

# SCIENCE WEEK

#scienceweek

7-14 Nov 2021

Supported by Science Foundation Ireland

# BIOECONOMY

# ABOUT CREATING OUR FUTURE



Creating Our Future is a Government of Ireland campaign to stimulate a national conversation between everyone in Ireland on their ideas on how to make our country better for all. While we might not always think about it, research and innovation affect nearly every part of our lives. The COVID-19 pandemic in particular has shown the importance and value of research and innovation in our lives – medically, socially, politically, and economically. Ideas are the starting point for all research and innovation. Anyone, anywhere, can have an idea that inspires research and innovation. It could be based on an opportunity or challenge that someone has identified in their own life, for their community, for Ireland or for the world. Or it could be based on a topic that someone is curious or passionate about. Creating Our Future wants to hear them all – in particular from our young people. All ideas will be captured and will help inform the future direction of research and innovation in Ireland.

Secondary school students are invited to take part in this national conversation on research. Research carried out in the present will have an impact on your future, and you have the opportunity to have your say on research that will help to make a better future for all in Ireland.

Some of us are excited to go back to exactly the way things were before the pandemic, others have found recent times to be a relief and want to keep the changes we've experienced, others want to hold on to some of the changes but not all of them. Our impact on the environment has improved in so many ways, such as air quality, and yet deteriorated in others, such as the use of single-use plastics. Remote working is the new norm for a significant number, this has directly impacted on quality of life in the positive and the negative for so many, for others it has resulted in a serious hit to livelihoods as footfall in office areas drop. Throughout this journey, the public has been largely united in turning to science for the data to inform decisions for today, and to bring hope for tomorrow.

Use these discussion toolkits in the weeks leading up to Science Week to debate and discuss STEM topics with your class that will affect our future, from changes in the fashion industry to using technology to enhance our cities and communities. During Science Week, submit your own idea to [creatingourfuture.ie](https://creatingourfuture.ie) to help researchers in Ireland to create a better future.

This toolkit provides background and discussion stimulus on bioeconomy, particularly discussion the fair use and allocation of natural resources on our planet, as well as how we can use waste as a resource to make something new. There are video and news sources linked throughout the document to help stimulate the conversation.

# INTRODUCTION AND BACKGROUND

At the moment we rely on oil for most of our needs (heating our homes, transport, making things, materials such as plastic), but we cannot continue to do this because of the climate impact that is changing the world we live in.

In addition to the climate impact of oil, our way of life is leading to overexploitation of all our resources. We want to have too many things. This is causing other impacts such as species extinction, decline in water quantity and quality, scarcity of critical resources.

Bioeconomy is a way of satisfying our needs by using plants and animals instead of oil. We can make food, valuable chemicals, plastics, energy and other useful things from biological resources.

This sounds like a great solution because we can keep growing plants and animals to meet our needs. However, there are some big problems that need to be considered. Food production already places great pressure on the land, and we are not sure we will continue to have enough space to grow the food we need.

This leads to the question of 'fair share'. How much land should we use for food and how much for other purposes? If we need land to grow things for bioeconomy, how much of our land should that be?

We do not have enough resources on earth to continue living in the way we do now. In 2021 we exceeded the sustainable supply of resources on 29th July (known as earth overshoot day). Everything we have used since then has been the environmental and ecological equivalent of a bank overdraft. We have borrowed it from the future.

We need to start thinking about how much we consume and waste, what a fair share of sustainable resources might be, and how we will decide what is a 'fair share' of the environment for farms, industry, communities and countries.

Additionally, what is often called a waste is itself a valuable resource that has been disposed of incorrectly.



Instead of using materials in a linear way (Source -> Produce -> Use -> Dispose), wastes can be used as an input into a new product or service. The pathway to this sustainable use of materials is called the circular economy approach – reusing wastes as a resource. In time, waste will be seen as a valuable resource and the path between waste and resources will become a closed loop.

