

# INTRODUCTION TO PAPER RECYCLING

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This lesson covers a range of different considerations for paper recycling, how paper can fit in with the circular economy, and bringing together arguments both for and against using paper packaging.

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## LESSON OBJECTIVES

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Students will be able to:

- Describe the key stages in the paper recycling process
  - Understand some of the benefits and limitations of paper recycling
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## SUMMARY OF TASKS

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### PART 1 – INTRODUCTION

- Ask students to brainstorm how many paper-based products they have used in the last 24 hours (this can be done as small groups or the whole class).
- Highlight how widespread paper use is and introduce some of the facts from the 'Introduction to Paper Recycling' fact sheet

### PART 2 – ACTIVITY

- In small groups, ask students to complete the 'Stages of Paper Recycling' activity. (This could also be converted to a digital activity through a platform such as kahoot or quizlet.)
- Watch 'How It's Made: Paper Recycling' video<sup>1</sup> (6 mins)
- Use the video to discuss the student's responses to the activity

### PART 3 – DISCUSSION

- In small groups ask students to write down their ideas to the following questions:
  - What are the benefits of paper recycling?
  - What are the limitations of paper recycling?
- Come back together as a whole group and ask groups to share some of their ideas with everyone
- Finish by sharing some of the facts and figures about the pros and cons of paper recycling from the 'Introduction to Paper Recycling' fact sheet

### RESOURCES/ EQUIPMENT

- 'Introduction to Paper Recycling' fact sheet
- 'Stages of Paper Recycling' activity

### HOMEWORK/ EXTRA ACTIVITIES

- Students select one of the 'Fact Sheets' on TwoSides.<sup>2</sup> Ask them to summarise the key points in the fact sheet and decide if the fact sheet is for or against the use of paper.
- Ask students to create their own WW2 style propaganda poster to encourage more recycling – examples can be seen in online archives e.g. [www.iwm.org.uk/](http://www.iwm.org.uk/)

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<sup>1</sup> <https://www.youtube.com/watch?v=2c8YxMb0tlk>

<sup>2</sup> <https://www.twosides.info/fact-sheets/>

# FACT SHEET: INTRODUCTION TO PAPER RECYCLING

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FACT SHEETS HAVE BEEN DESIGNED FOR TEACHER USE TO AID CREATING OF TEACHING RESOURCES, OR THEY ARE FREE TO BE REPURPOSED FOR STUDENT USE.

## PART 1 – INTRODUCTION

Paper is one of the most recycled materials in the EU. 72% of paper was recycled in Europe in 2012, which was an increase from 20% in 2000. The current target set within Europe for 2020 is to reach a 74% recycling rate.<sup>3</sup> Similar figures are reported by the US Environmental Protection Agency, with 44.2 million tons of paper were recycled in 2017, equating to a recycling rate of 66% in the USA.<sup>4</sup> In the paper industry 46.2% of all materials used came from recycled materials, which equated to 47.8 million tonnes used in the industry in 2016. Paper recycling is nothing new, the first patent for paper recycling was granted to Matthias Koops, in 1800. There was also a large drive for paper recycling during WWII, which was part of the ongoing war effort on the home front. This was known as the 'National Salvage Campaign'.<sup>5</sup>



Figure 1: “I need your wastepaper” - War propaganda poster – Ministry of Supply Poster No. 121.  
Image: © IWM Art.IWM PST 14737

## PART 2 – HOW IS PAPER RECYCLED?

The paper recycling process is made up of a number of individual stages listed below:

**Stage 1:** Wastepaper is collected from various sources, such as offices, schools, and household recycling bins. It is very important to ensure that wastepaper is placed into the correct recycling bin to make sure it has some chance of being recycled and does not end up being taken to landfill.

**Stage 2:** Once collected the paper is transported to a recycling facility. The paper is then processed to remove any large unwanted materials from the paper stream, e.g. plastic wrapping. The remaining paper is sorted by its quality, which determines the possible end uses of the recycled paper.

**Stage 3:** A pulp is then created which is done through the addition of water and several different chemicals. Any non-paper contaminants still present in the pulp, such as metal staples, are removed at this stage.

