

Understanding Sustainability

Life cycle analysis – wood and PVC window frames

Comparing wood and PVC window frames

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Wood or PVC window frames?

Students work in groups of 3-4 (30mins). Using the sustainability-ed web site, students critically look at the complexity of a product's life cycle and compare the sustainability of wood and PVC window frames.

Level: key stage 4 or 5 students.

Resources Photocopies of sheets and scissors to cut out cards.
2 copies of sheet *PVC or wood window frames 2*.
1 copy of sheet *PVC or wood window frames 3*.

Activity Have students use the prompt cards to produce two flow diagrams for the life cycles of PVC and wooden window frames.

Prompt students with an initial discussion of the processes:

- Materials – wood (natural) and PVC (synthetic from oil).
- Obtaining wood – forests, felling, cutting and treatment for preservation.
- PVC production – oil, salt, chemical change.
- Transport.
- Production and fitting of window frames.
- Maintenance in use and life-span.
- Disposal of any wastes.
- What happens at the end of the frame's useful life? Are the materials that can be recycled actually recycled?

Also highlight the social aspects:

- Employment and wealth creation.
- Convenience for consumer.
- Consumer preferences (aesthetic issues).

On completion of the life cycles, students discuss the use of the materials for window frames.

Extension activity requires students to draw a radar graph comparing the two materials (more able students). For extra information, see the Ecodesign web in the 'tools' section at: <http://ecodesign.lboro.ac.uk/>

Plenary discussion

Questions to pose during plenary:

1. How does each material affect the environment?
2. How do the different materials create employment and generate wealth?
3. How does each material rate in terms of the convenience to the consumer (householder)?
4. How easy is it to think about a life cycle? Where should the 'boundary' be drawn to stop it spreading out further and further?

Some points to look for in a discussion include:

- Lots of things can be brought into a life cycle. For example, the energy needed to make the machinery that cuts down the trees. Stress that there must be a decision made at some point to limit its scope.
- Both materials use natural resources. PVC from non-renewable resource of oil or gas. Trees use up land. Sustainable forestry is increasing but also hardwoods are often obtained by clearing rainforests. See Forestry Stewardship Council at www.fsc.org
- The use of both materials create jobs and generate economic wealth.
- Energy is required to cut and process raw materials.
- Wood is usually treated with chemical preservatives to increase its life span. It should also be regularly painted during its life time. PVC does not require painting.
- Energy is used in transport.
- Waste PVC can be recycled.
- PVC window frames can be recycled to make new frames. How can this recycling be increased?
- Wood is biodegradable. Good for waste disposal but also means it needs protecting with paints / treatments to prevent rot during use.

Sustainable window frames: wood or PVC window frames?

We all have windows. Should the window frames be made from wood or the plastic PVC? Look at the life cycle to see what you think is the more sustainable.

Your task

1. Go to **www.sustainability-ed.org**
2. Navigate to the Sustainable Development Case Studies and select the Water Pipes and Window Frames section.
3. Look at the Window frames case study.
4. Use the picture cards to produce **two** flow diagrams. One showing the life cycle of a PVC window frame and the other the life cycle of a window frame made from wood.

