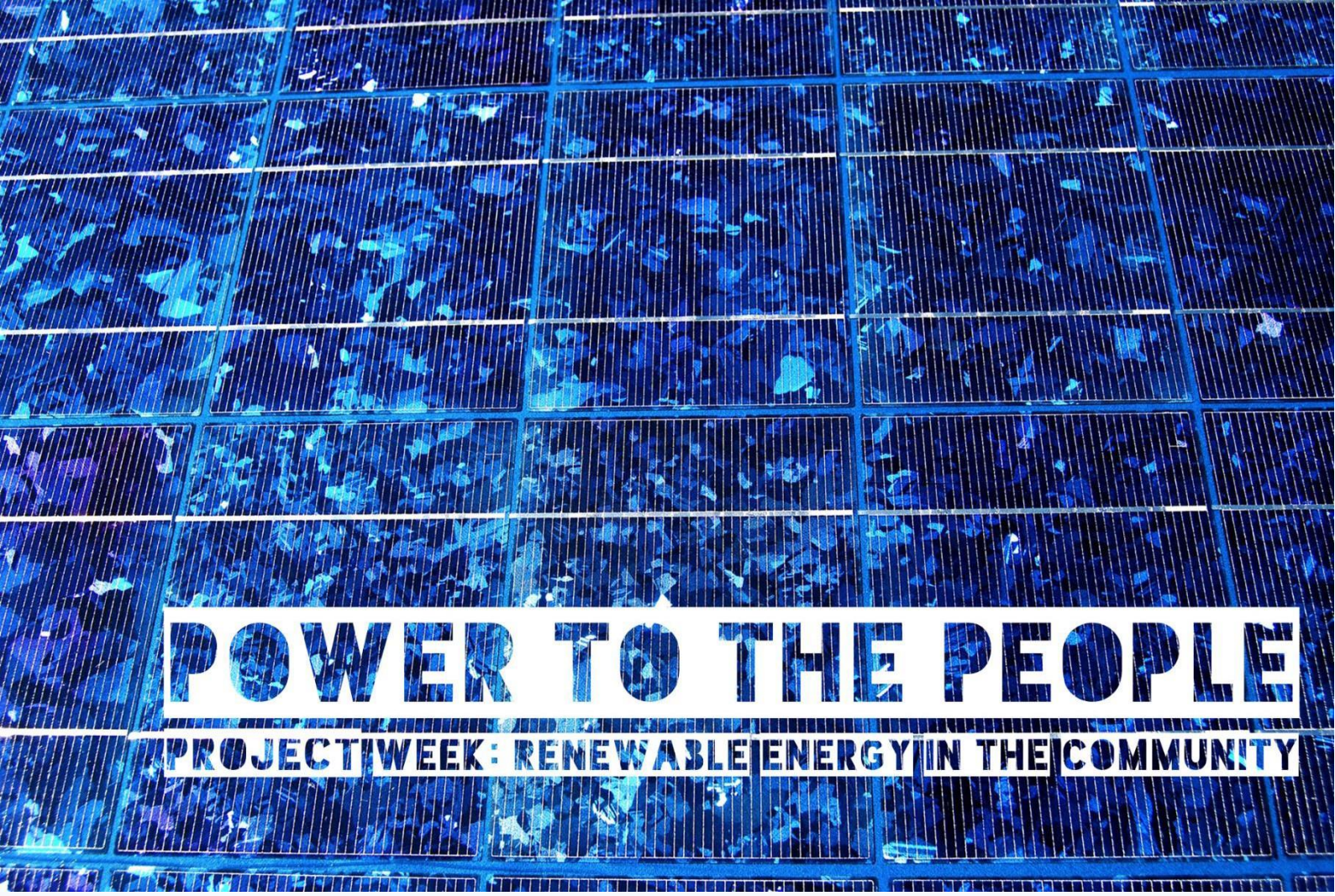

"Attention! The mayor of Leinwig is seeking your help to transform her town's energy supply. But the clock is ticking and you must present your blueprint to an expert commission at the end of this week. The citizens of Leinwig are counting on you. Will you answer their call and help build the town's future?"

» *Teacher's handbook and printable worksheets*

Last updated: August 24, 2022

TEACH ABOUT U.S.

The project week POWER TO THE PEOPLE is an interdisciplinary curriculum connecting the Science and English language curricula and is the latest addition to Going Green. Students are asked to investigate the energy infrastructure in a fictional town, understand the science behind renewable energies, and develop a concept for their community's future energy supply.

LEUPHANA UNIVERSITY OF LÜNEBURG

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Bildung Umwelt Chancengleichheit

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Contents

Background

The project week POWER TO THE PEOPLE is an interdisciplinary curriculum connecting the Science and English language curricula and is the latest addition to Going Green. Students are asked to investigate the energy infrastructure in a fictional town, understand the science behind renewable energies, and develop a concept for their community's future energy supply. The subsequent chapters will discuss the individual parts in greater detail.

Every participating course is provided with a private e-classroom with ready-made materials and interactive. It is password protected so that everything uploaded or posted in this course is only visible to enrolled participants (except for some blog posts, see below). The following subchapters are meant as a brief and systematic overview of your course in terms of course sections, activity types, and side blocks.

In order to combat the global phenomenon of climate change and the warming of our planet's atmosphere, different goals of national and international scope are being developed in order to reduce the greenhouse gas emissions that largely cause this effect. Common strategies include the transition toward renewable energy sources and the implementation of energy efficient technologies. But while climate goals like the Paris Climate

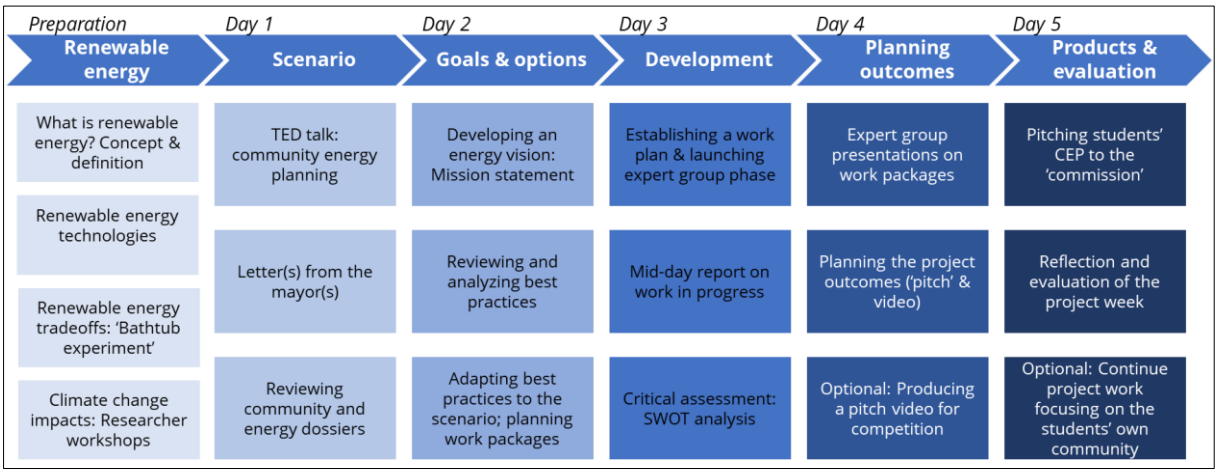
Agreement are negotiated internationally, it is the responsibility of localities—communities and cities—to put these decisions into action. Their geographic concentration, their complex structures and use of energy for housing, commerce, industry, traffic, and leisure, make communities and cities a major producer of green-house gases. At the same time, however, this offers a large potential for reducing these emissions.

Project Week

This is where the project week curriculum for Power to the People starts. Modelled after community energy planning guidelines by the U.S. department of energy and the German Deutsche Energie Agentur dena, it introduces students to the context of the fictional town of Leinwig whose mayor is reaching out to your students to develop a plan for the town's transition to renewable energy sources. This includes the steps of exploring this fictional scenario, comparing it to real-life case studies and best practices in the U.S. and Germany, and developing an action plan that is economically, ecologically, and technologically viable. As a project outcome, students present their solution in a 3-minute video and pitch their approach to an expert commission. A student competition with awards for outstanding project week outcomes will conclude the project.

With this approach, we intend to break up the borders between school subjects. The project week addresses contents and competences of both English language and Science instruction. We thus suggest that English language and Science teachers team up to carry out the project together. In preparation to the project week, preparatory science modules can be covered in science classes focusing on the concept of renewable energy sources, their availability and tradeoffs, as well as the science behind the different technologies.

Here is the project week curriculum at a glance:



Overview of the project week curriculum: The preparatory modules on renewable energy are intended to be used in (bilingual) science classes. Each of its four parts can be taught in a double lesson. Each section of the project week curriculum represents one full school day (e.g. six lessons). Materials can be easily adapted to different time budgets.

The project week curriculum at a glance:

IDEA: The mayor of the fictional town of Leinwig needs your help! Her town is struggling with the transition toward a renewable energy portfolio and asks you to develop a community energy plan. You have one week to come up with a scientifically-backed and context-sensitive plan and pitch it to an expert commission.

CONTENT FOCUS: renewable energy sources and the energy transition in a transatlantic perspective, especially at the community level.

SCHOOL SUBJECTS: English as a foreign language, STEM school subjects, social studies; we encourage Science and EFL teachers to partner up for the project.

COUNTRIES: groups from Germany and the U.S. (and of course other countries as well) can participate.

DURATION: 5 school days (c. 6 lessons each day) for the project week curriculum; four STEM-based preparatory study modules on renewable energy are available; curriculum can be adapted to shorter time budgets.

TARGET PARTICIPANTS: advanced secondary students (10th grade and older) MATERIALS & TOOLS: all materials are available in an online Moodle course and as copy-ready PDF files; internet access and computers or other digital devices are recommended.

COSTS: All materials on Teach About US are available at no cost upon registration.

OUTCOMES: Students pitch their community energy plan to an expert commission at their school. They present their concept in a 3-minute video and submit it to a student competition.

TIME FRAME: The project week curriculum can be implemented flexibly (no specific date or week). The submission deadline for the video contributions will be announced soon.

How to Use this Teacher's Handbook

This teacher's handbook is a condensed version of the teaching materials and task-cycles to be found on the Teach about US platform at http://teachaboutus.org. The following pages contain the core activities for all five-day course Power to the People in the form of print-ready worksheets. You can use these activities in your classrooms entirely or make your selection and cover the Power to the People curriculum in a more cursory fashion. While the activities outlined in the worksheets do not require that your students enroll on the platform individually or that you complete all activities in your school's computer lab, they do focus on using different sorts of digital texts and applications. This means that activities like participating in forum discussions, contributing to an online course glossary, or collaborating in a course wiki have been intentionally excluded from the worksheets. But your students will have to complete several activities using a computer and going online. These online phases are always linked back to face-to-face classroom activity to allow for effective integration into traditional teaching contexts.

Except for these introductory remarks, the teacher's handbook comes without further instructions for teachers like lesson plans or extensive teaching rationales. The preview Power to the People e-classroom, however, includes detailed 'Teaching Notes' at the beginning of each curriculum section. In addition to information and useful tips for integrating the suggested classroom work in your daily practice, they also offer selected background information complementing the tasks and materials.

Section 1: What is Renewable Energy

What do we mean by 'renewable energy sources'? What is the science behind this concept? What do renewable energy sources have to do with climate change – and with you? This is a science-based introduction to this project week. Complete these tasks in your science classes in the weeks leading up to the project week.

This introductory module contains four sections that serve as a science-based introduction to the project week. It is designed to be implemented in science classes prior to the actual project week. Every section can be completed in a double lesson. The sections are:

The section includes four task cycles:

- What is renewable energy?
- Renewable energy technologies
- Renewable energy tradeoffs: Carbon dioxide emissions
- Climate change impacts

In this activity, students explain given terms on the topic of renewable energy sources. At the beginning, the students' prior knowledge about is tested via a questionnaire. In this module, the students deal with given terms on the topic of (renewable) energy sources, discuss them and reflect critically. For this purpose, historical sources (e.g. the oil crisis) and a video are used.

- Questionnaire: What's your view on renewables?

The QUESTIONNAIRE should elicit and make students aware of these stereotypes and activate prior knowledge and assumptions. We suggest that your students fill it out and then discuss the outcomes in class together. If you have the time, why don't you ask your students to summarize their results on a poster? They could review these at the end of the project and reflect upon their changed views and insights.

1. Fill out the questionnaire. Think about and answer the questions. The goal is to reflect on your personal assumptions towards sustainability, so there are no right or wrong answers here.
2. Review your classmates' responses. You can discuss them orally in your class. These questions could be helpful:

Are there any responses that surprised you or that you did not expect?
Are there any questions that reveal larger trends? Which ones?
Are there questions with opposing responses? What are some of the extreme answers?

Questionnaire: what are your attitudes towards Sustainability?

1. We need energy from different resources in our daily lives, for example in the form of heat or electric power. But what are the different energy resources or energy carriers that we use?

Note down all energy resources that come to your mind.

.....

.....

.....

2. Defining renewable energy sources

A common distinction that is often mentioned in speeches, the media, or the literature is that between renewable and non-renewable energy sources. You have probably heard these terms before, but what do they actually mean?

We will get to these terms' scientific definitions in the next tasks, but first think about what they mean to you and how you understand them.

a. How would you define renewable energy sources in your own words?

Renewable energy sources are...

.....

.....

.....

b. How would you define non-renewable energy sources in your own words?

Non-renewable energy sources are...

.....

.....

.....

c. Which of the following primary energy sources do you consider "renewable"? Tick the circles.

◯ Coal	◯ Mineral oil	◯ Natural gas
◯ Sun	◯ Biomass	◯ Geothermal heat
◯ Uranium	◯ Water	◯ Wind

3. Now briefly explain why you categorized these energy sources the way you did.

4. You may have come across the term "energy transition" (or "Energiewende" in German) in the media or public discourse. What comes to your mind when you think of this?

5. You have probably heard that carbon dioxide emissions released by power plants can be a real problem for the environment. How much carbon dioxide do you think do these different types of power plants release into the air?

	none	**low**	**moderate**	**high**	**N/A**
Coal power plant	O	O	O	O	O
Wind turbine	O	O	O	O	O
Gas power plant	O	O	O	O	O
Nuclear power plant	O	O	O	O	O
Solar cell	O	O	O	O	O
Biomass power plant	O	O	O	O	O

6. Now briefly explain your answers. For example, why do you think some power plant types emit more carbon dioxide than others? Which ones emit the most, which ones the least carbon dioxide?

7. Finally, what are you interested in regarding this topic? What would you like to learn more about? What questions do you have at the moment?

LEAD-IN: What's in a name?

In order to understand renewable energy sources, we need to establish a shared understanding of its terms and definitions. But sometimes, these meanings get lost or hijacked in different contexts and different communities.

Task:

Here are some examples of how the word 'energy' (and related forms like 'power') is used in popular discourse. What do the speakers mean by energy? Which meanings do you find useful, which ones not? Discuss.

SOURCE 1

Greens warn Labor not to do clean energy deal that protects coal power

> (...) With parliament due to resume on Monday, and with the Turnbull [i.e. the Australian Prime Minister] government inching closer to finally resolving and outlining its energy policy, the Greens' climate change spokesman, Adam Bandt, will bring forward a bill to prolong and expand the existing renewable energy target scheme. (...)
> — The Guardian, September 3, 2017 [1]

SOURCE 2

Hurricane Harvey, global warming and the need for alternative energy

> As Houston experiences its third "500-year" flood in three years, we must realize that alternative energy is no longer an alternative. It's essential. The floodwaters have already claimed the lives of at least 46 people, and caused several environmental hazards. But the damage left behind by Harvey will not be isolated to southern Texas alone. (...)
> — The Denver Post, September 1, 2017 [2]

SOURCE 3

Logo of the EU 'Sustainable Energy Week', June 19-25, 2017, in Brussels, Belgium, to "exchange ideas about providing secure, clean and efficient energy.

— Sustainable Energy Week, 2020 [3]

SOURCE 4

> Fusion is the holy grail of energy production. And plenty of investors around the world are betting on it as the emission-free, waste-free energy of the future. There's no real proof we're there yet, but we're close.
> — Voice of America, May 5, 2017 [4]

RESOURCES FOR THIS TASK

1. Greens warn Labor not to do clean energy deal that protects coal power
The Guardian | https://bit.ly/2WTpEdT

2. Hurricane Harvey, global warming and the need for alternative energy
The Denver Post | https://dpo.st/3pl6J7S

3. EU Sustainable Energy Week
The European Commission | https://bit.ly/3nJx7I0

4. Scientists, Investors Betting on Fusion
VOA News | https://bit.ly/3TmN6fB

TASK: What is 'renewable energy'

The TASK: What is 'renewable energy' is subdivided in three sections:

The section includes three activities:

(a) What do we mean by 'energy' Assignment (in German)
(b) Defining renewable energy
(c) 'Renewable energy' – history of a term

(a) What do we mean by 'energy' Assignment (in German)

The following text describes the different meanings of the word "Energie" in German. Many of these meanings are also associated with the word "energy" in the English language. "Energy"/"Energie" has been used in both languages for centuries. Importantly, this is such a common term that it has been used in both scientific and non-scientific contexts. That is, it has assumed colloquial and scientific meanings – which all too often can be very different.

