

# Supporting Ethical Discussions

## Introduction

Developing the skills students need to make ethical judgements through discussions can help students construct “a coherent body of facts, learn how and where to access knowledge, and develop scientific habits of mind and reasoning skills to build a foundation for understanding the events and phenomena they encounter in everyday life” Science Specification pg. 11

Engaging students in discussions in the science classroom in general, offers opportunity for teachers to gather evidence that students are developing a scientific habit of mind.

Talking heads as a strategy offers an approach to support engaging students in ethical discussions that could help students feel more comfortable with sharing their point of view on a controversial topic, for example. It may also be easier for students to consider other points of view.

## Learning Outcomes in Focus

**Biology World 9:** Students should be able to explain human sexual reproduction; discuss medical, ethical, and societal issues

**Physical World 8:** Students should be able to research and discuss the ethical and sustainability issues that arise from our generation and consumption of electricity

**Nature of Science 8:** Students should be able to evaluate media-based arguments concerning science and technology

## Learning Intentions

1. To recognise the unique opportunities afforded by the skill of discussion for developing a scientific habit of mind
2. To explore the opportunity classroom discussions offer for gathering evidence that students are developing a scientific habit of mind.

## Teacher Guidelines

- Read the **case studies**
- Consider the **talking heads strategy** with *sample question*, as an approach to support ethical discussions
- Use the **focus question** to guide group discussions and feedback.



### Focus Question:

How does this approach support students in discussing ethical issues?

### Case Study 1

In teaching of **BW9** a teacher wanted to get her students to discuss ethical issues. She found her students struggled to come up data and evidence to support their discussions on ethical arguments around human sexual reproduction. In researching approaches to encourage her students she decided to adapt an approach from BEST (Best Evidence Science Teaching).

[www.stem.org.uk/sites/default/files/pages/downloads/BEST\\_Approaches\\_Diagnostic%20questions.pdf](http://www.stem.org.uk/sites/default/files/pages/downloads/BEST_Approaches_Diagnostic%20questions.pdf)

The teacher posed the following question to her students:

**“Should IVF be discontinued as a way to reduce population growth?”**

For homework students were asked to find one or two sources of information on this issue. A selection of these sources are in the appendices. On the day of the discussion, students were presented with the talking heads student activity on page 2. Working independently at first, with the option of drawing on their own sources of data from their homework, students studied the 5 talking heads statements. The class then had a discussion using the 3 discussion prompt questions below the talking heads.

## Talking Heads Student Activity

“Should IVF be discontinued as a way to reduce population growth?”

**Aaron**

The world has enough for everyone's needs, but not enough for everyone's greed. It's how we live not how many of us there are.

**Luke**

Population growth is only high as people are living longer. Life expectancy will not go much higher, population growth will stabilise.

**Sarah**

Population growth is not sustainable our government need to control it. IVF should not be allowed.



**Meabh**

My mother had IVF to have me, it should be for each person to choose if they want to go down that method.

**Polly**

If people need help to have children so be it! More people mean more people to progress science and society.

### Class discussion prompt questions

- Who do you agree with? Why?
- Do people's choices around the issue affect others or our planet?
- What is the link between the issue and sustainability?

## Case Study 2

In teaching of **PW8** a teacher wanted to get her students to discuss ethical issues. She found her students struggled to come up with a range of ethical arguments that arise from our generation of electricity. In researching approaches to encourage her students she decided to adapt an approach from BEST (Best Evidence Science Teaching). [www.stem.org.uk/sites/default/files/pages/downloads/BEST\\_Approaches\\_Diagnostic%20questions.pdf](http://www.stem.org.uk/sites/default/files/pages/downloads/BEST_Approaches_Diagnostic%20questions.pdf)

The teacher posed the following question to her students:

**“Should we be building more windfarms to meet Ireland’s electricity needs?”**

For homework students were asked to find one or two sources of information on this issue. A selection of these sources are in the appendices. On the day of the discussion, students were presented with the talking heads student activity on page 2. Working independently at first, with the option of drawing on their own sources of data from their homework, students studied the 5 talking heads statements. The class then had a discussion using the 3 discussion prompt questions below the talking heads.

