

SciFest Engagement Pack

EirGrid Cleaner Climate Award



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Introduction

The EirGrid Cleaner Climate Award will support students in developing key STEM skills and showcase their innovation and creativity in addressing an existential challenge like climate change. Partaking in this award category will support students in better understanding the role that energy plays across society and in achieving decarbonisation.

Award Criteria

This award is presented to the project that best demonstrates the design of a creative, innovative approach which contributes to a cleaner energy future. Projects should focus on at least one of the following:

- Climate Change - these could include social studies, data studies, etc.
- Renewable Energy
- Electricity Transmission
- Existing and alternative energy generation, including wind energy and solar energy
- Carbon Footprint
- Energy Savings
- Air Quality

See the appendices section for more information on what is meant by ‘Climate and Cleaner Energy Future’, and the role that EirGrid have as Ireland’s Transmission System Operator.

Useful Links

- [EirGrid](#)
- [EirGrid Smart Grid Dashboard](#)
- [EirGrid’s Shaping Our Electricity Future](#)
- [SEAI](#)
- [ESB](#)
- [United Nations - Climate Change](#)
- [Department Environment, Climate and Communications - Climate Action Plan](#)
- [EPA Ireland](#)
- [Air Quality - Ireland](#)
- [Greenhouse Gas Emissions and Projections - EPA](#)
- [ESB Networks - Beat the Peak](#)
- [Climate Ireland](#)
- [The Intergovernmental Panel on Climate Change](#)
- [UN Sustainable Development Goals](#)

Project Ideas

Climate Change

Greenhouse gas emissions from burning fossil fuels are one of the primary contributors to climate change. A significant reduction in these emissions will support meeting the targets set out in global agreements such as the Paris Agreement, which will limit the most dangerous and irreversible effects of climate change.

“Climate projections for the next century indicate changes in wind speeds and storm tracks; increased likelihood of river and coastal flooding; changes in distribution of plant and animal species and in the timing of lifecycle events of native species; water stress for crops, pressure on water supply and adverse impacts on water quality and negative impacts on human health and wellbeing” (EPA).

Have you ever wondered what impact climate change will have on Ireland?

You might like to:

- Investigate the potential impacts of exceeding the 1.5°C target on Ireland
- Research the causes of climate change and design an experiment to demonstrate their effect (e.g. measure temperatures to learn about the greenhouse gas effect or explore how melting ice affects sea levels)
- Design a study to investigate how aware the public is of climate change (e.g. causes, impacts, solutions)
- Design an experiment to report on your school’s carbon footprint and detail actions on how to reduce it: transport, electricity use, food consumption, etc.



Renewable Energy

One of the leading contributing factors to climate change is power generation from burning fossil fuels such as coal, oil and natural gas (United Nations). Countries have made pledges to become net zero through decarbonisation, in which renewable energy will play a monumental role.

Renewable energy is energy derived from natural sources that are replenished at a higher rate than they are consumed (United Nations). Renewable energy sources come in various forms, but what they have in common is that they are in plentiful supply and can be found all around us such as wind. Governments worldwide are investing in renewable energy infrastructure and funding new projects to support in meeting their respective targets.

Have you ever wondered how renewable energy works and if it will reverse the damage caused by climate change?

You might like to:

- Evaluate the different types of renewable energy generation
- Investigate which type of renewable energy source is the most efficient for Ireland to use
- Investigate how local community groups or schools could develop their own renewable sources of energy and determine the environmental and social benefits of this
- Investigate the impact of the energy crisis on the transition to renewable energy
- Design and create structures that use renewable sources to produce energy to operate common objects (e.g. a fan or charge a phone)



Electricity Transmission

Electricity transmission is where electricity is transported from the point of generation (e.g. solar or wind farms) to the demand centres (cities, towns and businesses). The electricity is transmitted through a network of high voltage overhead lines and underground cables. These lines and cables then meet at different points called substations. Once the electricity reaches the substation, it is then converted to a lower voltage and distributed to buildings and homes. The large overhead line towers are called pylons, which vary in size depending on the voltage they can carry. You will typically see overhead electricity lines in rural areas as they can cover greater distances, whereas underground cables will be commonly found in built-up towns and cities.

