



# Congruence between Scientific Solutions to Net Zero and Legislative Speeches

**Brian Boyle and Stefan Müller**

University College Dublin

13/05/2023

# Background

---

- Ireland one of many countries to adopt targets of net zero emissions by 2050, and 50% reduction by 2030
- Concept of net zero and associated goals:
  - Origins in climate science research
  - Diffused via NGOs and IGOs
  - Commitments from national governments (2015 Paris Agreement)

# Research Questions

---

1. What are the main topics that have emerged within the scientific literature on net zero?
2. To what extent are these topics discussed by policymakers in parliamentary speeches?

# **Scientific research on net zero**

## Elsevier Scopus citation and abstract database

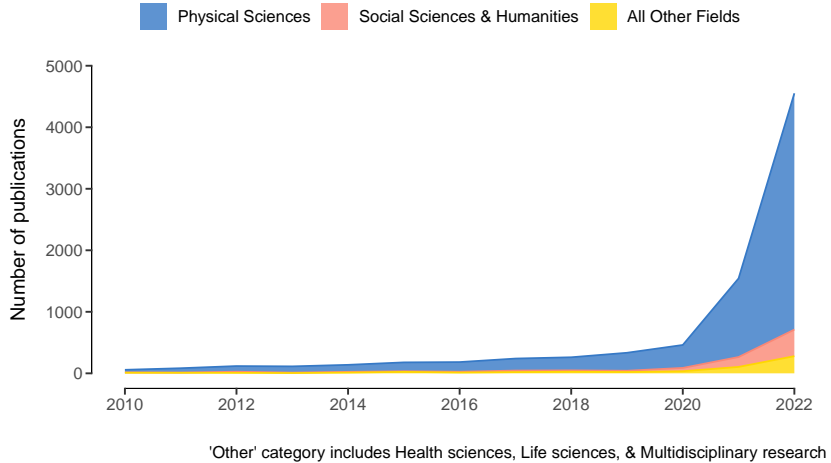
- 85 million documents across 25,000 publication outlets
- Publications mentioning 'net zero' or 'carbon neutrality' in:
  - Title, abstract text, or keywords
- API accessed via the rscopus package

Table 1: Scopus Journal Article Abstract Data Collection

	Data collection stage	Documents
<b>Input</b>	All search results	16,903
<b>Filters</b>	Contains DOI	15,222
	Abstract text available	16,445
	Journal article	11,005
	Subject area code present	13,476
	Author affiliation country present	16,221
	Post 1999	16,830
<b>Output</b>	Final selected documents	10,014

Articles mentioning 'net zero' or 'carbon neutrality'

Figure 1: Net zero journal article publications over time by subject area



# Method

---

- Semi-supervised keyword assisted topic models (keyATM) Eshima et al. (2023)
- Allows labels to be supplied prior to fitting models
- Can also include additional unlabelled topics



# Creating the corpus and STMs

---

- Corpus based on abstract text, preprocessed, tokenised, and converted to document-feature matrix (accounting for multiword expressions)
- STMs applied to corpus with varying number of topics