## Talking Heads Student Activity

“Should we be building more windfarms to meet Ireland’s electricity needs?”

### Tomasz

There is enough energy being produced but how it is used is the problem. Why should we scar more of Ireland just to be able to use a hair dryer?

### Tiernan

Ireland is being fined for not reducing our CO<sub>2</sub> emissions. We need to use this money to build windfarms to solve the problem and not kick it down the road.

### Sally

The issue is not if we should build windfarms but where. Bog and sea habitats are suffering as people don’t want them near their homes.



### Wendy

We don’t know how many animals are killed by other sources of electricity, maybe wind is the least harmful to wildlife.

### Fred

The life span of a wind farm is 20-25 years, and they don’t generate electricity if wind is too high or too low. We cannot invest in any more wind farms.

### Class discussion prompt questions

- Who do you agree with? Why?
- Do peoples’ choices around the issue affect others or our planet?
- What is the link between the issue and sustainability?

## Appendix- Extracts of Data Gathered by Students

### *Related to BW 9*

#### **Can 10 billion people live and eat well on the planet? Yes.**



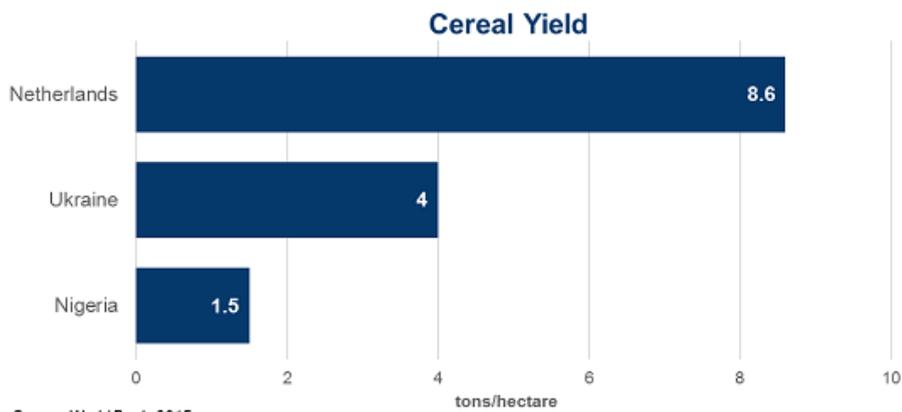
“There are too many people on too little land” says BBC presenter David Attenborough. “A planet of 10 billion looks like a nightmare” says Stephen Emmott. The “population explosion” is a threatening concept for many. Why should the world feed ever more people and threaten its own existence? Farmland and water are scarce, world temperatures are rising, and environmental problems of modern agriculture are a threat for world ecosystems. Are we naïve to aim for reducing poverty and eliminating hunger?

For many, overpopulation is an appealing emotional concept. Daily broadcasts of convincing pictures, of refugees, poverty, malnutrition, and hunger are overriding the facts. However, population explosion is a myth. Today, we have 7.3 billion people. In 2050, we will have around 9 billion, and in 2100 the world population will possibly reach its peak with about 10-11 billion people. This implies an actual annual population increase of less than 1 percent with a tendency to fall to zero by 2100. With rising income world fertility and food consumption patterns change. Calorie intakes of poor and rich people are surprisingly similar, but rich people consume more protein. This increases food demand which means that the world will need to produce approximately two percent more food annually if today’s poor become rich. Will we be able to sustainably supply that extra two percent? The answer is most likely yes.

The world produces about 2.5 billion tons of cereals at present. A person needs a little more than 500 grams a day in grain-based diets, the equivalent to one ton of cereals for a family of five. If we consider that the family would become richer and shift its consumption patterns to include more milk, meat, and eggs, it would need more cereals because animals would need to be partly fed with cereals. If we consider a grain-based diet, with an already-moderate consumption of protein, current world cereals production could feed more than 10 billion people if distributed well.