Tasks

- Read the text and discuss unclear passages and contents with a partner or in class.
- Note all different meanings associated with "Energie" along with the context in which it is used and/or an example.
- Why do you think can this term cause confusion and misunderstanding?

Der Energiebegriff[1]

Das Wort "Energie" hat einen griechischen Ursprung "Enérgeia", zu deutsch "Wirksamkeit". Enérgeia war für Aristoteles (384-322 v.Chr.) die Wirkkraft, durch die Mögliches in Seiendes übergeht.

In einem Konversationslexikon des Jahres 1898 ist über den Begriff Energie der nebenstehende Text zu lesen. Hier die "Übersetzung" in moderner Schrift: ***Energie*** *(grch.), in sittlicher Bedeutung soviel wie Willenskraft, Tatkraft, d.h. die Fähigkeit, seinen Willen auch mit der Tat zu beweisen. Davon energisch, tatkräftig. - In physikalischer und technischer Hinsicht heißt E. die Fähigkeit eines Körpers, eine mechan. Arbeit (s.o.) zu leisten; sie läßt sich also kurz als Arbeits- oder Wirkungsfähigkeit der Körper bezeichnen. Die E. ist entweder kinetische E. (Bewegungsenergie) oder potentielle E. (E. der Lage oder Anordnung).*

Heute ist der Begriff "Energie" in aller Munde, dabei wurde er für die Physik erst etwa 1850 von ***Lord Kelvin*** *vorgeschlagen, da bis zu dieser Zeit die kinetische Energie als "lebendige Kraft", die potentielle Energie als "Fallkraft" oder "Spannkraft" bezeichnet wurde. Um eine saubere Unterscheidung zur newtonschen Kraft herzustellen, machte Kelvin diesen Vorschlag. Trotzdem halten sich noch heute manche Begriffe bei denen "Kraft" und "Energie" gleichgesetzt werden: Kraftwerk; Kraftstoff usw.*

[1] We use this text with permission by the Joachim Herz Stiftung and the website www.leifiphysik.de.

*Es wurde bereits im 18. Jahrhundert vermutet, dass es so etwas wie den Energieerhaltungssatz gibt. Schon **Leonardo da Vinci** stellte um 1500 fest, dass alle Pläne ein Perpetuum mobile (Gerät, welches Energie aus dem Nichts erzeugt) zu bauen zum Scheitern verurteilt wären. Ab 1775 lehnte die französische Akademie der Wissenschaften Entwürfe für ein Perpetuum mobile mit der Begründung ab: "Diese Art Forschung hat mehr als eine Familie zugrunde gerichtet, und in vielen Fällen haben Techniker, die Großes hätten leisten können, ihr Geld, ihre Zeit und ihren Geist darauf verschwendet." Heute weiß man, dass ein Perpetuum mobile ein Widerspruch zum Energiesatz wäre.*

*Erst Mitte des 19. Jahrhunderts wurde aber der Energiesatz explizit formuliert. Als erster schrieb der deutsche Arzt und Naturphilosoph **Robert Mayer** (1814-1878): "Fallkraft, Bewegung, Wärme, Licht, Elektrizität . . . sind ein- und dasselbe Objekt in verschiedenen Erscheinungsformen."*

*Mayer war in der Physik ein Außenseiter und wurde zunächst wenig beachtet. Aber auch der namhafte deutsche Physiker **Hermann von Helmholtz** (1821-1894) formulierte in seinem Buch "Erhaltung der Kraft" den Energiesatz, die Zeit war reif.*

*Der englische Bierbrauer **Prescott Joule** (1818-1889), der von vornherein vom Energiesatz überzeugt war (er wollte nicht annehmen, dass die Arbeit, die beim Anheben eines Bierfasses verrichtet wird, beim Herunterfallen vollständig vernichtet wird) ging experimentell an die Sache heran. In seiner berühmten Apparatur, bei der sinkende Gewichtsstücke die Schaufelräder in einem wassergefüllten Kessel drehten und dabei das Wasser erwärmten, konnte er die Erhaltung der Energie demonstrieren.*

(b) Defining renewable energy

First things first. 'Renewable energy' is an important concept for this project, but what does it actually mean? The term is being used both in scientific research and popular discourse, sometimes with different or unclear meanings. In this project, it is important that we all understand the same thing by this term.

1. Learn from a video

Watch the video Renewable Energy 101 [1] and answer the questions:

- What is 'renewable energy'? How would you define the term?
- What is the definition of renewable energy given in the video? Take notes, look up unknown vocabulary, and try to rephrase the definition in your own words. Can you think of examples that fit this definition?
- What are some of the general advantages and disadvantages (or challenges) related to renewable energy?

Exchange your results with a partner and discuss them in class.

2. A scientific definition of 'renewable energy'

- Read the following definition taken from a science book on renewable energy. Discuss unclear vocabulary and contents. (This is a challenging text – you may

have to read it more than once.)

- Compare this scientific definition to the ones your course discussed in the introductory **QUESTIONNAIRE: What's your view on renewables?** What differences and similarities can you identify?

> *"The renewable energy systems […] include power from solar radiation (sunshine), wind, biomass (plant crops), rivers (hydropower), ocean waves, tides, geothermal heat and other such continuing resources. All of these systems are included within the following general definition:*
>
> ***Renewable energy is energy obtained from naturally repetitive and persistent flows of energy occurring in the local environment.***
>
> *An obvious example is solar (sunshine) energy that "persists" and "repeats" day after day, but is obviously not constant but variable. Similarly, plants have an annual growing season, which stores energy from sunshine in their structure that is released in combustion and metabolism. With a renewable energy resource, the energy is already passing through the environment as a current or flow, irrespective of there being a device to intercept and harness this power. The phrase "local environment" refers to the location of such a device to intercept the flow. [...] Such energy may also be referred to as green energy or sustainable energy.*
>
> *In contrast,*
>
> ***Non-renewable energy is energy obtained from static stores of energy that remain underground unless released by human interaction.***
>
> *Examples are nuclear fuels and fossil fuels of coal, oil and natural gas. With these sources, the energy is initially an isolated energy potential, and external action is required to initiate the supply of energy for practical purposes.*

— Twidell, John & Weir, Tony (2015). Renewable Energy Resources (3rd ed.). New York: Routledge. Page 3.

(c) 'Renewable energy' – history of a term

The term '(non-) renewable energy' is not free from criticism. In its most basic meaning, it makes a distinction between energy sources that are renewable and energy sources that are not.

1. Reflect on the word meaning

Think about the following questions and discuss them with a partner or in class:

- What does the term (non-) renewable energy highlight – and what does it hide?
- What other criteria can you think of to group different types of energy sources – besides being (non-) renewable?
- Why do you think has the term 'renewable energy' such an important meaning

today?

2. Explore the historic background of 'renewable energy'

The term 'renewable energy' became widely used in the 1960s and 70s. Understanding why this concept was introduced to public discourse can help you understand the wider meaning of this terminology. Examine this historical background with the following resources. You can split up in different groups and focus on one of the resources each.

- Study the following diagrams and explain what they show.
- To structure your work, you can apply the **TIP: Analysing visual texts (charts and tables)** and the Questions for analyzing diagrams as a help. If you need hep on your statistics description consult the Tips section at the end of this Booklet.

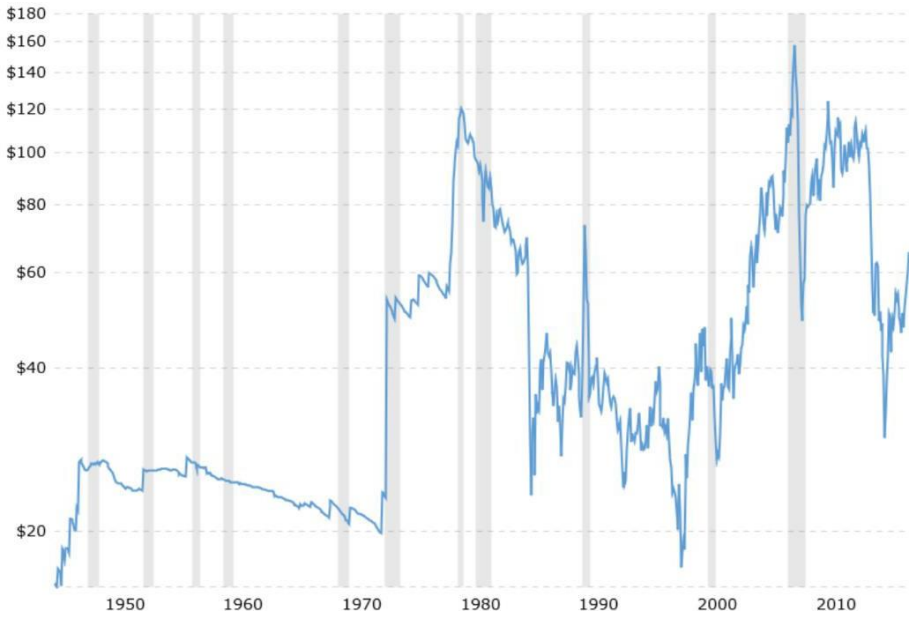


Figure 1: Historical chart of West Texas Intermediate (WTI or NYMEX) crude oil prices per barrel back to 1946. (The price of oil shown is adjusted for inflation using the headline CPI and is shown by default on a logarithmic scale. Source: Crude Oil Prices - 70 Year Historical Chart [2].

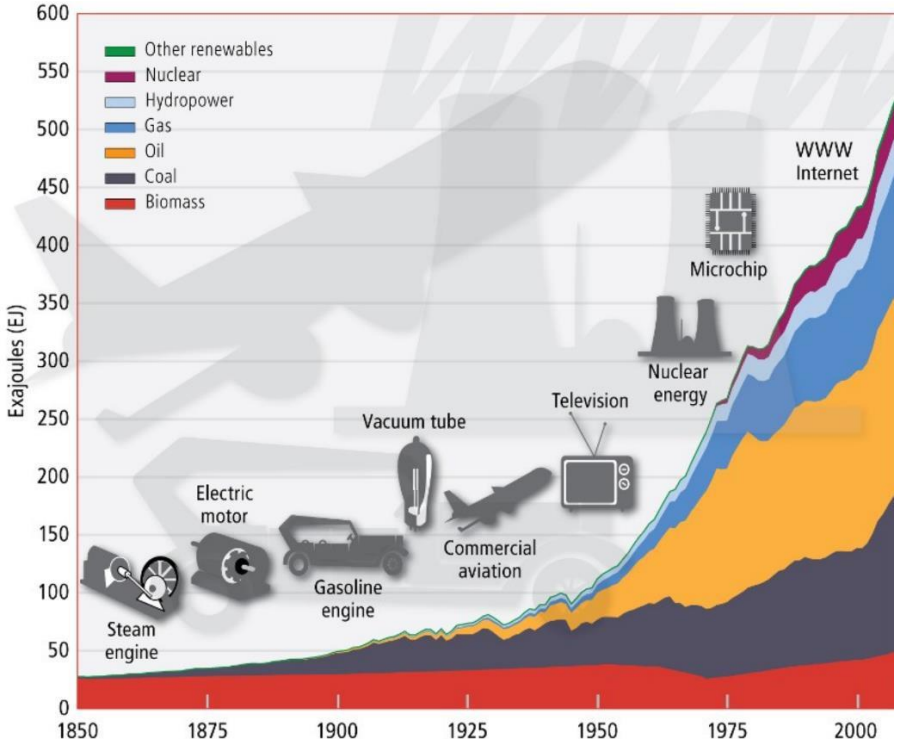


Figure 2: World Primary Energy Use: The figure shows the explosive growth of global primary energy with two clear development phases, the first characterized by a shift from reliance on traditional energy sources to coal and subsequently to oil and gas. Hydropower, biomass, and nuclear energy during the past decades have a combined share of almost 22%. New renewables such as solar and wind are hardly discernible in the figure. Biomass refers to traditional biomass until the most recent decades, when modern biomass became more prevalent and now accounts for one-quarter of biomass energy. Source: Grubler A et al. (2012). Chapter 1—Energy Primer. In: Global Energy Assessment—Toward a Sustainable Future, IIASA, Vienna, Austria and Cambridge University Press, Cambridge, UK and New York, NY, USA

Further information

Both diagrams have to do with the consequences of the so-called oil and energy crisis of the 1960s and 70s. This was a time when the West's access to crude oil (or mineral oil) - the main energy resource at the time and, in many contexts, still today - was limited by the oil producing countries in the Middle East. The lack of such an important energy resource created severe consequences for western economies, especially the U.S., that could also be felt by people in their everyday lives.

The National Museum of American History writes:

> *"The energy crisis played a key role in the economic downturn of the 1970s. With the OPEC oil embargo of 1973, oil prices jumped 350%, and the higher costs rippled through the economy. Although business and government asked consumers to help by conserving energy, and entrepreneurs worked on solutions,*

the economic crises worsened. As things got more expensive, businesses laid off workers. Inflation and economic stagnation produced "stagflation" and shook confidence in the American dream".

— National Museum of American History

RESOURCES FOR THIS TASK

1. Renewable Energy 101
Student Energy | https://bit.ly/3nKdYpz

2. Crude Oil Prices - 70 Year Historical Chart
Macrotrends | https://bit.ly/2KxDYWK

3. Energy Crisis
National Museum of American History | https://s.si.edu/3mI2iSV

4. An Illustrated History of Energy
Howstuffworks | https://bit.ly/2WHQy8d

Section 2: Renewable energy technologies

TASK: Comparing Energy Technologies

You have seen in this course section that electric power can be generated from different sources. But how do these different technologies actually work? And what are their impacts on our environment? Get an overview of the different technologies and compare their features in the following steps.

Step 1: Preparation

Get together in groups of (at least) four students. Each group will focus on a different technology for generating electric power. As a group, pick one of these technologies:

- solar cell power
- nuclear power
- natural gas
- wind power
- coal
- biomass

Your primary resources are the **'FACT SHEETS: Renewable energy technologies'**. They cover various features of the technologies. In your group, determine which person will have a closer look at which features:

- Carbon dioxide released + environmental impacts
- Other pollution/ waste + noise
- Land use and ecology + safety
- Availability + reliability

Read the fact sheet and your features carefully and take notes. Discuss questions that might arise among each other.

Step 2: Expert groups

Meet the other students who focused on the same features. Share and compare your results. Can you spot similarities between the technologies or are there striking differences concerning the features? Compare the different technologies.
Document your findings in the form of two posters (each poster covering one feature), and practice presenting your findings to others.

Step 3: Class

Present your poster in class. Be prepared to answer your classmates' questions. Leave the posters up on the wall – you will need them again later in the project.

Fact sheet: Coal[2] (carbon dioxide released into the air)

How it works	Coal plants burn coal to make steam. The steam is used to power a type of engine, called a "turbine". This turbine runs a generator to make electricity. When coal is burned, carbon dioxide is released by the plant. In this plant, the carbon dioxide escapes into the air because no equipment is added to capture the carbon dioxide.
Carbon dioxide released	Traditional coal plants release carbon dioxide to the air.
Environmental Impacts	— These plants produce a lot of solid waste (ash). Coal mining also produces waste products. The waste may contain a small amount of hazardous chemicals and radioactive materials. — Some solid waste produced by these plants can be recycled, such as to make concrete. The leftover waste is usually put in a landfill near the plant. Unlike disposal of household waste, the disposal of coal waste in landfills is not regulated by the federal government. — Coal mining near the surface disturbs the land, plants and animals. It also disrupts and pollutes streams. Underground mining can cause acidic water to leak into streams. If the mine collapses, it can also cause the ground to sink or shift.
Other Pollution/ Waste	— While these plants are much cleaner than in the past, they still release CO_2, nitrogen oxides, sulfur dioxide, mercury and particulates to the air. These pollutants can cause people to have many different health problems. — Traditional coal plants produce a lot of ash that contain hazardous chemicals. Some ash can be recycled, for example, to make concrete. The leftover solid waste is usually put in a landfill near the plant. — — Traditional coal plants use a lot of water to cool the plant's equipment. The water comes from wells, lakes, rivers or oceans. Some of it will evaporate after use. The rest is returned to its source. Since it is hot, the water may disturb plants and animals living in the water source.
Noise	These plants are about as loud as average street traffic.
Land use and ecology	Coal mining near the surface disturbs the land, plants and animals. It also disrupts and pollutes streams. Underground mining can cause acidic water to leak into streams. If the mine collapses, it can also cause the ground to sink or shift.
Safety	These plants are quite safe for operators. Coal mining is dangerous for the miners. However, coal-mining related deaths have gone down over time. Mining now has stricter regulations and safer mining equipment.
Availability	The availability of coal in Germany has decreased tremendously in the past decades; in the U.S. it is projected to last for another 50 to 100 years.
Reliability	Coal can provide steady and dependable electricity.