**Stage 4:** The pulp then undergoes a process known as de-inking. Often several cycles of de-inking are required before enough colour is removed for the pulp to be turned into new usable paper. During the de-inking process air is blown into the pulp solution, the ink within the pulp can then stick to the air

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<sup>3</sup> European Declaration on Paper Recycling 2016-2020

<sup>4</sup> <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/paper-and-paperboard-material-specific-data>

<sup>5</sup> M. Riley, *Area*, 2008, 40, 79–89.

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bubbles which then rise to the surface for the ink to be removed. The pulp may also be bleached using hydrogen peroxide during this phase. (*Read more about this process in link iv. of the additional resources below.*)

**Stage 5:** At this stage, some brand-new paper fibres may need to be added to the recycled pulp, this increases the quality of the paper, improving properties such as the smoothness and strength of the paper.

**Stage 6:** The pulp can then be used to make paper products in the same way as 'new' paper is made. This includes spreading out the pulp, followed by numerous drying stages to remove the large amounts of water.

### PART 3 – BENEFITS AND ISSUES OF PAPER RECYCLING

#### Benefits of paper recycling

There are numerous benefits to recycling and using recycled paper, rather than making paper from new materials every time:

- By recycling paper, the amount of paper ending up as waste is reduced, with around 2.3 m<sup>3</sup> of landfill space saved per tonne of paper recycled
- Between 28–70% reduction in energy consumption by recycling rather than making new paper
- The EPA estimate that recycling one ton of paper saves approx. 17 trees
- Producing recycled paper generates between 20 and 50 % fewer CO<sub>2</sub> emissions than the production of new paper

#### Issues with paper recycling

It is not possible to recycle paper forever, as you can, for example, with many metals. This is because the fibres which make up the paper are impacted during the recycling process which means it reaches a point where it can no longer be recycled. It is well reported that the fibres which make up paper can only be recycled up to 7 times, so it is not a limitless process.

Because of the impact on the quality of the paper fibres during the recycling process, there is a downgrading of the final paper product after recycling when compared with the paper product which was originally disposed of. Therefore, paper recycling is not an ideal circular process when compared with the aims of the circular economy, as paper is not kept at the same initial quality through recycling.

Sludge is a by-product of paper recycling, which is made up of all the fibres which are no longer high enough quality to be used to make paper and waste from the de-inking process. A lot of this paper sludge is disposed of in landfill. However, there are other uses of sludge which include:<sup>6</sup>

- Land spreading
- Composting
- Energy Recovery
- Utilisation in brick, light aggregates, and cement production

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<sup>6</sup> M. Likon and P. Trebše, in *Industrial Waste*, IntechOpen, 2012, Ch. 4.

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- Landfill capping
- Conversion to a sorbent material

ADDITIONAL RESOURCES

- Reading:
- i. <https://www.twosides.info/fact-sheets/>
  - ii. <https://www.thebalancesmb.com/an-introduction-to-paper-recycling-4036123>
  - iii. <https://www.norcalcompactors.net/what-is-the-process-of-recycling-paper/>
  - iv. <http://thedpda.org/paper-recycling-and-deinking>
- Video: <https://www.youtube.com/watch?v=jAqVxsEgWIM>

## ACTIVITY: STAGES OF PAPER RECYCLING

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### Instructions

*This resource introduces the processes involved in paper recycling and includes explanations of what takes places during each process.*

*It supplements the 'Introduction to Paper Recycling' fact sheet and lesson plan*

### Task

Ask students to work in small groups to:

1. Order the processes found in paper recycling
2. Match each of the processes to the explanation of what takes place during each process

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Process	Explanation
Collection	All the small amounts of paper to be recycled from homes, schools, offices etc. are brought together
Sorting	Any unwanted materials are removed from the paper stream, and the remaining paper is grouped depending on its quality
Pulping	The paper waste is then processed to become a slurry-like solution
Cleaning	The slurry is screened to remove any further non-paper contaminants such as remaining plastic wrappers or metal staples
De-inking	Through several cycles any colour which is still present in the pulp is removed, resulting in a colourless slurry
Pressing	The slurry is then rolled out to form large paper like sheets, and lots of water is removed by passing through large rollers
Drying	The water content is removed from the slurry/pulp through heating
Finishing	The large sheets are then finalised to turn into what would be obviously paper!