



Do you live in a city? If so, you are part of half the world's population of people who do so. With growing numbers of people living in cities, there are many challenges in maintaining cities in a way that continues to create jobs, provide basic services such as housing, energy supplies, transport, water and sanitation for all people.



School children waiting for their bus in Zimbabwe



A Kenyan woman sorting through waste plastic for recycling



Have you heard about the **Sustainable Development Goals (SDGs) or Global Goals?**

These are 17 Goals that were put together by global leaders from many countries around the world to **end poverty, protect the planet and ensure prosperity for all** by 2030.

To find out more about the Global Goals, you can watch a video about them vimeo.com/181766755 and/or go to www.globalgoals.org

One of these, **Global Goal 11** is about **Sustainable Cities and Communities**. The overall aim is to make cities inclusive, **safe, resilient and sustainable** by 2030.

This 2 minute video explains the SDGs and the importance of Goal 11 <http://bit.ly/2eBg3Uf>

Targets for Global Goal 11 include:

- Ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums
- Provide access to safe, affordable, accessible and sustainable transport systems for all
- Reduce the environmental impact of cities

These are the targets that the use of STEM knowledge and skills can help us reach.

SOME IDEAS TO GET YOU STARTED

We hope you will do a lot of research yourself, looking at websites, videos etc. so that you get a clear picture of what is happening in the world before you start designing your Global STEM challenge. To help you we have some ideas and links to things you might like to look at - all related to sustainable cities. Don't feel you have to select one of these, what you do is up to you!

The main thing to keep in mind is how STEM skills can help deliver this Global Goal, either in Europe or a developing country.

Housing

The need for shelter is a human necessity. But many cities struggle to provide adequate shelter for everyone. Today 328 million people live in slum housing with poor access to basic services. There are many things to consider when developing housing including their social, economic and environmental sustainability and suitability to changing climates.

Upgrading slum areas

To ensure housing is sustainable, its important to explore the use of locally available building materials and construction techniques that are affordable, and of best interest to the local community. Could you challenge be around developing a sustainable home for a slum?



A Kenyan family outside their home with wooden frame, mud walls and a metal roof

- Take a look at the main housing issues arising from the United Nations Habitat conference on sustainable development in developing countries <http://www.un.org/sustainabledevelopment/habitat3/>.
- There are also case studies of European and global designs for sustainable housing <http://practicalaction.org/case-studies-construction>

Adaption to climate change and resilience to disaster

Around the world, we are experiencing changing climates patterns. Many of the world's poorest and most vulnerable people are affected.

STEM can play a major role in reducing people's risk to natural disasters, by helping people to have suitable housing in areas most affected by climate change. There are a few examples below. Do you think a challenge around building a flood-proof or earthquake-proof house would be interesting for younger children?

- Flood - resistant housing <http://practicalaction.org/flood-resistant-housing-drr>
- This video shows what materials and methods were used to build a flood proof community in Bangladesh <http://practicalaction.org/video-beat-the-flood-1>
- For Earthquake proof housing take a look at <http://practicalaction.org/earthquake-resistant-houses>
- This 3 minute video introduces some important issues for building peoples resilience to disasters as well as buildings <http://www.un.org/sustainabledevelopment/blog/2016/10/sdgs-explained-communities-and-resilience/>

Transport

In many countries in the world, poor transport services is one of the major causes of poverty. Imagine what it would be like to live in any remote area with no access to any kind of transport. You wouldn't be able to get to school, work or access health services.

By improving transport and infrastructure (such as roads) people without previous means to travel are able to get to markets where they can buy or sell goods for income and make better use of essential services such as health, education and employment.

STEM skills can play a major role in helping people to access affordable and sustainable transport systems. Here are a few examples from the developing world. <http://practicalaction.org/transport>.

They include:

Ropeways and bridges

These are used in Nepal, where communities have developed pulley systems to help get people and/or goods down the mountain or across a river <http://practicalaction.org/gravity-ropeways> and <http://practicalaction.org/tuin-river-crossings-3> (check the tab on further information for technical information).

Maybe building a model to show how a tuin could be used to enable children to get across a river to go to school would be a good STEM challenge?

Bicycles and trailers

Many different types have been developed in Kenya and Zimbabwe, where communities have needed to get people to health services or collect waste materials <http://practicalaction.org/bicycle-trailers-3> (check the tab on further information for technical information).



Community in Bangladesh outside their flood-proof community hall



Waste Management

The rapid growth of cities all over the world places a huge strain on urban services, such as waste management.

The vast amounts of waste materials provide opportunities for STEM innovation to reduce environmental impact and improve the quality of life for people. Practical Action works with some of the poorest communities to improve waste management and collection methods in cities, creating safer and healthier places to live and work.

Maybe you could build a project around how to collect and dispose of waste more effectively in a country in Europe or in the developing world.

