A "Spatially Just" Transition in the Electricity Sector on the island of Ireland: mapping regional risk

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we are increasingly faced with the immediate effects of climate change

Photo by Bruno Figueiredo on Unsplash

Introduction

Climate change represents a key challenge facing societies around the world. Where formerly, its risks and the efforts needed to curb them appeared remote, we are increasingly faced with the immediate effects of climate change. Ever worsening effects, and policy response timelines are now much more immediate.

A key element of transition efforts on the island of Ireland will relate to a transition on the existing shared grid between Northern Ireland and the Republic of Ireland. Electricity represents a key strategic sector, both as renewable technologies are increasingly feasible to abate emissions in a sector which is a major emitter itself and as a key means to reduce emissions by "electrifying everything".

In contrast to renewable generation, which is often more diffuse, fossil fuel generation sites generating emissions are relatively concentrated in specific regions. This relative concentration and spatial distribution of sites, which will have to undergo some form of change if we're to meet our emissions reductions goals, raises issues of spatial capacity and justice in relation to transition. If transition must occur at these sites, which may imply closure, are these areas equipped to deal with the economic and social effects?

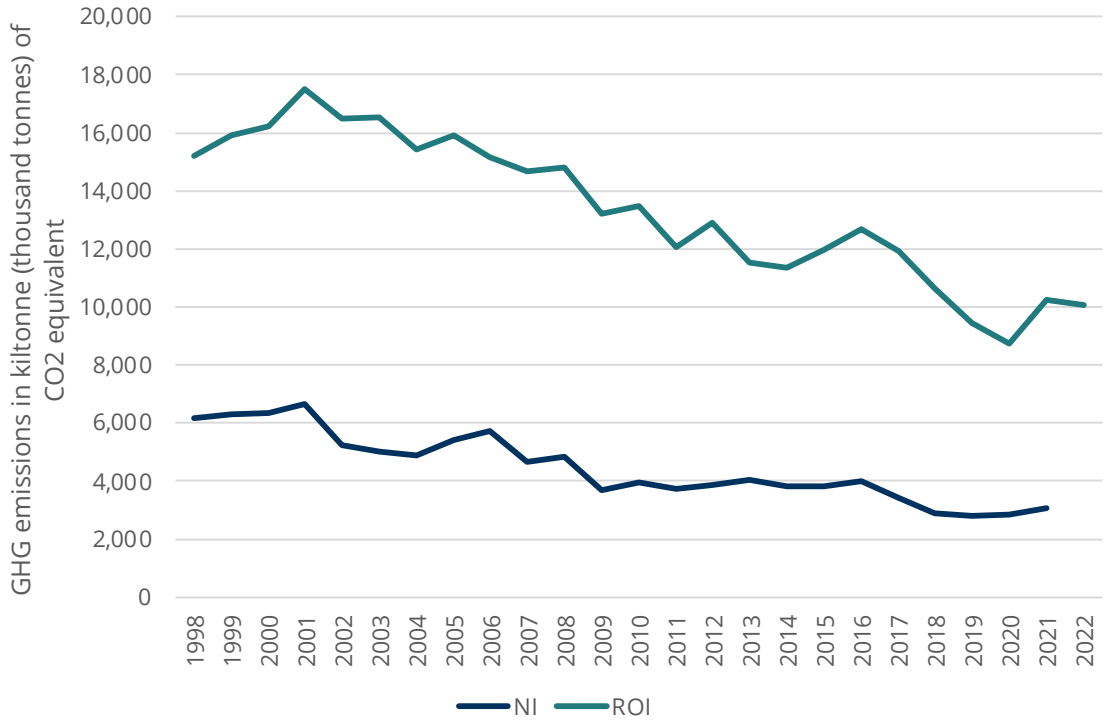
This report seeks to offer some evidence in relation to this question. Using the generation capacity statement for the all-island grid, we identify key fossil fuel generation sites on the island. The analysis proceeds with an examination of the significance of the sector in employment and pay terms. We find that the sector offers unusually well-paid employment relative to other sectors, and that these advantages are concentrated at lower skills levels in both jurisdictions on the island.

Our analysis proceeds with an examination of the regional significance of electricity employment and the regional concentration of these sites. We further examine regional risk factors relating to sites of labour market weakness and social risk in the form of poverty measures. The report ends with a risk matrix summarising these findings identifying key sites which may represent sites of high risk in the context of transition efforts.

Fossil fuel electricity generation on the island of Ireland

Historically there has been progress in reducing emissions for the power generation sector. Between 1998 and 2021, total GHG emissions decreased by a fifth in Northern Ireland (NI). This is largely thanks to halving of emissions from energy supply from 6.2 to just under 3.1 million tonnes of CO_2 equivalent, driven by a large move away from coal-fired power generation plants.

Chart 1: Emissions from power generation on the island of Ireland 1998-2022



EPA (2023) Ireland's Provisional Greenhouse Gas Emissions 1990-2022; Northern Ireland Greenhouse gas 2021 statistical bulletin

Nevertheless, data published by the Environmental Protection Agency (EPA) shows that the emissions declines in the Republic of Ireland (ROI) have been more modest, falling by 8.3% over the same period. This has landed the ROI at a place as the second highest greenhouse gas emitter measured per capita in the European Union (EU), with only Luxemburg emitting more GHG measured per capita.

However, emissions reductions from the energy sector have led aggregate reductions in the Republic. South of the border, emissions stemming from electricity generation fell by more than a third between 1998 and 2022, after peaking in the early 2000s. This

fall in emissions of some 5.1 million tonnes of CO_2 equivalent accounts for more than nine in every ten tonnes of emissions reductions achieved for the state as a whole over that period. While some of the decline after 2008 may have been associated with falling economic activity, the trend after 2016 has generally been downwards.

Despite recent reductions in emissions in the electricity sector, and the growth in renewable energy generation, the sector remains among the most emissions intensive in both jurisdictions. Recent emissions reductions have arisen in many cases due to the phase out of particularly carbon intensive fossil fuel generation like peat and coal. However, the grid remains heavily reliant on other fossil fuels like natural gas. Existing and pending carbon budgets also imply large reductions in emissions over relatively short time frames in both jurisdictions, implying significant challenges in terms of transition plans for workers and regions.

Recent emissions reductions have arisen in many cases due to the phase out of particularly carbon intensive fossil fuel generation like peat and coal

In the Republic, EPA projections which incorporate all proposed climate measures imply that emissions will have only declined by 29% relative 2018 levels by 2030, far below the 51% mandated in legislation. The electricity generation sector's emissions ceilings are the most stringent in the Republic's climate plans, implying emissions reductions of 75% over 2018 levels by the end of the decade. On current evidence, existing overshoots across the economy, and in the energy sector specifically, imply significant greening challenges for the sector.

Similarly, recent legislation in Northern Ireland commits the region to carbon budgets (to be set by the end of 2023) consistent with a 48% reduction in emissions over 1990 levels. This is spearheaded by the electricity sector, which is planned to be 80% renewable by the end of the decade, entailing an emissions fall of 73% for the energy sector.

