| Learning Tool Code | Title |
|---|---|
| SDG7-SDGfP | **Affordable and clean energy** |

## Objectives

- Students distinguish between energy sources (renewable and non-renewable), describe the use of energy conversion

- Students interpret the benefits of renewable energy sources (do not pollute the environment, safer for energy production, have no harmful effects on human health, cheaper production)

- Explain the terms "clean energy" and "available energy"

- Students explain the causes of possible shortcomings in the use of renewable energy sources (geographical location)

- Students explain the consequences of using fossil fuels

- Students connect the use of renewable energy sources with environmental protection

- Analyze data on the use of different energy sources in the world (tables, charts)

- They connect the energy consumption in a certain country with its development

- They research data on the use of energy sources in their country on a given website and compare them with other countries

- Students create simple models of collecting energy from renewable sources

- Explore the possibilities of using renewable energy sources in their local community (Project - number of sunny hours in the place of residence, use of solar benches in the city, occupations of the future, etc.)

- Only the regulation of one's own attitude towards energy

- Team work and teamwork development

- Application of critical thinking (application of energy sources and modern technology) and problem solving

- Developing modeling skills

- Application of critical thinking in the analysis of data from different sources

- Developing a positive attitude about the importance of preserving the environment

## Activity details

- ❖ Material – see annex
- ❖ Duration – 135 min

| ❖ Group number 15-20 students |
|---|

## Instructions

**Lesson one (45 min)**

1. Introduction to the topic:

Motivational questions for students:

What does the term pure energy mean?

What does the term "available energy" mean?

2. Students receive a table (worksheet 1) which they fill in during their work

They write in the table their previous knowledge of these terms (which I already know)

(Table 1. see annex)

3.Students watch a video:

a) Renewable energy

https://www.youtube.com/watch?v=T4xKThjcKaE&t=21s

b) SDG Report 2021 - Goal 7

https://www.youtube.com/watch?v=yMB1jlGtHYE

4 Students read the given text. (see annex)

5. Students solve tasks in the worksheet (complete Table 1, solve Table 2. and answer questions) (see annex)

6. Discussion and discussion after solving tasks.

**Lesson two (90 min)**

1. Students analyze data in diagrams, answer questions (worksheet 2)

2. Comment on the data in the diagrams

3. Search the database on clean and available energy on the interactive map for their country and enter in Table 3. (data from 2000. to 2018.)

4. Draw conclusions on changes in the use of clean energy for their country for the period from 2000. to 2018.

5. Compare the data on clean and available energy of their country with Norway or Sweden, which have the highest share of clean and available energy
(Table 4)

6. They make a model of a windmill or a more complex model of a windmill in cooperation with a teacher of technical culture (windmill with electric motor)

7. Choose a project task (possibilities of using solar energy, wind energy, hydropower according to the geographical location of a particular place or region, occupation of the future)

(see annex)

## Tips for the facilitator

1) Teacher asks questions and tries to ask as many student possible.
2) Teacher introduces the lesson about Energy.
3) Teacher prepares assignments (worksheets - tables, graphs, questions, conclusions).
4) The teacher instructs students how to read diagrams, compare data in diagrams, tables, search the data on the offered website, draw conclusions, instruct in the way of creating a project task.
5) The teacher directs students to select relevant websites.
6) The teacher gives feedback on the accuracy of the completed task.

## Debriefing

Students make a model of a windmill.

Students carry out a project task in their place of residence, home or school (possibilities of using solar energy, wind energy, hydropower according to the geographical location of a particular place or region, explore future occupations related to clean energy).

## Follow-up/Inspiration for the future

Publication of project works and models on school websites. Collaborate with technical culture or robotics to create a more advanced windmill model that will include an electric motor or make a solar panel model to charge a simple device.

## References/Further reading

Downloaded October 30th 2021.

