Superconductor Use in Energy Production Efficiency

Benjamin Zak, Nathen Urry, Nick Molchak, Carson Smith
Cleveland State University

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ABSTRACT

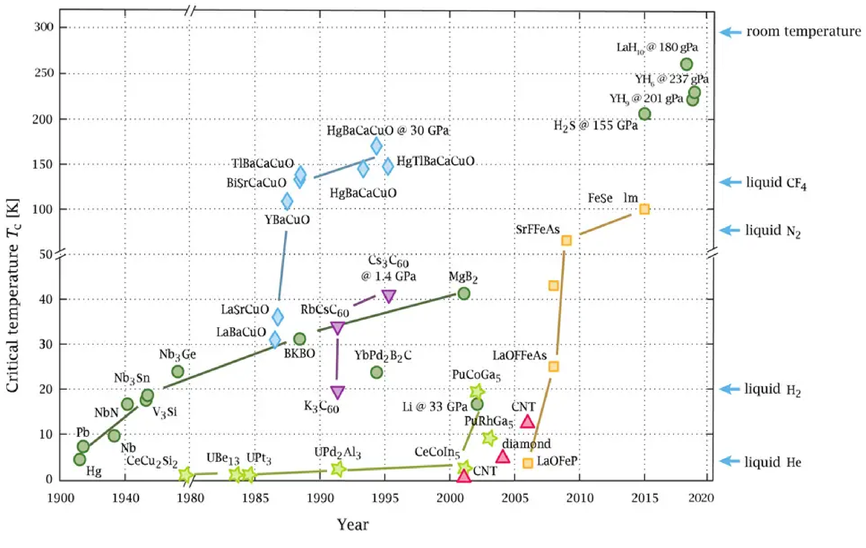
Majority of power produced in the United States is not even harnessed, instead it is lost in conversion. If there was a way to cut that loss down it could mean huge savings, less fossil fuel usage, and more capability for green energy. High temperature superconductors that have no resistance to electric flow could be the key to removing this huge power loss. This change can cut back the required use of fossil fuels, enable the capability to switch the United States to a greener power production, and save money. With advancements in superconductors this could become a reality.

INTRODUCTION

Superconductors are materials that under certain conditions has no resistance to electron flow. This means there is no loss of energy while electrons flow through the material. However, these conditions tend to have to be extreme in order to produce the superconductor effect. These conditions are temperature and pressure. With extremely cold temperature or high pressures this makes majority of superconductors unreasonable for widescale use.

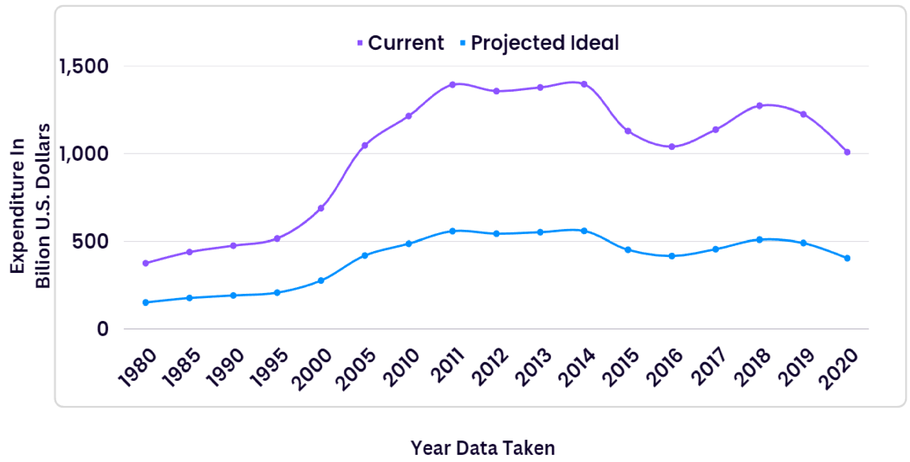
OBJECTIVES

Through research discover how much potential high temperature superconductors have in the current energy production process and provide examples of possible superconductors with a manageable critical temperature and pressure.