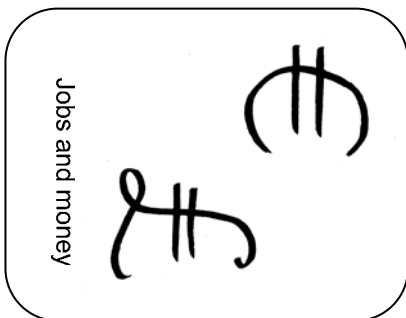
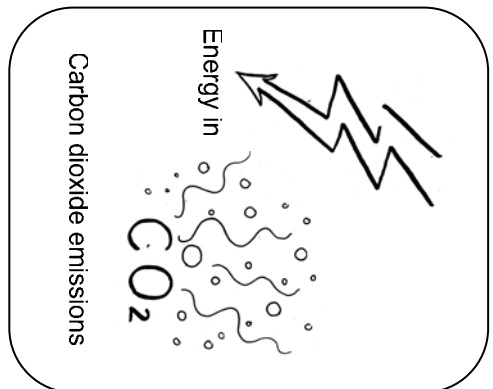
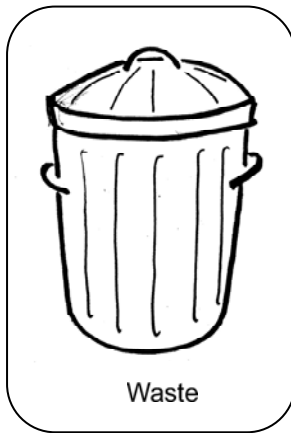
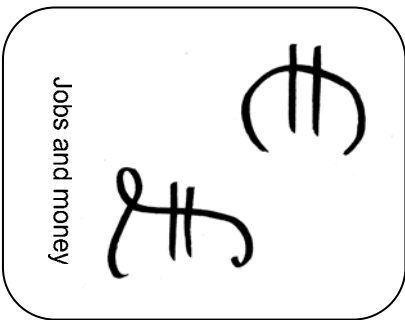
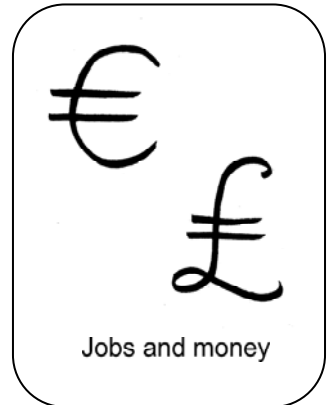
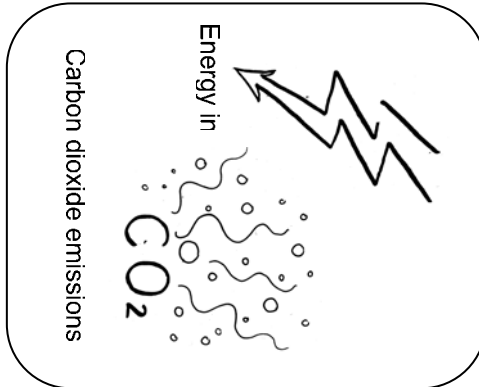
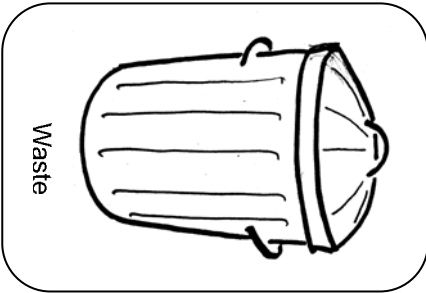
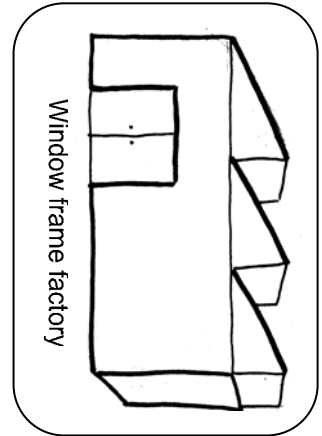
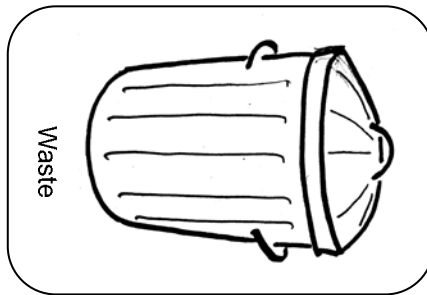
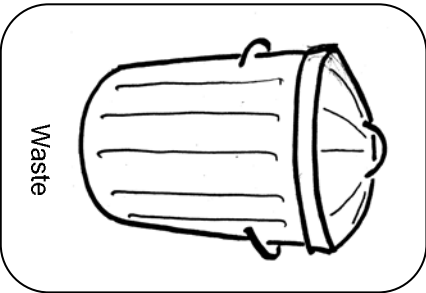
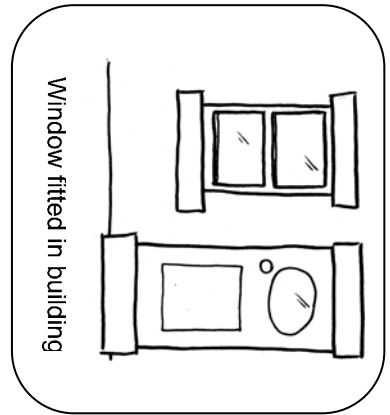
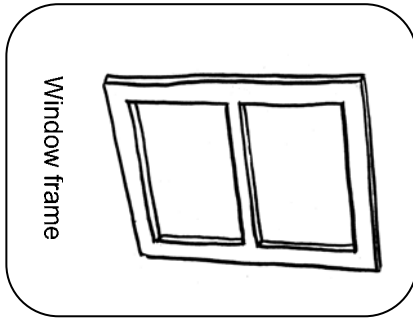
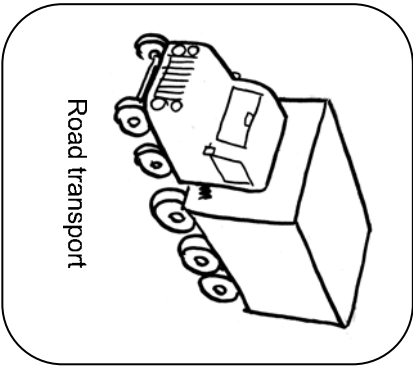
Life cycle

