LESSON 3

Understanding the challenge of ‘finite’ resources

ELLEN MACARTHUR FOUNDATION

LESSON THREE:

Understanding the challenge of 'finite' resources

Ellen MacArthur

"If we could build an economy that would use things, rather than use them up, we could build a future that really could work in the long term."

This lesson is part of a series that introduces students to a different way of thinking about how our economy could work: a circular economy. The series builds up exactly how a circular economy is different from the status quo, and looks at the economic, environmental and social advantages of a new approach.

The series looks like this:

- (1/5) Challenging common conceptions
- (2/5) Exploring the circular economy
- **(3/5) Understanding the challenge of 'finite' resources**
- (4/5) Designing for a circular economy
- (5/5) The circular economy and modern agriculture

Subjects: Economics, Geography, Environmental Systems, Sociology, Business, Citizenship,

Age range: 12-19 years

Total time: 45-70 minutes

Learning outcomes:

- To understand the urgent challenge that finite resources pose to our current economic system
- To explore economic history since the industrial revolution through personal narrative
- To critically evaluate our current consumption and production systems and explore better ways of dealing with resources.

Preparation:

- Read the summary of the basic ideas behind a circular economy as attached in Appendix 1
- Set up projector/video screening facilities
- Prepare a white board to document students responses
- Print out copies of the video questions in Appendix 2 or allow access for students on educanon and access the video here. For watching with your students or reviewing their answers through the Blended Learning function, you have to create a free Playposit account. Please allow for some time familiarising yourself with this feature.

Introduction – 15 min

Open the topic with a discussion of some of the conventional approaches to sustainability, i.e. reduce, reuse, recycle. See Lesson 1 in this series: 'Seeing the Bigger Picture' for more detail.

Direct the discussion toward our use of fini e resources. You might ask: What kind of resources are we using in our everyday life? Could we keep going with the way we currently live forever? What are the limitations? What could we do about it?

Ask the students to discuss in pairs or groups fir t. Then collect some responses on the white/black board.

Then ask the students: How can we best come up with ideas and responses to the challenge that soon we will run out of non-renewable resources?

Exploring resources through personal experience – 25 min

Now introduce Ellen MacArthur and the sport of sailing. You might say:

"It is sometimes in surprising circumstances, when we least expect it, that the best ideas come to us. In 2005 Dame Ellen MacArthur was the fir t woman to sail single-handed around the world, breaking the world record at the time by completing the journey in 71 days. On her voyage she started thinking about the way we relate to the planet and use its resources…"

Show the video of Ellen's TED talk (17 min): https://www.youtube.com/watch?v=ooIxHVXgLbc

You can also read out the transcript of the talk (Appendix 3).

In order for the students to get an uninterrupted impression of Ellen's story and the ideas around resource constraints, watch the video as a whole without interruption.

LEARNING ACTIVITY

What can be done? – 25 min (Also ideal for Homework)

Click here to watch on Playposit's website. You can print and share the questions from Appendix 2 to reinforce learning from the video. Watch and re-watch it if necessary.

Note: Educanon's playposit will allow you to collect and review students' responses electronically.

TAKE ACTION

Take Action on the planet's resource constraints – 10 min

One of the barriers to using non-renewable resources better and longer, and increasing the share of renewable resources and renewable energy in our economy, is that many people think that 'reduce, reuse, and recycle' is enough.

Ask the students to think of 5 people they would want to talk to in order to shift the way we use finite resources to a more restorative one.