Existing fossil fuel generation capacity and phase out plans

NI and ROI share the island-wide electricity grid which is operated by Eirgrid and System Operator Northern Ireland (SONI). These two operators publish a Generation Capacity Statement (GCS) once a year.

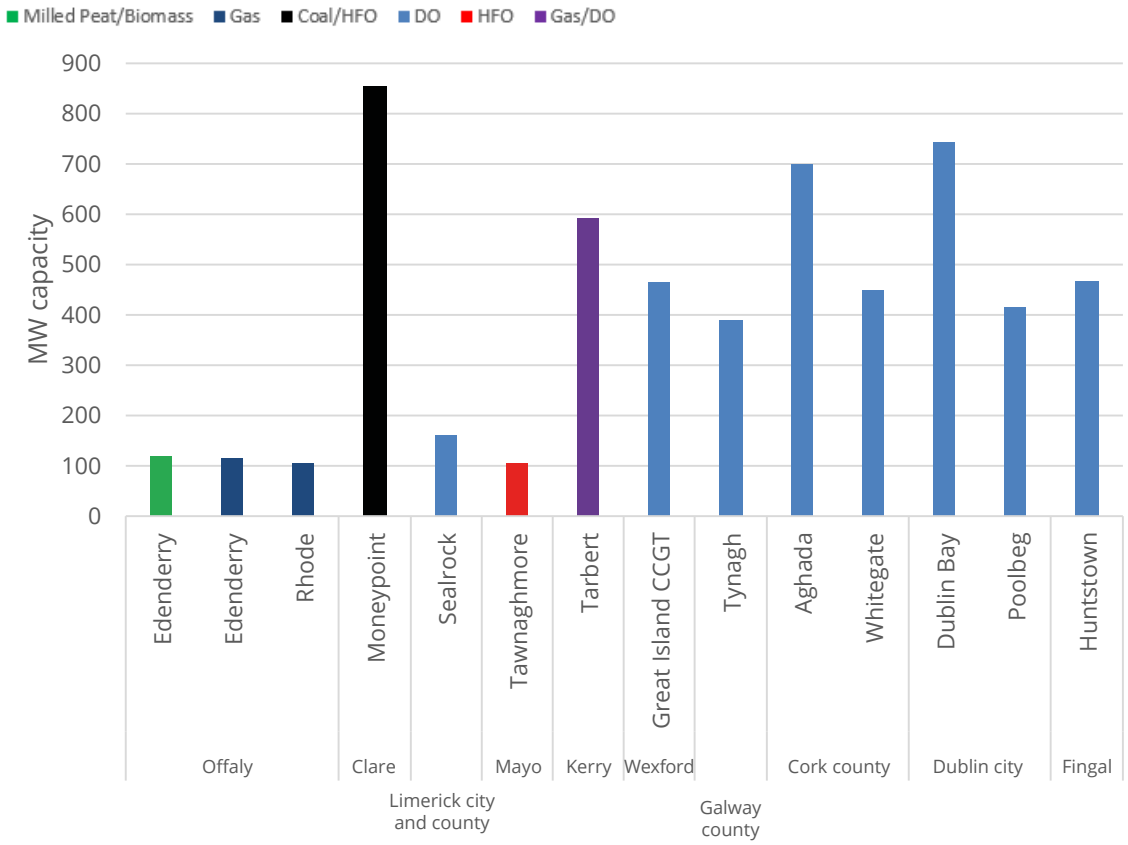
Chart 2: Major fossil fuel generation sites on the island of Ireland

Source: Produced using Google maps; Eirgrid and SONI capacity statement 2022
Note: Sites such as Coolkeeragh are colour labeled according to the larger portion of registered capacity.

The GCS gives an overview of the current electricity generation plants operating across the Island. According to this year's GCS, the island houses seventeen fossil-fuelled power plants generating a majority of the electricity that is fed into the island-wide electricity grid. Four of these plants are located in NI and the remaining thirteen located south of the border.

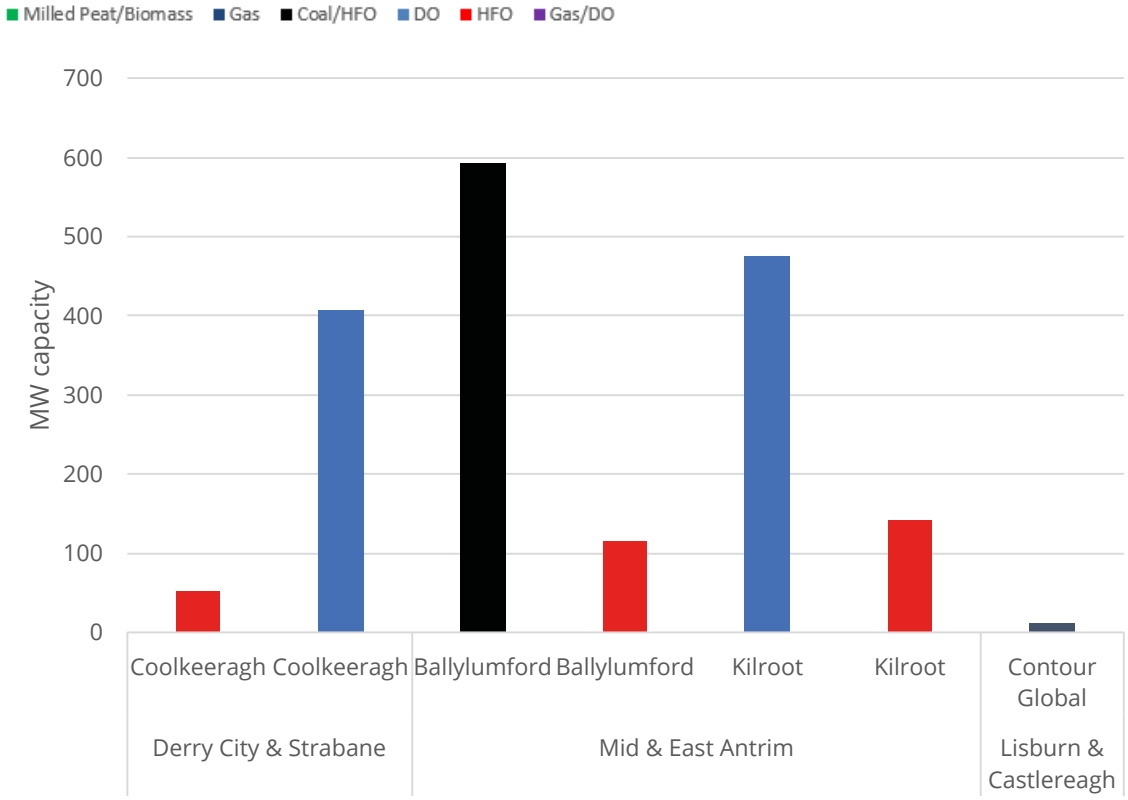
The sites vary in generation output (MW), but governmental plans in both jurisdictions to reach net zero emissions imply substantial reductions from the electricity generation sector, and thus a phase out or significant adjustment to the operations of these sites. Plans to switch to burning biofuel instead of the highly polluting peat, have been put forward at the Bord Na Móna plant in Edenderry. Similarly, plans to offset current emissions from carbon capture technology are a widely accepted, though controversial, means of continuing operations while reaching the goal of net zero energy generation.

