ALL-ISLAND CO-ORDINATION OF ENERGY INFRASTRUCTURE AND RENEWABLE ENERGY SUPPORTS

Cathal Menton, Genaro Longoria, Niall Farrell, Muireann Lynch

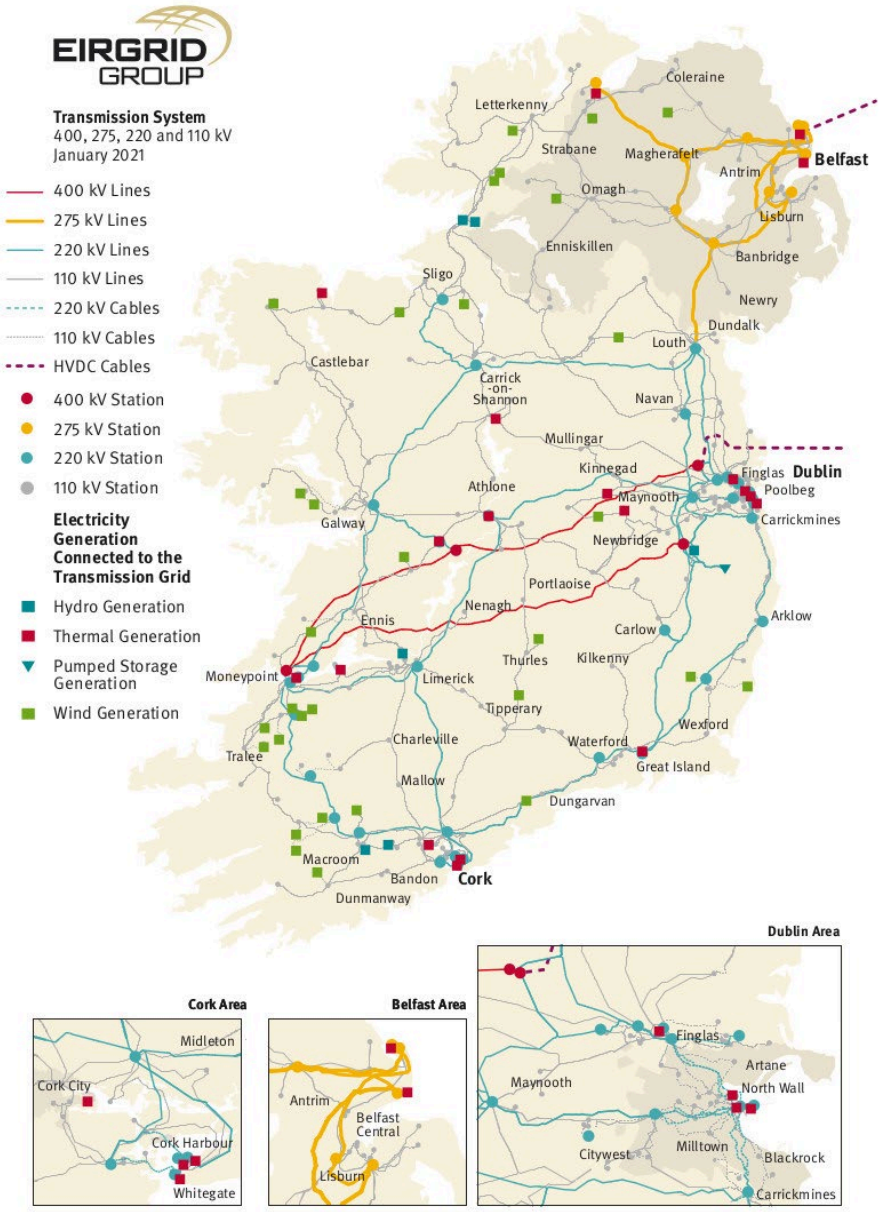
#SharedIsland

ESRI ECONOMIC & SOCIAL RESEARCH INSTITUTE

Introduction

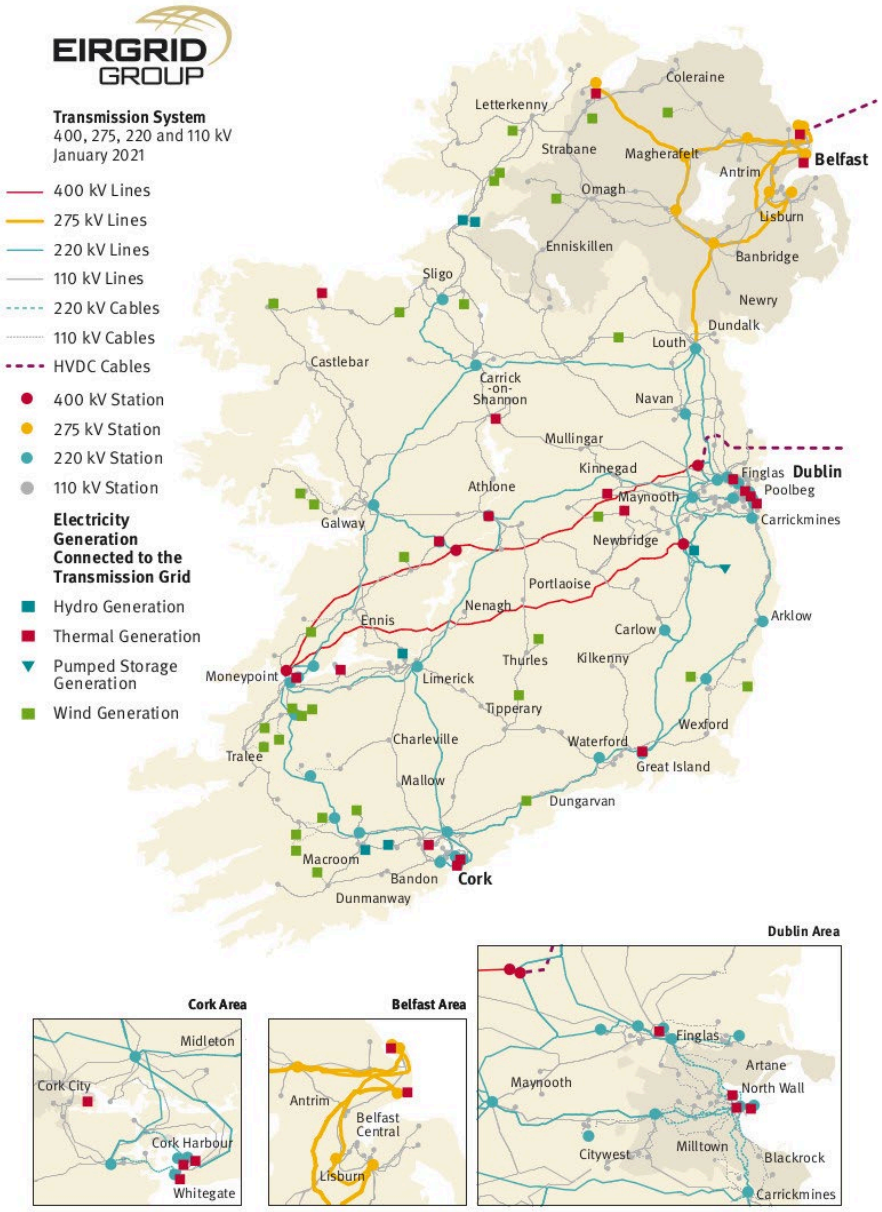
Introduction

- The island of Ireland is a Single Electricity Market
  - Planning and development is co-ordinated on an all-island basis



Introduction

- However, each jurisdiction is responsible for their own renewable energy targets
  - This has been co-ordinated in the past
  - Recent developments have continued this co-ordination
    - 80% IE target
    - 70% NI recently updated to 80%
  - What is the value of this coordination?



Introduction and Motivation

- Renewable Energy policy co-ordination on the island
  - Three aspects
  1. Alignment of targets
     - Historically, renewable energy targets in Ireland and Northern Ireland have tended to move in tandem
     - This allows for co-ordinated infrastructure development on the island.
  2. North-South Interconnector
     - We quantify the benefit of this infrastructure to further interconnect electricity systems in Ireland and Northern Ireland
  3. 'Effort Sharing'
     - Are there further efficiencies possible through an application of effort-sharing principles, as outlined in many international climate change agreements.

Previous work

Literature - where this study fits

- This report considers
  - The implications of cross-jurisdictional co-ordination on system development

  - Incorporates analyses of
    - System cost of expansion
    - Impact of renewables on consumer costs
    - Impacts of policy supports on consumer costs

Literature - where this study fits

- Cross-jurisdictional analyses
  - Curtis et al. (2014) – potential impact of carbon price floor in NI alone
    - Explored the welfare transfers that may occur.
  - We consider cross-jurisdictional impacts of renewable energy targets

  - RES-E deployment and electricity prices focussed on operational expenditures
    - Ex post: di Cosmo & Malaguzzi Valeri (2018)
    - Ex ante: Lynch and Curtis (2016)
  - This paper considers operational and investment expenditures
    - Long term trajectory