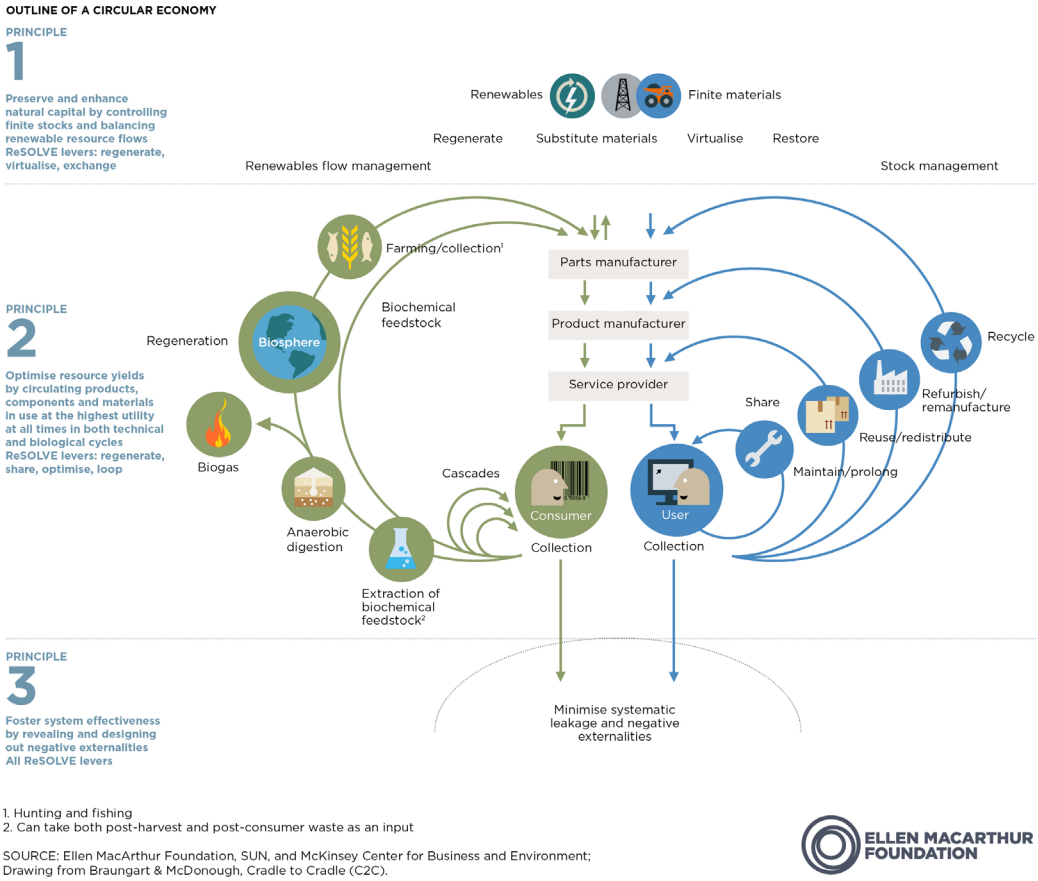
Ask them to give a reason for why the 5 people they have choses are the most important people to inform, and how they can make that change happen.

You might want to discuss the importance and the limits of individual action, as well as the importance and limit of advocacy / campaigning.

Advanced Question: Why is it important that a solution around resource constraints also makes economic sense?

Now you have explored some of the common assumptions about resources and the challenge of their fini e nature, it is a perfect moment to explore the circular economy as a response to this challenge. Go to **Lesson 4: Designing for a Circular Economy.**

APPENDIX 1: OVERVIEW OF A CIRCULAR ECONOMY



1. Hunting and fishing
2. Can take both post-harvest and post-consumer waste as an input

SOURCE: Ellen MacArthur Foundation, SUN, and McKinsey Center for Business and Environment; Drawing from Braungart & McDonough, Cradle to Cradle (C2C).

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Introduction to the Circular economy

The circular economy refers to an industrial economy that is restorative by intention; aims to rely on renewable energy; minimises, tracks, and hopefully eliminates the use of toxic chemicals; and eradicates waste through careful design.

The term goes beyond the mechanics of production and consumption of goods and services, in the areas that it seeks to redefine examples include rebuilding capital including social and natural, and the shift from consumer to user). The concept of the circular economy is grounded in the study of non-linear, particularly living systems.

Watch this short animation to learn more: https://youtu.be/zCRKvDyyHml

A major outcome of taking insights from living systems is the notion of optimising systems rather than components, which can also be referred to as ‘design to fi ’— by analogy, the tree is nothing without the forest. It involves a careful management of material fl ws, which in the circular economy are of two types as described by McDonough and Braungart (Cradle to Cradle, Re-making the way we make things): biological nutrients, designed to re-enter the biosphere safely and build natural capital; and technical nutrients, designed to circulate at high quality without entering the biosphere.