[2] The fact sheets are adapted from materials by the Gelfand Center at Carnegie Mellon University, Pittsburgh, PA. (URL: https://bit.ly/3n3EQ2p). These materials were produced with support from the Center for Climate and Energy Decision Making (SES-0949710), through a cooperative agreement between the National Science Foundation and Carnegie Mellon University. Information on biomass was also retrieved from https://bit.ly/383Wwqy.

Fact sheet: Wind Power

How it works	Modern wind machines are much larger than the old windmills in Holland, or the metal windmills that pumped water for cattle in the American West. They are often between 100 and 300 feet high. That is about as tall as a 10 to 30 story building. The machines have blades that look like an airplane propeller. The wind turns the blades, and this runs a generator to make electricity.
Carbon dioxide released	Wind machines release no carbon dioxide to the air.
Environmental Impacts	— There is almost no solid waste from wind farms. — Wind farms with many machines require hundreds of acres. If the machines are built on farm land, most of it can still be used for farming. In forests, trees must be cleared to build the machines. This can disturb the plants and animals. On mountain ridges, wind farms can be very visible. — Wind farms make some low noise. It is less than the noise from most other power plants. But, since wind farms are in the country, the noise is often more noticeable. — The blades of wind machines sometimes strike and kill birds and bats. New wind machines are being located away from bird (migration) flight paths. Less is known about how to prevent bat deaths.
Other Pollution/ Waste	— Wind farms, by themselves, release no air or water pollution. However, wind farms alone cannot make a steady amount of electricity. When it is not windy, the wind farms need natural gas plants to fill in these gaps in electricity. These natural gas plants do release nitrogen oxides into the air. — There is almost no solid waste from wind farms. — Wind farms use a very small amount of water to clean the wind machines.
Noise	Wind farms make some low noise. It is less than the noise from most other power plants. But, since wind farms are in the country, the noise is often more noticeable.
Land use and ecology	Each wind machine needs between 45 and 75 acres. That is about the size of 35 to 55 football fields. Wind farms with many machines require hundreds of acres. If the machines are built on farm land, most of it can still be used for farming. In forests, trees must be cleared to build the machines. This can disturb the plants and animals. On mountain ridges, wind farms can be very visible.
Safety	Wind farms do not harm people. The blades of wind machines do sometimes strike and kill birds and bats.
Availability	Wind farms work well when built in windy areas like hilltops or in the open sea ('off-shore wind parks'). However, even the best wind farms in Germany and the U.S. only make a small fraction of the power that would be possible if the wind was always blowing. They cannot make 100% because sometimes the wind is not blowing. Wind farms are often located far away from where people live, since this is where it is the windiest. It is expensive to transmit the wind electricity across long distances. On the other hand, wind parks located close to residential areas can draw citizens' criticism.
Reliability	— Wind varies in strength, which can make it less dependable for making electricity. Because of this, wind farms cannot consistently make electricity. Natural gas plants must be built to "back up" or fill in electricity during times when it is not windy. In the future, we might use very large batteries to store electricity from wind, but that is very costly to do today. — On average, a newly built wind farm can make about 0.5 TWh of electricity over the course of the year. The natural gas plant built to fill in electricity when it is not windy will have to make about 1.2 TWh over the course of the year.

Fact sheet: Natural Gas

How it works	— Much of the natural gas in Europe is used to heat homes. But, it can also be used in power plants to make electricity. In the plant, natural gas is burned in a type of engine, called a "turbine". This turbine then runs a generator to make electricity. The left-over hot gas is used to make steam. The -team also powers a turbine connected to a second generator to make more electricity. Because it uses two turbines, the plant is more efficient. — Natural gas comes from several sources. Conventional natural gas is found deep underground in sandstone and other sponge-like layers of rock. Gas wells are created by drilling down into these rocks, which causes the gas to naturally rise to the surface because of changes in pressure underground. One type of unconventional natural gas is shale gas. This natural gas is also found deep underground, but it is trapped inside hard layers of rock called shale. To get to this gas requires first drilling down deep underground. Next a hole is drilled sideways through the shale. A salty water solution is pushed down through the well at high pressure to break up the rock. This releases the natural gas from the rock, and the gas can then rise to the surface.
Carbon dioxide released	Natural gas plants release about half as much carbon dioxide to the air as traditional coal plants.
Environmental Impacts	There is almost no solid waste from gas plants. Natural gas pipelines sometimes must be built under private land. The landowner and pipeline company will have to agree about how to maintain the land around the pipeline. Drilling for natural gas can disturb local land, plants, and animals. This is especially true in unpopulated areas, like parts of Alaska.
Other Pollution/ Waste	— Natural gas plants release nitrogen oxides into the air. These plants are often used along with solar plants or wind power. Natural gas plants fill in power when it is not sunny or windy. In this case, the natural gas plant must be turned on quickly. This can increase the nitrogen oxides released into the air. This pollutant can cause people to have some health problems. — There is almost no solid waste from gas plants. — Natural gas plants use a lot of water to cool the plant's equipment. The amount is less than traditional coal plants. The water comes from wells, lakes, rivers or oceans. Some of it will evaporate after use. The rest is returned to its source. Since it is hot, the water may disturb plants and animals living in the water source
Noise	These plants are about as loud as average street traffic.
Land use and ecology	These plants do not use much land. But, pipelines sometimes must be built under private land. The landowner and pipeline company will have to agree about how to maintain the land around the pipeline. Drilling for natural gas can disturb local land, plants and animals. This is especially true in unpopulated areas, like Alaska.
Safety	— These plants are quite safe for operators. It is rare for natural gas to leak from a pipeline. If it does occur, unlike carbon dioxide, natural gas can burn or explode. Like carbon dioxide, people can suffocate from natural gas. — All types of natural gas production must meet strict environmental and safety standards. Thus, drilling for gas shale should be just as safe as it is for other types of natural gas. *
Availability	Today, most natural gas used in Germany and parts of the U.S. comes by pipeline (e.g., from the Gulf Coast, Russia, and other places). This natural gas is produced from conventional gas wells or transported from foreign countries (such as the Middle East) in large tanker ships. In the future, more natural gas will come from unconventional sources. Experts say that the U.S. has enough natural gas to meet its needs for at least 100 years. This is not the case in Germany, which depends on imported gas. Much of the gas in the U.S. is from unconventional sources, including gas shales.
Reliability	Natural gas can provide steady and dependable electricity.

Fact sheet: Nuclear

How it works	Nuclear plants use uranium that has been slightly processed, or "enriched". In a nuclear plant, the uranium atoms break apart and release heat that is used to make steam. The steam is used to power a type of engine, called a "turbine". This turbine runs a generator to make electricity. Nuclear plants built in the future will have a more advanced design than existing ones. Nuclear power plants are described as safe by the industry, but history has shown that accidents involving nuclear power plants create extreme consequences for humans, animals, and plants, which are not comparable to any other power plant technology. In Germany, the government has decided to phase out all nuclear power plants in the near future.
Carbon dioxide released	Advanced nuclear plants release no carbon dioxide to the air.
Environmental Impacts	— Uranium fuel must be mined, but the amount that is mined is much less than that of coal. — Nuclear plants do have a small amount of waste. It is much less than the waste from coal plants. — The leftover fuel (waste) from a nuclear plant will produce radiation for thousands of years. This is why the German government mandates a secure storage of nuclear waste for at least 1 million (!) years. Radiation can cause cancer in people. Today, the leftover fuel is being stored in facilities close to the power plants, but central and long-term solutions have not yet been found. How soon that will happen is unclear. Engineers can design nuclear waste storage facilities that prevent radiation from getting out. Incidents like the Fukushima nuclear catastrophe (Japan, 2011) or in Chernobyl (USSR, 1986) remind us that accidents in the wake of earthquakes, or potential cyber or terrorist attacks continue to pose a risk.
Other Pollution/ Waste	— Normally operating nuclear plants cause almost no air or water pollution. — Nuclear plants release some radiation into the air, ground, and water. Although nuclear power plant operators deny it, even such low levels of radiation have been found to cause cancer and birth defects in people living close to the facilities. — — — The leftover fuel from a nuclear plant will produce radiation for thousands of years (see above). Nuclear accidents have been quite frequent since the end of World War II. — — — Advanced nuclear plants use a lot of water to cool the plant's equipment. Existing nuclear plants use about the same amount as traditional coal plants. But, advanced nuclear plants will likely use much less. The water comes from wells, lakes, rivers or oceans. Some of it will evaporate after use. The rest is returned to its source. Since it is hot, this water disturbs plants and animals living in the water source.
Noise	These plants are about as loud as average street traffic.
Land use and ecology	Uranium fuel must be mined. This can disturb land, plants and animals. The amount of uranium that is mined is much less than that of coal.
Safety	Like coal plants, nuclear plants are safe for operators. All mining is dangerous for the miners. But mining uranium is generally much safer than mining coal. Nuclear plants release some radiation into the air, ground, and water. Although nuclear power plant operators deny it, even such low levels of radiation have been found to cause cancer and birth defects in people living close to the facilities. The threat of a nuclear accident is real. Nuclear material might leak into the air and water if there is an accident. Although nuclear plants cannot explode like an atomic bomb, past accidents have shown that they are not safe from accidents and natural catastrophes (like earthquakes). Cyber and terrorist attacks can also create risks. Unlike older plants in some parts of the world (Russia), all U.S. and German plants are built inside strong concrete buildings. These are built to prevent leaks if there is an accident. Since the end of World War II, over two dozen nuclear accidents have occurred worldwide. Many citizens worry about terrorism involving a nuclear plant, although governments, electric utility companies and other industries are working to make all industrial plants safer against terrorism. In France, Japan and England, portions of the nuclear fuel are separated and reused. This process changes the fuel into a product that could be used in nuclear weapons.
Availability	There is enough uranium available to power any new nuclear plants built in Germany and the U.S. for the life of the plants. Nevertheless, uranium cannot be generated on earth and is a very rare resource.
Reliability	Nuclear power can provide steady and dependable electricity.

Fact sheet: Solar Cell Power

How it works	There are two ways to make electricity from sunlight. In the first, sunlight is absorbed into solar cells. The energy from sunlight is then turned directly into electricity. In deserts, a second way is used. The heat from the sun is used to make steam. The steam is used to power a type of engine, called a "turbine". This turbine runs a generator to make electricity. While the second way is cheaper, it cannot be used in many parts of the U.S. and either in Germany because there the sun is not intense enough. Many solar cells can be joined together on open land to make a large-scale solar power plant. On a smaller scale, solar cells can be put on the roofs of homes and businesses. Even though the governments may provide some rebates, the initial cost to the home- or business-owner can be very large.
Carbon dioxide released	Solar plants release no carbon dioxide to the air.
Environmental Impacts	— While there is almost no solid waste from solar cell power, the cells are made of some toxic materials. There may be some pollution if they are not properly disposed of at the end of their lifetime. — Many solar cells must be put together to make a solar plant. Therefore, they use a lot of land. Unlike wind, this land cannot be used for other purposes. — The production of solar cells requires many resources and so although the cells themselves do not produce emissions, their production does.
Other Pollution/ Waste	— Solar plants, by themselves, release no air or water pollution. However, solar plants alone cannot make a steady amount of electricity. When it is not sunny, the solar plants need natural gas plants to fill in these gaps in electricity. These natural gas plants do release nitrogen oxides into the air. — Solar cells are made of some toxic materials. They can cause pollution if they are not properly disposed of at the end of their lifetime. — Solar plants use a very small amount of water to clean the solar cells.
Noise	Solar plants are silent.
Land use and ecology	Many solar cells must be put together to make a solar plant. Therefore, they use a lot of land. Unlike wind, this land cannot be used for other purposes.
Safety	These plants are quite safe for operators and for the people who live around them.
Availability	There is no sunlight at night. There is less sunlight on cloudy days. In Germany and many (northern) parts of the U.S., the solar plants only make a small fraction of their possible power. They cannot make 100% because the sun does not always shine at maximum strength or for 24 hours per day. Also, solar panels can become 25% less productive when they are not regularly cleaned from dust or when the level of air pollution is too high.
Reliability	— The dependability of solar cell power varies with the amount of sunlight. Because of this, solar plants cannot consistently make electricity. Natural gas plants must be built to "back up" or fill in electricity during times when it is not sunny. In the future, we might use very large batteries to store electricity from solar power, but that is very costly to do today. — On average, a newly built large-scale solar farm can make 0.1 TWh of electricity over the course of the year. The natural gas plant built to fill in electricity when it is not sunny will have to make about 0.8 TWh over the course of the year.

Fact sheet: Biomass

How it works	Biomass refers to the organic material that is used for production of energy. Biomass is primarily found in the form of living or recently living plants and biological wastes from industrial and home use. Due to the breadth of the term, the physical composition of biomass is inconsistent, but generally includes carbon, water and organic volatiles. To produce energy from biomass, feedstock (= whatever type of organic material will be used to produce a form of energy) is needed. The feedstock must then be converted to a usable energy form through one of many processes: Feedstock + Process -> Usable Energy Form Common biomass conversion processes include: combustion (burning flammable materials to produce heat), gasification (using heat, pressure, and partial combustion to produce gas that can be used in place of natural gas), anaerobic digestion (bacteria are used to break down organic material, producing methane and solid residue from which energy can be produced), fermentation (adding bacteria or yeast to the feedstock to covert the plants' glucose into alcohol or acid).
Carbon dioxide released	While some biomass processes such as waste-to-energy are touted for their lower carbon dioxide emissions, some processes, such as combustion, release carbon dioxide and particulate matter that is a significant concern for human health. In some contexts, biomass has been declared a "carbon neutral" energy source. This is based upon the logic that carbon emissions from burning biomass will be recaptured by the plants grown to feed biomass reactors in the future, thus forming a carbon cycle for the plant.
Environmental Impacts	— Large land areas are often necessary to grow the feedstock for biomass plants. Often this feedstock will be grown in monocultures with severe impacts on biodiversity (diversity of plants and animals). Chemicals used to grow biomass can pollute the soil and water. — Some biomass comes from woody waste products. But, on a larger scale, new trees or plants will need to be grown for biomass. This could mean that farms will grow less food, driving food prices up. Land may need to be cleared to grow more biomass or food. This could cause soil erosion and disturb the animals and plants.
Other Pollution/ Waste	— Depending on the type of biomass conversion processes involved, by-products like char and other solid residues. These can be either burned to produce power, or in some cases be used as cattle feed.
Noise	Biomass plants produce noise caused by vents, boilers, conveyor systems etc. inside the plant as well as by truck/fuel unloading operations.
Land use and ecology	Depending upon the source of biomass used, deforestation, cropland degradation (due to diverting agricultural residues), and changes in land use can all be relevant issues associated with biomass. Large areas of land may be used for growing the feedstock instead of growing food products, which is a concerning issue especially in developing countries.
Safety	The lack of appropriate ventilation mechanisms for burning biomass is a major health concern and contributes to short life expectancies in much of the developing world.
Availability	Generally, land and resources (water, work, sunlight, etc.) are necessary to grow or produce the feedstock for biomass plants. Biomass can be found everywhere in the U.S. and Germany. But, many types of biomass are traditionally used for other things, such as for food (from farm crops). This means that electricity companies will have to compete with other buyers of the biomass "fuel". Often, the question of what feedstock and processes will be used is determined by their local availability. For example, often residual products from agriculture and waste are used to fuel biomass plants.
Reliability	— Biomass power can provide steady and dependable electricity.

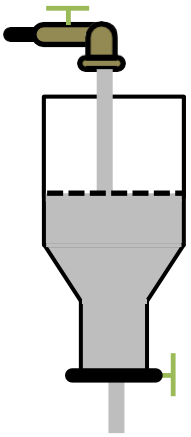
Section 3: Renewable energy tradeoffs, carbon dioxide emissions

TASK: The bathtub experiment[3]

You are going to do a demo experiment in class (i.e. only one group of students or your teacher will perform the experiment while the others observe and document what happens).

