# 2023 National Energy Research and Policy Conference

**SEAI National Research, Development & Demonstration Funding Programme**

**energyresearch@seai.ie**

## Session 2

# Research Sprint

**11.30am – 1.00pm**

**Noreen Brennan (Slide 4)**

- ***Renewable energy and storage: An economic assessment of policy requirements in Ireland***

**Vahid Aryanpur (Slide 12)**

- ***Exploring the Implications of Road Freight Decarbonisation on Energy Security in Ireland***

**Alan Henry (Slide 19)**

- ***SIMREI - De-risking Ireland's Floating Offshore Wind Targets***

**Sarah Stanley (Slide 26)**

- ***Energy security in low inertia electrical grids***

**Conall Mahon (Slide 34)**

- ***Options for hard-to-abate infrastructure***

**Fiona Devoy McAuliffe (Slide 40)**

- ***Floating Offshore Wind Arrays – a key step in achieving Ireland's energy security***

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European Regional Development Fund

# National Energy Research and Policy Conference 2023

# Achieving Sustainable Energy Security

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# Renewable energy and storage: An economic assessment of policy requirements in Ireland

Dr. Noreen Brennan
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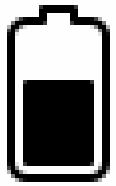
University of Galway

# RENEWABLE ENERGY AND STORAGE

- Increased renewables -> increase energy security.
- Issue: intermittency.
- Storage: Energy security, system services, arbitrage opportunities, environmental and social benefits.
- What are barriers and opportunities to renewable sector engagement?
- What are public preferences for renewable storage?
- Industry survey & focus groups.
- Public survey & focus groups.

# IMPACT OF STORAGE AND POLICY CHANGES ON PREFERENCES

**Battery storage**



WTP: €300

Public survey: 1107 respondents, preferences for wind energy that incorporates intermittency management.

Heterogeneity: 62% strong positive; 34% strong negative, 16% no significant preferences.

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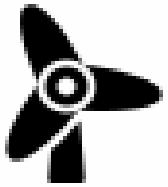
Industry: Preferences for storage and policy changes to increase energy storage. 27 attendees at two focus groups, 10 interviews, 19 survey respondents.

Class 1

**Dispatch down reduced by 80%**

WTP: 37%

**Green Grid Policy**



WTP: 53%

**Long Duration**


WTP: -54%

Class 2

**Medium Duration**


WTP: 120%

**Long Duration**


WTP: 212%

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# POLICY IMPLICATIONS

**INFORMATION CAMPAIGN**

Europe-wide campaign providing information on need for storage, technology, costs and benefits, scale and health and safety

**COMMUNITY ENERGY STORAGE**

Create supports for the development of Renewable Energy Communities and Community Energy Storage

**LEGAL FRAMEWORK**

Develop homogenous definition of storage across EU and remove barriers to engagement in the ex-ante market

**TARGETS**

Set EU level and national targets for storage

**IRISH NATIONAL POLICIES**

Publish Electricity Storage Policy Framework and Hydrogen Strategy

**IRISH FUNDING SUPPORTS**

Include plans for the creation of additional funding supports as part of the Electricity Storage Policy

**GREEN HYDROGEN POLICY**

Prioritise renewable energy supply to the grid before conversion and the development of green hydrogen over other forms of hydrogen

**SKILLS AND TRAINING**

Include skills required by energy storage sector in renewable energy employment strategies

**GREEN GRID POLICY**

Make changes to RESS policy to permit storage of renewable power from the grid

# RESEARCH REQUIREMENTS

- More input from the renewable energy and storage sector into survey.
- International study of factors impacting storage policy across EU.
- National study of viability of community energy with storage.

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# Thank *you*

*References:*


*Brennan, N. and van Rensburg, T. (2023). Renewable energy and storage: An economic assessment of policy requirements in Ireland and the EU. Report prepared for the Interreg STEPS project. https://vb.nweurope.eu/media/20763/nb-steps-project-report.pdf*

*Brennan,N. and van Rensburg, T. (2023). Does intermittency management improve public acceptance of wind energy? A discrete choice experiment in Ireland, Energy Research & Social Science, Vol. 95. https://www.sciencedirect.com/science/article/abs/pii/S2214629622004200*



**For more information please contact:**
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Email: noreen.brennan@universityofgalway.ie
www.windenergyresearchireland


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# Exploring the Implications of Road Freight Decarbonisation on Energy Security in Ireland

**Dr Vahid Aryanpur**

vahid.aryanpur@ucc.ie | SEAI National Energy Research & Policy Conference | September 14, 2023

Project: DecaRbonisation Irish HDV FleeT (DRIFT-HDV)

UCC: Prof. Brian O'Gallachoir; Dr. Fionn Rogan
TCD: Dr. Bidisha Ghosh; Dr. Mounisai Siddartha Middela

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An Roinn Iompair
Department of Transport

Trinity College Dublin

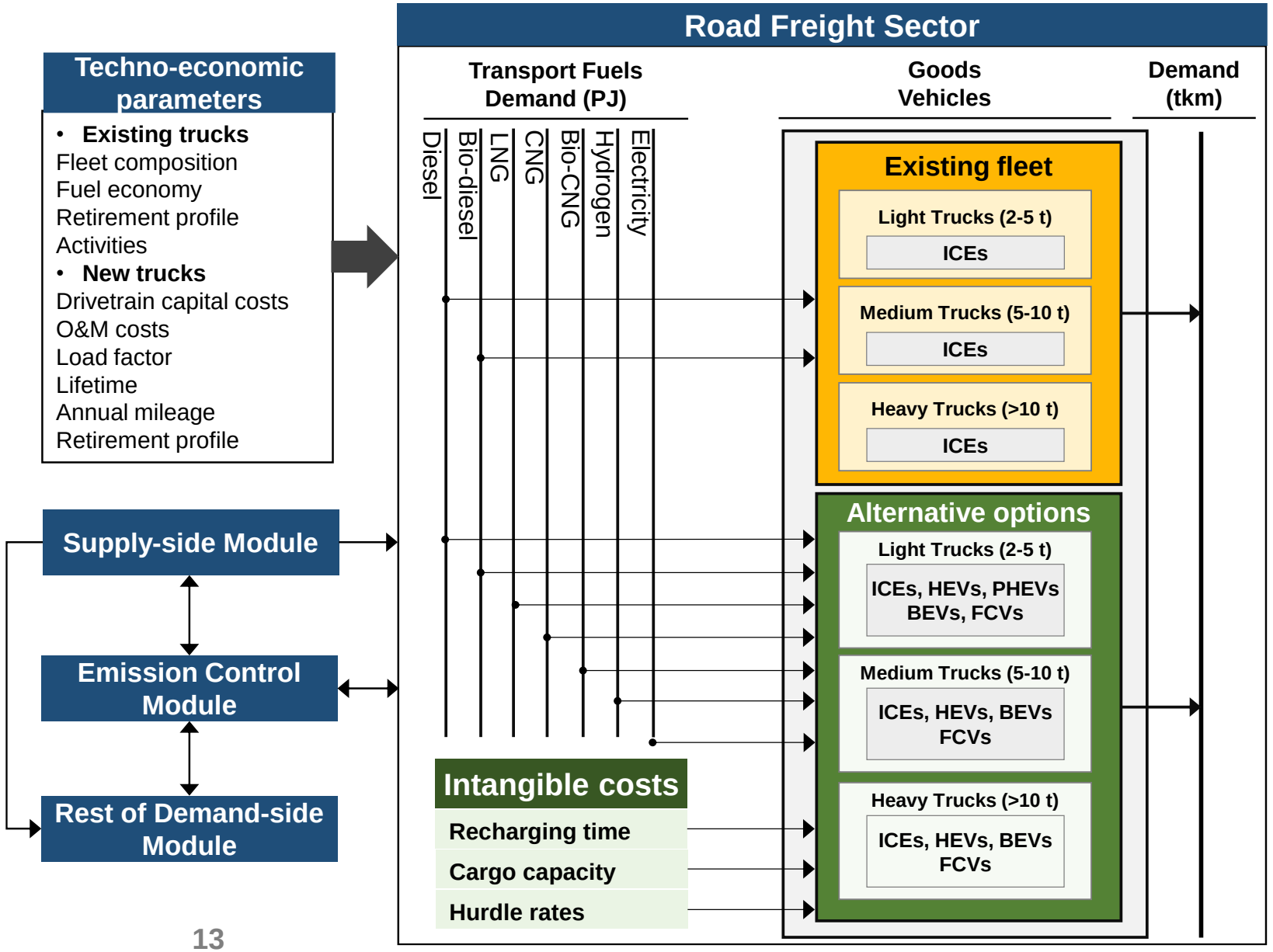
UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