Chart 3: Fossil fuel generation by location, capacity and fuel type Republic of Ireland 2022



Source: Eirgrid and SONI capacity statement 2022

Chart 4: Fossil fuel generation by location, capacity and fuel type Northern Ireland 2022



Source: Eirgrid and SONI capacity statement 2022

Another useful data source within the GCS are projections of power plants that are subject to planned phase out within the next 3-4 years. From the GCS it appears that there will be changes to the way the Kilroot power plan in county Antrim in NI is generating electricity. The plant in Kilroot is currently running two steam turbines on heavy fuel oil (HFO) and coal. The two steam turbines, which together produce a total output of 476 MW, are projected to cease operations in 2023.

In ROI, changes in the operations of four plants are projected in the GCS. Most noticeable are the planned closures of the Tarbert power plant (592 MW) in county Kerry by 2023, and Moneypoint (855 MW) in county Clare by 2024. The closures of these plants remove sources of electricity generated by a mixture of coal and HFO, with Moneypoint generating electricity from coal and HFO and Tarbert generating purely from HFO. Combined, Moneypoint and Tarbert deliver 22.75% of the electricity generated from fossil-fuels in the Republic of Ireland.

Additionally, the GCS projects a significant change in operations for the Bord Na Móna plant in Edenderry, county Offaly. This plant is surrounded by much controversy as it is the last plant in Ireland to generate power using highly carbon-intensive peat to fuel its turbines. The Bord Na Móna plant is currently using a combination of peat and biomass to fuel a 118 MW steam turbine.

However, the GCS reveals that there is a plan in place to phase out peat and run this turbine exclusively on biomass from 2024. Furthermore, the plant in Edenderry is planning to phase out the use of Distilated Oil (DO) in its generation capacity by 2025. DO has been used in combination with gas to run two smaller turbines with a combined output of 116 MW. These two turbines will continue to produce electricity solely from gas. Lastly, the GCS shows that there are changes planned for the Aghada plant where one 90 MW gas/DO-fired turbine is planned to be taken offline before the end of 2023. Nevertheless, the GSC show that another gas/DO-fired turbine at Aghada has increased its output from 431 MW to 449 MW.

When looking at the spatial distribution of power plants across the Island, we see that there is a high concentration of fossil generation capacity in Dublin and the South-West

When looking at the spatial distribution of power plants across the Island, we see that there is a high concentration of fossil generation capacity in Dublin and the South-West of the Republic of Ireland. In Northern Ireland three of the four plants are placed within the vicinity of Belfast and one is placed in Derry. Of the planned closures, the two power plants that are projected to cease operations completely, according to the GCS, are both placed in the South-West of the island. More specifically, both the power plant at Moneypoint and the power plant at Tarbert are situated within proximity to each other at the outer county borders of Clare and Kerry. As both Moneypoint and Tarbert deliver a high volume (MW) of the electricity that is fed into the island-wide electricity grid, it would be reasonable to assume both plants are employing a significant proportion of workers who work in the electricity generation sector in this area of the country.

Correspondingly, according to the GCS, there will be changes to the operations of the Kilroot power plant in county Antrim in Northern Ireland and the Bord Na Móna plant in Edenderry. Nevertheless, as these plants are planned to continue to generate electricity, the changes are likely to cause less disruptive changes in employment in these two counties on the island. Nevertheless, since the projected changes for the Kilroot power plant will see a downgrade in output by as much as 476 MW, and a complete abandonment of generators fueled by coal and HFO, there could be significant job losses and or job changes at the plant. The Bord Na Móna plant in Edenderry has already seen notable changes to operations in the last few years. The plant has been undertaking an phase out of the large-scale use of peat to fuel the generators operated at the plant.

Despite the planned closures projected in the GCS, projections indicate that the Irish electricity grid will be highly dependent on fossil fuels to generate electricity going forward and until further closures are planned. This will undoubtedly influence GHG emission targets in both NI and the ROI.

Employment in the electricity sector on the island of Ireland

Aggregate employment and pay

The electricity sector is a significant source of employment on the island of Ireland. According to the latest available data, 11,516 individuals were employed in *Electric power generation, transmission and distribution* in the Republic of Ireland, in 2022. In Northern Ireland, the Business Register and Employment Survey (BRES) indicates that there were 1,498 employees working in the same sector in 2021.

The NI data also offer a further breakdown by 3 digit subsector. According to BRES data 370 employees worked within *Production of electricity*, 463 worked in *Transmission of electricity*, 450 in *Distribution of electricity* and 215 in *Trade of electricity.* Applying the same proportions to ROI totals for the broader sector implies some 2,800 in electricity production, 3,600 in transmission, 3,500 in distribution and 1,600 in the trade of electricity.

Table 1 Employment in *Electric power generation, transmission and distribution* (NACE D351)

NACE Sector	NI	ROI
D3511 Production of electricity	370	2,800*
D3512 Transmission of electricity	463	3,600*
D3513 Distribution of electricity	450	3,500*
D3514 Trade of electricity	215	1,600*
D351 Electric power generation, transmission and distribution (Total)	**1,498**	**11,516**

Sources:; Business Register and Employment Survey (NISRA 2023), Census 2022 (CSO 2023), author's calculations

Note: ROI data refer to totals for 2022 from the Census for total persons employed, While NI data is for 2021 and refers to employees. Indicative data from the structural business statistics in 2020 indicates 99.7% of ROI employment is accounted for by employees * ROI data are imputed to the nearest hundred based on relative proportions in NI data

Eurostat and ONS also offer data for the wider sector NACE D or *Electricity ,Gas, Steam and Air Conditioning Supply*, includes the previously mentioned D351 subsector alongside *Manufacture of gas; distribution of gaseous fuels through mains* and *Steam and air conditioning supply,* relating to the green economy. The *Environmental Goods and Services Sector* with Sector D accounted for some 1,620 full-time equivalent jobs (FTE)[1] in the Republic of Ireland and 15,900 FTE jobs in the UK in 2020 and 2019 respectively.[2]

1 Full-time equivalent is a standardised unit which accounts for working time. A full-time worker is counted as a full FTE equivalent, while part-time workers are scored according to relative hours worked. If, for example, a full-time worker on average worked a 40 hour week, while part time workers worked 20 hours, part-time employments would be counted as 0.5 FTE.

2 These data are only available for the UK as a whole. Regional data for Northern Ireland are unavailable.

According to this definition of green jobs, green employment remains relatively limited in this sector in both states. In the Republic of Ireland, we estimate that EGSS employment accounted for around 14% of employment within *Electricity, gas, steam and air conditioning supply* in 2020, while the same figure for the UK was just over 8% in 2019.[3] This implies significant additional scope for sectoral greening.

