Demographic Analysis for Nuclear Reactor Siting

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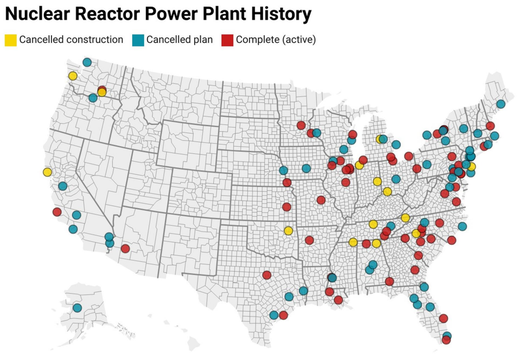
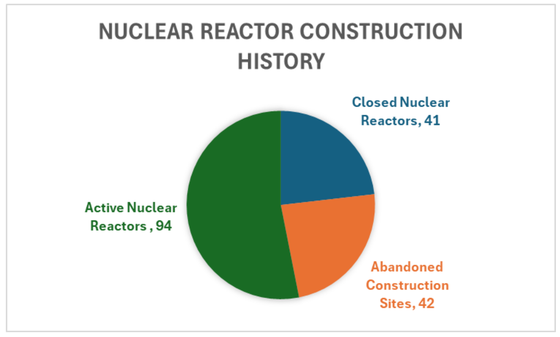
Background:

Since the development of the first nuclear power plants in the United States, dozens of additional reactors have been proposed or begun construction, only to be abandoned before reaching operational status. These cancellations were often the result of compounding factors such as budget overruns, public and political opposition, shifting regulations, and a decreasing demand for electricity. Understanding why these projects failed is crucial for shaping the future of nuclear energy development.

This research examines historical reactor outcomes to identify site-related challenges. By analyzing where and why cancellations occurred, the study highlights common factors and patterns that contributed to project failure.

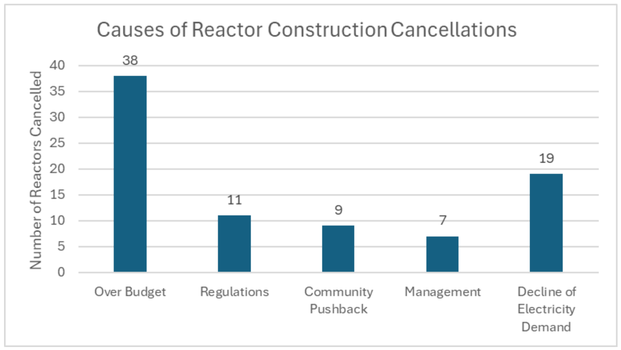


Source: Ihédate, & ihedate. (2021, April 22). World Nuclear Power Reactors 1951–2022 - The WNISR Interactive DataViz. World Nuclear Industry Status Report. https://www.worldnuclearreport.org/reactors.html#tab=iso



Outcomes of 177 U.S. nuclear reactors, highlighting the number of discontinued projects and the importance of informed site selection.

Source: Ihédate, & ihedate. (2021, April 22). World Nuclear Power Reactors 1951–2022 - The WNISR Interactive DataViz. World Nuclear Industry Status Report. https://www.worldnuclearreport.org/reactors.html#tab=iso

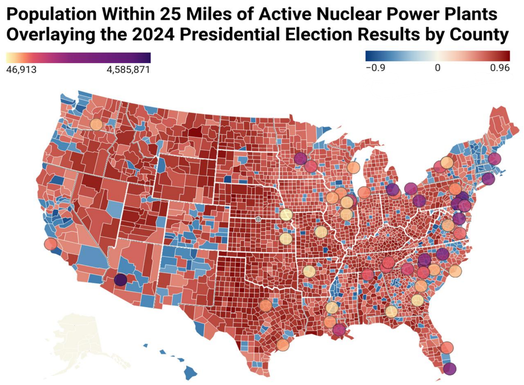


Common reasons behind the cancellation of 42 nuclear reactor projects, each having multiple contributing factors that led to its cancellation.

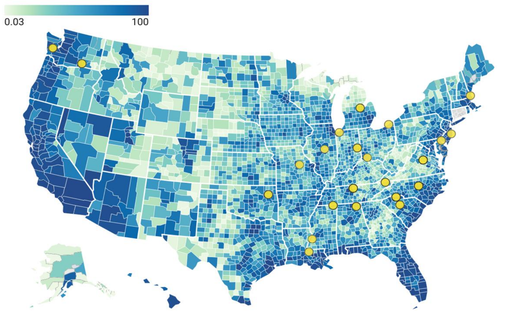
Source: Ihédate, & ihedate. (2021, April 22). World Nuclear Power Reactors 1951–2022 - The WNISR Interactive DataViz. World Nuclear Industry Status Report. https://www.worldnuclearreport.org/reactors.html#tab=iso

Methodology:

- Collected and processed datasets across key categories:
  - Demographics: population density, education levels, population growth, political affiliation
  - Socioeconomics: poverty rate, unemployment, average income, crime rate
  - Environmental: natural disaster risk, average yearly and summer temperature, wet bulb temperatures
- Analyzed existing operational, cancelled, and failed reactor sites for patterns in siting outcomes.
- Incorporated the FEMA National Risk Index to assess each county's exposure to natural hazards and resilience.
- Mapped energy production and consumption data to highlight counties with energy deficits or surpluses.