1. https://unstats.un.org/sdgs/report/2021/goal-07/

2. https://www.youtube.com/watch?v=yMB1jIGtHYE
3. https://sdgs.un.org/topics/energy
4. https://trackingsdg7.esmap.org/data/files/download-documents/2021_tracking_sdg7_report.pdf
5. https://trackingsdg7.esmap.org//

Downloaded November 11th 2021.
6. https://www.youtube.com/watch?v=T4xKThjcKaE&t=21s

Downloaded November 5th 2021.
7. https://www.youtube.com/watch?v=cFvuwMyzviQ
8. https://www.youtube.com/watch?v=qeVTCe8HLio

Downloaded November 6th 2021.
9. https://meteo.hr/klima.php?section=klima_hrvatska&param=k1_8
10. https://meteo.hr/klima.php?section=klima_pracenje&param=klel
11. https://www.google.com/maps/search/geografska+karta/@45.4537404,15.5301795,11z/data=!5m1!1e4

## Annex

**LESSON 1.**

**Worksheet 1.**

**Table 1.:** what I already know / what I have learned

Part 1.: it is done at the beginning before watching the video and reading the text

Part 2.  students solve after watching the video and reading the text

| terms | What I already know | What I have learned |
|---|---|---|
| "clean energy" | | |
| Renewable energy sources | | |
| Affordable energy | | |
| Sustainable energy | | |

Table 1.

Text:

Goal 7 of sustainable development is about clean energy, which is energy that enables sustainable development because it does not harm the environment and human health. Part of the goal is to enable the availability of energy for people, the use of modern technology in energy production and reliability in energy production. Access to "clean, modern and sustainable" energy is key to improving the health and living standards of people around the world. The construction of solar power plants, wind power plants, geothermal power plants and hydroelectric power plants will enable the achievement of goal 7 by 2030. The use of renewable energy sources (Sun, water, wind, geothermal sources) requires the further development of modern technologies to ensure a still clean and healthy environment.

What does it mean to have access to affordable energy?

 The heterogeneity of energy use worldwide is largely due to the state's diverse natural resources and purchasing power. For example, a country with large coal deposits is likely to make extensive use of this resource to industrialize its economy. People living in this country are likely to use it as their primary means of producing energy.

Today, approximately 2.7 billion people (about 40 percent of the world's population) rely on traditional biomass fuels for cooking. Such low quality fuels can be a major source of indoor air pollution. Even with the expansion of energy availability and economic development, the annual number of deaths from indoor air pollution will still be over 1.5 million people. If a country's level of development is low and energy production costs are high, then people will lack access to energy. In many parts of the developing world, energy sources are

often scarce and their supply insecure. Today, 20% of the world's population still does not have access to electricity.

Electricity, automated transport and information technology are essential for economic development. They are also fundamental features of modern society, so energy sources and systems that reliably and affordably meet these needs can be considered "modern". The constant flow of energy enables the satisfaction of basic human needs, the maintenance and improvement of society as a whole and the improvement of living standards.

Today, coal still provides about 40 percent of the world's electricity. Coal is not sustainable globally because of its contribution to anthropogenic climate change, nor at the local level because it poses a threat to public health and environmental conditions (harmful combustion products).

It is important to transfer clean energy technology to developing countries, but it is also important for each of us to act locally. This means using energy sources that will not be harmful to the environment and saving energy.

Table 2.

| Renewable energy sources | Production technology | Energy conversion |
|---|---|---|
|  | Wind farm |  |
| Sun |  |  |
|  | Geothermal power plant |  |
| Water |  |  |
|  | Biomass power plant | Chemical energy⯈ electricity |

Answer the questions.