# Trucks in Ireland

- ❑ **Vehicle population: 5%**
- ❑ **Transport emissions: 20%**
- ❑ **Demand by 2050 doubles**

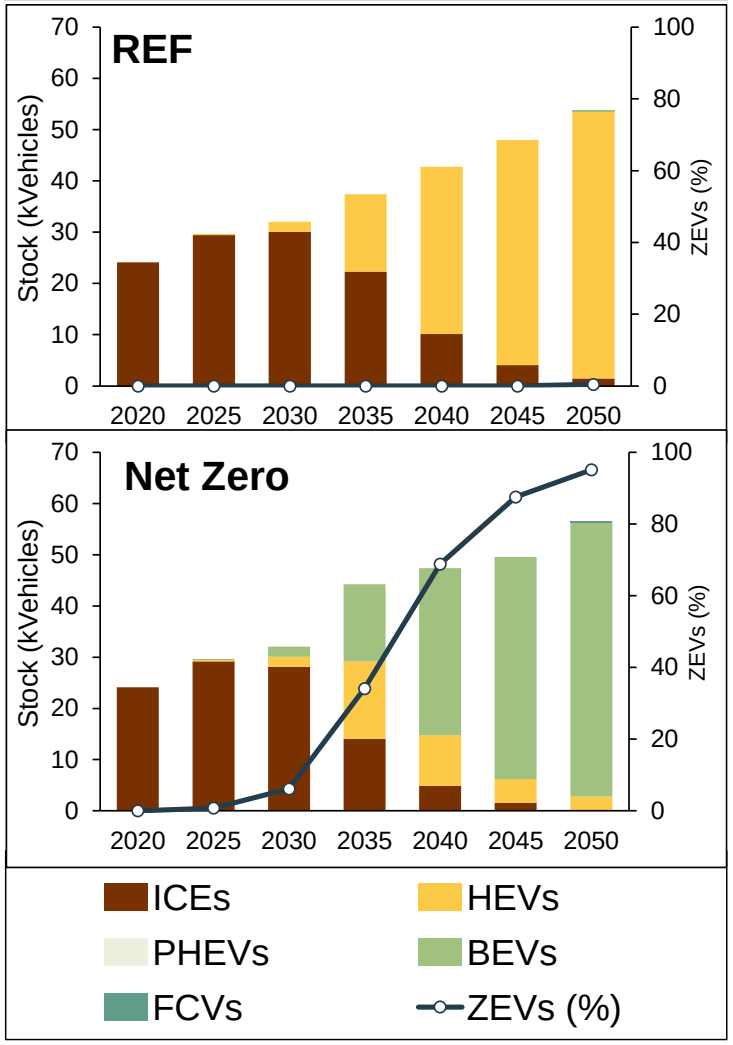
Scenario Analysis

- REF (BAU)
- Net Zero by 2050 (NZ)
- NZ+ Intangible costs (NZI)

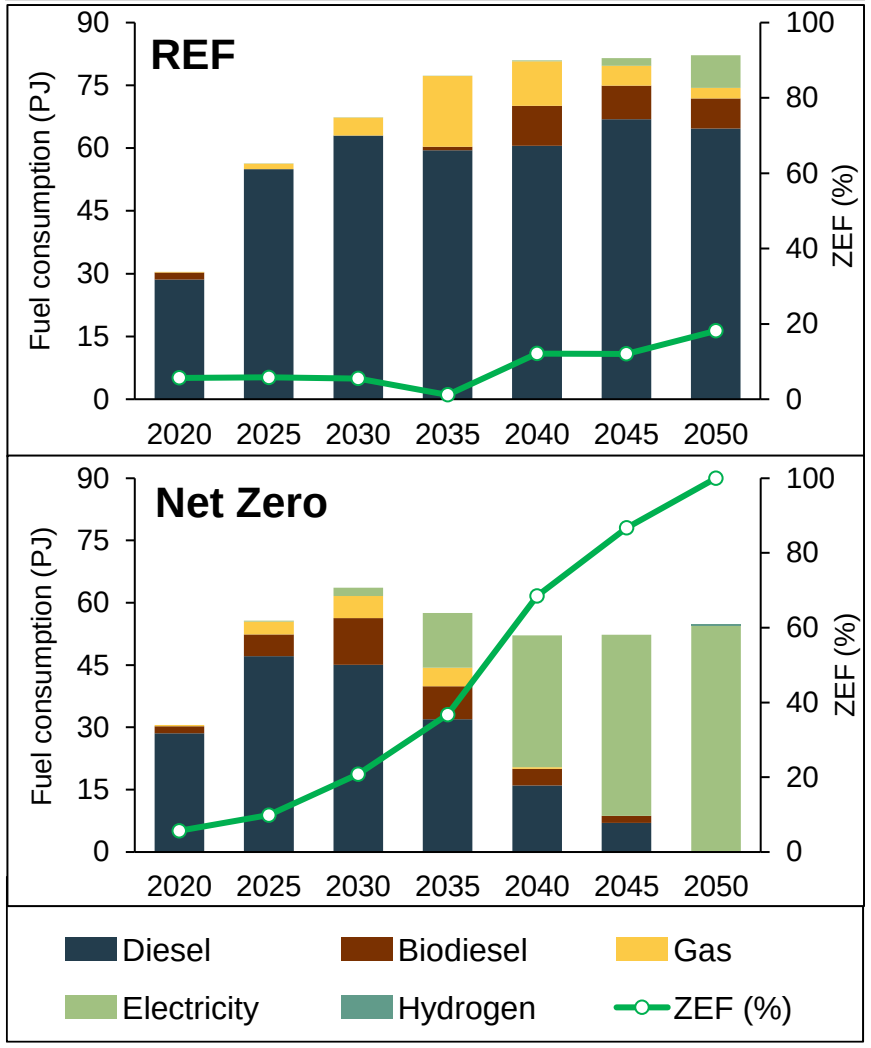


# Cost-optimal Results

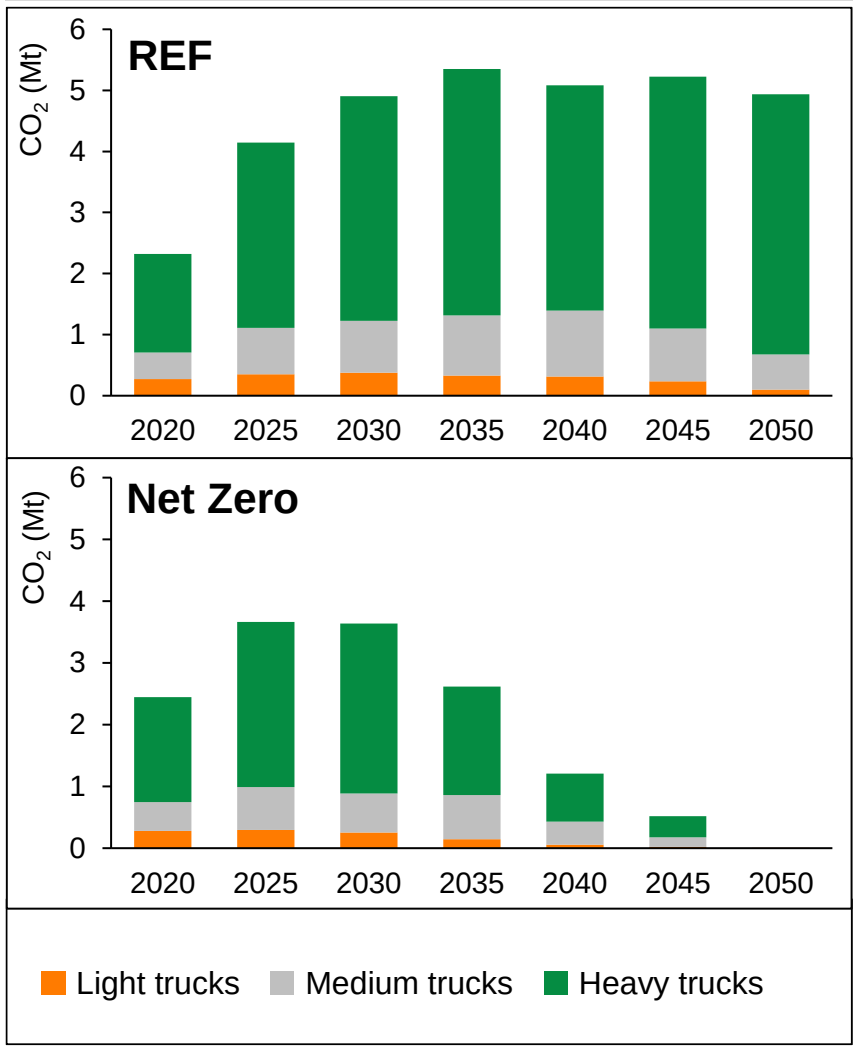
## Stock (heavy)




