NIMBY Effect on Nuclear Power Support in Taiwan:

A Survey Experiment on Public Attitudes and Policy Solutions

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Taiwan's Energy Challenges

- Geopolitical Tensions

- Energy Security Concerns

- Environmental Goals

Nuclear Power in Taiwan

- 1970s–1980s: Taiwan embraced nuclear energy with the construction of three active nuclear power plants (NPPs): Jinshan, Kuosheng, and Maanshan.

- 1990s–2000s: Rising anti-nuclear sentiment led to delays in the construction of the Longmen Nuclear Power Plant (NPP4).

- 2014: The DPP administration suspended the Longmen (NPP4) project amid growing public opposition.

- 2016–Present: The DPP committed to phasing out nuclear power by 2025, a policy reinforced after the 2011 Fukushima disaster.

Current Status

- Chinshan (NPP1) was decommissioned in 2019, with Kuosheng (NPP2) scheduled for decommissioning by 2023 and Maanshan (NPP3) by 2025.

- Nuclear energy accounts for only about 5% of Taiwan's total electricity generation, down from nearly 20% in the early 2000s.
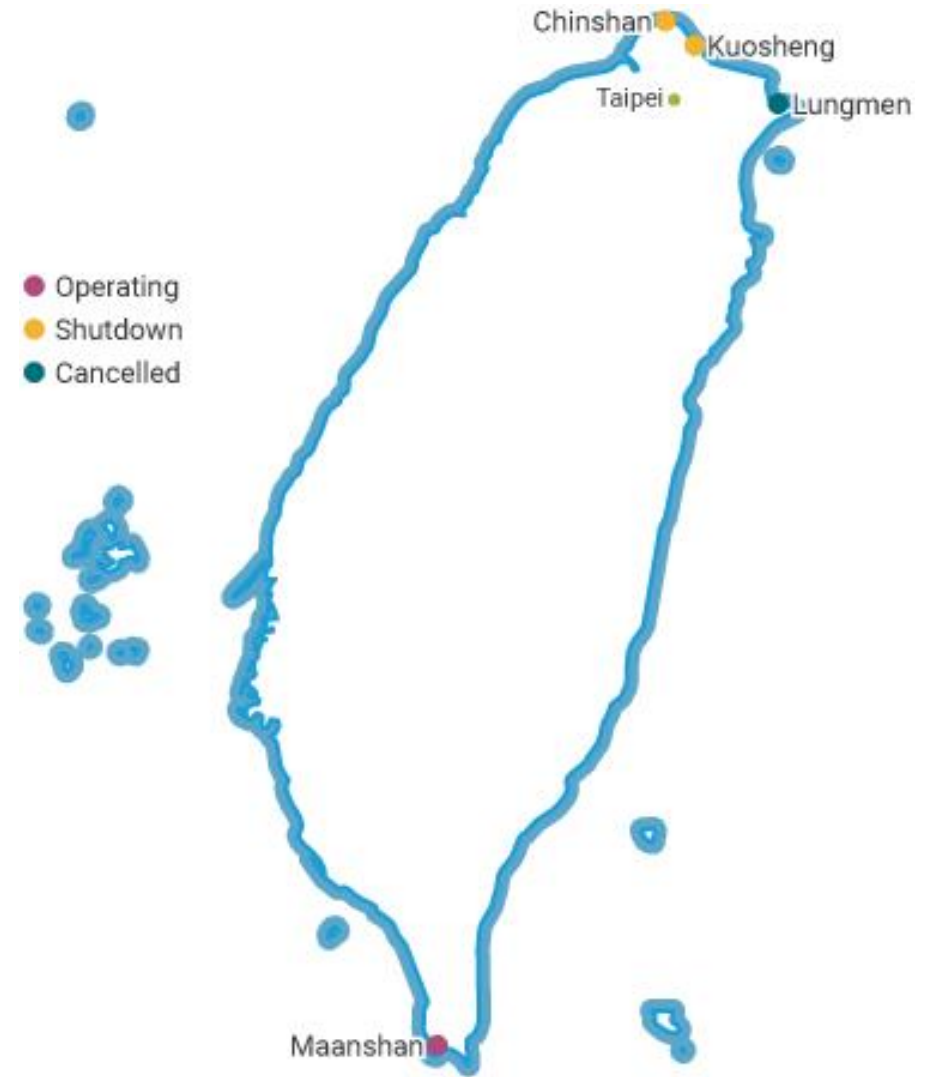
Source: World Nuclear Association

The Persistent Debate

- Political polarization

- Power outages in Northern Taiwan (4 times in 2 weeks in early 2024)

- Expansion of High-Tech (Highest Electricity Consumption) Industries like TSMC

"Do we need nuclear power?"
"If yes, where should we build them and store all the radioactive waste?"