Figure 2: Abstracts - Expected proportion of corpus associated with each topic

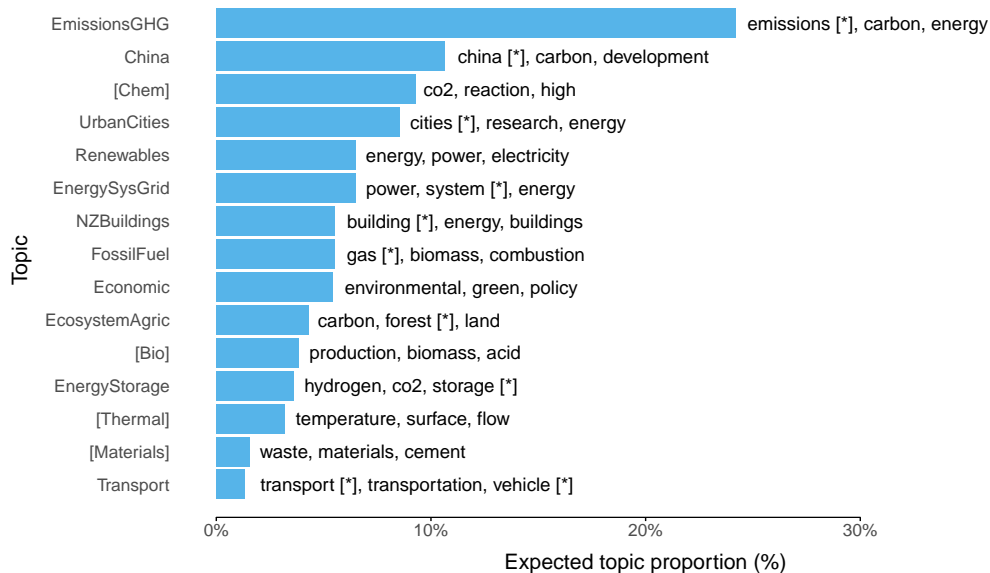
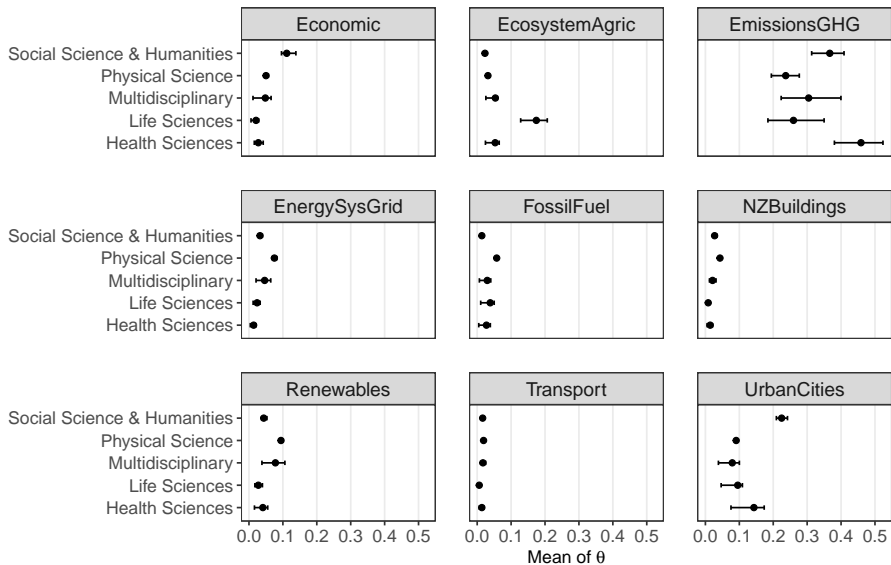


Figure 3: Mean document-topic proportion by subject area



# **Legislative speeches on energy and the environment**

## **ParLEE parliamentary speech dataset (Greene et al., 2023)**

- Speeches from the Oireachtas between 2009–2019
  - 3,988,025 sentences, 342 speakers, 13 political parties.
- Aggregated to paragraph level
- Filtered only those containing mentions of:
  - 'Energy' or 'Environment' (108,161 paragraphs)