## Fuel demand (total)

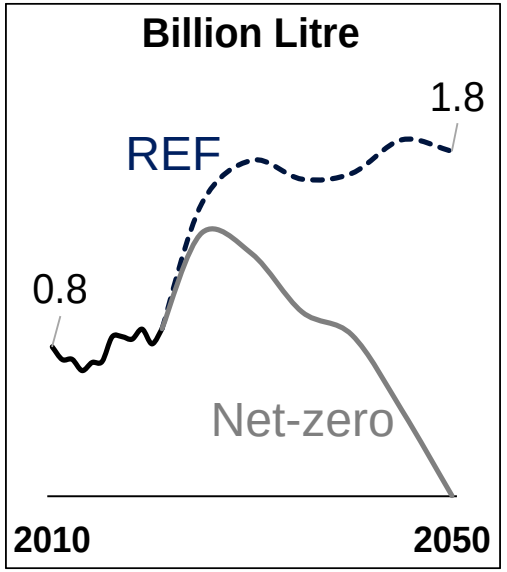



## Emissions (total)

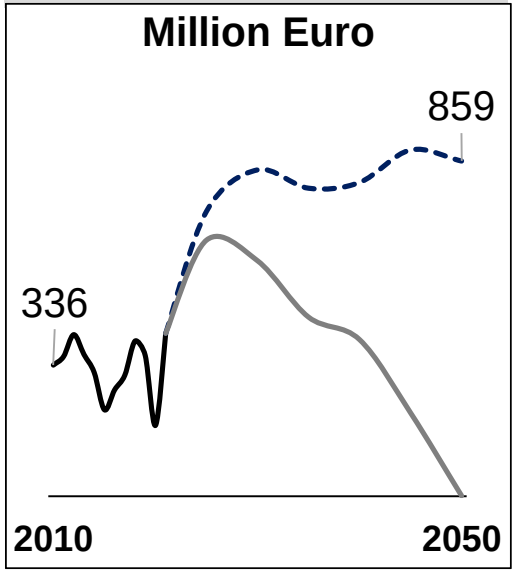


# Implications for energy security

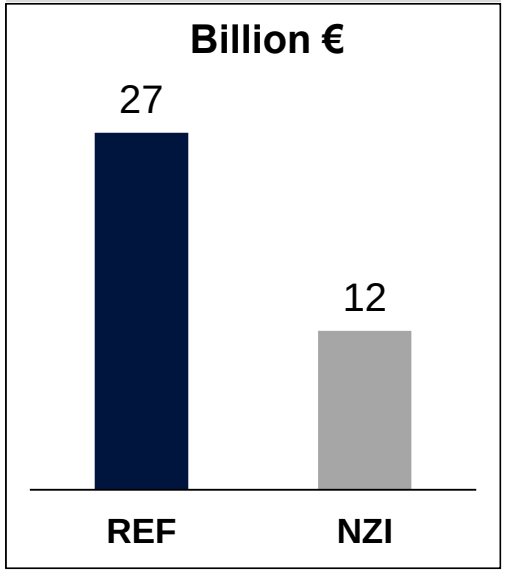
## Diesel demand



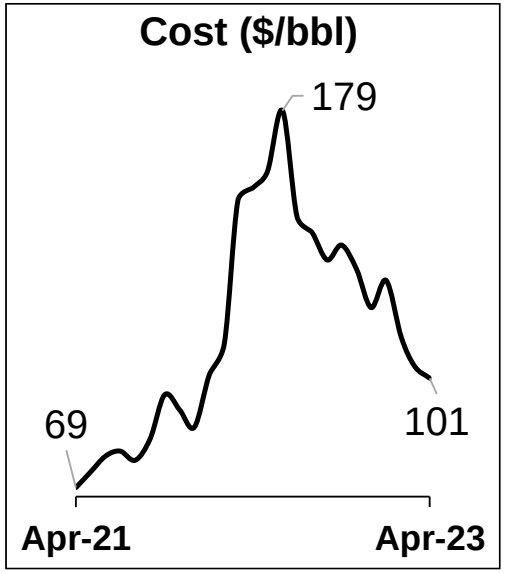

## Diesel import cost



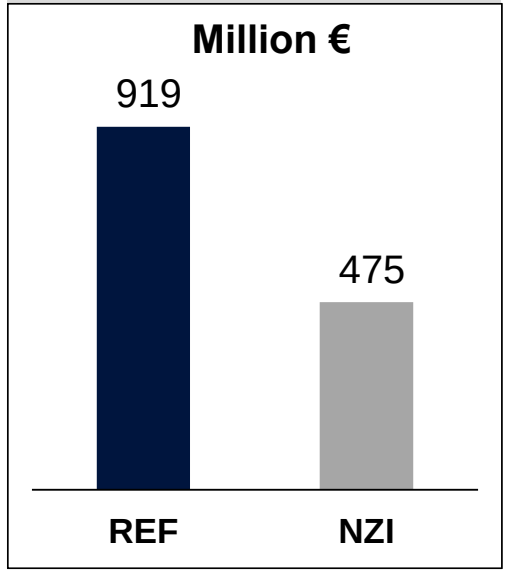

## Cumulative diesel cost



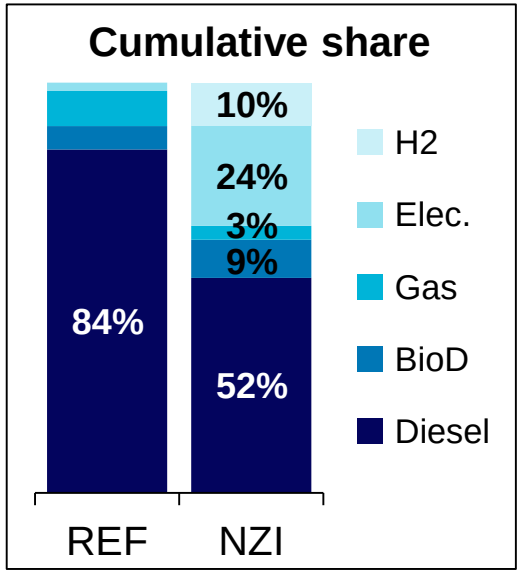

## Volatility



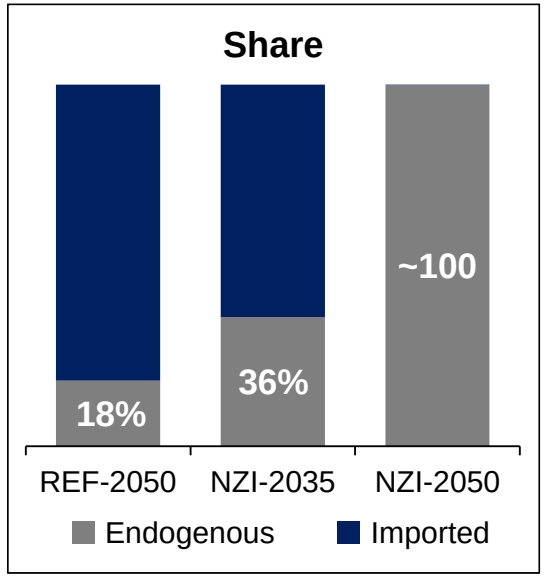

## Health co-benefits




## Diversification of energy sources



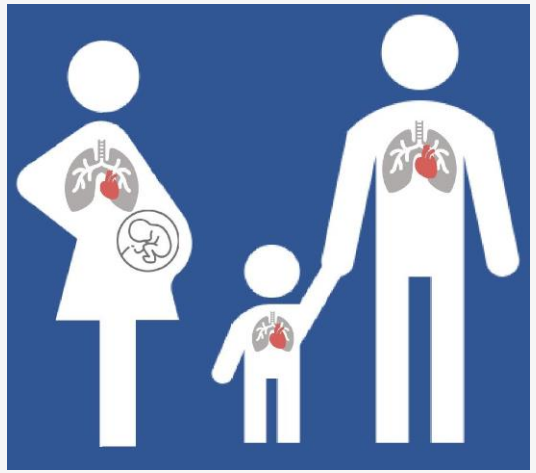

## Local and sustainable energy sources

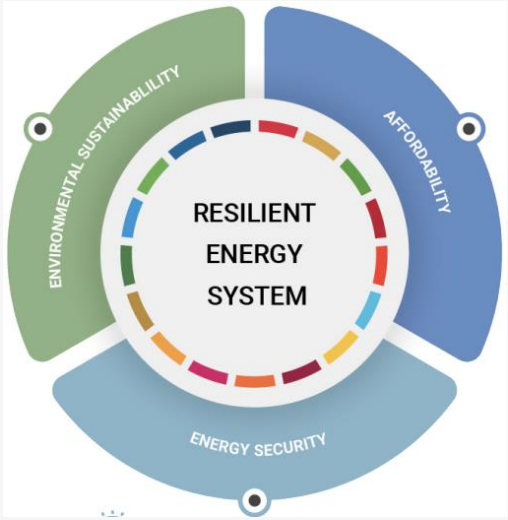


# Insights for policy making

- ❑ Mitigation policies have energy security co-benefits (cost, health, self-sufficiency)
- ❑ Heavy trucks have the highest emissions of freight sector so should be prioritised
- ❑ Early action is vital to prevent lock-in effects
- ❑ Policy should consider OPEX as well as CAPEX factors

# Research to support energy security







**Energy security strategies** to promote the domestic production of green fuels and job creation opportunities

**H2/Electricity infrastructure resilience** to ensure continued operation

**Contact-line electric road systems** to assess techno-economic viability

**Public health assessment** to quantify the healthcare cost savings

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# SIMREI