Timeline of the discovery for advancements in superconductors (1900-2020)

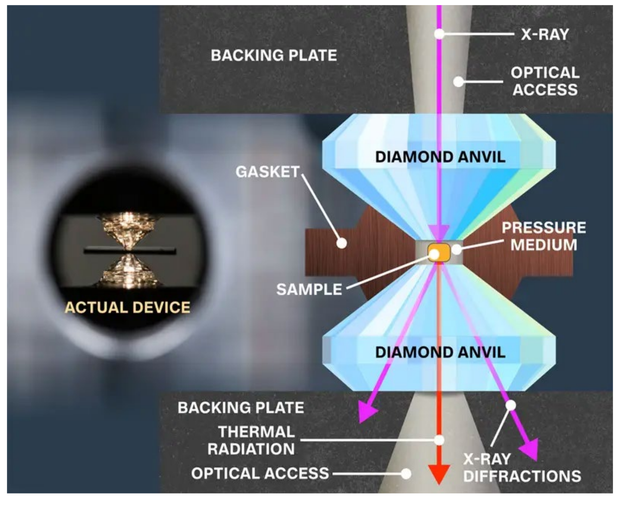
Energy Expenditure



USA expenditure on energy production in billions (current vs ideal)

RESULTS

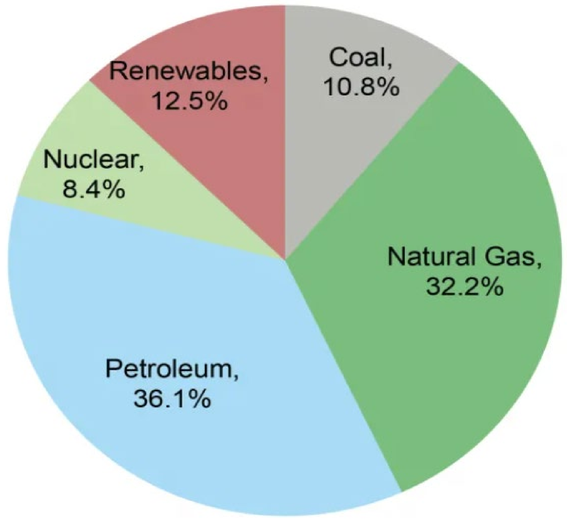
- Many high temperature super conductors capable of being cooled by liquid N2 or CF4
- 17073.13 Billion U.S. Dollars spent on energy years 1980-2020 (Statista)
- If we cut down the energy lost and made it ideal it would have been 6829.252 billion instead (Statista)
- Room temperature superconductor was discovered however requires such a high pressure it isn't feasible but shows promising potential (Rochester)
- With this cut down on energy loss the amount of fossil fuel usage can be cut down



Model of how a room temperature superconductor was created (Rochester Lab)

CONCLUSIONS

High temperature super conductors can have a huge impact on the efficiency of power production. Sixty percent of the power generated is lost in conversion. Being able to cut that loss down is very impactful to cost, and green energy. There are high temperature superconducts that can be applicable, however some require an unmanageable pressure. With the discovery of a room temperature superconductor this is coming closer to a possibility.



Percent material consumption for current energy production

FUTURE WORK

The other paths needed to be explored is if this is even reasonable cost productive path, and how to incorporate high temperature superconductors into the energy production process.

References

"Expenditure on energy in the United States from 1980 to 2020." Statista, Jan 31 2023

"U.S. Energy System Factsheet." Center For Sustainable Systems University Of Michigan, 2021, Pub. No. CSS03-11

"Room temperature superconductor? Rochester lab sets new record toward long-sought goal." University of Rochester, March 30 2021

Acknowledgments (Calibri, 40 points, bold)

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