Have you ever wondered how energy is transported and reaches our homes? You might like to:

- Design an experiment to investigate the impact that increasing the voltage has on the efficiency of transmitting electricity
- Investigate which common material is most effective in electricity transmission
- Design an experiment to investigate the effectiveness of wireless electricity transmission



Wind Energy

Wind energy is a form of renewable energy which is used to generate electricity. This form of generation is a much more sustainable alternative to fossil fuel electricity generation. In Ireland, wind turbines are used both onshore and offshore to generate wind energy. Over the next decade, more and more wind farms will be built offshore as Ireland aims to generate 7 GW of offshore wind power by 2030. This will support Ireland in meeting its Climate Action Plan 2023 target to have 80% of electricity generated from renewable energy sources on the grid by 2030.

Have you ever wondered why wind energy is so important for Ireland? You might like to:

- Investigate what conditions are required for optimum wind generation such as weather, height, location etc.
- Design your own wind turbine, which could be used to power individual homes
- Compare onshore and offshore wind generation, and investigate which is more efficient to produce
- Investigate the different types of wind turbines, and determine which is the most effective for wind energy generation e.g. compare size, number of blades, material



Solar Energy

Solar energy is produced by nuclear fusion that takes place in the sun. It is necessary for life on Earth and can be harvested for human uses such as electricity (National Geographic). An increase in solar energy produced will support in reducing our reliance on fossil fuels. Solar panels that produce electricity are known as solar photovoltaic (PV) modules. These panels generate DC electricity when exposed to light (SEAI). The Government have set out a target for Ireland to generate up to 5 GW of solar by 2025, and 8 GW by 2030. This will support Ireland in meeting its Climate Action Plan 2023 target to have 80% of electricity generated by renewable energy on the grid by 2030.

Have you ever wondered what role solar energy will have in reducing Ireland's reliance on fossil fuels?

You might like to:

- Design an experiment to investigate the different conditions required for the production of solar energy (e.g. location, angle etc.)
- Research the different types of solar panels, and investigate which are the most effective for solar energy generation in Ireland (e.g. compare size, material etc.)
- Design an experiment that uses solar energy to operate common objects (e.g. charge a phone)



Energy Storage

As Ireland moves away from conventional fossil fuel generation and towards renewable energy such as wind energy, we will need to start utilising long-term energy storage. Currently, with fossil fuels, we can control when we generate energy, which allows us to ensure we have enough energy to meet demand during peak times. With renewable energy, we cannot control when the wind blows or the sun shines and therefore at windy and sunny times, we can create lots of energy but if there's no demand for that energy, we have to stop the wind turbines or solar panels from generating energy. Storing energy will allow us to keep this energy for use later when it is less windy or sunny. There are several methods to store energy, including pumped hydro and batteries. Looking to the future renewable hydrogen could be used for longer-term energy storage.

Have you ever wondered about the future of energy storage? You might like to:

- Develop an experiment demonstrating a method of storing energy
- Investigate how Ireland's pumped hydro storage station at Turlough Hill works and how this technology will work with increased renewable energy production
- Investigate how renewable hydrogen can be used to store energy and how this would be a benefit to Ireland
- Investigate the pros and cons of battery storage and how 'daisy chaining' could help store energy short term
- Design a new system for energy storage in Ireland. You can look at projects such as 'Energy Vault' for inspiration [here](#)



Carbon Footprint

The energy crisis has put a spotlight on the important role we can all play in saving energy. Energy saving at home will see a reduction in energy bills and the household's carbon footprint. Our carbon footprint is “a measure of the impact your activities have on the amount of carbon dioxide (CO₂) produced through the burning of fossil fuels and is expressed as a weight of CO₂ emissions produced in tonnes” (WHO). As individuals, we can reduce our personal carbon footprint by rethinking our use of energy, water and transport as well as the food we eat.