## Support Infrastructure for Marine Renewable Energy in Ireland

Alan Henry

SEAI National Energy Research & Policy Conference

September 2023

Rockall Research Limited

WaveVenture

MMCC Port Marine Ltd

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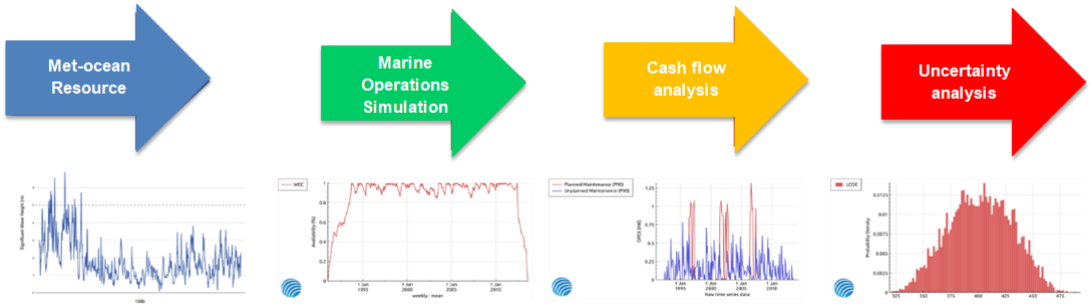
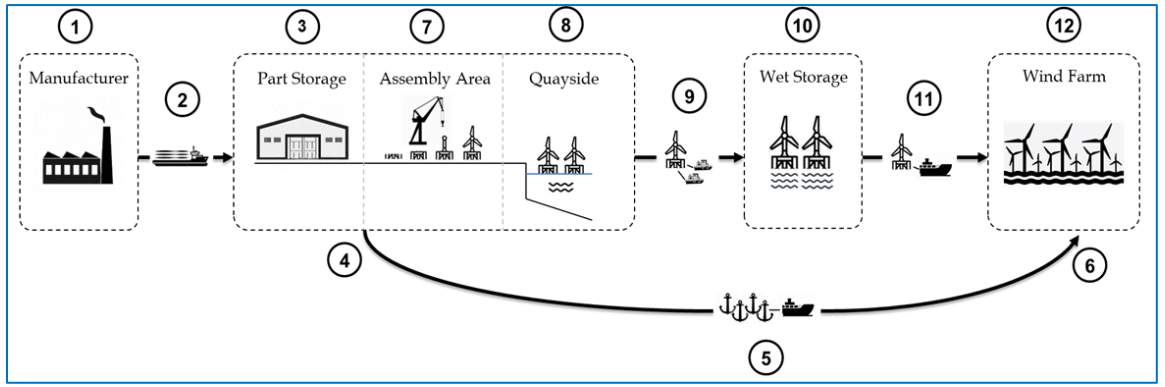
# SIMREI project overview

**Objective:** Determine the needs of the Floating Offshore Wind industry In Ireland in terms of Port infrastructure.

**Method:** Evidence based approach using marine operations simulations of the build-out of Floating Offshore Wind farms in Ireland.

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# Outcomes and learnings

**Port infrastructure**

- Port storage capacity for a minimum of 3 full sets of components to be stored in the port before assembly.
- Quayside capacity for assembly of a minimum of 3 FOWTs.
- A minimum of 3 ports with the above capacity, working in coordination are required to achieve the 2050 targets.

**Wet Storage** is a critical component due to weather conditions off our Coasts. *Without any wet storage, installation rates for a 1GW FOW farm were found to exceed 8 years in some scenarios.*

**Weather restrictions** mean more vessels are required year-round to take advantage of infrequent weather windows.

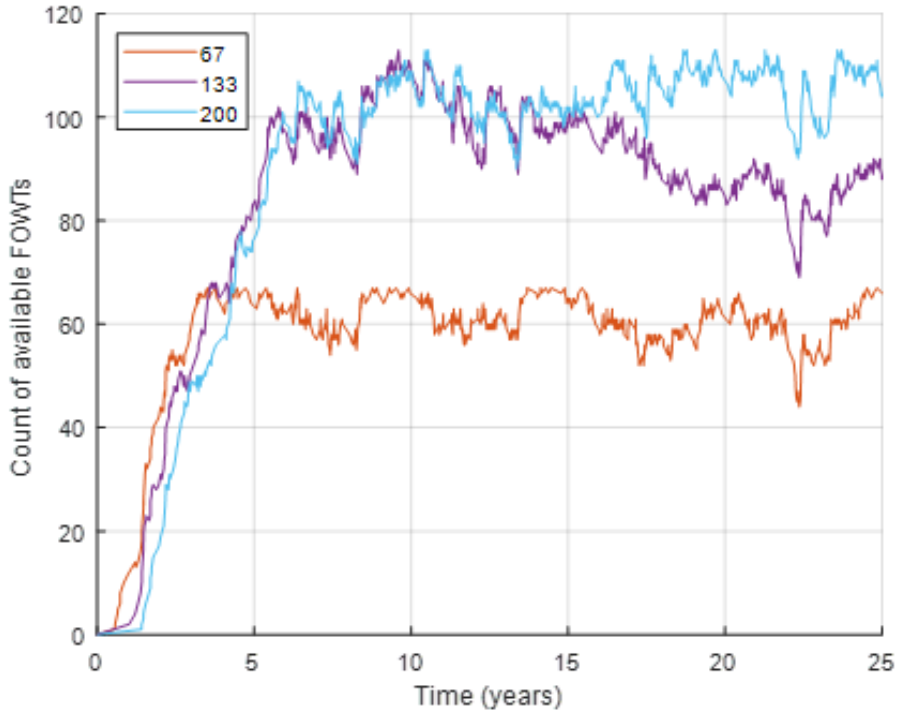


*Figure 5: Installation timeline and availability for 1, 2 and 3GW FOW deployment using the Shannon Estuary*