As a result, the circular economy draws a sharp distinction between the consumption and use of materials. In a circular economy there is a need for a ‘functional service’

model in which manufacturers or retailers increasingly retain ownership of their products and act as service providers, selling the use of the products, rather than the products themselves. This shift has direct implications for the development of efficien and effective take-back systems. It also requires changes in product design and business models to generate more durable products that are designed for disassembly and remanufacture or refurbishment.

This lesson was produced by the Ellen MacArthur Foundation. The Ellen MacArthur Foundation works with business, government and academia to build a framework for an economy that is restorative and regenerative by design.

We have produced a number of educational resources which are free to download from www.ellenmacarthurfoundation.org

If you have any suggestions, questions or feedback about these lesson plans, or just want to get in touch with the Schools and Colleges team, please email info@ellenmacarthurfoundation.org*. You can also sign up to the Schools & Colleges Programme Newsletter to* join our community *and stay in touch.*

APPENDIX 2: WORKSHEET QUESTIONS FOR VIDEO

1. Why is the moment Ellen MacArthur describes herself as a four-year old child so memorable?

2. What encouraged Ellen MacArthur to begin an apprenticeship in sailing?
    - Being told by her school that she wasn't clever enough to be a vet
    - Finally having saved up all the money needed to buy a sailing boat
    - Being offered a job as a sailing instructor
3. Take a moment to reflect on our dream and how to make it come true. What problems would you like to solve? What challenges would you need to overcome?

4. Where in the world did Ellen MacArthur encounter challenges around Christmas Day?

5. Why was it so dangerous to sail through that part of the world?

6. Ellen MacArthur compares her voyage through these dangerous parts of the world to driving a car at high speed, without wind-screen wipers and headlights. What does she want to show with this comparison? Why does it work? And what other comparison could you come up with?

7. If Ellen asked you now to go off and find verything you need for your survival for the next three months, what would you take? Why?

8. “All we have out there, is everything we have and we have no more.” What does ‘fini e’ mean to you?

9. What did Ellen MacArthur do after she broke the world-record for sailing around the world?

10. What did Ellen's grandfather do?
    - He was a farmer.
    - He was a coal miner.
    - He was unemployed.
    - He was a gardener.
11. What is the greatest challenge Ellen had ever come across?
    - Icebergs in the Southern ocean
    - The future of the global economy
    - The death of her grandfather
    - The end of the coal mining industry
12. Materials like copper and zinc are fini e. But we use them up at an increasing speed. What does this mean for our economy? What does that mean for your own life?

13. The more Ellen MacArthur learned about the resources and materials that our economy is based on, the more worried she got. Because the speed at which we are using up our resources is part of the problem, she - like many others - started using less, traveling less and consuming less. What would you have to give up in your everyday life in order for our resources to last longer? Would that approach work forever? Why or why not?

14. Describe a ‘linear economy’.

15. What can we and our economy learn from nature?

16. How is a ‘circular economy’ different from the linear model?

17. Ellen MacArthur gives a range of example products that could be redesigned so that they would never become waste: cars; packaging; lamps and engines. Take a look at the room that you are sitting in or the house you live in and pick one product that needs redesigning. What could be done to ensure that it would never become waste?

18. What would you do to change the economic system? Who would you talk to? Where would you start? Explain your choices.

19. Reflecting on the li e of her grandfather, Ellen MacArthur shows how many things have changed and developed in his lifetime alone: the use of cars increased, planes were invented, the fir t computers arrived, mobile phones and the internet are now widely available. A transition to a circular economy is possible - why is it so important? And what opportunities does it bring in your opinion?

Appendix 3: Transcript of Ellen MacArthur's TED talk

When you're a child, anything and everything is possible. The challenge, so often, is hanging on to that as we grow up. And as a four-year-old, I had the opportunity to sail for the fir t time.