Table 2 Environmental Goods and Services Sector within NACE D

Jurisdiction	Proportion of total sector employment**	Total EGSS FTE within NACE D
ROI	13.8%	1,620
UK*	8.3%	15,900

Sources: Full-time and part-time employment by sex and economic activity (from 2008 onwards, NACE Rev. 2 (Eurostat 2023),)Average number of usual weekly hours of work in main job, by sex, age, professional status, full-time/part-time and economic activity (from 2008 onwards, NACE Rev. 2) (Eurostat, 2023), author calculations

Note: ROI data refer to 2020, while UK data are for 2019. Proportion estimates arise from the use of average hours worked, and full and part time employment counts to estimate adjusted full time equivalent values. In the ROI case, this is imputed from CSO estimates of FTE counts for the composite category "Industry" (NACE Sectors B-E) which are applied to the unadjusted NACE D count.

In NI and ROI, available data suggest that employment within the electricity sector is well paid in relation to the wider economy. The CSO's Earnings Hours and Employment Costs Survey offers a breakdown of average weekly earnings by NACE category for ROI. The relevant category for the sector in the data is a composite of Sector D and Sector E *Water supply; Sewerage, Waste Management and Remediation Activities*.[4] In the first quarter of 2023, average weekly earnings in this composite category were €1,1247.56. This was over 35% above average weekly earnings for the whole economy, €923.48.

Table 3 Average Weekly earnings by sector ROI Q1 2023

Sector	Earnings per week
NACE D&E	€1,247.56
All Sectors	€923.48

Source: EHECS Earnings Hours and Employment Costs Survey- QuarterlyAverage Earnings, Hours Worked, Employment and Labour Costs

The NI data use a broader *Industry* breakdown, which covers NACE sectors B through E.[5] The wage premium effect in NI was more modest, but still significant. Average and median - the middle of the sector's distribution or 50th percentile - pay in NI is between 9 and 11% higher than typical for the economy as a whole at £619.30 and £568.20 vs £554.00 and £497.80.

3 See note on Table 2 for details regarding estimation.
4 These data are preferred over the more sectorally detailed Structural Business statistics given the observed volatility in the data series.
5 Alongside D and E, this includes NACE B *Mining and Quarrying* and NACE C *Manufacturing*.

Table 4 Employee weekly pay 2022 Industry (B-E) relative to wider economy NI

Average weekly pay in Industry	Average weekly pay (all)	Median Weekly pay in Industry	Median Weekly pay (all)
£619.30	£568.20	£554.00	£497.80

Sources: Employee earnings in NI 2022

Data showing income breakdowns within *Industry* also suggest that these differences aren't simply driven by the highest paid cohorts within these sectors. Occupational classifications are based on skills levels and often used as a broad proxy for socio-economic groups. While every occupational grade within *Industry* in ROI showed higher weekly earnings than typical for the whole economy, this was greatest at the lower occupational grades in Q3 2022 which don't require a third level qualification. *Clerical, sales and service employees* in *Industry* were paid more than 52% more than was typical in the economy as a whole, while *Production, transport, craft and other manual workers* earned over a quarter more than comparable workers in the wider economy.

Table 5 Estimates of average weekly earnings by broad occupational categories ROI Q4 2022

Occupational category	NACE Sector	Average weekly earnings
Managers, professionals and associated professionals		
	Industry (B-E)	€1,696.63
	All	€1,445.98
Clerical, sales and service employees		
	Industry (B-E)	€972.53
	All	€638.43
Production, transport, craft and other manual workers		
	Industry (B-E)	€840.95
	All	€669.22

Source: Earnings and Labour Costs Q4 2022 (Final) Q1 2023 (Preliminary Estimates)

The relative gap between the top grade and the other categories was also smaller in Industry than for the economy as a whole in ROI. While average wages for *Managers, professionals and associated professionals* were nearly 2.3 times the average for *Clerical, sales and service employees* for all sectors, this gap was reduced to around 1.7 times in *Industry*. This was smaller, but still significant in the *Production, transport, craft and other manual workers* occupational grade, where the wider ratio of just under 2.2 fell to approximately 2.0 in *Industry*.

Data for NI measured in a different way nevertheless indicate a similar trend. Annual Survey of Hours and Earnings (ASHE) data display incomes at percentile thresholds. The 20th percentile threshold indicates the income below which a fifth of workers fall.

For *Industry* in NI in 2022, 20% of workers earned less than £418.90. This is 46% higher than the same threshold for the economy as a whole, at £286.20. At the 40th percentile, wages in *Industry* were about 18% higher than the same threshold for the economy as a whole at £512.40 vs £433.70. Interestingly, the threshold which demarcates the top quarter of workers – the 75th percentile – inverts the pattern. In *Industry*, this threshold is just under 4% below the same point for the economy as a whole at £711.30 vs £738.50.

Table 6 Gross weekly pay by percentile NI 2022

NACE Sector	20th percentile	40th percentile	75th percentile
Industry (B-E)	£418.90	£512.40	£711.30
All	£286.20	£433.70	£738.50

Source: Employee earnings in NI 2022

Thus, in both jurisdictions, the evidence suggests that the electricity sector is a significant source of well-paid employment relative to the wider economy. In addition, the positive wage effect is especially pronounced for workers who typically earn the lowest wages. A possible shift in employment from this sector – from changes in job type or wider job losses – would likely leave effected workers in more poorly paid jobs on average.

Regional Risk factors

Regional employment in the Electricity sector

The employment in the electricity sector displays a varied spatial picture in both jurisdictions. Table 7 below shows employment in the Electricity sector (NACE D351) by Administrative county in the Republic of Ireland at the 2022 census.

The selected administrative counties in Table 7 below correspond to those with existing fossil fuel generation sites. This table presents Census measured employment alongside expected employment. This latter category refers to a counterfactual where sectoral employment is spread evenly around the country according to the relative size of the labour market of the administrative area. Since the sector comprises 0.50% of aggregate employment across the ROI[6], this estimate equals 0.5% of total area employment in each council.

Dublin city council and Fingal represent the most prominent areas in employment terms[7], with both showing greater than expected employment in the sector. However, the most prominent areas of overrepresentation according to this metric are the Offaly and Kerry administrative county areas, which show significant overrepresentation of 73.1% and 21.5% respectively. Clare county council also shows an overrepresentation of 9.3%.

6 Total employment is estimated by subtracting "Unemployed looking for first job and Unemployed, having lost or given up previous job" from "Total in Labour Force".
7 Measured on a residence, rather than place of work basis.

Table 7 Administrative county with generation sites employment in Electric power generation, transmission and distribution (D351) 2022 ROI

Administrative county (Council area)	Sector D351 Employment	Expected D351 employment	Discrepancy from expected employment
Dublin city	1,545	1,490	3.7%
Fingal	855	770	11.0%
Offaly	303	175	73.1%
Wexford	293	345	-15.1%
Clare	305	279	9.3%
Cork county	789	800	-1.4%
Kerry	407	335	21.5%
Galway county	297	426	-30.3%
Limerick city and county council	383	450	-14.9%
Mayo	225	290	-22.4%

Source: Census 2022 FY060 - Population Aged 15 Years and Over in the Labour Force

A similar exercise can be carried out by ITL1 region – which correspond to Local Council areas - in Northern Ireland with 2021 data from the BRES for the wider aggregate NACE D sector. Focusing on regions with generation sites, we see overrepresentation in Derry City & Strabane and Lisburn & Castlereagh. In Derry City & Strabane, employment is over 50.1% above that expected by the regional employee share, while its 25% in Lisburn & Castlereagh. Underrepresentation occurs in Mid &East Antrim, which shows sectoral employment levels about a quarter below what would be expected given the regional employee share.