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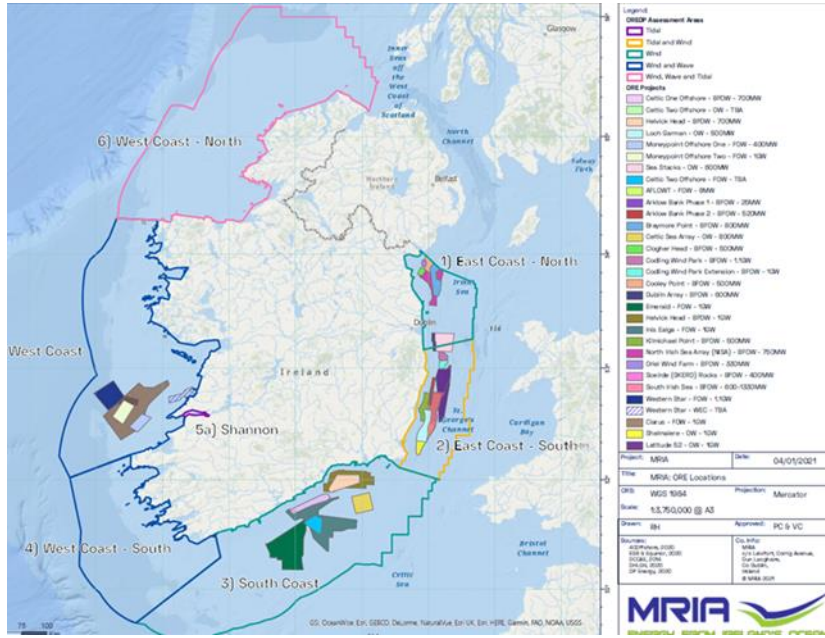
# Input to Policy

Ireland has targets to develop 30GW of Floating Offshore wind by 2050

## SIMREI project findings should inform:

- Port development strategy and funding
- Port coordination strategy
- ORESS
- Marine Spatial Planning

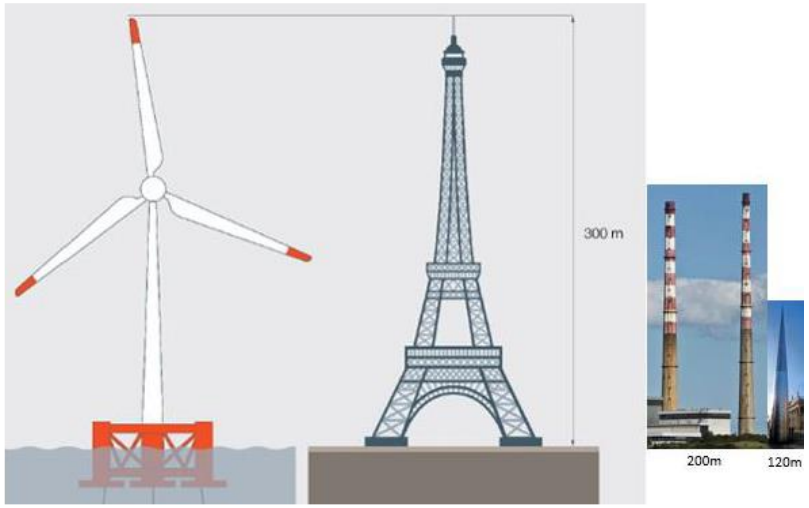


# Research required to enable and support energy security in Ireland

Floating Offshore Wind represents the largest opportunity for Ireland to ensure its energy security, but we need ports and supply chain.

The SIMREI simulation and analysis method is needed to provide evidence-based outputs to guide policy and derisk the sector.

Further research is needed to expand the outputs of the project to give stakeholders the information needed to ensure the successful deployment of Floating Offshore Wind in Ireland.




*Size of a 15MW Floating Wind Turbine*

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# Please get in touch to discuss our research.

**Alan Henry**

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www.linkedin.com/in/alan--henry/

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Department of the Environment, Climate and Communications

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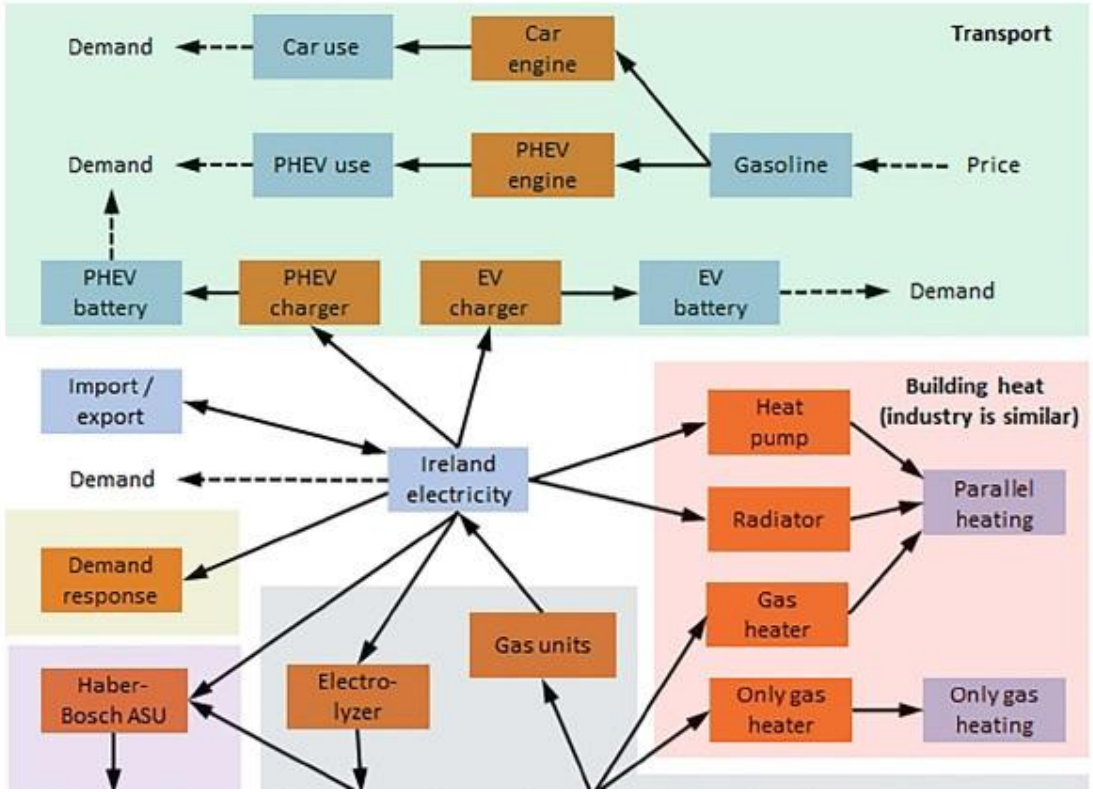
# Energy security in low inertia electrical grids