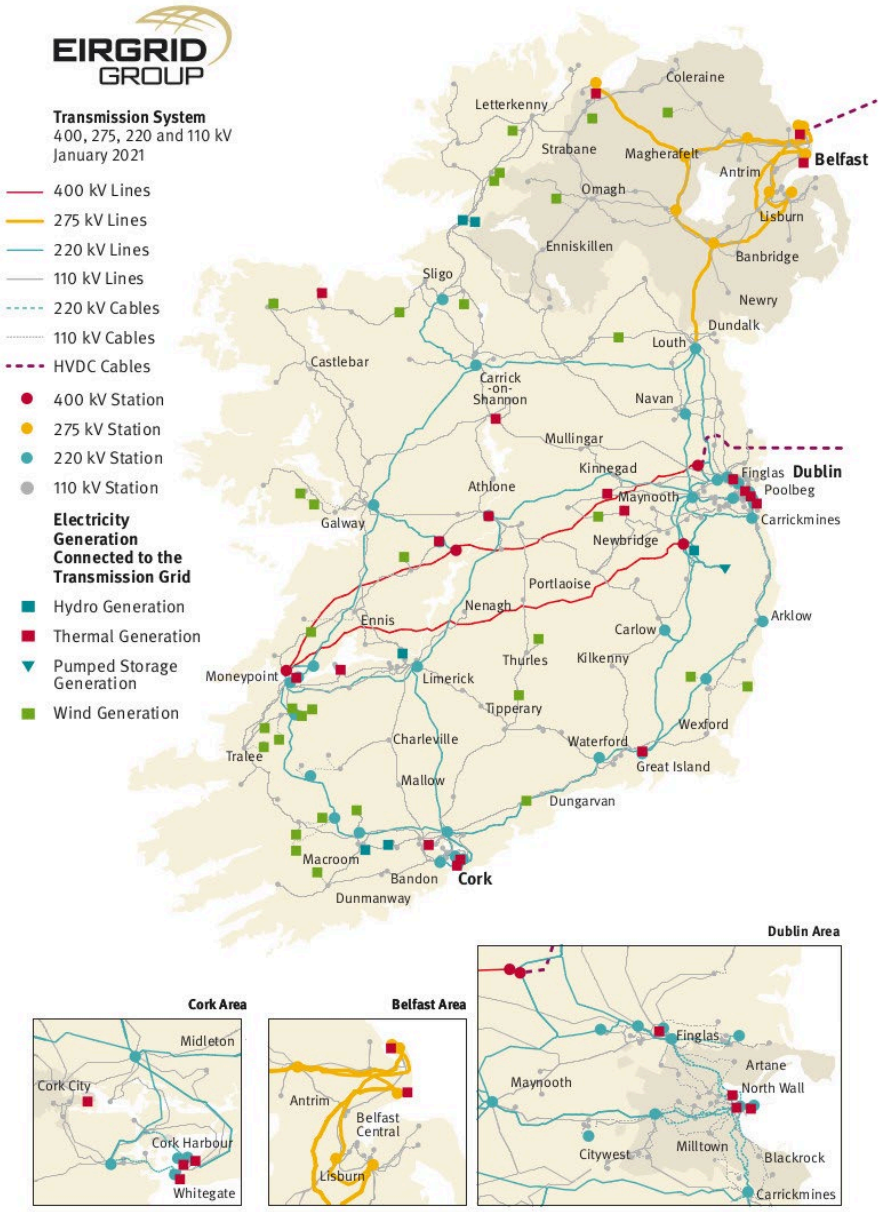
Literature - where this study fits

- Cost of subsidies/prices supports
  - Farrell and Lyons (2015); Groesche and Schroeder (2014) examine the costs to consumers of supporting RES-E.
    - PSO levy in Ireland
    - This is influenced by the quantity of RES-E and the electricity prices
      - RES-E is jurisdiction specific
      - Prices are system-wide
    - How will changes in policy targets affect subsidy costs per household?

Methodology

Methodology

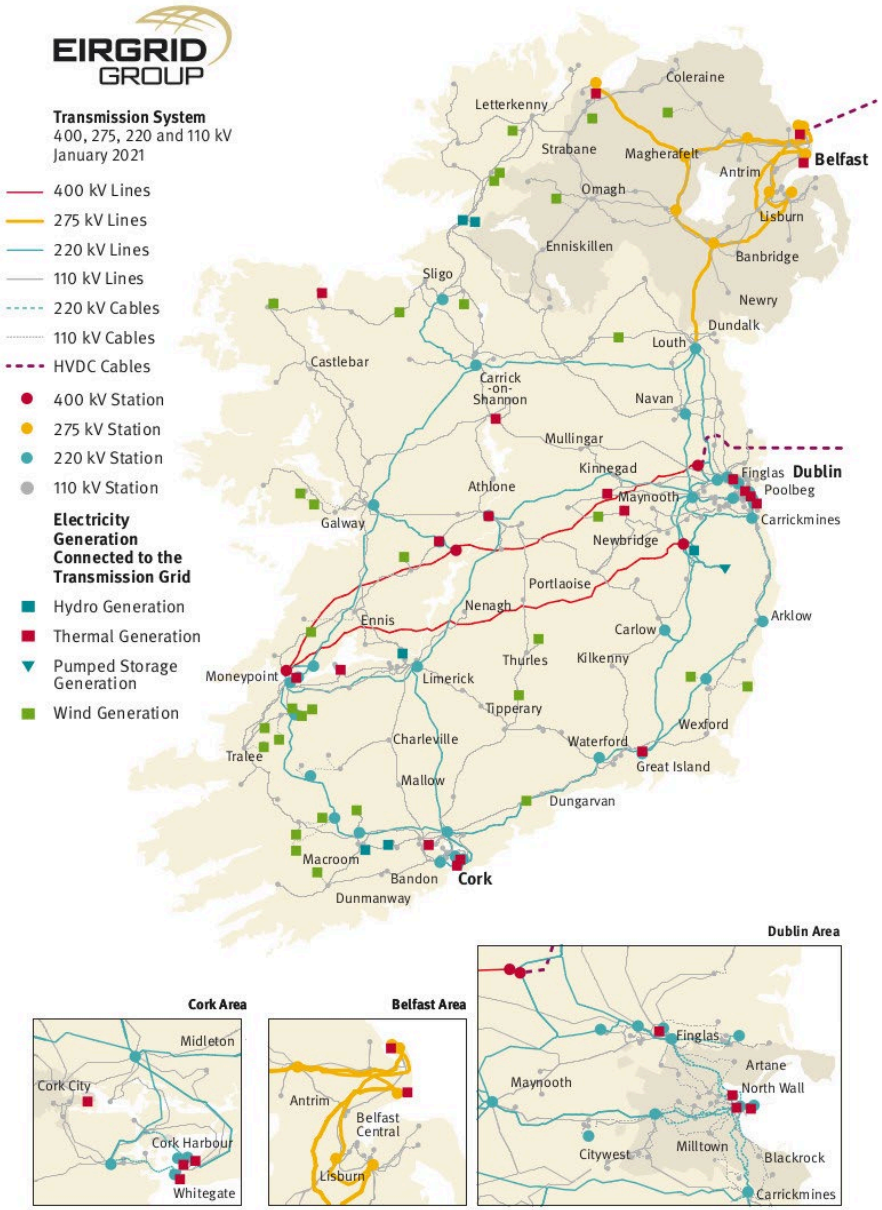
- ENGINE Model
  - Electricity Network and Generation INvEstment (ENGINE) model
  - Planning model for the Irish generation and transmission system.
  - Consider a policy scenario to 2030 and models the optimal infrastructure and generation investment to meet this objective



