Can fusion help decarbonize the US power sector?

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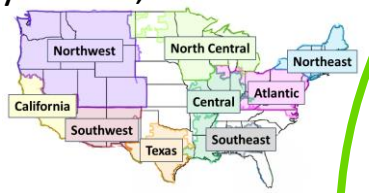
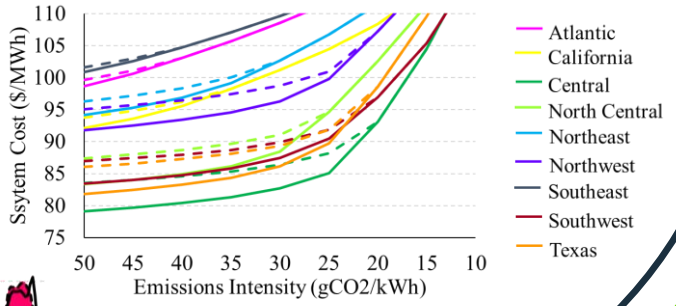
Introduction

- The US has goals to achieve a carbon neutral electric grid by 2035, but EIA's 2023 Energy Outlook projects a 2035 emissions intensity of ~150 gCO_2/kWh
- Unique solutions required for each region
- Fusion is safe, energy-dense, renewable option, but is complex, expensive and still developing



Research Highlights

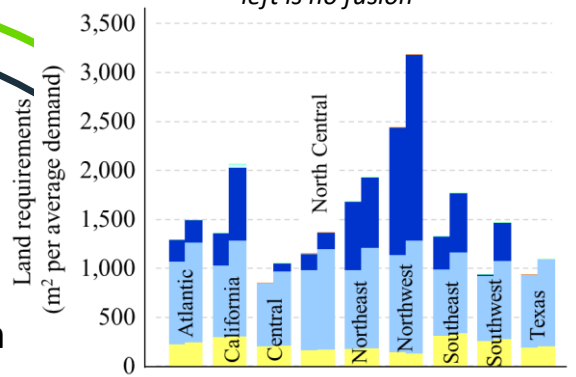
- Fusion is a major contributor in all regions at low emissions ceilings
- Forcing fusion into the system at more lenient carbon caps increases system price by 1-6%



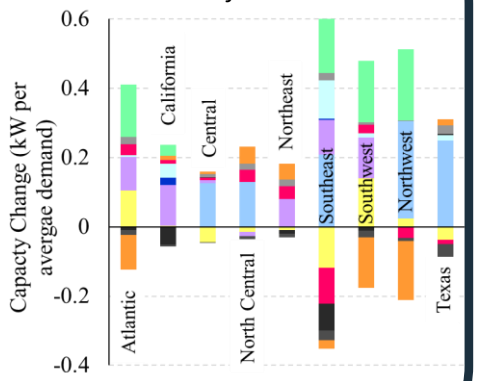
- Fusion is competitive in land-restricted regions

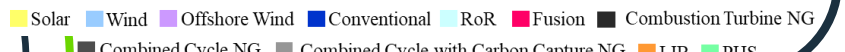
Graphs

Right column is 10% fusion, and left is no fusion



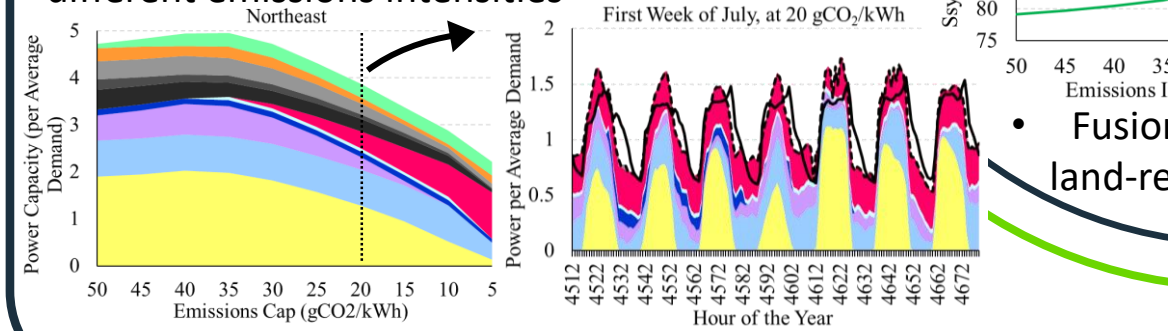
Positive values indicate an increase when fusion is baseload





Methods

Linear programming is used to determine least-cost design of electric grid, at different emissions intensities



Discussion

- Fusion becomes economically viable at carbon ceilings of 40 – 20 CO_2/kWh
- Restricting fusion to baseload operations has a non uniform affects on regions. To compensate, regions will either:
  a) invest in other technologies
  b) increase fusion capacity
- Souring 10% of electricity load from fusion can decrease land requirements by up to 33%

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