*Sarah Stanley,*
*University College Dublin*

*Co-authors: Lisa Ryan, Damian Flynn*

SEAI National Energy Research & Policy Conference,
September 2023

# Operational security with 80% RESe

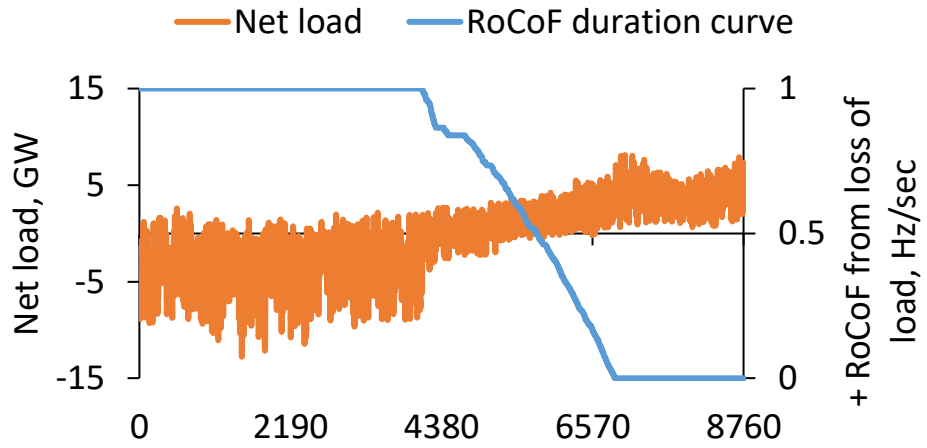


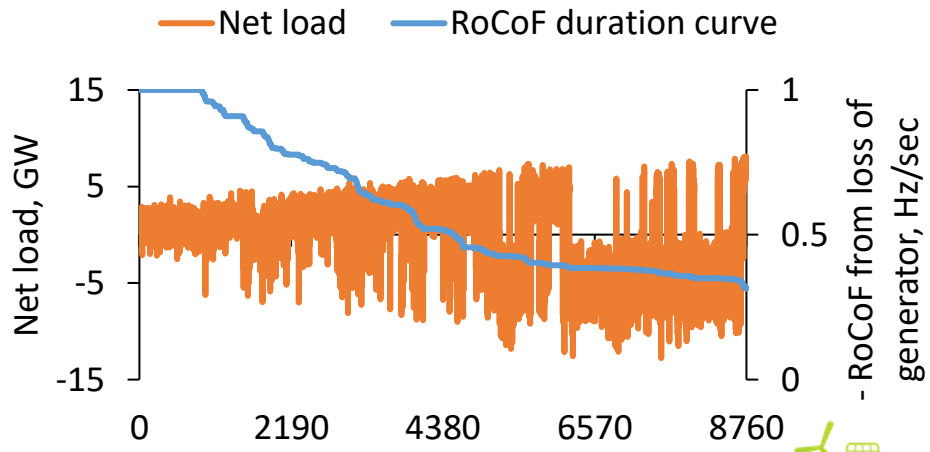

Backbone energy systems UCED model
https://gitlab.vtt.fi/backbone/backbone

- Operational reserve requirements
  - Fast frequency, primary, tertiary reserve, …
- Rate of change of frequency (RoCoF)
  - Maximum infeed / outfeed 700 MW
- Minimum inertia (MWs)
  - Large, centralised units
- Minimum online regional units
  - Voltage support, regional splits, etc.
- System non-synchronous penetration (SNSP)
  - Up to 95% wind + solar + HVDC
- Enhanced flexibility
- Grid-forming inverters, CCS, hydrogen, ...

# Rate of Change of Frequency (RoCoF)

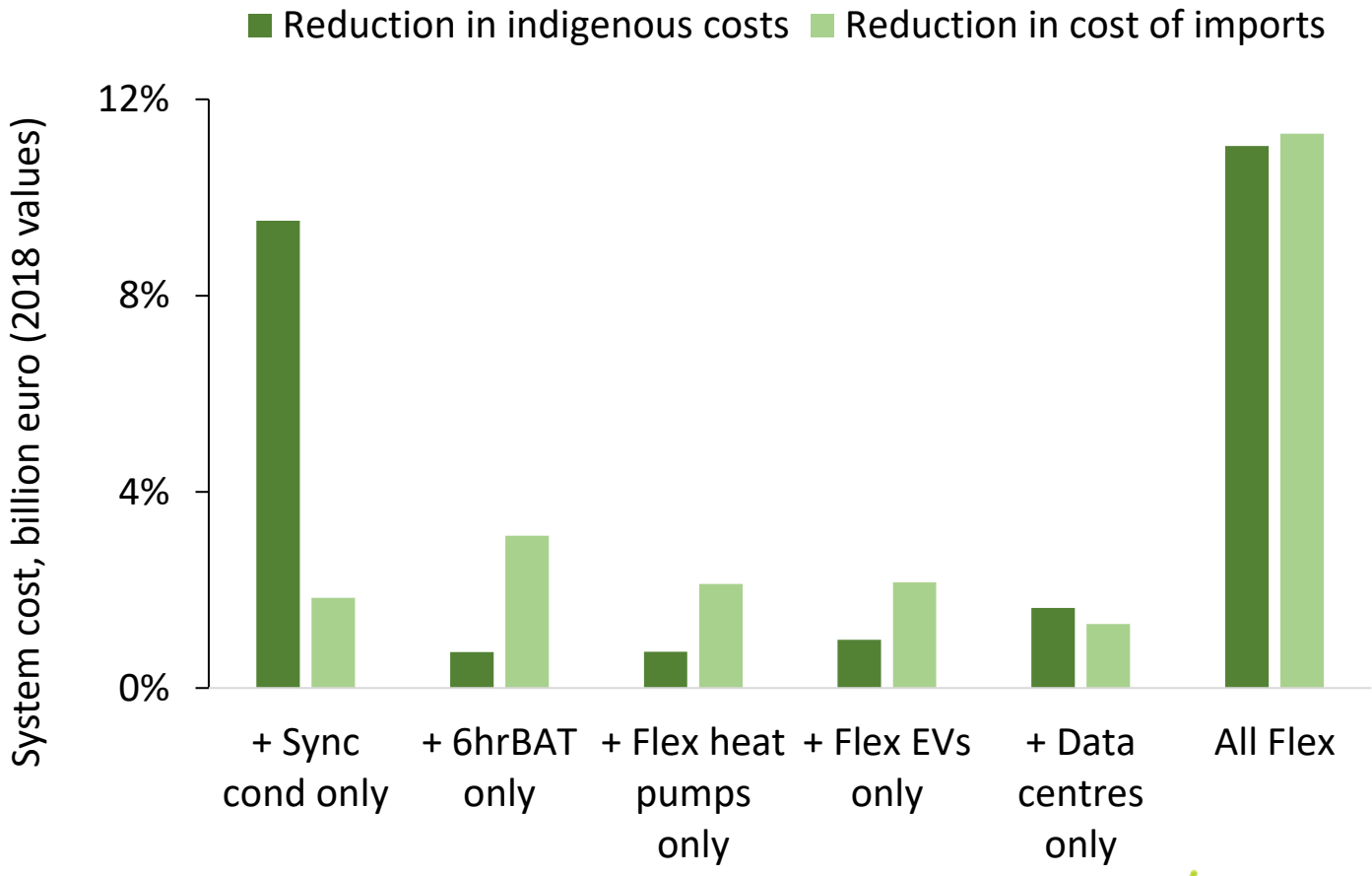
- Exporting at maximum ~50% time
- Potential for loss of 700 MW
- Inertia from conventional generation (~40%), synchronous condensers (~50%), hydro (~10%)
- Downward reserves from curtailing RESe, turn off generators
- High RoCoF from loss of generator when net load is close to zero
- Upward reserves from RESe, storage, ICs