The [Carbon Clock](#) feature on EirGrid's Smart Grid Dashboard shows the best and worst time to use electricity throughout the day in terms of carbon intensity.

Have you ever wondered what impact your household or school's carbon footprint is having on the environment?

You might like to:

- Calculate your personal, household or school's carbon footprint and investigate the impact it has on the environment and how to reduce it
- Compare Ireland's carbon footprint with that of other countries and determine the reasons why Ireland ranks higher or lower per capita (e.g. higher car ownership in Ireland than country X leading to an increase in emissions)
- Design an experiment to test which common materials are most effective in preventing household heat loss or increasing the efficiency of energy use in a home
- Design and implement a creative campaign to highlight awareness of energy savings and monitor how effective it is



Energy Savings at Home and School

Energy efficiency at home or school has several benefits from saving on energy bills to becoming more environmentally friendly as we reduce our carbon footprint.

When it comes to electricity specifically, being more energy efficient has many advantages. Managing how we use electricity will help to maintain a secure supply of electricity to our homes and schools. A way that individuals can do this is by supporting in managing peak electricity demand. This can be achieved by reducing electricity use at times when the electricity demand is at its peak and the system is tighter. Ways in which we can save energy at home and school are by turning the lights off, layering up and taking public transport, walking, or cycling to school.

Have you ever wondered how you could encourage people to reduce their energy use at home and school?

You might like to:

- Investigate how your community (school, home, town etc.) could reduce its energy demand
- Design a survey to investigate the public's perception of energy saving at home and determine the reasons why people will reduce their consumption (e.g. cost, reduced carbon footprint etc.)
- Investigate Ireland's energy consumption patterns and determine the causes of either an increase or decrease in energy use compared to previous years
- Design and implement a campaign to spread awareness of how individuals can reduce their energy consumption (e.g. walk, cycle or take public transport to school or work) and monitor its progress



Air Quality

One of the main benefits of decarbonisation is less air pollution as a result of an increase in renewable energy and investment in green technologies. Air pollution is the contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere. Common causes of air pollution are household combustion devices, motor vehicles, industrial facilities, and forest fires. An increase in electric vehicles on our roads will see air quality improve. However, this electrification of society will increase demand on the electricity grid which will have to be managed and planned for.

Have you ever wondered how different forms of energy use impact air quality?

You might like to:

- Design an experiment to test air quality in the area surrounding your school or local community
- Investigate conditions which lead to greater air pollution e.g. traffic congestion
- Investigate the impact that the electrification of the heat or transport sector will have on energy demand
- Design a study to investigate how aware the public is of air pollution (e.g. causes, impacts, solutions)



Alternative Energy Generation

The energy crisis has reinforced the need to transition to renewable energy. In response to this, the events and performance industry have had to look to alternative sources of energy generation to reduce demand on the grid and reduce their carbon footprint.

Coldplay in their recent tour, '*Music of the Spheres*', have pledged to cut their emissions by 50%. It is proposed this will be done by "supporting new green technologies and developing new sustainable, super-low carbon touring methods". Coldplay has begun to use kinetic energy to support powering their shows by installing kinetic floors which converts the energy from fans' dancing into energy to power the show. Kinetic energy is energy that a body possesses by being in motion.

For more information on Coldplay's pledge visit their website [here](#).

Have you ever wondered what alternative energy generation solutions exist and how they can be harnessed to support decarbonisation?

You might like to:

- Design an experiment to test how effective kinetic energy is at powering common objects
- Design a device to collect kinetic energy which can be used by individuals as they go about their day-to-day tasks
- Research piezoelectric materials and determine whether they can produce electrical energy when squeezed or stretched



Appendices

Appendix 1: Climate and Delivering a Cleaner Energy Future

Climate change refers to long-term shifts in temperatures and weather patterns. These shifts may be natural, such as through variations in the solar cycle. But since the 1800s, human activities have been the main driver of climate change, primarily due to burning fossil fuels like coal, oil and gas (United Nations).

Greenhouse gas emissions are produced as a result of burning fossil fuels, which rise into the atmosphere, trapping the sun's heat which causes temperatures to rise.