Figure 4: Speeches - Expected proportion of corpus associated with each topic

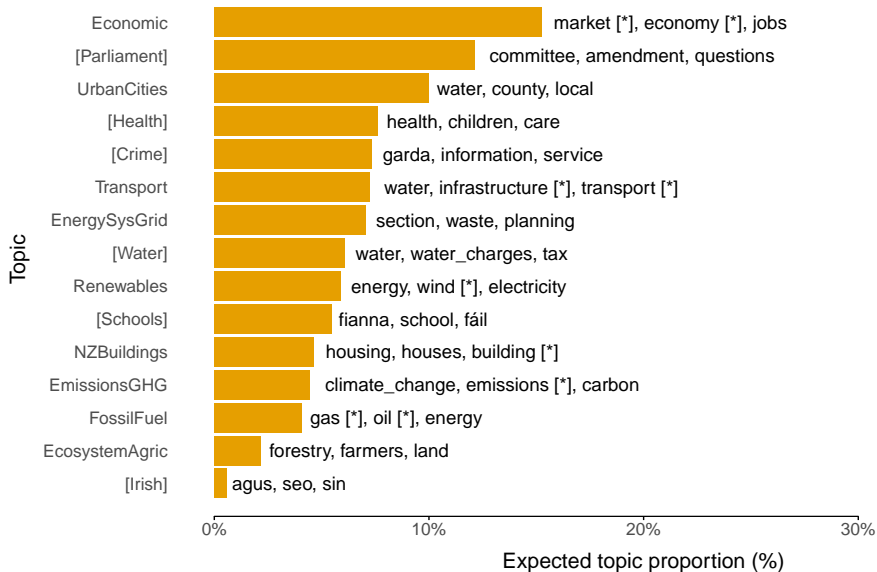
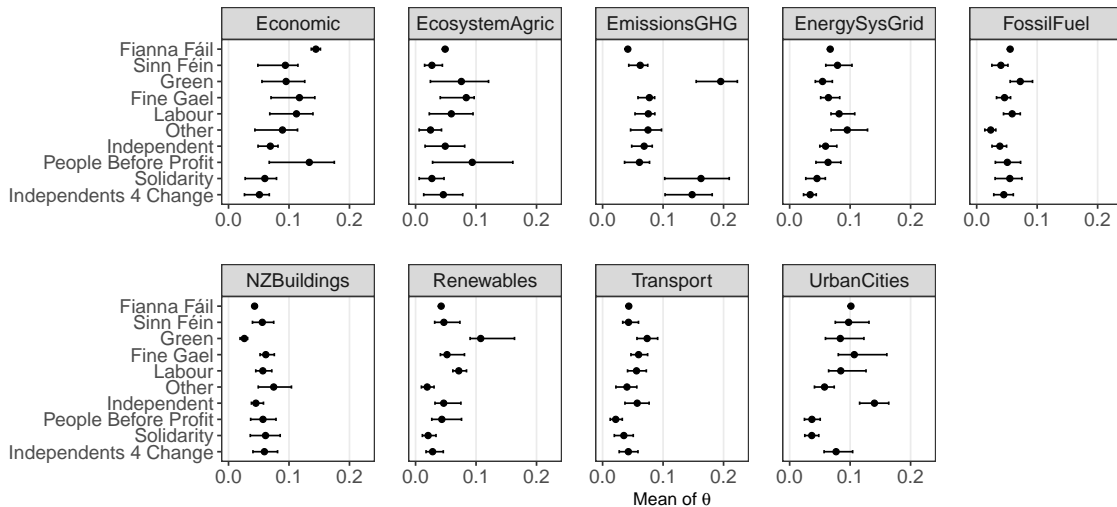


Figure 5: Mean document-topic proportion by party



# **Comparing scientific articles and legislative speeches**



Figure 6: Expected proportion of corpus associated with each topic

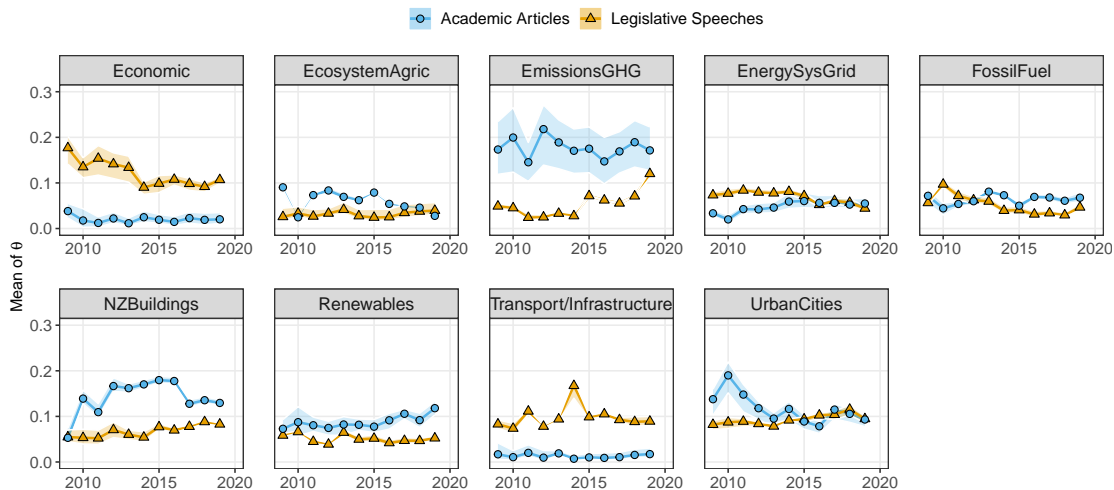
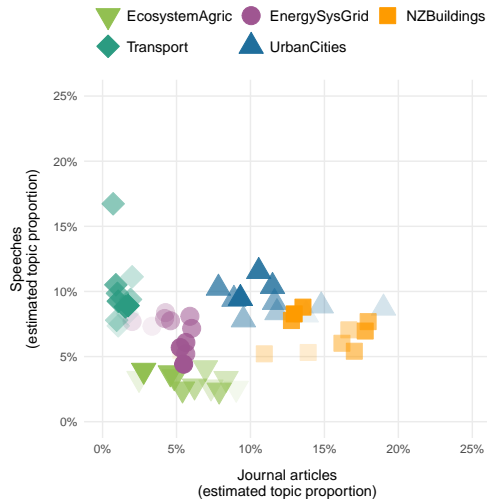
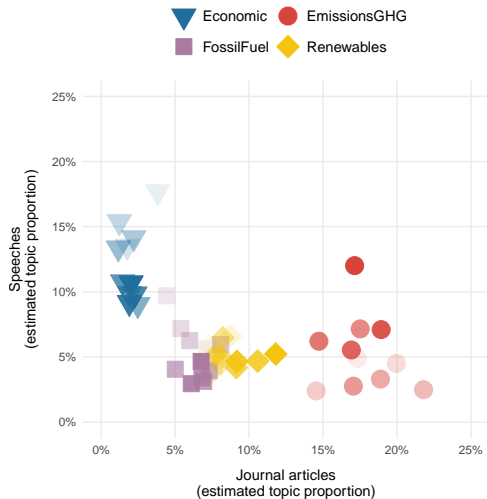