1. Explain the importance of clean energy for human health.

2. Explain the connection between economic development and the availability of electricity

3. Why is coal considered a "bad" source of energy?

**LESSON 2.**

**Worksheet 2.**

## 1. Study the given diagram and answer the questions

The diagram shows the access to electricity by world regions in 2010 and in 2019 in percentages. Globally, there has been a visible increase since 2010 when 83% of the world's population had access to electricity to 90% in 2019. But still in 2019, 759 million people worldwide were without electricity.
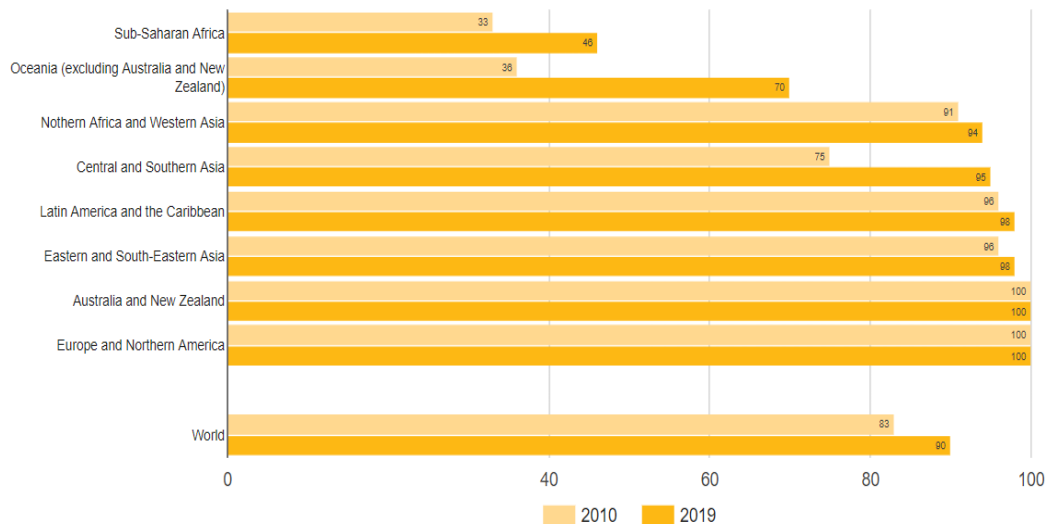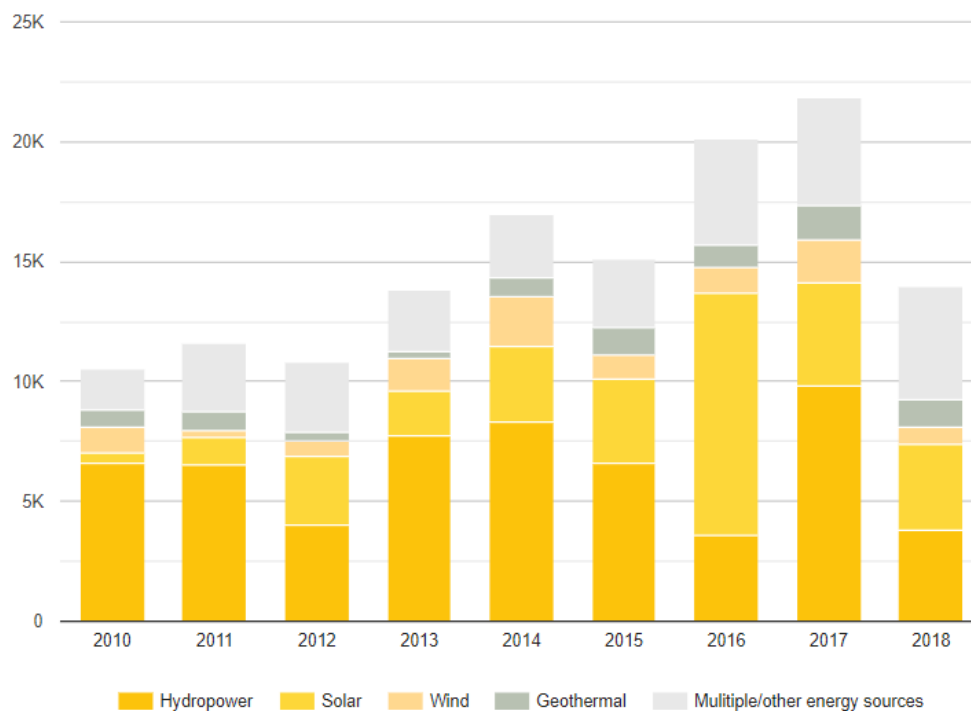