Supplies for the future must mainly come from available farmland rather than fragile ecosystems. A combination of finance, investments, innovation, and knowledge are needed to lessen the yield gap, between what is needed and what is being produced on farmlands. Cereal production per hectare varies worldwide (see Figure 1).

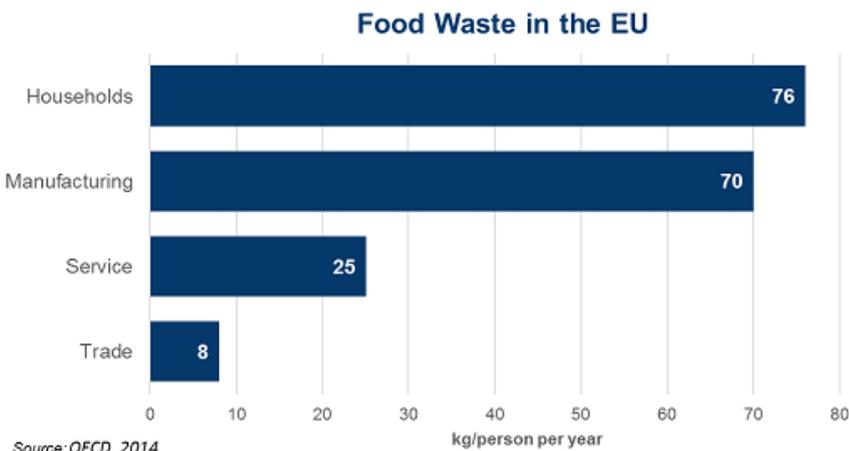
**Figure 1:** A Dutch cereal farm is almost six times more productive than a Nigerian one



Source: World Bank, 2015

On the demand side, food waste levels also vary worldwide. Reducing food waste can have a significant impact on the availability of food and can improve the efficiency of food value chains. This in turn would help distribute food more evenly to those in need. (see Figure 2)

**Figure 2:** The average European wastes 179 kg of food



Source: OECD, 2014

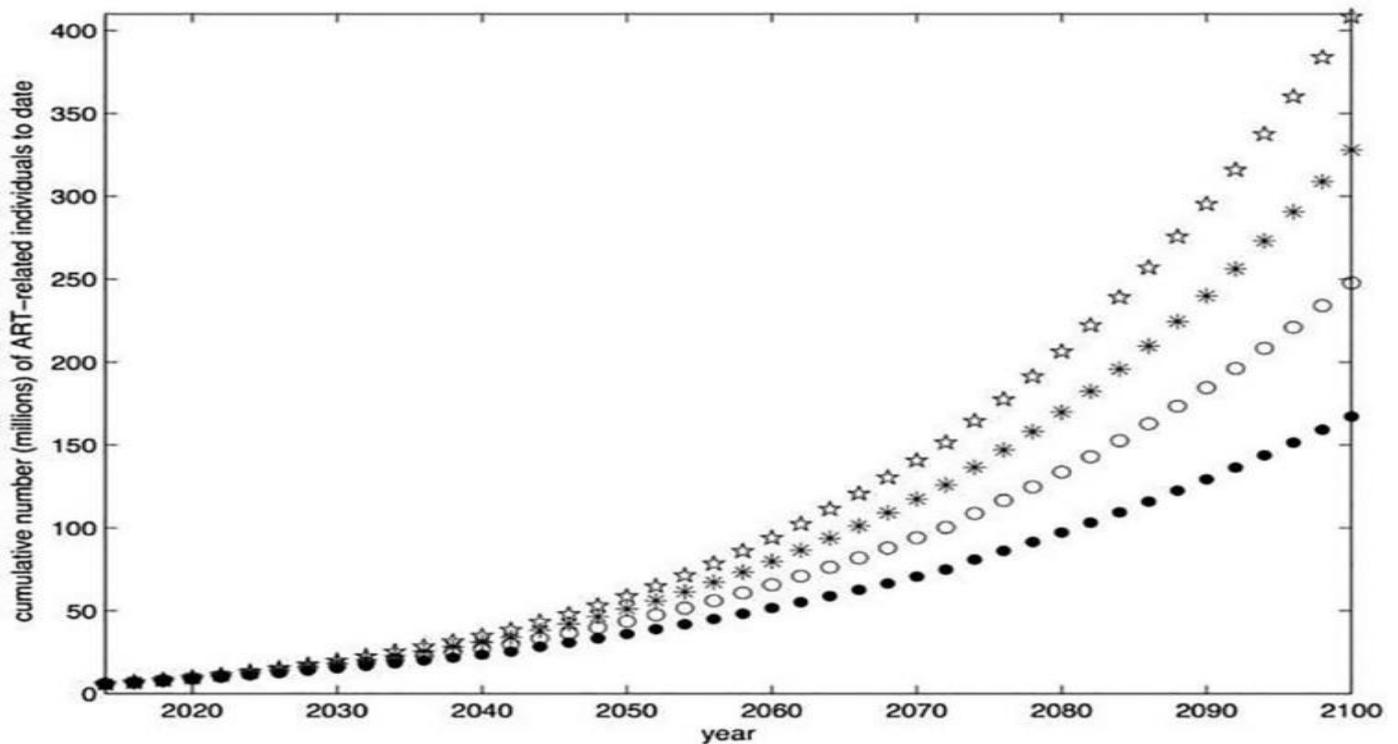
We could quite easily provide food for 10 billion people on the planet by supporting farmers to intensify production and by minimising waste in rich countries.