Better recycling and reuse of resources can reduce pressure on raw materials that are extracted from the environment. Improving resource efficiency will lessen demand on energy, reduce waste, and lower greenhouse gas emissions. This not only benefits the planet, but keeps economic value of materials and helps ensure we have enough resources to maintain our society. This idea is called sustainable development. Sustainable consumption of materials is the key to achieving sustainable development in Europe. In 1987, sustainable development was defined as “meeting the needs of the present without compromising the ability of future generations to meet their own needs.”

Lots of everyday waste materials can be turned into other surprising products using new and innovative technologies. Biodegradable bottles can be made from waste wood fibres; insulation for houses can be produced from old sanitary ware (toilets, baths, sinks); energy can be produced from manure; plant pots can be created from residual potato fibres. All it takes is identifying a waste and turning it into a resource using some clever technologies!

**Some facts about waste worldwide and in Ireland:**

- Around the world, 1 million plastic bottles are bought every minute.
- 5 trillion plastic bags are thrown away each year.
- You can make a bicycle out of 650 aluminium cans.
- Glass never decomposes, but it is 100% recyclable and can be recycled endlessly without loss in quality or purity.
- 55,000 tonnes of sewage sludge that contains useful nutrients is produced in Ireland each year.
- One million tonnes of food waste is produced in Ireland annually. That's enough food waste to fill Croke Park two and a half times!

*Developed in collaboration with:*



# DISCUSSION STIMULUS

## Background to oil, where it comes from, how it is used, and some of the problems

This video explains where oil comes from, why it is useful to us, and a brief look at some of the problems associated with it. It is worth looking at [studentenergy.org](http://studentenergy.org) to get some insights into how we might fix the problems with oil from the bottom up.



Source: YouTube - Student Energy

## Over exploitation of land

This video from the World Wildlife Fund scans through the idea of over using land and resources. It does not provide many numbers, but touches on various issues. It should stimulate thinking about what changes we are aware of in recent years.



Source: YouTube - WWF International

## Background to bioeconomy

Both of these videos introduce bioeconomy. Both offer a very upbeat and positive tone. While it is right to focus on the positives of bioeconomy, it is also important to think about some of the issues.



Source: YouTube - EU Science and Innovation



Source: YouTube - Energy & Environment Institute, University of Hull



## Fair share of land (food and technology solution focused)

This video was made by Nutrien, the world's largest provider of crop inputs, services and solutions. There are two important issues to consider when watching: (1) it puts food first and does not make much mention of bioeconomy, so where do you think bioeconomy fits in here? (2) it only suggests technical solutions, what about demanding and consuming less?

We need to first understand what we want our society to look like and identify wastes before we can develop (technological, societal, economic) solutions to create a better world for ourselves and future generations.



Source: YouTube - Nutrien

---

## What is a Circular Economy? by Ellen MacArthur Foundation

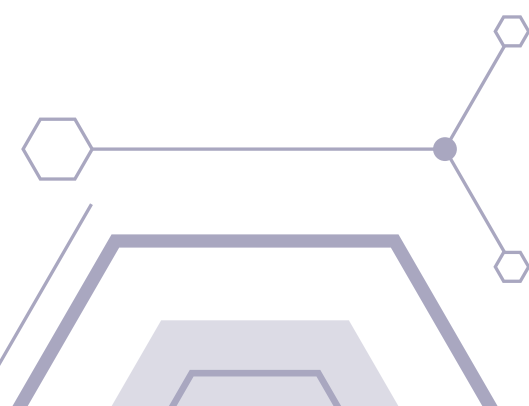


Source: YouTube - Ellen MacArthur  
Foundation

## Explaining the circular economy: Rethink Progress by Ellen MacArthur Foundation



Source: YouTube - Ellen MacArthur  
Foundation



# Guiding Questions for Discussion

1. Look around the room and identify which things are likely to be (a) made from oil (e.g., plastics, synthetic clothing), and (b) made possible because of oil (e.g., almost everything relied on oil for manufacture and transport).

Almost everything in a typical classroom is made possible because of oil. We are totally dependent on it.

2. Can you think of any environmental or ecological changes related to (a) the immediate world around you (e.g., your home, public spaces, school, countryside) and (b) the wider world that you have heard about through family, friends, media, reading or other sources?