Figure 7: Estimated mean document-topic prevalence by year (2009–2019)



# Findings

---

- Explosion in net zero research over the past 3 years
- Topics from the scientific literature are present in national parliamentary speeches
- But clear differences in issue emphasis
  - Speeches: economy, infrastructure, water charges
  - Science: Emissions, net zero buildings

## Next Steps

---

- Extend analysis to additional countries
- Variation over time, pre-post Paris Agreement
- What issues do policymakers identify as potential barriers or solutions to reaching net-zero emissions targets?
- How does this compare with the barriers and solutions identified by scientific research in this area?

Thanks for listening!

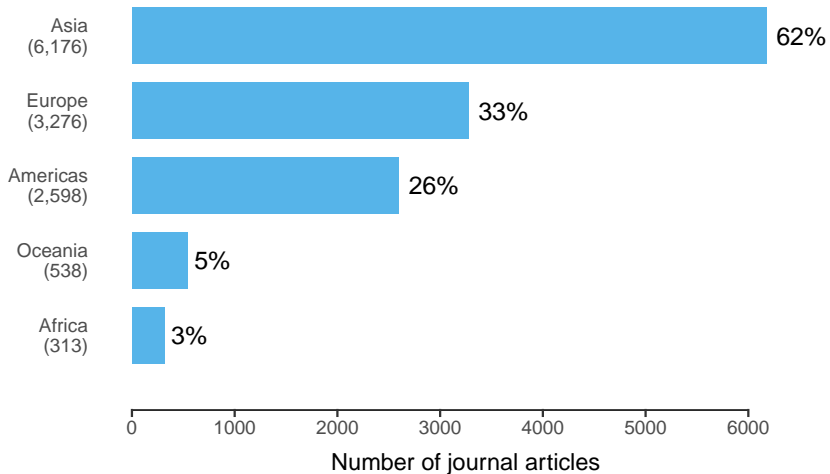
Table 3: KeyATM Topic Keywords

Topics	Keywords
1. NetZeroBuildings	building, nzeb
2. EcosystemAgric	forest, ecosystem
3. EmissionsGHG	emissions, ghg, greenhouse_gas
4. EnergySysGrid	power, grid, systems
5. Transport	transport, infrastructure, vehicles, vehicle
6. UrbanCities	urban, city, cities, community
7. FossilFuel	oil, coal, gas, fossil_fuel
8. Renewables	renewable, renewable_energy, solar, wind
9. Economic	economic_growth, trade, market, economy
10. EnergyStorage*	storage, battery, batteries
11. China*	china

\* = only included in article abstract models

15 topics included total: 4 unlabelled in article abstracts, 6 unlabelled in speech models