What you need:

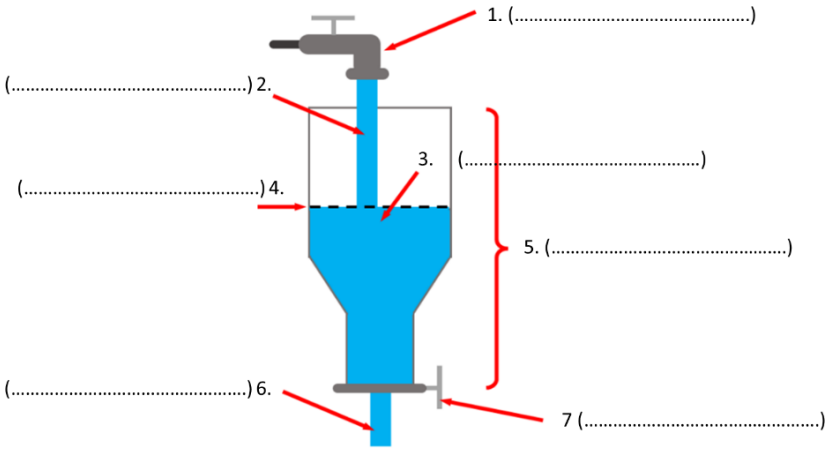
You need a transparent container into which you can fill water at the top and – at the same time – drain water at the bottom. It should resemble the figure to the right. For example, you can use:



- a PET bottle (cut off its bottom and insert a valve into the bottleneck, or – if you do not have a valve, use three different lids, one with a small-sized hole, one with a medium sized-hole, one with a large-sized hole)
- a transparent plastic bucket into whose bottom you can punch a hole and insert a valve
- a water dispenser that has an opening at the top and a faucet or valve at the bottom
- a water glass or beaker glass that you can fix to a lab stand in a slightly tilted way

Experiment:

1. Before you start, review the necessary vocabulary first. Name the different parts of the experiment apparatus by labelling its individual parts correctly[4].



[3] This task cycle is adapted from: Niebert, K. (2017). Den Klimawandel bremsen lernen. In U. Kattmann (Ed.), Biologie unterrichten mit Alltagsvorstellungen – Didaktische Rekonstruktion in Unterrichtseinheiten (pp. 92–105). Seelze: Friedrich Verlag.

[4] **Answer:** 1. faucet; 2. water inflow; 3. water; 4. water level; 5. container; 6. water outflow; 7. drain or valve.

2. Place the container and lab stand under a faucet. You are going to simultaneously fill water into the container and drain water from it at different rates. Note down your observations after each step.

a) Turn on the faucet and open the valve. Observation[5]:

.....

.....

.....

b) Now close the valve (for the outflow from the container). Observation[6]:

.....

.....

.....

c) Open the valve again; slightly turn off the faucet so that less water than before enters the container. Observation[7]:

.....

.....

.....

Analysis:

3. Complete the following sentences based on your observations from the experiment[8].

1. The amount of water in the container depends on .....
and .....
2. If water is entering the container at a faster rate than it is flowing out, then
.....
3. If water is entering the container at a slower rate than it is flowing out,
.....

4. Describe what this model shows[9]. Use the vocabulary bank as a help.

outflow • inflow • rate • stock size • flow • dynamic (dis-) equilibrium[10]

[1] **Answer:** Water flows in and out of the container. If the rates of inflow and outflow are the same, the amount of water in the container doesn't change.

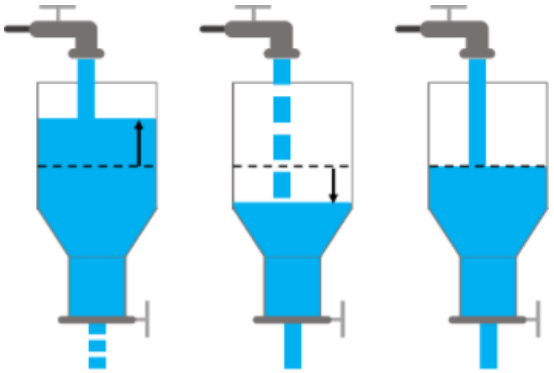
[2] **Answer:** If the drain is closed. the water level rises until eventually water spills over.

[3] **Answer:** If water flows out of the drain faster than it enters through the top, the water level sinks.

[4] **Answer:** 1. the rate of inflow / the rate of outflow. 2. the water level in the container will rise. 3. the water level in the container will sink.

[5] **Answer:** The model represents the behavior of a system with stocks and flows. Different rates of in- and outflows result in states of dynamic (dis-) equilibrium. If the rates of in- and outflows are in equilibrium, the stock size remains constant. If the rate of inflow is larger than that of the outflow, the stock size increases. If the rate of the outflow is larger than that of the inflow, the stock size decreases.

[6] a state of balance, especially between opposing forces or influences.



……
……
……
……

5. Let's assume this model is an analogy of the carbon dioxide concentration in the earth's atmosphere.

What do its individual components stand for (e.g., water inflow and outflow, the container, water level, etc.)? Match the parts of the models with the aspects they represent.

a. the bathtub:

b. the water:

c. the flow rate of water entering the bathtub:

d. the flow rate of water leaving the bathtub:

e. clogging of the bathtub drain:

f. the water level in the bathtub:

g. water spilling over the side of the bathtub:

1. the amount of carbon dioxide and other greenhouse gases in the atmosphere
2. because the concentration of carbon dioxide and other greenhouse gases in the atmosphere becomes too high, the temperature rises significantly, and the world becomes uninhabitable as we know it
3. the earth's atmosphere
4. the rate of carbon dioxide and other greenhouse gases being added to the atmosphere (through combustion of fossil fuels, decay of plants, etc.)
5. changes in the ability of sinks to absorb carbon dioxide and other greenhouse gases
6. carbon dioxide and other greenhouse gases
7. the rate of carbon dioxide and other greenhouse gases being removed from the atmosphere through sequestration in forests or oceans, etc.)

6. Let's now take the bathtub/climate analogy one step further. You have noticed in the previous task that what is important in this model is the relation between the rates of inflow and outflow, resulting in either rising, falling, or stable greenhouse gas concentrations in the atmosphere.

a. Evaluating popular assumptions

One popular assumption regarding climate change goes as follows:

"If we want to reduce the greenhouse effect and the warming of our climate, we must stop producing more global carbon dioxide emissions. Our goal should be to stabilize carbon dioxide emissions at today's level."

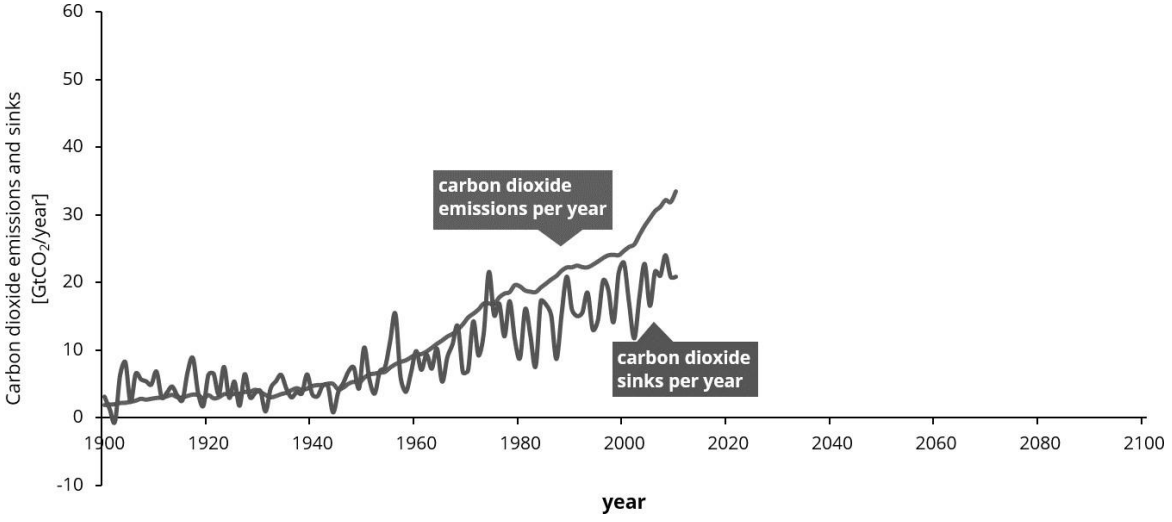
What do you think about this statement – do you agree or disagree? Justify your opinion using your observations from the bathtub experiment.

Discuss your responses in class. You can have a quick poll of who agrees and who disagrees with the statement.

b. Exploring future scenarios (Option 1)

What happens if we cap carbon dioxide emissions at today's levels? Or if they continue to grow? Or if they are reduced? Below is a graph representing the annual global carbon dioxide emissions and removals, i.e. nature's capability to absorb carbon dioxide in the land and water masses.

- Take a look at the line graph below and describe what it shows. (What do the axes represent? What do the lines stand for? What phenomenon does the graph describe?)
- Make an informed projection: What direction should both graph lines take so that the concentration of carbon dioxide in the atmosphere does not continue to rise? Complete the graph lines until the year 2100 to your best knowledge and explain your solution.



A line graph representing the annual global carbon dioxide emissions and sinks in Gigatons of carbon dioxide per year, i.e. nature's capability to absorb carbon dioxide in the land and water masses. The green line represents today's level of annual carbon dioxide sinks.

Working with a simulation (option 2)

Instead of completing the line graph, you can also run the simulation pictured below.

The simulation gives you three different scenarios:

- Carbon dioxide emissions continue to rise as they have in the past decades (i.e. "wait-and-see scenario")
- Carbon dioxide emissions level off (i.e. they stabilize at the current level)
- Carbon dioxide emissions are significantly reduced (e.g. through aggressive climate protection policies)

Run all three scenarios [1] and see what effects each scenario would have on the concentration of carbon dioxide in the atmosphere. Take detailed notes for each scenario and discuss them in class.

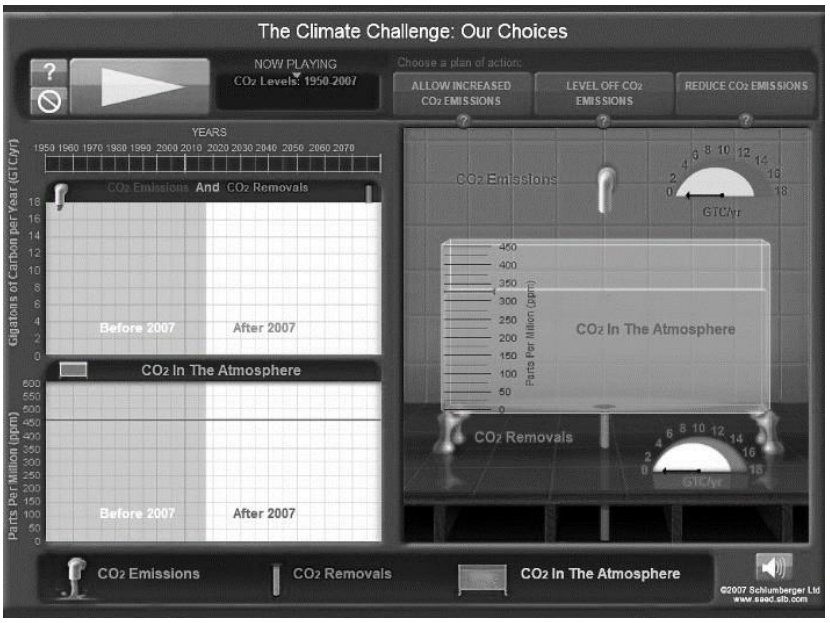


Fig. 1 Image of the climate bathtub simulation tool. © Schlumberger Ltd.

1. Climate Bathtub Simulation
Climate Interactive | https://bit.ly/38AgQP9

2. An Illustrated History of Energy
How stuff works | https://bit.ly/3b9UaIq

Section 4: Climate change impacts

1. Warm-up: Climate change impacts

Take a look at these photos of climate change impacts. What are your associations? Do you have any personal connections or experiences related to these motives?

1.

2.

3.

4.

5.

6.

7.

Image sources: 1. Oscar Arzola; 2. Lorant Fulop; 3. Liara Brown; 4. Guru Thilak; 5. Laxman; 6. Peter Aloisio; 7. Wim Delen (all taken from freeimages.com).

2. Lead-in: Words and actions

Climate change and environmental protection are popular commonplaces in the media or political speeches.

Task:

- Take a look at the following quotations from political leaders and activists.
- How do you assess these quotes? Do you agree or disagree with them?
- Where do you see difficulties or discrepancies between 'words and actions'?

Quotations

QUOTATION 1

> *We can choose to believe that superstorm Sandy, and the most severe drought in decades, and the worst wildfires some states have ever seen were all just a freak coincidence. Or we can choose to believe in the overwhelming judgment of science, and act before it's too late.*
>
> — Barack Obama, Fmr. President of the USA, 2013

QUOTATION 2

> *I believe that the situation that we face [related to climate change], [...] is as dangerous as any of the sort of real crises that we talk about.*
>
> *Today we had a hearing [...] on the subject of Syria, and we all know what's happening with respect to Iran, and nuclear weapons and the possibility even of a war. Well, this issue [of climate change] actually is of as significant a level of importance, because it affects life itself on the planet.*
>
> — John Kerry, Fmr. Secretary of State

QUOTATION 3

> *At a time when governments throughout the world are struggling to boost growth, increase access to energy and improve food security, it is essential that the full costs and benefits of climate policies are more clearly understood.*
>
> — Nicolas Stern, British Economist, October 2013

QUOTATION 4

> *The energy transition is finally underway, and no-one can return to the old structures! And I don't know anyone who would seriously want to.*
>
> — Professor Klaus Töpfer, Fmr. executive director of the United Nations Environment Program (UNEP), November 2013

3. TASK: Exploring global climate impacts

Rising greenhouse gas concentrations in our atmosphere, higher temperatures, more aggressive climate - from afar the causes and effects of our changing climate may seem abstract and one can wonder what all of this has to do with our daily lives. Get to know concrete consequences and impacts of climate change in this task.

Explore some of the ways that climate change will affect you. Split up into small groups (up to five groups) and visit the National Geographic feature on "5 Ways Climate Change Will Affect You" [1]. The groups are:

1. Water
2. Crops
3. Heat
4. Weather
5. Health

Find out, what your selected issue is about:

- What happens?
- Who is affected?
- Where does it happen?
- How does it affect people's lives?

Share your findings with the other groups, for example in a group puzzle. Alternatively, you can prepare short class presentations.

As a course, produce a mind-map of the different climate change impacts that you have researched.

1. (Five) 5 Ways Climate Change Will Affect You
National Geographic | https://on.natgeo.com/34H85li

2. Climate change impacts mind-map
Teach about US | https://bit.ly/3pmozHo

TASK: Exploring global climate impacts

We have all seen images of melting ice caps and distressed polar bears. But have you ever wondered how climate change is impacting your neighborhood right now and what its impacts are going to be in the future? You can find this out in the following tasks. Below are six "research workshops" that focus on different areas affected by the changing climate. They all rely on a massive database of the world-renowned Potsdam Institute of Climate Impact Research and feature aggregated climate data from 1901-2010 and projections for the years 2011-2100. The database is available in German [1] and in English [2].

Task

Get together in groups and select one of these research workshops. Each workshop includes guiding questions and activities that help you research your topic. Once you have collected all research results, prepare a presentation.

For your presentation, you can proceed as follows:

1. Create an outline.
2. Summarize your results in short texts.
3. Visualize your findings/ information in graphs, maps and pictures (if possible).
4. Use the platform "KlimafolgenOnline-Bildung.de" to visualize developments.

Present your group's research findings in class, for example as a/an …

- presentation (with Prezi or PowerPoint)
- newspaper article
- interview with an expert
- video (documentary)
- blog post

Forest (research workshop 1)

Pictures: Ines Blumenthal

People in Germany and the U.S. alike use forests as recreation areas as well as for forestry. What potential consequences does climate change have on our forests? What impacts might it have on forests as recreation areas? How might it change forestry?

You are an expert team for regional development and are in charge of researching the changing conditions of forests in your region in the next 50–100 years. For your research of the expected developments use the platform "Klimafolgen Online" [1] and other resources if necessary [3 – 6].

Take the following research questions into consideration:

1. How are forests in your region used for tourism or as recreation areas?
2. How are forests in your region used for forestry?
3. What potential changes are likely to occur in your region in the next 50–100 years?

Divide the work between the members of your group.

Review your research findings critically and present each other's findings within the group.

Agriculture (research workshop 2)

Pictures: Carolin Schlenther

Corn is the most important crop in agriculture. Nowadays, there is the tendency to cultivate not only forage corn but also silage corn to use them in biogas plants for the generation of fuel and electric power.

You are employed on a farm in Brandenburg that has cultivated corn for human consumption for 50 years. Does it make sense for your farm to enter into the business of silage corn? Create materials for the managing board that serves as an aid for the decision.

Focus your research on the following tasks and guiding questions:

1. What importance does corn farming have in your region?
2. Visit Maiskomitee [7] and compare the economic importance of corn for human consumption and silage corn in Germany. What proportion of Germany's total corn yield did corn for human consumption make up in 2020?
3. Have a look at the time period from 2016 to 2066 on the platform "KlimafolgenOnline-Bildung.de" [1]. Estimate the values on the basis of the diagrams and calculate the change of corn yields in the federal states of Brandenburg and Bavaria in this time period (in percent). Compare the sustainability of silage corn in both states and evaluate in which state the cultivation of silage corn might be more profitable.