Table 8 NI Local Authority areas with generation sites Regional Employment in NACE D 2021

Local Authority Area	Employee numbers Sector D	Expected employment based on NI share	Discrepancy from expected employment
Derry City & Strabane	218	145	50.1%
Lisburn & Castlereagh	186	149	25.0%
Mid & East Antrim	81	107	-24.1%
Total	485	401	21.0%

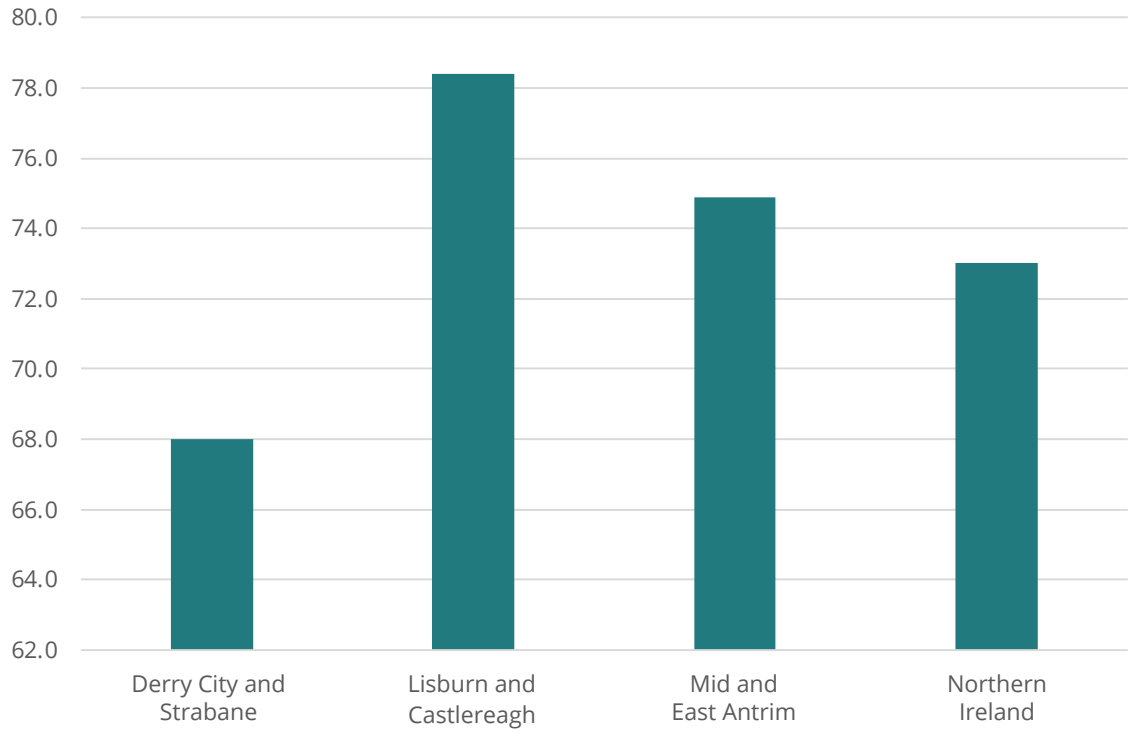
Source: Business Register and Employment Survey (NISRA 2023)

Wider regional labour market indicators

Labour Force participation rates are useful when measuring how well an economy is performing in terms of employing people of a working age. Despite some terminological difference – economic activity rate tends to be used in Northern Ireland whereas in the Republic, Labour force participation rate is more frequently used – these data are comparable across regions.

On the regional NUTS 3 and ITL 1 level, the regional data in chart 5 and 6 shows that in NI and in the ROI, the economically activity rate and LPR varies significantly between the different regions. Focusing on the regions with fossil generation sites shows a varied pattern. On the one hand, the Lisburn and Castlereagh area had an activity rate 5.4 percentage points (78.4 percent) above the NI average of 73 percent. This was the best performing region in Northern Ireland on this metric. Similarly, Mid and East Antrim shows an economic activity rate of 74.9 percent, 1.9 percentage points above the NI average in 2021 . On the other hand, the ITL1 region of Derry and Strabane was NI's poorest performer in participation terms 5 percentage point below NI average at 68 percent.

Chart 5 Economic Activity rate 16-64 by Local Authority Area with generation sites NI

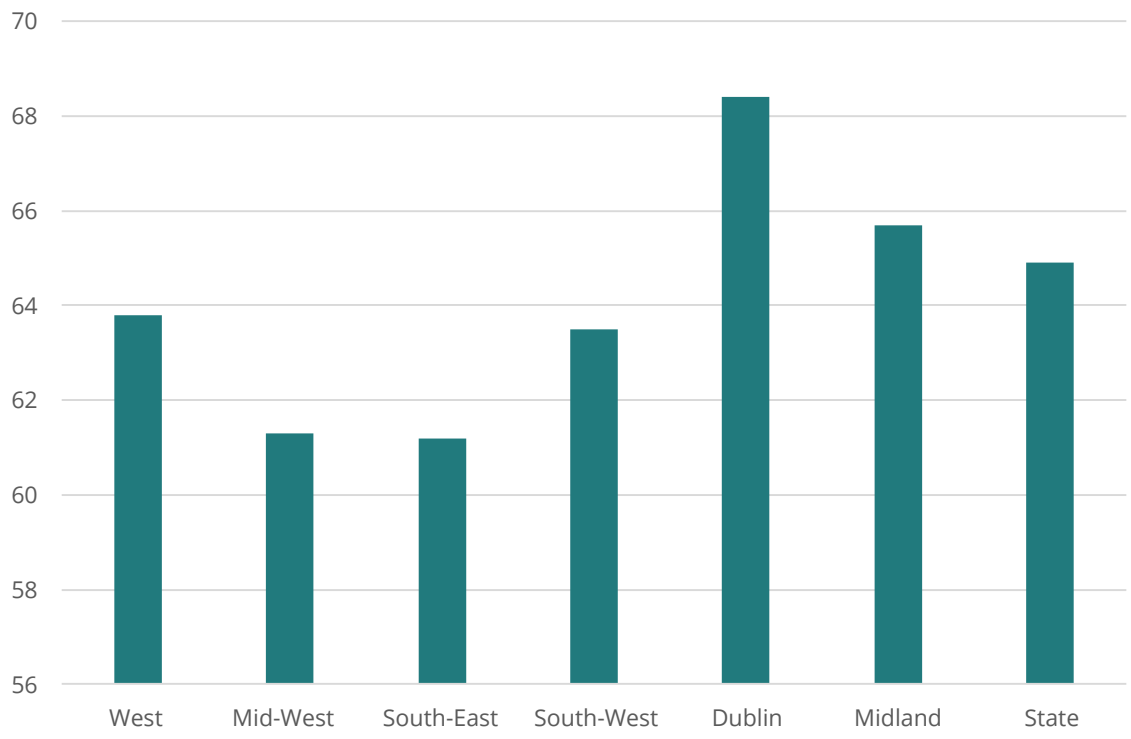


Source: Labour Force Survey Historical Tables- March 2023

In the Republic, we see a similarly varied pattern, although this differs by data source. The Labour Force Survey in the Republic uses ILO definitions of economic status and offers the most up to date data by broader NUTS 3 region. The Dublin and Midlands region showed Labour Force Participation rates (LFPR) for over 15s of 68.4 and 65.7 percent respectively in the first quarter of 2023, above the national rate of 64.9 percent. However, four of the six NUTS 3 regions with generation sites showed LFPR below the national average.