Adapted from: [www.brookings.edu/blog/future-development/2015/04/28/can-10-billion-people-live-and-eat-well-on-the-planet-yes](http://www.brookings.edu/blog/future-development/2015/04/28/can-10-billion-people-live-and-eat-well-on-the-planet-yes)

## Human Sexual Reproduction and Sustainability

Since the first IVF baby in 1978, the number of people conceived by reproductive technology has grown much faster than expected, reaching several million today and rapidly approaching 0.1% of the total world population.

### Cumulative numbers of people worldwide projected to be conceived by assisted reproductive technologies (ART), including their genetic descendants.



Plots represent number of calculated projections from 2014 to 2100

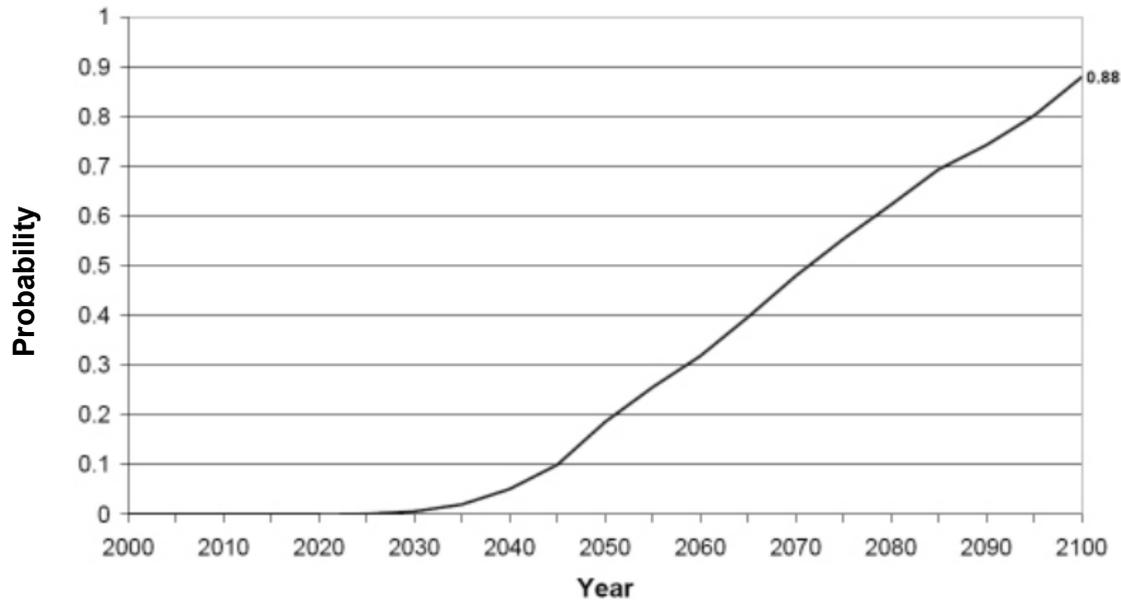
- (•) calculated projections with no overall increase in birth rates
- (○) calculated projections with birth rates rising annually by 10,000
- (\* ) calculated projections with birth rates rising annually by 20,000
- (★) calculated projections with birth rates rising annually by 30,000