Here are a few examples of Practical Action projects:

- Urban water and waste case studies
<http://practicalaction.org/urban-water-sanitation-waste>
- Plastic waste collection and enterprise in Nepal
<http://practicalaction.org/urban-waste-water-sanitation-nepal> (check tab downloads for useful information)
- Recycling waste plastics in Kenya
<http://practicalaction.org/plastics-recycling>
- Case study and technical information on recycling waste material
<http://answers.practicalaction.org/our-resources/collection/recycling-6>
- A video showing food waste collection in Bangladesh which is then used to produce biogas!
<http://practicalaction.org/video-marvellous-microbes-1>



A group of people using a Tuin pulley system to cross a river in Nepal

RECYCLING ORGANIC WASTE

Introduction

Organic waste is produced wherever there is human habitation. The main forms of organic waste are household food waste, agricultural waste, human and animal waste. In industrialised countries the amount of organic waste produced is increasing dramatically each year. Although many gardening enthusiasts "compost" some of their kitchen and garden waste, much of the household waste goes into landfill sites and is often the most hazardous waste. The organic waste component of landfill is broken down by micro-organisms to form a liquid "leachate" which contains bacteria, rotting matter and maybe chemical contaminants from the landfill. This leachate can present a serious hazard if it reaches a watercourse or enters the water table. Digesting organic matter in landfills also generates methane, which is a hazardous greenhouse gas, in large quantity. Human organic waste is usually pumped to a treatment plant where it is treated, and then the effluent enters a watercourse, or it is deposited directly into the sea. Little effort is made to reclaim the valuable nutrient or energy content of this waste.

In developing countries, there is a different approach to dealing with organic waste. In fact, the word "waste" is often an inappropriate term for organic matter, which is often just its end use. The economies of most developing countries dictates that materials and resources must be used to their full potential, and this has propagated a culture of reuse, repair and recycling. In many developing countries there exists a whole sector of recyclers, scavengers and collectors, whose business is to salvage "waste" material and reclaim it for further use.

Where large quantities of waste are created, usually in the major cities, there are inadequate facilities for dealing with it, and much of this waste is either left to rot in the streets, or is collected and dumped on open land near the city limits. There are few environmental controls in these countries to prevent such practices.

There are a variety of ways of using organic waste and in this technical brief we hope to outline a few of the principle methods used for putting it to good use. The three main ways of using organic waste that we will look at are for soil improvement, for animal raising and to provide a source of energy.

Organic waste – types, sources and uses

As mentioned earlier, there are a number of types of organic waste which are commonly discarded. Below we will look at the types and sources of organic waste and some examples of common uses for this waste.

Domestic or household waste

This type of waste is usually made up of food scraps, either cooked or uncooked, and garden waste such as grass cuttings or trimmings from lawns and hedges. Domestic kitchen waste is often mixed with non-organic materials such as plastic packaging, which cannot be composted. It is beneficial if this type of waste can be separated at source – this makes recycling of both types of waste far easier. Domestic or household waste is usually produced in relatively small quantities. In developing countries, there is a much higher organic content.

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Please Help The People of Nepal, NPL, USA

technical brief



Paper recycling in Sri Lanka



Cardboard recycling in Nairobi, Kenya



Useful Links

Global Goal 11—sustainable cities

<http://www.un.org/sustainabledevelopment/cities>

Targets and more information on Global Goal 11

Global Goal 11—poster

<http://www.globalgoals.org/global-goals/sustainable-cities-and-communities/>

Case studies on housing

<http://practicalaction.org/sustainable-construction-and-buildings>

Case studies of sustainable building with links to materials information

Technical briefs on Construction

<http://practicalaction.org/technical-briefs-schools-construction>

Technical briefs from Practical Action on construction

Technical briefs on transport

<http://practicalaction.org/technical-briefs-schools-transport>

Technical information from Practical Action on Transport

Habitat for humanity

www.habitat.org

A charity aiming to eliminate poverty housing. Useful stories and videos

Shelter—International

<https://www.shelter.org/about-us-2/what-we-do/shelter>

Information on the building of transitional homes from international development charity

Design briefs

www.practicalaction.org/design-briefs-3-and-4-construction

Design briefs on how to build a sustainable home

Videos

www.practicalaction.org/videos-disaster-risk-reduction

Videos from Practical Action including how they have worked with communities to make housing more resilient to disasters such as floods and earthquakes

World bank

www.worldbank.org/en/topic/transport

World bank projects on transport

Transaid

www.transaid.org

A charity that works to support development in Africa

Transport images

<http://practicalaction.org/transport-image-gallery>

Photographs of transport from around the world

Waste management images

<http://practicalaction.org/recycling-image-gallery>

Photographs of waste management and recycling projects