Methodology

Inputs

- Existing system infrastructure
- Demand profile at each transmission node
- The availability of wind and solar at each transmission node
- Financial data: investment costs of new generation and the operational costs of new and existing generators.

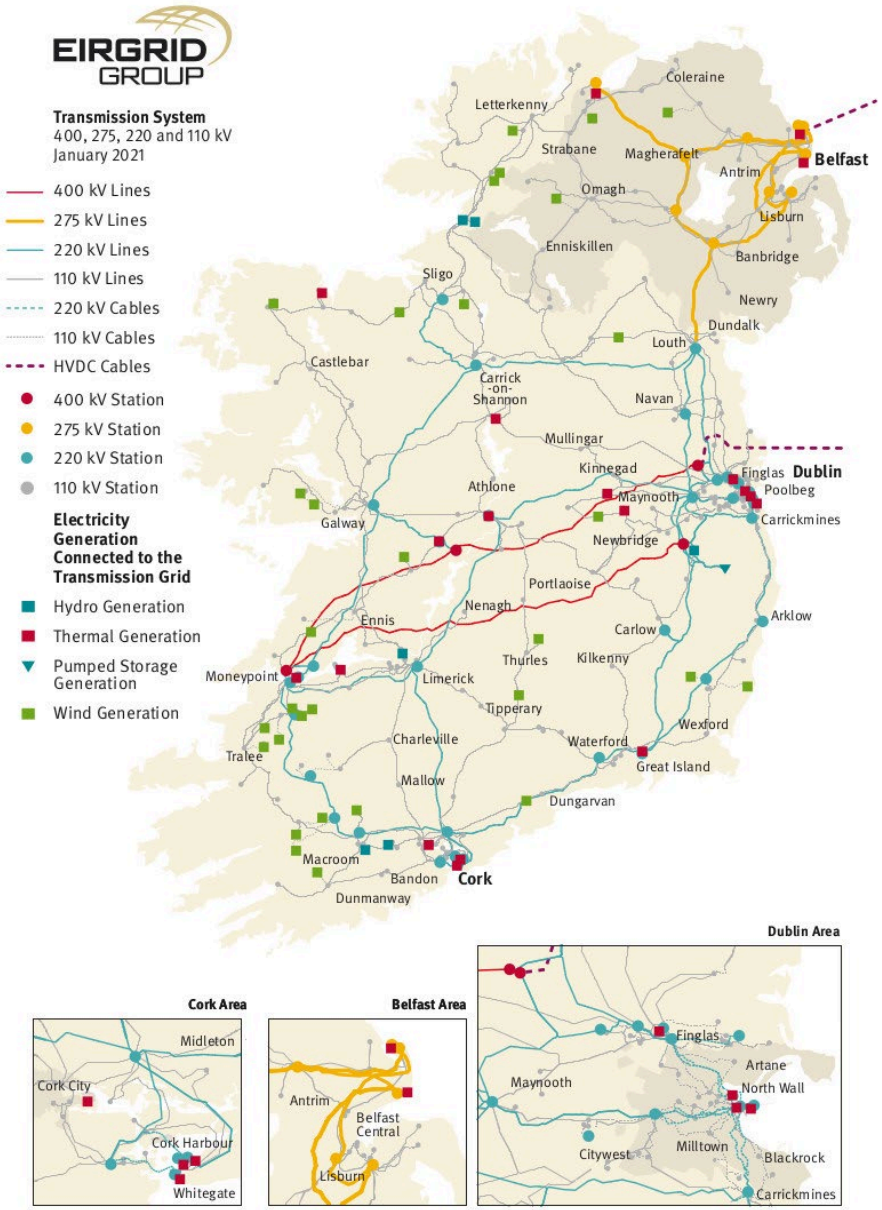


Methodology

Inputs

- Existing system infrastructure
- Demand profile at each transmission node
- The availability of wind and solar at each transmission node
- Financial data: investment costs of new generation and the operational costs of new and existing generators.