Start with the raw materials and end with the frames after they are removed from the building. Some things to think about are below.

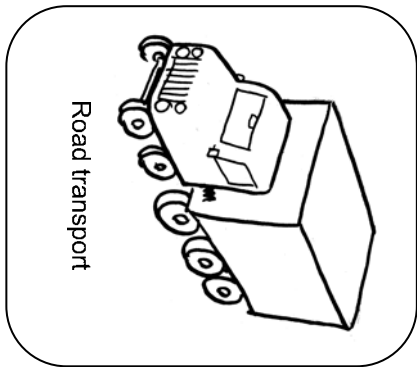
Wooden window frames	<p>Soft-wood can be from sustainable forests. Hardwoods often from cutting down rainforests. This can cause problems although some rainforests are managed in a more sustainable manner.</p> <p>The wood is often chemically treated to help preserve it.</p> <p>Wooden window frames need to be painted to prevent rotting.</p> <p>At the end of its life, a wooden frame is biodegradable.</p>
PVC window frames	<p>PVC is a synthetic plastic made from oil or gas.</p> <p>PVC window frames do not need painting during their lifetime.</p> <p>The PVC can be recycled when the frame needs replacing.</p>

Look at the two life cycles that you have constructed and answer these questions. Give reasons for your answers.

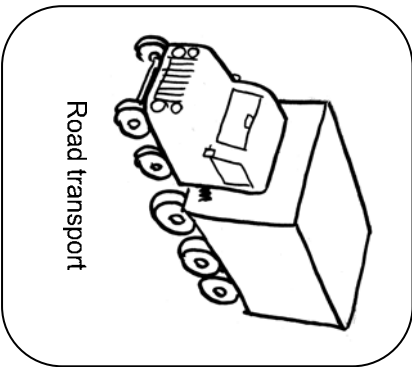
1. How does each type of window frame affect the environment?
2. How do the different materials create employment and generate wealth?
3. How does each material rate in terms of the convenience and appearance to the consumer (householder)?
4. How easy is it to think about a life cycle? Where should the 'boundary' be drawn to stop it spreading out too much?



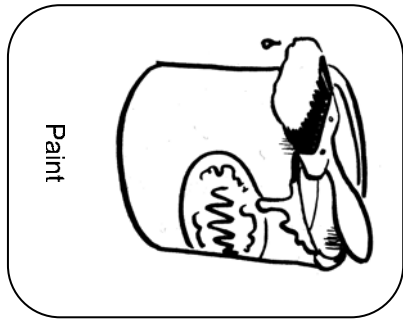
Two copies of this page per group.



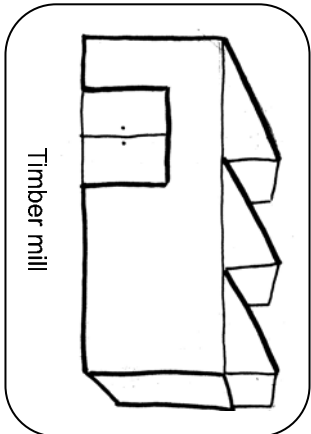
Road transport



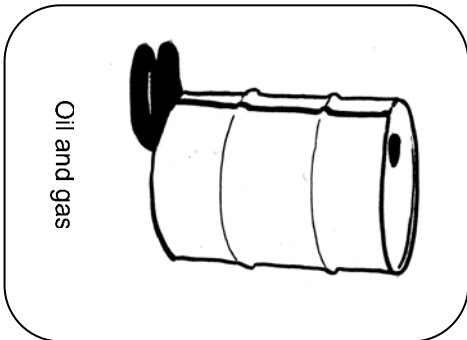
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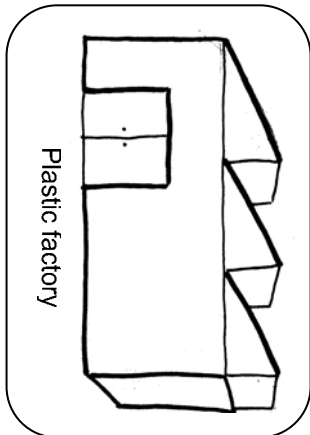
Paint