There is immediate evidence of change due to pressure on the environment. This will vary by place and experience, but could include: types of foods, wildlife in gardens and open areas, removal of peat bogs, coastal erosion, weather patterns.

3. Can you identify things around you that could be described as being produced by bioeconomy (e.g., wooden table and other fittings, food)?

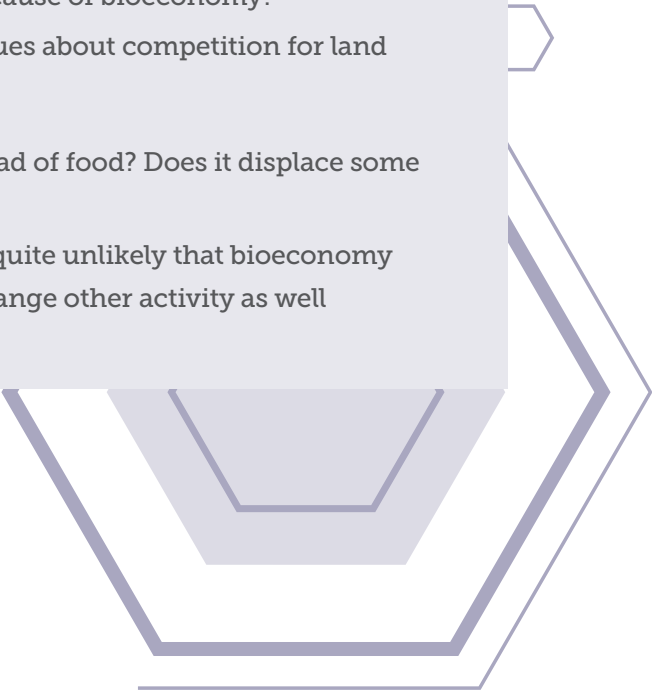
Bioeconomy has always been with us. The changes that is happening, is to make it more important and do more of the 'heavy lifting' to supply us with our wants and needs.

4. Can you think of any problems that might arise because of bioeconomy?

Bioeconomy is not a perfect solution. There are issues about competition for land for food, energy and materials.

5. Where does bioeconomy fit? Is it with food or instead of food? Does it displace some other land use?

We need to optimise the food system, but it seems quite unlikely that bioeconomy can transform our dependence on oil unless we change other activity as well



6. How do we decide what a fair share of environmental resources looks like?

We need to think about the rules and how they might be formulated. Things to consider include supply of land, supply of resources for making things, demand for things, individual and community need, social circumstances, standard of living, cost, the physical and biological limits of the environment and so on.

7. What everyday items do you, your family, or your school use that once used to be a waste? Can you find other examples of wastes being turned into resources?

Lots of companies are using wastes to make the products you use every day, some examples include: Kanken Fjallraven backpacks made from plastic bottles, clothes from recycled fibres or plastic bottles, IKEA rugs made from leftover upholstery fabric, Glanbia turning milk waste into protein shakes

8. What would have happened to these wastes if they weren't recycled?

Would these wastes have ended up in landfill or the ocean? How would this have affected the environment or biodiversity?

100,000 marine animals die from getting entangled and ingesting plastic every year – this is just the creatures we find!

9. What other large sources of waste can you identify? What useful resource could these wastes be turned into?

7% of the world's gold may be contained in e-waste – your old phones and laptops.

1 in 2 people throw their unwanted clothes straight in the trash, this means that 21 billion garments end up in landfill each year.