ENGINE



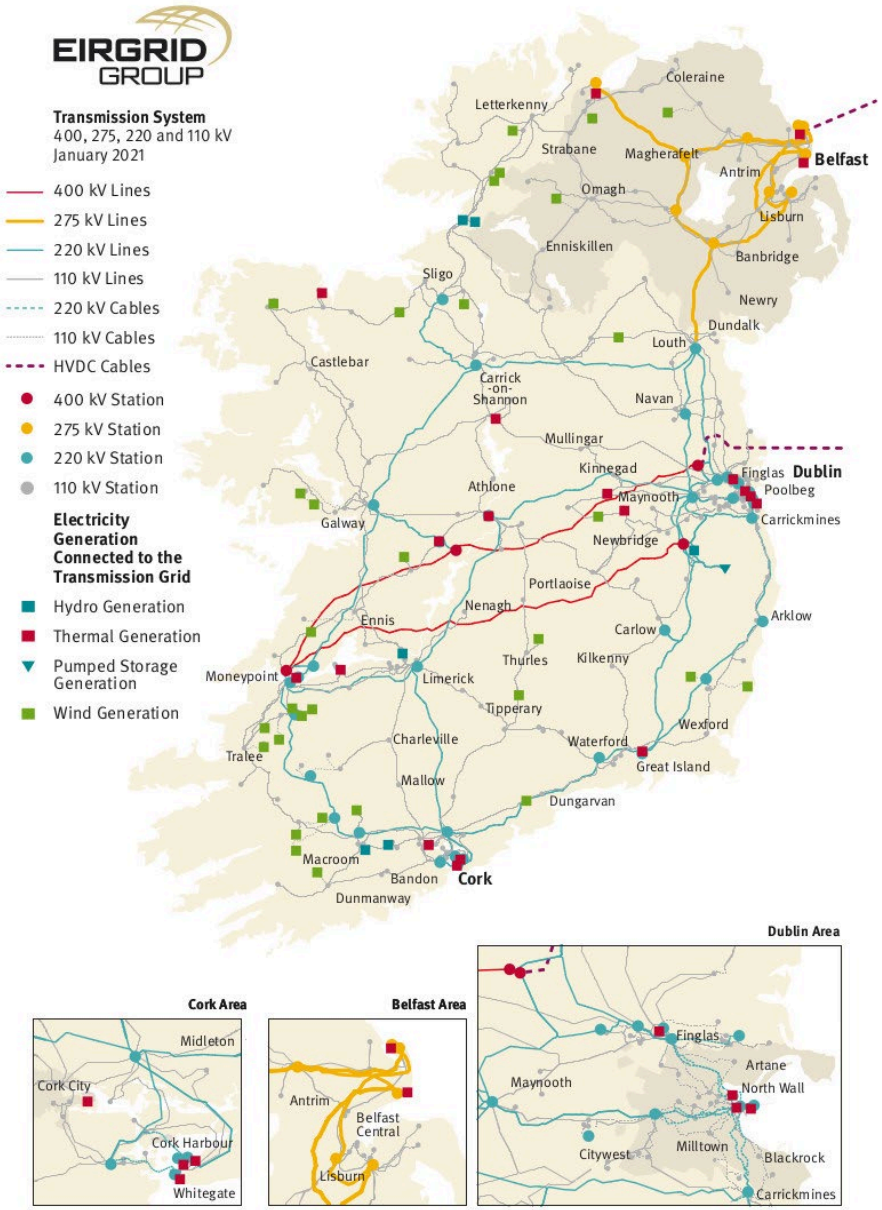
Methodology

Inputs

- Existing system infrastructure
- Demand profile at each transmission node
- The availability of wind and solar at each transmission node
- Financial data: investment costs of new generation and the operational costs of new and existing generators.

ENGINE

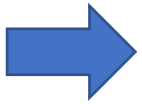
- Scenarios
- RES-E
- N-S Interconnector



Methodology

Inputs

- Existing system infrastructure
- Demand profile at each transmission node
- The availability of wind and solar at each transmission node
- Financial data: investment costs of new generation and the operational costs of new and existing generators.