Figure 8: Articles with at least 1 author from region



Total articles with author affiliation information: 10,015

Table 5: Legislative Speech Corpus – Paragraph Frequency by Party

Party	Paragraphs	(% Total)
Fine Gael	28,592	29%
Fianna Fáil	26,303	27%
Independent	12,967	13%
Labour Party	10,733	11%
Sinn Féin	10,122	10%
Green Party	3,281	3%
Other	2,151	2%
Independents 4 Change	2,005	2%
Solidarity – People Before Profit	1,959	2%
People Before Profit Alliance	1,009	1%

'Other' category includes: Progressive Democrats, Renua, Workers and Unemployed Action, Socialist Party, Anti-Austerity Alliance, and Social Democrats



Table 7: Scopus Abstracts KeyATM Topics and Top Words

1_NZBuildings	2_EcosystemAgric	3_EmissionsGHG	4_EnergySysGrid	5_EnergyStorage
building [*] energy buildings design performance heat heating system [*] thermal cooling	carbon forest [*] land soil ecosystem [*] sink carbon_sequestration biomass net co2	emissions [*] carbon energy potential global sector emission climate future technologies	power system [*] energy optimization operation control new optimal network performance	hydrogen co2 storage [*] process technology energy carbon production technologies utilization
6_Transport	7_UrbanCities	8_FossilFuel	9_Renewables	10_China
transport [*] transportation vehicle [*] vehicles [*] infrastructure [*] fuel electric charging electric_vehicles evs	cities [*] research energy urban [*] policy sustainability city [*] sustainable development social	gas [*] biomass combustion fuel oil [*] coal [*] co2 temperature process high	energy power electricity solar [*] system [*] cost renewable_energy [*] wind [*] systems heat	china [*] carbon development carbon_emissions china's carbon_neutrality energy industry low-carbon spatial

11_Economic	12_Materials*	13_Chem*	14_Thermal*	15_Bio*
environmental	waste	co2	temperature	production
green	materials	reaction	surface	biomass
policy	cement	high	flow	acid
carbon	concrete	catalyst	thermal	process
market [*]	material	catalysts	heat	organic
impact	strength	conversion	water	treatment
countries	recycling	performance	phase	sludge
financial	properties	energy	field	microalgae
economy [*]	mechanical	electrochemical	properties	water
economic_growth [*]	production	carbon	pressure	wastewater

\*No keywords were supplied to the model for Topics 12-15

Table 10: Irish Legislative Speech KeyATM Topics and Top Words

1_NZBuildings	2_EcosystemAgric	3_EmissionsGHG	4_EnergySysGrid	5_Transport
housing	forestry	climate_change	section	water
houses	farmers	emissions [*]	waste	infrastructure [*]
building [*]	land	carbon	planning	transport [*]
homes	turf	targets	act	investment
rent	forest [*]	climate	water	funding
accommodation	wildlife	farmers	environment	supply
social_housing	conservation	national	environmental	national
local_authorities	bog	agriculture	local	service
private	coillte	global	national	broadband
problem	cutting	climate_action	management	local_authorities
6_UrbanCities	7_FossilFuel	8_Renewables	9_Economic	10_IrishLanguage*
water	gas [*]	energy	market [*]	agus
county	oil [*]	wind [*]	economy [*]	seo
local	energy	electricity	jobs	sin
community [*]	fuel	renewable_energy [*]	european	atá
rural	prices	investment	economic	leis
dublin	electricity	renewable [*]	banks	bhfuil
city [*]	price	national	billion	mar
cork	companies	sustainable	countries	ann
communities	exploration	jobs	companies	bhí
town	costs	power [*]	europe	ach

11_Schools*	12_WaterCharges*	13_Parliament*	14_Health*	15_Crime*
fianna	water	committee	health	garda
school	water_charges	amendment	children	information
fáil	tax	questions	care	service
children	charge	dáil	hse	hse
schools	charges	order	hospital	commission
education	allowance	forward	service	review
day	per	deputies	child	investigation
fine	income	environment	women	health
deputies	payment	stage	families	cases
something	waste	oireachtas	mental	questions

\*No keywords were supplied to the model for Topics 10-15

## References

Eshima, S., Imai, K. and Sasaki, T. (2023), 'Keyword-Assisted Topic Models', *American Journal of Political Science* .

Greene, Z., Sylvester, A., Ershova, A., Khokhlova, A. and Yordanova, N. (2023), 'ParLEE plenary speeches V2 data set: Annotated full-text of 15.1 million sentence-level plenary speeches of six EU legislative chambers'.

**URL:** <https://doi.org/10.7910/DVN/VOPK0E>