The West and South West regions show participation rates 1.1 and 1.4 percentage points below the national average. However, the lowest participation rates in the state occur in the Mid-West and South-East regions, which show participation deficits of over 3.5 percentage points relative to the national average at 61.3 and 61.2 percent.

Chart 6 ILO participation rate (15+) by NUTS 3 region with generation sites Q1 2023



Source: LFS Quarterly series QLF08 - Persons aged 15 years and over

The latest census provides more disaggregated data by county, showing slightly different trends.[8] The relative overperformance of the Council areas in the Dublin regions carries over into the census data. However, Offaly become a more prominent underperformer than is evident in the wider regional data, showing a deficit of 2.2 percentage points relative to the national average. Performance is particularly weak in Clare, Wexford, Kerry and Mayo, which all show deficits of more than 1.5 percentage points.

8 The census tends to estimate a higher labour force participation rate than the LFS. Nonetheless, the census offers data at a more granular scale, and is useful for comparisons between regions.

Table 9 Administrative county with generation sites Labour Force participation rates Census 2022

Administrative county (Council area)	Labour Force Participation rate (15+)	LFPR Discrepancy from national average (percentage point)
Dublin City	65.4	-4.2
Fingal	65.6	-4.4
Offaly	59	2.2
Wexford	58.6	2.6
Clare	59.4	1.8
Cork county	60.5	0.7
Kerry	58.1	3.1
Limerick city and county council	58.3	2.9
Galway county	60.6	0.6
Mayo	57.4	3.8
Total	61.2	0

Source: Census 2022 FY056A - Rates for Labour Force Participation and Unemployment

This geographically distinct employment picture is also reflected in pay data by area. Data for 2021 in ROI show that most areas with generation sites – apart from Dublin and Cork – show median and average pay below the national average. Several counties with fossil fuel generation show median pay more than 10% below the national level: Kerry showed a deficit of 13.6% , Wexford 12.2% and Mayo 10.2%. This is even more stark in relation to mean weekly pay with gaps in these cases approaching 20%, Kerry 18.4%, Wexford 18.2% and Mayo 16.1%. The counties Offaly, Limerick, Galway, and Clare show less significant gaps of 5.7%, 2.9%, 2%, and 1.4% in median pay terms, and 13.3%, 5.7%, 6.3% and 6.3% in mean weekly pay.

Table 10 ROI Historic County with generation sites Median and Mean Weekly Earnings 2021

Historic County	Median Weekly Pay	Median as % of national value	Mean Weekly Pay	Mean as % of national value
Dublin	€708.08	109.9%	€958.15	116.7%
Offaly	€607.94	94.3%	€711.47	86.7%
Wexford	€565.97	87.8%	€671.27	81.8%
Clare	€635.50	98.6%	€769.64	93.7%
Cork	€656.17	101.8%	€822.58	100.2%
Kerry	€557.08	86.4%	€670.14	81.6%
Limerick	€625.96	97.1%	€774.33	94.3%
Galway	€631.50	98.0%	€769.17	93.7%
Mayo	€578.51	89.8%	€688.83	83.9%
Total	€644.55	100.0%	€820.95	100.0%

Source: Earnings Analysis using Administrative Data Sources NEA04 - Mean and Median Weekly Earnings

Similar data for Northern Ireland regions reveal disparities. Pay in Lisburn and Castlereagh is relatively high, with median weekly pay 10% above that typical for Northern Ireland as a whole or 12.2% in mean terms. In Derry City & Strabane, Median pay was only 88.6% of the wider NI average while average pay was 83.6% of the NI average in 2022. Similarly, Mid & East Antrim shows a pay disparity of 4.1% and 7.1% for median and average pay.

Table 11 Median and Average Gross Weekly Pay by Local Authority area NI with generation sites 2022

Region (ITL1)	Median Gross Weekly Pay	Median as % of national value	Mean Gross Weekly Pay	Mean as % of national value
Derry City & Strabane	£441.10	88.6%	£475.20	83.6%
Lisburn & Castlereagh	£547.40	110.0%	£637.80	112.2%
Mid & East Antrim	£477.60	95.9%	£528.00	92.9%
Total	£497.80	100.0%	£568.20	100.0%

Source: Employee earnings in NI 2022

Social risk indicators

Differentiations in regional labour markets are also reflected in social risk indicators in both jurisdictions, namely Disposable Income per person (DIPP) in the Republic and Gross Disposable Household Income per head in Northern Ireland, as well as poverty rates, and the Republic specific indicator of enforced deprivation.

The data from CSO shows a significant pattern of differentiation across the Republic in DIPP terms. Of the county areas with generation sites, Dublin and Cork are the most successful, with DIPP measures above the national average in 2019 and 2020, though this advantage is significantly more modest in Cork's case. In contrast, Offaly and Mayo show the poorest performance over 2019 and 2020, with deficits between 14.6% and 22.7% (Mayo and Offaly respectively in 2019) relative to national averages. Across both years, all other sites show a deficit in excess of 7% relative to the national average.

Table 12 Disposable Income per Person (DIPP) by historic county ROI with generation sites

Historic County	2019 Disposable Income per person (DIPP)	2019 DIPP as % of national value	2020 Disposable Income per person (DIPP)	2020 DIPP as % of national value
Dublin	€ 25,566.70	115.7%	€ 27,686.21	118.0%
Offaly	€ 17,058.57	77.2%	€ 18,757.43	80.0%
Wexford	€ 19,737.20	89.3%	€ 20,271.61	86.4%
Clare	€ 20,376.27	92.2%	€ 21,421.80	91.3%
Cork	€ 22,741.85	102.9%	€ 23,855.61	101.7%
Kerry	€ 19,934.48	90.2%	€ 20,462.13	87.2%
Limerick	€ 24,909.49	112.7%	€ 26,247.83	111.9%
Galway	€ 20,419.62	92.4%	€ 21,436.84	91.4%
Mayo	€ 19,086.36	86.4%	€ 19,952.30	85.1%
Total	€ 22,103.30	100.0%	€ 23,460.59	100.0%

Source: County Incomes and regional GDP - Estimates of Household Income

Examining Gross Disposable Household Income per head for local authority areas in Northern Ireland with fossil sites highlights Derry City and Strabane as a region of underperformance. Whereas Lisburn and Castlereagh and Mid and East Antrim show incomes above the NI average - around 14.4% above the NI average in the first case for both years, and 4.7% and 4.2% for 2019 and 2020 in Mid and East Antrim – Derry City and Strabane shows a deficit of more than 10% for both years.