ENGINE

- Scenarios
- RES-E
- N-S Interconnector

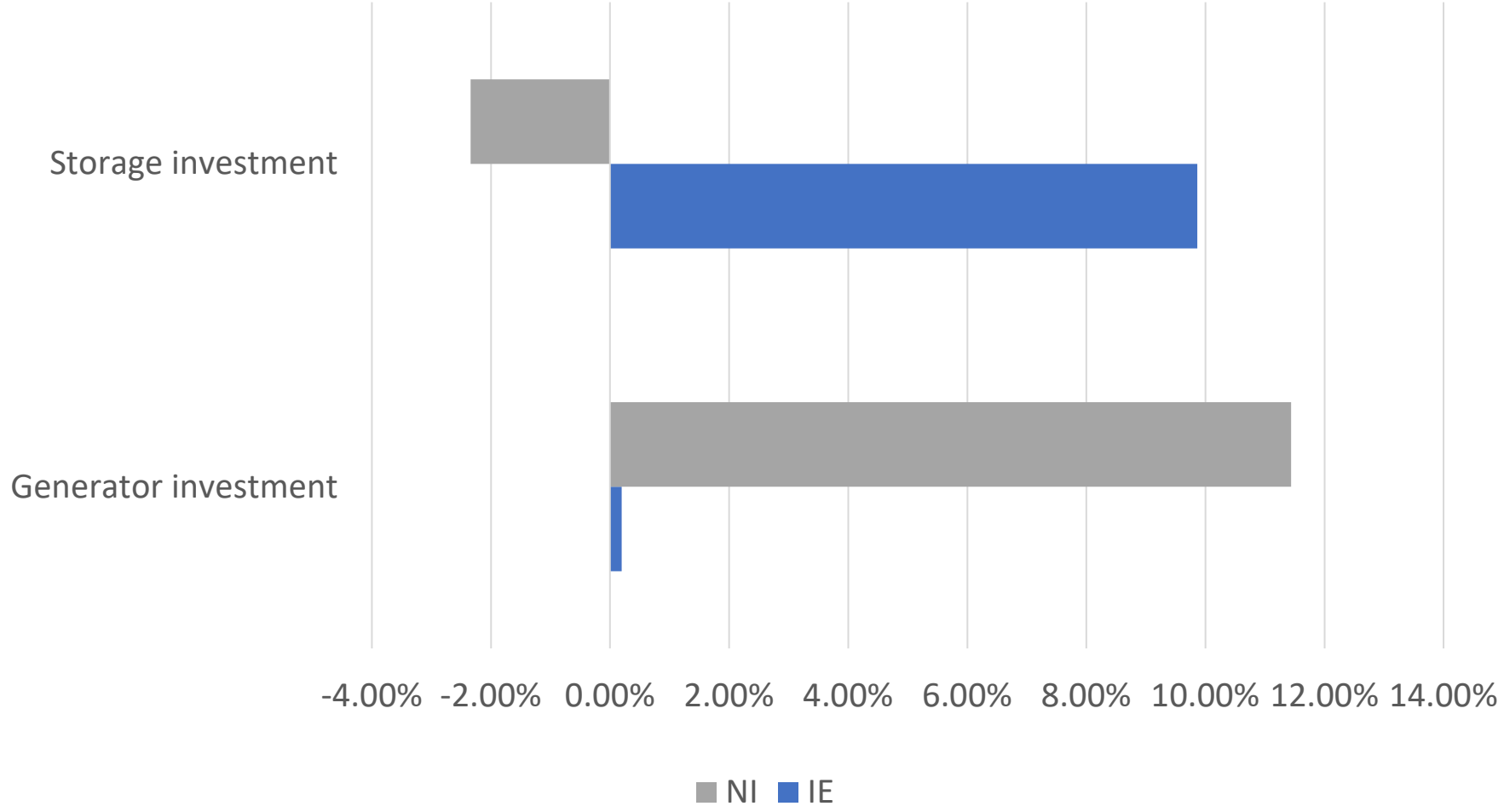
Outputs

- Total system costs
- Prices
- Subsidy requirements ('viability gap')
- System investments