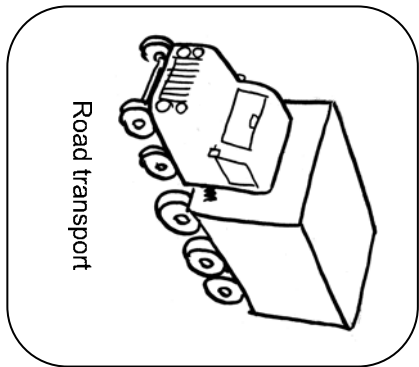
Timber mill



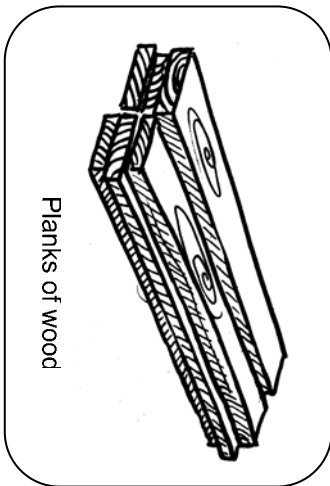
Oil and gas



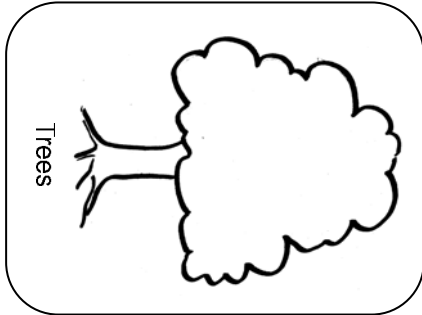
Plastic factory



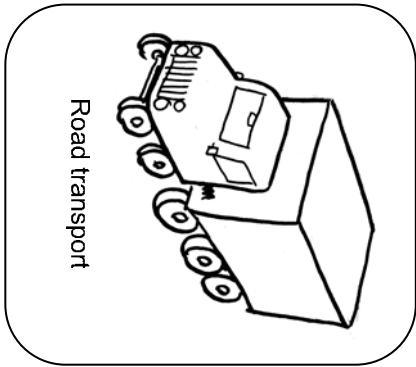
Road transport



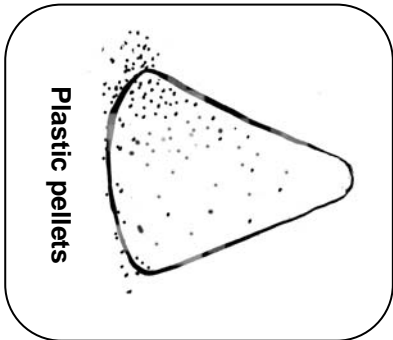
Planks of wood



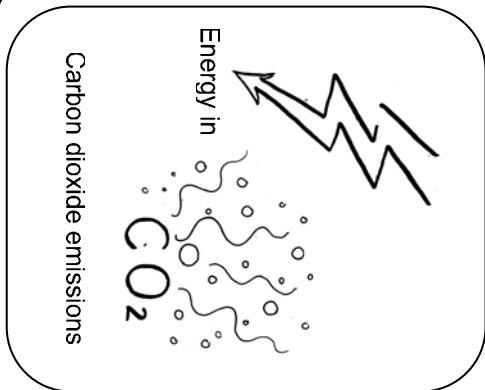
Trees



Road transport



Plastic pellets



Carbon dioxide emissions

One copy of this page per group.

More sustainable window frames: wood or PVC window frames?

1. Go to www.sustainability-ed.org.
2. Look at the information on the life cycle analysis of wood and PVC window frames.
3. Choose appropriate features to compare. Think about things like getting the materials to make the frames, how the frames are made and used and then how they are disposed of when they reach the end of their useful life. For extra information, see the Ecodesign web in the 'tools' section at: <http://ecodesign.lboro.ac.uk/>
4. Use the axes below to draw a radar graph comparing wood and PVC window frames.