00:26

I will never forget the excitement as we closed the coast. I will never forget the feeling of adventure as I climbed on board the boat and stared into her tiny cabin for the fir t time. But the most amazing feeling was the feeling of freedom, the feeling that I felt when we hoisted her sails. As a four-year-old child, it was the greatest sense of freedom that I could ever imagine. I made my mind up there and then that one day, somehow, I was going to sail around the world.

00:59

So I did what I could in my life to get closer to that dream. Age 10, it was saving my school dinner money change. Every single day for eight years, I had mashed potato and baked beans, which cost 4p each, and gravy was free. Every day I would pile up the change on the top of my money box, and when that pile reached a pound, I would drop it in and cross off one of the 100 squa es I'd drawn on a piece of paper. Finally, I bought a tiny dinghy. I spent hours sitting on it in the garden dreaming of my goal. I read every book I could on sailing, and then eventually, having been told by my school I wasn't clever enough to be a vet, left school age 17 to begin my apprenticeship in sailing.

01:43

So imagine how it felt just four years later to be sitting in a boardroom in front of someone who I knew could make that dream come true. I felt like my life depended on that moment, and incredibly, he said yes. And I could barely contain my excitement as I sat in that fir t design meeting designing a boat on which I was going to sail solo nonstop around the world. From that fir t meeting to the finish line of the ace, it was everything I'd ever imagined. Just like in my dreams, there were amazing parts and tough parts. We missed an iceberg by 20 feet. Nine times, I climbed to the top of her 90-foot mast. We were blown on our side in the Southern Ocean. But the sunsets, the wildlife, and the remoteness were absolutely breathtaking. After three months at sea, age just 24, I finished in se ond position. I'd loved it, so much so that within six months I decided to go around the world again, but this time not in a race: to try to be the fastest person ever to sail solo nonstop around the world. Now for this, I needed a different craft: bigger, wider, faster, more powerful. Just to give that boat some scale, I could climb inside her mast all the way to the top. Seventy-fi e foot long, 60 foot wide. I affectionately called her Moby. She was a multihull. When we built her, no one had ever made it solo nonstop around the world in one, though many had tried, but whilst we built her, a Frenchman took a boat 25 percent bigger than her and not only did he make it, but he took the record from 93 days right down to 72. The bar was now much, much higher.

03:31

And these boats were exciting to sail. This was a training sail off the F ench coast. This I know well because I was one of the fi e crew members on board. Five seconds is all it took from everything being fine o our world going black as the windows were thrust underwater, and that fi e seconds goes quickly. Just see how far below those guys the sea is. Imagine that alone in the Southern Ocean plunged into icy water, thousands of miles away from land.

04:02

It was Christmas Day. I was forging into the Southern Ocean underneath Australia. The conditions were horrendous. I was approaching a part in the ocean which was 2,000 miles away from the nearest town. The nearest land was Antarctica, and the nearest people would be those manning the European Space Station above me. (Laughter) You really are in the middle of nowhere. If you need help, and you're still alive, it takes four days for a ship to get to you and then four days for that ship to get you back to port. No helicopter can reach you out there, and no plane can land. We are forging ahead of a huge storm. Within it, there was 80 knots of wind, which was far too much wind for the boat and I to cope with. The waves were already 40 to 50 feet high, and the spray from the breaking crests was blown horizontally like snow in a blizzard. If we didn't sail fast enough, we'd be engulfed by that storm, and either capsized or smashed to pieces. We were quite literally hanging on for our lives and doing so on a knife edge.

05:10

The speed I so desperately needed brought with it danger. We all know what it's like driving a car 20 miles an hour, 30, 40. It's not too stressful. We can concentrate. We can turn on the radio. Take that 50, 60, 70, accelerate through to 80, 90, 100 miles an hour. Now you have white knuckles and you're gripping the steering wheel. Now take that car off oad at night and remove the windscreen wipers, the windscreen, the headlights and the brakes. That's what it's like in the Southern Ocean. (Laughter) (Applause) You could imagine it would be quite difficult o sleep in that situation, even as a passenger. But you're not a passenger. You're alone on a boat you can barely stand up in, and you have to make every single decision on board. I was absolutely exhausted, physically and mentally. Eight sail changes in 12 hours. The mainsail weighed three times my body weight, and after each change, I would collapse on the floor soa ed with sweat with this freezing Southern Ocean air burning the back of my throat.