Results I: Policy alignment without the North-South Interconnector

70% NI & 80% IE target -> 80% NI & 80% IE

Results I: Policy alignment without the interconnector



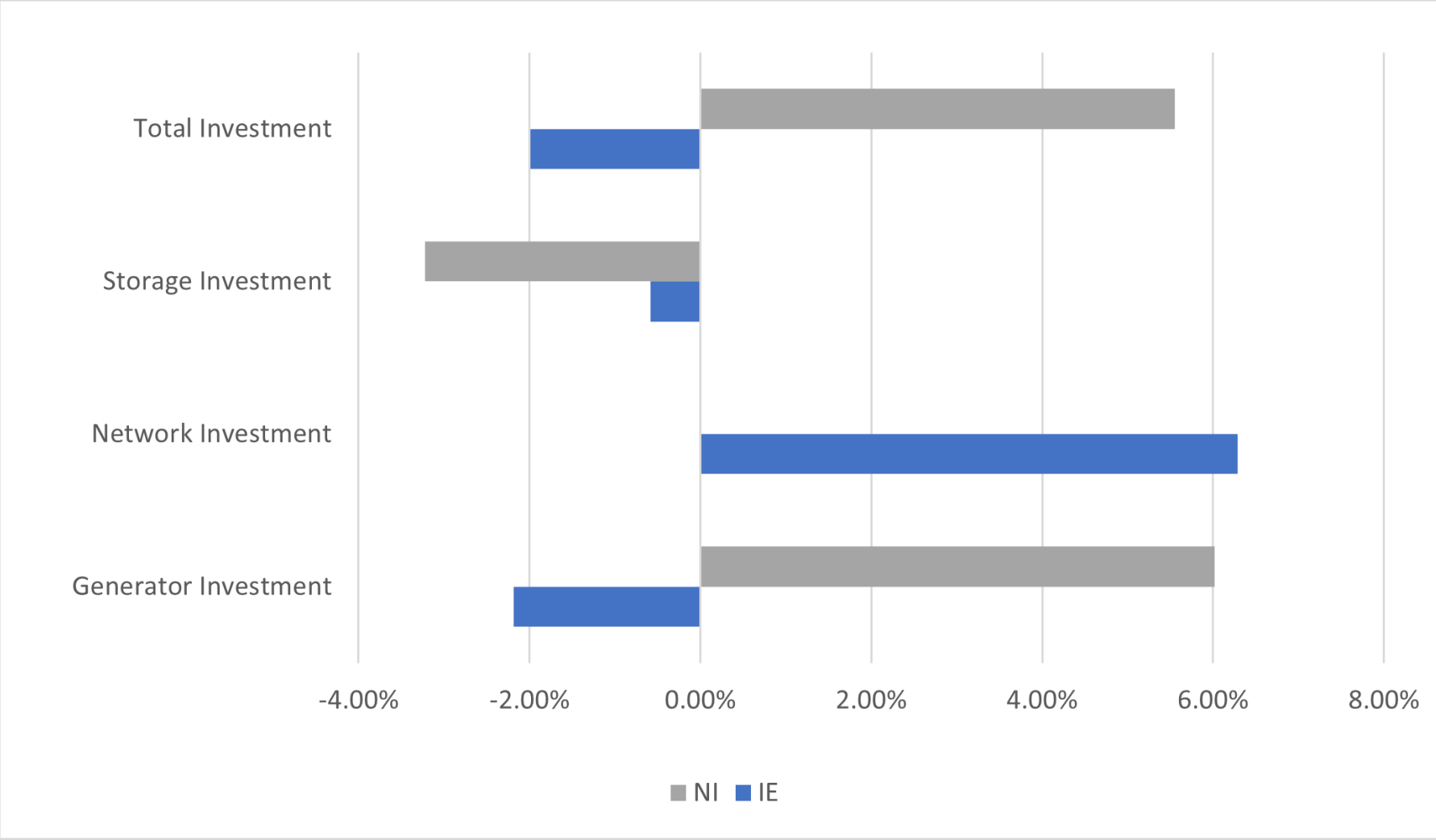
Results I: Policy alignment without the interconnector

- Renewable generation investment increases by 11.4% in Northern Ireland
- This leads to a shifting capacity for storage on the island
  - Prior to alignment, there would have been a greater amount of electricity storage sited in Northern Ireland
  - With alignment, this requirement falls.
  - Two potential drivers
  1. There is more generation in Northern Ireland so more scope for this to be absorbed as required, rather than drawing on stored electricity
  2. Greater excess which is absorbed in IE

Results II: Isolating the impact of the North-South Interconnector

70% NI & 80% IE target, no IC -> 70% NI & 80% IE, IC

Results II: Introducing the North-South interconnector



Results II: Introducing the North-South interconnector

- Two effects of note
  1. There is a greater siting of generation assets in Ireland before we introduce the North-South IC.
  - With the North-South IC, there is scope to site more generation in NI. This is cost-effective.
    - Perhaps there are industrial policy and regional development implications?

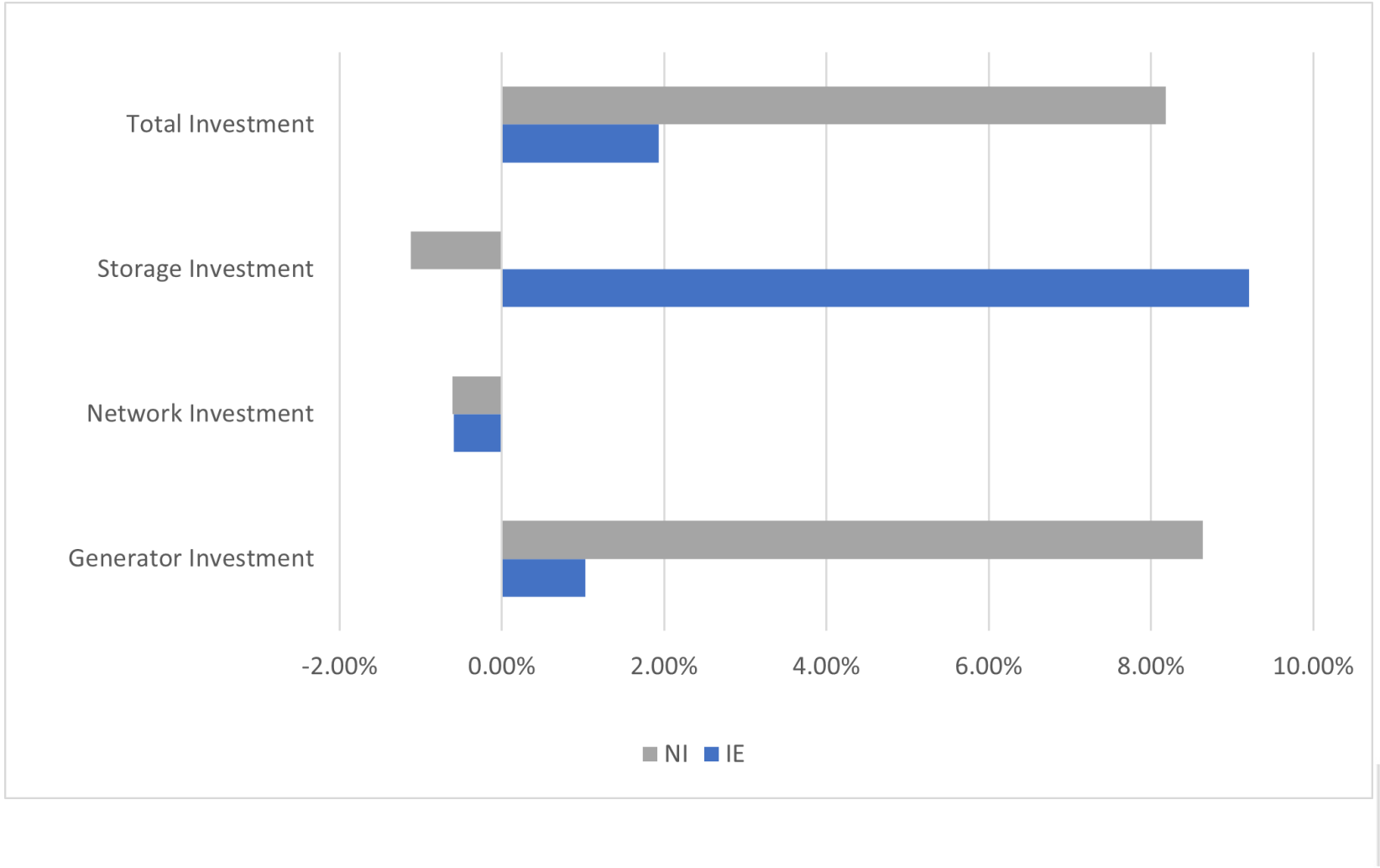
Results II: Introducing the North-South interconnector – 70% NI target (no alignment)