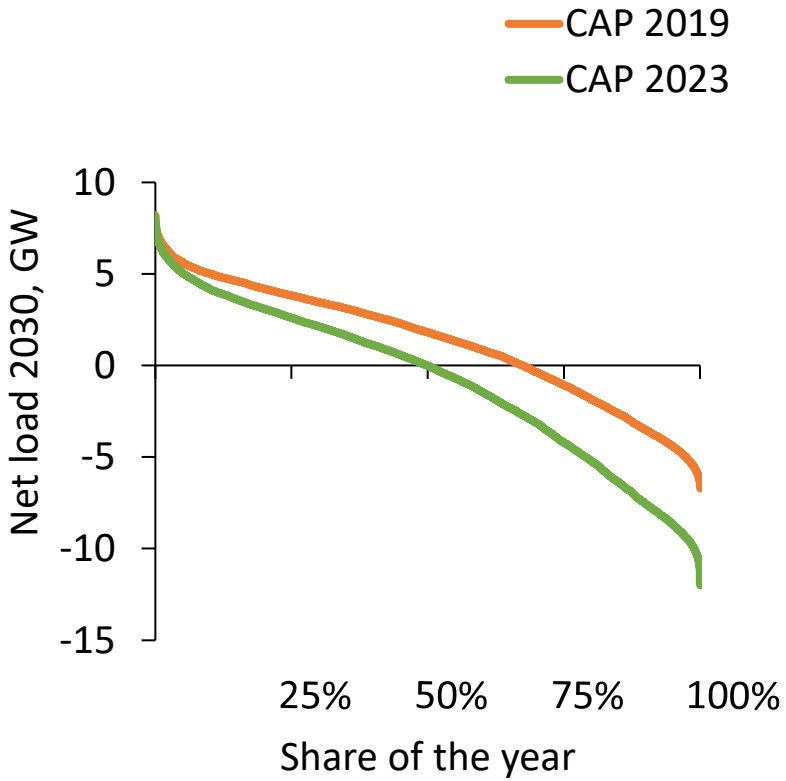



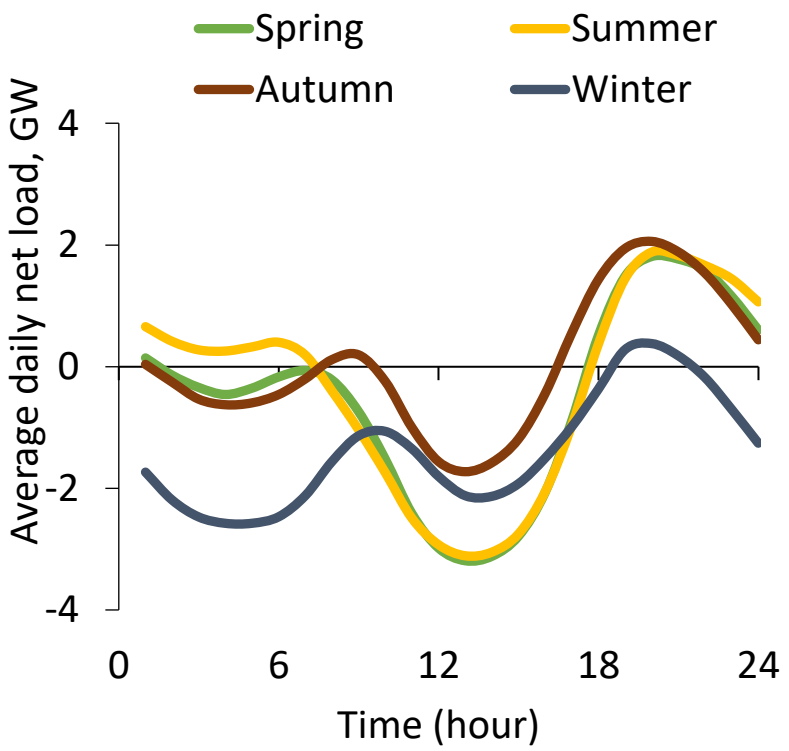
# Impact of flexibility

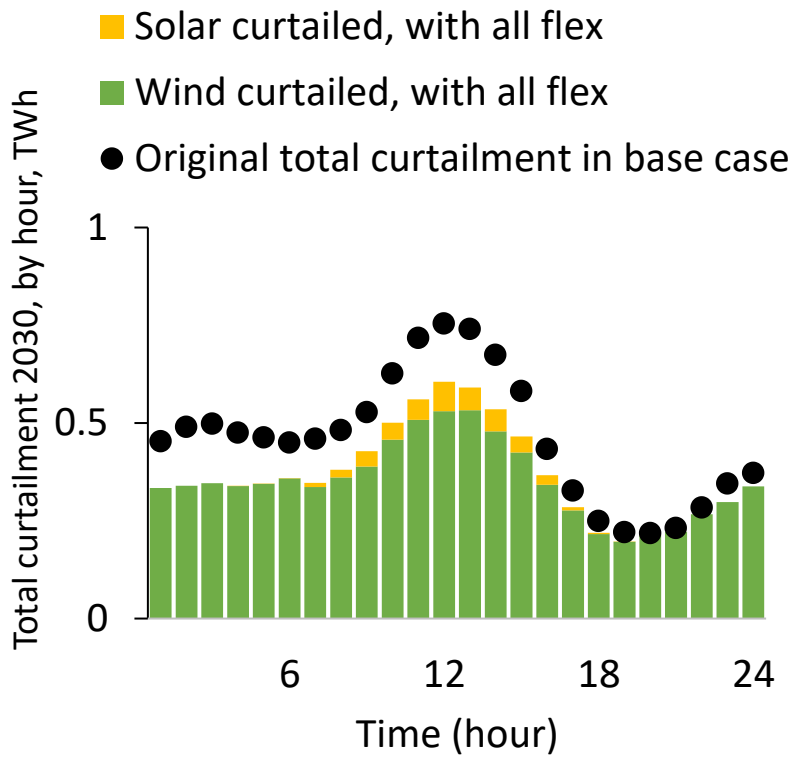
| Base case<br>Installed capacity, MW | 2022 | CAP<br>2023 |
|---|---|---|
| Gas plants | 5,300 | 7,300 |
| Existing pumped hydro storage | | 300 |
| Battery storage (up to 2h) | | 1,500 |
| Interconnectors | 1,000 | 2,200 |
| Testing Additional Flexibility<br>Peak capacity, MW | | |
| Synchronous condensers (GW sec) | | 8.5 |
| Medium duration storage (6h) | | 550 |
| Heat pumps (residential + comm) | | 2,000 |
| Electric vehicles (residential + comm) | | 900 |
| Data centre load shifting | | 1,290 |



# Curtailment



# Policy implications

- Flexibility and stability
- Stability-oriented constraints force CCGT units online
- Cost of operational security reduced by synchronous condensers
- Flexible loads reduce peak plant, increase solar
- Greater interconnection
- Emissions beyond 3 Mt target at 80% RESe
- More research into low carbon fast frequency response and generation adequacy during periods of low wind and/or solar
- Interconnection has benefits, but high cost

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Department of the Environment,
Climate and Communications

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*We gratefully acknowledge funding from the Irish Department of Environment, Climate and Communications*

Sarah Stanley
University College Dublin
sarah.stanley1@ucdconnect.ie

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# Options for hard-to-abate infrastructure

Conall Mahon – Programme Executive Decarbonised Heat (SEAI)