The graph shows the annual numbers, over time, of people who owe their lives to assisted reproductive technologies. If no further growth in fertility services occurs this century, it is calculated that 167 million people owing their lives to assisted reproductive technologies will have been born by 2100. However, according to the way things are going, advances in technology will continue to grow strongly and the number of births is likely to be much higher. The number of assisted reproductive technology-related individuals could eventually approach one in ten in some countries and by the end of the century their total number is likely to exceed the size of the current population in Russia and possibly even the USA.

[www.rbmojournal.com/article/S1472-6483\(18\)30039-7/fulltext](http://www.rbmojournal.com/article/S1472-6483(18)30039-7/fulltext)

## Peak Human Population

There is a high probability, that the population of the world will reach a peak sometime during the current century. The UN predicts the 12<sup>th</sup> billionth person will never be born as total population growth is slowing down due to decreased birth rates in developed countries.



**Supplementary Figure 1.** Probability that the world's population will reach a peak by the indicated date.

[pure.iiasa.ac.at/id/eprint/14782/1/Sergei-web-total.pdf#page=60](http://pure.iiasa.ac.at/id/eprint/14782/1/Sergei-web-total.pdf#page=60)

## Appendix- Extracts of Data Gathered by Students Related to PW 8 Impact of Wind Generated Electricity on Ecology

Irish Independent 

November 04, 2020, 06:30 AM



Three White-Tailed Sea Eagles have been killed in wind-turbine strikes in Kerry since a project set up to monitor raptor casualties in the country was initiated in 2011.

The RAPTOR project report (Recording and Addressing Persecution and Threats to Our Raptors) - published by the National Parks and Wildlife Service - reveals Kerry as one of the most dangerous counties in Ireland for birds of prey, where 30 raptors have been killed through poisoning, in the main, between 2007 and 2019.

The report shows that Kerry witnessed the third-highest rate of fatality for birds of prey in the period, with 33 deaths logged in Tipperary and 57 in Wicklow.

[www.independent.ie/regionals/kerryman/news/three-eagles-killed-by-wind-turbines-in-kerry-39703385.html](http://www.independent.ie/regionals/kerryman/news/three-eagles-killed-by-wind-turbines-in-kerry-39703385.html)

### Wind Turbines and Bird Deaths

The U.S. Fish and Wildlife Service estimates that turbines could already kill 140,000 to 500,000 birds a year in America. Even at the high end, that is a small number compared to the hundreds of millions of bird deaths from collisions with buildings and automobiles or the billions of birds killed by cats, but it still looms large in permitting decisions.

A move from turbines in the 8-megawatt range to larger models of up to 12 MW apiece could make up to a 30 percent difference, said Norman. The effect is even more marked with taller turbines, because “birds have a very strong affinity to the sea surface. As you go up, you get fewer and fewer birds.”

This means collisions can be avoided by increasing the "air gap," or the space between the sea surface and the lowest point in the circumference of the turbine blades. With an air gap of 45 meters (148 feet), “you may not have a measurable impact at all” on marine birds, Norman said.

It's important to note that the environmental benefits of larger, taller turbines are less clear-cut onshore. On land, birds that are migrating or using thermals, can rise high above ground level, so very tall turbines could in some cases result in more avian mortality rather than less.