- Two effects of note
  2. Transmission replaces storage in NI.
  - More efficient distribution of electricity throughout the island reduces the need for storage.
  - More cost-effective outcome.

Results III: The North-South Interconnector and Policy Alignment

70% NI & 80% IE target, no IC -> 80% NI & 80% IE, IC

Alignment with the North-South Interconnector



The North-South Interconnector and Policy Alignment

- Increased storage required with alignment
  - This holds regardless of whether the N-S interconnector is operational
    - Additional storage in Ireland is a ‘no regrets’ policy
  - Much less transmission investment than the unaligned scenario
    - This storage is likely a substitute for this.

Results IV: Effort sharing?

80% NI & 80% IE target -> 80% NI & IE

Effort sharing

- General idea
- 80% of renewable energy in Ireland, 80% in Northern Ireland
  - => 80% on the island
- But what if all the wind is on the west coast, for example?
  - Would it be cheaper to co-ordinate across the island and achieve the total 80% in a different IE and NI disaggregation?
- The foundation for ‘effort sharing’ mechanisms introduced in international climate change agreements

Impact of effort sharing on proportional change in total cost

We find that the introduction of an all-island effort-sharing mechanism would not lead to considerable cost reductions. The North-South Interconnector minimises any discrepancy

	North-South Interconnector	
Targets	**Not Operational**	**Operational**
Individual	0.234%	0.195%
Effort sharing	0.217%	0.185%

Note: Table shows proportional change in total cost relative to baseline of total costs under Unaligned, NoIC.

Results IV: Prices and policy costs

Prices

- Alignment of policy targets leads to a reduction in prices of about 4.5%
- The distribution of system cost changes is even across the island

Proportional change in prices

Scenario	IE	NI
UnAligned, NoIC to Aligned, NoIC	-4.21%	-4.47%
UnAligned, IC to Aligned, IC	-4.34%	-4.54%
UnAligned, NoIC to UnAligned, IC	-0.08%	0.10%
Aligned, NoIC to Aligned, IC	-0.21%	0.03%

Policy costs

- Policy costs are the difference between prices and the cost
- As prices fall by 4.5%, this may increase the requirement for renewable energy price supports
  - **IF** fuel prices are low

- If fuel prices are high, the cost depends on the policy in place
  - Future deployment in Ireland under the Renewable Energy Support Scheme will not incur an additional cost

  - In Northern Ireland, cost is dependent on the future policy – to be decided
  - If similar design to RESS, merit order effects will not affect policy costs

In summary

- Alignment of policy leads to changing pattern of energy absorption on the island
  - Additional storage in Ireland is perhaps a ‘no regrets’ policy
    - A cost-effective option under aligned policy targets, with or without the interconnector in place.
    - Indeed, unaligned policy targets may have directed investment towards storage in NI, which would have been less suitable post-2030.

In summary

- Increased renewables puts downward pressure on prices. This benefits consumers across the island.
  - Whether this affects subsidy requirements depends on fuel prices and the policy scheme in place
    - Schemes that provide a hedge for the consumer (e.g. RESS) can minimise the likely subsidy cost

In summary

- The system is close to the theoretical optimal in terms of efficiency
  - The North-South Interconnector can help realise these efficiencies.

Thank you!

niall.farrell@esri.ie

@farrellniall

@niallfarrell@mastodon.ie