10. Would using waste as an input into new products be more or less expensive for companies?





# Additional Resources

## Context

- (1) Student Energy: [studentenergy.org](http://studentenergy.org)
- (2) WWF: [www.worldwildlife.org/teaching-resources/toolkits/lpr-for-youth](http://www.worldwildlife.org/teaching-resources/toolkits/lpr-for-youth)
- (3) Ecological Footprint: [www.footprintnetwork.org/our-work/earth-overshoot-day/](http://www.footprintnetwork.org/our-work/earth-overshoot-day/)

## Fair share

- (4) Europe taking more than it share: [www.footprintnetwork.org/content/uploads/2019/05/WWF\\_GFN\\_EU\\_Overshoot\\_Day\\_report.pdf](http://www.footprintnetwork.org/content/uploads/2019/05/WWF_GFN_EU_Overshoot_Day_report.pdf)  
(summary published by BBC: [www.bbc.com/news/science-environment-48215453](http://www.bbc.com/news/science-environment-48215453))
- (5) Fair share: WWF/Oxfam discussion paper on fair share: [assets.wwf.org.uk/downloads/wwf\\_oxfam\\_scarcityfairsharesdev2011.pdf](http://assets.wwf.org.uk/downloads/wwf_oxfam_scarcityfairsharesdev2011.pdf)  
(summary published in The Guardian newspaper: [www.theguardian.com/global-development/poverty-matters/2011/jul/20/fair-share-natural-resources](http://www.theguardian.com/global-development/poverty-matters/2011/jul/20/fair-share-natural-resources))

## Irish and EU policy / research

- (6) EU Bioeconomy strategy: [ec.europa.eu/info/research-and-innovation/research-area/environment/bioeconomy/bioeconomy-strategy\\_en](http://ec.europa.eu/info/research-and-innovation/research-area/environment/bioeconomy/bioeconomy-strategy_en)
- (7) Irish Bioeconomy strategy: [www.gov.ie/en/publication/9a7e1-the-bioeconomy/](http://www.gov.ie/en/publication/9a7e1-the-bioeconomy/)
- (8) BiOrbic Bioeconomy, SFI Research Centre: <https://biorbic.com/>

There are many more resources easily found with an internet search. These are selected because the sources are more or less reliable but they do have bias: Videos #6 and #7 from the Discussion Stimulus section come from a known political perspective; #2, #5 come from a known environmental perspective.



Here are some exciting examples of wastes being turned into resources by large companies and individual people:

- Chewing gum being recycled into rubber wellies, shoes, etc.  
<https://www.youtube.com/watch?v=cnt0Yb870Vg>
- Wastewater being turned into fertiliser, energy, and construction material  
<https://www.bbc.co.uk/programmes/p087hpm5>
- Fishing nets recycled into textiles – clothes and carpets  
<https://www.econyl.com/video/#lg=1&slide=0>
- Leftover coffee grounds are being turned into sunglasses  
<https://www.bbc.co.uk/programmes/p080zbkm>
- Plastic can be turned into earrings and tiles among lots of other things  
<https://www.bbc.co.uk/programmes/p09t039b>

Dame Ellen MacArthur is a retired yachtswoman who broke the record for the fastest solo trip around the globe. In 2010, she launched the Ellen MacArthur foundation which works with businesses and schools to help the transition to a circular economy. A TedTalk by Dame Ellen MacArthur:

[https://www.ted.com/talks/dame\\_ellen\\_macarthur\\_the\\_surprising\\_thing\\_i\\_learned\\_sailing\\_solo\\_around\\_the\\_world?language=en](https://www.ted.com/talks/dame_ellen_macarthur_the_surprising_thing_i_learned_sailing_solo_around_the_world?language=en)

Reuse, repair, recycle: 'Circular economy' legislation set to have huge impact article in The Irish Times