<https://www.greentechmedia.com/articles/read/the-wind-sector-trend-helping-turbines-to-kill-fewer-birds>

## Landslides Caused by Windfarms

Watch this short video (2:13 min) showing the devastation a landslide caused by a near-by windfarm in Donegal.

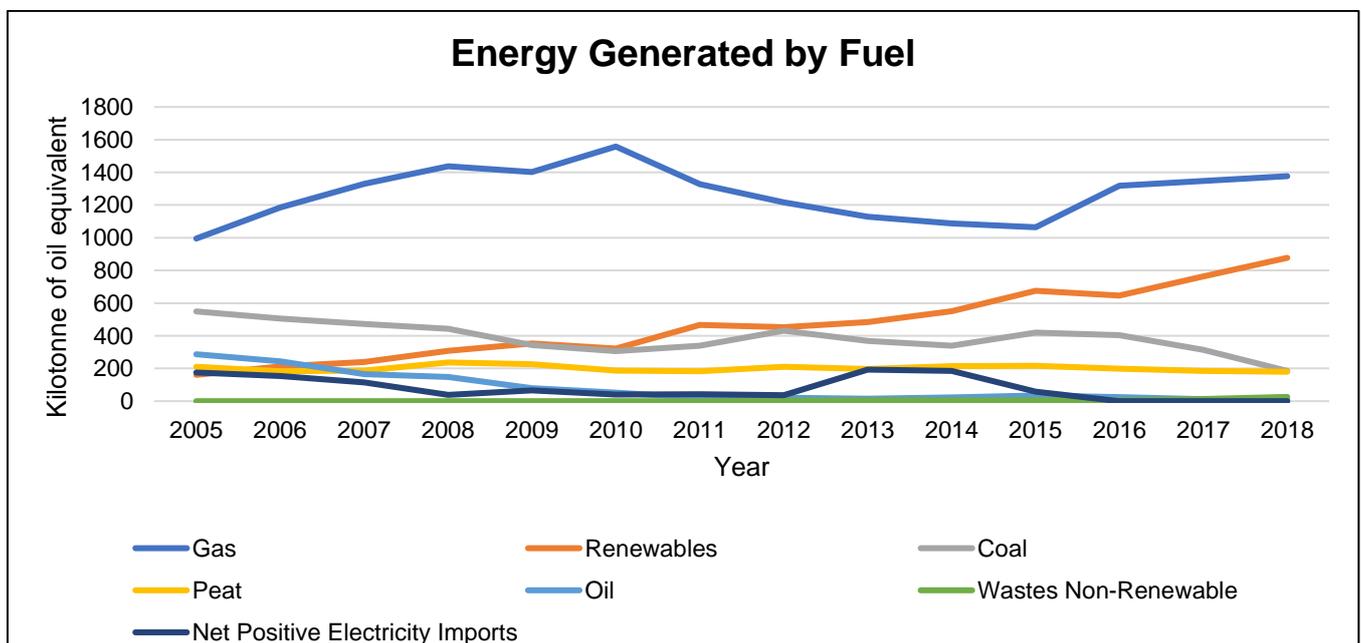


<https://www.youtube.com/embed/Whuo69ZXG3A?feature=oembed>

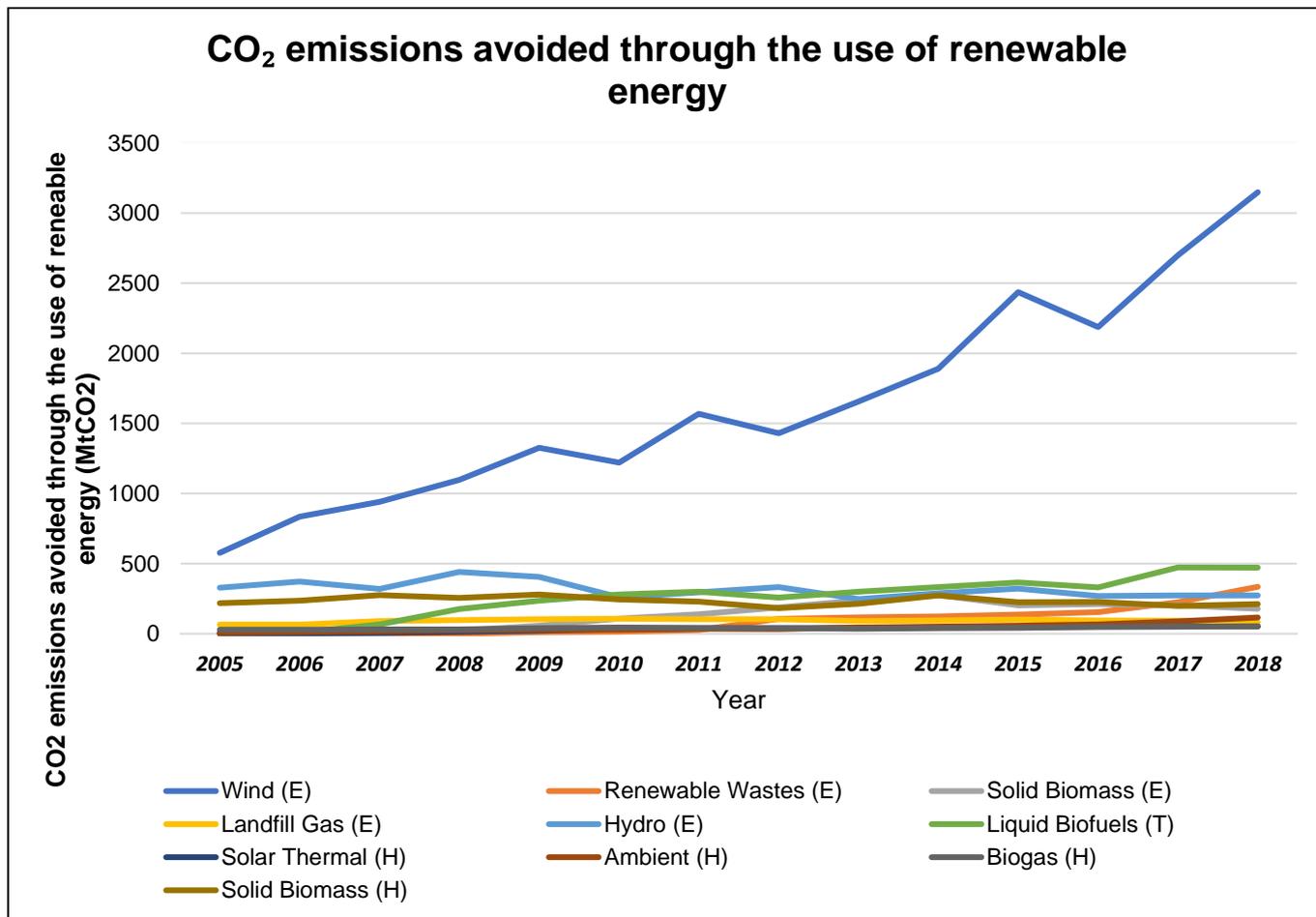


## Energy in Ireland

Below is a graph that compares the amount of energy released from burning 1 tonne of crude oil to other methods of energy production.



The graph below shows how there was a reduction of carbon dioxide emissions due to the increase in different renewable energy sources.



Wind generated electricity alone was responsible for avoiding 3.1 million tonnes of CO<sub>2</sub> being sent out into the atmosphere. Reduction of carbon in the generation of electricity is becoming increasingly important as more and more is used for transport and heat. The use of renewable electricity ensures that switching to electric vehicles and heat pumps results in a large reduction in CO<sub>2</sub> emissions compared to using fossil fuels.

[www.seai.ie/data-and-insights/seai-statistics/key-statistics/renewables/](http://www.seai.ie/data-and-insights/seai-statistics/key-statistics/renewables/)