Answer the questions:

1. In which regions of the world is electricity 100% affordable?
2. In which world regions have the greatest changes in access to electricity occurred in a given period?
3. Which world region has the lowest electricity accessibility in 2019?
4. Connect the accessibility of electricity with the economic development of the area.

## 2. Study the given diagram and answer the questions

Co-funded by the
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НАЦИОНАЛНА АГЕНЦИЈА
ЗА ЕВРОПСКИ ОБРАЗОВНИ
ПРОГРАМИ И МОБИЛНОСТ

The chart shows billions of dollars in financial investment to developing countries to support clean and renewable energy. In 2018, a total of $ 14 billion was invested in these purposes.



Answer the questions:

1. Does the type of financial investment in "clean" energy depend on the geographical characteristics of a developing country? Explain.

2. What is the possible reason for the constant smallest financial investments in geothermal and wind energy? Explain.

3. Can we determine the trend of further investments in clean energy from the chart? Explain.

**3.a) Analyze energy data for your country and solve tasks with the help of an interactive map.**

https://trackingsdg7.esmap.org/

Read the following data on the interactive map by selecting the data specified in the table in the menu:

Table 3.

| My country | Affordable electricity | Approach to healthy cooking | Energy from renewable sources |
|---|---|---|---|
| 2000. | | | |
| 2018. | | | |
| Changes over a period of 18 years | | | |

**3b) Compare the same data from your country with data from Norway or Sweden, using the same interactive map.**

Table 4.

| Sweden or Norway | Affordable electricity | Approach to healthy cooking | Energy from renewable sources |
|---|---|---|---|
| 2000. | | | |
| 2018. | | | |
| Changes over a period of 18 years | | | |

Answer the question:

Explain how we can conclude from the data from the interactive map about the economic development of a particular country?

**POSSIBLE PROJECT TASKS**

1.  **Make a model of a windmill (conversion of wind energy into energy that allows the body to move).**

    https://www.youtube.com/watch?v=qeVTCe8HLio
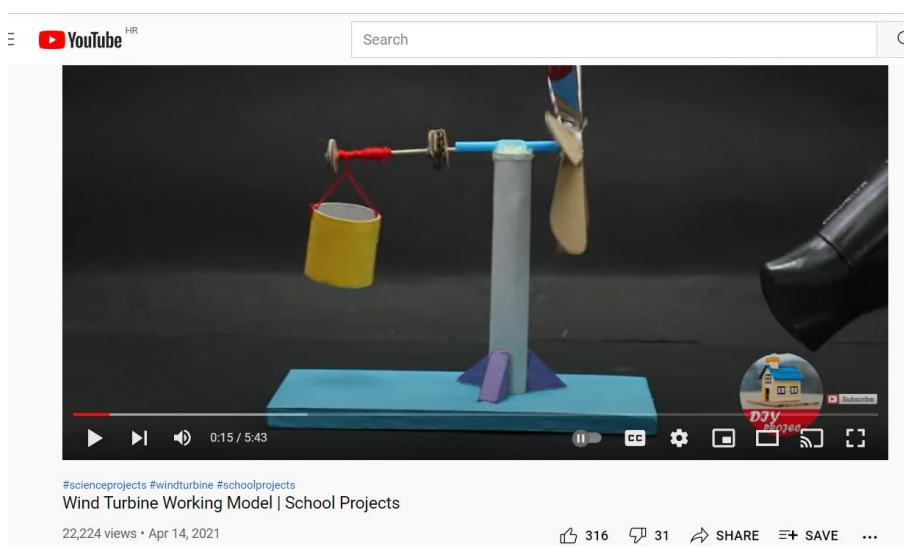