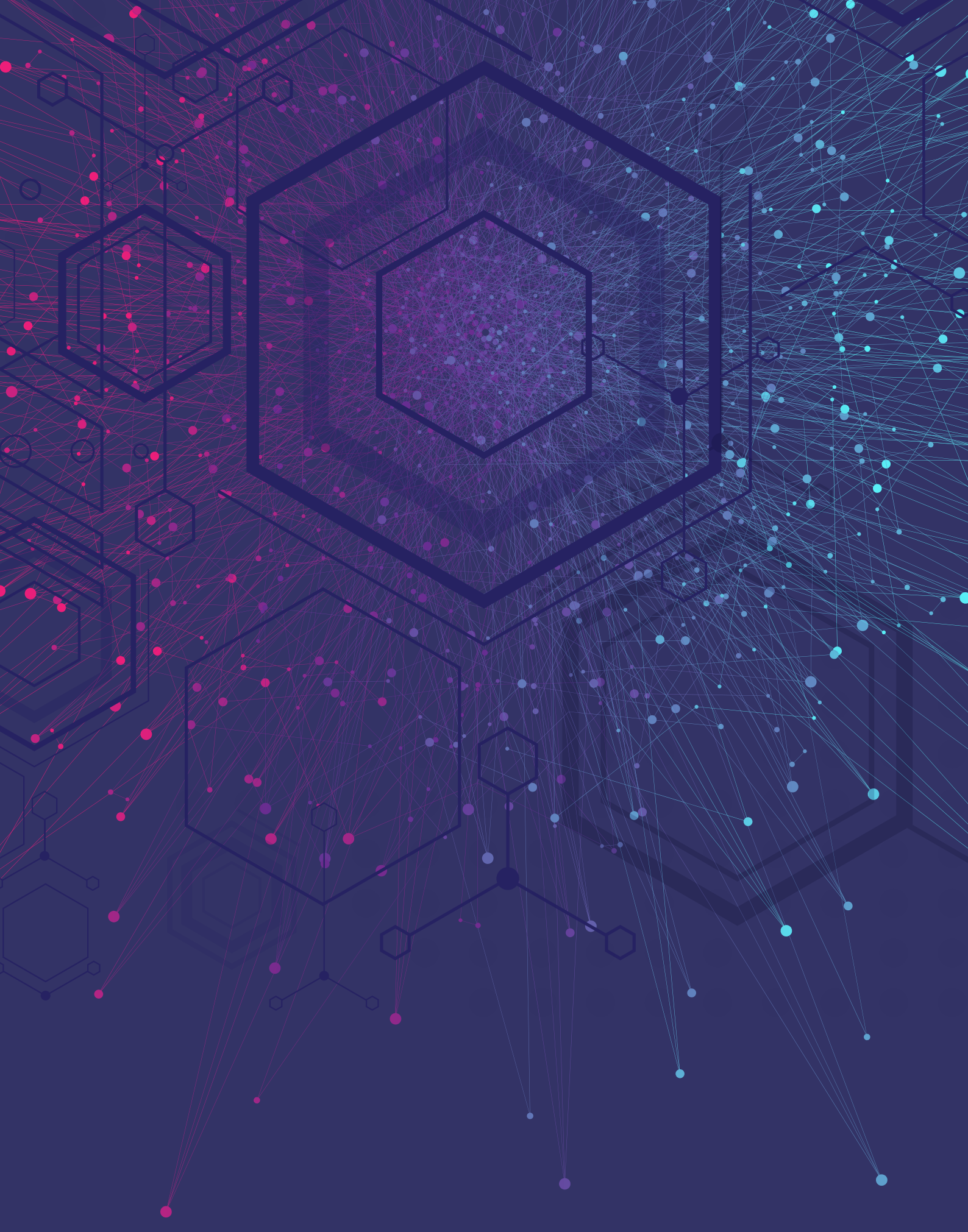
<https://www.irishtimes.com/news/environment/reuse-repair-recycle-circular-economy-legislation-set-to-have-huge-impact-1.4597151>

# Ireland's Biggest Brainstorm - have your ideas heard!

Now that you have discussed smart communities and internet connectivity, take five minutes to think of an opportunity or challenge you see for yourself, your community, Ireland or the world on this topic.

These can be captured in the classroom using this [template](#) and emailed to [creatingourfuture@sfi.ie](mailto:creatingourfuture@sfi.ie) or if you have access to a computer lab log on to [creatingourfuture.ie](http://creatingourfuture.ie) and submit your idea directly on the website.





Science Foundation Ireland  
3 Park Place,  
Hatch Street Upper, Dublin 2.  
[scienceweek@sfi.ie](mailto:scienceweek@sfi.ie)

Science  
Foundation  
Ireland **sfi**  
For what's next

CREATING  
**OUR**  
FUTURE