Picture: National Museum of Taiwan History: The anti-nuclear march on May 5, 1991 - Anti-nuclear candlelight and father and son

Why NIMBY(Not In My Back Yard)ism? Size matters.

NIMBY Phenomenon and Energy Policy

- "NIMBY": opposition to the development of infrastructure projects near one's place of residence, despite *support* for projects (in principle).

- Unique Challenges with Energy Development:

  - **Safety**: Fear of accidents (e.g. Fukushima disaster) and radioactive waste.

  - **Environmental Impact**: Potential harm to local ecosystems.

  - **Distrust in Authorities**: Skepticism about the government's ability to manage risks and emergencies.

- NOPEs vs. NIMBYs: While NIMBYism can be mitigated through incentives, ideologically entrenched **"NOPEs" (Not On Planet Earth)** remain a barrier to infrastructure acceptance.

(Gervers 1987; Dear 1992; Vittes, Pollock, and Lilie 1993; Schreurs and Ohlhorst 2015)

Research Questions

- **RQ1.1** In Taiwan, what are the factors contributing to the public attitudes toward nuclear power facilities, which can be classified into NOPEs, NIMBYs, and YIMBYs?

- **RQ2.** What incentives can be employed to address NIMBY and NOPE attitudes?

NIMBYs, YIMBYs, and NOPEs

- NIMBY: Those who support development in principle but oppose local implementation

    - Ignorance, property value/selfishness, risks and distrust to authorities (Dear, 1992; Freudenberg and Pastor 1992; Devine-Wright, 2009; Burningham et. al, 2006)

- YIMBY: Those who actively support local implementation of infrastructure projects

    - Economic reason, evironmental gains (Dear, 1992). Sometimes lead to *'reversed-NIMBYism'*(Konisky et al, 2020; Uiji et al, 2021)

- NOPE: Those who oppose infrastructure projects under all circumstances

    - Ideologies and institutional factors (Wolsink, 2000)

- However, there is significant partisan division on nuclear power in Taiwan.

Ways to Solve "NIMBY Syndrome"

There several approaches being used to address NIMBY syndrome (Frech, 1991; Richmond, 2002; Toke, 2005; Gallo, 2019; Konisky et al, 2020):

- Financial Incentives

- Community Investments

- Public Participation and Transparency

- Institutional Support - claim *limited* significance of NIMBYism (Wolsink, 2000)

Picture: ABC

Key Gaps in the Literature

- Lack of Public Opinion Research:
  - Few studies empirically test NIMBY attitudes and their underlying factors, except for Konisky et al. (2020) and Uiji et al. (2021).

- Regional and Temporal Limitations:
  - Most studies focus on US or West European countries, with limited research on the Asia-Pacific region (except Japan after 2011).
  - Many foundational studies are outdated, failing to address modern geopolitical and energy challenges.

- Limited Evidence for NIMBY Solutions:
  - Minimal empirical evaluation of strategies like financial incentives or community investments, also few insights on mitigating ideological resistance (e.g., NOPEs).

Research Questions & Hypotheses (1)

- **RQ1.1** In Taiwan, what are the factors contributing to the public attitudes toward nuclear power facilities, which can be classified into NOPEs, NIMBYs, and YIMBYs?

	NOPE	NIMBY	YIMBY
1. Party ID	DPP+		
2. Current EPZ (Emergency Planning Zones) residents		+	
3. Experienced power outage	-		
4. Expect military risk with China	-		
5. Positive attitude to NP	-		

Research Questions & Hypotheses (2)

- **RQ2.** What incentives can be employed to address NIMBY and NOPE attitudes?

