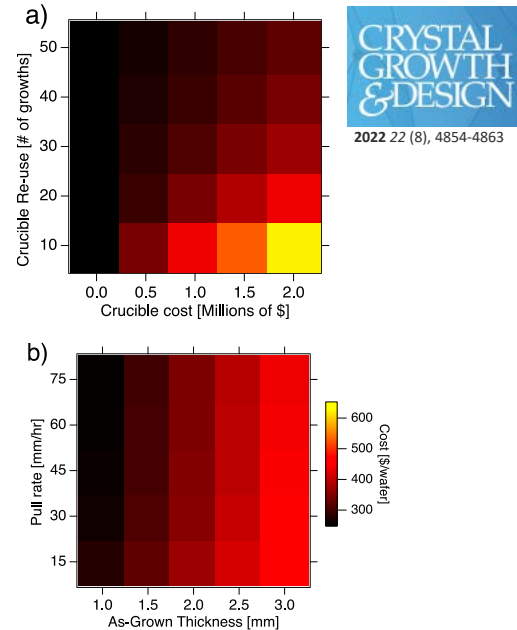
Edge-defined Film-fed Growth Method



Joule
Volume 3, Issue 4, 17 April 2019, Pages 903-907



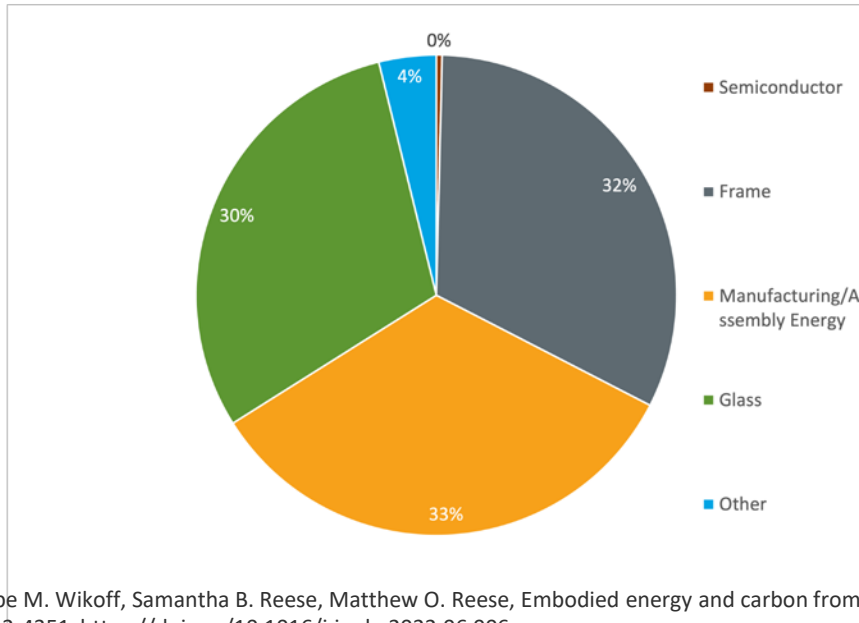
Future Energy
How Much Will Gallium Oxide Power Electronics Cost?
Samantha B. Reese¹, Timothy Remo¹, Johnney Green², Andriy Zakutayev¹



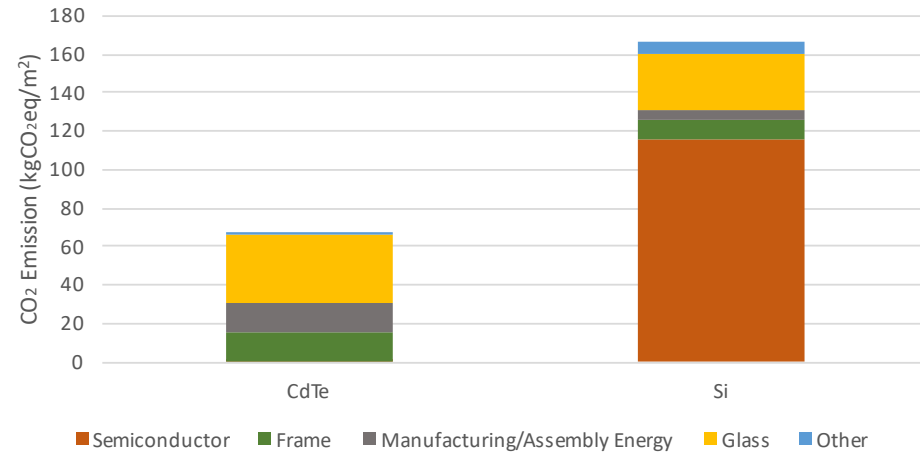
CRYSTAL GROWTH & DESIGN
2022 22 (8), 4854-4863