Divide the work between the members of your group. Further sources [8 - 10] can be consulted.

Review your research findings critically and present each other's findings within the group.

Winter Tourism (research workshop 3)

Pictures: Carolin Schlenther und Ines Blumenthal

For winter tourism it is highly important when and for how long a region gets snow. However, climate change causes rising temperatures so that the guarantee of snow declines in many places. Winter tourism suffers from this development already.

You inherit an old hotel in Oberwiesenthal (Ore Mointains / Erzgebirge) from your aunt. It has always been your dream to run your own ski school. Now you have the opportunity, but does it pay off to open a ski school in Oberwiesenthal with regard to the progressive climate change in the next 50 years?

Focus your research on the following tasks and guiding questions:

1. Find the skiing area Oberwiesenthal on the platform "KlimafolgenOnline-Bildung.de" [1].
2. Which parameters on the platform help you to determine the guarantee of snow for the skiing area?
3. How will the relevant parameters develop in the next 30 resp. 50 years?

Divide the work between the members of your group. The sources [11 - 17] can help you expand your research.

Review your research findings critically and present each other's findings within the group.

Viticulture (research workshop 4)

Pictures: pixabay free images

Climate change causes the fact that vine cultivation is becoming increasingly attractive in Germany. One important factor is the rising quality of wine due to favorable climate conditions. This development results in a higher demand for German wine. Therefore, wine-growers search for new areas of cultivation and some wine connoisseurs think about entering this economic sector. So does your uncle. He asks you to research how the climatic conditions for viticulture in Germany will develop within the next 50 years.
Focus your research on the following tasks and guiding questions:

1. Research the ideal climatic conditions for viticulture. How do the possibilities for wine cultivation in Germany change due to climate change? What is the situation like in your region?
2. Has there been an expansion of vineyards in Germany since the year of 1990? Research online using the document [18]
3. Can an expansion of vineyards be expected due to the changing climate conditions in the future? What might this potential development look like? Research for the development and the parameters using the platform "KlimafolgenOnline-Bildung.de" [1].
4. Take a look at the German city of Delmenhorst on "KlimafolgenOnline-Bildung.de". What development can you see for viticulture in this region over the next 30 to 50 years? Does the shift of the vine blossom improve the preconditions for wine cultivation?

Further resources (in German) [19 – 20].

Water (research workshop 5)

Pictures: Carolin Schlenther, pixabay free images

A major challenge associated with climate change is the water supply. Especially the Eastern part of Germany will suffer from droughts and water shortages due to the increasing climate change.

You are an intern at "Eins Energie in Sachsen" in Chemnitz. Your manager is responsible for developing adaptation strategies regarding climate change to ensure the drinking water supply in the city. It is your task to assist him in the project by collecting data on the development of water availability in Chemnitz.

Focus your research on the following tasks and guiding questions:

1. Research the fresh water availability in Germany over the next 50 years using the platform "KlimafolgenOnline-Bildung.de" [1]. Assume that water availability is dependent on the parameter groundwater recharge.
2. How will the situation in the region of Chemnitz develop?
3. Summarize your findings briefly (keywords).
4. The water consumption in Germany decreased over the last 20 years. Is that also the case in the region of Chemnitz? Calculate by what percentage the water consumption dropped in Saxony between the years 1992 and 2013. Additionally, calculate the percentage change for Germany as a whole. Compare and discuss potential reasons for the divergent results. You will find the necessary values for the calculations on the following websites Heizsparer [21] and Sachsen [22]. Additional sources for your research are available at [23 – 25].

Health (research workshop 6)

Pictures: pixabay free images

It has been shown that climate change has negative impacts on people's health as well. An increasing number of hot and humid days can cause cardiovascular problems, for example. Children, elderly and sick people and those in need of care are particularly at risk. This aspect needs to be considered in planning processes of schools, hospitals and nursing homes.

At your school's physical education teachers' conference, the teachers discuss potential adaptations for sports classes. As the elected students' representative of your school you are invited to the conference and asked to contribute ideas.

Focus your research on the following tasks and guiding questions:

1. Research the development of hot and humid days in Germany up to the year 2030 using the platform "KlimafolgenOnline-Bildung.de" [1]. Find the number of hot days for your federal state in the current decade (2010-2020) and for the following decade. Calculate the percentage change. Additionally, search for further resources (e.g. newspaper articles, online sources) that deal with the topic.
2. Name the regions that are particularly affected by hot and humid days. What is the situation respectively in your region?
3. Research the health risks from heat and humidity and discuss them in your group.
4. What are potential adaptation strategies for physical education classes at your school?
5. Summarize your findings briefly (keywords).

Further resources [26 – 29].

Exploring global climate impacts: Optional project ideas

Can you find any information about the situation/possible consequences of climate change for your topic (forestry/agriculture/...) in your partner school's region?

You can start your research from here:

General information about climate change impacts by state
State Fact Sheets | https://bit.ly/38CLMhO
U.S. Global Change Research Program: Regions & Topics | https://bit.ly/3homNTC
U.S. Global Change Research Program: Resources, Data & Multimedia | https://bit.ly/37M3Hn6
U.S. National Climate Assessment| https://bit.ly/3nOnpnT

Forest
U.S. Forest Service | https://bit.ly/3PJ7PH6

Health
National Institute of Environmental Health Sciences | https://bit.ly/3AgLfQv
Centers for Disease Control and Prevention | https://bit.ly/2JhsKF8

Agriculture
United States Department of Agriculture | https://bit.ly/3wnMH2r

1. Klimafolgen Online
Potsdam Institute of Climate Impact Research | https://bit.ly/3aElrTl

2. Climate change impacts mind-map
Potsdam Institute of Climate Impact Research | https://bit.ly/2WGhAN9

3. Forestry in Germany
Forestry in Germany | https://bit.ly/3pgRRHm

4. Waldstrategie 2050
Bundesministerium für Ernährung und Landwirtschaft | https://bit.ly/3R2G7WV

5. Klimaschutz und Klimaanpassung
Bundesministerium für Ernährung und Landwirtschaft | https://bit.ly/2KxX1jH

6. Tourism Policy
Bundesministeriums für Wirtschaft und Energie | https://bit.ly/38xvyXt

7. Deutsches Maiskomitee
Deutsches Maiskomitee | https://bit.ly/2Kq7KwI

8. Forage quality and the growing conditions of silage corn
Land Brandenburg | https://bit.ly/3rowLsx

9. Bienenfreundliche Pflanzen
Bundesministerium für Ernährung und Landwirtschaft | https://bit.ly/3mIpoIR.

10. Sortenratgeber
Land Brandenburg | https://lelf.brandenburg.de/lelf/de/landwirtschaft/acker-und-pflanzenbau/landessortenwesen/

11. Deutsche Alpenverein
Deutsche Alpenverein | https://bit.ly/3aKa10f

12. Klimawandel im Alpenraum
Deutsche Alpenverein | https://bit.ly/3rtrq3p

13. Erhalt von Skigebieten kostet Steuerzahler Millionen
Welt | https://bit.ly/34EVhw0

14. Regierung gibt zwei Drittel der deutschen Skigebiete verloren
Spiegel | https://bit.ly/37Nvm7b

15. Sterben Wintersport und Skitourismus in Deutschland aus?
Ski Info | https://bit.ly/3nObOoR

16. Field of Action Tourism
Umwelt Bundesamt | https://bit.ly/3rt1l4g

17. Monitoringbericht 2019
Umwelt Bundesamt | https://bit.ly/3mO8AAr

18. Deutscher Wein Statistik
Deutsche Weine | https://bit.ly/2WFvT4G

19. Riesling wine, holding out between pesticides and climate change
DW | https://bit.ly/3PKC6FJ

20. Wasserbrauch Deutschland
Heizsparer | https://bit.ly/3rp28Dn

21. Wasserverbrauch
Sachsen | https://bit.ly/3Tcq76A

22. Field of Action Water Resources, Water Management, Coastal and Marine Protection
Umwelt Bundesamt | https://bit.ly/38xsqux

23. Das Wichtigste zu unserem Wasser
Die Stadtwerke Potsdam | https://bit.ly/3hg72Oo

24. Saving water: wise, overdone or practiced too excessively?
Umwelt Bundesamt | https://bit.ly/37LSxi2

25. Climate change and health
Umwelt Bundesamt | https://bit.ly/2KUaQsF

26. Hamburger Bildungsserver
Hamburger Bildungsserver | https://bit.ly/2WLapDI

27. Heat illness in athletes
Dr. Nabil Ebraheim | https://youtu.be/G2nP0D024X8

28. Gesundheit und Klimawandel
Climate service Center | https://bit.ly/34IJMU3

Day 1: Scenario

Day 1 is dedicated to introducing your students to the scenario of the project week / simulation. In other words, students will be provided with varied input materials. They should use these materials to deduce information about the general situation in Leinwig (descriptive level), define the underlying problem posed to them (analytic level), and map out the different fields of action that they will address in the coming days (application level).

In terms of language skills, this phase emphasizes receptive skills of reading and listening/viewing comprehension. While the suggested viewing and reading tasks scaffold this process, you should evaluate which other support your students may need here. Have your students use the glossary "Energy Lingo" to create annotations and share definitions of important terms and concepts.

The section includes three task cycles:

- TASK: Think like a community energy planner
- TASK: Solve Leinwig's energy challenge
- TASK: Define the problem

TASK: Think like a community energy planner

Objective

In this activity students can describe the concept of community energy planning, the action areas it involves, and can connect this concept to their own home community.

Procedures

Students will watch a TED talk on community energy planning and answer and discuss open questions and viewing comprehension questions from the viewing guide in class, including pre-, while- and post-viewing questions.

Students will discuss the relevance of community energy planning for their own community and identify examples of such activities they have come across.

Notes

- This is an authentic video (TED talk), but English subtitles are available.
- The viewing comprehension questions pop up directly in the video.
- You can have your students watch the video together in class.
- If they are to watch it individually, ask them to bring headphones.
- Answers can be discussed orally in class or in writing in the forum.
- Alternatively, you can print the viewing guide (2 pages) for all students ahead of the class.

Think like a community energy planner

Richard Dooley is Arlington's, VA community energy coordinator. The city's energy plan is a long-term vision for transforming how citizens generate, use, and distribute energy in their community. It has been awarded different prizes and serves as a role model for other communities in the U.S. and beyond.

Watch the TED talk [1] by Mr. Dooley. Make a pause in the given minute to answer the following questions: [11]

- (0:13) Before you watch the talk, pause for a minute and note down all the ways in which you have used energy today until now. Write down as many examples as you can! Once the minute is up, exchange and discuss your results with a partner.
- (1:17) "Energy is like background noise." What could Rich Dooley mean by this? Can you think of situations when you might experience this, too?
- (3:45) "Now, there's nothing magical about energy planning. To be honest with you, it's a lot like trying to lose weight." How do losing weight and energy planning compare to each other? What steps are involved?
- (4:17) When you try to lose weight, you step on the scale, say how much weight you want to lose by when, determine what you will do to achieve this, and scale yourself again after some while to see how it worked out. Stop for a moment to think about what you could learn from this regarding energy planning.
- (4:57) **Summary** Community energy planning involves these steps:
    - Establish a baseline (energy inventory, greenhouse gas emissions inventory, ...)
    - Set specific goals (e.g. reduce energy waste by 30% by 2030)
    - Select methods or measures (e.g. increase energy efficiency in buildings, financial incentive programs)
    - Evaluate progress (e.g. repeat the energy inventory after two years)
- (6:30) We can look at energy planning through three lenses:
    - Economic competitiveness
    - Energy security and resiliency
    - Environmental commitment and climate change

    Note at least one example for each as you continue watching the video.
- (7:18) **Hint** Gross domestic product (GDP) [2]

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[11] SOLUTION

Economic competitiveness: Energy demands rise world-wide, and with it also the price for energy. The more energy efficient countries are, the more competitive they become. Energy intensity (comparison of energy and a country's GDP) [3] is a good indicator for this.

Energy security and resiliency: Energy price fluctuations are caused by global influences like wars, weather disruptions, man-made activities and terrorism. 'Resiliency' means how fast we can get the energy supply going again after such disruptions. The brightly lit Empire State Building [4] in New York during hurricane Sandy [5] in 2012 amidst a blackout is an example of such resiliency.

Environmental commitment: Power plants can release carbon dioxide and other greenhouse gas emissions as well as other pollutants into the environment. They impact our air, water, soil, weather and climate, and ultimately our health. Some of the biggest recent examples include the BP oil spill in the Gulf of Mexico (2010) [6] and the Fukushima nuclear catastrophe (2011) [7].

- (11:00) What are some examples of these 'three lenses' mentioned by Dooley?
- (11:25) Dooley talks about Arlington's, VA community energy plan [8], which includes buildings, district energy, renewable energy, transportation, county government actions, education and human behavior. While you watch the rest of the video, note down two examples or strategies that you find interesting or want to learn more about.
- (13:49) After viewing the talk, discuss with your classmates the following questions:
    - What do you think is community energy planning? Why is it necessary? What are its benefits for a community?
    - Think of your own community. Can you identify any community energy planning or climate actions and measures? How do they affect you?

1. Community energy planning: Government can't (and shouldn't!) do it alone - Rich Dooley
TED talks | https://youtu.be/sGRrUbtcI7M

2. Gross domestic product (GDP)
Wikipedia | https://bit.ly/37M7aSt

3. Energy intensity
Wikipedia | https://bit.ly/3hiICUo

4. In pictures: New York flooded by Tropical Storm Sandy
BBC | https://bbc.in/2WMhRyq

5. Hurricane Sandy
Wikipedia | https://bit.ly/3nP0kkY

6. Deepwater Horizon oil spill
Wikipedia | https://bit.ly/3hgNGZv

7. Fukushima Daiichi nuclear disaster
Wikipedia | https://bit.ly/2WJvZs5

8. Community Energy Plan (CEP)
Arlington Virginia | https://bit.ly/3rrGDlp

TASK: Solve Leinwig's energy challenge

Objective

Students can analyze and synthesize information from multiple text-based and visual sources to describe the project scenario. They understand the overall goal of the project week, i.e. that they will develop a community energy plan for the City of Leinwig that adequately addresses the issues raised by the mayor and reflects knowledge of renewable energy science and best practices.

Procedures

Students read a letter from the Lord Mayor of the City of Leinwig in which she addresses the course as the 'Climate Solutions Council'. She asks the students for support to develop a community energy plan that should meet the city's ambitious climate and energy targets.

Students analyze and synthesize information from the different information sources provided about Leinwig and collaboratively create a digital or paper-and-pencil profile of the current situation of the city.

Notes

- This task has a primary focus on reading comprehension.
- The resource Letter from Mayor Johannsen [1] provides the overall context of the project.
- Annotations of basic terms are provided, but students can research further.
- The letter and the additional materials reflect a certain redundancy of information, i.e. learners must systematically filter the key details they will need for the upcoming modules.
- The last part of the task requires learners to create a city profile. This can be done interactively with Popplet, which has the advantage that all learners can access it simultaneously and at anytime and anywhere, and they can add links and multimedia content.

Solve Leinwig's energy challenge

Attention! The mayor of the City of Leinwig, Dr. Michaela Johannsen, is seeking your help to create a community energy plan for her town. She has written you a letter on behalf of Leinwig's citizens detailing the status quo of her town's energy supply and outlining future goals.

Leinwig needs your help, Dr. Johannsen writes:

> *"We are asking you to develop a renewable energy action plan for our community that adequately addresses the aspects mentioned in this letter. The clock is ticking, and you will have to present your blueprint to our energy commission at the end of this week. Please find more information, and additional materials attached to this letter. Leinwig City and County are counting on your help. We hope you will answer our call and help to build our future."*
>
> — Dr. Michaela Johannsen, Lord Mayor of Leinwig

This is going to be your overall task for the project week:

Develop a community energy plan for Leinwig that corresponds with the town's climate and energy targets and provides an innovative and realistic blueprint for the town's future. 'Pitch' your plan to a commission of local experts on energy policy and affected citizens.

(You can peek at the exact TASK: Make a pitch for a community energy plan (day 4) and the TASK: Create a video and participate in the school competition (day 4).

This is going to be your overall task for the project week:

1. Read mayor Johannsen's letter [1] carefully. Note down any questions you might have. Look up unknown vocabulary.

2. Read the letter again and take notes on the following questions. Highlight important passages in the text. Discuss the questions in small groups first and then in class. Collect all results.
    a. What do you learn about the City of Leinwig in general? (Population? Location? Size? Current debates?)
    b. What do you learn about the current situation – the status quo – of energy supply in the City and County of Leinwig? (What energy sources? Recent changes or developments? Expectations for the future?)
    c. What do you learn about mayor Johannsen's goals and targets? What does she wish for the future of her community?