Source: CNN. (2024). Election 2024: Presidential results. CNN. https://www.cnn.com/election/2024/results/president?election-data-id=2024-PG&election-painting-mode=projection-with-lead&filter-key-races=false&filter-flipped=false&filter-remaining=false
Bureau, U. C. (2022). County Population Totals: 2020-2023. Census.gov. https://www.census.gov/data/tables/time-series/demo/popest/2020s-counties-total.html

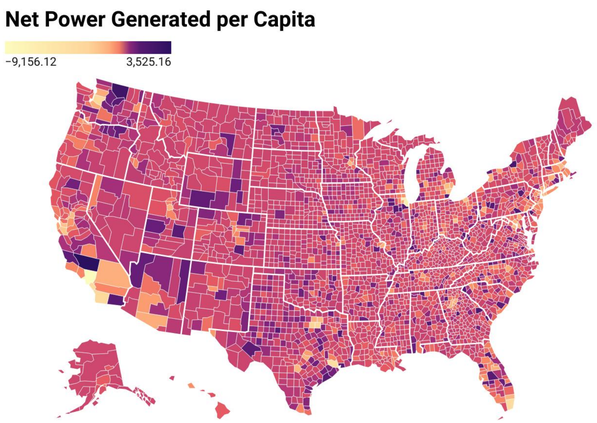


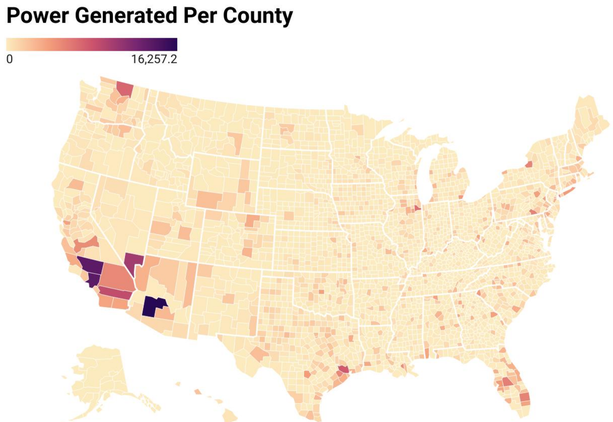
Expected Annual Loss (EAL) represents the average yearly financial impact of natural hazards. Each county is assigned a standardized score based on its relative risk—where higher scores indicate areas more prone to costly disasters.

Source: Expected Annual Loss | National Risk Index. (n.d.). Hazards.fema.gov. https://hazards.fema.gov/nri/expected-annual-loss

Objective:

- Identify key factors influencing successful and failed nuclear reactor projects.
- Analyze county-level data across demographic, socioeconomic, and environmental variables.
- Develop a statistical framework to evaluate potential reactor sites.
- Align site selection criteria with both public acceptance and technical feasibility.
- Provided data-driven insight for potential socioeconomic impact.





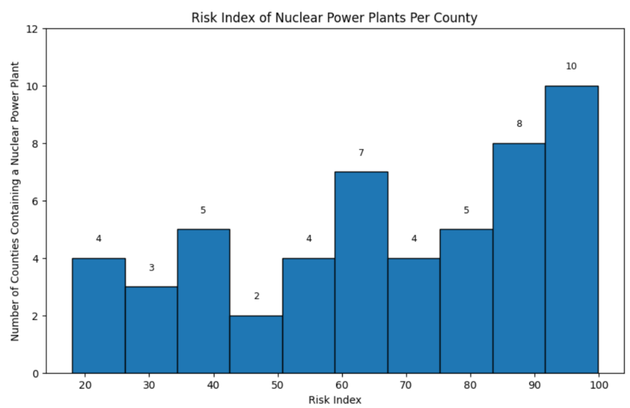
Power output by population shows counties with energy deficits or surpluses, assisting in the identification of areas that may benefit from additional power sources.

Source: Power Plants. (2020). Eia.gov. https://atlas.eia.gov/datasets/eia::power-plants/explore?location=33.740816%2C61.504000%2C2.71
Bureau, U. C. (2022). County Population Totals: 2020-2023. Census.gov. https://www.census.gov/data/tables/time-series/demo/popest/2020s-counties-total.html

Source: Power Plants. (2020). Eia.gov. https://atlas.eia.gov/datasets/eia::power-plants/explore?location=33.740816%2C61.504000%2C2.71

Results:

- Public and political acceptance is influenced by population demographics, income levels, education, and political affiliation.
- Counties with lower education and income levels often show higher resistance to nuclear development.
- Risk index analysis suggest that environmental hazards and community factors may influence siting decisions.
- Preliminary findings suggest that both technical and social conditions play a role in the outcome of a reactor project.



Source: Data Resources | National Risk Index. (2024). Fema.gov. https://hazards.fema.gov/nri/data-resources#csvDownload
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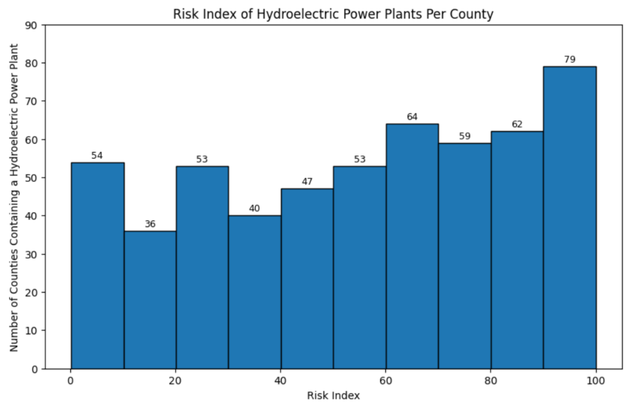

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