Economics of Emissions

- Understand where emissions are coming from
- Implications against other technologies



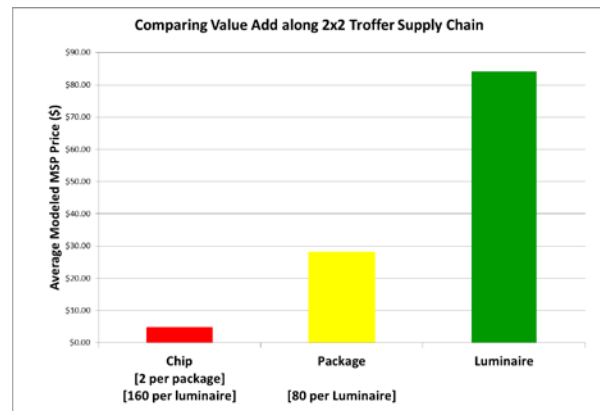
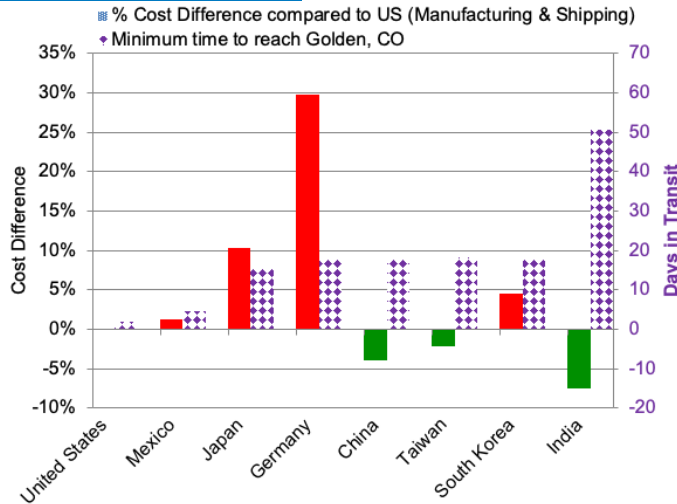
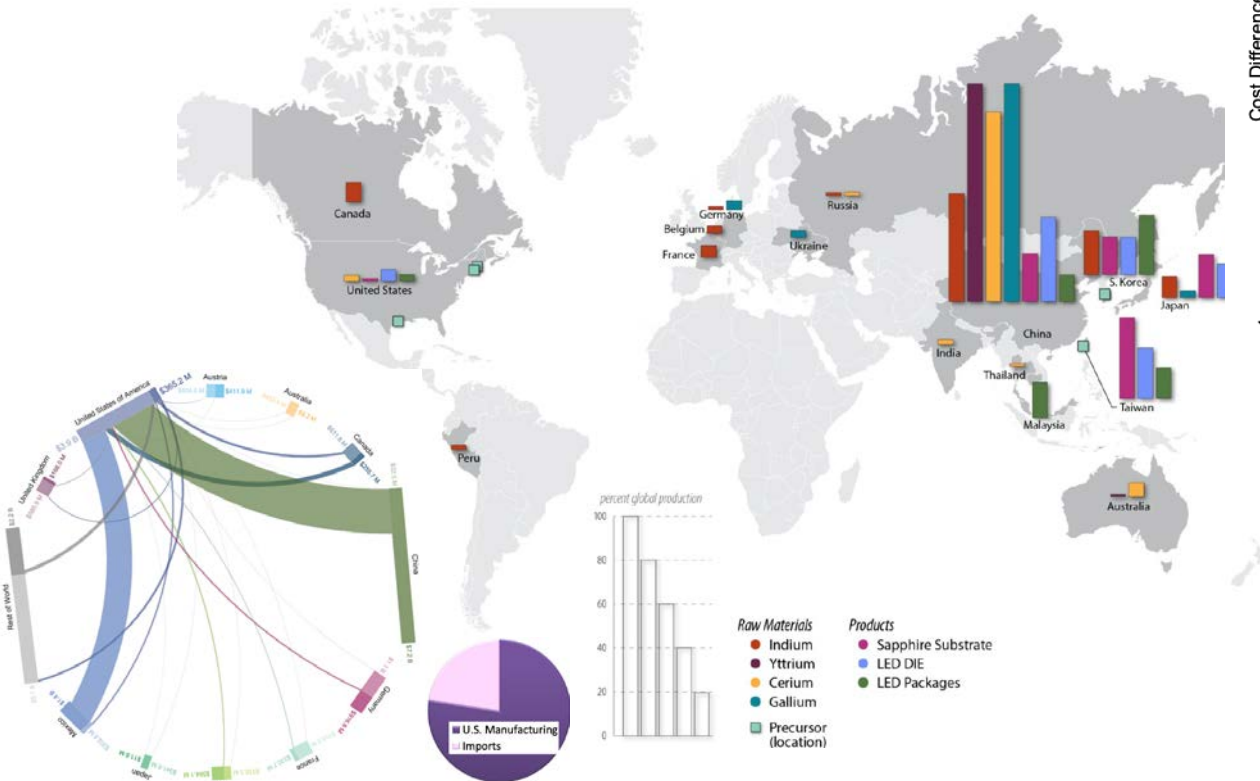
CO2 Contributions by Material