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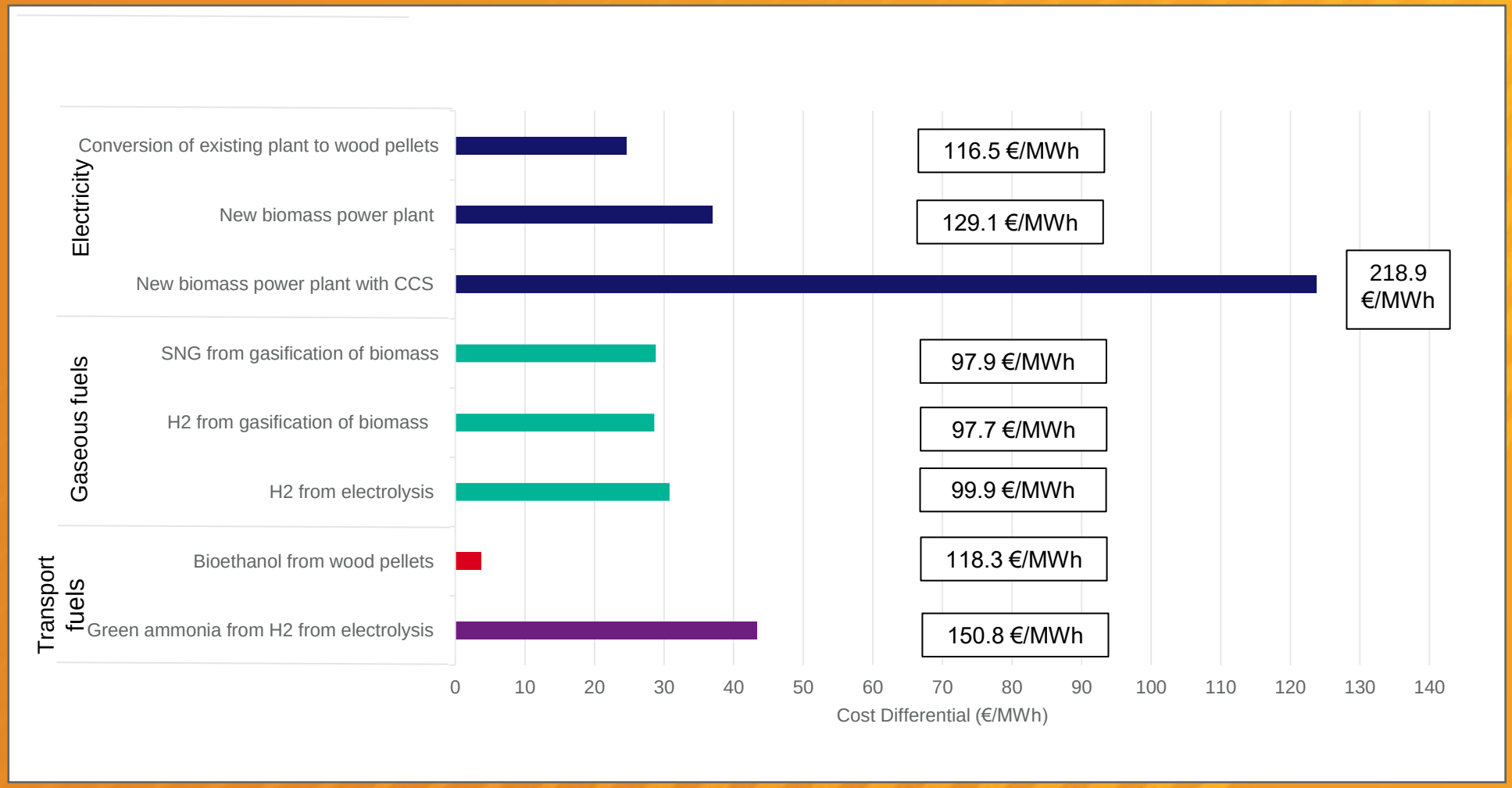
# Project Context

- Hard to abate – High Temperature, using cheap fossil fuel
- Challenge and opportunities for Large Industrial sites
- Irish specific data gap
- Cost and CO2 analysis of 8 mainly bioenergy technologies

# Results – Cost Differential




Electricity | Natural gas | Gasoline | Fuel Oil



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# Results – Carbon Emissions




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| Learnings | Recommendations |
| --- | --- |
| Consider whole life cycle/ supply chain | Embed LCA methodology into Policy analysis |
| With support renewable options analysed may be feasible to supply | Further analysis is needed into demands for these fuels |
| Strategic view and optimise biomass use | Renewable Fuels Strategy |

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IDEA - IRL
INTEGRATED DESIGN OF FLOATING WIND ARRAYS IRELAND

# FLOATING OFFSHORE WIND ARRAYS

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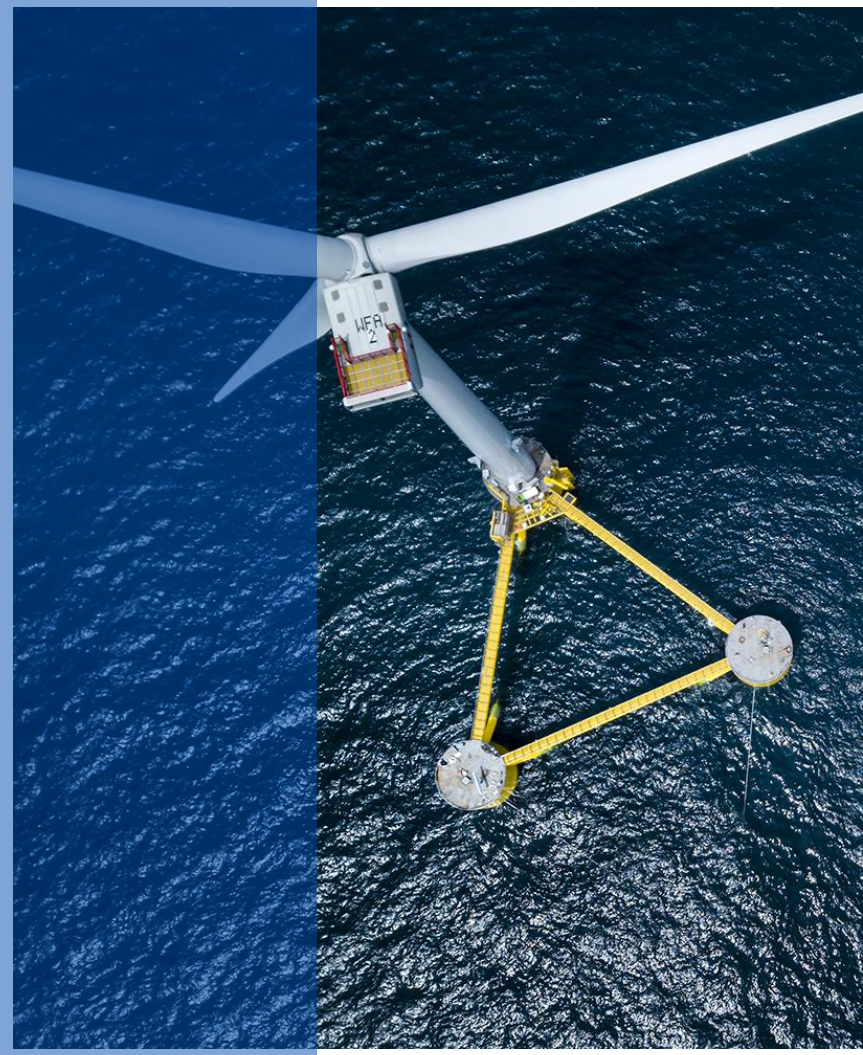
## A KEY STEP IN ACHIEVING IRELAND'S ENERGY SECURITY

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# ACHIEVING ENERGY SECURITY

Energy security: '*the uninterrupted availability of energy sources at an affordable price*' (International Energy Agency (IEA))

- Floating offshore wind (FLOW) - a key step in Ireland's decarbonisation pathway & attaining energy security.
- Emerging industry => little experience or reliable data.
- IDEA-IRL will fill the research gaps.

# EXPECTED OUTCOMES

## IEA TASK 49

Supporting Ireland's participation
&
Placing Ireland at the forefront of a collaborative, international effort to facilitate FLOW development

## REFERENCE SITES & FARMS

Open-source site datasets

&

FLOW array reference designs (incl. inputs for engineering, cost and environmental impact models)

## MARINE SPATIAL PLANNING

Engage with international FLOW experts & MSP agencies to learn best practices & collect open research questions & potential innovations

## ENGAGE IRISH STAKE-HOLDERS

Assess the Irish supply-chain - gaps and opportunities - via surveys and interviews

Raise awareness of FLOW in Ireland

## ROADMAP FOR IRELAND

Irish scenario-based modelling

A long-term roadmap for the sustainable development of FLOW in Ireland

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# INFORMING POLICY

Provide recommendations including

- Level of financial support and/or seabed leasing fee
- FLOW specific amendments to the MSP regime
- Realistic local content requirements
- Supports, policies and programs to max local content
- Strategic infrastructure & investment timelines

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GDG
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WIND ENERGY IRELAND

iea wind

# PROJECT FEB 2023-JAN 2026

## GET INVOLVED...

Surveys
Interviews
Podcasts
Reports

Contact List

This research was funded by the Sustainable Energy Authority of Ireland

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# ANY QUESTIONS?

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This research was funded by the Sustainable Energy Authority of Ireland