	NOPE	NIMBY	YIMBY
1. Transperency (Safety)	X	X	X
2. Financial incentive (Cash)	X	+	+
3. Community investment (Infrastructure)	X	+	+

Data Collection Through Online Survey

- **Implementation Date**: 17 May to 30 June 2024

- **Opt-In Sample**:

  - **Recruitment**: Non-probability panel recruited for academic research (NTUWS)
  - **Sample Size**: n=4,216 (3,577 after quality-check process^)

- **Probability-based Sample**:

  - **Recruitment**: SMS Push-to-web with randomly generated mobile phone numbers
  - **Sample Size**: n = 1,088 (825 after quality-check process)

- 4,402 cases left for analysis; standardized biases calculated for balance check.

^Quality check involves dropping cases that are: speeders, inattentive respondents (did not pass attention check), respondents without residential postcode information, and those who select a non-land area in heatmap questions

Dependent Variables: Finding NIMBYs From a Map

1. What is your preference for the future development of the following power generation methods in Taiwan? [Nuclear Power]

- Immediately increase development (1), Gradually develop (2), Reduce development but remain as part of the power generation mix (3) → *Continue to next question*

- Immediately stop development (4) → *Recoded as "NOPEs"*: 0 for the distance

2. Assuming that a new nuclear power plant is needed in Taiwan in addition to the existing nuclear power plants in order to ensure an adequate supply of electricity, **where do you think would be the best place to build it? Please click on the following map of Taiwan to find out where you think the best location would be.^**

^Please note: Due to the basic principle of high voltage power transmission, the nuclear power plant will be located mainly on the main island, and those who choose an off-island or off-shore location will be regarded as an invalid answer.

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Dependent Variable

- Heatmap survey questions with georeferencing

- Haversine distance calculated from the residential postcode to the selected point.

Model Selection

- Hurdle model (linear)

- Grouping respondents to test RQ2:
  - NOPEs (0)

  - YIMBYs (if same residential "region" selected)

  - NIMBYs (if different "region" selected)

  - Multinomial regression for robustness check

Vignette Experiment

(Control) In order to dispose of the nuclear waste generated by nuclear power generation, Taiwan needs to build a new storage site. (Safety) It is assumed that the storage site will be buried more than 3,000 metres deep underground and that the ground will be free from radiation. (Financial) At the same time, nearby residents would receive cash subsidies of up to NT$20,000 per month, (Community) and the government would build and maintain public facilities such as parks, schools, hospitals, and nursing homes. **Where do you think would be the best location for a nuclear waste storage site? Please click on the map of Taiwan below to find out where you think the best location is.^**

Vignette Experiment

- We did not utilise factorial design due to reduced statistical power ($2^3 = 8$ group is too many as anticipated experimental effects may be low)

- In the end, the experiment included four arms:
  - Control (X)
  - Control + Safety (S)
  - Control + Safety + Cash (SC)
  - Control + Safety + Cash + Infrastructure (SCI)

Independent Variables

- Party ID

- Experience of power outage after April 2024

- Expectation of Chinese military action next year

- Reside within EPZ (20 km radius)

- Attitudes toward NP (clean, cheap energy source or not)

- Demographical controls (gender, education, age)

Results

Multinomial Logit Model

- The effect of Party ID and ideology remains, while the effects of others have diminished.

Vignette Experiment: Average Marginal Effect

Summary of Quantitative Findings

RQ1	RQ2
1. Classification matters 2. Partisanship as a key driver 3. Ideology's role 4. Limited impact of power outages 5. Perceived risk from China and YIMBYism 6. NIMBYism among EPZ residents	1. Transparency and safety claims Are ineffective. 2. Cash benefits are the only effective incentive.

Implications for Other Countries

1. Nuclear Power as a Cultural and Political Issue: Reflection on Australian Politics.

2. Geopolitical Threats Do Not Guarantee Support: Implication for Europe

3. The Double-Edged Nature of Having Nuclear Power

Methodology Implications

1. Heatmap Surveys with Georeferencing

   - Interactive maps capture spatial preferences.

   - Enables precise analysis of concept like NIMBYism using distance metrics.

2. Segmented Analysis of Policy Effects

   - Classifies respondents as NOPEs, NIMBYs, or YIMBYs before survey experiment.

   - Reveals policy effect like cash benefits work for NIMBYs but fail to shift NOPEs.

Thanks for having us!