Carbon dioxide and methane are examples of the GHG produced from burning these fuels. These are produced from using gasoline for driving a car or coal for heating a building, for example. Clearing land and forests can also release carbon dioxide. Landfills for rubbish are a major source of methane emissions. Energy, industry, transport, buildings, agriculture and land use are among the main emitters. The energy sector is composed of activities relating to renewables, natural gas, coal and oil industries. These fuels can then be used to generate electricity.

Global climate action will be required to address the effects of climate change. The European Union have pledged to reach Net Zero by 2050. Similarly, Ireland has set out its targets which will act as a roadmap for becoming carbon neutral.

The electricity sector in Ireland will play an integral role in the decarbonisation of other sectors, such as transport and heating through electrification. The electrification of society will support Ireland in reducing the level of carbon emissions it emits. The benefits of these reductions will support mitigating against the effects of climate change. At present, observed and projected impacts of climate change for Ireland include:

- **Temperature trends:** By the middle of this century (2041 - 2060) the average annual temperatures are projected to increase by between 1-1.2°C and 1.3-1.6°C depending on the emissions trajectory.
- **Precipitation:** Significant reductions are expected in average levels of annual, spring and summer rainfall. Projections indicate a substantial increase in the frequency of heavy precipitation events in Winter and Autumn (approx. 20%).
- **Sea level rise:** Rising sea levels around Ireland would result in increased coastal erosion, flooding and damage to property and infrastructure.

(EPA, 2023)

Under the Climate Action and Low Carbon Development (Amendment) Act 2021, Ireland's national climate objective requires the State to pursue and achieve, by no later than the end of the year 2050, the transition to a climate-resilient, biodiversity-rich, environmentally sustainable and climate-neutral economy. The Act also provides for a reduction of 51% in GHG emissions by 2030, compared to 2018 levels.

Electricity has a critical role to play in achieving this outcome. If we can decarbonise our electricity supplies, we can then use electrification (such as using electric vehicles and electric heating) to decarbonise our broader economy. The latest set of targets for the Irish electricity sector from the Climate Action Plan 2023 are as follows:

	Target 2025	2030
<i>Renewable Electricity Share</i>	50%	80%
<i>Onshore Wind</i>	6 GW	9 GW
<i>Solar</i>	Up to 5 GW	8 GW
<i>Offshore Wind</i>	-	At least 5 GW
<i>New Flexible Gas Plant</i>	-	At least 2 GW
<i>Demand Side Flexibility</i>	15 - 20%	20 - 30%

(Climate Action Plan, 2023)

Additional steps to increase renewable electricity generation include:

- Accelerate the delivery of onshore wind, offshore wind, and solar through a competitive framework to reach 80% of electricity demand from renewable energy by 2030
- Target 6 GW of onshore wind and up to 5 GW of solar by 2025
- Target 9 GW onshore wind, 8 GW solar, and at least 5 GW of offshore wind by 2030 (and an additional 2 GW offshore wind for green hydrogen production);
- All relevant public bodies to carry out their functions to support the achievement of the 80% renewable electricity target
- Support at least 500 MW of local community-based renewable energy projects and increased levels of new micro-generation and small-scale generation.

(Climate Action Plan, 2023)

Carbon budgets and sectoral emission ceilings are two of the mechanisms put in place to support carbon emissions reduction. “A carbon budget represents the total amount of emissions, measured in tonnes of CO₂ equivalent, that may be emitted by a country or region during a specific time-period” (Climate Action Plan, 2023). Sectoral emissions ceilings represent the maximum amount of greenhouse gas emissions which different sectors can emit during a specific carbon budget period. The Climate Action Plan details the electricity sector’s sectoral emissions ceilings, which are a maximum of 60Mt CO₂ equivalent for 2021-2030, and a maximum of 3Mt CO₂ equivalent in 2030.

These targets have been set out to support decarbonisation in Ireland which will see a reduction in the processes and activities which emit carbon dioxide emissions from the atmosphere. This will only be made possible through collaboration and partnership with the Irish public and both the public and private sectors.