(continue on next page)

3. Create a profile of the current situation in Leinwig from the materials [1- 5]

The profile could be a Popplet wall [6] or actual index cards stuck to your chalkboard. Form groups and divide up the work. For example, you could focus on these topics:

- Leinwig – City and community
- Energy and emission targets
- Energy sources – renewable and non-renewable
- Energy sources – status quo and future potentials
- …

RESOURCES FOR THIS TASK

1. Letter from Mayor Johannsen
Teach about US | https://bit.ly/38x3SSx

2. Leinwig Community Portfolio
Teach about US | https://bit.ly/34FufnV

3. Climate data for Leinwig City
Teach about US | https://bit.ly/3nPBVM9

4. Leinwig energy portfolio
Teach about US | https://bit.ly/3mP1GdW

5. Leinwig county utility map
Teach about US | https://bit.ly/3pm8Qbj

6. Popplet ideas visualizer
Popplet | https://bit.ly/37NMdqr

TASK: Define the problem

Objective

Students can differentiate and describe different components of a larger problem and infer decision makers, decision criteria, and potential restrictions.

Procedures

Students analyze the scenario and define the problem in small groups using the handout "Defining a problem". They identify the underlying problem question that is to be solved, the status quo, who the decision makers and affected persons are, as well as the decision criteria and restrictions or limitations of the solutions and discuss these aspects with their classmates.

Notes

- This task focuses on reading and writing skills, but also speaking skills (oral discussion of results).
- It aims at developing a more analytic understanding of the scenario by re-examining the materials from above with a more fine-grained perspective.
- The results can be discussed orally in class.

Define the problem

Creating a community energy plan is a complex task. So far, you have gathered some general information about this and you have read the mayor's letter seeking your help. You know about the general scenario, but what exactly is the problem that is to be solved?

In order to sort the available information and define the problem that Mayor Johannsen is asking you to tackle, discuss the five steps of defining a problem (see below) with your classmates.

Day 2: Possible solutions

Day 2 of the project week serves to familiarize your students with different aspects of the potential solution to the overall problem by introducing them to various best practice examples of community energy planning (CEP) in the U.S. and Germany.

In terms of language skills, the research phases focus on receptive skills and information literacy, i.e. filtering contents adequately to facilitate further project steps. The subsequent presentation/discussion fosters speaking skills and the negotiation of meaning with classmates.

The section includes two task cycles:

- TASK: Develop a vision – your mission statement
- TASK: Review best practices

TASK: Develop a vision – your mission statement

Objectives

Students analyze mission statements for community energy planning by U.S. communities and understand their components and function(s) for developing, administering, and evaluating a CEP. They can formulate their own mission statement that reflects the values and goals for Leinwig's CEP.

Procedures

Students will analyze sample mission statements and identify their components and linguistic features.

Students will discuss the targets mentioned by the mayor and decide what goal(s) they would like to pursue in their CEP.

Students will formulate a mission statement collaboratively, beginning with three powerful words, critical verbs, and ambitious but achievable goals.

Notes

- While Leinwig's mayor mentions concrete climate and energy targets in her letter, the specific focus and scope of the CEP is up to your students. They can shape these aspects with the mission statement.
- Have your students collect their suggestions for the mission statement and/or their three-word statements in the Course Forum to facilitate a greater focus on form and a documentation of the work process.

Develop a vision—your mission statement

Your city's mission statement is the first building block of your community energy plan.

An effective energy vision statement offers a representation of what the community wants to look like 10-20 years into the future. A clearly articulated, transparent, and shared vision of the community's energy future sets the direction for subsequent decisions about goals, strategies, and actions.

Before you start developing Leinwig's energy vision statement, look at how this can be done most effectively. Below you will find important characteristics of a convincing vision:

- **Vivid:** Paint a picture of the desired future.
- **Inspirational and meaningful:** Connect people to the effort.
- **Unique to the local situation:** Speak to the local community's culture and values.
- **Simply stated and easy to understand:** Communicate clearly to the target groups.

Now it's your turn. Develop a focused energy vision statement that outlines what Leinwig will look like once you implemented your energy transition project successfully. This mission statement will outline your overall project goal and lead you throughout the working process. Preparing such a high-level statement can be tricky.

To develop a mission statement, follow these steps:

***Step 1:** Review Leinwig's climate action targets as specified in the mayor's letter. Be sure that your energy vision statement includes these goals implicitly or explicitly.*

***Step 2:** Start with three words. Find a powerful three-word vision and then only add words you absolutely need to complete it.*

***Step 3:** Ask yourself and your fellow students what one outcome you/they would most like to see. Collect those suggestions (on a wall or chalkboard) and try to generate a vision statement that incorporates them all.*

***Step 4:** Think about what is impossible, and then back off just a bit to end up with an ambitious but achievable vision.*

***Step 5:** Focus on the "critical verb" and use it in the future tense – for example, what will Leinwig:*

be	*generate*	*avoid*
build	*create*	*reduce*
produce	*lead*	*eliminate*

***Step 6:** Study the vision statements adopted by other cities. Below are a few examples of community-wide energy strategic visions. Notice that they show a range from very broad and general statements to more-specifically energy related. Which of these examples would you consider to be most effective? Why?*

BROAD	We want Austin to be the most livable community in the country. – *Austin, TX*
	Reduce climate change impact, and become the renewable energy capital of Canada. – *Toronto, ON*
	Albany is a model of community health and sustainability in its planning, restorative development, and conservation of energy, water, and natural resources. – *Albany, NY*
	Assuring reliable, affordable, and clean electricity is essential to the continued attraction and retention of [New York] businesses and residents. – *New York, NY*
SPECIFIC	Montpelier and its neighboring communities will be leaders in creating an economically sustainable and environmentally responsible community reducing fossil fuel consumption by at least 80% by 2030. – *Montpelier, VT*

Extra

Review different ways of formulating climate action goals.

Make sure that your energy vision statement encompasses the climate targets specified in the mayor's letter (greenhouse gas reduction rate, share of renewable energy sources, time frame).

TASK: Review best practices

Objectives

Students can identify best practices in sample CEPs and deduce potential action areas and measures for their own CEP. They can adapt best practices to a defined local context (Leinwig).

Procedures

Students will brainstorm in class potential actions Leinwig can take to meet the goals of its CEP.

Students will review and analyze CEPs from German and U.S. communities in groups and identify best practices and potential action areas relevant to their plan.

Students will evaluate the transferability of best practices, summarize their findings on a poster, and present/discuss their results orally in a 'fishbowl' format.

Students will select action areas and measures for their own CEP.

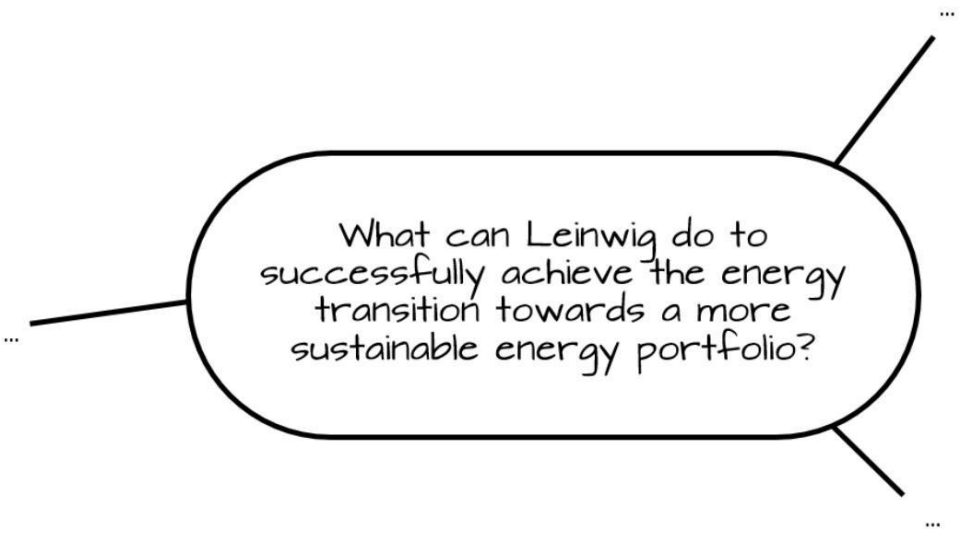
Notes

- The brainstorming activity can be done using the chalkboard, have your students take a photo of the result.
- The case studies target different action areas, e.g. energy efficiency, transportation, emissions reduction, etc. Your CEP does not have to include all of these areas.
- The posters can be created in paper-and-pencil format or digitally, e.g. using apps like Popplet.

Review best practices

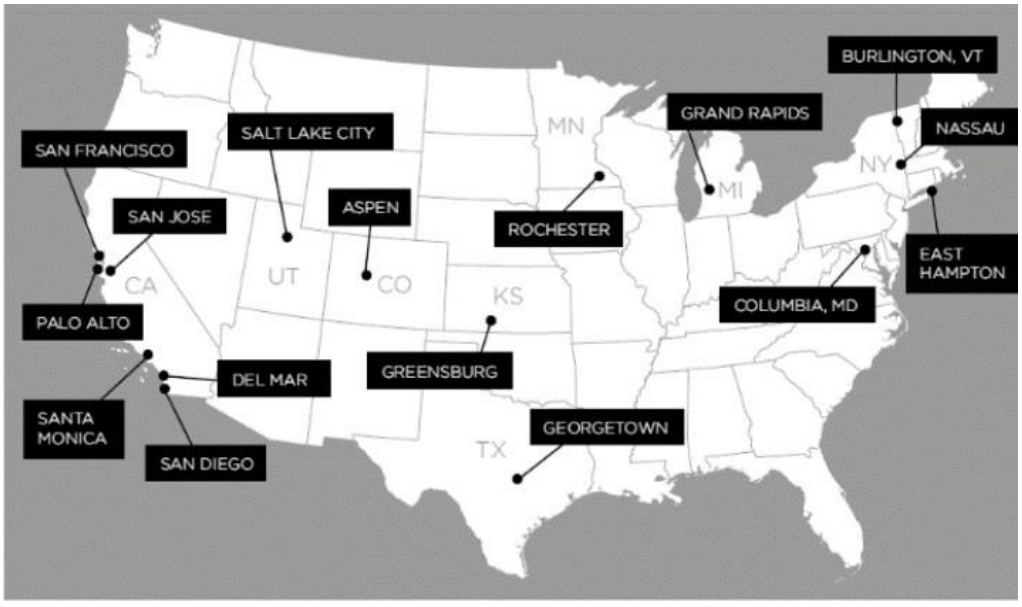
1. Brainstorming

Do a brainstorming in class to collect ideas and examples on possible climate actions for the city of Leinwig. Focus on the leading question:



2. Reviewing case studies

Form small work groups (4 students) and review at least three case studies of communities implementing climate actions for a transition towards renewable energy sources. You can find selected case studies here:



Community-based best practices for climate actions:

- Sierra Club: Cities are Ready for 100% Clean Energy – 10 Case Studies [1] (PDF, 10 case studies in the U.S.)

- Go 100 Percent Renewable Energy: Interactive Map [2] (Website, case studies from around the world incl. Germany and the U.S.)
- Global 100%RE: Interactive Map [3] [Website, case studies from around the world incl. Germany and the U.S.]
- Sierra Club: Is Your City #ReadyFor100? [4] (Website, case studies and assessment of efforts by U.S. cities)

3. Analyzing case studies

Select one case study investigate in greater detail. Look at the following aspects and take notes:

- What is the situation of the city? *Main facts / context of the city like population size, geographical location, climate*
- Why do they act on climate? *Background and motivation for local climate action*
- What is their goal? *Aims and climate action targets like GHG reduction goals, renewable energy targets*
- How is the goal to be achieved? *Approach or method to achieve the goals like financial incentives, local policies, public-private partnerships, local-state partnerships*
- When is the goal to be achieved? *Time frame for the plan or measure? How far are they in their plan? Current situation / evaluation (if possible)*
- What can we learn from this example? *Explain the case's relevance for your project goal. In what ways is the case study relevant for your work? What is unique to your case study and what can other cities learn from it?*

4. Fishbowl discussion

Summarize your group's findings on a poster. Focus on lessons that can be learned from that case study. Deduce at least three concrete suggestions from your case study that could be transferred to your project.
Present your findings (i.e. lessons learned from best practice examples) in a fishbowl discussion (select a speaker, bring notes, refer to your poster).

Method guide: Fishbowl discussion

- *Choose one student as your group speaker and help him/her summarize your findings. All group speakers, together with a moderator, sit in the inner circle.*
- *The speakers take turns in presenting their group's findings. Provide reasons for the suggestions based on your case study (use the guiding questions above). You should refer to your poster.*
- *Group members in the audience (outer circle) can join in to support their speaker or ask critical questions – but only after being called upon by the moderator.*
- *In the final part of your contribution you should answer the following questions: What aspects from the case studies are relevant for your course's project? Which measures can be transferred to your case? How should these measures be adapted or changed to fit your specific scenario?*

5. Select ideas for your own project

Collect ideas and best practices from the case studies investigated by you and your classmates.

Discuss how they could be adapted to your case, i.e. in most cases you will not be able to simply copy one city's approach and apply it to your case since geographical, economic and other factors are likely to differ.

Also, you need to decide as to what measures you can transfer – you probably will not be able to use all the examples you have reviewed / e.g. a small city cannot adopt all measures a city like Los Angeles might have implemented.

1. Cities are ready for 100% clean energy 10 case studies
Sierraclub | https://bit.ly/2WJq8D1

2. Go 100 Percent Renewable Energy: Interactive Map
Go 100% | https://www.global100re.org/

Project plan template for individual work units

Objectives

Students can reflect on and plan their own learning process and formulate achievable learning goals for their work.

Procedures

Students will decide on different action areas for their CEP collaboratively and form expert groups accordingly.
Students will fill out the project plan template, which outlines their work unit's focus, its main goals, time frame, involved stakeholders, and the necessary resources and materials.

Notes

- In keeping with the project-based approach, students take responsibility for their own work and plan their next procedures.
- The task provides a PDF template. Make enough copies in advance and have your students.

Project plan template for individual work units template

End this day by deciding on different work units or work packages that will be part of your final pitch. Form small groups that will focus one of these packages: The following could be possible work units: Renewables in Leinwig, replacing carbon-based energy sources, transportation in Leinwig, PR and educating the public about our plan, jobs and economic issues, etc.

Project plan template. Fill out the template in your work groups to plan the remainder of the project week. Fill out the paper-and-pencil version / PDF.

Title: .....

Group members: .....

.....

What are our action's main goals? .....

.....

.....

.....

What is our action's time frame? .....

.....

.....

Who are our action's stakeholders and decision makers? .....

.....

.....

What materials and resources do we plan to use? .....

.....

.....

.....

.....

Day 3: Developing our plan

The primary focus of Day 3 is on developing the CEP in the expert groups. For this purpose, students organize their time and procedures more independently with the help of the Project plan template. The second focus is to critically evaluate their work units by performing a SWOT analysis.

In terms of language use, this day involves a strong focus on oral interaction, whether in the groups during collaborative processes or in class for the presentation of work results and discussion of further plans.

The section includes one task cycle:

- TASK: Do a SWOT analysis

TASK: Do a SWOT analysis

Objective

Students can organize and carry out their group work procedure independently. They can develop and critically evaluate a selected work unit / action plan for their CEP.

Procedures

Students will meet in class to report their day's plan and launch the expert group phase.

Students will develop their work unit collaboratively with the help of the materials from the previous modules, e.g. the best practices.

Students will perform a SWOT analysis of their work unit and report their results orally and/or in a forum.

Notes

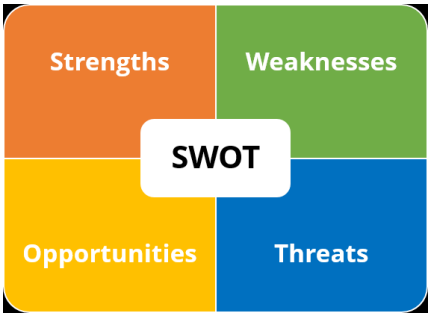
- Students can organize their group work independently here, but you can include a kick-off, mid-day, and end-of-day student conference and have students briefly report about their plans, achievements/results, encountered/expected challenges and problems.
- While it may not always possible to have your students speak English during the group phase, you could have them report their work results and procedures in a written report.
- Consider having different work stations, e.g. with different media and materials (e.g., tablet computer, handiwork supplies, etc.).

Do a SWOT Analysis

For this task you will perform a so-called SWOT analysis. Before you proceed, take some time to learn what this is. Below is an introduction. Discuss any questions you might have with your classmates and teacher.