Carbon tax could mean ~\$0.02-0.04/W difference for Silicon vs. CadmiumTelluride manufactured in US

Supply Chain

- Understand value chain and logistics



Questions?

www.nrel.gov

Samantha.Reese@nrel.gov

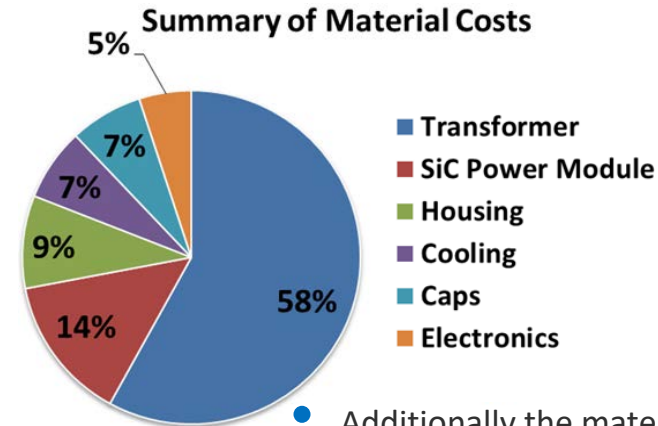
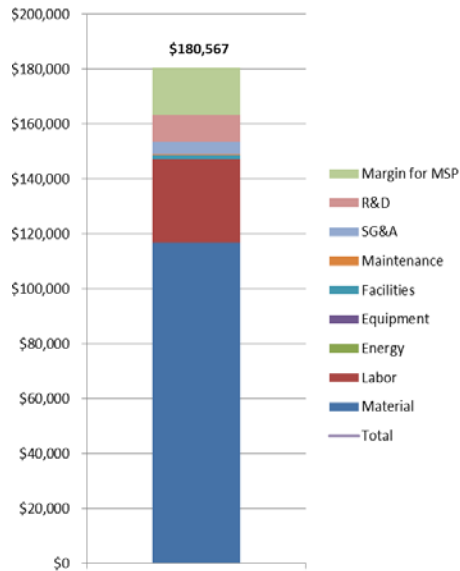
NREL/PR-6A20-86873

This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by the United States Department of Energy Office of Energy Efficiency and Renewable Energy Advanced Manufacturing Office now the Industrial Efficiency and Decarbonization and Advanced Materials and Manufacturing Technologies Offices. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.



System Manufacturing Cost Comparison

- The minimum sustainable price (MSP) of new technology can be calculated and compared to incumbent technology
- In this example a medium voltage variable frequency motor drive using SiC power electronics is comparable in price to incumbent technology based on Si



- Additionally the material cost analysis shows that further gains could be realized if SiC based electronics replace the transformer in the motor drive

Lithium Ion Batteries