Table 13 Gross Disposable Household Income per head (GDHIPH) for Local Authority Region NI with generation sites

Local Authority Region (ITL1)	GDHIPH 2019	GDHIPH % of national value 2019	GDHIPH 2020	GDHIPH % of national value 2020
Derry City & Strabane	£15,538	89.3%	£15,470	89.4%
Lisburn & Castlereagh	£19,902	114.4%	£19,795	114.4%
Mid & East Antrim	£18,220	104.7%	£18,022	104.2%
Total	£17,395	100%	£17,301	100%

Source: ONS 2022 Regional gross disposable household income, UK: 1997 to 2020

The Survey of Income and Living conditions (SILC) provides data on poverty indicators in the Republic of Ireland. For the purposes of this analysis, we focus on two such indicators measured on a broad NUTS 2 (See Appendix) regional basis – the at risk of poverty rate and the Enforced deprivation rate. Enforced deprivation refers to an inability to afford at least two items from a list of 11 considered to be the norm for society. The more standard at risk of poverty indicator refers to incomes below 60% of

the median (middle) disposable income in the state. Both indicators are measured on a household level.

The most recent data show the Eastern and Midland region as the state's best performer, showing an at risk of poverty rate a full 2 percentage points below the national average, and an enforced deprivation rate 1.7 points below national levels. The Northern and Western region shows significantly elevated poverty rates relative to the national average (18.6% versus 13.1%) while enforced deprivation rates were 1.2 percentage points below the national average. The Southern region showed underperformance on both metrics, although this was particularly pronounced for enforced deprivation, with over a fifth (21.2%) of individuals affected, compared to the national average of 17.7%.

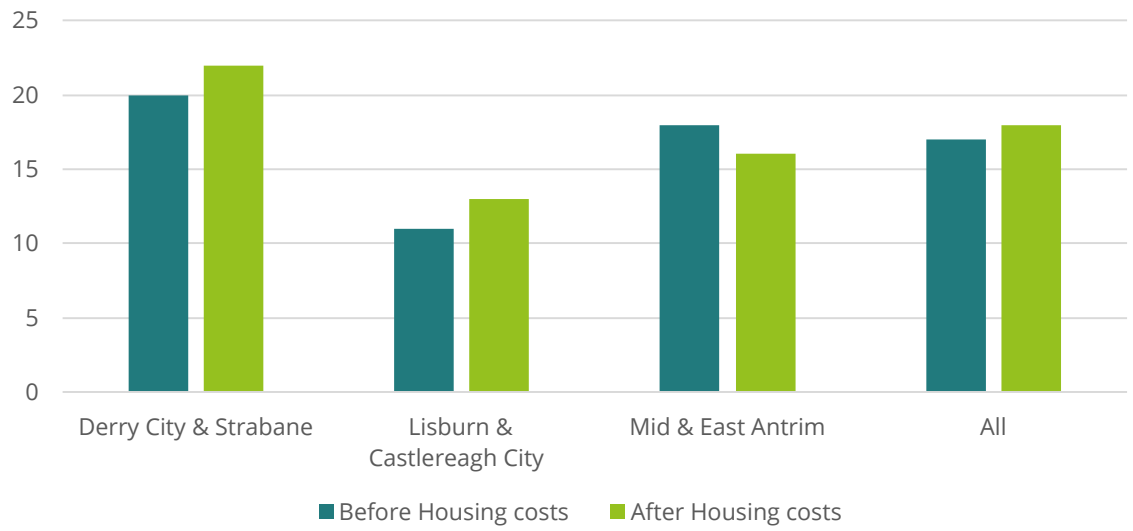
Table 14 At risk of Poverty and Enforced Deprivation Rates by NUTS 2 region ROI 2022

NUTS 2 Region	At risk of poverty rate %	Enforced Deprivation rate %
Northern and Western	18.6%	16.5%
Southern	13.3%	21.2%
Eastern and Midland	11.1%	16.0%
National average	13.1%	17.7%

Source: Survey of Income and Living Conditions (SILC) 2022 SIA68 - Income and Poverty Rates

The Department for Communities in Northern Ireland produce regional poverty indicators before and after housing costs are incorporated for households after tax. The 3-year averages produced for Local government districts show Lisburn and Castlereagh as the strongest performer among regions with fossil generation, with poverty rates measuring favourably against NI averages at 11% versus 17% of individuals before housing costs and 13% versus 18% after these costs are incorporated. Mid and East Antrim shows varying performance, before housing costs are incorporated, poverty rates exceed the NI average (18% vs 17%) while poverty rates decline once housing costs are incorporated (16% versus 18%). Derry City and Strabane is again the poorest performer, with poverty rates 3 points higher before housing costs and a full 5 points higher after they are incorporated.

Chart 7 Poverty rates by Local Government District with generation sites Northern Ireland (pre and post housing costs) 2018/19 to 2021/22 average



Source: Northern Ireland Poverty and Income Inequality report 2021-22

Conclusion

The available data – summarised in Tables 15 and 16 below – suggest that certain fossil fuel sites are located in areas which are more highly exposed to risk factors which may impede transition.

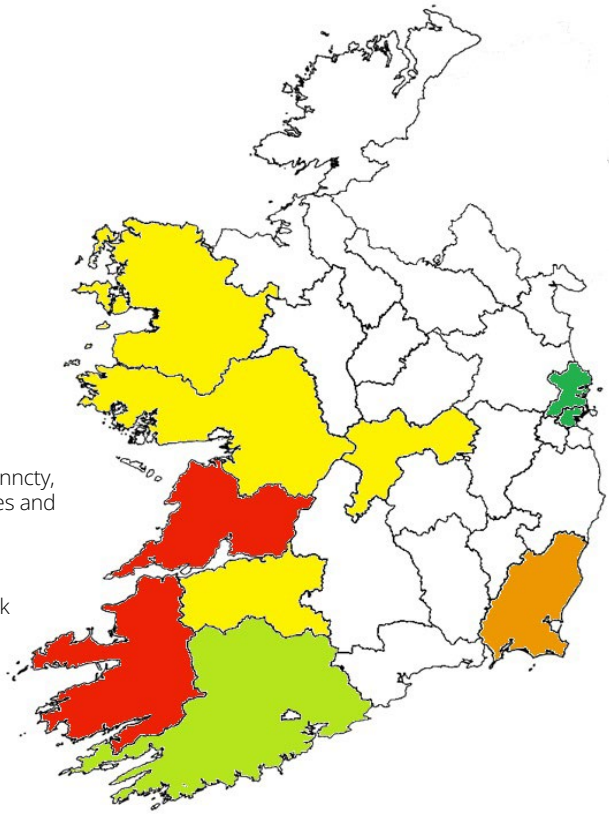
All sites appear to show some risk factors relative to national averages, but risks appear especially pronounced for certain sites. Moneypoint in Clare, and Tarbert in Kerry show risk in every factor measured: across sectoral exposure, county level labour market indicators and wider regional social risk factors. This is particularly notable as these sites are slated to close in 2023 and 2024. This analysis suggests that these areas should be the subject of immediate policy efforts to curb transition risks and encourage high quality green employment.