Appendix 2: EirGrid, Ireland's Transmission System Operator

What is EirGrid responsible for?

EirGrid operate and develop the electricity grid in Ireland. We are leading the secure transition of our electricity grid to a low carbon, renewable future. As part of this role, EirGrid work to:

- plan the future of the grid on the island of Ireland;
- operate the grid every minute of every day;
- link with neighbouring grids in countries such as Wales (interconnection);
- run the wholesale electricity market (where electricity is bought and sold by generators and suppliers).

In brief, EirGrid makes sure that everyone has power when they need it, at the most economic price possible, while also planning for a more sustainable grid for a more sustainable future.

How does the electricity grid work?

Moving large amounts of electricity around Ireland requires overhead lines and underground cables. This is the grid - and it's been safely bringing power from electricity generators to homes and businesses for decades. The grid supplies the local electricity network, which gives power to every home, farm, community, and business on the island of Ireland. The grid also directly powers large energy users, such as manufacturing companies and data centres.

Why is electricity part of the solution to climate change?

Electricity can be generated from renewable sources such as wind, sun and water. These sources of clean energy will reduce our reliance on fossil fuels like coal and oil. In the future, electricity will increasingly be used for transport, heating and other activities. To prepare for this future, Ireland's Government have set ambitions which require EirGrid to make the grid ready so that up to 80% of electricity can come from renewable sources by 2030. At present, around 40% of electricity comes from renewable generation. Low carbon, renewable energy is the future. We need it to address our climate commitments, for our economic success, and for generations to come.

Why are we talking about Ireland's electricity future?

Ireland's climate commitments are understandably ambitious, while Increased demand for electricity is anticipated as we move through this decade. To accommodate both, the grid will need huge change through to 2030. Electricity generated through traditional methods (like coal and gas) will be increasingly replaced by electricity generated from cleaner sources. This power will have to be generated, connected to the grid and delivered throughout the island. It is a huge undertaking. But it will significantly help deliver on our climate commitments, and encourage further investment and economic activity. It will also make the island of Ireland more energy independent and will significantly reduce air pollution caused by electricity generation from fossil fuels.

How will the grid prepare for clean electricity?

A cleaner grid is a stronger and more flexible grid. The grid will need to carry more power. Most of this power will come from renewable generation that varies depending on the weather. Where we can, we will use the existing grid to meet this goal. However, given the scale of

change needed, we must also plan for a great deal of new grid infrastructure - such as underground cables, pylons and substations. We can't make major changes to the grid while power is flowing. Neither can we turn off the grid to get work done. If we are to keep Ireland's electricity secure, we need to time grid projects carefully to make sure we keep the lights on.

How will we change how we operate the grid for clean electricity?

To achieve our renewable targets, we must develop our grid operations to allow up to 95% of the grid's electricity at any one time to come from renewable sources by 2030. This is a huge technical challenge, but EirGrid are already world leaders in this area. Enhancements to current operational policies, and electricity market rules, together with support from regulators and government bodies, will be needed to allow this.

What changes will have to be made to the wholesale electricity market?

The markets are operated using a series of regulatory rules. At present, these rules are largely driven by the price paid for energy. These rules were designed to ensure consumers pay the lowest costs possible when generators use fossil fuels like oil and gas. However, a market dominated by renewable generation creates new financial and technical challenges. In particular, renewable generation costs more to develop, but then has lower operating costs. Therefore, alongside changing how the grid operates with electricity from more clean sources, the market will have to change too.

EirGrid and the Sustainable Development Goals

EirGrid's sustainability journey is guided by three key pillars:

- Driving climate action and transformation of the electricity system
- Committed to a sustainable society
- Being a responsible business

EirGrid Group's most impactful contribution from a sustainability perspective is to drive climate action through the transformation of the electricity system and realise the broader decarbonisation benefits that can materialise across Irish society through electrification. In doing so, we are directly at the centre of supporting the outlook for a net zero society that is shared across the island.



(EirGrid, 2023)