2.  **Make a model of a windmill with an electric motor (conversion of wind energy into electricity).**

    https://www.youtube.com/watch?v=cFvuwMyzviQ
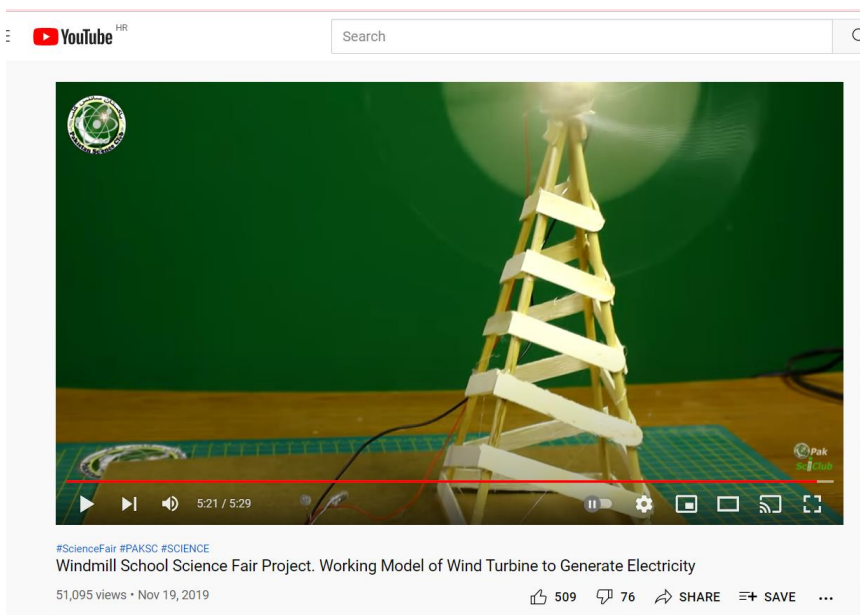
## 3. Jobs of the future



*IRENA_1_Photo_by_Spielvogel_Wikimedia_Commons_Wind_farm_near_North_Sea_coast*

People of different professions are involved in decisions about the construction and construction of wind farms in an area. In addition to deciding on construction, certain occupations follow other activities. Read the tasks and imagine yourself in one of the future jobs. Write a composition of about one working day in such a workplace in the future.

a) Teacher

   Teaching children what is a wind farm and a benefit to the settlement?

b) Ecologist/biologist

How do wind farms affect the environment and which crops will grow on

the surface below them?

c) Specialist communication

Explain to the people in the settlement that they will benefit from

wind farms.

d) Financial specialist

How much money is needed to build wind farms and how much is the

profit on the obtained energy?

e) Electrical engineering

Construction and maintenance of wind farms.

f) Electronics and computing engineering

Application of modern technology in wind farm operation control.

g) Geologist/ geographer

Research of soil base and wind quantity, determination of

   geographical position where wind power plants will be built.

h) Medical doctor

Care for the health of all workers during construction and after

the commissioning of all wind farms.

i) Economist in the municipality

Development of a time plan for the construction of wind farms,

convening construction experts on agreements.

4. **Investigate the geographical features of your place of residence and atmospheric factors. Based on the collected data, decide which renewable sources in your area (town, region) people can use.**

Geographical location:

a) Using a geographical map, describe the geographical position of your place (elevation, slope, vegetation, climate, running water, geothermal springs).
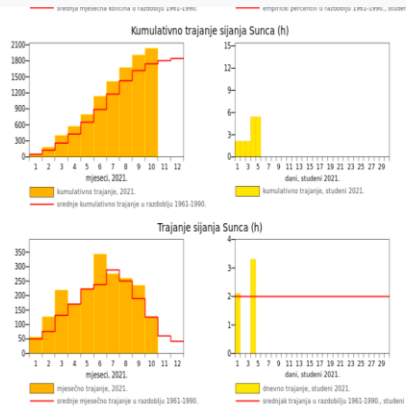
Comment on the possibility of building hydroelectric power plants, geothermal power plants.