The Great Island power station in Wexford also shows risk in five indicators, suggesting the site may also be high risk.

Table 15 ROI generation sites risk matrix

Generation site	NACE D351 Overrepresentation Local Authority	County Pay % of national median	County Participation rate (15+)	2019 County DIPP as % of national	Poverty (NUTS 2)	Deprivation (NUTS 2)
Dublin Bay	3.7%	109.9%	65.4	115.7%	11.1%	16.0%
Huntstown	11.0%	109.9%	65.6	115.7%	11.1%	16.0%
Poolbeg CC	3.7%	109.9%	65.4	115.7%	11.1%	16.0%
Edenderry	73.1%	94.3%	59	77.2%	11.1%	16.0%
Rhode	73.1%	94.3%	59	77.2%	11.1%	16.0%
Moneypoint	9.3%	98.6%	59.4	92.2%	13.3%	21.2%
Sealrock	-14.9%	97.1%	58.3	112.7%	13.3%	21.2%
Aghada	-1.4%	101.8%	60.5	102.9%	13.3%	21.2%
Whitegate	-1.4%	101.8%	60.5	102.9%	13.3%	21.2%
Tarbert	21.5%	86.4%	58.1	90.2%	13.3%	21.2%
Tawnaghmore	-22.4%	89.8%	57.4	86.4%	18.6%	16.5%
Tynagh	-30.3%	98.0%	60.6	92.4%	18.6%	16.5%
Great Island CCGT	-15.1%	87.8%	58.6	89.3%	13.3%	21.2%
National	0%	100%	61.2	100%	13.1%	17.7%

Chart 8: ROI Local Authority areas with generation site by risk



Source: Edited version of wikicommons image. Lasunncty, Republic of Ireland counties and cities , colouration, CC BY-SA 3.0

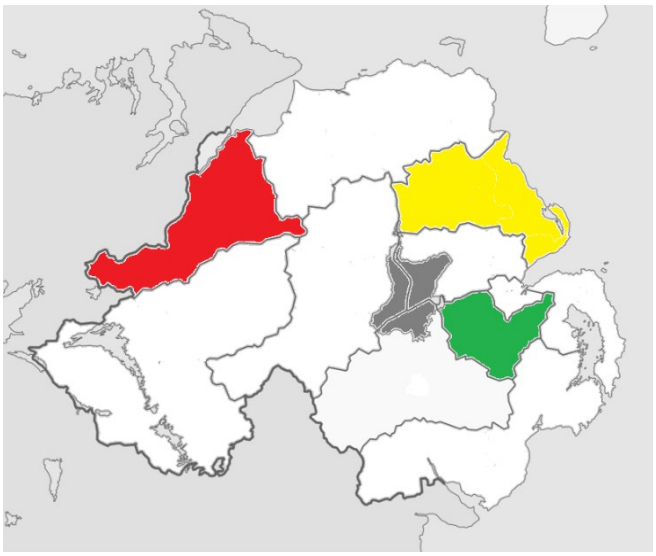
Note: Red represents 6 risk factors, orange 5, yellow 4 and green 1.

Other sites, such as Sealrock in Limerick, Tynagh in Galway, Tawnaghmore in Mayo, as well as the Edenderry and Rhode sites in Offaly show some risk in four domains. In some cases, such as the latter sites in Offaly, this is likely an understatement of risk, given the lack of detailed spatial disaggregation for poverty and deprivation rates, and their incorporation within the larger NUTS 2 statistical area, which includes Dublin, the state's wealthiest location.

Table 16 NI generation sites risk matrix

Generation site	Regional NACE D overrepresentation	Regional pay % of national median	Regional Economic activity rate (15-64)	2019 Regional GDIPH as % national	Poverty before housing costs	Poverty after housing costs
Ballylumford	-24.1%	95.9%	74.9	104.7%	18%	16%
Kilroot	-24.1%	95.9%	74.9	104.7%	18%	16%
Coolkeeragh	50.1%	88.6%	68.0	89.3%	20%	22%
Contour Global	25.0%	110.0%	78.4	114.4%	11%	13%
National	0%	100%	73.0	100.0%	17%	18%

Chart 9: NI Local Authority areas with generation site by risk



Source: Edited version of wikicommons image. TUBS , Northern Ireland, administrative divisions - Nmbrs - colored ,co-louration, CC BY-SA 3.0

Note: Red represents 5 risk factors, yellow 2, green 1.

Spatial risk in Northern Ireland appears more regionally focused, with the Coolkeeragh generation site located in Derry city and Strabane, which shows risk across all dimensions including sectoral concentration, poor broader labour market performance and poverty factors. Other Local authorities with generation sites show lower risk. Mid and East Antrim, the site of Ballylumford and Kilroot generation sites, shows risk in two of five assessed domains – regional pay and poverty before housing costs. Lisburn and

Castlereagh, on the other hand, shows risk in only one domain, reflecting higher than expected sectoral employment.

As we note in our introduction, the Republic's underperformance in relation to its legally mandated carbon budgets may entail a faster than anticipated closures for many fossil fuel sites. Dramatic climate policy developments or overshoot elsewhere may instigate change across the island along expedited timelines. Northern Ireland's recently introduced carbon budgets may face differing challenges, among which is the absence of functioning devolved government to advance policy.

In light of these risk factors, and some suggestive statistics which imply the sector presents a source of high quality employment, particularly at the low end of the income scale, our analysis suggests that transition plans must factor in these issues and respond accordingly. In particular, our finding that the electricity sector broadly represents a key source of well paid employment at the bottom of the labour market is a source of some concern. Possible job losses among those who face worse prospects at similar job skill levels elsewhere in the economy, interacting with local risk factors could present a troubling cocktail of factors impeding transition efforts. Policy should be attentive to the potential spatial challenges posed by a transition in the energy sector, and act to ensure that this transition is just.

Appendix

Republic of Ireland Regional breakdown

NUTS 2 Region	NUTS 3 Region	Historic County	Administrative County/Local Authority
Eastern & Midlands	Dublin	Dublin	Dublin City Council
			Dún Laoghaire–Rathdown County Council
			Fingal County Council
			South Dublin County Council
	Mid-east	Wicklow	Wicklow County Council
		Kildare	Kildare County Council
		Meath	Meath County Council
		Louth	Louth County Council
	Midlands	Longford	Longford County Council
		Westmeath	Westmeath County Council
		Offaly	Offaly County Council
		Laois	Laois County Council
Northern and Western	Border	Donegal	Donegal County Council
		Sligo	Sligo County Council
		Letrim	Leitrim County Council
		Cavan	Cavan County Council
		Monaghan	Monaghan County Council
	West	Galway	Galway City Council
			Galway County Council
		Mayo	Mayo County Council
		Roscommon	Roscommon County Council
Southern	Mid-west	Clare	Clare County Council
		Tipperary	Tipperary County Council
		Limerick	Limerick City and County Council
	South East	Waterford	Waterford city and County Council
		Kilkenny	Kilkenny County Council
		Carlow	Carlow County Council
		Wexford	Wexford County Council
	South-west	Cork	Cork City Council
			Cork County Council
		Kerry	Kerry County Council

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