06:12

But out there, those lowest of the lows are so often contrasted with the highest of the highs. A few days later, we came out of the back of the low. Against all odds, we'd been able to drive ahead of the record within that depression. The sky cleared, the rain stopped, and our heartbeat, the monstrous seas around us were transformed into the most beautiful moonlit mountains.

06:39

It's hard to explain, but you enter a different mode when you head out there. Your boat

is your entire world, and what you take with you when you leave is all you have. If I said to you all now, “Go off in o Vancouver and find verything you will need for your survival for the next three months,” that’s quite a task. That’s food, fuel, clothes, even toilet roll and toothpaste. That’s what we do, and when we leave we manage it down to the last drop of diesel and the last packet of food. No experience in my life could have given me a better understanding of the definition of the ord “fini e.” What we have out there is all we have. There is no more.

07:18

And never in my life had I ever translated that definition of fin e that I’d felt on board to anything outside of sailing until I stepped off the bo t at the finish line h ving broken that record.

07:29

(Applause)

07:35

Suddenly I connected the dots. Our global economy is no different. It’s entirely dependent on fini e materials we only have once in the history of humanity. And it was a bit like seeing something you weren’t expecting under a stone and having two choices: I either put that stone to one side and learn more about it, or I put that stone back and I carry on with my dream job of sailing around the world.

08:01

I chose the fir t. I put it to one side and I began a new journey of learning, speaking to chief executives, experts, scientists, economists to try to understand just how our global economy works. And my curiosity took me to some extraordinary places.

08:17

This photo was taken in the burner of a coal-fi ed power station. I was fascinated by coal, fundamental to our global energy needs, but also very close to my family. My great-grandfather was a coal miner, and he spent 50 years of his life underground. This is a photo of him, and when you see that photo, you see someone from another era. No one wears trousers with a waistband quite that high in this day and age. (Laughter) But yet, that’s me with my great-grandfather, and by the way, they are not his real ears. (Laughter)

08:52

We were close. I remember sitting on his knee listening to his mining stories. He talked of the camaraderie underground, and the fact that the miners used to save the crusts of their sandwiches to give to the ponies they worked with underground. It was like it was yesterday. And on my journey of learning, I went to the World Coal Association website, and there in the middle of the homepage, it said, “We have about 118 years of coal left.” And I thought to myself, well, that’s well outside my lifetime, and a much greater figu e than the predictions for oil. But I did the math, and I realized that my great-grandfather had been born exactly 118 years before that year, and I sat on his knee until I was 11 years old, and I realized it’s nothing in time, nor in history. And it

made me make a decision I never thought I would make: to leave the sport of solo sailing behind me and focus on the greatest challenge I'd ever come across: the future of our global economy.

09:48

And I quickly realized it wasn't just about energy. It was also materials. In 2008, I picked up a scientific tudy looking at how many years we have of valuable materials to extract from the ground: copper, 61; tin, zinc, 40; silver, 29. These figu es couldn't be exact, but we knew those materials were fini e. We only have them once. And yet, our speed that we've used these materials has increased rapidly, exponentially. With more people in the world with more stuff, we've effectively seen 100 years of price declines in those basic commodities erased in just 10 years. And this affects all of us. It's brought huge volatility in prices, so much so that in 2011, your average European car manufacturer saw a raw material price increase of 500 million Euros, wiping away half their operating profits th ough something they have absolutely no control over.

10:44

And the more I learned, the more I started to change my own life. I started traveling less, doing less, using less. It felt like actually doing less was what we had to do. But it sat uneasy with me. It didn't feel right. It felt like we were buying ourselves time. We were eking things out a bit longer. Even if everybody changed, it wouldn't solve the problem. It wouldn't fix the ystem. It was vital in the transition, but what fascinated me was, in the transition to what? What could actually work?