(example Karlovac, Croatia)
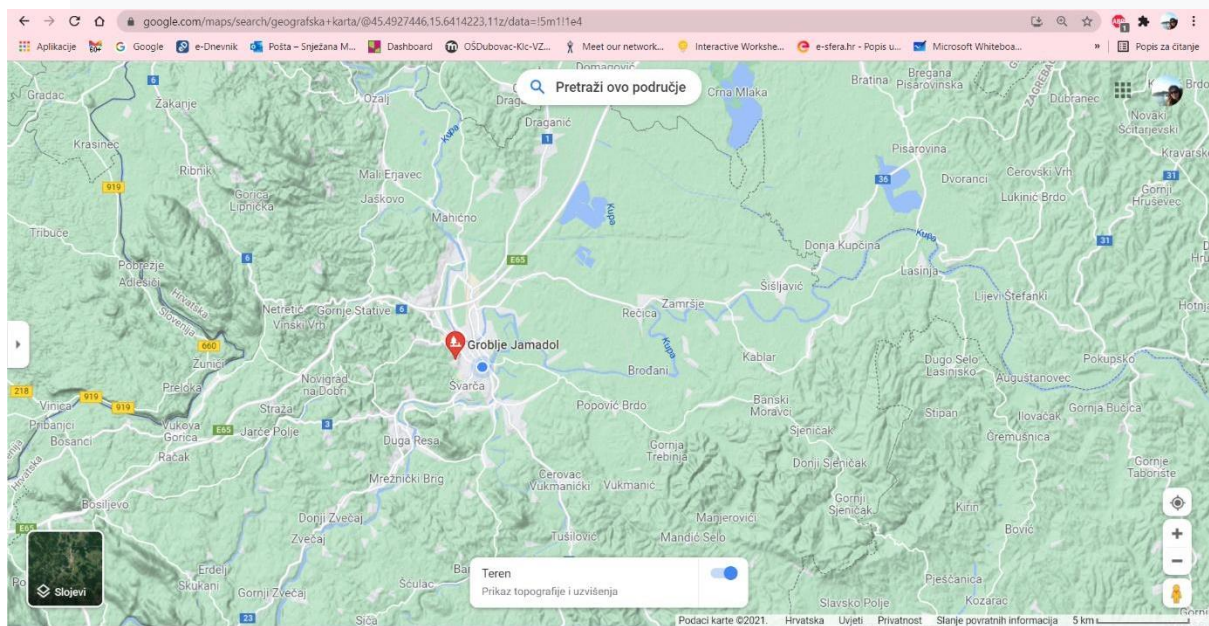


b) In the data of the Meteorological Institute for your country, find data for the number of sunny days a year and comment on the profitability of investing in solar panels.
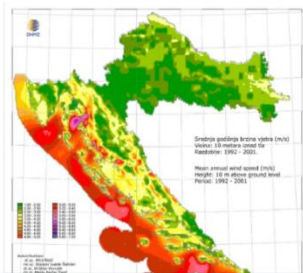
(example Karlovac, Croatia)

c) In the data of the meteorological institute for your country, find (or search for) data for the number of windy days and wind strength in the year and comment on the profitability of investments in wind farms.

(example Karlovac, Croatia)



Downloaded October 30<sup>th</sup> 2021.

1. https://unstats.un.org/sdgs/report/2021/goal-07/
2. https://www.youtube.com/watch?v=yMB1jIGtHYE
3. https://sdgs.un.org/topics/energy
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9. https://meteo.hr/klima.php?section=klima_hrvatska&param=k1_8

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5.5301795,11z/data=!5m1!1e4