What is a SWOT analysis?

SWOT stands for strengths, weaknesses, opportunities, and threats. A SWOT analysis is an organizational exercise that helps planners to identify the strengths and weaknesses as well as opportunities and threats that will support or prevent the success of a plan or project. In business and economics, SWOT analyses are often performed to assess the potential of a company or the success of a business idea. It is also useful for community energy planning.



Components

Strengths. *Existing resources that can be used to meet the goals of the community energy plan (for example, stable funding, a system that monitors power use and carbon dioxide emissions, designated areas for power plants, etc.)*

Weaknesses. *Existing barriers or challenges that must be overcome to meet the goals of the community energy plan (for example, slow bureaucratic procedures, insufficient funding, insufficient technology for electricity storage, laws and regulations, etc.)*

Opportunities. *External influences that could support the plan in the future, i.e. they are visible on the horizon and are less easy to assess or measure (for example, future trends, conditions, or events that can be exploited to support the success of the plan like political initiatives, rapidly dropping prices for renewable energy technologies, expected government funding and subsidies, etc.).*

Threats. *External challenges or risks for the plan's future, i.e. they are visible on the horizon and less easy to assess or measure (for example, reduction of government support for renewable energy sources, changing political climate or competition with other political issues, etc.).*

Procedure

The first step of a SWOT analysis is to analyze your project/idea/approach with regard to these four areas. Once this is done, these four areas must be compared and assessed. Important questions to ask include:

- *How can strengths be used?*
- *How can weaknesses be stopped?*
- *How can opportunities be exploited?*
- *How can threats be defended against?*

Third, based on how these questions are answered, guidelines or strategies for a plan can be formulated that will systematically guide future actions.

Summary

Look at this video [1] about doing a SWOT analysis to learn more about it

Before you start, review your assigned work unit in your expert group, or complete this using the project plan template if you have not done this already. You will do a SWOT analysis for your work unit, i.e. the goal and proposed actions or measures that belong to your work unit.

1. SWOT analysis: Focus on strengths and weaknesses

Form two groups: Group 1 will look at strengths, group 2 will look at weaknessess. Begin by filling in the relevant strengths, or weaknesses respectively. Start from the following resources:

- renewable energy technology sheets
- documents on air, health, and water impacts and financial costs
- the mayor's letter
- your city's community and energy profiles
- relevant best practice case studies
- if necessary, other information online

Use the SWOT template in the handout (see resources below).

2. 2. SWOT analysis: Focus on opportunities and threats

Now, do the same for opportunities (Group 1) and threats (Group 2). Use the same resources as above. (Note that opportunities and threats concern the future of your work package like potential changes in technology, pricing, public perception, policies and so on.)

3. SWOT analysis: Exchanging findings

Groups 1 and 2, brief each other on your results and complete the SWOT chart with your partners' findings. Based on your analysis, decide on at least three measures or strategies to be implemented as a result of your work package.

4. 4. SWOT analysis: Evaluate your findings

Finally, evaluate your results and make changes to your original work packages if necessary:

- What are the biggest opportunities and the biggest threats connected to a successful execution of your work package?
- Do strengths and opportunities outweigh weaknesses and threats?
- How can strengths be used? How can weaknesses be stopped? How can opportunities be exploited? How can threats be defended against?

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1. How to Conduct a SWOT Analysis
DecisionSkills | https://bit.ly/2WHSPAk
2. Extra: Understanding Electricity Impacts
Gelfand Center at Carnegie Mellon University | https://bit.ly/2LogMdW

Day 4: Preparing Outcomes

On Day 4, students will begin working towards the outcomes of the project week, i.e. they will finish up their work units and arrange them together to form a coherent CEP for Leinwig. This final outcome is going to be a pitch, i.e. an oral presentation to an expert commission (to be organized by you), along with written summaries from the individual expert groups. If your course opts to participate in the school competition, they will have to produce a short video describing their CEP.

In terms of language skills, the pitch is an opportunity to practice oral presentation skills and review criteria of effective presentations. Writing summaries / practice reports can be practiced with the written expert group reports. The video fosters media skills and creative speaking and improvisation.

The section includes two task cycles:

- TASK: Make a pitch for a community energy plan
- TASK: Create a video and participate in the school competition

TASK: Make a pitch for a community energy plan

Objective

Students can collect research findings collaboratively and integrate them in a joint product (CEP for Leinwig). They can plan and deliver a presentation to an expert audience with the help of different presentation media.

Procedures

Students will discuss and decide on a format and structure of their final CEP pitch, including the selection of speakers and moderators.

Students will practice presenting the results of their work unit orally to an expert commission.

Students will summarize their work unit's results on a two-page handout.

Notes

- For the pitch, you (or your students) will have to invite an expert commission. It could be comprised of the EFL and science teachers, members of the school administration, representatives of the community, e.g. people who are involved with CEP like business people, elected officials, parents involved in NGOs etc.
- Also, the pitch should be moderated by a student who introduces speakers, addresses the commission, gives a closing statement etc.
- Provide the evaluation criteria for your students in advance. A suggestion can be found in the course. It can be adapted to your context.

Make a pitch for a community energy plan

At the end of the week, you (the Climate Solutions Council) will be invited to pitch your blueprint for Leinwig's community energy plan (CEP) to an expert commission. This commission will be comprised of community representatives like the local government, businesses, and residents.

In terms of content, your CEP pitch should…

- address Leinwig's community energy and climate targets adequately,
- include a convincing vision for the community,
- refer to the status quo of Leinwig's energy supply (your 'baseline'),
- describe concrete measures in different action areas to achieve the goals and that reflect the work of the various expert groups,
- be backed up with references to the science behind renewables,
- provide support in terms of best practices from other communities,
- and critically acknowledge challenges and impacts or costs.

Your pitch should not exceed 45 minutes in total (i.e. for all expert groups together). Representatives of all expert groups should contribute to the pitch.

Select one or two students who will moderate the pitch, introduce speakers, and address the commission, maybe also close the pitch with a powerful closing statement.

In addition, each expert group is asked to provide a two-page documentation of their contribution to the CEP. This can also include more details that you researched but could not fit into your oral presentation. Together, the summaries from all expert groups will form a CEP portfolio.

Create a video and participate in the school competition

Objective

Students can plan and produce a video introducing their CEP to an online audience in a creative and convincing way.

Procedures

Students will collaboratively write a video script.

Students will act out and/or film different scenes according to their script.

Students will engage in different aspects of video production, e.g. filming, directing, cutting, editing visual and audio elements.

Notes

- The video competition is a great opportunity to open the project to a wider audience and implement explicit practice of media skills (writing a script, recording the video, using different camera angles, using background music and visual and sound effects, producing the video etc.).
- The video can (and should) also be used for the pitch (see above).
- You do not need highly specialized video equipment - most smartphones will be capable of producing a video of sufficient quality.

Create a video and participate in the school competition

Sometimes having a good idea is only part of the solution to a problem; communicating your idea compellingly can be just as important if you want it to influence how people think about an issue.

Teach About US calls all project week participants to contribute to a video competition for creative and innovative approaches to local community energy planning!

What are the problems that you identify concerning community energy planning in the 21st century? How can we tap renewable sources in a way to provide reliable and affordable energy to our communities? How can we increase the efficiency of appliances, housing, and transportation to become less dependent on fossil fuels? What is the contribution that we can make in our everyday lives to cut greenhouse gas emissions and thus mitigate climate change? These are big questions and community energy planning is directly concerned with all of them.

Produce a creative video about your course's community energy pitch and submit it to the Teach About US project week competition.

- Your video should creatively present the results of your project week participation. Think of a good story or an interesting question to be answered.
- It should not be longer than 3 minutes.
- It should be in English, or German and English.
- It should be submitted on behalf of your class; only one video per course can be accepted.
- You may use video editing software to create and edit your video.
- You may not use copyrighted (chart) music. Instead, use platforms like the free music archive [1], but always check how the author and composer are to be attributed. The same goes for stock photos [2] [3] and stock videos [4].
- All persons who appear in your video must consent to them being recorded. All persons depicted in the video must be at least 14 years old by June 1, 2018.
- By submitting your video, you agree that it will be posted to the Teach About US website together with your names.

Do you have further questions? Post them in the Virtual Town Hall or contact a Teach About US representative.

To submit your video, fill out the form in the Virtual Town Hall [5] and upload the link to your video (only one course representative has to do this)

RESOURCES FOR THIS TASK

1. Free music archive
Free music archive | https://bit.ly/2KWeTEy

2. Freepik
Freepik | https://bit.ly/37NXY04

3. Pexels
Pexels | https://bit.ly/3rrGnD1

4. Dareful
Dareful | https://bit.ly/37M248S

5. DATABASE: Your sustainability action plan
Teach about US | https://bit.ly/3mXpblv

Day 5: Pitch & evaluation

Day 5, the final day of the project week, focuses on the presentation of results, i.e. the oral pitch, the written summaries/portfolio, and the video. In this context, the students' achievements should be acknowledged. Enough time should be reserved for a critical reflection and evaluation of the project and a debriefing.

In terms of language skills, this day's main emphasis is on oral presentation skills and listening comprehension, as well as spoken interaction with the expert commission and the audience in general.

Finish both tasks from day 4 (**TASK: Make a pitch for a community energy plan** and **TASK: Create a video and participate in the school competition**).

Your teacher will inform you about the exact structure of the 'expert commission meeting' where you will pitch your solution (or you will decide this together with your teacher).

TASK: Final evaluation and reflection

Objective

Students can reflect upon and evaluate their learning in terms of procedures and outcomes. They can identify successful strategies as well as ineffective behavior and can suggest adequate alternatives for future learning encounters.

Procedures

There is no concrete procedure suggested for this phase. Select a procedure that fits the project implementation in your specific learner group and your overall curricular goals.

Notes

- This task is not posted to the curriculum but should be implemented by you after the CEP pitch.
- This final phase should provide room for both individual and collaborative reflection.
- A final reflection and evaluation should focus on the learning processes and outcomes. The following aspects could be of interest:
    - Has the initial project goal been sufficiently met? Has the problem defined at the onset been successfully solved?
    - Have the students engaged in successful and effective behavior and have they applied learning strategies effectively? Have learners encountered challenges or breakdowns in their learning that kept them from attaining their goals?
    - Have learners engaged in language learning (implicitly or explicitly)? What language skills has the project fostered?
    - What content knowledge have learners acquired during the project? What do they know now that they did not know before?
    - How is that knowledge or are the fostered skills relevant to the students' lifeworld? How can they apply knowledge and skills in other contexts as well?
    - What has been left out in the project? What would students like to learn more about going forward?
    - Do learners want to continue the project in some form, e.g. focus on CEP in their own community?

Evaluation criteria for oral pitch presentations (template)

Evaluation criteria for the presentation (only visible for teachers)

Criteria	**Names**			
	1.	2.	3.	4.
Content knowledge: — information — accuracy				
Methodological competence — Structure (organization of contents, introduction, conclusion) — Use of media (appropriateness, effectiveness, creativity)				
Social competence — Interaction with team members — Transitions/moderation				
Personal competence — Language (free speech, comprehensible, accurate) — Appearance (mimicry, gesture, persuasiveness, enthusiasm)				
Summary				
Grade/points				

TIPS: Analyzing Cartoons

Like written texts visual materials, i.e. pictures (photographs, paintings, drawings, cartoons), tables, graphs and charts use certain elements to convey information. In your analysis of visual texts you are expected to identify those visual elements, describe them systematically and explain their use and function. Furthermore, with regard to pictures, you need to evaluate their effect on the reader; with regard to tables, graphs and charts, you need to evaluate the quality of the information provided.

PREPARATION

1) Study the task carefully.
2) Examine the cartoon in detail, keeping the task in mind. Find out where and when the cartoon was published; study the visual elements of the cartoon (people, objects, setting, speech bubbles etc.) and, if provided, the caption; consider symbolism and (metaphorical) meaning with regard to your task and/or a specific (topical) context.
3) Take notes.
4) Structure your notes/key words.

WRITING ABOUT A CARTOON: *Include…*

- the following elements in the introductory sentence(s):
  - the central idea/aspect of the cartoon, i.e. say what the cartoon is about
  - the cartoonist 's name, where and when the cartoon was published
- a detailed description of the cartoon:
  - Name the different parts the cartoon consists of (visual elements, captions, speech or thought bubbles).
  - Describe the depicted objects or people (striking/physical features, clothing, positioning and size of objects/figures, facial expressions, body language, colour, what people say or think), the action and the setting (i.e. where and when the action takes place).
- an explanation of what the cartoonist wants to say or show and what techniques he/she uses:
  - Analyse the different elements (the visual elements, captions, speech or thought bubbles) of the cartoon.
  - Analyse the techniques used to convey the message (symbols, exaggeration, caricature, irony, all of them often with a critical intention).
  - Say which elements are striking and why (exaggerated, distorted, etc.).
  - Say which of the objects and characters carry a meaning that goes beyond the obvious. Explain what they represent.
  - Say how the different elements interact.
  - Say what effect the elements have on the reader.
  - Explain what message the cartoonist wants to convey.

POINTS TO REMEMBER

- On the basis of your notes/key words structure your text.
- Use appropriate linking words.

- Use present tense/present continuous for actions.

Source: Berlin Senatsverwaltung für Bildung. Wissenschaft und Forschung (2011). Materialien zum selbstständigen standardorientierten Lernen in der gymnasialen Oberstufe Englisch, pp. 18-20.

Conducting research

Following these steps will help you plan your research together with your group members.

1. Research topic: What is the topic or issue?
Decide on the general topic of your research first. It may help to do a brainstorming of possible topics, a quick web-research or talk to an expert first. Some possible topics could be "plastic pollution on our school campus", "plastic recycling in our city", "plastic dependence of our household(s)" etc.

2. Research question: What do we want to find out?
Now decide what it is that you want to find out. Formulate a question that addresses your issue. Your question must be specific enough so that you can answer it. A possible research questions could be "How much plastic waste does our household produce over a week?" or "What are people's opinions on raising the price of plastic bags?"

3. Research method: How will we find out?
Decide what you will do to answer your question. This will include collecting evidence like interviews, survey answers, photographs and videos, experiment results, and so on. Also think about who is going to do what and when, and what tools and resources you will need.

4. Research hypothesis: What results do we expect?
Briefly note what results you think you will get. This is called a hypothesis. Your research may confirm your hypothesis or it may produce different results.

5. Research report: How will we document and present our findings?
Note how you will document your findings and present them later on in class and online. For example, if you do an online survey, you could create a PowerPoint presentation with diagrams, or you could write a blog entry about your research, or even produce a video or photo story interesting findings.

Source: Berlin Senatsverwaltung für Bildung. Wissenschaft und Forschung (2011). Materialien zum selbstständigen standardorientierten Lernen in der gymnasialen Oberstufe Englisch, pp. 17-18.

Doing project work

The following guidelines are not all equally applicable to all the different kinds of project work that exist but can be adapted to your needs.

- Consult your teacher if you are not definitely sure if the topic is suitable.
- Speak English throughout the whole work process as this will help you express your contributions in English.

Preparing your project work:

- Start with some brainstorming about what you want to deal with, what you want to find out, what results you expect.
- Note down aspects you will have to cover.
- Note down the kinds of material useful for your project.
- Outline the content of your project and structure your ideas.
- Decide who in your group is responsible for what.
- Write "to do lists" for all team members. Keep on doing so during the whole process.
- Devise a schedule which includes the different stages of your work, deadlines met and the names of the students who are responsible for certain tasks.

Carrying out research together:

- When carrying out research draw on different sources and assess their validity (see Tip 2).
- Keep a record of your results by making notes (see Tip 3). Also. if you come across new words and phrases which you need to deal with and which are relevant to the task. note them down and learn them.
- If need be, make use of the "Skills Pages" in your English textbooks, refer to dictionaries, grammar books, encyclopedias, etc. (see Tip 4).
- In the course of your work you might have to redefine some aspects of your work or aims of your project. Do not hesitate to ask your teacher for advice.
- While working you will have to alter/update parts of your schedule, but make sure to meet the final deadline.

Reflecting on your work:

- At the end of your work assess your results/products/what you have learnt and achieved and discuss what you will do differently the next time.

Tip 2: Assessing the reliability and validity of sources

- Determine what kind of publication it is and where and by whom the source was published (eq. university. serious/popular newspaper, commercial website).
- Look at the date of publication to make sure you are not referring for material that is outdated not useful for your purposes.
- Examine the source closely for information about the author/s and find out what qualifications he/she/they has/have for writing about the topic.
- Establish whether the author/s seems/seem objective or biased by considering

his/her/their language and purpose (e.g. to inform, to comment to influence/persuade the reader, to sell a product).
- Compare the information with information you have found about the topic in other sources. Does it confirm/contradict information from these other sources?