11:13

It struck me that the system itself, the framework within which we live, is fundamentally fl wed, and I realized ultimately that our operating system, the way our economy functions, the way our economy's been built, is a system in itself. At sea, I had to understand complex systems. I had to take multiple inputs, I had to process them, and I had to understand the system to win. I had to make sense of it. And as I looked at our global economy, I realized it too is that system, but it's a system that effectively can't run in the long term.

11:49

And I realized we've been perfecting what's effectively a linear economy for 150 years, where we take a material out of the ground, we make something out of it, and then ultimately that product gets thrown away, and yes, we do recycle some of it, but more an attempt to get out what we can at the end, not by design. It's an economy that fundamentally can't run in the long term, and if we know that we have fini e materials, why would we build an economy that would effectively use things up, that would create waste? Life itself has existed for billions of years and has continually adapted to use materials effectively. It's a complex system, but within it, there is no waste. Everything is metabolized. It's not a linear economy at all, but circular.

12:36

And I felt like the child in the garden. For the fir t time on this new journey, I could see exactly where we were headed. If we could build an economy that would use things

rather than use them up, we could build a future that really could work in the long term. I was excited. This was something to work towards. We knew exactly where we were headed. We just had to work out how to get there, and it was exactly with this in mind that we created the Ellen MacArthur Foundation in September 2010.

13:06

Many schools of thought fed our thinking and pointed to this model: industrial symbiosis, performance economy, sharing economy, biomimicry, and of course, cradle-to-cradle design. Materials would be defined as either echnical or biological, waste would be designed out entirely, and we would have a system that could function absolutely in the long term.

13:29

So what could this economy look like? Maybe we wouldn't buy light fittings, but e'd pay for the service of light, and the manufacturers would recover the materials and change the light fittings when e had more efficient oducts. What if packaging was so nontoxic it could dissolve in water and we could ultimately drink it? It would never become waste. What if engines were re-manufacturable, and we could recover the component materials and significantly educe energy demand. What if we could recover components from circuit boards, reutilize them, and then fundamentally recover the materials within them through a second stage? What if we could collect food waste, human waste? What if we could turn that into fertilizer, heat, energy, ultimately reconnecting nutrients systems and rebuilding natural capital? And cars -- what we want is to move around. We don't need to own the materials within them. Could cars become a service and provide us with mobility in the future? All of this sounds amazing, but these aren't just ideas, they're real today, and these lie at the forefront of the circular economy. What lies before us is to expand them and scale them up.

14:35

So how would you shift from linear to circular? Well, the team and I at the foundation thought you might want to work with the top universities in the world, with leading businesses within the world, with the biggest convening platforms in the world, and with governments. We thought you might want to work with the best analysts and ask them the question, "Can the circular economy decouple growth from resource constraints? Is the circular economy able to rebuild natural capital? Could the circular economy replace current chemical fertilizer use?" Yes was the answer to the decoupling, but also yes, we could replace current fertilizer use by a staggering 2.7 times. But what inspired me most about the circular economy was its ability to inspire young people. When young people see the economy through a circular lens, they see brand new opportunities on exactly the same horizon. They can use their creativity and knowledge to rebuild the entire system, and it's there for the taking right now, and the faster we do this, the better.

15:37

So could we achieve this in their lifetimes? Is it actually possible? I believe yes. When you look at the lifetime of my great-grandfather, anything's possible. When he was

born, there were only 25 cars in the world; they had only just been invented. When he was 14, we fl w for the fir t time in history. Now there are 100,000 charter flights very single day. When he was 45, we built the fir t computer. Many said it wouldn't catch on, but it did, and just 20 years later we turned it into a microchip of which there will be thousands in this room here today. Ten years before he died, we built the fir t mobile phone. It wasn't that mobile, to be fair, but now it really is, and as my great-grandfather left this Earth, the Internet arrived. Now we can do anything, but more importantly, now we have a plan.

16:32

Thank you.