Tip 3: Making, compiling and organising note:

When you make notes you collect condensed information from a text.
- Focus on the information relevant to your task. Skimming or scanning can help you find the passages you need. If possible, highlight them in the text.
- When making notes write keywords, not complete sentences.
- Divide up the information by means of headings, subheadings, numbers letters. etc.
- Group together notes with similar information.
- Arrange different notes in a logical order. This might already reflect the structure of your paper or presentation.
- Graphic organisers such as concept maps or diagrams can also help you develop structure and understand interconnections and relationships.

Tip 4: Using Encyclopedias

Encyclopedias are reference books containing general and/or specific information which is usually arranged in alphabetical order. There are basically two types of encyclopedias: general encyclopedias (e.q. the Encyclopedia Britannica). covering all subject areas and branches of knowledge, and subject-related ones (e.g. International Encyclopedia of Women Scientists), providing in-depth knowledge on one area only. Encyclopedias can consist of one or many volumes. Most of them are also available as CD ROMs and some are online.

- Use an encyclopedia if you want to get general background information, narrow down a topic you are dealing with and check on information you are not sure about.
- Refer to the index and table of contents if the alphabetical order of the encyclopedia does not yield satisfactory results for you.
- Skim and scan the entry/article and look at fact boxes or pictures with captions to find relevant information.
- Look at the cross-references/hyperlinks (on the Internet) which lead you to other articles related to the topic.
- Study the bibliography which leads you to articles, books etc. that you might need.

Source: Berlin Senatsverwaltung für Bildung. Wissenschaft und Forschung (2011). Materialien zum selbstständigen standardorientierten Lernen in der gymnasialen Oberstufe Englisch, pp. 14-16.

Giving presentations

The following criteria primarily apply to PowerPoint presentations, but with minor alterations they can also be used for talks and formal speeches and be enhanced by over head transparencies or other visual material. They are applicable to group presentations as well as to talks given by individual students.

Planning and putting together your presentation your talk on your project work:

Make sure you understand the task. Do not hesitate to ask your classmates or your Teacher.

Preparation of the talk:

- Structure your presentation clearly (introduction, main part, conclusion/summary/outlook/open questions). and present this structure at the beginning of your presentation.
- Think of a catchy beginning/teaser to attract your audience's attention, e.g. an anecdote, a thought-provoking question, quote or picture. You might also state why the topic you have chosen is of so much interest to you and/or of relevance to your audience.
- Use striking facts to keep your audience interested and give good examples to illustrate your points.
- Stick to the topic/ key question(s) of your presentation.
- In case of a group presentation, make sure that everybody has contributed equally to it and that this also shows in your presentation. 5upport each other and act as a team.
- Consider how much time you want to allot to each point and ensure you stay within the time allowed, including questions that might be asked at the end.
- Decide on how to provide yourselves with prompts (keywords, cards).
- Rehearse your presentation/speech before you give it, e.g. in front of friends, family or a mirror. Do not memorize whole sentences.
- Make sure you can pronounce difficult words correctly. If you use online dictionaries such as leo.org or macmillandictionary.com you can listen to the pronunciation.
- Anticipate questions you may be asked at the end of your presentation and prepare a response.

Visual aids

- Decide on the kind of visual aids most suitable for your topic and material.
- In the course of your preparation, keep in mind that you have to collect visual material suitable for illustrating your results in your presentation.
- Consider carefully why you have chosen certain visual aids (photos, film clips, graphs, etc) and what purpose they serve in your presentation; use your visuals sparingly.

PPP and OHP

- Layout your slides/transparencies clearly and carefully: Use a large font (at least 32 point size) leave sufficient margins on all four sides: in particular at the bottom so that everything can also be seen from the back of the room.
- Do not overload your slides/transparencies with too much information. Use headings, keywords or phrases instead of sentences; make sure they are clear and easy to understand and proofread them for spelling errors.
- If you need a slide more than once, avoid having to go back. Reproduce it at the place where you need it.

Technical preparation:

- On the day before the presentation check that all technical equipment is working.
- Prepare a backup (e.g overhead projector/transparencies, a second notebook) in case the technical equipment is not working on the day of your presentation.
- Bring all the material you need on the day of the presentation; consider using a remote-control device to avoid standing next to the computer.
- Clean chalkboards, whiteboards etc., even if you do not intend to use them.

Giving your presentation / presenting your project work:

- Only start your presentation when everybody is quiet. Pause when listeners are talking.
- Look at the audience and make eye contact.
- Speak clearly, slowly, loudly. fluently and freely (however, you may use index cards
- as cues if necessary).
    - Do not read out from the slides/transparencies or your cue cards. Use the information on them as support to keep you focused on the structure of your presentation.
    - Take your time Pause in the right places, give your audience enough time to look at the slides/transparencies/visual aids and to ask questions at the end of the presentation.
- Do not stand in front of the screen. Use a pointer or a pen if you want to show something on the screen.

Reflecting on your work:

After the presentation think about your strengths and weaknesses and what you would do better next time (cf. assessing one's own work and that of others).

Handout

If you do not use PowerPoint or transparencies or do not want your audience to take notes, prepare a handout which you can pass out before or after the presentation. (In the latter case tell your audience beforehand that they will get a handout.)

Consider the following aspects:

- Write your school name. subject/course, your name(s), the date and title at the top. If necessary also include the occasion for the presentation.
- Do not include too much information and make sure your handout relates to what

is said in the presentation.

- As a rule of a thumb: The handout should not exceed two pages in at least font size 10 for a twenty-minute presentation unless you need to present additional information / relevant data.
- Structure it clearly and logically so that it is easy to read. Avoid long texts, using e.g. bullet points and keywords instead. Distinguish between main points and supporting points.
- Consider whether you want to leave room for notes.
- Make sure your handout is legible and visually attractive.
- Cite your sources and include a bibliography of words quoted at the end.
- Proofread your handout.
- Staple and punch holes in your handout and make sure you have enough copies for everybody.

Source: Berlin Senatsverwaltung für Bildung. Wissenschaft und Forschung (2011). Materialien zum selbstständigen standardorientierten Lernen in der gymnasialen Oberstufe Englisch, pp. 19- 22.

Linking ideas and sentences

There are various ways to connect thoughts and arguments. Structures help you to avoid unnecessary words and make a text more coherent and readable.

Examples:

main clauses	subordinate clause
He left the house. Soon afterwards he got into his car.	Soon after he had left the house he got into his car.
	present participle
He left the house. He was waving good-bye to his wife.	He left the house waving good-bye to his wife.
	past participle used as an adjective
She got lost in the crowd. She asked for help.	Lost in the crowd, she asked for help.
	past participle clause
He left the house. Soon afterwards he drove away.	Having left the house he soon drove away.
	infinitive
He went to the supermarket. He did so as he wanted to buy some milk.	He went to the supermarket in order to buy some milk.

Another way of joining clauses, sentences and paragraphs is through linking words and phrases. They will help you link your ideas, point out similarities, highlight differences, justify statements or provide examples and conclusions.

Frequently used linking words are: for example, and, because, moreover, as a result, however. Note that they are used in very different contexts.

Most linking words can either connect clauses or start a sentence to form a link between sentences. Generally you should avoid starting a sentence with or, and or but. If linking words start a sentence, they are followed by a comma.

nevertheless, … … and the hotels had very high standards. Nevertheless, some tourists complained about …

in conclusion, … … In conclusion, if there is a moral obligation to protect life, gene technology should be a questionable choice for scientific researchers.

If you are not sure about the usage, consult a good monolingual learner's dictionary.

NOTE: This is not a comprehensive list. You might want to add your own linking words and phrases.

If you want to add to your argument:

additionally, …	zusätzlich …	…, too.	auch
in addition, …	noch dazu, außerdem	moreover, …	außerdem, weiter
apart from …	abgesehen davon	... and ...	und
besides …	ferner, überdies	also, ...	außerdem
furthermore, …	außerdem, ferner	... as well as …	so wie auch

If you want to emphasise a statement:

apparently	offenbar, scheinbar	evidently	offensichtlich, zweifellos
naturally	natürlich,	obviously	selbstverständlich offensichtlich, klar
hardly likely	kaum wahrscheinlich	undoubtedly, …	zweifellos
actually	tatsächlich	in fact	genaugenommen

If you want to make comparisons:

similarly, … ähnlich in the same way … ähnlich similarly annoying ebenso ärgerlich

... likewise … ebenso, gleichfalls equally, … gleichermaßen compared to/with Im Vergleich zu equally slow(ly) gleich langsam …

not only … but also nicht nur, sondern … just like … wie auch … auch …

If you want to highlight contrast/show differences:

although …	obwohl	in contrast (to) …	im Gegensatz zu
yet, …	aber dennoch, doch	neither … nor …	weder … noch
despite …	ungeachtet dessen	nevertheless, …	nichtsdestotrotz
in spite of	trotz	whereas, …	während, wohingegen
however, …	jedoch, dennoch	on the one hand … on the other (hand)	einerseits … andererseits

When providing reasons:

because (of) … infolge dessen /von wegen due to for this reason aus diesem Grund on the basis of auf Grund von so that sodass in this way … auf diese Art und Weise, deswegen so deshalb, daher for this purpose …

When explaining results:

accordingly, … demgemäß, in consequence folglich
as a consequence entsprechend owing to this, ... infolge, wegen
folglich
as a result, ... folglich therefore, ... deshalb consequently folglich hence, ...
folglich, daher thus, … somit, folglich

When providing examples:

…, for example … zum Beispiel … …, such as … wie (z.B.) …
…, for instance … z.B. ... …, including … einschließlich
…, e.g. … z.B. ... ..., namely … nämlich …
..., i.e. ... d.h. …

When showing a sequence (of events):

first .../firstly ... erstens another (point) ein weiterer
last but not least, (Punkt)
… nicht zuletzt
second zweitens finally /last… schließlich, zuletzt
…/secondly
next … als nächstes

When drawing conclusions and summing up:

all in all, ... alles in allem in brief, … kurz gesagt as a result, … Als Ergebnis
in conclusion, … abschließend on balance, … alles in allem therefore, … daher
finally, … abschließend to conclude, … abschließend in other
words, … mit anderen Worten to sum up, … zusammenfassend

Source: Berlin Senatsverwaltung für Bildung. Wissenschaft und Forschung (2011). Materialien zum selbstständigen standardorientierten Lernen in der gymnasialen Oberstufe Englisch, pp. 60-62.

Solving a mediation task

The main goal of mediation (Sprachmittlung) is 'getting the message across' in another language. **Do not translate literally!** Merely render the information asked for in factual language and pay attention to the purpose and addressee as stated in the task.

The person you are producing the mediation for might have asked you to outline certain aspects of a text (cf. above: "outlining information"). Thus: Include only what is necessary for giving information about these aspects!

PREPARATION

1) Read the task well. Find out which ideas contained in the original you have to mention.
e.g. For a project on native peoples sum up what the German text says about the living conditions of the Lakota.
2) Identify and highlight key words and/or key sentences you need to complete the mediation task. Then take notes on all the information you need to complete your task in English.
3) Think of ways to paraphrase words which you do not know.
4) Consider ideas/names/technical terms which you need to explain to a reader who might not be familiar with them due to e.g. a different cultural background.

MEDIATING INFORMATION

- See: "Outlining information"

POINTS TO REMEMBER

- Do not translate. Paraphrase the idea/issue/message you would like to explain.
    - Do not interpret or comment; focus on the contents of the text.
- Consider what exactly the information is that is needed from you / what the person you are writing for exactly wants you to do.

Source: Berlin Senatsverwaltung für Bildung. Wissenschaft und Forschung (2011). Materialien zum selbstständigen standardorientierten Lernen in der gymnasialen Oberstufe Englisch, pp. 13 - 14.

Writing an article

When writing an article, you want to inform your readers about a certain issue, and express your opinion about it. You might also want to give advice or suggest actions to your readers.

Your language and its degree of formality should be appropriate for your readers. If you use ideas from other materials, restate in your own words the author's views, arguments, or examples or what might be relevant to your point.

PREPARATION

1) Study the task carefully. Does the task tell you
   - the target group your article should address?
   - the kind of magazine/brochure you are writing for (e.g.
   - political/educational/business/entertainment)?
   - which aspects you should be dealing with?
   - the purpose your article should fulfil: e.g. to discuss/comment on an opinion / evaluate/offer solutions to a problem?

2) If you are asked to base your article on information from a given text/s, study it/these carefully. Find and underline the information that is relevant to the task.

3) Highlight key ideas/arguments referring to the topic of your article. Consider which aspects you want to use to support your argument and message.

4) Add your own ideas based on your knowledge about the issue, making notes for your introduction, main part and conclusion:
   - Select a beginning suitable for arousing the audience's interest at the
   - beginning of the article.
   - Note down arguments the main part should contain or refute.
   - Note down facts, examples etc. illustrating your arguments and
   - counterarguments.
   - Find facts, experiences, values, issues/problems etc. which show that the message of your article is relevant to the readers' interest.

5) Put your notes in a convincing/logical order.

6) Make sure the content of your notes is relevant to the task, your target group and the message you want to convey.

7) Find an adequate eye-catching heading (and subheadings). Make it as catchy as possible, but bear in mind the type of magazine/brochure and target group you are writing for.

WRITING THE ARTICLE

INTRODUCTION

- Try to arouse the readers' interest with an intriguing opening sentence.
- You can include anecdotes, amusing stories, interesting events, etc. to capture the readers' attention.
- Clearly define your topic focusing on the central idea/aspect of the main message you want to convey.
- Outline the facts explaining What? Who? When? Where?
- Make clear why your issue is important.
- Briefly introduce your main arguments.

MAIN PART

- Focus on the most important points/arguments
- If you base your article on available texts, refer to the general ideas of the material. (When using quotations and direct speech name the source.)
- Underline your main arguments by giving convincing explanations.
- Include examples, evidence, statistical information, personal experiences, etc. to illustrate and strengthen your arguments.

CONCLUSION

- Indicate that you are coming to your conclusion through phrases such as in conclusion, finally, as a result, to sum up, etc.
- Make sure your readers get your message through a convincing final statement / repetition of your main point(s) / an outlook for the future / a call to action etc.

THROUGHOUT YOUR TEXT

- Write clear sentences.
- Be careful with lengthy sentences: Unlike German English tends to use short sentences.
- Write in an appealing way.
- Give examples, avoid clichés.
- Give well-founded arguments/convincing reasons/examples/important facts to back up your points.
- Follow a clear and logical structure by using paragraphs.
- Use active verbs wherever possible.
- Use vocabulary that is appropriate for your target group and purpose.

POINTS TO REMEMBER

- Use your own words when referring to ideas from the given material. (see above)
- Make sure what you write helps to convey your message.
- Prove what you say with facts/text references.

Source: Berlin Senatsverwaltung für Bildung. Wissenschaft und Forschung (2011). Materialien zum selbstständigen standardorientierten Lernen in der gymnasialen Oberstufe Englisch, pp. 33-36.

Web tools, apps, and resources for your competition entry

Word clouds
Wordle: http://www.wordle.net/ word cloud
WordArt: https://wordart.com/ word cloud

Voice, sound, podcast
Create a voki: http://www.voki.com/site/create animated videos

Podcasts
Podomatic | http://www.podomatic.com/directory podcasting
Learn how to podcast | http://podcastanswerman.com/learn-how-to-podcast/
Spreaker | http://www.spreaker.com/ podcasting

Create MP3-Files
Audacity: http://audacity.sourceforge.net/ audio recording/editing

VoiceThreads
VoiceThread: http://voicethread.com/ multimedia presentation video

Presentation and visualization
Prezi | https://prezi.com/ interactive presentations
Slideshare: https://www.slideshare.net/ online slideshow
Google slides: https://www.google.com/slides/ online slideshow
Glogster | https://edu.glogster.com/ multimedia posters
Visual.ly | https://visual.ly/ infographics visualizations
Smilebox: https://www.smilebox.com/
Calaméo: http://www.calameo.com/ online publishing

Timelines, puzzles, brainstorming
Dipity | http://www.dipity.com/ timeline
Timetoast | https://www.timetoast.com/ timeline
Padlet | https://padlet.com/ online notice board
JigsawPlanet | http://www.jigsawplanet.com/ online puzzles

Online comics and movies
Bitmoji | https://www.bitmoji.com/ online comic
Make belief comix | https://www.makebeliefscomix.com/ online comic
Pixton | https://www.pixton.com/ online comic
Vyond | https://www.vyond.com/ online comic
Dvolver Moviemaker | http://www.dvolver.com/moviemaker/make.html video editing

Royalty-free resources
Free images and stock photos
Unsplash: https://unsplash.com/
Freepik: https://www.freepik.com/
Freeimages: https://www.freeimages.com/

Free stock videos
Dareful: https://www.dareful.com/
Pexels: https://www.pexels.com/
Pixabay: https://pixabay.com/

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